Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Fiscal Year 2021 Annual Administrative Record

Prepared for:
U.S. Bureau of Reclamation
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Albuquerque, New Mexico 87102

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Acronyms and Abbreviations

AAR	Annual Administrative Record
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
Admin Ad Hoc Group	Administrative Ad Hoc Group
AMWG	Adaptive Management Work Group
AM	adaptive management
BDD	Buckman Direct Diversion
BEMP	Bosque Ecosystem Monitoring Program
BO	biological opinion
CoA	City of Albuquerque
CEM	Conceptual Ecological Model
CPUE	Catch per unit effort
EC	Executive Committee
ESA	Endangered Species Act
FPC	Fiscal Planning Committee
FY	fiscal year
HR	habitat restoration
HRWG	Habitat Restoration Work Group
LTP	Long-Term Plan
MAT	Minnow Action Team
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MRG	Middle Rio Grande
MRGCD	Middle Rio Grande Conservancy District
MRGESCP/Collaborative Program/Program	Middle Rio Grande Endangered Species Collaborative Program
NMAGO	New Mexico Attorney General's Office
NMDGF	New Mexico Department of Game and Fish
NMISC	New Mexico Interstate Stream Commission
NMMJM	New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)
PESU	Pecos sunflower (*Helianthus paradoxus*)
PMWG	Population Monitoring Work Group
PoI	Pueblo of Isleta
PoS	Pueblo of Sandia
PoSA	Pueblo of Santa Ana
PST	Program Support Team
Reclamation	U.S. Bureau of Reclamation
RGSM	Rio Grande silvery minnow (*Hybognathus amarus*)
S&AM Plan	Science & Adaptive Management Plan
S&T Ad Hoc Group	Science & Technical Ad Hoc Group
SAMC	Science and Adaptive Management Committee
ScW	Science Work Group
SOW	scope of work
SWM	Species Water Management Work Group
SWFL	southwestern willow flycatcher (*Empidonax traillii extimus*)
UNM	University of New Mexico

USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEST, Inc.	Western Ecosystems Technology, Inc.
YBCU	Yellow-billed cuckoo (*Coccyzus americanus*)

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PREPARING THE FY21 ANNUAL ADMINISTRATIVE RECORD

The Fiscal Year 2021 (FY21) Annual Administrative Record (AAR) is a compilation of materials from the public meetings of the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP/Collaborative Program/Program). The FY21 AAR includes materials from public meetings that took place between October 1, 2020 and September 30, 2021.

The FY21 AAR includes the following types of documents generated for public meetings of the Collaborative Program Executive Committee (EC), Fiscal Planning Committee (FPC), Science and Adaptive Management Committee (SAMC), and Population Monitoring Work Group (PMWG).

1. Approved meeting agendas
2. Approved meeting minutes
3. Meeting read-aheads
4. Meeting presentations
5. Meeting follow-up documents

This record includes all draft documents associated with public Program meetings in order to track the development of Program work products. Final documents are available on the Program Portal. This record does not include correspondences between Collaborative Program members or scopes of work (SOWs).

EXECUTIVE COMMITTEE MEETINGS

Executive Committee Meeting

October 27, 2020

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *Recommendations to the EC on SAMC Membership [read-ahead]*
- *Draft Charter for SAMC of the MRGESCP [read-ahead, draft]*
- *2020 SAMC Selection and Draft S&AM Plan [presentation]*
- *Approved Charter for SAMC of the MRGESCP [follow-up]*

Middle Rio Grande Endangered Species Collaborative Program

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Executive Committee (EC) Meeting
October 27, 2020
2:00 – 4:00 PM MT

Location: Zoom Meeting
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Call-In: +1-669-900-6833
Meeting ID: 898-359-3120; Passcode: 1251

Meeting Agenda

Meeting Objectives:

- *Approve the Science and Adaptive Management Committee (SAMC) charter*
- *Discuss recommendations for and vote on SAMC membership*
- *Move to convene the SAMC*

2:00 – 2:10	**Welcome, Introductions, Agenda Review** • Ground rules for zoom meeting ➢ **Decision**: Approval of October 27, 2020 EC meeting agenda	*EC Co-chairs*
2:10 – 2:20	**September 1, 2020 Meeting Summary** • Action Items Review ➢ **Decision**: Approval of September 1, 2020 EC meeting minutes Read ahead: ☐ September 1, 2020 EC meeting minutes	*EC Co-chairs*
2:20 – 2:45	**Science and Adaptive Management Committee (SAMC) Charter** • Review and discussion of draft SAMC charter Read ahead: ☐ Draft SAMC charter ➢ **Decision**: Approve SAMC charter	*Catherine Murphy, Program Support Team (PST)* *Facilitated discussion*
2:45 – 3:00	**SAMC Membership** • Review of SAMC application process • Recommendations from the administrative ad hoc group	*Catherine Murphy, PST* *Facilitated discussion*

- Voting on SAMC members
- Nominations and voting for EC ex-officio member

If the EC cannot agree via vote on the ad hoc group recommendations, the EC will go into a closed door session following the EC meeting for further deliberations.

Read ahead:

- ☐ Ad hoc group recommendations on SAMC membership

- ➢ **Decision**: Finalize/Approve SAMC members
- ➢ **Action Item**: Convene the SAMC

3:00 – 3:40 **Next Steps on Science & Adaptive Management Plan, Long-Term Plan, and SAMC** *PST*

- Overview of the Science & Adaptive Management Plan and timeline of next steps
- Framework for Adaptive Management Database and Long-Term Plan

3:40 – 3:45 **Announcements**

3:45 – 3:50 **Public Comment**

3:50 – 4:00 **Meeting Summary and Action Items Review** *EC Co-chairs*

- ➢ Next EC Meeting: December 17, 2020
  - o Science & Adaptive Management Plan approval
  - o Long-Term Plan approval
  - o 2021 Work Plan

4:00 **Adjourn**

Middle Rio Grande Endangered Species Collaborative Program

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Executive Committee (EC)
Meeting Minutes

October 27, 2020; 2:00 PM–4:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of October 27, 2020 EC meeting agenda
- ✓ Approval of September 1, 2020 EC meeting minutes with amendments
- ✓ Approval of the Science and Adaptive Management Committee (SAMC) Charter with amendments
- ✓ Approval of the following SAMC membership, as recommended by the SAMC Applications Administrative Ad Hoc Group:
    - Mo Hobbs, aquatic ecology expert
    - Thomas Archdeacon, aquatic ecology expert
    - Dave Moore, terrestrial ecology expert
    - Meaghan Conway, ecosystem function expert
    - Ryan Gronewold, hydrology expert
    - Megan Friggens, climate science expert
    - Ari Posner, geomorphology expert
    - Ara Winter, statistics and modeling expert
- ✓ Approval of Alan Hatch, Pueblo of Santa Ana, as the EC ex officio member of the SAMC
- ✓ Approval to sunset all existing science and technical groups as of the December 17, 2020 EC meeting

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Notify SAMC applicants of the EC's decision on SAMC membership	10/29/2020
PST	Notify the existing science and technical group chairs of the December 17th sunset date	11/4/2020
PST	Schedule the first SAMC meeting	Early November
PST	Schedule one-on-one meetings with EC representatives to discuss comments on the Science and Adaptive Management (S&AM) Plan and signatory requests for the Long-Term Plan (LTP)	11/18/2020
EC	Provide comments on the S&AM Plan to the PST	11/23/2020
PST	Draft letters of appreciation for the members of existing science and technical groups for approval by the EC	12/10/2020
PST	Provide final S&AM Plan and LTP for approval at the December 17th meeting	12/10/2020
OUTSTANDING ACTION ITEMS		

Non-Federal Signatories	Submit FY20 Cost Share to the PST	12/1/2020
All Signatories	Submit FY20 MRGESCP Annual Report write-ups to the PST	12/15/2020

Next Meeting: December 17, 2020; 9:00 AM–12:00 PM

Meeting Summary

Welcome, Introductions, Agenda Review
Ground rules for Zoom meeting

Wayne Pullan, U.S. Bureau of Reclamation (Reclamation) and Federal Co-Chair, opened the meeting and led introductions. The EC approved the meeting agenda with no amendments.

- ✓ **Decision**: Approval of the October 27, 2020 meeting agenda by the EC

September 1, 2020 Meeting Summary
Action items review

Debbie Lee, Program Manager with the PST, reviewed action items from the September 1, 2020 meeting. The September 1, 2020 meeting minutes were approved by the EC with suggested amendments.

- ✓ **Decision**: Approval of the September 1, 2020 EC meeting minutes by the EC with amendments

Science and Adaptive Management Committee Charter
Review and discussion of draft SAMC charter

Catherine Murphy, Science Coordinator with the PST, presented a slideshow on the 2020 SAMC, which covered the SAMC Charter (see presentation). The EC approved the SAMC Charter with the following revisions:

- "Best management practices" was changed to "best management alternatives."
- The charter was revised to align with the description of the SAMC in the S&AM Plan.
- The caveat preventing PST members from offering scientific and technical expertise was removed.
- If a vacancy occurs mid-term, the seat will remain open unless the EC chooses to fill the position for the rest of the term.
- The EC ex officio member of the SAMC will advise on policy.
- Non-members of the SAMC may speak outside the restrictions of the non-member comment period at the request of the SAMC.
- SAMC members will recuse themselves if they identify a potential financial conflict of interest.

- ✓ **Decision**: Approval of the SAMC Charter with amendments

Science and Adaptive Management Committee Membership
Review of SAMC application process
Recommendations from the administrative ad hoc group

Voting on SAMC members
Nominations and voting for the EC ex officio member

Catherine M. continued the 2020 SAMC presentation, first discussing the preliminary list of SAMC tasks for 2020–2021, and then the list of SAMC applicants recommended by the SAMC Application Administrative Ad Hoc Group (see presentation). These were the main points from the presentation and following discussion:

SAMC Membership

- The Administrative Ad Hoc Group convened for 2.5 hours to discuss the 16 applications from 14 applicants (two applicants submitted two applications each).
- There were applicants for each of the specified SAMC positions (aquatic ecology, terrestrial ecology, ecosystem function, and hydrology), plus a variety of applicants for flexible positions.
- The following applicants were recommended by the Administrative Ad Hoc Group to sit on the SAMC:
    - Mo Hobbs (aquatic ecology expert)
    - Thomas Archdeacon (aquatic ecology expert)
    - Dave Moore (terrestrial ecology expert)
    - Megan Conway (ecosystem function expert)
    - Ryan Gronewold (hydrology expert)
    - Megan Friggens (climate science expert)
    - Ari Posner (geomorphology expert)
    - Ara Winter (statistics and modeling expert)
- One EC member asked if the applicants understood the time commitment related to a position on the SAMC.
    - The applicants are aware of the time commitment of 10-15 hours per month.
    - The bulk of the work will be completed by Catherine M., as the SAMC Facilitator, and Science & Technical Ad Hoc Groups to whom the SAMC will delegate specific tasks. Catherine M. will stay organized and prepare for meetings to ensure the SAMC members are using their time well.
- The conflict of interest statement in the charter is general, only stating that members will abide by all federal, state, tribal, and local agency rules and regulations regarding conflict of interest. Does there need to be a more detailed statement that describes some of the conflicts of interest SAMC members will face?
    - One EC member noted a preference for a soft statement that allows the SAMC to be self-policing. The members are trusted to know the rules that apply to them, and are empowered to decide how to proceed.
- The Collaborative Program is appreciative of the many qualified applicants for the SAMC. There will be future iterations of the SAMC, and applicants who were not selected this round are highly encouraged to apply again.
- Applicants who were not selected are on a growing list of experts the SAMC can reach out to for technical input.
- The EC approved the SAMC applicants recommended by the SAMC Applications Administrative Ad Hoc Group.

- ✓ **Decision**: Approval of the following SAMC membership, as recommended by the SAMC Applications Administrative Ad Hoc Group:
    - Mo Hobbs, aquatic ecology expert
    - Thomas Archdeacon, aquatic ecology expert
    - Dave Moore, terrestrial ecology expert
    - Meaghan Conway, ecosystem function expert
    - Ryan Gronewold, hydrology expert
    - Megan Friggens, climate science expert
    - Ari Posner, geomorphology expert
    - Ara Winter, statistics and modeling expert

EC Ex Officio Member

- The EC nominated members for the EC ex officio position on the SAMC. There is no alternate for the position.
- The time commitment is an issue for many EC members. Would the ex officio member have a lower time commitment than the other SAMC members?
    - Yes, as he or she would not be expected to read all the scientific reports and other documents. The EC ex officio member may not be required at some meetings.
- Alan Hatch, Pueblo of Santa Ana, was approved as the EC ex officio member.

- ✓ **Decision**: Approval of Alan Hatch, Pueblo of Santa Ana, as the EC ex officio member of the SAMC

Disbanding Existing Science and Technical Groups

- Does the EC approve of disbanding all existing science and technical groups at the December EC meeting and allowing them to be reconstituted at the discretion of the SAMC?
    - There is support for the SAMC having a fresh start.
    - Groups with active work can be re-banded with specific charges under the SAMC.
    - Will there be a transition period, so the SAMC can be updated on what groups are doing?
        - The groups are ready to disband or preparing summary materials.
        - The Adaptive Management Work Group (AMWG) had a final meeting. AMWG members approved the distribution of the S&AM Plan to the larger Collaborative Program and are ready to sunset the group.
        - The Population Monitoring Work Group (PMWG) is summarizing its accomplishments in a report to the EC. The PMWG will present the report at the December EC meeting.
            - The summary report will be given to the SAMC. The SAMC will break down the remaining tasks of the PMWG and assign them to Science and Technical Ad Hoc Groups.
        - Will the By-Laws Ad Hoc Group (BLG) continue?
            - Yes, the BLG was tasked by the EC with revising the by-laws, and will be considered an Administrative Ad Hoc Group under the new structure when the need arises. The next meeting was on hold until the EC made decisions on how the SAMC will operate. The BLG can now incorporate the approved SAMC charter into the by-laws.
        - The Minnow Action Team (MAT) is separate from the Collaborative Program and will continue to meet as usual.

        - The EC wants to recognize the work of the members of the disbanding groups with a letter of appreciation.

- ✓ **Decision**: Approval of sunsetting all existing science and technical groups as of the December 17, 2020 meeting
- ➢ **Action Item**: The PST will notify the existing science and technical group chairs of the December 17th sunset date
- ➢ **Action Item**: The PST will draft letters of appreciation for the members of existing science and technical groups for the EC Co-chairs to sign on behalf of the EC and the Collaborative Program

Next Steps on S&AM Plan, LTP, and SAMC

Overview of the S&AM Plan and timeline of next steps
Framework for Adaptive Management Database and LTP

Catherine M. presented on the S&AM Plan, LTP, and SAMC (see presentation). These are the main points from the presentation:

- S&AM Plan and LTP
    - Together, the S&AM Plan and LTP provide the framework for implementation of the Collaborative Program's science and adaptive management (AM) process.
    - The S&AM plan defines the Collaborative Program's role and its science and AM process.
    - The LTP is an evolving communication and planning tool that organizes scientific activities into periodic work plans.
- Science and AM Process – Next Steps
    - So far, the S&AM Plan has been drafted and reviewed by the PST, AMWG, and WEST technical editing. It is now out for review by the EC.
        - The review period is from October 22nd to December 2nd.
        - During the review period, the PST will be meeting with signatories to discuss and get feedback on the S&AM Plan.
        - At these meetings, the PST will also ask signatories what they need in the LTP.
    - The PST will be calling SAMC applicants to inform them of the EC's decision on SAMC membership. The PST will also be scheduling the SAMC's first meeting.
    - The PST will be revising the S&AM Plan and working on a draft LTP. Final versions of both will be presented at the December EC meeting for approval.
    - The LTP presented in December is meant to help U.S. Army Corps of Engineers (USACE) secure funding.
        - The LTP will draw heavily from USACE long-term plan documents. Those documents directly align with what the Collaborative Program wants to do moving forward.
- What's New in S&AM Plan
    - Re-organization with the SAMC
        - The SAMC is a hub of information. It will make sure the EC gets shorter, more useful summaries of Collaborative Program work.
    - Construction of the AM Database and Project Bank
        - The AM Database will be populated using existing information. The AM Database will store and disseminate accurate, up-to-date information, facilitate transparent prioritization of activities, and support informed decision-making.

        - Answers to common questions on the AM Database:
            - The PST is building the AM Database.
            - The AM Database is being developed on MS Access but can be transitioned to a SQL server.
            - The PST will manage the AM Database during development. Once established, the Collaborative Program can decide to host it on the Program Portal or a cloud-based service.
    - Commitment to iterative learning
        - The Collaborative Program commits to iterative learning through tracking, evaluating, and incorporating scientific evidence into its objectives, experimental designs, and decision-support tools.
        - What does the SAMC communicate to EC?
            - Modifications to objectives and tools with scientific justifications.
            - Recommended modifications to the LTP with scientific justifications.
            - Recommended management alternatives with analysis and scientific justifications.
    - What will the Collaborative Program communicate through the EC?
        - Recommended studies and projects that reduce uncertainties.
        - Recommended adjustments to management actions backed by scientific evidence.
- LTP
    - The first iteration will be approved in December 2020.
        - It will include the Project Bank, but it will not be prioritized.
    - The LTP will be updated in late spring/early summer 2021.
        - Linkages to draft objectives and uncertainties will have been developed, so the list of potential scientific activities will include top-down objectives and be query-able using filters.
        - In the future LTP, objectives will be linked to uncertainties, uncertainties will be linked to hypotheses, and hypotheses will be linked to projects.
        - Projects will be categorized by type, focus, necessary water conditions, reach, authority, etc.
            - The PST needs input from the EC to fill out the authority of each project.

- **Action Item**: The PST will schedule the first SAMC meeting
- **Action Item**: The PST will notify SAMC applicants of the EC's decision on SAMC membership
- **Action Item**: The PST will schedule one-on-one meetings with EC representatives to discuss comments on the S&AM Plan and signatory requests for the Long-Term Plan
- **Action Item**: The EC will provide comments on the S&AM Plan to the PST
- **Action Item**: The PST will provide final S&AM Plan and Long-Term Plan for approval at the December 17th meeting

Announcements

- There is a Rio Grande Compact Commission meeting on November 12th. For more information, visit the Office of the State Engineer Interstate Stream Commission website.
- The Collaborative Program's 2020 Science Symposium is scheduled for December 1-3, 2020. It will be a series of half-day Zoom events. An agenda will be sent out in the next week or two.

Public Comment

No public comments were received.

Meeting Summary and Action Items Review

- Debbie L. reviewed meeting action items.
- The next meeting is scheduled for December 17, 2020 from 9:00 AM to 12:00 PM.

Meeting Participants

Participant	Organization
Alan Hatch	Pueblo of Santa Ana
Andy Dean	U.S. Fish and Wildlife Service
Anne Marken	Middle Rio Grande Conservancy District
Bill Grantham	New Mexico Office of the Attorney General
Catherine Murphy	Program Support Team
Dale Strickland	Program Support Team
Debbie Lee	Program Support Team
Debra Hill	U.S. Fish and Wildlife Service
Elizabeth Anderson	Albuquerque Bernalillo County Water Utility Authority
Jennifer Faler	U.S. Bureau of Reclamation
Jim Wilber	U.S. Bureau of Reclamation
John Stomp	Albuquerque Bernalillo County Water Utility Authority
Julie Dickey	Program Support Team
Kate Mendoza	Albuquerque Bernalillo County Water Utility Authority
Katrina Johns	U.S. Army Corps of Engineers
Kim Eichhorst	Bosque Ecosystem Monitoring Program
Luke Pierpont	Buckman Direct Diversion
Lynette Giesen	U.S. Army Corps of Engineers
Mark Kelly	Albuquerque Bernalillo County Water Utility Authority
Matthew Wunder	New Mexico Department of Game and Fish
Michelle Tuineau	Program Support Team
Mike Marcus	Assessment Payers Association of the Middle Rio Grande Conservancy District
Mo Hobbs	Albuquerque-Bernalillo County Water Utility Authority
Page Pegram	New Mexico Interstate Stream Commission
Ryan Gronewold	U.S. Army Corps of Engineers
Shawn Sartorius	U.S. Fish and Wildlife Service
Shay Howlin	Program Support Team
Thomas Turner	University of New Mexico
Wayne Pullan	U.S. Bureau of Reclamation

Recommendations to the Executive Committee
on Science and Adaptive Management Committee Membership

At the Executive Committee (EC) meeting on September 1, 2020, an administrative ad hoc group was formed and charged with reviewing applications for Science and Adaptive Management Committee (SAMC) membership. The administrative ad hoc group reviewing applications was comprised of the following members:

- Anne Marken, Middle Rio Grande Conservancy District (MRGCD)
- Grace Haggerty, New Mexico Interstate Stream Commission
- Jim Wilber, U.S. Bureau of Reclamation (Reclamation)
- Kate Mendoza, Albuquerque Bernalillo County Water Utility Authority (ABCWUA)
- Vicky Ryan, participating in place of Shawn Sartorius, U.S. Fish and Wildlife Service (USFWS)
- Janet Jarratt, Assessment Payers Association of the MRGCD

The administrative ad hoc group met on October 7, 2020. Sixteen applications from fourteen individuals were received and reviewed. Two applicants submitted applications for two positions. Below is a summary of the recommendations provided by the administrative hoc group to the EC:

- **Aquatic Ecologist**
  - Mo Hobbs, Water Resources Scientist, ABCWUA
    - Mo has worked on a variety of Rio Grande silvery minnow (RGSM) projects with a number of different organizations. She would also bring a fresh perspective to discussions.
  - Thomas Archdeacon, Fisheries Biologist, USFWS
    - Thomas understands the research history regarding the RGSM and has an extensive breadth of technical knowledge.

- **Terrestrial Ecologist**
  - Dave Moore, Wildlife Biologist, Reclamation
    - Dave has extensive expertise with both the SWFL and YBCU species and could bring an outside perspective to the SAMC.

- **Ecosystem Function Expert**
  - Meaghan Conway, Aquatic and Riparian Habitat Specialist, N.M. Department of Game and Fish
    - Meaghan has a wide range of expertise and a diverse background. In her application, she noted that she enjoyed summarizing scientific information.

- **Hydrologist**
  - Ryan Gronewold, Planning Branch Chief & Engineer, U.S. Army Corps of Engineers (USACE)
    - In the initial round of applications, there were no applicants for the hydrology position. The administrative ad hoc group requested that the Program Support Team reach out to USACE for potential applicants.
    - Ryan has a deep knowledge of the hydrology of the Middle Rio Grande.

- **Flexible Specialties**
    - *Climate Science*: Megan Friggens, Research Ecologist, USDA Forest Service, Rocky Mountain Research Station
        - Megan has expertise in climate science, which would be helpful for long-term planning. She can also bring an outside perspective.
    - *Geomorphology*: Ari Posner, Physical Scientist, Reclamation
        - Ari has a strong background with geomorphology in the Middle Rio Grande, including sediment transport.
    - *Statistics and Modeling*: Ara Winter, Data Manager, Bosque Ecosystem Monitoring Program
        - A statistician would be a strong addition to the SAMC. Ara brings an ecosystem approach to statistics and modeling.

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Charter for Science and Adaptive Management Committee
of the Middle Rio Grande Endangered Species Collaborative Program

I. Overview

The Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) By-Laws state that the Executive Committee (EC) may establish committees and ad hoc groups to carry out activities that further the MRGESCP's mission and goals. Upon approval of this charter, the EC establishes the Science and Adaptive Management Committee (SAMC).

The SAMC will operate under defined schedules, objectives, and tasks established in coordination with the EC. Methods for accomplishing established activities will be identified by the SAMC. The Program Support Team (PST) will coordinate with the SAMC to ensure that objectives and work products are clearly defined, assigned tasks are completed, and schedules are met.

The SAMC is not a voting or decision-making group. It will synthesize scientific findings, translate results into recommendations, cite appropriate evidence, and include rationale for any supported differences of opinion within the MRGESCP. Products of the SAMC will be delivered to the EC for approval and next steps. The EC continues to hold decision-making authority for the MRGESCP.

II. SAMC Purpose

The SAMC will coordinate the implementation of MRGESCP-related science initiatives and signatory efforts by defining and delegating tasks to Science and Technical (S&T) Ad Hoc Groups; compiling results from scientific studies, modeling, and monitoring efforts; and translating scientific findings into recommendations for best management practices in the Middle Rio Grande.

III. Responsibilities

The SAMC will be directed by the EC to implement the MRGESCP's Science & Adaptive Management (S&AM) Plan and Long-Term Plan. SAMC responsibilities include:

- Convening and coordinating S&T Ad Hoc Groups to complete tasks in support of the S&AM Plan
- Reviewing MRGESCP-related field studies and modeling/monitoring activities and translating results into best management practices
- Working with the Fiscal Planning Committee to coordinate EC-approved work products (e.g., studies, projects)
- Communicating to the EC the progress of S&AM Plan implementation, including a summary of updates to MRGESCP objectives and tools, with associated scientific justifications
- Regularly communicating updates at each EC meeting, which includes:
    - Presenting potential work products and the status of in-progress work products

- Proposing S&T Ad Hoc Groups with draft charges for EC review and approval
- Proposing implementation schedules for EC approval
- Suggesting amendments to the S&AM Plan
- Providing the documented range of SAMC opinions, as necessary, for EC review and consideration of next steps
- Providing new science-based recommendations for best research and management practices
- Providing new recommendations for independent peer review

IV. Membership

The SAMC shall consist of no more than eight (8) subject matter expert members, appointed by the EC. These positions include:

- Four (4) specified subject matter experts with the following areas of expertise:
    1. Aquatic ecology
    2. Terrestrial ecology
    3. Ecosystem
    4. Hydrology
- Up to four (4) flexible subject matter experts selected based on science-related needs, as determined by the EC. The SAMC may provide input on which areas of expertise would benefit the group, but the ultimate decision will be made by the EC.

One (1) EC member shall serve in an ex officio and advisory capacity to the SAMC. This position will not count towards the eight (8)-count membership, and the member will not participate in scientific deliberations as a technical expert.

The SAMC will be facilitated by the MRGESCP Science Coordinator and supported by the Program Support Team (PST). Members of the PST will not count towards the eight (8)-count membership and will not participate in scientific deliberations as technical experts.

V. Application Process

The EC, in coordination with the Science Coordinator and Program Support Team, will oversee and administer the application process. Interested individuals shall submit a formal application to the Science Coordinator. Individuals may apply for more than one SAMC position and must submit one application per position. Applications will be accepted from experts both internal and external to the MRGESCP.

The EC will review submitted applications and each EC representative will cast one vote per SAMC position. The EC will nominate EC members for the ex officio position and vote to fill the position. The EC has final decision-making authority on SAMC membership.

VI. Membership Terms

SAMC members shall be appointed by the EC for an initial two (2)-year term. Sitting SAMC members may apply for one (1)-year term limit extensions. Individuals may not serve on the SAMC for more than four (4) consecutive years, except as authorized by the EC.

VII. Roles

The eight (8) subject matter expert members will:

- Be chosen based on their technical qualifications and will serve as technical experts in their respective fields
- Not represent a signatory or organization as members of the SAMC
- Safeguard and support the scientific rigor of MRGESCP investigations and initiatives

The EC ex officio position will:

- Serve in an advisory capacity to the SAMC
- Provide the larger MRGESCP perspective
- Ensure topics and recommendations are within the scope decided by the EC
- Provide direction for completion of summary documents to the EC

The Facilitator (MRGESCP Science Coordinator) will:

- Coordinate meetings
- Facilitate the SAMC administrative functions, including:
    - Drafting S&T Ad Hoc Group charges
    - Coordinating with the FPC, S&T Ad Hoc Groups, and any independent peer review tasks
    - Relaying updates and recommendations to the EC

VIII. SAMC Meeting Operations

The SAMC shall meet at minimum once per quarter. The SAMC may meet more frequently if determined necessary based on work assignments. Formal agendas will be drafted for review and approval at each meeting. The PST will post SAMC meetings on the Program Portal event calendar and include draft agendas and read-aheads for download. Meeting agendas and read-aheads will be made available to SAMC members no later than one week in advance of the meeting date.

SAMC meetings shall be open to an audience of non-SAMC members. Only SAMC members may participate in meeting deliberations. Prior to the meeting, the SAMC may invite Ad Hoc Group leaders and/or outside experts to participate on specific agenda items, as needed. At each meeting, time will be included on the agenda for non-member comment. Non-members who wish to provide comment will have up to three (3) minutes to speak during this time, or they can choose to submit written comments to the Facilitator at any time.

The PST shall record formal meeting minutes that will be used to document meeting deliberations and communicate activities to MRGESCP members and external interested parties. Finalized agendas, read-aheads, and minutes will be included in the MRGESCP Annual Administrative Record and stored on the Program Portal.

IX. Science & Technical Ad Hoc Groups

The SAMC shall convene S&T Ad Hoc Groups to carry out discrete tasks necessary for executing the MRGESCP S&AM Plan and Long-Term Plan. These tasks include:

- Completing executive summaries to delineate alternative hypotheses regarding critical uncertainties, as needed
- Developing, refining, and updating conceptual ecological models
- Developing scopes of work to test research hypotheses and/or collect necessary data
- Compiling and synthesizing the results of field studies, monitoring, and modeling to develop recommendations
- Analyzing data to address hypotheses linked to scientific uncertainties
- Updating the S&AM Plan as new information becomes available and new questions emerge

The SAMC shall approve a charge for each S&T Ad Hoc Group that specifies:

- An assigned task
- A deadline to complete the assigned task
- Deliverables to the SAMC
- Membership

Once the task of a S&T Ad Hoc Group is complete and approved by the SAMC, the Ad Hoc Group will be sunsetted.

X. Recommendations to the EC

The SAMC will not be a decision-making body. When making science-based recommendations to the EC, the SAMC will strive to operate by consensus. In a report to the EC, the SAMC will include:

- (If consensus was reached) The consensus recommendation with scientific justification
- Considered alternatives to a recommendation
- (If consensus was not reached) Documentation of competing positions with appropriate scientific justification

Ultimately, the EC that determines the final recommendations of the MRGESCP.

If there is not a consensus recommendation from the SAMC, the EC may:

- Direct the SAMC to form a S&T Ad Hoc Group to investigate the issue in more detail
- Determine, with input from the SAMC, there is a need for independent peer review

XI. Annual Update and Evaluation of the SAMC by the EC

The MRGESCP Science Coordinator shall provide a formal annual update to the EC that summarizes:

- Accomplishments from the past year
- Status of the SAMC Work Plan
- Updates to MRGESCP science and adaptive management tools (e.g., conceptual ecological models, geospatial mapper, etc.)

- Any recommended amendments to the S&AM Plan or Long-Term Plan, including MRGESCP objectives

As part of the annual update, the EC shall evaluate SAMC membership. If there are empty seats on the SAMC, the EC may choose to seek applicants. The EC may also review requests for (1)-year term limit extensions or extensions past the limit of four (4) consecutive years.

XII. Conflict of Interest

SAMC members will abide by all federal, state, tribal, and local agency rules and regulations regarding conflict of interest.

XIII. Amendment of the SAMC Charter

This charter may be revised and amended as deemed appropriate by the MRGESCP By-Laws. Potential amendments will be open to input from the SAMC and must be approved by the EC.

Middle Rio Grande Endangered Species Collaborative Program's

2020 Science & Adaptive Management Committee (SAMC) Selection

27 October 2020

Program Support Team presentation to Executive Committee

SAMC Charter highlights

- ***Purpose***: The SAMC will coordinate the implementation of MRGESCP-related science initiatives and signatory efforts by defining and delegating tasks to Science and Technical (S&T) Ad Hoc Groups; compiling results from scientific studies, modeling, and monitoring efforts; and translating scientific findings into recommendations for best management alternatives in the Middle Rio Grande.
- ***Membership***: Up to 8 scientists including 4 specified subject matter experts in Aquatic Ecology, Terrestrial Ecology, Ecosystem Function and Hydrology; and up to 4 flexible subject matter experts; plus 1 *ex officio* EC member and 1 facilitator (PST Science Coordinator)

SAMC Preliminary Tasks for 2020-2021

- Orientation and review of S&AM Plan, CP Structure and AM Tools
- Present a topic at the Science Symposium?
- Organize MRGESCP Objectives Workshops – define objectives to address CP goals and guide scientific activities
- Analyze and dissect remainder of Population Monitoring Work Group tasks into manageable questions; Develop charges and convene Technical Ad Hoc Groups to address each
- Determine components of AM database requiring input from subject matter experts and organize workshops/ad hoc groups
- Help develop and update the Long-Term Plan

2020 SAMC Membership Recommendations

Administrative Ad Hoc Group:

Anne Marken (MRGCD)

Grace Haggerty (NMISC)

Jim Wilber (Reclamation)

Kate Mendoza (ABCWUA)

Janet Jarratt (APA) *unable to attend*

Vicky Ryan (USFWS)

Recommended SAMC Members:

Mo Hobbs (Aquatic Ecology)

Thomas Archdeacon (Aquatic Ecology)

Dave Moore (Terrestrial Ecology)

Megan Conway (Ecosystem Function)

Ryan Gronewold (Hydrology)

Megan Friggens (Climate Science)

Ari Posner (Geomorphology)

Ara Winter (Statistics & Modeling)

Alan Hatch (EC *ex officio*)

Middle Rio Grande Endangered Species Collaborative Program's

Draft Science & Adaptive Management Plan

27 October 2020

Program Support Team presentation to Executive Committee

Science & AM Plan and Long-Term Plan

- Together, the Science & AM Plan and the Long-Term Plan provide the framework for implementation of the Collaborative Program's science and AM process.
  - The **Science & AM Plan** defines the MRGESCP's role and associated processes in providing science-based recommendations for management of the MRG. It describes the MRGESCP's science and AM process.
  - The **Long-Term Plan** is an evolving communication and planning tool that is generated by organizing scientific activities into periodic work plans (i.e., annual, biennial, triennial). It is heavily informed by the AM Database.

Science & Adaptive Management Process - Next Steps

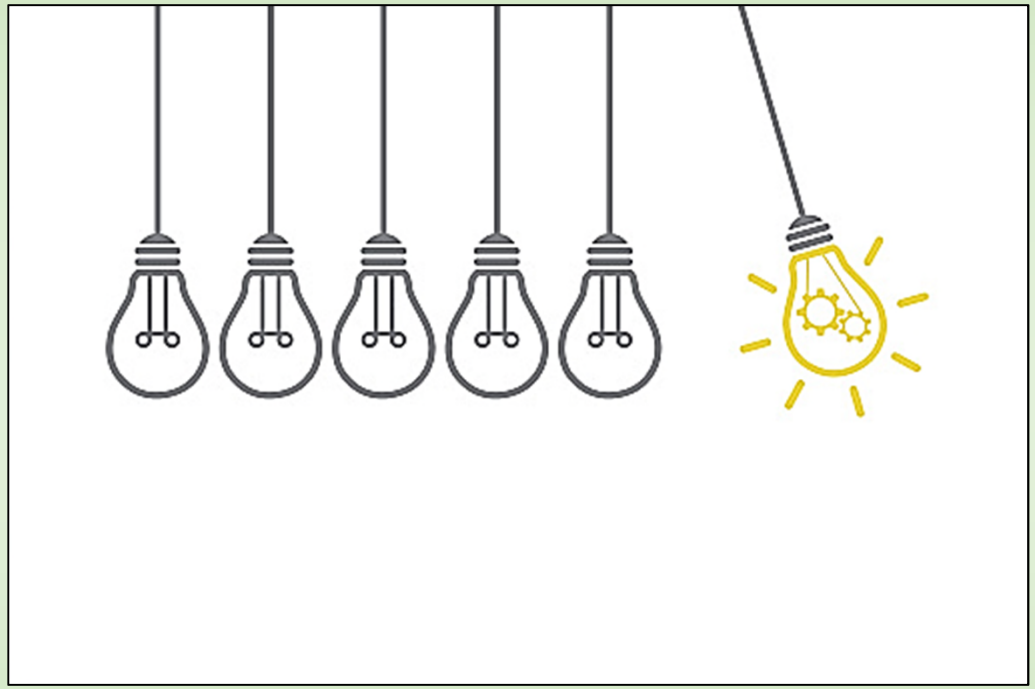
- ✓**AMWG Review**: August 20, 2020 – September 17, 2020
- ✓**PST & AMWG Individual Review Meetings**: August 27, 2020 – September 17, 2020
- ✓**PST Revision:** September 17 – 29, 2020
- ✓**Revised Draft to the MRGESCP**: September 30, 2020 – October 7, 2020
- ✓**PST Revision & WEST Technical Editing**: October 8 – 16, 2020
- **Final Draft S&AM Plan to EC for Review**: October 22, 2020 – December 2, 2020
- **First SAMC Meeting**: November 2020
- **Draft Long-Term Plan (LTP) Framework to the SAMC**: November 2020
- **PST & EC Individual Review Meetings**: October 26, 2020 – November 18, 2020
- **PST Revision**: November 18, 2020 – December 4, 2020
- **Final S&AM Plan Draft to EC as Read Ahead**: Week of December 7, 2020
- **Objectives Workshop**: Week of December 7, 2020
- **EC Meeting – Final S&AM Plan and LTP Approval**: December 17, 2020
- **Operational AM Database**: Spring 2021
- **LTP Update:** Late Spring/Summer 2021

MRGESCP Science & Adaptive Management Plan – What's New?

I. Re-organization with the Science and Adaptive Management Committee

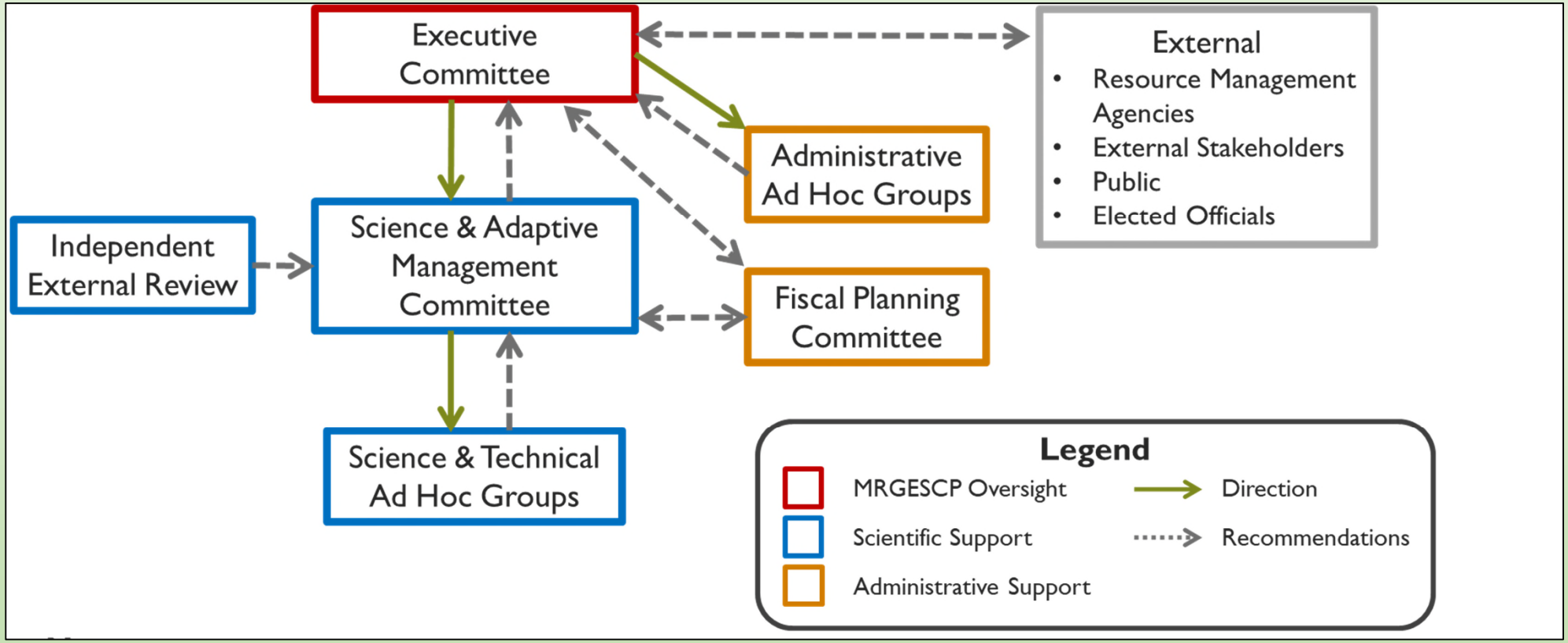
II. Construction of an Adaptive Management Database and Project Bank

III. Commitment to iterative learning



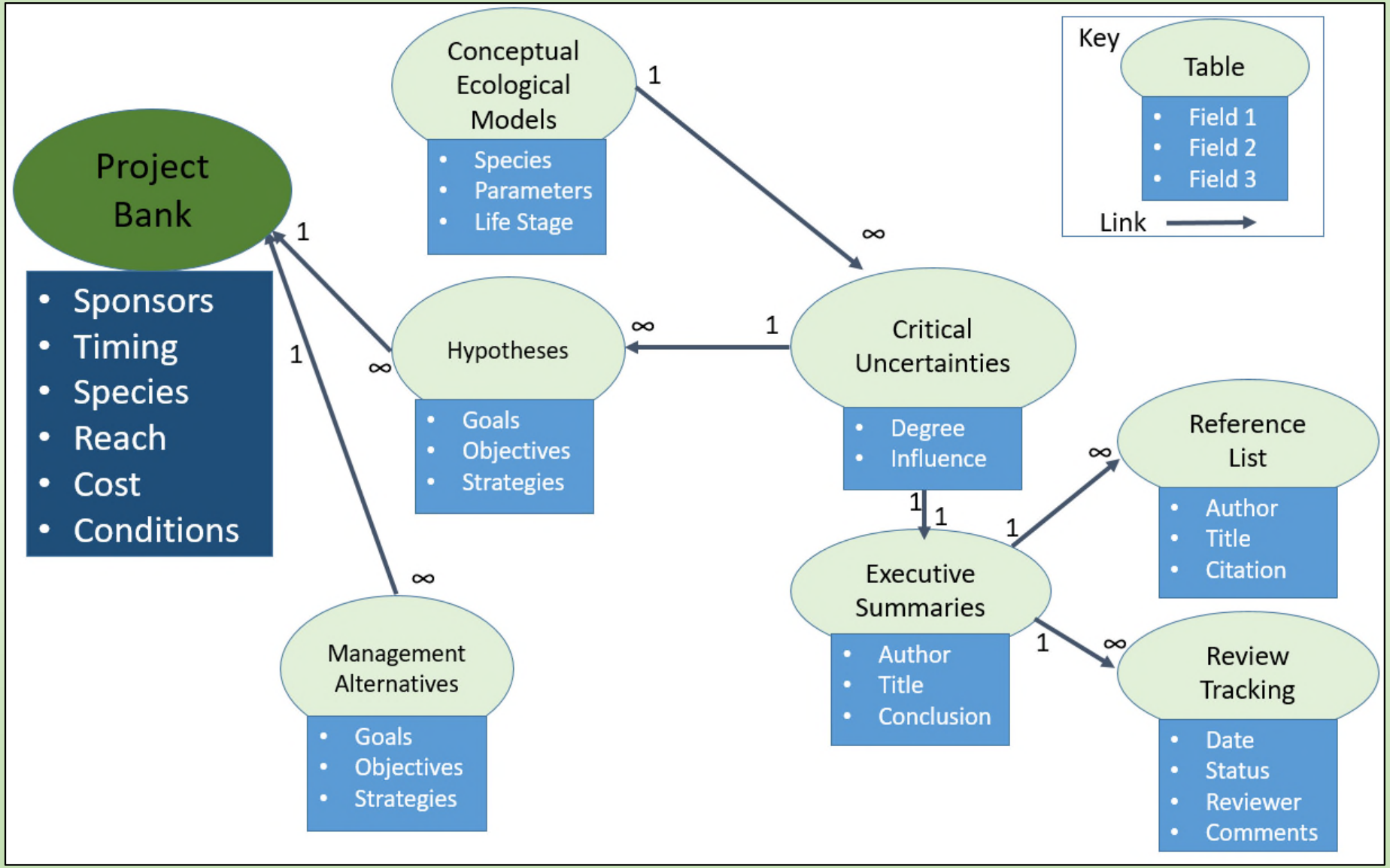
MRGESCP Science & Adaptive Management Plan – What's New?

I. Re-organization of the Collaborative Program's structure, with the Science and Adaptive Management Committee translating and relating scientific evidence to the Executive Committee.



MRGESCP Science & Adaptive Management Plan – What's New?

II. Construction of an AM Database to store and disseminate accurate, up-to-date information on AM uncertainties, projects, and monitoring information, and to facilitate transparent prioritization and support informed decision making.



Adaptive Management Database FAQ

- Who is developing the AM Database?

  The Program Support Team (PST) is building the AM Database and establishing the functional linkages that make it relational. Linkages can be reviewed and modified by Administrative and Technical Ad Hoc Groups.

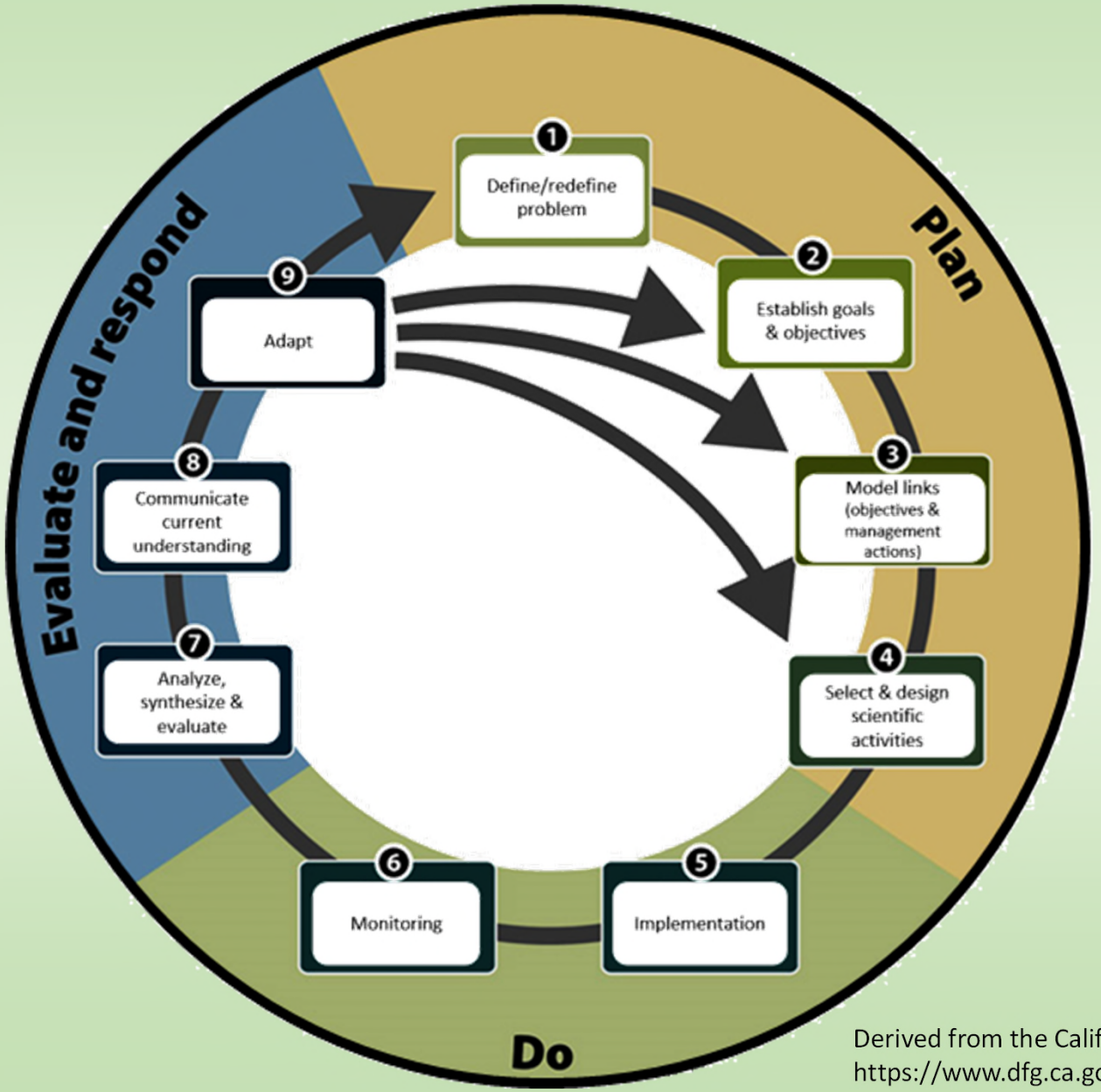
- On what platform is the AM Database being developed?

  Initially, the AM Database is being formatted using MS Access (for convenience). Once formatting is complete, it can be transitioned to a SQL server (for stability).

- Who will manage and host the AM Database?

  During development, the PST will manage and host the AM Database. Once established, the Collaborative Program can decide between the Program Portal or a cloud-based hosting service. Scoping for these and additional options can be provided by the PST.

MRGESCP Science & Adaptive Management Plan – What's New?



III. Commitment to iterative learning through tracking, evaluating, and incorporating scientific evidence into Collaborative Program objectives, experimental designs and decision-support tools.

Derived from the California Department of Fish and Wildlife:
https://www.dfg.ca.gov/erp/adaptive_management.asp

MRGESCP Science & Adaptive Management Plan – What will the SAMC communicate to the EC?

- Summary of modifications to MRGESCP objectives and tools (e.g., CEMs) *with scientific justifications*.
- Recommended modifications to the Long-Term Plan *with scientific justifications*.
- Recommended management alternatives *with analysis and scientific justifications*.



MRGESCP Science & Adaptive Management Plan – What will the MRGESCP communicate?



- Recommend studies and projects that reduce critical, management-relevant uncertainties (i.e., Long-Term Plan)
- Recommend adjustments to management actions backed by scientific evidence

Long-Term Plan

- LTP first iteration – December 2020
  - The Project Bank with linkages to draft objectives and identified uncertainties
  - Will not be prioritized
- LTP update – late Spring/early Summer 2021
  - Top-down from agreed upon objectives
  - Query-able using different filters

Long-Term Plan Linkages

- Objectives → Uncertainties → Projects
- Sortable and query-able by:
  - Project type
  - Project focus
  - Necessary physical conditions
  - Reaches
  - Authority
- Also query-able by:
  - Cost estimate
  - Temporal scale

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Charter for Science and Adaptive Management Committee
of the Middle Rio Grande Endangered Species Collaborative Program

Approved by the Executive Committee on October 27, 2020

I. Overview

The Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) By-Laws state that the Executive Committee (EC) may establish committees and ad hoc groups to carry out activities that further the MRGESCP's mission and goals. Upon approval of this charter, the EC establishes the Science and Adaptive Management Committee (SAMC).

The SAMC will operate under defined schedules, objectives, and tasks established in coordination with the EC. Methods for accomplishing established activities will be identified by the SAMC. The Program Support Team (PST) will coordinate with the SAMC to ensure that objectives and work products are clearly defined, assigned tasks are completed, and schedules are met.

The SAMC is not a voting or decision-making group. It will synthesize scientific findings, translate results into recommendations, cite appropriate evidence, and include rationale for any supported differences of opinion within the MRGESCP. Products of the SAMC will be delivered to the EC for approval and next steps. The EC continues to hold decision-making authority for the MRGESCP.

II. SAMC Purpose

The SAMC will coordinate the implementation of MRGESCP-related science initiatives and signatory efforts by defining and delegating tasks to Science and Technical (S&T) Ad Hoc Groups; compiling results from scientific studies, modeling, and monitoring efforts; and translating scientific findings into recommendations for best management practices in the Middle Rio Grande.

III. Responsibilities

The SAMC will be directed by the EC to implement the MRGESCP's Science & Adaptive Management (S&AM) Plan and Long-Term Plan. SAMC responsibilities include:

- Convening and coordinating S&T Ad Hoc Groups to complete tasks in support of the S&AM Plan
- Reviewing MRGESCP-related field studies and modeling/monitoring activities and translating results into best management alternatives
- Working with the Fiscal Planning Committee to coordinate EC-approved work products (e.g., studies, projects)
- Communicating to the EC the progress of S&AM Plan implementation, including a summary of updates to MRGESCP objectives and tools, with associated scientific justifications

- Regularly communicating updates at each EC meeting, which includes:
    - Presenting potential work products and the status of in-progress work products
    - Informing the EC on formation of S&T Ad Hoc Groups with assigned tasks and deadlines
    - Proposing implementation schedules for EC approval
    - Suggesting amendments to the S&AM Plan
    - Providing the documented range of SAMC opinions, as necessary, for EC review and consideration of next steps
    - Providing new science-based recommendations for best research and management alternatives
    - Providing new recommendations for independent peer review

IV. Membership

The SAMC shall consist of no more than eight (8) subject matter expert members, appointed by the EC. These positions include:

- Four (4) specified subject matter experts with the following areas of expertise:
    1. Aquatic ecology
    2. Terrestrial ecology
    3. Ecosystem
    4. Hydrology
- Up to four (4) flexible subject matter experts selected based on science-related needs, as determined by the EC. The SAMC may provide input on which areas of expertise would benefit the group, but the ultimate decision will be made by the EC.

One (1) EC member shall serve in an ex officio and advisory capacity to the SAMC. This position will not count towards the eight (8)-count membership, and the member will not participate in scientific deliberations as a technical expert.

The SAMC will be facilitated by the MRGESCP Science Coordinator and supported by the Program Support Team (PST). Members of the PST will not count towards the eight (8)-count membership.

V. Application Process

The EC, in coordination with the Science Coordinator and Program Support Team, will oversee and administer the application process. Interested individuals shall submit a formal application to the Science Coordinator. Individuals may apply for more than one SAMC position and must submit one application per position. Applications will be accepted from experts both internal and external to the MRGESCP.

The EC will review submitted applications and each EC representative will cast one vote per SAMC position. The EC will nominate EC members for the ex officio position and vote to fill the position. The EC has final decision-making authority on SAMC membership.

VI. Membership Terms

SAMC members shall be appointed by the EC for an initial two (2)-year term. Sitting SAMC members may apply for one (1)-year term limit extensions. Individuals may not serve on the SAMC for more than four (4) consecutive years, except as authorized by the EC.

VII. Membership Vacancies

If a vacancy on the SAMC occurs mid-term, it will remain open unless the EC determines a need to fill the position for the remainder of the term.

VIII. Roles

The up to eight (8) subject matter expert members will:

- Be chosen based on their technical qualifications and will serve as technical experts in their respective fields
- Not represent a signatory or organization as members of the SAMC
- Safeguard and support the scientific rigor of MRGESCP investigations and initiatives

The EC ex officio position will:

- Serve in an advisory capacity to the SAMC on policy
- Provide the larger MRGESCP perspective
- Ensure topics and recommendations are within the scope decided by the EC
- Provide direction for completion of summary documents to the EC

The Facilitator (MRGESCP Science Coordinator) will:

- Coordinate meetings
- Facilitate the SAMC administrative functions, including:
    - Drafting S&T Ad Hoc Group charges
    - Coordinating with the FPC, S&T Ad Hoc Groups, and any independent peer reviewers
    - Relaying updates and recommendations to the EC

IX. SAMC Meeting Operations

The SAMC shall meet at minimum once per quarter. The SAMC may meet more frequently if determined necessary based on work assignments. Formal agendas will be drafted for review and approval at each meeting. The PST will post SAMC meetings on the Program Portal event calendar and include draft agendas and read-aheads for download. Meeting agendas and read-aheads will be made available to SAMC members no later than one week in advance of the meeting date.

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or at the specific request of the SAMC, or they can choose to submit written comments to the Facilitator at any time.

The PST shall record formal meeting minutes that will be used to document meeting deliberations and communicate activities to MRGESCP members and external interested parties. Finalized agendas, read-aheads, and minutes will be included in the MRGESCP Annual Administrative Record and stored on the Program Portal.

X. Science & Technical Ad Hoc Groups

The SAMC shall form S&T Ad Hoc Groups charged with carrying out discrete tasks necessary for executing the MRGESCP S&AM Plan and Long-Term Plan. These tasks include:

- Addressing specified scientific uncertainties
- Completing executive summaries to delineate alternative hypotheses regarding critical uncertainties, as needed
- Developing, refining, and updating conceptual ecological models
- Developing scopes of work to test research hypotheses and/or collect necessary data
- Compiling and synthesizing the results of field studies, monitoring, and modeling to develop recommendations
- Analyzing data to address hypotheses linked to scientific uncertainties
- Updating the S&AM Plan as new information becomes available and new questions emerge

The SAMC shall approve a charge for each S&T Ad Hoc Group that specifies:

- An assigned task
- A deadline to complete the assigned task
- Deliverables to the SAMC
- Membership

Once the task of a S&T Ad Hoc Group is complete and approved by the SAMC, the Ad Hoc Group will be sunsetted.

XI. Recommendations to the EC

The SAMC will not be a decision-making body. When making science-based recommendations to the EC, the SAMC will strive to operate by consensus. In a report to the EC, the SAMC will include:

- (If consensus was reached) The consensus recommendation with scientific justification
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Ultimately, the EC that determines the final recommendations of the MRGESCP.

If there is not a consensus recommendation from the SAMC, the EC may:

- Direct the SAMC to form a S&T Ad Hoc Group to investigate the issue in more detail
- Determine, with input from the SAMC, there is a need for independent peer review

XII. Annual Update and Evaluation of the SAMC by the EC

The MRGESCP Science Coordinator shall provide a formal annual update to the EC that summarizes:

- Accomplishments from the past year
- Status of the SAMC Work Plan
- Updates to MRGESCP science and adaptive management tools (e.g., conceptual ecological models, geospatial mapper, etc.)
- Any recommended amendments to the S&AM Plan or Long-Term Plan, including MRGESCP objectives

As part of the annual update, the EC shall evaluate SAMC membership. If there are empty seats on the SAMC, the EC may choose to seek applicants. The EC may also review requests for (1)-year term limit extensions or extensions past the limit of four (4) consecutive years.

XIII. Conflict of Interest

SAMC members will abide by all federal, state, tribal, and local agency rules and regulations regarding conflict of interest. SAMC members are required to recuse themselves when they identify a potential financial conflict of interest.

XIV. Amendment of the SAMC Charter

This charter may be revised and amended as deemed appropriate by the MRGESCP By-Laws. Potential amendments will be open to input from the SAMC and must be approved by the EC.

Executive Committee Meeting

December 17, 2020

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *MRGESCP Approved 2020 Work Plan Overview [read-ahead, spreadsheet]*
- *Draft 2021 MRGESCP Work Plan [read-ahead, draft, spreadsheet]*
- *Draft S&AM Plan [read-ahead, draft]*
- *S&AM Plan Responses to Written Comments [read-ahead, spreadsheet]*
- *Draft LTP [read-ahead, draft]*
- *LTP Responses to Written Comments [read-ahead, spreadsheet]*
- *SAMC Update [presentation]*
- *PMWG Update to the EC [follow-up]*
- *2008 MOA for the MRGESCP [follow-up, not included]*
- *MRGESCP 2008 MOA Addendum Admin Ad Hoc Group Charge [follow-up]*
- *MRGESCP By-Laws Admin Ad Hoc Group Charge [follow-up]*
- *Approved LTP [follow-up, not included]*
- *Approved S&AM Plan [follow-up, not included]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Executive Committee (EC) Meeting
December 17, 2020
9:00 AM – 12:00 PM

Location: Zoom Meeting
https://west-inc.zoom.us/j/89835931 20?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Call-In: +1-669-900-6833
Meeting ID: 898-359-3120; Passcode: 1251

Meeting Agenda

Meeting Objectives:

- *Approve the Science & Adaptive Management Plan (S&AM Plan)*
- *Approve the Long-Term Plan (LTP)*
- *Approve the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) 2021 Work Plan*
- *Discuss an extension of the 2008 Memorandum of Agreement for MRGESCP signatories*

9:00 – 9:10	**Welcome, Introductions, Agenda Review** • Ground rules for Zoom meeting ✓ **Decision**: Approval of December 17, 2020 EC meeting agenda	*EC Co-chairs*
9:10 – 9:20	**October 27, 2020 Meeting Summary** • Action Items Review ✓ **Decision**: Approval of October 27, 2020 EC meeting minutes Read-ahead: ☐ Draft October 27, 2020 EC meeting minutes	*EC Co-chairs*
9:20 – 9:40	**Program Manager Update** • 2020 Accomplishments • Administrative Announcement: o FY20 Annual Report write-ups submissions o FY20 Non-Federal cost share report submissions • Program Portal Updates ➢ **Action Item**: Submit FY20 Annual Report items to PST by January 15, 2021 ➢ **Action Item**: Submit FY20 cost share items to PST by January 22, 2021	*Debbie Lee, Program Support Team (PST)*

	Read-ahead: ☐ 2020 MRGESCP Work Plan Review	
9:40 – 9:50	**Science & Adaptive Management Committee (SAMC) Update**	*Catherine Murphy, PST*
9:50 – 10:00	**Population Monitoring Work Group (PMWG) Update** • Update and timeline on PMWG summary report • Next steps for PMWG tasks and incorporating into SAMC efforts ➢ **Action Item**: SAMC draft a charge to form a Science & Technical Ad Hoc Group for the purpose of completing the summary report by the March 2021 EC meeting	*Rich Valdez, SWCA Environmental Consultants*
10:00 – 10:20	**2021 MRGESCP Work Plan** ✓ **Decision**: Approval of MRGESCP 2021 Work Plan Read-ahead: ☐ Draft MRGESCP 2021 Work Plan	*Debbie Lee, PST*
10:20 – 10:30	**Break**	
10:30 – 11:00	**Science & Adaptive Management Plan** • Discussion of S&AM Plan ✓ **Decision**: Approval of MRGESCP S&AM Plan Read-ahead: ☐ Draft MRGESCP S&AM Plan ☐ Response to S&AM Plan Written Comments	*Catherine Murphy, PST*
11:00 – 11:30	**Long-Term Plan** • Purpose of LTP • Discussion of LTP ✓ **Decision**: Approval of MRGESCP LTP Read-ahead: ☐ Draft MRGESCP LTP ☐ Response to LTP Written Comments	*Debbie Lee, PST*
11:30 – 11:35	**Sunsetting of Scientific and Technical Work Groups** • Formal sunsetting of MRGESCP scientific and technical work groups o Science/Habitat Restoration Work Group o PMWG o Adaptive Management Work Group o Genetics Work Group • Letters of appreciation	*EC Co-chairs*

11:35 – 11:40	**Memorandum of Agreement**	*EC Co-chairs*

- **Action Item**: Form an Administrative Ad Hoc Group to draft an addendum to extend the 2008 MOA for one year by February 12, 2020
- **Action Item**: Signatories complete a review of the addendum by the March 2021 EC meeting

11:40 -11:50 **Announcements**

- Rick Billings Memorial Award
  - About
  - Nominations
- Recognition of John Stomp, Albuquerque Bernalillo County Water Utility Authority

11:50 – 11:55 **Public Comment**

11:55 – 12:00 **Meeting Summary and Action Items Review** *EC Co-chairs*

- Next EC Meeting: March 2021

12:00 **Adjourn**

Note: An Executive session will follow the adjournment of the public portion of the EC meeting for EC members to discuss the Program and Science Support contract.

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Executive Committee (EC)
Meeting Minutes

December 17, 2020; 9:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of December 17, 2020 EC meeting agenda
- ✓ Approval of October 27, 2020 EC meeting minutes
- ✓ Approval of the Science & Adaptive Management (S&AM) Plan
- ✓ Approval of the 2021 MRGESCP Work Plan
- ✓ Approval of the Long-Term Plan (LTP) with amendments
- ✓ Approval of formation of an Administrative Ad Hoc Group to write an addendum to the 2008 Memorandum of Agreement (MOA), extending the MOA for one calendar year to May 2022, with the following membership:
    - Bill Grantham, New Mexico Office of the Attorney General
    - Chris Shaw (for review), New Mexico Interstate Stream Commission (NMISC)
    - Jim Wilber, U.S. Bureau of Reclamation (Reclamation)
    - Kim Bannerman, Office of the Solicitor, U.S. Department of the Interior
- ✓ Approval of formation of an Administrative Ad Hoc Group to revise the MRGESCP By-Laws, with the following membership:
    - Bill Grantham
    - Chris Shaw
    - Jim Wilber
    - Kim Bannerman
    - Trevor Stevens, U.S. Army Corps of Engineers (USACE)
- ✓ All standing science and technical work groups are sunsetted as of December 17, 2020

Announcements:

- ❖ John Stomp, Albuquerque Bernalillo County Water Utility Authority (ABCWUA), was awarded the Rick Billings Memorial Award
- ❖ Mark Kelly, ABCWUA, will serve as the Non-Federal EC Co-Chair starting January 2021

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Schedule the next EC meeting for March 25, 2021	12/17/2020
PST	Send letters of appreciation to members of sunsetted science and technical work groups with signatures from the EC co-chairs	ASAP
PST	Upload the S&AM Plan and LTP to the Program Portal	12/21/2020
PST	Send the 2008 MOA in the EC follow-up	12/21/2020

Science and Adaptive Management Committee (SAMC)	Draft charges to form the following Science & Technical (S&T) Ad Hoc Groups: • Rio Grande silvery minnow (RGSM) genetics based on a specified question/on a per question basis/to answer XX question • Population Monitoring Work Group summary report • RGSM population modeling	1/13/2021
PST	Send the initial draft S&T ad hoc group charges to the EC for review and comment	1/15/2021
Lynette Giesen	Check with U.S. Geological Survey on timing needs for the future Program Portal contract, given the timing of licensing renewals and USACE's ability to continue funding	Early January
Reclamation, ABCWUA, MRGCD	If USACE can no longer fund the Portal, discuss alternative Portal funding options	ASAP once provided info from USACE
Fiscal Planning Committee (FPC)	Draft a proposal for changing cost share reporting to be objective-driven, marketable for the Collaborative Program, and not onerous, and submit the proposal for EC review	3/18/2021
2008 MOA Addendum Administrative Ad Hoc Group	Draft an addendum to the 2008 MOA to extend it by one year to May 2022; provide the draft addendum for EC review	3/18/2021
By-Laws Administrative Ad Hoc Group	Revise the MRGESCP By-Laws to include updates resulting from implementation of the S&AM Plan, the LTP, and the new organizational structure	7/2021
OUTSTANDING ACTION ITEMS		
All Signatories	Submit FY20 MRGESCP Annual Report write-ups to the PST	1/15/2021
Non-Federal Signatories	Submit FY20 Cost Share to the PST	1/22/2021

Next Meeting: March 25, 2021; 9:00 AM–12:00 PM

Meeting Summary

Welcome, Introductions, Agenda Review
Ground rules for Zoom meeting

Wayne Pullan, Reclamation, and Federal Co-Chair, opened the meeting and led introductions. The EC approved the December 17, 2020 meeting agenda with no amendments.

- ✓ **Decision**: Approval of the December 17, 2020 meeting agenda by the EC

October 27, 2020 Meeting Summary
Action items review

Debbie Lee, Program Manager with the PST, reviewed action items from the October 27, 2020 meeting. The October 27, 2020 meeting minutes were approved by the EC with no amendments.

- ✓ **Decision**: Approval of the October 27, 2020 EC meeting minutes by the EC

Program Manager Update
Debbie L. presented the Collaborative Program's 2020 accomplishments, made administrative announcements, and gave Program Portal updates. These were the main points of the Program Manager update:

2020 Accomplishments:

- Completed items on the 2020 Collaborative Program Work Plan, including the LTP and S&AM Plan.
- Completed development of the new Collaborative Program infrastructure, which included the sunsetting of the standing science and technical work groups.
- Formed the SAMC.
- Partially completed discussion on goals, objectives, and strategies.
    - Goals were approved in early 2020.
    - Draft objectives and strategies are included in the S&AM Plan, and will be finalized at the Objectives Workshop in February 2021.
- Revisions of the MRGESCP by-laws were not completed in 2020, as the structure of the SAMC was not finalized until late in the year.
    - The By-Laws Ad Hoc Group will commence in 2021, with the goal of completing revisions by the July EC meeting.
- 2020 work plans for all work groups were completed. 2021 work plans were not developed, as standing works groups were to be sunsetted. The 2021 MRGESCP Work Plan is up for approval.
- The Fiscal Year (FY) 2019 Annual Report was adopted in September.
- FY19 cost share was reported in February 2020.
- The Program Portal was completed; it features an event calendar, a document library, downloadable datasets, an interactive mapper, public pages, and internal work group pages.
    - There will not be funding for further development from USACE.
- The 2020 Science Symposium was held early December 2020.

Administrative Announcements:

- Submit 2020 annual report write-ups by January 15, 2021.
- Submit 2020 cost share by January 22, 2021.
    - An EC member requests that federal agencies share their total contributions to the Collaborative Program, including personnel and project funds
        - Reclamation has a cost structure for the Collaborative Program; it may be easiest to share what was charged to those cost authorities.
        - USACE and Reclamation shared basic cost breakdown by category in past annual reports.
        - U.S. Fish and Wildlife Service (USFWS) funds projects that are not directly related to the Collaborative Program, and may be able to come up with different numbers.
    - To clarify, the EC member is asking for an accounting of all the money spent on the Collaborative Program from all signatories to get a better sense of funding and participation levels.
    - This issue has been discussed a few times over the past several years, and the EC agreed that the level of information provided to EC would be consistent in that all signatories would have to commit to providing the same level of detail in their financial reporting.
    - The number reported by federal agencies would not be meaningful as it varies.
    - If the non-federal agencies are at 25% cost share, they need to know what number to match.
    - The Collaborative Program needs to discuss the issue further.
        - The purpose and objectives of reporting needs to be clear, there needs to be a consistent means of reporting, and reporting should not be burdensome.
    - At the 2017 EC retreat, the EC discussed waiving the non-federal cost share obligations.
        - Public agencies have a responsibility to report information and the Collaborative Program has a great story to tell.
    - The Collaborative Program should highlight benefits and accomplishments, not just money spent.
    - The PST will work with the FPC to draft a proposal that changes cost share reporting.

➢ **Action Item**: The PST will work with the FPC to draft a proposal for changing cost share reporting to be objective-driven, marketable for the Collaborative Program, and not onerous, and submit the proposal for EC review

Program Portal Updates:

- Current USACE funding for the Program Portal is ending January 2021.
- ABCWUA or Middle Rio Grande Conservancy District (MRGCD) may be able to pick up funding.
    - Funding for maintenance is $12,000–$16,000 a year. This will not include any further development.
- USACE will know in January if it can continue to provide funding.
- How does the Collaborative Program ensure there is not a break in funding?
    - U.S. Geological Survey (USGS) may be able to continue hosting for a couple months if there is a break in funding, but there will be no further development.
        - The PST can upload documents and make edits, but cannot fix anything that breaks.

    - If USACE cannot continue funding past January, ABCWUA, MRGCD, and Reclamation will figure out funding as soon as possible.
- The Collaborative Program needs to know when USGS licenses are up for renewal, as those are big costs.
    - Lynette G., USACE, will confirm that with USGS.

➢ **Action Item**: Lynette Giesen will check with USGS on timing needs for the future Program Portal contract, given the timing of licensing renewals and USACE's ability to continue funding
➢ **Action Item:** If USACE can no longer fund the Portal, MRGCD, ABCWUA, and Reclamation will discuss alternative Portal funding options

Science & Adaptive Management Committee Update

Catherine Murphy, Science Coordinator and SAMC Facilitator with the PST, gave the SAMC update (see slides). These were the main points from the update:

- The SAMC had two meetings, and decided to meet once a month.
- The Collaborative Program will be reorganizing information using a hierarchical approach that starts at the top with mission, then goals, then objectives, then strategies.
- A Collaborative Program-wide Objectives Workshop will be held to revise the preliminary objectives (listed in the S&AM Plan).
    - The draft objectives will be reworked to be S.M.A.R.T. (Specific, Measurable, Attainable, Relevant, Time-bound).
    - Objectives will be aligned with the mission statement and goals.
        - The Objectives Workshop will be held annually to maintain this alignment.
- The SAMC is working to transition remaining tasks from the standing work groups to the S&T Ad Hoc Group format under the new Collaborative Program structure.
    - The SAMC gave the following feedback on forming and assigning tasks to groups:
        - When designing tasks, the critical uncertainties to be addressed should be identified, if appropriate.
        - Limit the scope of tasks.
        - Tasks should be S.M.A.R.T.
        - Tasks should be designed iteratively. The SAMC will present an ad hoc group with a question, the group will come up with approaches, and the SAMC will pick the most suitable approach.
        - Reports from ad hoc group should list all assumptions and characterize uncertainty.
    - Work that is outstanding from sunsetted work groups will be transitioned to an S&T Ad Hoc Group structure:
        - Rio Grande silvery minnow (RGSM) population modeling group from the Population Monitoring Work Group (PMWG).
        - Prioritized RGSM genetics questions, such as those related to development of high-throughput markers.
        - PMWG summary report authors.
- The SAMC will integrate the independent science panel recommendations with the conceptual ecological models to develop one list of uncertainties.
- The SAMC will incorporate climate science elements into the long-term planning strategies.
- The SAMC will work to characterize variability, precision, bias, and confidence associated with recommendations.

Population Monitoring Work Group Update

Update and timeline on PMWG summary report
Next steps for PMWG tasks and incorporating into SAMC efforts

Rich Valdez, SWCA Environmental Consultants, and chair of the PMWG, provided an update on the status of the PMWG summary report (see update). These were the main points from the update:

- The PMWG is working on two projects: the summary report and population modeling effort.
    - Summary Report:
        - PMWG was assigned three tasks. Tasks 1 and 2 are summarized in the report. Task 3 has not yet been completed.
        - The findings and recommendations from the PMWG summary report will be incorporated by the SAMC into the efforts to implement the new S&AM Plan.
        - The report is expected to be completed in March 2021.
        - A summary of findings and recommendations will be presented to the EC in March.
    - Population Modeling:
        - Charles Yackulic, USGS, is developing an integrated model that uses the population monitoring data to predict RGSM responses to different factors.
        - Members of the PMWG are working with Charles Y., and may need to continue working with him through June 2021.
- How will this group continue under the SAMC?
    - The population modeling group and summary report group will continue as separate S&T Ad Hoc Groups. They will iteratively help the SAMC design their tasks.
- Is there an EC function in group development?
    - The SAMC does not require the oversight of the EC to form groups.
    - The SAMC can choose to present important group charges to the EC for feedback.
    - The EC requested that the first S&T Ad Hoc Group charges be presented to the EC for feedback, in the interest of transparency in the new process.
- The SAMC will draft charges for proposed S&T Ad Hoc Groups.
    - The groups will form in the first quarter of 2021.
    - The EC will be able to provide input on the charges, and the SAMC will review the feedback, make any necessary changes, and approve the charges.
- Are these standing groups or do they all have an end date?
    - All the ad hoc groups will have specific charges with deliverables and schedules, and will be sunsetted by the SAMC once deliverables have been completed.

➢ **Action Item**: The SAMC will draft charges to form the following S&T Ad Hoc Groups:
    - RGSM genetics based on a specified question/on a per question basis/to answer XX question
    - PMWG summary report
    - RGSM population modeling

➢ **Action Item**: The PST will send the initial draft S&T ad hoc group charges to the EC for review and comment

2021 MRGESCP Work Plan

Debbie L. presented the 2021 MRGESCP Work Plan (see plan), which was approved by the EC without amendment.

- ✓ **Decision**: Approval of the 2021 MRGESCP Work Plan by the EC

Science & Adaptive Management Plan

Catherine M. opened discussion regarding the S&AM Plan (see plan), which was approved by the EC without amendment. These were points of discussion:

- The S&AM Plan is a living document and can be changed to meet Collaborative Program needs.
- There was a suggestion to approve the S&AM Plan and document examples of how it works as the Collaborative Program moves through it.

- ✓ **Decision**: Approval of the S&AM Plan by the EC

Long-Term Plan

Debbie L. opened discussion regarding the LTP (see plan), which was approved by the EC with amendment. These were points of discussion:

- The purpose of the December 2020 LTP is to assist USACE in obtaining funding.
- The LTP will be updated in summer or fall of 2021 to include the objectives as defined and approved by the Collaborative Program.
- Development of the LTP is an iterative process; once the objectives and strategies are approved, they can be linked to the Project Bank to inform the LTP.

- ✓ **Decision**: Approval of the LTP by the EC with amendment
- ➢ **Action Item**: The PST will upload the approved S&AM Plan and LTP to the Program Portal

Sunsetting of Standing Scientific and Technical Work Groups

Formal sunsetting of MRGESCP standing scientific and technical work groups
Letters of appreciation

Wayne Pullan led the EC in thanking the members of the sunsetted groups for their work over the years.

- Letters of appreciation will be sent to sunsetted group members.
- Under the new structure, the Collaborative Program will strive to do justice by the work that has been done.

- ✓ **Decision**: All standing science and technical workgroups are sunsetted as of December 17, 2020
- ➢ **Action Item**: The PST will send letters of appreciation to members of sunsetted science and technical groups work groups with signatures from the EC co-chairs

Memorandum of Agreement

Wayne Pullan opened discussion on extending the 2008 MOA.

- The MOA expires in May 2021. It has been suggested that the MOA be extended by one year.
    - An Administrative Ad Hoc Group needs to be formed to write an addendum to the 2008 MOA, to be signed by the EC before May 2021.
- The MOA needs to be reconstituted to reflect the changes in the Collaborative Program, and there is not enough time to complete that before May 2021.
- Debbie L. presented a charge template for 2008 MOA Addendum Administrative Ad Hoc Group, which was approved by the EC.
    - Group membership:

- Bill Grantham, New Mexico Office of the Attorney General
- Chris Shaw (for review), New Mexico Interstate Stream Commission
- Jim Wilber, Reclamation
- Kim Bannerman, Office of the Solicitor, U.S. Department of the Interior

By-Laws

Debbie L. opened discussion on revising the MRGESCP By-Laws to reflect changes made in the Collaborative Program.

- Debbie L. presented a charge template for By-Laws Administrative Ad Hoc Group, which was approved by the EC.
  - Group membership:
    - Bill Grantham
    - Chris Shaw
    - Jim Wilber
    - Kim Bannerman
    - Trevor Stevens, USACE

✓ **Decision**: EC approval of formation of an Administrative Ad Hoc Group to write an addendum to the 2008 MOA, extending the MOA for one calendar year to May 2022

✓ **Decision**: Approval of formation of an Administrative Ad Hoc Group to revise the MRGESCP By-Laws

➢ **Action Item**: The 2008 MOA Addendum Administrative Ad Hoc Group will draft an addendum to the 2008 MOA to extend it by one year to May 2022; provide the draft addendum for EC review

➢ **Action Item**: The By-Laws Administrative Ad Hoc Group will revise the MRGESCP By-Laws to include updates resulting from implementation of the S&AM Plan, the LTP, and the new organizational structure

Update from the Non-Federal Signatories

- John Stomp, ABCWUA, will no longer be the Non-Federal EC Co-Chair as of January 1, 2021.
- Mark Kelly, ABCWUA, will assume the position of Non-Federal EC Co-Chair as of January 1, 2021.

❖ **Announcement**: Mark Kelly, ABCWUA, will serve as the Non-Federal EC Co-Chair starting January 2021

Announcements

- Reclamation awarded the first Rick Billings Memorial Award to John Stomp.
  - The award will be given annually to a member of the Collaborative Program for contributions to the success of the Collaborative Program.
  - In years to come, Reclamation will contact EC members towards the end of each year for recommendations.

❖ **Announcement**: John Stomp, ABCWUA, was awarded the Rick Billings Memorial Award

Public Comment

No public comments were received.

Closing Discussion

- The next EC meeting was scheduled for March 25, 2021.

- **Action Item**: The PST will schedule the next EC meeting for March 25, 2021

Closed Session

The EC meeting adjourned for a closed session to discuss the Program and Science Support contract.

Meeting Participants

Participant	Organization
Alan Hatch	Pueblo of Santa Ana
Andy Dean	U.S. Fish and Wildlife Service
Anne Marken	Middle Rio Grande Conservancy District
Bill Grantham	New Mexico Office of the Attorney General
Catherine Murphy	Program Support Team
Colleen McRoberts	City of Albuquerque, Open Space
Dale Strickland	Program Support Team
Debbie Lee	Program Support Team
Debra Hill	U.S. Fish and Wildlife Service
Grace Haggerty	New Mexico Interstate Stream Commission
Jennifer Faler	U.S. Bureau of Reclamation
Jim Wilber	U.S. Bureau of Reclamation
John Stomp	Albuquerque Bernalillo County Water Utility Authority
Julie Dickey	Program Support Team
Kate Mendoza	Albuquerque Bernalillo County Water Utility Authority
Kim Bannerman	Office of the Solicitor, Department of Interior
Kim Eichhorst	Bosque Ecosystem Monitoring Program
Luke Pierpont	Buckman Direct Diversion
Lynette Giesen	U.S. Army Corps of Engineers
Mark Kelly	Albuquerque Bernalillo County Water Utility Authority
Matthew Wunder	New Mexico Department of Game and Fish
Maureen Rudolph	U.S. Army Corps of Engineers
Michael Scialdone	Pueblo of Sandia
Michelle Tuineau	Program Support Team
Mike Marcus	Middle Rio Grande Water Advocates
Mo Hobbs	Albuquerque Bernalillo County Water Utility Authority
Page Pegram	New Mexico Interstate Stream Commission
Patrick Stevens	U.S. Army Corps of Engineers
Paul Tashjian	Audubon New Mexico
Rick Carpenter	Buckman Direct Diversion
Rich Valdez	SWCA Environmental Consultants
Ryan Gronewold	U.S. Army Corps of Engineers
Shawn Sartorius	U.S. Fish and Wildlife Service
Thomas Turner	University of New Mexico
Trevor Birt	New Mexico Interstate Stream Commission
Trevor Stevens	U.S. Army Corps of Engineers
Wayne Pullan	U.S. Bureau of Reclamation

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Approved 2020 Work Plan Overview

Task	Program Group	Deadline	Deliverable	Status	Notes	Completed Date
STRATEGIC PLANNING						
Complete the Program's Long-Term Plan (LTP)	EC & PST	September 2020	LTP	Pending	The EC will consider approval of the draft LTP at the December 2020 meeting	
Finalize development of the MRGESCP's AM Process	AMWG & PST	Nov-20	Integration of the MRGESCP's AM Process	Pending	The EC will consider approval of the draft S&AM Plan at the December 2020 meeting	
Implement the new MRGESCP structure as approved in 2018	EC & PST	September 2020	Revised and implemented MRGESCP structure	Complete	The EC approved the SAMC at the September 2020 meeting, and agreed at the October 2020 to sunset all existing science & technical work groups as of December 17, 2020.	December 2020
Continue discussions related to the MRGESCP's goals, objectives, and strategies	EC, AMWG & PST	June 2020	Program goals	Partially Complete	The EC approved Program Goals at the January 2020 meeting. Draft objectives were developed and included in the Draft Science & AM Plan distributed for comment, and will be finalized at a February 2021 workshop.	
Revise by-laws as needed	By-laws & PST	December 2020	Updated By-Laws	Ongoing	The By-Laws Ad Hoc Group will meeting in 2021 to finalize By-Laws revisions to reflect updates to the Program's structure and operations.	
ANNUAL PLANNING						
Implement the MRGESCP 2020 Work Plan	MRGESCP & PST	Ongoing through 2020	Completed 2020 Annual Work Plan tasks	Complete		December 2020

Develop the MRGESCP 2021 Work Plan	MRGESCP & PST	November - December 2020	Finalized 2021 Annual Work Plan for implementation	Pending	The EC will consider approval of the MRGESCP 2021 Work Plan at the December 2020 meeting.	
Implement the Science/Habitat Restoration Work Group (ScW/HR) 2020 Work Plan	ScW/HR & PST	Ongoing through 2020	Completed 2020 Annual Work Plan tasks	Complete		July 2020
Develop the ScW/HR 2021 Work Plan	ScW/HR & PST	November - December 2020	Finalized 2021 Annual Work Plan for implementation	N/A	The ScW/HR is not included in the new Program structure and will not have a 2021 work plan.	N/A
Implement the Population Monitoring Work Group (PMWG) 2020 Work Plan	PMWG & PST	Ongoing through 2020	Completed 2020 Annual Work Plan tasks	Complete	The PMWG is presenting a summary report of accomplishments at the December 2020 EC meeting.	December 2020
Develop the PMWG 2021 Work Plan	PMWG & PST	November 2020	Finalized 2021 Annual Work Plan for implementation	N/A	The PMWG is not included in the new Program structure and will not have a 2021 work plan.	N/A
ADMINISTRATION & REPORTING						
Annual Report						
Prepare first draft FY19 Annual Report for Program review	MRGESCP & PST	May 2020	Draft FY19 Annual Report for review	Complete		July 2020
Finalize and approve FY19 Annual Report	EC & PST	August 2020	Finalized FY19 Annual Report	Complete	The EC approved the FY19 Annual Report at the September 2020 meeting.	September 2020
Begin preparing for the first draft FY20 Annual Report	MRGESCP & PST	October 2020	Signatory coordination	Ongoing	Signatory's send FY20 write-ups to WEST.	
Cost-Share						
Report FY19 Non-Federal Signatory Cost-Share	Non-Feds & PST	February 2020	Cost Share Report	Complete	The PST reported FY19 Non-Federal Cost Share at the February 2020 EC meeting.	February 2020

Report FY20 Non-Federal Signatory Cost-Share	Non-Feds & PST	August 2020	Cost Share Report	Pending	The PST will report FY20 Non-Federal Cost Share once all non-federal signatories have submitted their cost share.	
Program Portal (Formerly DBMS)						
Maintain and Update Program Portal	MRGESCP & PST	December 2020	Operational Program Portal for MRGESCP use	Complete	The Program Portal is fully functional, with a document library, event calendar, downloadable datasets, and interactive geospatial mapper.	December 2020
ENGAGEMENT & OUTREACH						
Science Symposium						
Hold targeted science workshop(s) on specific topics relevant to MRGESCP activities and planning	MRGESCP & PST	December 2020	Science Workshops	Complete	A brown bag on climate change in the MRG (Megan Friggens) was held March 2020. A brown bag on the HR in Los Lunas (Dave Moore) was scheduled for April 2020 but cancelled due to technical difficulties. A 2020 Science Symposium was held December 1-3, 2020.	December 2020

2021
Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) Work Plan

Tasks

1	Update MRGESCP Objectives
2	Task Science & Technical Ad Hoc Groups
3	Utilitze Conceptual Ecological Models
4	Improve Science Communication
5	Plan for the Future of Adaptive Science
6	Develop and update the Long-Term Plan
7	Implement new MRGESCP organizational structure
8	Administrative tasks

TASK	SUBTASK	EC	AAH	SAMC	S&T	FPC	PST	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
	Executive Committee (EC) meeting	X								X				X			X		X
	Science & Adaptive Management Committee (SAMC) meeting			X				X	X		X	X				X	X	X	
	Fiscal Planning Committee (FPC) meeting					X			X			X			X			X	
1a	Convene an Objectives Workshop for each species			X			X		X										
1b	Report objectives and their implications for science initiatives to the EC for review and approval			X			X			X	X	X	X	X					
1c	Integrate objectives and strategies into the Adaptive Management (AM) Database						X					X	X						
2a	Identify critical carry-over work from past MRGESCP efforts, including panel recommendations, and begin breaking large issues into specific questions			X	X			X	X	X	X	X	X	X	X	X	X	X	X
2b	Form Science & Technical (S&T) Ad Hoc groups to address specific questions			X	X			X	X	X	X	X	X	X	X	X	X	X	X
2c	Task S&T Ad Hoc Group to finalize Population Monitoring Work Group work in a summary report			X	X			X	X	X									
3a	Assess status of identified critical uncertainties				X			X	X	X	X	X	X	X	X	X	X	X	X
3b	Link uncertainties to appropriate elements in the AM Database			X	X			X	X	X	X	X	X	X	X	X	X	X	X
3c	Integrate Rio Grande silvery minnow, yellow-billed cuckoo, and southwestern willow flycatcher conceptual ecological models (CEM) into the AM Database by converting schematics into graphical models and individual relationships				X		X	X	X	X	X	X	X	X					
3d	Populate the Project Bank with past and current projects. Specify research hypotheses, where appropriate			X			X	X	X	X									
3e	Develop CEMs for New Mexico meadow jumping mouse and Pecos sunflower				X						X	X	X	X	X	X	X	X	X
4a	Define the peer review process, including both internal reviews and external reviews			X			X	X	X	X									
4b	Revise the scope of work process to incorporate the Science & AM (S&AM) Plan elements			X			X	X	X										
4c	Refine the topical Executive Summary writing and review processes			X			X	X	X										
4d	Provide training on the AM Database application	X		X	X	X	X									X	X		
5a	Organize and convene Scenario Planning Workshop to consider ecosystem trends and forecasts			X						X	X	X	X						
5b	Develop decsion trees and action plans for various scenarios			X	X						X	X	X	X	X				
5c	Update the S&AM Plan				X							X	X	X					
6a	Develop an administrative schedule					X	X		X	X									
6b	Populate the Long-Term Plan with a scientific activities list from the AM Database as aligned with guiding principles			X	X		X				X	X	X	X					
6c	Update the Long-Term Plan	X		X								X	X	X					
7a	Update and adopt By-laws to reflect new MRGESCP structure and operations	X	X					X	X	X	X	X	X	X					
7b	Draft and adopt a new Memorandum of Agreement	X	X					X	X	X									
7c	Develop processes for SAMC and FPC coordination on Collaborative Program recommendations			X		X				X	X								
8a	Maintain and update the Program Portal						X	X	X	X	X	X	X	X	X	X	X	X	X
8b	Draft and approve FY20 Annual Report	X					X	X	X	X	X	X	X	X					
8c	Develop schedule for input into signatory priority activities					X			X	X	X								

TASK	SUBTASK	EC	AAH	SAMC	S&T	FPC	PST	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
8d	Develop a format for a concise Annual Report						X							X	X				
8e	Begin drafting FY21 Annual Report						X							X	X	X	X	X	X
8f	Develop annual summary report			X			X							X	X	X	X		
8g	Compile and report on FY21 Non-federal Cost Share	X					X										X	X	X
8h	Develop and approve 2022 Annual Work Plan	X					X											X	X
8i	Update the MRGESCP contact lists to reflect changes to the new structure	X					X	X	X										



Science & Adaptive Management Plan

Draft

December 2020

Prepared on behalf of and for use by the
Middle Rio Grande Endangered Species Collaborative Program

by

Western Ecosystems Technology, Inc.
Program Support Team

FORWARD

This Science & Adaptive Management (S&AM) Plan is a living document that will be updated annually to reflect changes in our understanding of the Middle Rio Grande ecosystem, species interactions, and the management approaches used, as well as the Middle Rio Grande Endangered Species Collaborative Program's (Collaborative Program) approach to incorporating that knowledge into its recommendations. This S&AM Plan builds on past efforts to incorporate adaptive management into the Collaborative Program's operations, including the 2011 Murray et al. *Adaptive Management Plan Version 1* and the 2018 Caplan et al. *Middle Rio Grande Adaptive Management Framework: Identifying Critical Scientific Uncertainties*.

Modifications to this S&AM Plan will serve to document iterative learning within the Collaborative Program.

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Appendix E. Consolidated Recovery Goals, Criteria, and Actions

ACRONYMS AND ABBREVIATIONS

2014 Bernalillo to Belen BO	Biological Opinion on the Effects of the U.S. Army Corps of Engineers' Mountain View, Isleta, and Belen Levee Units for Middle Rio Grande Flood Protection, Bernalillo County to Belen, New Mexico
2016 MRG BO	Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
APA	Assessment Payers Association of the Middle Rio Grande Conservancy District
AM	adaptive management
BDD	Buckman Direct Diversion
BEMP	Bosque Ecosystem Monitoring Program
BO	biological opinion
CEM	conceptual ecological model
CoA	City of Albuquerque
EC	Executive Committee
ESA	Endangered Species Act
FPC	Fiscal Planning Committee
MOA	Memorandum of Agreement
MRG	Middle Rio Grande
MRGCD	Middle Rio Grande Conservancy District
Collaborative Program	Middle Rio Grande Endangered Species Collaborative Program
NMAGO	New Mexico Attorney General's Office
NMDGF	New Mexico Department of Game and Fish
NMISC	New Mexico Interstate Stream Commission
NMMJM	New Mexico meadow jumping mouse
PESU	Pecos sunflower
PST	Program Support Team
Reclamation	U.S. Bureau of Reclamation
RIO	River Integrated Operations
RIP	Recovery Implementation Program
RGSM	Rio Grande silvery minnow
S&AM Plan	Science & Adaptive Management Plan
S&T Ad Hoc Group	Science & Technical Ad Hoc Group
SAMC	Science and Adaptive Management Committee
SWFL	southwestern willow flycatcher
UNM	University of New Mexico
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
YBCU	yellow-billed cuckoo

1.0 INTRODUCTION

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) is a partnership of federal, state, and local governmental entities, Indian Tribes and Pueblos, and non-governmental organizations that aims to protect and recover federally listed species in the riparian corridor of the Middle Rio Grande (MRG), while preserving the area's existing and future water uses in compliance with applicable state, federal, and tribal laws, rules, and regulations. The Collaborative Program currently aids in the recovery of five species listed under the Endangered Species Act (ESA): the endangered Rio Grande silvery minnow (*Hybognathus amarus*; RGSM), the endangered southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL), the endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; NMMJM), the threatened yellow-billed cuckoo (*Coccyzus americanus*; YBCU), and the threatened Pecos sunflower (*Helianthus paradoxus*; PESU).

1.1 Purpose and Role of Adaptive Management in the Collaborative Program

It has become increasingly difficult to protect and recover listed species in the MRG due to increased environmental and administrative challenges, such as persisting drought and diminishing administrative resources. To better utilize resources to meet challenges in the area, the Collaborative Program signatories agreed to use and support the use of adaptive management (AM) in the MRG. The primary role of the Collaborative Program in AM of the MRG is developing scientific evidence that informs decision-making. The Collaborative Program then provides scientifically defensible recommendations for management actions that benefit listed species to the MRG's natural resource managers.

Together, the Science & Adaptive Management Plan (herein referred to as the S&AM Plan) and the Long-Term Plan (See Section 4.2 and the 2020 Long-Term Plan) provide the framework for implementing the Collaborative Program's science and AM process.

1.2 Collaborative Program Guiding Principles

In 2019, the Collaborative Program adopted a revised mission statement (Box 1), which expanded on the 2008 Memorandum of Agreement's (MOA) statement of purpose. The revised mission statement maintains the Collaborative Program's intent to recover listed species and protect water uses, while further emphasizing the need for and use of scientific analysis to support AM in the MRG.

Box 1. Collaborative Program Mission Statement.

The Middle Rio Grande Endangered Species Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management to the benefit and recovery of the listed species pursuant to the Endangered Species Act within the Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules, and regulations.

In 2020, the Executive Committee (EC) approved species-specific goals in support of its revised mission (Box 2). These are large-scale goals that are meant to be continually strived for. As such, they serve to guide the Collaborative Program's science and AM process.

Box 2. Collaborative Program Goals.

- Establish and maintain a self-sustaining population of endangered RGSM distributed throughout the MRG.
- Maintain and protect the MRG recovery unit goals for endangered SWFL.
- Maintain and protect suitable threatened YBCU habitat in the MRG.
- Establish and maintain a self-sustaining endangered NMMJM population in the MRG.
- Maintain and protect the threatened PESU in the MRG.
- Avoid the future listing or up-listing of species in the Collaborative Program area.
- Manage available water to meet the needs of endangered species and their habitat.

The Collaborative Program's mission and goals inform development of objectives and strategies, which guide the direction of scientific initiatives. These links ensure the Collaborative Program produces initiatives that serve its mission and goals. To increase the efficiency and effectiveness of Collaborative Program efforts, goals and objectives are informed by to species recovery plans. By developing strategies that build on recovery criteria, the Collaborative Program can document the progress made on each recovery objective and goal. Given the connection between strategies and species recovery plans, the Collaborative Program is poised to inform recovery plans during their five-year reviews.

Preliminary objectives and strategies were designed to achieve Collaborative Program goals by focusing efforts on essential aspects of species recovery criteria. Appendix D presents a list of suggested preliminary objectives and strategies that is meant to offer a starting point for the development of Collaborative Program objectives. The preliminary objectives were developed using past Collaborative Program objective development efforts and a compiled list of recovery goals, criteria, and actions from species recovery plans.

1.3 Area of Interest

The geographic area of interest covered by the Collaborative Program follows the Rio Grande, including its tributaries, stretching from the New Mexico/Colorado border downstream to the elevation of the spillway crest of Elephant Butte Reservoir, excluding the land reserved for the full pool of Elephant Butte Reservoir. Under the S&AM Plan, five reaches have been delineated within the MRG (Figure 1). From north to south, the reaches are delineated as follows:

- Northern Reach (from the Colorado-New Mexico border to Cochiti Dam)
- Cochiti Reach (from Cochiti Dam to Angostura Diversion Dam)
- Angostura (or Albuquerque) Reach (from Angostura Diversion Dam to Isleta Diversion Dam)
- Isleta Reach (from Isleta Diversion Dam to San Acacia Diversion Dam)
- San Acacia Reach (from San Acacia Diversion Dam to the elevation of the spillway crest of Elephant Butte Reservoir)

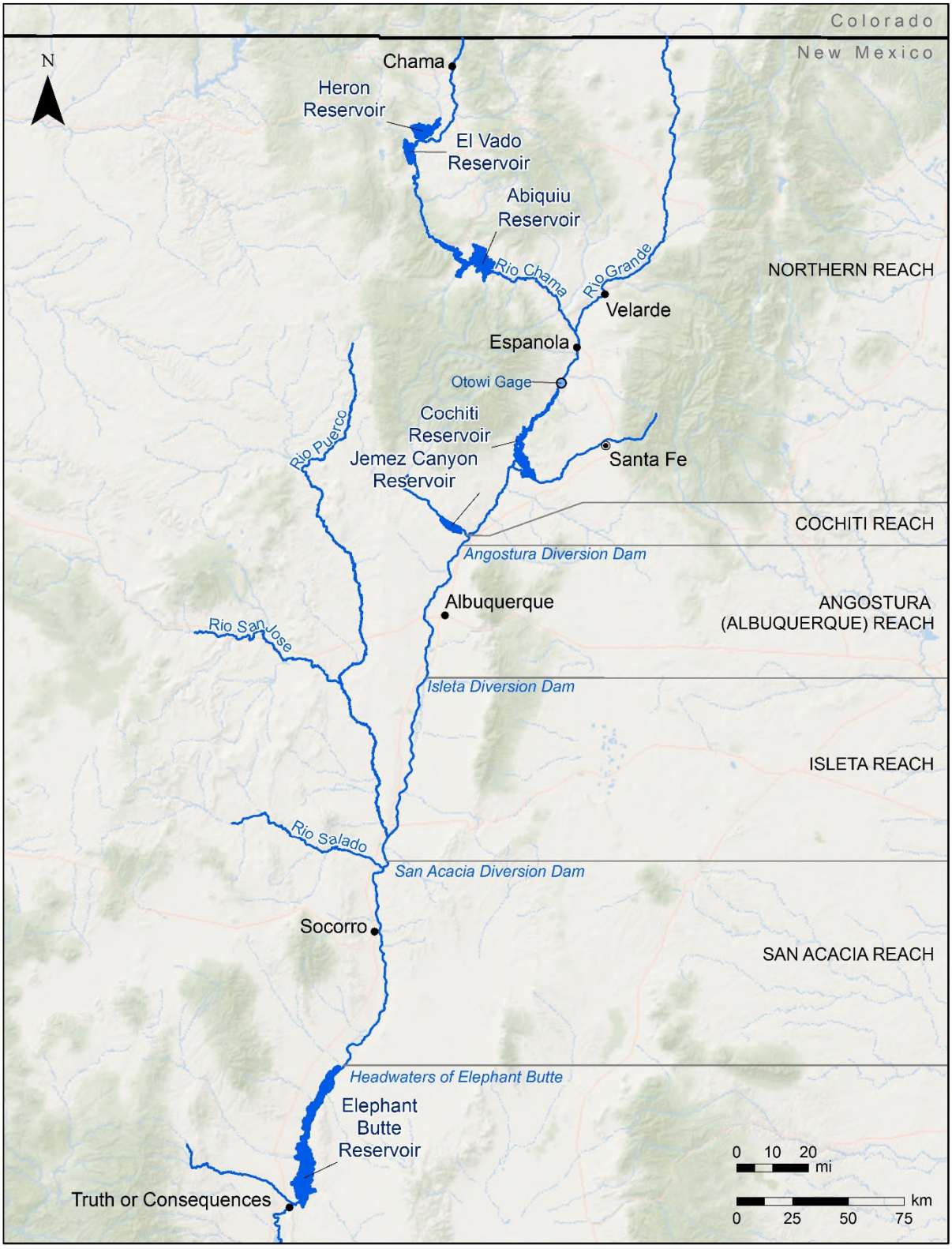


Figure 1. Collaborative Program Area of Interest.

1.4 Stakeholders

A Collaborative Program stakeholder is an organization whose members have vested interests in listed species recovery and protection of water uses in the MRG. Primarily, the Collaborative Program stakeholders are the seventeen signatories to the 2008 MOA:

- Albuquerque Bernalillo County Water Utility Authority (ABCWUA)
- Assessment Payers Association of the Middle Rio Grande Conservancy District (APA)
- Audubon New Mexico
- Bosque Ecosystem Monitoring Program (BEMP)
- Buckman Direct Diversion (BDD)
- City of Albuquerque (CoA)
- Middle Rio Grande Conservancy District (MRGCD)
- New Mexico Attorney General's Office (NMAGO)
- New Mexico Department of Game and Fish (NMDGF)
- New Mexico Interstate Stream Commission (NMISC)
- Pueblo of Isleta
- Pueblo of Sandia
- Pueblo of Santa Ana
- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Reclamation (Reclamation)
- U.S. Fish and Wildlife Service (USFWS)
- University of New Mexico (UNM)

Beyond the Collaborative Program signatories, MRG stakeholder groups include soil and water conservation districts, Acequia Associations, the New Mexico Environment Department, the Mid-Region Council of Governments, and other land and natural resource management entities and interest groups not listed as signatories. The Minnow Action Team is a group of Collaborative Program signatory and non-signatory resource managers, contractors, and scientists that produce biologic, hydrologic, and monitoring recommendations to benefit the RGSM. Although the group operates outside of the Collaborative Program, its vested interest in listed species recovery make it a Collaborative Program stakeholder. Input by external stakeholders adds value to the Collaborative Program and strengthens the impact of its work. These entities also benefit from interacting with the Collaborative Program and its work.

1.5 Operational Space

Signatories have varied missions, interests, obligations, and authorities under which they participate in the Collaborative Program. Participation by signatory scientists, technical experts, natural resource managers, and administrators is necessary for navigating the Collaborative Program's operational space, which is defined by scientific uncertainty and regulatory obligations. This section frames the assumptions around the Collaborative Program's science support role in AM, including its opportunities and boundaries, and describes the administrative foundation for that role.

1.5.1 Operational Assumptions

Several assumptions shape the Collaborative Program's operations as a science-based program that provides recommendations for scientific activities and management actions in the MRG. These assumptions are listed in Box 3.

Box 3. Collaborative Program Operational Assumptions.

1. The Collaborative Program aids in the systematic reduction of uncertainty related to species vulnerabilities, resulting in science-based recommendations that help guide management of the MRG.
2. Collaborative Program efforts contribute valuable research to inform the recovery of the listed species; however, the Collaborative Program is not an entity that is collectively bound by any legal responsibility to recover the threatened and endangered species of the MRG.
3. Resource management decisions by individual Collaborative Program signatories often require consideration of species response to system changes.
4. The Collaborative Program has no authority to implement adaptive management in the MRG.
5. There is no central decision-making or funding authority in the MRG; the Collaborative Program does not have decision-making authority on any individual signatory's budget, contracts, or management actions.

1.5.2 Preceding Adaptive Management Efforts

The Collaborative Program's current position on AM of the MRG is one developed over many years. Since the mid-2000's, the Collaborative Program has worked towards incorporating an AM framework into its efforts. The S&AM Plan builds from preceding Collaborative Program AM endeavors and aims to complement other AM efforts in the MRG.

In *Middle Rio Grande Endangered Species Collaborative Program Adaptive Management Plan Version 1*, Murray et al. (2011) were contracted to provide a comprehensive concept for implementing an AM approach for management of the RGSM and SWFL. The report identified tasks needed for implementation of AM and recommended next steps for subsequent Collaborative Program AM plans, including guidance for each step of the AM cycle.

In tandem with the 2011 effort, the Collaborative Program drafted a Recovery Implementation Program (RIP) document to restructure the Collaborative Program's governance, and develop processes to support an AM framework. In response to the *2016 Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water*

Management and Maintenance Activities on the Middle Rio Grande, New Mexico (herein referred to as the 2016 MRG BO; (described below), the Collaborative Program decided not to implement the RIP, and instead focused on renewed efforts to develop an AM framework to complement its position in the MRG.

Following up on the initial 2011 effort, USACE contracted GeoSystems Analysis, Inc. to complete the *Middle Rio Grande Adaptive Management Framework: Identifying Critical Scientific Uncertainties* (Caplan et al. 2018) report, which built on recommendations from Murray et al. (2011). As recommended by Murray et al. (2011), the Caplan et al. (2018) report used a structured process to identify critical scientific uncertainties and recommended studies to reduce those uncertainties for RGSM, SWFL, YBCU, and NMMJM. As outlined by the Caplan et al. (2018) report, the next steps for continuing development of the Collaborative Program's AM strategy are as follows:

- Use a structured decision-making process to prioritize study recommendations based on direct linkages to well-defined management objectives and performance measures;
- Develop a multi-year strategic science plan that incorporates results from the structured decision-making process; and
- Establish a standing independent science advisory group to provide outside peer review and to support the Collaborative Program's implementation of the strategic science plan through various stages of the AM cycle.

The Collaborative Program's science and AM process outlined in this S&AM Plan builds on previous AM efforts by incorporating the next steps and recommendations identified in past documents. Box 4 synthesizes the evolution of the Collaborative Program's science and AM process with a list of accomplishments made under an AM framework, beginning with the Murray et al. (2011) report. This evolution has helped refine the Collaborative Program's role in AM of the MRG.

Box 4. Collaborative Program Accomplishments Under an Adaptive Management Framework.

- Established a framework for conducting activities to deliberately and explicitly reduce management uncertainties.[1]
- Identified a preliminary adaptive management (AM) design and carried it through the AM cycle.[1]
- Identified scientific uncertainties and data gaps (by species) considered important for supporting management decisions and informing AM experiments.[2]
- Prioritized uncertainties and provided preliminary study plan considerations for four of the listed species.[2]
- Adopted a revised mission focused on science and AM (see Section 1.2).
- Developed and adopted long-term species-specific Collaborative Program goals (see Section 1.2).

[1]Murray et al. 2011 [2]Caplan et al. 2018

1.5.3 Operational Considerations

Collaborative Program stakeholders work within a fully allocated and highly regulated river system, which poses challenges for management related to the recovery of listed species. Following is a brief overview of existing Biological Opinions (BO) and non-ESA obligations, other AM-specific efforts in the MRG, and opportunities for Collaborative Program engagement in AM.

Biological Opinions

Several signatories operate within the MRG under programmatic and/or project specific BOs (Table 1). One of the more expansive BOs in the MRG is the 2016 MRG BO. Signatory partners to this BO include Reclamation, NMISC, and MRGCD. ABCWUA and BDD operate under separate programmatic BOs in the MRG (Table 1).

In addition to programmatic BOs, several signatories consult with USFWS on specific projects. More information on these projects can be found using the following links to the USFWS website: https://www.fws.gov/southwest/es/NewMexico/ES_bio_op.cfm and https://ecos.fws.gov/ecp/.

Table 1. Current Middle Rio Grande Signatories' Biological Opinions.

Signatory Parties	Year Issued	Title
ABCWUA	2004	Biological Opinion on the Effects of Actions Associated with the Programmatic Biological Assessment for the City of Albuquerque Drinking Water Project
BDD	2007	Biological Opinion on the Effects of Actions Associated with the Biological Assessment for the Buckman Water Diversion Project, Santa Fe National Forest, USDA Forest Service
USACE	2014	Biological Opinion on the Effects of the U.S. Army Corps of Engineers' Mountain View, Isleta, and Belen Levee Units for Middle Rio Grande Flood Protection, Bernalillo County to Belen, New Mexico (Bernalillo to Belen BO)
Reclamation NMISC MRGCD	2016	Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico

Sources: U.S. Fish and Wildlife Service (2004, 2007, 2014, 2016).

ABCWUA = Albuquerque Bernalillo County Water Utility Authority, BDD = Buckman Direct Diversion, USACE = U.S. Army Corps of Engineers, Reclamation = U.S. Bureau of Reclamation, NMISC = New Mexico Interstate Stream Commission, MRGCD = Middle Rio Grande Conservancy District, USDA = U.S. Department of Agriculture, BO = biological opinion.

Obligations Beyond Endangered Species Act Compliance

The Rio Grande supports numerous water uses, including for ecological, tribal, agricultural, municipal, and recreational purposes. Water allocation and delivery in the MRG is highly managed and regulated by multiple entities. This includes several individual signatories that have water delivery obligations within the MRG and to downstream users.

1.5.4 Other Regulatory Adaptive Management Efforts

As part of the 2016 MRG BO, BO partners plan to implement River Integrated Operations (RIO), an AM approach for river operations designed to address species and water management needs, while improving sustainable management of the MRG. Efforts on the RIO are currently underway. Additionally, the BO for USACE's Bernalillo to Belen flood risk management project (USFWS 2014; Table 1) includes measures for integrating AM in monitoring projects and evaluating their success in order to determine if mitigation actions are sufficient to avoid, minimize, or compensate for adverse impacts.

As the Collaborative Program progresses with implementation of its S&AM Plan, its efforts to provide science-based recommendations are expected to complement all AM efforts in the MRG. By reducing uncertainty around the management of listed species and their habitats, the Collaborative Program intends to improve management of the MRG.

1.5.5 Opportunities for Science Support

Collaborative Program operations, lacks the authority to implement or direct river management actions. Although this limits the Collaborative Program's involvement in regulatory activities, it does not reduce its value to management of the MRG's listed species. Instead, this limitation presents several unique opportunities.

As the Collaborative Program operates outside the purview of signatory BOs and other non-ESA obligations, it is free to use BO requirements as guidance for its activities, while expanding beyond them. This freedom has allowed the Collaborative Program to address ecosystem-level questions and habitat considerations not specified by species recovery plans. Under the S&AM Plan, the Collaborative Program's charge is to develop scientifically defensible solutions and recommend evidence-based best management alternatives for the recovery of listed species in the MRG. With a diverse group of collaboratively engaged signatory members, the Collaborative Program is distinctly positioned to support the work of its signatories and other MRG stakeholders. Furthermore, each signatory contributes individually to Collaborative Program operations (Table 2), which collectively strengthens its work.

Given its unique strengths and limitations, the Collaborative Program has had to carve its own operational space in AM of the MRG. Within this space, the Collaborative Program's role has been refined to one of scientific support. Backed by empirical evidence, recommendations originating from the science-based Collaborative Program are designed to influence management of listed species in the MRG and garner public and political support.

Table 2. Opportunities for Signatory Involvement under the Science and Adaptive Management Plan.

Signatory Contributions	ABCWUA	APA	Audubon	BEMP	BDD	CoA	MRGCD	NMAGO	NMDGF	NMISC	PoI	PoS	PoSA	USACE	Reclamatio	USFWS	UNM
Scientific and Technical Expertise: SAMC Positions and S&T Ad Hoc Groups																	
Aquatic biology						X			X	X				X	X	X	X
Terrestrial biology			X						X					X	X	X	
Ecosystem function and structure			X	X		X	X			X	X	X	X	X		X	
Hydrology	X		X				X			X				X	X		
Statistical analysis				X						X						X	X
Informing Management, Operations, and Activity Implementation																	
Conducting laboratory studies	X					X	X			X					X	X	X
Ability to conduct field studies	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Knowledge of system management	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X
Routinely collect field observations	X	X		X		X	X		X	X	X	X	X		X	X	X
Conduct scientific activities	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Forecasting and modeling	X			X			X			X				X	X	X	X
Administrative Expertise: Administrative Ad Hoc Groups																	
Updates to By-laws		X			X			X		X				X	X		
Draft, review, and update administrative documents	X	X					X			X				X	X		
Science Communication and Outreach																	
Contribute to public outreach	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Communicate to the scientific community via peer-reviewed publications and presentations at conferences	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Regulation and Policy Expertise: Executive Committee; other groups as needed																	
Conservation laws					X		X	X	X	X				X	X	X	
Water regulations and policy	X				X		X	X		X				X	X		
Administrative policy					X			X		X				X	X		

ABCWUA = Albuquerque Bernalillo County Water Utility Authority; APA = Assessment Payers Association of the Middle Rio Grande Conservancy District; BEMP = Bosque Ecosystem Monitoring Program; BDD = Buckman Direct Diversion; CoA = City of Albuquerque; MRGCD = Middle Rio Grande Conservancy District; NMAGO = New Mexico Attorney General's Office; NMDGF = New Mexico Department of Game and Fish; NMISC = New Mexico Interstate Stream Commission; PoI = Pueblo of Isleta; PoS = Pueblo of Sandia; PoSA = Pueblo of Santa Ana; USACE = U.S. Army Corps of Engineers; Reclamation = U.S. Bureau of Reclamation; SAMC = Science and Adaptive Management Committee; S&T = Science and Technical.

2.0 ADAPTIVE MANAGEMENT APPLICATION

The Collaborative Program uses a science and AM process to determine how to best manage limited resources in the MRG to benefit listed species. Specifically, the Collaborative Program's science and AM process is designed to reduce uncertainty around species management and lead to recommendations for science-supported management alternatives and activities aimed at improving understanding of species-system interactions. This section outlines the general AM cycle, tailors each step of the AM cycle to the Collaborative Program, and defines the role of AM in the Collaborative Program.

2.1 The Adaptive Management Cycle

AM is a structured, science-based process that maximizes learning by incorporating management alternatives to reduce critical uncertainties (Williams et al. 2009; Murray et al. 2011). The AM process has been applied to a wide variety of natural resource and ecosystem management problems since the 1970s (Holling 1978; Environmental and Social systems Analysts 1982; McDonald et al. 1999; Gregory et al. 2006), and is summarized as an iterative cycle that involves six steps (Figure 2; Williams et al. 2009).

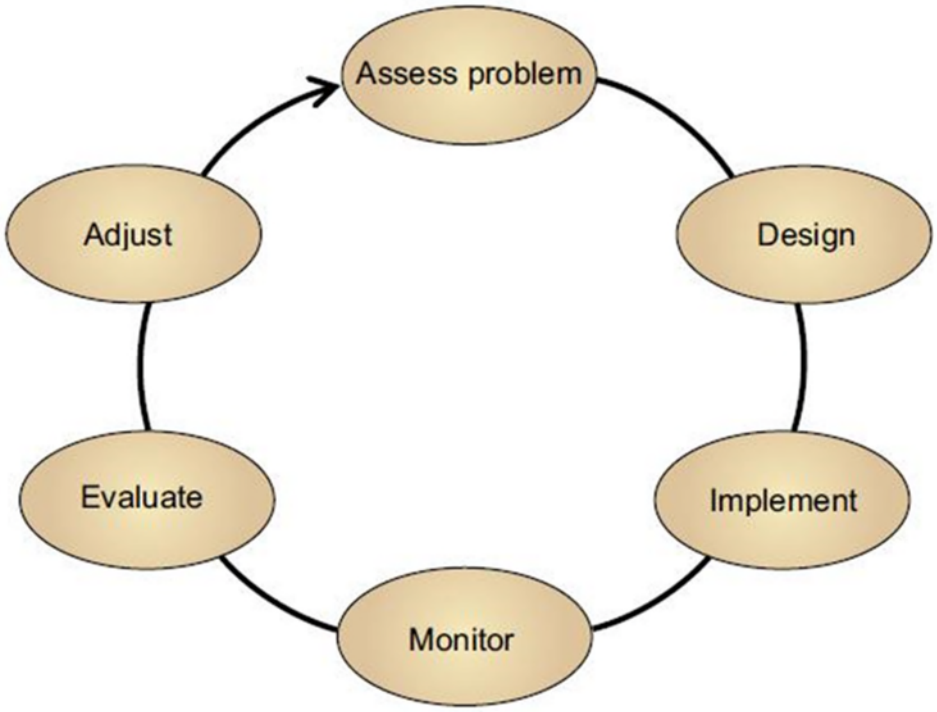


Figure 2. Adaptive Management Cycle.

Each step of the AM cycle contributes to the continual reduction of uncertainty around management actions, which ultimately leads to better-informed decision-making. Following are the Collaborative Program's definitions for the AM cycle steps:

- **Assess Step**: Sets the foundation for the rest of the AM cycle by identifying critical uncertainties about how a system functions. As the starting point for a new learning cycle, this step also involves consolidating, synthesizing, and incorporating information from previous cycles. Most importantly, assessment places scientific findings in the context of management and recovery objectives.
- **Design Step**: Alternative hypotheses are formulated around the critical uncertainties identified during assessment. Studies are designed to address these hypotheses as they relate to management decisions, thus increasing their relevance to Collaborative Program goals. Robust study designs to test hypotheses ensure economical use of money, time, and labor.
- **Implement Step**: Scientific activities are resourced and executed. Importantly, the Collaborative Program cannot implement or direct activities. Individual signatories and MRG stakeholders are responsible for carrying out scientific activities.
- **Monitor Step**: Monitoring is also implemented outside of the Collaborative Program and is defined as the systematic observation and documentation of responses (e.g., species population metrics, habitat quality) to management actions. Long-term monitoring and research strictly follows standardized data collection protocols to evaluate trends over time. Short-term monitoring aims to compare a response to an acute modification to that of an established baseline.
- **Evaluate Step**: Collected data are analyzed and synthesized in order to learn from new findings. Investigators document how listed species respond to changing conditions in a system, both natural and anthropogenic.
- **Adjust Step:** Modifications to management actions and AM decision tools (Section 4) are recommended based on what was learned. New scientific evidence is added to the knowledge base to reduce uncertainty and enhance understanding of the system and its species. Re-assessment of objectives is advisable following substantial changes to the knowledge base, but is not required with each iteration.

The specific steps required to complete an iteration of the AM cycle vary depending on a variety of factors, including the ecosystem of focus, the spatial and temporal scale of the management problem, the management options, the regulatory landscape, the species of interest, and stakeholder engagement. Adaptive management is a continuous learning process that increases the value of Collaborative Program products by subjecting them to a rigorous scientific process. The resulting products are designed to improve decision-making in management of the MRG. Documenting each iteration of the AM process tracks decision-making, ensuring that accumulated knowledge is incorporated into future decisions and choices are refined.

Adaptive management is useful to natural resource managers because of its use of structured decision-making to facilitate iterative learning. Structured decision-making ensures that a problem is decomposed into smaller, more manageable questions, each of which is addressed with a transparent, replicable, hypothesis-driven approach (Conroy and Peterson 2013). Martin et al.

(2009) proposes that iterative learning is most effective when a structured decision-making process is developed and implemented under a strong science-based program.

Caplan et al. (2018) began development of just such an approach and stated that structured decision-making is a stepwise process of generating and evaluating strategies, which are organized under a shared set of clear objectives. The process enables managers to evaluate how uncertainties influence their choices and target the uncertainties with the greatest potential impact or consequence. As an iterative form of structured decision-making, AM helps managers refine critical questions over time and allows them to focus on the "need to know" instead of "nice to know" aspects of the system they manage.

Structured-decision making has four primary components (Walters 1986, Conroy and Peterson 2013):

1. Clearly-stated, shared objectives;
2. Specific management alternatives to meet those objectives;
3. Use of decision-support models and tools to predict the effect of the alternatives; and
4. A sequential decision process (e.g., decisions through time build on previous iterations)

Additionally, the Collaborative Program's operation incorporates the following complementary actions:

1. Re-organization of the Collaborative Program's structure (Section 3), with the Science and Adaptive Management Committee (SAMC) translating and communicating scientific evidence to the EC;
2. Construction of the AM Database (Section 4.1), which stores and link goals, objectives, strategies, metrics, uncertainties, and the Project Bank (Section 4.1), to facilitate transparent prioritization of the Collaborative Program's scientific activities; and
3. Commitment to iterative learning through tracking (via the AM Database), evaluating, and incorporating scientific evidence into experimental designs, decision support tools (Section 4), and Collaborative Program objectives (Appendix D) on at least an annual basis.

2.2 Defining Adaptive Management for the Collaborative Program

The Collaborative Program S&AM Plan presents a science-based process aimed at reducing uncertainty within the MRG ecosystem relating to management of listed species. The Collaborative Program's definition of AM, as developed by the AM Work Group and approved by the EC, is stated in Box 5.

Box 5. Collaborative Program Definition of Adaptive Management.

> Adaptive management is a process for integrating science and learning into management under changing conditions coupled with an iterative process for producing improved systematic understanding of needs to meet the established goals.

This definition describes the Collaborative Program's understanding of its role in AM and the role of its signatories, both independently and as part of the Collaborative Program. In this definition, science and learning are posited as the central components of Collaborative Program activities. This positions science and learning as the primary tenets guiding production of the Collaborative Program's evidence-based recommendations to inform management decisions within the MRG.

3.0 COLLABORATIVE PROGRAM ORGANIZATIONAL AND OPERATIONAL STRUCTURES

Scientific activities take time to move through the AM cycle and require a structured, long-term planning approach. To meet the need for more intensive out-planning, the Collaborative Program's science and AM process has undergone restructuring. The resulting Collaborative Program structure promotes proactive, thorough, and timely Collaborative Program efforts. One of the biggest changes that occurred in restructuring of the Collaborative Program is the addition of the SAMC. Activating a small, focused committee of topical experts lends to the productive messaging of science into management-relevant recommendations.

The following outlines the Collaborative Program's operations and structure designed to facilitate the science and AM process. Figure 3 illustrates the hierarchical organization of the Collaborative Program, and Figure 4 depicts organizational operations under the S&AM Plan.

3.1 Organizational Structure

The EC directs the implementation of the Collaborative Program's science and AM process, which requires the formation of the SAMC and administrative groups. Under EC oversight, the SAMC is tasked with implementing the S&AM Plan. To do so, the SAMC forms and tasks Science and Technical (S&T) Ad Hoc Groups and collaborates with other Collaborative Program groups.

The EC forms Administrative Ad Hoc Groups to draft, review, and update administrative documents, such as the Collaborative Program By-Laws and Long-Term Plan. The Fiscal Planning Committee (FPC) serves as a platform for signatories to collaborate on financial and administrative resources for Collaborative Program-related scientific activities. The Program Support Team (PST), made up of the Program Manager, Science Coordinator, and supporting staff, are directed by the EC and provide administrative, scientific, and technical support to all Collaborative Program committees and groups. Details on each group's role and composition are provided in the Collaborative Program By-Laws, committee charters, and ad hoc group charges.

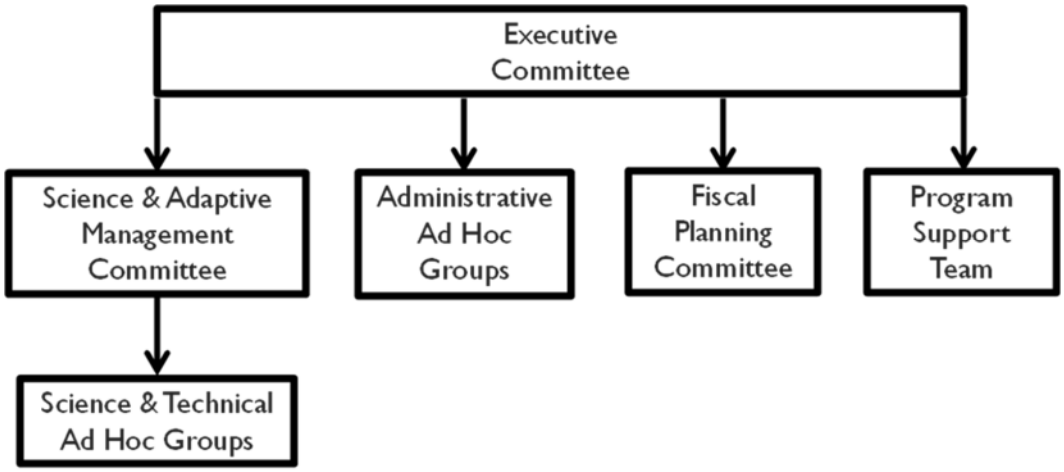


Figure 3. Collaborative Program Hierarchical Structure.

3.2 Operational Structure

The Collaborative Program is structured to include three components: 1) science and technical support, 2) policy and guidance, and 3) administrative support. This operational structure takes into account the assumptions outlined in Box 3 and the Collaborative Program's role as a science-based program. Following is a general description of the responsibilities of Collaborative Program groups and their roles related to the listed components. Figure 4 illustrates communication and workflow under the S&AM Plan.

3.2.1 Science and Technical Support

Under the new operational structure, the Collaborative Program's role in the MRG is that of a science-based program providing recommendations for scientific activities and best management alternatives. Scientific and technical support is key to the success of the S&AM Plan. The SAMC is responsible for implementation of the S&AM Plan, with support from the S&T Ad Hoc Groups and PST, and in coordination with the EC and FPC. Specifically, the SAMC's responsibilities include:

- Forming S&T Ad Hoc Groups charged with addressing specified scientific uncertainties;
- Tasking S&T Ad Hoc Groups with work such as data analyses, study plan development, and model updates in support of the S&AM Plan;
- Compiling the results of S&T Ad Hoc Group analyses, and translating them into recommendations for scientific activities and best management alternatives;
- Communicating regularly with the EC on the progress of the S&AM Plan efforts, including a summary of modifications to Collaborative Program objectives and tools with scientific justifications;

- Communicating recommendations to the EC for consideration of next steps, which may include recommended modifications to the Long-Term Plan with scientific justifications, or recommended management alternatives with analysis and scientific justifications; and
- Following up with MRG resource managers post implementation of Collaborative Program recommendations to ensure results of implemented activities can be assessed.

The flow of information and relationships between the Collaborative Program's scientific groups is illustrated in Figure 4. As the name implies, S&T Ad Hoc Groups are formed by the SAMC to complete specific scientific and technical tasks directed at reducing uncertainty regarding species response to management actions. Lack of consensus around scientific topics will prompt the SAMC to direct internal reviews via topical executive summaries (Section 4.4), or engage independent expert reviews, with approval from the EC.

The PST also assists with the scientific and technical aspects of Collaborative Program activities. Support includes compilation and analyses of reports, data, and information; coordination with contracting agencies, Collaborative Program committees and groups, and independent external reviewers; data management oversight; and drafting, reviewing, and updating study designs, scopes of work, and other work products as necessary.

Internal and External Work Product Reviews

The Collaborative Program's committees and ad hoc groups are tasked with producing scientific and administrative work products as part of their scientific investigations and/or technical endeavors. Work products from group activities include executive summaries, proposals, project descriptions, scopes of work, white papers, journal articles, modeling results, bibliographies, glossaries, and work plans. To ensure that work products are clear, accurate, and relevant to Collaborative Program efforts, they undergo various levels of internal and/or external review. The review process is designed to be rigorous enough to ensure document quality and support a range of scientific opinions. The Collaborative Program's internal and external review processes are described below.

Internal Review

All work products from Collaborative Program committees and ad hoc groups undergo a standardized process of internal review, which may include in-group peer review, statistical review, editorial review, and contextual review. Not every work product requires the same type of internal review. For example, the intensity of a statistical review depends on the nature of the product (e.g., sampling design for an experimental protocol versus evaluation of empirical data). Additionally, some work products may require multiple rounds of statistical or editorial review. The SAMC directs all internal review processes and determines how work products will move through the review steps. The internal review process can be highly tailored to a product, which allows the degree of flexibility required for reviewing the Collaborative Program's wide array of work products.

External Review

The goal of an external review is to provide a rigorous scientific evaluation of the Collaborative Program's work from an independent perspective. External reviews are used to address and finalize specific work products that require an independent review or specialized expertise that is not available within the Collaborative Program. Previous examples of external reviews are Hubert et al. (2016), which evaluated the RGSM Population Monitoring Program, and Noon et al. (2017), which examined the state of the science pertaining to RGSM life history characteristics. The recommendations from these reviews and progress on their implementation is tracked in the AM Database. Although these efforts are highly important to the Collaborative Program, they require a high level of resources to bring about. Due to the resource intensity of planning, convening, and addressing external reviews, they are not meant to be a regular part of the AM review process.

External reviews are meant to examine foundational or big picture products or questions that would benefit from additional scientific and technical expertise. This type of scrutiny is necessary to ensure the Collaborative Program is following the most recent and prudent scientific methods, as well as to prevent institutional bias. External reviews occur infrequently on an as needed basis, as determined by the EC in collaboration with the SAMC.

3.2.2 Policy and Guidance

While the SAMC is responsible for implementation of the S&AM Plan, the EC is the Collaborative Program's decision-making body. As such, the EC provides leadership, oversight, and approval for implementation of the S&AM Plan. EC representatives provide a collective knowledge of management regulations, policies, and operations related listed species in the MRG. Under the S&AM Plan, the EC holds the following responsibilities:

A. Reviewing recommendations and deciding next steps;

B. Communicating recommendations to natural resource management organizations; and

C. Evaluating Collaborative Program activities.

A. Reviewing Recommendations and Deciding Next Steps

The SAMC provides a variety of scientific and technical recommendations for which the EC decides next steps. The FPC may also provide recommendations for financing options to implement the SAMC's recommended activities. After deliberating recommendations, the EC may:

- Determine a recommendation is feasible or not in the context of existing policy;
- Incorporate a recommended activity into the Collaborative Program Project Bank, with a documented explanation of the decision to delay implementation and a timeline for future consideration;
- Request more information or further work from the SAMC or the FPC;

- Request independent external review of information upon SAMC recommendation;
- Instruct Administrative Ad Hoc Groups to complete an update, review, or draft administrative documents; or
- Communicate recommendations directly to implementing organizations and resource managers.

B. Communicating Recommendations to Natural Resource Management Organizations

Under the S&AM Plan, the EC relays recommendations for scientific activities and science-based best management alternatives to the appropriate resource managers. Recommended scientific activities are organized in the Long-Term Plan (Section 4.2) based on management-relevant categories and priority planning objectives agreed on by the Collaborative Program. In addition to being a planning tool for the Collaborative Program, the Long-Term Plan can be used by resource managers to out-plan their own activities.

The EC makes recommendations on best management alternatives based on the current scientific understanding of species responses to conditions in the ecosystem. The Collaborative Program evaluates and adjusts its recommendations as understanding evolves with new scientific findings. The EC also encourages managers to bring questions to the Collaborative Program for consideration.

C. Evaluating Science and Adaptive Management Activities

The EC annually (or more frequently at their discretion) evaluates Collaborative Program activities and committees/groups using guiding principles. Guiding principles include the Collaborative Program's mission, goals, and objectives. By performing regular reviews, decision-makers, including the EC members, Congressional and State representatives, and others, can be assured that the Collaborative Program actions are accomplishing the mission and benefitting the listed species. The EC assigns evaluation-related tasks to Administrative Ad Hoc Groups and the PST as appropriate. Collaborative Program activities and committees/groups are assessed based on how they address the up-to-date guiding criteria. Outcomes of the annual EC evaluation may include the following:

- Modifications to the composition of committees/groups
- Sunsetting groups
- Updates or clarifications to committee charters or group charges
- Adjustments of timelines and deadlines
- Amendments and updates to the S&AM Plan, Long-Term Plan, and/or by-laws
- Re-scoping work plans as necessary

3.2.3 Administrative Support

Under the Collaborative Program's hierarchical structure (Figure 2), three administrative groups exist to support the operations portion of the S&AM Plan: Administrative Ad Hoc Groups, the FPC, and the PST. The EC provides direction to each group, and individual EC representatives may be tasked with participating in Administrative Ad Hoc Group and FPC meetings as necessary.

Administrative Ad Hoc Groups

The EC may task a small group of individuals with reviewing and revising Collaborative Program documents in regards to policy. For example, an Administrative Ad Hoc Group may be tasked with revising the Collaborative Program By-Laws, reviewing SAMC applications, reviewing science-backed management recommendations in a regulatory context, or with better defining a portion of the S&AM Plan or the Long-Term Plan. Administrative Ad Hoc Groups report findings and recommendations to the EC.

Fiscal Planning Committee

The FPC is composed of signatory staff appointed by the EC. At the direction of the EC, and in coordination with the SAMC, the FPC meets to determine resource availability for Collaborative Program-supported activities. The FPC recommends an implementation schedule for EC-approved activities based on funding availability and regulatory commitments. The FPC is also responsible for engaging authorized and interested signatories through lobbying efforts for funding and partnerships as directed by the EC.

Program Support Team

In addition to scientific and technical support, the PST serves as administrative support for each of the Collaborative Program's committees and groups. The PST's responsibilities include leading the development of the Collaborative Program and SAMC Annual Work Plans; data storage and Program Portal oversight; development and administration of processes and procedures; organizing and facilitating meetings; and drafting, reviewing, and editing charters, charges, and other documents as needed to support the S&AM Plan. The PST also coordinates overall Collaborative Program operations, as depicted in Figure 4.

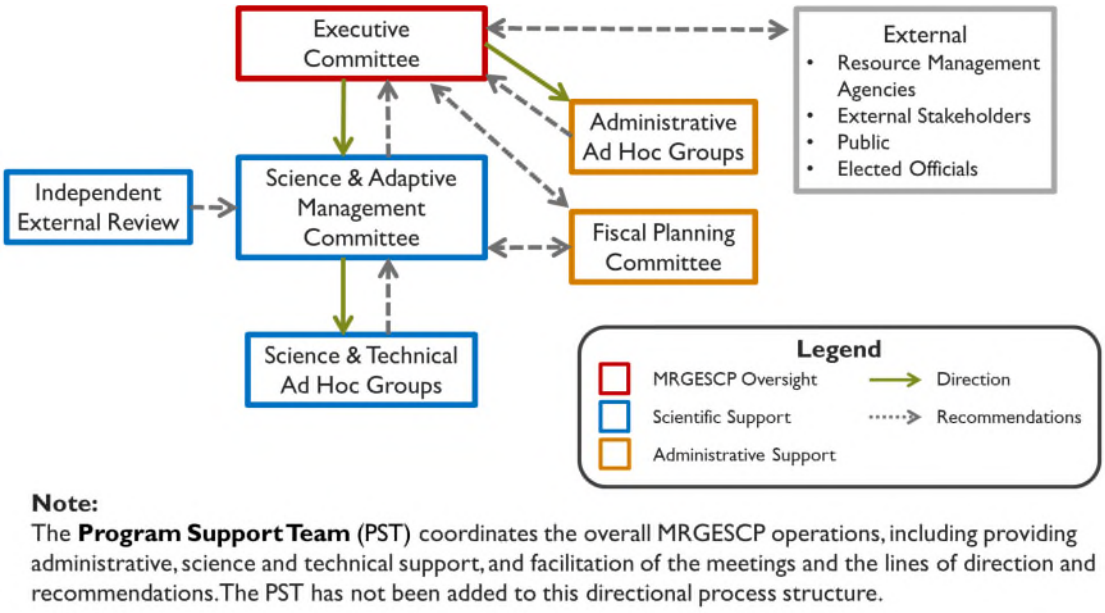


Figure 4. Communication and work flow for implementing the Science and Adaptive Management Plan.

4.0 TOOLS SUPPORTING THE SCIENCE AND ADAPTIVE MANAGEMENT PLAN

The Collaborative Program employs the use of several decision support, administrative, and planning tools to support the science and AM process. Below, these tools are described in regards to their relationship to the science and AM process.

4.1 Adaptive Management Database

The Collaborative Program's AM Database serves as a knowledge base that is regularly updated with new information to reflect current conditions in the MRG. The primary purposes of this information repository are to integrate Collaborative Program-supported science into system management, to evaluate past decisions, and to explore future scenarios. By linking information, such as critical uncertainties, planning objectives, proposed projects, management alternatives, and the state of the science, the AM Database gives much-needed context to Collaborative Program participants, enabling them to prioritize research needs and inform decision-making.

The AM Database provides a means for tracking the evolution of Collaborative Program work and MRG stakeholder endeavors. As a result, the tool allows the Collaborative Program to inform management of the system proactively, rather than reactively. The AM Database informs a variety of scientific and administrative processes, including the following:

- Maintenance of conceptual ecological models (CEM)
- Development of the Long-Term Plan

- Tracking reduction of scientific uncertainty
- Tracking status of scientific activities
- Justification of funding for Collaborative Program-related efforts via links to management authorities or obligations (where provided), and species recovery plans
- Systematic reduction of scientific uncertainties related to effects of management actions
- More frequent updates to the "state of the science" within the MRG
- Broader context for scientific analyses and management alternatives
- Generation of summaries for annual reports
- Summary of agency participation in Collaborative Program efforts
- Coordination and tracking of the development and review of work products

A common theme throughout AM literature, as well as in operational documents for the Collaborative Program, is the need to align scientific uncertainties, and the research efforts addressing them, with management questions (Walters, 1986, Williams et al. 2009, Murray et al. 2011, Caplan et al. 2018). In the 2011 description of a potential AM framework for the Collaborative Program, Murray et al. listed the conditions that must be met for successful implementation of AM:

- Feasibility for conducting a test of management actions
- Potential for learning about effectiveness of actions within a reasonable time frame
- Acceptable risk from failure of those tests
- Flexibility to change management practices based on what is learned

The AM Database fulfills the conditions for successful AM listed above. As a relational database, it aligns the Collaborative Program's scientific support with management objectives, critical uncertainties, past and current Collaborative Program efforts, and the Collaborative Program's guiding principles. The data are structured as a collection of tables linked to each other in relational pathways. Users have the flexibility and control to query and summarize data via an interface application. As the AM Database tracks learning in real time and relates scientific activities to the Collaborative Program's goals, it ensures regular stakeholder engagement and enables a long-term approach to AM, two concepts that Dreiss et al. (2017) found increased the effectiveness of AM.

One important component of the relational database is the Project Bank. The Project Bank is a cumulative list of scientific activities (proposed, in progress, and competed) and their descriptive details. The list is used to track progress, justify funding, and facilitate short- and long-term planning. Proposed activities are indexed according to their relevance to Collaborative Program objectives, which link to species recovery criteria. Associated metadata include conditions

necessary for implementation (e.g., logistical concerns, hydrologic condition, presence/absence of a listed species) and feasibility criteria (i.e., cost, linkages to authorities and obligations). The Project Bank tracks activity status, from development to deliverable, while facilitating transparent and objective prioritization. This allows the Collaborative Program's scientific pursuits to proceed in a strategic and timely manner.

4.2 Long-Term Plan

A long-term plan is an important tool for implementing structured decision-making in AM of natural resources, as it uses clear and measurable goals to develop a vision for desired products. By using the Collaborative Program's goals to establish objectives and strategies, a long-term plan helps identify needed resources, develop contingencies, and prioritize strategic work along a meaningful timeline. Commitment to consistent updates makes the plan adaptive and ensures that tasks are adjusted and realigned to goals as conditions change. Providing a long-term plan with administrative schedules and deadlines facilitates the timely completion of tasks.

Development of the Collaborative Program's Long-Term Plan is guided by information in the AM Database, predominantly the Project Bank. In addition to serving as a tool for scientific planning, the Long-Term Plan informs the Collaborative Program's administrative needs (e.g., updates to science and AM decision-support tools, deadlines for work products, timetables for meaningful recommendations on management alternatives, tracking of project statuses). Using the AM Database to query priority Collaborative Program objectives and uncertainties generated a list of linked ongoing and proposed scientific activities with descriptive labels for sorting and filtering. This list helps managers prioritize activities, identify logistical concerns, and secure funding and other resources.

The Collaborative Program's Long-Term Plan provides program-wide context and describes the specific ways in which listed activities support the Collaborative Program's guiding principles, and reduce critical scientific uncertainties related to management needs. Additionally, the administrative tasks needed for carrying on normal operations and fulfilling upcoming obligations within the Collaborative Program are outlined in the plan. The Long-Term Plan is assessed and adjusted regularly in order to accommodate changing operational and/or environmental conditions.

4.3 Program Portal

The Program Portal serves as a communication and administrative support tool. The tool houses the Collaborative Program's document library, datasets, event calendar, Long-Term Plan, and Geospatial Mapping Application (Section 4.5).

The Portal's event calendar is regularly updated with upcoming Collaborative Program-related events, including meetings, presentations, and symposiums. One week before meetings, calendar events are tagged with meeting minutes, agendas, and meeting materials for download.

The document database facilitates the storage and sharing of important documents. Scientific documents concerning species, hydrology, and more can be accessed using the site search

function. Signatories can also access administrative documents, including meeting minutes, agendas, work plans, and charters. The document database is regularly updated with new scientific reports, meeting materials, and references works, and will continue to be developed as needs arise and new documents and/or data become available.

4.4 Topical Executive Summaries

The SAMC will direct the completion of topical executive summaries, as needed, in an effort to condense relevant information about a particular topic and uncover uncertainties and research questions yet to be addressed. This exercise helps identify lack of consensus in study findings and alternative hypotheses by topic. The executive summaries will serve the following purposes:

1. Provide reference lists of relevant literature on each topic to identify and document knowledge gaps and points of non-consensus ;
2. Inform Collaborative Program recommendations for scientific activities designed to resolve key uncertainties related to listed species; and
3. Document progress in the reduction of uncertainty and provide a synopsis by topic to the SAMC, the EC, and Collaborative Program signatories, as necessary.

Each executive summary highlights findings from the latest relevant literature that provide evidence in support of (or against) key arguments. Understanding what is currently known and what remains unknown is crucial for prioritizing key scientific uncertainties and developing effective management alternatives.

The SAMC will use the executive summaries to direct activities that reduce key scientific uncertainties. These activities may include additional literature reviews, modeling exercises, monitoring activities, or field studies. Documenting progress supports the science and AM process.

4.5 Geospatial Mapping Application

The geospatial mapping application (mapper) on the Program Portal features interactive visualization tools that facilitate effective management of data resources in support of Collaborative Program goals and objectives. The map is a powerful visual aid for interagency collaboration and communication, as it allows users to examine the overlap of georeferenced data layers that are relevant to management of the MRG. The Program Portal mapper includes monitoring sites and territory boundaries for listed species, habitat restoration areas, water quality measurements, and control structures. In using the mapper, scientists and managers may discover data associations that were not discernible with non-spatial analyses.

Finding more connections, between biotic response metrics and habitat parameters in particular, improves the accuracy of models by accounting for variability in the response (i.e., reducing uncertainty). In addition, the identification of areas where critical habitat for two or more species overlaps may allow managers to focus resources more efficiently and provide enhanced justification for funding. The use of a single geospatial tool for coordination amongst Collaborative Program signatories generates an additional dimension for decision support, as new connections are revealed at multiple spatial scales. Mapping provides geographical context for activities, such

as monitoring and habitat restoration, which helps demonstrate benefits to multiple species or the potential for unintended consequences. This type of information greatly enriches the AM process by directly addressing the objectives and values of the stakeholders.

4.6 Modeling Tools

A shared understanding of the dynamics of the MRG system and its influence on decision processes allows scientific and technical experts, natural resource managers, and decision-makers to communicate the purpose of a management action and its intended effects. The process of documenting the current understanding of system dynamics also prevents institutional knowledge from being lost as a result of personnel turnover.

One way to assess trends and compare/contrast the effects of different management actions is with models. The term “models” refers to anything that provides a reasonable representation of a system that is the setting for a natural resource management problem (Williams 2011). Models can be as basic as a verbal or written description, or as complicated as a series of mathematical models.

In the framework of AM, models connect management actions with stakeholder objectives (Conroy and Peterson 2013). Models used in the AM process should be viewed as useful, albeit imperfect, tools that are subject to continuous refinement as new information becomes available. A model does not make a decision but instead informs and often guides that process.

Conceptual ecological models, such as those in Appendix B and C, are useful for education and communication purposes, both internally and externally to the Collaborative Program. The Collaborative Program has four primary goals for using species-specific CEM tools:

1. Transparency around the decision-making process;
2. Communication of information;
3. Identification of critical uncertainties; and
4. Connection of management actions and objectives.

5.0 SCIENCE AND ADAPTIVE MANAGEMENT PLAN IMPLEMENTATION

Through the science and AM process, the Collaborative Program provides scientific and technical support to natural resource managers to inform the continual improvement of management actions for listed species. As discussed in Section 2, this process emphasizes learning from the results of scientific activities to inform management. Under the S&AM Plan, the Collaborative Program:

- Identifies critical uncertainties and develops research hypotheses to address them

- Designs experiments to test hypotheses and reduce uncertainties
- Evaluates new information and data gathered within the context of Collaborative Program objectives to determine what has been learned
- Translates the scientific evidence into management-relevant, constructive, timely recommendations for scientific activities and management alternatives
- Communicates the results of field and laboratory research, habitat restoration projects, and monitoring and modeling efforts
- Enables iterative learning through tracking, evaluation, and incorporation of scientific evidence into objectives and decision-support tools, such as the AM Database

As part of the science and AM process, the Collaborative Program determines the key scientific questions on which to focus efforts within specific management categories. These categories may pertain to any of the listed species and/or the MRG system, and include, but are not limited to, the list in Box 5.

Box 6. Management Categories.

- Applied Research: Field, Laboratory
- Flow Modification
- Habitat Restoration: Research, Construction, Monitoring
- Hydrologic Modeling
- Population Management: Monitoring, Modeling, Propagation
- River Modification: In-Channel, Off-Channel
- Water Quality Management: Land Use, Monitoring

Within these categories, the Collaborative Program:

1. Helps fill knowledge gaps or reduce uncertainties to enable implementing organizations to make more informed management decisions;
2. Recommends scientific activities that fill knowledge gaps or reduce uncertainties related to management actions for implementation by signatories; or
3. Evaluates management alternatives using scientific evidence.

The steps described below guided the Collaborative Program's implementation of the AM cycle (Figure 2.1). Appendix A complements these steps with a task list for implementation of the science and AM process, with the following three main tasks outlined:

1. Finalize and implement the S&AM Plan, the Long-Term Plan, and associated tools
2. Develop and agree on processes to support the implementation of the science and AM process
3. Implement the new organizational structure

Following is an outline of each AM cycle stage as it relates specifically to the Collaborative Program. Under each stage are the main steps the Collaborative Program must complete to implement and maintain the science and AM framework.

5.1 Assess Stage

A. Agree on Collaborative Program Objectives

Step 1. Assess objectives identified during previous efforts
The Collaborative Program uses signatory values and species recovery expectations as a starting point for developing objectives. These AM objectives are informed by past efforts described in previous sections through a systematic assessment of each one. Evaluation of relevance, priority, and specification ensures that no work is discarded.

Step 2. Convene a workshop to identify objectives that guide the S&AM Plan
As part of the workshop, signatory members evaluate and/or refine the objectives identified from Step 1; add new objectives, if needed; and identify signatory expectations regarding participation in the science and AM process. In addition to clearly defining objectives, workshop participants develop strategies to meet objectives and identify metrics for success.

Step 3. Adopt objectives
The SAMC summarizes the results of the workshop and communicates them to the EC for review and approval. The approved objectives address critical uncertainties and direct work within the science and AM process.

B. Identify Management Alternatives

Step 4. Compile and organize management actions and scientific activities
The Collaborative Program tracks current and proposed management actions, management alternatives, and scientific activities. These lists are stored in the AM Database.

Step 5. Develop potential management alternatives
The list of management alternatives developed in step 4 consists of potential actions for benefitting listed species in the MRG. The SAMC tasks S&T Ad Hoc Groups with developing new management approaches using innovative solutions, even if they are not currently feasible.

Step 6. Relate management alternatives to hypotheses
Management alternatives are connected to hypotheses via study designs using the AM Database. In this way, research hypotheses link scientific uncertainties with resource management.

C. Develop Models

Step 7. Continue developing additional species-specific CEMs

The Collaborative Program developed CEMs for RGSM, SWFL, and YBCU (Appendices B and C). CEMs for NMMJM and PESU are in development. The SAMC directs S&T Ad Hoc Groups to finalize the NMMJM and PESU CEMs and incorporate them into the AM Database.

Step 8. Additional CEM development based on identified critical uncertainties
The Collaborative Program uses species-specific CEMs to depict relationships in the ecosystem. These models are developed and updated based on the current understanding of those relationships. The Collaborative Program evaluates uncertainties and their links to management, and prioritizes model improvements that clarify essential relationships. If appropriate, additional modules or refinements to existing models can be developed to more accurately represent a component group (e.g., hydrology, genetics).

Step 9. Link CEMs to management alternatives and objectives
The SAMC tasks S&T Ad Hoc Groups with deconstructing the CEMS into individual components and connecting those components with the management alternatives and objectives identified in the steps above. This provides an initial framework for determining what management actions can be used to test hypotheses related to those uncertainties. These linkages are documented in the AM Database.

These linkages can also be used to parameterize quantitative models using the science and AM process. Quantitative tools enable users to better understand how specific uncertainties influence the decision-making process and management strategies.

5.2 Design Stage

D. Develop AM Planning Tools

Step 10. Continue developing the AM Database
The AM Database is the platform for the Collaborative Program's science and AM process, and is regularly updated.

Step 11. Design scientific activities for reducing uncertainty
The Collaborative Program develops research hypotheses to reduce scientific uncertainties that are not clarified with existing data and information. The SAMC directs the design of new scientific activities (e.g., scopes of work) to populate the Project Bank (Step 12).

Step 12. Populate a Project Bank
The Project Bank contains specifics for each Collaborative Program -related scientific activity and includes connections to scopes of work, required conditions, geospatial and temporal scales, collected data, and relation to objectives and scientific uncertainties. The Project Bank is used to prioritize scientific activities with which to update the Long-Term Plan. As new options for reducing scientific uncertainties are developed, they are incorporated into the Project Bank.

5.3 Implementation Stage

E. Develop Administrative Tools to Support the Science and Adaptive Management Process

Step 13. Identification of administrative resource availability and scheduling

The FPC develops a schedule of funding and contracting deadlines with input from signatories. The schedule is not exhaustive but notes the key deadlines for contracting and funding opportunities. This allows the Collaborative Program to coordinate on activity implementation and fundraising efforts.

The FPC collaborates on leveraging signatory resources for Collaborative Program activities. These resources may be financial, personnel-related, administrative (e.g., administering contract, accepting grant money), or operational (e.g., laboratory space, equipment). This streamlines the FPC's efforts in identifying opportunities for funding and/or partnerships.

Step 14. Refine the Long-Term Plan

The Long-Term Plan is modified in response to changing administrative constraints and/or Collaborative Program objectives. The AM Database documents these changes and tracks the status of funded projects in real time, thus facilitating out-planning and evaluation of projects.

5.4 Monitor Stage

F. Continue supporting monitoring efforts

Step 15. Support monitoring efforts

The Collaborative Program supports ongoing long-term monitoring and data collection efforts. These datasets establish trends through time, inform future scientific activities, and are key inputs into quantitative models. The Program Portal houses the datasets as appropriate.

5.5 Evaluate Stage

G. Establish the Current State of the Science

Step 16. Analyze existing data

The Collaborative Program has amassed a large amount of information on the MRG system and its listed species. The SAMC, or the assigned S&T Ad Hoc Group(s), continue to refine understanding of system interactions. Consequently, new data pertaining to species life histories and relationships to management implications, as well as existing data is used to inform hypotheses identified in the previous steps.

Step 17. Identify uncertainties and develop hypotheses

As described above, the CEMs indicate uncertainty associated with biotic responses to certain environmental variables. If an uncertainty is linked to a Collaborative Program objective, the SAMC or assigned S&T Ad Hoc Group(s) first dissects the uncertainty into responses, drivers, individual questions, and hypotheses, then links the components to management alternatives, data resources, and the Project Bank. After, the SAMC tasks S&T Ad Hoc Group(s) with developing scientific activities around the identified research hypotheses.

Step 18. Draft topical executive summaries
When there is non-consensus on the state of the science around a topic, the SAMC tasks an S&T Ad Hoc Groups with drafting an executive summary that synthesizes relevant literature and provides evidence in support of alternative hypotheses.

5.6 Adjust Stage

H. Incorporate New Findings

Step 19. Communicate new scientific findings
The S&AM Plan and its associated tools are specifically designed to improve communication within the Collaborative Program. The SAMC translates scientific results into coherent, management-relevant recommendations for the EC. The Program Portal and AM Database supplies scientists and managers with a common set of facts from which to initiate discussions. Signatory members and other experts communicate research findings at the Science Symposium, after which, the SAMC or an assigned S&T Ad Hoc Group compiles and evaluates new scientific evidence as it relates to Collaborative Program objectives. Additionally, formal documentation of study results in peer-reviewed journals strengthens recommendations generated by the Collaborative Program.

Step 20. Incorporate results of data analyses into Executive Summaries and models
When new information is generated, through data analysis, modeling, or literature reviews, the SAMC evaluates it within the broader context of the management landscape and state of the science. Research findings that improve on the understanding of species-system interactions are documented in the CEMs, quantitative models, and executive summaries.

Step 21. Document the learning process
When incorporating new scientific evidence, the Collaborative Program asks the following questions:

- Is the evidence supported and durable?
- Did we learn enough to justify a change to a model?
- Did we learn enough to modify a Program objective?

The SAMC evaluates whether there is sufficient evidence to modify the CEMs, quantitative models, and/or Collaborative Program objectives, and periodically reports to the EC on the state of the science.

Step 22. Update the Long-Term Plan
As changes are made in steps 1 through 21, adjustments to the Long-Term Plan may be necessary. The SAMC utilizes the AM Database to track changes.

Table 3. Linking the Collaborative Program's Adaptive Management (AM) Cycle Steps to the Tasks Associated with Implementation of the Science and Adaptive Management (S&AM) Plan.

Steps to Implement the Collaborative Program AM Cycle (Section 5)	Tasks to Implement the S&AM Plan (Appendix A)
ASSESS STAGE	
A. Agree on Collaborative Program Objectives	
Step 1. Assess objectives identified during previous efforts	Task 1.3a
Step 2. Convene a workshop to identify objectives that guide the S&AM Plan process	Task 1.3b
Step 3. Adopt objectives	Task 1.3c
B. Identify Management Alternatives	
Step 4. Compile and organize management actions and scientific activities	Task 1.3d
Step 5. Develop potential management alternatives	Task 1.3e
Step 6. Relate management alternatives to hypotheses	Task 1.3f
C. Develop Models	
Step 7. Continue developing additional species-specific conceptual ecological models (CEMs)	Task 1.2a
Step 8. Additional CEM development based on identified critical uncertainties	Task 1.2b
Step 9. Link CEMs to management alternatives and objectives	Task 1.2d
DESIGN STAGE	
D. Develop Adaptive Management Planning Tools	
Step 10. Continue developing the AM Database	Task 1.3
Step 11. Design scientific activities for reducing uncertainty	Task 1.3o
Step 12. Populate a Project Bank	Tasks 1.3n and 1.3o
IMPLEMENTATION STAGE	
E. Develop Administrative Tools to Support the Science and AM Process	
Step 13. Identification of administrative resource availability and scheduling	Task 1.5
Step 14. Refine the Long-Term Plan	Task 1.6
MONITOR STAGE	
F. Continue supporting monitoring efforts	
Step 15. Support monitoring efforts	Task 1.1
EVALUATE STAGE	
G. Establish the Current State of the Science	
Step 16. Analyze existing data	Task 1.3i
Step 17. Identify uncertainties and develop hypotheses	Tasks 1.3g, 1.3h, 1.3j
Step 18. Draft topical executive summaries	Task 1.3k
ADJUST STAGE	
H. Incorporate New Findings	
Step 19. Communicate new scientific findings	Task 4.3
Step 20. Incorporate results of data analyses into Executive Summaries and models	Task 1.7
Step 21. Document the learning process	Task 1.8
Step 22. Update the Long-Term Plan	Tasks 1.6 and 1.7

6.0 GLOSSARY

Adaptive Management: A rigorous approach for designing and implementing management actions to maximize learning about uncertainties that affect management decisions. It involves synthesizing existing knowledge, identifying uncertainties with management relevance, and developing hypotheses related to those uncertainties. The process then calls for exploring management alternatives to test hypotheses, making predictions of their outcomes, selecting one or more actions to implement, and conducting monitoring and research to see if the outcomes match those predicted. The results are used to learn and adjust future management and policy.

Adaptive Management for the Collaborative Program (2018): Effective environmental management in the face of uncertainty by integrating science and learning into effective management under changing conditions coupled with a cyclic strategy producing improved systematic understanding of needs to meet the established goals.

Management Alternatives: Includes possible management actions that can be taken given the environmental and funding conditions at the time. “No action” is always an alternative. The Collaborative Program explores and compares the performance of management alternatives available to MRG managers.

Management Relevance: When an uncertainty has management relevance, activities performed to reduce that uncertainty will inform management of a system. The results of these activities enable managers to compare the performance of management alternatives in meeting stated objectives. Uncertainties without management relevance may limit understanding of system behavior, but have low to no impact on management decisions.

Scientific Activities: The collective of studies, projects, data collection, monitoring, and experimentation.

Uncertainties: Gaps in knowledge of a system; indeterminate or inexact understanding of a system state or feature in natural resource management. Being uncertain is not the same as knowing nothing. The Collaborative Program will work to reduce uncertainties that have management relevance as this practice enables natural resource managers to compare the performance of management alternatives in meeting stated objectives.

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Appendix A. Science and Adaptive Management Plan Implementation Task List

Table A1. Science & Adaptive Management (S&AM) Plan Implementation Task List.

Tasks	Responsible Group(s)					
	EC	SAMC	AAH	FPC	S&T	SIG
1. FINALIZE AND IMPLEMENT THE S&AM PLAN, THE LONG-TERM PLAN, AND ASSOCIATED TOOLS						
1.1 Support data collection efforts						
1.1a Provide statistical review for sampling designs		X			X	
1.1b House collected datasets on the Program Portal, as appropriate		X				
1.2 Continue development and refinement of conceptual ecological models (CEMs)						
1.2a Develop and refine the NMMJM and PESU CEMs					X	X
1.2b Continually refine the RGSM, YBCU, and SWFL CEMs, as appropriate					X	
1.2c Provide training on use of each species CEM		X			X	
1.2d Link CEMs to management alternatives and objectives		X				
1.3 Populate the Adaptive Management (AM) Database with the following:						
A. Objectives						
1.3a. Assess the objectives identified during previous efforts		X				
1.3b. Convene an objectives workshop to: • Solicit signatory values to inform development of the objectives • Assess and refine preliminary objectives • Identify additional objectives, as needed • Develop strategies for each objective • Determine and define any metrics		X				X
1.3c. Review and adopt approved objectives	X					
B. Management Alternatives						
1.3d. Compile and categorize management alternatives		X			X	
1.3e. Identify additional management alternatives		X			X	
1.3f. Link management alternatives and Collaborative Program objectives		X				
C. Scientific Uncertainties and Hypotheses						
1.3g. Review and update compiled list of scientific uncertainties		X			X	
1.3h. Determine which scientific uncertainties are reducible		X			X	
1.3i. Determine which reducible scientific uncertainties can be addressed using existing data		X			X	
1.3j. Define alternative hypotheses for reducible uncertainties		X			X	
1.3k. Develop executive summaries for uncertainties for which there is non-consensus about hypotheses. Executive summaries should do the following: • Summarize the available literature • Note areas of agreement • Provide alternative hypotheses • Identify knowledge gaps					X	
1.3l. Link hypotheses to Collaborative Program objectives, management alternatives, and recovery goals		X				

Table A1. Science & Adaptive Management (S&AM) Plan Implementation Task List.

Tasks	Responsible Group(s)					
	EC	SAMC	AAH	FPC	S&T	SIG
1.3m. Identify limiting factors for addressing a hypothesis, for example: • Preliminary studies • Necessary river conditions • Documented presence of species • Technology/equipment needs • Financial resources • Regulatory or political constraints		X		X		
D. Scientific Activities						
1.3n. Compile existing scientific activities (e.g., project ideas list, annual reports), assign a status, and link to hypotheses (i.e., Project Bank)					X	
1.3o. Develop new scopes of work to address the alternate hypotheses and knowledge gaps for inclusion into the Project Bank					X	
1.4 Operationalize the AM Database						
1.4a Provide training on use of the AM Database		X		X	X	X
1.5 Develop an administrative schedule with the following: • Signatory funding deadlines • Administrative deadlines • Recovery plan five-year reviews				X		X
1.6 Populate the Long-Term Plan using the AM Database and the Project Bank						
1.6a Use the AM Database to rank scientific activities based on relevance to management alternatives and Collaborative Program objectives, and feasibility		X				
1.6b Deliberate on incorporation of scientific activities recommended by the SAMC into the Long-Term Plan	X					
1.6c Review the Long-Term Plan and incorporate recommendations into individual signatory out-planning						X
1.7 Reevaluate Collaborative Program objectives and tools, in light of scientific findings						
1.7a Synthesize analyses and conclusions into evidence-based recommendations for management alternatives		X				
1.7b Review the Long-Term Plan and incorporate recommendations into individual signatory out-planning						X
1.7c Update tools with new scientific findings, as necessary					X	
1.8 Provide regular progress reports to the EC						
1.8a Provide quarterly progress reports		X				
1.8b Provide an annual science and AM report		X				
2. DEVELOP AND AGREE ON PROCESSES TO SUPPORT THE IMPLENTATION OF THE S&AM PLAN AND THE LONG-TERM PLAN						
2.1 Revise the scope of work process to incorporate elements from the S&AM Plan		X				
2.2 Refine the peer review process, including both internal and external review			X			
2.3 Refine the topical executive summary process		X				

Table A1. Science & Adaptive Management (S&AM) Plan Implementation Task List.

Tasks	Responsible Group(s)					
	EC	SAMC	AAH	FPC	S&T	SIG
2.4 Develop a process for supporting signatory resources and efforts (e.g., lobbying, funding, letters of support)			X			
3. IMPLEMENT THE NEW ORGANIZATIONAL STRUCTURE						
3.1 Clarify signatory expectations under the Collaborative Program's science and AM process with the following: • Annual report • Cost share	X					X
3.2 Sunset all existing work groups and incorporate any ongoing work into the charges and charters of new ad hoc groups and committees under the new structure	X					
3.3 Identify the tasks to be completed under the science and AM process, and draft S&T charges to complete those tasks		X				
3.4 Convene S&Ts to complete charges					X	
3.5 Update the By-Laws to reflect the new organizational structure and governance	X		X			
3.6 Draft and adopt a new Memorandum of Agreement	X		X			
4. COMMUNICATION						
4.1 Science						
4.1a Hold Brown Bags						X
4.1b Host Science Symposium		X				
4.1c Complete topical executive summaries					X	
4.1d Publish peer-reviewed works						X
4.2 Recommendations to resource managers						
4.2a Deliberate on SAMC findings and make final evidence-based recommendations on best management alternatives	X					
4.2b Make recommendations on scientific activities for implementation	X	X				
4.3 Collaborative Program communication						
4.3a Update and maintain the Program Portal	Program Support Team, in coordination with the Collaborative Program					
4.3b Distribute bi-monthly Collaborative Program newsletter						
4.3c Participate in community outreach						

EC = Executive Committee; SAMC = Science and Adaptive Management Committee; AAH = Administrative Ad Hoc Groups; FPC = Fiscal Planning Committee; S&T = Science and Technical Ad Hoc Groups; SIG = signatories; RGSM = Rio Grande silvery minnow; SWFL = southwestern willow flycatcher; YBCU = yellow-billed cuckoo; NMMJM = New Mexico meadow jumping mouse; PESU = Pecos sunflower; Collaborative Program = Middle Rio Grande Endangered Species Collaborative Program.

Appendix B. Rio Grande Silvery Minnow Conceptual Ecological Model

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Figure B7. Rio Grande silvery minnow (RGSM) conceptual ecological model (CEM) relationship matrix

RIO GRANDE SILVERY MINNOW LIFE HISTORY

The Rio Grande Silvery Minnow (*Hybognathus amarus*, RGSM) is a small-bodied member of the Cyprinid family, native to the Rio Grande basin. The RGSM once occurred throughout the Rio Grande Basin, from the MRG (Middle Rio Grande) all the way to the Gulf of Mexico. Historically, it was also found in important tributaries such as the Rio Chama, Jemez River, and Pecos River (Sublette et al. 1990, Bestgen and Platania 1991, Horwitz et al. 2018).

Currently, the RGSM occupies approximately seven percent of its historic range (U.S. Fish and Wildlife Service [USFWS] 2010, Mortensen et al. 2019). The majority of the population is found in the 280-kilometer reach of the MRG between Cochiti Dam and Elephant Butte Reservoir. Additionally, a much smaller, experimental population was introduced into a small portion of the Rio Grande, near Big Bend, Texas, in 2008. Although limited natural reproduction occurs within the MRG population, the Big Bend population is not believed to be self-sustaining at this time (USFWS 2008, Edwards 2017). The contraction of the RGSM's range is mostly attributed to modifications in hydrology resulting from anthropogenic changes in water use and storage in the basin (USFWS 2016, 2018). Historical loss of RGSM habitat, and an overall decline in RGSM abundance, resulted in the species being listed as endangered under the Endangered Species Act in 1994.

The life history of the RGSM is typical of similar small-bodied, riverine cyprinids that occupy lowland floodplain rivers of western North America (Platania et al. 2020). Spawning begins in the spring during the freshet, just prior to and during peak flows (typically mid-April to mid-May). The exact mechanism that initiates spawning is still unknown, but is likely related to hydrologic and temperature cues (Dudley et al. 2018, USFWS 2018). RGSM are broadcast spawners and highly fecund; a single female may produce anywhere from 2,000 to 10,000 eggs (Caldwell et al. 2019). Eggs become semi-buoyant after fertilization and drift downstream while they incubate. Egg incubation typically lasts for 24–48 hours and is highly temperature dependent (Platania 2000). The spawning strategy of the RGSM depends on reliable flows that are able to disperse eggs and larvae into slower moving, overbank and floodplain nursery habitats (Gonzales et al. 2014). Larvae hatch from their eggs at 4 millimeters (mm) standard length (SL), and, on average, become free swimming four days later, once they reach 5–10 mm SL. Larvae are gape limited and known to eat algae, diatoms, small invertebrates, cyanobacteria, detritus, periphyton, seeds, and pine pollen (Shirey et al. 2008, Magana 2009, Watson et al. 2009, Bixby and Burdett 2014). The larval life stage lasts until mid-July, when larvae transition to juveniles and reach 13–64 mm SL.

Juveniles primarily occupy in-channel habitats, as declining freshet flows have receded floodplain habitats. Juvenile habitats are notably deeper and in faster moving water than larval habitats. Juvenile RGSM have similar diets to larvae, as RGSM tend to be generalists. Juveniles grow through the summer and fall, before transitioning into adults and reaching 35–90 mm SL, beginning in December. During the summer, it is common for portions of the MRG to dry, leading to fragmentation of suitable RGSM habitats. When drying occurs, the lack of suitable habitat leads to stranding and high mortality for RGSM.

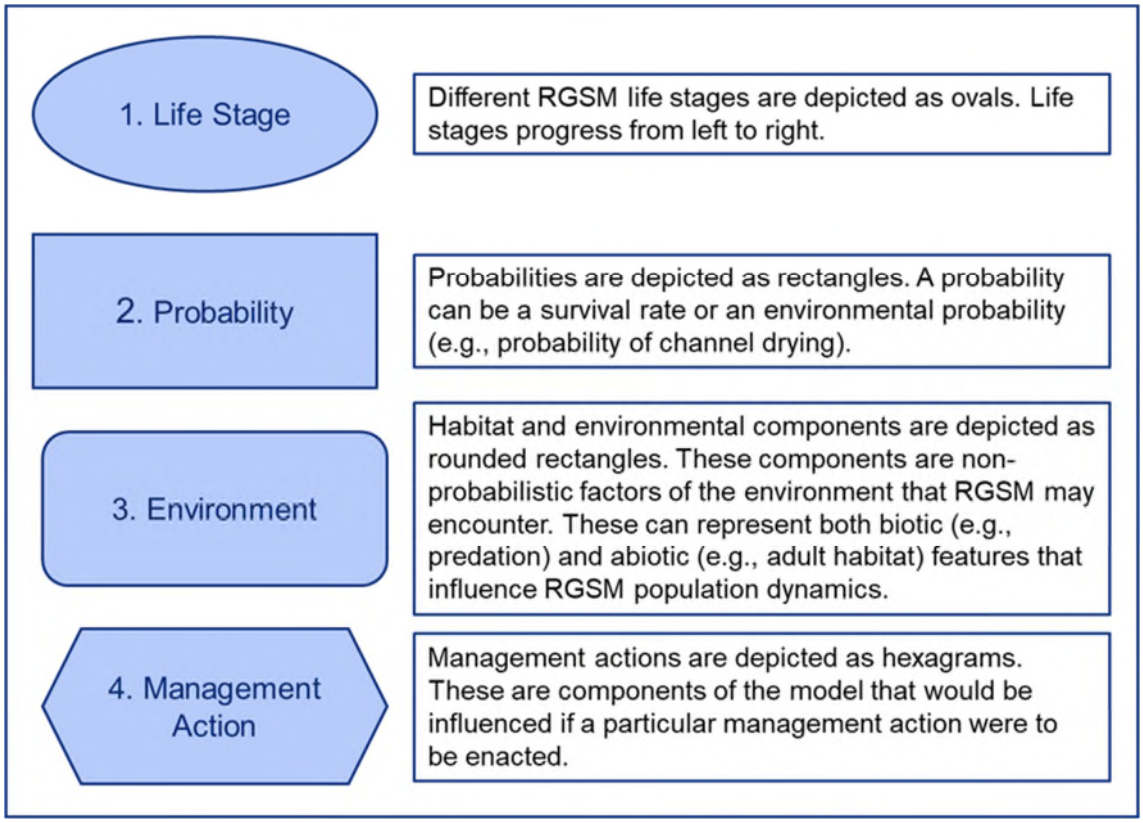
Adult RGSM have almost identical habitat use and diets to juveniles. During the winter, RGSM occupy deeper, slower habitats with adequate cover, which allows them to conserve energy (Platania and Dudley 2003). Sexual maturity is often achieved in less than 12 months, thus fish hatched the previous spring are able to contribute to the population the following spawning

season. The typical life span of RGSM in the MRG is two years; however, individuals as old as five years have been observed (Dudley et al. 2018, Horwitz et al. 2018).

CONCEPTUAL ECOLOGICAL MODEL DESCRIPTION

The RGSM conceptual ecological model (CEM) describes and depicts the life history of RGSM and all related biotic and abiotic factors of the MRG. With that in mind, transition schematics were developed for five RGSM life stages: adult egg production, egg to larvae, larvae to juvenile, juvenile to adult, adult to adult age 2+ (Figures B1–B5). A graphical RGSM CEM was developed from these schematics (Figure B6). The CEM is a variation of an influence diagram, which documents relationships between model components using arrows. There are four types of model components in the RGSM CEM, each one represented by a unique shape, as depicted in Box B1.

Box B1. Rio Grande Silvery Minnow (RGSM) Conceptual Ecological Model (CEM) Components.



Each CEM component is connected to at least one other component by an arrow. The direction of the arrow indicates the direction of influence and flow of information. All arrows are unidirectional, meaning a single arrow can only represent a single relationship. The thickness of the arrow represents the importance that the parent component has on the child component (destination; Table B1, Figure B6). The color of the arrow indicates the current level of understanding of the relationship between the components (Table B1). Black arrows indicate life stage transitions.

Table B1. Relational Arrow Key for the Rio Grande Silvery Minnow Conceptual Ecological Model.

Level	Importance of Parent Component to Child Component	Understanding of Relationship
High		
Medium		
Low		

COMPONENT GROUPS

All model components fall under one of ten categories, which are distinguished by different colors in the graphical model (Figure B6). The ten categories are defined in Table B2 and each one is a factor that influences RGSM. Determining general patterns in the relationships between these factors increases understanding of the RGSM life history. The ten categories also provide specific areas of focus for future studies.

In general, the CEM follows the life history of RGSM from adults in time step *t* to adults in time step *t+1*. The CEM moves chronologically left to right, beginning when adults in time step *t* spawn to create eggs, and progressing as the eggs become larvae, then juveniles, and finally adults in time step *t+1.* Mortality is represented between each time step by survival probabilities. Survival probabilities are informed by various components in the lower portion of the model (Figure B6). A full description of each model component can be found on Table B3.

Table B2. Rio Grande Silvery Minnow (RGSM) Conceptual Ecological Model Component Categories.

Component Category	Definition
1. Life History	Life history components are either RGSM life stages or population vital rates. These components comprise the RGSM life cycle, and are the end points of most other components in the model.
2. Food Availability	Food availability components represent food availability at three different RGSM life stages: larval, juvenile, and adult. Food availability directly influences age-specific survival rates.
3. Predation	Predation components represent the three most common predator categories: fish, avian, and invertebrate. RGSM are prey to a variety of other species in the Middle Rio Grande (MRG), and predation rates directly influence RGSM age-specific survival.
4. Hydrology	Hydrology is a large component because of its influence on and interconnectedness with the system; it influences the RGSM life cycle through temperature, flow, and floodplain inundation. Most hydrologic components are related to flow (*Q*).
5. Geomorphology	Geomorphic components represent the processes that affect the physical shape and environment of the river. These processes determine sediment scouring/deposition, overall river geometry, and other river hydraulics.
6. Habitat	The three types of habitat occupied by RGSM are larval, juvenile, and adult. In general, RGSM use a wider range of stream velocities and depths as they grow from larvae to adults. Habitat availability may directly influence age-specific survival rates.
7. Vegetation	Vegetation components refer to the diversity and density of vegetation that exists in the floodplains and main channel of the MRG. Vegetation helps determine floodplain inundation and overall river geometry.
8. Disease and Parasites	The prevalence of disease and parasites that can adversely affect survival rates of RGSM.
9. Genetics	Genetic diversity is the only component in the genetics category. Genetic diversity is informed by the density of adults present in the system, and influences overall fecundity.
10. Photoperiod	Photoperiod is the change in the amount of daylight throughout the year. The photoperiod component may be a spawning cue, and may only influence fecundity.

CONCEPTUAL ECOLOGICAL MODEL SCALE

The RGSM CEM assumes specific spatial and temporal scales. Spatially, the extent of the model includes four reaches of the MRG (Cochiti Reach, Angostura (or Albuquerque) Reach, Isleta Reach, San Acacia Reach). Due to this scale, the model is spatially implicit at resolutions finer than the listed reaches. For example, fish occupying different parts of the same reach are assumed to experience the same mortality rates, and have the same access to habitat. The Northern Reach was excluded from the spatial scale of the RGSM CEM, as RGSM do not exist there. The five MRG reaches are defined in Section 1.3 of the *Science & Adaptive Management Plan*.

The current format of the RGSM CEM depicts the direction, importance, and current level of understanding of the relationships between model components. At this time, it is not possible to identify specific mechanisms for each relationship depicted in the RGSM CEM. However, this

model is a tool intended to help managers and stakeholders identify the components and relationships that are most influential to management of RGSM.

Temporally, the RGSM CEM operates on an annual time step. Although much of the biology of RGSM occurs on finer spatial and temporal scales, little monitoring has been done to build a useful system-wide model that can operate at finer resolutions (e.g., 10-km reaches, or on a daily time step). The temporal scale of the RGSM CEM was chosen to reflect the current monitoring methods and population dynamics modeling efforts.

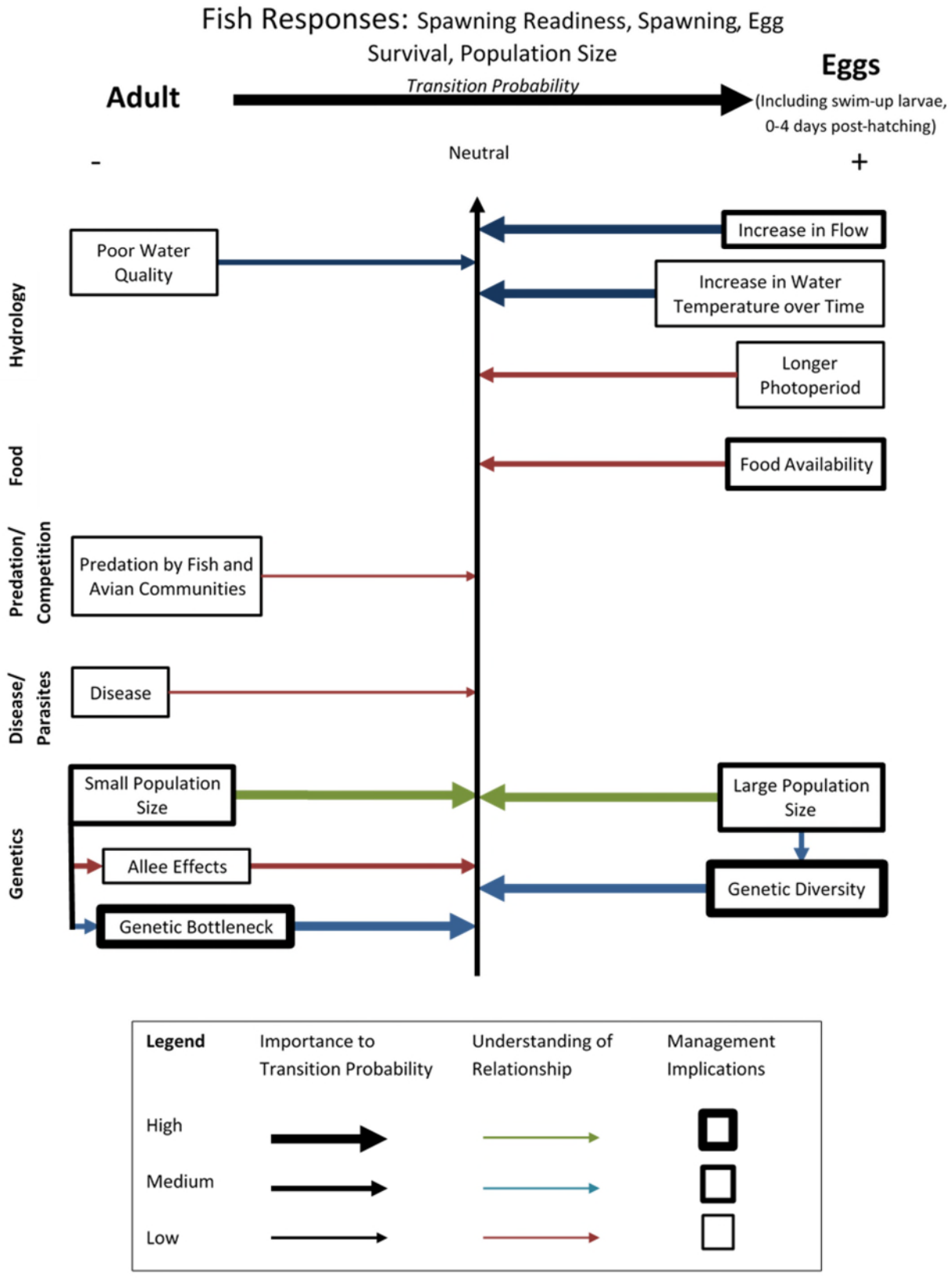


Figure B1. Rio Grande Silvery Minnow Adult Egg Production Transition Schematic.

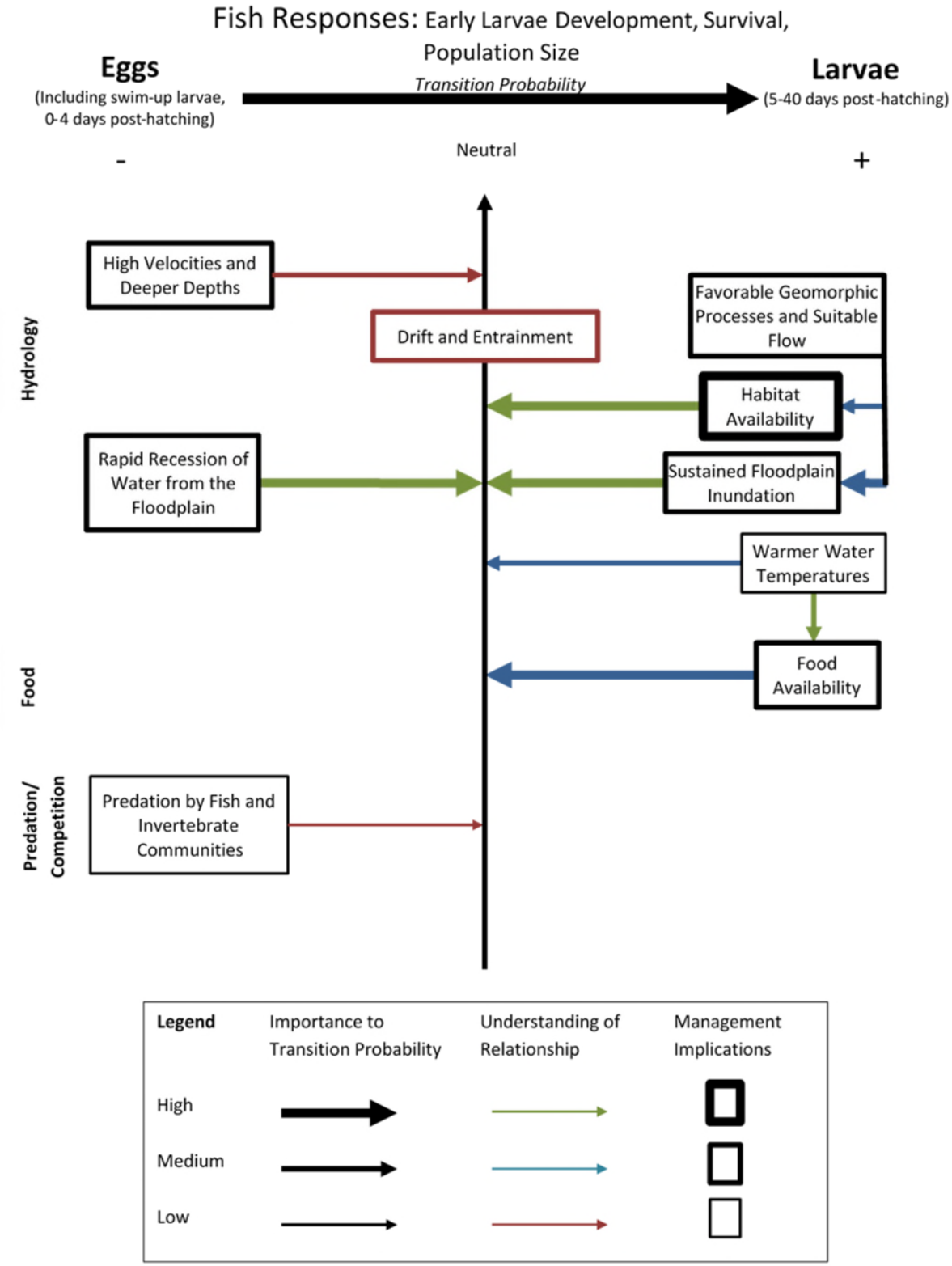


Figure B2. Rio Grande Silvery Minnow Egg to Larvae Transition Schematic.

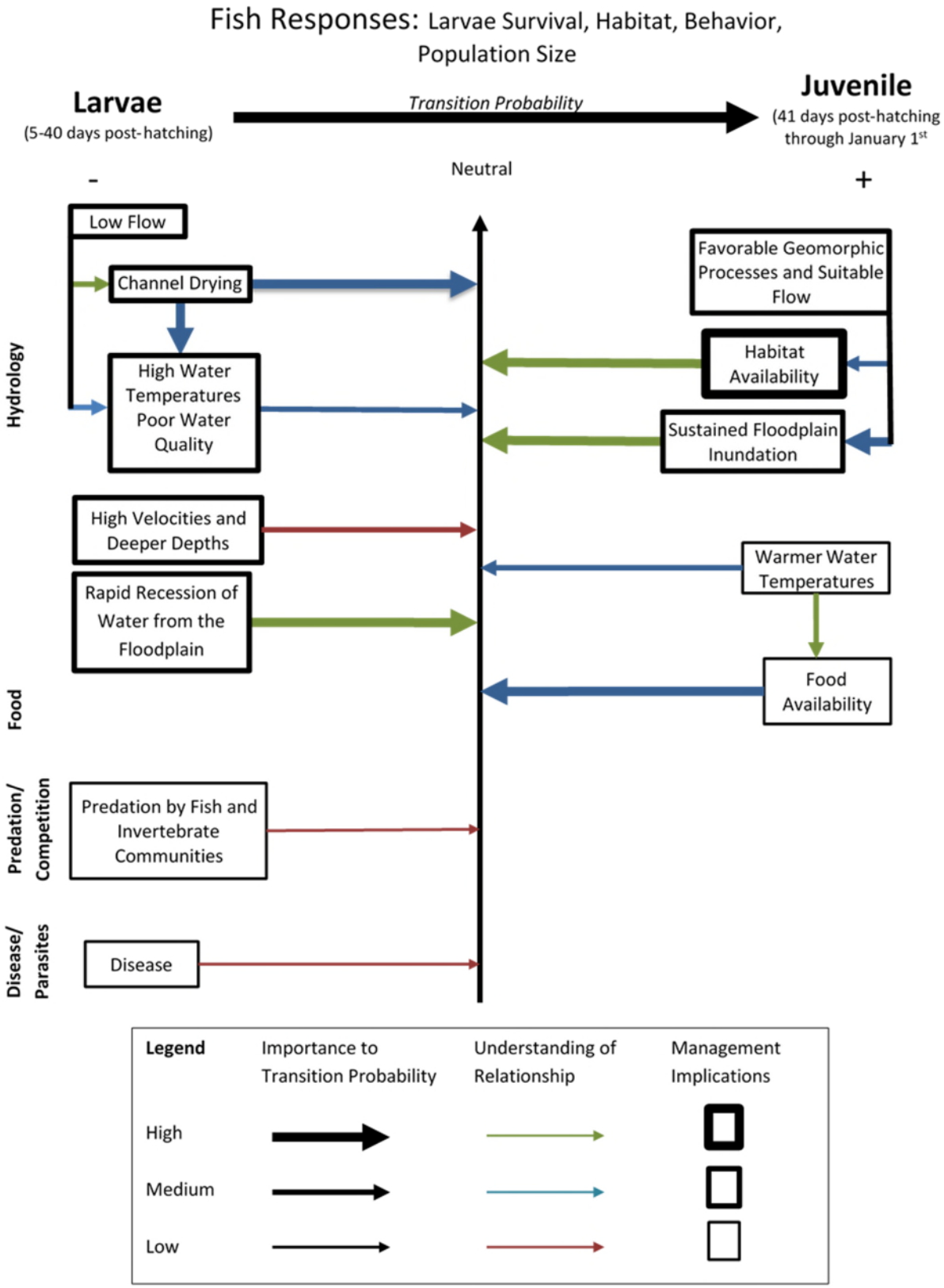


Figure B3. Rio Grande Silvery Minnow Larvae to Juvenile Transition Schematic.

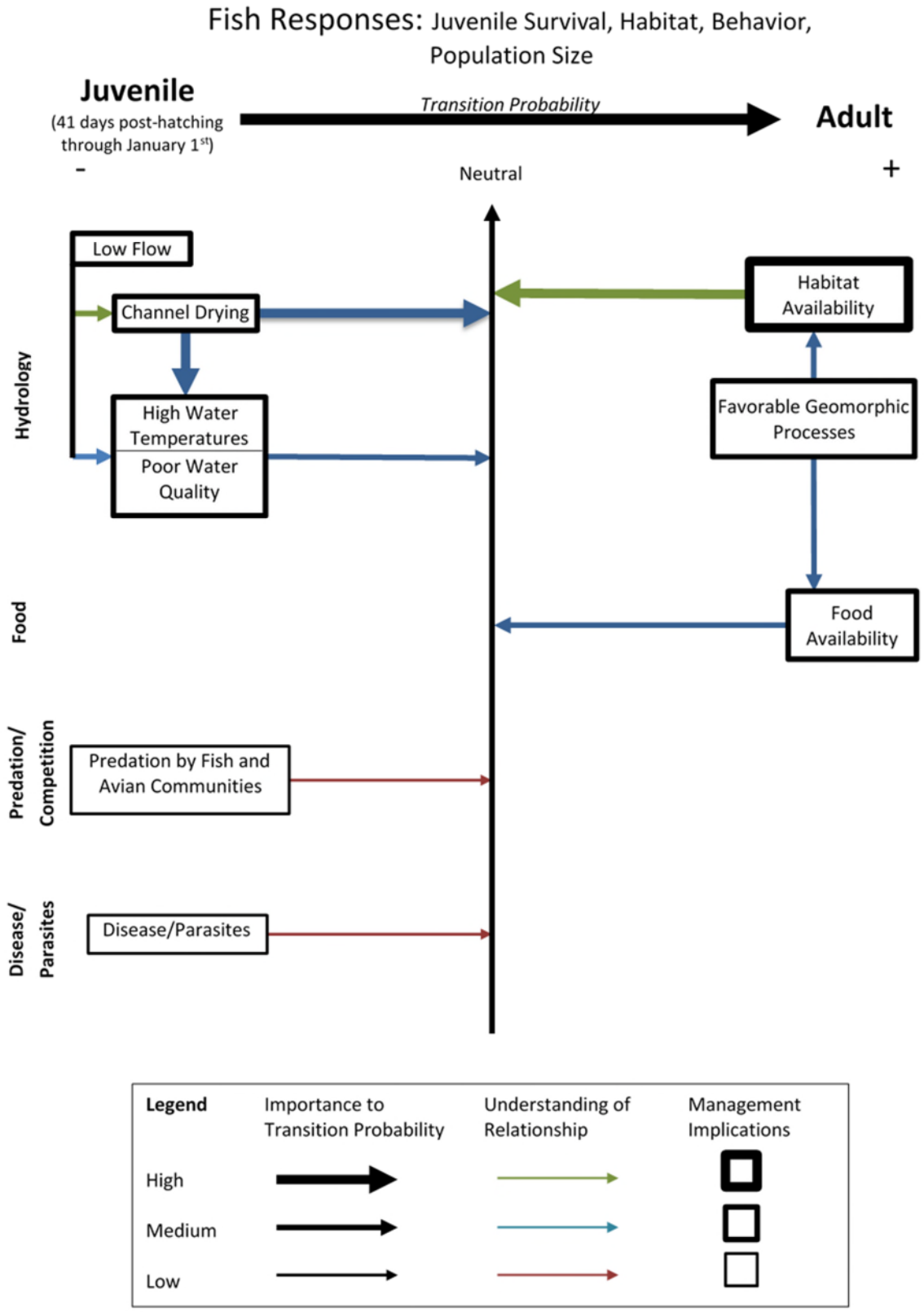


Figure B4. Rio Grande Silvery Minnow Juvenile to Adult Transition Schematic.

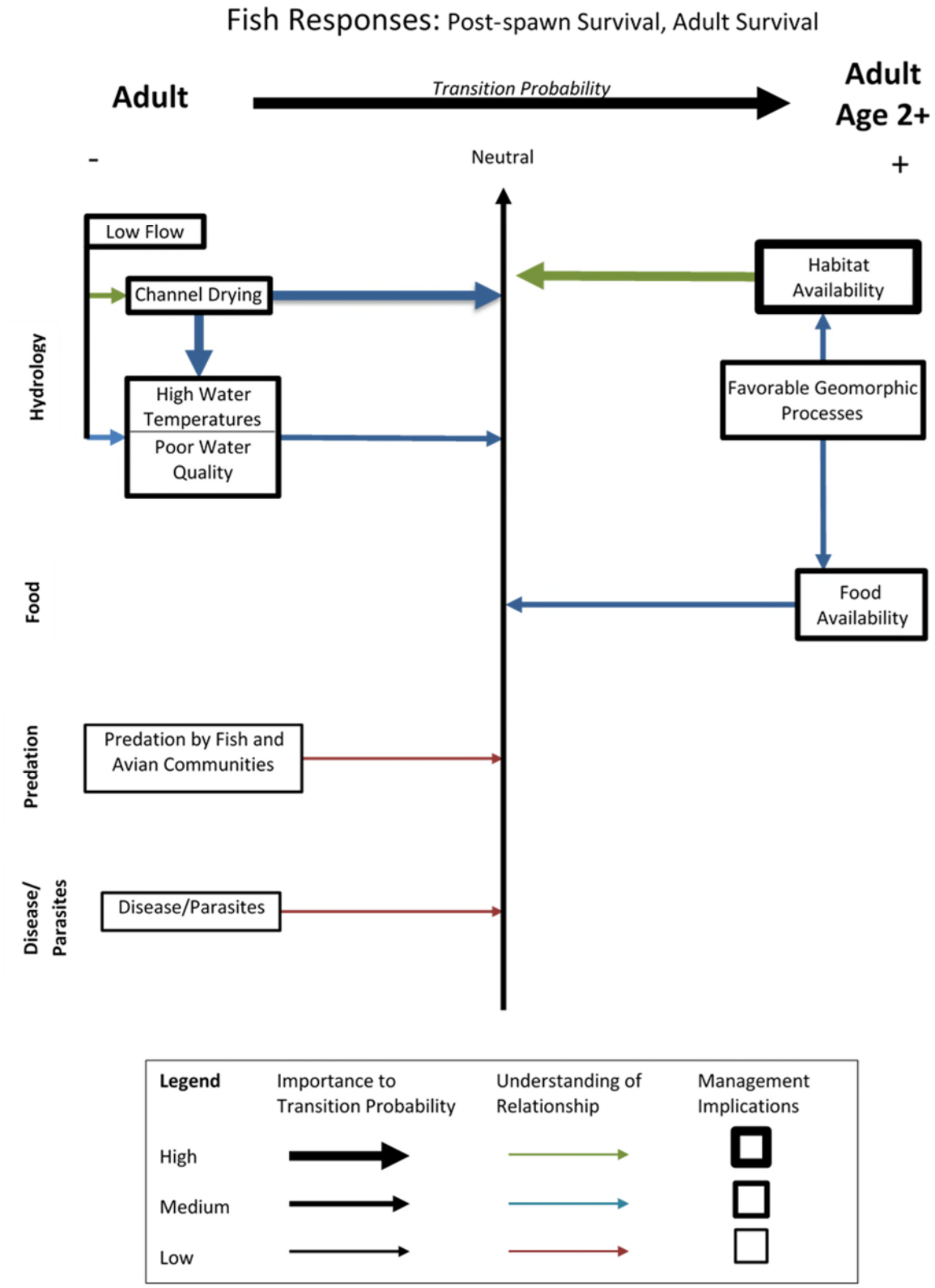


Figure B5. Rio Grande Silvery Minnow Adult to Adult Age 2+ Transition Schematic.

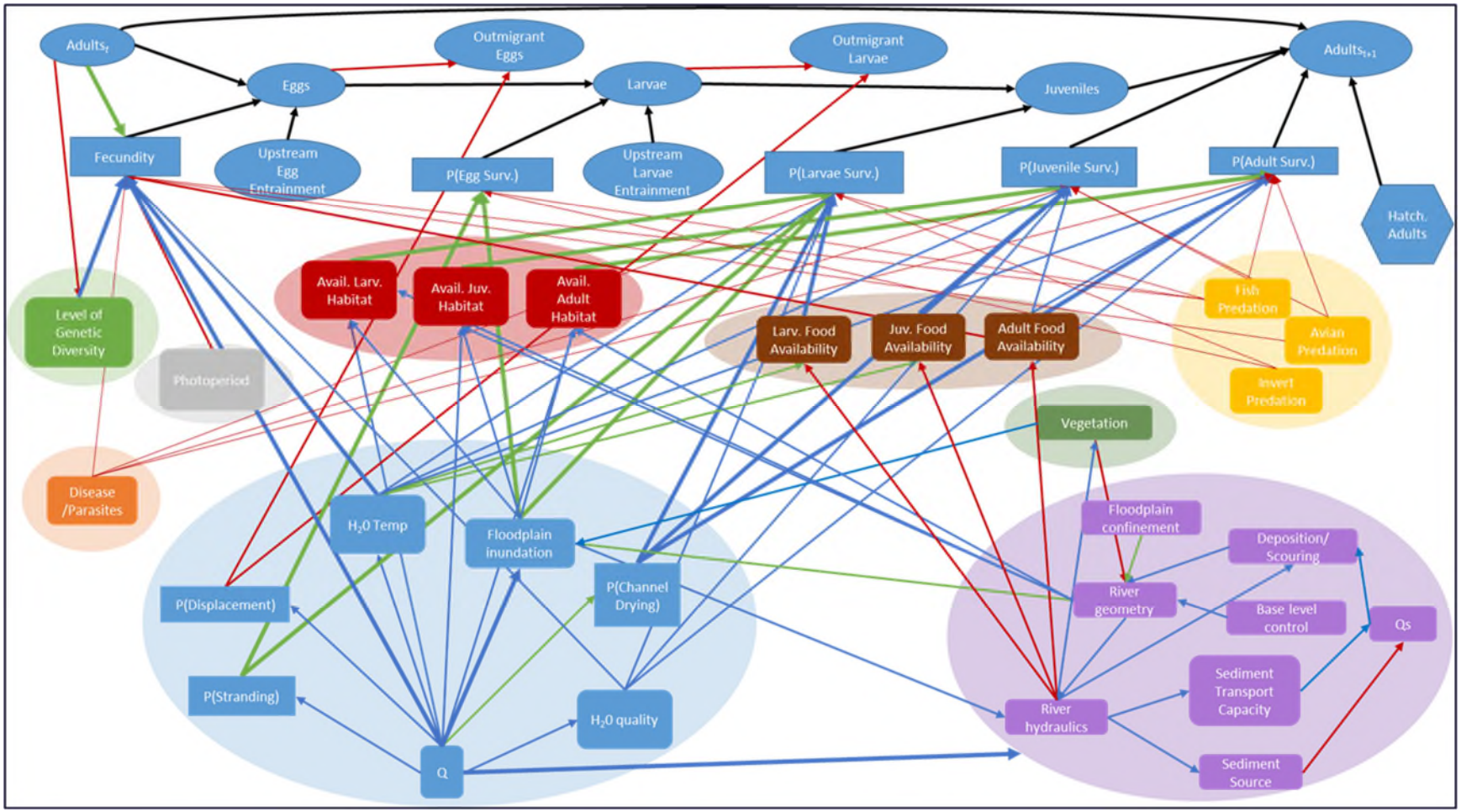


Figure B6. Graphical conceptual ecological model for the Rio Grande silvery minnow.

Each model component is connected to at least one other component with an arrow. The direction of the arrow indicates the direction of influence in the relationship and flow of information. The thickness of the arrow represents the importance that the parent component has on the child component. The color of the arrow indicates the current level of understanding of that relationship (red=low, blue=medium, green=high). Black arrows indicate life stage transitions.

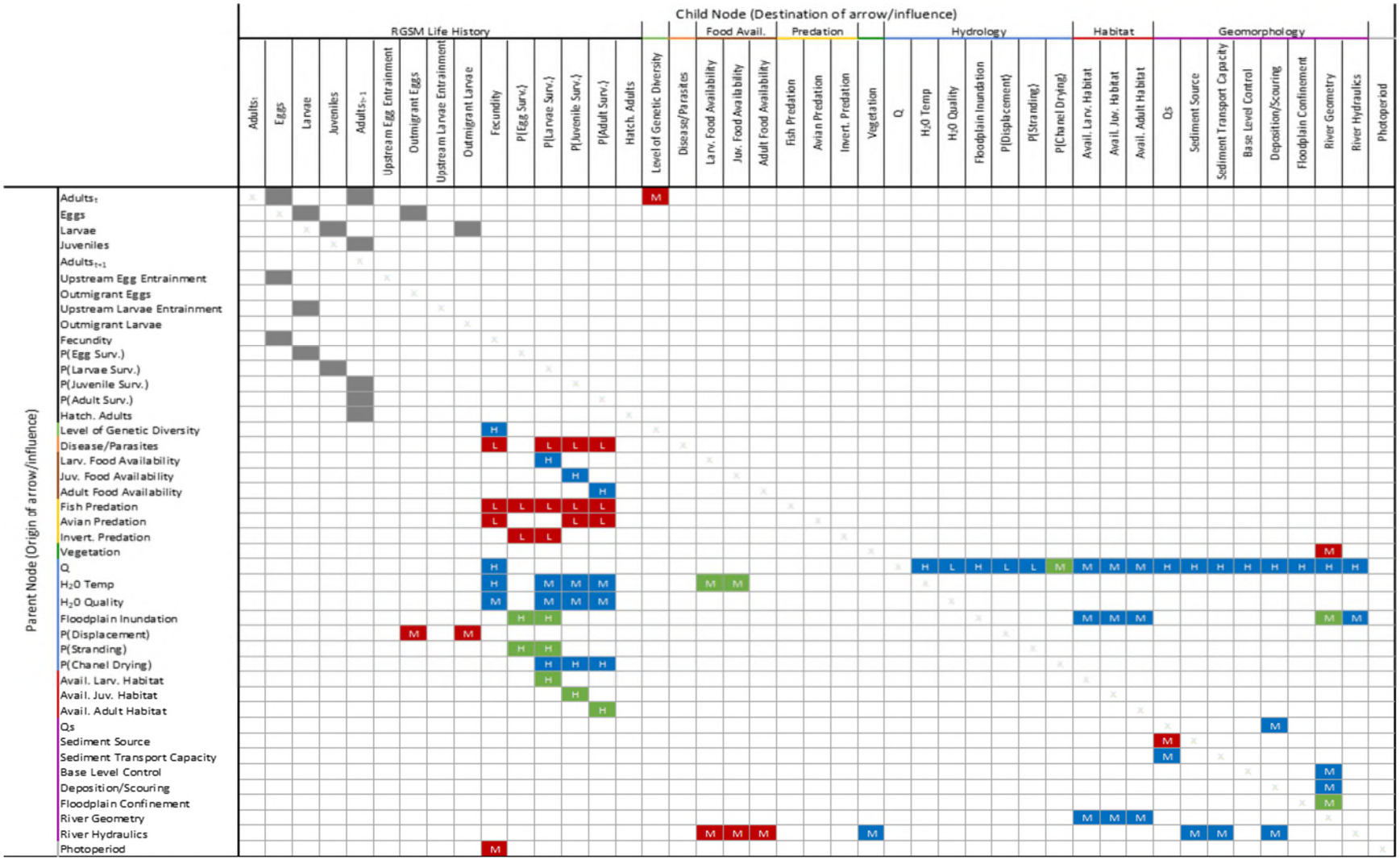


Figure B7. Rio Grande silvery minnow (RGSM) conceptual ecological model (CEM) relationship matrix.

The matrix describes every relationship (arrow) in the graphical RGSM CEM. Each row contains the component where a relationship originates (parent), and each column contains the component where that relationship ends (child). The color of the cell at the intersection of a parent and child component indicates the level of understanding of the relationship between them (red=low, blue=medium, green=high), and the letter in each cell indicates the importance the parent component has on the child component (L=low, M=medium, H=high). Grey boxes indicate life history transitions, and blank cells indicate no relationship.

Table B3. Conceptual Ecological Model Component Descriptions.

Component	Category	Description
$Adults_t$	Life History	Adult abundance at time step *t*. Adults are present year round in the Middle Rio Grande (MRG), and are classified as individuals >35 millimeters (mm). Adult age Rio Grande silvery minnow (RGSM) are predominately made up of one- and two-year-old fish; however, a small segment of fish can live up to five years. All adults are considered sexually mature and available to spawn.
Eggs	Life History	Total number of eggs produced during spawning during time step *t*, calculated by applying the spawning success rate (P(Spawning Success)) to $Adults_t$.
Larvae	Life History	The number of larvae produced during time step *t*, calculated by applying the egg survival rate (P(Egg Survival)) to Eggs. Larvae are classified as individuals between 4–13 mm standard length (SL), and can be found in the MRG between mid-April to mid-July.
Juveniles	Life History	The number of juveniles produced during time step *t*, calculated by applying larval survival rate (P(Larvae Survival)) to Larvae. Juveniles are classified as individuals between 13–64 mm SL, and can be found in the MRG between mid-July to December.
$Adults_{t+1}$	Life History	Adult abundance at time step *t+1. Adults*$_{t+1}$ are comprised of both Juveniles that survive into adulthood as well as Adults from the previous time step *t*.
Upstream Egg Entrainment	Life History	The total number of eggs that are entrained from upstream reaches.
Out-migrant Eggs	Life History	The total number of eggs that disperse downstream out of the system/reach.
Upstream Larvae Entrainment	Life History	The total number of larvae that are entrained from upstream reaches.
Out-migrant Larvae	Life History	The total number of larvae that disperse downstream out of the system/reach.
Fecundity	Life History	The mean number of eggs produced by an individual RGSM.
P(Egg Survival)	Life History	The mean probability that an individual egg will survive to hatching during time step *t.*
P(Larvae Survival)	Life History	The mean probability that an individual larvae will survive to transition into the juvenile life stage during time step *t*.
P(Juvenile Survival)	Life History	The mean probability that an individual juvenile will survive to transition into the adult life stage during time step *t*.
P(Adult Survival)	Life History	The mean probability that an individual adult will survive to the next time step *t*.
Hatch. Adults	Life History	The number of hatchery origin adults stocked in the reach.
Level of Genetic Diversity	Genetics	The total amount of RGSM genetic diversity present in the MRG.
Disease/Parasites	Disease/Parasites	The prevalence of disease and parasites that can adversely affect survival rates of RGSM.
Larval Food Availability	Food Availability	The density of suitable diet items available for consumption by larval RGSM.
Juv. Food Availability	Food Availability	The density of suitable diet items available for consumption by juvenile RGSM.
Adult Food Availability	Food Availability	The density of suitable diet items available for consumption by Adult RGSM.

Fish Predation	Predation	The prevalence of fish that prey on RGSM.
Avian Predation	Predation	The prevalence of birds that prey on RGSM.
Invert. Predation	Predation	The prevalence of invertebrates that prey on RGSM.
Vegetation	Vegetation	The diversity and density of vegetation that can influence the geomorphic processes in the MRG.
Q	Hydrology	Discharge, referring to the magnitude (in terms of peak discharge or volume of water), duration (how long discharge events last), frequency (how often they occur, what time of year they occur), and time sequence (the occurrence of discharge events within a year or over multiple years/decades)
H_20 Temp	Hydrology	In-stream temperature.
H_20 Quality	Hydrology	General water quality.
Floodplain Inundation	Hydrology	The amount of floodplain habitat created during spring runoff or during other water management activities.
P(Displacement)	Hydrology	The probability high flows may displace and disperse eggs and larvae out of the system.
P(Stranding)	Hydrology	The probability high flows that create floodplain habitat may recede too quickly and strand RGSM eggs and larvae in disconnected floodplains
P(Channel Drying)	Hydrology	The probability low flows may cause portions of the main channel to dry and fragment RGSM habitats.
Available Larval Habitat	Habitat	The total amount of RGSM larval habitat available to larval RGSM.
Available Juvenile Habitat	Habitat	The total amount of RGSM juvenile habitat available to juvenile RGSM.
Available Adult Habitat	Habitat	The total amount of RGSM adult habitat available to adult RGSM.
Qs	Geomorphology	Sediment load, referring to the magnitude (peak concentration or load or volume of sediment), gradation of sediment, portion of sediment size class moving in suspension or as bedload (or in-between), etc.
Sediment Source	Geomorphology	Where the transported sediment comes from (banks or beds of rivers, uniform or concentrated deposition sources from tributary inputs, e.g., fines from a tributary may coat a large section of a river, whereas coarser material deposits on the alluvial fan at the tributary confluence). The sources may be recent deposits, older deposits that have consolidated, or erosion of the bed or bank.
Sediment Transport Capacity	Geomorphology	The theoretical ability of the channel to move sediment of a given size class.
Base Level Control	Geomorphology	The influence of reservoir or in-stream channel features to cause backwater effects influencing river geometry and river hydraulics
Deposition/ Scouring	Geomorphology	The process of sediment being added or subtracted to a given cross section. This is dependent on grain size, and both addition and subtraction may occur at a given location, e.g., a bank could be eroding, while at the same time deposition is occurring on a bar opposite the erosion.
Floodplain Confinement	Geomorphology	The lateral constraint of the river from local geology or placement of engineered/spoil levees.
River Geometry	Geomorphology	The slope, width, mean depth, channel sinuosity, channel planform, cross section shape, wetted perimeter, XS area

River Hydraulics	Geomorphology	How fast the water is moving (velocity), depth of the water, force the water applies at interfaces (shear stress, drag, water buoyancy, etc.)
Photoperiod	Photoperiod	The changes in daylight duration during the spring time, which may act as a spawning cue.

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Appendix C. Southwestern Willow Flycatcher and Yellow-Billed Cuckoo Conceptual Ecological Models

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AVIAN SPECIES CONCEPTUAL ECOLOGICAL MODELS

The conceptual ecological models (CEMs) for the southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL) and yellow-billed cuckoo (*Coccyzus americanus*; YBCU) were developed in tandem, and are very similar. The SWFL and YBCU CEMs were developed around each species' life cycle. As both species are neo-tropical migratory songbirds, their basic life stages are the same (Figure C1). With the exception of Migration Southbound, Overwinter, and Migration Northbound, all other life stages are applicable to the Middle Rio Grande (MRG).

The avian species CEMs do not show relationships between variables in the way the RGSM CEM does (Appendix B). Much uncertainty exists in both the SWFL and YBCU basic life histories. These knowledge gaps must be addressed before building relational CEMs, like that of the RGSM.

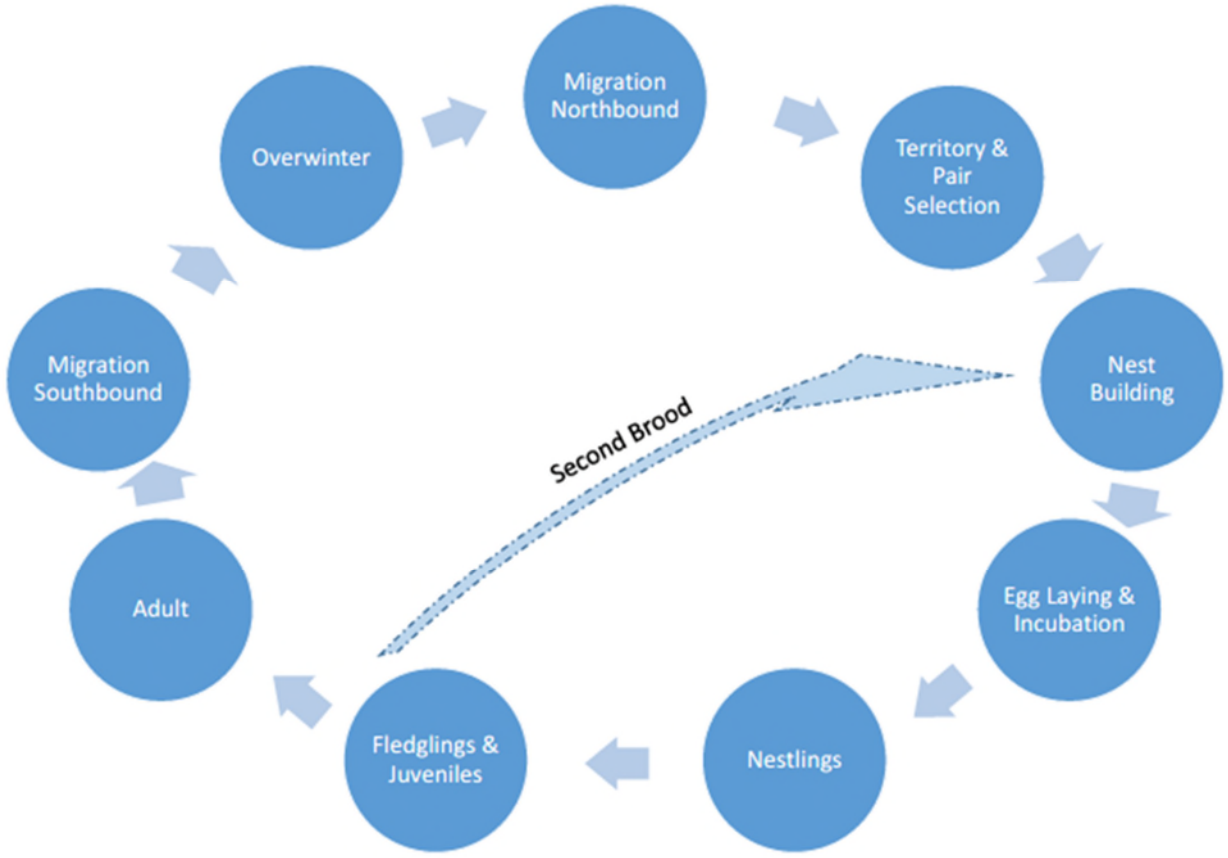


Figure C1. Basic Life Cycle for the Southwestern Willow Flycatcher and Yellow-Billed Cuckoo.

Southwestern Willow Flycatcher Life History

The SWFL is a small perching bird less than 15 centimeters long, from bill to tail. It was listed as endangered in 1995 (Sogge et al. 2010). A primary reason for the species decline is the loss and degradation of its dense, native riparian habitat due to the anthropogenic modification of waterways through channelization and damming, water diversions and groundwater pumping,

and alterations to the riparian zone. The SWFL is one of four recognized subspecies of willow flycatcher. SWFL overwinter in Mexico, Central America, and northern South America. They migrate north to breed in dense riparian habitats in the Southwest, including in the MRG (U.S. Fish and Wildlife Service [USFWS] 2002).

USFWS revised critical habitat for the YBCU in January 2013 to follow Recovery Plan goals, and identified 1,975 stream kilometers in Arizona, New Mexico, southern California, Nevada, Utah, and Colorado as breeding habitat (USFWS 2013). The current range of the YBCU is similar to their historic range, but population numbers have declined due to loss of suitable riparian habitat.

Northbound migrating SWFL arrive in the MRG in early May, and select territories and mating pairs through the spring (USFWS 2002; Sogge 2010). Little information exists on SWFL pair selection. The female of the breeding pair ultimately selects the nest site, choosing territory that can provide food, water, and shelter. SWFL breeding pairs prefer dense riparian habitat near or adjacent to surface water, or with saturated soil, which are both important for creating a microclimate at the nest site and habitat for the SWFL prey base of flying insects, such as mosquitoes (Sedgwick 2000; USFWS 2002; Sogge 2010). Generally, SWFL nesting sites are characterized by multi-age vegetation stands with 50–75 percent mid-story cover and dense cover that is 3–6 meters high (USFWS 2002). This dense vegetation provides protection from predators, and contributes to the cooler microclimate of the nest site (Sedgwick 2000). The species also exhibits site fidelity, and breeding pairs have been observed returning to the same nesting site in subsequent years, even if the quality of the site has degraded.

Within two weeks of pair selection, the female builds a cup-shaped nest over the course of 5–7 days, without help from the male (USFWS 2002; Sedgwick 2020). Egg laying generally occurs from mid-May through mid-June. SWFL lay 3–4 eggs per clutch over a span of 4–5 days. Eggs hatch in 12–14 days. Once hatched, the nestlings remain in the nest for 14–15 days before they fledge (leave the nest but are not fully independent). SWFL fledglings are capable of short flights (approximately 30 meters), and after leaving the nest, will remain in their parents' nesting territory for about 14 days before dispersing (Sedgwick 2020).

There is very little information on SWFL young-of-year once they have fledged and become juveniles, as surveys stop at that life stage. The life history of SWFL between the fledging life stage and leaving for the southern migration is a large data gap. Broods likely break up once the SWFL become juveniles, as there have been no reports of flocking immature SWFL.

SWFL sometimes have a second brood within a single breeding season. The likelihood of a second brood increases when the offspring from the first clutch fledge by late June or very early July. Re-nesting is common if the first nest is lost or abandoned. Clutch size decreases with each nest attempt. The proximity of the second nest to the first varies greatly, and could be on the same plant or up to several kilometers away (USFWS 2002; Sedgwick 2020).

The migration of SWFL south to their overwinter grounds is believed to begin sometime in mid-August through September, though there is uncertainty around the exact timing of migration, and the factors that influence that timing, as survey efforts have been focused around the breeding season (USFWS 2002).

Yellow-Billed Cuckoo Life History

The Western U.S. Distinct Population Segment (DPS) of the YBCU was listed as threatened under the ESA on October 3, 2014 (USFWS 2014). YBCU are medium-sized birds about 30

centimeters in length. The YBCU's historic range was west of the Continental Divide, stretching from British Columbia down to northern Mexico. Today, the breeding habitat of the Western DPS of the YBCU population is along rivers in Arizona, California, and New Mexico (USFWS 2014; Hughes 2020). YBCU are riparian species, and require large expanses of riparian habitat at the landscape level with a mosaic of different vegetation (Johnson 2009; Hughes 2020).

YBCU arrive at their breeding grounds in mid- to late May to mid-June (Sechrist et al 2012; Hughes 2020). Little is known about YBCU pair selection (Johnson 2009). YBCU require a nest patch size of about five hectares with 50–75 percent mid-story cover that is 3–10 meters high. YBCU foraging territory is even larger, and individuals have been observed to have territories of 75–100 hectares (Johnson 2009; Dillon and Moore 2020).

At the nest patch scale, canopy cover is critical for providing the protection and microhabitat necessary for nest success. YBCU also prefer nest habitat in close proximity to water, especially if there is a low velocity flow of shallow depth underneath the nest. Nearby water contributes to the nest microclimate, and provides habitat for the YBCU's insect prey base. Both the male and female in a pair build the nest on a horizontal branch or fork of a tree over the course of several days (Hughes 2020).

While females can lay between 1–5 eggs per clutch, clutch size is usually 2–3 eggs. One egg is usually laid every other day, but females may wait up to five days between eggs. Eggs are incubated over 9–11 days. The duration of the egg laying and incubation period varies between 13–20 days total. Both parents help with incubation (Hughes 2020). Additionally, pairs may have younger males that assist with incubation (USFWS 2014; Hughes 2020). The degree of contribution from colony incubation is a knowledge gap, in terms of both level of effort, and genetics. There are data showing that different males and females may genetically contribute to eggs in the same brood (McNeil 2015).

YBCU are opportunistic feeders; they mainly eat large insects, but also prey on small lizards and amphibians. YBCU require a large amount of food, especially as nestlings. Both parents feed and brood the young equally, and nestlings transition to the fledgling stage by day 7–9. Once YBCU fledglings become juveniles, they (along with their parents) leave the nest patch after a day. Adult YBCU may lay second, and even third, clutches, sometimes with different partners (USFWS 2014).

As with the SWFL, little is known about YBCU life history once the young reach the juvenile stage. YBCU leave for their fall migration beginning in early to late August, with most birds departing by mid-September (Sechrist 2012; Hughes 2020).

AVIAN SPECIES CONCEPTUAL ECOLOGICAL MODELS DESCRIPTION

The avian CEMs were developed in tandem, and are very similar. Both CEMs focus on life stages, with each life stage depicted as a bulls-eye graphic divided into wedges. Each wedge represents a driver or stressor at a particular life stage. A driver is a variable that is beneficial to the species at a specific life stage, and contributes to species success. A stressor is a variable that negatively affects the species at a specific life stage, and contributes to species failure, including mortality. The bulls-eye models also depict the level of importance of each variable, the ability to manage each variable, and if there are high level uncertainties related to each variable. The relative size of each variable wedge has no significance Figure C2 provides a legend for the avian CEMs.

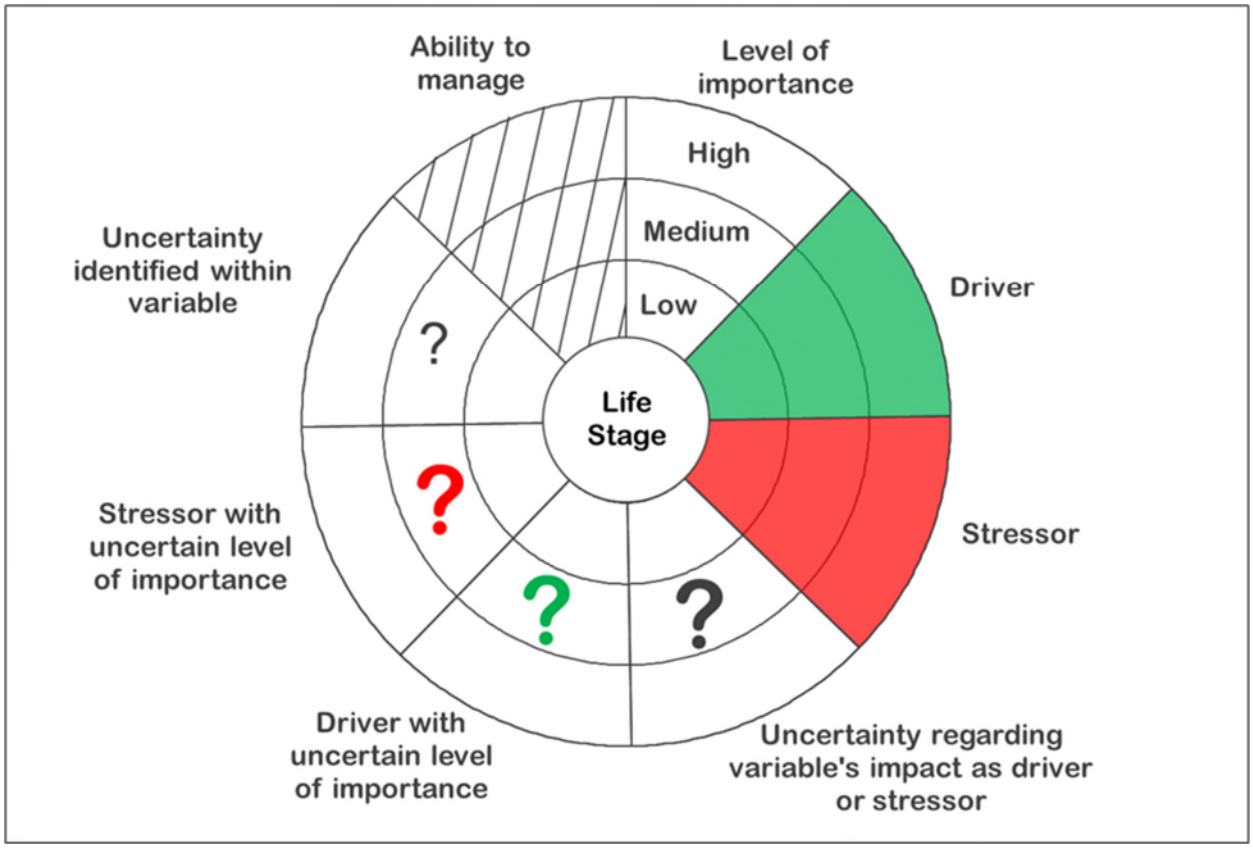


Figure C2. Avian Conceptual Ecological Model Legend.

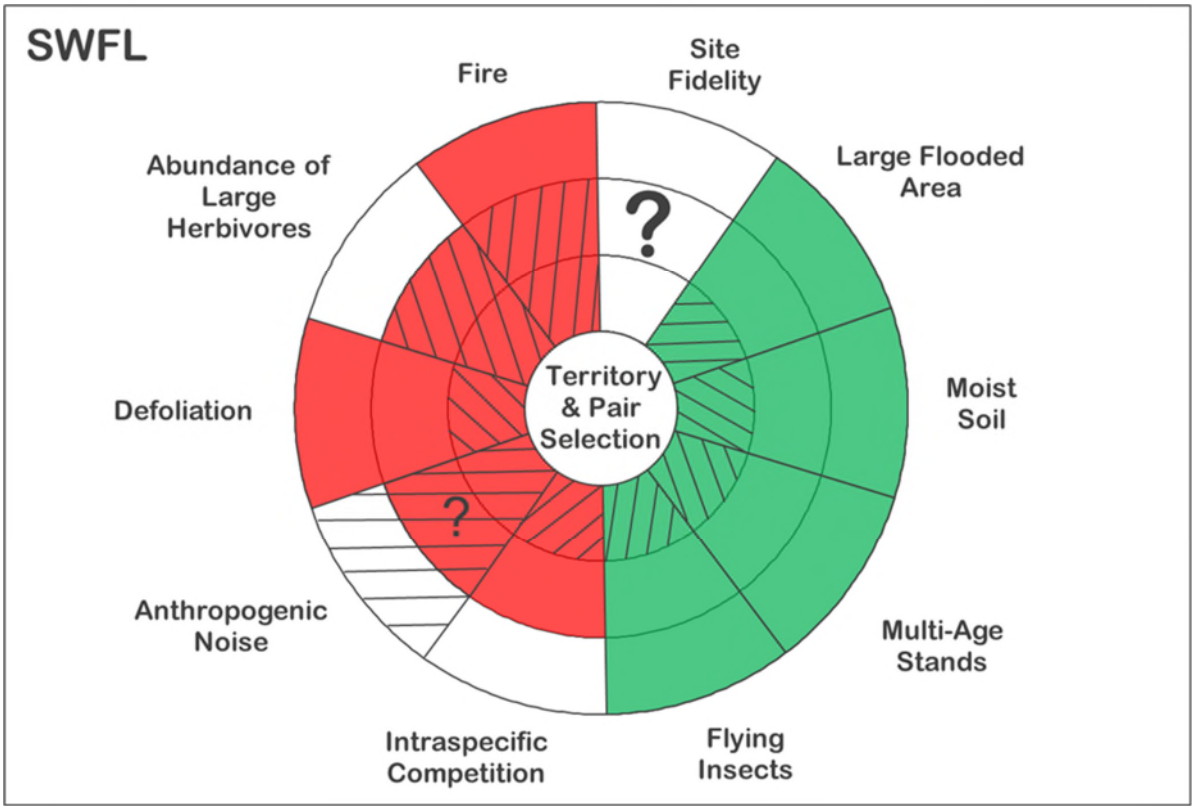


Figure C3. Southwestern Willow Flycatcher Territory and Pair Selection Life Stage.

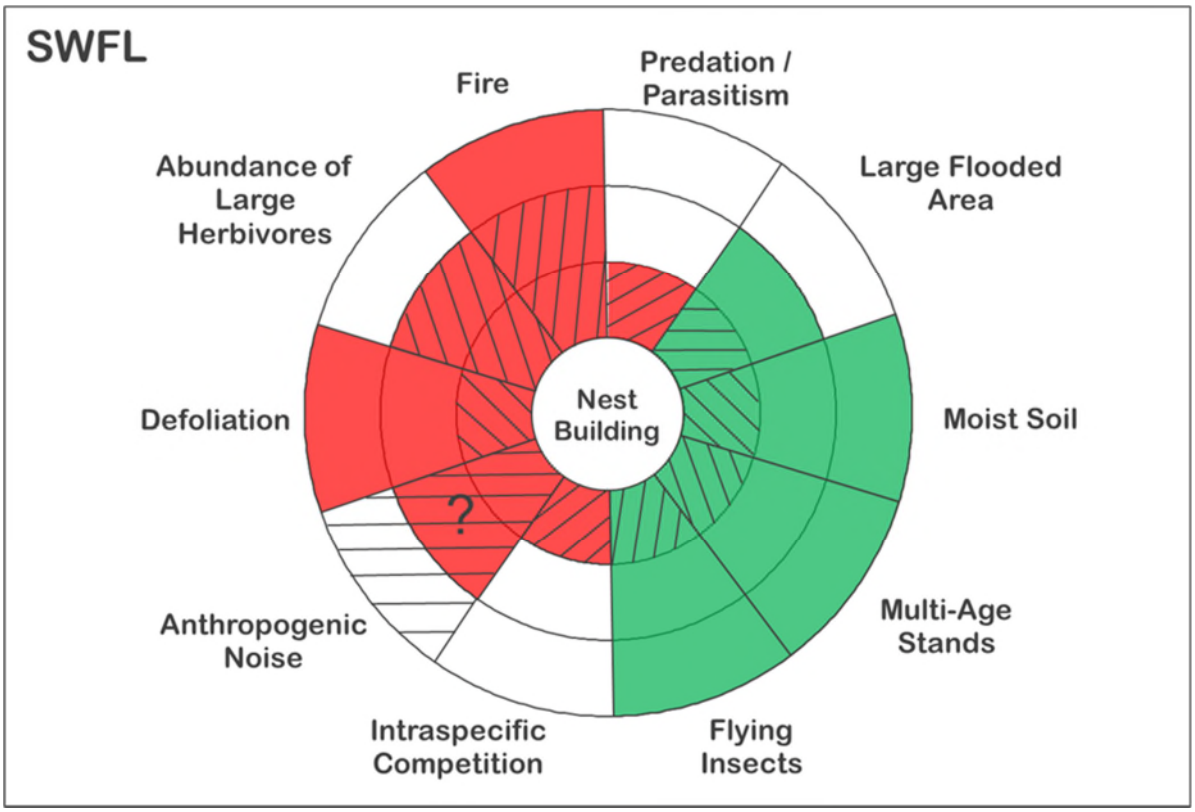


Figure C4. Southwestern Willow Flycatcher Nest Building Life Stage.

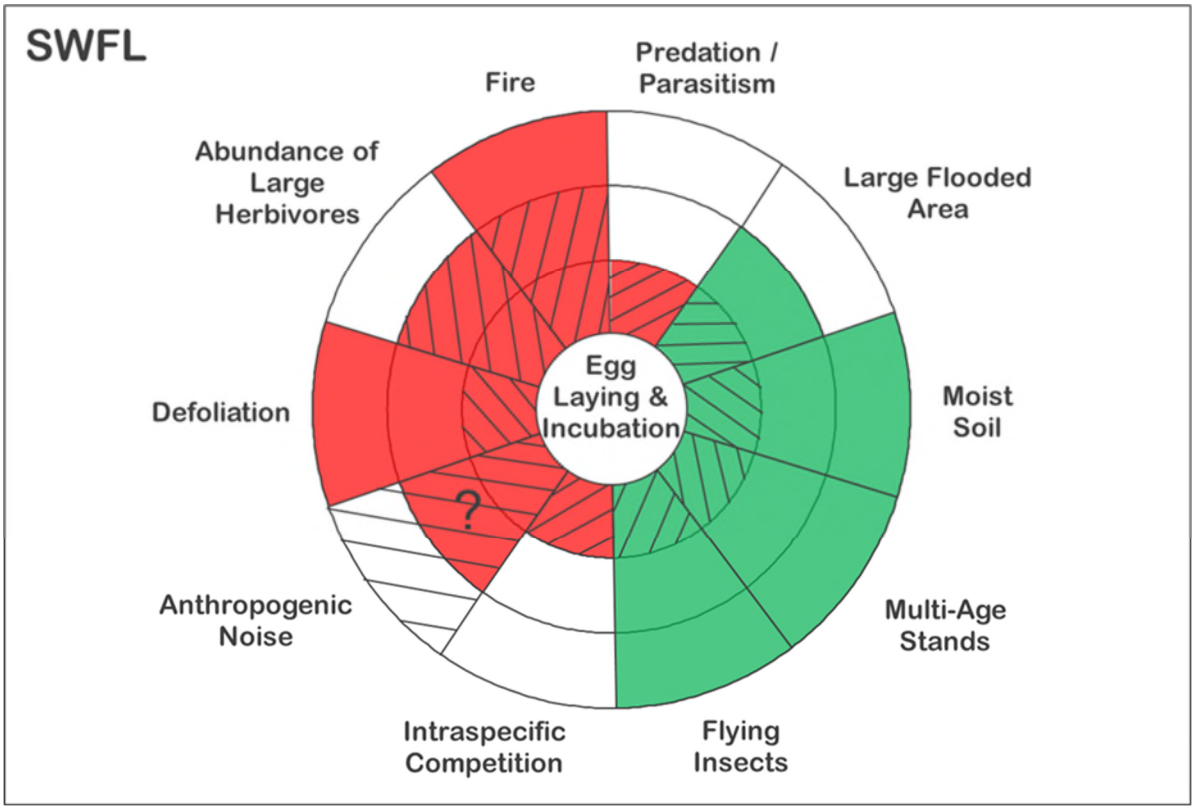


Figure C5. Southwestern Willow Flycatcher Egg Laying and Incubation Life Stage.

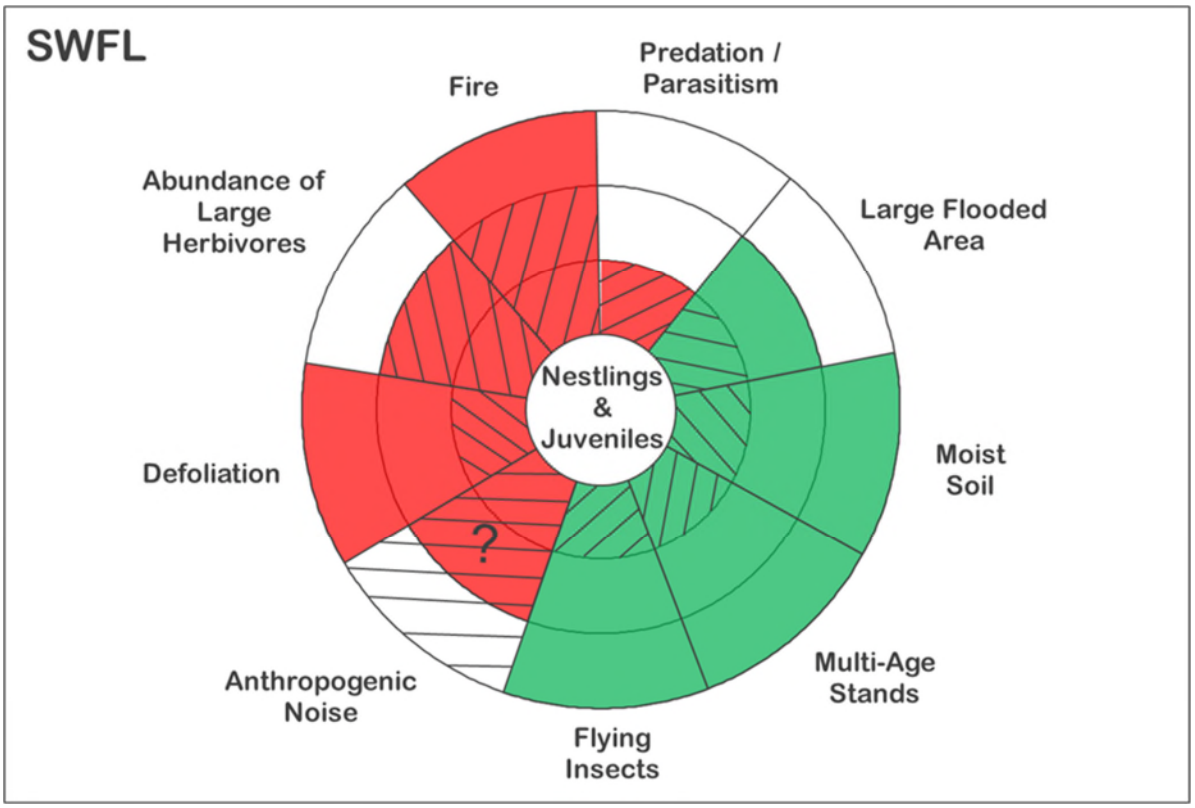


Figure C6. Southwestern Willow Flycatcher Nestlings and Juveniles Life Stage.

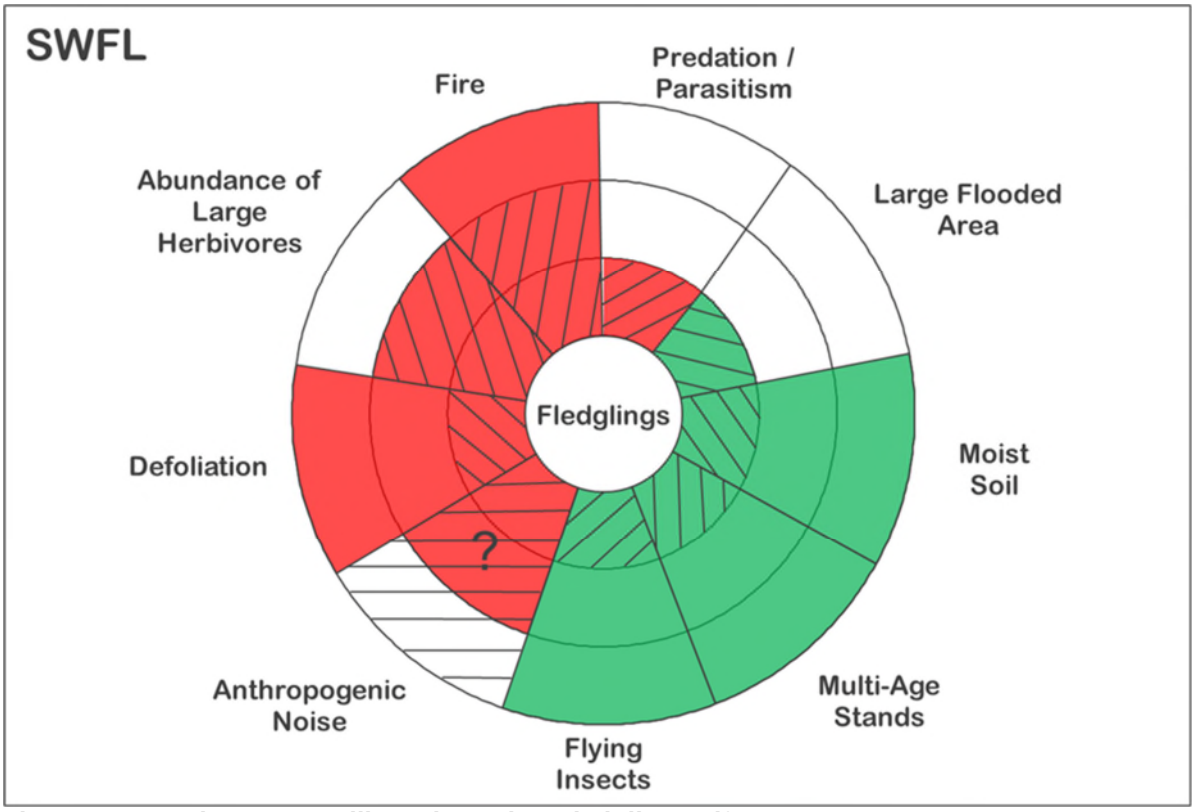


Figure C7. Southwestern Willow Flycatcher Fledglings Life Stage.

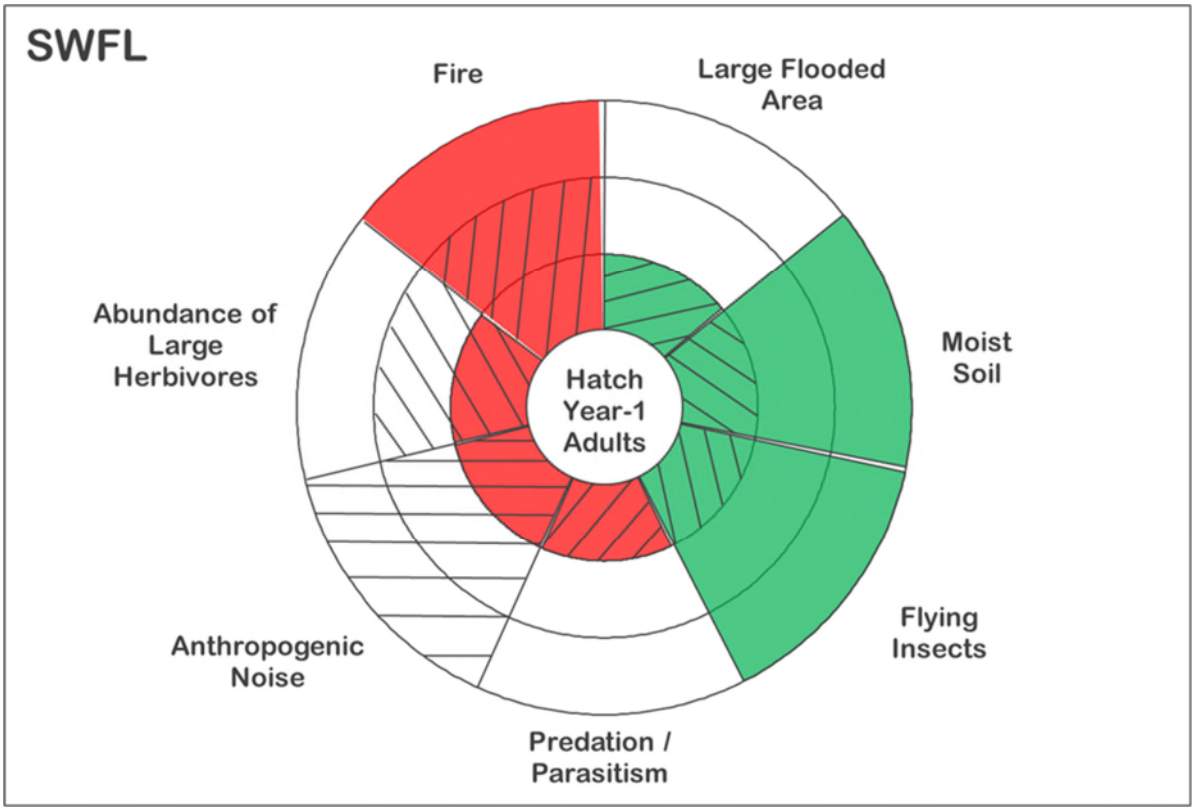


Figure C8. Southwestern Willow Flycatcher Hatch Year-1 Adults Life Stage.

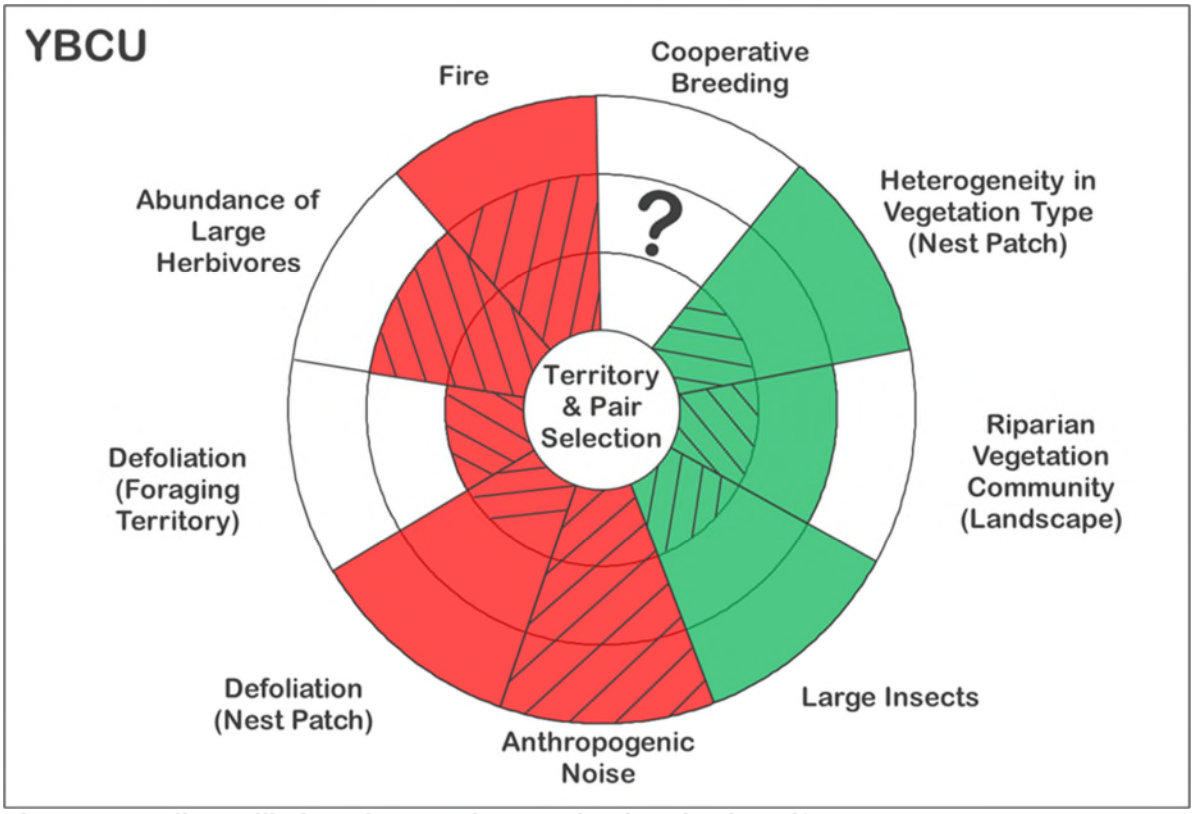


Figure C9. Yellow-Billed Cuckoo Territory and Pair Selection Life Stage.

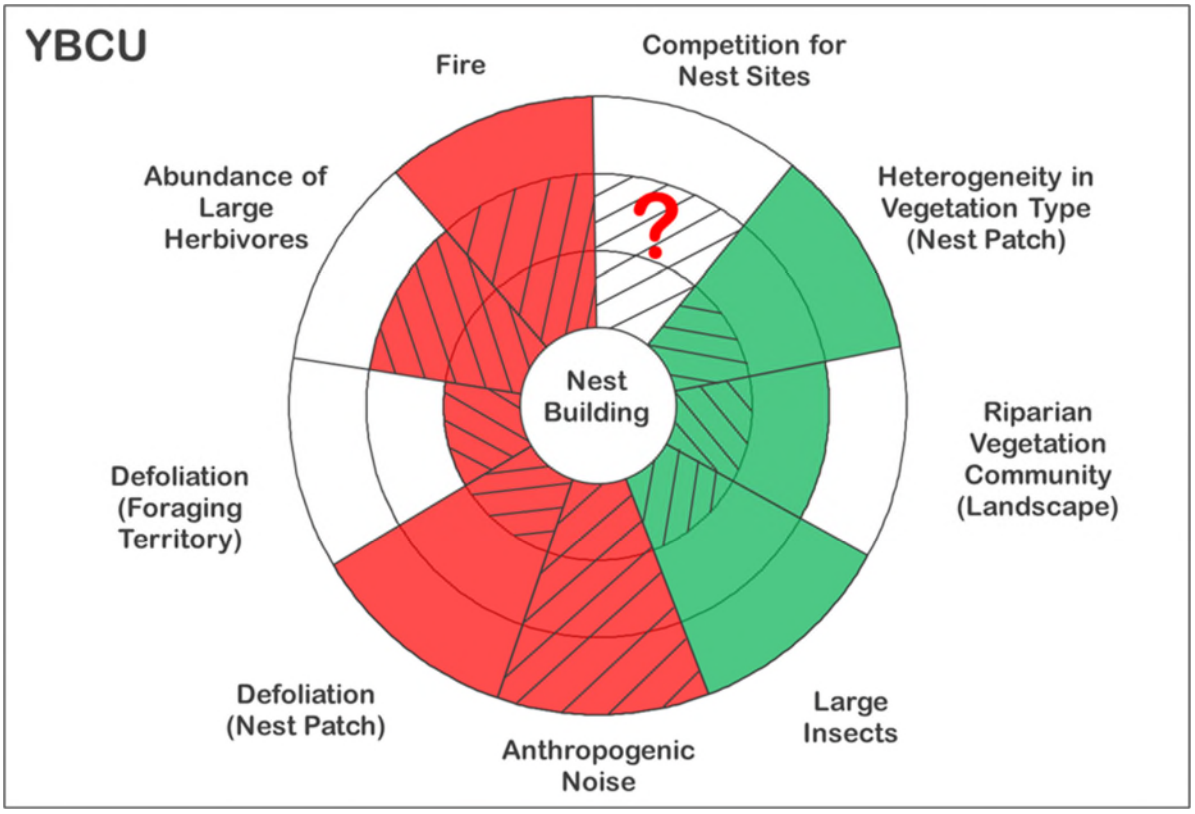


Figure C10. Yellow-Billed Cuckoo Nest Building Life Stage.

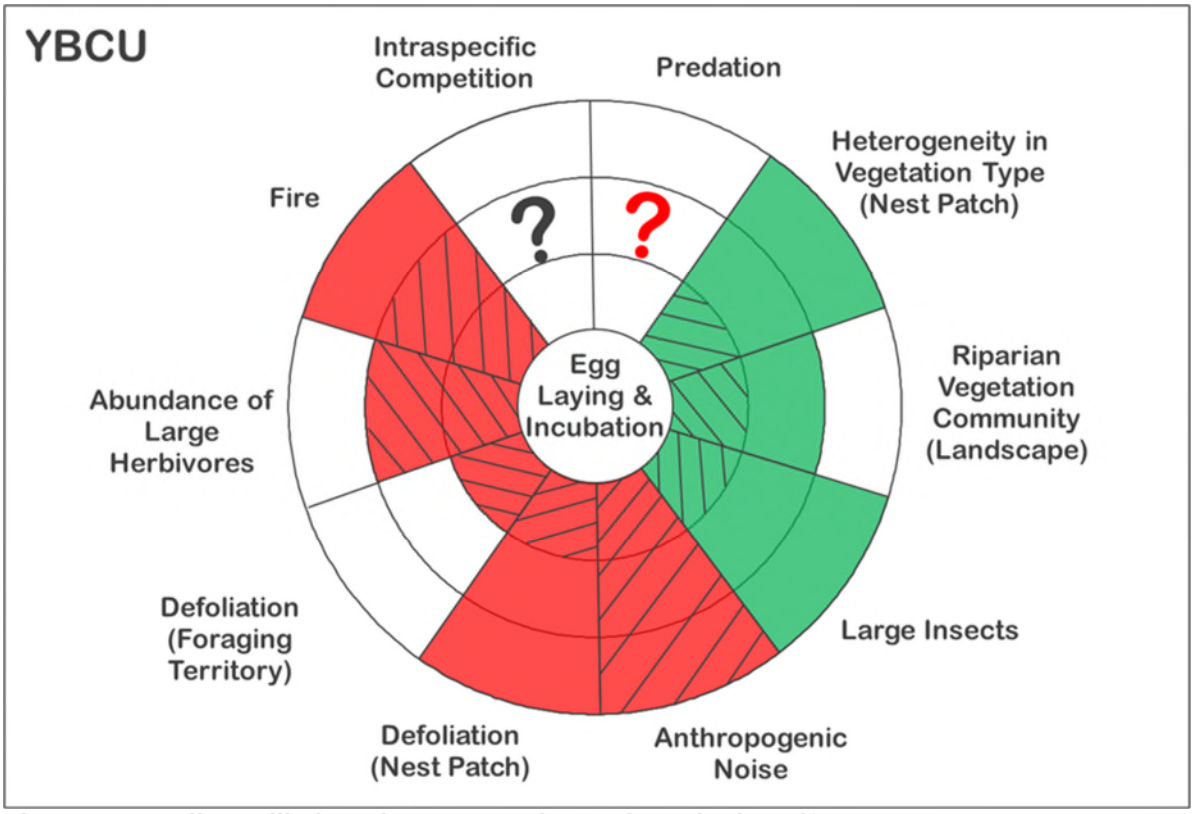


Figure C11. Yellow-Billed Cuckoo Egg Laying and Incubation Life Stage.

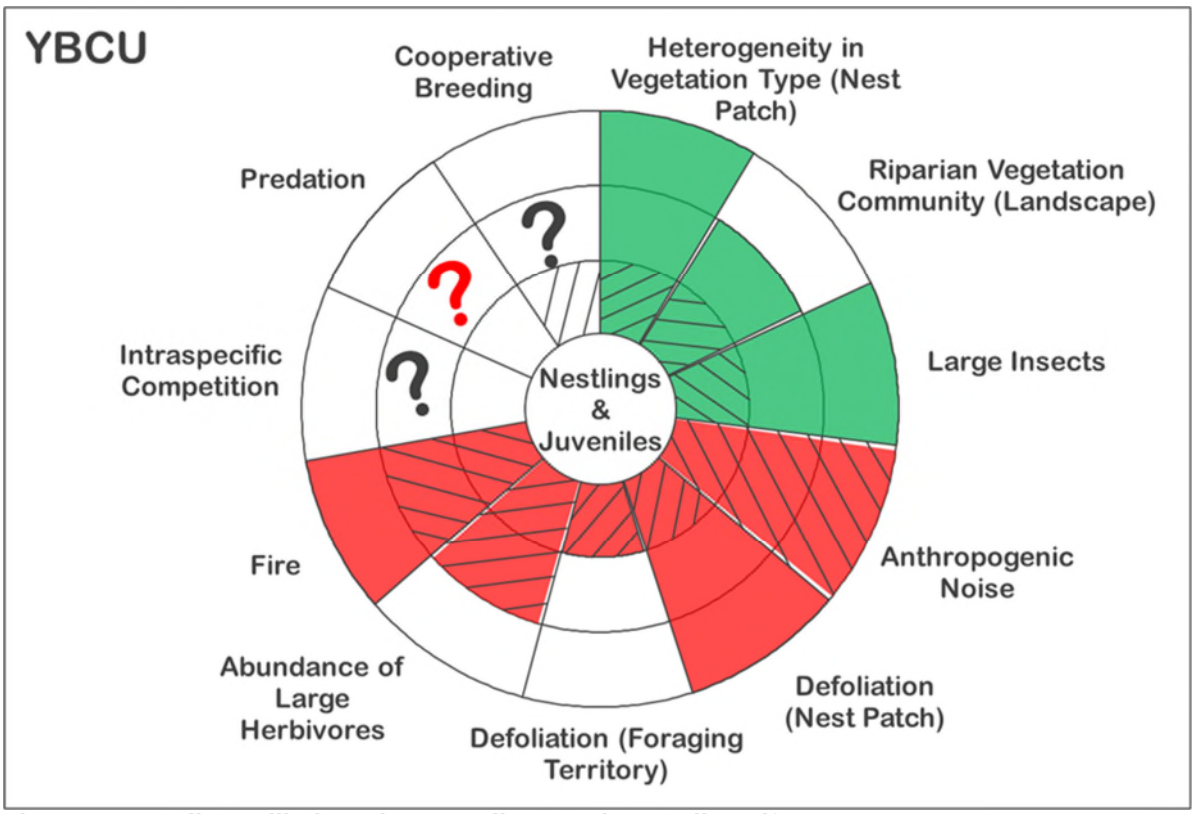


Figure C12. Yellow-Billed Cuckoo Nestlings and Juveniles Life Stage.

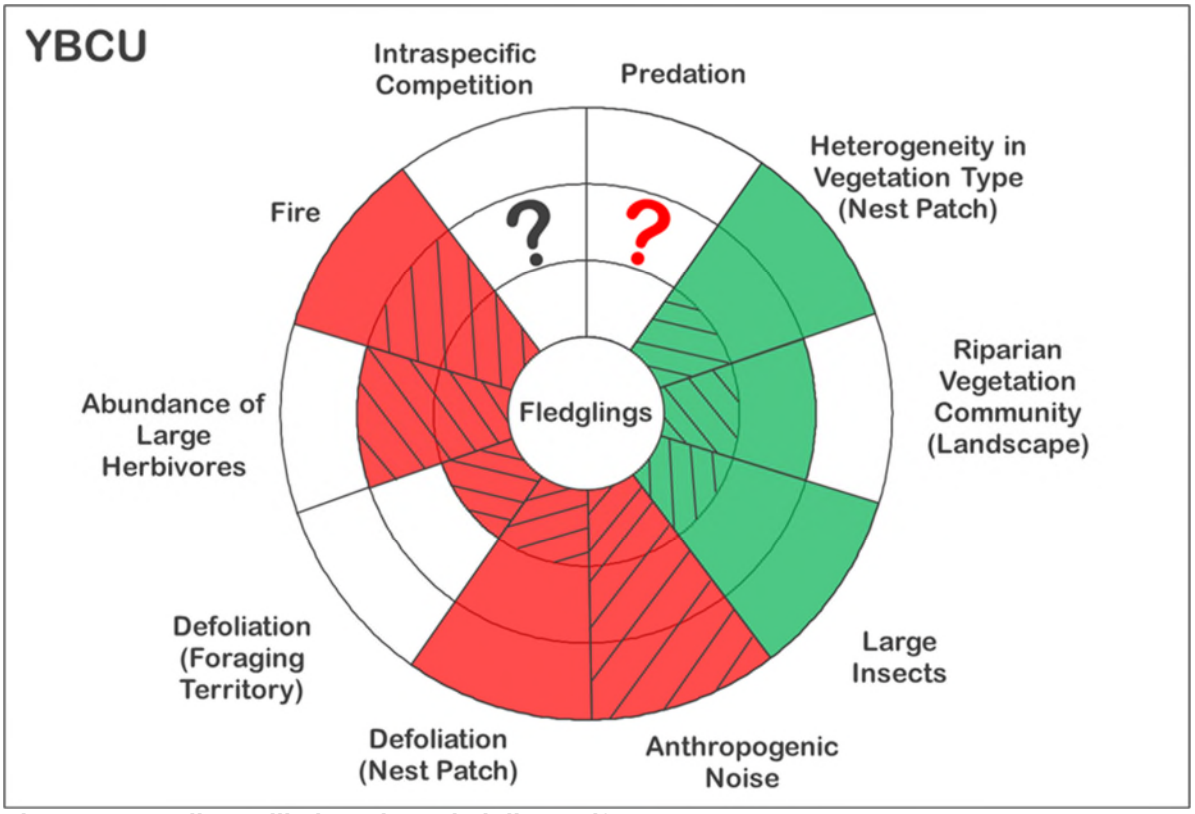


Figure C13. Yellow-Billed Cuckoo Fledglings Life Stage.

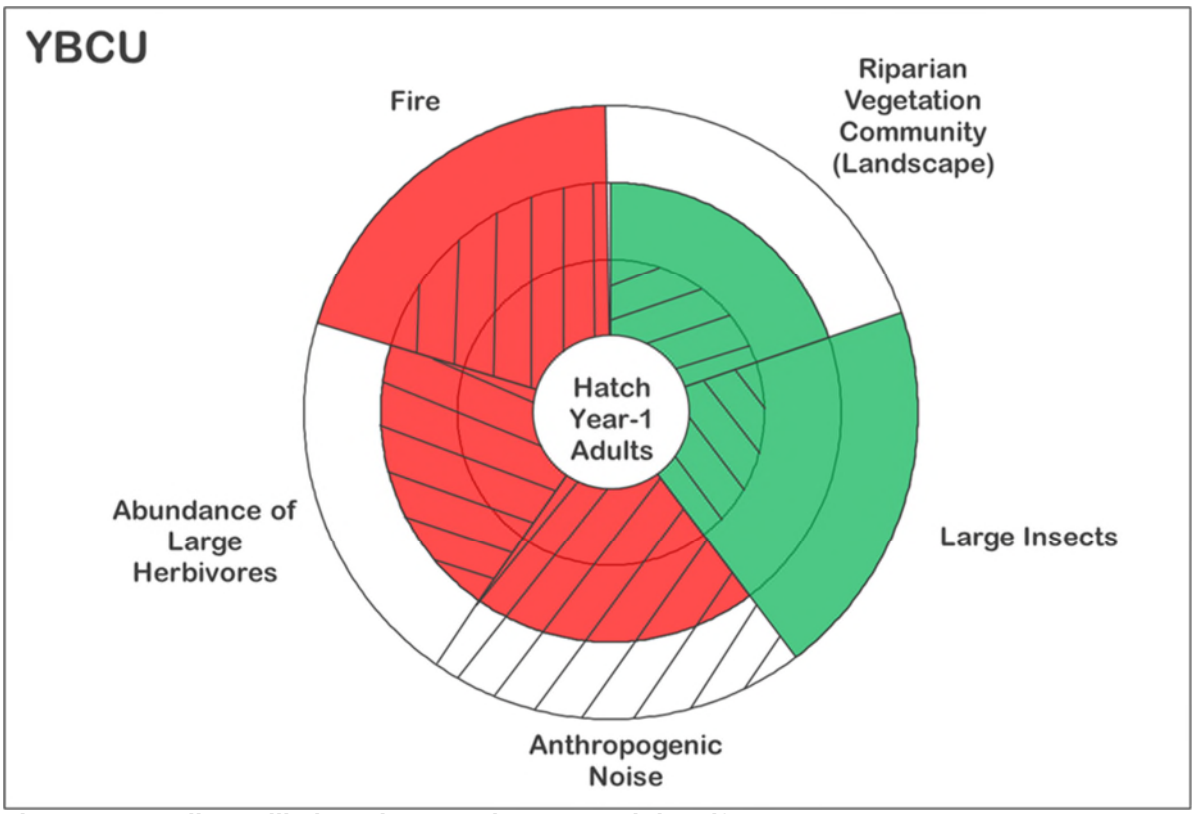


Figure C14. Yellow-Billed Cuckoo Hatch Year-1 Adults Life Stage.

AVIAN CONCEPTUAL ECOLOGICAL MODELS LIFE STAGES DEFINITIONS

Migration and Overwintering

SWFL

Northbound Migration: SWFL are late spring migrants with arrival dates as early as May in Arizona (Phillips et al. 1964), and from the second week of May to mid-June in California (Small 1994). Captures recorded in 1994 and 1995 during spring migration occurred in the central Rio Grande valley of New Mexico between May 13 and June 8, with a peak in the first week of June, but varied by site and year (Yong and Finch 1997). Habitat used during spring migration is likely similar to that described for fall. In New Mexico, the SWFL is known to migrate regularly along the Rio Grande (Yong and Finch 1997) and the Pecos River (Hubbard 1987), and occurs regularly as a migrant in the southwestern-most desert region and the eastern-most plains region of the state (Hubbard 1987). Migration requires high-energy expenditures and successful foraging in unfamiliar areas, and exposes SWFL to predators. As a result, migration is the period of highest mortality within the annual cycle of the SWFL (Paxton et al. 2007). Willow flycatchers of all subspecies sing during northbound migration, perhaps to establish temporary territories for short-term defense of food resources.

Southbound Migration: Fall migration begins when adult birds depart from their breeding territories, generally in early to mid-August, but some birds may stay until mid-September if they fledged young late in the season (Phillips et al. 1964, Yong and Finch 1997). Unpaired males that fail to attract a mate, and pairs that repeatedly lose nests to nest parasitism or predation, may leave territories by early July. Fledglings leave the breeding areas a week or two after adults, likely because young birds undergo pre-basic molt on breeding grounds (adding to the length of their stay), while adults delay pre-basic molt until they reach wintering grounds (Unitt 1987, Yong and Finch 1997). Habitat use during migration is similar to breeding habitat, including riparian woodlands with open overstory and dense mid- and low-stories, and adjacent agricultural fields with close proximity to water. The highest capture rates in one study along the Middle Rio Grande occurred within willow habitat, followed by dense young cottonwood-Russian olive stands. The affinity for willow habitat and higher body mass recorded for SWFL in this habitat is likely due to higher densities of arthropods (McCabe 1991, Yong and Finch 1997). The mass gained by recaptured YBCU suggests stopover to replenish fat stores during migration is necessary for the species (Yong and Finch 1997). In New Mexico, birds are known to migrate regularly along the Rio Grande (Yong and Finch 1997).

Overwinter: The Pacific lowlands of Costa Rica, as well as other regions of Central America, seem to be the most important wintering grounds for the *extimus* subspecies based on genetic data (Paxton et al. 2011). On the wintering grounds, flycatchers use habitat with standing or slow-moving water and/or saturated soils, patches of trees, woody shrubs, seasonally inundated floodplains with emergent vegetation, pastures, and open areas, often within agricultural landscapes (Lynn et al. 2003, Schuetz et al. 2007). The presence of water or saturated soils seems to be more important than vegetative structure (Schuetz et al. 2007). Individuals defend territories throughout the winter and show high fidelity to wintering territories (Koronkiewcz et al. 2006, Sogge et al. 2007). Survivorship is thought to be high over the wintering period (Koronkiewcz et al. 2006). Threats on the wintering grounds include human-driven disturbance, such as mining and logging, as well as grazing by domestic livestock (Schuetz et al. 2007).

YBCU

Migratory routes of western YBCU are not well known because few YBCU specimens collected on wintering grounds have been assigned to western or eastern populations. Western YBCU depart 2–3 weeks earlier than eastern cuckoos (Hughes 2020). Departures begin in early to late August, with most birds gone by mid-September, though some may depart later (Hughes 2020, McNeil et al, 2011).

Most information on migratory routes is based on two birds fitted with geolocators. Both birds suggested a loop migration route, with distances between 9,500–9,900 kilometers. The first recaptured bird migrated south, through Central America, to winter in portions of Bolivia, Brazil, Paraguay, and Argentina (Sechrist et al. 2012). The second bird passed through the Caribbean region, and wintered from mid-November to late April in the Gran Chaco of central South America, near the borders of Paraguay, Bolivia, and Argentina (McNeil et al. 2015).

Spring migration routes differed for both birds; the first bird migrated north through the Caribbean, and moved between New Mexico and Mexico at the end of summer in 2009, and again in 2010, before being recaptured at its breeding site. The second bird passed through Peru and Central America on its way north (McNeil et al. 2015). This bird also appeared to pause in southern Arizona or Sonora before and after migration, paralleling the first tracked bird. Data from these two birds show dynamic migration strategies, and suggest the monsoonal region may be important to the western YBCU population during the migratory stage of its life cycle.

Western YBCU arrive on breeding grounds starting mid- to late May, 4–8 weeks later than eastern YBCU occurring at the same latitude (Franzreb and Laymon 1993). Considerable numbers of Western YBCU are usually not present until early to mid-June, and transients continue to travel through late June to mid-July (Hughes 2020).

Little information exists for habitat use during migration. Western YBCU may migrate north, along greening riparian corridors and surrounding landscapes, following monsoon precipitation (Wallace et al. 2013).

Territory and Mate Selection

This life cycle stage occurs upon arrival of adult birds to the breeding ground, where they must choose a mate and select a breeding territory. Birds choose territories that can provide food, water, shelter, and nesting sites.

SWFL

Little information exists on SWFL pair selection. Studies on other *Empidonax* species indicate that pairs form using coordinated movements and sounds (Tarof and Ratcliffe 2000). Female SWFL ultimately select their nest sites.

YBCU

There is even less information on YBCU pair selection. Pairs may visit potential nest sites together frequently prior to building nests.

Nest Building

Nest building occurs when a bird or mated pair is actively building a nest before egg-laying begins. Nest building within a territory usually begins within a week or two of pair formation. Nest building is an energetically expensive activity for birds (Mainwaring and Hartley 2013).

SWFL

The female SWFL builds a nest over the course of 5–7 days without help from the male. The nest begins with a platform of grass or strips of vegetation, and, using her beak and body, the female weaves grass through the platform vegetation to form a cup.

YBCU

Together, a male and female YBCU build a nest over the course of several days. The nest is placed on a horizontal branch or fork of a tree, and is constructed from small twigs, pine needles, and similar material.

Egg-Laying and Incubation

Egg laying generally begins between mid-May and mid-June, depending on the geographic area and elevation. This life cycle stage begins when females are actively laying eggs and continues through incubation until all eggs hatch. The energetic cost of egg production and incubation for female birds is poorly understood.

SWFL

SWFL lay 3–4 eggs per clutch. Generally, one egg is laid per day, with one day skipped, so the egg-laying period takes between 4–5 days. SWFL eggs hatch in 12–14 days, thus the entire egg-laying and incubation period is between 16–20 days, on average. Males do not assist with incubation.

YBCU

YBCU females can lay between 1–5 eggs in a clutch, but usually lay 2–3. Usually, YBCU lay one egg every other day, but females may wait up to five days between laying eggs. Eggs hatch in 9–11 days, and male and female YBCU share incubation duties. Helper males may assist with incubation. YBCU start incubation as soon as the first egg is laid, often resulting in nestlings of different ages in the same nest. The YBCU egg-laying and incubation period can be quite variable, lasting between 13–20 days.

Knowledge Gap: There is uncertainty around YBCU colony incubation and colony helping. Who contributes to eggs? Who contributes to incubation?

Nestlings

The nestling life cycle stage occurs from the time the first egg hatches until the young leave the nest. During this life stage, nestlings and their adult parents are very vulnerable; nestlings are susceptible to predation, while adult parents expend a lot of energy foraging and protecting the nest.

SWFL

The nestling life cycle stage is very energetically costly for SWFL parents, as they bring food to their nestlings up to 22 times per hour. Female SWFL do the majority of brooding and feeding the young, but males do play a role in food provisioning. The nestling period lasts around 14–15 days.

YBCU

Growth is extremely rapid for YBCU nestlings; the YBCU nestling life stage can be as short as 17 days from the start of incubation, which is among the shortest of any bird species. Both parents brood and feed the young equally. Occasionally, a nonparent adult, or “helper” bird, will assist with caring for nestlings. Most YBCU nestlings have fledged and started to venture away from the nest by day eight.

Fledglings

The fledgling life cycle stage occurs after young birds leave the nest, but before they are fully independent from their parents. Studies on fledgling survival for most bird species are lacking.

SWFL

SWFL young are capable of short (30 meter) flights at the time they leave the nest. SWFL young huddle together for 3–4 days after leaving the nest, and remain in adult SWFL territory for around 14 days before dispersing.

YBCU

YBCU young leave the nest at 7–9 days, and both parents and young leave the vicinity of the nest after one day.

Knowledge Gap

The uncertainty around what happens between the SWFL and YBCU fledgling life cycle stage and when they leave for full migration. There is some indication that the species may be vulnerable once they fledge, but there is no monitoring data.

Juveniles

The juvenile life cycle stage occurs after young birds leave parent territory, and no longer depend on their parents for food.

SWFL

SWFL broods likely break up once the young enter the juvenile life cycle stage, as the flocking of immature SWFL has not been reported.

YBCU

There is little information for YBCU in the juvenile life cycle stage.

SOUTHWESTERN WILLOW FLYCATCHER AND YELLOW-BILLED CUCKOO CONCEPTUAL ECOLOGICAL MODEL GLOSSARY

As noted previously, the size of the wedges on the life stage charts of the conceptual ecological models do not hold any significance. They are simply a product of the number of variables included in each life stage.

Abundance of Large Herbivores

This variable includes both domesticated animals, such as cattle, and wild animals, such as elk, beavers, and feral hogs. Grazing and browsing from domesticated and wild herbivores can negatively impact the success of restoration sites and SWFL and YBCU nesting sites by stripping trees, knocking down vegetation, compacting soil, and causing erosion. Additionally, a growing herbivore population can also attract more predators, which increases trails that negatively impact SWFL and YBCU habitat.

Stressful environmental conditions, such as drought, exacerbate the negative impact of grazing, even when there is no increase in the herbivore population.

Properly managed herbivore populations could provide some benefit by increasing soil nutrients. In the short term, the large herbivore population could negatively impact water quality by trampling vegetation at the water's edge, which often contains riparian plant species that are important for SWFL nesting habitat.

YBCU

Because YBCU have long-distance vision and large home ranges, they may benefit from edge effects near agricultural areas, which may have greater food availability.

Anthropogenic Noise

Anthropogenic noise can negatively affect SWFL and YBCU communication and nest success. This could hinder pair selection and, if the noise impact is too great, lead to nest abandonment. There are uncertainties related to how the timing, duration, and constancy of noise, as well as distance from the noise source, affect the degree of impact. Introduced noise may be less critical once nestlings have fledged; however, the lack of monitoring after fledging has led to uncertainties around this.

SWFL

There is an unpublished study at the Bosque del Apache National Wildlife Refuge on the impact mowing has on nests. Observations revealed that SWFL adults were initially defensive but began following the mowers due to the increase in insect activity.

YBCU

YBCU have large territories, which may indicate that they communicate over long distances. If so, YBCU may be greatly impacted by noise.

There is published literature that indicates YBCU vocalization frequency overlaps with the frequency of constant traffic, which leads to communication interference. YBCU have been

observed to avoid high-traffic areas, and may even select lower quality habitat in order to avoid traffic noise. (Goodwin and Shriver 2011)

Cooperative Breeding

YBCU are known to form colonies. Young juvenile males will act as “helper males” within a nest and help with feeding and incubation. A genetic study in Arizona found that eggs in the same nest had varied genetic parentage (McNiel 2015). There are many uncertainties around the degree to which colony size and cooperation contribute to nest success and to the genetic success of the population as a whole. Researchers may be overestimating the number of YBCU territories as a result of the colony nature of these birds.

Defoliation

Defoliation increases the risk of predation and negatively impacts the microclimate needed for nest success. Causes of defoliation include the tamarisk leaf beetle, drought, fire, and tree senescence.

Defoliation that occurs during the breeding season will have different impacts than defoliation that occurs between seasons. During the breeding season, defoliation may cause the failure of existing nests. Defoliation that occurs before territory selection decreases habitat availability, as, SWFL and YBCU pairs are less likely to build nests in affected areas.

YBCU

Given the larger range of YBCU, defoliation effects on the species will be different at the nest patch scale compared to the larger foraging territory scale. Defoliation away from the nest patch, and in the foraging territory, will affect food availability. However, as the foraging territory of the YBCU is so large, impact may be minimal unless there is widespread defoliation. Widespread defoliation can be caused by the tamarisk leaf beetle, high intensity fire, drought, tree over-maturity, or overgrazing. If defoliation is localized, YBCU can forage in other areas.

Fire

Depending on the intensity, fire can negatively affect riparian habitat, as it reduces short-term and long-term habitat availability. In the case of a catastrophic fire, sterilized soil may limit vegetation regrowth. In areas where the water table has been lowered due to water diversions, the historic riparian plant community may be unable to recover after a catastrophic fire and will transition to an upland or shrubland state. However, prescribed burns have been used to spur native plant rejuvenation and can produce post-fire soil benefits. Increase in leaf litter following defoliation can increase fire intensity. Non-native species and altered hydrology also alter fire behavior. More fire studies in riparian areas are needed.

Flying Insects

SWFL mainly prey on flying insects, such as mosquitoes. These insects require slow-moving and/or standing water. Thus, abundant standing water is required to provide adequate insect prey for SWFL. Pesticide use, defoliation, drought, and other factors that dry out soil, negatively impact insect populations.

Heterogeneity in Vegetation Type (Nest Patch)

YBCU require a nest patch size of over five hectares with 50–75 percent mid-story cover that is 3–10 meters high. Canopy cover is critical at the nest patch scale. (USFWS 2014; Johnson 2020)

Intraspecific Competition

There are many uncertainties around how much intraspecific competition affects SWFL and YBCU breeding success. A site's ecological carrying capacity may be dependent on food availability.

SWFL

SWFL generally have a 20- to 40- meter foraging patch size. However, multiple SWFL may use high quality habitat patches, creating a high population density. SWFL pairs tend to spread out when adequate habitat is available, or when new habitat patches become available on the landscape; possibly as a result of lower food availability during early patch establishment.

YBCU

YBCU may compete amongst each other for nest sites and food sources, although the degree of competitive interactions is unknown. Competition may include intraspecific nest parasitism, which may be common for YBCU (McNiel 2015).

Proximity to Water

Large flooded areas result in low velocity flows of shallow depths underneath nests. These areas contribute to the insect populations that make up the prey base for SWFL and YBCU, are beneficial for plant health, and facilitate the cooler microclimate needed for nest success.

Moist soil underneath the nest is vital for maintaining the microclimate needed for nest success. Additionally, moist soil boosts insect populations, plant health, and seed establishment.

SWFL

During migration, SWFL have been observed to be attracted to large flooded areas.

Large Insects

YBCU are opportunistic feeders that feed on large insects and small lizards. They require a large amount of food, especially when they are young. YBCU young grow rapidly and fledge in seven days. YBCU may choose territory based on insect outbreaks. Pesticide use, drought, and defoliation negatively affect their prey base.

Multi-Age Stands

SWFL breeding pairs prefer multi-age vegetation stands with 50–75 percent mid-story cover and dense cover that is 3–6 meters high. Dense vegetation provides protection from predators and contributes to the cooler microclimate of the nest site.

Nest Parasitism and Nest Predation

SWFL and YBCU nest predators include snakes, raccoons, skunks, rodents, and other birds. Loss of vegetative cover, drought, and other stressors can lead to predation and parasitism. There are uncertainties around how much edge effects impact parasitism and predation.

SWFL

Cowbirds are known to parasitize SWFL nests. Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, therefore

not specific to the SWFL. Data show that predation and parasitism balance out to about the same total combined level every year.

YBCU

YBCU tend to be quiet around their nests, so as not to attract predators. Loss of canopy cover, drought, and other stressors can increase the risk of predation.

Riparian Vegetation Community (Landscape)

YBCU require large expanses of riparian habitat at the landscape level with a mosaic of different vegetation types for both the nest patch and foraging areas. The estimated home-range size of the YBCU is between 62–91 hectares (Sechrist et al. 2013; Dillon and Moore 2020).

Site Fidelity

SWFL site fidelity can negatively or positively influence reproductive success, depending on site health and other characteristics. There is uncertainty around the degree of SWFL site fidelity, and what might influence dispersal to another site.

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Appendix D. Middle Rio Grande Endangered Species Collaborative Program Objectives and Strategies

PRELIMINARY COLLABORATIVE PROGRAM OBJECTIVES

These preliminary objectives are the starting point for conversation at the Objectives Workshop, described in Section 3.2, Task A of the *Science & Adaptive Management (S&AM) Plan*. These objectives are not final and will be revised prior to adoption by the Science and Adaptive Management Committee (SAMC). The objectives and strategies adopted by the SAMC will help the Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) achieve its goals in addressing species needs. The preliminary objectives are primarily split between these five species: Rio Grande silvery minnow (*Hybognathus amarus*; RGSM), southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL, yellow-billed cuckoo (*Coccyzus americanus*; YBCU), New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; NMMJM), and Pecos sunflower (*Helianthus paradoxus*; PESU). A list of other objectives and strategies follow those related to each species. A revised Section 4.1 in the *S&AM Plan* will incorporate the adopted objectives and supersede Appendix D.

Rio Grande Silvery Minnow

Objective A-1: Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the Middle Rio Grande (MRG).

Reclamation sponsors a long-term population monitoring program, which samples a minimum of 20 sites per year to document the presence or absence of marked and unmarked RGSM. This supports the recovery goals and Criteria 1.A.1, 1.A.2, 2.A.1, and 2.A.2 (Appendix E) in the *2010 U.S. Fish and Wildlife Service (USFWS) RGSM Recovery Plan* (USFWS 2010). This long-term monitoring effort provides indispensable data for evaluating the status of RGSM in the MRG.

Strategy A-1a:

Continue to support the monitoring effort and keep it as a high-priority for the Collaborative Program. Explore additional applications of the data, if possible.

Strategy A-1b:

Evaluate (temporarily) increasing the sample size and adding targeted sites to facilitate a statistically robust experimental design that addresses habitat use and informs habitat restoration efforts.

Objective A-2: Continue to support research into the life history of the RGSM to inform management of the species.

Contributing to ongoing research of the life history of the RGSM will help inform management decisions that benefit or reduce impacts to the species. The Collaborative Program has developed a RGSM conceptual ecological model (CEM) that is useful for deriving questions about the species' life history. This supports Recovery Goals 1, 2, and 3 (Appendix E) in the *2010 USFWS RGSM Recovery Plan* (USFWS 2010).

Strategy A-2a:

Generate research proposals to address previous panel recommendations (Noon et al. 2016, Fraser et al. 2013, etc.) and uncertainties identified with the RGSM CEM to better understand the life history of the RGSM.

Strategy A-2b:

Track life history research using the Adaptive Management (AM) Database to generate more timely management and study recommendations.

Objective A-3: Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.

Base flows are important in maintaining wetted habitat; this habitat represents the overall carrying capacity for RGSM in any given area of the MRG. The following strategies support Recovery Criteria 2.B.1 and 3.B.1 (Appendix E) from the *2010 USFWS RGSM Recovery Plan* (USFWS 2010).

Strategy A-3a:

Review current research publications and develop hypotheses to address habitat availability during base flow periods (outside of spring runoff).

Strategy A-3b:

Support development of models, such as a population viability analysis, to analyze habitat availability during base flow periods.

Strategy A-3c:

Clearly define assumptions/uncertainties involving minimum base flow, sufficient habitat, and survival rates.

Objective A-4: Support research and modeling efforts to determine the timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.

The timing, duration and magnitude of spring runoff are important to RGSM reproduction and have been demonstrated to have a significantly positive correlation with the October population density. The following strategies support Recovery Criteria 2.B.2, 2.B.3, 3.B.2, and 3.B.3 (Appendix E) from the *2010 USFWS RGSM Recovery Plan* (USFWS 2010).

Strategy A-4a:

Review current research publications and develop hypotheses to address nursery habitat availability during spring runoff.

Strategy A-4b:
Support development of models to analyze habitat availability during spring runoff.

Strategy A-4c:

Clearly define assumptions/uncertainties involving flow characteristics, sufficient habitat, and recruitment rates.

Objective A-5: Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.

Habitat availability varies by reach and flow regime in the MRG, and more research and modeling efforts are needed to help determine the best balance between water management and habitat restoration to support species recruitment and survival. The following strategies support Recovery Criteria 2.B.3, 2.B.4, 3.B.3, and 3.B.4 (Appendix E) of the *2010 USFWS RGSM Recovery Plan* (USFWS 2010).

Strategy A-5a:

Perform modeling to determine the amount of habitat needed to support a self-sustaining population in each reach during 1) spring runoff, 2) summer low flow periods, and 3) fall and winter base flow periods needed.

Strategy A-5b:

Identify uncertainties related to recruitment of RGSM and perform literature reviews to develop research hypotheses on this topic.

Strategy A-5c:

Identify uncertainties related to survival of RGSM and perform literature reviews to develop research hypotheses on this topic.

Strategy A-5d:

Review new and existing research to identify specific metrics to measure habitat quality in support of recruitment and survival of RGSM for a self-sustaining population in each reach. Recommend a habitat monitoring protocol to provide empirical data.

Southwestern Willow Flycatcher

Objective B-1: Continue monitoring for SWFL in designated critical habitat areas to track territories in the MRG management unit of the Rio Grande recovery unit.

SWFL territories and nests have been consistently found in the MRG management unit and the number of territories have increased in the last ten years. Continued contributions to monitoring in the MRG will help track species recovery. The following strategies support all recovery criteria (Appendix E) listed in the *2002 USFWS Final Recovery Plan SWFL* (USFWS 2002).

Strategy B-1a:

Ensure designated critical habitat areas in the MRG are monitored annually for SWFL territories to contribute to understanding species recovery.

Strategy B-1b:

Analyze available monitoring data annually to ensure SWFL territories are not decreasing in the MRG management unit. If the number of territories are decreasing, review habitat areas where territories have decreased to make recommendations for improving habitat to increase SWFL territories.

Objective B-2: Continue monitoring critical SWFL habitat and contribute to research on the impacts from non-native and exotic species on SWFL recovery.

Habitat requirements for the SWFL have been well documented, but impacts from the management of the non-native and exotic tamarisk on SWFL recovery are poorly understood. The following strategy supports recovery Criterion 2.B (Appendix E) from the *2002 USFWS Final Recovery Plan SWFL* (USFWS 2002).

Strategy B-2a:

Perform literature reviews and recommend best management alternatives regarding non-native and exotic species to support SWFL and their habitat.

Objective B-3: Support large-scale restoration efforts to protect and expand SWFL habitat in the MRG.

Strategy B-3a:

Annually map or update maps of SWFL habitat in the MRG management unit.

Strategy B-3b:

Review habitat areas biennially and identify sites that can be expanded based on occupied territories to prioritize restoration efforts.

Yellow-Billed Cuckoo

Objective C-1: Contribute to research and understanding of habitat needs for the YBCU.

Critical habitat areas were proposed and revised by USFWS in 2020. The area includes much of the MRG, with the exception of the Albuquerque reach. More research is needed to determine habitat features needed to help prevent the up-listing of the YBCU. There is not currently a recovery plan for this species.

Strategy C-1a:

Perform literature reviews and make recommendations for research to better understand the habitat needs to support the YBCU.

Strategy C-1b:

Annually map or update maps of YBCU habitat in the MRG. Make recommendations to support expansion of habitat to support the species.

New Mexico Meadow Jumping Mouse

Objective D-1: Contribute to efforts to expand habitat and preserve existing NMMJM habitat in the MRG.

There is currently one known population of NMMJM in the Collaborative Program area, located at the Bosque del Apache National Wildlife Refuge. The biggest stressor to the species is habitat loss, typically a result of grazing, water management practices, drought, wildfire and other pressures. The following strategies support the findings in the *2014 USFWS Recovery Outline NMMJM* (USFWS 2014).

Strategy D-1a:

Provide a biennial assessment of opportunities to expand NMMJM habitat in the MRG to achieve a self-sustaining population.

Strategy D-1b:

Perform literature reviews and pursue opportunities to support research to better understand the life history of the NMMJM, including movement behavior, to support habitat recommendations.

Pecos Sunflower

Objective E-1: Continue monitoring for PESU stands in the West-Central New Mexico Recovery Region and preserve habitat.

In the *2005 USFWS PESU Species Recovery Pla*n (USFWS 2005), the USFWS listed at least one potential core conservation area for an existing population of PESU within the West-Central New Mexico Recovery Region in the Collaborative Program area—the La Joya State Waterfowl Management Area. The area around the La Joya Drain is of particular interest. Monitoring and maintenance in that area should consider how to improve habitat for PESU.

Strategy E-1a:

Monitor one new area per year for PESU to see if the species is present. Monitoring could occur simultaneously with other monitoring occurring for habitat restoration sites or site maintenance monitoring. Consider monitoring in newly restored habitat areas in the Lower Reach Plan, where habitat for PESU may be suitable.

Strategy E-1b:

Devise a list of potential ways to keep the La Joya Drain area perennial to continue to provide suitable habitat for PESU.

Other Objectives and Strategies

Objective F-1: Monitor the status of other threatened species in the MRG.

The Collaborative Program will track the status of other species of concern in the MRG to prevent future listings or up-listings within the Collaborative Program area.

Strategy F-1a:

Review the biennial assessment from the New Mexico Department of Game and Fish for status of various species in the Collaborative Program area. Consider including protection measures for applicable threatened species in restoration efforts, where possible.

Strategy F-1b:

Include an update on status of other threatened and endangered species at Collaborative Program science symposia.

Objective G-1: Support the establishment and maintenance of a conservation storage pool in Abiquiu Reservoir.

Efforts are underway to change authorizations at Abiquiu Reservoir, so native Rio Grande water can be stored in addition to the already authorized San Juan-Chama water storage. The flexibility to store both San Juan-Chama and native Rio Grande water will provide options for managing water resources on the MRG.

Strategy G-1a:

Provide monitoring data to support the environmental assessment process to establish the conservation storage pool.

Strategy G-1b:

When possible, find available water to support the conservation storage pool to benefit species and habitat.

Appendix E. Consolidated Recovery Goals, Criteria, and Actions

RIO GRANDE SILVERY MINNOW RECOVERY PLAN, FIRST REVISION (USFWS 2010)

Recovery Goals

1. Prevent the extinction of the Rio Grande silvery minnow (*Hybognathus amarus*; RGSM) in the Middle Rio Grande (MRG) in New Mexico.
2. Recover the RGSM to an extent sufficient to change its status on the List of Endangered and Threatened Wildlife from endangered to threatened (downlisting).
3. Recover the RGSM to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Recovery Criteria

1.A.1. Using the standard sampling protocol (Appendix E, USFWS 2010), and sampling at a minimum of 20 sites distributed throughout the MRG in New Mexico, document the presence of RGSM (all unmarked fish) at ¾ of all sites, per reach, sampled during October.

1.A.2. Annual reproduction in the MRG below Cochiti Reservoir, as indicated by the presence of young-of-year at ¾ of all sites, per reach, sampled during October.

1.B.1. A captive population of 50,000 to 100,000 fish with a composition and distribution (among facilities) consistent with the recommendations of the *RGSM Genetics Management and Propagation Plan* (USFWS 2007).

2.A.1. Using the standard sampling protocol (Appendix E, USFWS 2010), and sampling at a minimum of 20 sites distributed throughout the MRG in New Mexico, document for at least five consecutive years, an October catch-per-unit-effort from all monitoring sites within each reach of > 5 fish/100 m^2.

2.A.2. Annual reproduction in the MRG below Cochiti Reservoir, as indicated by the presence of young-of-year from ¾ of the monitoring sites, per reach, for at least five consecutive years.

2.A.3. Two additional populations of RGSM, in the historical range of the species but outside the MRG of New Mexico, that each demonstrate (by quantitative analysis) a probability of extinction in the wild of less than 10 percent within 50 years.

2.B.1. Base flow within occupied habitat sufficient to generate survival rates necessary to achieve Criterion 2.A.1. Wetted habitat represents the overall carrying capacity of a particular area for RGSM and influences survival rates for the population. The amount and distribution of base flows necessary for recovery can be informed by a population viability analysis.

2.B.2. Recruitment flows that generate population growth rates necessary to achieve Criterion 2.A.1.

2.B.3. Habitat of sufficient quantity and quality to generate recruitment and survival rates that meet Criterion 2.A.1. Quantity and quality will vary by site but each location is likely to need increased nursery habitat and overall channel complexity. These increases can be achieved through restoration, flow management, and removing

impediments to river migration, such as giant cane (*Arundo donax*) in the Big Bend area.

2.B.4. Improve water quality within occupied areas and reintroduction sites to support recruitment and survival rates necessary to achieve Criterion 2.A.1.

3.A.1. Three populations of RGSM, in the historical range of the species, each of which demonstrate (using quantitative analysis) a probability of extinction in the wild of less than 10 percent within 100 years.

3.B.1. Base flows within occupied habitat sufficient to generate survival rates necessary to achieve Criterion 3.A.1.

3.B.2. Recruitment flows that generate population growth rates necessary to achieve Criterion 3.A.1.

3.B.3. Habitat of sufficient quantity and quality to generate recruitment and survival rates that meet Criterion 3.A.1.

3.B.4. Water quality within occupied areas and reintroduction sites to support survival rates of RGSM necessary to achieve Criterion 3.A.1.

Recovery Actions

1. Develop a thorough knowledge of RGSM life history, ecology, and behavior, and the current status of its habitat.
2. Restore, protect, and alter habitats as necessary to alleviate threats to the RGSM.
3. Ensure the survival of the RGSM in its current habitat and reestablish the species in suitable habitats within its historical range.
4. Implement and maintain an adaptive management program so that appropriate research and management activities are implemented in a timely manner to achieve recovery of the RGSM.
5. Design and implement a public awareness and education program.

FINAL RECOVERY PLAN SOUTHWESTERN WILLOW FLYCATCHER (USFWS 2002)

Recovery Goals

1. Recover the southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL) to an extent sufficient to change its status on the List of Endangered and Threatened Wildlife from endangered to threatened (downlisting).
2. Recover the SWFL to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Recovery Criteria

1.A. Increase the total known population to a minimum of 1,950 territories (equating to approximately 3,900 individuals), geographically distributed to allow proper functioning as metapopulations, so that the SWFL is no longer in danger of extinction. *For reclassification to threatened status, these prescribed numbers and distributions must be reached as a minimum, and maintained over a five-year period*.

1.B. Increase the total known population to a minimum of 1,500 territories (equating to approximately 3,000 individuals), geographically distributed among Management Units and Recovery Units, so that the SWFL is no longer in danger of extinction. *For reclassification to threatened status, these prescribed numbers and distributions must be reached as a minimum, and maintained over a three-year period, and the habitats supporting these SWFL must be protected from threats and loss.*

2.A. Meet and maintain, at a minimum, the population levels and geographic distribution specified under reclassification to threatened Criterion 1.A.

2.B. Provide protection from threats and create/secure sufficient habitat to assure maintenance of these populations and/or habitats over time.

Recovery Actions

1. Increase and improve occupied, suitable, and potential breeding habitat;
2. Increase metapopulation stability;
3. Improve demographic parameters;
4. Minimize threats to wintering and migration habitat;
5. Survey and monitor;
6. Conduct research;
7. Provide public education and outreach;
8. Assure implementation of laws, policies, and agreements that benefit the SWFL;
9. Track recovery progress.

RECOVERY OUTLINE NEW MEXICO MEADOW JUMPING MOUSE (USFWS 2014)

Note: The goals and criteria are inferred from the Preliminary Recovery Strategy, and are not explicitly listed as such.

Recovery Goal

Establish the number and distribution of resilient populations to provide the needed levels of representation and redundancy (genetic and ecological diversity) for the New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*; NMMJM) species to demonstrate viability.

Recovery Criteria

To ensure viability, establish at least two resilient populations (where at least two existed historically) within each of eight identified geographic conservation areas.

Recovery Actions

1. Establish partnerships to design and install effective barriers or exclosures or change livestock management techniques (e.g., fencing, reconfiguration of grazing units, off-site water development, or changing the timing or duration of livestock use) to limit ungulate grazing and protect riparian habitats from damage.

2. Work cooperatively with stakeholders to maintain the required microhabitat components or modify or limit actions (e.g., bridge and road realignment projects, water use and management, stream restoration, and vegetation management) that preclude their development and restoration, in order to stabilize and expand current NMMJM populations.
3. Identify priority areas to reduce fuels to minimize the risk of severe wildland fire and identify techniques for post-fire stabilization in areas that burn.
4. Modify off-road vehicle use and manage dispersed recreation through fencing, signage, education, and timing of use.
5. Facilitate the natural expansion of NMMJM habitat through the management and restoration of beaver. In New Mexico, beaver can no longer be relocated or transplanted without written consent from all property owners, land management agencies, or other affected parties (e.g., irrigation districts) within an 8-kilometer (5-mile) radius of the proposed release site or connective waters (New Mexico Department of Game and Fish 2009, entire).
6. Complete an emergency contingency and salvage plan to capture NMMJM and bring individuals into captivity in the event of severe wildland fire, post-fire flooding, or severe drought.
7. Establish a monitoring protocol to determine presence/absence or estimate the abundance of NMMJM populations.
8. Investigate the genetic diversity of populations to identify and address where long term management strategies may be needed to enhance their genetic integrity.
9. Formally evaluate whether assisted translocation or a captive breeding program for NMMJM would be beneficial as a recovery option.
10. Conduct research on the critical aspects of NMMJM life history (e.g., reproduction, abundance, survival, movement behavior).

PECOS SUNFLOWER RECOVERY PLAN (USFWS 2005)

Recovery Goal

Removal from the Federal list of threatened and endangered species (delisting). Protect and manage in perpetuity significant, sustainable populations of Pecos sunflower (*Helianthus paradoxus*; PESU) and habitat within its native range so that the protection of the Endangered Species Act is no longer required for the conservation and survival of the species.

Recovery Criteria

1.A. Identify and establish at least one core conservation area for PESU in each of four distinct recovery regions that would collectively, if protected, ensure the long-term survival of the species. Each core habitat must occur on wetlands that are not threatened by depletion of the contributing aquifer and have demonstrated a self-perpetuating stand of PESU of greater than 5,000 individuals for a minimum of seven out of ten years. In addition to the core conservation area, each region should have at minimum one additional isolated stand of protected PESU with greater than 1,600 individuals for at least seven out of ten years to protect against catastrophic loss of the regional population.

1.B. Assure long-term protection of designated core conservation areas and designated isolated stands in perpetuity through the implementation of appropriate management plans, conservation easements, or land acquisition.

Recovery Actions

1. Identify and establish core conservation areas and isolated stands.
2. Identify and address information gaps, compatible uses, and management actions regarding Pecos sunflower distribution, biology and aquifer stability.
3. Protect core conservation areas and isolated stands through landowner education, implementation of management plans, conservation easements, and land acquisition.
4. Monitor PESU conservation areas and management actions as needed to satisfy delisting criteria.

WESTERN YELLOW-BILLED CUCKOO CONSERVATION STRATEGY (USFWS 2020)

Note: This information is based off the latest proposal for revised critical habitat designation in the Federal Register (Feb. 2020, Vol. 85, No. 39)

Recovery Goal

The goal of our conservation strategy for the western yellow-billed cuckoo (*Coccyzus americanus*: YBCU) is to recover the species to the point where the protections of the Endangered Species Act are no longer necessary.

Recovery Criteria

1.A. Identify the specific areas within the western YBCU's range that provide essential physical and biological features (e.g., breeding habitat), without which range-wide resiliency, redundancy, and representation could not be achieved.

1.B. Identify the fundamental parameters of the species' biology and ecology based on well-accepted conservation-biology and ecological principles for conserving species and their habitats and more general riparian and avian conservation management prescriptions.

Recovery Actions

1. Designate critical habitat, focused on breeding habitat, which includes areas for nesting and foraging and also provides for dispersal habitat when breeding or food resources may not be optimal.
2. Include breeding habitat within three general habitat settings to allow for within-year and year-to-year movements to take advantage of any spatial and temporal changes in habitat resources and food abundance.
    a. Large river systems (mainstem rivers and their tributaries) in the southern and central portions of New Mexico, Arizona, and along the California border with Arizona (generally referred to as the Southwest);

b. Locations within southern Arizona not associated with major river systems or their tributaries;

c. Large river systems outside the Southwest (as identified in [a.] above) that occur in different ecological settings that are being consistently used as breeding areas by western YBCU (such as areas in parts of California, Utah, Idaho, or Colorado).

3. Monitor population potential for:

   a. Maintaining its existing distribution;

   b. Moving between areas depending on food, resource, and habitat availability;

   c. Increasing the size of the population to a level where it can withstand potentially negative genetic or demographic impacts;

   d. Maintaining its ability to withstand local- or unit-level environmental fluctuations or catastrophes.

References

U.S. Fish and Wildlife Service 2002. Southwestern Willow Flycatcher (*Empidonax traillii extimus*) Recovery Plan. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service 2010. Rio Grande Silvery Minnow (*Hybognathus amarus*) Recovery Plan, First Revision. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service 2005. Pecos Sunflower (*Helianthus paradoxus*) Recovery Plan.

U.S. Fish and Wildlife Service 2014. New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*) Recovery Outline. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service 2020. Western Yellow-Billed Cuckoo (*Coccyzus americanus*) Conservation Strategy. Federal Register (Feb. 2020, Vol. 85, No. 39).

Comment #	Page	Section	Comment	Response
1	1	1	Maybe remove 'currently aids in' and say The Collaborative Program continues to develop and implement projects based on sound science to further the conservation and the recovery …(whatever here) of TE listed species in the Rio Grande. Despite what Reclamation wants I think we want the CP to be a bit more useful than what it is being relegated to.	Section 1.5.1 (Box 3) outlines the assumptions under which the Program operates. No change made.
2	1	1	This is incorrect and maybe hard to condense given there are 17? Signatories to the Program. Remove signatory, does not mean anything here and implies it is NGSO. And federal, state, local are generally not organizations but agencies. Federal, state, and local agencies, tribe and pueblos, non-governmental organizations, and stakeholder groups… (you forgot universities for example) something like that?	Change was made to be consistent with the By-laws in the following sentence: The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) is a partnership of **federal, state, and local governmental entities, Indian Tribes and Pueblos, and non-governmental organizations** that aims to protect and recover federally listed species in the riparian corridor of the Middle Rio Grande (MRG), while preserving the area's existing and future water uses in compliance with applicable state, federal, and tribal laws, rules, and regulations.
3	1	1.1	Need some introduction of what the Long term plan is	Section 4.2 describes the Long-Term Plan. The Long-Term Plan was provided for EC review on November 25, 2020.

4	1	1.1	Reading this makes me wonder why the CP exists. I would go on a more positive route here. Why for example do we need a CP? Do we not trust the federal and other agencies to use their money wisely and to not create issues for water users in the MRG? (Answer was in the 90's a resounding NO). Can we think of an overall more positive message? How about: The Collaborative Program's diverse collective allows for creative and innovative approaches to adaptive management of the region's scarce resources, especially water, and other challenges that continue to imperil its native species, including climate change and loss of habitat. Understanding critical uncertainties and developing scientific information is a priority for the CP to allow for improved and informed decision making . (the last two sentences can be used to flesh out the concept. Don't restrict the CP, it should continue to seek empowerment in decision making (but don't need to say that here)..	No change made.
5	1	1.2	Did it really EXPAND on the MOA? I don't have it in front of me but I think we contracted from the initial purpose of the CP.	In reference to the following: "In 2019, the Collaborative Program adopted a revised mission statement (Box 1), which **expanded** on the 2008 Memorandum of Agreement's (MOA) statement of purpose." The sentence that follows provides more context: **The revised mission statement maintains the Collaborative Program's intent to recover listed species and protect water uses, while further emphasizing the need for and use of scientific analysis to support AM in the MRG.**

6	1	1.2	Remove a " list of: and say "six" and remove 'long-term' as not necessary	Change made from the original: "In 2020, the Executive Committee (EC) approved long-term species-specific goals in support of its revised mission (Box 2)." to the following: "**In 2020, the Executive Committee (EC) approved species-specific goals in support of its revised mission (Box 2).**"
7	1	1.2	I also think you don't really need the second 2 sentences. Large scale is ambiguous and continually strived for is wiggly. I request that you remove superfluous language in this document. Just state Goals!	No change made.
8	1	1.1	Suggest use "see" citation to indicate that section 4.2 is not the LTP itself	Change made as follows: "Together, the Science & Adaptive Management Plan (herein referred to as the S&AM Plan) and the Long-Term Plan (**See Section 4.2 and the 2020 Long-Term Plan**) provide the framework for implementing the Collaborative Program's science and AM process."
9	2	1.2	This is really confusing. Like huh? Also the recovery plans can be used to formulate what the science should be but ensure it is not what we need to do.	A cohesive, organized, and productive program requires a strong set of hierarchical guiding principles. Thus, the mission is supported by goals, goals are addressed with objectives, objectives are achieved with strategies, and strategies are implemented through projects. Guiding principles such as these are fundamental to any strategic plan. Also, by having the objectives informed by the recovery goals, the Program can potentially have more substantial input into future revisions of the recovery plans.

10	2	1.2	As provided in previous comments it is questionable that the recovery goals criteria and actions need to included in this document. Also there are a lack of recovery plans for all species and this is not included in the discussion.	As shown in Appendix E, recovery plans exist for the RGSM, PESU, NMMJM, and SWFL. Similar information for the YBCU was taken from the Conservation Strategy. Recovery (and conservation) documents are referenced because of the language used in the Collaborative Program's goals. A program that calls itself an endangered species collaborative program and sets goals dealing with population and habitat management for listed species will, by definition, relate to the recovery and conservation documents developed for those species.
11	2	1.2	Suggest changing "represent" to "serve"	Change was made in the following sentence: "These links ensure the Collaborative Program produces initiatives that **serve** its mission and goals."
12	2	1.2	Regarding the following sentence: "To increase the efficiency and effectiveness of Collaborative Program efforts, goals and objectives **are linked** to species recovery plans." What exactly does this mean? "Linked" suggests some sort of discrete cross referencing between goals, objectives, and elements of species recovery plans, but this doesn't seem to be the case, especially as objectives are preliminary at this point. ("will be linked" ?) Maybe "are informed by"? I'm not sure if an edit is needed – it may need to stay somewhat vague – but if more precision is possible it would be good.	Change was made in the following sentence: "To increase the efficiency and effectiveness of Collaborative Program efforts, goals and objectives **are informed by** to species recovery plans."
13	3	1.4	Suggest replace "with" with "whose members have"	Change was made to the following sentence: "A Collaborative Program stakeholder is an organization **whose members have** vested interests in listed species recovery and protection of water uses in the MRG."

14	4	1.4	Suggest taking out the first sentence and just state who the signatories are. I don't really see the State of NM as a stakeholder but do see us as signatories.	No change made.
15	4	1.4	I think line 85 to 93 can be shortened. It's confusing to add in the Minnow Action Team and Acequia Associations w/o permission to do so and I don't think the list you have here were great examples of stakeholders who are not signatories. I would suggest instead: "Although the CP members include a diverse and fairly comprehensive governance body the Rio Grande has a number of smaller cities, towns, and counties as well as Pueblo and Tribal lands along it that are not part of the formal CP but may be considered to be stakeholders in the work of the CP; and engagement by the CP and other stakeholders is critical for successful adaptive management implementation. Additionally, soil and water conservation districts, other land resource agencies (NMDA, US Forest Service, USGS) are expected to be included as stakeholders, technical experts and/or decision makers in outcomes of the SAM Plan. " something in that vein	Change made to the following sentence: "Beyond the Collaborative Program signatories, MRG stakeholder groups include soil and water conservation districts, Acequia Associations, the New Mexico Environment Department, the Mid-Region Council of Governments, and **other land and natural resource management entities and interest groups not listed as signatories**." During AMWG reviews, requests were made to include a reference to the MAT, acequia associations, and other organizations as MRG stakeholders external to the Program.
16	4	1.4	The MAT is identified as an external stakeholder group--interesting.	Noted.
17	5	1.5.2	Incorporating instead of incorporation	Change made to the following sentence: Since the mid-2000's, the Collaborative Program has worked towards **incorporating** an AM framework into its efforts.
18	5	1.5.2	Suggest replace "in" with "on"	Change made in the following sentence: "The Collaborative Program's current position **on** AM of the MRG is one developed over many years."

19	5	1.5.2	Suggest verb tense change from "was" to "were"	Change made in the following sentence: "In Middle Rio Grande Endangered Species Collaborative Program Adaptive Management Plan Version 1, Murray et al. (2011) **were** contracted to provide a comprehensive concept for implementing an AM approach for management of the RGSM and SWFL."
20	5	1.5.2	[suggest rewording the sentence] so it doesn't sound like the program just dropped the ball	Change made to the following sentence: "**In response to the 2016 MRG BO (described below)**, the Collaborative Program **decided not to** implement the RIP, and instead focused on renewed efforts to develop an AM framework to complement its position in the MRG."
21	7	1.5.3	1.5.3 is still really long and how much is needed? Table 1. Change title. Should say US Fish and Wildlife Biological Opinions related to signatory proposed actions. Signatories don't operate under Bos, they are opinions to guide ESA compliance under Section 7. Also I think that ABCWUA and Reclamation or Corps are together on that 2004 opinion because there is a federal nexus. May need to check on that I could be wrong. On table 2 add ecosystem function and structure as we have contractors that can support that work. Shouldn't UNM have all the science boxes checked? I'm not sure NMISC should be checked for Conservation Laws. Not sure what that is. Env/ESA laws instead? FWS are not experts on water regulations and policy so that should go. However UNM could have that included to their check box with Utton Center.	Table 1 title shortened to **Current Middle Rio Grande Signatories' Biological Opinions.** UNM signatory representatives indicated that their engagement in the Program is adequately represented in Table 2. Added an "X" under Ecosystem function and structure to represent participation by NMISC contractors. Conservation Laws refers to the Endangered Species Act and related laws and policy. It is considered that Chris Shaw is available to provide expertise within the Program as needed.
22	7	1.5.3	Suggest change from "organizations" to "entities"	Change made in the following sentence: "Water allocation and delivery in the MRG is highly managed and regulated by multiple **entities**."

23	8	1.5.5	Suggest wording changes to the following sentence: "Collaborative Program operations, except by mandate, preclude the implementation or directing of management actions."	Change made to the following as suggested: "The Collaborative Program operations **lack the authority** to implement or direct **river** and other management actions."
24	10	2.1	I don't see the connections between the structured decision making four components with the 3 next listed items. For example there is not one decision making process described. Is the database a decision support model? Yackulic's model is but not anything mentioned here. Just having problems connecting those two lines of thinking in this section for me.	Replaced "Under the S&AM Plan, the Collaborative Program has incorporated the above components into the fabric of its operation in three substantial ways:" with "**Additionally, the Collaborative Program's operation incorporates the following complementary actions:"** to better reflect the connection between what the literature states about structured decision making, and the Program's appraoch to incorporating structured decision making.
25	11	2.2.1	6 th bullet: Scientific evidence "is" added	Change made to the following sentence: "New scientific evidence **is added** to the knowledge base to reduce uncertainty and enhance understanding of the system and its species."
26	13	2.2	Did CP or AMWG approve that definition in Box 5? It's pretty deep. The only question I have is the producing improved systemic understanding of needs to meet the established goals. What if our goals change as a result of AM? Also 'understand of needs' seems wrong on some level. 'Necessary steps or direction' maybe?	The AMWG developed the Program's definition of adaptive management in 2018, which was presented to the EC on April 12, 2018.

27	13	3	We never had an AM process. Been waiting for some time to have that in place. Maybe just my wanting to have a very readable and succinct document but seems to be much 'thinking it out' ' mental management' and 'excuses' etc in this document. Suggest removing the first 2 sentences as superfluous and start with "The CP has been restructured to include as its priority using the adaptive management process. Thus the Science and AM Committee (SAMC) was formed to focus efforts by CP signatories on addressing scientific uncertainties related to the 5 listed species and their habitats." And I'm not sure why the word translation is used so much. What does that mean? Can you translate what that looks like? I'm not sure the EC needs translations. If we were talking to politicians, perhaps but these are heads of technical/science entities for the most part.	The use of translation in the document was replaced as follows: "Activating a small, focused committee of topical experts lends to the productive **messaging** of science into management-relevant recommendations."
28	13	3.1	I don't know if the EC discussed this yet with so many years devoted to the AM workgroup formation but Administrative Ad Hoc Groups are what? Could they be within the folds of the Program Support Team or even Fiscal Planning Committee? Seems like a big but currently empty box. You may hold it there as a place holder but the question will come up and we'll have to discuss it. I personally think it could be problematic. Also where does the Independent Science Panel reside? I would say they should be under the EC directly.	Administrative Ad Hoc Groups are described in Section 3.2.3. See also: Table 2, Section 3.1, and Section 3.2.2 A. Needs for future independent science reviews are described in Section 3.2.1.

29	14	3.2	When are we getting back to AM Plan? I think as you discuss the CP you should have the EC first in your discussion. Policy and guidance or Direction and decision making? They don't make decisions for the agencies but do so for the CP. Otherwise why be in the CP or on the EC? Then go to Science and AM And then to Funding and Implementation ? Like how do we carry out the recommendations from the SAMC and approved by the EC? Who facilitates that actual projects get done, whether Research, monitoring or on the ground/operations/OM etc.? This is slightly discussed in B but what does that process look like and what response are we expecting. It's like doing homework but never being graded and not receiving a diploma. What good is all that work if you aren't moving forward? The EC needs to grapple with this, I don't expect WEST to have those answers as they are difficult. – good attempt!	During the AMWG review, requests and suggestions were made throughout the document to address the scientific and technical aspects up front as it is a Science & Adaptive Management Plan, with the administrative, policy, and guidance sections following. These changes were made to be consistent throughout the document at that time. Section 3.2 describes the operational structure, including lines of communication amongst committees and groups.

30	18	3	The role of the FPC seems rather huge and daunting. It is the link I discussed missing above and generally fills in the role of the Management Committee we had at one time that dealt with getting projects funded. But the difference is the FPC (and it may end up being in conflict with the AAHG at times) seems rather ad hoc itself. I'm a committee chair and haven't heard from WEST in over 6 months about fiscal planning. If the Program Support Team is fulfilling this role already through going to BOR or other then I'm not sure this Committee is needed. Something to think about. I'm not sure what will happen in its connections with SAMC. For example, if SAMC says we need to conduct a new vegetation survey, does it then go to the FPC to find a sponsor before it goes to EC or after? I know this isn't necessary to have in the plan, it is the only opportunity we have to bring forward questions. I also don't see the FPC as administrative support. Maybe once the SAMC has their first set of recommendations we'll see what happens? That seems to be the plan here.	The role of the FPC in the Program is detailed in the EC approved charter for the group. Once the S&AM Plan and Long-Term Plan are approved to be fully implemented, the FPC will work with the SAMC and the EC, as necessary, to coordinate resources and capabilties to complete work in the MRG. One item on the 2021 Work Plan is to request that the FPC develop schedules and timelines in coordination with the individual signatory's and the SAMC. These efforts will result in updates to the Long-Term Plan schedules and recommended activities. Currently, the AM Database and the Objectives Workshop need to be completed before the FPC can function fully in its intended role.

31	19	3.2.3	The Figure 4 kindof depicts another structure for CP that now has an independent external review. I think that review needs to be connected directly to the EC. Also EXTERNAL? Probably the SAMC and other groups are communicating with 'EXTERNAL' as well. Not sure what this is meant to say. In truth I think the PST is heading up the SAMC isn't it? The PST is also heading up the FPC? It doesn't have to but currently we await calls from Julie. I don't see this diagram as useful and could cause confusion. I would take it out. For the AM Plan perhaps you can have a more directed flow diagram on communication??	Figure 4 is a diagram depicting communication and work flow, while Figure 3 is the Program's hierarchical structure. Under the S&AM Plan, the EC will approve requests from the SAMC to conduct independent reviews. It is intended that the SAMC work with any independent external reviews with regular updates to the EC (see Section 3.2.1). The EC interactions with the SAMC and stakeholders are described in Section 3.2.2 A and B. The Senior Science Coordinator, which is currently a position on the third party contracted Program Support Team, serves as the non-voting chair of the SAMC as laid out in the EC-approved SAMC charter. The FPC has two co-chairs, with support from the PST. This is the Program's Science & Adaptive Management Plan.
32	21	4.2	The Long Term Plan really is a necessity dictated by the Corps. I would shorten this to a paragraph until we have a long term plan. Also I still like Wegner's approach to Planning Documents (triennial plan).	The S&AM Plan and the Long-Term Plan lend to both iterative learning and continuous planning within the Program. The temporal scale may be on an annual, biennial, triennial, 5-year, or 10-year basis as the planning needs of 17 signatories vary. A Long-Term Plan has been developed to address the U.S. Army Corps of Engineer's needs. The Program will complete continuous updates to accomodate the Program's needs on a regular basis.
33	21	4.2	A Long-Term Plan is still identified as a document to be somehow developed later. It will be key	The Long-Term Plan was provided for EC review on November 25, 2020.

34	22	4.4	The PST will have to take on the Executive Summaries. The SAMC directs others now? Who? The PST or? These may be hard if we don't have a table/plan that everyone agrees addresses our priorities first.	Completion of Executive Summaries will be guided by the SAMC as needs arise as described in Section 4.4. The Executive Summary process is detailed further in a separate document and will undergo SAMC review with subsequent updates as needed. The SAMC's role in guiding the scientific and technical aspects of the Program are outlined in Section 3.2.
35	23	5	I think the main section of this Plan is a bit buried. Section 5 maybe could stand alone w/o all the stuff before it. Maybe making sure people don't get discouraged they can be specifically directed to Section 5 as the AM Plan. This section actually is a plan for the plan but at least is the real purpose of this stage of the planning process.	Noted.
36	24	5	Box 6 is cut off.	Formatting fixed.
37	25	5.1	Is workshop described in 5.1 different than the December workshop?	The workshop (Objectives Workshop to refine the Program's objectives) referenced in verbal discussions with WEST is the same as referenced in Section 5.1. The Objectives Workshop was originally intended for December, but the SAMC decided to schedule it for early February 2021.

38	25	5.1	Step 2: SAMC has a bunch of steps for each issue- yikes. Is there a way you can avoid another workshop? Is that necessary? I think we have enough to go on w/o that step. For a 3 year round of trying to get things going. Workshops can follow when we have more directed questions to ask. Workshops are expensive. WEST intends to eliminate a workgroup effectively getting something done from a workshop PMWG but wants to launch another one that will end up with forming the PMWG all over again. Don't throw the baby out w/bathwater always remember… Also the idea of the SAMC is to have a small group to facilitate faster end products so let's see how that goes w/o workshop.	The current draft objectives and strategies are outlined in Appendix D and require further development and subsequent EC approval. An Objectives Workshop will be held by the SAMC for the Program to continue development of objectives and associated strategies. Once developed with buy-in from the Program, the SAMC will present the objectives to the EC for review and approval. The Objectives Workshop addresses program-wide guiding principles, not the task(s) of a single work group. Participants have an opportunity to provide feedback prior to the workshop, thus allowing specific items to be prioritized. This workshop is not a proposed work group.
39	27	5.4	F. should be all caps in line with other lettered headings.	Formatting fixed.
40	29	5	Table 3 is useful. Again how about convene workshop if needed? Maybe after a 3-5 year plan is in place? Is it to get buy in or get financial support? Also do you have in the AM process Communication with other than EC? In other words Science Symposiums and other Outreach.	The current draft objectives and strategies are outlined in Appendix D and require further development and subsequent EC approval. An Objectives Workshop will be held by the SAMC for the Program to continue development of objectives and associated strategies. Once developed with buy-in from the Program, the SAMC will present the objectives to the EC for review and approval. Section 3 and Section 5.6, Step 19 describe communication. The Science Symposium is included as a task in Table A1 and referred to in Section 5.6, Step 19.

41	29	5	Table 3: In implementation stage it looks pretty bare bones. Like maybe have a CP Science Contact for Project Implementation? Otherwise you can't get to the F, G, or H. In other programs they control all the strings. The CP doesn't and thus needs some threads even if they are gossamer thin to follow projects and accomplishments. FWS is a great example. We have to really bug FWS to find out what new projects or modifications to their Programs they are doing. Maybe ISC the same and others, Corps etc?	The Adaptive Management Database (Section 4.1) will track project status, findings, reports and updates to tools and guiding principles. Signatories and stakeholders that participate in the Program are responsible for working with the Program Support Team (currently WEST) to population and update the AM Database. Value of the AM Database to signatories is commensurate with their level of engagement.
42	Appendices A & B	Appendices A & B	The conceptual models are still referenced and included in the document as guidance for species and environmental interactions.	Noted.

43	Appendix E	Appendix B	Suggest that Appendix B be jettisoned (or actually taken out and kept for refinement, peer review, and used as intro for Volumen II. SMART Plan. It remains incorrect, incomplete, and hasn't really been reviewed fully. Can we please go back to the ASIR conceptual model for RGSM even if it isn't perfect as the one someone can actually understand at a glance if WEST wants to show conceptual models for species? The transitions schematics for RGSM are not that useful for audience reviewing this plan and were intended for a more in depth look than this plan needs. Please take out the Pick up Sticks RGSM diagram as again it is way too complex for the purpose of this plan. We (AMWG) specifically intended to give the audience a general understanding of the species life history, not state that everything affects everything in nature. That is obvious to all of us scientists (including the EC who manage technical organizations). The SAMC can do more with Appendix B but it isn't ready to be attached to the SAM Plan. I think SAMC can take Appendix B and improve it by simplifying and then developing the table of uncertainties etc. SAM Plan Volume II. Perhaps then we can have a workshop. Also please include the Valdez paper and there are others that need to be cited if this is to be issued as such.	The MRGESCP Rio Grande Silvery Minnow Conceptual Ecological Model and component transition schematics are the result of substantial collaborative efforts by the Science and Habitat Restoration Work Group members. As Collaborative Program products, they are part of a scientific (and administrative) record and, as such, will not be disregarded. Moving forward under the Science and Adaptive Management Plan, all documentation of the Collaborative Program's work is considered in-development and subject to regular evaluation and improvement. Therefore, dissatisfaction with the RGSM CEM, or any other CP tool, should prompt a request to modify (with accompanying justifications) to be submitted to the SAMC for consideration. Different versions of the CEMs depicting different levels of detail are under development because, as communication tools, they need to address the diverse needs of varied audiences.

44	Appendix C	Appendix C	I also think the diagram needed for SWFL is the first one maybe. Again the intent for this plan was to present in a postcard the species and habitats they interact with. Both science workgroups went above and beyond the intent of the AMWG request, which was good that Science and WEST started discussion but not needed for this particular plan even in appendix. I think we all agree that this document is not the Science plan or AM plan but a process plan to get those in place. I applaud the appendix B but it needs more refinement before it is a final document.	See comment #43. The purpose of the S&AM Plan is not to "present in a postcard" any aspect of the Collaborative Program's work to date. Rather, it describes the transition of the MRGESCP from a collection of disparate ideas often accompanied by redundant and outdated information to a science-based program with work and recommendations aligned to an adaptive set of guiding principles. Nothing that is adaptive will be considered final.
45	General	General	What does the long term plan look like?	Section 4.2 describes the Long-Term Plan. Additionally, the Long-Term Plan was provided for EC review on November 25, 2020.
46	General	General	What does the AM database look like?	Section 4.1 describes the AM Database as does Section XX of the Long-Term Plan. A presentation of its utility and function is available on the Program Portal: https://webapps.usgs.gov/MRGESCP/symposium2020/2020-detailed-agenda-and-abstracts.
47	General	General	I suggest just labeling it as SAM Plan the & is awkward and harder to type and that's what acronyms are all about, easier, We'll call it the SAM Plan I'm sure.	Noted.
48	General	General	General Comment: This plan reflects a ton of work and thought. I congratulate you for accomplishing this and moving ahead with reorganization. I know the pandemic complicated things but maybe allowed some time to put this together. Thanks so much.	Noted.
49	General	General	I finally finished the review of the S&AM plan and I think it looks great. I support the overall premise and am glad that it has been executed with the level of detail that you all have put into it. I don't have any substantive comments and thank you for your hard work on this.	Noted.

50	General	General	WEST incorporated many of our suggestions/recommendations into the document, some nearly verbatim.	Noted.
51	General	General	The document reads better in relating adaptive management to the Collaborative Program and acknowledges the many and varied signatories, as well as no central funding source or decision-making body for water management.	Noted.
52	General	General	The species recovery criteria area also still included, but the language has been softened a bit to distinguish that the Program will assist recovery, although this is still not consistent throughout.	Noted.
53	General	General	Overall, the AM Plan is short on detail as to how the signatories will interact under adaptive management. That may be good, as it falls short of being too prescriptive.	Noted.



Long-Term Plan

Draft

December 10, 2020

Prepared on behalf of and for use by the
Middle Rio Grande Endangered Species Collaborative Program

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Appendix A. Middle Rio Grande Endangered Species Collaborative Program Objectives and Strategies

ACRONYMS AND ABBREVIATIONS

2D	two-dimensional
AAH	Administrative Ad Hoc
AM	Adaptive Management
CEM	conceptual ecological model
Collaborative Program	Middle Rio Grande Endangered Species Collaborative Program
EC	Executive Committee
ESA	Endangered Species Act
FPC	Fiscal Planning Committee
GIS	Geographic Information System
H&O	Hink and Ohmart
HR	Habitat Restoration
LLSMR	Los Lunas Silvery Minnow Refugium
LTP	Long-Term Plan
MRG	Middle Rio Grande
NMMJM	New Mexico meadow jumping mouse
PASS	Program and Science Support
PESU	Pecos sunflower
PST	Program Support Team
PVA	Population Viability Analysis
RGSM	Rio Grande silvery minnow
S&AM	Science and Adaptive Management
S&T	Science and Technical
SAMC	Science and Adaptive Management Committee
SIG	Signatories
SOW	scope of work
SWFL	southwestern willow flycatcher
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
YBCU	yellow-billed cuckoo

FORWARD

This Long-Term Plan is a living document that will be updated annually to reflect changes in our understanding of the Middle Rio Grande ecosystem, species interactions, and the management approaches used, implementation of proposed projects, and the Middle Rio Grande Endangered Species Collaborative Program's (Collaborative Program) guiding principles. This Plan complements the Collaborative Program's Science & Adaptive Management Plan.

Modifications to this Plan will serve to document iterative learning within the Collaborative Program.

1 INTRODUCTION TO THE COLLABORATIVE PROGRAM'S LONG-TERM PLAN

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) uses a science and adaptive management (S&AM) process for its operations in support of its mission and goals, and to support greater adaptive management (AM) efforts in the MRG. The Long-Term Plan complements the S&AM Plan, which defines the Collaborative Program's role and associated processes in providing science-based recommendations for management of the MRG. Together, the S&AM Plan (Collaborative Program 2020) and this Long-Term Plan provide the framework for implementing the science and AM process.

1.1 Overview of the Middle Rio Grande Endangered Species Collaborative Program

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) is a partnership of federal, state, and local governmental entities, Indian Tribes and Pueblos, and non-governmental organizations aiming to protect and recover federally listed species in the riparian corridor of the Middle Rio Grande (MRG), while preserving the area's existing and future water uses in compliance with applicable state, federal, and tribal laws, rules, and regulations. The Collaborative Program currently aids in the recovery of five species listed under the Endangered Species Act of 1973 (ESA): the endangered Rio Grande silvery minnow (*Hybognathus amarus*; RGSM), the endangered southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL), the endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; NMMJM), the threatened yellow-billed cuckoo (*Coccyzus americanus*; YBCU), and the threatened Pecos sunflower (*Helianthus paradoxus*; PESU).

The Collaborative Program was formally established in 2003 with the signing of a Memorandum of Understanding. Seventeen signatories support the Collaborative Program's mission by performing scientific, technical, and administrative activities. The signatories fund and staff scientific studies, population management efforts, water operations, and habitat restoration to the benefit of the MRG's listed species, while also participating in Collaborative Program planning, administration, and technical support.

1.2 Long-Term Plan Purpose

The Long-Term Plan is an evolving communication and planning tool that serves to orient the Collaborative Program's long-term scientific efforts under the S&AM Plan. It is structured to present the Collaborative Program's focus and priorities within a given period (i.e., annual, five-year, 10-year) and provide an administrative timeline for operations under the S&AM Plan. None of the signatories are obligated to implement the activities detailed out in the Long-Term Plan, but signatories may use the document to aid their administrative out-year planning efforts, and give coverage for their authorities under which they participate in the Collaborative Program. This Long-Term Plan lists tasks associated with the implementation of the new framework as an S&AM-based program.

1.3 Development and Structure

Development of the Long-Term Plan is directed by the Collaborative Program's guiding principles (i.e., mission, goals, and objectives). This Long-Term Plan houses the Collaborative Program's priority objectives

for a given time period and provides a related listing of recommended scientific activities systematically prioritized by the Collaborative Program. The recommended activities list (Section 7) is presented as a potential activities to address the planning objectives in the MRG. The list is informed by the Project Bank contained within the AM Database described in Section 4, and is intended to help resource managers in their planning efforts by providing Collaborative Program-recommended short- and long-term priorities. Additionally, the Long-Term Plan hosts an administrative timeline that facilitates tracking, coordination and timely completion of Collaborative Program efforts.

1.4 Updates

The EC annually (or more frequently at their discretion) evaluates Collaborative Program activities and committees/groups using guiding principles in order to update priorities in the Long-Term Plan. Additionally, as the results of scientific activities are analyzed and new information accumulates, the SAMC will make recommendations to the EC for updates to the Long-Term Plan. The EC can decide to form an Administrative Ad Hoc (AAH) Group to complete necessary updates and ensure the Collaborative Program's efforts remain aligned with changing conditions.

Although annual updates to the Long-Term Plan will occur routinely, every five years the Collaborative Program will evaluate the need to adjust its guiding principles. This five-year evaluation includes using the science and AM support tools (S&AM Plan; Section 4) to complete a broad-scale review of any changes in the MRG system, conceptual ecological models and associated uncertainties, and Collaborative Program goals in light of objectives addressed, placing these in context of what has been learned over time. This effort may result in the re-prioritization of objectives and scientific activities listed in the Long-Term Plan. Subsequent updates will be made with EC approval and all changes will be documented along with justifications for future reference.

In early 2021, the Collaborative Program will continue to identify scientific uncertainties; develop objectives and associated strategies; and build support tools, including the AM Database (Section 4). Using the AM Database, linkages will be defined among uncertainties, objectives, hypotheses, proposed activities, and management needs. Those linkages will inform a revision of the Long-Term Plan, which will likely occur between summer and fall of 2021. The updates will include agreed upon priority objectives and strategies, and scientific activities aimed at meeting the objectives under specified hydrologic conditions. The revision will help reframe the Collaborative Program's set of proposed and ongoing activities under the structure of the new S&AM Plan.

2 GUIDING PRINCIPLES

The Collaborative Program's mission, goals, and objectives serve to guide the direction of its science and AM efforts. The Long-Term Plan describes their purpose and outlines the administrative process to update these guiding principles.

2.1 Mission

In 2019, the Collaborative Program adopted the following mission statement:

Box 1. Collaborative Program Mission Statement

> *The Middle Rio Grande Endangered Species Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management to the benefit and recovery of the listed species pursuant to the Endangered Species Act (1973) within the Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules, and regulations.*

2.2 Goals

The Collaborative Program's long-term species-specific goals (Box 2) are linked to the species recovery plans. They are meant to be aspirational and complementary to existing and future efforts in the MRG. The Collaborative Program assists its signatories and partners in pursuit of these goals by providing scientifically defensible recommendations for management actions benefitting the listed species. When the Collaborative Program-related initiatives are kept in line with its guiding principles, they pave the way for a collaborative approach toward future management of the MRG and its listed species.

The EC evaluates progress towards goals annually in conjunction with the review of the Collaborative Program's annual work plans. The goals can only be modified through amendment as approved by the EC, and not as part of updates to the Long-Term Plan or the S&AM Plan.

Box 2. Collaborative Program Goals

- Establish and maintain a self-sustaining population of endangered RGSM distributed throughout the MRG.
- Maintain and protect the MRG recovery unit goals for endangered SWFL.
- Maintain and protect suitable threatened YBCU habitat in the MRG.
- Establish and maintain a self-sustaining endangered NMMJM population in the MRG.
- Maintain and protect the threatened PESU in the MRG.
- Avoid the future listing or up-listing of species in the Collaborative Program area.
- Manage available water to meet the needs of endangered species and their habitats.

2.3 Objectives

The Collaborative Program's objectives (Appendix A) guide the focus of the S&AM initiatives. The objectives derive from the goals and align the Collaborative Program's efforts with aspects of the recovery criteria within the species recovery plans for RGSM, SWFL, and PESU; the recovery outline for NMMJM; and the conservation strategy for YBCU. The strategies associated with each objective present the Collaborative Program's approach to measuring progress toward achieving the objectives.

The Collaborative Program uses the species recovery plans, published literature, and input from scientific and technical experts to develop objectives and associated strategies. Objectives will be refined in a workshop in February 2021, with subsequent review by the SAMC, recommendations with justification to the EC, and final review and approval by the EC. On an annual basis thereafter, the SAMC will evaluate the objectives and strategies and make recommendations with justification for any changes to the EC for

review and approval. Any objective or strategy that is not approved as a current Collaborative Program focus will be tabled and reevaluated in following years.

The Collaborative Program's recommended scientific activities and future direction, as outlined in this Long-Term Plan, are adaptive and determined by the prioritized objectives. As such, changes to the objectives and strategies will trigger updates to the Long-Term Plan.

3 SUPPORTING ADAPTIVE MANAGEMENT IN THE MIDDLE RIO GRANDE

Over the past decade, the Collaborative Program's EC has reaffirmed its commitments to use S&AM as the central tenets for its operations and decision-making processes, and to support a broader vision for the MRG. In response, the 2020 S&AM Plan provides a comprehensive response to that commitment. In summary, the S&AM Plan restructures the Collaborative Program's organization and operations around an S&AM-based platform with mechanisms for tracking progress, improving communication, and adjusting for new information. Where the S&AM Plan defines the Collaborative Program's scientific process and protocols to support communication and transparency, this Long-Term Plan lists tasks associated with the implementation of the new framework as an S&AM-based program (Section 6).

Additionally, the Long-Term Plan describes activities that support the S&AM Plan by addressing critical scientific uncertainties, integrating new information and forecasts, and implementing AM strategies as described in Section 7. In 2009, the U.S. Geological Survey (USGS)'s *Climate Change and Water Resources Management: A Federal Perspective* lists out four elements of a collaborative process and sound science strategy (Table 1). These foundational elements are incorporated throughout the Collaborative Program's S&AM Plan and processes, and are instrumental in ensuring the plan's value and utility to individual signatories and to AM in the MRG.

Table 1. The Elements of a Collaborative Process and Sound Science Strategy.

Element	Definition
Consolidate the Needs of the Natural Resource Management Community	Identify the common needs of the federal and non-federal natural resource management community for information and tools required to support adaptation as climate changes
Inform the Scientific Community	Guide and foster federal and non-federal research and technology investments toward meeting these "user-defined" needs
Teamwork and Participation	Generate collaborative efforts across the natural resource management and scientific communities to develop, test, and apply new methods, tools, and capabilities
Flexible and Inclusive	Issue periodic updates as new information and additional perspectives are obtained

The Collaborative Program embraces these elements in the implementation of the S&AM process. Common needs across the natural resource management community of the MRG are assessed through regular engagement with the SAMC. The SAMC will take into account the needs and challenges of each signatory organization, and will translate scientific evidence into management-relevant recommendations designed to meet the Collaborative Program's objectives (Appendix A). In addition, annual evaluation of

the objectives will ensure activities are aligned to address management needs and changing hydrologic conditions, while reducing critical scientific uncertainties. Impartial prioritization of research efforts is based on level of scientific impact, timeliness, and relevance to management needs. This prioritization, along with coordination and incorporation of new information, is achieved primarily through systematic use and maintenance of the AM Database.

Updates to the AM Database and associated justifications are documented to create a record of decisions able to be referenced as needed for carrying out AM actions. With a shared understanding of past decisions and the motivations behind them, scientists and managers are able to build forward-thinking and proactive contingencies into their decision-making processes. For future scenarios, the Long-Term Plan lays out a path along which the Collaborative Program can inform AM while considering the wider uncertainty of climate conditions.

3.1 Incorporating Future Planning into the Long-Term Plan

The U. S. Army Corps of Engineers (USACE) and U. S. Bureau of Reclamation (Reclamation) built upon the USGS foundational elements (2009) with a 2011 planning guide, *Addressing Climate Change in Long-Term Water Resources Planning and Management*, that details eight technical steps to categorize ways of incorporating climate trends and forecasts into longer-term natural resource planning. These are:

1. *Summarize Relevant Literature*
2. *Obtain Climate Change Information*
3. *Make Decisions* about *How to Use the Climate Change Information*
4. *Assess Natural Systems Response*
5. *Assess Socioeconomic and Institutional Response*
6. *Assess System Risks and Evaluate Alternatives*
7. *Assess and Characterize Uncertainties*
8. *Communicating Results and Uncertainties to Decision*-Makers

These same steps can be used to help the Collaborative Program incorporate other information besides climate change into future planning. By incorporating forecasting, modeling, and condition-dependent planning, as described in the S&AM Plan, the Collaborative Program can proactively strategize for future conditions and prioritize relevant planning activities.

For complex scientific uncertainties with extensive supporting literature, an internal review process exists for the development of executive summaries. These documents help to identify the various competing hypotheses and relevant evidence, as well as providing managers with a concise description of the issue. Regarding climate change data and natural systems response, the SAMC invites technical experts to share insights and help devise methods to incorporate data and model outputs into the AM tools for the MRG.

Similarly, socioeconomic factors, risk, and uncertainty are assessed at multiple levels of the planning process by engaging regularly with experts and stakeholders. To ensure that Collaborative Program activities are most relevant to management, the individual signatories will work with the SAMC to identify

the questions and priority scientific uncertainties needing to be addressed for each signatory's own planning efforts. As appropriate, these can be incorporated into the scientific priorities for the Collaborative Program in updates to the Long-Term Plan.

Strategies for dealing with uncertainty and allowing it to inform the decision-making process will be prioritized during the first year of the S&AM Plan implementation. Furthermore, improving communication at all levels within the Collaborative Program (i.e., among scientists, between scientists and managers, between the Collaborative Program and external efforts) is the motivating force behind the new S&AM Plan and gave rise to many of the changes to the Collaborative Program's structure and operations.

4 ADAPTIVE MANAGEMENT DATABASE

The AM Database is currently under construction and will be instrumental in updating the Long-Term Plan in 2021 and beyond. It stores a variety of scientific and administrative information to provide up-to-date reporting of Collaborative Program and affiliated activities. The purpose of the database is to store, track, and disseminate accurate and current information related to scientific uncertainties, studies, monitoring, and strategies to inform AM. The database facilitates the identification of priority research needs to support informed decision making.

The Collaborative Program and its signatories have a large quantity of information regarding scientific studies, monitoring data, habitat restoration (HR), management actions, independent review panels, and modeling efforts. Without a clearinghouse for this institutional knowledge, scientists and managers can overlook valuable context, duplicate past efforts, miss out on potential learning, and not realize important interrelationships. Additionally, AM requires that new information be incorporated into this knowledge base and that the accumulation of new knowledge (i.e., learning) compels the adjustment of management actions. In order to effectively inform and support AM, the Collaborative Program first needs a tool to track its learning. The AM Database is that tool.

4.1 The Project Bank

The cornerstone of the AM Database is the Project Bank: a list of past, current, and proposed activities in the MRG. This continuously updated list of projects contains the technical, logistical, and administrative details needed to categorize and sort projects to create customized reports for managers. These details also allow for generations of metadata and linkages to other aspects of the AM Database useful for prioritizing and tracking activities.

The Project Bank, through the development of these linkages, facilitates the Collaborative Program's ability to generate a list of activities based on agreed-upon priority objectives.

4.2 Process Pathways in the Adaptive Management Database

Process pathways represent relationships among the different types of information housed within the AM Database. These relationships can also be characterized as processes delineating potential workflow steps to reduce a specific critical uncertainty. For example:

1. A critical uncertainty is identified through the evaluation of the conceptual ecological model for a species.
2. This gap in knowledge is characterized by life stage, ecological factors and biotic response, as well as degree and influence of uncertainty.
3. A research hypothesis is formulated.
4. A study is devised to test the hypothesis, which may relate to one or more Collaborative Program objectives.
5. The proposed study, with its set of direct and indirect linkages, becomes a line item in the project bank.

4.3 Using the Adaptive Management Database

Figure 1 below depicts an example set of relationships between the Project Bank and other AM building blocks, such as critical uncertainties, conceptual ecological models, and management alternatives. These relationships will enable filtering and export (i.e., query) of project subsets with characteristics (i.e., fields) selected from the tables. Example queries can potentially include:

- List of ongoing projects that address critical uncertainties about a species of interest;
- List of completed projects funded by a particular agency within a specified time frame; or
- List of all Collaborative Program objectives and recovery criteria addressed by a specified project.

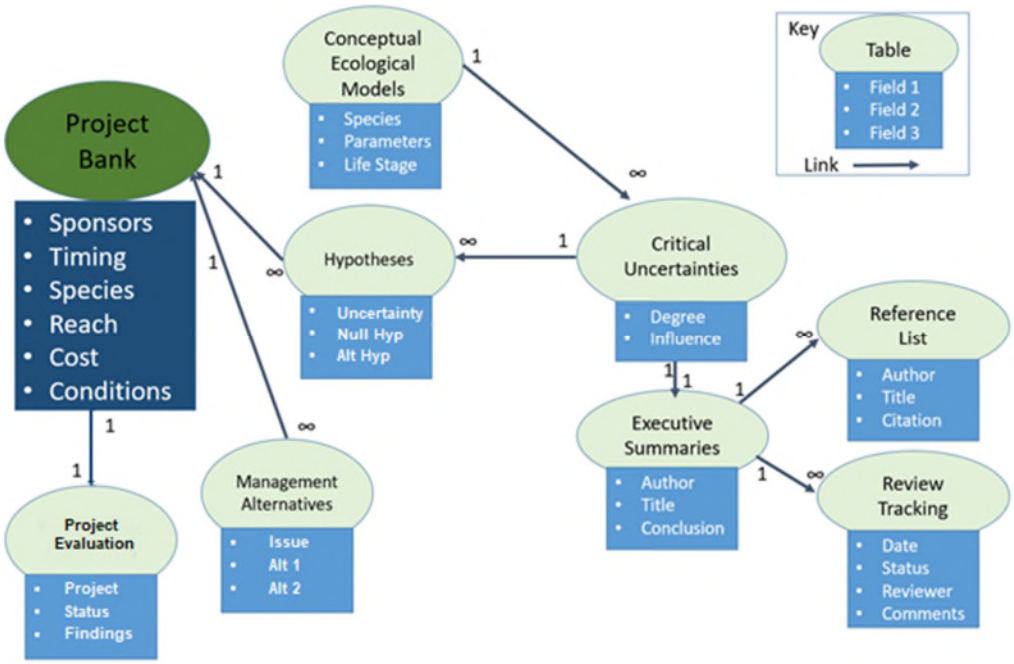


Figure 1. Example Relationships in the Adaptive Management Database

In addition to queries and on-demand reporting, the AM Database provides a platform for impartial prioritization of research efforts. By comparing the number and relative importance of connections to each project, for example, a user might rank a set of projects based on selected criteria. This prioritization process can also be applied broadly to organize projects and other activities along a timeline for long-term planning purposes. Sorting studies by species, river reach, year, or type of activity facilitates collaboration among researchers and promotes leveraging of resources, such as data and personnel. Summarizing the estimated costs and feasibility of a set of projects, as well as their collective value to a recovery plan or biological opinion, could help to expedite the procurement of research funds. On a larger scale, summary statistics could be generated to examine the allocation of resources across the different listed species or across the geographic reaches for different fiscal years. These types of comparisons help the Collaborative Program track its progress and realign supported activities to its goals over time.

5 ADMINISTRATIVE SCHEDULE

Integrating an administrative schedule into the Collaborative Program's science and AM framework is a critical component of providing timely recommendations for priority scientific activities to signatories and others working in the MRG. This section provides details for tasks that should occur every year, but is not an exhaustive list. Additional tasks that are not mentioned may include external funding deadlines related to grants, Collaborative Program efforts related to specific requests or recommendations, or other activities that are not bounded by an annual schedule.

5.1 Committee Tasks and Coordination

Table 2 lists the annual responsibilities of each Collaborative Program committee and the timeframe in which tasks must be completed. Highlighted time periods refer to the development of specific work products, while an "x" indicates a deadline or a review and approval point. While the EC's listed tasks are their responsibility, the EC may direct an AAH Group or the Program Support Team (PST) to complete the administrative tasks for EC approval.

Executive Committee Tasks and Coordination

The EC annually evaluates Collaborative Program activities and committees/groups (*Table 2, Task A*) using the Collaborative Program's guiding principles (i.e., mission and goals). By performing regular Collaborative Program-wide reviews of activities, the decision-makers (including EC members, Congressional and State representatives, and others) can be assured that Collaborative Program actions are accomplishing the Collaborative Program's mission and benefitting the listed species. Additionally, this effort provides evidence that federal and non-federal expenditures and efforts are producing tangible benefits for the listed species and their habitats.

Several potential outcomes of the annual evaluation are listed in the S&AM Plan (Section 3.2.2.C), and may include updates to the Long-Term Plan (*Table 2, Task H*). The resulting work product, completed by an AAH Group or the PST as directed by the EC, is the Collaborative Program's Annual Report, which is

approved by the EC each March (*Table 2, Task B*). At the EC's direction, the Fiscal Planning Committee (FPC) will submit the Annual Report to Congressional and State representatives, Collaborative Program signatories, and other interested parties in an effort to maintain and garner further support for Collaborative Program activities (*Table 2, Task V*).

Each year, the EC will direct an AAH Group or the PST to draft the Collaborative Program's Annual Work Plan, which the EC will approve in December of that year (*Table 2, Task C*). Drafting the Work Plan includes working with each committee to include their administrative tasks, deadlines, and reporting periods, as well as the tasks of the EC. While the Collaborative Program's and the FPC's Annual Work Plans (*Table 2, Task M*) are administrative, the SAMC's Annual Work Plan focuses on the scientific activities undertaken by the Collaborative Program under their charge (*Table 2, Task I*). In addition to drafting an Annual Work Plan for EC review and approval (*Table 2, Tasks D and E*), the SAMC and the FPC will draft and submit an Annual Summary Report (*Table 2, Tasks J and N*) to the EC.

Science and Adaptive Management Committee Tasks and Coordination

The SAMC appointments include up to eight positions that hold two-year staggered terms. Each year, the Collaborative Program's Science Coordinator works with the EC to nominate applicants, accept and review applications, and approve appointments for empty positions (*Table 2, Tasks F and G*). Annually, the SAMC will review the Collaborative Program's objectives, and recommend which ones should move forward as the next year's priority objectives (*Table 2, Task K*). The recommended priority objectives will be submitted in the SAMC's Annual Work Plan to the EC for review and approval (*Table 2, Task D*). Every other year, the SAMC will host the Collaborative Program's Science Symposium (*Table 2, Task L*). The SAMC will work with the EC and the PST to complete planning tasks, including soliciting and approving abstracts, and determining the Science Symposium focus.

Fiscal Planning Committee Tasks and Coordination

Each year, the FPC, with help from the PST, is tasked with gathering Reclamation's and the non-federal signatory's cost share reports (*Table 2, Task O*). The PST submits individual non-federal cost share reports to Reclamation. The PST then submits the combined report of Reclamation's contribution, and the total combined non-federal signatory's contributions are reported to the EC (*Table 2, Task O*).

On a quarterly basis, the FPC, with assistance from the PST, is tasked with coordinating the individual signatory's activities reviews, contract status, deadlines, financial information, and other pertinent information to update the AM Database (*Table 2, Task P*). This effort helps to ensure that the AM Database remains updated and useful. The FPC also works to coordinate signatory interests, authorities, contracting, and funding capabilities to complete Collaborative Program-recommended scientific activities in the Long-Term Plan (*Table 2, Task Q*). *Task Q* includes submitting annual requests to signatories during their input periods to communicate Collaborative Program priority activities (*Table 2, Tasks R and S*). The highlighted periods for each signatory includes their input period for consideration of the Collaborative Program-priority activities that relate to funding and contracting deadlines, and other board, commission, and legislative outreach and support schedules.

In addition to coordinating signatory assistance to report cost share, updating the AM Database, and developing recommendations to implementing Collaborative Program activities, the FPC works to garner additional, and maintain current monetary and administrative support for the Collaborative Program. Each year, in addition to distributing the Annual Report (*Tasks B and V*), letters of support are drafted and sent to federal and state representatives and appropriate signatory partners (*Tasks T and U*).

The schedule in Table 2 ensures the timely completion of annual administrative Collaborative Program activities supporting operations benefitting the listed species in the MRG.

Table 2. Collaborative Program's Annual Administrative Tasks

COMMITTEE TASKS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Executive Committee			**X**							**X**		**X**
A. Collaborative Program Evaluation			X									
B. Develop and Approve Annual Report			X									
C. Develop and Approve Annual Work Plan												X
D. Review & Approve SAMC Work Plan and Summary												X
E. Review & Approve FPC Work Plan and Summary												X
F. SAMC Membership Applications Due									X			
G. Review and Approve SAMC Membership										X		
H. Update Long-Term Plan			X							X		X
Science & Adaptive Management Committee	**X**	**X**		**X**	**X**				**X**	**X**	**X**	
I. Develop Annual Work Plan												X
J. Develop Summary Report												X
K. Evaluate Objectives and Assign Annual Priority												X
L. Hold Science Symposium (Biennial)												X
Fiscal Planning Committee	**X**			**X**			**X**			**X**		
M. Develop Annual Work Plan												X
N. Develop Annual Summary Report												X
O. Gather and Report Cost Share Contributions												X
P. Update AM Database w/Signatory Activities	X			X			X			X		
Q. Coordinate Signatory Activity Interest/Capacity	X						X					
R. Submit Priority Activity Placeholders to USBR				X								
S. Submit Priority Activity Recommendations:												
Albuquerque-Bernalillo County Water Utility								X				
City of Albuquerque								X				
Middle Rio Grande Conservancy District								X				
N.M. Department of Game and Fish		X										
N.M. Interstate Stream Commission		X										
U.S. Army Corps of Engineers										X		
T. Submit Legislative Support Letters to signatory partners											X	
U. Submit Support Letters to Legislative Parties		X						X				

Table 2. Collaborative Program's Annual Administrative Tasks

COMMITTEE TASKS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
V. Submit Annual Report to Legislative Parties		X										

6 IMPLEMENTATION TASK LIST[1]

Included in this Long-Term Plan are the specific administrative tasks necessary to implement the S&AM Plan, move the Long-Term Plan forward, and develop the associated tools to support the Collaborative Program's efforts. These tasks, along with the responsible Collaborative Program group, are detailed below in Table 3. This is Implementation Task List makes up the Collaborative Program's work plan for Fiscal Year 2021.

Table 3. Implementation Task List

Tasks	Responsible Group(s)[2] EC	SAMC	AAH	FPC	S&T	SIG
1. FINALIZE AND IMPLEMENT THE SCIENCE AND ADAPTIVE MANAGEMENT PLAN, THE LONG-TERM PLAN, AND ASSOCIATED TOOLS						
1.1 Support data collection efforts						
1.1a Provide statistical reviews of sampling designs		X			X	
1.1b House collected datasets on the Program Portal as appropriate		X				
1.2 Continue developing and refining conceptual ecological models (CEMs)						
1.2a Develop and refine the NMMJM and PESU CEMs					X	X
1.2b Continuous refinement of the RGSM, YBCU, and SWFL CEMs, as appropriate					X	
1.2c Training to use the CEMs for each species		X			X	
1.2d Link CEMs to management alternatives and objectives		X				
1.3 Populate the AM Database with the following:						
A. Objectives						
1.3a Assess the objectives identified during previous efforts		X				
1.3b Convene workshop to: • Solicit signatory values to inform development of the objectives • Assess and refine preliminary objectives • Identify additional objectives as needed • Develop strategies for each objective • Determine and define any metrics		X				X

[1] This Implementation Task List is also included in the 2020 S&AM Plan, Appendix A.
[2] S&T: Science and Technology; SIG: Signatories

Table 3. Implementation Task List

Tasks	Responsible Group(s)[2]					
	EC	SAMC	AAH	FPC	S&T	SIG
1.3c Review and adopt the objectives	X					
B. Management Alternatives						
1.3d Compile and categorize management alternatives		X			X	
1.3e Identify additional management alternatives		X			X	
1.3f Link management alternatives and Collaborative Program objectives		X				
C. Scientific Uncertainties and Hypotheses						
1.3g Review and update compiled list of scientific uncertainties		X			X	
1.3h Determine which scientific uncertainties are reducible		X			X	
1.3i Determine which reducible scientific uncertainties can be addressed using existing data		X			X	
1.3j Define alternative hypotheses for reducible uncertainties		X			X	
1.3k Develop Executive Summaries for uncertainties for which there is non-consensus about hypotheses • Summarize the available literature • Note areas of agreement • Provide alternative hypotheses • Identify knowledge gaps					X	
1.3l Link hypotheses to Collaborative Program objectives, management alternatives, and recovery goals		X				
1.3m Identify limiting factors for addressing a hypothesis, for example: • Preliminary studies • Specific river conditions necessary • Documented presence of species • Technology/equipment needs • Financial resources • Regulatory or political constraints		X		X		
D. Scientific Activities						
1.3n Compile existing scientific activities (e.g., project ideas list, annual reports), assign a status, and link to hypotheses (i.e., Project Bank)					X	
1.3o Develop new scopes of work to address the alternate hypotheses and knowledge gaps for inclusion into the Project Bank					X	
1.4 Operationalize the AM Database						
1.4a Training on the use of the AM Database		X		X	X	X
1.5 Develop an administrative schedule, for example:						
• Signatory funding deadlines				X		X
• Administrative deadlines						

Table 3. Implementation Task List

Tasks	Responsible Group(s)[2]					
	EC	SAMC	AAH	FPC	S&T	SIG
• Recovery plan five-year reviews						
1.6 Populate the Long-Term Plan Using the AM Database and the Project Bank						
1.6a Use the AM Database to rank scientific activities based on relevance to management alternatives, Collaborative Program objectives, and feasibility		X				
1.6b Deliberate on the SAMC's scientific activity suggestions to incorporate into the Long-Term Plan for recommendations to implementing organizations	X					
1.6c Review the Long-Term Plan and incorporate recommendations into individual signatory out-planning						
1.7 Reevaluate Collaborative Program objectives and tools in light of scientific findings						
1.7a Synthesize analyses and conclusions into evidence-based recommendations for management alternatives		X				
1.7b Review the Long-Term Plan and incorporate recommendations into individual signatory out-planning						X
1.7c Update tools with new scientific findings as necessary					X	
1.8 Provide regular progress reports to the EC						
1.8a Quarterly progress reports		X				
1.8b Annual S&AM report		X				
2. DEVELOP AND AGREE ON PROCESSES TO SUPPORT THE IMPLEMENTATION OF THE SCIENCE & AM PLAN AND THE LONG-TERM PLAN						
2.1 Revise the scope of work process to incorporate the Science & AM Plan elements		X				
2.2 Refine the peer review process, including both internal reviews and external reviews			X			
2.3 Refine the topical Executive Summary process		X				
2.4 Develop a process for supporting signatory resources and efforts (i.e., lobbying, funding, letters of support)			X			
3. IMPLEMENT THE NEW ORGANIZATIONAL STRUCTURE						
3.1 Clarify signatory expectations under the Collaborative Program's science and AM process, for example: • Annual report • Cost share	X					X
3.2 Sunset all existing work groups and incorporate any ongoing work into the charges and charters of new committees and groups under the new structure	X					

Table 3. Implementation Task List

Tasks	Responsible Group(s)[2]					
	EC	SAMC	AAH	FPC	S&T	SIG
3.3 Identify the tasks to be completed as relates to the science and AM process, and draft S&T Ad Hoc Group charges to complete the tasks		X				
3.4 S&T Ad Hoc Group(s) convene to complete charge(s)					X	
3.5 Update the By-laws to reflect the new organizational structure and governance	X		X			
3.6 Draft and adopt a new Memorandum of Agreement	X		X			
4. COMMUNICATION						
4.1 Science						
4.1a Hold brown bags seminars						X
4.1b Host Science Symposium		X				
4.1c Topical Executive Summaries					X	
4.1d Peer-reviewed publications						X
4.2 Recommendations to resource managers						
4.2a Deliberate on SAMC findings and make final evidence-based recommendations on best management practices	X					
4.2b Make recommendations on scientific activities for implementation	X	X				
4.3 Collaborative Program Communication						
4.3a Update and maintain the Program Portal	Program Support Team in coordination with the Collaborative Program					
4.3b Distribute bi-monthly Collaborative Program newsletter						
4.3c Participate in community outreach						

7 COLLABORATIVE PROGRAM RECOMMENDED ACTIVITIES

In addition to the administrative tasks listed in Section 6, the recommended activities for this Long-Term Plan are also listed below (Table 4). These activities fall into the following categories:

- Baseline studies and assessment
- Technical studies
- Monitoring
- Management
- Public outreach
- Collaborative Program management and administration

The recommended activities are grouped by the elements found in Table 1 to illustrate how the Collaborative Program can holistically support a collaborative scientific strategy.

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Long-Term Plan Element: *Consolidate Natural Resource Management Needs*					
Baseline Studies and Assessments	Watershed Surveys and Assessments	RiverEyes data compilation	Update the RiverEyes data for archiving on the Program Portal.	Ongoing annually	USACE
Baseline Studies and Assessments	Watershed Surveys and Assessments	Program-wide system monitoring and trend analysis for AM	Implement a systems monitoring plan in order to document changes to the river system so as to provide context for Program activities as part of AM.		
Management	HR	Design and environmental compliance support for HR Projects	Provide professional services for work associated with HR Project design, engineering, and environmental compliance	Draft Scope Work (SOW) delivered to Reclamation 12-21-09	
Management	HR	HR planning and design	A HR/maintenance plan will be developed that loosely outlines a conceptual river system that provides for flood control, water delivery and ecosystem function to benefit the listed species within the current and/or foreseeable conditions.		
Management	HR	HR implementation	HR within the Program area will be phased and implemented following prioritization schedules		
Management	Avian	Conservation and Management Plan of SWFL Breeding Territory			
Management	Avian	SWFL Management Plan	Investigate where more SWFL habitat is needed.		

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Monitoring	Other	Develop and implement Program-wide system monitoring and trend analysis for AM	Strategically and efficiently implement a systems monitoring plan in order to document changes to the river system (hydrology, geomorphology, ecology, management) so as to provide context for Program activities as part of AM.		
Monitoring	Other	USGS MRG river gage operations and maintenance			USACE
Monitoring	RGSM	Fish Monitoring Plan	Based on evaluation of the Fish Monitoring Program, consolidate and refine to provide recommendations on revisions to fish monitoring activities in the MRG.		
Program Management and Administration	Program Portal	Relational Program Portal	Establish a relational Program Portal that is web-accessible, multi-disciplinary, and spatially referenced to consolidate, organize, document, store, analyze, and distribute both scientific and administrative information related to the Program.	Contracted; Ongoing	USACE
Program Management and Administration	Science Program	Collaborative Program planning objectives workshop	Hold an annual workshop to realign Collaborative Program planning objectives with critical scientific uncertainties, management needs, signatory values and system forecasts.	In Planning	

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Program Management and Administration	Program Portal	Ongoing Program Portal administration	Transfer data and documents from the old Portal to the new Portal developed by USGS under contract with USACE. Populate this Portal with all current data and documents.	Included in the PASS Contract	USBR
Program Management and Administration	Geographic Information system (GIS) Map	Update GIS Map – HR projects compilation	Update the compiled historic HR projects and their associated reports and data geospatial map housed on the Program Portal. All Collaborative Program signatories and users of the Portal are responsible with supplying data on an ongoing basis.		
Program Management and Administration	Program Portal	Ongoing maintenance of database; uploading data to the database	As part of upkeep to the Program Portal, new data should be uploaded to the database as soon as practical after the data has been examined for quality assurance/quality control and finalized. All Program signatories and users of the Portal are responsible with supplying data on an ongoing basis.	Ongoing; partially included in the PASS contract	USBR/USACE

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Program Management and Administration	Program Portal	Additional DBSM enhancements annually, as needed	The Program Portal is intended to be accessible, multi-disciplinary, spatially referenced, relational database management system to consolidate, organize, document, store, analyze, and distribute both scientific and program management information related to the Collaborative Program in a cost efficient, effective and transparent manner.		USACE
Program Management and Administration	Program Portal	Recurring hardware and software updates as required	Provide hardware and software updates as necessary for the Collaborative Program Portal to maintain function and capabilities. Updates would be determined on an annual basis and subject to variability from year to year.		USACE
Technical Studies	RGSM	Develop and utilize a decision tool to test the feasibility of re-establishing RGSM populations at potential reintroduction locations	Develop a criteria-based decision tool using ranked values assigned to key parameters to help with analyzing RGSM habitat reintroduction potential for all historic occupied reaches.		
Technical Studies	RGSM	Identify and Assess Habitat Needs, Management Activities, and Any Major Hurdles to RGSM Reintroduction into Upper and Lower Rio Grande and Pecos River Reaches	To aid in reintroduction planning, identify data gaps for particular river reaches that need to be resolved before further reintroduction efforts.		

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Long-Term Plan Element: *Inform Scientific Community*					
Baseline Studies and Assessments	Terrestrial Mapping	Hink and Ohmart (H&O) vegetation mapping	Use the H&O method of vegetation mapping to extend the geographic coverage of the existing map to include more or all of the Program area, and create a GIS compatible map of the mapped areas.	SOW developed/ approved	USBR
Baseline Studies and Assessments	Watershed Surveys and Assessments	Presence/absence surveys and habitat assessment studies for listed species in un-altered Collaborative Program areas	Conduct surveys to determine the presence or absence of listed species within areas of the MRG that have not been altered/recently altered, and if found, determine various population parameters.		
Baseline Studies and Assessments	Hydrologic and Hydraulic	Ground water–surface water interactions in the riparian zone	Define the ground water–surface water interactions along a selected stretch of the Rio Grande in order to establish baseline quality of surface and ground water.		USACE
Baseline Studies and Assessments	Hydrologic and Hydraulic	Data collection and two-dimensional (2D) modeling of high-flow channels	Collection of geomorphic and hydrodynamic data, focusing on high-flow channels, and modeling of specific Project features.		
Baseline Studies and Assessments	Terrestrial Mapping	HR Projects Assessment	Conduct a watershed-level assessment of completed restoration projects within the Program area.		

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Baseline Studies and Assessments	Watershed Surveys and Assessments	Short-interval assessment of whole-stream Rio Grande metabolism	Document fine-scale patterns in Rio Grande productivity, identify terrestrial-hydrological connectivity for energy supply within the river.		
Baseline Studies and Assessments	Watershed Surveys and Assessments	Watershed topography and geomorphology mapping	Develop a watershed map of the river and connected riparian area's topography and geomorphology using existing photography, mapping, and other resources.		
Baseline Studies and Assessments	Watershed Surveys and Assessments	Assessing temporal and spatial continuous water quality trends in the Isleta and San Acacia reaches of the MRG	Collect long-term and high-frequency measurements of water temperature, specific conductance, DO, pH, and turbidity at four locations within the Isleta and San Acacia reaches.		
Management	RGSM	Continue RGSM augmentation and monitoring	Reintroduce RGSM into a newly designated non-essential population (NEP) reach of the Rio Grande or Pecos River under Section 10(j) rule.	Contracted, Ongoing	USBR/ U.S. Fish and Wildlife Service (USFWS)
Management	RGSM	Optimize survivorship of RGSM during transportation and stocking for post-release retention at a reintroduction and augmentation site [Conduct necessary activities to support future 10(j) population reintroductions]	Investigate impacts of stressors to RSGM during transport and stocking efforts, and how to minimize them.	Some studies ongoing or completed	USFWS

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Management	HR	Monitor and Evaluate SWFL HR	Monitor developing SWFL habitat and maintain existing habitat, accommodating succession and evaluating the existing strategy, decision framework, and recommended timeframes.		
Management	HR	Implement the Strategy for Maintenance and Construction of SWFL Habitat	Implement the comprehensive SWFL management plan for maintenance of existing SWFLr habitat and construction of new habitat, beginning with high-priority projects.		
Monitoring	RGSM	Monitor RGSM Genetics	Monitor and assess wild and captive propagated RGSM genetics in order to provide critical information to minimize genetic risks of supplementation/ augmentation of RGSM from captive stocks.	Contracted, Ongoing	USBR
Monitoring	RGSM	RGSM Spawning Monitoring	Acquires spatial and temporal information on the reproductive output of RGSM in the MRG.	Contracted, Ongoing	USBR
Monitoring	RGSM	Continue RGSM Population Monitoring	Determine long-term and short-term trends in fish populations of the MRG using statistical approaches; evaluate the influence of discharge timing, magnitude, and duration on fish populations; examine spatial correlation of RGSM population dynamics over time.	Contracted, Ongoing	USBR

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Monitoring	Avian	SWFL and YBCU Surveying	Surveys conducted as per ESA	Contracted, Ongoing	USBR, MRGCD
Monitoring	Avian	SWFL and YBCU population monitoring and surveys	Implement the current surveying and monitoring protocols.	Contracted, Ongoing	USBR, MRGCD
Monitoring	RGSM	RGSM monitoring at 10(j) reintroduction sites to evaluate stocked populations	Continue monitoring efforts at reintroduction sites following reintroduction efforts.	Ongoing	
Monitoring	Other	Data collection and 2D-modeling of high-flow Channels			USACE?
Monitoring	RGSM	RGSM population estimation	Provide a statistically rigorous estimate of population size.		
Monitoring	RGSM	Monitoring PIT-tagged RGSM	Assist in determining distances and rates of dispersal for various life stages of RGSM.		
Program Management and Administration	Science Program	Forecasting and scenario planning	Incorporate system trends into scenario planning by employing the latest models, tools and methods.	In Planning	
Public Outreach	Activities	Develop the Fiscal Year 2020 Program Annual Report		Included in the PASS contract	USBR
Technical Studies	RGSM Genetics	Development of high-throughput markers for RGSM		Contracted, Ongoing	USBR

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Technical Studies	RGSM	Effects of temperature degree days and photoperiod on RGSM spawning	Determine the minimum threshold, optimal, and range of temperature degree days and photoperiod that will produce spawning (initiation, peak, and completion) of RGSM when subjected to an increase in flow or stage.	SOW developed	
Technical Studies	Avian Studies	YBCU genetics/genomics	Determine the geographic boundary between the eastern and western cuckoo populations using nationwide samples that have already been collected. Specifically, the contractor will focus on samples collected from the Pecos, Rio Grande, and along the Continental Divide where the current boundary between the two populations exists.	SOW developed	
Technical Studies	RGSM Genetics	Evaluation of paired spawning and communal spawning for RGSM	Initiate paired spawning pilot studies and compare to communal spawning methods.	SOW in development	
Technical Studies	RGSM Genetics	PIT-tagging and genetic characterization of broodstock	Characterize genotypes of identified RGSM individuals in the captive population using available markers and new markers as they become available.	SOW in development	
Technical Studies	Other	USGS groundwater/surface water interaction			
Technical Studies	RGSM	Design studies to quantify piscine predators and competitors	Develop a sampling program to document piscine predators for prey utilization study.		

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Technical Studies	RGSM	Ecotoxicity of RGSM	Evaluate the relationship between water quality conditions and RGSM occurrence and density.		
Technical Studies	RGSM	Increase understanding of RGSM life history and habitat needs through focused scientific studies	Determine which suites of habitats the RGSM will occupy in different life stages, if that habitat is available and the effects on long-term survival including relationship curves by life stages, and identify meso-habitat needs vs. reach-wide needs.		
Technical Studies	RGSM	RGSM spawning and recruitment study at the Los Lunas Silvery Minnow Refugium (LLSMR)	Determine aspects of RGSM spawning behavior and how variations in habitat use during spring runoff translate into age-0 recruitment for the species using a model system, the LLSMR.		NMISC
Technical Studies	RGSM	Evaluate water quality in the MRG in relation to the RGSM			
Technical Studies	RGSM	Determine the rate of development and hatching success under various environmental conditions for the RGSM	This Project would examine the relationship between RGSM age and/or size class and fecundity, as well as hatching success, under a variety of environmental conditions.		
Technical Studies	RGSM	Continue to support the development of Population Viability Analysis (PVA) models	Support the development of PVA models to assess extinction probabilities for existing and reintroduced populations.		

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Technical Studies	RGSM	RGSM ecological studies evaluating habitat use and recruitment	Investigate RGSM life history parameters related to spawning, egg drift and incubation, and recruitment of larval fish.		USACE
Technical Studies	RGSM Genetics	Genetic comparison of RGSM eggs/larvae collected on the floodplain to those collected in the main channel			
Technical Studies	RGSM Genetics	Comparison of environmental conditions Experienced by RGSM in hatchery facilities to those experienced in the MRG	Compare the genetics of RGSM eggs/larvae collected in the main channel of the river to RGSM eggs/larvae collected in on the floodplain.		
Technical Studies	RGSM Genetics	RGSM genetics over time in hatchery facilities	Follow each cohort of RGSM genetically as they arrive at the facility and over time.		
Technical Studies	Habitat Planning	Use modeling tools (e.g., FLO-2D and HEC-RAS) to estimate frequency and extent of overbank inundation and in-channel habitat in the MRG	Continue development and presentation of hydrologic models.		USACE?
Technical Studies	Avian Studies	Water requirements for SWFL and YBCU habitat and nesting	Better understand the effects of timing, distribution, and abundance of water on SWFL and YBCU reproduction.		
Long-Term Plan Element: *Teamwork & Participation*					
Management	RGSM	RGSM rescue/salvage		Contracted, Ongoing	USBR, USFWS

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Management	RGSM	RGSM egg collection		Contracted, Ongoing	USBR, ABCWUA
Program Management and Administration	Administration and Support	Program and science support (third-party management)	The objective of the Program and Science Support Services are to facilitate achievement of Program goals by providing program management services, science coordination services, and other support services.	Contracted	USBR
Program Management and Administration	Science Program	Improve Collaborative Program information exchange with external efforts	Develop linkages between Collaborative Program and external conservation and modeling efforts to utilize the most up-to-date information and methods.	In Planning	
Program Management and Administration	Administration and Support	Ongoing attendance and support of Program-related meetings and tasks	All Program signatories are expected to be active participants in the Program. This includes attending committee and work group meetings, completing assigned tasks and action items, reviewing documents and reports, and adhering to deadlines and timelines.	Ongoing	
Program Management and Administration	Science Program	AM Database	Build a relational database that links Collaborative Program planning objectives, management needs, critical scientific uncertainties, recovery criteria, etc., and tracks activities, recommendations and decisions in support of AM.	Ongoing	

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Program Management and Administration	Program Planning	Develop and refine the Program's SOW process	As part of moving to a triennial study plan, and to better coordinate with federal agencies' out-year planning, the Program will be developing a multi-year structured process to developing SOWs for approval by the EC. These SOWs would then be recommended to be funded and implemented.	Ongoing, part of PASS Contract	USBR
Program Management and Administration	GIS Map	Ongoing maintenance of the GIS map	Once the GIS map is completed, it will have to be continually updated and maintained. The hope is that the map will be housed on the Program Portal, to be a resource for the entire Program and beyond.		
Public Outreach	Activities	MRG Citizen Science, Bosque Education and Outreach	Bosque Ecosystem Monitoring Program (BEMP)	Ongoing	ABCWUA/UNM/USACE/USBR
Long-Term Plan Element: *Flexible and Inclusive*					
Management	RGSM	Support the annual update to revise Controlled Propagation and Augmentation Plans for the RGSM		Ongoing	USFWS?
Management	HR	Maximizing success for HR Projects by optimizing alternatives for active revegetation, supplemental watering, and other management activities	Analyze existing data and produce specific recommendations for appropriate site-specific considerations and techniques.		

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Management	HR	HR revegetation techniques	Compare HR techniques that establish native vegetation using active planting versus allowing for natural revegetation		
Management	Other	Decision tree hydrologic conditions	Develop a decision tree that considers anticipated hydrologic conditions in selecting Program research projects to be implemented for the coming year.		
Management	Other	Application of Rio Grande Riparian Groundwater Models to support the Endangered Species Collaborative Program and Water Operations Assessments			
Management	HR	Evaluate and apply modification to habitat management projects as necessary	Implement water management activities that provide improved habitats for RGSM throughout the life history and result in persistence of the species amongst reaches		
Management	Future Planning	Develop options to benefit the RGSM	Predict how different water management scenarios will affect river flows and reservoir storage to develop short-term and long-term predictions of the key drivers of RGSM population dynamics.		

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Management	Future Planning	Develop options to benefit SWFL and YBCU	Predict how different water management scenarios will affect river flows and reservoir storage to develop short-term and long-term predictions of the key drivers of SWFL and YBCU population dynamics.		
Monitoring	HR	Monitor HR projects for effectiveness	A streamlined approach for environmental compliance is desirable and beneficial for future Program HR projects to contain costs and save time on compliance processes.		
Program Management and Administration	Science Program	Develop and draft a Program Science Process		Complete - part of PASS Contract	USBR
Program Management and Administration	Science Program	Develop formal internal and external peer review procedures and process		Complete - part of PASS Contract	USBR

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Program Management and Administration	Science Program	Collaborative Program annual assessment and adjustment	Incorporate new information via the AM Database, as needed, and evaluate annually the Collaborative Program's mission, goals and objectives against the accumulated knowledge to determine whether modifications are justified.	In Planning	
Program Management and Administration	Program Planning	Develop and refine the Program's AM Plan and Program	The EC agreed to move forward with AM as the basis for the Collaborative Program. The PST has been working with signatories to develop an AM Plan that incorporates previous efforts, develops a timeline and transition plan for implementation, takes into account individual agency authorities, and provides a framework for collaborative science and decision-making.	Ongoing	USBR
Program Management and Administration	Science Program	Plan and convene an annual Science Forum	To support the AM process, the Program will convene a regular science forum to: (a) Share the results of studies related to the MRG since the last forum; (b) Provide a civil space for scientific discussion, debate, and inquiry; and (c) Inform the development of future studies and projects.	Ongoing	USBR

Table 4. List of Collaborative Program Recommended Activities

Category	*Sub-category*	*Title*	*Brief Description*	*Status*	*Sponsor*
Program Management and Administration	Science Program	Plan and convene Peer Review/Science Advisory panels – as required	One element of a good science program is regular and periodic peer review. The Program has convened previous peer review panels and participants have expressed a desire to do so in the future. When the EC members agree there is a need for a peer review or science advisory panel, a third-party (possibly the PST) will be contracted to hold the panel workshop.		
Public Outreach	Planning	Develop and implement the Program's external communication plan		Part of PASS Contract	USBR
Public Outreach	Activities	Develop Collaborative Program Education and Outreach Materials		Part of PASS Contract	USBR
Public Outreach	Planning	Program messaging and re-branding	Help the Program with developing external communication strategies to various audiences.	Part of PASS Contract	
Technical Studies	Other	Impacts of climate change on MRG water and species management	Evaluate future water management strategies in the context of projected climate change along the MRG.		
Technical Studies	Other	Using URGWOM to evaluate future water management strategies	Analyze water resources and ecosystem impacts resulting from potential changes in water management along the MRG.		

8 REFERENCES

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Appendix A. Middle Rio Grande Endangered Species Collaborative Program Objectives and Strategies

PRELIMINARY COLLABORATIVE PROGRAM OBJECTIVES

These preliminary objectives are the starting point for conversation at the objectives workshop described in Section 3.2, Task A. They are not final and will be revised prior to adoption by the Collaborative Program. The adopted objectives and strategies will help the Collaborative Program achieve its goals in addressing species needs. A revised Section 4.1 in the S&AM Plan incorporating the adopted objectives will supersede this Appendix A.

Rio Grande Silvery Minnow

Objective A-1: Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.

Reclamation sponsors a population monitoring program to sample a minimum of 20 sites per year to document the presence or absence of marked and unmarked RGSM. This supports 1-A-1, 1-A-2, 2-A-1, and 2-A-2 recovery goals and criteria from the 2010 USFWS Species Recovery Plan. This long-term monitoring effort provides indispensable data for evaluating the status of RGSM in the MRG.

> ***Strategy A-1a***: Continue to support this long-term monitoring effort, keeping it as a high-priority for the Collaborative Program. Explore additional applications of these data, if possible.
> ***Strategy A-1b***: Evaluate (temporarily) increasing the sample size and adding targeted sites to facilitate a statistically robust experimental design that addresses habitat use and informs HR efforts.

Objective A-2: Continue to support research into the life history of the RGSM to further inform management of the species.

Contributing to ongoing research of the life history of the species will help inform management decisions that benefit or reduce impacts to the species. The Collaborative Program has developed a CEM useful for deriving questions about the RGSM's life history. This supports recovery goals 1, 2, and 3.

> ***Strategy A-2a***: Generate research proposals to address previous panel recommendations (e.g., Noon et al. 2016, Fraser et al. 2013) and CEMs uncertainties to better understand the life history of the RGSM.
> ***Strategy A-2b***: Track life history research using the AM Database to generate more timely management and study recommendations.

Objective A-3: Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.

Base flows are important in maintaining wetted habitat, which represents the overall carrying capacity for the RGSM in any given area of the MRG. The following strategies support 2-B-1 and 3-B-1 recovery criteria from the 2010 USFWS Species Recovery Plan.

> ***Strategy A-3a***: Review current research publications and develop hypotheses to address habitat availability during base flow periods (outside of spring runoff).
> ***Strategy A-3b***: Support development of models, such as a PVA, to analyze habitat availability during base flow periods.
> ***Strategy A-3c***: Clearly define assumptions/uncertainties involving minimum base flow, sufficient habitat and survival rates.

Objective A-4: Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.

The timing, duration and magnitude of spring runoff are important to RGSM reproduction and have been demonstrated to have a significantly positive correlation with the October population density. The following strategies support recovery criteria 2-B-2, 2-B-3, 3-B-2, and 3-B-3 from the 2010 USFWS Species Recovery Plan.

> ***Strategy A-4a***: Review current research publications and develop hypotheses to address nursery habitat availability during spring runoff.
> ***Strategy A-4b***: Support development of models to analyze habitat availability during spring runoff.
> ***Strategy A-4c***: Clearly define assumptions/uncertainties involving flow characteristics, sufficient habitat, and recruitment rates.

Objective A-5: Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.

Habitat availability varies by reach and flow regime in the MRG and more research and modeling efforts are needed to help determine the best balance between water management and HR to support species recruitment and survival. The following strategies support recovery criteria 2-B-3, 2-B-4, 3-B-3, and 3-B-4 of the 2010 USFWS Species Recovery Plan.

> ***Strategy A-5a***: Perform modeling to determine the amount of habitat needed in each reach during 1) spring runoff, 2) summer low flow periods, and 3) fall and winter base flow periods needed to support a self-sustaining population.

Strategy A-5b: Identify uncertainties related to recruitment of RGSM and perform literature reviews to develop research hypotheses on this topic.
Strategy A-5c: Identify uncertainties related to survival of RGSM and perform literature reviews to develop research hypotheses on this topic.
Strategy A-5d: Review new and existing research to identify specific metrics to measure habitat quality in supports of recruitment and survival of RGSM for a self-sustaining population in each reach. Recommend a habitat monitoring protocol to provide empirical data.

Southwestern Willow Flycatcher

Objective B-1: Continue monitoring for SWFL in designated critical habitat areas to track territories in the MRG management unit of the Rio Grande recovery unit.

SWFL territories and nests have been consistently found in the MRG management unit and the number of territories have increased in the last ten years. Continued contributions to monitoring in the MRG will help track species recovery. The following strategies support all recovery criteria listed in the 2002 USFWS Species Recovery Plan.

Strategy B-1a: Ensure designated critical habitat areas in the MRG are monitored annually for SWFL territories to contribute to understanding species recovery.
Strategy B-1b: Analyze available monitoring data annually to ensure SWFL territories are not decreasing in the MRG management unit. If the number of territories are decreasing, review habitat areas where territories have decreased to make recommendations for improving habitat to increase SWFL territories.

Objective B-2: Continue monitoring critical SWFL habitat and contribute to research on the impacts from non-native and exotic species on SWFL recovery.

Habitat requirements for the SWFL have been well documented, but impacts from the management of the non-native and exotic tamarisk on SWFL recovery are poorly understood. The following strategy supports recovery criteria 2-B from the 2002 USFWS Species Recovery Plan.

Strategy B-2a: Perform literature reviews and recommend best management practices regarding non-native and exotic species to support SWFL and their habitat.

Objective B-3: Support large-scale restoration efforts to protect and expand SWFL habitat in the MRG.

Strategy B-3a: Annually map or update maps of SWFL habitat in the MRG management unit.
Strategy B-3b: Review habitat areas biennially and identify sites that can be expanded based on occupied territories to prioritize restoration efforts.

Yellow-Billed Cuckoo

Objective C-1: Contribute to research and understanding of habitat needs for the YBCU.

Critical habitat areas were proposed and revised by the USFWS in 2020. The area includes much of the MRG, with the exception of the Albuquerque reach. More research is needed to determine habitat features needed to help prevent up-listing of the YBCU. There is not currently a recovery plan for this species.

> ***Strategy C-1a***: Perform literature reviews and make recommendations for research to better understand the habitat needs to support the YBCU.
> ***Strategy C-1b***: Annually map or update maps of YBCU habitat in the MRG. Make recommendations to support expansion of habitat to support the species.

New Mexico Meadow Jumping Mouse

Objective D-1: Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

There is currently one known population of NMMJM in the Collaborative Program area, located at the Bosque del Apache National Wildlife Refuge. The biggest stressor to the species is habitat loss, typically a result of grazing, water management practices, drought, wildfire and other pressures. The following strategies support the findings in the 2014 USFWS Recovery Outline for the species.

> ***Strategy D-1a***: Provide a biennial assessment of opportunities to expand NMMJM habitat in the MRG to achieve a self-sustaining population.
> ***Strategy D-1b***: Perform literature reviews and pursue opportunities to support research to better understand the life history of the NMMJM, including movement behavior, to support habitat recommendations.

Pecos Sunflower

Objective E-1: Continue monitoring for PESU stands in the West-Central New Mexico Recovery Region and preserve habitat.

In the 2005 Species Recovery Plan, the USFWS listed at least one potential core conservation area for an existing population of PESU within the West-Central New Mexico Recovery Region in the Collaborative Program area – the La Joya State Waterfowl Management Area. The area around the La Joya Drain is of particular interest. Monitoring and maintenance in that area should consider how to improve habitat for PESU.

> ***Strategy E-1a***: Monitor one new area per year for PESU to see if species is present. Monitoring could occur simultaneously with other monitoring occurring for HR sites or site maintenance monitoring. Consider monitoring in newly restored habitat areas in the Lower Reach Plan, where habitat for PESU may be become suitable.

Strategy E-1b: Devise a list of potential ways to keep the La Joya Drain area perennial to continue to provide suitable habitat for the PESU.

Other Objectives and Strategies

Objective F-1: Monitor the status of other threatened species in the MRG.

The Collaborative Program will track the status of other species of concern in the MRG to prevent future listings or up-listings within the Collaborative Program area.

Strategy F-1a: Review the biennial assessment from the NMDGF for status of various species in the Collaborative Program area. Consider including protection measures for applicable threatened species in restoration efforts, where possible.
Strategy F-1b: Include an update on status of other threatened and endangered species at the Science Symposium.

Objective G-1: Support the establishment and maintenance of a Conservation Storage pool in Abiquiu Reservoir.

Efforts are underway to change authorizations at Abiquiu Reservoir so native Rio Grande water can be stored in addition to the already authorized San Juan-Chama water storage. The flexibility to store both San Juan-Chama and native Rio Grande water will provide options for managing water resources on the MRG.

Strategy G-1a: Provide monitoring data to support the environmental assessment process to establish the conservation storage pool.
Strategy G-1b: When possible, find available water to support the conservation storage pool to benefit species and habitat.

Comment #	Page	Section	Comment	Response
	General	General	From the FWS perspective, the projects that are listed as RPMs/T&C's in the multiple BO's in the valley would be our priorities, as we feel they would minimize take or continue monitoring. There are some projects that are also BO commitments and it might be good to have a column to make that connection. Making this clear could assist action	In the updated 2021 LTP, signatories will have the opportunity to provide linkages between scientific activities and their authorities and obligations. These will be included into the AM Database and will be
	General	General	In 2018 FWS recommended the prioritization of projects depending on how they support Recovery Goals associated with Recovery Plans of the species. This approach is included in the objectives and strategies, and we hope that they remain in the Long-Term Plan, as updated in the spring.	Objectives are related to the recovery plans, and the plan is to continue to do so.
	1	1 Introduction	Would be helpful (specifically for those unfamiliar with both plans) to introduce the two plans, and explain that they are complementary documents and what differentiates them. I know it is a little duplicative of the next sections on purpose and structure, but it would be helpful for readers to understand that there are two plan documents and	Included defintion of the S&AM Plan in the introduction opening, including noting that the two plans are complementary.

1	1.1 Purpose	This does not match the S&AM Plan description “The Collaborative Program’s Long-Term Plan provides Collaborative Program-wide context and describes the specific ways in which listed activities help meet the Collaborative Program’s goals and objectives, and reduce critical scientific uncertainties related to management. Additionally, the administrative tasks needed for carrying on normal operations and fulfilling upcoming obligations within the Collaborative Program are outlined in the plan. The Long-Term Plan is assessed and adjusted regularly in order to accommodate changing operational and/or environmental conditions.” While I understand there are still steps to take to consolidate/develop uncertainties and create Collaborative Program priorities, there is currently no attempt to describe how Recommended Activities (Table 4) are connected to the Collaborative Program’s goals and objectives.	More details on how the recommended activities are connected to Collaborative Program guiding principles will be included in the 2021 LTP update. For the purposes of this document, those linkages are not yet developed as the objectives have not been finalized and adopted by the Collaborative Program. No change made.
1	1.2 Development and Structure	Recommend changing to “The” because “This” plan does not yet have priorities.	Comment incorporated.
1	1.2 Development and Structure	The database + project bank is intended to help with identifying short and long-term priorities, rather than providing recommended short- and long-term priorities?	The LTP is a list of recommended activities, that are tiered off of the Collaborative Program's short- and long-term priorities (its guiding principles). These linkages will be built into the AM database. See Section 4 Adaptive Management Database. No change made.
1	1.2 Development and Structure	Isn’t there already an administrative timeline in the S&AM Plan? Do they match?	There is no timeline in the S&AM Plan. There is an implementation task list, which is also included in the LTP. No change made.

1	1.3 Updates	Is annually the right frequency for reviewing priorities? I think it might be better to set priorities for 5 years to allow time for data collection and research, and make a note that priorities will be adjusted as needed in the interim. I could see that a specific species issue may become a priority if it wasn't already highlighted, but I have trouble picturing a scenario where we are changing priorities annually. Frequent priority changes could result in work being started but never completed.	The annual review is not meant to be onerous, rather, it will be a checklist as part of the process outlined in the S&AM Plan (Section 3.2.2 C) to ensure that the guiding principles are still relevant on a regular basis. If they are not, then the checklist will aid in determining other elements that may need to be reassessed. Whether or not changes are needed, the Program will re-adopt guiding principles each year to reinforce their importance to planning efforts. Changes can be made on whatever time scale is appropriate. Progress on work items will be tracked via the AM Database, and thus cannot be abandoned, unless justification adn approval for doing so is document. No change made.
1	1.3 Updates	Which groups (EC, SAMC)?	Revised to note that the EC performs the evaluation, and that the SAMC makes recommendations on updates to the EC, and the EC can task an Administrative Ad Hoc Group to complete the updates. See Section 3 in the S&AM Plan for more details.
1	1.3 Updates	How does long-term direction differ from guiding principles (i.e. mission, goals, and objectives) that are updated annually?	Replaced "long-term direction" with "guiding principles".
2	1.3 Updates	Previously, as in the projects proposed in the 2018 Interim Long Term Plan?	Removed "previously".

3	2.3 Objectives	Clarify which recovery plans.	Comment incorporated: "the recovery criteria within the species recovery plans for RGSM, SWFL, and PESU; the recovery outline for NMMJM; and the conservation strategy for YBCU."
3	2.3 Objectives	Same comment as above, once we have objectives and strategies established for the Program, do we need to spend time evaluating them annually? Can this be done in detail every 5 years or as needed? Reviewing annually to report a status makes sense to me, but reevaluation seems unnecessary.	See response on line 10.
3	2.3 Objectives	It may be more useful would be a written memo from the SAMC of the recommendations (if there are any) to submit to the EC and then EC minutes with decision narratives are attached to track why something was accepted or not.	This is the intent - there will be a written record of all recommendations and decisions. Capturing the record of decisions, including recommendations and accompanying justifications, approvals, and/or dissents with rationale, and any subsequent actions taken, is fundamental to adaptive learning. Decisions will be tracked via the AM Database. No change made.
3	3 Supporting Adaptive Management in the Middle Rio Grande	Should provide in intro.	Comment incorporated.

4	Table 1	I like the 'Teamwork' element and definition for moving science forward. The activities listed in the LTP table are really participation, and don't approach the definition presented. The CP is focused on maintaining the status quo activities listed and discourages new ideas. Suggest adding a 'Participation' Element with a definition in Table 1 for continuing activities described in the LTP Objectives table.	Revised this element to be "Teamwork and Participation" throughout document.
7	Figure 1	It would be useful to identify the appropriate location for project evaluation and learning. Review tracking and executive summaries should both explicitly address these components in the AM database	Comment incorporated.
10	6 Implementation Task List	Already described in S&AM plan, seems a little duplicative.	The Implementation Task List is Appendix A in the S&AM Plan, and is included in both documents to be the next steps for implementing both plans. Included a footnote noting that this task list is also in the S&AM Plan.
15	7 Collaborative Program Recommended Activities	There is no information on why these are recommended, how they were developed, or how they will be used.	The list of proposed and ongoing Program activities was organized around relevant long-term planning guidance in order to meet a specific need for this LTP. The prioritization tools needed for a more structured treatment of this list are under development and require some level of Program input. No change made.
27-28	Table 4	RGSM rescue occurs as rows 1 & 3 under the LTP Objective: Teamwork heading	Removed duplicate line.
27-29	Table 4	Revise LTP Teamwork Objective to 'Participation' to more accurately represent the activities in the table	Comment incorporated.

27-29	Table 4	Suggestions for some activities in “LTP Objective: Teamwork” that better represent the definition in Table 1: • eDNA marker development for RGSM w/ field testing & calibration • expand larval fish studies to better define hydraulic habitat criteria • map/model larval fish hydraulic habitat • develop soundscape methods & criteria for avian monitoring • develop new monitoring and evaluation techniques	These suggestions for scientific activities that can be included in the Project Bank. Signatories are encouraged to develop their ideas and submit them for the Project Bank, for consideration in future LTPs. No change made.

Middle Rio Grande Endangered Species Collaborative Program

Science and Adaptive Management Committee UPDATE

Catherine Murphy, Science Coordinator

Program Support Team / WEST, Inc.

December 17, 2020

Science & Adaptive Management Process – Guiding Principles



Guiding Principles: Objectives Workshop (*Feb 2021*)

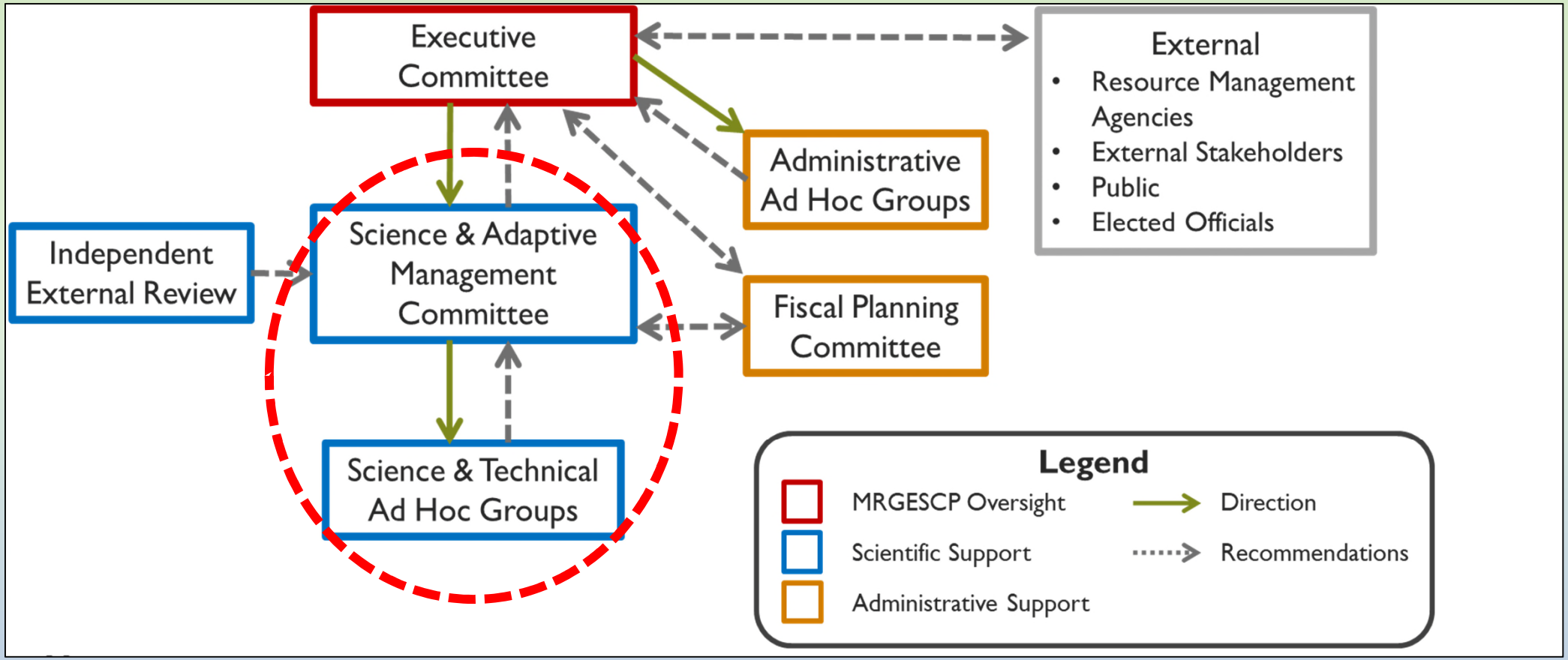
PURPOSE

- Align the Collaborative Program's planning objectives with its mission statement and goals.
- Appraise the objectives and associated strategies yearly with input from stakeholders and technical experts.

DESIGNING S.M.A.R.T. OBJECTIVES

- ✓ **S**pecific
- ✓ **M**easureable
- ✓ **A**ttainable
- ✓ **R**elevant
- ✓ **T**ime-bound

New Collaborative Program structure under S&AM Plan



Science & Technical Ad Hoc Groups

DESIGNING TASKS

- Identify the critical uncertainty to be addressed
- Limit the scope of the task
- S.M.A.R.T. tasks
- Define approach iteratively to maximize group input
- Report should list assumptions and account for uncertainty

S&T Ad Hoc Groups ready to continue through the transition to the S&AM Plan include:

- ✓ Population Monitoring modeling small group
- ✓ Genetics work group
- ❑ Population Modeling summary report completion

Informing Adaptive Management

AM DATABASE

- Integrate compiled Independent Science Panel recommendations with conceptual ecological model uncertainties
- Identify areas of overlap and redundancy
- Characterize assumptions and confidence
- Link to Guiding Principles

APPLYING CONCEPTS

- Symposium generating feedback
- Additions to geospatial map tool
- Invited speakers
- Scoping issues at climate scale
- Quantifying variability, precision, bias and confidence for risk assessment

Population Monitoring Work Group (PMWG) Update
To the Executive Committee
Richard A. Valdez, Ph.D.
Chair, Population Monitoring Workgroup
December 17, 2020

One of the most important aspects of the Middle Rio Grande Endangered Species Collaborative Program is the ability to confidently monitor key resources. In 2012, the Executive Committee (EC) formed and convened the Population Monitoring Workgroup (PMWG) to evaluate the fish monitoring plan for the Middle Rio Grande, with a focus on the Rio Grande silvery minnow. The EC charged the workgroup with three tasks. Task 1 was a workshop with external scientists and signatory technical representatives designed to evaluate the CPUE index and sampling methods. The workshop was held in December 2015, with a report and presentation to the EC by Dr. Wayne Hubert in 2016. Task 2 is an evaluation of the sampling design, methods, protocols, and analyses that is the primary subject of a status report currently in development. Task 3 is to be initiated at the completion of Task 2, and would evaluate refinements to the monitoring plan.

The draft status report for Tasks 1 and 2 is currently in development and review by the PMWG. The report evaluates the monitoring program, and is designed to inform the EC and the SAMC about the strengths and weaknesses of the program, especially as it describes the status and trends of the silvery minnow. Basic questions about the sampling design and methodologies are posed and addressed in the report with responses that also identify critical uncertainties. The results of this report are designed to be incorporated by the SAMC into the new adaptive management plan. This Status Report is expected to be completed about March 1, and a Summary of Findings and Recommendations will be presented to the EC at the March webinar.

Members of the workgroup are also involved in a project to help develop a Rio Grande silvery minnow population model. Dr. Charles Yackulic of the USGS has been retained by the New Mexico Interstate Stream Commission to develop an integrated model that uses the population monitoring data to predict responses by the silvery minnow to different factors, such as stocking, salvage, spring flows, and low summer flows and intermittency. Six members of the workgroup are currently serving as Subject Matter Experts with Dr. Yackulic to help parameterize the model through an elicitation process. This small modeling group will need to continue to meet virtually with Dr. Yackulic, possibly through the end of his contract period in June 2021.

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
2008 MOA Addendum Administrative Ad Hoc Group Charge

Approved by the Executive Committee (EC) on *December 17, 2020***.**

Parent Committee
Administrative Ad Hoc Groups are formed by and report to the EC.

Ad Hoc Group Charge
Draft an addendum to the 2008 Memorandum of Agreement (MOA) to extend the MOA one calendar year to May 2022.

Membership

A. Criteria for membership

- Familiarity with 2008 MOA
- Legal expertise

B. Member List

Jim Wilber
Kim Bannerman
Chris Shaw (for review)
Bill Grantham

Tasks and Deliverables

1. Draft 2008 MOA Addendum

Objective of Task One
Provide the EC with a draft addendum to the 2008 MOA, extending the MOA for one calendar year to May 2022.

Deliverable(s): Draft addendum to the 2008 MOA

Timeline and Reporting Scheduling

Task	Deliverable	To Be Completed By
Draft 2008 MOA addendum	Draft addendum to the 2008 MOA, extending the MOA for one calendar year to May 2022, for EC consideration	One week prior to March 2021 EC meeting

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
By-Laws Administrative Ad Hoc Group Charge

Approved by the Executive Committee (EC) on *December 17, 2020***.**

Parent Committee
Administrative Ad Hoc Groups are formed by and report to the EC.

Ad Hoc Group Charge
Make revisions to the MRGESCP By-Laws consistent with implementation of the new MRGESCP organizational structure, Science & Adaptive Management (S&AM) Plan and Long-Term Plan (LTP).

Membership

A. Criteria for membership

- Familiarity with S&AM Plan and LTP
- Legal expertise

B. Member List

Chris Shaw
Kim Bannerman
Jim Wilber
Trevor Stevens
Bill Grantham

Tasks and Deliverables

1. Revised MRGESCP By-Laws

Objective of Task One
Provide the EC with recommended revisions to the 2012 MRGESCP By-Laws that reflect the new organizational structure and direction, including the S&AM Plan and LTP.

Deliverable(s): Revised MRGESCP By-Laws to the EC, one week prior to the July 2021 meeting

Timeline and Reporting Scheduling

Task	Deliverable	To Be Completed By
Revised MRGESCP By-Laws	Revised MRGESCP By-laws for EC consideration	One week prior to July 2021 EC meeting

Executive Committee Meeting

March 25, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *2008 MOA [read-ahead, not included]*
- *2021 Addendum to the 2008 MOA [read-ahead, not included]*
- *Revised MRGESCP 2021 Work Plan [read-ahead, not included]*
- *Program Activity Definition [read-ahead, draft]*
- *Science and AM Update [presentation]*
- *Program Portal [presentation]*
- *Draft 2021 Science Objectives [follow-up, draft]*
- *Revised Program Activity Definition [follow-up, draft]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Executive Committee (EC) Meeting
March 25, 2021
9:00 AM – 12:00 PM

Location: Zoom Meeting
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Call-In: +1-669-900-6833
Meeting ID: 898-359-3120; Passcode: 1251

Meeting Agenda

Meeting Objectives:

- *Approve an addendum to the 2008 Memorandum of Agreement (MOA) extending the MOA term by one calendar year.*
- *Receive an update on the Program Portal and learn of its different functionalities.*
- *Hear the results from the Objectives Workshop.*
- *Learn about opportunities for the Adaptive Management Relational Database.*
- *Define a "Program activity."*

9:00 – 9:05	**Welcome, Introductions, Agenda Review**
	• Ground rules for Zoom meeting
	• New EC members:
	  o Mark Kelly, Non-Federal Co-Chair, Albuquerque-Bernalillo County Water Utility Authority (ABCWUA)
	  o Sarah Hendrickson, ABCWUA (alternate)
	  o Greg Kaufman, Pueblo of Sandia (alternate)
	✓ **Decision**: Approval of March 25, 2021 EC meeting agenda
		EC Co-chairs

9:05 – 9:10	**December 2020 Meeting Summary** • Action items review ✓ **Decision**: Approval of December 17, 2020 EC meeting minutes Read ahead: ☐ December 17, 2020 EC meeting minutes	*EC Co-chairs*

9:10 – 9:20	**Program Manager Update**
	• Administrative announcement:
	  o FY20 Annual Report deadlines
	  o 2020 Science Symposium presentations
	  o 2020 Bibliography
	• By-laws revisions update
	• Science and Adaptive Management Committee (SAMC) update
	➢ **Action Item**: Submit comments on the FY20 Annual Report to the PST by March 30, 2021
		Debbie Lee, Program Support Team (PST)
		Catherine Murphy, PST

9:20 – 9:30	**2008 Memorandum of Agreement Addendum** ✓ **Decision**: Approval of 2008 MOA Addendum	*Debbie Lee, PST*

	➢ **Action Item**: All signatories sign the 2008 MOA Addendum by May 1, 2021 Read ahead: ☐ 2008 MOA ☐ 2008 MOA Addendum	
9:30 -9:45	**2021 MRGESCP Work Plan** • Proposed revisions to the 2021 Work Plan ✓ **Decision**: Approval of MRGESCP 2021 Work Plan revisions Read ahead: ☐ Revised MRGESCP 2021 Work Plan	*Debbie Lee, PST*
9:45 – 10:00	**Program Portal Presentation** • Program Portal features • Next steps on Portal funding ➢ **Action Item**: Task the Fiscal Planning Committee with investigating additional funding options for the Portal	*Debbie Lee, PST*
10:00 – 10:10	**Hydrology and Rio Grande Silvery Minnow (RGSM) Update** • 2021 hydrology forecasts • RGSM augmentation and rescue plans	*Jennifer Faler, U.S. Bureau of Reclamation* *Debra Hill, U.S. Fish & Wildlife Service*
10:10 – 10:35	**Results from the Objectives Workshop** • Presentation ➢ **Action Item**: Provide comments on objectives to the PST by April 2	*Catherine Murphy, PST*
10:35 – 10:45	**Break**	
10:45 – 11:10	**Adaptive Management Relational Database** • Updates and next steps • Reporting application	*Catherine Murphy, PST*
11:10 – 11:30	**Program Activities** • What is a "Program activity"? • Discussion on how this relates to a cost-share, and how signatory contributions to the Program are reported and tracked. ✓ **Decision**: Definition of "Program activity" ➢ **Action Item**: Fiscal Planning Committee continue discussing changes to cost-share/signatory contributions based on EC discussion Read ahead: ☐ Proposed "Program activity" definition	*Debbie Lee, PST* *Facilitated Discussion*
11:30 – 11:50	**Program and Science Support (PASS) Contract** • Update on PASS contract	*EC Co-chairs*
11:50 – 11:55	**Announcements and Public Comment**	
11:55 – 12:00	**Meeting Summary and Action Items Review** ➢ Next EC Meeting: July 2021	*EC Co-chairs*
12:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Executive Committee (EC)
Meeting Minutes

March 25, 2021; 9:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of March 25, 2021 EC meeting agenda
- ✓ Approval of December 17, 2020 EC meeting minutes
- ✓ Approval of 2008 Memorandum of Agreement (MOA) Addendum
- ✓ Approval of 2021 Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) Work Plan revisions

Announcements:

- ❖ Wayne Pullan, U.S. Bureau of Reclamation (Reclamation), will be replaced as Federal Co-chair by Katrina Grantz, Reclamation, by the next EC meeting.
- ❖ Funding for Bosque Ecosystem Monitoring Program (BEMP) was heavily cut. BEMP will cut staff and school programs, which means fewer monitored sites. BEMP will be working with partners to decide which sites to continue monitoring and is pursuing funding through any available routes.
- ❖ The U.S. Army Corps of Engineers (USACE) received funding for the Sandia Pueblo to Isleta Pueblo Ecosystem Restoration project and is seeking a non-federal sponsor during the design stage. There are two years of funding for design at a total of $1.8 million. Cost-share is 50/50.
- ❖ Through July, the City of Santa Fe and Buckman Direct Diversion will be scoping for a new project to return treated wastewater to the Rio Grande. Program participants can contact Kyle Harwood for more information.
- ❖ The City of Albuquerque received a WaterSMART grant, with Reclamation as the lead federal agency.
- ❖ The Rio Grande Compact Commission meeting will be held virtually on April 8, 2021. The link to attend is on the New Mexico Interstate Stream Commission (NMISC) website.

Action Items:

WHO	ACTION ITEM	BY WHEN
PST (Program Support Team)	Send out a Doodle Poll to schedule the next EC meeting for the last half of July	3/26/2021
PST	Send out presentations in the meeting follow-up	3/26/2021
Annual report contributors	Submit comments on the FY20 Annual Report to the PST	3/30/2021
PST	Draft a 2008 MOA Addendum cover letter for EC Co-chairs to review and to be sent with the Addendum to each signatory	4/1/2021
EC	Provide comments on the draft science objectives to the PST	4/9/2021

PST	Draft and send a thank you letter from the MRGESCP to U.S. Geological Survey (USGS) to be signed by the EC co-chairs	4/15/2021
PST	Draft and send a letter of support from the MRGESCP for BEMP to be signed by the EC co-chairs	4/16/2021
Jim Wilber and PST	Work with Ashleigh Morris, Office of the Solicitor, U.S. Department of the Interior (DOI), to produce written confirmation of the decision made on changes to cost-share	4/16/2021
Fiscal Planning Committee (FPC)	Discuss changes to cost-share/signatory contributions based on EC discussion	4/21/2021
All signatories	Sign the 2008 MOA Addendum	5/15/2021
Signatories without signed 2008 MOA signature pages	Sign the 2008 MOA	5/15/2021
PST	Add the objectives for defining "program activity" to the document, refine the definition as necessary based on EC discussion, and bring it back to the EC for review at the next meeting	July 2021
FPC	Investigate future funding options for the Portal	7/1/2021

Next Meeting: July 2021

Meeting Minutes

Welcome, Introductions, Agenda Review

Wayne Pullan, Reclamation, and Federal Co-Chair, opened the meeting and led introductions. Wayne P. announced that Katrina Grantz, Assistant Regional Director for Reclamation's Upper Colorado Basin, will be replacing him as Federal Co-chair by the next EC meeting. Debbie Lee, Program Manager with the PST, reviewed the March 25, 2021 meeting agenda and no amendments were made.

- ✓ **Decision**: Approval of the March 25, 2021 meeting agenda by the EC
- ❖ **Announcement**: Wayne Pullan will be stepping down as Federal Co-chair by the next EC meeting, and will be replaced by Katrina Grantz

December 17, 2020 Meeting Minutes

The December 17, 2020 meeting minutes were reviewed by the EC and approved with no amendments.

- ✓ **Decision**: Approval of the December 17, 2020 EC meeting minutes by the EC

Program Manager Update

Debbie L. provided the Program Manager update. Summary points are below:

Administrative announcements:

- The draft FY20 Annual Report was sent to contributors for review. Comments are due March 30, 2021.
- Recordings of the 2020 Science Symposium presentations are available on the Portal.
- The 2020 MRGESCP Bibliography is available on the Portal.

By-laws revisions update:

- The By-Laws Ad Hoc Group has been revising the MRGESCP By-Laws one section at a time. The finalized version will be available for EC review prior to the July EC meeting.

Catherine Murphy, Science Coordinator with the PST, gave a Science and Adaptive Management Committee (SAMC) update. Summary points are below:

SAMC update:

- Three Science & Technical (S&T) Ad Hoc Groups are in different stages of development.
- The SAMC convened the 2021 Science Objectives Workshop and draft objectives are ready for EC review.
- The SAMC is working on a habitat restoration initiative based on multiple requests.

- ➢ **Action Item**: The annual report contributors will submit comments on the FY20 Annual Report to the PST

2008 Memorandum of Agreement Addendum

Debbie L. presented the draft 2008 MOA Addendum for EC approval (see draft addendum). Summary points are below:

- The draft 2008 MOA Addendum extends the 2008 MOA by one calendar year, giving the MRGESCP time to draft a new one that reflects the Collaborative Program's shift to operating as a science and adaptive management program.
- The current 2008 MOA ends in May 2021, but the addendum extends it to May 2022.

- Signing the 2008 MOA Addendum signifies a commitment to continued participation in the MRGESCP. Only active signatories are eligible to sign.
- There is no record of 2008 MOA signature pages from several signatories. Those with missing signature pages will also be sent the 2008 MOA to sign.
- What should EC representatives tell their respective entities about the one-year extension?
    - The extension gives the MRGESCP time to advance under the new science and adaptive management process and to draft a new MOA for EC approval in 2022. The revised 2021 MRGESCP Work Plan includes a task for developing the new MOA.
    - The PST will draft a cover letter for the addendum noting the above.

✓ **Decision**: Approval of the 2008 MOA addendum by the EC
➢ **Action Item**: The PST will draft a 2008 MOA Addendum cover letter for EC Co-chairs to review and to be sent with the Addendum to each signatory
➢ **Action Item**: All signatories will sign the 2008 MOA Addendum
➢ **Action Item**: Signatories without a signed signature page to the 2008 MOA will sign the 2008 MOA

2021 MRGESCP Work Plan

Debbie L. reviewed the proposed revisions to the 2021 MRGESCP Work Plan. Summary points are below:

- The deadlines for updating the Long-Term Plan and Science & Adaptive Management Plan were pushed out from July to the end of calendar year.
    - The Adaptive Management Relational Database (AMRDB) needs to be developed further to facilitate planning.
- The task of developing a scenarios planning workshop was taken out and scenario planning will be charged to a S&T Ad Hoc Group by the SAMC.
- There is a new task of drafting a MOA by the end of year for EC approval in 2022.

✓ **Decision**: Approval of 2021 MRGESCP Work Plan revisions by the EC

Program Portal Presentation

Debbie L. presented an update on the Program Portal and its current functionalities (see presentation). Summary points are below:

- USACE funding for development of the Portal by USGS ended in January 2021.
- The Portal features an "About" section, announcements banner, dataset repository, event calendar, downloadable meeting read-ahead materials, interactive map, document library, science symposium information, species pages, hydrology resources, and more.
- Although the PST can continue updating most of these features, no funding is currently available for adding new functionalities or updating/adding filters to the interactive map.
- Next steps:
    - The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) will provide base level funding to keep the Portal online for at least the next year.
    - Adding new functionalities will require more funding. For example, the site is not currently mobile-friendly and no updates can be made to the interactive map.
    - The PST can continue uploading documents, updating datasets, and maintaining the calendar.
    - Program participants should inform the PST of any bugs on the site.
    - The EC tasks the FPC with investigating future funding options for the Portal.

- The EC tasked the PST with writing a thank you letter to the USGS development team.
- In the future, can Portal funding be included in the program and science support (PASS) contract from Reclamation?
    - Portal funding can be folded into the new request for proposal (RFP), but responding to Portal needs may be less nimble.
        - A smaller agency could be more responsive as far as contract changes.
        - Reclamation would need to commit to one price every year with no changes.
    - The Portal is currently hosted on a USGS server and there may be issues if Reclamation contracts USGS through the PASS contract. If the Portal needs to be moved to a new server, there is the risk of losing information or functionality.
- The Portal search function is slow, which needs to be addressed in the future.

➢ **Action Item**: Draft and send a thank you letter from the MRGESCP to USGS to be signed by the EC co-chairs
➢ **Action Item**: The FPC will investigate future funding options for the Portal

Hydrology and Rio Grande Silvery Minnow Update

Jennifer Faler, Reclamation, presented a hydrology update using the New Mexico Drought Monitor, River Basin Storage, and SNOTEL Interactive Map pages on the Portal. Summary points are below:

- According to the drought monitor, most of the state is in exceptional drought.
- According to the teacup diagrams, reservoir storage is 14% full at El Vado and 40% full at Abiquiu. Although reservoirs should be filling up at this time of year, they are fairly empty.
- According to the interactive SNOTEL map, the snow water equivalent at Elephant Butte Reservoir is 64% of average.
- There was a dry fall, which means the average snowmelt runoff will not result in as much water as with a wet fall. The 50-70% snowpack will not have a big effect on the reservoirs.
- At Heron Reservoir, inflow into the Azotea Tunnel is 20-30 cubic feet per second (cfs).
- San Juan-Chama allocation was zero in January. There will be a small amount of water in April.
- 11,000 acre-feet of water is stored at El Vado. That water is stored for the pueblos. No additional native water will be stored under Article VII.
- The irrigation season was delayed a month. Farmers will start getting water in mid-April.
- About 1,300 acre-feet of Rio Grande silvery minnow (RGSM) water was carried over from 2020. More water will be purchased around May or June. In the early part of the irrigation season, there may be no water to supplement the fish.

Additional updates from Page Pegram, NMISC, and Dave Gensler, Middle Rio Grande Conservancy District (MRGCD), are below:

- The State Engineer decided there would be no relinquishment credit storage under Article VII.
    - The big problem this year is no upstream storage. We will have to rely on river runoff.
- 2021 is shaping up to be a bad water year. 2018-2021 have been sequential bad water years.
    - In 2019, a large volume of water in the middle valley did not make it to Elephant Butte Reservoir because of inefficiencies in the river system. We cannot make our Rio Grande Compact deliveries in high water years.
- Despite some snow, the March 1 forecast went down.
- Rio Grande Compact storage is 200,000 acre-feet. New Mexico has an accrued debit of nearly 100,000 acre-feet.
- San Juan-Chama allocation is expected to be 75% or 15,000 acre-feet of water.

    - Dave G. recommends holding onto that water and using it in 2022.
- There is about 680 cfs coming through the middle valley. When MRGCD starts operations April 1, they will use 400 cfs immediately. That will increase to 500 cfs in mid-April and 600 cfs by the end of April.
    - Early drying is expected, possibly as early as April without runoff.
- U.S. Fish and Wildlife Service (USFWS) should consider emergency actions for the RGSM if the river dries up to Angostura this year.

Debra Hill, USFWS, gave an update on RGSM recovery efforts. Summary points are below:

- The New Mexico Fish and Wildlife Conservation Office (NMFWCO) will not be augmenting fish this spring because there will only be three months of water.
- NMFWCO will not preemptively conduct fish rescue. Rescue will start at first drying, which may be early compared to other years.
- Due to COVID-19 restrictions, NMFWCO will not have mixed crews.
- The augmentation plan is based on September surveys and predicted spring flows in April. The hatcheries will likely produce 250,000-300,000 RGSM, which is the maximum number.
- Although there will not be a "jiggle," natural runoff could facilitate spawning.
- Is egg salvage planned this year?
    - Yes, the MAT will likely organize volunteers with the Albuquerque BioPark leading the effort.

Science & Adaptive Management Progress Report

Catherine M. gave a Science & Adaptive Management Progress Report (see presentation). Summary points are below:

Results from the Objectives Workshop

- The purpose of the workshop was to align the science objectives with the MRGESCP's mission and goals. The science objectives and strategies should be assessed annually.
- 40 participants representing approximately 20 organizations attended.
- The workshop groups revised or developed 23 total draft science objectives with multiple strategies for each.
- The EC will review the draft science objectives by April 9, 2021.
- The SAMC will form S&T Ad Hoc Groups to develop the strategies further.
    - Details that appear to be missing in the objectives will be included in the strategies.

- **Action Item**: The EC will provide comments on the draft science objectives to the PST

Science & Technical Ad Hoc Groups

- RGSM Population Monitoring Work Group Summary Report – *concluding*
    - The SAMC will review the report and add larger context before it heads to the EC.
    - This is the first group testing SAMC processes.
- RGSM Population Modeling – *in progress*
    - Charles Yackulic, USGS, is incorporating expert elicitation into the model. Results will be out in the summer.
- RGSM Conceptual Ecological Model (CEM) Enhancement – *in formation*
    - The group's work will provide a template for other species CEMs.

- Genetics and augmentation/propagation program components need to be added to the RGSM CEM.
- Wade Wilson, USFWS Southwestern Native Aquatic Resources and Recovery Center, will lead the group.

Adaptive Management Relational Database

- The AMRDB content team is wrapping up populating content. The AMRDB design team is building relationships among different database tables and designing queries.
- The design team is defining different user needs to create reporting tools.
  - The two types of users are scientific and administrative.
- MRGESCP members are encouraged to reach out to the PST about scientific and administrative query needs, including how information could best be summarized for grant applications, internal reporting, signatory presentations, etc.
  - Which data fields should be included? What filters are needed to sort information? How should the summary report be formatted?
  - Suggestion to send a snapshot or sketch of a desired report format.

Comments:

- Will project costs be added to the AMRDB?
  - Yes, if provided, each proposed project will include an estimated contract cost.
  - Sensitive information can be password-protected.
- What pivot tables will be produced?
  - The Long-term Plan pivot table will have project titles with linkages to science objectives, recovery criteria, management actions, and priority based on the number and quality of linkages. Metadata for each project, including type, reach, species, hydrological conditions, etc. can be used to sort the table.
  - The SAMC and EC can use the Long-Term Plan report as a decision support tool to help determine which projects to recommend.
  - When MRGESCP members submit project proposals, project descriptions, or annual report write-ups, they are filling out fields in the AMRDB.
- How far back will you go when pulling project information?
  - Proposed projects from the previous Long-Term Plan are in the Project Bank (2018-present).
  - Only recently implemented and proposed projects will be included.
    - Information from new projects is needed for use in adaptive management.
  - Scientific findings and uncertainties from past projects are linked to the CEMs and other tables within the AMRDB.

Program Activities

Debbie L. opened discussion on the definition of a program activity. Summary points are below:

- The proposed definition sent as a read-ahead was revised based on comments.
  - Edits: Specify signatory activities, specify species in the Middle Rio Grande, and reference the Long-Term Plan.
- The first part of the definition covers contributions to MRGESCP operations. The second part covers science contributions.

Comments:

- The definition can be limiting the MRGESCP. Suggestion to add categories for on-the-ground habitat restoration activities, public outreach, water management, land management, fish management, etc. to encompass more of the work being done.
  - The MRGESCP is on the right track and the definition is compatible with that. The addition of other categories could slow scientific momentum.
- Is there a cost-share requirement?
  - Yes, the DOI Solicitor, Ashleigh Morris, is investigating the possibility of flexibility in the 25% non-federal cost-share requirement.
  - The program activity definition conversation is intended to help the FPC discussion around a new cost-share proposal.
- A limited definition could affect NMISC as its work is largely on the ground, unless there is no cost-share requirement.
  - The impact of on-the-ground work should be monitored and incorporated into the MRGESCP to inform management recommendations.
- Project updates could be included in the newsletter to help share information and coordinate efforts without taking up meeting time.
- Implementing on-the-ground projects and managing habitat is a focus of the Pueblo of Santa Ana and that should be represented in the definition.
  - Every habitat change is a field experiment and data should be collected to study the effects. The scientific value of that work will be incorporated.
- The FPC will continue the conversation on changing cost-share/signatory contributions based on EC discussion.
- Ashleigh M. will provide an answer on the flexibility in the cost-share requirement by the next FPC meeting.
- The FPC could be utilized to coordinate partners for projects, and projects could be announced at EC meetings.
- The MRGESCP can create a list of all scientific and on-the ground activities when necessary. The program activity definition is adequate so long as the scientific impacts of all work is acknowledged.
- The MRGESCP EC will wait for an answer from the DOI Solicitor before they vote on approval of the definition.
- The EC members request written confirmation of the decision made by the DOI solicitor on cost-share requirement.
- The objectives for defining a program activity should be added to the definition.

- **Action Item**: Jim Wilber, Reclamation, and the PST will work with Ashleigh Morris, Office of the Solicitor, DOI, to produce written confirmation of the findings related to flexibility with cost-share
- **Action Item**: The FPC will discuss changes to cost-share/signatory contributions based on EC discussion
- **Action Item**: The PST will add the objectives for defining "program activity" to the document, refine the definition as necessary based on EC discussion, and bring it back to the EC for review at the next meeting

Program and Science Support Contract

Jennifer F. gave an update on the Program and Science Support contract. Summary points are below:

- The ABCWUA will not take over management of the MRGESCP at this time.

- Reclamation approved a six-month extension (ending March 2022) of the Western EcoSystems Technology, Inc. (WEST) contract.
- Reclamation has started a new RFP.
- There will be a transition period of a few months to the new PST if it is not WEST.

Announcements

- **Announcement**: Funding for BEMP was heavily cut. BEMP will cut staff and school programs, which means fewer monitored sites. BEMP will be working with partners to decide which sites to continue monitoring and is pursuing funding through any available routes.
    - BEMP is applying to different grants and working with lobbyists to get funding.
    - The MRGESCP EC will provide a letter of support for BEMP.
    - BEMP data is critical for learning during a bad water year, like 2021.
    - The BEMP report will be out at the end of March.
- **Announcement**: USACE received funding for the Sandia Pueblo to Isleta Pueblo Ecosystem Restoration project and is seeking a non-federal sponsor during the design stage. There are two years of funding for design; the total amount for design is $ 1.8 million and cost-share is 50/50.
- **Announcement**: Through July, the City of Santa Fe and Buckman Direct Diversion will be scoping for a new project to return treated wastewater to the Rio Grande. Program participants can contact Kyle Harwood for more information.
- **Announcement**: The City of Albuquerque received a WaterSMART grant, with Reclamation as the lead federal agency.
- **Announcement**: The Rio Grande Compact Commission meeting will be held virtually on April 8, 2021. The link to attend is on the NMISC website.

- **Action Item**: The PST will draft and send a letter of support from the MRGESCP for BEMP to be signed by the EC co-chairs

Public Comment

No public comments were received.

Closing Items

- **Action Item**: The PST will send out a Doodle Poll to schedule the next EC meeting for the last half of July
- **Action Item**: The PST will send out presentations in the meeting follow-up

Meeting Participants

Participant	Organization
Alan Hatch	Pueblo of Santa Ana
Alyssa O'Brien	City of Albuquerque, Open Space
Bill Grantham	New Mexico Office of the Attorney General
Catherine Murphy	MRGESCP Support Team
Cynthia Naha	Santo Domingo Pueblo
Dale Strickland	MRGESCP Support Team
David Gensler	Middle Rio Grande Conservancy District
Debbie Lee	MRGESCP Support Team
Debra Hill	U.S. Fish and Wildlife Service
Grace Haggerty	New Mexico Interstate Stream Commission
Jennifer Faler	U.S. Bureau of Reclamation
Jim Wilber	U.S. Bureau of Reclamation
Julie Dickey	MRGESCP Support Team
Kim Eichhorst	Bosque Ecosystem Monitoring Program
Kyle Harwood	Buckman Direct Diversion
Lynette Giesen	U.S. Army Corps of Engineers
Major Katrina Johns	U.S. Army Corps of Engineers
Mark Kelly	Albuquerque Bernalillo County Water Utility Authority
Matthew Wunder	New Mexico Department of Game and Fish
Megan Osborne	University of New Mexico
Michael Scialdone	Pueblo of Sandia
Michelle Tuineau	MRGESCP Support Team
Page Pegram	New Mexico Interstate Stream Commission
Paul Tashjian	Audubon New Mexico
Rich Valdez	SWCA Environmental Consultants
Rick Carpenter	Buckman Direct Diversion
Ryan Gronewold	U.S. Army Corps of Engineers
Sarah Hendrickson	Albuquerque Bernalillo County Water Utility Authority
Shawn Sartorius	U.S. Fish and Wildlife Service
Trevor Birt	New Mexico Interstate Stream Commission
Trevor Stevens	U.S. Army Corps of Engineers
Wayne Pullan	U.S. Bureau of Reclamation
Yasmeen Najmi	Middle Rio Grande Conservancy District

A Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) activity is defined as follows:

(1) An activity that contributes to MRGESCP operations, including:
    - Active participation in MRGESCP committees and ad hoc groups, and
    - Administrative support of the MRGESCP.

(2) An activity that advances the scientific contribution of the MRGESCP, including:
    - Reducing a scientific uncertainty by addressing one or more MRGESCP objectives,
    - Providing findings for incorporation into the MRGESCP's science and adaptive management tools (e.g., Adaptive Management Relational Database, conceptual ecological models, etc.),
    - Contributing to the collective body of knowledge about the Middle Rio Grande, and
    - Informing the MRGESCP's recommendations on future scientific activities and/or management actions.

Middle Rio Grande Endangered Species Collaborative Program

Science & Adaptive Management Progress Report

25 March 2021

Science Coordinator update to Executive Committee

Science & Adaptive Management Accomplishments

Science Objectives Workshop

- February 10-11, 2021
- Purpose:
  - ❖Align the Collaborative Program's scientific planning objectives with its mission statement and goals.
  - ❖Appraise the objectives and associated strategies yearly with input from stakeholders and technical experts.

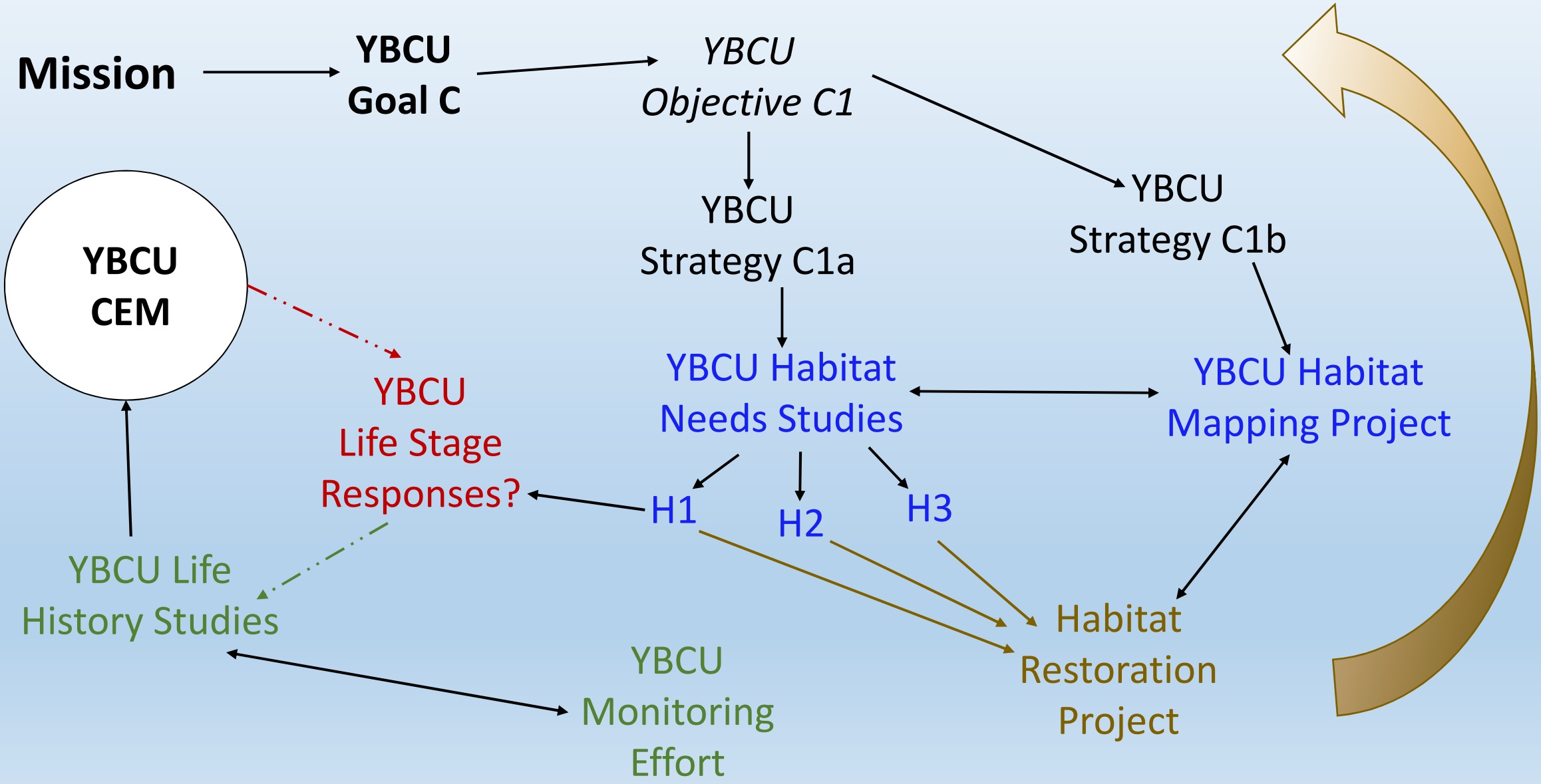


Science & Adaptive Management Accomplishments

Science Objectives Workshop – February 10-11, 2021

- ✓Purpose:
  - ❖Align the Collaborative Program's scientific planning objectives with its mission statement and goals.
  - ❖Appraise the objectives and associated strategies yearly with input from stakeholders and technical experts.
- 40 participants representing ~20 organizations/offices
- Revised/drafted 23 objective statements to address MRGESCP goals
- Reviewed by SAMC; ready for review by EC
- Suggested strategies will be assessed by SAMC and further developed by Science & Technical ad hoc groups
- Science objectives are being linked to projects to enable transparent prioritization for long-term planning

Science & Adaptive Management Plan – Pieces to pathways



DRAFT 2021 Science Objectives - RGSM



Objective A-1: Estimate the abundance of augmented and wild born RGSM populations in the Angostura, Isleta, and San Acacia reaches from year to year.

Objective A-2: Increase understanding of how the life history traits of the RGSM change over time and space, to better inform management of the species and increase the probability of recovery.

Objective A-3: Determine the relationships between base flow and survival and recruitment of RGSM in the Middle Rio Grande.

Objective A-4: Determine suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph) needed to cue spawning and recruitment for the RGSM population, given system constraints and opportunities.

DRAFT 2021 Science Objectives - RGSM



Objective A-5:

A-5.1: Refine existing research and modeling efforts to understand the quantity and quality of habitat available at different flow regimes.

A-5.2: Develop a range of options for increasing habitat availability and refugia at life stage-limiting flow regimes for all life stages.

Objective A-6:

A-6.1: Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM genetic diversity.

A-6.2: Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM population viability.

DRAFT 2021 Science Objectives - SWFL



Objective B-1: Monitor for SWFL in the MRG management unit of the Rio Grande recovery unit.

Objective B-2: Determine habitat availability for SWFL within the MRG.

Objective B-3:

B-3.1: Characterize optimal breeding habitat conditions in currently occupied SWFL locations to inform restoration.

B-3.2: Manage successional processes that maintain existing SWFL breeding habitat in the Program Area.

B-3.3: Expand SWFL breeding habitat through restoration efforts in the Program Area.

DRAFT 2021 Science Objectives - YBCU



<u>Objective C-1</u>:

C-1.1: Characterize optimal habitat (i.e., foraging and nesting) conditions on landscape and microhabitat levels in currently occupied YBCU locations to inform habitat mapping and restoration efforts.

C-1.2: Determine successional processes that promote optimal YBCU habitat (i.e., foraging and nesting) in the Program Area.

C-1.3: Expand monitoring efforts for YBCU.

DRAFT 2021 Science Objectives - NMMJM



<u>Objective D-1</u>:

D-1.1: Initiate and support NMMJM monitoring efforts to locate existing populations, identify relevant habitat features, and identify potentially suitable unoccupied habitat.

D-1.2: Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

DRAFT 2021 Science Objectives - PESU



<u>Objective E-1</u>:

E-1.1: Continue and expand monitoring and surveying for PESU stands in the West-Central New Mexico Recovery Region.

E-1.2: Preserve and expand existing habitat stands in the West-Central New Mexico Recovery Region.

DRAFT 2021 Science Objectives - OTHER



Objective F-1: Monitor trends in ecosystem function in the MRG for indications of decline (e.g., changes in vegetation structure and composition, population trends in other special status species, etc.).

Objective G-1: Support efforts to enhance the operational flexibility of water managers to support species.

Objective H-1: Determine the impacts from non-native vegetation on listed species' habitat availability and population dynamics.


MIDDLE RIO GRANDE
ENDANGERED SPECIES
COLLABORATIVE PROGRAM

Break

Science & Adaptive Management Accomplishments

✓Science Objectives Workshop

❑Science & Technical Ad Hoc Groups

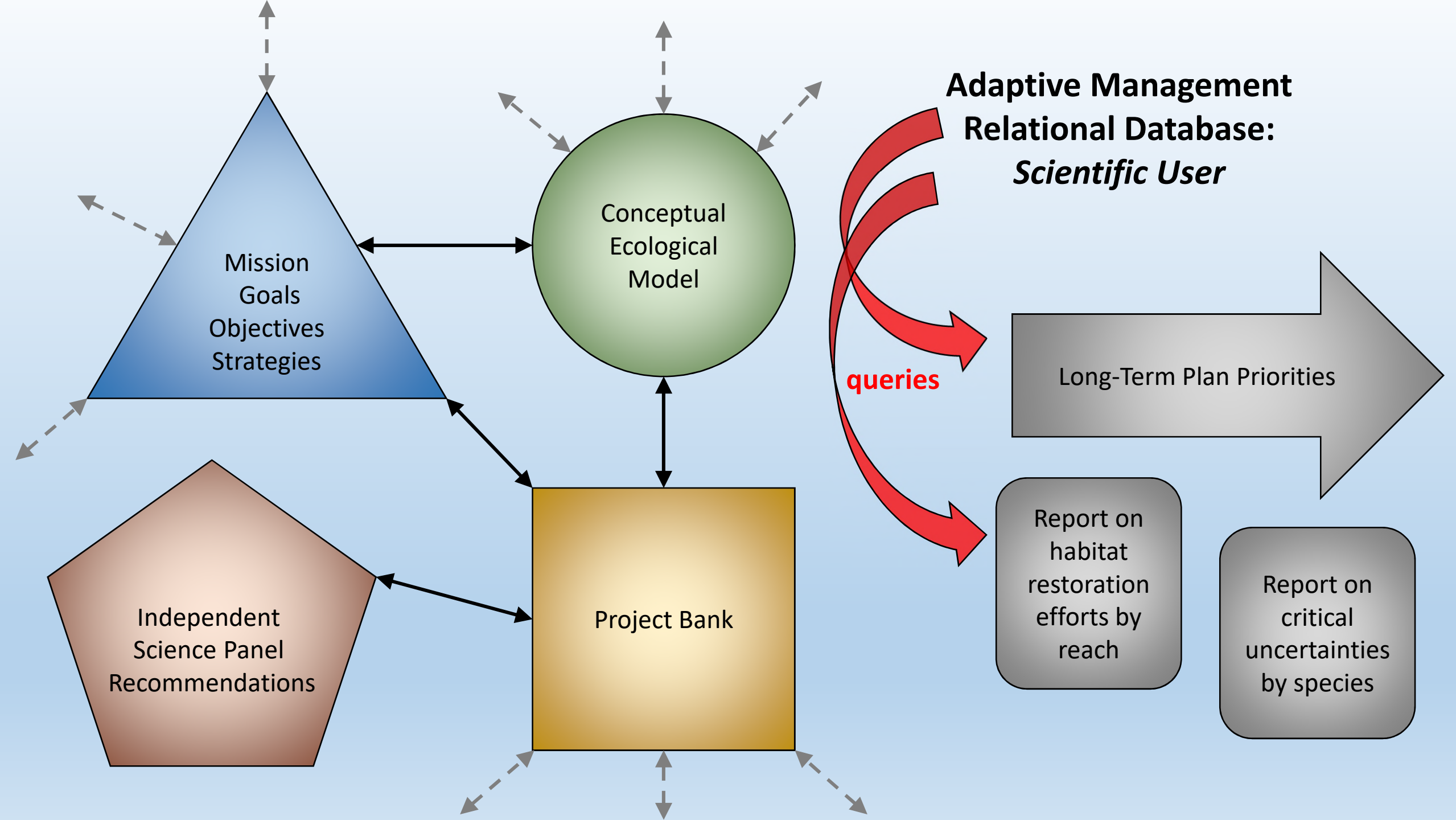
- RGSM Population Monitoring Work Group summary report (R. Valdez) - *concluding*
- RGSM Population Modeling group (C. Yackulic) – *in progress*
- RGSM Conceptual Ecological Model enhancement (W. Wilson) – *in formation*

❑ Adaptive Management Relational Database

- Populating content, building relationships, designing queries
- Defining different user needs to construct reporting tools

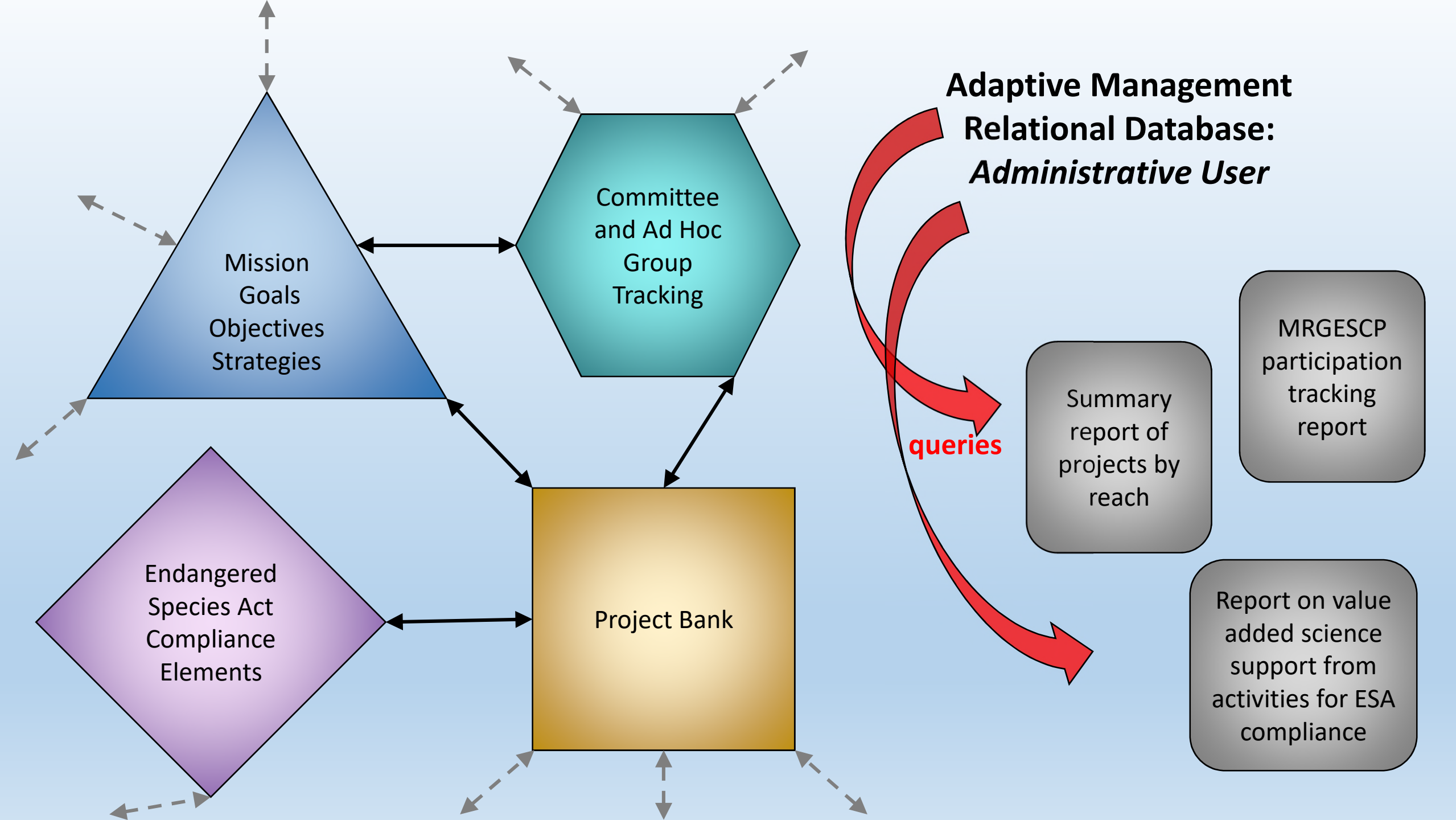
Adaptive Management Relational Database Users

- User – a Collaborative Program participant wishing to search for information and generate reports on MRGESCP activities (completed, ongoing, proposed), and to relate activities to science and adaptive management initiatives.
  - Scientific user – a user with scientific or technical queries, such as:
    - Track progress being made on critical uncertainties
    - Summarize scientific investigations by reach, species or type
    - Determine how a particular project supports the science objectives


Adaptive Management
Relational Database:
Scientific User
Mission
Goals
Objectives
Strategies
Conceptual
Ecological
Model
queries
Long-Term Plan Priorities
Report on
habitat
restoration
efforts by
reach
Report on
critical
uncertainties
by species
Independent
Science Panel
Recommendations
Project Bank

Adaptive Management Relational Database Users

- User – a Collaborative Program participant wishing to search for information and generate reports on MRGESCP activities (completed, ongoing, proposed), and to relate activities to science and adaptive management initiatives.
  - Scientific user – a user with scientific or technical queries, such as:
    - Track progress being made on critical uncertainties
    - Summarize scientific investigations by reach, species or type
    - Determine how a particular project supports the science objectives
  - Administrative user – a user with administrative queries, such as:
    - Track participation in MRGESCP ad hoc groups and committees
    - Quickly summarize projects by reach, species or type
    - Evaluate science support gained from carrying out activities for ESA compliance


Adaptive Management
Relational Database:
Administrative User
Mission
Goals
Objectives
Strategies
Committee
and Ad Hoc
Group
Tracking
Endangered
Species Act
Compliance
Elements
Project Bank
queries
Summary
report of
projects by
reach
MRGESCP
participation
tracking
report
Report on value
added science
support from
activities for ESA
compliance

Please let us know your reporting needs

What types of queries/reports do you need?

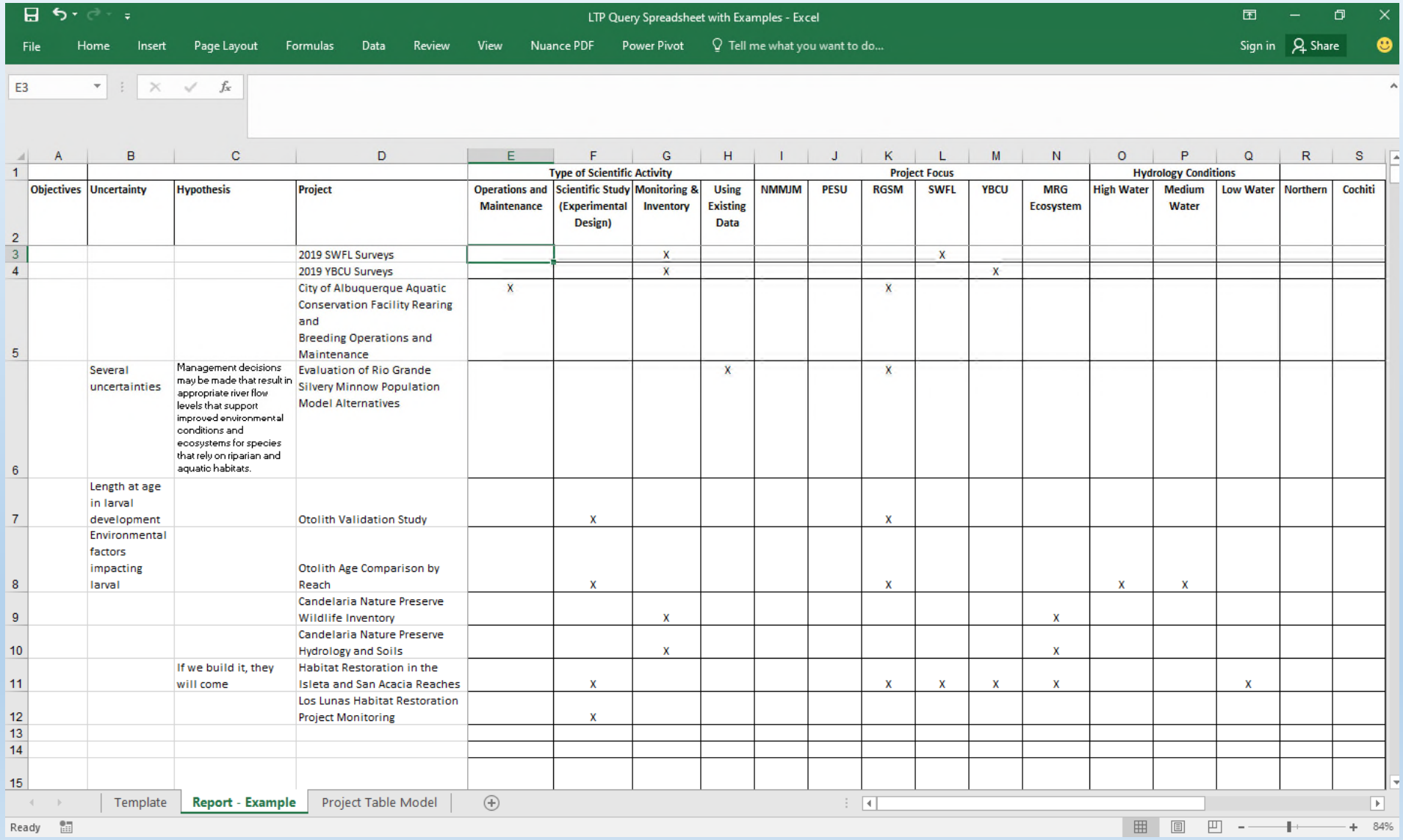
- Scientific
- Administrative
- Quickly summarize information for grant applications or presentations
- Others?

Which data fields should be included?

What sort filters you would like to enable (species, reach, year, agency, etc.)?

How would you like your report formatted (table, list, graphic)?

Example of report: Long-Term Plan



LTP Query Spreadsheet with Examples - Excel

File Home Insert Page Layout Formulas Data Review View Nuance PDF Power Pivot Tell me what you want to do... Sign in Share

E3

					Type of Scientific Activity						Project Focus						Hydrology Conditions		
Objectives	Uncertainty	Hypothesis	Project	Operations and Maintenance	Scientific Study (Experimental Design)	Monitoring & Inventory	Using Existing Data	NMMJM	PESU	RGSM	SWFL	YBCU	MRG Ecosystem	High Water	Medium Water	Low Water	Northern	Cochiti
			2019 SWFL Surveys			X					X							
			2019 YBCU Surveys			X						X						
			City of Albuquerque Aquatic Conservation Facility Rearing and Breeding Operations and Maintenance	X						X								
	Several uncertainties	Management decisions may be made that result in appropriate river flow levels that support improved environmental conditions and ecosystems for species that rely on riparian and aquatic habitats.	Evaluation of Rio Grande Silvery Minnow Population Model Alternatives				X			X								
	Length at age in larval development		Otolith Validation Study		X					X								
	Environmental factors impacting larval		Otolith Age Comparison by Reach		X					X				X	X			
			Candelaria Nature Preserve Wildlife Inventory			X							X					
			Candelaria Nature Preserve Hydrology and Soils			X							X					
		If we build it, they will come	Habitat Restoration in the Isleta and San Acacia Reaches		X					X	X	X	X			X		
			Los Lunas Habitat Restoration Project Monitoring		X													

Template | Report - Example | Project Table Model

Ready 84%

Adaptive Management Relational Database FAQ

- Who is developing the AM Relational Database (AMRDB)?

  The WEST Program Support Team (PST) is building the AMRDB and establishing the functional linkages that make it relational. Linkages can be reviewed and modified by Administrative and Technical Ad Hoc Groups.

- On what platform is the AMRDB being developed?

  Initially, the AMRDB is being formatted using MS Office (for convenience). Once formatting is complete, it can be transitioned to a SQL server (for stability).

- Who will manage and host the AMRDB?

  During development, the PST will manage and host the AMRDB. Once established, the Collaborative Program can decide between the Program Portal or a cloud-based hosting service. Scoping for these and additional options can be provided by WEST.

Program Portal

Presentation

Debbie Lee, Program Manager

Executive Committee Meeting

March 25, 2021

https://webapps.usgs.gov/MRGESCP/

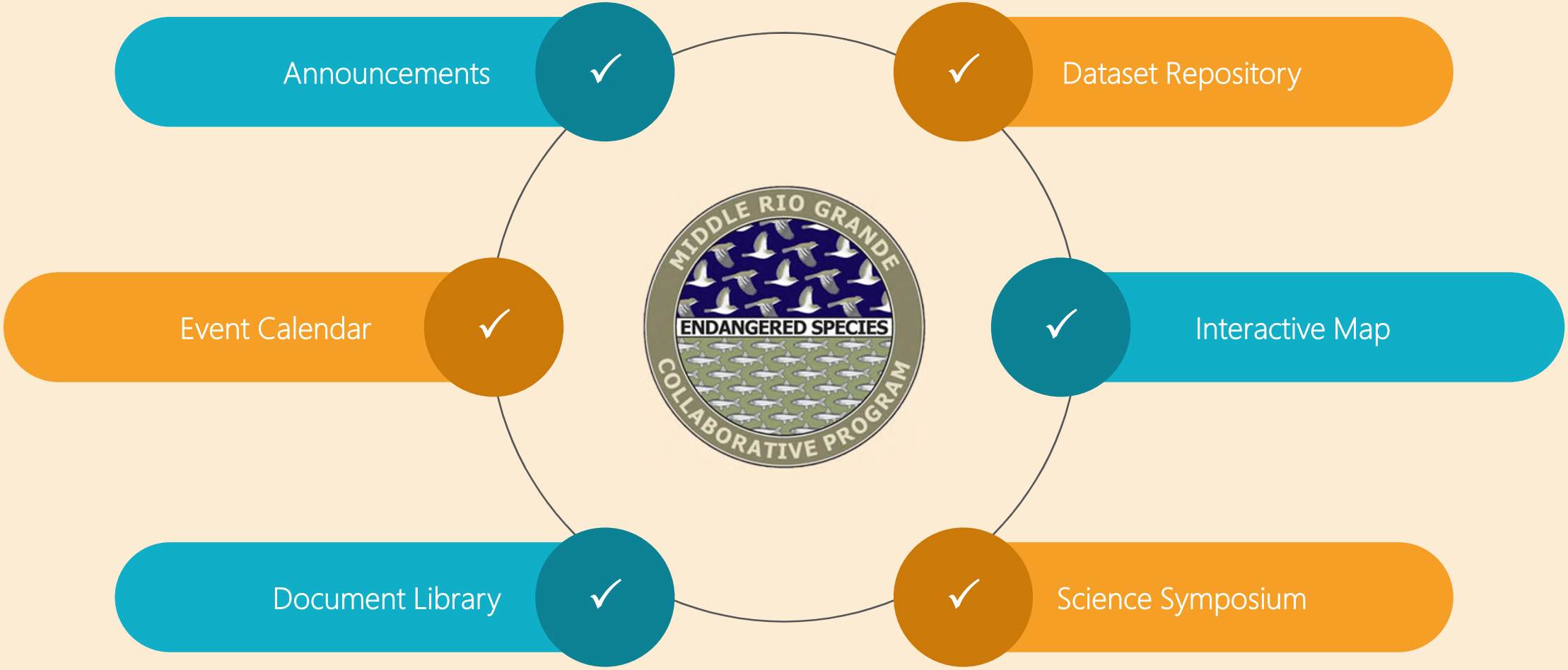
https://webapps.usgs.gov/MRGESCP



Development Summary

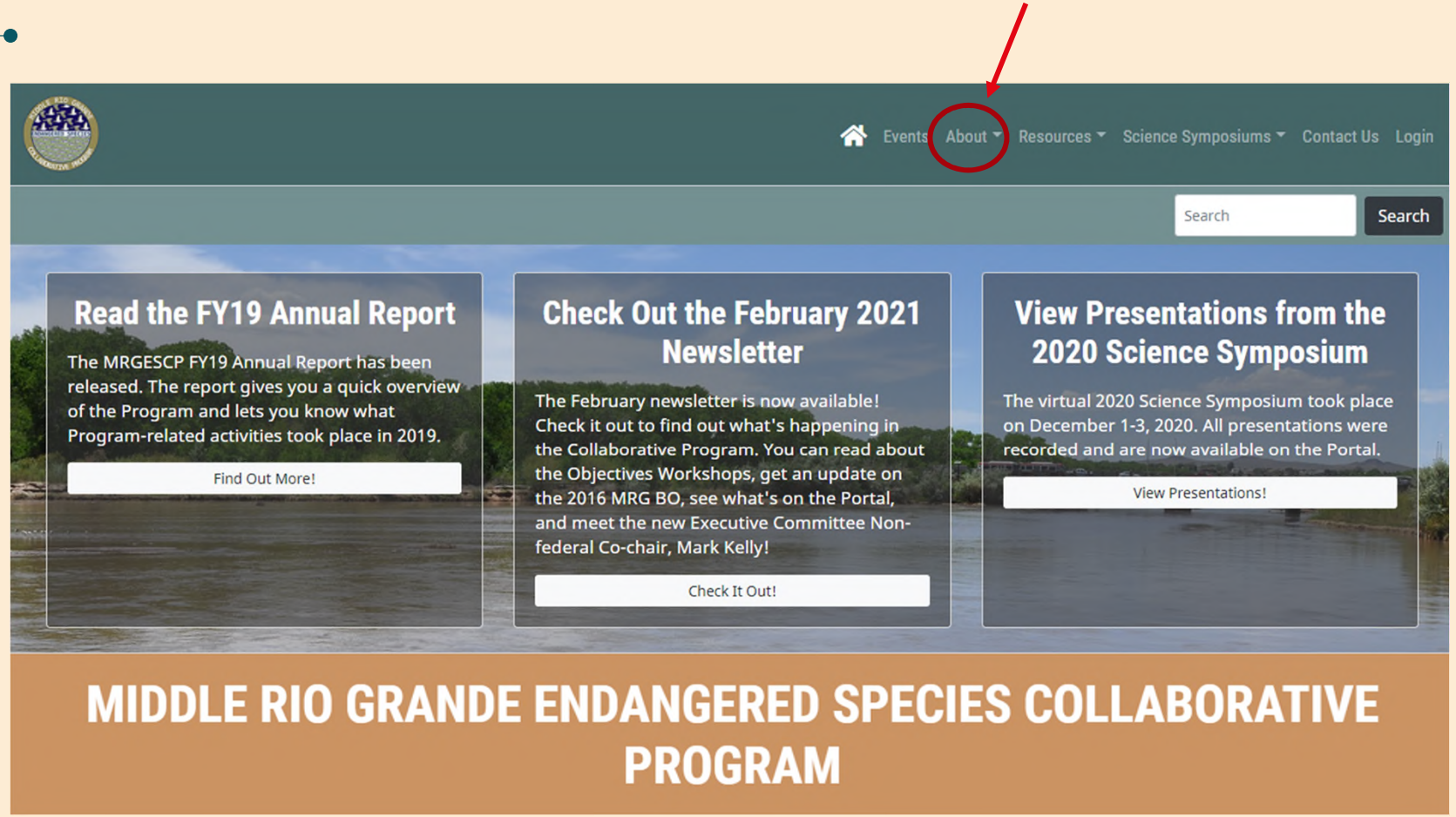
- Previous DBMS contract ended in 2017
- December 2017: The Executive Committee requested the U.S. Army Corps of Engineers (USACE) contract development of a new Program website with the U.S. Geological Survey (USGS)
- April 2018: Beta site launched
- May 2018: User survey sent
- May 2018: Program scoping meeting
- October 2018: Program data protocol meeting
- December 2019: Program Portal site launched
- December 2020: Interactive map launched
- January 2021: USACE funding ended

Portal Features



Program Portal Front Page

- Navigation menu
- Search bar
- Announcements
- Mission
- Upcoming Events
- Recent Publications
- Species of Interest



About

- Basic Collaborative Program information
  - Background
  - Program area
  - Signatory list
  - Mission and Goals
  - Organizational structure
- Information about the species of interest
- Standing Collaborative Program committees
  - Executive Committee
  - Science & Adaptive Management Committee
  - Fiscal Planning Committee

Event Calendar

- Time and Location
- Host
- Read ahead documents



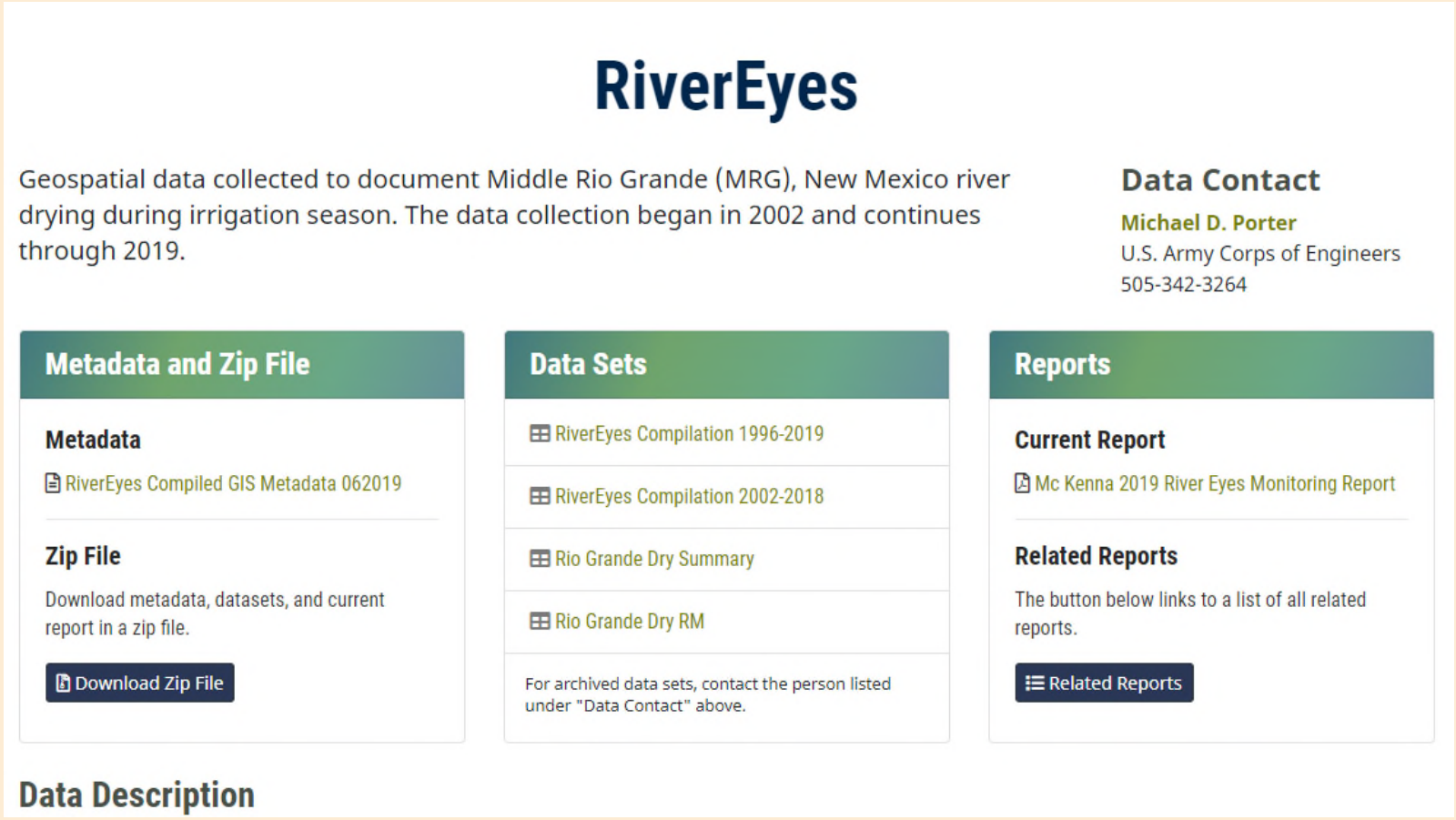
Document Library

- Under “Resources”
- Search by keyword
- Filter by:
  - Date
  - Document Type
  - Species
  - Group
  - Organization



Dataset Repository

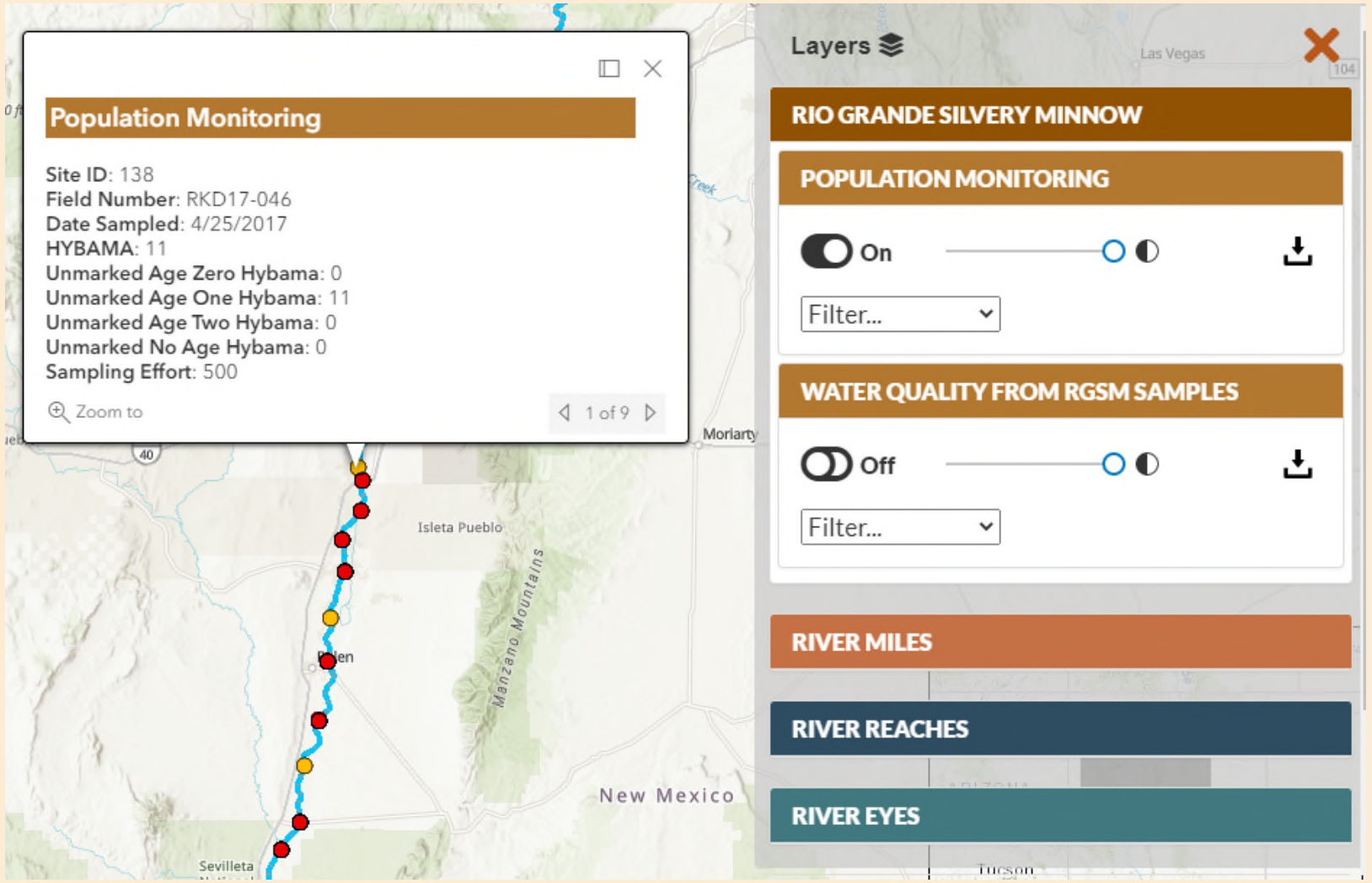
- Under “Resources”
- Current datasets:
  - River reaches
  - River miles
  - RioRestore
  - RGSM rescue
  - Vegetation
  - RGSM monitoring
  - RiverEyes



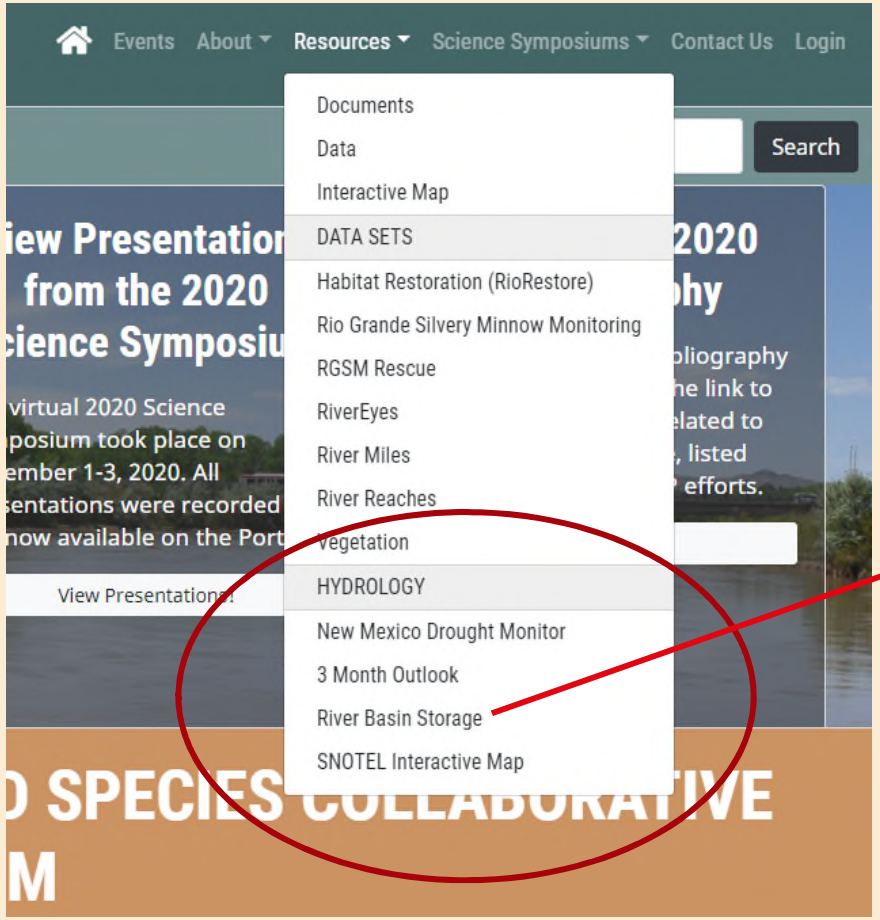
Interactive Map

- Under “Resources”
- Layers:
  - River miles
  - River reaches
  - RGSM data
  - RiverEyes
  - Habitat restoration
  - Hink & Ohmart

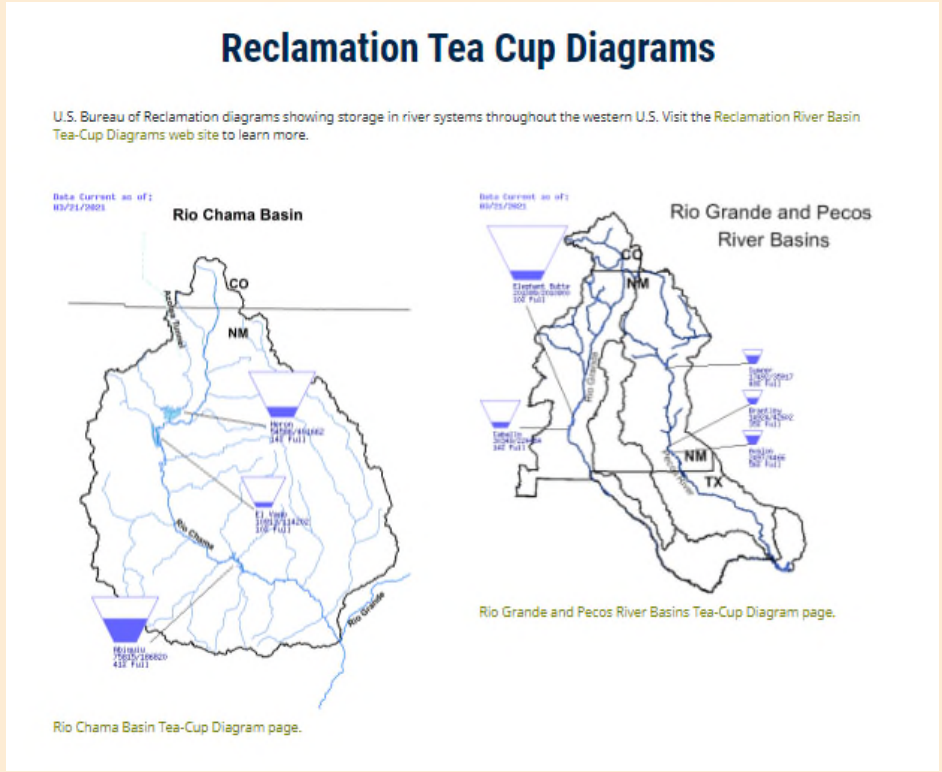
Adding new layers or updating existing layers is additional development



Hydrology Resources



Pulls from the most current hydrology information with links



Science Symposium

- Archives 2019 and 2020 agenda, abstracts, and presentations
  - Embedded YouTube videos

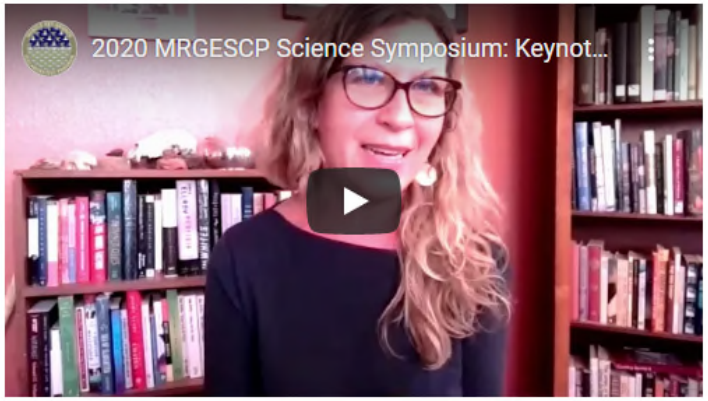


Click on presentation titles to view abstracts, download presentations, or watch presentation recordings.

11:30 – 12:00	Keynote Speaker – Laura Paskus	Moderated By: Debbie Lee

Keynote Speaker – Laura Paskus

Laura Paskus, New Mexico PBS



Program Portal Next Steps

- Albuquerque-Bernalillo County Water Utility Authority will be funding basic maintenance for at least the next year
- Any future development will require additional funding
  - New functionality
  - Updates or new layers to the interactive map
- Program Support Team (PST) will continue uploading documents, updating datasets, and maintaining the event calendar
- Report any bugs with the Program Portal to the PST

➢Investigate options for future Program Portal funding

Acknowledgements

USGS Development Team

- Toby Welborn
- Shannon Watermolen
- Florence Thompson
- Chad Fanguy
- Lauren Sherson
- Daniel Pearson
- Justin Robertson

MRGESCP Coordination

- Lynette Giesen, USACE
- Mick Porter, USACE
- Ashlee Rudolph, Reclamation
- Grace Haggerty, NMISC
- Program Support Team


Questions?

MRGESCP 2021 Science Planning Objectives
Presented for Executive Committee review on 25 March 2021

Below is a list of MRGESCP science planning objective statements drafted at the February 10-11, 2021 Science Objectives Workshops and revised by the Science and Adaptive Management Committee (SAMC). A list of workshop attendees for each day is provided on the last page. The science objective statements are presented to the Executive Committee (EC) for review and comment by April 9, 2021. The final revision will inform SAMC-recommended updates to the EC-approved Science and Adaptive Management Plan, Adaptive Management Relational Database, and Long-Term Plan for the MRGESCP.

RGSM Objective A-1

Revised statement:
Estimate the abundance of augmented and wild born RGSM populations in the Angostura, Isleta, and San Acacia reaches from year to year.

RGSM Objective A-2

Revised statement:
Increase understanding of how the life history traits of the RGSM change over time and space, to better inform management of the species and increase the probability of recovery.

RGSM Objective A-3

Revised statement:
Determine the relationships between base flow and survival and recruitment of RGSM in the Middle Rio Grande.

RGSM Objective A-4

Revised statement:
Determine suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph) needed to cue spawning and recruitment for the RGSM population, given system constraints and opportunities.

RGSM Objective A-5

Revised statements:

A-5.1) Refine existing research and modeling efforts to understand the quantity and quality of habitat available at different flow regimes.

A-5.2) Develop a range of options for increasing habitat availability and refugia at life stage-limiting flow regimes for all life stages.

RGSM Objective A-6

Proposed statements:

A-6.1) **Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM genetic diversity.**

A-6.2) **Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM population viability.**

SWFL Objective B-1

Revised statement:

Monitor for SWFL in the MRG management unit of the Rio Grande recovery unit.

SWFL Objective B-2

Revised statement:

Determine habitat availability for SWFL within the MRG.

SWFL Objective B-3

Revised statements:

B-3.1) Characterize optimal breeding habitat conditions in currently occupied SWFL locations to inform restoration.

B-3.2) Manage successional processes that maintain existing SWFL breeding habitat in the Program Area.

B-3.3) Expand SWFL breeding habitat through restoration efforts in the Program Area.

YBCU Objective C-1

Revised statements:

C-1.1) Characterize optimal habitat (i.e., foraging and nesting) conditions on landscape and microhabitat levels in currently occupied YBCU locations to inform habitat mapping and restoration efforts.

C-1.2) Determine successional processes that promote optimal YBCU habitat (i.e., foraging and nesting) in the Program Area.

C-1.3) Expand monitoring efforts for YBCU.

NMMJM Objective D-1

Revised statements:

D-1.1) Initiate and support NMMJM monitoring efforts to locate existing populations, identify relevant habitat features, and identify potentially suitable unoccupied habitat..

D-1.2) Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

PESU Objective E-1

Revised statements:

E-1.1) Continue and expand monitoring and surveying for PESU stands in the West-Central New Mexico Recovery Region.

E-1.2) Preserve and expand existing habitat stands in the West-Central New Mexico Recovery Region.

OTHER Objective F-1

Revised statement:

Monitor trends in ecosystem function in the MRG for indications of decline (e.g., changes in vegetation structure and composition, population trends in other special status species, etc.).

OTHER Objective G-1

Revised statement:
Support efforts to enhance the operational flexibility of water managers to support species.

OTHER Objective H-1

Proposed statement:
Determine the impacts from non-native vegetation on listed species' habitat availability and population dynamics.

Workshop Attendees (Day 1 - RGSM)	**Workshop Attendees (Day 2 – Avian/Other)**
Alison Hutson, NMISC	Alyssa O'Brien, City of ABQ Open Space
Alyssa O'Brien, City of ABQ Open Space	Amy Erickson, Audubon Southwest
Andy Dean, USFWS ES Office	Andy Dean, USFWS ES Office
Anne Marken, MRGCD	Ari Posner, USBR
Ara Winter, BEMP	Casey Ish, MRGCD Conservation Program
Ari Posner, USBR	Dave Moore, USBR Technical Service Center
Ashlee Rudolph, USBR	Debra Hill, USFWS
Carolyn Donnelly, USBR	Eric Gonzales, USBR
Casey Ish, MRGCD Conservation Program	Grace Haggerty, NMISC
Charles Yackulic, USGS	Hector Garcia, USBR
Cynthia Naha, Santo Domingo Pueblo	Jenny Davis, USFWS
Dale Strickland, WEST, Inc.	Lawrence Abeita, BIA
Debra Hill, USFWS	Liza Yazzie, Realty Specialist, USBR
Eric Gonzales, USBR	Mark Kelly, ABCWUA
Grace Haggerty, NMISC	Maya Pinon, Rep. Deb Haaland--NM01
Guilherme Dias, UNM Department of Biology	Meaghan Conway, NMDGF
Hector Garcia, USBR	Megan Friggens, USFS Rocky Mountain
Liza Yazzie, Realty Specialist, USBR	Mo Hobbs, ABCWUA
Mark Kelly, ABCWUA	Ondrea Hummel, Tetra Tech
Maya Pinon, Rep. Deb Haaland--NM01	Ryan Gronewold, USACE
Meaghan Conway, NMDGF	Trevor Birt, NMISC
Megan Osborne, UNM	*Catherine Murphy, PST*
Mick Porter, USACE	*Debbie Lee, PST*
Mike Marcus, MRG Water Advocates Board	*Melissa Welsch, PST*
Mo Hobbs, ABCWUA	*Michelle Tuineau, PST*
Nate Caswell, USFWS New Mexico FWCO	
Nathan Schroeder, Pueblo of Santa Ana	
Quantina Martine, Audubon Southwest	
Reynalden Delgarito, USACE	
Rich Valdez, SWCA, representing NMISC	
Ryan Gronewold, USACE	
Steve Zipper, SWCA	
Thomas Archdeacon, USFWS-NMFWCO	
Catherine Murphy, PST	
Debbie Lee, PST	
Julie Dickey, PST	
Melissa Welsch, PST	
Michelle Tuineau, PST	

A Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) activity is defined as a signatory activity that:

(1) Contributes to MRGESCP operations, including:
    - Active participation in MRGESCP committees and ad hoc groups, and
    - Administrative support of the MRGESCP.

(2) Advances the scientific contribution of the MRGESCP, including:
    - Reducing a scientific uncertainty by addressing one or more MRGESCP objectives in the Long-Term Plan,
    - Providing findings for incorporation into the MRGESCP's science and adaptive management tools (e.g., Adaptive Management Relational Database, conceptual ecological models, etc.),
    - Contributing to the collective body of knowledge about the listed species in the Middle Rio Grande, and
    - Informing the MRGESCP's recommendations on future scientific activities and/or management actions.

Executive Committee Meeting

July 28, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *MRGESCP 2021 Science Objectives [read-ahead, draft]*
- *MRGESCP FY20 Annual Report [read-ahead, draft]*
- *MOA Admin Ad Hoc Group Charge [read-ahead, draft]*
- *Proposal for Signatory Contributions [read-ahead, draft]*
- *Revised 2021 MRGESCP By-Laws [read-ahead, draft]*
- *Summary of Revisions to the By-Laws [read-ahead]*
- *2012 MRGESCP By-Laws [read-ahead, not included]*
- *Status Report of the PMWG: Review of the MRG Fish Monitoring Program [read-ahead, not included]*
- *SAMC Memo on the PMWG Summary Report [read-ahead]*
- *HR Workshop Proposal [read-ahead]*
- *Annual MRGESCP Evaluation [presentation]*
- *MRGESCP Annual Report: Proposed New Format [presentation]*
- *Status Report of the PMWG: Review of the MRG Fish Monitoring Program [presentation]*
- *SAMC Memo to the EC on Recommended Next Steps for PMWG Summary Report Findings [presentation]*
- *Approved Proposal for Signatory Contributions [follow-up]*
- *Approved 2021 MRGESCP By-Laws [follow-up, not included]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Executive Committee (EC) Meeting
July 28, 2021
9:00 AM – 12:00 PM

Location: Zoom Meeting
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Call-In: +1-669-900-6833
Meeting ID: 898-359-3120; Passcode: 1251

Meeting Agenda

Meeting Objectives:

- *Approve the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) 2021 Science Objectives.*
- *Approve the Fiscal Year 2020 (FY20) Annual Report.*
- *Hear and discuss a proposed process to undertake an annual MRGESCP evaluation.*
- *Approve forming an Administrative Ad Hoc Group to draft a new MRGESCP Memorandum of Agreement (MOA).*
- *Approve a proposal for signatory contributions.*
- *Approve a new annual report format for 2021 and beyond.*
- *Approve the new MRGESCP By-Laws.*
- *Approve the Science and Adaptive Management Committee (SAMC)'s recommended next steps regarding the findings from the Population Monitoring Work Group (PMWG).*
- *Approve holding a workshop focused on demonstrating habitat restoration effectiveness.*

9:00 – 9:05	**Welcome, Introductions, Agenda Review**
	• Ground rules for Zoom meeting
	• New EC members:
	  o Katrina Grantz, U.S. Bureau of Reclamation, Federal Co-Chair
	  o Yasmeen Najmi, Middle Rio Grande Conservancy District (alternate)
	  o Ryan Gronewold, U.S. Army Corps of Engineers (alternate)
	✓ **Decision**: Approval of July 28, 2021 EC meeting agenda
		EC Co-chairs

9:05 – 9:10	**March 2021 Meeting Summary** • Action items review ✓ **Decision**: Approval of March 25, 2021 EC meeting minutes Read ahead: ☐ March 25, 2020 EC meeting minutes	*EC Co-chairs*

9:10 – 9:25	**Program Manager Update**
	• Administrative announcement:
	  o June newsletter
	  o 2021 MRGESCP Work Plan update
	  o MOA addendum
	• FY20 Annual Report
	• SAMC update
	  o Science Objectives
		Debbie Lee, Program Support Team (PST)
		
		Catherine Murphy, PST

- ✓ **Decision**: Approval of FY20 Annual Report
- ✓ **Decision**: Approval of MRGESCP 2021 Science Objectives

Read-aheads:
- ☐ Draft MRGESCP 2021 Science Objectives
- ☐ Draft MRGESCP FY20 Annual Report

9:25 – 9:35 **Annual Collaborative Program Evaluation** *Debbie Lee, PST*

- Proposed evaluation process

- ➢ **Action Item**: The EC will provide preliminary comments on the proposed process
- ➢ **Action Item**: The PST will finalize the process for the October EC meeting

9:35 – 9:40 **2022 Memorandum of Agreement** *Debbie Lee, PST*

- ✓ **Decision**: Approve an administrative ad hoc group to draft a new MOA for EC review

Read ahead:
- ☐ Draft MOA Administrative Ad Hoc Group charge

9:40 – 10:10 **Proposal for Signatory Contributions** *Facilitated Discussion*

- Categories of signatory contributions
- Impacts on annual report, Adaptive Management Relational Database (AMRDB), and Long-Term Plan

- ✓ **Decision**: Approve proposal to compile information on signatory contributions

Read ahead:
- ☐ Proposal for Signatory Contributions

10:10 – 10:20 **Proposed New Annual Report Format** *Julie Dickey, PST*

- ✓ **Decision**: Approve new MRGESCP Annual Report format
- ➢ **Action Item**: The PST will use the new format to complete a 2021 Annual Report

10:20 – 10:30 **Break**

10:30 – 10:55 **Revised MRGESCP By-Laws** *Debbie Lee, PST*

- ✓ **Decision**: Approve revised MRGESCP By-Laws
- ➢ **Action Item**: The By-Laws Administrative Ad Hoc Group will revise the section regarding the annual MRGESCP evaluation for EC review and approval
- ➢ **Action Item**: The PST will revise the appropriate committee charters to reflect the changes in the approved By-Laws

Read aheads:
- ☐ Draft revised By-Laws
- ☐ Summary of revisions to the By-Laws
- ☐ 2012 By-Laws *(for reference)*

10:55 – 11:25 **Population Monitoring Work Group Summary Report Science & Technical Ad Hoc Group** *Rich Valdez, SWCA Environmental Consultants*

Catherine Murphy, PST

- Findings from the PMWG Summary Report
- Recommended next steps from the SAMC

- ✓ **Decision**: Approve the next step recommendations from the SAMC

Read aheads:
- ☐ PMWG Summary Report
- ☐ SAMC memo

11:25 – 11:35	**Adaptive Management Relational Database Update** • Documenting adaptive management in the AMRDB ➢ **Action Item**: The PST will incorporate the findings from the PMWG summary report into the AMRDB	*Catherine Murphy, PST*
11:35 – 11:45	**Habitat Restoration (HR) Workshop** ✓ **Decision**: Approve a SAMC-hosted habitat restoration workshop in August/September ➢ **Action Item**: The PST will schedule the HR workshop ➢ **Action Item**: The PST will send out a pre-workshop questionnaire Read ahead: ☐ HR Workshop Proposal	*Catherine Murphy, PST*
11:45 – 11:50	**Program and Science Support (PASS) Contract**	*Jennifer Faler, Bureau of Reclamation*
11:50 – 11:55	**Announcements and Public Comment**	
11:55 – 12:00	**Meeting Summary and Action Items Review** ➢ Next EC Meeting: October 2021	*EC Co-chairs*
12:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Executive Committee (EC)
Meeting Minutes

July 28, 2021; 9:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of the July 28, 2021 EC meeting agenda with amendments
- ✓ Approval of the March 25, 2021 EC meeting minutes with amendments
- ✓ Approval of the Fiscal Year 2020 (FY20) Annual Report
- ✓ Approval of the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) 2021 Science Objectives
- ✓ Approval of the 2022 Memorandum of Agreement (MOA) Administrative (Admin) Ad Hoc Group Charge to draft a new MRGESCP MOA for EC and individual signatory review
- ✓ Approval of the proposal to compile information on signatory contributions
- ✓ Approval of a new MRGESCP annual report format
- ✓ Approval of the revised MRGESCP By-laws
- ✓ Approval of the Science and Adaptive Management Committee (SAMC)'s next step recommendations for the Population Monitoring Work Group (PMWG) findings
- ✓ Approval of a SAMC-hosted Habitat Restoration Workshop in August/September

Announcements:

- ❖ Katrina Grantz, U.S. Bureau of Reclamation (Reclamation), replaced Wayne Pullan as the EC Federal Co-chair.
- ❖ Anne Marken replaced Dave Gensler as the Middle Rio Grande Conservancy District (MRGCD) EC representative. Yasmeen Najmi replaced Anne M. as the alternate MRGCD EC representative.
- ❖ Ryan Gronewold replaced Lynette Giesen as the alternate U.S. Army Corps of Engineers (USACE) EC representative. Danielle Galloway replaced Lynette G. as the USACE Program Manager for the MRGESCP. She will serve a 120-day detail in that role.
- ❖ Lynette G. has joined Reclamation and will be the new contract officer representative (COR) for the Program and Science Support (PASS) contract.
- ❖ USACE is included in the FY22 President's Budget and will receive $1.94 million. Funds will not be available until April 2022 at the earliest.
- ❖ USACE will resume funding for the Bosque Ecosystem Monitoring Program (BEMP) in FY22. In FY21, BEMP dropped 6-7 monitoring sites, but most others will be maintained.
- ❖ The Assessment Payers Association of the MRGCD (APA) missed three consecutive EC meetings and did not respond to an official notice of potential membership termination. Per the MRGESCP By-Laws, APA is no longer a signatory member of the MRGESCP as of the July 28, 2021 EC meeting.

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Send out a calendar invite for the October 27, 2021 EC meeting	7/28/2021
PST	Follow up with Pueblo of Isleta on signing the Addendum to the 2008 MOA	8/13/2021
All Program Portal users	Complete the July Collaborative Poll located on the Program Portal to give feedback about the Program Portal	8/16/2021
EC Co-chairs and PST	Notify the APA of membership termination	8/16/2021
MRGESCP Signatories	Suggest topics of interest for Collaborative Seminars to the PST	8/31/2021
EC	Provide comments on the proposed annual MRGESCP evaluation process	8/31/2021
PST	Finalize the annual MRGESCP evaluation process proposal for review at the October EC meeting	10/20/2021
EC	Suggest additional members for the 2022 MOA Admin Ad Hoc Group to the PST	8/6/2021
PST	Follow up with MRGCD on adding a member to the 2022 MOA Admin Ad Hoc Group	8/6/2021
PST	Convene the 2022 MOA Admin Ad Hoc Group to draft a new MRGESCP MOA	8/31/2021
PST	Distribute the revised proposal for signatory contributions	7/30/2021
PST	Distribute Reclamation's opinion memo on cost share	8/16/2021
EC	Provide comments on the new format for the MRGESCP annual report	8/31/2021
PST	Finalize the approved MRGESCP By-laws and post them on the Program Portal	7/30/2021
PST	Revise the Fiscal Planning Committee (FPC) and SAMC committee charters to reflect the changes in the approved By-Laws	10/20/2021
By-laws Admin Ad Hoc Group	Revise the section regarding annual MRGESCP evaluation in the By-Laws for EC review	10/20/2021
PST	Incorporate the findings from the PMWG summary report into the Science and Adaptive Management Information System (SAMIS)	8/26/2021
MRGESCP Signatories	Suggest people to include in the list of participants for the Habitat Restoration (HR) Workshop	8/16/2021
PST & SAMC	Send out the Pre-HR Workshop Questionnaire	8/16/2021
PST	Schedule the HR Workshop	8/30/2021

Next Meeting: October 27, 2021; 9:00 AM – 12:00 PM

Meeting Minutes

Welcome, Introductions, Agenda Review

Mark Kelly, Albuquerque Bernalillo County Water Utility Authority (ABCWUA), and Non-Federal Co-Chair, opened the meeting and led introductions. Mark K. reminded the group that EC meetings are public record and all meeting minutes are stored on the Program Portal. The following new members of the EC were introduced: Katrina Grantz (Reclamation, Federal Co-Chair), Yasmeen Najmi (MRGCD, alternate), and Ryan Gronewold (USACE, alternate). Ryan G. replaced Lynette Giesen, who joined Reclamation and will serve as the new COR for the PASS contract.

Debbie Lee, Program Manager with the PST, reviewed the July 28, 2021 agenda and noted the following amendments: the EC will not approve the proposed process for annual program evaluation and the PASS contract update will be given by Jennifer Faler instead of Ashlee Rudolph, Reclamation.

- ✓ **Decision**: Approval of the July 28, 2021 meeting agenda with amendments

March 2021 Meeting Summary

Debbie L. reviewed the March 25, 2021 meeting minutes and action items. Ryan G. made the following amendment to the hydrology and announcements sections: cost share for the Sandia Pueblo to Isleta Pueblo Ecosystem Restoration project is 65% federal/35% non-federal. Ryan G. announced USACE's Collaborative Program funding is included in the FY22 President's Budget for $1.94 million. USACE will resume funding for BEMP in FY22. Danielle Galloway will replace Lynette G. as the USACE Program Manager for the MRGESCP and serve for the next 120 days.

- ✓ **Decision**: Approval of the March 25, 2021 EC meeting minutes with amendments
- ➢ **Action Item**: The PST will follow up with Pueblo of Isleta on signing the Addendum to the 2008 MOA

Program Manager Update

Debbie L. gave the Program Manager update. Summary points are below:

- The June newsletter is available on the Program Portal.
- The MRGESCP is hosting Collaborative Seminars around specific topics (e.g., research papers, restoration projects, innovations, etc.). Each seminar presentation will be followed by a Q&A session. The first will be presented on August 24, 2021 by Rob Dudley, American Southwest Ichthyological Researchers and Museum of Southwestern Biology (Fishes), UNM, regarding the 2020 Rio Grande silvery minnow (RGSM) Population Monitoring Program. Everyone is invited to contact the PST to set up a seminar on a project or topic of their choice. Student seminars are encouraged.
- The MRGESCP will host an HR Workshop.
- Polls will be regularly posted to the Program Portal to garner input from MRGESCP participants. Results from the first poll, regarding HR, are in the June newsletter. The July poll, regarding feedback on the Program Portal, was posted to the Program Portal.
- The MRGESCP is asking signatories for collaborative opportunities to highlight in the newsletter.
- The MRGESCP is on track to complete the 2021 Work Plan.
- The 2021 Addendum to the 2008 MOA was signed and will be implemented through May 2022.
- A final draft of the FY20 Annual Report was prepared and sent to the EC.

- ✓ **Decision**: Approval of the Fiscal Year 2020 (FY20) Annual Report
- ➢ **Action Item**: All Program Portal users will complete the July Collaborative Poll located on the Program Portal to give feedback about the Program Portal
- ➢ **Action Item**: MRGESCP signatories will suggest topics of interest for Collaborative Seminars to the PST

Catherine Murphy, Science Coordinator with the PST, gave a SAMC update. Summary points are below:

- The SAMC moved from monthly to bi-monthly meetings with interim one-on-one meetings between PST and SAMC members.
- The RGSM Population Monitoring Summary Report Ad Hoc will conclude with a presentation to the EC by the group lead, Rich Valdez, SWCA Environmental Consultants. The group is the first Science & Technical (S&T) Ad Hoc Group to wrap up.
- Charles Yackulic, U.S. Geological Survey, is making progress on the RGSM Population Modeling Ad Hoc. His contract to develop the model with New Mexico Interstate Stream Commission will be renewed, and he will be working on a report with the ad hoc group.
- The RGSM Conceptual Ecological Model (CEM)/Genetics Ad Hoc is adding components to the CEM to incorporate the propagation and augmentation program.
- The Avian CEM Refinement Ad Hoc is adding elements to the Southwestern willow flycatcher (SWFL) and Yellow-billed cuckoo (YBCU) CEMs and characterizing uncertainties in the CEMs.
- The draft 2021 Science Objectives were previously discussed at the March 2021 EC meeting. The Science Objectives form a bridge between MRGESCP goals and the science activities it supports. The Science Objectives will be revisited, as needed, each year. There was one revision to the 2021 Science Objectives since the March meeting: Objective H was wrapped into Objective F, so that each objective addresses a goal.

- ✓ **Decision**: Approval of the 2021 Science Objectives

Annual Collaborative Program Evaluation

Debbie L. discussed the annual Collaborative Program evaluation (see presentation). Summary points are below:

- The Science & Adaptive Management (S&AM) Plan includes an annual MRGESCP evaluation. The objectives of the annual Collaborative Program evaluation are to provide an administrative review, to assess the relevance of the guiding principles, to inform updates to plans, tools, and processes, and to identify areas for improvement.
- The process is integral to adaptive management (AM) of the MRGESCP.
- The PST will use feedback from the EC to revise the draft evaluation process. At the October meeting, the PST will present a more detailed proposal for approval. Between October and December, the process will be implemented.
- Implementation of the evaluation could be more frequent than annually, if the EC determines there is a need. The process will align with development of the next year's work plan and updates to the S&AM Plan. The PST will coordinate the effort.

- ➢ **Action Item**: The EC will provide comments on the proposed annual MRGESCP evaluation process
- ➢ **Action Item**: The PST will finalize the annual MRGESCP evaluation process proposal for review at the October EC meeting

2022 Memorandum of Agreement

Debbie L. discussed development of the 2022 MRGESCP MOA. Summary points are below:

- The Addendum to the 2008 MOA is in effect until May 2022, after which a new MOA is needed.
- A draft charge for the 2022 MOA Admin Ad Hoc Group, including proposed members, was included in the read-ahead materials.
- The draft 2022 MOA will be completed by the December 2021 EC meeting. After a review period and revisions, it will be up for approval at the March 2022 EC meeting. The PST will work to get signatures through the spring.
- All proposed members have agreed to join the group. EC members are invited to email the PST suggestions for additional members. The PST will follow up with MRGCD to add a potential member to the group.

✓ **Decision**: Approval of the 2022 MOA Admin Ad Hoc Group Charge to draft a new MRGESCP MOA for EC and individual signatory review

➢ **Action Item**: The EC will suggest additional members for the 2022 MOA Admin Ad Hoc Group to the PST

➢ **Action Item**: The PST will follow up with MRGCD on adding a member to the 2022 MOA Admin Ad Hoc Group

➢ **Action Item**: The PST will convene the 2022 MOA Admin Ad Hoc Group to draft a new MRGESCP MOA

Proposal for Signatory Contributions

Debbie L. presented a proposal for signatory contributions. Summary points are below:

- At the March 2021 EC meeting, the group discussed a proposal for defining a *Program Activity*. The Fiscal Planning Committee was directed to roll the topic into their discussion on reframing cost share. The EC asked that cost share be more useful, less onerous, and tell the story of the MRGESCP. The FPC developed the idea of *Signatory Contributions*, which is described in the proposal.
- Signatory contributions can be either administrative (e.g., sitting on committees and ad hoc groups, workshop participation, etc.) or scientific (i.e., findings/results of signatory activities).
- All signatory activities are divided into five categories: Program Management & Administration, Habitat Assessment & Modeling, Population Monitoring & Modeling, Species Management & Recovery, and Field & Laboratory Experiments.
    - These categories help determine which activities are under the purview of the MRGESCP. The MRGESCP can demonstrate progress/success in each category.
- The proposal was revised based on a suggestion to make clear that no contributions are mandatory. A statement to that effect was added.
- Since the March EC meeting, the Office of the Solicitor, U.S. Department of the Interior (DOI) has addressed and continues to verify changing cost share for the MRGESCP.
    - Reclamation made the case that the 2009 language authorizing cost share is dated because the MRGESCP evolved away from implementation of Reclamation's Biological Opinion (BO). In addition, the 2016 BO includes direct contributions from BO partners.
    - The DOI solicitor stated that requirement of cost share could be determined by Reclamation.
    - Reclamation produced a draft memo and stated there is no cost share requirement for the MRGESCP.

        - The caveat is any grants or agreements MRGESCP enters into related to BO requirements may require cost share.
    - Signatory contributions will still be collected, including cost, but not solely for the purpose of federal/non-federal cost share.
- The move to signatory contributions will impact the annual report, SAMIS, and Long-Term Plan.
    - The SAMIS will be used to share information on signatory activities and link them to scientific uncertainties, objectives, etc. to increase relevance to management priorities.
    - The end-of-the-year reports produced using the SAMIS are designed to show signatories the value added to their work within the context of the science program through membership in the MRGESCP.
    - The Long-Term Plan and annual report will also utilize the categories and linkages in the SAMIS.

✓ **Decision**: Approval of the proposal to compile information on signatory contributions
➢ **Action Item**: The PST will distribute the revised proposal for signatory contributions
➢ **Action Item**: The PST will distribute Reclamation's opinion memo on cost share

Proposed New Annual Report Format

Julie Dickey, PST, discussed a proposed new format for the MRGESCP annual report (see presentation). Summary points are below:

- The annual report should be a tool for documenting MRGESCP progress, highlighting activities that work towards MRGESCP objectives, garnering support, and communicating science.
- Future annual reports would be on a calendar year basis, up to 15 pages, and highly MRGESCP-specific (goals, objectives, milestones, benefits to species, forecasting for next year).
- The 15 pages includes a title page, a letter/statement, a committee members list, MRGESCP by the numbers, milestones/accomplishments, MRGESCP outlook, and a back page.
- The new annual report would be less onerous on signatories and take less time to create (by about six months). The PST would start working on it in October, and it would be ready for approval at the March EC meeting.
- The EC is invited to comment on the proposed format, even post approval. Changes can always be incorporated.

✓ **Decision**: Approval of a new MRGESCP annual report format
➢ **Action Item**: The EC will provide comments on the new format for the MRGESCP annual report

Revised MRGESCP By-Laws

Debbie L. discussed revisions to the MRGESCP By-Laws. Summary points are below:

- The MRGESCP By-Laws have been undergoing revisions for several years.
- The By-Laws Ad Hoc Group recently reconvened to continue revisions after the MRGESCP implemented the new structure in the S&AM Plan.
- The previously approved 2012 version and the 2021 revision were included the read-aheads. A summary table of all high-level changes was also included. All changes were made to be consistent with the new S&AM Plan and Long-Term Plan, unless otherwise noted in the summary table.
- Notable Changes (not made for consistency):
    - A quorum was redefined; it was previously 50% but is now 2/3.
    - The signatory membership cap was removed; it was previously 20.

        - All memberships must be approved by unanimous consent.
    - A dispute resolution step was added if the EC cannot make a decision. If the EC cannot reach unanimous consent, it will form an Administrative Ad Hoc Group to work through the disagreement and bring recommendations to the next EC meeting. If there is no agreement at the next meeting, there will be a super majority vote.
- Two Questions from the By-Laws Ad Hoc Group for the EC:
    - 1) How will ad hoc work products be documented?
        - The PST proposes including a summary document deliverable in every ad hoc group charge and tracking every ad hoc group as a task in the SAMIS.
    - 2) How should the role of the EC to the PST be noted?
        - The By-Laws acknowledge that the PST may be a third-party contractor and roles/responsibilities may change at the direction of the EC, subject to applicable contract regulations.
        - There was a suggestion to add "requirements" in addition to "regulations." The language change is to be mindful of federal contracting rules.
- The Annual Collaborative Program Evaluation section of the By-Laws is not complete; it will be revised in the future, and the EC will vote to approve the amendment.
- The PST will revise charters for the FPC and SAMC to reflect changes in the By-Laws.

✓ **Decision**: Approval of the revised MRGESCP By-laws

➢ **Action Item**: The PST will finalize the approved MRGESCP By-laws and post them on the Program Portal

➢ **Action Item**: The PST will revise the FPC and SAMC charters to reflect the changes in the approved by-laws

➢ **Action Item**: The By-Laws Ad Hoc Group will revise the section regarding annual MRGESCP evaluation in the By-Laws for EC review

RGSM PMWG Summary Report Science & Technical Ad Hoc Group

Rich V., group lead of the Ad Hoc and former chair of the PMWG, presented on the PMWG summary report (see presentation). Summary points are below:

- The tasks of the PMWG were as follows: 1) Conduct a catch-per-unit (CPUE) workshop, 2) Review the Middle Rio Grande fish monitoring plan (FMP), and 3) Update the FMP.
- Tasks 1 and 2 were completed, and Task 3 was partially implemented. Based on the Hubert et al. (2016) findings, the PMWG recommended eight changes to Reclamation's FMP in 2017 (see section 4.1 of summary report [Valdez 2021]); all were incorporated and are still in effect today.
- The PMWG has accomplished the following: 1) holding a CPUE workshop, 2) recommendations to Reclamation's FMP, 3) consolidation of science panel recommendations, 4) analysis of FMP data, 5) providing expertise for development of RGSM integrated population model, 6) review of FMP for EC, and 7) findings and recommendations to the SAMC and EC.
- Rich V., with review from ad hoc group members, authored the PMWG summary report, which includes four findings and eight recommendations.
- The four findings (section 6.0 of summary report) are:
    1. FMP provides systematic sampling that tracks year-to-year trends in relative abundance of the RGSM, but lacks spatial and temporal resolution to evaluate species response to specific management actions.
    2. FMP provides monthly data for estimating population demographic parameters of RGSM (e.g., age, growth rate, survival, recruitment).

3. Hydrologic and geomorphic variabilities of MRG, and stochasticity of RGSM population, limit the level of precision possible for the CPUE index.
4. Complete redesign of FMP is not warranted, but refinements could improve precision of CPUE, and better represent density of RGSM in MRG.

- The eight recommendations (section 7.0 of summary report) include four studies/refinements to the FMP that may involve fieldwork and four analyses/refinements to the FMP that do not require fieldwork.

Summary points for questions/ comments/responses are below:

- RE: Summarizing wintertime support for RGSM
  - RGSM prefer slow moving water (pools) with internal cover (standing vegetation, root wads) in the fall/winter. These can be utilized in stream restoration.
- RE: The possibility of recommendations for the FMP in the future
  - SAMC will form S&T Ad Hoc Groups based on findings and recommendations from the PMWG summary report. Future recommendations for the FMP will come from these groups.
- RE: Growth rate measurements
  - Growth rates are calculated from measurements taken as part of the monthly surveys for the FMP. If temperatures are seasonal in RGSM refugia, growth rates should be similar.
- RE: If money was not an issue, what would be recommended?
  - Continue doing what is being done, but there are complexities in the system that may not be able to be overcome. These complexities can be addressed with desktop exercises and increasing the number of sampling sites.
  - The FMP cannot answer AM questions or address uncertainties. A different program is needed to evaluate specific management actions.

Catherine M. presented the SAMC memo with recommended next steps for the PMWG summary report findings and recommendations (see presentation). Summary points are below:

- The SAMC provided a memo regarding the PMWG summary report to the EC, including next steps for Task 3 of the PMWG.
- Reviews of the FMP have been undertaken regularly by the MRGESCP and others. Reviews were focused on a few generalized topics, but environmental covariates and management applications were the most important to the MRGESCP.
- The SAMC acknowledges these realities: the long-term monitoring protocol of the FMP must continue in order to track year-to-year trends, the FMP data cannot address all unresolved questions, management needs persist and evolve, and periodic evaluation and update is integral to AM.
- It is important to match the right data to questions.
  - Data from the Population Estimation Program (PEP) may be able to answer questions the FMP data cannot. Estimates were compared from the FMP and PEP. Although they were close at the time, the PEP report recommended the PEP be run again for further comparison of the estimates. The first PEP was 10 years ago.
  - Targeted studies will be needed to answer specific questions.
- The next steps recommended by the SAMC are as follows:
  1. Form S&T Ad Hoc Groups to a) translate recommendations from the PMWG summary report into specific questions and hypotheses, b) determine the appropriate data for

each hypotheses, and c) identify management-relevant questions to review as QA/QC for the FMP and PEP,
2. Survey managers on their needs and devise appropriate measures to address them,
3. Consider repeating the PEP,
4. Implement the QA/QC strategy,
5. Consider QA/QC strategies for other MRGESCP species, and
6. Form ad hoc groups to develop and scope projects.

Summary points for questions/ comments/responses are below:

- RE: AM and monitoring success of RGSM fish passages
  - The FMP does not monitor fish passage. A study would need to be proposed for that.
  - Reclamation has a movement study in which fish are tagged below San Acacia Dam and monitored to see if they are moving upstream. This a baseline for fish passage. Plans for monitoring and AM of fish passage are being formed now.
  - USACE did a fish passage study at the ABCWUA dam in the Albuquerque San Juan Chama Water Treatment Facility.
- RE: Sampling design for targeted studies
  - Sampling design would be allocated to S&T Ad Hoc Groups. The SAMC does not have a direct role in designing studies, but they may opt to contribute.
- RE: 20 years of monitoring information
  - S&T Ad Hoc Groups should be doing literature searches and reaching out to agencies to check what information is available.
  - The SAMIS will store and relate findings, so they are accessible to everyone.

✓ **Decision**: Approval of the SAMC's next step recommendations for the PMWG findings

➢ **Action Item**: The PST will incorporate the findings from the PMWG summary report into the SAMIS

Adaptive Management Relational Database Update

Catherine M. presented on the Adaptive Management Relational Database (now titled the Science and Adaptive Management Information System [SAMIS]; see SAMIS schematic in memo presentation). Summary points are below:

- The elements and pathways in the SAMIS have been discussed as part of the next steps for the PMWG findings. These include the guiding principles pathway (goals, science objectives, and science strategies), the research pathway (CEMs, critical uncertainties, and hypotheses), the independent science panel recommendations, and the AM pathway (project findings, management recommendations, and management actions).
- The MRGESCP will provide recommendations to action agencies and, if implemented, will document the results. Action agencies will be able to show they are taking part in AM through participation in the MRGESCP. This gives credit and adds value to activities taking place.

Habitat Restoration (HR) Workshop

Catherine M. discussed the proposed HR Workshop. Summary points are below:

- The SAMC proposed holding a workshop focused on HR in late August/September. This was in response to a series of questions from MRGESCP participants regarding HR, including how to maximize return on investment with a new HR project, defining achievable restoration goals, and how to demonstrate success through monitoring.

- The HR Workshop will bring together those working on different aspects of HR to discuss defining goals and success.
- If an agency is working on a species-focused HR project for years, there may be additional variables it can add to the monitoring protocol that can show incremental success.
- Outside of restoration targets, there are ancillary benefits from HR that should be documented (e.g., creating recreation areas and green spaces, removing invasive species).
- Monitoring is data collection, and the sampling design should be able to demonstrate direct effects from the restoration activity.
- The HR Workshop will not cover specific projects but will focus on general resources and guidance for HR from start to finish.

✓ **Decision**: Approval of a SAMC-hosted Habitat Restoration Workshop in August/September
➢ **Action Item**: MRGESCP signatories will suggest people to include in the list of participant for the HR Workshop
➢ **Action Item**: The PST will send out the Pre-HR Workshop Questionnaire
➢ **Action Item**: The PST will schedule the HR Workshop

Program and Science Support (PASS) Contract

Jennifer Faler, Reclamation, discussed the PASS contract. Summary points are below:

- Reclamation finalized the 6-month (October 2021 through March 2022) extension to the PASS contract with Western EcoSystems Technology, Inc. (WEST).
- Reclamation is working on an RFP for a new PASS contract and targeting a late December/early January award.
- There is time in the 6-month extension for transitioning to a new contractor if WEST is not awarded the contract.
- There are limitations to the scope of WEST's 6-month contract. Only 75% of the full scope is funded, and excluded services include the science symposium, Admin Ad Hoc Work Group support, and public outreach.
- Reclamation can share the scope of the RFP if the EC would like to comment.

Announcements and Public Comment

- There were no public comments.
- APA missed two consecutive EC meetings and were sent an official notice of membership termination given a third missed meeting. APA was absent for the third consecutive EC meeting on July 28, 2021 and, as per the MRGESCP By-Laws, is no longer a signatory member of the MRGESCP.
    - The PST will send APA notice of membership termination.
- Kim Eichhorst, BEMP, expressed gratitude for all who helped fund BEMP in FY21. BEMP dropped 6-7 monitoring sites, but most others will be maintained.

➢ **Action Item**: The PST will notify the APA of membership termination

Closing Items:

➢ **Action Item**: The PST will send out a calendar invite for the October 27, 2021 EC meeting

Meeting Participants

EC Representative	Organization
Alan Hatch	Pueblo of Santa Ana
Alyssa O'Brien	City of Albuquerque Open Space Division
Anne Marken	Middle Rio Grande Conservancy District
Bill Grantham	New Mexico Office of the Attorney General
Blane Sanchez (acting)	Pueblo of Isleta
Colleen McRoberts	City of Albuquerque Open Space Division
Debra Hill	U.S. Fish and Wildlife Service
Grace Haggerty	New Mexico Interstate Stream Commission
Greg Kaufman	Pueblo of Sandia
Jennifer Faler	U.S. Bureau of Reclamation
Jim Wilber	U.S. Bureau of Reclamation
Katrina Grantz	U.S. Bureau of Reclamation
Kim Eichhorst	Bosque Ecosystem Monitoring Program
Kyle Harwood	Buckman Direct Diversion
LTC Patrick Stevens	U.S. Army Corps of Engineers
Mark Kelly	Albuquerque Bernalillo County Water Utility Authority
Michael Scialdone	Pueblo of Sandia
Paul Tashjian	Audubon New Mexico
Ryan Gronewold	U.S. Army Corps of Engineers
Shawn Sartorius	U.S. Fish and Wildlife Service
Thomas Turner	University of New Mexico
Virginia Seamster (acting)	New Mexico Department of Game & Fish

Participant	Organization
Alison Hutson	New Mexico Interstate Stream Commission
Ari Posner	U.S. Bureau of Reclamation
Brenda McKenna	U.S. House of Representatives, Melanie Stansbury's Office
Catherine Murphy	Program Support Team
Chris Shaw	New Mexico Interstate Stream Commission
Danielle Galloway	U.S. Army Corps of Engineers
Debbie Lee	Program Support Team
Elijah Small	Pueblo of Isleta
George MacDonell	U.S. Army Corps of Engineers
Greg Dyson	Bosque Ecosystem Monitoring Program
Hannah Riseley-White	New Mexico Interstate Stream Commission
Julie Dickey	Program Support Team
Lynette Giesen	U.S. Army Corps of Engineers
Mary Carlson	U.S. Bureau of Reclamation
Michelle Tuineau	Program Support Team
Rich Valdez	SWCA Environmental Consultants
Trevor Birt	New Mexico Interstate Stream Commission
Trevor Stevens	U.S. Army Corps of Engineers
Tricia Snyder	Wild Earth Guardians

Middle Rio Grande Endangered Species Collaborative Program
2021 Science Objectives
Presented to the Executive Committee on July 28, 2021

After revising its mission statement, the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) adopted its goals in 2020. To pursue these goals, the Science and Adaptive Management Committee (SAMC) has proposed the following science objectives for Executive Committee (EC) consideration. Next, strategies to address each science objective will be developed to help devise new project ideas. Thus, these guiding principles will inform recommended updates to the MRGESCP's Science and Adaptive Management Plan, Adaptive Management Relational Database, and Long-Term Plan. As part of the adaptive management cycle, science objectives will be assessed annually to ensure that research questions are addressing management needs.

MISSION STATEMENT

The Middle Rio Grande Endangered Species Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management to the benefit and recovery of the listed species pursuant to the Endangered Species Act within the Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules, and regulations.

SPECIES

The MRGESCP works to inform the recovery of five species listed under the Endangered Species Act (ESA):

- Endangered Rio Grande silvery minnow (*Hybognathus amarus*; RGSM);
- Endangered Southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL);
- Endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; NMMJM);
- Threatened Yellow-billed cuckoo (*Coccyzus americanus*; YBCU); and
- Threatened Pecos sunflower (*Helianthus paradoxus*; PESU).

PROGRAM GOALS

A. *Establish and maintain a self-sustaining population of endangered RGSM distributed throughout the Middle Rio Grande (MRG).*
B. *Maintain and protect the MRG recovery unit goals for endangered SWFL.*
C. *Maintain and protect suitable threatened YBCU habitat in the MRG.*
D. *Establish and maintain a self-sustaining endangered NMMJM population in the MRG.*
E. *Maintain and protect the threatened PESU in the MRG.*
F. *Avoid the future listing or up-listing of species in the MRGESCP area.*
G. *Manage available water to meet the needs of endangered species and their habitat.*



RGSM Objectives

A-1) Estimate the abundance of augmented and wild born RGSM populations in the Angostura, Isleta, and San Acacia reaches from year to year.

A-2) Increase understanding of how the life history traits of the RGSM change over time and space, to better inform management of the species and increase the probability of recovery.

A-3) Determine the relationships between base flow and survival and recruitment of RGSM in the MRG.

A-4) Determine suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph) needed to cue spawning and recruitment for the RGSM population, given system constraints and opportunities.

A-5.1) Refine existing research and modeling efforts to understand the quantity and quality of habitat available at different flow regimes.

A-5.2) Develop a range of options for increasing habitat availability and refugia at life stage-limiting flow regimes for all life stages.

A-6.1) Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM genetic diversity.

A-6.2) Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM population viability.

SWFL Objectives

B-1) Monitor for SWFL in the MRG management unit of the Rio Grande recovery unit.

B-2) Determine habitat availability for SWFL within the MRG.

B-3.1) Characterize optimal breeding habitat conditions in currently occupied SWFL locations to inform restoration.

B-3.2) Manage successional processes that maintain existing SWFL breeding habitat in the Program Area.

B-3.3) Expand SWFL breeding habitat through restoration efforts in the Program Area.

YBCU Objectives

C-1.1) Characterize optimal habitat (i.e., foraging and nesting) conditions on landscape and microhabitat levels in currently occupied YBCU locations to inform habitat mapping and restoration efforts.

C-1.2) Determine successional processes that promote optimal YBCU habitat (i.e., foraging and nesting) in the Program Area.

C-1.3) Expand monitoring efforts for YBCU.

NMMJM Objectives

D-1.1) Initiate and support NMMJM monitoring efforts to locate existing populations, identify relevant habitat features, and identify potentially suitable unoccupied habitat.

D-1.2) Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

PESU Objectives

E-1.1) Continue and expand monitoring and surveying for PESU stands in the West-Central New Mexico Recovery Region.

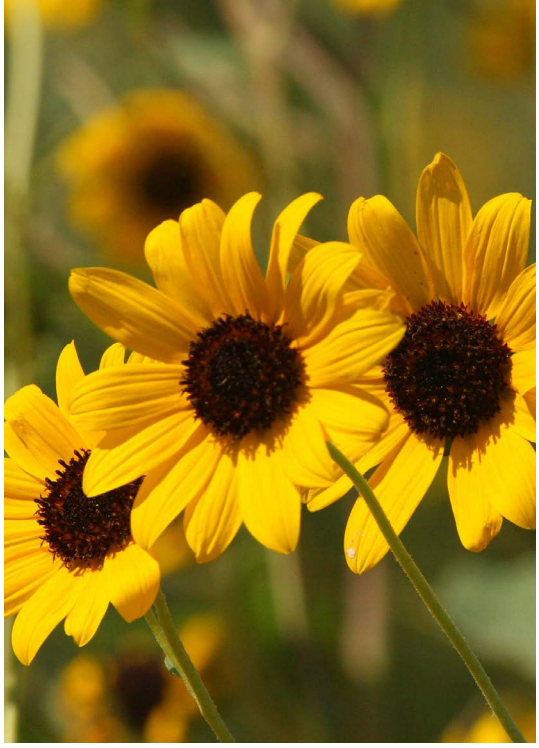
E-1.2) Preserve and expand existing habitat stands in the West-Central New Mexico Recovery Region.

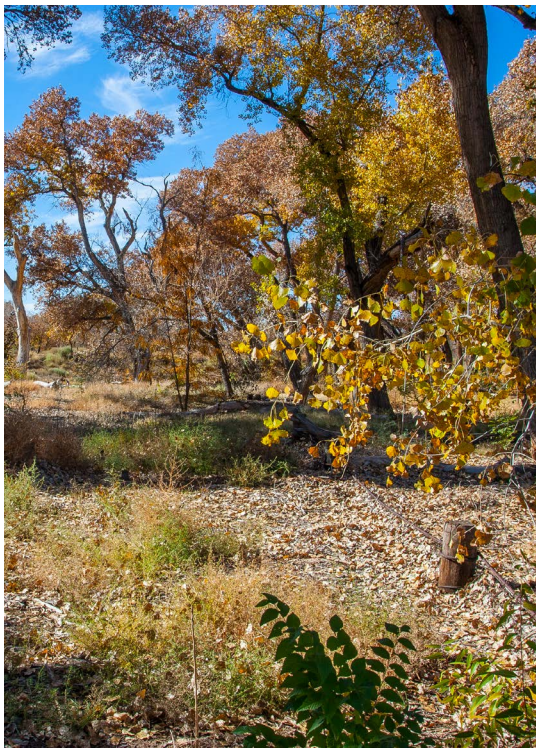
OTHER Objectives

F-1) Monitor trends in ecosystem function in the MRG for indications of decline (e.g., changes in vegetation structure and composition, population trends in other special status species, etc.).

F-2) Determine the impacts from non-native vegetation on listed species' habitat availability and population dynamics.

G-1) Support efforts to enhance the operational flexibility of water managers to support species.


Middle Rio Grande Endangered Species Collaborative Program

Fiscal Year 2020 Annual Report

Program Website: http://webapps.usgs.gov/MRGESCP/



Prepared by:

WEST

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On Behalf of:

The Middle Rio Grande Endangered Species Collaborative Program

Photo: Rio Grande cottonwood, Credit: Mike Marcus

Cover photos (top to bottom and left to right): New Mexico meadow jumping mouse, Credit: U.S. Fish and Wildlife Service | Pecos sunflower, Credit: J. N. Stuart, | Southwestern willow flycatcher, Credit: Scarlett Howell, U.S. Geological Survey | Yellow-billed cuckoo, Credit: Andy Reago and Chrissy McClarren | Rio Grande cottonwoods in the Middle Rio Grande, Credit: Mike Marcus | Rio Grande silvery minnow, Credit: Museum of the Big Bend

Back photo: Rio Grande cottonwoods in the Middle Rio Grande, Credit: Mike Marcus

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Acronyms & Abbreviations

Acronyms/Abbreviations	Definition
2016 MRG BO	Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
ACF	Aquatic Conservation Facility
Admin Ad Hoc Group	Administrative Ad Hoc Group
AM	adaptive management
ARRC	Aquatic Resource and Recovery Center
Audubon	Audubon New Mexico
BEMP	Bosque Ecosystem Monitoring Program
CEM	conceptual ecological model
cfs	cubic feet per second
CoA	City of Albuquerque
Collaborative Program	Middle Rio Grande Endangered Species Collaborative Program
CPUE	catch-per-unit-effort
EC	Executive Committee
ESA	Endangered Species Act
FPC	Fiscal Planning Committee
FY	fiscal year
GTseq	Genotyping-in-Thousands by sequencing
IDD	Isleta Diversion Dam
MOA	Memorandum of Agreement
MRG	Middle Rio Grande
MRGCD	Middle Rio Grande Conservancy District
NM	New Mexico
NMDGF	New Mexico Department of Game and Fish
NMFWCO	New Mexico Fish and Wildlife Conservation Office
NMISC	New Mexico Interstate Stream Commission
NMMJM	New Mexico meadow jumping mouse
PESU	Pecos sunflower

Acronyms/Abbreviations	Definition
PIT	Passive Integrated Transponder
PoSA	Pueblo of Santa Ana
PST	Program Support Team
Reclamation	U.S. Bureau of Reclamation
RGSM	Rio Grande silvery minnow
S&AM Plan	Science & Adaptive Management Plan
S&T Ad Hoc Group	Science & Technical Ad Hoc Group
SADD	San Acacia Diversion Dam
SAMC	Science and Adaptive Management Committee
SWCA	SWCA Environmental Consultants
SWFL	southwestern willow flycatcher
UNM	University of New Mexico
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USU	Utah State University
YBCU	yellow-billed cuckoo



Photo: Field of Pecos sunflowers, Credit: J. N. Stuart

Executive Summary

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) is a partnership of federal, state, tribal, and local signatory entities that supports actions in the Middle Rio Grande (MRG) aimed at protecting and recovering listed species, while remaining committed to preserving the area's existing and future water uses. The Collaborative Program supports the recovery of five listed species inhabiting the MRG: the endangered Rio Grande silvery minnow, the endangered southwestern willow flycatcher, the endangered New Mexico meadow jumping mouse, the threatened yellow-billed cuckoo, and the threatened Pecos sunflower.

In Fiscal Year 2020 (FY20), the Collaborative Program worked towards its goal of using science to inform management in the recovery of the MRG's listed species. With that in mind, the Collaborative Program established and adopted goals, developed species-level conceptual ecological models, and prepared a draft Science & Adaptive Management (S&AM) Plan. In anticipation of implementing the S&AM Plan, the Collaborative Program approved a new program structure, which features a Science and Adaptive Management Committee designed to focus scientific inquiry and inform management of listed species in the MRG

These activities directly contributed to development of the Collaborative Program's science and adaptive management framework. Collaborative Program signatories engaged in development of this framework by providing technical and administrative feedback. In addition to this support, signatories continued to fund and support scientific studies, population monitoring and management efforts, water operations, and habitat restoration to the benefit of listed species in the MRG. This report summarizes the activities of the Collaborative Program and its signatories in FY20.

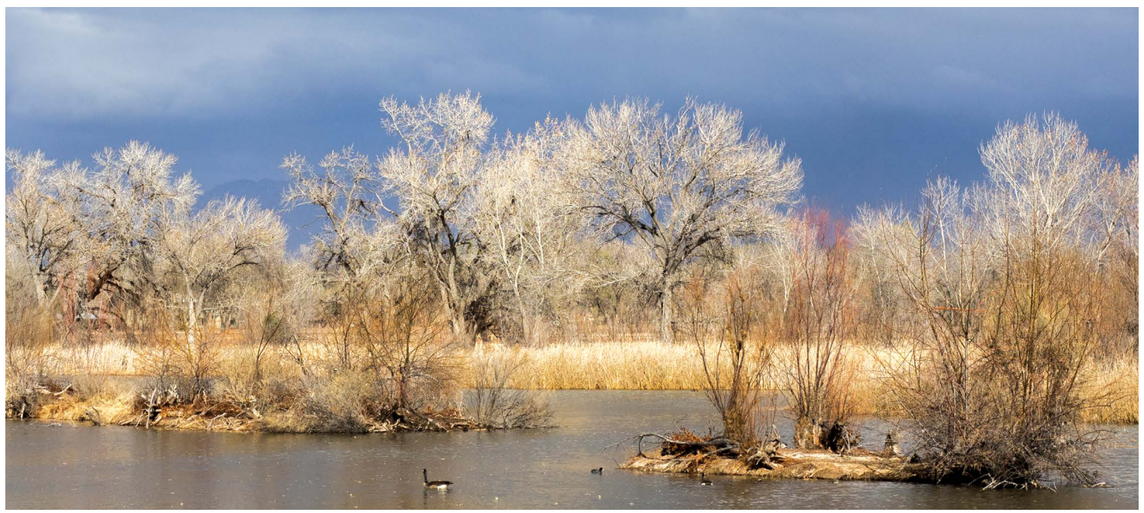


Photo: Scenic view at the Rio Grande Nature Center, Credit: Mike Marcus

The Middle Rio Grande Endangered Species Collaborative Program

Background

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) is a partnership of federal, state, and local governmental entities, Pueblos, and non-governmental organizations that supports efforts to protect and recover federally listed species in the riparian corridor of the Middle Rio Grande (MRG), while preserving the area's existing and future water uses. The Collaborative Program has gradually changed over the years, but was first formed in response to several events: the federal listing of the endangered Rio Grande silvery minnow (*Hybognathus amarus*; RGSM) under the Endangered Species Act (ESA) in 1994, the listing of the endangered southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL) in 1995, drought in 1996, and litigation related to these events in 1999.

In 2000, stakeholder organizations that were interested in species recovery and protection of water uses in the MRG formed the ESA Work Group. This group led to the development of the Collaborative Program, which was officially established in 2002 with the signing of the Memorandum of Understanding. Program signatories reaffirmed their commitment by signing the 2008 Memorandum of Agreement (MOA).

The Collaborative Program has brought diverse participants together to provide a variety of support for activities that benefit the MRG's listed species. Over time, the Collaborative Program expanded its species of interest to also include the following listed species: the threatened yellow-billed cuckoo (*Coccyzus americanus*; YBCU), the endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; NMMJM), and the threatened Pecos sunflower (*Helianthus paradoxus*; PESU).

Area of Interest

The geographic area of interest covered by the Collaborative Program follows the Rio Grande, including its tributaries, stretching from the Colorado-New Mexico border downstream to the elevation of the spillway crest of Elephant Butte Reservoir, excluding the land reserved for the full pool of Elephant Butte Reservoir (Figure 1). The following five reaches are delineated within the MRG from north to south:

- Northern Reach (from the Colorado-New Mexico border to Cochiti Dam)
- Cochiti Reach (from Cochiti Dam to Angostura Diversion Dam)
- Angostura (or Albuquerque) Reach (from Angostura Diversion Dam to Isleta Diversion Dam)
- Isleta Reach (from Isleta Diversion Dam to San Acacia Diversion Dam)
- San Acacia Reach (from San Acacia Diversion Dam to the elevation of the spillway crest of Elephant Butte Reservoir)

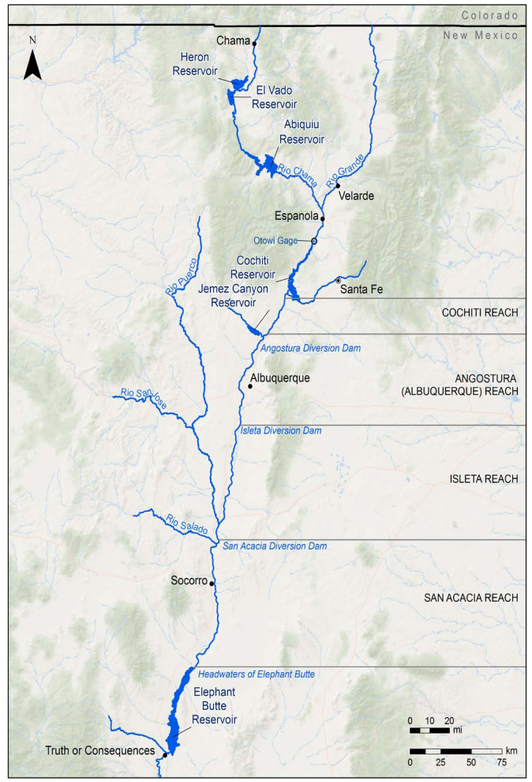


Figure 1. Program area map

Guiding Principles

Mission

The Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management (AM) to the benefit and recovery of the listed species pursuant to the ESA within the Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules, and regulations.

Goals

- Establish and maintain a self-sustaining population of endangered RGSM distributed throughout the MRG
- Maintain and protect the MRG recovery unit goals for endangered SWFL
- Maintain and protect suitable threatened YBCU habitat in the MRG
- Establish and maintain a self-sustaining endangered NMMJM population in the MRG
- Maintain and protect the threatened PESU in the MRG
- Avoid the future listing or up-listing of species in the Collaborative Program area
- Manage available water to meet the needs of endangered species and their habitat

Signatories

Signatories are those entities signed to the Collaborative Program's 2008 MOA, as amended. Representatives from these signatories, as well as other interested parties, work collaboratively to complete Collaborative Program activities. The following 17 stakeholder organizations were signatories of the 2008 MOA in FY20:

- Albuquerque Bernalillo County Water Utility Authority (ABCWUA)
- Assessment Payers Association of the Middle Rio Grande Conservancy District
- Audubon New Mexico (Audubon)
- Bosque Ecosystem Monitoring Program (BEMP)
- Buckman Direct Diversion
- City of Albuquerque (CoA) Open Space Division
- Middle Rio Grande Conservancy District (MRGCD)
- New Mexico Attorney General's Office
- New Mexico Department of Game and Fish (NMDGF)
- New Mexico Interstate Stream Commission (NMISC)
- Pueblo of Isleta
- Pueblo of Sandia
- Pueblo of Santa Ana (PoSA)
- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Reclamation (Reclamation)
- U.S. Fish and Wildlife Service (USFWS)
- University of New Mexico (UNM)

Governance

Adopted in 2008, the Collaborative Program By-Laws describe the governance structure, decision-making processes, and roles and responsibilities of its signatories. The By-laws have been amended over the years to accommodate Collaborative Program development. Documents relating to governance, including by-laws, authorities, and charters, are maintained on the Program Portal, which can be accessed at https://webapps.usgs.gov/MRGESCP/.

Organizational Structure

EXECUTIVE COMMITTEE

Federal Co-chair: Brent Esplin, Reclamation (through March 2020); Wayne Pullan, Reclamation (April 2020)

Non-Federal Co-chair: John Stomp, ABCWUA

The Collaborative Program is governed by the Executive Committee (EC), which consists of one representative from each signatory. The EC directs the implementation of the Collaborative Program's science and AM process, oversees committee and group activities, and acts as the face of the Collaborative Program.

FISCAL PLANNING COMMITTEE

Federal Co-chair: Lynette Giesen, USACE

Non-federal Co-Chair: Grace Haggerty, NMISC

The Fiscal Planning Committee (FPC) is a group of signatory representatives selected by the EC to collaborate on financial and administrative resources that enable scientific activities. The FPC works to identify signatory funding capabilities, potential funding resources, and gaps in resources.

PROGRAM SUPPORT TEAM

The Program Support Team (PST), made up of the Program Manager, Science Coordinator, and supporting staff, provide administrative, scientific, and technical support to all Collaborative Program committees and groups.

WORK GROUPS

Work groups were established by the EC to address specific Collaborative Program directives and activities by providing focused scientific and technical expertise and coordinating on signatory efforts. Work groups were made up of signatory staff and contractors, as well as additional parties with appropriate expertise and interest. The following work groups met during FY20:

- Adaptive Management Work Group
- Population Monitoring Work Group
- Science and Habitat Restoration Work Group

AD HOC GROUPS

As necessary, Collaborative Program committees and work groups formed temporary subgroups to work on specific projects or tasks. Ad hoc groups reported to their primary committees or work groups and disbanded once their predetermined objectives were met. The following ad hoc groups met during FY20:

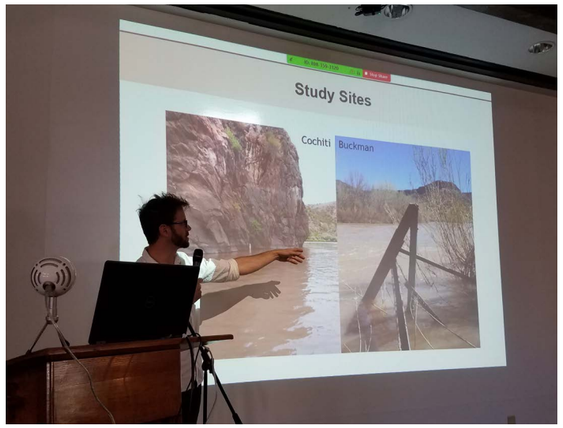
- Avian Conceptual Ecological Models (CEMs) Ad Hoc Group
- Flow Scenarios Ad Hoc Group
- Genetics Ad Hoc Group
- RGSM CEM Ad Hoc Group

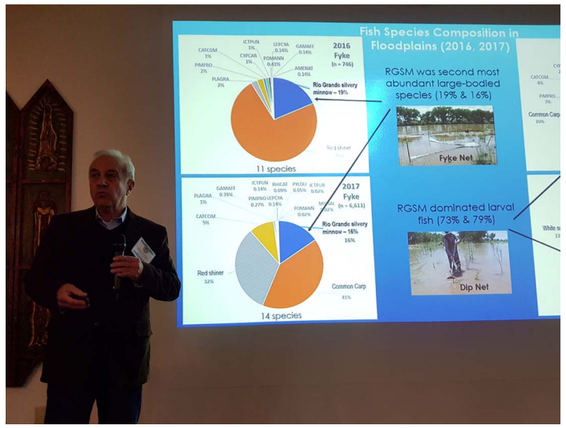
FY20 Accomplishments

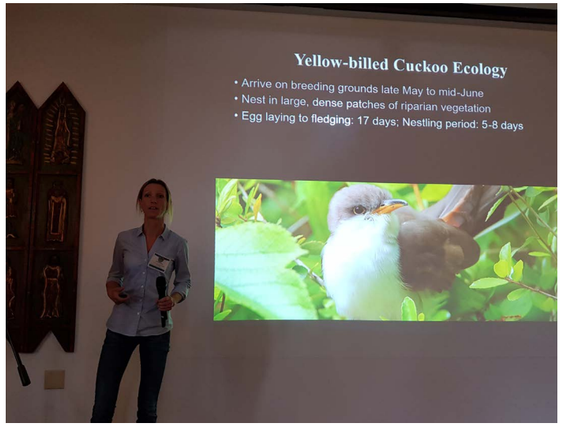
2019 Science Symposium

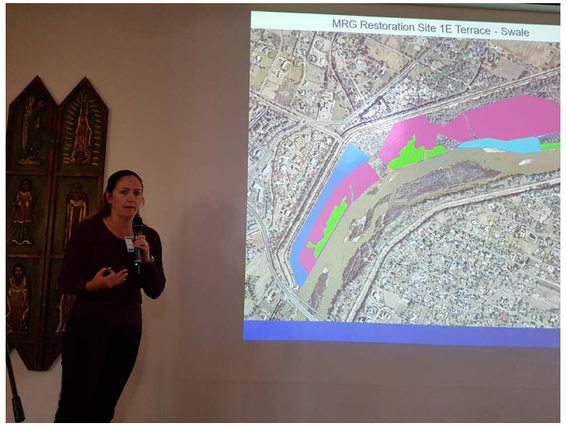
The 2019 Collaborative Program Science Symposium took place on December 3–4, 2019 at the Bosque Conference and Retreat Center in Albuquerque, NM. The symposium aimed to foster collaboration and exchange of information and ideas between participants working and interested in the MRG.

Over the two-day event, more than 85 attendees heard 36 presentations grouped into sessions on the MRG watershed, aquatic species, terrestrial species, and habitat. In an introductory lightning round, signatory representatives gave brief descriptions of their organizations and the roles they play in the MRG. Attendees also had the option of participating in bosque walks led by volunteers from NMDGF, Audubon, and CoA Open Space Division. Video and PDF versions of presentations from the 2019 Science Symposium are available on the Program Portal (https://webapps.usgs.gov/MRGESCP/).









Photos: 2019 Science Symposium presenters, Credit: Debbie Lee, Program Support Team

Conceptual Ecological Models

Collaborative Program participants developed preliminary schematics for RGSM, YBCU, and SWFL CEMs. These schematics illustrate the biotic and abiotic factors that influence the survival of each life stage of these species within the MRG. The relationship between each life stage and factor was characterized by discrete levels (i.e., high, medium, low) of influence and understanding. Life stage schematics will be integrated to create comprehensive graphical models for further development. When updated regularly with new research findings, the CEMs will represent the current state of the science for each species.

The CEMs will also be used to identify critical scientific uncertainties and linkages to management options, and to inform the scientific priorities of the Collaborative Program under the science and AM framework. For these reasons, the CEMs are valuable tools for generating research hypotheses, as well as for planning and collaborating.

Draft Science & Adaptive Management Plan

The Collaborative Program produced a draft S&AM Plan that details its role in and approach to providing scientifically defensible recommendations for management actions that benefit listed species in the MRG. The S&AM Plan provides a framework for implementing the Collaborative Program's science and AM process.

Program Goals

The Collaborative Program established and adopted the seven goals listed in the Guiding Principles section. These goals address each of the Collaborative Program's species of interest. The goals are related to establishing, maintaining, and protecting listed species, avoiding the listing or uplisting of species, and managing resources to benefit listed species.

Revised Program Structure

The EC approved a new Collaborative Program structure (Figure 2). The structure focuses on implementation of the science and AM framework that is outlined in the draft S&AM Plan, and includes the following new groups: the Science and Adaptive Management Committee (SAMC), Administrative (Admin) Ad Hoc Groups, and Science & Technical (S&T) Ad Hoc Groups.

Although the program structure shown was approved in FY20, the full rollout of the structure will not be completed until FY21. By the close of FY20, the SAMC was established, with its first meeting scheduled for early FY21.

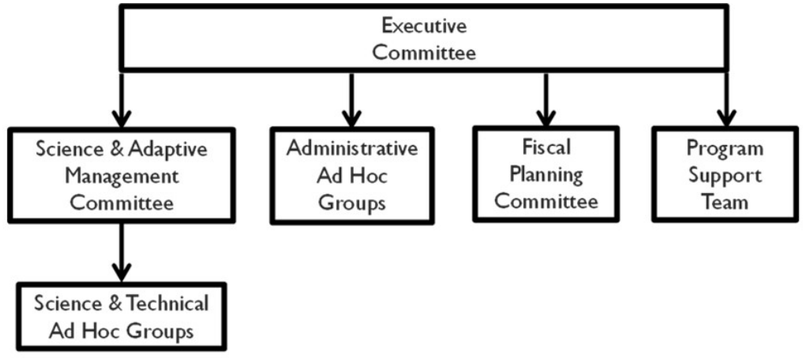


Figure 2. Revised Program structure



Photo: Jetty jacks in the Alameda Bosque, Credit: Mike Marcus

EXECUTIVE COMMITTEE

Under the new structure, the EC remains the Collaborative Program's decision-making body and provides leadership, oversight, and approval of Collaborative Program direction under the science and AM framework.

SCIENCE AND ADAPTIVE MANAGEMENT COMMITTEE

At the direction of the EC, the SAMC implements the Collaborative Program's science and AM framework. The SAMC is tasked with compiling results from scientific studies, modeling, and monitoring efforts, and translating the scientific findings from these efforts into recommendations for best management alternatives in the Middle Rio Grande

SCIENCE & TECHNICAL AD HOC GROUPS

S&T Ad Hoc Groups are formed by the SAMC to complete scientific and technical tasks designed to address specified scientific uncertainties and knowledge gaps, and to further the implementation of the Collaborative Program's S&AM Plan.

ADMINISTRATIVE AD HOC GROUPS

Admin Ad Hoc Groups are formed by the EC to carry out tasks related to Collaborative Program operations and administration, such as developing or updating foundational documents, or developing recommendations for decision items.

FISCAL PLANNING COMMITTEE

The FPC works to build a diverse financial support system and collaborate on financial and administrative resources for Collaborative Program-recommended activities.

PROGRAM SUPPORT TEAM

The PST provides support for the Collaborative Program. Under the new structure, the PST continues to provide administrative, scientific, and technical support for all Collaborative Program committees and groups.

Introduction to FY20 Signatory Activities

Each year, the Collaborative Program gathers reports on signatory activities related to recovery of listed species throughout the MRG. These activities include everything from habitat restoration and population monitoring to hydraulic modeling and genetic research. Much of this work is carried out in the name of ESA compliance and the combined findings and recommendations constitute an invaluable body of evidence that informs management and future scientific activities. Many studies inform each other or are synthesized to better explain species-habitat relationships.

Collaboration, informed decision-making, and adaptive management come about when entities with common goals work from the same collection of facts. Signatory contributions reported herein demonstrate this to great effect. Despite the many questions remaining within the MRG, much has been learned. The findings from these efforts must be synthesized and linked together to collectively inform our understanding of the listed species and the MRG ecosystem. As results are compiled and connections are drawn, uncertainties will be reduced and better decisions will emerge. This is the value of the Collaborative Program under the science and AM framework.



Photo: Scenic view at the Rio Grande Nature Center, Credit: Mike Marcus

FY20 Signatory Activities

Species Management & Recovery

Species management and recovery activities are non-research activities with influence on or relevance to recovery of one or more listed species within the MRG. These include rescue operations, support of captive propagation facilities, and control of invasive species. The species management and recovery activities performed by Collaborative Program signatories in FY20 are listed below.

2020 Minnow Action Team

Contributing Signatories: All

Species: RGSM

Reach: Cochiti, Angostura, Isleta, San Acacia



Photo: View of the 'jiggle' from the Isleta Diversion Dam, Credit: Catherine Murphy, Program Support Team

The Minnow Action Team (MAT) began in 2012 as an ad hoc multidisciplinary work group formed to provide an adaptive management focus to coordinate annual MRG water and species activities. The MAT evaluates potential management actions based on the projected hydrologic year and proposes recommendations for management and scientific activities, with the purpose of improving habitat conditions for spawning, recruitment, and survival of RGSM. The group provides a platform for entities to engage in exchange of information on current hydrology and RGSM status, and to inform resource management entities through annual coordination, evaluation, and recommendations for RGSM-related water operations. The MAT has also assisted with coordination of field activities, such as spring runoff monitoring, RGSM egg collection for captive propagation, floodplain and channel data collection, and summer flow measurements.

Hydrologic conditions for 2020 were poor due to warm temperatures in late winter that affected snowpack. Flows in the mainstem of the Rio Grande were insufficient to meet the needs of the basin, and stored water was used throughout most of the season to make up the difference.

The MAT met four times in 2020 to develop recommendations in response to the low water year. In late May, a 'jiggle' was conducted, during which water operations were temporarily shut down to stack water upstream of the Isleta Diversion Dam (IDD), before releasing it within a short period of time to temporarily increase flows to a sustained pulse of 300–500 cubic feet per second (cfs) through the Isleta and San Acacia reaches. This brief increase in flows successfully cued spawning, as indicated by observations of semi-buoyant RGSM eggs drifting downstream. RGSM egg collection was done by multiple entities to stock refuge populations in RGSM captive propagation facilities. Additionally, supplemental water was released throughout the summer to keep as much of the MRG as wet as possible. In 2020, 113,247 eggs were collected for captive propagation facilities, and RGSM persisted in low numbers throughout the summer, as evidenced by fish population monitoring.

City of Albuquerque Aquatic Conservation Facility Rio Grande Silvery Minnow Program Operations & Maintenance

Contributing Signatories: CoA, ABCWUA

Species: RGSM

Reach: Angostura, Isleta, San Acacia

The CoA Aquatic Conservation Facility (ACF) promotes the recovery of RGSM in the wild through captive propagation and augmentation. Each year, ACF staff collect naturally-spawned RGSM eggs and/or young-of-year fish from the MRG for use in the captive breeding program. In October 2019, the ACF, accompanied by USFWS, captured juvenile RGSM and transferred them to the facility to serve as broodstock for captive spawning operations. Captive spawning produced approximately 56,172 viable RGSM eggs in 2020. During the potential spawning season for RGSM in 2020 (April through June), water flow in the MRG was quite low and no potential spawning triggers were expected to occur. A 'jiggle' was conducted, during which a temporary shutdown of operations at a diversion facility was coordinated to create a pulse of water downstream. Diversions at the IDD were suspended from 2:00 am on May 24, 2020 to 3:00 am on May 25, 2020. This operation proved successful and led to the collection of 113,247 RGSM eggs for captive propagation facilities.

A total of 30,000 RGSM were tagged with visible implant elastomers in October 2019 and released into the San Acacia Reach in November 2019 (15,000 RGSM released) and February 2020 (15,000 RGSM released) as part of an experiment being conducted by the New Mexico Fish and Wildlife Conservation Office (NMFWCO). During each release, fish were distributed between the following three sites (5,000 RGSM per site): the north boundary of Bosque del Apache National Wildlife Refuge, the 9-mile outfall, and approximately 2 miles downstream of the San Acacia Diversion Dam (SADD).

Isleta Reach Outfall Water Supply

Contributing Signatories: Audubon, Reclamation, MRGCD

Species: SWFL, YBCU, RGSM

Reach: Isleta Reach

During July 2020, Audubon was able to provide 530 acre-feet of water for the northern part of the Isleta Reach via three outfall locations: Alejandro (Pueblo of Isleta), Los Chavez, and Lower Peralta #2. The water was San Juan-Chama water leased from the cities of Bernalillo, Los Lunas, and Belen, and included 200 acre-feet of water that was leased in 2019 and held in Heron Lake. Audubon provided 2–4 cfs of water through each outfall for the month of July 2020. This activity was coordinated with the municipalities.



Photo: Overhead view of the Middle Rio Grande, Credit: Jesse Shuck, SWCA Environmental Consultants

Pueblo of Isleta Bosque and Riverine Restoration & Fish Passage at Isleta Diversion Dam

Contributing Signatories: Pueblo of Isleta, Reclamation, MRGCD

Species: SWFL, YBCU, RGSM

Reach: Isleta

In 2020, the Pueblo of Isleta began developing a ravenna grass removal and control plan, and a plan and schedule for bosque restoration implementation. This was part of the ongoing Bosque Restoration Project being completed in coordination with Reclamation and MRGCD.

Additionally, in 2020, Reclamation, MRGCD, and the Pueblo of Isleta participated in a fish passage value planning meeting. Participants developed fish passage alternatives, evaluated all options, and prepared cost estimates. Numerical modeling was performed to depict the influence of fish passage on sediment and water delivery into the east and west side sluiceways in the IDD.

Rio Grande Silvery Minnow Population Management

Contributing Signatories: Reclamation, USFWS

Species: RGSM

Reach: Angostura, Isleta, San Acacia

Reclamation funded an agreement with the USFWS Fisheries and Aquatic Resource Conservation Program to aide in reestablishing, stabilizing, and enhancing populations of RGSM through 1) propagation of RGSM, 2) augmentation and monitoring of hatchery-produced or -reared fish, and 3) rescue or salvage of RGSM.

During FY20, USFWS maintained 73,415 RGSM as broodstock or as fish for PIT tagging, produced over 150,000 RGSM for augmentation at the Southwestern Native ARRC, and monitored the status of the augmented fish. The USFWS NMFWCO augmented 80,739 RGSM into the MRG during November 2019 and February 2020, and an additional 19,762 surgically PIT-tagged RGSM in support of field experiments.

Surface water was limited in 2020 and river channel drying in the MRG began on May 10th within the San Acacia Reach. The NMFWCO conducted rescue activities between June 8 and August 13, 2020. Drying was extensive, with 39.7 total river miles affected by drying in the San Acacia Reach, and 13 miles in the Isleta Reach. In 2020, the NMFWCO rescued 3,914 RGSM; of these, 29 were young-of-year, 79 were hatchery-reared, and 3,809 were wild adults. The NMFWCO documented 136 dead RGSM during river intermittency.

The NMFWCO also provided additional administrative, technical, research, publication, and regulatory support services to Reclamation and its BO Partners, as well as to the Collaborative Program.

Socorro Main Canal Fish Resue

Contributing Signatories: MRGCD

Species: RGSM

Reach: San Acacia

In FY20, MRGCD contracted SWCA Environmental Consultants (SWCA) to conduct fish rescue in the Socorro Main Canal after irrigation diversions ceased for the season. As MRGCD's water supply comes from the Rio Grande, fish can enter canals and become stranded in isolated pools during post-irrigation season drying. The purposes of the rescue efforts were to determine how many of the stranded fish were RGSM, and to return any captured RGSM to the adjacent river channel. Isolated pools in the Socorro Main Canal were sampled on three separate days in early to mid-November from just downstream of the SADD to approximately four miles downstream. Beach seines and backpack electrofishers were used to capture fish. All captured fish were identified and recorded, and any RGSM were measured for standard length, photographed, placed in a 5-gallon bucket and returned to the river just below the SADD.

U.S. Fish and Wildlife Service New Mexico Ecological Services Field Office Management and Support

Contributing Signatories: Reclamation, USFWS

Species: All

Reach: All

Reclamation funds an agreement with the USFWS New Mexico Ecological Services Field Office to support Reclamation and the 2016 MRG BO Partners with implementation of the 2016 MRG BO. USFWS activities include support for the accounting of incidental takes associated with activities exempted under the 2016 MRG BO. Reclamation also funds USFWS participation in the development of a science-based Adaptive Management Framework for water management, habitat restoration, and river connectivity, which includes participation in the Collaborative Program.

In FY20, USFWS reviewed environmental documents and Letters of Delegation, and issued Lists of Authorized Individuals for activities conducted by Reclamation and its Partners under the 2016 MRG BO. USFWS's participation in the Collaborative Program and on-the-ground support for recovery activities in FY20 helped Reclamation and its Partners avoid, minimize, or offset potential adverse effects on federally listed species or their critical habitats in the MRG.

Population Monitoring & Modeling

Population monitoring and modeling activities are descriptive empirical and/or mathematical investigations of population data for one or more listed species within the MRG. These include estimation of population size and trends over time, estimation of vital rates, and population viability forecasts. The population monitoring and modeling activities performed by Collaborative Program signatories in FY20 are listed below.

Assessment and Monitoring of Rio Grande Silvery Minnow Genetics

Contributing Signatories: Reclamation, UNM

Species: RGSM

Reach: Angostura, Isleta, San Acacia

In 2020, Reclamation funded an agreement with the UNM Department of Biology & Museum of Southwestern Biology to conduct genetic monitoring of RGSM in the MRG. This work has been conducted annually from 1999–2012 and 2014–2020. The RGSM population was sampled throughout its current range to assess the trajectory of genetic diversity measures, including allelic richness, heterozygosity, and genetic effective population size. Genetic variation was assessed at nine microsatellite loci and a mitochondrial gene. Genetic monitoring was also conducted on RGSM stocks that were bred or reared in captivity and released into the MRG. In 2020, genotyping was performed on 426 “wild” RGSM collected from all three occupied reaches of the MRG, as well as progeny of captive stocks held at three facilities: 1) the Southwestern Native Aquatic Resources and Recovery Center (ARRC), 2) the Albuquerque BioPark, and 3) the Los Lunas Silvery Minnow Refugium.

In 2020, the average number of alleles detected among RGSM was equal to the minimum benchmark level for diversity. At the reach level, allelic diversity and gene diversity were virtually identical between the Angostura and San Acacia reaches, while the sample size in the Isleta Reach was insufficient for meaningful comparison. Across all 2020 samples, ten mitochondrial haplotypes were detected in 2020. All metrics of genetic effective size increased in 2020 compared with 2019. These results are consistent with the substantial increase in the abundance of RGSM between 2018 and 2019. Genetic diversity of genotyped broodstocks from facilities with captive stocks were within the range seen in the wild population, and all ten haplotypes detected in the wild population in 2020 were present in the broodstock samples.

Over the past two decades, the RGSM population has experienced multiple, order-of-magnitude changes in density. Following commencement of augmentation with fish reared in captivity, variability in genetic diversity measures decreased from 2005 to 2012. Since 2015, genetic diversity has remained fairly stable. The results of genetic monitoring demonstrate that the RGSM augmentation program has been critical to maintenance of genetic diversity.

Pueblo of Santa Ana Fish Community Surveys

Contributing Signatories: PoSA, Reclamation, USFWS

Species: RGSM

Reach: Angostura

The PoSA is committed to protecting and enhancing wildlife habitat on its land. Through collaboration with federal, state, and local partners, the PoSA and their economic enterprise, the Hyatt Tamaya, have undertaken numerous ecosystem-based restoration initiatives resulting in the reduction of hazardous fuel loads from 1,321 acres. This has been accomplished by removing exotic plant species, restoring wetlands, promoting overbank flooding and widening the floodplain by lowering river bars, arresting river channel incision within the active floodplain, and restoring habitat important to sensitive and endangered species.

In 2020, the PoSA completed summer and fall fish community surveys with help from USFWS staff. These surveys provide management-relevant information on RGSM, including trends in population responses to habitat restoration projects. The spring data collection event was cancelled due to the COVID-19 pandemic.

The PoSA monitored eight sites in the Santa Ana stretch of the Rio Grande during the summer and fall seasons. The Rio Jemez was dry during both monitoring events. There were 120 hauls during both events. Catch-per-unit-effort (CPUE; fish/100 square meters [m2]) was 0.2 in the summer and 0.7 in the fall. RGSM made up 0.4% of the total number of fish caught during both events. Species richness (number of species in the region) was 13 in the summer and 12 in the fall, which is average for these months at the PoSA.

Pueblo of Santa Ana Southwestern Willow Flycatcher Monitoring

Contributing Signatories: PoSA, Reclamation

Species: SWFL

Reach: Angostura

In 2020, the PoSA monitored for SWFL according to standardized survey protocols. Along the PoSA’s six-mile stretch of the MRG, three to five surveys occurred across eight locations of restored riparian habitat (103 acres). During the summer (May 18, 2020 – July 17, 2020), the PoSA conducted a minimum of one survey during each of three survey periods. Three to five surveys were completed at each location spaced a minimum of five days apart.

Despite surveys continuing through mid-July, all SWFL detections during 2020 occurred during the migratory period. Surveyors had 32 detections during the first survey period and three detections during the second survey period. However, no SWFL were detected after June 2, 2020, likely a result of the extremely dry conditions. In 2020, river flows remained below the needed 2,000 cfs for the entire survey season, and thus there was no overbank flooding. These dry conditions reduced SWFL use of available habitats along the PoSA’s reach of the Rio Grande. In comparison, during 2019, an above average water year with overbank flooding, SWFL remained in the area into July.





Photos (left to right): Southwestern willow flycatcher perched on branch, Credit: Shannon Caruso | Southwestern willow flycatcher eggs, Credit: S. David Moore, U.S. Bureau of Reclamation | Southwestern willow flycatcher fledgling, Credit: S. David Moore

Rio Grande Silvery Minnow Population Monitoring

Contributing Signatories: Reclamation

Species: RGSM

Reach: Angostura, Isleta, San Acacia

Since 1993, Reclamation has funded or supported the systematic sampling of the MRG fish community, with a focus on the endangered RGSM. With some exceptions, fish sampling has been conducted monthly from April to November at 20 standard monitoring sites along the MRG. The catch of RGSM (and other fishes) are standardized to a density or CPUE (fish/100 m2). RGSM density data are then evaluated by site, month, markings, and assigned age, in three river reaches (Angostura, Isleta, and San Acacia), and for the MRG overall.

Based on monitoring data from only the 20 standard sites, RGSM were present at four of 20 sites with an overall density of 0.29 RGSM/100 m2 during October 2020. The October 2020 density for the 20 standard sites was less than the October 2019 density, but greater than the October 2018 density. However, based on 33 sampling sites (20 standard plus 13 nonstandard), the overall density was 0.36 RGSM/100 m2. Of the 51 unmarked RGSM collected at all 33 sites in October 2020, 21.6% (n=11) were assigned age-0, 15.7% (n=8) were age-1, and 62.7% (n=32) were age-2.

In all population monitoring annual reports, RGSM status, trends, and mixture model estimates ((E(x) as RGSM/100 m2) are used for long-term analyses, site occupancy, mesohabitat associations, evaluating sampling variation, and modeling to evaluate relationships with flows or other environmental conditions. The October 2020 estimated density (E(x)) will be available in 2021.

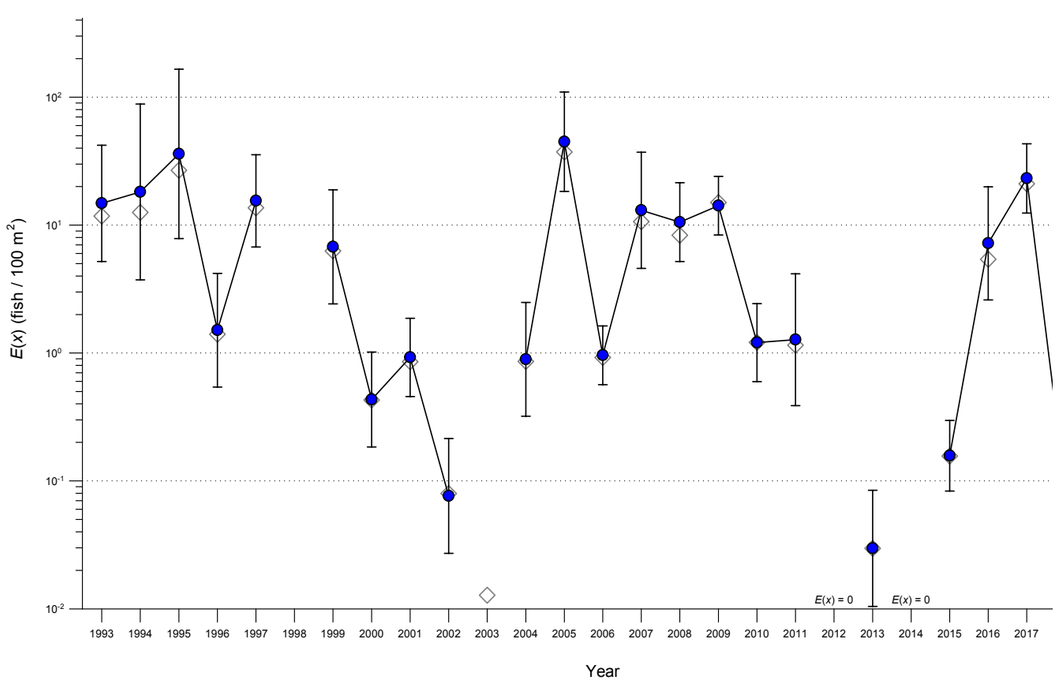


Figure 3. Rio Grande silvery minnow estimated densities (E(x)) using standard site October data for 1993-2019. Solid circles indicate estimated densities, bars represent 95% confidence intervals, and hollow diamonds represent simple methods-of-moments estimates.

Rio Grande Silvery Minnow Reproductive Monitoring

Contributing Signatories: Reclamation

Species: RGSM

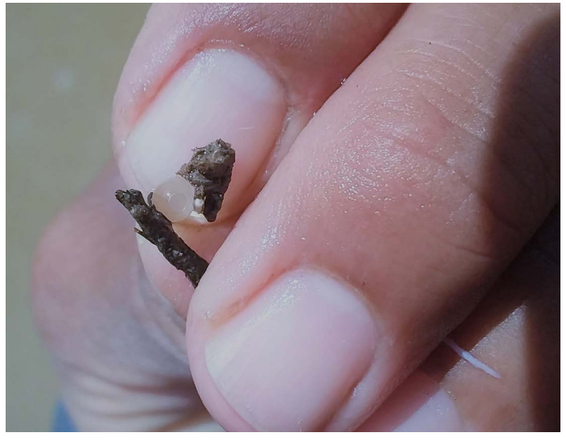
Reach: Angostura, Isleta, San Acacia

Since 2017, Reclamation has contracted the systematic reproductive monitoring of RGSM. The primary objectives of the RGSM Reproductive Monitoring Program are to characterize the timing, duration, frequency, and magnitude of RGSM spawning in the Angostura, Isleta, and San Acacia reaches. Additional objectives include characterizing reach-specific spawning patterns over time, assessing linkages between egg passage rates and seasonal flows across years, and examining relationships between flow, temperature, and spawning. RGSM spawn non-adhesive eggs that rapidly swell, become semi-buoyant, and are passively transported by water currents during their development. Downstream transport distance of RGSM progeny is dependent on a variety of factors, including flow magnitude and duration, water temperature, channel morphology, and developmental stage. Despite the seemingly large number of eggs transported downstream into the southern reaches each year, some portion of this reproductive effort remains upstream.

Spawning is generally associated with increases in discharge, such as spring runoff or summer rainstorms (primarily mid-April to mid-June). The 2020 study was a continuation of the long-term monitoring effort in the lower portion of the San Acacia Reach. Two additional sites in the Angostura [Albuquerque] and Isleta [Sevilleta] reaches were also sampled from 2017 to 2020. In 2020, 19,213 drifting RGSM eggs were collected for the reproductive monitoring program. Overall, the annual passage rates at Sevilleta and San Marcial were consistently higher than at Albuquerque. During the 2020 sampling season, an estimated 5,478,329 eggs, 44,104,215 eggs, and 1,026 RGSM eggs were transported downstream of Albuquerque, Sevilleta, and San Marcial, respectively.

The data showed the probability of collecting eggs (i.e., daily egg-occurrence probability) was highest when river flows increased substantially across consecutive days. Egg occurrence probabilities were higher during years with reduced and truncated spring flows, and egg passage rates were lower during years with elevated and extended spring flows. Additionally, daily egg presence/absence data also revealed associations with mean daily water temperature. The occurrence probability declined with increasing water temperature. Overall, the probability of collecting eggs increased with rapidly rising flows but decreased with elevated water temperatures. This long-term monitoring study provides insight into key environmental factors affecting trends in the temporal and spatial spawning patterns of RGSM, which can assist managers in developing successful recovery strategies.





Photos (left to right): Rio Grande silvery minnow eggs on a collector screen, Credit: Pauletta Dodge, New Mexico Interstate Stream Commission | Rio Grande silvery minnow egg attached to detritus, Credit: Pauletta Dodge



Photo: Overhead view of Southwestern willow flycatcher habitat, Credit: S. David Moore, U.S. Bureau of Reclamation

Southwestern Willow Flycatcher and Yellow-Billed Cuckoo Surveys and Nest Monitoring at U.S. Army Corps of Engineers Restoration Sites

Contributing Signatories: USACE

Species: SWFL, YBCU

Reach: Angostura

To assess the effectiveness of USACE restoration activities at sites constructed as early as 2004, presence/absence surveys for SWFL and YBCU were conducted at several locations within the Angostura Reach. Locations were evaluated for both SWFL and YBCU use and habitat suitability. USACE restoration sites are presently in various stages of riparian succession, each with different vegetative species compositions and structures, and associated habitat potential for SWFL and YBCU. The report on this effort includes trends, survey results, data analyses, and recommendations for future survey work based on current habitat conditions. The surveys provide an essential component for tracking the status of the two species. They provide a census of the present population, population trends, and the current distribution of SWFL and YBCU within the MRG and USACE restoration sites. These data enable managers to determine impacts to the species from specific actions, and to adapt management actions as necessary.

Southwestern Willow Flycatcher Surveys

Contributing Signatories: Reclamation, MRGCD

Species: SWFL

Reach: Isleta, San Acacia

Biologists have conducted SWFL surveys and nest monitoring in selected sites between Bandelier National Monument and Elephant Butte Reservoir since 1995. These studies are conducted to meet 2016 MRG BO requirements, to determine population trends, and to identify potential threats to SWFL populations and their habitats.

In 2020, Reclamation conducted surveys and nest monitoring at select project sites within the MRG basin to meet project compliance for Reclamation and MRGCD. Survey results were used to determine the distribution, abundance, and productivity of SWFL within the defined study area. Surveys were conducted in accordance with established survey protocols, and 263 flycatcher territories were documented.

Yellow-Billed Cuckoo Surveys

Contributing Signatories: Reclamation, MRGCD

Species: YBCU

Reach: Isleta, San Acacia

Biologists have conducted YBCU surveys within the MRG basin since 2006. These studies are designed to track YBCU population trends and provide insight into habitat use through presence/absence surveys. Survey results are used to determine the distribution and abundance of breeding YBCU within a defined study area.

In 2020, surveys were conducted within selected sites in the MRG to maintain project compliance for Reclamation and MRGCD. A total of 148 detections, comprising 36 breeding territories, were located.



Photo: Yellow-billed cuckoo perched on branch, Credit: Andy Reago & Chrissy McClarren



Photo: Scenic view at the Rio Grande Nature Center, Credit: Mike Marcus

Habitat Assessment and Modeling

Habitat assessment and modeling activities are descriptive empirical and/or mathematical investigations of physical environmental features that influence on one or more listed species or ecosystem in the MRG. These activities include hydrology and hydraulic modeling, mapping and geographic information systems, geomorphologic studies, and water quality and climate change studies. The habitat assessment and modeling activities performed by Collaborative Program signatories in FY20 are listed below.

2012 Middle Rio Grande Inundation Assessment

Contributing Signatories: USACE

Species: SWFL, YBCU, RGSM

Reach: Angostura

The report on the 2012 MRG inundation assessment was finalized in FY20. The purpose of this report was to update the 1992 and 2002 analyses, which estimated area of inundation at particular discharges throughout the MRG. In the newest analysis, 2012 geometry was used to estimate areas of inundation per mile from Cochiti to San Marcial, NM. The data will inform the development of the Collaborative Program's RGSM integrated population model as a quantification of RGSM habitat availability.

Control and Measurement Structure Construction Throughout the Middle Rio Grande Conservancy District

Contributing Signatories: MRGCD

Species: RGSM

Reach: Cochiti, Angostura, Isleta, San Acacia

In FY20, MRGCD continued its campaign to increase the efficiency of its conveyance system. This included sizing and replacing turnouts for increased delivery efficiency, and construction of weirs and flumes for water control and measurement. These structures, coupled with the real time data provided by telemetry, help MRGCD provide more reliable deliveries to irrigators, and inform management decisions. Water measurement and flow control are tools that allow MRGCD to operate more efficiently.

Engineering Modeling Applications for Quantifying Habitat for the Rio Grande Silvery Minnow

Contributing Signatories: USACE, Reclamation

Species: RGSM

Reach: All

This work utilized a hydraulic modeling method to characterize hydraulic habitat for RGSM. The study demonstrates the use of field data and literature review in generating a Habitat Suitability Index, testing the appropriateness of hydraulic metrics, and visualizing and quantifying suitable hydraulic areas. This work inspired discussion of how restoration sites contribute areas of suitable hydraulics for RGSM in the larval life stage, relative to surrounding natural floodplain terraces. There has also been discussion of model calibration/validation and the importance of monitoring data for implementing hydraulic modeling. The methodology used in the study provides insight on how different configurations of restoration sites contribute to RGSM restoration goals. The methodology may also be used as an assessment tool for analyzing alternatives for adaptive management, restoration site design, and water management decisions.

Environmental Flow Analysis for Rio Grande Silvery Minnow

Contributing Signatories: USACE

Species: RGSM

Reach: Angostura

This analysis focused on RGSM reproduction in response to spring runoff to improve understanding of environmental flow requirements. Water management on the Rio Grande over the past 100 years has changed hydrology and channel geomorphology. Determination of appropriate flow parameters supporting floodplain inundation provides important information for fish nursery habitat. Water management and drought have reduced the magnitude of the spring snowmelt hydrograph, while channelization and in-stream structures have reduced connectivity between the river and the floodplain. The availability of inundated floodplain habitat has important implications for RGSM reproduction, recruitment, and population viability.

The objective of this study was to better understand annual RGSM spawning and production in response to environmental flow parameters. Preliminary results indicate that spring flow less than 2,000 cfs for 14–21 days at the Albuquerque Gage is the minimum environmental flow for recruitment. This analysis supports adaptive management by identifying minimum environmental flow parameters for successful recruitment to inform water management strategies and restoration design criteria.

Evaluation of Sediment Dynamics in Habitat Restoration Features of the Angostura Reach

Contributing Signatories: USACE

Species: SWFL, YBCU, RGSM

Reach: Angostura

The ecosystem restoration projects constructed by USACE in the Angostura Reach focused on removing non-native vegetation, creating suitable habitat or endangered species, and promoting main channel to floodplain connection. Surveying the habitat restoration features installed at projects within the Angostura Reach included assessing morphological adjustments and sediment aggradation/erosion in a variety of hydrological features. Reports for surveys conducted from 2011 – 2018 documented observed changes at the sites. The objective of this monitoring effort was to collect data on morphological changes at habitat restoration features to assess how the features were functioning. Through repeated channel surveys and the establishment of photo points, changes over time in the various habitat restoration features were tracked. This information helped biologists and design engineers understand how the habitat restoration features were functioning relative to their design intent and the hydrologic conditions that initiate inundation.

Hydrological inundation of USACE habitat restoration features provides insight into potential conditions for RGSM spawning and recruitment and encourages vegetation growth, which is essential for establishment of SWFL habitat. The morphological changes that occurred through sedimentation in the habitat restoration features were evaluated using repeated surveys conducted both parallel and perpendicular to the flow. Deposition of sediment, which can reduce effective inundation, was then assessed. Initial results for all 17 sites indicated a general pattern of deposition in all overbanking feature types. Observation of the sites after the 2019 snowmelt runoff indicated that overbanking flows brought in sediment and invigorated native riparian vegetation. Based on an initial assessment of the field surveys, a combination of feature types may best promote habitat for endangered species. Overall, the habitat restoration sites in the Angostura Reach successfully encouraged more native riparian growth, created habitat development, and increased the river's connection with the floodplain.

The habitat restoration projects also benefit the community by providing local residents areas for recreation and opportunities or outreach and education. Increased use and appreciation of the MRG bosque benefits future generations of endangered species and humans alike.

Identifying Restoration Priorities for Threatened Tamarisk-Dominated Habitat to Benefit Future Habitat for Southwestern Willow Flycatcher

Contributing Signatories: USACE

Species: SWFL

Reach: Isleta, San Acacia

In 2020, SWFL nest site numbers and population size exceeded recovery goals for the MRG. Significant loss of quality nesting habitat for the species could result in a significant decrease in nesting success, which would potentially reduce future population sizes below recovery goals for the MRG. Timely efforts to restore at-risk, Tamarisk-dominated habitat near SWFL nesting sites with plantings of native riparian vegetation species help the SWFL population remain above minimum recovery size requirements.

The goal of this study was to provide site-specific verification and final priority rankings for the top 15 of 103 Tamarisk-dominated SWFL restoration sites identified in a 2015 report. The project included ground-truthing sites to verify their continued appropriateness in regards to restoration goals, including site access opportunities, vegetation community validation, and continued nearness to SWFL nesting sites, as well as hydrology and stage-discharge relationships, floodplain connection, and groundwater dynamics. The final priority site rankings were presented to the Collaborative Program Science and Habitat Restoration Work Group, and the report was finalized in spring 2020.

Middle Rio Grande Groundwater Monitoring

Contributing Signatories: USACE

Species: SWFL, YBCU

Reach: Angostura

This study increased understanding of impacts to species' environments, supported decision-making around operational strategy, and contributed to maintaining healthy and suitable habitat. Data from groundwater monitoring provides invaluable information regarding how long desired groundwater depths are sustained following repeated flood inundation. Moist surface soils are not only important for establishment and growth of riparian-wetland plant species, but also for organic soil development, nutrient cycling, invertebrate diversity, and other ecological processes.

Long-term monitoring of groundwater helped determine if depth thresholds were exceeded after restoration features became repeatedly inundated. In addition, monitoring was needed to evaluate if (and to what degree) soil moisture retention improved with time as restoration features became repeatedly inundated. These data are invaluable for evaluating the effect differences in soil moisture availability have on vegetation growth attributes in the constructed willow restoration features. This is particularly important for informing future designs for SWFL restoration projects. The data are also valuable for evaluating differences in primary biological productivity between restoration features with and without a direct river connection.

The final report, to be completed in spring 2021, will include a review of existing groundwater wells to determine if any of the existing wells can be retired from the monitoring network, and plans for development of a groundwater database.

Rio Grande Nature Center High Flow Channel Gage Monitoring

Contributing Signatories: USACE

Species: None

Reach: Angostura

This project benefits RGSM and SWFL in the Angostura Reach by reestablishing hydrological connection between the river and channel. The Rio Grande Nature Center Habitat Restoration Project was designed to restore an ephemeral side channel of the Rio Grande to reconnect the floodplain of the bosque to the river, and reestablish native habitat. The objective of this monitoring study was to collect data on stream flow through the channel during spring runoff. This information helps biologists understand whether, and for how long, flow conditions in the channel are suitable for RGSM spawning and recruitment. The amount and duration of flows also affect growth of native shrub species that provide essential SWFL habitat.

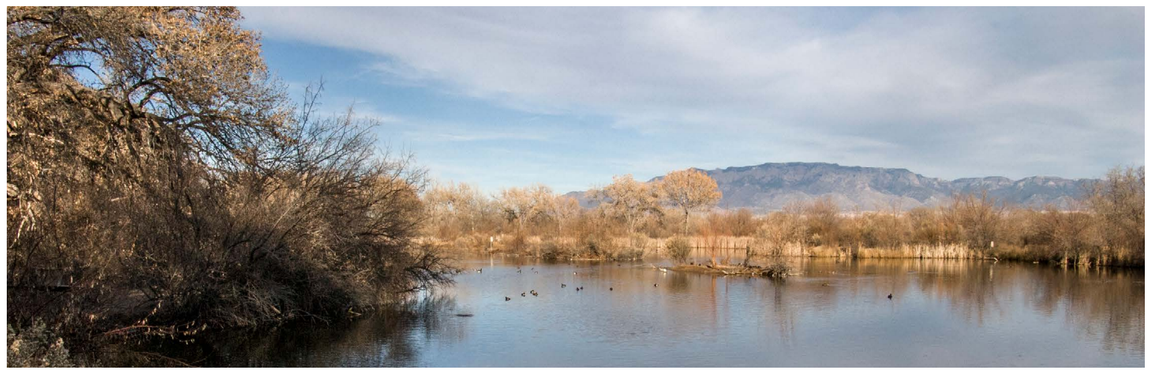


Photo: Scenic view at the Rio Grande Nature Center, Credit: Mike Marcus

Field and Laboratory Experiments

Field and laboratory experiments include any study designed to test a hypothesis about a listed species or other biotic response to a manipulation. Some of these activities are habitat manipulations of flows or vegetation, before-after control-impact restoration designs, and laboratory studies of physiological responses. The field and laboratory experiments performed by Collaborative Program signatories in FY20 are listed below.

Development of High-Throughput Markers for Rio Grande Silvery Minnow

Contributing Signatories: Reclamation

Species: RGSM

Reach: Angostura, Isleta, San Acacia

Genetic variation in the endangered RGSM has been monitored almost every year since 1999 using microsatellites and mitochondrial DNA. Since then, new genetic technologies have emerged (e.g., next generation sequencing [NGS]), which offer higher resolution for genetic monitoring, especially when evaluating changes over timescales relevant for adaptive management. As a first step toward transitioning the RGSM genetic monitoring program to an NGS platform, Reclamation funded an agreement with researchers at the UNM Department of Biology & Museum of Southwestern Biology to use restriction-site associated DNA sequencing to identify target nucleotide loci for use in a genotyping-in-thousands by sequencing (GTseq) panel. This panel will be used to routinely sequence up to ~300 loci to track genomic variation over time in the RGSM population in the Rio Grande, as well as in captive stocks.

During 2020, researchers identified 2,983 genetic loci for 373 archived RGSM samples collected from 1999 to 2018. However, due to the COVID-19 pandemic, the pace of research was delayed. The next step of GTseq panel development is to choose a subset of the loci identified for primer development and subsequent testing.

Los Lunas Habitat Restoration Site Surveying

Contributing Signatories: USACE, Reclamation, MRGCD

Species: SWFL, YBCU

Reach: Isleta

Habitat restoration may successfully create sustainable habitat features. Consistent monitoring ensures that constructed projects are functioning as designed, and assists in determining the efficacy and life span of various restoration techniques and treatments. As a result, designs for future restoration projects can be refined based on monitoring results. Following a fire in April 2000, the Los Lunas restoration site was selected as the first 2003 MRG Biological Opinion restoration area. Reclamation and USACE acted as joint lead federal agencies on this 40-acre project, and MRGCD was the primary non-federal cooperator.

The primary objective of the project was to improve habitat conditions for RGSM and SWFL. The project included removing non-native vegetation to promote native willow and cottonwood establishment and growth, excavating high-flow channels and terrace lowering to provide RGSM nursery habitat, and excavating a groundwater pond/wetland for other wildlife. Site surveying allowed researchers to monitor the availability and effectiveness of restored habitat, including physical elements related to habitat characteristics and the presence of RGSM and SWFL. The final report provided in spring 2020 included a summary of the past 20+ years of monitoring, as well as recommendations for where best to focus future monitoring efforts.

Middle Rio Grande Conservancy District Isleta Drain Outfall Monitoring

Contributing Signatories: MRGCD, Reclamation

Species: RGSM

Reach: Isleta

SWCA was contracted in summer 2020 to conduct a RGSM study of outfalls in the Isleta Reach. The study results indicated that RGSM used several of the drain outfalls as habitat during a year when the river channel dried from above the Los Chavez outfall to the area near the New Belen outfall. This highlights the potential of these sites to improve survival of RGSM in times of water scarcity. RGSM sampling was also performed at Sabinal, Lower Peralta #2, and Storey Wasteways.





Photos: Drain outfall monitoring, Credit: Anne Marken, Middle Rio Grande Conservancy District

Middle Rio Grande Conservancy District Outfall Restoration

Contributing Signatories: Audubon, MRGCD, Reclamation

Species: SWFL, YBCU, RGSM

Reach: Isleta

This project examined habitat conditions at irrigation outfalls along the MRG in order to assist MRGCD with endangered species conservation. The focus areas of this project were the outfalls within the Isleta Reach, starting near river mile 168, downstream of the IDD, and ending at river mile 116, near the SADD. These irrigation outfalls, or wasteways, are locations where water can be delivered from the irrigation systems, or back to the Rio Grande during periods of drought and low flow.

The conditions of six outfalls in the focus area were examined to determine if they provided (or have the potential to provide) suitable habitat for RGSM and SWFL. The outfalls were also assessed for their potential to provide ideal growing conditions for riparian plant species that support habitat for SWFL and promote floodplain habitat conditions for RGSM. As these outfalls are located throughout the MRG, they can be used to deliver water to specific drying areas, which allows for efficient water management during dry years.

Vegetative conditions were evaluated at each outfall site with the goal of determining how vegetative cover can be improved to benefit riparian birds, including SWFL and YBCU. High-quality native vegetation, including coyote willow and Rio Grande cottonwoods, was present at all sites. However, improvements need to be made at most sites to reduce the amount of non-native Tamarisk, and create a denser and more diverse understory plant community. Current outfall channel and neighboring floodplain conditions were also evaluated at each outfall site with the goal of determining how outfall channel and neighboring floodplain habitats can be modified to improve conditions for RGSM low flow survivability and high flow recruitment.

After outfall habitat conditions were reviewed, the following projects were proposed to improve RGSM and SWFL habitat at three of outfalls in the Isleta Reach:

a. Modify the outfall-channel morphology to increase the potential for RGSM to use the drain outfalls as habitat during low flow to dry years, which increases the survivability of juvenile and adult RGSM.

b. Plant native riparian vegetation, including coyote and Gooding's willow, and wetland species, like yerba mansa, along or near the outfall to improve habitat suitability for SWFL.

c. Improve floodplain connectivity between the Rio Grande and the outfall and neighboring bar habitat. Habitat improvements for SWFL have the potential to benefit other riparian bird species, including YBCU.



Photo: Overhead view of the Middle Rio Grande, Credit: Jesse Shuck, SWCA Environmental Consultants

Otolith Aging and Comparison of Wild Larval Rio Grande Silvery Minnow Captured in Restored Floodplains

Contributing Signatories: ABCWUA

Species: RGSM

Reach: Angostura, Isleta, San Acacia

ABCWUA contracted SWCA to age larval RGSM captured at restored floodplain sites in the Angostura Reach during 2017, 2019, and 2020. Larval RGSM were identified and aged using a small, calcified structure in the ear known as the otolith. Spring runoff in 2017 and 2019 was sufficient to inundate restored floodplain sites, and larval RGSM were captured during presence/absence monitoring of the sites.

In 2020, Rio Grande flows were not sufficient to inundate floodplain restoration sites, and monitoring occurred along banks and within in-channel habitats, such as pools, to collect larval fish. Larval fish collected in 2020 were identified by SWCA, and a subset of RGSM were aged as part of the otolith study to better understand how larval RGSM utilize main channel habitats during spawning season when floodplains are inaccessible. The growth trajectories, developmental stages, and standard lengths of RGSM were compared between sites and years, with consideration of local habitat features, such as temperature, depth, and vegetation cover. Improving understanding of the early life history of RGSM, and the role of floodplains as nursery habitat, could assist water managers in decision making in regards to the species.

Refugia for an Imperiled Fish During Flow Intermittency in a Large, Regulated River

Contributing Signatories: USFWS, Reclamation

Species: RGSM

Reach: San Acacia

Many once-perennial rivers have become intermittent. Drying is a major influence on aquatic organisms and can result in catastrophic mortality if refugia are not available. Understanding how fishes use refugia can provide insight for species persistence and help stakeholders manage limited resources.

Spatial and temporal patterns of RGSM abundance were examined in isolated pools over a decade of drying to determine pool characteristics and persistence of isolated pools over time. Researchers examined pool persistence, factors that influenced pool persistence, and the relative frequency of RGSM that occurred in pools that persisted or dried completely before flows returned.

Nearly all pools dried before flows return, and 99% of RGSM were stranded in pools that dried completely. Adults were collected in greater numbers closer to an upstream barrier, while age-0 RGSM were collected in greater numbers downstream. Rate of drying had little effect on the numbers of RGSM trapped in isolated pools.

The study concluded that channel intermittency causes catastrophic mortality of fishes through drying of pools, and presents a challenging environment for these fishes. For RGSM, a lack of other connected, wild populations to compensate and recolonize areas of drying jeopardizes their persistence in the MRG if other intervening management actions are not taken. Historically, persistence in the face of drying was likely accomplished because the species was widespread and abundant in a barrier-free river.

Rio Grande Silvery Minnow Movement Study

Contributing Signatories: Reclamation, USFWS

Species: RGSM

Reach: San Acacia

For FY20, Reclamation utilized an agreement with Utah State University (USU) to place PIT antennae in the San Acacia Reach. USU also used floating antennae to determine movement of PIT-tagged RGSM. In spring 2020, Reclamation and USFWS released approximately 10,000 PIT-tagged RGSM in lots below and above the SADD. The purpose of the study was to further determine the effects of the SADD on RGSM. Preliminary data show movement upstream and downstream of the dam, as well as movement of RGSM upstream through the dam when it is not in operation.

Rio Grande Silvery Minnow Spawning and Nursery Habitat Monitoring on Restored Floodplain Sites in the Middle Rio Grande

Contributing Signatories: ABCWUA, NMISC

Species: RGSM

Reach: Angostura, Isleta, San Acacia

In spring 2020, ABCWUA and NMISC continued collaborative research on the presence of larval and adult RGSM in floodplain habitats, restored floodplain habitats, and the mainstem during spring runoff. Discharge from spring runoff in 2020 was insufficient to inundate floodplains, which limited larval and adult RGSM monitoring of the main channel. The purpose of the 2020 mainstem monitoring was to identify key habitat features utilized by RGSM, specifically larval RGSM, in mainstem sites in the Angostura and San Acacia reaches. The project contractor, SWCA, captured a total of 144 adult RGSM, 76 unknown young-of-year, and 7,594 unidentified larvae. Due to the COVID-19 pandemic, identification of larvae was temporarily delayed but expected to be completed in 2021.





Photos (left to right): Rio Grande silvery minnow, Credit: Pueblo of Santa Ana staff | Rio Grande silvery minnow in net, Credit: Pueblo of Santa Ana staff

Program Management and Administration

Program management and administration activities include non-research support of the Collaborative Program's mission and goals through administrative assistance and aid in the funding, planning, coordination, and staffing of Collaborative Program activities. These activities include the Program and Science Support contract, Program Portal support, and public outreach initiatives. The program management and administration activities performed by Collaborative Program signatories in FY20 are listed below.

Middle Rio Grande Endangered Species Collaborative Program Portal

Contributing Signatories: USACE

Species: All

Reach: All

The Collaborative Program Portal provides a clearinghouse for data and information related to endangered species and critical habitat in the MRG. The Portal also functions as the Collaborative Program's website and event calendar.

The Portal's regulary updated document database facilitates the storage and sharing of important documents. Using the site search function, users can pull up scientific data, reports, and papers concerning listed species in the MRG, hydrology, habitat restoration, and more. Members can also access administrative documents, including meeting materials, work plans, and charters.

The Portal's event calendar displays all past and upcoming Collaborative Program-related events, including basic event information, agendas, meeting minutes, read-aheads, and presentations. Calendar events contain links to download all meeting materials prior to meetings.

The Portal also hosts Collaborative Program-related datasets and the interactive mapper. It is available for use by the public and can be found at https://webapps.usgs.gov/MRGESCP/.

Program and Science Support Contract for the Middle Rio Grande Endangered Species Collaborative Program

Contributing Signatories: Reclamation

Species: All

Reach: All

In FY20, Reclamation continued to contract Western EcoSystems Technology, Inc. to provide third-party program and science support services for the Collaborative Program. The PST includes a Program Manager, a Science Coordinator, and support staff. The PST is responsible for supporting the Collaborative Program by providing administrative, technical, and scientific operations. The PST communicates with signatories, prepares and implements plans, provides meeting support, performs outreach, disseminates information, and promotes communication amongst signatories.

Middle Rio Grande Endangered Species Collaborative Program

FY20 Annual Report



Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Administrative Ad Hoc Group (New Memorandum of Agreement)
Draft Charge

Approved by the Executive Committee (EC) on *July 28, 2021*.

Parent Committee
The MRGESCP Executive Committee.

Ad Hoc Group Charge
Draft a new MRGESCP Memorandum of Agreement (MOA) which reaffirms commitment of the Signatories to the MRGESCP and reflects the expectations of signatory participation under the new Science & Adaptive Management Plan (S&AM Plan) and Long-Term Plan (LTP) framework.

Membership

A. Suggested Criteria for membership

- Familiarity with the MRGESCP's By-laws, S&AM Plan, and LTP
- Familiarity with the MRGESCP
- Legal expertise

B. Member List

- Bill Grantham, NM Office of the Attorney General
- Kyle Harwood, Buckman Direct Diversion
- Ashleigh Morris, US Department of Interior, Office of the Solicitor
- Chris Shaw, NM Interstate Stream Commission
- Trevor Stevens, US Army Corps of Engineers
- Others?

Tasks and Deliverables

1. ***Draft of a new MOA***

   Objective of Task One
   Provide the EC with a draft MOA for review.

   Deliverable(s): Draft MOA for EC review prior to May 2022.

Timeline and Reporting Scheduling

Task	Deliverable	To Be Completed By
New MOA	Draft MOA for EC review	December 2021 EC meeting
	Revised Draft MOA for signatory review and comment	January 14, 2022
	Incorporated signatory edits and revised Draft MOA for EC review	March 2022 EC meeting
	Signatures on the Final MOA	May 2022

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Proposal for Reframing Cost-Share to Signatory Contributions

The Fiscal Planning Committee (FPC) was tasked with presenting a proposal to the Executive Committee on how to change non-federal cost-share. The FPC proposes compiling information on **signatory contributions**, including voluntarily provided costs related to activities that contribute to MRGESCP operations or work towards achieving its guiding principles (i.e., mission, goals, and objectives). No mandatory in-kind or cash contributions are required by the Collaborative Program. These fall into administrative and scientific categories:

- Administrative:
    - The contracts, grants, and agreements entered into by a signatory that support MRGESCP operations
    - Active participation by signatory representatives in MRGESCP committees, ad hoc groups, workshops, or in developing MRGESCP work products
- Scientific:
    - The findings and results from studies, monitoring, data collection, habitat restoration, literature reviews, research, and experiments that contribute to the MRGESCP's understanding of the listed species and their habitats

Signatory contributions are tracked using the Adaptive Management Relational Database (AMRDB). Findings, data, and final reports are provided to the MRGESCP for inclusion in science and adaptive management tools, such as the AMRDB and conceptual ecological models. A yearly report of each signatory's contributions can be provided from the AMRDB.

Scientific signatory contributions are collected, synthesized, and incorporated into the MRGESCP's activities, and are used to inform recommendations on future science activities (via the Long-Term Plan) and management alternatives.

Signatory contributions fall into the following categories:

- *Program Management and Administration* – Non-research support of the MRGESCP's guiding principles through administrative assistance and aid in funding, planning, coordination, and staffing of MRGESCP activities. Examples include the Program and Science Support contract, the Program Portal, and public outreach initiatives.
- *Species Management and Recovery* – Non-research activities with influence on or relevance to recovery of one or more listed species within the Middle Rio Grande (MRG). Examples include rescue operations, support of captive propagation facilities, and control of invasive species.
- *Population Monitoring and Modeling* – Descriptive empirical and/or mathematical investigations of population data for one or more listed species within the MRG. Examples include estimation of population size and trends over time, estimation of vital rates, and population viability forecasts.
- *Habitat Assessments and Modeling* – Descriptive empirical and/or mathematical investigations of physical environmental features at various spatial scales (e.g., site, reach, landscape) with influence on one or more listed species or the ecosystem of the MRG. Examples include hydrology and hydraulic modeling, mapping and geographic information systems, geomorphic studies, water quality studies, and climate change studies.
- *Field and Laboratory Experiments* – Any study designed to test a hypothesis about a listed species or other biotic response to a manipulation in a field or laboratory setting. Examples include habitat manipulations of flows or vegetation, before-after control-impact restoration designs, and laboratory studies of physiological responses.

MIDDLE RIO GRANDE ENDANGERED SPECIES COLLABORATIVE PROGRAM

BY-LAWS

Adopted by the Executive Committee on Month Day, 2021

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Article 1. NAME AND PURPOSE

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) is a collaborative effort consisting of federal, state, and local governmental entities, Indian Tribes and Pueblos, and non-governmental organizations. The Collaborative Program area includes the headwaters of the Rio Chama watershed and the Rio Grande, including tributaries, from the New Mexico-Colorado state line downstream to the elevation of the spillway crest of the Elephant Butte Reservoir at 4450 feet above mean sea level, excluding the land area reserved for the full pool of the Elephant Butte Reservoir. Indian Pueblo and Tribal lands and resources within the Collaborative Program area will not be included in the Collaborative Program without the express written consent of the affected Indian Pueblo or Tribe.

The Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management to the benefit and recovery of the listed species pursuant to the Endangered Species Act within the Collaborative Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules and regulations.

The Collaborative Program shall not support any action that may impair state water rights, or federal reserved water rights, of individuals and entities; federal or other water rights of Indian nations and Indian individuals, or Indian trust assets; San Juan-Chama Project contractual rights; and the State of New Mexico's ability to comply with Rio Grande Compact delivery obligations.

1.1. Authority

Under section 4(f)(2) of the Endangered Species Act, 16 U.S.C. § 1536(f)(2), the Secretary of the Interior is directed to develop and implement plans for the conservation of endangered species. The Secretary of the Interior may enlist the services of public and private agencies, individuals and institutions in developing and implementing such recovery plans. Advice from such agencies, individuals, and institutions, such as that offered by Signatories, is not subject to the Federal Advisory Committee Act, 5 U.S.C. app. 2. The Collaborative Program is consistent with section 4(f)(2). The Collaborative Program does not create an agency, board, commission, or any other entity of state government, nor does the Memorandum of Agreement, fully defined in Section 1.1., create a state advisory committee subject to Section 9-1-9 NMSA 1978.

1.2. Definitions

a) **Administrative Ad Hoc Group** – A small group formed by the Executive Committee to carry out discrete tasks related to fulfilling Collaborative Program operations and administrative functions.
b) **Collaborative Program** – Middle Rio Grande Endangered Species Collaborative Program.
c) **Executive Committee** – The Collaborative Program's governing body.
d) **Executive Committee member –** Representative designated by a Signatory to serve on the Executive Committee on behalf of the Signatory.
e) **Fiscal Planning Committee** – A group of signatory representatives that work to build a diverse partnership and financial support system for Collaborative Program activities in the Long-Term Plan.

f) **Guiding principles –** The mission, goals, and science objectives of the Collaborative Program, as adopted by the Executive Committee.
g) **Listed species** –The current threatened, endangered, or candidate species within the Collaborative Program Area as listed by the U.S. Fish and Wildlife Service, determined to be Collaborative Program priorities by the Executive Committee.
h) **Long-Term Plan** – An evolving communication and planning tool that serves to orient the Collaborative Program's long-term scientific efforts under the Science and Adaptive Management Plan, and structured to present the Collaborative Program's focus and priorities within a given period, provide an administrative timeline for operations under the Science and Adaptive Management Plan, aid Signatories with their administrative out-year planning efforts, and give coverage for Signatory authorities under which they participate in the Collaborative Program.
i) **Memorandum of Agreement** – The MOA of May 15, 2008, which established the Program as a collaborative effort consisting of federal, state, and local government entities, Indian tribes and Pueblos, and non-governmental organizations; and any subsequent MOA entered for that purpose. (Note: the 2008 MOA superseded an April 2002 Memorandum of Understanding).
j) **Originating Committee** – The committee for an ad hoc group which develops the ad hoc group's charge, directs the ad hoc group's activities, and to which the ad hoc group reports to. The Executive Committee is the originating committee for Administrative Ad Hoc Groups. The Science and Adaptive Management Committee is the originating committee for Science and Technical Ad Hoc Groups.
k) **Program Portal** – The Collaborative Program website, which includes an event calendar, document repository, and datasets.
l) **Program Support Team** – The dedicated support staff for the Collaborative Program, including a program coordination lead and a science coordination lead.
m) **Quorum** – Two-third (2/3) of the total number of the Executive Committee membership.
n) **Science and Adaptive Management Committee** – A group of subject matter experts appointed by the Executive Committee and tasked with coordinating the implementation of Collaborative Program scientific initiatives as outlined in the Science and Adaptive Management Plan.
o) **Science and Adaptive Management Plan** – A living document that defines the Collaborative Program's role and associated processes in providing science-based recommendations for management of the listed species and their habitat in the Middle Rio Grande.
p) **Science and Technical Ad Hoc Group** – A small group formed by the Science and Adaptive Management Committee to carry out discrete tasks necessary for implementing the Science and Adaptive Management Plan and Long-Term Plan.
q) **Signatory(ies) –** Party(ies) to the Memorandum of Agreement or their designated representative.
r) **Supermajority** – Seventy-five percent (75%) of the quorum of Executive Committee members present at the time of the vote.
s) **Unanimous Consent** – Agreement to a decision with no dissent from a quorum of Executive Committee Members present at the time of the decision.

1.3 Effective Date

These By-Laws shall be effective when adopted by unanimous consent of the Executive Committee.

1.4. Amendment

Modifications to the By-Laws may be made only by unanimous consent of the Executive Committee. Once modified, the amended version shall supersede any previous version of the By-Laws.

Article 2. CONFLICT OF INTEREST

Each Signatory shall follow the appropriate and applicable federal, state, municipal, and tribal rules, regulations, and laws governing conflict of interest.

Article 3. PROGRAM MEMBERSHIP

3.1. Membership

The Collaborative Program membership consists of Signatories to the Memorandum of Agreement. A list of current members shall be maintained by the program coordination lead and made publicly available.

In addressing requests to become a Signatory, the Executive Committee shall seek to maintain a broad and representative membership that includes:

a) Federal agencies;
b) Middle Rio Grande Pueblos (Sandia, Isleta, San Felipe, Cochiti, Santa Ana, and Kewa);
c) State of New Mexico agencies;
d) irrigation districts, including the Middle Rio Grande Conservancy District;
e) municipalities;
f) agricultural communities;
g) universities; and
h) environmental groups.

Members are expected to regularly, actively, and professionally participate in the Collaborative Program, including attending Executive Committee meetings, providing representatives to relevant committees and ad hoc groups, and remaining up-to-date on Collaborative Program activities and initiatives.

3.2. Addition of Signatories

Any organization that operates within the Collaborative Program area and that has a demonstrated interest in the success of the Collaborative Program may apply to become a Signatory.

To qualify for consideration, the applicant organization must submit a letter of interest to the Executive Committee co-chairs supporting the goals and success of the Collaborative Program and expressing its intent to sign the MOA if the application is accepted.

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Applications shall be submitted to the co-chairs through the program coordination lead and will be considered in the date-order they are received. The co-chairs shall acknowledge receipt to the applicant within 30 days of the application being received. The application will be announced to the Executive Committee at its next scheduled meeting. The co-chairs, with assistance from the program coordination lead, will do a preliminary review of the application, and may request more information or clarification before the application goes before the Executive Committee for deliberation.

Within 90 days of receipt of the application, or of a response from the applicant to a request for additional information or clarification, the application will be forwarded to the Executive Committee for consideration at its next meeting. All discussions and decisions regarding acceptance of applications received by the Executive Committee will be in a closed Executive Committee meeting session. The Executive Committee may request additional information of the applicant before the final decision is made. Acceptance of an application requires unanimous consent by the Executive Committee. The co-chairs will notify the applicant in writing of the Executive Committee's decision within one week following the Executive Committee action on the application.

The Executive Committee's consideration of each application may include, but is not limited to, the following criteria:

a) commitment to participation;
b) jurisdictional or regulatory responsibility, including sovereignty;
c) signatory contributions to the Collaborative Program, reported annually, including administrative contributions and scientific contributions, as applicable;
d) ability to contribute to the scientific understanding of the listed species and their habitats;
e) a demonstrated interest in contributing to the recovery of listed species within the Collaborative Program area;
f) ownership of an interest affected by the Collaborative Program, such as land, water, or other property rights;
g) whether the organization maintains a physical presence in the Collaborative Program area;
h) the number of individuals residing in the Collaborative Program area who are members of the organization; and/or
i) whether the organization provides a unique interest or perspective to the Executive Committee.

The Executive Committee has sole discretion in accepting an applicant for membership. The Executive Committee has the responsibility to maintain balanced interests and a practicable committee size, and to ensure that members further the Collaborative Program's purpose.

Applicants who are not accepted may reapply for membership one calendar year after the date of the letter notifying them of the rejection of their application.

3.3. Resignation, Removal, and Reinstatement of Signatories

A Signatory may resign from the Collaborative Program at any time upon written notice to the Executive Committee co-chairs through the program coordination lead. A Signatory that has resigned by this process may request reinstatement of membership by submitting a written

request to the co-chairs, and is not required to submit a new application for membership under the terms of Section 3.2. The co-chairs will announce such a past Signatory organization's intent to reengage with Collaborative Program at the next Executive Committee meeting. Reinstatement of a past Signatory to the Collaborative Program must be agreed to by unanimous consent of the Executive Committee.

If a Signatory is not represented at two consecutive Executive Committee meetings, the co-chairs and the program coordination lead shall provide written notice to that Signatory or its designee that its membership in the Collaborative Program will be terminated unless that Signatory is represented at the next Executive Committee meeting. The Executive Committee will consider members who are unresponsive to attendance-related inquiries as having terminated their membership and such members will not be counted toward a quorum. Signatories whose membership is terminated as a result of non-attendance may reapply for reinstatement in the Collaborative Program per the process laid out in Section 3.2, Addition of Signatories.

Article 4.0. TRIBAL INTERESTS AND PARTICIPATION

4.1. Trust Responsibilities

The Executive Committee recognizes that the federal government and federal agencies have trust responsibilities to Pueblo and Tribal governments pursuant to applicable federal law. *See e.g.* Executive Memorandum of April 29, 1994; Executive Order #13084 issued May 14, 1998 and superseded by Executive Order No. 13175 issued November 6, 2000; Secretarial Order #3206, dated June 5, 1997 and Secretarial Order #3215, dated April 28, 2000; Secretarial Order #3175, dated November 8, 1993, now incorporated in 512DM2; Reclamation's August 31, 1994 ITA Policy; and Corps' Policy Guidance Letter No. 57, Indian Sovereignty and Government-to-Government Relations with Indian Tribes. The federal participants will conduct government-to-government consultations with Tribes and Pueblos potentially affected by the Collaborative Program.

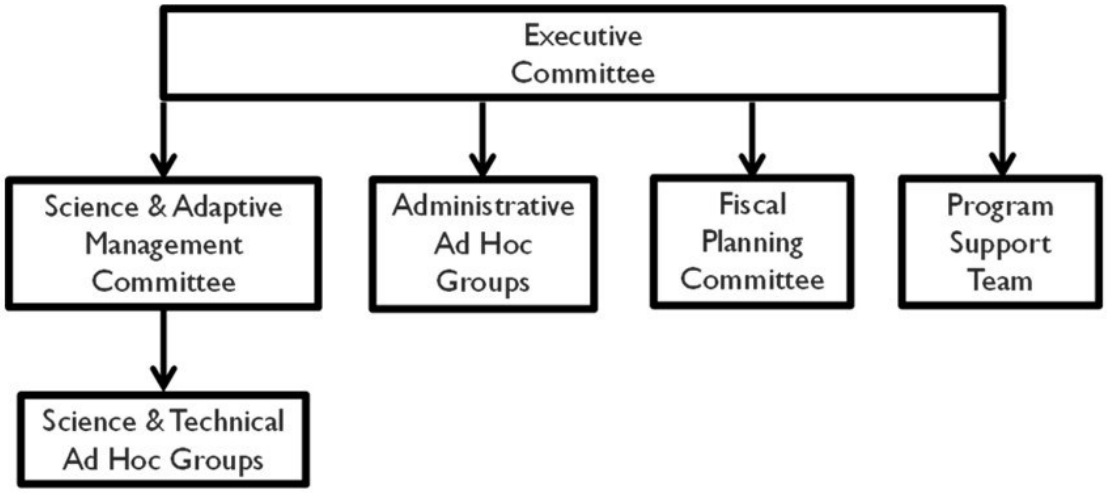
4.2. Pueblo and Tribal Involvement

The Executive Committee recognizes that Indian Pueblos and Tribes are sovereign entities and encourages them to become a Signatory. Whether or not any or all of the Tribes and Pueblos become directly involved, the Executive Committee will seek to engage and establish working partnerships with Pueblos and Tribes in implementing the Collaborative Program.

The Signatories recognize that the Indian Pueblos and Tribes may elect to not sign the MOA, and rather, conduct their sovereign affairs privately, which may include activities that contribute to the objectives of the Collaborative Program. Nothing in the MOA shall obligate any non-Signatory Indian Pueblo or Tribe to participate in, contribute to, or otherwise adopt elements of the MOA. The Federal government continues to have a trust responsibility to all potentially affected Indian Pueblos and Tribes, whether or not an Indian Pueblo or Tribe signs the MOA.

Article 5. ORGANIZATION

The Collaborative Program includes the Executive Committee, the Science and Adaptive Management Committee, the Fiscal Planning Committee, ad hoc groups, and the Program Support Team.



5.1. Executive Committee

The Executive Committee is the governing body of the Collaborative Program consisting of one representative from each of the Signatories. The Executive Committee provides a policy perspective, approves recommendations for science activities and management alternatives, and is responsible for formally providing decisions on all issues, unless specifically delegated to another Collaborative Program committee, an Administrative Ad Hoc Group, or the Program Support Team. The Executive Committee can charter standing committees, charge Administrative Ad Hoc Groups for specific tasks, or terminate existing committees or Administrative Ad Hoc Groups. For details on Executive Committee Operations, see Article 6.0.

5.2. Science and Adaptive Management Committee

The Science and Adaptive Management Committee is responsible for overseeing the Collaborative Program's scientific and information management activities, and is comprised of subject matter experts appointed by the Executive Committee. The Science and Adaptive Management Committee will be responsible for coordinating the implementation and updates of the Science and Adaptive Management Plan, sharing scientific findings, and supporting the scientific peer review process. The Science and Adaptive Management Committee will provide recommendations to the Executive Committee for action to coordinate the implementation of the Science and Adaptive Management Plan. For details on Science and Adaptive Management Committee operations, see Article 7.0.

5.3. Fiscal Planning Committee

The Fiscal Planning Committee is a group of Signatory representatives selected by the Executive Committee and tasked with identifying funding streams for Collaborative Program-recommended activities. The Fiscal Planning Committee reports directly to the Executive Committee and coordinates on Signatory funding capabilities (i.e. authorities, budget restraints, interests) to support priority Collaborative Program-recommended work, and will coordinate with the Science and Adaptive Management Committee to identify other potential resources, such as partnerships, to support Collaborative Program-related project implementation. If gaps in available funding for

activities and projects recommended as priority in the Long-Term Plan are identified, those gaps will be reported back to the Executive Committee.

The Fiscal Planning Committee will also engage in building a diverse financial support system for Collaborative Program-recommended activities outlined in the Long-Term Plan. The Fiscal Planning Committee will meet as needed to coordinate for various funding-related timelines and deadlines, and will help coordinate the supporting information for those Signatories that can appropriately seek additional funding. The Signatories that participate in the Fiscal Planning Committee, will meet to identify and pursue additional funding sources (i.e. seeking grants, requesting appropriations) and partnership opportunities in support of funding Collaborative Program-recommended activities. For details on Fiscal Planning Committee operations, see Article 8.

5.4. Ad Hoc Groups

Only the Executive Committee and Science and Adaptive Management Committee are authorized to form ad hoc groups. An ad hoc group is given a charge from its originating committee detailing out a specific written scope of work, defined products, and deadlines. Members of an ad hoc group may consist of Signatory representatives, contractors, and other parties who have expertise related to the assignment given to the ad hoc group. Ad hoc groups are intended to be limited in scope and duration with reporting requirements set by the originating committee.

The Executive Committee forms Administrative Ad Hoc Groups when additional assistance or expertise is beneficial to carrying out Collaborative Program operations and administration. The Science and Adaptive Management Committee forms Science and Technical Ad Hoc Groups to carry out tasks in support of the Science and Adaptive Management Plan. For details on ad hoc group formation and operations, see Article 9.0.

5.5. Program Support Team

The Program Support Team is comprised of a program coordination lead, science coordination lead, technical support staff, and administrative staff. The Program Support Team provides management and technical support to the Executive Committee and other Collaborative Program committees and ad hoc groups. The Program Support Team may be a third-party contractor. For details on the Program Support Team roles and responsibilities, see Article 10.0.

Article 6. EXECUTIVE COMMITTEE

6.1. Designees and Alternates

Each Signatory shall designate, by written notice to the program coordination lead, one representative to serve on the Executive Committee. Each Signatory, by written notice to the program coordination lead, may appoint one or more alternates to act as its representative in the absence of its regular Executive Committee representative. The program coordination lead shall keep an updated list of all representatives and alternates.

6.2. Responsibilities

The Executive Committee provides Collaborative Program direction, policies, and activities, and ensures that the Collaborative Program uses the best available science and utilizes an adaptive

management framework. Specific responsibilities of the Executive Committee include, but are not limited to:

a) **Program Planning** – Sets Collaborative Program policies and priorities. Supports the development and implementation of a Long-Term Plan.
b) **Governance** – Reviews and votes on Collaborative Program Signatory applications. Updates By-Laws. Establishes, oversees, and terminates committees and Administrative Ad Hoc Groups as necessary. Manages and oversees the Program Support Team in order to fulfill the Collaborative Program's goals, objectives, and operations.
c) **Fiscal Responsibilities** – Reviews budget information from Signatories annually. Develops multi-year recommendations for Collaborative Program activities, as identified in the Long-Term Plan. Coordinates with the Fiscal Planning Committee on funding requests.
d) **Communications** – Ensures that a Collaborative Program Annual Report is produced and distributed. Gives final approval on Collaborative Program recommendations on management alternatives, and communicates those recommendations to the appropriate entities. Engages with others in the community, including commissions, non-Signatory agencies, Pueblos and tribes, legislative bodies, and interest groups, to communicate the goals, objectives, and actions of the Collaborative Program and address the concerns and requests of these entities.

6.3. Officers

The Executive Committee officers shall include the Federal Co-chair and Non-federal Co-chair, collectively referred to as the co-chairs.

6.3.1. Selection of Federal and Non-federal Co-chairs

The Secretary of the Interior appoints the Federal Co-chair.

The non-federal members of the Executive Committee shall elect the Non-federal Co-chair.

6.3.2. Co-Chair Terms

Co-chair terms shall last at least one year.

6.3.3. Removal of Federal and Non-federal Co-chairs

The Executive Committee may recommend the Secretary of the Interior remove the Federal Co-chair through a supermajority vote of no confidence.

The Non-federal Co-chair shall be removed through a supermajority vote of no confidence by the non-federal members of the Executive Committee.

6.3.4. Resignation of Co-chairs

Federal and Non-federal Co-chairs must provide notice of resignation to the Executive Committee at least thirty (30) days before resigning.

6.3.5. Replacement of Co-chairs

Upon the resignation or removal of the Federal Co-chair, the Secretary of the Interior will appoint a new Federal Co-chair in a timely manner and notify the Executive Committee of that selection. The selected individual will immediately assume the responsibilities of the Federal Co-chair. The new Federal Co-chair shall be announced at the next Executive Committee meeting.

Upon the resignation or removal of the Non-federal Co-chair, the non-federal members of the Executive Committee shall elect a new Non-federal Co-chair. The selected individual will immediately assume the responsibilities of the Non-federal Co-chair. The new Non-federal Co-chair shall be announced at the next Executive Committee meeting.

6.3.6. Responsibilities of Co-chairs

The Federal Co-chair shall be a non-voting member of the Executive Committee. The Non-federal Co-chair shall be a voting member of the Executive Committee in his or her role as a Signatory representative. Either co-chair may chair meetings independently in the absence of the other co-chair.

The duties of the Federal and Non-federal Co-chairs shall include:

- convening the Executive Committee
- developing Executive Committee meeting agendas
- communicating to their respective Executive Committee members
- representing the Collaborative Program

Each co-chair shall interact with the Program Support Team to assure that assignments from the Executive Committee are completed and to develop Executive Committee meeting agendas.

6.4. Decision-Making Procedures

The Executive Committee seeks to have unanimous consent in reaching decisions. The Executive Committee may make decisions at meetings if a quorum is present. A quorum is not necessary for approval of meeting agendas, meeting minutes, future meeting dates, or action requests for Executive Committee members or the Program Support Team. No decisions requiring a quorum will be made without announcement at least seven (7) calendar days prior to the meeting date.

If unanimous consent is not reached on a decision item, the topic will be tabled and referred to an Administrative Ad Hoc Group that is representative of the spectrum of opinions, with members named by the Executive Committee co-chairs. This group will examine the issue and report recommendations for resolution at the next Executive Committee meeting. No decision items will be tabled more than once. If the Executive Committee does not reach unanimous consent on a tabled item following the recommendations of the Administrative Ad Hoc Group, the decision item may be approved by a supermajority vote (75% of the Signatories present at the meeting). If the item passes by a super majority vote, the members opposing the decision may submit a report to the Executive Committee co-chairs to be added to the official minutes of the meeting.

The Executive Committee recognizes that decision items must not violate applicable federal, state, tribal, or local laws.

6.4.1. Resolution of Concerns

If any Executive Committee member has concerns about Collaborative Program-related issues, they may submit a timely written request for resolution to the Executive Committee co-chairs. The written request must identify the issue of concern and offer a recommended resolution. The co-chairs will present the concerns to the Executive Committee no later than at the next meeting. The Executive Committee will review the written request, determine an appropriate resolution, and respond in a timely manner.

6.5. Meetings

The Executive Committee will hold meetings as necessary to conduct its business. At a minimum, the Executive Committee shall meet once each annual quarter and as called by the co-chairs. Executive Committee meetings shall be open to an audience of non-committee members. Only Executive Committee members or designated alternates may participate in meeting deliberations. Prior to the meeting, the Executive Committee may invite ad hoc group leads and/or outside experts to participate on specific agenda items, as needed. At each meeting, time will be included on the agenda for public comment. Non-members that wish to provide comment will have up to three (3) minutes to speak during this time, unless included on the agenda or at the specific request of the Executive Committee. Non-members may submit written comments to the program coordination lead prior to Executive Committee meetings. The co-chairs will ensure adequate opportunity for public comments and input at meetings.

6.5.1. Notice of Meetings

The program coordination lead shall give advance notice of Executive Committee meetings to Executive Committee members, additional interested parties, and the public. Notice will include draft and draft-final agendas with dates, times, locations, and decisions to be made that have been approved by the Executive Committee co-chairs. Prior to the meeting, any Executive Committee member may contact the co-chairs and make a timely request that an agenda item be included or altered. Draft agendas will be accompanied by supporting materials associated with meeting items as read-aheads, with the exception of materials under nondisclosure or confidentiality agreements, materials pertaining to closed portions of meetings, or materials declared confidential by the law.

The program coordination lead will distribute meeting materials to Executive Committee members at least seven (7) calendar days prior to the Executive Committee meeting through email. The meeting materials will be available to the public on the Program Portal.

6.5.2. Special Meetings

A special meeting may be called outside of the regular Executive Committee meeting schedule by the co-chairs or by an Executive Committee decision. Special meetings will adhere to the requirements set forth in Section 6.4.1.

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6.5.3. Emergency Meetings

Emergency meetings may be called by request of both co-chairs. Executive Committee members shall receive forty-eight (48) hours' notice of an emergency meeting by email. Read-aheads will be distributed to Executive Committee members as soon as possible but no later than twenty-four (24) hours prior to the emergency meeting. Decisions made during an emergency meeting will follow the same decision-making procedures of a regular meeting, with the exception that decisions may not be tabled, decisions may be decided by a super majority vote, and the notice period is shortened to at least 48 hours.

6.5.4. Cancellation of Meetings

An email notice of cancellation or postponement will be provided as early as possible and shall include the reason(s) for cancellation or postponement and a tentative date and/or time for rescheduling.

6.5.5. Closed Sessions

The Executive Committee may hold a closed session to address sensitive issues related to contracts, membership, personnel, or legal matters. The decision to hold a closed session is reached by unanimous consent of the Executive Committee. The purpose of a closed session shall be noted in the Executive Committee meeting minutes. Only the Executive Committee member or designated alternate shall attend a closed session.

6.6. Establishment of Administrative Ad Hoc Groups

The Executive Committee may establish Administrative Ad Hoc Groups to carry out tasks related to Collaborative Program operations and administration, such as developing or updating foundational documents, or developing recommendations for decision items per Section 6.4. Administrative Ad Hoc Groups will operate according to the protocols laid out in Article 8.

6.7. Annual Collaborative Program Evaluation

The Executive Committee annually (or more frequently at their discretion) evaluates Collaborative Program activities and committees/groups using guiding principles consistent with the Science and Adaptive Management Plan. Guiding principles include the Collaborative Program's mission, goals, and objectives. By performing regular evaluations, decision-makers, including the Executive Committee members, Congressional and State representatives, and others, can be assured that the Collaborative Program actions are accomplishing the mission and benefitting the listed species. The Executive Committee assigns evaluation-related tasks to Administrative Ad Hoc Groups and the Program Support Team as appropriate. Collaborative Program activities and committees/groups are assessed based on how they address the up-to-date guiding criteria. Outcomes of the annual Executive Committee evaluation may include the following:

- Modifications to the composition of committees/groups
- Sunsetting groups
- Updates or clarifications to committee charters or group charges
- Adjustments of timelines and deadlines

- Amendments and updates to the S&AM Plan, Long-Term Plan, and/or by-laws
- Re-scoping work plans as necessary

6.8. External Outreach and Engagement

The Executive Committee will consider the interests of the general public in implementing the Collaborative Program. The Executive Committee will determine the direction and messaging to parties external to the Collaborative Program, including legislatures, agency heads, media, and the general public.

The Executive Committee is responsible for communicating recommendations for scientific activities and science-based best management alternatives to the appropriate entities. Recommended scientific activities are identified in the Long-Term Plan and organized based on management-relevant categories and priority planning objectives agreed upon by the Collaborative Program.

The Executive Committee makes recommendations on best management alternatives based on the current scientific understanding of species responses to conditions in the ecosystem. The Collaborative Program uses adaptive management to evaluate and adjusts its recommendations as understanding evolves with new scientific findings. The Executive Committee also encourages managers to bring questions to the Collaborative Program for consideration.

Article 7. SCIENCE AND ADAPTIVE MANAGEMENT COMMITTEE

The Science and Adaptive Management Committee is a non-decision-making body and makes recommendations to the Executive Committee. It will coordinate the implementation of Collaborative Program-related science initiatives and Signatory efforts by defining and delegating tasks to Science and Technical Ad Hoc Groups; compiling results from scientific studies, modeling, and monitoring efforts; and translating scientific findings into recommendations for best management practices in the Middle Rio Grande.

7.1. Membership

The Science and Adaptive Management Committee shall consist of no more than eight (8) subject matter expert members appointed by the Executive Committee. These positions will include:

- Four (4) specified subject matter experts with the following areas of expertise:
    1. Aquatic ecology
    2. Terrestrial ecology
    3. Ecosystem
    4. Hydrology
- Up to four (4) flexible subject matter experts selected based on science-related needs, as determined by the Executive Committee. The Science and Adaptive Management Committee may provide input on which areas of expertise would benefit the group, but the ultimate decision will be made by the Executive Committee.

An individual may not hold more than one position on the Science and Adaptive Management Committee at one time.

One (1) Executive Committee member shall serve in an *ex-officio* advisory capacity to the Science and Adaptive Management Committee. This position will not count towards the eight (8)-count membership, and will not participate as a subject matter expert.

The Science and Adaptive Management Committee will be chaired by the science coordination lead and supported by the Program Support Team (Article 10). Neither the science coordination lead nor members of the Program Support Team will count towards the eight (8)-count membership.

7.1.1. Application Process

The Executive Committee, in coordination with the science coordination lead and program coordination lead, will oversee and administer the application process. Interested individuals shall submit a formal application to the science coordination lead. Individuals may apply for more than one Science and Adaptive Management Committee position and must submit one application per position. Applications will be accepted from experts both internal and external to the Collaborative Program.

The Executive Committee will review, or delegate review of, submitted applications and each Executive Committee representative will cast one vote per Science and Adaptive Management Committee position no later than the last Executive Committee meeting of the calendar year. The Executive Committee will nominate Executive Committee members for the *ex-officio* position and vote to fill the position. The Executive Committee has final decision-making authority on Science and Adaptive Management Committee membership.

7.1.2. Membership Terms

Science and Adaptive Management Committee members shall be appointed by the Executive Committee for staggered two (2)-year terms. Sitting Science and Adaptive Management Committee members may apply for one (1)-year term limit extensions. Individuals may serve on the Science and Adaptive Management Committee for no more than four (4) consecutive years, except as authorized by the Executive Committee.

7.1.3. Membership Vacancies

If a vacancy on the Science and Adaptive Management Committee occurs mid-term, it will remain open unless the Executive Committee, in coordination with the Science and Adaptive Management Committee, determines a need to fill the position. Upon a determination, the Executive Committee may appoint an individual for the remainder of the term.

7.2. Responsibilities

Science and Adaptive Management Committee responsibilities include:

- Coordinating with the science coordination lead and other Program Support Team staff to ensure the completion of Collaborative Program-related science initiatives
- Convening and coordinating Science and Technical Ad Hoc Groups to complete tasks in support of the Science and Adaptive Management Plan
- Reviewing results from Collaborative Program-related studies and modeling/monitoring activities and translating findings into recommended management alternatives
- Working with the Fiscal Planning Committee to coordinate Executive Committee-recommended work products (e.g., studies, projects)
- Reporting to the Executive Committee the progress of Science and Adaptive Management Plan implementation, including a summary of updates to Collaborative Program objectives

and strategies, and modifications to conceptual ecological models, with associated scientific justifications

- Providing updates at each Executive Committee meeting, which includes:
  - Discussing proposed work and the status of in-progress work products
  - Informing the Executive Committee of the formation of Science and Technical Ad Hoc Groups with assigned tasks and deadlines
  - Informing the Executive Committee of the disbanding of Science and Technical Ad Hoc Groups
  - Proposing implementation schedules for Collaborative Program science and adaptive management initiatives for Executive Committee approval
  - Suggesting amendments to the Science and Adaptive Management Plan
  - Documenting the range of Science and Adaptive Management Committee opinions with associated scientific justifications for Executive Committee review and consideration of next steps
  - Providing evidence-based recommendations for scientific research and management alternatives
  - Recommending research questions for independent peer review, as needed

7.3. Meetings

The Science and Adaptive Management Committee will hold meetings as necessary to conduct its business. At a minimum, the Science and Adaptive Management Committee shall meet once each annual quarter, and may meet more frequently, as needed. Meetings will be facilitated by the science coordination lead. Formal agendas will be drafted for review and approval at each meeting. The Program Support Team will announce Science and Adaptive Management Committee meetings on the Program Portal event calendar and will include draft agendas and read-aheads for download. Meeting agendas and read-aheads will be made available to Science and Adaptive Management Committee members no later than seven (7) calendar days in advance of the meeting date, with the exception of materials under nondisclosure or confidentiality agreements, materials pertaining to closed portions of meetings, or materials declared confidential by the law.

Science and Adaptive Management Committee meetings shall be open to an audience of non-committee members. Only Science and Adaptive Management Committee members may participate in meeting deliberations. Prior to the meeting, the Science and Adaptive Management Committee may invite ad hoc group leads and/or outside experts to participate on specific agenda items, as needed. At each meeting, time will be included on the agenda for non-member comment. Non-members that wish to provide comment will have up to three (3) minutes to speak during this time, unless included on the agenda or at the specific request of the Science and Adaptive Management Committee. Non-members may submit written comments to the science coordination lead prior to Science and Adaptive Management Committee meetings.

7.4. Establishment of Science and Technical Ad Hoc Groups

The Science and Adaptive Management Committee may establish Science and Technical Ad Hoc Groups to carry out tasks necessary for implementing the Science and Adaptive Management Plan and Long-Term Plan. Science and Technical Ad Hoc Groups will operate according to Article 9.0.

7.5. Evaluation of the Science and Adaptive Management Committee

As part of the annual Collaborative Program evaluation, the Executive Committee will evaluate the performance of the Science and Adaptive Management Committee with respect to its assigned duties and responsibilities, membership, and progress as described in Section 6.2.1.

Article 8. FISCAL PLANNING COMMITTEE

The Fiscal Planning Committee is created for the purpose of building a diverse financial support system for priority Collaborative Program activities set forth in the Long-Term Plan. The Fiscal Planning Committee shall report to the Executive Committee on securing funding and other resources for priority Collaborative Program-recommended activities set forth in the Long-Term Plan, as well as on any remaining funding needs or other resource gaps and recommended opportunities to fill those gaps. The Fiscal Planning Committee shall communicate with the Science and Adaptive Management Committee on the implementation of science activities set forth in the Long-Term Plan.

8.1. Membership

The Fiscal Planning Committee is comprised of Collaborative Program Signatory representatives. Representatives may vary to adequately achieve the objectives set for each meeting.

The Fiscal Planning Committee will select a federal co-chair and non-federal co-chair to serve as committee leaders for one-year terms, with no more than two consecutive one-year terms.

The Program Support Team shall support the Fiscal Planning Committee and serve as the designated point of contact for the committee.

8.2. Responsibilities

The Fiscal Planning Committee's responsibilities include the following:

- Coordinating on Signatory funding capabilities (i.e., authorities, budget restraints, interests, deadlines) to support priority Collaborative Program activities
- Identifying and pursuing additional funding sources (i.e., grants, appropriations) in support of funding Collaborative Program-related activities, including coordinating messaging for these efforts
- Identifying other potential resources (i.e., partnerships, grants) to support Collaborative Program-related project implementation
- Coordinating with other Collaborative Program committees and groups to achieve the Fiscal Planning Committee's purpose
- Reporting and communicating requests to the Executive Committee on the pursuit of external funding and other resources to support Collaborative Program activities
- Coordinating on implementation of Signatory activities of interest to the Collaborative Program within the purpose of the Fiscal Planning Committee, and at the invitation of the implementing Signatory
- Communicating with the Science and Adaptive Management Committee on updates regarding the implementation of science activities set forth in the Long-Term Plan

Individual Signatories reserve the right to ensure appropriate use of their respective commitments consistent with applicable laws and regulations. The Fiscal Planning Committee and the Executive Committee may make recommendations on how individual Signatories allocate their respective funding, but the ultimate decision lies with the individual Signatories.

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8.3. Meetings

The Fiscal Planning Committee will hold meetings as necessary to conduct its business. At a minimum, the Fiscal Planning Committee shall meet twice per year to accomplish activities in the Science and Adaptive Management Plan's annual administrative schedule, with additional meetings as needed to correspond with funding opportunities and timelines related to fulfilling its role. Meetings will be facilitated by a member of the Program Support Team. Formal agendas will be drafted for review and approval at each meeting. The Program Support Team will announce Fiscal Planning Committee meetings on the Program Portal event calendar, including draft agendas. Read-aheads will be provided via public download or email as appropriate. Meeting agendas and read-aheads will be made available to Fiscal Planning Committee members no later than seven (7) calendar days in advance of the meeting date.

Fiscal Planning Committee meetings shall be open to an audience of non-committee members. Only Fiscal Planning Committee members may participate in meeting deliberations.

The Program Support Team will keep minutes of all Fiscal Planning Committee meetings. Once approved by the Fiscal Planning Committee, the Program Support Team will make final meeting minutes publically available on the Program Portal.

8.4. Evaluation of the Fiscal Planning Committee

As part of the annual Collaborative Program evaluation, the Executive Committee will evaluate the performance of the Fiscal Planning with respect to its assigned duties and responsibilities, as described in Section 6.2.1.

Article 9. AD HOC GROUPS

9.1. Establishment of Ad Hoc Groups

The Executive Committee has exclusive authority to establish Administrative Ad Hoc Groups to carry out tasks related to carrying out Collaborative Program operations and administrative functions. The Science and Adaptive Management Committee has exclusive authority to establish Science and Technical Ad Hoc Groups to carry out tasks necessary for implementing the Science and Adaptive Management Plan and Long-Term Plan.

The originating committee shall complete a written charge for each ad hoc group it wishes to establish. Ad hoc group charges shall clearly define:

a) task(s) assigned
b) qualifications for ad hoc group membership
c) suggested ad hoc group membership
d) an ad hoc group lead
e) any attendance requirements or guidelines to achieve sufficient participation
f) deliverable(s)
g) schedule, including anticipated sunset date

An ad hoc group is not a standing group and shall disband once its charge is complete, or at the discretion of its originating committee.

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9.2. Membership

Membership on ad hoc groups will vary depending on the subject matter and may include:

a) Signatories;
b) professionals with expertise in the subject matter;
c) contractors;
d) a member of the Program Support Team; or
e) other parties with particular experience or expertise in the subject matter addressed by the ad hoc group.

Membership is voluntary, and subject to approval by the originating committee. Members are expected to regularly, actively, and professionally participate in their assigned groups.

In establishing an Administrative Ad Hoc Group, the Executive Committee will designate a leader that is responsible for ensuring the ad hoc group completes its task pursuant to its charge as assigned by the Executive Committee. The leader of an Administrative Ad Hoc Group may be a member of the Program Support Team.

In establishing a Science and Technical Ad Hoc Group, the Science and Adaptive Management Committee will designate a leader that is responsible for ensuring the ad hoc group completes its task pursuant to its charge as assigned by the Science and Adaptive Management Committee. The leader of a Science and Technical Ad Hoc Group may be a member of the Program Support Team. Science and Adaptive Management Committee members may sit on a Science and Technical Ad Hoc Group as technical experts, but may not serve as the ad hoc group leader.

9.3. Ad Hoc Group Support

The program coordination lead will work with the Executive Committee, and the science coordination lead will work with the Science and Adaptive Management Committee, to determine ad hoc group staffing needs, including a leader and the level of support from the Program Support Team. It is the responsibility of the ad hoc group leader to ensure work products are completed as assigned in the charge.

9.4. Meetings

An ad hoc group will meet as often as needed to complete the work within the schedule defined in its charge. It is the responsibility of the ad hoc group leader to ensure meetings are held with sufficient participation to complete its charge. A quorum is not needed for meetings unless specified in the charge.

9.5. Work Products

All final ad hoc group work products are subject to review and approval by the originating committee. The ad hoc group leader makes recommendations on dissemination of ad hoc group work products, and the originating committee determines next steps for all ad hoc group work products.

9.6. Review of Ad Hoc Groups

The Executive Committee shall receive progress updates from the program coordination lead or the ad hoc group leader regarding active Administrative Ad Hoc Groups at each meeting. The Science and Adaptive Management Committee shall receive progress updates from the science coordination

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lead or the ad hoc group leader regarding active Science and Technical Ad Hoc Groups at each meeting.

The originating committee may, as necessary, revise an ad hoc group's charge, schedule, or membership, or decide to sunset the ad hoc group early.

9.7. Disbanding Ad Hoc Groups

An ad hoc group shall be disbanded upon the completion of its charge or at the discretion of its originating committee. If the originating committee determines the need for additional work that is not included in the original charge, a new ad hoc group charge shall be developed as described in Section 9.1.

Article 10. PROGRAM SUPPORT TEAM

The Program Support Team provides administrative, management, and technical support for the Collaborative Program working to accomplish its goals and objectives through implementation of the Long-Term Plan and Science and Adaptive Management Plan. The role of the Program Support Team may be carried out by a third party contractor or by employees of one or more Signatories. The Program Support Team provides support to the Executive Committee, Science and Adaptive Management Committee, and Fiscal Planning Committee, and may provide support to ad hoc groups at the request of originating committees.

10.1. Roles

The Program Support Team consists of a program coordination lead, science coordination lead, and other support staff, as needed. These roles and respective responsibilities may be changed upon direction of the Executive Committee, subject to any applicable contracting requirements and regulations.

10.1.1. Program Coordination Lead

The program coordination lead serves as the Program Support Team's main point of contact for the Collaborative Program's Executive Committee, Fiscal Planning Committee, and Administrative Ad Hoc Groups, and ensures the completion of necessary tasks. The program coordination lead will provide a report at each Executive Committee meeting on Collaborative Program activities, accomplishments, and recommendations on next steps for Executive Committee consideration. Annually, the program coordination lead will direct the Collaborative Program evaluation on behalf of the Executive Committee and in coordination with the Executive Committee co-chairs. Additionally, the program coordination lead coordinates and facilitates Fiscal Planning Committee meetings.

10.1.2. Science Coordination Lead

The science coordination lead serves as the Program Support Team's main point of contact for the Collaborative Program's Science and Adaptive Management Committee and its Science and Technical Ad Hoc Groups. The science coordination lead is responsible for chairing the Science and Adaptive Management Committee; providing scientific oversight and guidance to ensure sound scientific principles are employed; and leading, coordinating, and facilitating Independent Science Panels. The science coordination lead will work with the program coordination lead to ensure the Collaborative Program's science activities align with the Collaborative Program's guiding principles

and direction of the Executive Committee, to coordinate the planning of science activities with the Fiscal Planning Committee, and evaluate the Collaborative Program's science program annually.

10.2. Responsibilities

10.2.1. General Duties

The duties of the Program Support Team include:

a) Regularly communicating with Collaborative Program Signatories and other participants on initiatives, activities, and upcoming meeting topics;
b) Ensuring the completion of tasks assigned from Collaborative Program meetings;
c) Planning support for the Collaborative Program, including helping with the development, updates, and implementation of the Long-Term Plan, Science and Adaptive Management Plan, and work plans;
d) Maintaining and updating the science and adaptive management tools;
e) Maintaining the Collaborative Program's records; and
f) Completing tasks to carry out Collaborative Program operations and guiding principles.

10.2.2. Support of Collaborative Program Committees

The Program Support Team will provide general administrative support to Collaborative Program committees, including transmitting committee communications, distributing agendas and meeting materials, developing and distributing meeting minutes, and organizing meetings.

10.2.3 Support of Ad Hoc Groups

The Program Support Team may provide support for ad hoc groups at the request of originating committees.

10.3. Evaluation of the Program Support Team

As part of the annual Collaborative Program evaluation, the Executive Committee will evaluate the performance of the Program Support Team with respect to its assigned duties and responsibilities, as described in Section 6.2.1.

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Appendix A: Initial Signatories

Initial Signatories to the 2008 MOA:

- Albuquerque-Bernalillo County Water Utility Authority
- Assessment Payers Association of the Middle Rio Grande Conservancy District
- City of Albuquerque
- Middle Rio Grande Conservancy District
- N.M. Department of Agriculture
- N.M. Department of Game and Fish
- N.M. Interstate Stream Commission
- N.M. Office of the Attorney General
- Pueblo of Isleta
- Pueblo of Santa Ana
- Pueblo of Santo Domingo/Kewa
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service
- U.S. Forest Service
- University of New Mexico

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Appendix B: Current Signatories

Last updated December 10, 2020.

Current Signatories to the 2008 MOA:

- Albuquerque-Bernalillo County Water Utility Authority
- Audubon New Mexico
- Assessment Payers Association of the Middle Rio Grande Conservancy District
- Bosque Ecosystem Monitoring Program
- Buckman Direction Diversion
- City of Albuquerque
- Middle Rio Grande Conservancy District
- N.M. Department of Game and Fish
- N.M. Interstate Stream Commission
- N.M. Office of the Attorney General
- Pueblo of Isleta
- Pueblo of Sandia
- Pueblo of Santa Ana
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service
- University of New Mexico

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By-Laws Administrative Ad Hoc Group
Summary of Proposed By-Laws Revisions

The By-Laws Administrative Ad Hoc Group was tasked with revising the Middle Rio Grande Endangered Species Collaborative Program's (Collaborative Program's) By-Laws, which were last amended April 13, 2012. Below is a summary of the proposed revisions, with the rationale for those changes, to inform the Executive Committee's review. Please note that section numbers have changed throughout the document to reflect additions and deletions. Additional changes are made throughout for clarity, style, and consistency.

2012 Section Reference	2021 Section Reference	Summary of Changes
1.0 Purpose of By-Laws	***Article 1. Name and Purpose***	Updated to include a more descriptive introductory paragraph about the Collaborative Program and the new mission statement. Defines the Collaborative Program area. *A previous version of this section was approved by the Executive Committee (EC), and has been further updated to include the new mission statement.*
1.4 Definitions	1.2. Definitions	Updated to reflect new terms in the rest of the By-Laws. Removed obsolete terms. Revision: Quorum is defined as 2/3 of the Executive Committee (previously 50%).
1.5 Effective Date	1.3. Effective Date	Revision: By-Laws are adopted by *unanimous consent* of the EC, instead of by vote.
1.6 Amendment	1.6. Amendment	Revision: Modifications are made by *unanimous consent* of the EC, instead of by vote. Addition: An amended version supersede previous versions.
	Article 2. Conflict of Interest	This is a new section that stipulates all Signatories must follow applicable laws, rules, and regulations regarding conflict of interest.
2.0 Program Membership	***Article 3. Program Membership***	
2.1 Initial Signatories		Removed this section from the By-Laws. A list of initial signatory organizations is included as Appendix A.
	3.1 Membership	This is a new section that defines membership, generalizes the types of organizations that may be included in the Collaborative Program, and generally describes the expectations of membership.
2.2 Addition of Signatories	3.2. Addition of Signatories	Addition: Organizations must operate within the Collaborative Program area.

		Revisions: • Removed the 20-member cap to encourage broader engagement, and noted it was the Executive Committee's responsibility to maintain balanced interests and a practicable committee size. • Revised the criteria for membership to be more relevant to a science-based program, and removed references to the RIP. • Revised the membership application and approval process to reflect the process followed.
2.3. Resignation and Reinstatement of Signatories	3.3. Resignation, Removal, and Reinstatement of Signatories	Revision: Expanded this section: • Signatories who resign may rejoin without the full application process, with unanimous consent of the Executive Committee. • Signatories who are terminated for non-attendance may rejoin by going through the application process. • Moved membership issues due to Executive Committee non-attendance from the old section 5.4 to this section, and added details regarding written notice procedures.
3.0 Tribal Interests and Participation	***Article 4. Tribal Interests and Participation***	No change
4.0 Organization	***Article 5. Organization***	Addition: Included the hierarchical organizational chart from the Science & Adaptive Management Plan in the section's introduction. Revisions: Updated this section to reflect the new Program structure: • Removed references to the Coordination Committee and Work Groups; changed "Program Management Team" to "Program Support Team;" and added the Science and Adaptive Management Committee, Fiscal Planning Committee, and Ad Hoc Groups. • Updated descriptions to reflect the roles and responsibilities laid out in the Science & Adaptive Management Plan.
5.0. Executive Committee	***Article 6. Executive Committee***	
5.1 Membership		Moved most details to Article 3. Program Membership. Remaining details moved to new section 6.1. Designees and Alternates.
	6.1. Designees and Alternates	Details about naming representatives and alternates to the Executive Committee from old Section 5.1 moved here, with clarification that the program coordination lead will handle the administration.
5.2 Responsibilities	6.2. Responsibilities	Revision: Condensed the list of responsibilities to four categories, and revised to reflect the Science & Adaptive Management Plan.

5.5 Officers	6.3. Officers	Moved this section earlier in the EC section for better document flow. Revision: Clarified the selection, resignation, and removal procedures for the co-chairs.
5.5.1 Election of Federal and Non-federal Co-chairs	6.3.1. Selection of Federal and Non-federal Co-Chairs	Deletion: Removed mention of the first meeting after the MOA. Simplified language.
5.5.5 Terms of Co-Chairs	6.3.2 Co-Chair Terms	Moved this section earlier. Generalized terms for to apply to both co-chairs.
5.5.3 Resignation of Co-Chairs	6.3.4. Resignation of Co-Chairs	Replaced "letter of resignation" with "notice of resignation." Deletion: Removed mention of the Federal Co-Chair resignation letter going to the Secretary of Interior, as there are internal procedures for notification.
5.5.4 Replacement of Co-Chairs	6.3.5. Replacement of Co-Chairs	Addition: Announcement of new co-chair at the next EC meeting. Revision: The selection of a new Non-federal Co-Chair does not happen at the EC meeting.
5.5.6 Responsibilities of Officers	6.3.6. Responsibilities of Co-chairs	Revision: Clarified that the Non-federal Co-Chair shall be a voting member of the EC *in his or her role as a Signatory representative*.
5.3 Voting Procedures	6.4. Decision-Making Procedures	Renamed to reflect that the EC seeks unanimous consent in making decisions. Revision: The following changes were made: • Changing what constitutes a quorum from 50% to 2/3 of the EC (as noted in the definitions) • *Instituting procedures for non-consensus decisions*: Once a decision is tabled at an EC meeting due to lack of unanimous consent, the issue is referred to a newly charged Administrative Ad Hoc Group representative of the range of opinions to deliberate on the topic and bring recommendations back to the EC at the next meeting. If unanimous consent can still not be reached, the decision can be made through a supermajority vote. Items cannot be tabled more than once.
5.3.1 Resolution of Concerns	6.4.1. Resolution of Concerns	Clarified that concerns are brought to the EC co-chairs.
5.4 Meetings	6.5. Meetings	Additions: • At minimum, the EC will meet once per quarter. • Included clarification that non-EC members may not participate outside of the public comment period, unless

		invited to by the EC on specific agenda items. Added procedures for public comment.
5.4.2 Special and Emergency Meetings	6.5.2. Special Meetings 6.5.3. Emergency Meetings	Separated out special and emergency meetings. • Special meetings are clarified to be outside of the scheduled meeting and must adhere to notice and decision-making procedures laid out in the By-Laws. • Emergency meetings must be called by both co-chairs, and have at least a 48-hour notice periods. Decisions cannot be tabled, and go to a super-majority vote if unanimous consent cannot be reached.
	6.6. Establishment of Administrative Ad Hoc Groups	New section to reflect the EC's role in establishing Administrative Ad Hoc Groups, referring to Article 8.
	6.7. Annual Collaborative Program Evaluation	New section to reflect the annual review described in the Science & Adaptive Management Plan. *<u>This section is not complete as the review process has not been approved, and we recommend that this section be updated and separately approved at a later EC meeting to reflect the agreed upon process.</u>*
5.6 Public Involvement	6.8. External Outreach and Engagement	<u>Addition</u>: This section is expanded to reflect the Executive Committee's responsibilities described in the Science & Adaptive Management Plan to communicate recommendations on behalf of the Collaborative Program to the appropriate entities.
6.0 Coordination Committee		This section was removed to reflect the new Program structure.
	Article 7. Science and Adaptive Management Committee	This section is new, and reflects what is laid out in the Science and Adaptive Management Committee (SAMC) charter with the following exceptions: • Clarifies that the EC *ex officio* member does not participate as a subject matter expert. • <u>Recommendation</u>: SAMC member terms are staggered. • Added a new responsibility of coordinating with the Program Support Team (PST). • Revised some of the responsibilities for clarity. • *Reporting* to the EC instead of "Updating" the EC. o <u>Addition</u>: New update responsibility to the EC around documenting the range of SAMC opinions with associated scientific justifications. • Clarified that some meeting materials may not be shared publicly due to confidentiality.
	Article 8. Fiscal Planning Committee	This section is new and reflects the Fiscal Planning Committee (FPC) charter with the following exceptions:

		• Addition: A new responsibility around communication with the SAMC on updates regarding implementation of science activities set forth in the Long-Term Plan. • Addition: FPC meetings are open to non-FPC members, but only members may participate.
7.0 Work Groups	***Article 9. Ad Hoc Groups***	Revision: This section was heavily rewritten to reflect the process laid out in the Science & Adaptive Management Plan on how ad hoc groups are formed, membership, and support. Flag for EC discussion: *How are ad hoc group work products recorded and archived? They will not be final until they are approved by the originating committee, but their work should be summarized in some way that can be searched and referenced.*
8.0 Program Management Team	***Article 10. Program Support Team***	Revision: This section was re-written using the roles and responsibilities laid out in the current Program and Science Support Contract. The key roles are the program coordination lead and the science coordination lead. The roles are generalized to avoid any future issues with titles. Flag for EC discussion: *Currently, roles and respective responsibilities may be changed upon direction of the EC. Is "direction" the correct word, as the PST may be a third-party contractor?*
	Appendix A: Initial Signatories	Moved from the membership section, as this is historic documentation and not necessary to include in the By-Laws.
	Appendix B: Current Signatories	This is meant to be a list maintained by the program coordination lead.

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

DATE: July 28, 2021

TO: The Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) Executive Committee (EC)

FROM: The MRGESCP Science and Adaptive Management Committee (SAMC)

RE: Recommended next steps with respect to findings and recommendations from the Science and Technical Ad Hoc Group: Rio Grande Silvery Minnow Population Monitoring Workgroup Summary Report

In January 2021, the SAMC tasked a Science and Technical Ad Hoc Group with summarizing all findings and recommendations resulting from the activities of the Rio Grande silvery minnow (RGSM) Population Monitoring Workgroup (PMWG) from 2012-2020. The report concludes that the RGSM Population Monitoring Program (PMP), in its current form, fulfills its intended purposes and that use of the data outside of those purposes should be assessed separately. As a noteworthy accomplishment, the SAMC would like to recognize the set of PMWG recommendations that were adopted into the ongoing monitoring plan by the Bureau of Reclamation in 2017 (*see PMWG memo dated October 31, 2017*). Additionally, the PMWG members who participated in the Ad Hoc Group's reviews are to be commended for their time and efforts, especially the ad hoc group lead and author of the summary report, Dr. Rich Valdez. This memorandum serves to supplement the summary report by providing next steps within the context of the Science and Adaptive Management Plan (WEST 2020).

Since regular collections were initiated in 1993, population monitoring of the RGSM has been updated over several iterations to meet the changing needs of resource managers. Recently, several reviews of the various technical aspects of the RGSM PMP have been undertaken. These have included, but are not limited to, a Science Work Group review of the report on RGSM PMP Results (included in Dudley and Platania 2011), a comparison of RGSM estimates from PMP and Population Estimation Program (PEP) data (Dudley et al. 2012), and an independent science panel convened by the PMWG to evaluate catch-per-unit-effort (CPUE) methodologies and sampling design (Hubert et al. 2016). A second panel, convened by GeoSystems Analysis, Inc. to identify RGSM critical uncertainties for development of an adaptive management framework (Noon et al. 2017), and a review of the analytical framework regarding effects of water management (Budy and Walsworth 2019) also considered treatment of RGSM population monitoring data.

Although these reviews varied in scope and purpose, each one offered feedback regarding all or a subset of the following generalized topics:

- Appropriate application of the CPUE metric;
- Sampling methods and design;
- Analytical methods and statistical considerations;
- Estimation of demographic parameters;
- Environmental covariates and management applications.

Uncertainty regarding application of the PMP data to address Collaborative Program needs is a common thread throughout the feedback from all of the reviews. Indeed, this summary of PMWG activities is no exception, as broad disagreements with one or more of the findings and recommendations have been documented. During our review of this report, we acknowledged the limitations of the PMP data to address all of the outstanding questions noted in the PMWG summary report. We also recognize the value of continuing the long-term monitoring protocol, as well as the iterative review and update of the PMP to address management needs. The SAMC, therefore, proposes the below next steps to ensure the appropriate actions for each recommendation, finding, or question in the summary report. These are in line with the MRGESCP Science and Adaptive Management Plan's process for managing disputes and providing solutions by informing decision support with relevant scientific findings.

- Formation of one or more Science and Technical Ad Hoc Groups to:
    1. Translate and refine recommendations from the summary report into specific questions with clear and testable hypotheses.
    2. Determine whether the PMP data, the PEP data, or a discrete study/analysis would be appropriate to address each of the refined hypotheses from #1.
    3. Identify from #1 the subset of essential, management-relevant questions that require periodic review as a quality assurance/quality control (QA/QC) procedure for the PMP and PEP.
- Survey managers regarding their expectations/needs, and create a dialogue to match those needs with the appropriate study designs, data collection protocols, analyses, and model outputs. Revisit biennially to address changing priorities and adjust accordingly.
- Consider repeating the PEP or other methodologies to collect the data to address the associated hypotheses identified from #2.
- Implement the QA/QC strategy from #3 at some interval (e.g., 5 years) and use the results to update protocols and decision support tools for adaptive management, if warranted.
- Consider the development of similar QA/QC review strategies for the Southwestern Willow Flycatcher, Yellow-billed Cuckoo, New Mexico Meadow Jumping Mouse and Pecos Sunflower.
- Regarding the hypotheses from #2 that require a discrete study/analysis, form Science and Technical Ad Hoc Groups to develop and scope projects for each. A related effort was initiated by Caplan et al. (2018) in their study ideas to address critical scientific uncertainties, which can serve as a logical starting place.

References Cited

Budy, P. and Walsworth, T.E. 2019. Review of the "Analytical framework for evaluating the proposed water management and maintenance actions on Rio Grande silvery minnow, southwestern willow flycatcher, and yellow-billed cuckoo and their critical habitats" with recommendations for future analytical considerations. USGS Utah Cooperative Fish and Wildlife Research Unit Report UCFWRU (1) 2019: 1-38.

Caplan, T., D. Lee, G. Wilde, H. Walker, and J. Frey 2018. Middle Rio Grande Adaptive Management Framework: Identifying Critical Scientific Uncertainties. Prepared for U.S. Army Corps of Engineers Albuquerque District on behalf of the Middle Rio Grande Endangered Species Collaborative Program. Prepared by GeoSystems Analysis, Inc. Albuquerque, New Mexico.

Dudley, R. K. and S. P. Platania. 2011. Rio Grande Silvery Minnow Population Monitoring Program Results from September 2009 to October 2010. Final Report submitted to the U. S. Bureau of Reclamation, Albuquerque, New Mexico. (*Includes document review comments from Middle Rio Grande Endangered Species Collaborative Program Science Work Group*)

Dudley, R. K., G. C. White, S. P. Platania, and D. A. Helfrich. 2012. Rio Grande Silvery Minnow Population Estimation Program Results from October 2011. Final Report submitted to the U. S. Bureau of Reclamation, Albuquerque, New Mexico.

Hubert, W., M. Fabrizio, R. Hughes, and M. Cusack. 2016. Summary of Findings by the External Expert Panelists: Rio Grande Silvery Minnow Population Monitoring Workshop Isleta Casino and Resort, 8-10 December 2015. Prepared on behalf of U.S. Bureau of Reclamation. Prepared by Atkins. Albuquerque, New Mexico.

Noon, B., D. Hankin, T. Dunne, G. Grossman, T. Caplan, D. Lee, G. Wilde, G. Bingham, A. Palochak. 2017. Independent Science Panel Findings Report: Rio Grande Silvery Minnow Key Scientific Uncertainties and Study Recommendations. Prepared for U.S. Army Corps of Engineers on behalf of the Middle Rio Grande Endangered Species Collaborative Program. Prepared by GeoSystems Analysis, Inc., Albuquerque, New Mexico.

Population Monitoring Work Group memorandum to U. S. Bureau of Reclamation. October 31, 2017. Recommendations on the 2018 Rio Grande Silvery Minnow Population Monitoring Contract.

Western EcoSystems Technology, Inc. (WEST) Project Support Team (PST). 2020. Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) Science & Adaptive Management Plan. Prepared for MRGESCP. Prepared by WEST. Approved by the Executive Committee on December 17, 2020.

Middle Rio Grande Endangered Species Collaborative Program
Habitat Restoration Workshop Proposal

The Science and Adaptive Management Committee (SAMC) is proposing a Middle Rio Grande Endangered Species Collaborative Program-hosted workshop around habitat restoration (HR) in late summer/early fall 2021. In recent months, several signatories have brought planned HR projects to the Collaborative Program for input, and have stated the desire to show the effectiveness of a specific HR project. This workshop will help organizations implementing HR in the Middle Rio Grande (MRG) to demonstrate success of projects, showcase additional benefits of HR, implement projects with greater success in the future, and broaden understanding of HR in the basin.

Workshop Objectives:

- To formulate research questions regarding HR to better define success.
- To identify potential metrics of success for HR projects, with associated considerations for data collection.
- To develop a list of environmental variables that will be modified, and potential responses to measure.

Participants:

- Any organization that plans and funds HR in the MRG
- Individuals with expertise in study design and data collection protocols
- Individuals with expertise in HR construction and monitoring in the MRG

When: August/September 2021

Location: Virtually on Zoom

Outcomes:

- Checklist of HR considerations to help plan effective HR projects
- Guidance on appropriate metrics, data collection methodologies and protocols, and sampling design elements tailored to HR goals

Annual Collaborative Program Evaluation

Executive Committee

July 28, 2021

Objectives

- Administrative evaluation of Collaborative Program operations and functions
  - Do the Collaborative Program's guiding principles and activities function as envisioned?
- Assess the continued relevance of the guiding principles in relation to the Collaborative Program's efforts to inform science and adaptive management in the Middle Rio Grande
- Inform updates to Collaborative Program plans, tools, and processes
- Identify areas for improvement regarding operational efficiency and signatory engagement

Adaptive Management of the Collaborative Program

- Integral to the successful implementation of the Science & Adaptive Management Plan
- Continually assessment and improvement of the tools and processes by which the Collaborative Program operates
- Applying lessons learned from the past year to improve future operations

Implementation of the Annual Evaluation

- Annually, but may be more frequent if the EC determines a need
- EC charges the PST to coordinate the effort
- Pre-determined scheduled to align with development of the next year's work plan

MRGESCP Annual Report

Proposed New Format

Future Annual Reports

Purpose

- Document and communicate MRGESCP progress
- Highlight activities that support the MRGESCP's objectives
- Garner continued support
- Science communication tool

Comparing Annual Reports

Future Annual Reports

- Calendar year
- Up to 15 pages
- MRGESCP-specific
  - Goals & objectives
  - Milestones & accomplishments
  - Focus on benefits to species
  - Meetings & participation
  - MRGESCP forecast/outlook

Past Annual Reports

- Fiscal year
- 50+ pages
- Annual repeat of MRGESCP history
- Report of individual signatory activities
- Limited to no theme or story

Jan-Dec 2021 Annual Report Format

1	Title/Front page
2	Letter/Statement
3	EC & SAMC committees
4	MRGESCP/MRG by the numbers (goals related)
5+	Milestones/Accomplishments
	MRGESCP activities
14	MRGESCP outlook for 2022
15	Back Page

Timeline

October-November	Begin gathering information
December	Incorporate results of the annual EC evaluation and annual work plan
January-February	Compile the draft annual report
February-March	Signatory review & edits
March	EC review & approval

Review of the Middle Rio Grande Fish Monitoring Program



Status Report of:

The Population Monitoring Workgroup

Rich Valdez, Workgroup Chair (2019-20)

Presented to:

The Middle Rio Grande Endangered Species Collaborative Program Executive Committee—July 28, 2021

Genesis of Population Monitoring Workgroup

- **USFWS Letter to Reclamation (March 23, 2012)**
  - Review of Scientific Review Report (Atkins, 2012).
  - Resolve issues of population estimation and population monitoring of RGSM.
  - Recommend that EC host a facilitated science workshop to discuss issues.

- **Executive Committee Approves PMWG (July 13, 2012)**
  - EC directed PMWG to work with Reclamation to plan the workshop.
  - Asked PMWG to review and update fish monitoring plan (FMP) for MRG.
  - PMWG not chartered.



Goal and Tasks of PMWG

GOAL

- Evaluate and update the fish monitoring plan for the MRG, and

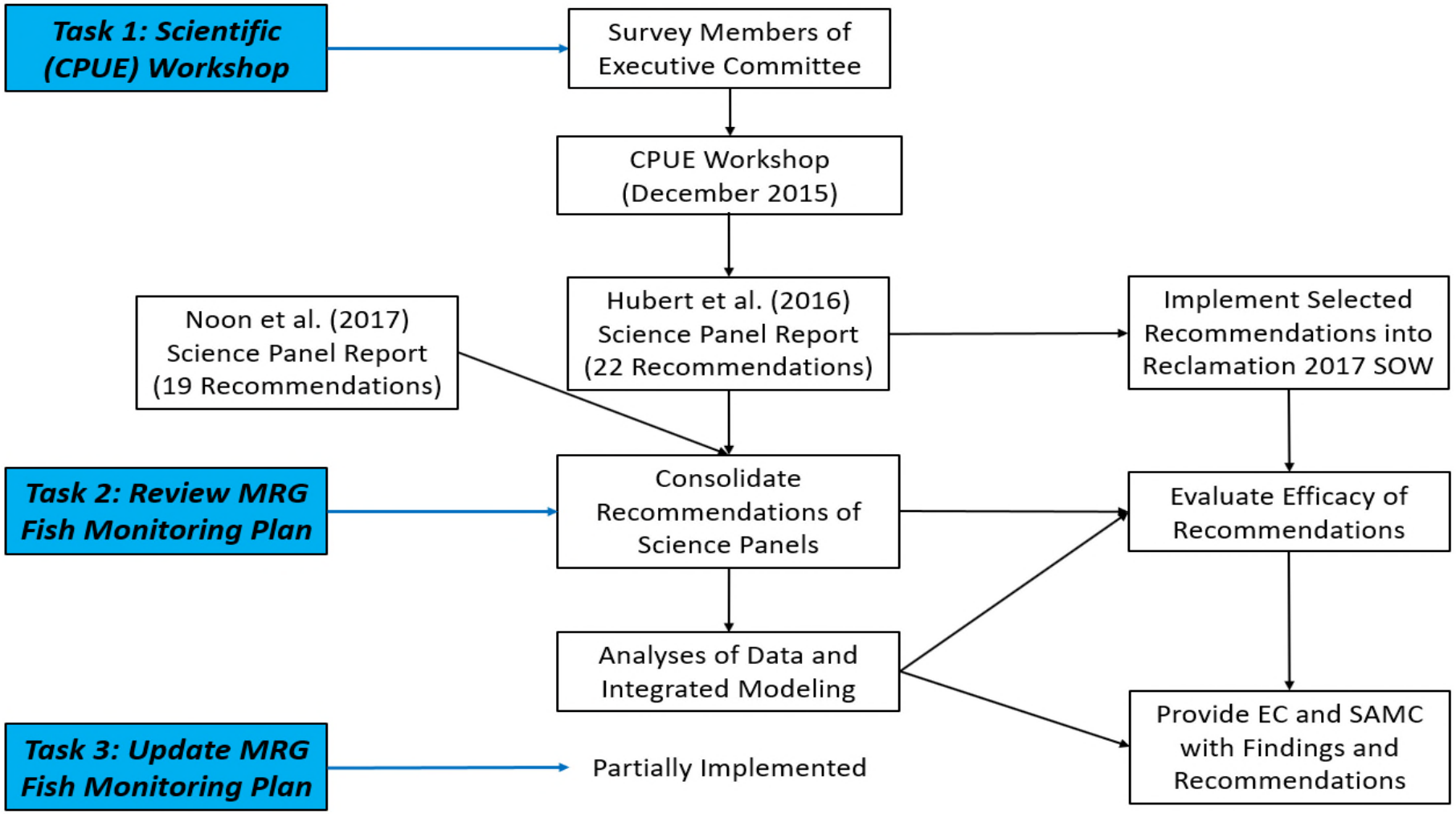
  Identify and develop population demographic parameters for RGSM.

TASKS

1. Conduct a workshop on catch-per-unit-effort (CPUE) methodology.
2. Review the MRG fish monitoring plan.
3. Update the MRG fish monitoring plan.



PMWG Process



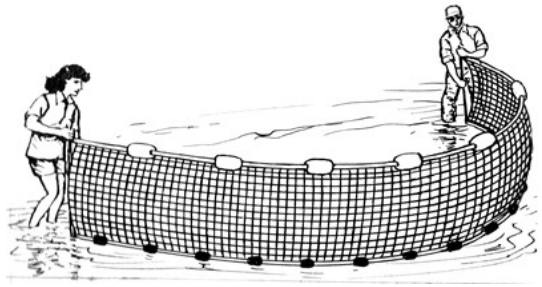


PMWG Accomplishments

1. CPUE Workshop and Report (Hubert et al. 2016).
2. Recommendations into Reclamation's 2017 SOW for FMP.
3. Consolidated Hubert (2016) and Noon (2017) Panel Recommendations.
4. Analyzed FMP data for demographic parameters (age, growth, survival).
5. RGSM Integrated Population Model (Yackulic).
6. Reviewed Fish Monitoring Program for EC.
7. Findings and Recommendations to SAMC and EC.



Fish Monitoring Plan Design



Basic Sampling Design

20 Nonrandom Sites Sampled Monthly (Apr-Nov)

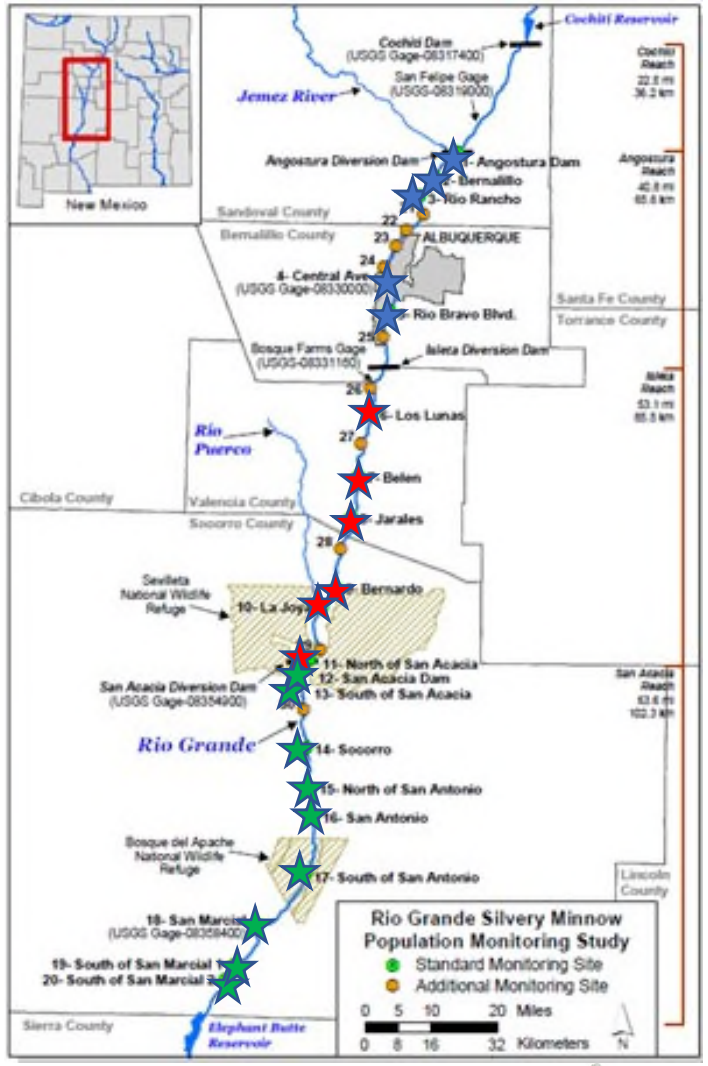
- Angostura Reach—5 Sites
- Isleta Reach—6 Sites
- San Acacia Reach—9 Sites

20 Seine Hauls Per Site Apportioned by Mesohabitat Type

Runs, shoreline pools (4 each)
Backwaters, pools, riffles (2 each)
Shoreline runs (~6)

October CPUE = Mean of 20 Site CPUEs, Computed with Mixture Model

Site CPUE = Sum of Fish in 20 Hauls/Sum of Area Seined



Plan Design and Recommendations

Basic Sampling Design

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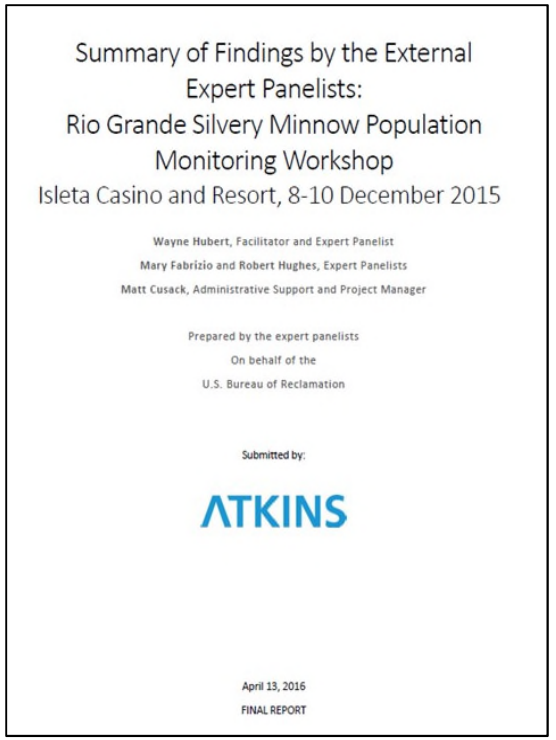
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Implemented PMWG Recommendations

- *30 Sites in October (10/reach)*
- *Replacement Sites for Dry Sites*
- *Additional Monthly Sampling (Dec & Feb)*
- *Intensive Sampling (Nov)*
- *Additional Data per Seine Haul*
- *Additional CPUE Calculations (mesh, age)*

Hubert et al. (2016)



Summary of Findings by the External Expert Panelists:
Rio Grande Silvery Minnow Population Monitoring Workshop
Isleta Casino and Resort, 8-10 December 2015

Wayne Hubert, Facilitator and Expert Panelist
Mary Fabrizio and Robert Hughes, Expert Panelists
Matt Cusack, Administrative Support and Project Manager

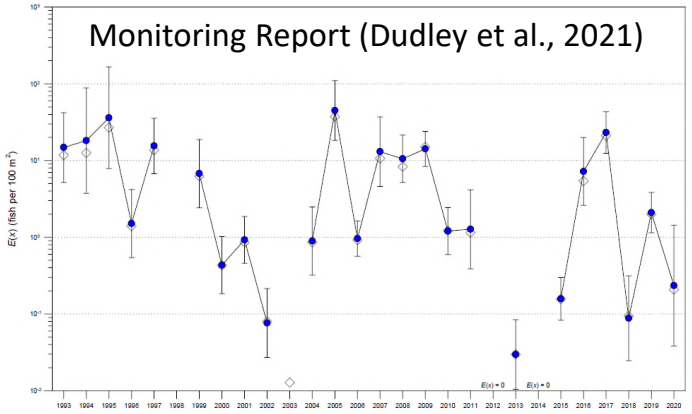
Prepared by the expert panelists
On behalf of the
U.S. Bureau of Reclamation

Submitted by:

ATKINS

April 13, 2016
FINAL REPORT

Uses of Fish Monitoring Data



Middle Rio Grande Fish Monitoring Program

Hydrology Data

October Data

Monthly Data (Apr-Nov)

Annual October Census for RGSM — *Oct CPUE*

Criteria for RGSM Recovery Plan — *Oct CPUE*

Measures for ITS of RGSM (2016 BiOp) — *Oct CPUE*

Help Determine RGSM Augmentation (Stocking) Targets — *Sept CPUE*

Monthly CPUE → Evaluate BiOp Compliance for River Operations and Maintenance

May-July Habitat → Environmental Flow Analyses

Population Demographic Parameters (age structure, growth, survival, recruitment, etc.) → Life History; PVA, Hydrologic, and Integrated Models

Key Scientific Assumptions

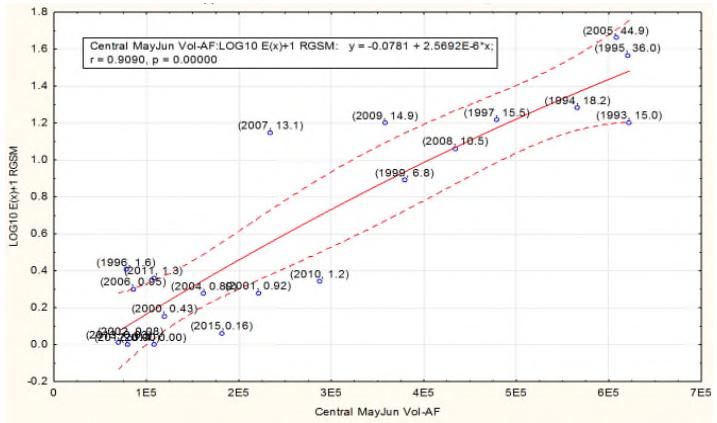
1. Mean annual October CPUE index represents overall density of RGSM in MRG.
   a. 20 sites x 200 m = 2.5 mi of 150 mi (1.7%) sampled.
   b. Additional sites are recommended.

Archdeacon et al. 2020



2. October CPUE index incorporates and reflects effects of natural flow and flow management in MRG on overall RGSM population.
   a. River flow and water operations managed mainly upstream of RGSM occupied habitat.
   b. Relationship integral to 2016 BiOp (USU model), but causations unclear.

2016 BiOp—Appendix A





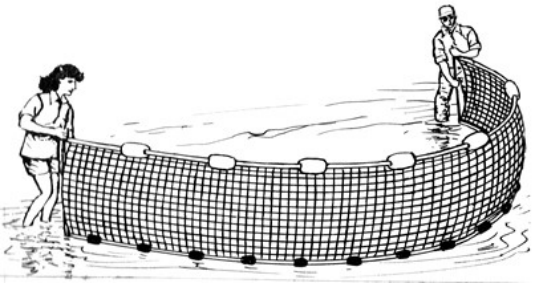
Principal Findings

1. FMP provides systematic sampling that tracks year-to-year trends in relative abundance of the RGSM, but lacks spatial and temporal resolution to evaluate species response to specific management actions.

2. FMP provides monthly data for estimating population demographic parameters of RGSM (e.g., age, growth rate, survival, recruitment).

3. Hydrologic and geomorphic variabilities of MRG, and stochasticity of RGSM population, limit the level of precision possible for the CPUE index.

4. Complete redesign of FMP is not warranted, but refinements could improve precision of CPUE, and better represent density of RGSM in MRG.



Recommendations

Category 1: Studies and Refinements to FMP—May Involve Additional Field Work

1. Continue to implement FMP, as conducted during 2017-2020 that includes the recommendations of the Hubert et al. (2016) science panel.

2. Evaluate the use of other fish sampling gears, in addition to beach seines, to inform and possibly supplement the current FMP.

3. Re-evaluate the relationship of CPUE to total abundance of RGSM.

4. Characterize the physical parameters of principal mesohabitat types to inform fish population models and hydraulic habitat models.



Recommendations (cont'd)

Category 2: Analyses and Refinements to FMP—No Field Work Needed

5. Refine the current monitoring plan to optimize precision and representation of the October CPUE at acceptable program costs.

6. Evaluate and compare other analytical methods against the mixture model and determine if other methods are more suitable for computing RGSM CPUE.

7. Develop and regularly evaluate integrated population models to help identify and reconcile complex influences on monitoring.

8. Draft a clear and concise MRG Fish Monitoring Plan for review and approval by the SAMC and the EC.





Acknowledgements

Population Monitoring Workgroup:

Member	Organization
Thomas Archdeacon	U.S. Fish and Wildlife Service
Rick Billings	Albuquerque Bernalillo County Water Utility Authority (ABCWUA)
Andy Dean	U.S. Fish and Wildlife Service
Kim Eichhorst	Bosque Ecosystem Monitoring Program, University of New Mexico
Lynette Giesen	U.S. Army Corps of Engineers
Eric Gonzalez	U.S. Bureau of Reclamation
Grace Haggerty	New Mexico Interstate Stream Commission (NMISC)
Mo Hobbs	Albuquerque Bernalillo County Water Utility Authority
Joel Lusk	U.S. Bureau of Reclamation
Mike Marcus	Assessment Payers Association, MRGCD
Anne Marken	Middle Rio Grande Conservancy District (MRGCD)
Mickey Porter	U.S. Army Corps of Engineers
Rich Valdez	SWCA, contracted by NMISC
Ara Winter	Bosque Ecosystem Monitoring Program, University of New Mexico
Matt Wunder	New Mexico Department of Game and Fish
Charles Yackulic	U.S. Geological Survey, contracted by NMISC and ABCWUA

Report Preparation and Reviewers:

- *Preparation of this report was supported and funded by the New Mexico Interstate Stream Commission.*

- *Members of the WEST Program Support Team were instrumental in coordinating workgroup meetings and providing support and review of workgroup activities and of this report.*

- *Thanks to Thomas Archdeacon, Steve Carothers, Grace Haggerty, Mo Hobbs, Joel Lusk, Mike Marcus, Catherine Murphy, and Dave Wegner for their reviews and comments on parts or all of this report.*





Science and Adaptive Management Committee

memo to

Executive Committee

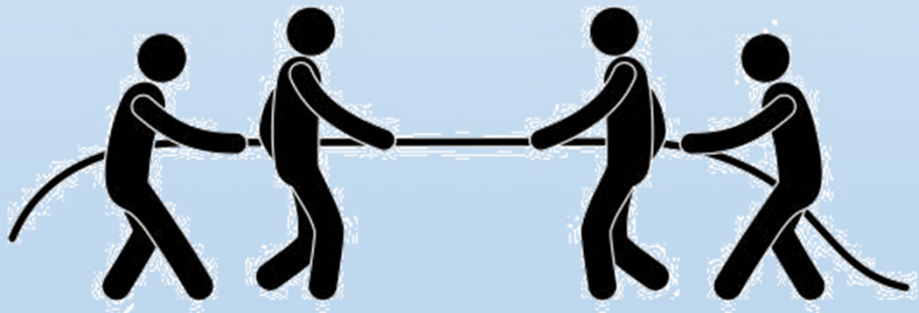
Recommended next steps with respect to findings and recommendations from the Science and Technical Ad Hoc Group: Rio Grande Silvery Minnow Population Monitoring Workgroup Summary Report

July 28, 2021

RGSM Population Monitoring Workgroup

Acknowledgements

- Completed Tasks 1 and 2, initiated Task 3
- Recommended changes to monitoring plan were implemented by Reclamation
- Participation in Science and Technical Ad Hoc Group for summary report enabled SAMC to develop standardized procedures for MRGESCP:
  - ❖Scientific citations
  - ❖Peer review
  - ❖Ad hoc deliverables and documentation



RGSM Population Monitoring Program

Various types of reviews are undertaken regularly

- Most recently: 2011, 2012, 2016, 2017, 2019
- Both within and external to the Collaborative Program

Focused on all or a subset of these generalized topics:

- Appropriate application of the CPUE metric
- Sampling methods and design
- Analytical methods and statistical considerations
- Estimation of demographic parameters
- Environmental covariates and management applications

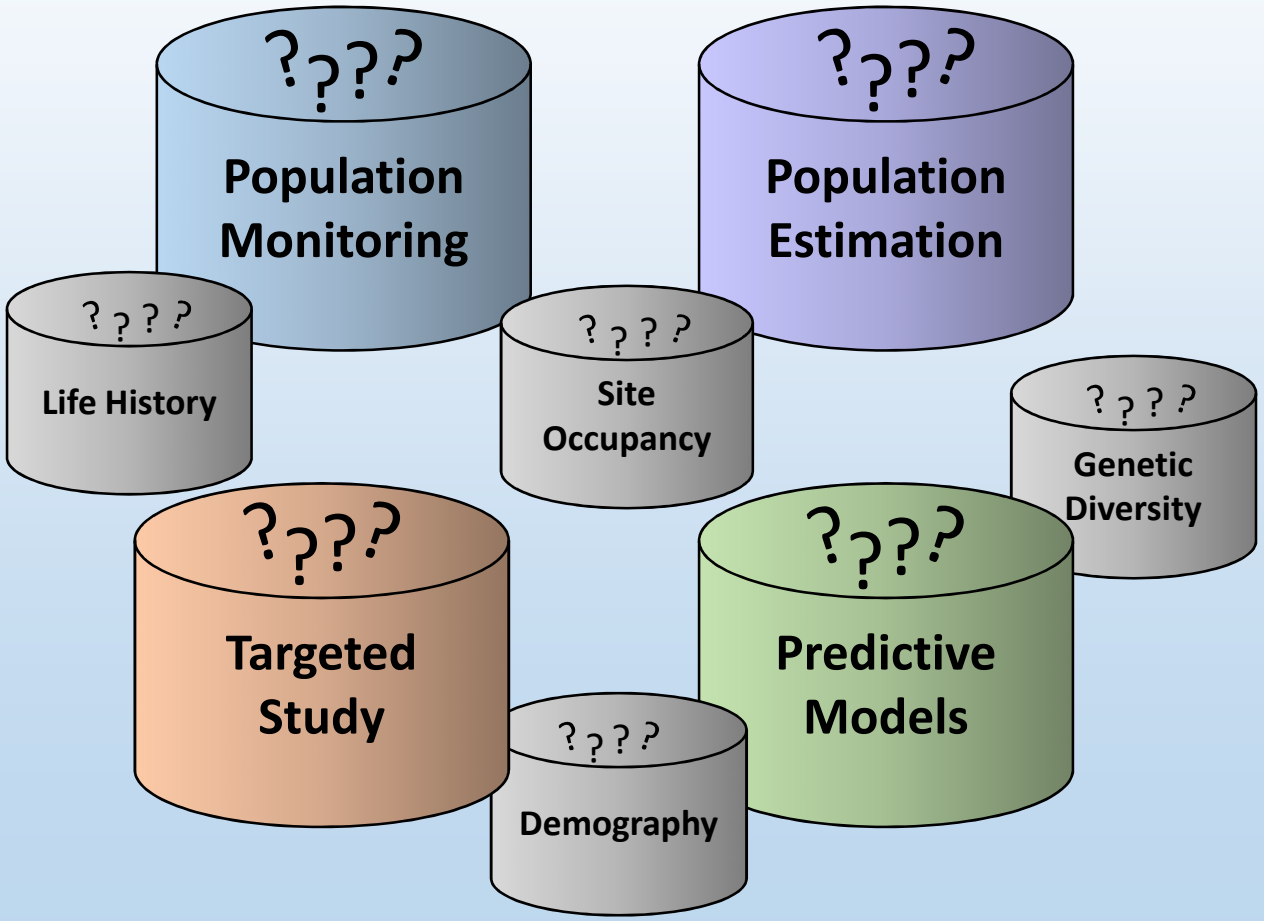


RGSM Population Management & Recovery

Acknowledge certain realities

- ✓The long-term monitoring protocol must continue for proper trend analysis
- ✓Population Monitoring Program data cannot address all unresolved questions
- ✓Management needs persist and evolve, despite any limitations of the data
- ✓Periodic evaluation and update are integral to adaptive management

Match data to questions



Science & Adaptive Management – next steps

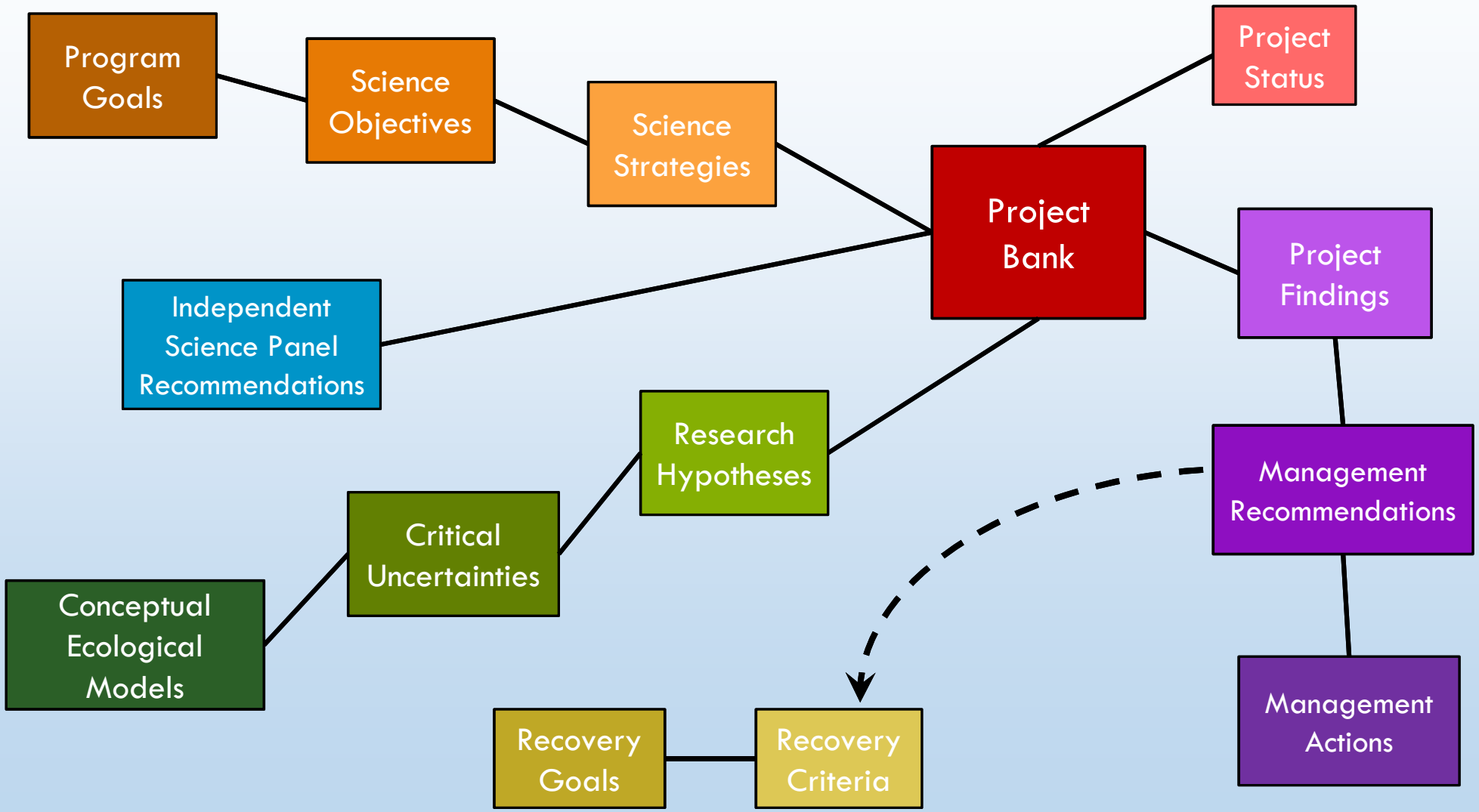
- Formation of Science and Technical Ad Hoc Groups to:

  1. Translate and refine recommendations from the summary report into specific questions with clear and testable hypotheses.
  2. Determine whether the PMP data, the PEP data, or a targeted study/analysis would be appropriate to address each of the refined hypotheses from #1.
  3. Identify from #1 the subset of essential, management-relevant questions that require periodic review as a quality assurance/quality control (QA/QC) procedure for the PMP and PEP.

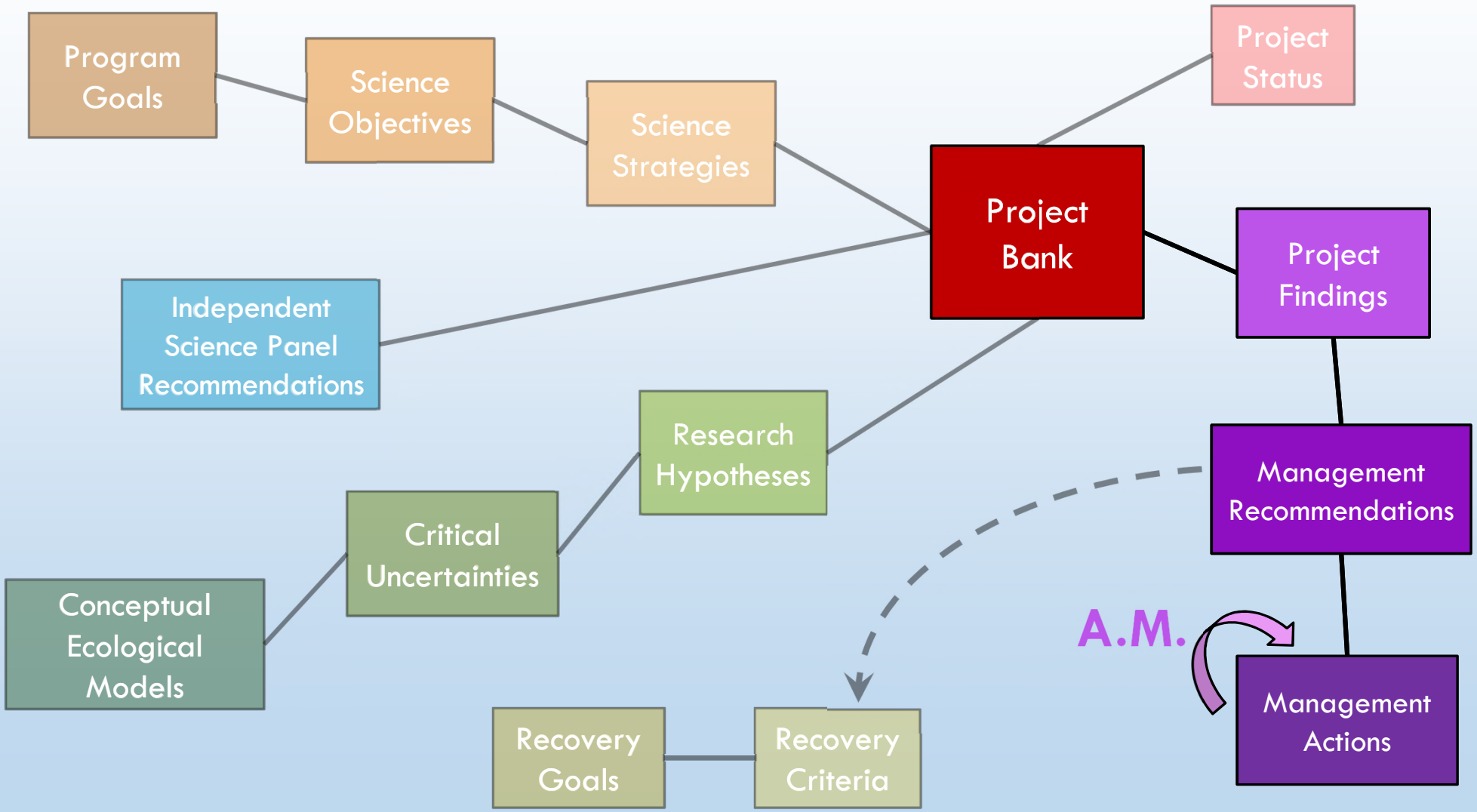
Science & Adaptive Management – next steps

- ❑ Survey managers regarding expectations/needs and match with appropriate study designs, data protocols, analyses, and outputs. Revisit biennially to adjust priorities.
- ❑ Consider repeating the PEP or other methodologies to address hypotheses from #2.
- ❑ Implement QA/QC strategy from #3 at some interval (e.g., 5 years) and update protocols and decision support tools for adaptive management, if warranted.
- ❑ Consider similar QA/QC review strategies for SWFL, YBCU, NMMJM and PESU.
- ❑ Regarding hypotheses from #2 that require a targeted study/analysis, form Science and Technical Ad Hoc Groups to develop and scope projects for each.

Science & Adaptive Management – next steps



Science & Adaptive Management – next steps



Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Proposal for Reframing Cost-Share to Signatory Contributions

The Fiscal Planning Committee (FPC) was tasked with presenting a proposal to the Executive Committee on how to change non-federal cost-share. The FPC proposes compiling information on **signatory contributions**, including voluntarily provided costs related to activities that contribute to MRGESCP operations or work towards achieving its guiding principles (i.e., mission, goals, and objectives). There is no mandatory in-kind or cash contributions required by the MRGESCP. These fall into administrative and scientific categories:

- Administrative:
    - The contracts, grants, and agreements entered into by a signatory that support MRGESCP operations
    - Active participation by signatory representatives in MRGESCP committees, ad hoc groups, workshops, or in developing MRGESCP work products
- Scientific:
    - The findings and results from studies, monitoring, data collection, habitat restoration, literature reviews, research, and experiments that contribute to the MRGESCP's understanding of the listed species and their habitats

Signatory contributions are tracked using the Adaptive Management Relational Database (AMRDB). Findings, data, and final reports are provided to the MRGESCP for inclusion in science and adaptive management tools, such as the AMRDB and conceptual ecological models. A yearly report of each signatory's contributions can be provided from the AMRDB.

Scientific signatory contributions are collected, synthesized, and incorporated into the MRGESCP's activities, and are used to inform recommendations on future science activities (via the Long-Term Plan) and management alternatives.

Signatory contributions fall into the following categories:

- *Program Management and Administration* – Non-research support of the MRGESCP's guiding principles through administrative assistance and aid in funding, planning, coordination, and staffing of MRGESCP activities. Examples include the Program and Science Support contract, the Program Portal, and public outreach initiatives.
- *Species Management and Recovery* – Non-research activities with influence on or relevance to recovery of one or more listed species within the Middle Rio Grande (MRG). Examples include rescue operations, support of captive propagation facilities, and control of invasive species.
- *Population Monitoring and Modeling* – Descriptive empirical and/or mathematical investigations of population data for one or more listed species within the MRG. Examples include estimation of population size and trends over time, estimation of vital rates, and population viability forecasts.
- *Habitat Assessments and Modeling* – Descriptive empirical and/or mathematical investigations of physical environmental features at various spatial scales (e.g., site, reach, landscape) with influence on one or more listed species or the ecosystem of the MRG. Examples include hydrology and hydraulic modeling, mapping and geographic information systems, geomorphic studies, water quality studies, and climate change studies.
- *Field and Laboratory Experiments* – Any study designed to test a hypothesis about a listed species or other biotic response to a manipulation in a field or laboratory setting. Examples include habitat manipulations of flows or vegetation, before-after control-impact restoration designs, and laboratory studies of physiological responses.

FISCAL PLANNING COMMITTEE MEETINGS

Fiscal Planning Committee Meeting

February 16, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

MRGESCP Legislation 2009 Omnibus Appropriations Act [read-ahead]

MRGESCP LTP [read-ahead, not included]

Program Planning & Signatory Input Timeline [read-ahead]

Charter for FPC of the MRGESCP [follow-up, not included]

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Fiscal Planning Committee (FPC)
Meeting Agenda

Date: February 16, 2021
Time: 1:00 – 3:00pm
Location: Zoom Meeting

Zoom Call-in Information
Link: https://west-inc.zoom.us/j/8983593120
Call-In: +1-669-900-6833
Meeting ID: 898-359-3120M
Passcode: 1251

Meeting Objectives:

- Select FPC co-chairs
- Develop proposal for fiscal year 2021 (FY21) + cost share reporting
- Develop an administrative out-planning schedule for the Program

1:00 – 1:05	**Welcome** • Introductions • Agenda Review ➢ ***Decision***: Approve meeting agenda	*Grace Haggerty, Non-Federal Co-chair; Lynette Giesen, Federal Co-chair*
1:05 – 1:15	**Co-Chair Selection Recommendations** • Co-chair term • Selection of co-chairs ➢ ***Decision***: Selection of a Non-Federal and a Federal Co-Chair	*Julie Dickey, Program Support Team (PST)*
1:15 – 2:00	**Cost Share Changes** • Purpose • Changes *Read-ahead:* • 2009 Omnibus Appropriations Act ✓ ***Action Item***: Summarize proposed changes to cost share reporting for review by the Program's Non-Federal signatories and the U.S. Bureau of Reclamation ✓ ***Action Item***: Continue the discussion, if needed, at the next FPC meeting, and prepare to report proposed changes at the July 2021 EC meeting	*Group Discussion*

2:00 – 2:10	**Break**	
2:10 – 2:55	**Administrative Schedule** • Purpose • Components *Read-aheads:* • Long-Term Plan (LTP) schedule (Section 5.0 of the LTP) • Presentation on signatory input timeline ✓ ***Action Item***: Refine the administrative schedule in the LTP to inform the Program's and its signatory's out-planning efforts	*Group Discussion*
2:55 – 3:00	**Meeting Review** • Action items • Next meeting	*Lynette G., Grace H., and Julie D.*
3:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Fiscal Planning Committee (FPC)
Draft Meeting Minutes

February 16, 2021; 1:00 PM–3:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of February 16, 2021 FPC meeting agenda
- ✓ Co-chair selection:
  - Non-federal co-chair – Grace Haggerty, New Mexico Interstate Stream Commission (NMISC)
  - Federal co-chair – Debra Hill, U.S. Fish and Wildlife Service (USFWS)

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Send out a Doodle Poll to schedule the April FPC meeting	2/18/2021
PST	Send the FPC Charter with the meeting follow-up	2/18/2021
PST	Prepare a proposal for changing cost share that can be facilitated by the Adaptive Management Relational Database (AMRDB), and used to inform annual report development	April meeting
PST	Edit the Long-Term Plan administrative schedule as discussed during the February meeting	April meeting
U.S. Bureau of Reclamation (Reclamation)	Discuss changes to the MRGESCP's non-federal cost share requirement with the Department of the Interior Solicitor	April meeting
FPC	Review FPC co-chair selections in six-months (September [fall] 2021)	Fall 2021

Next Meeting: April 2021

Meeting Minutes

Welcome, Introductions, and Agenda Review

Julie Dickey, PST, opened the meeting, led introductions, and reviewed the February 16, 2021 meeting agenda. The group briefly discussed the purpose of the FPC meeting, and participants made the following points:

- FPC members may want to discuss a way to share the activities their organizations are interested in contributing to, with money or staff hours (e.g., southwestern willow flycatcher projects). Group members may also want to share the expertise they bring to the fiscal aspect of the MRGESCP.
- All meeting minutes will be made available on the Program Portal.

✓ **Decision**: The FPC approved the February 16, 2021 FPC meeting agenda

Co-Chair Selection Recommendations

Julie D. opened discussion on co-chair selection with a brief history of the FPC, its purpose, and the role of the co-chairs. The main points are below:

- The FPC was formed to coordinate on resources for work products recommended by the MRGESCP.
- The PST will provide the EC-approved FPC Charter in the meeting follow-up.
- There is no set FPC membership. The meeting agendas determine the signatories that need to send a representative.
- The role of the FPC co-chairs is to work with the PST and the rest of the FPC to identify signatory funding needs, plan agenda topics, lead group discussions, and help ensure work products are completed.
- Co-chairs have one-year terms with the option for a one-year renewal.

The group then discussed co-chair selection. Main points are below:

- Lynette Giesen, U.S. Army Corps of Engineers, stepped down as the FPC Federal Co-chair.
- Debra Hill, USFWS, was selected as the new FPC Federal Co-chair.
- Grace Haggerty, NMISC, will continue to serve as the No-federal Co-chair.
    - Grace requested that the subject of FPC co-chair renewal be addressed in six-months (September 2021) rather than in one year

➢ **Action Item**: The FPC will review co-chair selections in six-months (September 2021)

Cost Share Changes

Debbie Lee, PST, opened discussion on changes to cost share reporting. The main points are below:

- The EC requested that the FPC develop a proposal for how to change cost share to be less onerous, objective-driven, and useful to the MRGESCP.
- Current cost share reporting includes staffing hours and actual expenditures via contracts.
- According to the 2009 Omnibus Appropriations Act, the U.S. Bureau of Reclamation's budget for activities under the 2003 and subsequent Biological Opinions (BO) and activities under the MRGESCP's Long-Term Plan (LTP) entails a 25 percent non-federal cost share.
- At its last meeting, the EC discussed the continued need and utility of collecting and reporting cost-share information, as it is currently not being used.
    - The objective for collecting cost-share needs to be redefined.

    - One use could be reporting cost share to Congress to try to get funding.
    - One reason to report cost share is that it is important for the MRGESCP to understand the effort being put into MRG issues.
- What would be helpful in reporting cost share to ensure continued signatory participation in the MRGESCP?
    - The City of Albuquerque Open Space Division could put out an annual report to capture the picture on activities happening in the bosque. It could include volunteer hours, amount of trees/shrubs planted, tracking funding to restoration projects.
        - That could be sent to the MRGESCP. It may get others interested in funding the activities.
- Big picture is more useful to the MRGESCP. Reporting should focus on MRGESCP accomplishments instead of costs so that the MRGESCP can tell its story as it supports science that informs management in the MRG.
    - Reporting big picture accomplishments is more helpful to USACE and others for continued funding.
- The conversation on cost share also informs changes to the annual report.
- Suggestion that one newsletter issue could cover signatory contributions; it does not have to be comprehensive and could highlight 10 accomplishments in a year.
    - It would be easy access before an EC meeting and could be discussed at the meeting if appropriate.
    - Newsletters come out more frequently than annual reports, and signatories could continually submit write-ups about their accomplishments. This would keep projects in the forefront of people's minds.
- The Adaptive Management Relational Database (AMRDB) will be a useful reporting tool also. Projects will be uploaded into the AMRDB to track their progress. The AMRDB also identifies links between projects and goals, objectives, etc. The information could be used to inform a big picture report on annual activities, including progress on addressing Program objectives and linked scientific uncertainties.
- Are we limiting what is considered part of the MRGESCP?
    - It is difficult for signatories to figure out what should be considered cost share.
        - Once a project is in the AMRDB, it could be part of the MRGESCP.
    - Projects (e.g., final reports, data, findings) should have to be shared with the MRGESCP and incorporated into the decision-making tools and recommendation process to be considered part of the MRGESCP.
- Instead of listing how many hours each MRGESCP participant contributed, the report can show signatory participation in each Program committee and ad hoc group and what the groups accomplished.
    - For what purpose? What story would that tell?
- There is interest in using the AMRDB to help identify contributing partners and resources for projects.
    - The MRGESCP needs to figure out a simple way to get that information from signatories.
    - Collaborative information can also be shared in other ways, including meetings.
- Suggestion that the annual report be made more useful in this effort, with the top three signatory accomplishments and some total stats. If there are specific projects that are very collaborative, those can be highlighted.
- The Potomac partners report is an example of a good annual report.
- The annual report could be four pages max and very graphical.

- The PST will put together a proposal to make cost share interface with the AMRDB and the annual report, including recommendations for a new annual report format.
- The FPC participants agreed to recommend that the 25 percent non-federal cost share requirement be removed.
    - Reclamation will discuss changes to the MRGESCP's non-federal cost share requirement with Department of the Interior Solicitor.
- Does the FPC find funding for projects?
    - Yes, there are projects (scopes of work) that have been developed from MRGESCP efforts, and the FPC has and will continue to work to identify funding for them.
    - There is interest in pursuing ongoing, reliable funding for projects versus one-time funding.
    - The FPC can help signatories go after grant money, develop messaging for non-federal partners to take to the legislature, and help create partnerships, so going after one-time funding is not as difficult.
- We may want to consider a new name for cost share, for example, "signatory reporting."

- **Action Item**: Prepare a proposal for changing cost share that can be facilitated by the AMRDB, and used to inform annual report development
- **Action Item**: Reclamation will discuss changes to the MRGESCP's non-federal cost share requirement with the Department of the Interior Solicitor
- **Action Item**: The PST will send the FPC Charter with the meeting follow-up

Administrative Schedule

Julie D. led a discussion on the administrative schedule in the LTP (see Table 2 in the LTP). The main points are below:

- The administrative schedule includes periods that inform funding cycles, planning schedules, and tasks to be done to maintain Program operations.
- The schedule is divided by the responsible Program group.
- How will the SAMC release priority activities?
    - The SAMC is still figuring out the process, but it was initially thought that the SAMC would determine priority objectives or scientific uncertainties based on the species conceptual ecological models (CEMs). Scientific activities are linked to scientific uncertainties, and can be prioritized based on the uncertainties. As uncertainties are addressed and CEMs are updated, priorities will change.
- Everyone should know priorities as early as possible to help organize funding.
- At a future meeting, the FPC needs to discuss the communication process between the FPC and SAMC in coordination with the Program Manager and Science Coordinator.
- The University of New Mexico submitted a request to the New Mexico congressional delegation for funding of MRGESCP federal signatory projects.
- With decreases in funding resources, Reclamation is promoting one-time funding sources, such as WaterSMART grants.
    - Signatories could request MRGESCP support to go after funding.
- Can WEST help pursue grants?
    - WEST can assist within the boundaries of the Program and Science Support contract.
- There are several reports listed in the administrative schedule, and the AMRDB will make preparing them easier.

- **Action Item**: The PST will edit the Long-Term Plan administrative schedule as discussed during the February meeting

Meeting Review

The FPC reviewed action items and discussed a date for the next meeting.

- The PST will send out a Doodle Poll to schedule a meeting for the end of April

- **Action Item**: The PST will send out a Doodle Poll to schedule the April FPC meeting

Meeting Participants

Alyssa O'Brien	City of Albuquerque Open Space
Anne Marken	Middle Rio Grande Conservancy District
Ashlee Rudolph	U.S. Bureau of Reclamation
Colleen McRoberts	City of Albuquerque Open Space
Debbie Lee	Program Support Team
Debra Hill	U.S. Fish and Wildlife Service
Grace Haggerty	New Mexico Interstate Stream Commission
Julie Dickey	Program Support Team
Lynette Giesen	U.S. Army Corps of Engineers
Mark Kelly	Albuquerque Bernalillo County Water Authority
Michelle Tuineau	Program Support Team

MIDDLE RIO GRANDE ENDANGERED SPECIES COLLABORATIVE PROGRAM
Legislation

OMNIBUS APPROPRIATIONS ACT, 2009, **PL 111-8**, March 11, 2009, 123 Stat 524

SEC. 106. Section 121 of the Energy and Water Development Appropriations Act, 2006 (Public Law 109–103; 119 Stat. 2256) is amended by striking subsection (a) and inserting the following:
"(a) Hereafter, the Secretary of the Army may carry out and fund planning studies, watershed surveys and assessments, or technical studies at 100 percent Federal expense to accomplish the purposes of the 2003 Biological Opinion described in section 205(b) of the Energy and Water Development Appropriations Act, 2005 (Public Law 108–447; 118 Stat. 2949) as amended by subsection (b) or any related subsequent biological opinion, and the collaborative program long-term plan. In carrying out a study, survey, or assessment under this subsection, the Secretary of the Army shall consult with Federal, State, tribal and local governmental entities, as well as entities participating in the Middle Rio Grande Endangered Species Collaborative Program referred to in section 205 of this Act: *Provided*, That the Secretary of the Army may also provide planning and administrative assistance to the Middle Rio Grande Endangered Species Collaborative Program, which shall not be subject to cost sharing requirements with non-Federal interests.".

SEC. 203. None of the funds appropriated or otherwise made available by this or any other Act may be used to pay the salaries and expenses of personnel to purchase or lease water in the Middle Rio Grande or the Carlsbad Projects in New Mexico unless said purchase or lease is in compliance with the purchase requirements of section 202 of Public Law 106–60.

SEC. 206. (a) Section 209 of the Energy and Water Development Appropriations Act, 2004 (Public Law 108–137; 117 Stat. 1850) is repealed.

(b) The Secretary of the Interior (referred to in this section as the "Secretary") shall establish and maintain an Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program (referred to in this section as the "Executive Committee") consistent with the bylaws of the Middle Rio Grande Endangered Species Collaborative Program adopted on October 2, 2006.

(c) Hereafter, in compliance with applicable Federal and State laws, the Secretary (acting through the Commissioner of Reclamation), in collaboration with the Executive Committee, may enter into any grants, contracts, cooperative agreements, interagency agreements, or other agreements that the Secretary determines to be necessary to comply with the 2003 Biological Opinion described in section 205(b) of the Energy and Water Development Appropriations Act, 2005 (Public Law 108–447; 118 Stat. 2949) as amended by section 121(b) of the Energy and Water Development Appropriations Act, 2006 (Public Law 109–103; 119 Stat. 2256) or

any related subsequent biological opinion or in furtherance of the objectives set forth in the collaborative program long-term plan.

(d)(1) The acquisition of water under subsection (c) and any administrative costs associated with carrying out subsection (c) shall be at full Federal expense.

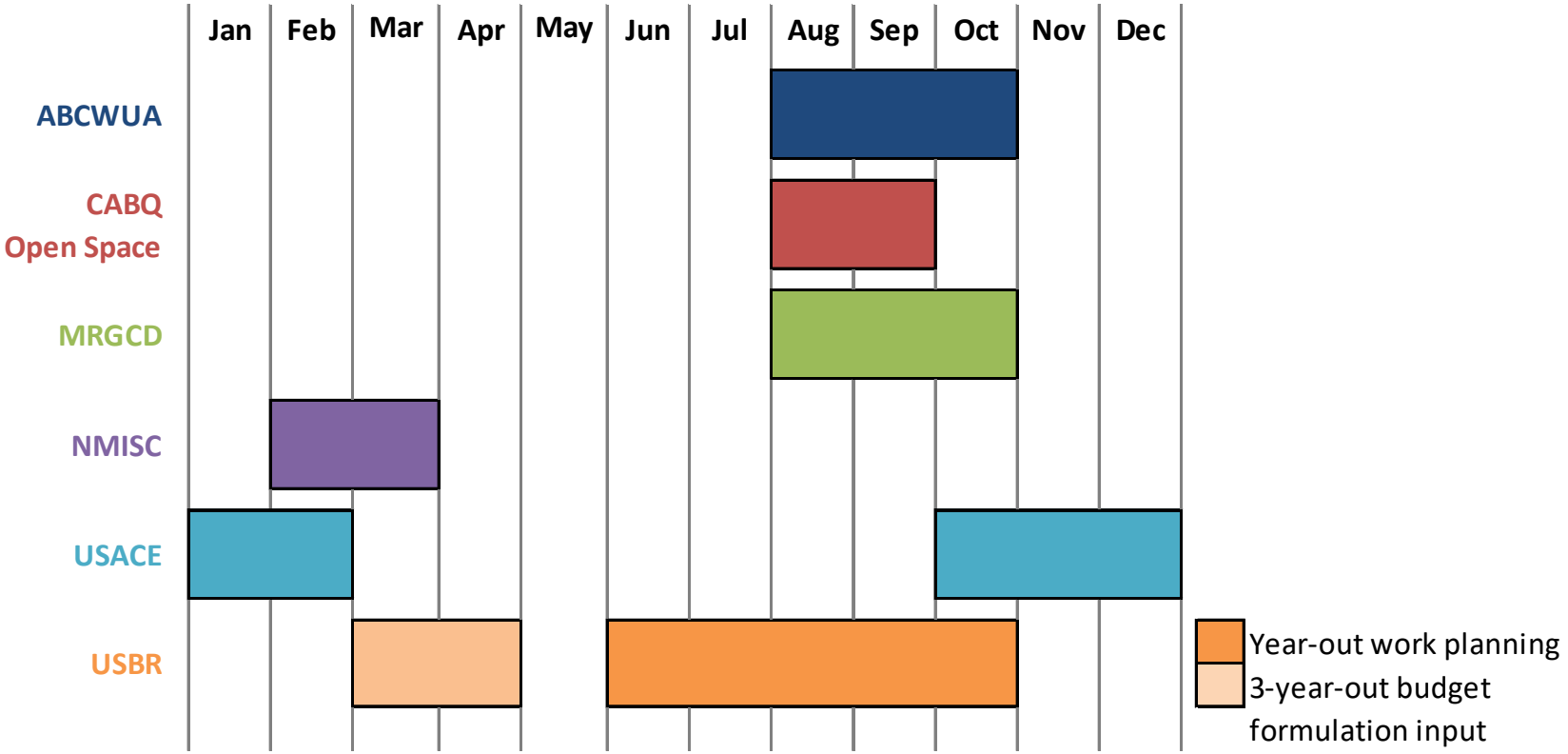
(2) Not more than 15 percent of amounts appropriated to carry out subsection (c) shall be made available for the payment of administrative expenses associated with carrying out that subsection.

(e)(1) The non-Federal share of activities carried out under subsection (c) (other than an activity or a cost described in subsection (d)(1)) shall be 25 percent. The non-Federal cost share shall be determined on a programmatic, rather than a project-by-project basis.

(2) The non-Federal share required under paragraph (1) may be in the form of in-kind contributions, the value of which shall be determined by the Secretary in consultation with the executive committee.

(f) Nothing in this section modifies or expands the discretion of the Secretary with respect to operating reservoir facilities under the jurisdiction of the Secretary in the Rio Grande Valley, New Mexico.

Program Planning & Input Timeline



ABCWUA → Fall (Aug - Oct)

CABQ (OS) → Fall (Aug - Sept)

MRGCD → Fall (Aug - Oct)

NMISC → Feb - Mar

USACE → Oct - Mar

USBR → Mar - May & Jun - Oct

Fiscal Planning Committee Meeting

April 21, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *Draft Definition of Program Activities [read-ahead, draft]*
- *ABCWUA HR: Southside Water Reclamation Plan Realignment Project [presentation]*
- *Signatory Contributions to Program Activities [presentation]*
- *Southside Wastewater Reclamation Plant Outfall Realignment Evaluation Project Memo [follow-up]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Fiscal Planning Committee (FPC)
Meeting Agenda

Date: April 21, 2021
Time: 10:00 – 12:00
Location: Zoom Meeting

Zoom Call-in Information
Link: https://west-inc.zoom.us/j/8983593120
Call-In: +1-669-900-6833
Meeting ID: 898-359-3120M
Passcode: 1251

Meeting Objectives:

- Discuss signatory support options
- Collaborate around future funding options for the Program Portal
- Continue to discuss development of a proposal for fiscal year 2021 (FY21) and future cost share reporting

10:00 – 10:05	**Welcome** • Introductions • Agenda Review ➢ ***Decision***: Approve meeting agenda	*Grace Haggerty, Non-Federal Co-chair; Debra Hill, Federal Co-chair*
10:05 – 10:10	**February 16, 2021 Meeting Review** • Action items • Draft meeting minutes o ***Read Ahead***: February 16, 2021 Draft Meeting Minutes ➢ ***Decision***: Approve meeting minutes	*Program Support Team (PST)*
10:10 – 10:25	**Albuquerque Bernalillo County Water Utility Authority (ABCWUA) Habitat Restoration Project** • Southside Water Reclamation Plan Realignment Project	*Mark Kelly, ABCWUA*
10:25 – 10:35	**Program Portal Future Funding**	*Group Discussion*
10:35 – 10:55	**Signatory Support** • MRGESCP's support role • Letters of support • Other avenues of support	*Group Discussion*

10:55 – 11:05	**Break**	
11:05 – 11:45	**Proposal to Change Cost-Share** • Cost share and the 2009 Omnibus Appropriations Act • Definition of Program Activities • Definition of Signatory Contributions • Changes for reporting FY21+ o ***Read Ahead***: Draft Definition of Program Activities ✓ ***Action Item***: Summarize proposed changes to cost share reporting for review by the Program's Non-Federal signatories and the U.S. Bureau of Reclamation ✓ ***Action Item***: Prepare a draft report of proposed changes for the July 2021 EC meeting	*Ashleigh Morris, U.S. Bureau of Reclamation* *Group Discussion facilitated by the PST*
11:45 – 11:55	**Announcements**	
11:55 – 12:00	**Meeting Review** • Action Items • Next Meeting	*Co-chairs & PST*
12:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Fiscal Planning Committee (FPC)
Meeting Minutes

April 21, 2021; 10:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of April 21, 2021 FPC meeting agenda
- ✓ Approval of February 16, 2021 FPC meeting minutes

Action Items:

WHO	ACTION ITEM	BY WHEN
Sarah Hendrickson	Share the Southside Wastewater Reclamation Plant Outfall Realignment Evaluation Project memo, if possible	4/26/2021
Program Support Team (PST)	Send Water Trust Board information to Sarah H.	4/30/2021
FPC	Share further potential funding and coordination opportunities for the Southside Wastewater Reclamation Plant Outfall Realignment Project with Sarah H. and Mark Kelly	ASAP
PST	Discuss the potential for collecting signatory dues or pooling funds for Portal funding with Ashleigh Morris, Office of the Solicitor, U.S. Department of the Interior	5/7/2021
PST	Call signatory representatives to determine interest in rotating Portal funding periods and their ability to do so	6/1/2021
PST	Create a template for letters of support meant to proactively support MRGESCP signatories	6/1/2021
PST	Draft a proposal changing cost share to signatory contributions based on Executive Committee (EC) and FPC discussions for FPC review	5/20/2021
PST	Provide a FPC-reviewed signatory contributions proposal for discussion at the July EC meeting	7/21/2021

Next Meeting: After July EC meeting

Meeting Minutes

Welcome, Introductions, and Agenda Review

Julie Dickey, PST, opened the meeting and reviewed the April 21, 2021 meeting agenda. Grace Haggerty, FPC Non-federal Co-chair, led introductions.

✓ **Decision**: The FPC approved the April 21, 2021 FPC meeting agenda

February 16, 2021 Meeting Review

Debbie Lee, Program Manager on the PST, reviewed minutes and action items from the February 16, 2021 meeting.

✓ **Decision**: The FPC approved the February 16, 2021 FPC meeting minutes

Albuquerque Bernalillo County Water Utility Authority Habitat Restoration Project

Sarah Hendrickson, Albuquerque Bernalillo County Water Utility Authority (ABCWUA), presented on ABCWUA's Southside Wastewater Reclamation Plant Outfall Realignment Evaluation Project (see presentation). Summary points are below:

- The Southside Wastewater Reclamation Plant releases 55 million gallons of treated effluent per day into the Rio Grande.
- ABCWUA would like to restore habitat in the area where treated wastewater enters the river.
- The land surrounding the outfall is co-managed by Middle Rio Grande Conservancy District and U.S. Bureau of Reclamation (Reclamation).
- ABCWUA's goals for the projects are to improve water quality, improve the trail system and public access to the area, and increase habitat for Rio Grande silvery minnow (RGSM).
- The consultant, Hazen and Sawyer, proposed and evaluated three alternatives:
    - Alternative 1: Restore the areas directly north and south of the outfall.
    - Alternative 2: Restore the area north and south of the outfall, connecting the area to existing swale restoration sites.
    - Alternative 3: Construct a wetland using diverted outfall water extending beyond existing sites.
- ABCWUA is interested in finding partners to collaborate on design, construction, monitoring, and maintenance.

Comments:

- How was water quality improvement estimated?
    - That information is in the Hazen and Sawyer report.
    - Sarah H. will share the Southside Wastewater Reclamation Plant Outfall Realignment Evaluation Project technical memo, if possible
- Is the primary purpose of this project to address water quality issues?
    - Yes.
- There has been discussion about the quality of habitat restoration with high water temperature. Should this be addressed?
    - Baseline temperature data on effluent is needed for discussion.
    - At low flows, effluent release raise temperatures and may affect fish downstream.
    - The temperature depends on what else is flowing downstream.

    - NMISC and University of New Mexico are installing a sond just below Isleta Reach, which could provide temperature information.
- FPC members suggested the City of Albuquerque Open Space, Audubon, and National Fish and Wildlife Foundation as potential partners.
- It is unclear if the project will produce RGSM habitat.
- Grace H. may be applying for Water Trust Board project funding this year, and would need partners. Projects can be combined into an Endangered Species Act collaborative project with multiple elements. She suggested ABCWUA look into Water Trust Board funding as an option.
    - What are the funding limits?
        - Unsure of limit, but max NMISC has previously received is $1.5 million.
    - The deadline is in August, and it is important to contact the Water Trust Board early.
    - The PST will send Water Trust Board information to Sarah H.
- Lynette Giesen, U.S. Army Corps of Engineers (USACE), can share any information on projects in the area.
- It was suggested that BEMP could do pre-monitoring or other work for the project.

- **Action Item**: Sarah Hendrickson will share the Southside Wastewater Reclamation Plant Outfall Realignment Evaluation Project memo, if possible
- **Action Item**: The PST will send Water Trust Board information to Sarah Hendrickson
- **Action Item**: The FPC will share further potential funding and coordination opportunities for the Southside Wastewater Reclamation Plant Outfall Realignment Project with Sarah Hendrickson and Mark Kelly

Program Portal Future Funding

Debbie Lee, PST, opened discussion on Portal funding. Summary points are below:

- The USACE contract with U.S. Geological Survey (USGS) to develop the Portal ended in January.
- ABCWUA will fund basic maintenance for at least the next year.
    - $15,000 for the Portal was added to an existing ABCWUA contract with USGS. The agreement is in place until 2023, but the currently funded amount will likely run out in March/April 2022.
- Any further development or updates to the geospatial mapper will require additional funding.
- The EC tasked the FPC with discussing funding options for the Portal.

Comments:

- Reclamation Update:
    - The original MRGESCP website (the DBMS) was created by a private company and was not functional.
    - Through USACE's contract with USGS, a functional site was developed, and there is a strong desire for USGS to continue hosting the Portal.
    - Reclamation has considered wrapping Portal funding into the MRGESCP support team contract, but USGS cannot contract with private entities.
        - Additional funding will be needed from signatories to maintain the Portal as is. Signatories could take turns funding the Portal or pay for pieces of the Portal (e.g., updating the spatial mapper).
- Could signatories pay MRGESCP dues to fund the Portal?
    - It was suggested the Portal funding should be around $25,000-$30,000 a year to provide the option for some future development beyond basic maintenance of the site.

    - Debbie L. previously discussed collecting dues with a Reclamation lawyer, and concluded that it was not possible under the MRGESCP's current structure.
    - Debbie L. will discuss the potential for changes to the MRGESCP structure to collect dues for Portal funding with Ashleigh Morris, Office of the Solicitor, U.S. Department of the Interior.
- The Portal could be funded on a rotating basis, five years at a time.
- Upgrades to the Portal should be incremental now. The major work is already done.
    - A future development could be making the site mobile-friendly.
- Should other signatories get involved by funding the Portal, or does Reclamation need to take over?
    - Any agency taking on the contract would have administrative costs. Federal agencies typically have higher associated administrative costs.
    - It would be cumbersome for Reclamation to begin funding the Portal with USGS, but that is preferable to having the same conversation every six months.
- The PST will call signatory representatives to determine interest in rotating Portal funding.
    - The PST has discussed Portal funding with signatories, but there has not been much interest in the past. Few signatories have funding to provide.

- **Action Item**: The PST will discuss the potential for collecting signatory dues or pooling funds for Portal funding with Ashleigh Morris
- **Action Item**: The PST will call signatory representatives to determine interest in rotating Portal funding periods and their ability to do so

Signatory Support

Julie D. discussed providing proactive support for MRGESCP signatories. Summary points are below:

- Letters of support need to be more timely and proactive.
- The Program should generate letters of support to legislative representatives on an annual basis.
    - Thank them for continued support and express the desire for continued support.
- There will be template letters for use, which will save time.
- It would also be beneficial to list the non-federal signatories backing future letters.

- **Action Item**: The PST will create a template for letters of support meant to proactively support MRGESCP signatories

Proposal to Change Cost-Share

Debbie L. opened discussion on changing cost share. Summary points are below:

- The EC discussed the proposed definition of a "Program activity." The topic informs cost share.
- Ashleigh Morris, DOI Solicitor, looked into the MRGESCP's cost share requirement and any restrictions there may be.
    - There is no statutory language stating how the 25% non-federal cost share is accounted.
    - Accounting should be reasonable and meet the objectives of transparency and accountability.
    - Ashleigh M.'s recommendation is to do what makes sense and meets the objectives of the Program.
- Debbie L. presented a slideshow on defining signatory contributions and their relationship to Program activities (see presentation). Summary points are below:

- Signatory contributions are all the activities carried out by the signatories under their own authorities and responsibilities.
- The MRGESCP uses the knowledge and results from those activities to reduce scientific uncertainty or to inform recommendations for management. The activities that inform the work of the MRGSECP are Program activities.
- The overlap between the two depends on how much signatories are willing to share.
- Program activities and signatory contributions are split into administrative and scientific buckets.
- Findings and results from scientific signatory contributions should come back to the MRGESCP. The MRGESCP provides a space for synthesis of the activities being done. The value the MRGESCP adds to signatory contributions is showing how they reduce scientific uncertainty and/or contribute to recommendations. This gives signatories additional credit for what they are already doing.
- Signatory contributions are categorized as:
  - Habitat Assessments & Modeling
  - Species Management & Recovery
  - Population Monitoring & Modeling
  - Program Management & Administration
  - Field & Laboratory Experiments
- These categories will be used in the Adaptive Management Relational Database (AMRDB), Long-Term Plan, and annual report.

Comments:

- How do signatory contributions relate to cost share?
  - The goal is to reframe cost share as contributions. It puts the focus on activity outcomes instead of money spent.
    - When activities are entered into the AMRDB, they can be pulled into reports.
    - Each year, there can be a report on each signatory's activities supporting the MRGESCP, including membership in committees and ad hoc groups.
- Non-federal cost share should end and be replaced with signatory contributions. Funds can be attributed to a biological opinion (BO) or other signatory authority instead of as part of the MRGESCP.
  - Reclamation is investigating the legal implications of the MRGESCP no longer being a cost share program.
- The language in the 2009 Omnibus Appropriations Act ties cost share to the 2003 Middle Rio Grande BO, subsequent BOs, and to the MRGESCP's Long-Term Plan. Reclamation has to show that cost share is met, but that could be done through a broader definition of signatory contributions.
- Under the new definition, contributions would be narrower. For example, NMISC and the Pueblos do a lot of on-the-ground work. This work is still included. Any change in the river could be considered an experiment. For example, fish passage could be implemented as a BO requirement and the abiotic and biotic responses could be monitored. The findings would then contribute to science and inform management, which is a Program activity.
  - Millions have been spent doing restoration work, which would not be included in the purview of the MRGESCP under the proposed definition.
- The EC is adamant about the need for tracking contributions. There is more interest in knowing the overall cost of the MRGESCP versus how much each signatory spends. The AMRDB can be a

tool used to track contributions, and if there is a question about specific signatory costs, it will be available provided the signatories contribute their financial information.
    - The benefits of activities should be highlighted rather than just costs. This can be done by linking activities to objectives, long-term goals, scientific uncertainties, etc.
- There is concern over where to draw the line on signatory contributions and how it affects the non-federal signatories as part of the 25% cost share.
- If Reclamation funded an eight million dollar fish passage project, the information from pre- and post-construction monitoring could be included as a signatory contribution, but not the construction costs, as the results from that monitoring can contribute to MRGESCP science.
- Where should the MRGESCP have input on these projects?
    - Signatories can announce projects at the EC, reach out for partnerships through the FPC, or bring the projects (e.g., proposed activity/study designs and/or results) to the SAMC to ask for input.
    - The MRGESCP can add value to these Signatory activities by analyzing results and information from the projects, and synthesizing them into recommendations for future scientific activities or recommendations for management to the signatories.
    - The MRGESCP can also provide recommendations to organizations proposing to implement projects via guidelines for habitat restoration, specific project recommendations, etc.
    - These are the benefits of involvement in the MRGESCP.
- The MRGESCP needs to be better about sharing information about Signatory studies and projects. There is already a lot of science being done, which needs to be incorporated into the Collaborative Program. The AMRDB can help with the sharing of projects and scientific findings.
    - Work can be synthesized via the AMRDB and shared with the entire MRGESCP. That is the incentive for each signatory to contribute to the AMRDB.
- There needs to be active communication channels throughout the year, not just the Science Symposium. The PST is considering topical seminars or workshops for individuals to share information around one area.

- **Action Item**: The PST will draft a proposal changing cost share to signatory contributions based on EC and FPC discussions for FPC review
- **Action Item**: The PST will provide a FPC-reviewed signatory contributions proposal for discussion at the July EC meeting

Meeting Review

The FPC reviewed action items and discussed a date for the next meeting.

- The FPC will not hold a meeting until after the July EC meeting.

Meeting Participants

Ashlee Rudolph	U.S. Bureau of Reclamation
Ashleigh Morris	U.S. Bureau of Reclamation
Debbie Lee	Program Support Team
Debra Hill	U.S. Fish and Wildlife Service
Grace Haggerty	New Mexico Interstate Stream Commission
Julie Dickey	Program Support Team
Lynette Giesen	U.S. Army Corps of Engineers
Michelle Tuineau	Program Support Team
Sarah Hendrickson	Albuquerque Bernalillo County Water Utility Authority

As part of its transition to a science-based adaptive management program, the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) needs to clearly define a MRGESCP activity. This definition both acknowledges the assumptions laid out in the Science & Adaptive Management Plan and outlines the opportunities for the MRGESCP to increase the scientific understanding of listed species in the Middle Rio Grande to better inform management.

A MRGESCP activity is defined as a signatory activity that:

(1) Contributes to MRGESCP operations through:
    - Active participation in MRGESCP committees and ad hoc groups, and
    - Administrative support of the MRGESCP.

(2) Advances the scientific merit of the MRGESCP by:
    - Reducing a scientific uncertainty by addressing one or more MRGESCP objectives in the Long-Term Plan,
    - Providing findings for incorporation into the MRGESCP's science and adaptive management tools (e.g., Adaptive Management Relational Database, conceptual ecological models, etc.),
    - Contributing to the collective body of knowledge about the listed species in the Middle Rio Grande, and
    - Informing the MRGESCP's recommendations on future scientific activities and/or management actions.

This definition recognizes that each signatory carries out activities to meet its individual mission, mandates, and responsibilities, and cannot abrogate that responsibility to the MRGESCP. Those activities often generate valuable scientific data and findings that can be compiled, synthesized, and used to strengthen science-based recommendations from the MRGESCP.

Defining a MRGESCP activity will inform the development of several work products and related processes, including:

- Revising cost-share reporting
- Drafting a new Memorandum of Agreement
- Structuring annual reports and newsletters
- Building the Adaptive Management Relational Database
- Updating the Science & Adaptive Management Plan
- Updating the Long-Term Plan

ABCWUA Habitat Restoration

Southside Water Reclamation Plan Realignment Project

April 21, 2021

Alternative 1

- 1.5 acres of new Bosque habitat
- 2 acres of riparian vegetation improvements
- 1,300 linear feet of new trail
- Water quality improvements:

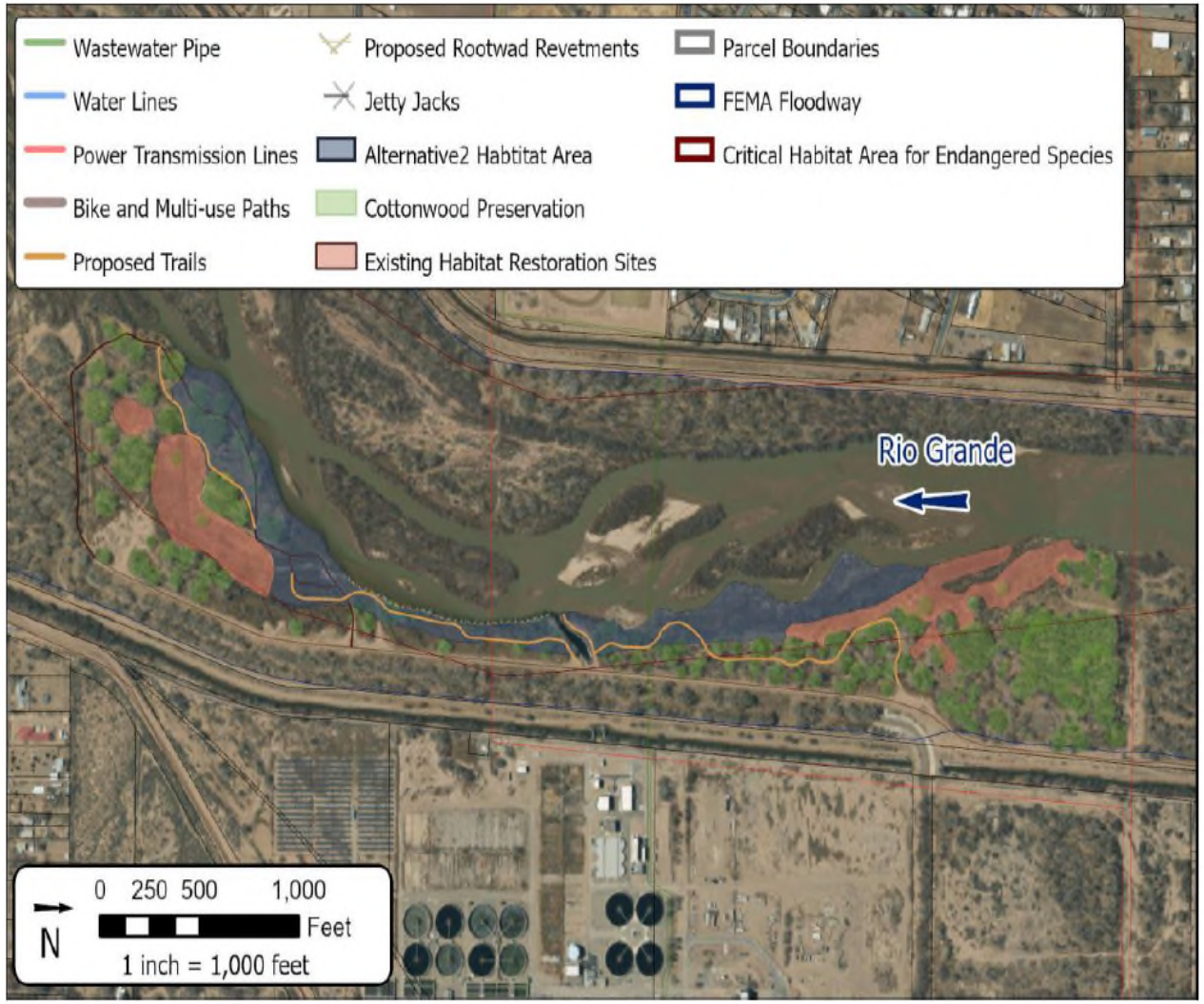
Pollutant	Load Reduction	Unit
TSS	15.8	tons/year
TN	39.3	lbs/year
TP	85.4	lbs/year
FC	29.4×10^6	ppb/year
EC	31.8×10^6	ppb/year



Alternative 2

- Improvements from Alternative 1 plus a tie into the existing willow swale restoration sites to the N and S
- 14.5 acres of new Bosque habitat
- 18 acres of riparian vegetation improvements
- Water quality improvements:

Pollutant	Load Reduction	Unit
TSS	151.6	tons/year
TN	376.5	lbs/year
TP	817.5	lbs/year
FC	4.9×10^9	ppb/year
EC	5.3×10^9	ppb/year



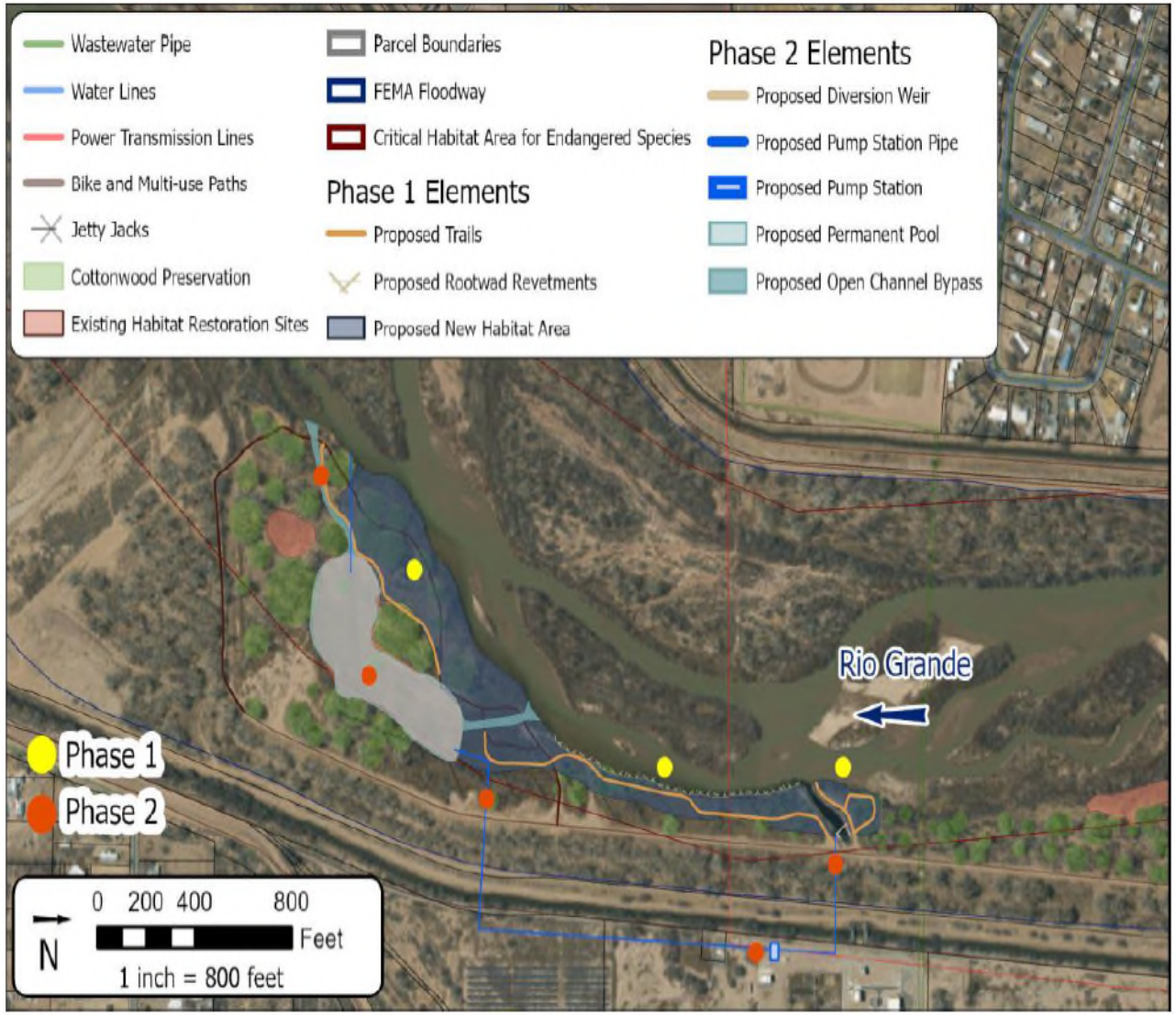
Alternative 3

- Create a constructed wetland using water diverted from SWRP channel
- Maintenance will be required to remove sediment from conveyance infrastructure
- 6.5 acres of new Bosque habitat
- 12 acres of riparian vegetation improvements
- 2,600 linear feet of new trail
- 33 acre-feet of permanent pool for recreation and waterfowl habitat
- Water quality improvements:

Pollutant	Phase 1 Load Reduction	Phase 2 Load Reduction	Unit
TSS	75.8	0 [1]	tons/year
TN	189	8591	lbs/year
TP	407	4233	lbs/year
FC	1.0 x 10^9	0 [2]	ppb/year
EC	1.1 x 10^9	0 [2]	ppb/year

[1] Monitoring data provided by the Water Authority indicates approximately 0 mg/L TSS loading rate to the outfall.

[2] Additional water quality benefits are expected by introducing the constructed wetland, however not enough data is available at the time of this study to compute load reductions for Fecal Coliform and E. Coli.



Opportunities and Considerations

- Monitoring recommended to evaluate the success of the project
  - Groundwater level
  - Water quality
  - Bank erosion
  - Vegetation survey
  - Aquatic biota survey
- Maintenance
  - Spot erosion repairs
  - Sediment removal
  - Native plant replacement (due to mortality during establishment)
  - Clean-up days

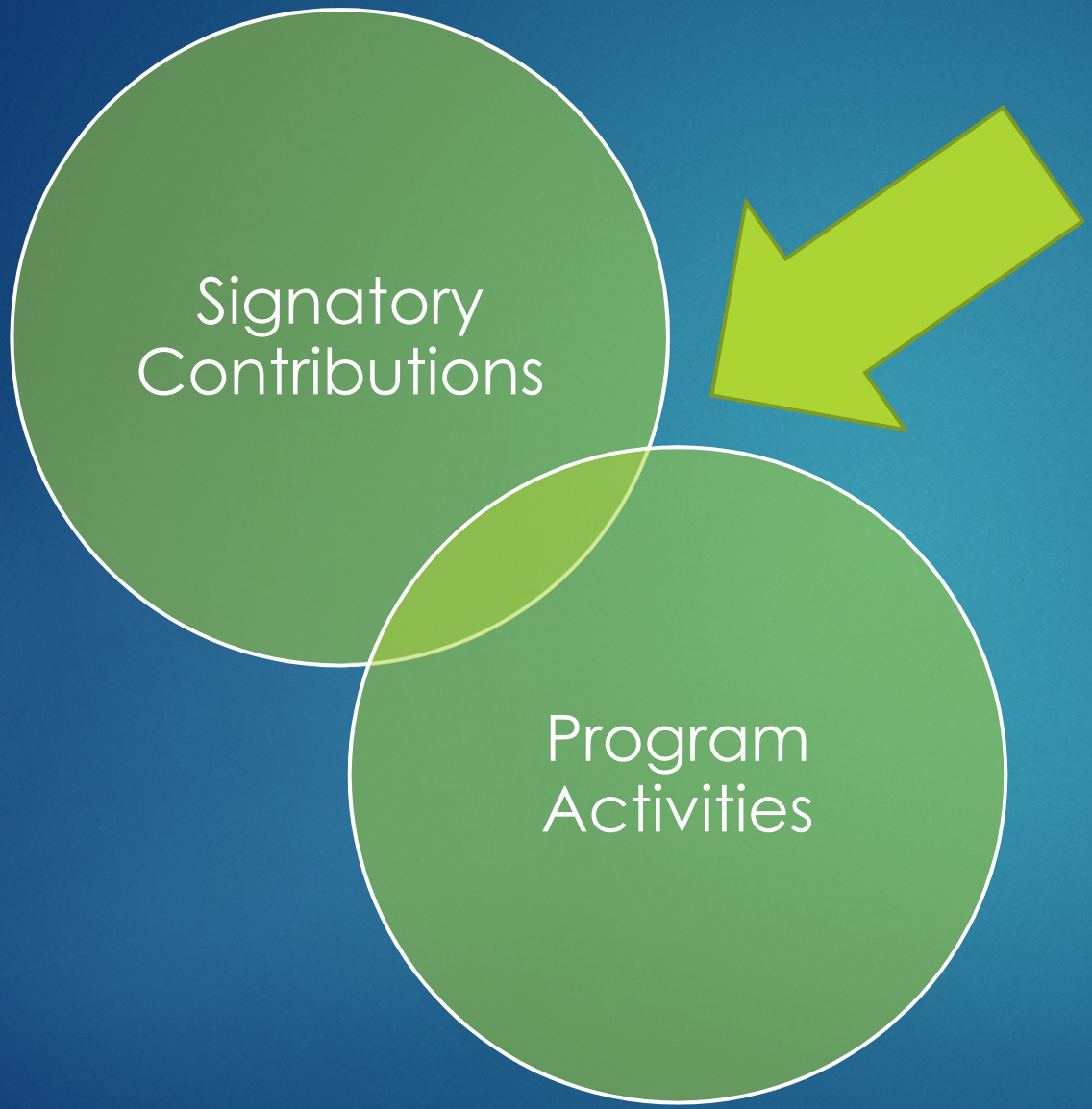
Signatory Contributions to Program Activities

FISCAL PLANNING COMMITTEE

APRIL 21, 2021

Assumptions from S&AM Plan

- The Collaborative Program has no authority to implement adaptive management in the MRG.
- There is no central decision-making or funding authority in the MRG; the Collaborative Program does not have decision-making authority on any individual signatory's budget, contracts, or management actions.
- Collaborative Program efforts contribute valuable research to inform the recovery of the listed species; however, the Collaborative Program is not an entity that is collectively bound by any legal responsibility to recover the threatened and endangered species of the MRG.
- Resource management decisions by individual Collaborative Program signatories often require consideration of species response to system changes.
- The Collaborative Program aids in the systematic reduction of uncertainty related to species vulnerabilities, resulting in science-based recommendations that help guide management of the MRG.



Overlap can be as much or as little as needed to fulfill the purpose of the Program, and at the input of the signatories

Program Activity (proposed at EC)

- Contributes to MRGESCP operations through:
  - Active participation in MRGESCP committees and ad hoc groups, and
  - Administrative support of the MRGESCP.
- Advances the scientific merit of the MRGESCP by:
  - Reducing a scientific uncertainty by addressing one or more MRGESCP objectives in the Long-Term Plan,
  - Providing findings for incorporation into the MRGESCP's science and adaptive management tools (e.g., Adaptive Management Relational Database, conceptual ecological models, etc.),
  - Contributing to the collective body of knowledge about the listed species in the Middle Rio Grande, and
  - Informing the MRGESCP's recommendations on future scientific activities and/or management actions.

What is a Signatory Contribution?

- Signatory-administered activities
  - Administrative:
    - Administration of contracts, grants, and agreements that support Collaborative Program operations Active participation in Collaborative Program committees, groups, and work products
  - Scientific:
    - The contributed findings and results from studies, monitoring, data collection, modeling, habitat restoration, literature reviews, research, and experiments
    - This includes recommended scientific activities in the Long-Term Plan

Delineating Signatory Contributions and Program Activities

- The Program provides the space for collection and synthesis of findings and results from all science activities
- Value added: Showing how a signatory contributes to the systematic reduction of scientific uncertainties, in the framework of the Program objectives, that contribute to new understanding of the species and better management recommendations
- Gives "credit" for activities signatories are already doing to meet their own obligations outside the Collaborative Program

Categories of Signatory Contributions

- Habitat Assessments & Modeling
- Species Management & Recovery
- Population Monitoring & Modeling
- Program Management & Administration
- Field & Laboratory Experiments

Signatory contributions are incorporated into the following Program tools:

- AM Relational Database
- Long-Term Plan
- Annual Report

Hazen *Technical Memorandum*

February 12, 2021

To: Albuquerque Bernalillo County Water Utility Authority

From: Hazen & Sawyer

Southside Wastewater Reclamation Plant Outfall Realignment Evaluation Project

Conceptual Alternatives Technical Memorandum

1. Project Background

Serving the greater Albuquerque population, the Southside Wastewater Reclamation Plant (SWRP) is operated by the Albuquerque Bernalillo County Water Utility Authority (Water Authority) and treats approximately 55 million gallons per day (MGD) of wastewater. The plant's treated effluent is continuously released to the Rio Grande via an outfall channel located on the east bank of the river. The land surrounding the outfall is owned by the Middle Rio Grande Conservancy District (MRGCD) and is jointly managed with the US Bureau of Reclamation (Reclamation). Access to the SWRP outfall is gained by an MRGCD maintenance road. Currently, there is active public use along this road and at the SWRP outfall; it is a popular area for hiking, biking, fishing, and occasionally swimming.

The purpose of this project is to evaluate opportunities and prepare alternative concepts for improvements to the outfall channel and surrounding areas to benefit water quality, facilitate public access, and create additional habitat for the endangered Rio Grande Silvery Minnow (*Hybognathus amarus*).

This technical memorandum documents the analysis performed to evaluate the feasibility of the SWRP outfall improvements. An interactive ArcGIS StoryMap was also prepared to communicate the preliminary results of the evaluation and can be accessed by following this provided hyperlink.

2. Goals & Objectives

To utilize the high quality SWRP effluent, the outfall realignment project has two primary goals and several secondary goals.

Primary objectives:

- Improve water quality in the Rio Grande
- Increase public access to the Bosque surrounding the outfall. This includes adding trails and other features, such as guided tours, to increase public engagement with this section of the Bosque.

Job no 70041-002

Secondary objectives:

- Improve habitat area for the Rio Grande silvery minnow (*Hybognathus amarus*)
- Provide seasonal water quality benefits to the connected groundwater systems in restored areas

Although initially a possibility for achieving these goals, realigning or moving the current SWRP outfall was deemed not desirable as it would require modification to the Water Authority's recently approved NPDES permit.

3. Existing Conditions Evaluation

The identification and selection process for developing the conceptual alternatives began with an evaluation of existing conditions including a literature review, desktop analysis, review of existing habitat creation sites, and a field investigation. The important findings from each of these activities are detailed below.

3.1 Literature Review

The literature review focused on the natural history of the Rio Grande silvery minnow as well as previous efforts and design criteria for habitat restoration. The Rio Grande silvery minnow was listed as an Endangered Species under the delineation of the U.S. Fish and Wildlife Service (USFWS) in 1994 and currently exists in less than 5% of its native range. The decrease in Rio Grande silvery minnow populations is directly correlated with man-made modifications and alterations to the Rio Grande over the past century. These modifications and alterations include water diversions for municipal and agricultural uses, alterations of the natural hydrological cycle of the Rio Grande, habitat degradation, and the construction of dams which prevent migration of the silvery minnow within its historical native range. From the literature review, the following criteria were confirmed for ideal silvery minnow habitat conditions:

- silt and sand substrate with some large gravel and boulders,
- shallow (1.5 ft depth or less), slow moving water (less than 0.5 fps), and
- during the winter, minnows are most commonly found in nearly still water with debris cover.
- during low flows, they are found in isolated pools and in watered reaches immediately down stream of diversion structures.

The USFWS and Reclamation have led efforts to restore silvery minnow habitat and have published reports summarizing approaches for habitat creation and restoration (USFWS, 2007 and USBR, 2004). These approaches include channel modifications to the Rio Grande, engineered log jams, vernal pools, log-crib habitat structures, and bendway weirs. Channel incision resulting from upstream dams and the creation of a levee system along the Rio Grande through Albuquerque have isolated floodplain habitat. Floodplain reconnection through overbank excavation of the Rio Grande has been implemented in areas throughout Albuquerque by the US Army Corps of Engineers (USACE) as part of the Middle Rio Grande Bosque Environmental Restoration (MRGBER) (USACE, 2011) as well as the Water Authority.

Historical biological opinions from USFWS on similar projects were generally favorable to this type of habitat restoration approach, given that measures are implemented to protect the silvery minnow during and after construction. Monitoring efforts performed through the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) indicate that populations of silvery minnow successfully inhabit and reproduce in the restored floodplain areas, including those performed by the Water Authority near Paseo del Norte (MRGESCP monitoring site ID 140). Therefore, this approach for habitat creation was selected for the project.

Research on water quality improvements from similar habitat restoration efforts was performed as well. The parameters of interest included Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorous (TP), E. Coli, and Fecal Coliform. Typical nutrient reduction percentages and estimated pollutant load reductions were estimated based on the water quality literature review.

3.2 Desktop Analysis

As a precursor to the site visit, desktop analysis of the SWRP site was completed. By reviewing aerial imagery and publicly available GIS data, important site considerations and potential conflicts were identified. The existing water system of pipes, pump stations, valves, and other water infrastructure were evaluated for possible conflicts near the outfall. Through evaluating these assets, the only potential constraint was a wastewater force main that conveys flows under the Rio Grande just north of the SWRP outfall. After further research, it was determined that the pipe has approximately 35 feet of cover on the east bank of the Rio Grande which would not pose a conflict with anticipated excavation activities for the SWRP outfall improvements considered for this project. Additional evaluation led to several other notable existing conditions:

- Land ownership and parcel boundaries show that the land surrounding the outfall is owned by MRGCD. Preliminary correspondence with MRGCD indicates that the land is jointly managed with US Bureau of Reclamation and that previous habitat restoration activities within the Bosque have required National Environmental Policy Act (NEPA) review; their coordination will be required before any modifications at the outfall may take place.
- Existing public access trails were noted with the intent for proposed paths to connect with the current trail system.
- Critical habitat area for threatened and endangered species, as defined by the USFWS, exists at the outfall and much of the surrounding area. The four federally listed threatened and endangered species are listed below.
    - Rio Grande Silvery Minnow (*Hybognathus amarus*), Endangered
    - Southwestern Willow Flycatcher (*Empidonax traillii extimus*), Endangered
    - Mexican Spotted Owl (*Strix occidentalis lucida*), Threatened
    - Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*), Threatened

This desktop analysis was essential to facilitating a smooth and informative field investigation.

3.3 Field Investigation

Hazen staff performed site visits to existing habitat creation sites as well as to the SWRP outfall site. These visits were essential to identifying the alternative concept elements as well as determining existing conditions.

3.3.1 Paseo del Norte Sites

The existing habitat creation sites were visited to determine points of success and failure. The sites visited were on the east and west banks of the Rio Grande, south of Paseo Del Norte. Both sites were designed for inundation at Rio Grande flows of 1,500 cubic feet per second (cfs). The east bank restoration site creates floodplain habitat at high flows, while the west bank restoration site creates side-channel habitat. Based on Water Authority staff feedback, floodplain inundation designs are preferable to side-channel habitats. Side-channel habitats often require additional maintenance as the channel entrance and exit tend to silt in; therefore, higher flows are required for inundation and may strand aquatic species when the channel dewaters.

From this site visit, Hazen staff concluded that floodplain habitat creation was less maintenance intensive and preferable to side-channel creation. New floodplain habitat may also be designed to follow the 1,500 cfs inundation guideline (USACE, 2014).

3.3.2 SWRP Site

In addition to visiting existing habitat sites, Hazen staff performed a site investigation to confirm concept approaches, develop possible alternatives, and evaluate existing conditions at and around the SWRP outfall. During the site visit, Hazen staff took measurements, collected representative photos, and noted site considerations and representative plant species.

The existing conditions identified during the site investigation include:

- **Powerlines** cross the project area just south of the SWRP outfall; the areas of proposed improvements were developed to not interfere with them; however, some coordination may be required to access and work within the powerline right-of-way.
- **Jetty jacks** were discovered sporadically north of the outfall and were widespread in an almost continuous line south of the outfall. The jetty jacks near the project site were installed by the USACE in 1956 to protect the Middle Rio Grande East levee. While the removal of jetty jacks is generally considered desirable, removing them may add additional costs.
- **Native plants**, primarily cottonwoods (*Populus wislizeni*), are present throughout the project area and should be preserved where possible. Additional native plants, such as coyote willows (*Salix exigua*), were also identified.
- **Invasive plants**, such as Siberian elm (*Ulmus pumila*), salt cedar / tamarisk (*Tamarix* spp.), kochia (*Kochia* spp.), and Russian olive (*Elaeagnus angustifolia*), were observed north and south of the outfall.

- **Existing willow swales** were identified in the field, through aerial imagery, and confirmed during discussions with USACE. There are two willow swales near the outfall, one north of the outfall that creates floodplain connectivity during high flows and the other is south of the outfall with a side-channel design. The willow swales were constructed around 2011 as part of the USACE's MRGBER project.

From the field investigation, the initial concept for modifying the SWRP outfall was to create floodplain habitat at and around the outfall. The extent of this floodplain creation and other requirements is detailed in the subsequent section.

4. Proposed Improvements

Following the existing conditions evaluation, a conceptual approach was developed for improvements to the SWRP outfall to meet project goals. Hazen performed planning-level analyses to confirm feasibility of the conceptual approach including site layout for several alternative configurations, hydrologic and hydraulic analysis, water quality benefits, permitting requirements, and opinions of probable cost for project implementation. A description of each activity and the associated results are discussed in the following subsections.

4.1 Rapid Hydrologic and Hydraulic Assessment

Hazen employed a rapid hydrologic and hydraulic assessment approach to approximate flood depths throughout the project area. A one-foot flood depth for the 1,500 cfs Rio Grande flood event across the floodplain is generally considered to be the minimum hydraulic design criteria to support desirable silvery minnow fishery refuge and spawning habitat.

Hazen used the following publicly available data to compute probable design flood depths. Additional detail and supplemental figures on the rapid hydrologic and hydraulic assessment and findings are provided in **Appendix A**.

- City of Albuquerque GIS 2-ft contours (2010).
- FEMA FIS flood rates and depths at lettered cross-sections (35001CV001D and 35001CV002D, last revised November 2016).
- USGS' Central Ave historical gage peak discharge measurements.

The modeling results confirmed a sufficient correlation between observed (i.e., USGS) and interpolated (i.e., FEMA) discharge rates during more frequent flood events. Hazen found that the 1-year flood event is roughly equivalent to the minimum design discharge (1,500 cfs) for silvery minnow habitat. Flood depths were interpolated to define conceptual-level floodplain excavation depths and extents (**Figure 1**). **Figure 2** provides a visualization of the floodplain reconnection and pedestrian access approach proposed for the SWRP improvements and illustrates the distribution of floodwaters across the landscape to create habitat for aquatic biota while improving water quality through stabilization of Rio Grande riverbanks and floodplains.

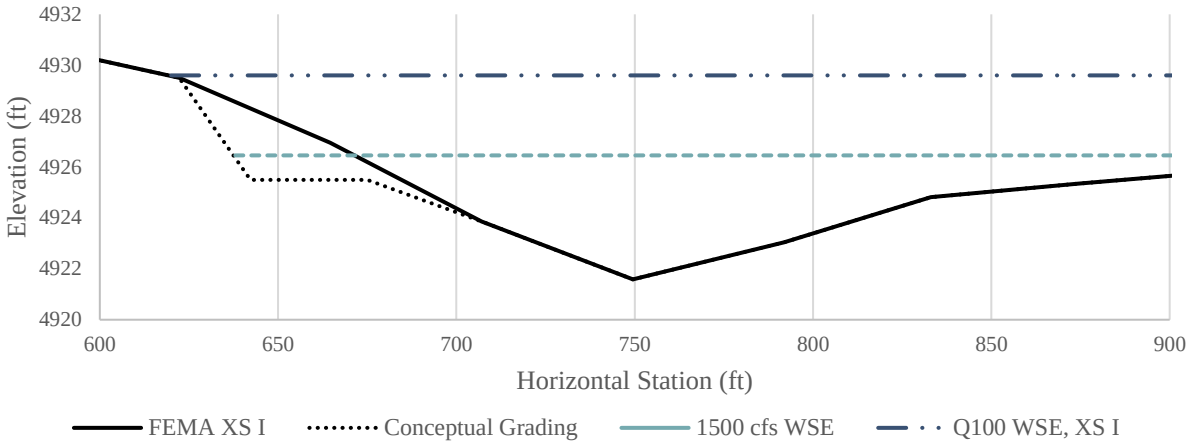


Figure 1: Conceptual Grading and Approximate Water Surface Elevations at the Project Site

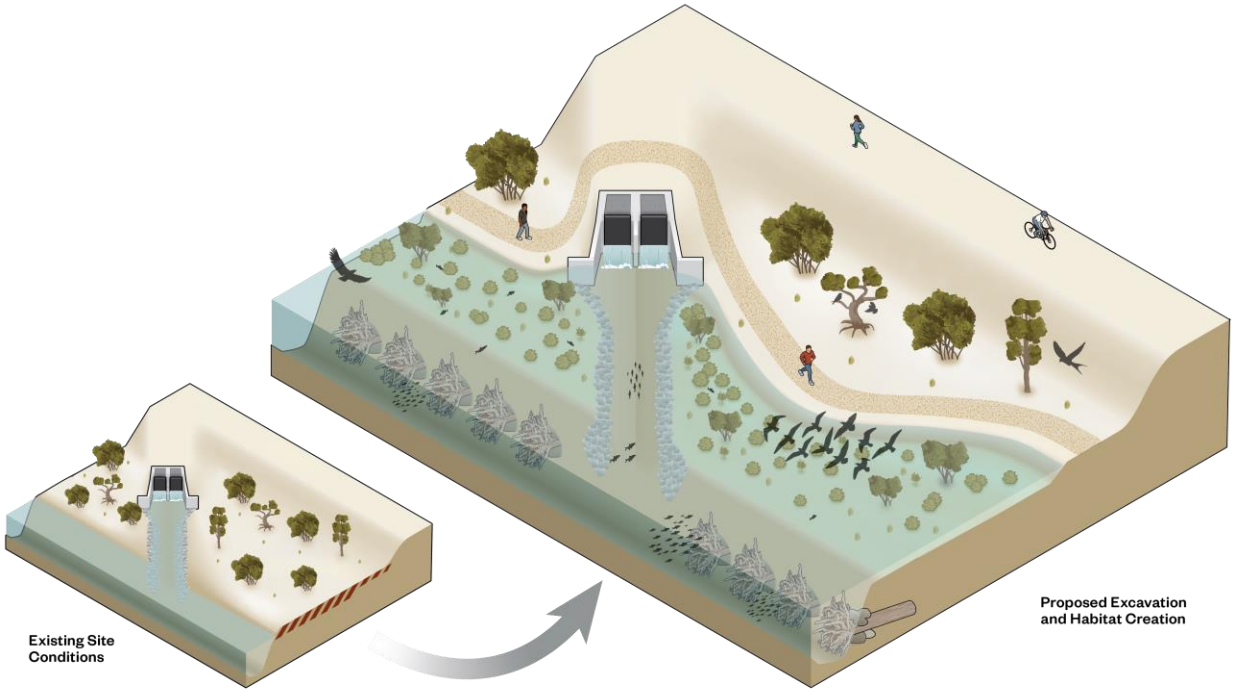


Figure 2: Visualization of Proposed SWRP Outfall Improvements

4.2 Concept Development

Hazen developed multiple conceptual alternatives according to the Water Authority's preferences on project goals and objectives. The first two alternatives are similar in approach but differ in the extent of floodplain reconnection activity. The third alternative incorporates partial baseflow diversion from the SWRP outfall channel to a downstream constructed wetland. All alternatives incorporate elements of public access to the Bosque via trail systems and habitat improvements for riparian and aquatic species.

Hazen used the following approach to develop planning-level estimates for water quality improvements associated with each alternative. The process bulleted below is based upon published, peer-reviewed literature and findings for estimating purposes.

- Schueler & Stack's (2014) peer-reviewed publication outlines procedures for estimating pollutant load reduction when performing stream restoration and floodplain reconnection. Protocol 1 (Credit for Prevented Sediment during Stream Flow) was used as the basis for estimating bank erosion quantities and conversion factors from total suspended solids (TSS) to total nitrogen (TN) and total phosphorous (TP).
- NRCS's *Web Soil Survey* was used to estimate the stream bank and floodplain sediment bulk density to convert bank erosion volumes to weight.
- K.N. Irvine et al's (2002) peer-reviewed publication correlates TSS to Fecal Coliform (FC) concentrations in surface water systems. Hazen used findings from this publication to convert TSS loading estimates to FC.
- USGS' (1993) peer-reviewed publication that correlates FC to E. Coli (EC) concentrations in surface water systems. Hazen used findings from this publication to convert estimated Fecal Coliform loading estimates to EC.
- The *International Stormwater BMP Database* is a public/private collaborative database that collates stormwater best management practice (BMP) projects by geography with statistical reporting capabilities for pre- and post-project implementation pollutant removal effectiveness. "Wetland Channel" was used for pollutant reduction values for this project.

4.2.1 Alternative 1

Alternative 1 Components

The intent of Alternative 1 is to create floodplain habitat upstream and downstream of the outfall assuming an approximate $1 million project budget. As seen in **Figure 3** and in **Appendix B**, construction of this alternative would realize the following community and ecosystem benefits.

- **1.5 acres** of new habitat along the Bosque
- **2 acres** of improvements to riparian vegetation communities through invasive species management and establishment of diverse, multi-strata native riparian species
- **1,300 linear feet** of new trails for the community, including maintenance access along the Bosque

Planning-Level Water Quality Improvements

Planning-level water quality improvements associated with this alternative were calculated using the protocols and previously stated. If constructed, this project could realize the following annual pollutant load reductions.

Table 1: Alternative 1 Planning-Level Pollutant Load Reduction

Pollutant	Load Reduction	Unit
TSS	15.8	tons/year
TN	39.3	lbs/year
TP	85.4	lbs/year
FC	29.4 x 10^6	ppb/year
EC	31.8 x 10^6	ppb/year



Figure 3: Alternative 1 Conceptual Design Elements

4.2.2 Alternative 2

Alternative 2 Components

The intent of Alternative 2 is to create floodplain habitat areas that extend upstream and downstream of the outfall and tie into the existing willow swale restoration sites to the north and south. The layout of Alternative 2 would be refined during the detailed design phase to minimize disturbance to cottonwood trees and other environmentally sensitive areas along the Bosque and include jetty jack removal. As seen

in **Figure 4** and **Appendix B**, construction of this alternative would realize the following community and ecosystem benefits.

- **14.5 acres** of new habitat along the Bosque
- **18 acres** of improvements to riparian vegetation communities through invasive species management and establishment of diverse, multi-strata native riparian species
- **4,800 linear feet** of new trails for the community, including maintenance access along the Bosque
- **1,100 linear feet** of rootwad revetments along the Rio Grande

Planning-Level Water Quality Improvements

Planning-level water quality improvements associated with this alternative were calculated using the protocols previously stated. If constructed, this project could realize the following annual pollutant load reductions.

Table 2: Alternative 2 Planning-Level Pollutant Load Reduction

Pollutant	Load Reduction	Unit
TSS	151.6	tons/year
TN	376.5	lbs/year
TP	817.5	lbs/year
FC	4.9×10^9	ppb/year
EC	5.3×10^9	ppb/year

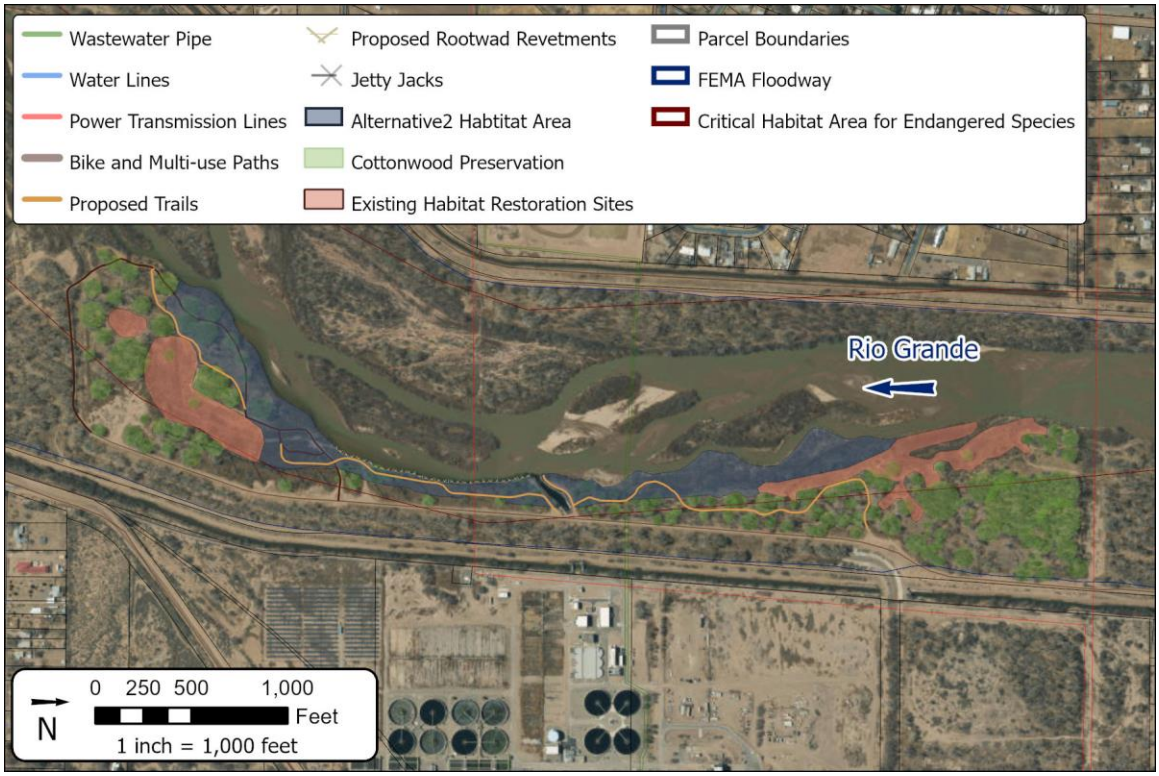


Figure 4: Alternative 2 Conceptual Design Elements

4.2.3 Alternative 3

Alternative 3 Components

The intent of Alternative 3 is to create a constructed wetland using water diverted from the SWRP channel and includes floodplain habitat creation downstream of the outfall. A pump station will divert a portion of the SWRP effluent from the outfall channel via a piped conveyance to the constructed wetland. It is recommended that the proposed pump station is located on the SWRP property for constructability and maintenance purposes. Approximately 2300 linear feet of 12-inch diameter pipe would be required, with a minimum of two 20 HP pumps to facilitate conveyance. The Rio Grande is prone to very high suspended sediment levels during flood events and associated turbidity measurements exceeding 5,000 NTUs are not uncommon. While design solutions to prevent riverine sediment from entering water infrastructure will be critical to the success of this project, maintenance to remove sediment from the constructed wetland and conveyance infrastructure is anticipated.

The constructed wetland would include a low-flow channel with depths ranging from 1-2 feet and shallow vegetated benches with depths ranging 0.5 foot or less. Water surface elevations in the constructed wetland would be controlled by an outlet control structure that would discharge to the Rio Grande. Similar to Alternative 2, Alternative 3 would also account for minimizing cottonwood removal along the Bosque while including jetty jack removal. As seen in **Figure 5** and **Appendix B**, construction of this alternative would realize the following community and ecosystem benefits.

- **6.5 acres** of new habitat along the Bosque
- **12 acres** of improvements to riparian vegetation communities through invasive species management and establishment of diverse, multi-strata native riparian species
- **2,600 linear feet** of new trails for the community, including maintenance access along the Bosque
- **1,100 linear feet** of rootwad revetments along the Rio Grande
- **33 acre-feet** of permanent pool for recreation and waterfowl habitat

It should be noted that the evaluation summarized above was developed using topographic information from GIS sources that were created in 2010 and augmented by Hazen's site investigation notes. Field run topographic survey information will be required to confirm critical design elevations. It is important to note that inclusion of a pump station requires perpetual costs associated with maintenance and to supply energy for pumping. In addition, due to periodic inundation and resulting sedimentation of the floodplain during Rio Grande flood events, the constructed wetland is likely to require maintenance associated with sediment removal to function as intended. A berm may be incorporated around the constructed wetland to reduce the frequency of inundation; however, this approach is counter to the goals of floodplain creation and would also require a flood-study to determine the impacts to FEMA floodplain elevations and may necessitate coordination with the City of Albuquerque Planning Department to request to a change to the Flood Insurance Rate Map (FIRM). Additionally, a fish ladder or similar consideration would likely be required for the silvery minnow to access the permanent pool during the Rio Grande's baseflow or low flow conditions. The Los Lunas Silvery Minnow Refugium (2018) has performed laboratory studies which provide information to establish design criteria for successful minnow passage between the Rio Grande and a permanent pool feature. Costs associated with a fish ladder, creation of a berm around the constructed wetland and associated revision of the FIRM have not been considered at this time.

Alternative 3 may be implemented in two phases as illustrated in Figure 5. Phase one includes floodplain habitat creation, rootwad revetments, and pedestrian trails. Phase two includes the constructed wetland and associated conveyance infrastructure. If construction activities are phased, it is recommended that design of the two phases be planned together so that layout of the proposed elements are considered and activities like grading and associated changes to FEMA floodplain elevations are coordinated simultaneously.

Planning-Level Water Quality Improvements

Planning-level water quality improvements associated with this alternative were calculated using the protocols as previously stated. If constructed, this project could realize the following annual pollutant load reductions. In addition to water quality benefits provided by streambank stabilization and floodplain reconnection, the proposed constructed wetland would provide additional annual pollutant reduction to the Rio Grande.

Table 3: Alternative 3 Planning-Level Pollutant Load Reduction

Pollutant	Phase 1 Load Reduction	Phase 2 Load Reduction	Unit
TSS	75.8	0 [1]	tons/year
TN	189	8591	lbs/year
TP	407	4233	lbs/year
FC	1.0×10^9	0 [2]	ppb/year
EC	1.1×10^9	0 [2]	ppb/year

[1] Monitoring data provided by the Water Authority indicates approximately 0 mg/L TSS loading rate to the outfall.

[2] Additional water quality benefits are expected by introducing the constructed wetland, however not enough data is available at the time of this study to compute load reductions for Fecal Coliform and E. Coli.

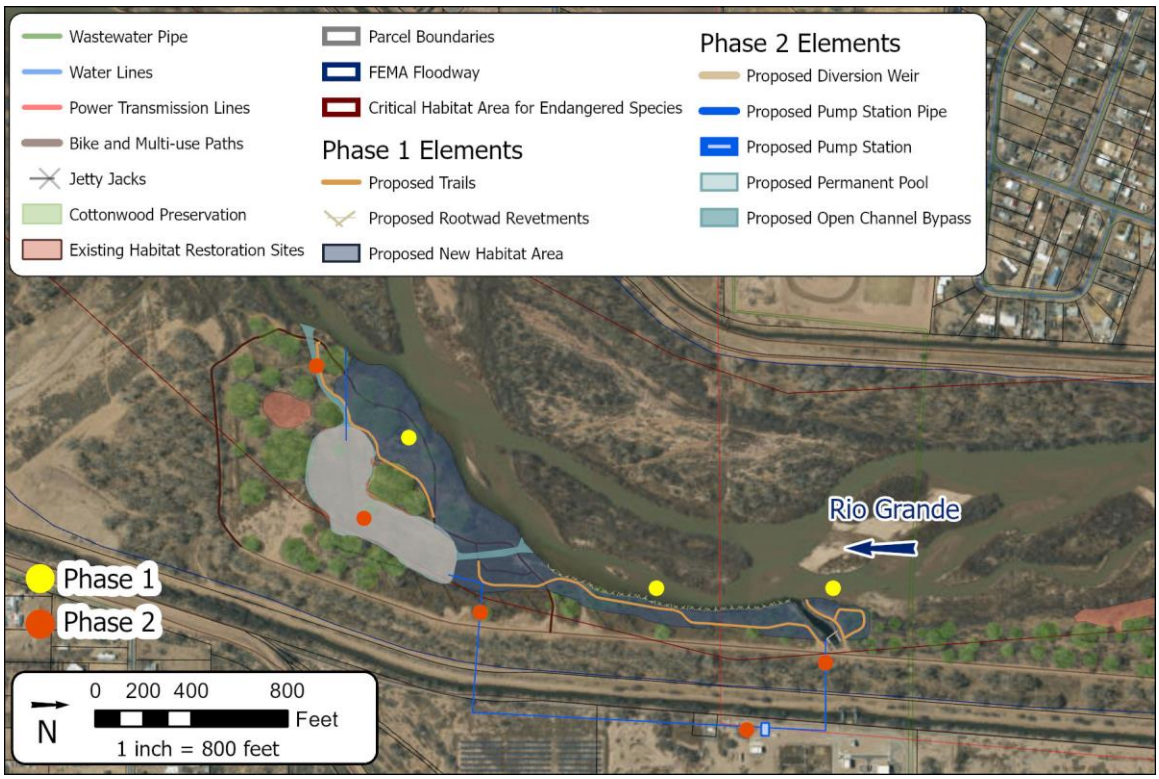


Figure 5: Alternative 3 Conceptual Design Elements

4.2.4 Construction Considerations

Implementation of the alternatives outlined above will require coordination with permitting agencies and communication with the surrounding community that use and monitor the Bosque and Rio Grande. The following bulleted considerations are recommended prior to the construction phase as the Water Authority prepares for future improvements.

- Develop detailed construction documents and secure funding for construction.

- Acquire all necessary permits and easements required prior to land disturbance.
- Perform biological surveys to identify sensitive habitat areas and adjust design and/or construction activity accordingly.
- Engage local stakeholders so that the community is well informed on project goals and schedule ahead of time while gathering input to ensure long-term success.
- Begin collecting baseline (or pre-construction) data for long-term performance analysis.

As the project enters the construction phase, Hazen recommends the following to ensure success.

- Select a contractor that is experienced with projects of similar scope and scale to the proposed improvements.
- Include a traffic control plan during construction for the Bosque maintenance road and parking area off Rio Bravo Blvd during construction. The contractor is likely to access the site via the unpaved maintenance road and use the parking area to haul and stage materials on and off-site.
- The contractor will need to consider access/egress for the Water Authority and electric utility provider for routine monitoring and maintenance activities during construction.
- Reuse of woody material onsite is desirable to facilitate variable habitat and pedestrian amenities.
- Fine grading should generally result in positive drainage towards the Rio Grande.
- Working "in the wet" should generally be minimized to the extent practical. Instances will be specific to rootwad revetment installation and streambank regrading.
- It is recommended that construction activity occurs in the Fall or Winter seasons to increase revegetation success & reduce temporary irrigation requirements for establishment.
- Broadcast permanent seeding to occur prior to monsoon season for increased success.

4.2.5 Monitoring Opportunities and Maintenance Considerations

As desired by the Water Authority, the alternatives presented in this evaluation do not require changes to the existing NPDES discharge permit requirements for the SWRP. However, Hazen recommends the Water Authority perform monitoring activities to evaluate the long-term success of the project. Leveraging partnerships with local stakeholders like MRGCD and existing citizen science programs like the Bosque Ecosystem Monitoring program lead by the University of New Mexico may reduce the financial burdens for the Water Authority while also engaging the local community. Anticipated pre- and post-restoration monitoring activities based on the project goals and objectives have been bulleted below:

- **Groundwater Level**: Monitor groundwater levels using piezometers to determine the effects of floodplain reconnection and groundwater recharge.
- **Water Quality**: Water quality samples above and below the proposed project area to evaluate pollutant load reduction for sediment, nutrients, and pathogens.
- **Bank Erosion**: Riverbank surveys at set locations along the proposed project to quantify pre- and post-restoration erosion rates.
- **Vegetation Survey**: Plots or transects to measure vegetation composition, abundance, and survivability of planted material.

- **Aquatic Biota Survey**: Fish surveys to assess trends in species composition, abundance, size and age structure, and fecundity.

Ongoing maintenance activities would likely include the following activities, typical to ecosystem restoration projects.

- Repair structures and streambanks where spot erosion is evident.
- Remove unwanted sediment accumulation near intake structures, conveyance infrastructure, pedestrian amenities, and constructed wetlands.
- Replacement of planted native vegetation due to mortality during establishment.
- Schedule stream and wetland "clean-up days" with the community to remove the trash, debris, and invasive species identified during monitoring activities.

4.3 Regulatory Requirements

As previously stated, the project is located on land that is jointly managed by the MRGCD and Reclamation. As a result, it is anticipated that environmental review of the project will be required to facilitate compliance with the National Environmental Policy Act (NEPA). As the federal agency having joint ownership over the land to be developed for the project (Proposed Action), Reclamation would serve as the NEPA lead agency. While a final decision on the level of review required would be made by Reclamation, Hazen anticipates that the project would require an Environmental Assessment (EA).

Preparation of the EA would be based on data collected as part of project design, desktop analyses, and data and analysis from other publicly available documents such as studies, EAs, or Environmental Impact Statements where the information is pertinent to the proposed project. It is anticipated tasks associated with EA development would include the following:

- Coordination of relevant consultations with local, state and federal agencies, including Section 106 of the National Historic Preservation Act and Endangered Species Act, as applicable;
- Evaluation of the nature, extent, and significance of potential beneficial and adverse impacts (including those occurring during construction) of the proposed project on applicable resource categories;
- Discussion of potential mitigation measures to be incorporated into the proposed project;
- Coordination of any required public review process, including assistance for public hearing, document distribution and development of responses to public comments; and
- Preparation of required NEPA documentation including Findings of No Significant Impacts Documents, public notices, and an Administrative Record.

As a result of NEPA regulations promulgated in 2020, the scope described herein may need to adjust to any new guidance from Reclamation related to the updated regulations.

In addition to tasks necessary to comply with NEPA, Hazen investigated permits required to construct the alternatives presented above. Generally, each alternative will require coordination with and permits from the following entities.

- Federal Agencies
  - USACE: NWP27 Aquatic Habitat Restoration
  - USWFS: Section 7 Formal Consultation
  - FEMA: Region 6 Floodplain Development Permit
- State/Regional Departments
  - Office of the State Engineer:
    - NOI to Construct Erosion/Flood Control Impoundment
    - Coordination to address return flows to the Rio Grande and associated crediting
  - MRGCD: License Application
  - NMED: 401 Water Quality Certification Review and Approval
  - SHPO: Project Review
  - NMDGF: Consultation
- Local Municipality
  - City of Albuquerque: Planning Department Review and Construction Permit

5. Cost Estimate

Hazen prepared a planning-level cost estimate for each alternative that represents "all-in" project costs, including data collection, engineering, regulatory compliance, and construction. Construction costs were derived from bid prices received from similar restoration projects in the Albuquerque and Southwest region. Line-item based planning-level cost estimates are provided in **Appendix C**. The cost estimate totals are not considered inclusive of all project costs but are representative of the primary concept elements shown in the figures above. Further, the cost estimate has been prepared using a Class 5 Cost Estimate range (+50%/-30%) as defined by the Associated for Advancement of Cost Engineering (AACE). **Table 4** below provides an abbreviated summary of the "all-in" project costs for each presented alternative.

Table 4: Planning-Level Construction Cost Estimates for Alternatives

Project Phase	Alternative 1	Alternative 2	Alternative 3 *Phase 1*	Alternative 3 *Phase 2*
Construction	$697,000.00	$2,304,000.00	$1,892,000.00	$3,383,000.00
Data Collection and Design [1]	$168,000.00	$485,000.00	$228,000.00	$406,000.00
Regulatory Compliance [2]	$135,000.00 [3]	$175,000.00 [4]	$175,000.00 [4]	$80,000.00
Construction Oversight	$70,000.00	$231,000.00	$114,000.00	$203,000.00
Contingency	$38,000.00	$89,000.00	$104,000.00	$138,000.00
Grand Total	**$1,108,000.00**	**$3,284,000.00**	**$2,513,000.00**	**$4,210,000.00**

[1] Activities include topographic survey, pre-construction monitoring, and preparation of construction documents.

[2] Activities include preparation of packages and meetings to acquire a land disturbance permit, FEMA No-Rise Certification, and associated federal, state, and local permits.

[3] It is assumed that the NEPA review associated with Alternative 1 would qualify for a Categorical Exclusion.

[4] It is assumed that the NEPA review associated with Alternatives 2 and 3 would require an Environmental Assessment.

With the understanding that all projects require maintenance for continued success, Hazen prepared estimated annualized maintenance costs for each alternative. It is important to note that these estimated costs will likely vary over time and are dependent on several variables such as Rio Grande flood activity and associated sediment removal, drought and associated plant replacement and irrigation, etc. Further, Hazen recommends that the Water Authority identify project partners who may be able to share the maintenance burden through in-kind services.

Tables 5 and **6** provide planning-level cost estimates for anticipated annualized maintenance and monitoring activities, respectively. Activities associated include but are not limited to those discussed in Section 4.2.5, *Monitoring Opportunities and Maintenance Considerations*, above. Estimated monitoring costs are intended to be reflective of typical post-restoration performance monitoring activities, conducted 1 to 5 years after construction.

Table 5: Planning-Level Maintenance Cost Estimates for Alternatives

Maintenance Burden	Alternative 1	Alternative 2	Alternative 3
Low	$43,000	$129,000	$279,000
Average	$61,000	$184,000	$398,000
High	$92,000	$276,000	$597,000

Maintenance burdens are expected to vary based upon a variety of factors such as flood occurrence, sediment deposition, pedestrian usage, and quality of construction. Activities could include but are not limited to bank erosion repair, pedestrian trail resurfacing, revegetation, pump station and conveyance piping activities, and reinstallation of monitoring devices on-site. The values presented above are representative and for planning purposes only. Additional analysis may be performed during future project planning and design phases to provide more precise cost estimates.

Table 6: Planning-Level Monitoring Cost Estimates for Alternatives

Monitoring Activity	Alternative 1	Alternative 2	Alternative 3
Low	$157,000	$241,000	$195,000
Average	$224,000	$343,000	$278,000
High	$336,000	$515,000	$417,000

Monitoring burdens are expected to vary based upon a variety of factors such as programmatic objectives, reporting requirements, and quality of construction. Activities could include but are not limited to bank erosion monitoring, ground and surface water monitoring, vegetation, aquatic, and avian surveys. The values presented above are representative and for planning purposes only. Additional analysis may be performed during future project planning and design phases to provide more precise cost estimates

6. Stakeholder Coordination Summary

During the preliminary design review phase of the project, Hazen met with the following stakeholders as early consultations to understand site-specific permitting requirements, desirable project elements, and lessons learned from other implemented projects along the Bosque. Meeting summaries are provided in **Appendix D** for future reference.

- USACE, Albuquerque District
- Office of Natural Resources Trustees (ONRT)
- Department of Game and Fish

Ultimately, all stakeholders communicated their general support of the project and the alternatives presented to provide increased habitat complexity and pedestrian amenities along the Bosque.

7. Recommendations & Next Steps

7.1 Recommendations

This evaluation of opportunities for potential improvements to the SWRP outfall channel and surrounding areas indicates that projects of similar scope and scale as those presented in this memo have been successful to improve water quality, facilitate public access, and create additional habitat for the endangered Rio Grande Silvery Minnow (*Hybognathus amarus*). Additionally, the approaches presented herein appear to be feasible from an engineering and construction perspective based on the information available during the evaluation. Incorporation of a constructed wetland in the proposed floodplain restoration activities could add a unique passive recreational feature for public enjoyment, similar to those at Tingley Beach, and could also add a variety of habitat for species that inhabit the Bosque and migrate through the area. Of all the elements considered, the constructed wetland also poses the most challenges for implementation and long-term success.

While preliminary communication with several stakeholders yielded favorable support of the project, additional coordination will be required to gain project acceptance and approval from various permitting

agencies. Several stakeholders noted potential sources that may help provide financial support for the project, notably the New Mexico Department of Game and Fish. The Water Authority should consider opportunities for funding on a case-by-case basis as some funding sources may increase the overall project schedule and level of effort due to the additional permitting and analysis that may be required to secure the funding.

7.2 Phasing

The alternatives presented in this memo represent a variety of options for implementation based on site-specific opportunities, conceptual elements, available budgets, and other factors. It should be noted that project elements and extents are conceptual and may be adjusted or modified as needed. Additionally, the project may be phased over time so that increments of various elements can be implemented as funding becomes available. Some elements of the project may be considered "critical path" items that may create challenges for future phases if performed out of sequence. A summary of some of these elements and their considerations is included in **Table 7**.

Table 7: Project Phasing Considerations

Element	Consideration
Vegetation Management	Invasive species management activities typically require several initial attempts of eradication followed by ongoing maintenance to successfully establish a native plant community. Prioritizing invasive species eradication prior to construction phases may limit the spread of seed and other means of vegetative propagation for undesirable species during future phases that require floodplain excavation and spoil removal.
Pedestrian Access	Thoughtful planning, implementation, and long-term maintenance of pedestrian access elements will be critical to their success. While pedestrian access elements may be implemented at various phases, Hazen recommends coordination with MRGCD and other stakeholders early to develop a master plan that maximizes the integration of the proposed improvements such that trails, interpretive elements, and monitoring activities can be considered.
Floodplain Reconnection	Floodplain reconnection north of the SWRP outfall channel appears to be the element with the least number of potential conflicts. If all alternatives are planned for implementation, prioritizing implementation of this project element first may be a good approach to demonstrate progress and gain stakeholder support for future phases. Floodplain reconnection south of the SWRP outfall channel requires additional consideration and coordination with PNM and USACE due to location of power transmission lines and presence of jetty jacks, respectively. Implementation of this portion of the project would likely occur second within this phase. Generally, the extents of the floodplain reconnection may be adjusted based upon available funding and environmental considerations.
Constructed Wetland (Alternative 3, Phase 2)	Preliminary location of the constructed wetland is south of the SWRP outfall and would ideally be surrounded by floodplain reconnection elements. Implementation of the constructed wetland will require coordination with and approval by USACE and the City of Albuquerque due to potential changes regarding flood elevations. The extents of the constructed wetland may be adjusted based on available funding and environmental considerations. Hazen recommends prioritizing plans to implement the constructed wetland early to avoid conflicts that may arise with construction of the various assets required for it to perform as intended and to secure potential funding that may rely on the attributes unique to this element (creation of a permanent water body).

7.3 Next Steps

A preliminary schedule of project implementation activities including a description and estimated duration of each activity is presented in **Table 8**. This table assumes all project elements would be performed at once to provide the Water Authority with a path for implementation. A phased approach would increase the timeframe for overall implementation.

Table 8: Preliminary Project Implementation Schedule

<table>
<tr><th colspan="4">Pre-Project Regulatory Consultations</th><th colspan="4">Data Collection and Stakeholder Outreach</th><th colspan="2">Design and Permitting</th><th>NEPA Public Review</th><th>Construction and Vegetation Establishment</th><th>Post-Restoration Monitoring and Maintenance</th><th>Long-Term Monitoring and Maintenance</th></tr>
<tr><td colspan="4">1 - 3 Months</td><td colspan="4">3 - 6 months (may be performed concurrent with Pre-Project Regulatory Consultations)</td><td colspan="2">6 - 9 months</td><td>3 months</td><td>18 - 24 months</td><td>1 - 5 years</td><td>In perpetuity</td></tr>
<tr><td>Contact MRGCD, owner of the property, to communicate project intent. Determine any conflicts that may arise from modifications to existing willow swales.</td><td>Contact USACE to communicate project intent and confirm 404 permit and jetty jack removal requirements. Determine any conflicts that may arise from modifications to existing willow swales.</td><td>Contact USFWS to communicate project intent and confirm Section 7 consultation requirements. Determine any conflicts that may arise from modifications to existing willow swales.</td><td>Coordinate with Office of the State Engineer to confirm return flow credit analysis requirements.</td><td>Perform pre-restoration monitoring activities.</td><td>Perform topographic survey of the anticipated project area.</td><td>Perform habitat surveys to determine presence/absence of T&E species and their habitats within the anticipated project area.</td><td>Perform public outreach to engage community members and potential project partners.</td><td>Prepare permit applications for USACE, USFWS, City of Albuquerque, and Office of the State Engineer.</td><td>Prepare detailed design for selected alternative including basis of design report and construction documents.</td><td rowspan="2">Public review and response to comments received</td><td rowspan="2">Construction of selected alternative including invasive vegetation management followed by installation of native vegetation.</td><td rowspan="2">Perform post-restoration monitoring and maintenance.</td><td rowspan="2">Perform monitoring, maintenance, and adaptive management as needed.</td></tr>
<tr><td colspan="4">Coordinate with Reclamation to begin NEPA Review</td><td colspan="6">Complete NEPA analysis and prepare Environmental Assessment</td></tr>
</table>

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Appendix A: Rapid Hydrologic & Hydraulic Analysis

Hazen performed a Bulletin 17C statistical analysis with USACE's HEC-SSP software to compute recurrence intervals and discharge rates for comparison against published FIS discharge rates. The bulleted, publicly available data used in this analysis is provided below.

- City of Albuquerque GIS 2-ft contours (2010)
- FEMA FIS flood rates and depths at lettered cross-sections (35001CV001D and 35001CV002D, last revised November 2016)
- USGS' Central Ave (08330000) historical gage peak discharge measurements.

Hazen determined there was a reasonable correlation between the FEMA published and SSP computed discharges during frequent flood events and used this relationship to interpolate approximate water surface elevations (WSE) below the 10-year flood event (**Figure A1**). The analysis indicated that a 1-year flood event is roughly equivalent to the desired design discharge (1,500 cfs) for the silvery minnow habitat. **Figure A2** depicts the conceptual 1,500 cfs water surface elevations as compared to published flood depths at each FEMA lettered cross-sections throughout the project area.

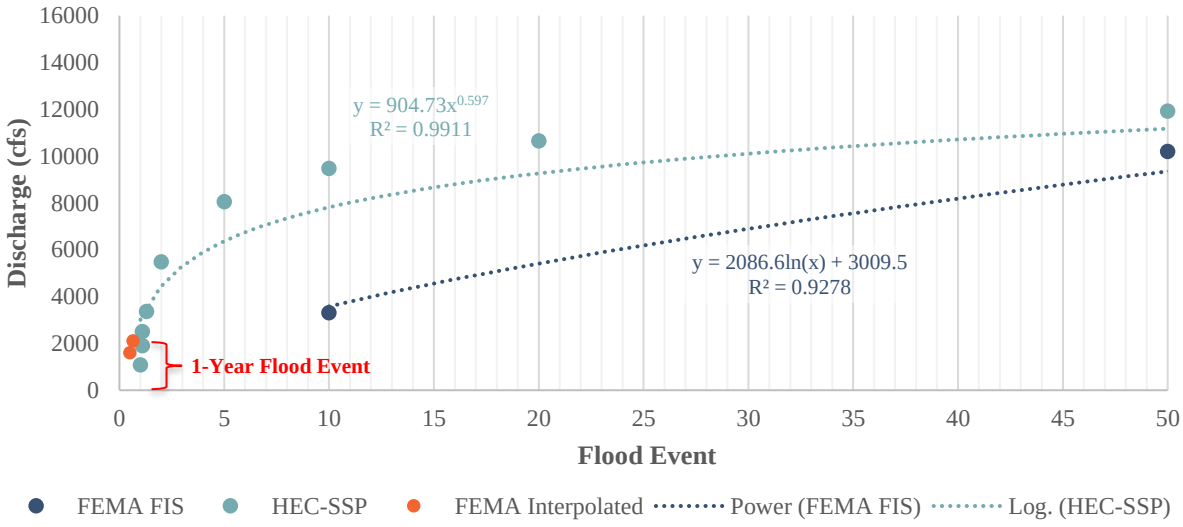


Figure A1: FEMA and HEC-SSP Peak Discharges for Departure Analysis

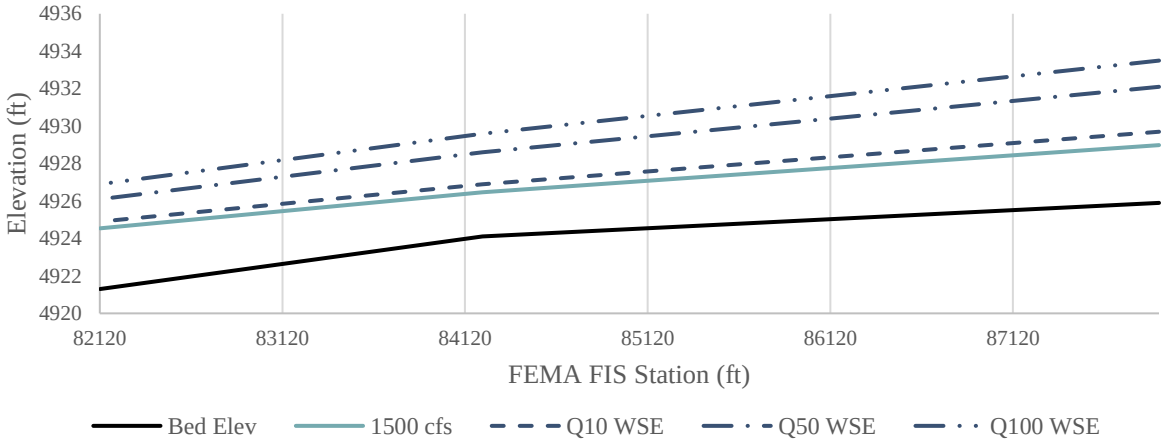


Figure A2: Interpolated Water Surface Elevation for Design Discharge

The results from the analysis were used as the hydraulic baseline to define target elevations for proposed floodplain excavation (approximately 4,926 ft) and lateral grading limits as shown in **Figure A3**.

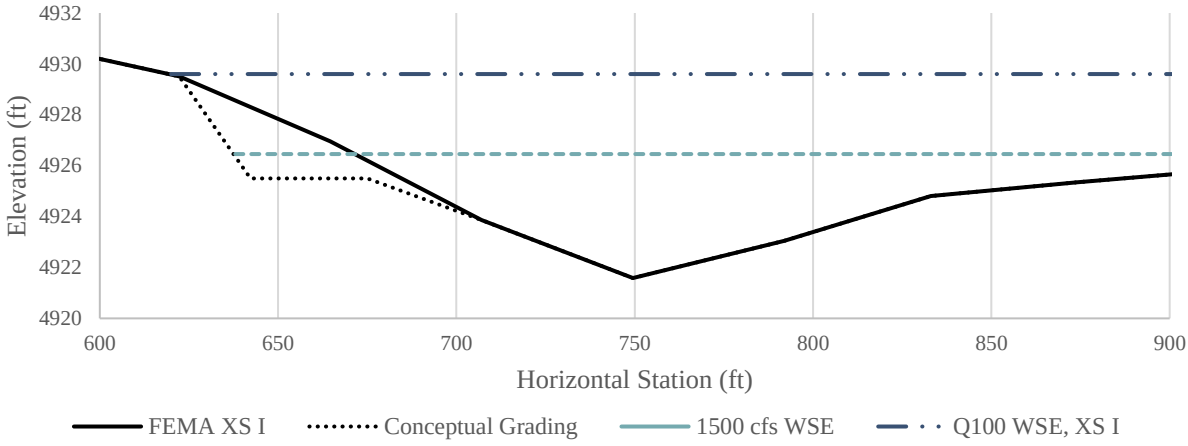
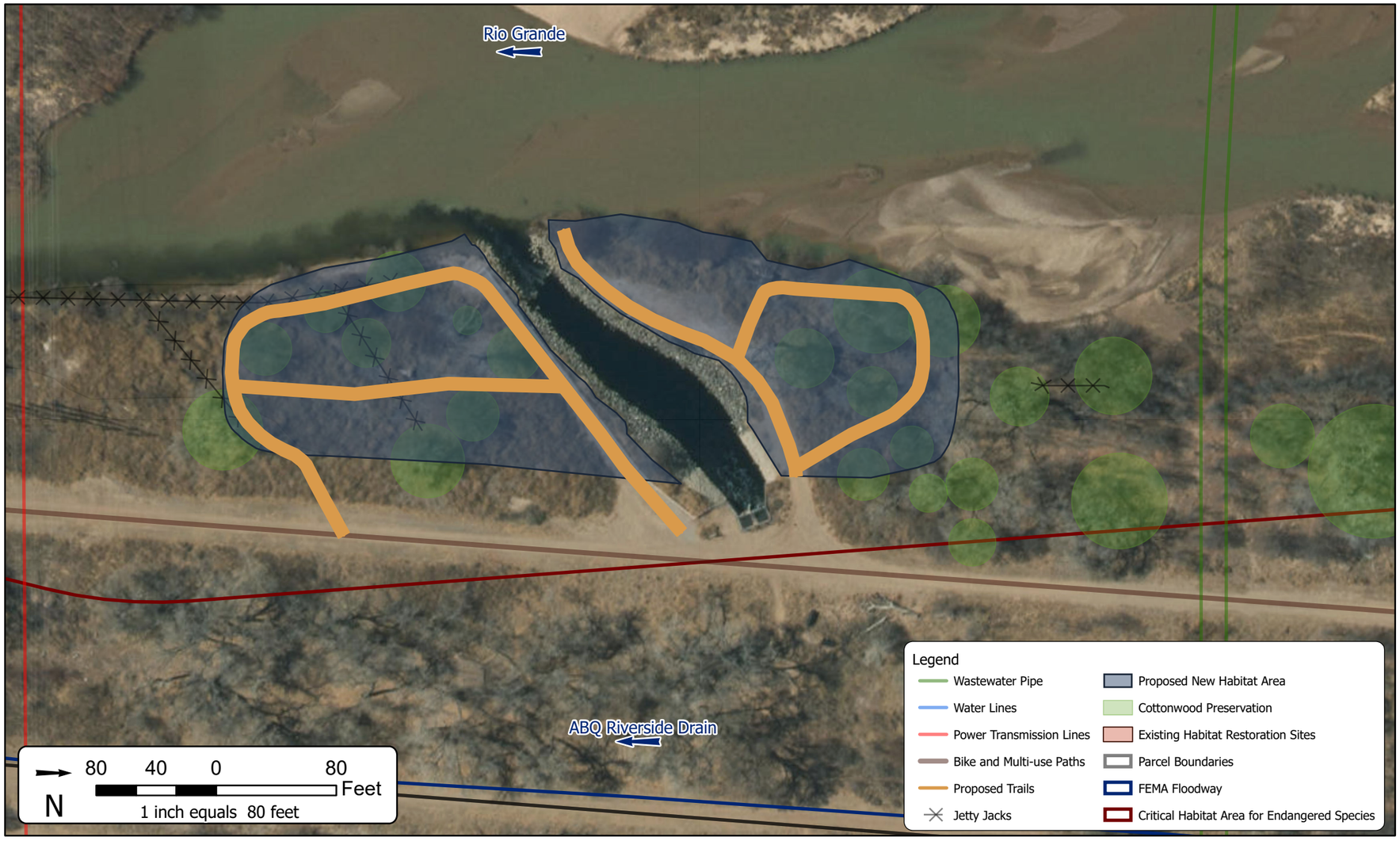


Figure A3: Conceptual Grading Geometries, Elevations, & Hydraulics

Appendix B: Concept Alternative Figures

SWRP Outfall Restoration Improvements Project
Concept Overview

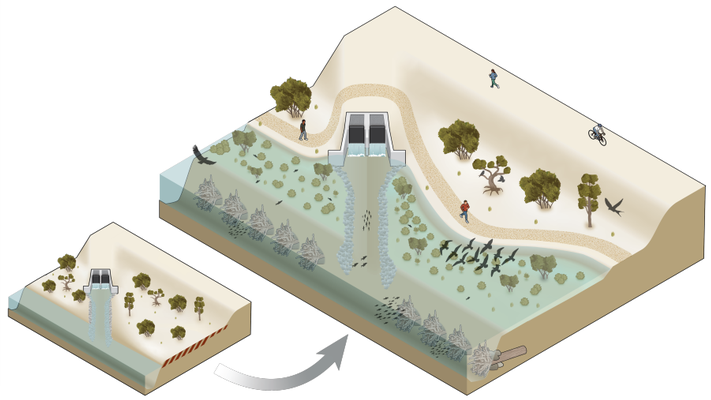


Existing Conditions

The Southside Wastewater Reclamation Plant (SWRP) serves the greater Albuquerque population, treating approximately 55 MGD. Effluent from the plant is released to the Rio Grande through an outfall channel located on the left bank of the river. The land surrounding the outfall is owned by the Middle Rio Grande Conservancy District (MRGCD) and is accessed by a MRGCD maintenance road. Currently, there is active public use along this road and at the SWRP outfall; it is a popular area for hiking, biking, fishing, and occasionally swimming.

Proposed Improvements

The proposed design conditions achieve the following Water Authority project goals and priorities: improve water quality in the Rio Grande, increase community and maintenance access, and facilitate habitat enhancement via floodplain reconnection for the Rio Grande silvery minnow. The proposed design also incorporates the preservation of sensitive habitats for threatened and endangered species and the historic Rio Grande Cottonwoods along the Bosque. The design provides floodplain inundation at the 1500 cfs (or greater) flood event. Additionally, there is a possibility of extending the new habitat and community areas to the bounding USACE habitat restoration sites to the north and south in future projects. The rendering below illustrates the existing conditions and proposed changes to achieve these benefits.



Site Information

Land Ownership:	MRGCD
Infrastructure Constraints:	Powerlines, Wastewater pipe, SWRP outfall infrastructure, Jetty jacks
Ecological Considerations:	Threatened and endangered species zone Large Cottonwood and willow preservation
Improvement Elements:	1.5 acres of new habitat 2 acres of revegetation 1,300 LF of new trails

Conceptual Level Estimates

Construction Cost:	$697,000	Total Suspended Solids Reduction:	15 tons/year
+50%:	$1,046,000	Total Nitrogen Reduction:	39 lbs/year
-30%:	$488,000	Total Phosphorus Reduction:	85 lbs/year
Engineering Fee:	$411,000	Fecal Coliform Reduction:	29 million ppb/year
Total Project Cost:	$1,108,000	E. Coli Reduction:	31 million ppb/year

Permitting Requirements: United States Army Corps of Engineers (USACE) NWP 27, United States Fish and Wildlife Service (USFWS) Section 7, Federal Emergency Management Agency (FEMA) Region 6 Floodplain Development Permit, United States Environmental Protection Agency (USEPA) Construction Stormwater Permit, Middle Rio Grande Conservancy District (MRGCD) License Application, New Mexico Environment Department (NMED) 401 WQ, and additional coordination with various state and local organizations

SWRP Outfall Realignment Evaluation - Concept 1

Albuquerque Bernalillo County
Water Utility Authority

February 2021

Concept Design - Not for Construction

SWRP Outfall Restoration Improvements Project
Concept Overview



View upstream of existing SWRP outfall. Floodplain reconnection and additional improvements proposed both north and south of outfall.



Existing south habitat willow swale creation site. During high flows, this area is inundated with water.

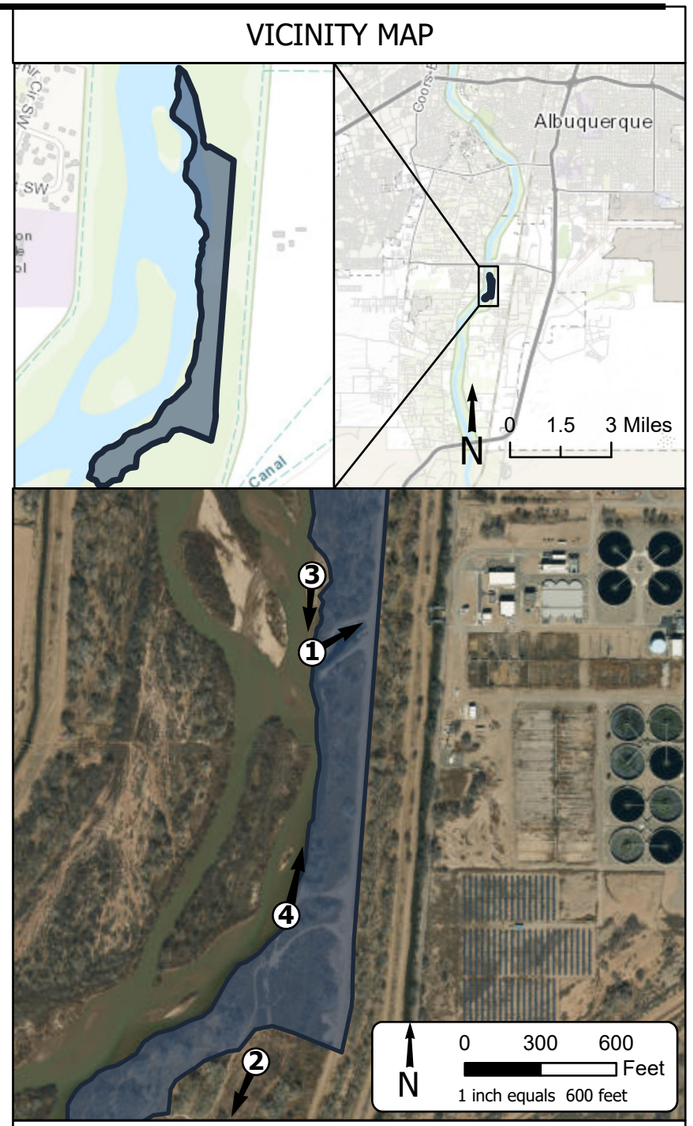


Side channel of Rio Grande mainstem north of the SWRP outfall. Proposed floodplain creation and removal of invasive species on portion of this left bank.



Typical vegetation pattern south of the SWRP outfall. No modifications proposed at this location.

See inset map on the right for photograph locations.
Photos included represent typical conditions within defined project area.



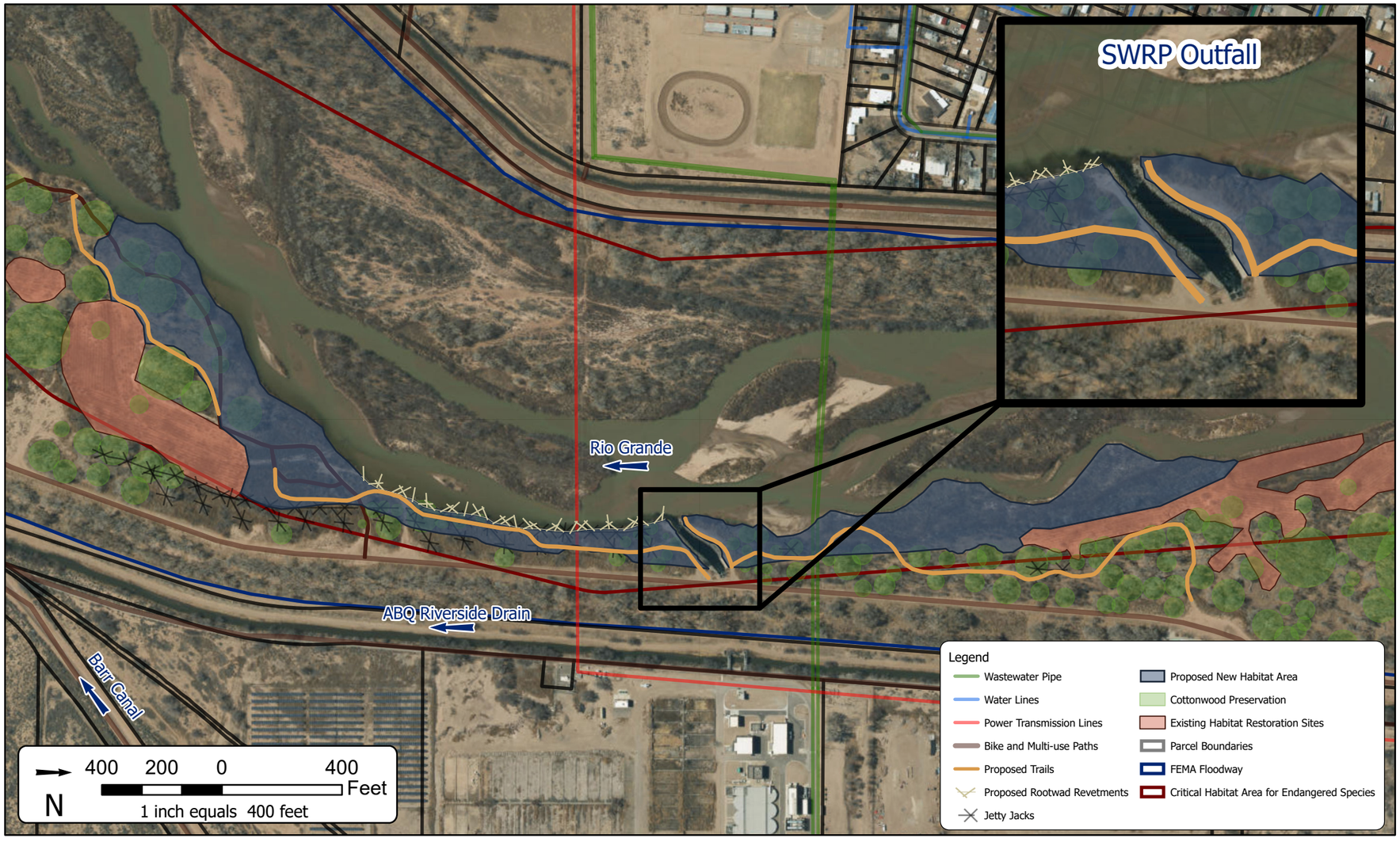
SWRP Outfall Realignment Evaluation - Concept 1

Albuquerque Bernalillo County Water Utility Authority

Sheet 2 of 2	February 2021

Concept Design - Not for Construction

SWRP Outfall Restoration Improvements Project
Concept Overview

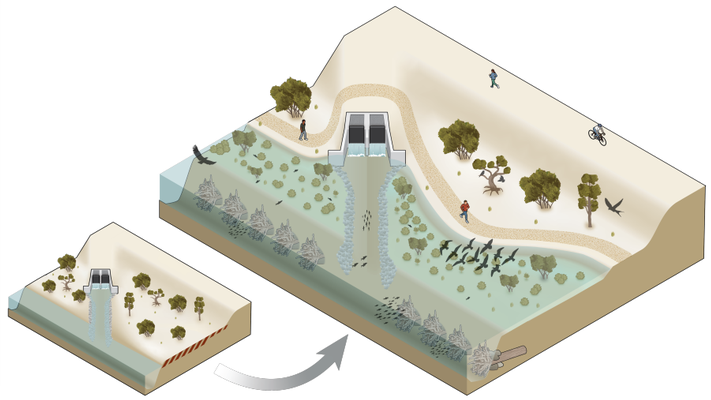


Existing Conditions

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Proposed Improvements

The proposed design conditions achieve the following Water Authority project goals and priorities: improve water quality in the Rio Grande, increase community and maintenance access, and facilitate habitat enhancement via floodplain reconnection and woody-debris structures for the Rio Grande silvery minnow. The proposed design also incorporates the preservation of sensitive habitats for threatened and endangered species and the historic Rio Grande Cottonwoods along the Bosque. The design provides floodplain inundation at the 1500 cfs (or greater) flood event. The new habitat and community areas will be tied-into the bounding USACE habitat restoration sites to the north and south, creating a holistic and interconnected project along the Bosque. The rendering below illustrates the existing conditions and proposed changes to achieve these benefits.



Site Information

Land Ownership:	MRGCD
Infrastructure Constraints:	Powerlines, Wastewater pipe, SWRP outfall infrastructure, Jetty jacks
Ecological Considerations:	Threatened and endangered species zone Large Cottonwood and willow preservation
Improvement Elements:	14.5 acres of new habitat 18 acres of revegetation 4,800 LF of new trails 1,100 LF of rootwad revetments

Conceptual Level Estimates

Construction Cost:	$2,304,000	Total Suspended Solids Reduction:	150 tons/year
+50%:	$3,456,000	Total Nitrogen Reduction:	370 lbs/year
-30%:	$1,613,000	Total Phosphorus Reduction:	810 lbs/year
Engineering Fee:	$980,000	Fecal Coliform Reduction:	4.9 billion ppb/year
Total Project Cost:	$3,284,000	E. Coli Reduction:	5.3 billion ppb/year

Permitting Requirements: United States Army Corps of Engineers (USACE) NWP 27, United States Fish and Wildlife Service (USFWS) Section 7, Federal Emergency Management Agency (FEMA) Region 6 Floodplain Development Permit, United States Environmental Protection Agency (USEPA) Construction Stormwater Permit, Middle Rio Grande Conservancy District (MRGCD) License Application, New Mexico Environment Department (NMED) 401 WQ, and additional coordination with various state and local organizations

SWRP Outfall Realignment Evaluation - Concept 2

Albuquerque Bernalillo County Water Utility Authority

Sheet 1 of 2

February 2021

Concept Design - Not for Construction

SWRP Outfall Restoration Improvements Project
Concept Overview

1



View upstream of existing SWRP outfall. Floodplain reconnection and additional improvements proposed both north and south of outfall.

2



Existing south habitat willow swale creation site. During high flows, this area is inundated with water. Proposed improvements to connect with this existing site.

3



Side channel of Rio Grande mainstem north of the SWRP outfall. Proposed floodplain creation and removal of invasive species on the left bank.

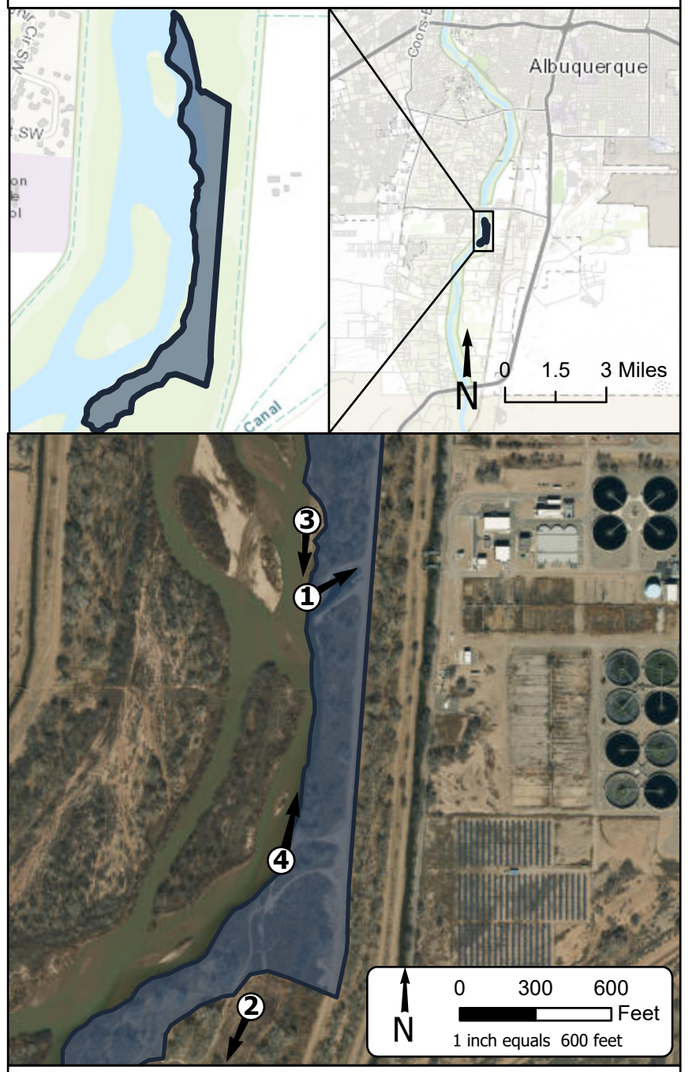
4



Typical vegetation pattern south of the SWRP outfall. Proposed floodplain creation and removal of jetty jacks along this bank.

See inset map on the right for photograph locations.
Photos included represent typical conditions within defined project area.

VICINITY MAP



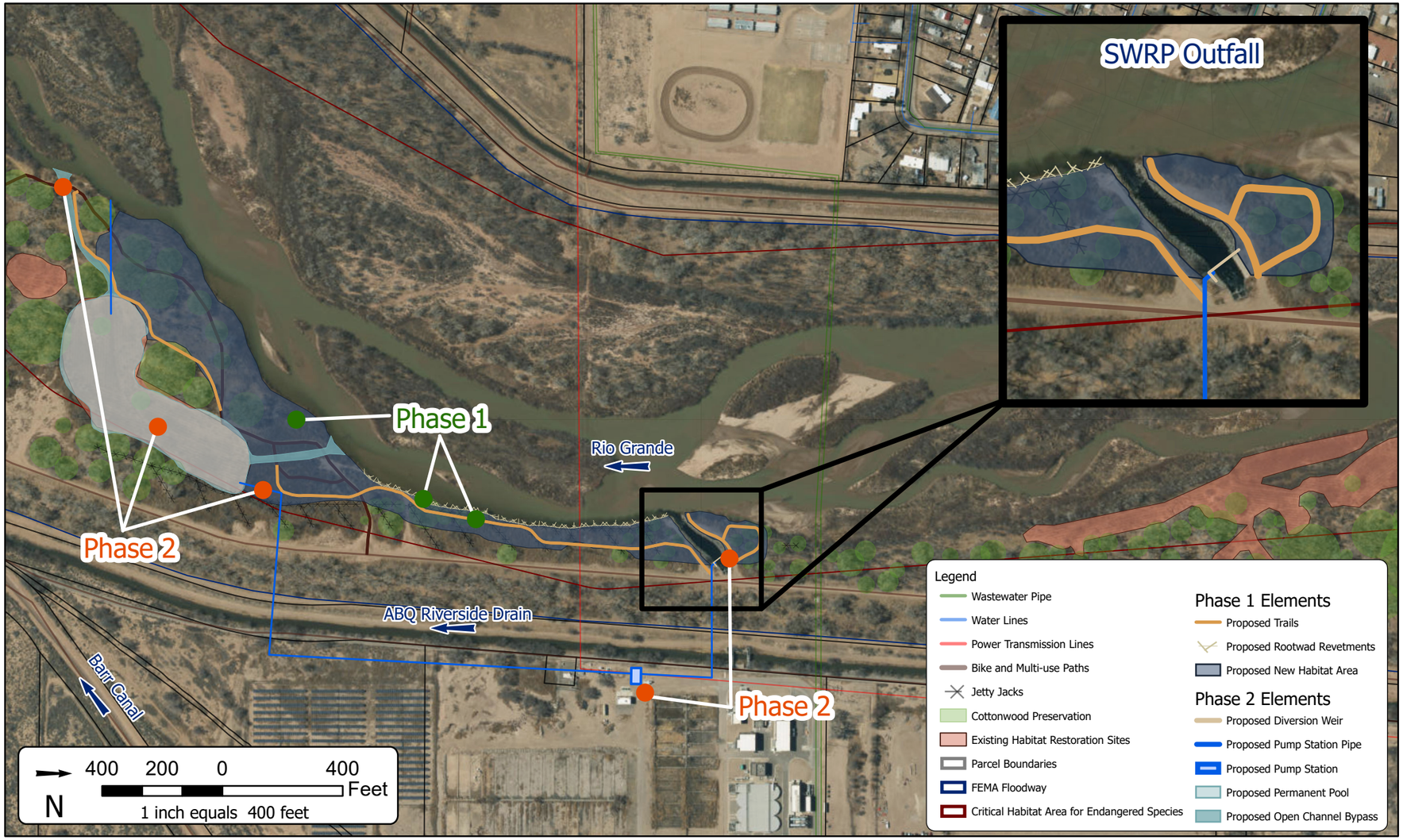
SWRP Outfall Realignment Evaluation - Concept 2

Albuquerque Bernalillo County Water Utility Authority

Sheet 2 of 2	February 2021

Concept Design - Not for Construction

SWRP Outfall Restoration Improvements Project
Concept Overview

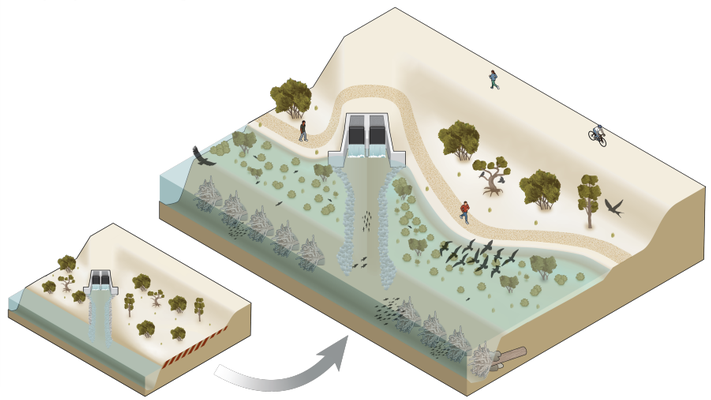


Existing Conditions

The Southside Wastewater Reclamation Plant (SWRP) serves the greater Albuquerque population, treating approximately 55 MGD. Effluent from the plant is released to the Rio Grande through an outfall channel located on the left bank of the river. The land surrounding the outfall is owned by the Middle Rio Grande Conservancy District (MRGCD) and is accessed by a MRGCD maintenance road. Currently, there is active public use along this road and at the SWRP outfall; it is a popular area for hiking, biking, fishing, and occasionally swimming.

Proposed Improvements

The proposed design conditions achieve the following Water Authority project goals and priorities: improve water quality in the Rio Grande, increase community and maintenance access, and facilitate habitat enhancement via floodplain reconnection and woody-debris structures for the Rio Grande silvery minnow. The proposed design has been divided into two phases. Phase 1 primarily provides floodplain inundation at the 1500 cfs (or greater) flood event as well as new community trails. Phase 2 consists of creating a permanent pool for recreation and waterfowl habitat via a pressurized pipe. The new habitat and community areas will be tied-into the bounding USACE habitat restoration site to the south, creating a holistic and interconnected project along the Bosque. The rendering below illustrates the existing conditions and proposed changes to achieve these benefits.



Site Information

Land Ownership:	MRGCD
Infrastructure Constraints:	Powerlines, Wastewater pipe, SWRP outfall infrastructure, Jetty jacks
Ecological Considerations:	Threatened and endangered species zone Large Cottonwood and willow preservation
Improvement Elements:	6.5 acres of new habitat 12 acres of revegetation 2,600 LF of new trails 1,100 LF of rootwad revetments 33 acre-feet of permanent pool creation

Conceptual Level Estimates

Construction Cost:	$5,275,000	Total Suspended Solids Reduction:	75 tons/year
+50%:	$7,913,000	Total Nitrogen Reduction:	8,700 lbs/year
-30%:	$3,693,000	Total Phosphorus Reduction:	4,600 lbs/year
Engineering Fee:	$1,448,000	Fecal Coliform Reduction:	1.0 billion ppb/year
Total Project Cost:	$6,723,000	E. Coli Reduction:	1.1 billion ppb/year

Permitting Requirements: United States Army Corps of Engineers (USACE) NWP 27, United States Fish and Wildlife Service (USFWS) Section 7, Federal Emergency Management Agency (FEMA) Region 6 Floodplain Development Permit, United States Environmental Protection Agency (USEPA) Construction Stormwater Permit, Middle Rio Grande Conservancy District (MRGCD) License Application, New Mexico Environment Department (NMED) 401 WQ, and additional coordination with various state and local organizations

SWRP Outfall Realignment Evaluation - Concept 3

Albuquerque Bernalillo County Water Utility Authority

February 2021

Concept Design - Not for Construction

SWRP Outfall Restoration Improvements Project
Concept Overview

1



View upstream of existing SWRP outfall. Floodplain reconnection and additional improvements proposed south of outfall.

2



Existing south habitat willow swale creation site. During high flows, this area is inundated with water. Proposed permanent pool at this existing site.

3



Side channel of Rio Grande mainstem north of the SWRP outfall. No proposed improvements at this site.

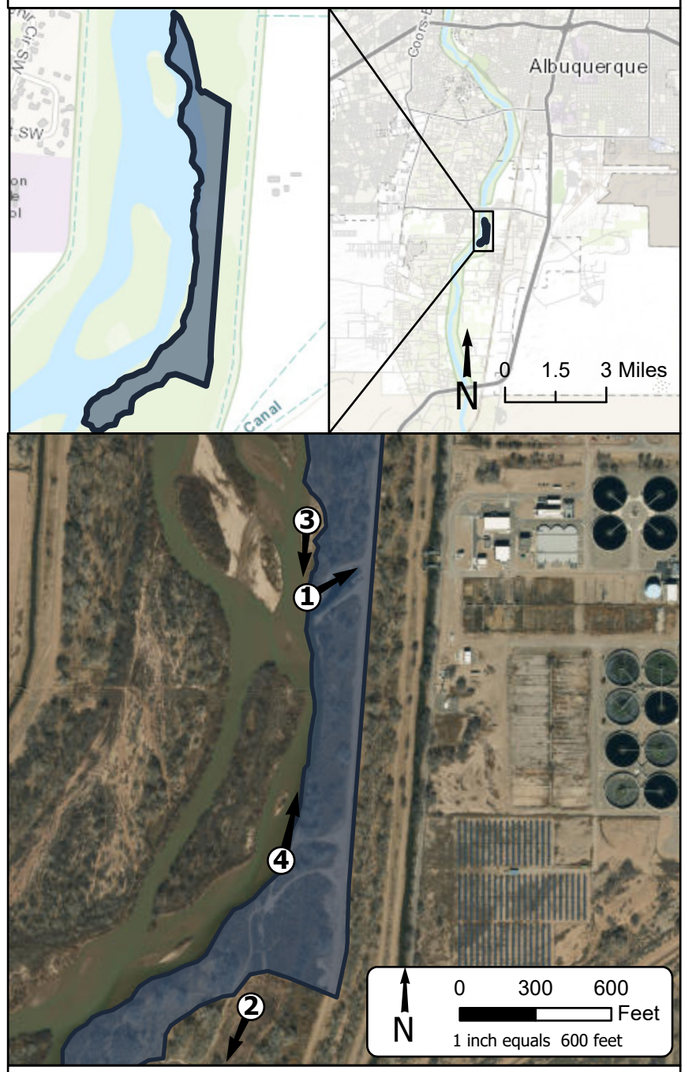
4



Typical vegetation pattern south of the SWRP outfall. Proposed floodplain creation and removal of jetty jacks along this bank.

See inset map on the right for photograph locations.
Photos included represent typical conditions within defined project area.

VICINITY MAP



SWRP Outfall Realignment Evaluation - Concept 3

Albuquerque Bernalillo County Water Utility Authority

Sheet 2 of 2	February 2021

Concept Design - Not for Construction

Appendix C: Planning-Level Cost Estimates

Planning-Level Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 1: Outfall Channel Enhancements

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization/Demobilization	**1**	**LS**	**--**	**$22,843.00**
Pre-Construction Services				**$52,340.00**
Construction Stake Out and As-Built Survey	80	HR	$500.00	$40,000.00
Permitting Services	40	HR	$250.00	$10,000.00
Construction Signage	3	EA	$780.00	$2,340.00
Sediment & Erosion Control	**1**	**LS**	**--**	**$45,686.00**
Floodplain Excavation & Demolition				**$341,660.00**
Dewatering	1	LS	$140,000.00	$140,000.00
Outfall Excavation & Haul-off	90	CY	$30.00	$2,700.00
Mainstem Excavation & Haul-off	1,380	CY	$30.00	$41,400.00
Concrete Demolition & Riprap Removal	900	CY	$50.00	$45,000.00
Inert Waste Haul-off	900	CY	$70.00	$63,000.00
Tree Removal	14	EA	$3,000.00	$42,000.00
Jetty Jax Removal	27	EA	$280.00	$7,560.00
Landscaping, Pedestrian, & Habitat Components				**$115,200.00**
Revegetation	2	AC	$30,000.00	$60,000.00
Maintenance Paths	1,320	LF	$40.00	$52,800.00
Educational Signage	3	EA	$800.00	$2,400.00
Owner Directed Work (Allowance)	**1**	**LS**	**--**	**$50,000.00**
Total Construction Cost				**$627,729.00**
Design Contingency				**$68,529.00**
Total Estimated Construction Cost with Contingency and ODW				**$696,258.00**
AACE Class 5 Estimate Range			+50%	$1,044,387.00
			-30%	$487,380.60

Planning-Level Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 1: Outfall Channel Enhancements

Engineering & Permitting Estimate				
Data Collection	1	LS	--	$63,000.00
Design	1	LS	--	$104,438.70
Permitting	1	LS	--	$60,000.00
NEPA Review	1	LS	--	$75,000.00
Construction Oversight	1	LS	--	$69,625.80
Contingency (10%)	--	--	--	$37,206.45
Total Engineering Fee, with Contingency				**$409,270.95**

Monitoring Estimate				
Groundwater Quality & Quantity	1	LS	--	$51,250.00
Surface Water Quality & Quantity	1	LS	--	$31,520.00
Bank Erosion & Sediment Deposition	1	LS	--	$44,040.00
Vegetation Survey	1	LS	--	$23,040.00
Aquatic Survey	1	LS	--	$30,040.00
Avian Survey	1	LS	--	$23,040.00
Contingency	--	LS	--	$20,320.00
Total Monitoring Estimate, with Contingency				**$223,520.00**
AACE Class 5 Estimate Range			+50%	$335,280.00
			-30%	$156,464.00

Annual Maintenance Burden Estimate				
Groundwater Quality & Quantity	1	LS	--	$6,600.00
Surface Water Quality & Quantity	1	LS	--	$375.00
Bank Erosion & Sediment Deposition	1	LS	--	$1,155.00
Pedestrian Amenities	1	LS	--	$11,160.00
Revegetation	1	LS	--	31,400.00
Contingency	--	LS	--	$10,138.00
Total Maintenance Estimate, with Contingency				**$60,828.00**
AACE Class 5 Estimate Range			+50%	$91,424.00
			-30%	$42,579.60

Planning-Level Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 1: Outfall Channel Enhancements

Total Project Cost	
Construction	$696,258.00
Engineering Design, Permitting, & Construction Oversight	$409,270.95
Monitoring	$223,520.00
GRAND TOTAL	**$1,329,048.95**

Planning-Level Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 2: Outfall Channel & Rio Grande Left Bank Enhancements

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization/Demobilization	**1**	**LS**	**--**	**$84,660.00**
Pre-Construction Services				**$52,340.00**
Construction Stake Out and As-Built Survey	80	HR	$500.00	$40,000.00
Permitting Services	40	HR	$250.00	$10,000.00
Construction Signage	3	EA	$780.00	$2,340.00
Sediment & Erosion Control	**1**	**LS**	**--**	**$169,320.00**
Floodplain Excavation & Demolition				**$777,200.00**
Dewatering	1	LS	$140,000.00	$140,000.00
Outfall Excavation & Haul-off	90	CY	$30.00	$2,700.00
Mainstem Excavation & Haul-off	13,190	CY	$30.00	$395,700.00
Concrete Demolition & Riprap Removal	900	CY	$50.00	$45,000.00
Inert Waste Haul-off	900	CY	$70.00	$63,000.00
Tree Removal	31	EA	$3,000.00	$93,000.00
Jetty Jax Removal	135	EA	$280.00	$37,800.00
Landscaping, Pedestrian, & Habitat Components				**$916,000.00**
Revegetation	18	AC	$30,000.00	$540,000.00
Maintenance Paths	4,800	LF	$40.00	$192,000.00
Educational Signage	10	EA	$800.00	$8,000.00
Rootwad Revetments	1,100	LF	$160.00	$176,000.00
Owner Directed Work (Allowance)	**1**	**LS**	**--**	**$50,000.00**
Total Construction Cost				**$2,049,520.00**
Design Contingency				**$253,980.00**
Total Estimated Construction Cost with Contingency and ODW				**$2,303,500.00**
AACE Class 5 Estimate Range			+50%	$3,455,250.00
			-30%	$1,612,450.00

Planning-Level Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 2: Outfall Channel & Rio Grande Left Bank Enhancements

Engineering & Permitting Estimate				
Data Collection	1	LS	--	$208,000.00
Design	1	LS	--	$276,420.00
Permitting	1	LS	--	$60,000.00
NEPA Review	1	LS	--	$115,000.00
Construction Oversight	1	LS	--	$230,350.00
Contingency (10%)	--	--	--	$56,677.00
Total Engineering Fee, with Contingency				**$978,747.00**

Monitoring Estimate				
Groundwater Quality & Quantity	1	LS	--	$97,280.00
Surface Water Quality & Quantity	1	LS	--	$57,280.00
Bank Erosion & Sediment Deposition	1	LS	--	$62,560.00
Vegetation Survey	1	LS	--	$23,040.00
Aquatic Survey	1	LS	--	$48,560.00
Avian Survey	1	LS	--	$23,040.00
Contingency	--	LS	--	$31,176.00
Total Monitoring Estimate, with Contingency				**$342,936.00**
AACE Class 5 Estimate Range			+50%	$514,040.00
			-30%	$240,055.20

Annual Maintenance Burden Estimate				
Groundwater Quality & Quantity	1	LS	--	$20,000.00
Surface Water Quality & Quantity	1	LS	--	$375.00
Bank Erosion & Sediment Deposition	1	LS	--	$60,200.00
Pedestrian Amenities	1	LS	--	$20,800.00
Revegetation	1	LS	--	$65,800.00
Contingency	--	LS	--	$16,717.50
Total Maintenance Estimate, with Contingency				**$183,592.50**
AACE Class 5 Estimate Range			+50%	$275,838.75
			-30%	$128,724.75

Planning-Level Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 2: Outfall Channel & Rio Grande Left Bank Enhancements

Total Project Cost	
Construction	$2,303,500.00
Engineering Design, Permitting, & Construction Oversight	$978,747.00
Monitoring	$342,936.00
GRAND TOTAL	**$3,625,183.00**

Planning-Level Construction Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 3: Outfall Channel Enhancements & Permanent Pool Diversion

Phase 1: Floodplain Reconnection				
Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Mobilization/Demobilization	**1**	**LS**	**--**	**$66,255.00**
Pre-Construction Services				**$52,340.00**
Construction Stake Out and As-Built Survey	80	HR	$500.00	$40,000.00
Permitting Services	40	HR	$250.00	$10,000.00
Construction Signage	3	EA	$780.00	$2,340.00
Sediment & Erosion Control	**1**	**LS**	**--**	**$132,510.00**
Floodplain Excavation & Demolition				**$737,100.00**
Dewatering	1	LS	$250,000.00	$250,000.00
Outfall Excavation & Haul-off	90	CY	$30.00	$2,700.00
Mainstem Excavation & Haul-off	8,760	CY	$30.00	$262,800.00
Concrete Demolition & Riprap Removal	900	CY	$50.00	$45,000.00
Inert Waste Haul-off	900	CY	$70.00	$63,000.00
Tree Removal	22	EA	$3,000.00	$66,000.00
Jetty Jax Removal	170	EA	$280.00	$47,600.00
Landscaping, Pedestrian, & Habitat Amenities				**$588,000.00**
Revegetation	12	AC	$25,000.00	$300,000.00
Maintenance Paths	2,600	LF	$40.00	$104,000.00
Educational Signage	10	EA	$800.00	$8,000.00
Rootwad Revetments	1,100	LF	$160.00	$176,000.00
Owner Directed Work (Allowance)	**1**	**LS**	**--**	**$50,000.00**
Total Construction Cost				**$1,626,205.00**
Design Contingency				**$265,020.00**
Total Estimated Construction Cost with Contingency and ODW				**$1,891,255.00**
AACE Class 5 Estimate Range			+50%	$2,836,837.50
			-30%	$1,323,857.50

Planning-Level Construction Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 3: Outfall Channel Enhancements & Permanent Pool Diversion

Engineering & Permitting Estimate (Phase 1)				
Data Collection	1	LS	--	$114,000.00
Design	1	LS	--	$113,473.50
Permitting	1	LS	--	$60,000.00
NEPA Review	1	LS	--	$115,000.00
Construction Oversight	1	LS	--	$113,473.50
Contingency (10%)	--	--	--	$103,189.40
Total Engineering Fee, with Contingency				**$619,136.40**

Phase 2: Permanent Pool Creation				
Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Mobilization/Demobilization	**1**	**LS**	**--**	**$121,490.00**
Pre-Construction Services				**$52,340.00**
Construction Stake Out and As-Built Survey	80	HR	$500.00	$40,000.00
Permitting Services	40	HR	$250.00	$10,000.00
Construction Signage	3	EA	$780.00	$2,340.00
Sediment & Erosion Control	**1**	**LS**	**--**	**$242,980.00**
Permanent Pool Creation				**$2,429,800.00**
Cast-in-Place Concrete	60	CY	600	$36,000.00
GAB	20	TON	40	$800.00
Pump Station and Conveyance Piping	1	LS	1,369,000	$1,439,000.00
Permanent Pool Excavation & Haul-off	29,700	CY	30	$891,000.00
Mainstem Channel Excavation & Haul-off	2,100	CY	30	$63,000.00
Owner Directed Work (Allowance)	**1**	**LS**	**--**	**$50,000.00**
Total Construction Cost				**$2,896,610.00**
Design Contingency				**$485,960.00**
Total Estimated Construction Cost with Contingency and ODW				**$3,382,570.00**
AACE Class 5 Estimate Range			+50%	$5,073,855.00
			-30%	$2,367,799.00

Planning-Level Construction Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 3: Outfall Channel Enhancements & Permanent Pool Diversion

Engineering & Permitting Estimate (Phase 2)				
Data Collection	1	LS	--	$203,000.00
Design	1	LS	--	$202,954.20
Permitting	1	LS	--	$80,000.00
Construction Oversight	1	LS	--	$202,954.20
Contingency (10%)	--	--	--	$137,781.68
Total Engineering Fee, with Contingency				**$826,690.08**

Monitoring Estimate				
Groundwater Quality & Quantity	1	LS	--	$74,400.00
Surface Water Quality & Quantity	1	LS	--	$44,400.00
Bank Erosion & Sediment Deposition	1	LS	--	$55,560.00
Vegetation Survey	1	LS	--	$14,400.00
Aquatic Survey	1	LS	--	$28,400.00
Avian Survey	1	LS	--	$14,400.00
Contingency	--	LS	--	$46,312.00
Total Monitoring Estimate, with Contingency				**$277,872.00**
AACE Class 5 Estimate Range			+50%	$416,808.00
			-30%	$194,510.40

Annual Maintenance Burden Estimate				
Groundwater Quality & Quantity	1	LS	--	$20,000.00
Surface Water Quality & Quantity	1	LS	--	$375.00
Bank Erosion & Sediment Deposition	1	LS	--	$1,620.00
Permanent Pool & Pump Station	1	LS	--	$233,000.00
Pedestrian Amenities	1	LS	--	$112,000.00
Revegetation	1	LS	--	$16,000.00
Contingency	--	LS	--	$14,999.50
Total Maintenance Estimate, with Contingency				**$397,994.50**
AACE Class 5 Estimate Range			+50%	$596,991.75
			-30%	$278,596.15

Planning-Level Construction Unit Cost Estimate Table

Southside WRF Outfall Realignment Evaluation Project

Alternative 3: Outfall Channel Enhancements & Permanent Pool Diversion

Total Project Cost	
Construction	$5,273,795.00
Engineering Design, Permitting, & Construction Oversight	$1,445,826.48
Monitoring	$277,872.00
GRAND TOTAL	**$6,997,493.48**

Appendix D: Stakeholder Meeting Summaries

Hazen *Meeting Minutes*

November 23, 2020

Location:	Teams Meeting
Subject:	SWRP Outfall Realignment Evaluation – Call with USACE Re: Middle Rio Grande
Attendees:	USACE: Lynette Giesen
	Hazen: Kevin Middlebrooks, Ty Smith

On Monday, November 23rd, Hazen conducted a phone call with Lynette Giesen/USACE to learn more about the Middle Rio Grande Bosque Environmental Restoration, particularly the willow swale projects north and south of the SWRP outfall. The following summary includes questions and a summary of responses and discussion from the call. Items deemed to be noteworthy are emphasized with orange text.

1. What were the goals of the project?
    - The Middle Rio Grande Bosque Environmental Restoration (MRGBER) project restored riparian woodland habitat (known locally as the "Bosque") to 916 acres of floodplain along a 26 mile stretch of the Rio Grande. This riparian corridor extends north across Albuquerque from its southern border to the northern limits of the city and includes the community of Corrales and the Pueblo of Sandia.
    - The main goals of ecosystem restoration within this reach of the river are to:
        - Protect and restore critical habitats for multiple species. These habitats have become degraded by urban development, as well as by flood control operations and the development of surface water supply facilities.
        - Restore the river to a more natural flow condition; one in which floodplain wetlands and channels can absorb overbanking flows. This will better mimic natural flood regimes providing for improved recruitment of native floodplain vegetation.
        - Reduce catastrophic fire risk within the Bosque (and the threat to adjacent homes and businesses) through changes in vegetation composition and structure.
        - Expand recreational opportunities while redirecting use away from sensitive riparian areas and flood control structures.

2. How was the project funded?
    - The project was 100% federally funded under a specific appropriation via the Water Resources Development Act (WRDA) whereby Middle Rio Grande Conservation District (MRGCD) acted as the local sponsor. The total project cost was $25 million.
    - The feasibility studies were performed under a General Investigation therefore interagency bids/competition was not required.
    - An incremental cost analysis was performed during the feasibility study to evaluate relative cost per habitat acre restored.

Job no

3. What were the project considerations from a planning and permitting perspective? What, if any, adaptations were made due to on-site T&D species?
    - The project required the following permit reviews:
        - Completion of NEPA process since the project was completed by a federal organization, included some segments of federal property, and was completed using federal funds.
            - Ms. Giesen recommended double checking ownership of properties where proposed improvements are planned to confirm there is no federal ownership.
        - Section 7 consultation for the Rio Grande Silver Minnow.
            - The point of contact with USFWS for the Section 7 consultation was Vicky Ryan.
        - Coordination with the New Mexico Interstate Stream Commission (Office of State Engineer) was required to evaluate flood water storage and return of the proposed restoration activities.
        - Ms. Giesen indicated that 404 authorization would be required for the project via USACE regulatory (Albuquerque District).
        - The flood protection levees along the Middle Rio Grande are generally comprised of two different types of levees (engineered and non-engineered) that have been designed and constructed by USACE and maintained by MRGCD. Coordination with USACE and MRGCD may be required if implementation requires placement of spoil material along the levee system.
            - Note also that activities that would result in disturbance to or increased exposure of levees is undesirable.
        - In some instances, USACE placed spoils on the riverside of the levees to reduce cost and help with reinforcement of the levee.
    - Ms. Giesen recommended coordination with MRGCD during project planning. Particularly if planned activities include construction adjacent to the existing MRGBER sites. Yasmeen Najimi is the planning specialist at MRGCD and is the recommended point of contact.

4. It appears jetty jacks were removed during construction. Where there any issues or mitigation requirements?
    - The USACE are responsible for authorizing jetty jack removal. Approval is determined on a case-by-case basis and involves a joint decision with input from USACE Hydrology and Hydraulics group (part of the ABQ District Engineering and Construction Branch), Bureau of Reclamation, and MRGCD (Ms. Najimi from MRGCD is primary point of contact for this as well).
    - Considerations for removal include a variety of factors including the width of the Rio Grande, flow considerations, embeddedness of jetty jacks in the soil, adjacent infrastructure, etc.

5. How was construction accomplished? It appears spoils from excavation were stockpiled near the levy, correct?
    - Construction was accomplished using traditional grading equipment, mostly excavators, skid steers, and dump trucks.
    - The project was constructed with contractor selection based on a USACE workforce development program that facilitates opportunities for novice contractors. USACE uses this program to develop understanding and skills for contractors working on restoration

projects. The contractors were able to meet the 1-inch grading tolerance specification in the USACE construction documents.

6. Where was the coyote willow and other vegetation sourced from?

- A key component of the MRGBER project was to establish a variety of riparian ecosystems including forested, shrublands and grasslands.
- Hydra Aquatic (Hydra) performed most of the revegetation efforts. A variety of sources were used depending on the vegetation type.
- Hydra coordinated with MRGCD to identify local stands of willows and cottonwoods and MRGCD approve harvesting of live cuttings for planting.
- A nursery in Santa Anna provided willows and some containerized plantings.
- A specialized seed mix was developed to for herbaceous vegetation. The specialized seed mix was used both in broadcast seeding as well as hydromulching.

7. What type of monitoring has been performed and what are the results?

- A variety of monitoring programs are in place to evaluate the efficacy of the MRGBER. The programs Ms. Giesen recommended reviewing are:
    - Bosque Ecosystem Monitoring Program (BEMP) run by UNM and relies on citizen science through local schools: http://bemp.org/
        - Monitoring typically include groundwater, leaf litter, and insect monitoring (similar to what Hazen staff observed on the site south of the SWRP).
    - Middle Rio Grande Endangered Species Collaborative Program: https://webapps.usgs.gov/mrgescp/about/default.html
- Due to the nature of the federal funding from WRDA, the recreational/pedestrian access improvements were limited. For example, Ms. Giesen noted the bridges and pedestrian access on the site south of the SWRP were not fully implemented due to a lack of funding.

8. Any additional lessons learned?

- Coordinate and communicate with stakeholders early and often.
- Establishment of vegetation can be challenging.
    - Disturbance of soils in the Bosque often leads to establishment of invasive non-native species.
    - Aggressive revegetation is required to mitigate establishment of invasive non-natives, along with other mechanical and herbicide prevention and removal techniques.
    - Kochia and tree of heaven have been particularly problematic.
    - "Knick and spray" technique has been effective for tree of heaven but is labor intensive.
    - A good understanding of depth to water table is important when restoring ecosystems and associated vegetative communities.

Following the phone call, Ms. Giesen provided the following reference for further review. Note that Hazen has not completed a review of all documents referenced below at the time of this meeting summary:

1. Middle Rio Grande Bosque Ecosystem Restoration Feasibility, FONSI and Technical Appendices. (Ms. Giesen is the best contact for this information and is confirming whether she can release the construction contract info, but the economic appendix has basic costs):
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRG%20Bosque,%20NM%20FR%20for%20ASA(CW)%20Approval.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRG%20Bosque%20Final%20Environmental%20Assessment%20Appendices.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRGBosque%20Tech%20AppendixSummary.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/App%20A_H&H%20Main%20report.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRG%20Bosque%20App%20B_Real%20Estate%20Plan.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRG%20Bosque%20EA%20App%20C_Model%20Doc%20Report.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRG%20Bosque%20EA%20App%20D%20Habitat%20Assessmen.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRG%20Bosque%20EA%20App%20E%20HTRW.pdf
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/MRG%20Bosque%20EA%20AppG_Geotechnical.pdf

2. Sandia to Isleta Feasibility study, FONSI and technical appendices. This is within the same footprint as reference #1 and it looks like another set of swales is planned for approximately the same area on the north side of the outfall that the Water Authority is evaluating, but only the study has been approved - no construction funding has been appropriated yet. Danielle Galloway who is the lead biologist for this project is the primary point of contact (Danielle.A.Galloway@usace.army.mil):
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/RGEMP-I_Sandia-Isleta_Final_FS-EA_S-A_Review.pdf?ver=2019-05-14-095831-267
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2018/RGEMP-I_Apdx_A-Civil_Engineering.pdf?ver=2018-07-25-162126-413
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2018/RGEMP-I_Apdx_B-Climate.pdf?ver=2018-07-25-162127-773
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2018/RGEMP-I_Apdx_C-Cultural_Resources.pdf?ver=2018-07-25-162128-647
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2018/RGEMP-I_Apdx_D-Economics.pdf?ver=2018-07-25-162129-973
    - https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2018/RGEMP-I_Apdx_E-Environmental_Engineering.pdf?ver=2018-07-25-162131-570

- https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2018/RGEMP-I_Apdx_F-Environmental_Resources.pdf?ver=2018-07-25-162236-600
- https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2018/RGEMP-I_Apdx_G-Geotechnical_Engineering.pdf?ver=2018-07-25-162244-053
- https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/RGEMP-I_Apdx_I_Real_Estate_Plan.pdf?ver=2019-05-14-095904-610
- https://www.spa.usace.army.mil/Portals/16/docs/environmental/fonsi/2019/RGEMP-I_Apdx_J-Cost_Engineering%20Feb2019.pdf?ver=2019-08-19-113842-507

3. Sponsor of both projects is the Middle Rio Grande Conservancy District, and Ms. Giesen recommends we contact them:

    - Yasmeen Najimi, Planning Specialist with MRGCD (Yasmeen@mrgcd.us)
        - She has been intimately involved in both projects and will need to be coordinated with for any project that may connect to existing features

4. Jetty Jack information included as Attachments A and B (will need approval from all 3 agencies and it can be a difficult coordination process)

    - **Attachment A** - Method and Cost Evaluation Report for the Middle Rio Grande Bosque Jetty Jack Removal Evaluation Study
    - **Attachment B** – Jetty Jacks Removal Authorization Map
    - Contact info at USACE: Stephen Scissons, Chief, Hydraulics and Hydrology Branch, Stephen.K.Scissons@usace.army.mil

5. Section 404 Regulatory Branch Info: https://www.spa.usace.army.mil/Missions/Regulatory-Program-and-Permits/

6. Middle Rio Grande Endangered Species Collaborative Program portal: https://webapps.usgs.gov/MRGESCP/

    - This portal houses the population monitoring reports for the Silvery Minnow and has lots of other useful info (best viewed with anything other than Internet Explorer)

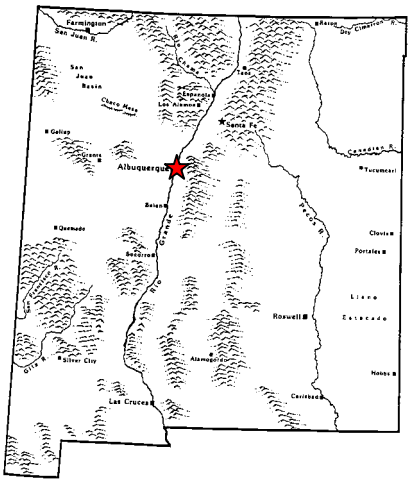
Attachment A - Method and Cost Evaluation Report for the Middle Rio Grande Bosque Jetty Jack Removal Evaluation Study

METHOD & COST EVALUATION REPORT

for the

MIDDLE RIO GRANDE BOSQUE JETTY JACK REMOVAL EVALUATION STUDY

JANUARY 2003



Prepared by

US Army Corps of Engineers®

Albuquerque District

BACKGROUND

Beginning in 1943 the US Army Corps of Engineers (Corps) and the Bureau of Reclamation (BOR) began a cooperative study that, among other relevant issues, considered the lack of adequate flood control within the Middle Rio Grande Valley. The results of this study were reported in the *Rio Grande Comprehensive Plan* and led to the authorization of the Food Control Act of 1948 (Act). The Act tasked the Corps with the construction of flood control reservoirs and rehabilitating, modifying, and extending the levee system constructed by the Middle Rio Grande Conservancy District (MRGCD) between 1930 and 1936. In addition, the BOR was responsible for clearing a floodway and installing jetty fields (*i.e*. Kelner Jetty Jacks) to establish and confine the river to a stable channel.

Jetty jacks perform this function by obstructively reducing the water flow velocities and thus causing the suspended sediments to settle-out of the water column. The cumulative depositional process eventually forms a well-defined channel by raising the relative elevation of the floodway. Consequently, the channel has an increased conveyance capacity that also resists its natural tendency to meander. Over time, as the depositional process continues, the established vegetation ultimately supplants the role of the jetty fields and provides the necessary bank and floodway stabilization. Moreover, this process generally illustrates a fundamental driving force in the structure and organization of the Middle Rio Grande bosque we observe today.

In many areas the jetty jack fields have become a non-functional eyesore that often complicate efforts toward restoration and fuels reduction activities (a preemptive measure in the reduction of fire threat and/or severity by the removal of dead-and-downed vegetation). Although not a permanent structure, the jetty jacks are often entrained within depositional sediments and/or vegetation and thus defy easy removal.

This study was an initial evaluation of various methods of jetty jack removal within the Rio Grande bosque. The overall intent of this study was to evaluate the efficiency and cost effectiveness of different removal methods with regard to jetty jack position, surroundings, and degree of sedimentary entrainment while attempting to minimize adverse environmental impacts. This evaluation study was needed, as methods for jetty jack removal are largely untested and lack the context and experience necessary to reasonably estimate time, ability, efficiency, and cost of removal efforts. The objective was therefore to determine the most efficient, cost effective, and safest method for removing jetty jacks given any particular set of conditions outlined above.

Authorization for this study is under of Section 1135(b) of the Water Resources Development Act (WRDA) of 1986 (P.L. 99-662), as amended, and is an essential experimental component of an ongoing feasibility report for the larger *Ecosystem Revitalization at Route 66* project. The knowledge gained by this study was requisite for the implementation of the larger project's restoration objectives. The 1135 program provides for the improvement of degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural functional condition. While flood protection will remain unchanged, both this study and larger project represent a significant step forward in large-scale bosque restoration. The Middle Rio Grande Conservancy District (MRGCD)

is the non-Federal Sponsor for this proposed evaluation study and the City of Albuquerque Open Space Division (OSD) and the National Hispanic Cultural Center of New Mexico (NHCCNM) are cooperating entities.

In addition to the knowledge and experience gained in jetty jack removal, this study provided a significant contribution to the sponsor's and cooperating entity's ongoing bosque restoration efforts.

STUDY LOCATIONS

There were two discrete locations for this study. The purposes for including two areas are to: 1) incorporate a variety specific conditions that future removal efforts will encounter (conservation of high-value vegetation, minimizing adverse environmental impacts, degree of jetty jack entrainment, etc.), 2) allow for an adequate number of jetty jacks to be removed such that the widest possible variety of methods can be explored and evaluated, and 3) become proficient in the aspects of jetty jack removal (*i.e*. methods, efficiency, safety, disposal, etc.).

SITE NUMBER ONE

The first site was located in northwest Albuquerque, New Mexico and extends from the Central Ave. Bridge north approximately 125 meters (410 feet) as measured along the levee on the east side of the Rio Grande (Fig.1). The approximate UTM coordinates for the northeast bridge abutment is N3884239, E346935 (Zone 13, NAD 27).

Description

Site number one (Fig.1) contains approximately 120 jetty jacks that will be removed (Fig. 4). These jetty jacks are no longer required for flood control purposes and the US Bureau of Reclamation, Albuquerque Area Office, granted permission to remove the jetty jacks in this area. The City of Albuquerque-Open Space Division (OSD), through many hours of staff and volunteer work, has cleared the site of many non-native exotic species such as saltcedar (*Tamarix chinensis*), Siberian elm (*Ulmus pumila*), Russian olive (*Eleagnus angustifolia*), and tree of heaven (*Ailanthus altissima*). The remaining native vegetation was protected to the greatest extent possible as methods in the preservation and protection of native plant species and minimizing adverse environmental impacts during jetty jack removal was one of the primary goals of the study.

SITE NUMBER TWO

The second site was located in southwest Albuquerque, New Mexico and extends from the Avenida César Chávez Blvd. Bridge south approximately 305 meters (1,000 feet) as measured along the levee on the east side of the Rio Grande. The approximate UTM coordinates for the southeast bridge abutment is N3881825, E348924 (Zone 13, NAD 27).

Description

Site number two (Fig. 2) contains approximately 300 jetty jacks that will be removed (Fig. 5) and the US Bureau of Reclamation, Albuquerque Area Office, also granted permission to remove these jetty jacks. The City of Albuquerque-OSD has also cleared this site of many exotic species and burned vegetation, thus providing an additional opportunity to evaluate methods for jetty jack removal as described previously.

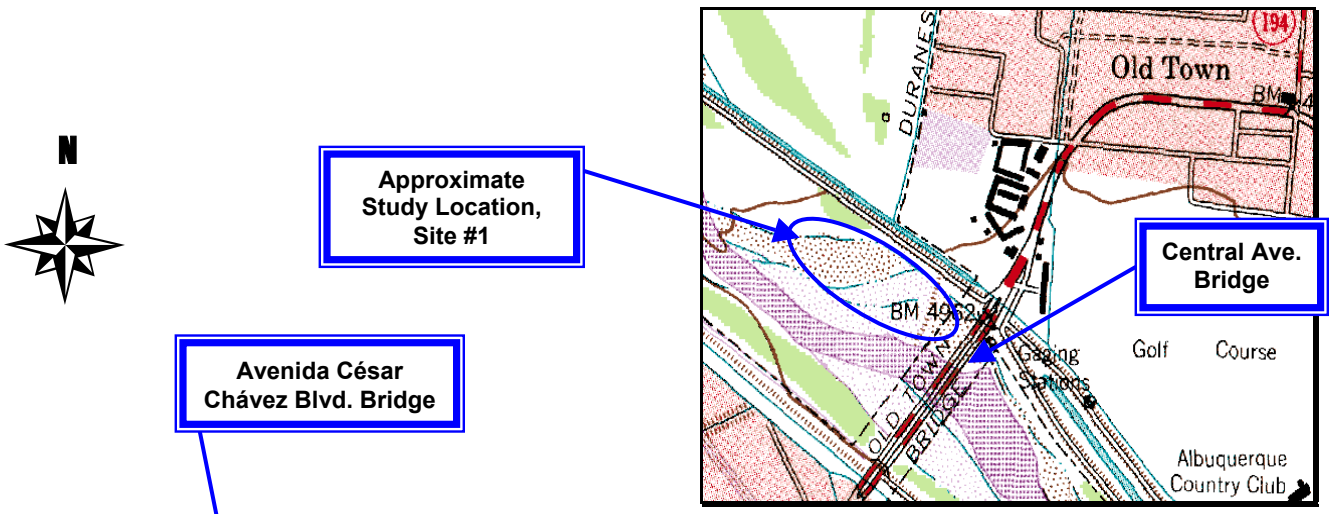
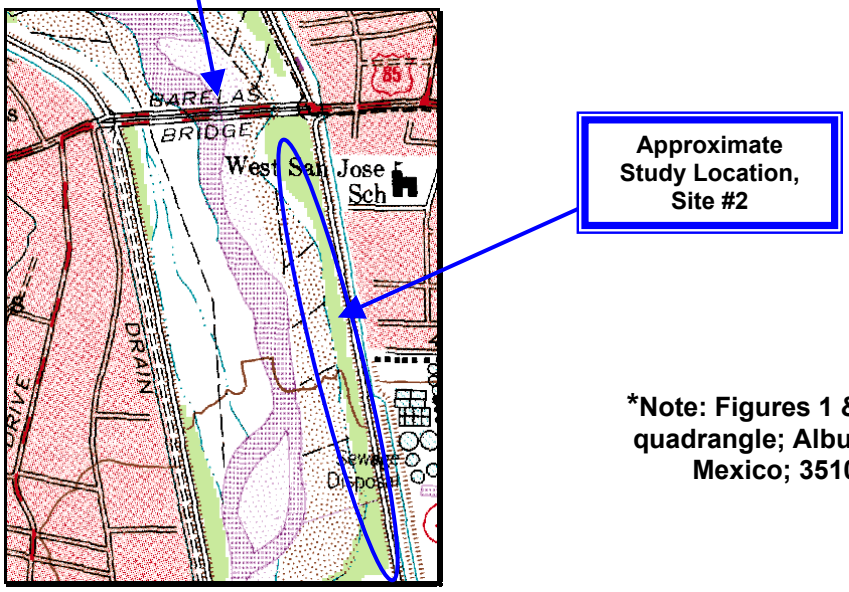


FIGURE 1. Site 1.



***Note: Figures 1 & 2 USGS 7½ minute quadrangle; Albuquerque West, New Mexico; 35106-A6, Zone 13.**

FIGURE 2. Site 2.

ACCESS

Site access was via the gated entrances onto the eastside levees at both sites. The entrance for site number one is located off the westbound lanes of Central Ave. directly west of the Albuquerque Biopark's "Additional" parking lot. For site number two, the entrance is located off the eastbound lane of Avenida César Chávez Blvd. Staging areas for both locations were located on-site and night security services was the responsibility of the contractor.

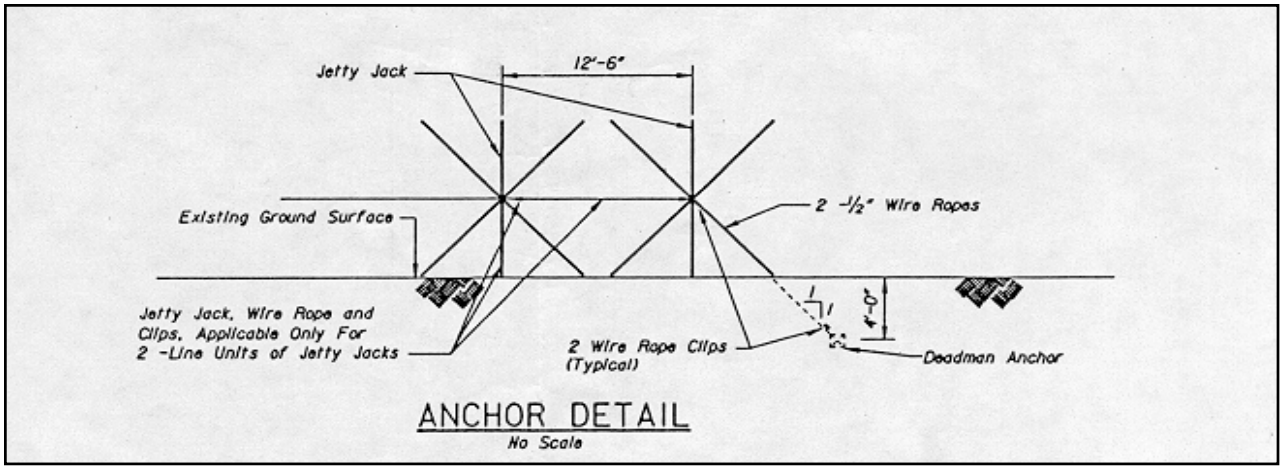


FIGURE 3. Detail of typical jetty jack and deadman anchoring



Figure 4. Jetty jacks at Site 1 (Central Ave. Bridge)



Figure 5. Jetty jacks at Site 2 (Avenida César Chávez Blvd. Bridge)

GENERAL DESCRIPTION & ACTIVITIES FOR BOTH SITES

- Work commenced at site number *one* (Central Ave.) on June 27th, 2002. On August 13, 2002, a press conference was held by New Mexico Senator Pete Domenici to

highlight future restoration efforts in the Rio Grande bosque. Also in attendance was Albuquerque Mayor Martin Chavez (Fig. 6).



Figure 6. Mayor Chavez removing jetty jacks

- Approximately 20% of the jetty jacks removed from both sites were at least one-half buried. Others are partially buried as in Figure 6 above.

- At site number two (Avenida César Chávez Blvd.), the City of Albuquerque-Open Space Division has cleared the site of dead and exotic vegetation; however, the woody vegetative debris remained. As a result, the contractor had to move some of the woodpiles to gain access to adjacent jetty jacks.

- All unburied jetty jacks were disassembled and subsequently salvaged for reuse (as fencing or gate structures) by the MRGCD and City of Albuquerque-OSD. All other materials from the jetty jacks, such as wires, cables, and severely damaged (bent) jacks were disposed of by the contractor in accordance with all Federal, State, and local ordinances, laws, and regulations governing the disposal of solid waste (including salvaging and recycling).

- Due to the extreme fire danger during removal, all use of cutting torches, grinders, chisels, etc. was closely monitored. Use of such equipment was only permitted in cleared areas where the risk fire ignition was reduced. Fire-watch personnel, fire-retardant blankets, fire extinguishers, and other precautionary measures were employed at all times when torches or spark-emitting equipment were in use. In addition, water pumped from the riverside drain (through a permit obtained from the MRGCD) was used to moisten the area around all areas that hot-work or spark-emitting equipment. Further, water from the riverside drain was also used for dust control.

POST JETTY JACK REMOVAL

Post jetty jack removal activities under this action included site clean-up and revegetation at both sites with native plants purchased by the Corps from the NRCS-Plant Materials Center.

Figure 7. Jetty jacks piled for recycling



Figure 8. Central Ave. after site clean-up



Revegetation was achieved during Dia del Rio (Day of the River) in August of 2002 through volunteer work by event participants. The City of Albuquerque Open Space Division, one of the local sponsors and Dia del Rio organizer, supplied tools, assistance, and supervision for planting activities. Overall, the event was a resounding success and many citizens turned out for the revegetation work and event's attractions and displays.

METHOD AND COST EVALUATION

In the following, costs for revegetation are factored out of the differing jetty jack removal methods. The plants supplied for this study cost approximately $8000.00 (750 potted plants). Labor to plant these plants is not quantifiable as the work was accomplished through volunteer efforts. Generally, however, it costs approximately $2.00/ea. to plant.

Method 1: Removal with Caterpillar 325B Trackhoe; cutting wires, cables, and bolts after removal

This method was the most efficient during the actual removal process, but possess a slight problem during stacking and hauling. In addition, this method was the only one possible when jetty jacks are 50% silted-in or buried. In most cases, jetty jacks removed by this method became twisted or otherwise unsuitable for any use except metal salvage (see Fig. 7). It is important to note that local salvage yards will not accept the large steel cables (1-inch wire rope) that tie the individual jacks together nor will they accept jetty jacks with the cables still attached or tangled within the jetty jacks being disposed. The scrap-metal processing machinery (shears, etc.) cannot contend with this material and local salvage yards do not have furnace equipment to melt down scrap. As such, the cable must be removed and disposed of separately. If cables are not removed, then disposal costs at appropriate landfills are approximately $20.00/yd^3 (also the cost for wire and cable disposal). In any case, this is summarily undesirable as either recycling or reusing for some other purpose is not realized.

This method is also the most cost effective. It allows for the quickest removal of jetty jacks from the site with the least manual labor involved. However, the jetty jacks, while being recycled, are not available for reuse as they are generally mangled. Jetty jacks removed by this method cost from $95.00-$100.00/ea (depending on accessibility, condition after removal, and the ability to manually remove wires and cables). This cost does not include the disposal of the wires or cables (see above).

Method 2: Removal with Caterpillar 325B Trackhoe; cutting wires, cables, and bolts prior to removal

This method proved to be less efficient and cost effective than Method 1. However, jetty jacks removed by this method were notably straighter and posed less of a problem during stacking and hauling. Further, even though large equipment was used for removal, a significant proportion of the jetty jacks ($\approx$ %50) could be salvaged for reuse. In addition, this method resulted in less clean-up after removal as wires and cables were removed and gathered more systematically.

This method, while slightly less cost effective, proved to be roughly equivalent to Method 1; the exception being that proportionally more jetty jacks could be reused for other purposes. Although more time and labor is required to cut wires and cables (leaving machinery idle), this is somewhat compensated for the decreased clean-up time. Jetty jack removal costs by this method are approximately $110.00-$120.00/ea. but do not include any costs associated with loading and hauling the reusable metal. These costs can be highly variable and is largely a function of quantity and distance hauled. The MRGCD expressed a desire to keep the usable material and took possession of upon

removal. Disposal costs of wires and cables are identical (but greater in volume) to those in Method 1 ($20.00/yd³) and are, again, not included in the jetty jack removal costs.

Method 3: Removal by hand and 263 Skidster loader (Bobcat)

This method is by far the most inefficient, least cost effective, and in many cases impossible. The only jetty jacks that can be removed by this method are those that are silted-in or buried less than %25. However, the majority of jetty jacks removed by this method are straight and can be stacked efficiently and reused for a wide variety of purposes.

This method is considerably more expensive. In short, the cost increase stems from the more labor-intensive approach and requires more time to complete any given project. Again, some jetty jacks require heavy equipment as they are buried beyond the means by which hand-methods can remove them. In other cases, however, when jetty jacks are amongst high-value vegetation hand methods can be the most advantageous and least invasive. Costs associated with method range from approximately $150.00-$180.00/ea. Disposal costs of wires and cables reflect those encountered in Method 2 above.

REUSE AND RECYCLING OF JETTY JACKS

Jetty jacks removed during this study (all methods) were used by the MRGCD for such things as fence posts and gate structures along the Rio Grande levee system. The U.S. Fish and Wildlife Service requested some material for construction of fish breeding facilities for the endangered Rio Grande silvery minnow. Other uses have been explored and contemplated, but no widespread need has currently been identified.

SITUATION NOT ENCOUNTERED IN THIS STUDY

Placement of *bankline* jetty jacks is perhaps the most lasting legacy of past flood control and river channelization efforts. These jetty jacks established the future position of the banks (as we see them today throughout much of the Middle Rio Grande) and began the process of widespread river incision. Typically, bankline jetty jacks are oriented in two parallel rows and can be either dry (not within the active, flowing channel) or wet (within the flowing channel). This can be either a function of degree of channel incision (and the subsequent isolation of the floodplain therein) or river stage (seasonal variability of flows and therefore extent of inundation). However, in most cases the bankline jetty jacks define the active channel and overbank inundation rarely extends far beyond that point.

In this study, no bankline jetty jacks were removed. In general, these jetty jacks are over %90 buried (either wet or dry) and require heavy equipment for removal. To accomplish this, access roads, staging/storage and refueling areas, and disassembly areas must be constructed. As such, removal of these jetty jacks can be vastly more destructive to the surrounding bosque. In addition, removal of these jetty jacks is significantly more expensive. Costs can run in excess of $225.00/ea. and reuse is largely excluded as removal severely damages the jetty jack. Metal salvage is generally the only option for disposal. Approximately, 950 bankline jetty jacks were removed at the Los Lunas Habitat Restoration Project (Corps and BOR 2002 a & b) by a combination of

methods. This site suffered a severe burn in 2000; therefore, impacts to high-value riparian habitat were minimized and was also a determining factor in site selection.

METHODS SUMMARY

Within the range of circumstances and methods evaluated here, and in the opinion of the contractor (AJAC Enterprises), the most efficient and cost effective method appears to be Method 1. Again, however, this does not readily foster widespread reuse of the material unless considerable effort is invested in cutting the jetty jacks with acetylene torches (with a commensurate increase in overall removal cost). With Method 1, the vast majority of material, then, is fated to be salvaged for scrap, which only partially offsets the cost of transport. The benefit here is a more rapid completion to a given project. It may also be summarily concluded that if either Method 2 or 3 were employed to maximize reuse, then the "market" for reuse would, at some point in time, be saturated and salvage would then be the major disposal outlet.

The combination of experience and knowledge gained from this study and the Los Lunas Habitat Restoration Project will greatly assist a wide range of future restoration efforts by a variety of agencies. Extensive removal of jetty jacks will continue to be a significant and preliminary phase of large-scale restoration within many areas of the Rio Grande bosque. As such, aspects regarding methods, safety, fire danger from equipment, and disposal has been well served by these initial jetty jack removal efforts. Future efforts should serve to further increase efficiency and reduce costs as the different facets of removal become more definite and familiar to those involved in large-scale restoration.

REFERENCES

U.S. Army Corps of Engineers. 2002. Environmental Assessment for Jetty Jack Removal Evaluation Study.

US Army Corps of Engineers and US Bureau of Reclamation. 2002a. Final environmental assessment and Finding of No Significant Impact (FONSI). Albuquerque, NM.

US Army Corps of Engineers and US Bureau of Reclamation. 2002b. Revegetation and Monitoring Plan for the Los Lunas, New Mexico Habitat Restoration Project. Proposal Submitted to the ESA Collaborative Program for fiscal year 2003 and 2004 funding. Albuquerque, NM.

US Bureau of Reclamation and US Army Corps of Engineers. 1946. Comprehensive plan for water resources development: Middle Rio Grande Project, Rio Grande Basin, New Mexico. Regional Office, Amarillo.

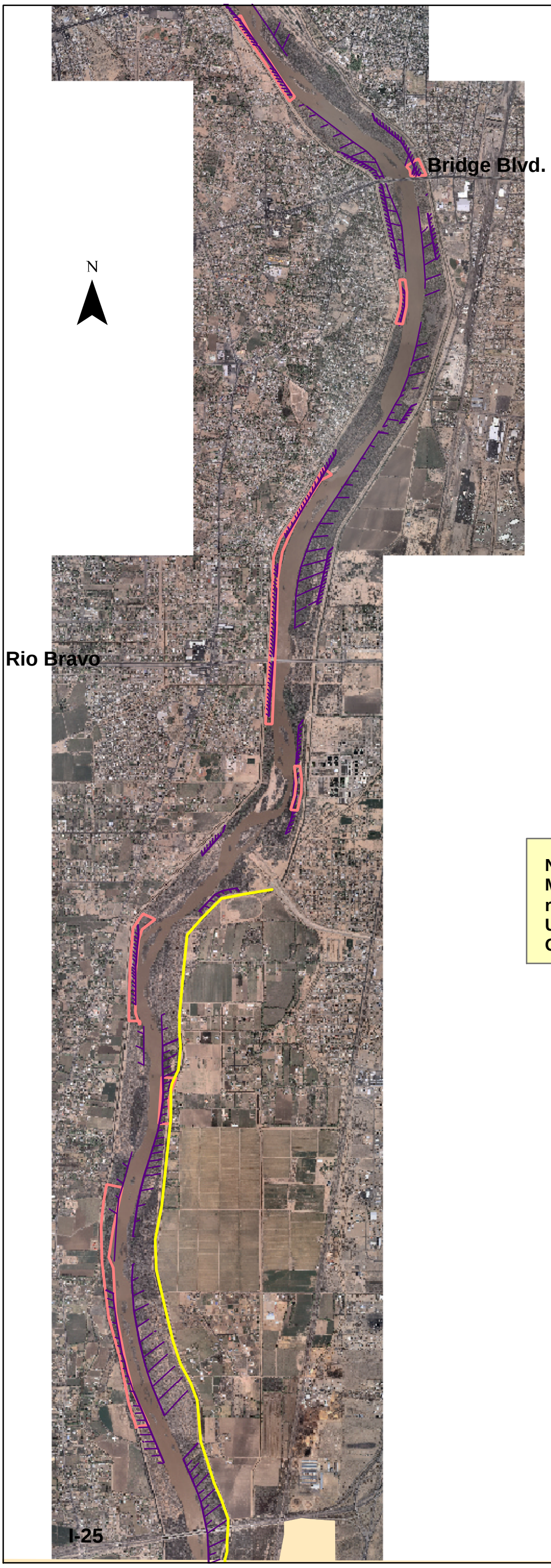
Attachment B – Jetty Jacks Removal Authorization Map

US Army Corps of Engineers®
Albuquerque District

Environmental Resources Section

May, 2009

Page 2 (South) - Bosque Wildfire Authorization for Removal of Jetty Jacks Albuquerque Reach



Base aerial photography:
Flown March 2004
New Mexico State Plane (Central)
NAD 83, Feet (U.S.)
Aerial photography provided courtesy of the Middle Rio Grande Council of Governments, Middle Rio Grande Conservancy District and the City of Albuquerque

Note: All areas NOT highlighted as 'Additional Mitigation Required' have been approved for removal by the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation and the Middle Rio Grande Conservancy District

Legend

- Non-Engineered Levee
- Additional Mitigation Required for Removal
- JACK_LINE

Miles
0 0.25 0.5 1 1.5 2

Hazen *Meeting Minutes*

December 3, 2020

Location:	MS Teams Meeting
Subject:	Water Authority SWRP Outfall Project Meeting with Game and Fish
Attendees:	Water Authority: Liz Anderson
	New Mexico Department of Game and Fish: Don Auer (Assistant habitat), Jacob Davidson (habitat program manager)
	Hazen: Kevin Middlebrooks, Greg Gates

On Thursday, December 3rd, representatives from the Water Authority, the New Mexico Department of Game and Fish (NMDGF), and Hazen met to review the results of the preliminary design evaluation for the SWRP Outfall. The following summarizes the key topics of discussion and action items (emphasized in orange text).

Introduction & Project Overview

- The Water Authority began the meeting with introductions and summarized the purpose of the meeting.
- The purpose for the meeting was to share results of the preliminary SWRP Outfall Realignment Evaluation with meeting participants and to learn more about potential project funding partnership opportunities with NMDGF.

NMDGF Conservation Program

- NMDGF provided an overview of their conservation activities and the State Wildlife Grants Program (SWG).
    - The SWG program is a collaborative effort to provide guidance and assistance in conserving species at population levels that ensure long-term persistence to prevent the need for federal species listing decisions.
    - Projects supported by SWG funds matched with other state monies (including revenues from hunting and fishing licenses) have benefitted a variety of activities including monitoring and survey, research, and habitat conservation and restoration for multiple species of invertebrates, fish, mammals, birds, reptiles, and amphibians.
- NMGF noted several considerations when reviewing opportunities for conservation projects including
    - Land ownership

Job no

  - Ability to align project with game species and a summary of which wildlife species would be affected and quantifiable metrics like net gain in winter habitat, acres of ponding or conversion of invasive to native plant communities, etc.
  - NMDGF reviews conservation opportunities from third-party groups on a case-by-case basis. Currently, a formal application process is not in place and there are no specific deadlines, application guidelines, federal/state match criteria, or other criteria.
  - NMDGF noted that projects that are shovel ready and/or have another agency to lead NEPA analysis are desirable.
  - Projects must demonstrate compliance with Section 106 (National Historic Preservation Act), Section 7 (Endangered Species Act), and NEPA process.
- NMDGF noted that they have provided funding on previous conservation partnerships ranging from $10M to $50k and indicated that the scope and scale of the SWRP Outfall Improvements project currently envisioned at the preliminary concept stage is not too large to preclude it from consideration.
- NMDGF funding does not typically require pre- and post-restoration monitoring.
- Funding that comes from NMDGF is likely to require legislative budget approval.

Action Items

- Hazen to provide NMDGF access to the Story Map which presents the results of the preliminary evaluation for the SWRP Outfall Improvements.
- Hazen and the Water Authority to coordinate with NMDGF following project feasibility efforts to determine next steps on potential project funding partnership eligibility and application.

Hazen *Meeting Minutes*

December 3, 2020

Location:	WebEx Meeting
Subject:	Water Authority SWRP Outfall Project Meeting with Office of Natural Resource Trustees (ONRT)
Attendees:	Water Authority: John Stomp, Liz Anderson, Mark Kelly
	ONRT: Maggie Hart Stebbins, Bill Fetner
	Department of Game and Fish: Don Auer
	Industrial Economics, Inc (IEC): Nadia Martin
	Hazen: Kevin Middlebrooks, Greg Gates

On Thursday, December 3rd, representatives from the Water Authority, Office of Natural Resources Trustee (ONRT), Department of Fish and Game, Industrial Economics, Inc (IEC) and Hazen met to review the results of the preliminary design evaluation for the SWRP Outfall. The following summarizes the key topics of discussion and action items (emphasized in orange text).

Project Overview

- Liz Anderson began the meeting with introductions and summarizing the purpose of the meeting. The objective for the meeting was to share results of the preliminary SWRP Outfall Realignment Evaluation with meeting participants.
- Hazen provided a brief overview of the results, referencing the project Story Map to illustrate key points associated with the project design criteria, onsite constraints, improvement alternatives and their associated benefits, and other project considerations including costs and permitting.
- The Water Authority noted that IEC is supporting the ONRT with preparation of a restoration plan summary for the SWRP outfall project for inclusion in a natural resource damage assessment.
    - Action Item: The Water Authority/IEC to coordinate with Hazen regarding details of information needed for restoration plan.
- ONRT noted that funding from Department of Game and Fish may be available if there is a benefit to games species.
    - Action Item: Hazen to coordinate with Department of Game and Fish regarding details of target species and/or potential project attributes that may be modified to enhance habitat for game species.
- The meeting participants discussed the project benefits related to water quality. Hazen noted that the calculated pollutant load reduction of the proposed alternatives is based on the

Job no

estimated reduction of sediment (and associated nutrients and pathogens) by stabilizing the riverbanks.

- ONRT noted a desire for the project to include a wetland or permanent pool component using water diverted from SWRP effluent. This would enable to the project to provide shallow surface water habitat during periods when the Rio Grande is below 1,500 cfs.
- Hazen noted that a wetland/permanent pool was considered during alternative 3 and summarized the considerations for feasibility including:
    - Maintenance burden associated with open channel diversion.
    - Negative hydraulic head or gradient from the SWRP outfall channel and target floodplain elevation
- The meeting participants noted that a diversion of SWRP effluent to a wetland or permanent pool may affect the Water Authority return flow crediting.
    - Action Item: The Water Authority to coordinate with the State Engineer regarding potential implication of return flow crediting.
    - Hazen to include an evaluation of a third alternative which would include a constructed wetland or permanent pool in the Bosque with flows from the SWRP effluent.
- The meeting participants discussed the projects benefits relative to groundwater return and noted that a constructed wetland or permanent pool component may contribute to shallow groundwater table through infiltration and seepage.
- The meeting participants discussed the adjacent restoration projects in the Bosque north and south of the SWRP outfall performed as part of the USACE Middle Rio Grande Bosque Environmental Restoration (MRGBER) project.
    - Hazen provided a brief summary of the goals of the MRGBER project which are similar to those of the SWRP Outfall improvements.
    - The meeting participants discussed what monitoring has been or is currently being performed at these sites. The Bosque Ecosystem Monitoring Program (BEMP) and the Middle Rio Grande Endangered Species Collaborative Program both perform monitoring in the area. Hazen also noted anecdotal information regarding monitoring performed at the Water Authority's Paseo del Norte habitat creation site which indicates that silvery minnow are inhabiting these areas successfully.
    - Action Item: Hazen will review BEMP and Middle Rio Grande Endangered Species Collaborative Program monitoring information to determine if information is available for the MRGBER sites north and south of the SWRP outfall.
    - Action Item: The Water Authority requested Hazen to include cost estimates for pre- and post- construction monitoring for the proposed alternatives.
- The meeting participants wrapped up the meeting with a discussion of next steps:
    - Action Item: The Water Authority plans to reach out to the State Engineer's Office to discuss project implications of return flow crediting.
    - Action Item: Hazen will prepare a technical memorandum summarizing the results of the SWRP outfall improvements evaluation and submit to the Water Authority in January 2021.

SCIENCE AND ADAPTIVE MANAGEMENT COMMITTEE MEETINGS

Science and Adaptive Management Committee Meeting

November 13, 2020

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *Charter for SAMC of the MRGESCP [read-ahead]*
- *Draft S&AM Plan [read-ahead, draft]*
- *Draft MRGESCP S&T Ad Hoc Group Charge Template [read-ahead, draft]*
- *Draft MRGESCP EC Charge to the PMWG [read-ahead, draft]*
- *Charter for HRWG of the MRGESCP [read-ahead]*
- *Charter for ScW of the MRGESCP [read-ahead]*
- *Charter for SWM of the MRGESCP [read-ahead]*
- *2020 SAMC [presentation]*
- *Draft MRG System CEM [follow-up, draft]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC) Meeting
November 13, 2020
9:00 AM–12:00 PM

Meeting Location: *Zoom*
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Meeting ID: 898-359-3120; Passcode: 1251
Call-In: +1-669-900-6833

Meeting Agenda

9:00 – 9:10	**Welcome, Introductions and Agenda Review** ➢ **Decision**: Approval of November 13, 2020 SAMC meeting agenda	*Catherine Murphy, Program Support Team*
9:10 – 9:30	**Overview of SAMC mission and meeting rules** • SAMC Charter overview and meeting operations • Highlights of S&AM Plan Read-aheads: ☐ SAMC Charter ☐ DRAFT Science & Adaptive Management (S&AM) Plan	*Facilitated discussion*
9:30 –10:00	**Discussion of procedure for forming Science & Technical (S&T) Ad Hoc Groups** ➢ **Decision**: Formation of S&T Ad Hoc Group for internal review process Read-ahead: ☐ S&T Ad Hoc Group charge template	*Facilitated discussion*
10:00 – 10:10	**Break**	
10:10 – 11:20	**Discuss SAMC Work Plan** • Discuss Adaptive Management Database • Plan S&AM Plan Objectives Workshop o Call for participation o Pre-workshop survey questions o Workshop goals and agenda • Discuss tasks for new S&T Ad Hoc Groups Read-aheads:	*Facilitated discussion*

- ☐ Preliminary S&AM Plan Objectives List (see Appendix B in the S&AM Plan)
- ☐ Population Monitoring Work Group Charge
- ☐ Science and Habitat Restoration Work Group Charters (originally three groups -- Habitat Restoration Work Group, Science Work Group, Species Water Management Work Group)

11:20 –11:30 **Meeting Summary and Action Items Review**

11:30 **Adjourn**

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

November 13, 2020; 9:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of November 13, 2020 SAMC meeting agenda with the addition of an overview of the history of adaptive management in the Collaborative Program

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Send the draft systems model to the SAMC	11/17/2020
PST	Send out a Doodle Poll to schedule the next SAMC meeting	11/17/2020
PST	Schedule the Objectives Workshop for January	Before December
SAMC	Introduce yourself and discuss the greatest challenge facing the Middle Rio Grande (MRG) during the SAMC Lighting Round at the 2020 Science Symposium	12/1/2020
SAMC	Read through the Science and Adaptive Management (S&AM) Plan, focusing on the task list and preliminary objectives (Appendix A, Appendix D), in preparation for the Objectives Workshop	12/3/2020
PST	Look into options for a SAMC work space on the Program Portal	Next meeting
Catherine Murphy	Draft the pre-Objectives Workshop survey questions for SAMC review	Before the next meeting

Next Meeting: Week of December 7th

Meeting Summary

Welcome, Introductions, Agenda Review

Catherine Murphy, SAMC Facilitator on the PST, opened the meeting and led introductions. SAMC members gave short introductions of their professional backgrounds. The SAMC reviewed the November 13, 2020 meeting agenda and asked for an overview of the Collaborative Program's past adaptive management efforts.

- ✓ **Decision**: The SAMC approved the November 13, 2020 SAMC meeting agenda with the addition of an overview of the history of adaptive management in the Collaborative Program

Adaptive Management in the Collaborative Program

Debbie Lee, PST, gave an overview of the history of adaptive management in the Collaborative Program. The main points from the overview were:

- The Collaborative Program was formally established when the Memorandum of Understanding was signed in 2003.
- Around 2009, the Collaborative Program moved towards using adaptive management (AM) as a guiding principle, and hired ESSA Technologies Ltd. to develop AM Plan Version 1.
- The ESSA 2011 Plan laid out a path for operating the Collaborative Program using AM.
    - AM Plan Version 1 is outdated, as it was developed under the assumption that the Collaborative Program would transition to a Recovery Implementation Program (RIP) structure.
    - Some of the next steps proposed in AM Plan Version 1 are included in the Science & AM Plan, but many are no longer applicable, as the Collaborative Program did not move to a RIP structure.
        - Under a RIP structure, the Collaborative Program would have had an active hand in working towards species recovery goals.
        - The Collaborative Program was not included in the 2016 Middle Rio Grande Biological Opinion (BO) as a conservation measure, as it was in the 2003 BO.
            - The 2011 AM Plan Version 1 was written under the assumptions in the 2003 BO.
- In 2015, GeoSystems Analysis (GSA) was contracted by U.S. Army Corps of Engineers to develop AM Plan Version 2. The GSA contract changed mid-way through because the U.S. Bureau of Reclamation found funding to contract third-party program management. Part of the third-party management contract was implementation of AM.
    - Rather than producing an AM plan, GSA developed scientific uncertainties to inform development of an AM plan (2018 Caplan report).
- To move forward with implementation of AM, the Collaborative Program needed to adopt a new organizational structure (with a SAMC) and modify operations to be more functional and supportive of AM.
- The S&AM Plan is an amalgamation of past Collaborative Program efforts.
- The Collaborative Program has been in a transitional stage, and this is the last year. In 2021, we will be testing the processes developed and course correcting where needed; the SAMC will be a big part of that.
- The draft S&AM Plan will be up for approval at the December 17th Executive Committee (EC) meeting. At the same meeting, a Collaborative Program Long-Term Plan (LTP) will be presented for approval.

    - The LTP presented at the December EC meeting is meant to help USACE secure more funding, and will only be a list of projects with a narrative.
- Over the next few months, the Collaborative Program will develop a strategic approach for prioritizing projects based on agreed-upon objectives. This will enable the Program's mission, goals, and objectives to influence recommended activities.
    - The SAMC will help develop objectives, build pathways from scientific uncertainties to hypotheses to projects, and relate these to strategies and objectives.
    - In late spring/early summer, there will be a major overhaul of the S&AM Plan and LTP to incorporate that work.
- The tools the Collaborative Program is developing will help synthesize past efforts. The AM Database links objectives, recovery goals, and other elements, so that everyone can work from the same pool of knowledge. The resulting information system should help facilitate informed decision-making.

Below are the main points from the discussion following the AM overview:

- Where are we starting? What is square one?
    - The SAMC can pick that, but square one for the PST was building the Project Bank for the AM Database. It is a table listing projects and their associated details, e.g., category, anticipated benefits, sponsor(s), cost, duration, scope of work, uncertainties.
- More information about the strategic process:
    - The SAMC is asked to review the implementation task list and preliminary Collaborative Program objectives (Appendices A and D, respectively) in the draft S&AM Plan.
        - The preliminary Collaborative Program objectives and strategies were developed by Kate Mendoza, Albuquerque Bernalillo County Water Utility Authority, as a starting point for Program discussion.
    - An Objectives Workshop will be convened and, with input from species experts, the SAMC will review the preliminary objectives and assess what to keep, change, or remove.
    - Through the linkages in the AM Databases, the agreed-upon objectives will structure Collaborative Program work in support of its mission and goals.
- The SAMC needs a work space where all documents can be stored and members can communicate with each other.
    - There are options like Zotero and Microsoft Teams.
    - The Program Portal may have the functionality, but the PST needs to look into it.

- **Action Item**: The SAMC will read through the S&AM Plan, focusing on the task list and preliminary objectives (Appendix A, Appendix D), in preparation for the Objectives Workshop
- **Action Item**: The PST will look into options for a SAMC work space on the Program Portal

Overview of SAMC mission and meeting rules

Catherine M. presented a slideshow summarizing information on the SAMC (see presentation). Here are some of the main points from the presentation and related discussion:

- The purpose of the SAMC is to coordinate implementation of Collaborative Program-related science initiatives by delegating tasks, compiling results, and translating scientific findings.
    - The SAMC will help bridge the gap between science and management by translating scientific results into management alternatives.

    - The SAMC does not vote or approve anything; it produces a list of recommended management alternatives with scientific justifications.
        - One alternative will always be ”no action”.
        - All supported recommendations will be accompanied by scientific justification. If there is disagreement about a recommendation, SAMC members can include a different recommendation, as long as it is justifiable.
- SAMC membership is up to eight scientists, four with specified areas of expertise and four with flexible areas of expertise. There is also one *ex officio* EC member and one facilitator.
- The Collaborative Program’s mission is to be a collaborative forum that supports science through the implementation of AM; its efforts are aimed at benefiting listed species in the MRG, while protecting water uses.
- In 2020, the Collaborative Program adopted species-specific goals for the Rio Grande silvery minnow (RGSM), yellow-billed cuckoo (YBCU), southwestern willow flycatcher (SWFL), Pecos sunflower (PESU), and New Mexico meadow jumping mouse (NMMJM).
    - The goals may benefit from being tied back to U.S. Fish and Wildlife Service (USFWS) recovery goals and criteria.
        - The Collaborative Program has the opportunity to use the information in the recovery plans and, if possible, inform those plans.
        - Linking to those plans also strengthens Collaborative Program project proposals.
    - It would be good to find out where USFWS is on those plans, so we can be sure to support those plans in their most current form.
        - We may need to reach out to recovery teams at USFWS and ask them to present us the latest information on the plans.
        - We are in the process of developing a timeline that includes dates for plan updates. Ideally, we will be able to present recommendations to USFWS in time to inform recovery plans. This can help us determine which activities should be completed before a given deadline.

Discussion on SAMC Charter overview and meeting operations:

- The charter may seem rigid but the group will have more flexibility. The charter provides structure to fall back on, if needed.
    - For example, meetings are open but outside input will be heard during a pre-determined time slot. If non-SAMC members want to contribute, there is structure for that.
    - We want to make sure the meeting discussions are not disrupted.
- The charter focuses on the S&AM Plan in terms of an annual update. It may make sense to communicate SAMC accomplishments through an annual report.
    - There may be things that happen tangentially to the S&AM Plan that could be documented in an annual report.
    - An annual report may help with securing funding.
    - The AM Database will enable the Collaborative Program to track items under development. The SAMC’s activities and recommendations will be tracked. The AM Database can be used to create an annual report summary table from the SAMC’s administrative record.
- SAMC members are not here as representatives of their organizations, but as representatives of their respective areas of expertise.
- Conversations at SAMC meeting should be free and open.

Discussion on SAMC Challenges (see presentation):

- Challenges:
    - The SAMC will build a science community. An important aspect of that is a resource network of people, information, and tools.
    - The SAMC will invite other experts to participate in critical conversations to help them make good recommendations.
    - The SAMC will also hold workshops to get feedback, buy-in, and additional participation from the Collaborative Program.
    - It would be beneficial to adopt the use of S.M.A.R.T. goals when producing program objectives and charges for Science and Technical Ad Hoc Groups. (S.M.A.R.T. stands for Specific, Measureable, Attainable, Relevant, and Time-bound)
- The SAMC may want to invite resource managers to educate us on their challenges and priorities. The SAMC's role is to help managers with decision-making by improving science communication and dealing with uncertainty; it would be worthwhile to get their input.
    - The SAMC needs to understand the needs of the managers to bridge the gap between science and management.
    - SAMC members are encouraged to compile a list of agencies or individuals to reach out to, and a list of questions to ask them.
    - We may want to start with a short survey for EC members, and reach out to them if we need more information.
- Different agencies have different perspectives on water management. By listening to those perspectives, the SAMC can see where opportunities and conflicts are, and how science can be used to address those.
    - The SAMC also needs to find out what format the managers need recommendations to take.
    - Water management changes often. Will SAMC recommendations always fall within given constraints, or will there be alternatives for changing conditions?
        - It would be good to have alternatives that are feasible under current river conditions and those that could work if different hydrological scenarios occur.
        - The less likely alternatives may not be chosen, but it would be nice to have them on the record.
- The Collaborative Program also needs to consider future needs. The river system is being impacted by climate change and we need to forecast what conditions managers might have to deal with in the future.
    - We need to incorporate climate forecasting into our models.
    - The State of New Mexico is starting a 50-year water plan that looks at climate change and how the landscape might change over the next 50 years. It will likely start in January/February.
        - Suggestion to identify efforts like these in the Long-Term Plan and schedule time to check in on them. Those efforts can inform us and we can inform them.

Are recommendations by the SAMC prescriptive?

- If so, there may be some conflict for SAMC members.
- No, the SAMC presents evidence and translates what that means.

- The SAMC produces two types of recommendations: supported activities and management alternatives. The EC makes the final decision on what the Collaborative Program will recommend.
    - "Alternatives" is intentionally used because the SAMC will present what should be considered, not what should be done.
    - There will be rationale provided for every supported management alternative.

Discussion of Procedure for Forming Science & Technical (S&T) Ad Hoc Groups:

- The main way the SAMC will delegate tasks is through formation of S&T Ad Hoc Groups.
    - Every ad hoc group will have a charge stating its task, membership, and deadline.
        - Once the group's task is complete, it will sunset.
        - Ad hoc groups can have more than one task, but all tasks should be included in the charge.
- Applicants to the SAMC who were not selected have agreed to be on-call technical experts.
    - They can be invited to speak at SAMC meetings or sit on S&T Ad Hoc Groups.
- The tasks assigned to ad hoc groups are very important; they should be small enough for groups to be able to complete in a reasonable amount of time. That way, group members can move on to other groups, and more will get done, in theory.
- The PST is familiar with the technical expertise within the Collaborative Program and can suggest members for groups.
- SAMC members can sit on S&T Ad Hoc Groups.
- Membership is not limited to active Collaborative Program members; we can reach out to non-members or those who are not currently active in the Collaborative Program.
- Ad hoc groups can be any size, but large groups are not recommended.
- Are there any considerations for funding on the S&T Ad Hoc Groups?
    - In the past, group members have volunteered hours or participated as part of their jobs. When funding was needed for external experts, like Charles Yackulic, a signatory paid to contract their participation.

Discuss SAMC Work Plan

Plan S&AM Plan Objectives Workshop:

- The format of the Objectives Workshop is open to allow the SAMC to provide input.
- The SAMC should have time to look at the preliminary list of objectives and determine if something needs to be added, changed, or removed.
- The Objectives Workshop can be pushed to January, as the next couple of months are busy.
    - We should be thoughtful about the workshop, as it will be done every year.
- The PST will call for participation in the workshop and create a survey of pre-workshop questions, to find out where there is broad approval and disagreement.
- Should objectives be evaluated in regards to the S.M.A.R.T. format?
    - It may be beneficial to, but the SAMC members will decide.
- The objectives need to support the Program's goals.
    - There are five species-specific Collaborative Program goals and two broader goals.
    - We have developed preliminary objectives and strategies (specific methods and resources needed to meet the objectives).
    - In the AM Database, each objective will be tied back to a goal.

    - The preliminary objectives were developed with the Collaborative Program goals and USFWS recovery goals in mind.
- To whom can SAMC members delegate work regarding the workshop?
    - The PST will take on most of the specific tasks related to the workshop and any meeting planning. The SAMC delegates to the PST.

Discuss tasks for new S&T Ad Hoc Groups:

- As there are a lot of Collaborative Program-related papers, it would be helpful to have people come in to present condensed versions.
- Another way to get condensed information is through topical executive summaries. If there is an complex issue the SAMC wants more information about, the SAMC can task an S&T Ad Hoc Group with producing an executive summary discussing the different hypotheses and supporting evidence.
    - The SAMC needs to be specific, so the group can focus on the relevant aspects of an issue.
- The PMWG will recommend tasks that should move forward and individuals who should join S&T Ad Hoc Groups to finish those tasks.
    - The SAMC will address the PMWG tasks first, as we do not want to lose the momentum they have generated.
- The Science and Habitat Restoration Work Group developed conceptual ecological models (CEMs) for the RGSM, SWFL, and YBCU. CEMs are still needed for the PESU and NMMJM.
    - Has critical habitat been defined for the NMMJM or PESU?
        - It has been for the NMMJM, not the PESU.
        - The PESU is threatened and there is no official recovery plan.
    - The Collaborative Program adopted five species that utilize different aspects of MRG ecosystem. Merging the species-specific models into a unified ecosystem model would be advantageous for management in the future.
    - The bird CEMs work nicely, but the RGSM CEM is confusing.
        - It was built with transition schematics for each RGSM life stage.
        - The schematics were combined to form a graphical model, which is complex.
        - Wade Wilson, USFWS, is adding more genetics elements into the RGSM CEM.
        - The Collaborative Program needs training to use the RGSM CEM.
        - The YBCU and SWFL CEMs were simpler, as less information is known about those species, including some fundamental life history questions.
        - The CEMs will be incorporated into the AM Database to link uncertainties to hypotheses and projects.
- The Genetics Ad Hoc Group is a small group that could be transitioned to an S&T Ad Hoc Group very easily.
    - The group is on hold, waiting for the RGSM single nucleotide polymorphism (SNP) panels to be completed next year.
    - The group's task should be to complete scopes of work for projects related to the SNP panels.

- **Action Item**: The PST will schedule the Objectives Workshop for January
- **Action Item**: Catherine M. will draft the pre-Objectives Workshop survey questions for SAMC review

Discussion on Systems Model:

- A system-level model was attempted previously, but further development was paused while the individual species models were being produced. The end goal was to build a MRG ecosystem model with the species models as modules within it.
- Ashley Tanner, the previous Collaborative Program Deputy Science Coordinator, developed a basic system model that depicted the sequence of bosque succession, where the different species habitats overlapped along the riparian zone, and the variables that can cause bosque succession to continue or backtrack.
- Managing for keystone species will probably do good by the system itself. It is best to move towards an integrated model versus individual species.
- Was there interest in building a CEM into a numerical, computational framework to test different hypotheses?
    - Yes. There may be enough information for the RGSM, but likely not the birds.
        - Charles Yackulic is building a RGSM population model.
    - There are leaders in systems dynamics modeling at Sandia Labs. We may want to get someone to present to us to help us develop a system approach to the MRG.
        - Vincent Tidwell, a hydrologist focusing on systems dynamics, would be a good choice.
    - We can invite someone when the specific need arises and more detailed questions can be posed.

➢ **Action Item**: The PST will send the draft systems model to the SAMC

Closing Discussion:

- 2020 Science Symposium
    - The event is three half-days with a SAMC Lightning Round on day one.
    - During the lightning round, SAMC members will be asked to discuss the greatest challenge facing the MRG and how the Collaborative Program can address that challenge.
        - If SAMC members cannot attend, they can email a statement they would like read on their behalf.
    - Alan Hatch's role as the *ex officio* EC member
        - Alan H. will help keep the SAMC grounded by expressing the needs of the EC, managerial needs, and policy issues.
        - It may be best to have the SAMC use the Program Portal to discuss their work, for the sake of transparency.

➢ **Action Item**: SAMC members will introduce themselves and discuss the greatest challenge facing the Middle Rio Grande (MRG) during the SAMC Lighting Round at the 2020 Science Symposium

➢ **Action Item**: The PST will send out a Doodle Poll to schedule the next SAMC meeting

Meeting Participants

Alan Hatch
Ara Winter
Ari Posner
Catherine Murphy
David Moore
Debbie Lee
Megan Friggens
Michelle Tuineau
Mo Hobbs
Ryan Gronewold

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Charter for Science and Adaptive Management Committee
of the Middle Rio Grande Endangered Species Collaborative Program

Approved by the Executive Committee on October 27, 2020

I. Overview

The Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) By-Laws state that the Executive Committee (EC) may establish committees and ad hoc groups to carry out activities that further the MRGESCP's mission and goals. Upon approval of this charter, the EC establishes the Science and Adaptive Management Committee (SAMC).

The SAMC will operate under defined schedules, objectives, and tasks established in coordination with the EC. Methods for accomplishing established activities will be identified by the SAMC. The Program Support Team (PST) will coordinate with the SAMC to ensure that objectives and work products are clearly defined, assigned tasks are completed, and schedules are met.

The SAMC is not a voting or decision-making group. It will synthesize scientific findings, translate results into recommendations, cite appropriate evidence, and include rationale for any supported differences of opinion within the MRGESCP. Products of the SAMC will be delivered to the EC for approval and next steps. The EC continues to hold decision-making authority for the MRGESCP.

II. SAMC Purpose

The SAMC will coordinate the implementation of MRGESCP-related science initiatives and signatory efforts by defining and delegating tasks to Science and Technical (S&T) Ad Hoc Groups; compiling results from scientific studies, modeling, and monitoring efforts; and translating scientific findings into recommendations for best management practices in the Middle Rio Grande.

III. Responsibilities

The SAMC will be directed by the EC to implement the MRGESCP's Science & Adaptive Management (S&AM) Plan and Long-Term Plan. SAMC responsibilities include:

- Convening and coordinating S&T Ad Hoc Groups to complete tasks in support of the S&AM Plan
- Reviewing MRGESCP-related field studies and modeling/monitoring activities and translating results into best management alternatives
- Working with the Fiscal Planning Committee to coordinate EC-approved work products (e.g., studies, projects)
- Communicating to the EC the progress of S&AM Plan implementation, including a summary of updates to MRGESCP objectives and tools, with associated scientific justifications

- Regularly communicating updates at each EC meeting, which includes:
    - Presenting potential work products and the status of in-progress work products
    - Informing the EC on formation of S&T Ad Hoc Groups with assigned tasks and deadlines
    - Proposing implementation schedules for EC approval
    - Suggesting amendments to the S&AM Plan
    - Providing the documented range of SAMC opinions, as necessary, for EC review and consideration of next steps
    - Providing new science-based recommendations for best research and management alternatives
    - Providing new recommendations for independent peer review

IV. Membership

The SAMC shall consist of no more than eight (8) subject matter expert members, appointed by the EC. These positions include:

- Four (4) specified subject matter experts with the following areas of expertise:
    1. Aquatic ecology
    2. Terrestrial ecology
    3. Ecosystem
    4. Hydrology
- Up to four (4) flexible subject matter experts selected based on science-related needs, as determined by the EC. The SAMC may provide input on which areas of expertise would benefit the group, but the ultimate decision will be made by the EC.

One (1) EC member shall serve in an ex officio and advisory capacity to the SAMC. This position will not count towards the eight (8)-count membership, and the member will not participate in scientific deliberations as a technical expert.

The SAMC will be facilitated by the MRGESCP Science Coordinator and supported by the Program Support Team (PST). Members of the PST will not count towards the eight (8)-count membership.

V. Application Process

The EC, in coordination with the Science Coordinator and Program Support Team, will oversee and administer the application process. Interested individuals shall submit a formal application to the Science Coordinator. Individuals may apply for more than one SAMC position and must submit one application per position. Applications will be accepted from experts both internal and external to the MRGESCP.

The EC will review submitted applications and each EC representative will cast one vote per SAMC position. The EC will nominate EC members for the ex officio position and vote to fill the position. The EC has final decision-making authority on SAMC membership.

VI. Membership Terms

SAMC members shall be appointed by the EC for an initial two (2)-year term. Sitting SAMC members may apply for one (1)-year term limit extensions. Individuals may not serve on the SAMC for more than four (4) consecutive years, except as authorized by the EC.

VII. Membership Vacancies

If a vacancy on the SAMC occurs mid-term, it will remain open unless the EC determines a need to fill the position for the remainder of the term.

VIII. Roles

The up to eight (8) subject matter expert members will:

- Be chosen based on their technical qualifications and will serve as technical experts in their respective fields
- Not represent a signatory or organization as members of the SAMC
- Safeguard and support the scientific rigor of MRGESCP investigations and initiatives

The EC ex officio position will:

- Serve in an advisory capacity to the SAMC on policy
- Provide the larger MRGESCP perspective
- Ensure topics and recommendations are within the scope decided by the EC
- Provide direction for completion of summary documents to the EC

The Facilitator (MRGESCP Science Coordinator) will:

- Coordinate meetings
- Facilitate the SAMC administrative functions, including:
    - Drafting S&T Ad Hoc Group charges
    - Coordinating with the FPC, S&T Ad Hoc Groups, and any independent peer reviewers
    - Relaying updates and recommendations to the EC

IX. SAMC Meeting Operations

The SAMC shall meet at minimum once per quarter. The SAMC may meet more frequently if determined necessary based on work assignments. Formal agendas will be drafted for review and approval at each meeting. The PST will post SAMC meetings on the Program Portal event calendar and include draft agendas and read-aheads for download. Meeting agendas and read-aheads will be made available to SAMC members no later than one week in advance of the meeting date.

SAMC meetings shall be open to an audience of non-SAMC members. Only SAMC members may participate in meeting deliberations. Prior to the meeting, the SAMC may invite Ad Hoc Group leaders and/or outside experts to participate on specific agenda items, as needed. At each meeting, time will be included on the agenda for non-member comment. Non-members who wish to provide comment will have up to three (3) minutes to speak during this time, unless included on the agenda

or at the specific request of the SAMC, or they can choose to submit written comments to the Facilitator at any time.

The PST shall record formal meeting minutes that will be used to document meeting deliberations and communicate activities to MRGESCP members and external interested parties. Finalized agendas, read-aheads, and minutes will be included in the MRGESCP Annual Administrative Record and stored on the Program Portal.

X. Science & Technical Ad Hoc Groups

The SAMC shall form S&T Ad Hoc Groups charged with carrying out discrete tasks necessary for executing the MRGESCP S&AM Plan and Long-Term Plan. These tasks include:

- Addressing specified scientific uncertainties
- Completing executive summaries to delineate alternative hypotheses regarding critical uncertainties, as needed
- Developing, refining, and updating conceptual ecological models
- Developing scopes of work to test research hypotheses and/or collect necessary data
- Compiling and synthesizing the results of field studies, monitoring, and modeling to develop recommendations
- Analyzing data to address hypotheses linked to scientific uncertainties
- Updating the S&AM Plan as new information becomes available and new questions emerge

The SAMC shall approve a charge for each S&T Ad Hoc Group that specifies:

- An assigned task
- A deadline to complete the assigned task
- Deliverables to the SAMC
- Membership

Once the task of a S&T Ad Hoc Group is complete and approved by the SAMC, the Ad Hoc Group will be sunsetted.

XI. Recommendations to the EC

The SAMC will not be a decision-making body. When making science-based recommendations to the EC, the SAMC will strive to operate by consensus. In a report to the EC, the SAMC will include:

- (If consensus was reached) The consensus recommendation with scientific justification
- Considered alternatives to a recommendation
- (If consensus was not reached) Documentation of competing positions with appropriate scientific justification

Ultimately, the EC that determines the final recommendations of the MRGESCP.

If there is not a consensus recommendation from the SAMC, the EC may:

- Direct the SAMC to form a S&T Ad Hoc Group to investigate the issue in more detail
- Determine, with input from the SAMC, there is a need for independent peer review

XII. Annual Update and Evaluation of the SAMC by the EC

The MRGESCP Science Coordinator shall provide a formal annual update to the EC that summarizes:

- Accomplishments from the past year
- Status of the SAMC Work Plan
- Updates to MRGESCP science and adaptive management tools (e.g., conceptual ecological models, geospatial mapper, etc.)
- Any recommended amendments to the S&AM Plan or Long-Term Plan, including MRGESCP objectives

As part of the annual update, the EC shall evaluate SAMC membership. If there are empty seats on the SAMC, the EC may choose to seek applicants. The EC may also review requests for (1)-year term limit extensions or extensions past the limit of four (4) consecutive years.

XIII. Conflict of Interest

SAMC members will abide by all federal, state, tribal, and local agency rules and regulations regarding conflict of interest. SAMC members are required to recuse themselves when they identify a potential financial conflict of interest.

XIV. Amendment of the SAMC Charter

This charter may be revised and amended as deemed appropriate by the MRGESCP By-Laws. Potential amendments will be open to input from the SAMC and must be approved by the EC.



Science and Adaptive Management Plan

Draft

October 2020

Prepared on behalf of and for use by the
Middle Rio Grande Endangered Species Collaborative Program

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ACRONYMS AND ABBREVIATIONS

2014 Bernalillo to Belen BO	Biological Opinion on the Effects of the U.S. Army Corps of Engineers' Mountain View, Isleta, and Belen Levee Units for Middle Rio Grande Flood Protection, Bernalillo County to Belen, New Mexico
2016 MRG BO	Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
APA	Assessment Payers Association of the Middle Rio Grande Conservancy District
AM	adaptive management
BDD	Buckman Direct Diversion
BEMP	Bosque Ecosystem Monitoring Program
BO	biological opinion
CEM	conceptual ecological model
CoA	City of Albuquerque
EC	Executive Committee
ESA	Endangered Species Act
FPC	Fiscal Planning Committee
MOA	Memorandum of Agreement
MRG	Middle Rio Grande
MRGCD	Middle Rio Grande Conservancy District
MRCESCP/Collaborative Program	Middle Rio Grande Endangered Species Collaborative Program
NMAGO	New Mexico Attorney General's Office
NMDGF	New Mexico Department of Game and Fish
NMISC	New Mexico Interstate Stream Commission
NMMJM	New Mexico meadow jumping mouse
PESU	Pecos sunflower
PST	Program Support Team
Reclamation	U.S. Bureau of Reclamation
RIO	River Integrated Operations
RIP	Recovery Implementation Program
RGSM	Rio Grande silvery minnow
S&AM Plan	Science and Adaptive Management Plan
S&T Ad Hoc Group	Science and Technical Ad Hoc Group
SAMC	Science and Adaptive Management Committee
SDM	structured decision-making
SWFL	southwestern willow flycatcher
UNM	University of New Mexico
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
YBCU	yellow-billed cuckoo

1 INTRODUCTION

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) is a partnership of federal, state, tribal, local, and non-governmental signatory organizations that aims to protect and recover federally listed species in the riparian corridor of the Middle Rio Grande (MRG), while preserving the area's existing and future water uses in compliance with applicable state, federal, and tribal laws, rules, and regulations. The Collaborative Program currently aids in the recovery of five species listed under the Endangered Species Act (ESA): the endangered Rio Grande silvery minnow (*Hybognathus amarus*; RGSM), the endangered southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL), the endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; NMMJM), the threatened yellow-billed cuckoo (*Coccyzus americanus*; YBCU), and the threatened Pecos sunflower (*Helianthus paradoxus*; PESU).

1.1 Purpose and Role of Adaptive Management for the Collaborative Program

It has become increasingly difficult to protect and recover listed species in the MRG due to increased environmental and administrative challenges, such as persisting drought and diminishing administrative resources. To better utilize resources to meet challenges in the area, the Collaborative Program signatories agreed to use and support the use of adaptive management (AM) in the MRG. The primary role of the Collaborative Program in AM of the MRG is developing scientific evidence that informs decision-making. The Collaborative Program then provides scientifically defensible recommendations for management actions that benefit listed species to the MRG's natural resource managers.

Together, the Science and Adaptive Management Plan (herein referred to as the S&AM Plan) and the Long-Term Plan (Section 4.2) provide the framework for implementing the Collaborative Program's science and AM process.

1.2 Collaborative Program Guiding Principles

In 2019, the Collaborative Program adopted a revised mission statement (Box 1), which expanded on the 2008 Memorandum of Agreement's (MOA) statement of purpose. The revised mission statement maintains the Collaborative Program's intent to recover listed species and protect water uses, while further emphasizing the need for and use of scientific analysis to support AM in the MRG.

Box 1. Collaborative Program Mission Statement

> *The Middle Rio Grande Endangered Species Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management to the benefit and recovery of the listed species pursuant to the Endangered Species Act within the Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules, and regulations.*

In 2020, the Executive Committee (EC) approved a list of long-term species-specific goals in support of its revised mission (Box 2). These are large-scale goals that are meant to be continually strived for. As such, they serve to guide the Collaborative Program's science and AM process.

Box 2. Collaborative Program Goals

- Establish and maintain a self-sustaining population of endangered RGSM distributed throughout the MRG.
- Maintain and protect the MRG recovery unit goals for endangered SWFL.
- Maintain and protect suitable threatened YBCU habitat in the MRG.
- Establish and maintain a self-sustaining endangered NMMJM population in the MRG.
- Maintain and protect the threatened PESU in the MRG.
- Avoid the future listing or up-listing of species in the MRGESCP area.
- Manage available water to meet the needs of endangered species and their habitat.

The Collaborative Program's mission and goals inform development of objectives and strategies, which guide the direction of scientific initiatives. These links ensure the Collaborative Program produces initiatives that represent its mission and goals. To increase the efficiency and effectiveness of Collaborative Program efforts, goals and objectives are linked to species recovery plans. By developing strategies that build on recovery criteria, the Collaborative Program can document the progress made on each recovery objective and goal. Given the connection between strategies and species recovery plans, the Collaborative Program is poised to inform recovery plans during their five-year reviews.

Preliminary objectives and strategies were designed to achieve Collaborative Program goals by focusing efforts on essential aspects of species recovery criteria. Appendix D presents a list of suggested preliminary objectives and strategies that is meant to offer a starting point for the development of Collaborative Program objectives. The preliminary objectives were developed using past Collaborative Program objective development efforts and a compiled list of recovery goals, criteria, and actions from species recovery plans.

1.3 Area of Interest

The geographic area of interest covered by the Collaborative Program follows the Rio Grande, including its tributaries, stretching from the New Mexico/Colorado border downstream to the elevation of the spillway crest of Elephant Butte Reservoir, excluding the land reserved for the full pool of Elephant Butte Reservoir. Under the S&AM Plan, five reaches have been delineated within the MRG (Figure 1). From north to south, the reaches are delineated as follows:

- Northern Reach (from the Colorado-New Mexico border to Cochiti Dam)
- Cochiti Reach (from Cochiti Dam to Angostura Diversion Dam)
- Angostura (or Albuquerque) Reach (from Angostura Diversion Dam to Isleta Diversion Dam)
- Isleta Reach (from Isleta Diversion Dam to San Acacia Diversion Dam)
- San Acacia Reach (from San Acacia Diversion Dam to the elevation of the spillway crest of Elephant Butte Reservoir)

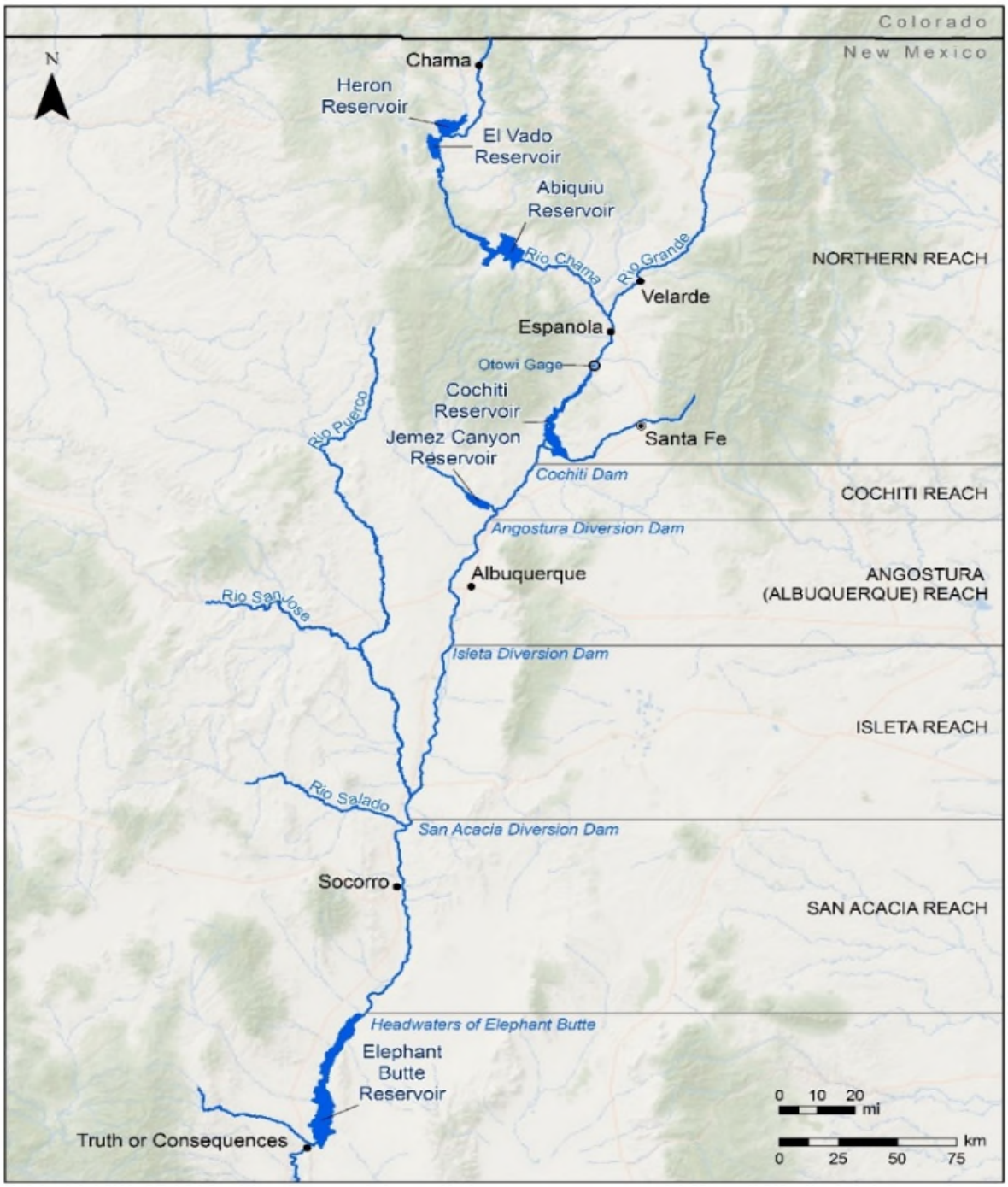


Figure 1. Collaborative Program Area of Interest

1.4 Stakeholders

A Collaborative Program stakeholder is an organization with vested interest in listed species recovery and protection of water uses in the MRG. Primarily, the Collaborative Program stakeholders are the seventeen signatories to the 2008 MOA:

- Albuquerque Bernalillo County Water Utility Authority (ABCWUA)

- Assessment Payers Association of the Middle Rio Grande Conservancy District (APA)
- Audubon New Mexico
- Bosque Ecosystem Monitoring Program (BEMP)
- Buckman Direct Diversion (BDD)
- City of Albuquerque (CoA)
- Middle Rio Grande Conservancy District (MRGCD)
- New Mexico Attorney General's Office (NMAGO)
- New Mexico Department of Game and Fish (NMDGF)
- New Mexico Interstate Stream Commission (NMISC)
- Pueblo of Isleta
- Pueblo of Sandia
- Pueblo of Santa Ana
- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Reclamation (Reclamation)
- U.S. Fish and Wildlife Service (USFWS)
- University of New Mexico (UNM)

Beyond the Collaborative Program signatories, MRG stakeholder groups include soil and water conservation districts, Acequia Associations, the New Mexico Environment Department, the Mid-Region Council of Governments, and others. The Minnow Action Team is a group of Collaborative Program signatory and non-signatory resource managers, contractors, and scientists that produce biologic, hydrologic, and monitoring recommendations to benefit the RGSM. Although the group operates outside of the Collaborative Program, its vested interest in listed species recovery make it a Collaborative Program stakeholder. Input by external stakeholders adds value to the Collaborative Program and strengthens the impact of its work. These entities also benefit from interacting with the Collaborative Program and its work.

1.5 Operational Space

Signatories have varied missions, interests, obligations, and authorities under which they participate in the Collaborative Program. Participation by signatory scientists, technical experts, natural resource managers, and administrators is necessary for navigating the Collaborative Program's operational space, which is defined by scientific uncertainty and regulatory obligations. This section frames the assumptions around the Collaborative Program's science support role in AM, including its opportunities and boundaries, and describes the administrative foundation for that role.

1.5.1 Operational Assumptions

Several assumptions shape the Collaborative Program's operations as a science-based program that provides recommendations for scientific activities and management actions in the MRG. These assumptions are listed in Box 3.

Box 3. Collaborative Program Operational Assumptions

1. The Collaborative Program aids in the systematic reduction of uncertainty related to species vulnerabilities, resulting in science-based recommendations that help guide management of the MRG.
2. Collaborative Program efforts contribute valuable research to inform the recovery of the listed species; however, the Collaborative Program is not an entity that is collectively bound by any legal responsibility to recover the threatened and endangered species of the MRG.
3. Resource management decisions by individual Collaborative Program signatories often require consideration of species response to system changes.
4. The Collaborative Program has no authority to implement adaptive management in the MRG.
5. There is no central decision-making or funding authority in the MRG; the Collaborative Program does not have decision-making authority on any individual signatory's budget, contracts, or management actions.

1.5.2 Preceding Adaptive Management Efforts

The Collaborative Program's current position in AM of the MRG is one developed over many years. Since the mid-2000's, the Collaborative Program has worked towards incorporating an AM framework into its efforts. The S&AM Plan builds from preceding Collaborative Program AM endeavors and aims to complement other AM efforts in the MRG.

In *Middle Rio Grande Endangered Species Collaborative Program Adaptive Management Plan Version 1*, Murray et al. (2011) was contracted to provide a comprehensive concept for implementing an AM approach for management of the RGSM and SWFL. The report identified tasks needed for implementation of AM and recommended next steps for subsequent Collaborative Program AM plans, including guidance for each step of the AM cycle.

In tandem with the 2011 effort, the Collaborative Program drafted a Recovery Implementation Program (RIP) document to restructure the Collaborative Program's governance, and develop processes to support an AM framework. The Collaborative Program did not implement the RIP, and instead focused on renewed efforts to develop an AM framework to complement its position in the MRG.

Following up on the initial 2011 effort, USACE contracted GeoSystems Analysis, Inc. to complete the *Middle Rio Grande Adaptive Management Framework: Identifying Critical Scientific Uncertainties* (Caplan et al. 2018) report, which built on recommendations from Murray et al. (2011). As recommended by Murray et al. (2011), the Caplan et al. (2018) report used a structured process to identify critical scientific uncertainties and recommended studies to reduce those uncertainties for RGSM, SWFL, YBCU, and NMMJM. As outlined by the Caplan et al. (2018) report, the next steps for continuing development of the Collaborative Program's AM strategy are as follows:

- Use a structured decision-making process to prioritize study recommendations based on direct linkages to well-defined management objectives and performance measures;
- Develop a multi-year strategic science plan that incorporates results from the structured decision-making process; and

- Establish a standing independent science advisory group to provide outside peer review and to support the Collaborative Program's implementation of the strategic science plan through various stages of the AM cycle.

The Collaborative Program's science and AM process outlined in this S&AM Plan builds on previous AM efforts by incorporating the next steps and recommendations identified in past documents. Box 4 synthesizes the evolution of the Collaborative Program's science and AM process with a list of accomplishments made under an AM framework, beginning with the Murray et al. (2011) report. This evolution has helped refine the Collaborative Program's role in AM of the MRG.

Box 4. Collaborative Program Accomplishments Under an AM Framework

- Established a framework for conducting activities to deliberately and explicitly reduce management uncertainties.[1]
- Identified a preliminary adaptive management (AM) design and carried it through the AM cycle.[1]
- Identified scientific uncertainties and data gaps (by species) considered important for supporting management decisions and informing AM experiments.[2]
- Prioritized uncertainties and provided preliminary study plan considerations for four of the listed species.[2]
- Adopted a revised mission focused on science and AM (see Section 1.2).
- Developed and adopted long-term species-specific Collaborative Program goals (see Section 1.2).

[1]Murray et al. 2011 [2]Caplan et al. 2018

1.5.3 Operational Considerations

Collaborative Program stakeholders work within a fully allocated and highly regulated river system, which poses challenges for management related to the recovery of listed species. Following is a brief overview of existing Biological Opinions (BO) and non-ESA obligations, other AM-specific efforts in the MRG, and opportunities for Collaborative Program engagement in AM.

Biological Opinions

Several signatories operate within the MRG under programmatic and/or project specific BOs (Table 1). One of the more expansive BOs in the MRG is the 2016 *Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico*. Signatory partners to this BO include Reclamation, NMISC, and MRGCD. ABCWUA and BDD operate under separate programmatic BOs in the MRG (Table 1).

In addition to programmatic BOs, several signatories consult with USFWS on specific projects. More information on these projects can be found using the following links to the USFWS website: https://www.fws.gov/southwest/es/NewMexico/ES_bio_op.cfm and https://ecos.fws.gov/ecp/.

Table 1. Current Middle Rio Grande Biological Opinions under which signatories operate

Signatory Parties	Year Issued	Title
ABCWUA	2004	*Biological Opinion on the Effects of Actions Associated with the Programmatic Biological Assessment for the City of Albuquerque Drinking Water Project*
BDD	2007	*Biological Opinion on the Effects of Actions Associated with the Biological Assessment for the Buckman Water Diversion Project, Santa Fe National Forest, USDA Forest Service*
USACE	2014	*Biological Opinion on the Effects of the U.S. Army Corps of Engineers' Mountain View, Isleta, and Belen Levee Units for Middle Rio Grande Flood Protection, Bernalillo County to Belen, New Mexico* (Bernalillo to Belen BO)
Reclamation NMISC MRGCD	2016	*Final Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico*

Sources: U.S. Fish and Wildlife Service (2004, 2007, 2014, 2016)

Obligations Beyond Endangered Species Act Compliance

The Rio Grande supports numerous water uses, including for ecological, tribal, agricultural, municipal, and recreational purposes. Water allocation and delivery in the MRG is highly managed and regulated by multiple organizations. This includes several individual signatories that have water delivery obligations within the MRG and to downstream users.

1.5.4 Other Regulatory Adaptive Management Efforts

As part of the 2016 MRG BO, BO partners plan to implement River Integrated Operations (RIO), an AM approach for river operations designed to address species and water management needs, while improving sustainable management of the MRG. Efforts on the RIO are currently underway. Additionally, the BO for USACE's Bernalillo to Belen flood risk management project (USFWS 2014; Table 1) includes measures for integrating AM in monitoring projects and evaluating their success in order to determine if mitigation actions are sufficient to avoid, minimize, or compensate for adverse impacts.

As the Collaborative Program progresses on implementation of its S&AM Plan, its efforts to provide science-based recommendations are expected to complement all AM efforts in the MRG. By reducing uncertainty around the management of listed species and their habitats, the Collaborative Program intends to improve management of the MRG.

1.5.5 Opportunities for Science Support

Collaborative Program operations, except by mandate, preclude the implementation or directing of management actions. Although this limits the Collaborative Program's involvement in regulatory activities, it does not reduce its value to management of the MRG's listed species. Instead, this limitation presents several unique opportunities.

As the Collaborative Program operates outside the purview of signatory BOs and other non-ESA obligations, it is free to use BO requirements as guidance for its activities, while expanding beyond them. This freedom has allowed the Collaborative Program to address ecosystem-level questions and habitat

considerations not specified by species recovery plans. Under the S&AM Plan, the Collaborative Program's charge is to develop scientifically defensible solutions and recommend evidence-based best management practices for the recovery of listed species in the MRG. With a diverse group of collaboratively engaged signatory members, the Collaborative Program is distinctly positioned to support the work of its signatories and other MRG stakeholders. Furthermore, each signatory contributes individually to Collaborative Program operations (Table 2), which collectively strengthens its work.

Given its unique strengths and limitations, the Collaborative Program has had to carve its own operational space in AM of the MRG. Within this space, the Collaborative Program's role has been refined to one of scientific support. Backed by empirical evidence, recommendations originating from the science-based Collaborative Program are designed to influence management of listed species in the MRG and garner public and political support.

Table 2. Opportunities for Signatory Involvement under the Science and Adaptive Management Plan

SIGNATORY CONTRIBUTIONS	ABCWUA	APA	Audubon	BEMP	BDD	COA	MRGCD	NMAGO	NMDGF	NMISC	Isleta	Sandia	Santa	USACE	USBR	USFWS	UNM
Scientific and Technical Expertise: SAMC Positions and S&T Ad Hoc Groups																	
Aquatic biology						X			X	X				X	X	X	X
Terrestrial biology			X						X					X	X	X	
Ecosystem function and structure			X	X		X	X				X	X	X	X		X	
Hydrology	X		X				X			X				X	X		
Statistical analysis				X						X						X	X
Informing Management, Operations, and Activity Implementation																	
Conducting laboratory studies	X					X	X			X					X	X	X
Ability to conduct field studies	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Knowledge of system management	X	X	X		X	X	X		X	X	X	X	X	X	X	X	X
Routinely collect field observations	X	X		X		X	X		X	X	X	X	X		X	X	X
Conduct scientific activities	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Forecasting and modeling	X			X			X			X				X	X	X	X
Administrative Expertise: Administrative Ad Hoc Groups																	
Updates to By-laws		X			X			X		X				X	X		
Draft, review, and update administrative documents	X	X					X			X				X	X		
Science Communication and Outreach																	
Contribute to public outreach	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Communicate to the scientific community via peer-reviewed publications and presentations at conferences	X		X	X		X	X		X	X	X	X	X	X	X	X	X
Regulation and Policy Expertise: Executive Committee; other groups as needed																	
Conservation laws					X		X	X	X	X				X	X	X	
Water regulations and policy	X				X		X	X		X				X	X		
Administrative policy					X			X		X				X	X		

2 ADAPTIVE MANAGEMENT APPLICATION

The Collaborative Program uses a science and AM process to determine how to best manage limited resources in the MRG to benefit listed species. Specifically, the Collaborative Program's science and AM process is designed to reduce uncertainty around species management and lead to recommendations for science-supported management alternatives and activities aimed at improving understanding of species-system interactions. This section outlines the general AM cycle, tailors each step of the AM cycle to the Collaborative Program, and defines the role of AM in the Collaborative Program.

2.1 The Adaptive Management Cycle

Adaptive management is a structured, science-based process that maximizes learning by incorporating management alternatives to reduce critical uncertainties (Williams et al. 2009; Murray et al. 2011). The AM process has been applied to a wide variety of natural resource and ecosystem management problems since the 1970s (Holling 1978; Environmental and Social systems Analysts 1982; McDonald et al. 1999; Gregory et al. 2006), and is summarized as an iterative cycle that involves six steps (Figure 2; Williams et al. 2009).

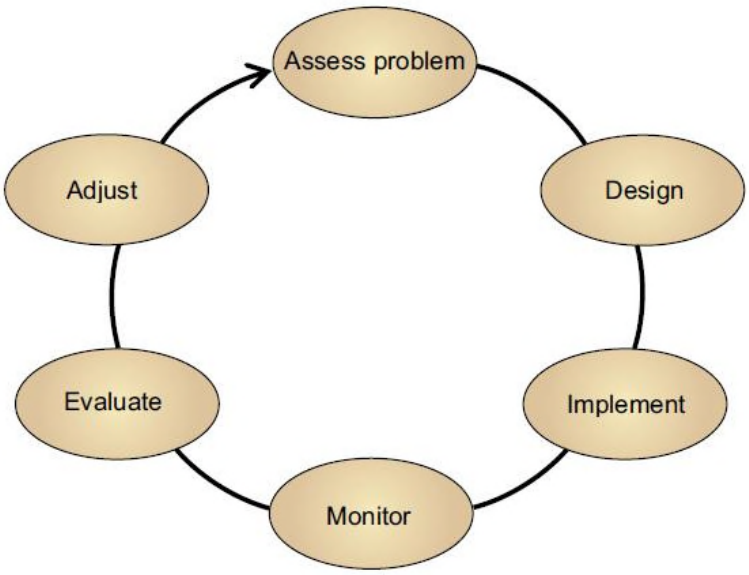


Figure 2. Adaptive Management Cycle

Each step of the AM cycle contributes to the continual reduction of uncertainty around management actions, which ultimately leads to better-informed decision-making. Following are the Collaborative Program's definitions for the AM cycle steps:

- **Assess Step**: Sets the foundation for the rest of the AM cycle by identifying critical uncertainties about how a system functions. As the starting point for a new learning cycle, this step also involves consolidating, synthesizing, and incorporation information from previous cycles. Most importantly, assessment places scientific findings in the context of management and recovery objectives.

- **Design Step**: Alternative hypotheses are formulated around the critical uncertainties identified during assessment. Studies are designed to address these hypotheses as they relate to management decisions, thus increasing their relevance to Collaborative Program goals. Robust study designs to test hypotheses ensure economical use of money, time, and labor.
- **Implement Step**: Scientific activities are resourced and executed. Importantly, the Collaborative Program cannot implement or direct activities. Individual signatories and MRG stakeholders are responsible for carrying out scientific activities.
- **Monitor Step**: Monitoring is also implemented outside of the Collaborative Program and is defined as the systematic observation and documentation of responses (e.g., species population metrics, habitat quality) to management actions. Long-term monitoring and research strictly follows standardized data collection protocols to evaluate trends over time. Short-term monitoring aims to compare a response to an acute modification to that of an established baseline.
- **Evaluate Step**: Collected data are analyzed and synthesized in order to learn from new findings. Investigators document how listed species respond to changing conditions in a system, both natural and anthropogenic.
- **Adjust Step:** Modifications to management actions and AM decision tools (Section 4) are recommended based on what was learned. New scientific evidence are added to the knowledge base to reduce uncertainty and enhance understanding of the system and its species. Re-assessment of objectives is advisable following substantial changes to the knowledge base, but is not required with each iteration.

The specific steps required to complete an iteration of the AM cycle vary depending on a variety of factors, including the ecosystem of focus, the spatial and temporal scale of the management problem, the management options, the regulatory landscape, the species of interest, and stakeholder engagement. Adaptive management is a continuous learning process that increases the value of Collaborative Program products by subjecting them to a rigorous scientific process. The resulting products are designed to improve decision-making in management of the MRG. Documenting each iteration of the AM process tracks decision-making, ensuring that accumulated knowledge is incorporated into future decisions and choices are refined.

Adaptive management is useful to natural resource managers because of its use of structured decision-making to facilitate iterative learning. Structured decision-making ensures that a problem is decomposed into smaller, more manageable questions, each of which is addressed with a transparent, replicable, hypothesis-driven approach (Conroy and Peterson 2013). Martin et al. (2009) proposes that iterative learning is most effective when a structured decision-making process is developed and implemented under a strong science-based program.

Caplan et al. (2018) began development of just such an approach and stated that structured decision-making is a stepwise process of generating and evaluating strategies, which are organized under a shared set of clear objectives. The process enables managers to evaluate how uncertainties influence their choices and target the uncertainties with the greatest potential impact or consequence. As an iterative

form of structured decision-making, AM helps managers refine critical questions over time and allows them to focus on the "need to know" instead of "nice to know" aspects of the system they manage.

Structured-decision making has four primary components (Walters 1986, Conroy and Peterson 2013):

1. Clearly-stated, shared objectives;
2. Specific management alternatives to meet those objectives;
3. Use of decision-support models and tools to predict the effect of the alternatives; and
4. A sequential decision process (e.g., decisions through time build on previous iterations)

Under the S&AM Plan, the Collaborative Program has incorporated the above components into the fabric of its operation in three substantial ways:

1. Re-organization of the Collaborative Program's structure (Section 3), with the Science and Adaptive Management Committee (SAMC) translating and communicating scientific evidence to the EC;
2. Construction of the AM Database (Section 4.1), which stores and link goals, objectives, strategies, metrics, uncertainties, and the Project Bank (Section 4.1), to facilitate transparent prioritization of the Collaborative Program's scientific activities; and
3. Commitment to iterative learning through tracking (via the AM Database), evaluating, and incorporating scientific evidence into experimental designs, decision support tools (Section 4), and Collaborative Program objectives (Appendix D) on at least an annual basis.

2.2 Defining Adaptive Management for the Collaborative Program

The Collaborative Program S&AM Plan presents a science-based process aimed at reducing uncertainty within the MRG ecosystem relating to management of listed species. The Collaborative Program's definition of AM is stated in Box 5.

Box 5. Collaborative Program Definition of AM

> Adaptive management is a process for integrating science and learning into management under changing conditions coupled with an iterative process for producing improved systematic understanding of needs to meet the established goals.

This definition describes the Collaborative Program's understanding of its role in AM and the role of its signatories, both independently and as part of the Collaborative Program. In this definition, science and learning are posited as the central components of Collaborative Program activities. This positions science and learning as the primary tenets guiding production of the Collaborative Program's evidence-based recommendations to inform management decisions within the MRG.

3 COLLABORATIVE PROGRAM ORGANIZATIONAL AND OPERATIONAL STRUCTURES

Scientific activities take time to move through the AM cycle and require a structured, long-term planning approach. To meet the need for more intensive out-planning, the Collaborative Program's science and AM process has undergone restructuring. The resulting Collaborative Program structure promotes proactive,

thorough, and timely Collaborative Program efforts. One of the biggest changes that occurred in restructuring of the Collaborative Program is the addition of the SAMC. Activating a small, focused committee of topical experts lends to the productive translation of science into management-relevant recommendations.

The following outlines the Collaborative Program's operations and structure designed to facilitate the science and AM process. Figure 3 illustrates the hierarchical organization of the Collaborative Program, and Figure 4 depicts organizational operations under the S&AM Plan.

3.1 Organizational Structure

The EC directs the implementation of the Collaborative Program's science and AM process, which requires the formation of the SAMC and administrative groups. Under EC oversight, the SAMC is tasked with implementing the S&AM Plan. To do so, the SAMC forms and tasks Science and Technical (S&T) Ad Hoc Groups and collaborates with other Collaborative Program groups.

The EC forms Administrative Ad Hoc Groups to draft, review, and update administrative documents, such as the Collaborative Program By-Laws and Long-Term Plan. The Fiscal Planning Committee (FPC) serves as a platform for signatories to collaborate on financial and administrative resources for Collaborative Program-related scientific activities. The Program Support Team (PST), made up of the Program Manager, Science Coordinator, and supporting staff, are directed by the EC and provide administrative, scientific, and technical support to all Collaborative Program committees and groups. Details on each group's role and composition are provided in the Collaborative Program By-Laws, committee charters, and ad hoc group charges.

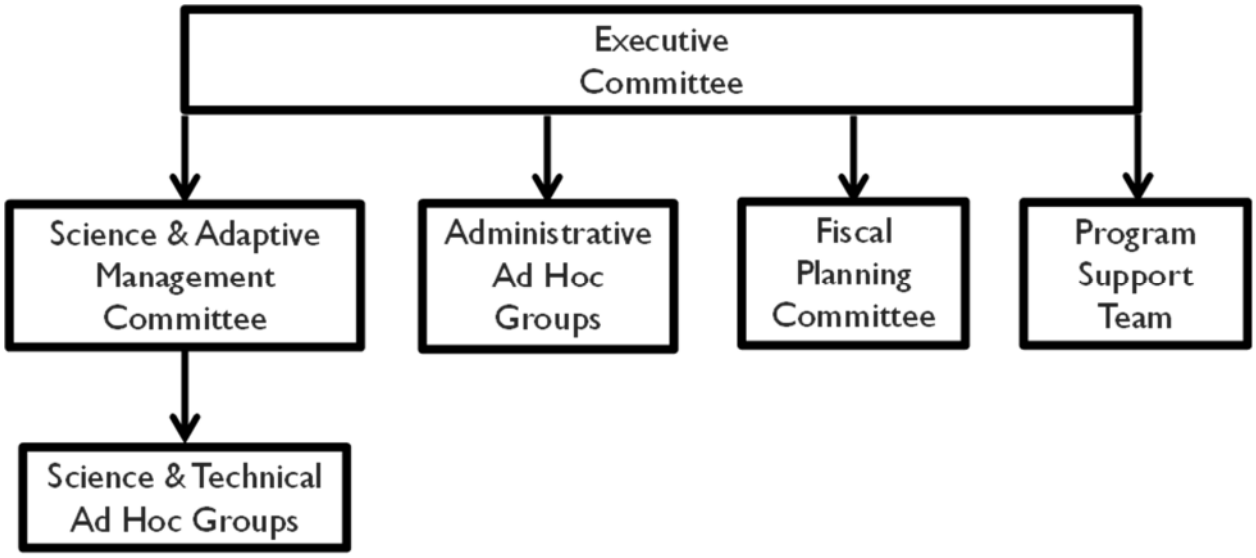


Figure 3. Collaborative Program Hierarchical Structure

3.2 Operational Structure

The Collaborative Program is structured to include three components: 1) science and technical support, 2) policy and guidance, and 3) administrative support. This operational structure takes into account the assumptions outlined in Box 3 and the Collaborative Program's role as a science-based program. Following is a general description of the responsibilities of Collaborative Program groups and their roles related to the listed components. Figure 4 illustrates communication and workflow under the S&AM Plan.

1. Science and Technical Support

Under the new operational structure, the Collaborative Program's role in the MRG is that of a science-based program providing recommendations for scientific activities and best management practices. Scientific and technical support is key to the success of the S&AM Plan. The SAMC is responsible for implementation of the S&AM Plan, with support from the S&T Ad Hoc Groups and PST, and in coordination with the EC and FPC. Specifically, the SAMC's responsibilities include:

- Forming S&T Ad Hoc Groups charged with addressing specified scientific uncertainties;
- Tasking S&T Ad Hoc Groups with work such as data analyses, study plan development, and model updates in support of the S&AM Plan;
- Compiling the results of S&T Ad Hoc Group analyses, and translating them into recommendations for scientific activities and best management practices;
- Communicating with the EC on the progress of the S&AM Plan efforts, including a summary of modifications to Collaborative Program objectives and tools with scientific justifications;
- Communicating recommendations to the EC for consideration of next steps, which may include recommended modifications to the Long-Term Plan with scientific justifications, or recommended management alternatives with analysis and scientific justifications; and
- Following up with MRG resource managers post implementation of Collaborative Program recommendations to ensure results of implemented activities can be assessed.

The flow of information and relationships between the Collaborative Program's scientific groups is illustrated in Figure 4. As the name implies, S&T Ad Hoc Groups are formed by the SAMC to complete specific scientific and technical tasks directed at reducing uncertainty regarding species response to management actions. Lack of consensus around scientific topics will prompt the SAMC to direct internal reviews via topical executive summaries (Section 4.4), or engage independent expert reviews, with approval from the EC.

The PST also assists with the scientific and technical aspects of Collaborative Program activities. Support includes compilation and analyses of reports, data, and information; coordination with contracting agencies, Collaborative Program committees and groups, and independent external reviewers; data management oversight; and drafting, reviewing, and updating study designs, scopes of work, and other work products as necessary.

Internal and External Work Product Reviews

The Collaborative Program's committees and ad hoc groups are tasked with producing scientific and administrative work products as part of their scientific investigations and/or technical endeavors. Work products from group activities include executive summaries, proposals, project descriptions, scopes of

work, white papers, journal articles, modeling results, bibliographies, glossaries, and work plans. To ensure that work products are clear, accurate, and relevant to Collaborative Program efforts, they undergo various levels of internal and/or external review.[1] The review process is designed to be rigorous enough to ensure document quality and support a range of scientific opinions. The Collaborative Program's internal and external review processes are described below.

Internal Review

All work products from Collaborative Program committees and ad hoc groups undergo a standardized process of internal review, which may include in-group peer review, statistical review, editorial review, and contextual review. Not every work product requires the same type of internal review. For example, the intensity of a statistical review depends on the nature of the product (e.g., sampling design for an experimental protocol versus evaluation of empirical data). Additionally, some work products may require multiple rounds of statistical or editorial review. The SAMC directs all internal review processes and determines how work products will move through the review steps. The internal review process can be highly tailored to a product, which allows the degree of flexibility required for reviewing the Collaborative Program's wide array of work products.

External Review

The goal of an external review is to provide a rigorous scientific evaluation of the Collaborative Program's work from an independent perspective. External reviews are used to address and finalize specific work products that require an independent review or specialized expertise that is not available within the Collaborative Program. Previous examples of external reviews are Hubert et al. (2016), which evaluated the RGSM Population Monitoring Program, and Noon et al. (2017), which examined the state of the science pertaining to RGSM life history characteristics. The recommendations from these reviews and progress on their implementation is tracked in the AM Database. Although these efforts are highly important to the Collaborative Program, they require a high level of resources to bring about. Due to the resource intensity of planning, convening, and addressing external reviews, they are not meant to be a regular part of the AM review process.

External reviews are meant to examine foundational or big picture products or questions that would benefit from additional scientific and technical expertise. This type of scrutiny is necessary to ensure the Collaborative Program is following the most recent and prudent scientific methods, as well as to prevent institutional bias. External reviews occur infrequently on an as needed basis, as determined by the EC in collaboration with the SAMC.

2. Policy and Guidance

While the SAMC is responsible for implementation of the S&AM Plan, the EC is the Collaborative Program's decision-making body. As such, the EC provides leadership, oversight, and approval for implementation of the S&AM Plan. EC representatives provide a collective knowledge of management regulations, policies, and operations related listed species in the MRG.

[1] Section 6, Task 2.2

Under the S&AM Plan, the EC holds the following responsibilities:

1) Reviewing recommendations and deciding next steps;
2) Communicating recommendations to natural resource management organizations; and
3) Evaluating Collaborative Program activities.

A. Reviewing Recommendations and Deciding Next Steps

The SAMC provides a variety of scientific and technical recommendations for which the EC decides next steps. The FPC may also provide recommendations for financing options to implement the SAMC's recommended activities. After deliberating recommendations, the EC may:

- Determine a recommendation is feasible or not in the context of existing policy;
- Incorporate a recommended activity into the Collaborative Program Project Bank, with a documented explanation of the decision to delay implementation and a timeline for future consideration;
- Request more information or further work from the SAMC or the FPC;
- Request independent external review of information upon SAMC recommendation;
- Instruct Administrative Ad Hoc Groups to complete an update, review, or draft administrative documents; or
- Communicate recommendations directly to implementing organizations and resource managers.

B. Communicating Recommendations to Natural Resource Management Organizations

Under the S&AM Plan, the EC relays recommendations for scientific activities and science-based best management practices to the appropriate resource managers. Recommended scientific activities are categorized in the Long-Term Plan (Section 4.2) based on critical management-related uncertainties agreed on by the Collaborative Program. In addition to being a planning tool for the Collaborative Program, the Long-Term Plan can be used by resource managers to out-plan their own activities.

The EC makes recommendations on best management practices based on the current scientific understanding of species responses to conditions in the ecosystem. The Collaborative Program evaluates and adjusts its recommendations as science evolves. The EC also encourages managers to bring questions to the Collaborative Program for consideration.

C. Evaluating Science and Adaptive Management Activities

The EC annually (or more frequently at their discretion) evaluates Collaborative Program activities and committees/groups using guiding criteria. Guiding criteria include the Collaborative Program's mission, goals, and objectives. The EC assigns evaluation-related tasks to Administrative Ad Hoc Groups and the PST as appropriate. Collaborative Program activities and committees/groups are assessed based on how they address the up-to-date mission, goals, and objectives.

Outcomes of the annual EC evaluation include the following:

- Modifications to the composition of committees/groups
- Sunsetting groups
- Clarifications to committee charters or group charges

- Adjustments of timelines and deadlines
- Amendments to the S&AM Plan, Long-Term Plan, and/or by-laws
- Re-scoping work plans as necessary

3. Administrative Support

Under the Collaborative Program's hierarchical structure (Figure 2), three administrative groups exist to support the operations portion of the S&AM Plan: Administrative Ad Hoc Groups, the FPC, and the PST. The EC provides direction to each group, and individual EC representatives may be tasked with participating in Administrative Ad Hoc Group and FPC meetings as necessary.

Administrative Ad Hoc Groups

The EC may task a small group of individuals with reviewing and revising Collaborative Program documents in regards to policy. For example, an Administrative Ad Hoc Group may be tasked with revising the Collaborative Program By-Laws, reviewing SAMC applications, reviewing science-backed management recommendations in a regulatory context, or with better defining a portion of the S&AM Plan or the Long-Term Plan. Administrative Ad Hoc Groups report findings and recommendations to the EC.

Fiscal Planning Committee

The FPC is composed of signatory staff appointed by the EC. At the direction of the EC, and in coordination with the SAMC, the FPC meets to determine resource availability for Collaborative Program-supported activities. The FPC recommends an implementation schedule for EC-approved activities based on funding availability and regulatory commitments. The FPC is also responsible for engaging authorized and interested signatories through lobbying efforts for funding and partnerships as directed by the EC.

Program Support Team

In addition to scientific and technical support, the PST serves as administrative support for each of the Collaborative Program's committees and groups. The PST's responsibilities include leading the development of the Collaborative Program and SAMC Annual Work Plans; data storage and Program Portal oversight; development and administration of processes and procedures; organizing and facilitating meetings; and drafting, reviewing, and editing charters, charges, and other documents as needed to support the S&AM Plan. The PST also coordinates overall Collaborative Program operations, as depicted in Figure 4.

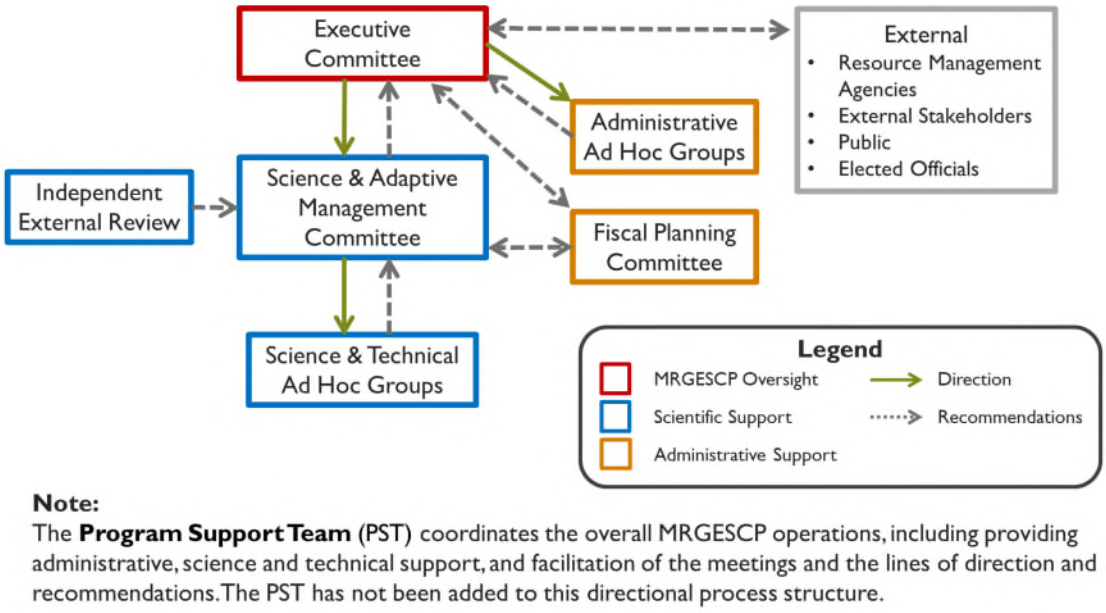


Figure 4. Communication and work flow for implementing the Science and Adaptive Management Plan.

4 TOOLS SUPPORTING THE SCIENCE AND ADAPTIVE MANAGEMENT PLAN

The Collaborative Program employs the use of several decision support, administrative, and planning tools to support the science and AM process. Below, these tools are described in regards to their relationship to the science and AM process.

4.1 Adaptive Management Database

The Collaborative Program's AM Database serves as a knowledge base that is regularly updated with new information to reflect current conditions in the MRG. The primary purposes of this information repository are to integrate Collaborative Program-supported science into system management, to evaluate past decisions, and to explore future scenarios. By linking information, such as critical uncertainties, research objectives, potential projects, management strategies, and the state of the science, the AM Database gives much-needed context to Collaborative Program participants, enabling them to prioritize research needs and inform decision-making.

The AM Database provides a means for tracking the evolution of Collaborative Program and MRG stakeholder endeavors. As a result, the tool allows the Collaborative Program to inform management of the system proactively, rather than reactively.

The AM Database informs a variety of scientific and administrative processes, including the following:

- Revision of conceptual ecological models (CEM)
- Development of the Long-Term Plan
- Tracking reduction of scientific uncertainty
- Tracking development and status of scientific activities

- Justification of funding for Collaborative Program-related efforts via links to management authorities, obligations, and species recovery plans
- Systematic reduction of scientific uncertainties related to impacts to species from management actions
- Updates to the current "state of the science" within the MRG
- Provision of broader context for scientific analyses and management alternatives
- Summary generation for annual reports
- Summary generation on agency participation in Collaborative Program efforts
- Coordination of the development and review of work products

A common theme throughout AM literature, as well as in operational documents for the Collaborative Program, is the need to align scientific uncertainties, and the research efforts addressing them, with management questions (Walters, 1986, Williams et al. 2009, Murray et al. 2011, Caplan et al. 2018). In the 2011 description of a potential AM framework for the Collaborative Program, Murray et al. listed the conditions that must be met for successful implementation of AM:

- Feasibility for conducting a test of management actions;
- Potential for learning about action effectiveness within a reasonable time frame;
- Acceptable risk from failure of those tests; and
- Flexibility to change management practices based on what is learned.

The AM Database fulfills the conditions for successful AM listed above. As a relational database, it aligns the Collaborative Program's scientific support with management objectives, scientific uncertainties, up-to-date understanding of relationships within the system, and past and current Collaborative Program efforts. This data is structured as a collection of tables linked to each other in complex ways. Users have the flexibility and control to manage and manipulate interrelated data. As the AM Database tracks learning in real time, it requires regular stakeholder engagement and enables a long-term approach to AM, two concepts that Dreiss et al. (2017) found increased the effectiveness of AM.

One important component of the relational database is the Project Bank. The Project Bank is a cumulative list of scientific activities (proposed, in progress, and competed) and their associated metadata. The list is used to track progress, justify funding, and facilitate short- and long-term planning. Proposed projects are indexed according to their relevance to Collaborative Program objectives, individual signatory authorities and obligations, and species recovery plan criteria. They are also linked to necessary conditions for implementation (e.g., hydrologic condition, presence/absence of a listed species). The Project Bank tracks development and status of projects, while facilitating transparent and objective prioritization of them. This allows the Collaborative Program's scientific pursuits to proceed in a smoother and timelier manner.

4.2 Long-Term Plan

A long-term plan is an important tool for implementing structured decision-making in AM of natural resources, as it uses clear and measurable goals to develop a vision for desired products. By breaking goals into smaller, more specific tasks, a long-term plan helps identify resources that will be needed, develop

contingencies, and prioritize along a timeline. Commitment to consistent updates makes the plan adaptive and ensures that tasks are adjusted and realigned to goals as conditions change. Providing a long-term plan with administrative schedules and deadlines facilitates the timely completion of tasks.

Development of the Collaborative Program's Long-Term Plan was guided by information in the AM Database, predominantly the Project Bank. In addition to serving as a tool for scientific planning, the Long-Term Plan informs the Collaborative Program's administrative needs (e.g., updates to science and AM decision-support tools, deadlines for work products, timetables for meaningful recommendations on management alternatives, tracking of project statuses). Using the AM Database to query priority Collaborative Program objectives and uncertainties generated a list of linked ongoing and proposed scientific activities with descriptive labels for sorting and filtering. This list helps managers prioritize activities, identify logistical concerns, and secure funding and other resources.

The Collaborative Program's Long-Term Plan provides Collaborative Program-wide context and describes the specific ways in which listed activities help meet the Collaborative Program's goals and objectives, and reduce critical scientific uncertainties related to management. Additionally, the administrative tasks needed for carrying on normal operations and fulfilling upcoming obligations within the Collaborative Program are outlined in the plan. The Long-Term Plan is assessed and adjusted regularly in order to accommodate changing operational and/or environmental conditions.

4.3 Program Portal

The Program Portal serves as a communication and administrative support tool. The tool houses the Collaborative Program's document library, datasets, event calendar, Long-Term Plan, and Geospatial Mapping Application (Section 4.5).

The Portal's event calendar is regularly updated with upcoming Collaborative Program-related events, including meetings, presentations, and symposiums. One week before meetings, calendar events are tagged with meeting minutes, agendas, and read-aheads for download.

The document database facilitates the storage and sharing of important documents. Scientific documents concerning species, hydrology, and more can be accessed using the site search function. Signatories can also access administrative documents, including meeting minutes, agendas, work plans, and charters. The document database is regularly updated with new scientific reports, meeting materials, and references works, and will continue to be developed as needs arise and new documents and/or data become available.

4.4 Topical Executive Summaries

The SAMC will direct the completion of topical executive summaries as necessary in an effort to assimilate and synthesize relevant information about a particular species or topic so that uncertainties and research questions can be identified and addressed. This exercise helps identify consensus, alternative hypotheses, and uncertainties by topic. The executive summaries will serve the following purposes:

1. Provide reference lists of relevant literature on each topic to identify and document knowledge gaps and non-consensus areas on available information;
2. Help to inform Collaborative Program recommendations for scientific activities designed to resolve key uncertainties related to listed species; and
3. Document progress in the reduction of uncertainty and provides a brief synopsis by topic to the SAMC, the EC, and Collaborative Program signatories, as necessary.

Each executive summary highlights current, relevant literature that provides evidence in support of the summarized statements. Understanding what is currently known and what remains unknown is crucial for prioritizing key scientific uncertainties and developing effective management alternatives.

The SAMC will use the executive summaries to direct activities that reduce key scientific uncertainties. These activities may include additional literature reviews, modeling exercises, monitoring activities, or field studies. Documenting progress supports the science and AM process.

4.5 Geospatial Mapping Application

The geospatial mapping application (mapper) on the Program Portal features interactive visualization tools that facilitate effective management of data resources in support of Collaborative Program goals and objectives. The map is a powerful visual aid for interagency collaboration and communication, as it allows users to examine the overlap of georeferenced data layers that are relevant to management of the MRG. The Program Portal mapper includes monitoring sites and territory boundaries for listed species, habitat restoration areas, water quality measurements, and control structures. In using the mapper, scientists and managers may discover data associations that were not discernible with non-spatial analyses.

Finding more connections, between biotic response metrics and habitat parameters in particular, improves the accuracy of models by accounting for variability in the response (i.e., reducing uncertainty). In addition, the identification of areas where critical habitat for two or more species overlaps may allow managers to focus resources more efficiently and provide enhanced justification for funding. The use of a single geospatial tool for coordination amongst Collaborative Program signatories generates an additional dimension for decision support, as new connections are revealed at multiple spatial scales. Mapping provides geographical context for activities, such as monitoring and habitat restoration, which helps demonstrate benefits to multiple species or the potential for unintended consequences. This type of information greatly enriches the AM process by directly addressing the objectives and values of the stakeholders.

4.6 Modeling Tools

A shared understanding of the system dynamics that influence decision processes allows scientific and technical experts, natural resource managers, and decision-makers to communicate why a management action was implemented and what its intended effects were. The process of documenting the current understanding of system dynamics also prevents institutional knowledge from being lost as a result of personnel turnover.

One way to document system dynamics and compare/contrast the effects of different management actions is with models. The term "models" refers to anything that provides a reasonable representation of a system that is the setting for a natural resource management problem (Williams 2011). Models can be as basic as a verbal or written description, or as complicated as a series of mathematical models.

In the framework of AM, models connect management actions with stakeholder objectives (Conroy and Peterson 2013). Models used in the AM process should be viewed as useful, albeit imperfect, tools that are subject to continuous refinement as new information becomes available. A model does not replace decision makers or the decision-making process but instead provides input into that process.

Conceptual ecological models, such as those in Appendix B and C, are useful for education and communication purposes, both internally and externally to the Collaborative Program. The Collaborative Program has four primary goals for using species-specific CEM tools:

1. Transparency around the decision-making process;
2. Communication of information;
3. Identification of critical uncertainties; and
4. Connection of management actions and objectives.

5 SCIENCE AND ADAPTIVE MANAGEMENT PLAN IMPLEMENTATION

Through the Collaborative Program's science and AM process, the Collaborative Program provides scientific and technical support to natural resource managers to inform the continual improvement of management practices for listed species. As discussed in Section 2, this process emphasizes learning from the results of scientific activities to inform management. Under the S&AM Plan, the Collaborative Program:

- Identifies critical uncertainties and develops research hypotheses to address them;
- Designs experiments to test hypotheses and reduce uncertainties;
- Evaluates new information and data gathered within the context of Collaborative Program objectives to determine what has been learned;
- Translates the scientific evidence into management-relevant, constructive, timely recommendations for scientific activities and management alternatives;
- Communicates the results of field and laboratory research, habitat restoration projects, and monitoring and modeling efforts; and
- Enables iterative learning through tracking, evaluation, and incorporation of scientific evidence into objectives and decision-support tools, such as the AM Database.

As part of the science and AM process, the Collaborative Program determines the key scientific questions on which to focus efforts within specific management categories. These categories may pertain to any of the listed species and/or the MRG system, and include, but are not limited to[2], the list in Box 5.

[2] Appendix A, Task 1.3d and 1.3e

Box 6. Management Categories

- Applied Research: Field, Laboratory
- Flow Modification
- Habitat Restoration: Research, Construction, Monitoring
- Hydrologic Modeling
- Population Management: Monitoring, Modeling, Propagation
- River Modification: In-Channel, Off-Channel
- Water Quality Management: Land Use, Monitoring

Within these categories, the Collaborative Program[3]:

1. Helps fill knowledge gaps or reduce uncertainties in order for implementing organizations to make more informed management decisions;
2. Recommends scientific activities that fill knowledge gaps or reduce uncertainties related to management actions for implementation by signatories; or
3. Evaluates management alternatives using scientific evidence.

The steps described below guided the Collaborative Program's implementation of the AM cycle (Figure 2.1). Appendix A complements these steps with a task list for implementation of the science and AM process, with the following three main tasks outlined:

1. Finalize and implement the S&AM Plan, the Long-Term Plan, and associated tools
2. Develop and agree on processes to support the implementation of the science and AM process
3. Implement the new organizational structure

Following is an outline of each AM cycle stage as it relates specifically to the Collaborative Program. Under each stage are the main steps the Collaborative Program must complete to implement and maintain the science and AM framework.

5.1 Assess Stage

A. Agree on Collaborative Program Objectives

Step 1. ***Assess objectives identified during previous efforts***

The Collaborative Program uses signatory values and species recovery expectations as a starting point for developing objectives. These AM objectives are informed by past efforts described in previous sections through a systematic assessment of each one. Evaluation of relevance, priority, and specification ensures that no work is discarded.

Step 2. ***Convene a workshop to identify objectives that guide the S&AM Plan***

As part of the workshop, signatory members evaluate and/or refine the objectives identified from Step 1; add new objectives, if needed; and identify signatory expectations regarding participation in the science and AM process. In addition to clearly defining objectives, workshop

[3] Appendix A, Task 1.3f

participants develop strategies to meet objectives and, when possible, identify metrics for success.

Step 3. ***Adopt objectives***

The SAMC summarizes the results of the workshop and communicates them to the EC for review and approval. The approved objectives address critical uncertainties and direct work within the science and AM process.

B. Identify Management Alternatives

Step 4. ***Compile and organize management actions and scientific activities***

The Collaborative Program tracks current and proposed management actions, management alternatives, and scientific activities. These lists are stored in the AM Database.

Step 5. ***Develop potential management alternatives***

The list of management alternatives developed in step 4 consists of potential actions for benefitting listed species in the MRG. The SAMC tasks S&T Ad Hoc Groups with developing new management approaches using innovative solutions, even if they are not currently feasible.

Step 6. ***Relate management alternatives to hypotheses***

Management alternatives are connected to hypotheses via the AM Database. In this way, research hypotheses link scientific uncertainties with resource management.

C. Develop Models

Step 7. ***Continue developing additional species-specific CEMs***

The Collaborative Program developed CEMs for RGSM, SWFL, and YBCU (Appendices B and C). CEMs for NMMJM and PESU are in development. The SAMC directs S&T Ad Hoc Groups to finalize the NMMJM and PESU CEMs and incorporate them into the AM Database.

Step 8. ***Additional CEM development based on identified critical uncertainties***

The Collaborative Program uses species-specific CEMs and quantitative models to depict relationships in the ecosystem. These models are developed and updated based on the current understanding of those relationships. The Collaborative Program evaluates uncertainties and their links to management, and prioritizes model improvements that clarify essential relationships. If appropriate, additional models or refinements to existing models are developed in order to depict increased precision in a particular area (e.g., hydrology, genetics).

Step 9. ***Link CEMs to management alternatives and objectives***

The SAMC tasks S&T Ad Hoc Groups with deconstructing the CEMS into individual components and connecting those components with the management alternatives and objectives identified in the steps above. This provides an initial framework for determining what management actions can be used to test hypotheses related to those uncertainties. These linkages are documented in the AM Database.

These linkages can also be used to parameterize quantitative models using the science and AM process. Quantitative tools provide and enable users to more precisely understand how specific uncertainties influence the decision-making process and management strategies.

5.2 Design Stage

D. Develop AM Planning Tools

Step 10. ***Continue developing the AM Database***

The AM Database is the platform for the Collaborative Program's science and AM process, and is regularly updated.

Step 11. ***Design scientific activities for reducing uncertainty***

The Collaborative Program develops research hypotheses to reduce scientific uncertainties that are not clarified with existing data and information. The SAMC directs the design of new scientific activities (e.g., scopes of work) to populate the Project Bank (Step 12).

Step 12. ***Populate a Project Bank***

The Project Bank contains specifics for each Collaborative Program -related scientific activity and includes connections to scopes of work, required conditions, geospatial and temporal scales, collected data, and relation to objectives and scientific uncertainties. The Project Bank is used to prioritize and generate the Long-Term Plan. As new options for reducing scientific uncertainties are developed, they are incorporated into the Project Bank.

5.3 Implementation Stage

E. Develop Administrative Tools to Support the Science and Adaptive Management Process

Step 13. ***Identification of administrative resource availability and scheduling***

The FPC develops a schedule of funding and contracting deadlines with input from signatories. The schedule is not exhaustive but notes the key deadlines for contracting and funding opportunities. This allows the Collaborative Program to coordinate on activity implementation and fundraising efforts.

The FPC collaborates on leveraging signatory resources for Collaborative Program activities. These resources may be financial, personnel-related, administrative (e.g., administering contract, accepting grant money), or operational (e.g., laboratory space, equipment). This streamlines the FPC's efforts in identifying opportunities for funding and/or partnerships.

Step 14. ***Refine the Long-Term Plan***

The Long-Term Plan is modified in response to changing administrative constraints and/or Collaborative Program objectives. The AM Database documents these changes and tracks the status of funded projects in real time, thus facilitating out-planning and evaluation of projects.

5.4 Monitor Stage

F. Continue supporting monitoring efforts

Step 15. ***Support monitoring efforts***

The Collaborative Program supports ongoing long-term monitoring and data collection efforts. These datasets establish trends through time, inform future scientific activities, and are key inputs into quantitative models. The Program Portal houses the datasets as appropriate.

5.5 Evaluate Stage

G. Establish the Current State of the Science

Step 16. ***Analyze existing data***

The Collaborative Program has amassed a large amount of information on the MRG system and its listed species. The SAMC, or the assigned S&T Ad Hoc Group(s), continue to refine understanding of system interactions. Consequently, new data pertaining to species life histories and relationships to management implications, as well as existing data is used to inform hypotheses identified in the previous steps.

Step 17. ***Identify uncertainties and develop hypotheses***

As described above, the CEMs indicate uncertainty associated with biotic responses to certain environmental variables. If an uncertainty is linked to a Collaborative Program objective, the SAMC or assigned S&T Ad Hoc Group(s) first dissects the uncertainty into responses, drivers, individual questions, and hypotheses, then links the components to management alternatives, data resources, and the Project Bank. After, the SAMC tasks S&T Ad Hoc Group(s) with developing scientific activities around the identified research hypotheses.

Step 18. ***Draft topical executive summaries***

When there is non-consensus on the state of the science around a topic, the SAMC tasks an S&T Ad Hoc Groups with drafting an executive summary that synthesizes relevant literature and provides evidence in support of alternative hypotheses.

5.6 Adjust Stage

H. Incorporate New Findings

Step 19. ***Communicate new scientific findings***

The S&AM Plan and its associated tools are specifically designed to improve communication within the Collaborative Program. The SAMC translates scientific results into coherent, management-relevant recommendations for the EC. The Program Portal and AM Database supplies scientists and managers with a common set of facts from which to initiate discussions. Signatory members and other experts communicate research findings at the Science Symposium, after which, the SAMC or an assigned S&T Ad Hoc Group compiles and evaluates new scientific evidence as it relates to Collaborative Program objectives. Additionally, formal documentation of study results in peer-reviewed journals strengthens recommendations generated by the Collaborative Program.

Step 20. ***Incorporate results of data analyses into Executive Summaries and models***

When new information is generated, through data analysis, modeling, or literature reviews, the SAMC evaluates it within the broader context of the management landscape and state of the science. Research findings that improve on the understanding of species-system interactions are documented in the CEMs, quantitative models, and executive summaries.

Step 21. ***Document the learning process***

When incorporating new scientific evidence, the Collaborative Program asks the following questions:

- Is the evidence supported and durable?

- Did we learn enough to justify a change to a model?
- Did we learn enough to modify a Program objective?

The SAMC evaluates whether there is sufficient evidence to modify the CEMs, quantitative models, and/or Collaborative Program objectives, and periodically reports to the EC on the state of the science.

Step 22. ***Update the Long-Term Plan***

As changes are made in steps 1 through 21, adjustments to the Long-Term Plan may be necessary. The SAMC utilizes the AM Database to track changes.

Table 3. Linking the Collaborative Program's Adaptive Management Cycle Steps to the Tasks Associated with Implementation of the Science and Adaptive Management Plan

Steps to Implement the Collaborative Program AM Cycle (Section 5)	Tasks to Implement the S&AM Plan (Appendix A)
ASSESS STAGE	
A. Agree on Collaborative Program Objectives	
Step 1. Assess objectives identified during previous efforts	Task 1.3a
Step 2. Convene a workshop to identify objectives that guide the S&AM Plan process	Task 1.3b
Step 3. Adopt objectives	Task 1.3c
B. Identify Management Alternatives	
Step 4. Compile and organize management actions and scientific activities	Task 1.3d
Step 5. Develop potential management alternatives	Task 1.3e
Step 6. Relate management alternatives to hypotheses	Task 1.3f
C. Develop Models	
Step 7. Continue developing additional species-specific CEMs	Task 1.2a
Step 8. Additional CEM development based on identified critical uncertainties	Task 1.2b
Step 9. Link CEMs to management alternatives and objectives	Task 1.2d
DESIGN STAGE	
D. Develop Adaptive Management Planning Tools	
Step 10. Continue developing the AM Database	Task 1.3
Step 11. Design scientific activities for reducing uncertainty	Task 1.3o
Step 12. Populate a Project Bank	Tasks 1.3n and 1.3o
IMPLEMENTATION STAGE	
E. Develop Administrative Tools to Support the Science and AM Process	
Step 13. Identification of administrative resource availability and scheduling	Task 1.5
Step 14. Refine the Long-Term Plan	Task 1.6
MONITOR STAGE	
F. Continue supporting monitoring efforts	
Step 15. Support monitoring efforts	Task 1.1
EVALUATE STAGE	
G. Establish the Current State of the Science	
Step 16. Analyze existing data	Task 1.3i
Step 17. Identify uncertainties and develop hypotheses	Tasks 1.3g, 1.3h, 1.3j
Step 18. Draft topical executive summaries	Task 1.3k
ADJUST STAGE	
H. Incorporate New Findings	
Step 19. Communicate new scientific findings	Task 4.3
Step 20. Incorporate results of data analyses into Executive Summaries and models	Task 1.7
Step 21. Document the learning process	Task 1.8
Step 22. Update the Long-Term Plan	Tasks 1.6 and 1.7

6 GLOSSARY

Adaptive Management: A rigorous approach for designing and implementing management actions to maximize learning about uncertainties that affect management decisions. It involves synthesizing existing knowledge, identifying uncertainties with management relevance, and developing hypotheses related to those uncertainties. The process then calls for exploring management alternatives to test hypotheses, making predictions of their outcomes, selecting one or more actions to implement, and conducting monitoring and research to see if the outcomes match those predicted. The results are used to learn and adjust future management and policy.

Adaptive Management for the Collaborative Program (2018): Effective environmental management in the face of uncertainty by integrating science and learning into effective management under changing conditions coupled with a cyclic strategy producing improved systematic understanding of needs to meet the established goals.

Management Alternatives: Includes possible management actions that can be taken given the environmental and funding conditions at the time. "No action" is always an alternative. The Collaborative Program explores and compares the performance of management alternatives available to MRG managers.

Management Relevance: When an uncertainty has management relevance, activities performed to reduce that uncertainty will inform management of a system. The results of these activities enable managers to compare the performance of management alternatives in meeting stated objectives. Uncertainties without management relevance may limit understanding of system behavior, but have low to no impact on management decisions.

Scientific Activities: The collective of studies, projects, data collection, monitoring, and experimentation.

Uncertainties: Gaps in knowledge of a system; indeterminate or inexact understanding of a system state or feature in natural resource management. Being uncertain is not the same as knowing nothing. The Collaborative Program will work to reduce uncertainties that have management relevance as this practice enables natural resource managers to compare the performance of management alternatives in meeting stated objectives.

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Appendix A. Science and Adaptive Management Plan Implementation Task List

Table A1. Science and Adaptive Management Plan Implementation Task List

Tasks	Responsible Group(s)					
	EC	SAMC	AAH	FPC	S&T	SIG
1. FINALIZE AND IMPLEMENT THE SCIENCE & AM PLAN, THE LONG-TERM PLAN, AND ASSOCIATED TOOLS						
1.1 Support data collection efforts						
1.1a Provide statistical reviews of sampling designs		X			X	
1.1b House collected datasets on the Program Portal as appropriate		X				
1.2 Continue developing and refining CEMs						
1.2a Develop and refine the NMMJM and PESU CEMs					X	X
1.2b Continuous refinement of the RGSM, YBCU, and SWFL CEMs as appropriate					X	
1.2c Training to use the CEMs for each species		X			X	
1.2d Link CEMs to management alternatives and objectives		X				
1.3 Populate the AM Database with the following:						
A. Objectives						
1.3a Assess the objectives identified during previous efforts		X				
1.3b Convene workshop to: • Solicit signatory values to inform development of the objectives • Assess and refine preliminary objectives • Identify additional objectives as needed • Develop strategies for each objective • Determine and define any metrics		X				X
1.3c Review and adopt the objectives	X					
B. Management Alternatives						
1.3d Compile and categorize management alternatives		X			X	
1.3e Identify additional management alternatives		X			X	
1.3f Link management alternatives and MRGESCP objectives		X				
C. Scientific Uncertainties and Hypotheses						
1.3g Review and update compiled list of scientific uncertainties		X			X	
1.3h Determine which scientific uncertainties are reducible		X			X	
1.3i Determine which reducible scientific uncertainties can be addressed using existing data		X			X	
1.3j Define alternative hypotheses for reducible uncertainties		X			X	
1.3k Develop Executive Summaries for uncertainties for which there is non-consensus about hypotheses • Summarize the available literature • Note areas of agreement • Provide alternative hypotheses • Identify knowledge gaps					X	

Table A1. Science and Adaptive Management Plan Implementation Task List

Tasks	Responsible Group(s)					
	EC	SAMC	AAH	FPC	S&T	SIG
1.3l Link hypotheses to MRGESCP objectives, management alternatives, and recovery goals		X				
1.3m Identify limiting factors for addressing a hypothesis, for example: • Preliminary studies • Specific river conditions necessary • Documented presence of species • Technology/equipment needs • Financial resources • Regulatory or political constraints		X		X		
D. Scientific Activities						
1.3n Compile existing scientific activities (e.g., project ideas list, annual reports), assign a status, and link to hypotheses (i.e., Project Bank)					X	
1.3o Develop new scopes of work to address the alternate hypotheses and knowledge gaps for inclusion into the Project Bank					X	
1.4 Operationalize the AM Database						
1.4a Training on the use of the AM Database		X		X	X	X
1.5 Develop an administrative schedule, for example: • Signatory funding deadlines • Administrative deadlines • Recovery plan five-year reviews				X		X
1.6 Populate the Long-Term Plan Using the AM Database and the Project Bank						
1.6a Use the AM Database to rank scientific activities based on relevance to management alternatives, MRGESCP objectives, and feasibility		X				
1.6b Deliberate on the SAMC's scientific activity suggestions to incorporate into the Long-Term Plan for recommendations to implementing organizations	X					
1.6c Review the Long-Term Plan and incorporate recommendations into individual signatory out-planning						X
1.7 Reevaluate MRGESCP objectives and tools in light of scientific findings						
1.7a Synthesize analyses and conclusions into evidence-based recommendations for management alternatives		X				
1.7b Review the Long-Term Plan and incorporate recommendations into individual signatory out-planning						X
1.7c Update tools with new scientific findings as necessary					X	
1.8 Provide regular progress reports to the EC						
1.8a Quarterly progress reports		X				
1.8b Annual science and AM report		X				

Table A1. Science and Adaptive Management Plan Implementation Task List

Tasks	Responsible Group(s)					
	EC	SAMC	AAH	FPC	S&T	SIG
2. DEVELOP AND AGREE ON PROCESSES TO SUPPORT THE IMPLENTATION OF THE SCIENCE & AM PLAN AND THE LONG-TERM PLAN						
2.1 Revise the scope of work process to incorporate the Science & AM Plan elements		X				
2.2 Refine the peer review process, including both internal reviews and external reviews			X			
2.3 Refine the topical Executive Summary process		X				
2.4 Develop a process for supporting signatory resources and efforts (i.e., lobbying, funding, letters of support)			X			
3. IMPLEMENT THE NEW ORGANIZATIONAL STRUCTURE						
3.1 Clarify signatory expectations under the MRGESCP's science and AM process, for example: • Annual report • Cost share	X					X
3.2 Sunset all existing work groups and incorporate any ongoing work into the charges and charters of new committees and groups under the new structure	X					
3.3 Identify the tasks to be completed as relates to the science and AM process, and draft S&T Ad Hoc Group charges to complete the tasks		X				
3.4 S&T Ad Hoc Group(s) convene to complete charge(s)					X	
3.5 Update the By-laws to reflect the new organizational structure and governance	X		X			
3.6 Draft and adopt a new MOA	X		X			
4. COMMUNICATION						
4.1 Science						
4.1a Hold Brown Bags						X
4.1b Host Science Symposium		X				
4.1c Topical Executive Summaries					X	
4.1d Peer-reviewed publications						X
4.2 Recommendations to resource managers						
4.2a Deliberate on SAMC findings and make final evidence-based recommendations on best management practices	X					
4.2b Make recommendations on scientific activities for implementation	X	X				
4.3 MRGESCP Communication						
4.3a Update and maintain the Program Portal	Program Support Team in coordination with the MRGESCP					
4.3b Distribute bi-monthly MRGESCP newsletter						
4.3c Participate in community outreach						

Appendix B. Rio Grande Silvery Minnow Conceptual Ecological Model

RIO GRANDE SILVERY MINNOW LIFE HISTORY

The RGSM is a small-bodied member of the Cyprinid family, native to the Rio Grande basin. The RGSM once occurred throughout the Rio Grande Basin from the MRG (Rio Grande Reaches found in New Mexico) all the way to the Gulf of Mexico. Historically, it was also found in important tributaries such as the Rio Chama, Jemez River, and Pecos River (Sublette et al. 1990, Bestgen and Platania 1991, Horwitz et al. 2018). Currently, the RGSM only occupies approximately seven percent of its historic range (USFWS 2010, Mortensen et al. 2019). The majority of the current population is found in the 280km reach of the MRG between Cochiti Dam and Elephant Butte Reservoir, with a much smaller, experimental population introduced into a small portion of the Rio Grande near Big Bend, TX in 2008. Limited natural reproduction occurs within the MRG population, however the Big Bend population is not thought to be self-sustaining at this time (USFWS 2008, Edwards 2017). The contraction of the RGSM's range is mostly attributed to modifications in hydrology as a response to anthropogenic changes in water use and storage in the basin (USFWS 2016, 2018). The loss of RGSM habitat and the overall decline in abundance ultimately resulted in the species being listed as endangered under the ESA in 1994.

The life history for the RGSM is typical of similar small-bodied, riverine cyprinids that occupy lowland floodplain rivers of Western North America (Platania et al. 2020). Spawning begins in the spring during the freshet, just prior and during peak flows (typically mid-April to mid-May). The exact mechanism that initiates spawning is still unknown, but it is likely related to hydrologic and temperature cues (Dudley et al. 2018, USFWS 2018). RGSM are broadcast spawners and highly fecund; a single female may produce anywhere from 2,000 to 10,000 eggs (Caldwell et al. 2019). Eggs become semi-buoyant after fertilization and drift downstream while they incubate. Eggs incubation typically lasts for 24 to 48 hours and is highly temperature dependent (Platania 2000). The spawning strategy of the RGSM depends on reliable flows that are able to disperse eggs and larvae into slower moving, overbank and floodplain nursery habitats (Gonzales et al. 2014). Larvae hatch from their eggs at only 4mm standard length (SL) and on average, become free swimming four days later once they reach 5-10mm SL. Larvae are gape limited and known to eat algae, diatoms, small invertebrates, cyanobacteria, detritus, periphyton, seeds and pine pollen (Shirey et al. 2008, Magana 2009, Watson et al. 2009, Bixby and Burdett 2014). The larval life stage lasts until mid-July when they transition to juveniles (13-64 mm SL).

Juveniles primarily occupy in-channel habitats as floodplain habitats begin to recede with declining freshet flows. These habitats are notably deeper and in faster waters compared to larval habitat. Juvenile RGSM have a similar diet to that of larvae, as RGSM tend to be generalists. During the summer, it is common for portions of the MRG to dewater, leading to fragmentation of suitable RGSM habitats. When dewatering occurs, RGSM experience high levels of mortality due to a lack of suitable available habitat and stranding. Juveniles continue to grow through the summer and fall before transitioning into adults (35-90 mm SL) beginning in December.

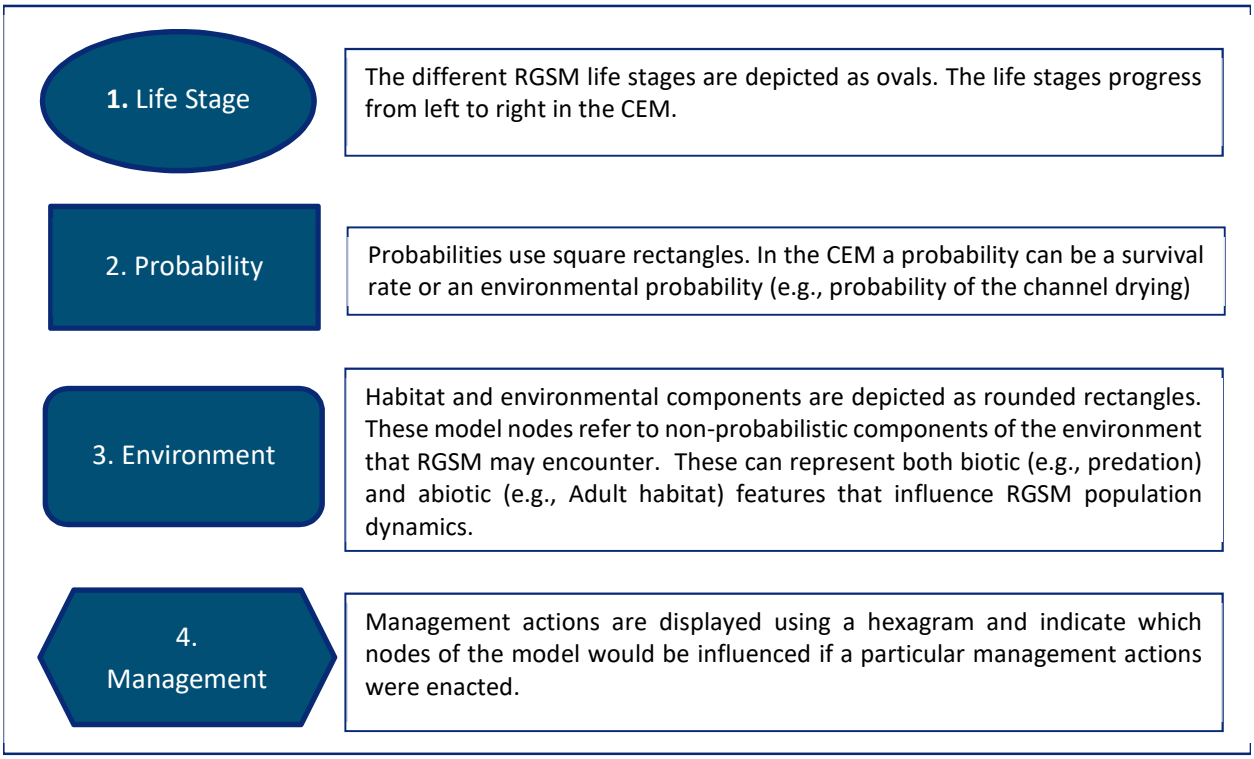
Adults have almost identical habitat use and diet as juveniles. During the winter RGSM occupy deeper, slower habitat with adequate cover where they can conserve energy (Platania and Dudley 2003). Sexual

maturity is often achieved in less than 12 months, thus fish hatched in the previous spring are able to contribute to the population during the following spawning season. The typical life span of RGSM in the MRG is two years, however individuals as old as five years have been observed (Dudley et al. 2018, Horwitz et al. 2018).

CONCEPTUAL ECOLOGICAL MODEL DESCRIPTION

The RGSM CEM describes and depicts the life history of RGSM and all the biotic and abiotic factors of the MRG that influence the RGSM population. With that in mind, a graphical representation of the RGSM life cycle was developed as the basis for the model (Figures 6 and 7). The CEM is a variation of an influence diagram, which documents relationships between model components using arrows. There are four types of model components in this CEM, each is presented by a different shaped node as shown in Box B1.

Box B1. Rio Grande Silvery Minnow Conceptual Ecological Model Components (Nodes)



Each CEM node is connected to at least one other node using arrows. The direction of the arrow indicates the direction of the influence in the relationship and flow of information. All arrows are unidirectional, meaning a single arrow can only represent a single relationship. The thickness of the arrow represents the importance that the parent node (origin) has on the child node (destination; Figure B2). The color of the arrow indicates the current level of understanding of that relationship as shown in Table B1. Black arrows in the model indicate life stage transitions.

Table B1. Arrows of Influence and Understanding Depicted in the Rio Grande Silvery Minnow Conceptual Ecological Model

Level of Understanding	Importance of Parent Node to Child Node	Understanding of Relationship
High		
Medium		
Low		

COMPONENT GROUPS

Ten categories that all the current model components fall under were defined to determine general patterns in the understanding of the factors that influence the RGSM. These categories also allow a focus on specific areas of future study. They are defined in Table B2.

In general, the CEM follows the life history of RGSM from adults in time step t, to adults in time step t+1. The CEM moves from left to right as adults in time step t spawn to create eggs, which then progress as larvae, juveniles, and finally adults in the next time step (t+1). Mortality is applied between each time step in the form of survival probabilities. Survival probabilities are informed by various child nodes in the lower portion of the model. A full description of each individual model component can be found in Table B3.

Table B2. Rio Grande Silvery Minnow Conceptual Ecological Model Component Groups

1. Life History	Life history nodes are either RGSM life stages or population vital rates. These components are the end points for most of the other components in the model and comprise the RGSM life cycle.
2. Food Availability	Food availability nodes represent food availability for the RGSM at its three different feeding life stages: larval, juvenile, and adult. Food availability directly influences age-specific survival rates.
3. Predation	Predation nodes represent the three most common predator categories: fish, avian, and invertebrate. RGSM are prey to a variety of other species in the MRG, and predation rates directly influence RGSM age-specific survival.
4. Hydrology	Hydrology is a large node because of its large influence and interconnectedness on the system. It influences the RGSM life cycle in the form of temperature, flow, and floodplain inundation. Most hydrologic components are related to flow (Q).
5. Geomorphology	Geomorphic nodes reflect the processes that shape the physical shape and environment of the river. These processes determine sediment scouring/deposition, overall river geometry, and other river hydraulics.
6. Habitat	Three types of habitat occupied by RGSM are defined as: larval, juvenile, and adult. In general, RGSM use a wider range of stream velocities and depths as they grow from larvae to adults. Habitat availability may directly influence age-specific survival rates.
7. Vegetation	Vegetation nodes refer to the diversity and density of vegetation that exists in the floodplains and main channel of the MRG. Vegetation helps determine floodplain inundation and overall river geometry.
8. Disease and Parasites	Hydrology is a large model component grouping because of its large influence and interconnectedness on the system. It influences the RGSM life cycle in the form of

	temperature, flow, and floodplain inundation. Most hydrologic components are related to flow (Q).
9. Genetics	The level of genetic diversity is the only model component in this grouping. Genetic diversity is informed by the density of adults present in the system and influences overall fecundity.
10. Photoperiod	The photoperiod model component may be a spawning cue and may only influences fecundity. Photoperiod is the change in the amount of daylight through the year.

CONCEPTUAL ECOLOGICAL MODEL SCALE

This CEM assumes specific spatial and temporal scales. Spatially, the extent of this model includes four reaches of the MRG, with a grain size equal to four separate reaches. This scale also means the model is spatially implicit at resolutions finer than reaches listed above. For example, fish occupying different parts of the same reach are assumed to experience the same mortality rates and have same access to habitat. The Northern Reach was described in Section 1.3 and shown in Figure 1 of the Science & AM Plan was excluded from the spatial scale of this CEM as RGSM do not exist in the Northern Reach. For the purposes of understanding the RGSM CEM spatial scale, the four reaches have been defined in Section 1.3 of the Science & AM Plan.

The current format of the CEM only depicts the direction, importance, and the current level of understanding of each relationship between model components. At this time, it is not possible to identify specific mechanisms for each relationship defined in the CEM. However, this model is intended as a tool to help managers and stakeholders identify the components and relationships that are most influential to the management of RGSM.

Temporally, the model operates with an annual time step. Although much of the biology of the RGSM occurs as finer spatial and temporal scales, little monitoring is done in order to build a useful system-wide model that can operate at those fine resolutions (e.g., 10km reaches or at a daily time step). The scale was chosen to reflect the current monitoring methods and population dynamic modeling efforts. The collection of transition schematics (Figures B1) were used to derive the graphical model (Figure B2).

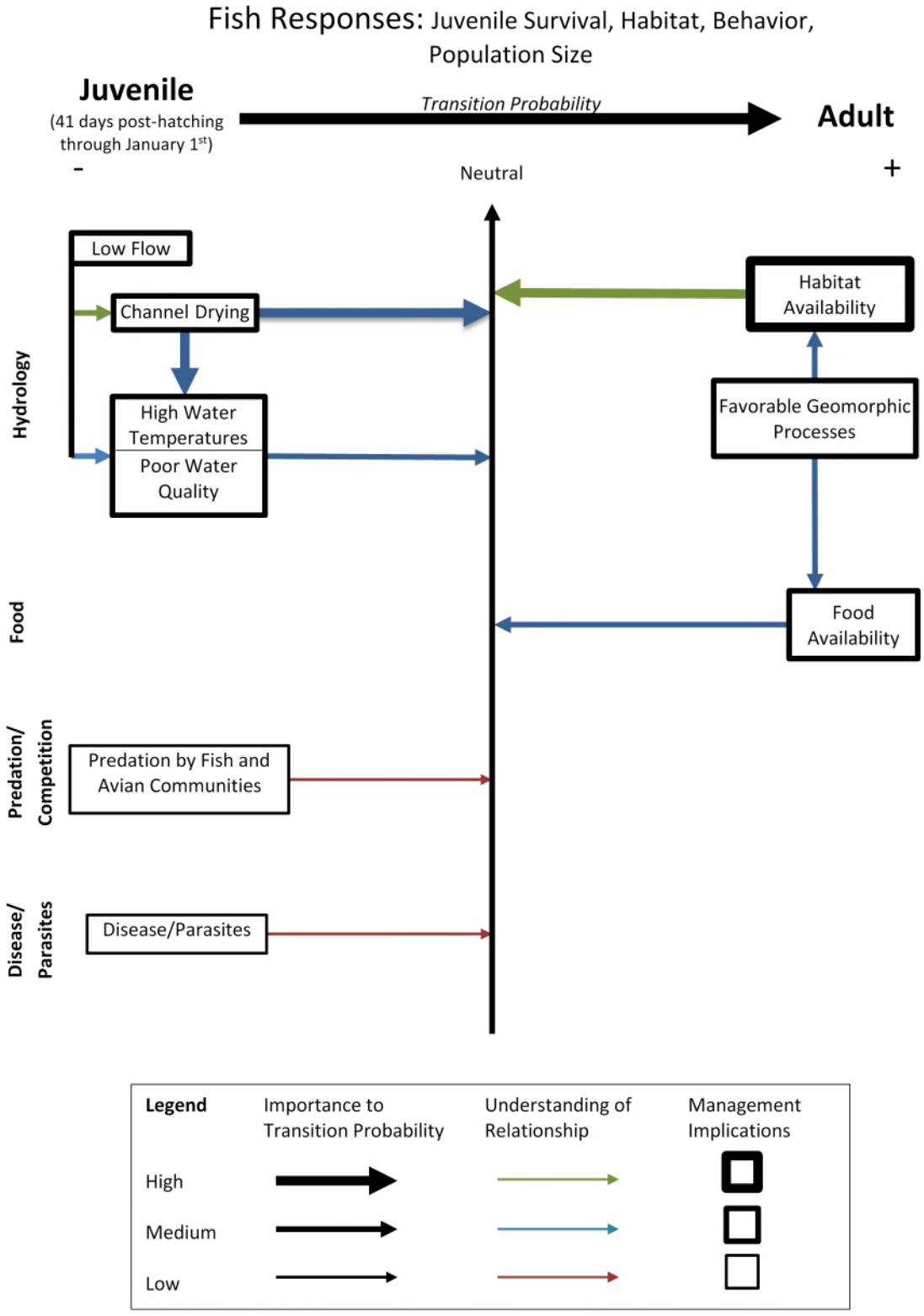


Figure B1. Rio Grande Silvery Minnow Life History Transition Schematics.

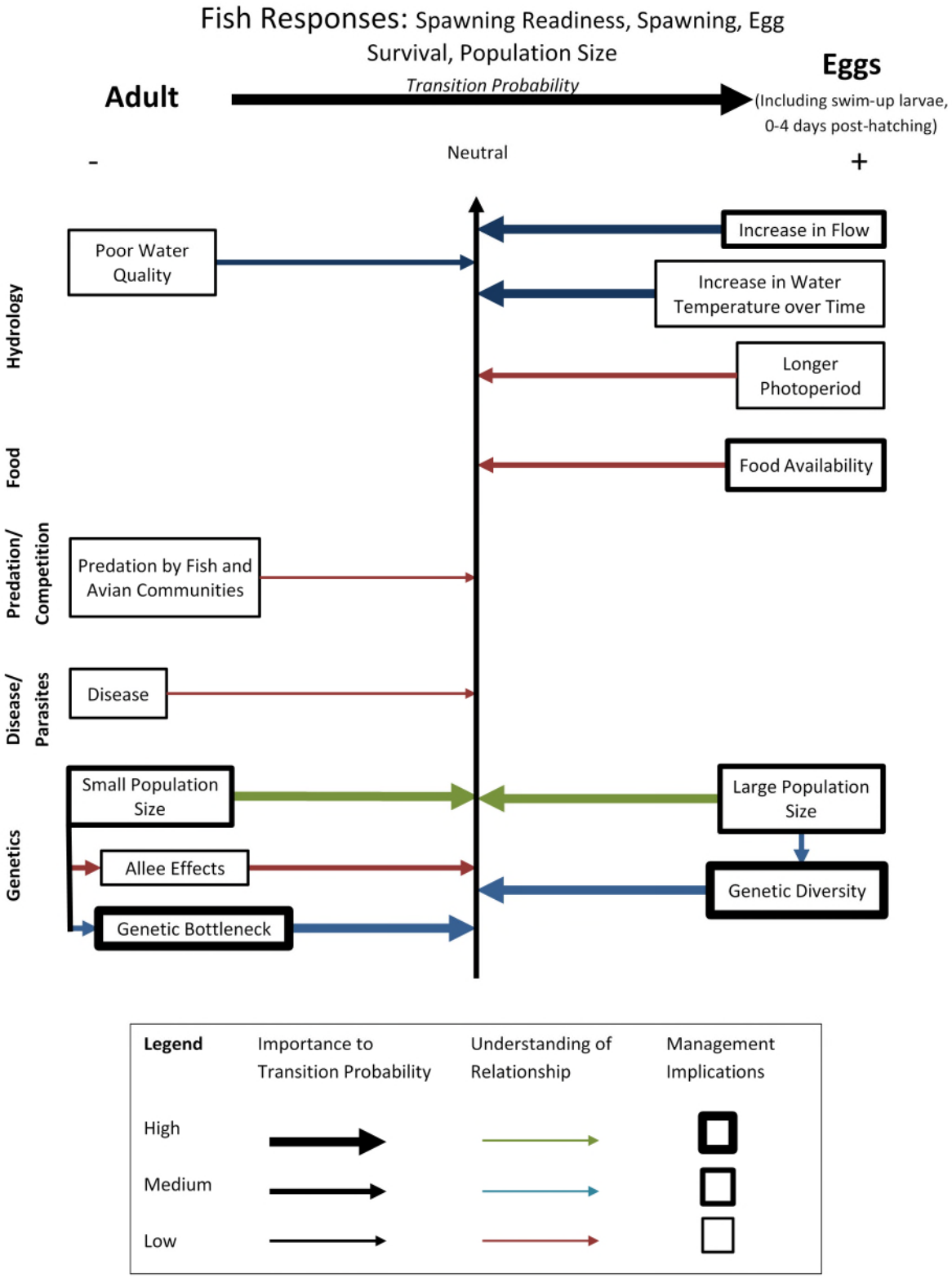


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

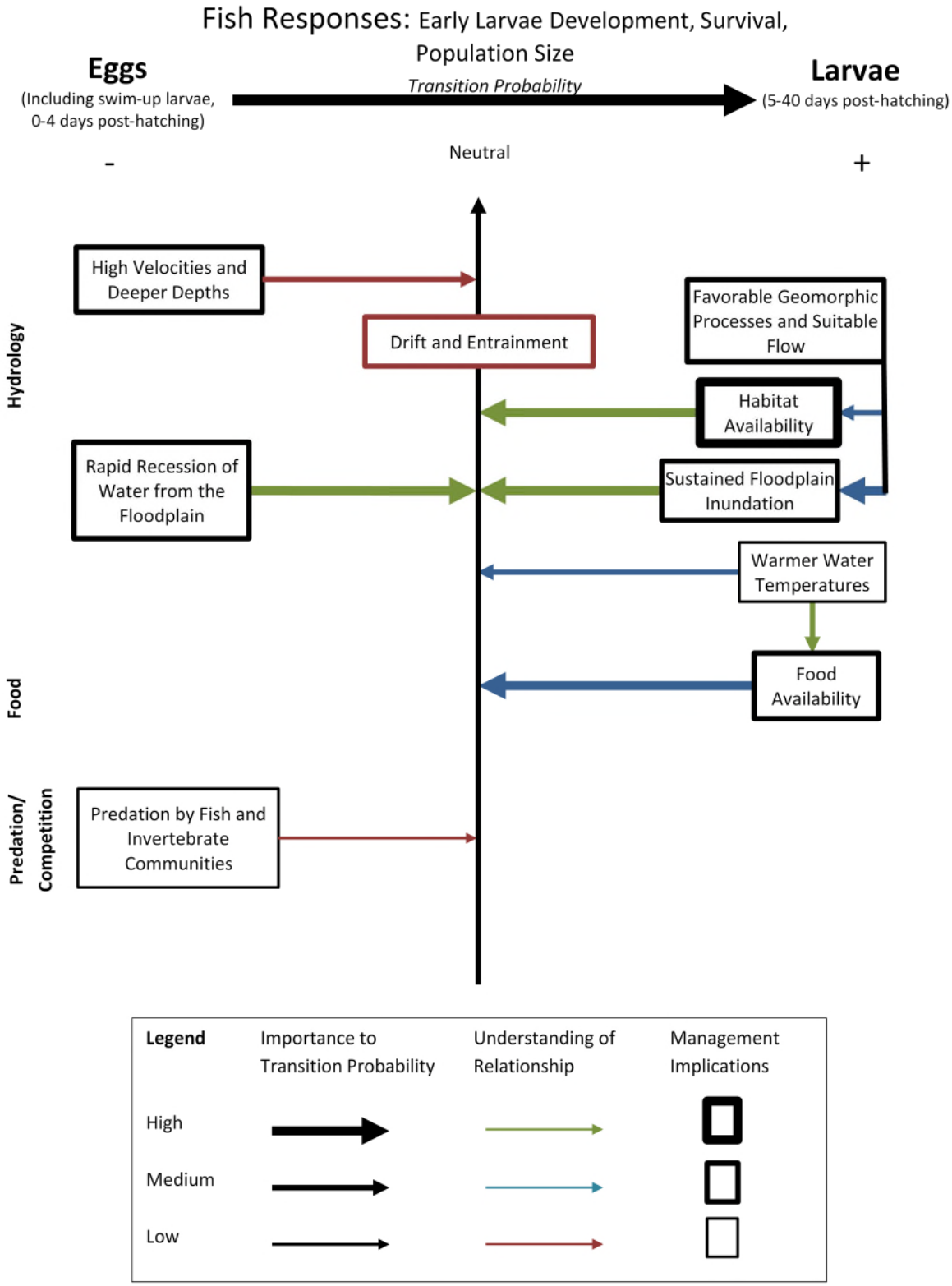


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

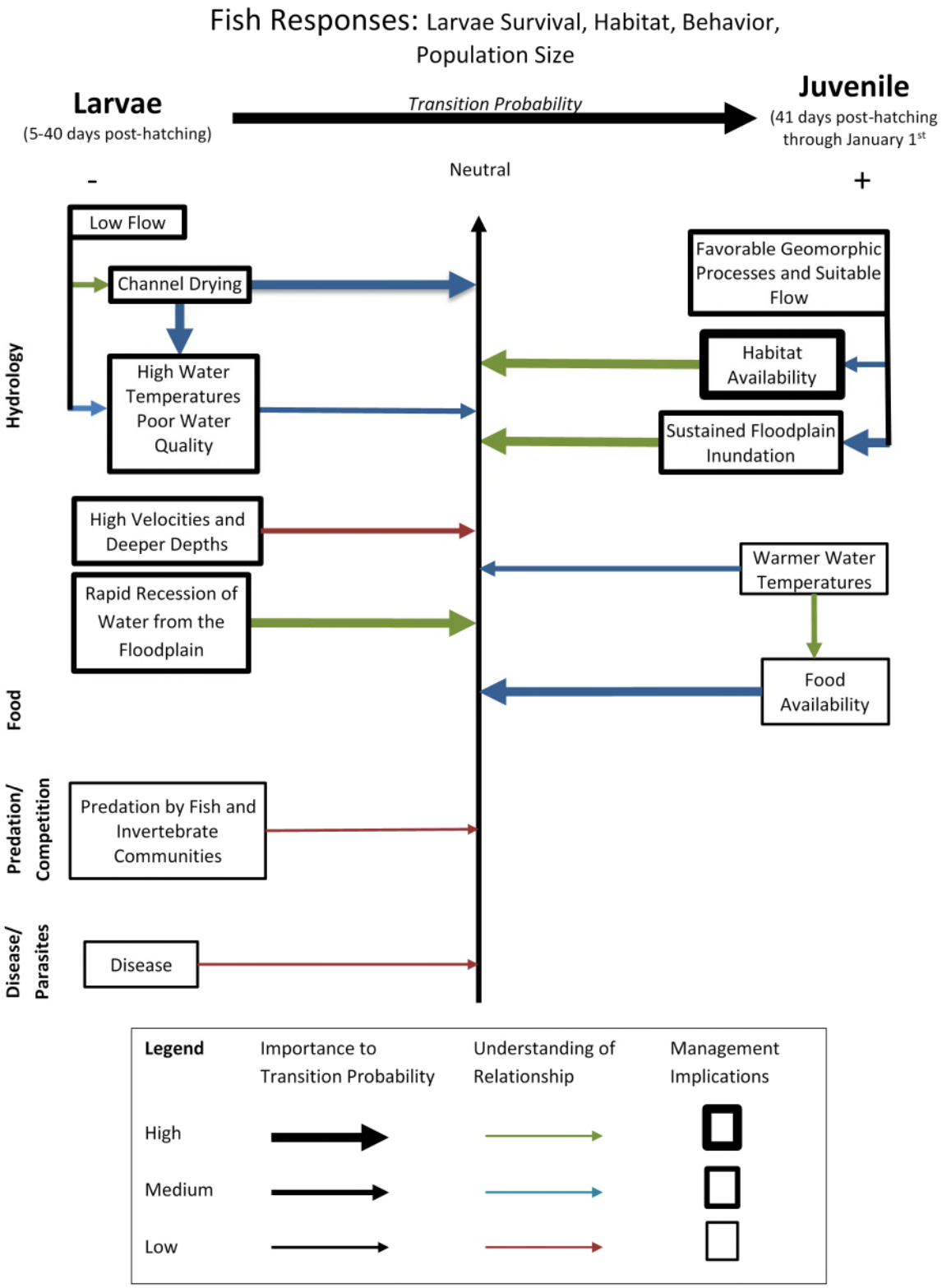


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

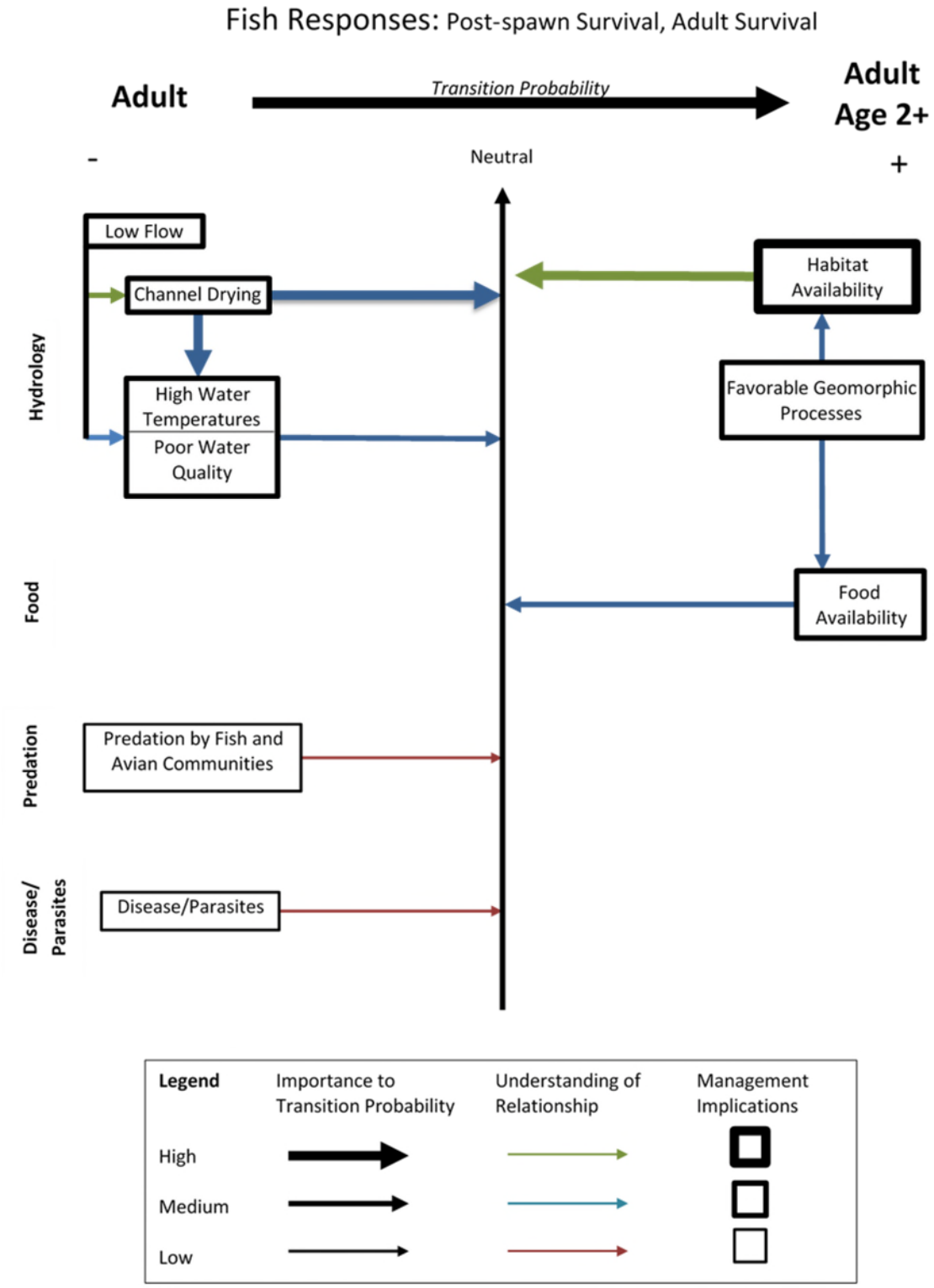


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

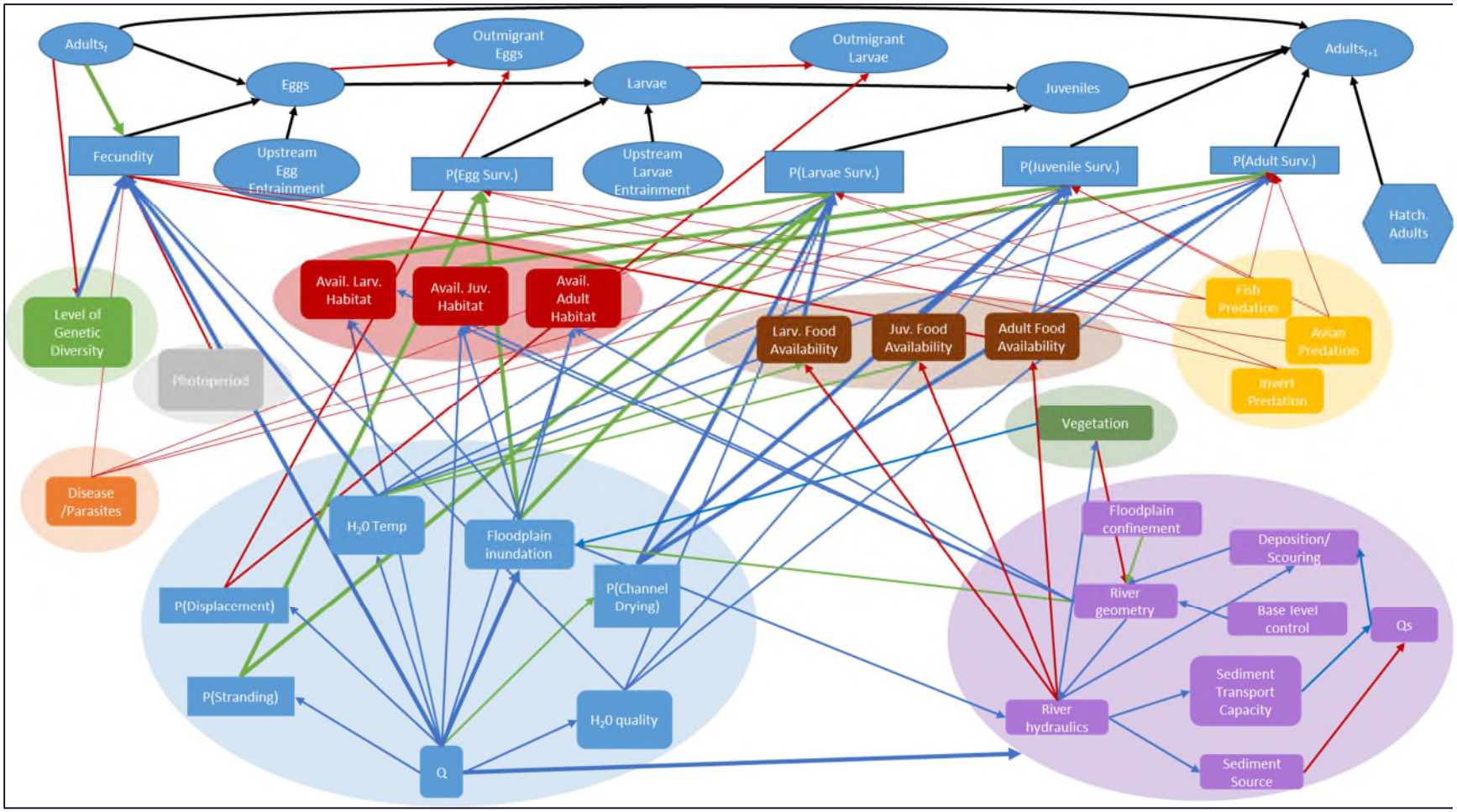


Figure B2. Graphical conceptual ecological model for the Rio Grande silvery minnow. Each model node is connected to at least one other node using arrows. The direction of the arrow indicates the direction of the influence in the relationship and flow of information. The thickness of the arrow represents the importance that the parent node (origin) has on the child node. The color of the arrow indicates the current level of understanding of that relationship (Red=low, Blue=Medium, Green=High). Black arrows indicate life stage transitions.

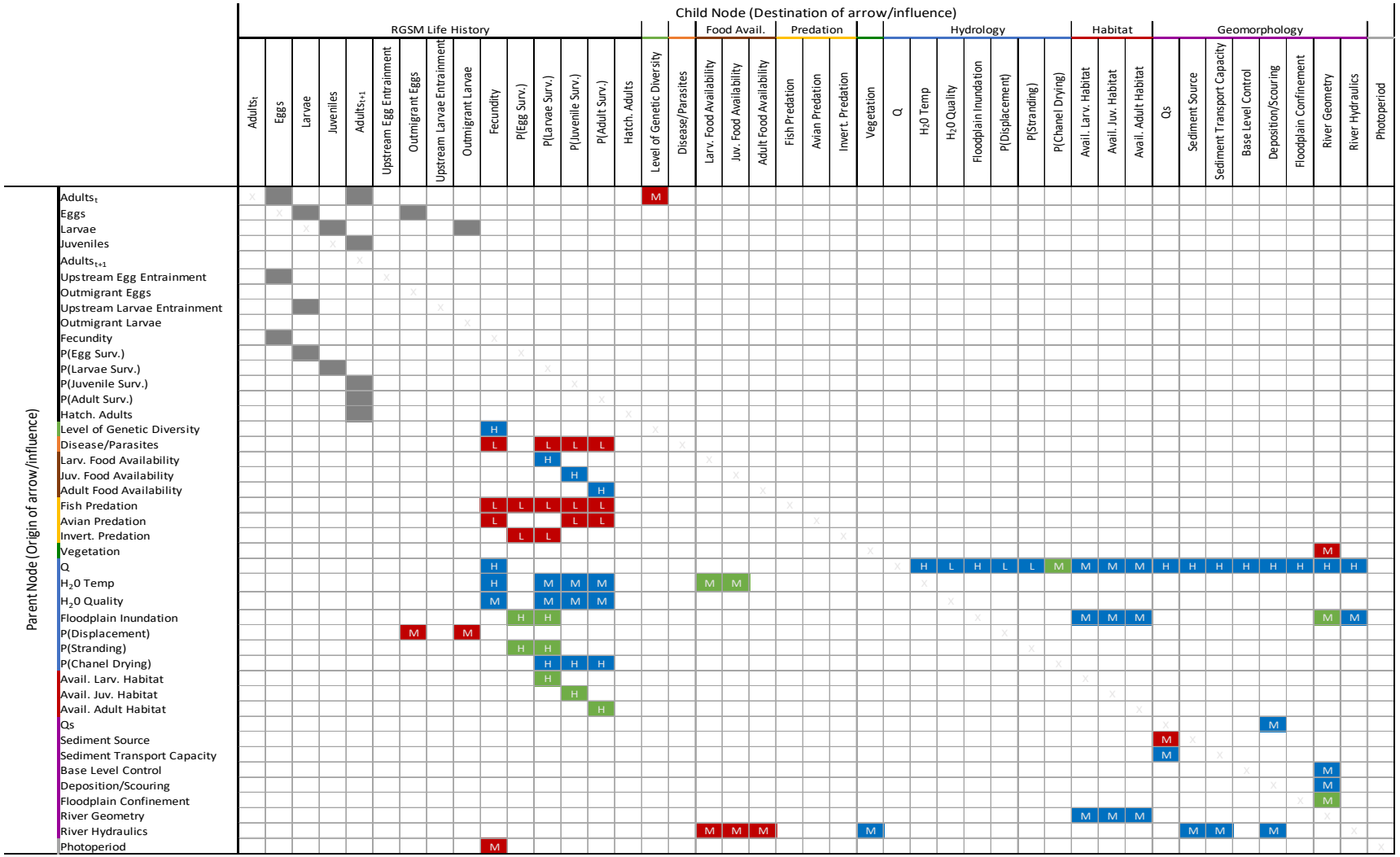


Figure B3. Conceptual ecological model (CEM) relationship matrix. The matrix describes every relationship (arrow) in the CEM. Rows indicate the component where the relationship originates and columns show the component where the relationship ends (e.g., direction of the CEM arrow). The color of the cell indicates level of understanding of that relationship (Red=low, Blue=medium, Green=high) and the letter in each cell indicates the importance that the parent node (origin) has on the child node (L=low, M=medium, H=high). Grey boxes indicate life history transitions and blank cells represent no relationship.

Table B3. Conceptual Ecological Model Component Descriptions

Component	Category	Description
$Adults_t$	Life History	Adult abundance at time step *t*. Adults are present year round in the MRG and are classified as individuals >35mm. The age structure of the adults is predominately made up of 1 and 2 year old fish, however a small segment of fish can live up to 5 years. All adults are considered sexually mature and available to spawn.
Eggs	Life History	Total number of eggs produced during spawning during time step *t*. calculated by applying the spawning success rate (*P(Spawning Success)*) to $Adults_t$.
Larvae	Life History	The number of larvae produced during time step *t*. calculated by applying the egg survival rate (*P(Egg Surv)*) to *Eggs*. Larvae are classified as individuals between 4 and 13mm standard length and can be found in the MRG between mid-April to mid-July.
Juveniles	Life History	The number of Juveniles produced during time step *t*. calculated by applying larval survival rate (*P(Larvae Surv.)*) to *Larvae*. They are classified as individuals between 13 and 64mm standard length and can be found in the MRG between mid-July to December.
$Adults_{t+1}$	Life History	Adult abundance at time step *t+1.* This group is comprised of both Juveniles that survive into adulthood as well as Adults from the previous time step *t*.
Upstream Egg Entrainment	Life History	The total number of eggs that are entrained from upstream reaches.
Out-migrant Eggs	Life History	The total number of eggs that disperse downstream out of the system/reach.
Upstream Larvae Entrainment	Life History	The total number of larvae that are entrained from upstream reaches.
Out-migrant Larvae	Life History	The total number of larvae that disperse downstream out of the system/reach.
Fecundity	Life History	The mean number of eggs produced by an individual RGSM.
P(Egg Survival)	Life History	The mean probability that an individual egg will survive to hatching during time step *t.*
P(Larvae Survival)	Life History	The mean probability that an individual larvae will survive to transition into the juvenile life stage during time step *t*.
P(Juvenile Survival)	Life History	The mean probability that an individual juvenile will survive to transition into the adult life stage during time step *t*.
P(Adult Survival)	Life History	The mean probability that an individual adult will survive to the next time step *t*.
Hatch. Adults	Life History	The number of hatchery origin adults stocked into the reach.
Level of Genetic Diversity	Genetics	The total amount of RGSM genetic diversity present in the MRG.
Disease/Parasites	Disease/Parasites	The prevalence of disease and parasites that can adversely affect survival rates of RGSM.
Larval Food Availability	Food Availability	The density of suitable diet items available for consumption by larval RGSM.
Juv. Food Availability	Food Availability	The density of suitable diet items available for consumption by juvenile RGSM.
Adult Food Availability	Food Availability	The density of suitable diet items available for consumption by Adult RGSM.
Fish Predation	Predation	The prevalence of fish that prey on RGSM.

Avian Predation	Predation	The prevalence of birds that prey on RGSM.
Invert. Predation	Predation	The prevalence of invertebrates that prey on RGSM.
Vegetation	Vegetation	The diversity and density of vegetation that can influence the geomorphic processes in the MRG.
Q	Hydrology	Discharge referring to the magnitude (in terms of peak discharge or volume of water), duration (how long does flood last), frequency (how often it occurs, what time of year it occurs), and time sequence (the occurrence of discharge events within a year or over multiple years/decades)
H_20 Temp	Hydrology	In-stream temperature.
H_20 Quality	Hydrology	General water quality.
Floodplain Inundation	Hydrology	The amount of floodplain habitat created during spring run off or during other water management activities.
P(Displacement)	Hydrology	The probability that high flows may displace and disperse eggs and larvae out of the system.
P(Stranding)	Hydrology	The probability that high flows that create floodplain habitat may recede too quickly and strand RGSM eggs and larvae in disconnected floodplains
P(Channel Drying)	Hydrology	The probability low flows may cause portions of the main channel to dry and fragment RGSM habitats.
Available Larval Habitat	Habitat	The total amount of RGSM larval habitat available to larval RGSM.
Available Juvenile Habitat	Habitat	The total amount of RGSM Juvenile habitat available to Juvenile RGSM.
Available Adult Habitat	Habitat	The total amount of RGSM Adult habitat available to Adult RGSM.
Qs	Geomorphology	Sediment load referring to the magnitude (peak concentration or load or volume of sediment), gradation of sediment, portion of sediment size class moving in suspension or as bed load (or in between), etc.
Sediment Source	Geomorphology	Where the transported sediment comes from (banks or beds of river, uniform or concentrated deposition sources from tributary inputs – e.g., fines from a tributary may coat a large section of a river, whereas coarser material deposits on the alluvial fan at the tributary confluence). The sources may be recent deposits, older deposits that have consolidated, or erosion of the bed or bank).
Sediment Transport Capacity	Geomorphology	The theoretical ability of the channel to move sediment of a given size class.
Base Level Control	Geomorphology	The influence of reservoir or in-stream channel features to cause backwater effects influencing river geometry and river hydraulics
Deposition/ Scouring	Geomorphology	The process of sediment being added or subtracted to a given cross section. This is dependent on grain size and both processes may occur at a given location (e.g., bank could be eroding while at the same time deposition is occurring on a bar opposite the erosion).
Floodplain Confinement	Geomorphology	The lateral constraint of the river from local geology or placement of engineered/spoil levees.
River Geometry	Geomorphology	The slope, width, mean depth, channel sinuosity, channel planform, cross section shape, wetted perimeter, XS area
River Hydraulics	Geomorphology	How fast the water is moving (velocity), depth of the water, force water applies at interfaces (shear stress, drag, water buoyancy, etc.)
Photoperiod	Photoperiod	The changes in day light duration during the spring time which may act as a spawning cue.

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Appendix C. Southwestern Willow Flycatcher and Yellow-Billed Cuckoo Conceptual Ecological Models

LIST OF FIGURES

Figure 1. Basic Life Cycle for SWFL and YBCU
Figure 2. Avian Conceptual Ecological Model Legend
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AVIAN SPECIES CONCEPTUAL ECOLOGICAL MODELS

The CEMs for the SWFL and the YBCU were developed in tandem and are very similar. Both were developed around the species' life cycle, and as both are neo-tropical migratory songbirds, the basic life stages are the same (Figure C1). With the exception of the Migration Southbound, Overwinter, and Migration Northbound, all other life stages are applicable to the MRG.

The avian species CEMs do not show relationships between variables in the way that the RGSM CEM does. Much uncertainty exists in both the SWFL's and the YBCU's basic life history. These knowledge gaps must be addressed before building a relational CEM like that of the RGSM.

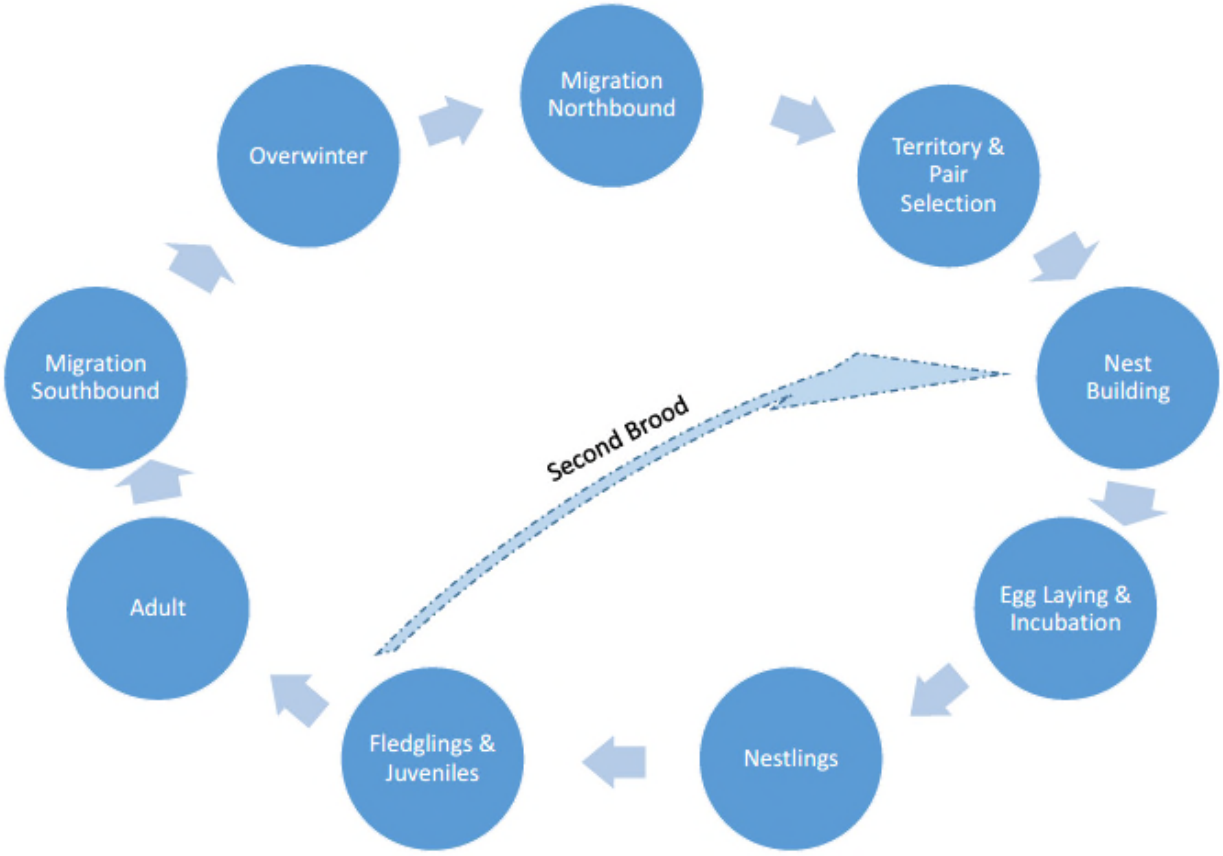


Figure C1. Basic Life Cycle for the Southwestern Willow Flycatcher and Yellow-Billed Cuckoo

Southwestern Willow Flycatcher Life History

The SWFL is a small perching bird of less than 15 centimeters long from bill to tail. It was listed as endangered in 1995 (Sogge et al. 2010). A primary reason for the species decline is the lost and degradation of its dense, native riparian habitat due to the anthropogenic modification of waterways

through channelization and damming, water diversions and groundwater pumping, and alterations to the riparian zone. It is one of four recognized subspecies of willow flycatcher. SWFLs overwinter in Mexico, Central America, and northern South America. They migrate north to breed in dense riparian habitats in the Southwest, including in the MRG (USFWS 2002).

The USFWS-designated critical habitat was revised in January 2013 to follow Recovery Plan goals, and identifies 1,975 stream kilometers in Arizona, New Mexico, southern California, Nevada, Utah, and Colorado that the species uses as breeding habitat (USFWS 2013). Their current range is similar to their historic range, but population numbers have declined due to the loss of suitable riparian habitat.

Northbound migrating SWFL arrive in the MRG in early May, and they select territories and mating pairs through the spring (USFWS 2002; Sogge 2010). Little information exists on SWFL pair selection. The female of the breeding pair ultimately chooses the nest site, looking for territory that can provide food, water, and shelter. SWFL breeding pairs prefer dense riparian habitat near or adjacent to surface water or with saturated soil, which are important both for creating a microclimate at the nest site and as habitat for their prey base of flying insects, such as mosquitoes(Sedgwick 2000; USFWS 2002; Sogge 2010). Generally, the nesting site is characterized by multi-age vegetation stands with 50-75 percent mid-story cover and dense cover that is 3-6 meters high (USFWS 2002). This dense vegetation provides protection from predators and contributes to the cooler microclimate of the nest site (Sedgwick 2000). The species also exhibit site fidelity, and breeding pairs have been observed returning to the same nesting site in subsequent years, even if the quality has degraded.

Within two weeks of pair selection, the female builds a cup-shaped nest over the course of 5-7 days without help from the male (USFWS 2002; Sedgwick 2020). Egg laying generally occurs from mid-May through mid-June. SWFLs lay 3-4 eggs per clutch over a span of 4-5 days. Eggs hatch in 12-14 days. Once hatched, the nestlings remain in the nest for 14-15 days before they fledge (leave the nest but are not fully independent from the parents). SWFL fledglings are capable of short flights (approximately 30 meters), and after leaving the nest, will remain in their parents' nesting territory for about 14 days before dispersing (Sedgwick 2020).

There is very little information on SWFL young of year once they have fledged and become juveniles, as surveys stop at that life stage. The life history of SWFL between fledging and leaving for the southern migration is a large data gap. Broods likely break up once they become juveniles as there have been no reports of flocking of immature SWFLs.

SWFLs sometimes have a second brood within a single breeding season. The likelihood of a second brood increases if the offspring from the first clutch fledge by late June or very early July. Re-nesting is common if the first nest is lost or abandoned. Clutch size decreases with each nest attempt. The proximity of the second nest to the first varies greatly, and could even be in the same plant or up to several kilometers away (USFWS 2002; Sedgwick 2020).

Migration south to their overwinter grounds begins sometime in mid-August through September, though due to survey efforts being focused around the breeding season, there is uncertainty around the exact timing of the migration and the factors that influence that timing (USFWS 2002)

Yellow-Billed Cuckoo Life History

The Western U.S. Distinct Population Segment (DPS) of the YBCU was listed as threatened under the ESA October 3, 2014 (USFWS 2014).[4] YBCU are medium-sized birds of about 30 centimeters in length. Their historic range was west of the Continental Divide, stretching from British Columbia down to northern Mexico. Today, the Western DPS of the YBCU's breeding habitat is along rivers in Arizona, California, and New Mexico (USFWS 2014; Hughes 2020). YBCU are riparian species and require large expanses of riparian habitat at the landscape level with a mosaic of different vegetation (Johnson 2009; Hughes 2020).

The species arrive at their breeding grounds in mid-late May to mid-June (Sechrist et al 2012; Hughes 2020). Little is known about pair selection (Johnson 2009). YBCU require a nest patch size of about five hectares with 50-75 percent mid-story cover that is 3-10 meters high. YBCU foraging territory is even larger, with individuals observed to have territories of 75-100 hectares (Johnson 2009; Dillon and Moore 2020).

At the nest patch scale, canopy cover is critical to provide protection and the microhabitat necessary for nest success. YBCU also prefer nest habitat in close proximity to water, especially if there is a low velocity flow of shallow depth underneath the nest. This also contributes to the nest microclimate, and provides habitat for an insect prey base. Both the male and female build the nest over the course of several days, which is located on a horizontal branch or fork of a tree (Hughes 2020).

While females can lay between 1-5 eggs per clutch, clutch size is usually 2-3 eggs. One egg is usually laid every other day, but females may wait up to five days between eggs. Eggs are incubated over 9-11 days. The duration of the egg laying and incubation period varies, between 13-20 days total. Both parents help with incubation (Hughes 2020). Additionally, pairs may have younger males that assist (USFWS 2014; Hughes 2020). The degree of contribution from colony incubation is a data gap, both in terms of level of effort and in terms of genetics. There are data showing that different males and females may genetically contribute to eggs in the same brood (McNeil 2015).

YBCU are opportunistic feeders. They mainly eat large insects, but also prey on small lizards and amphibians. They require a large amount of food, especially as nestlings. Both parents feed and brood the young equally, and nestlings transition to the fledgling stage by day 7-9. Once they become juveniles, both parents and the young leave the nest patch after a day. YBCU may lay second and even third clutches, sometimes with different partners (USFWS 2014).

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[4] The USFWS received a petition to delist the Western DPS, and there is currently a species status assessment underway with anticipated findings later in 2020

Like with SWFL, little is known about YBCU life history once the young reach the juvenile stage. The YBCU leave for their fall migration beginning in early-late August, with most birds departing by mid-September (Sechrist 2012; Hughes 2020).

AVIAN SPECIES CONCEPTUAL ECOLOGICAL MODEL DESCRIPTION

The two avian CEMs were developed were developed in tandem and both focused on life stages, with each depicted as a bulls-eye graphic divided into wedges. Each wedge represents a driver or stressor at that life stage for the species. A driver is a variable that is beneficial to the species at a specific life stage and contributes to species success. A stressor is a variable that negatively impacts the species at a specific life stage and contributes to species failure, including mortality. The bulls-eyes also depicts the level of importance of each variable, the ability to manage the variable, and if there are high level uncertainties related to the variable. The relative size of each variable's wedge is not indicative of any importance (Figure C2).

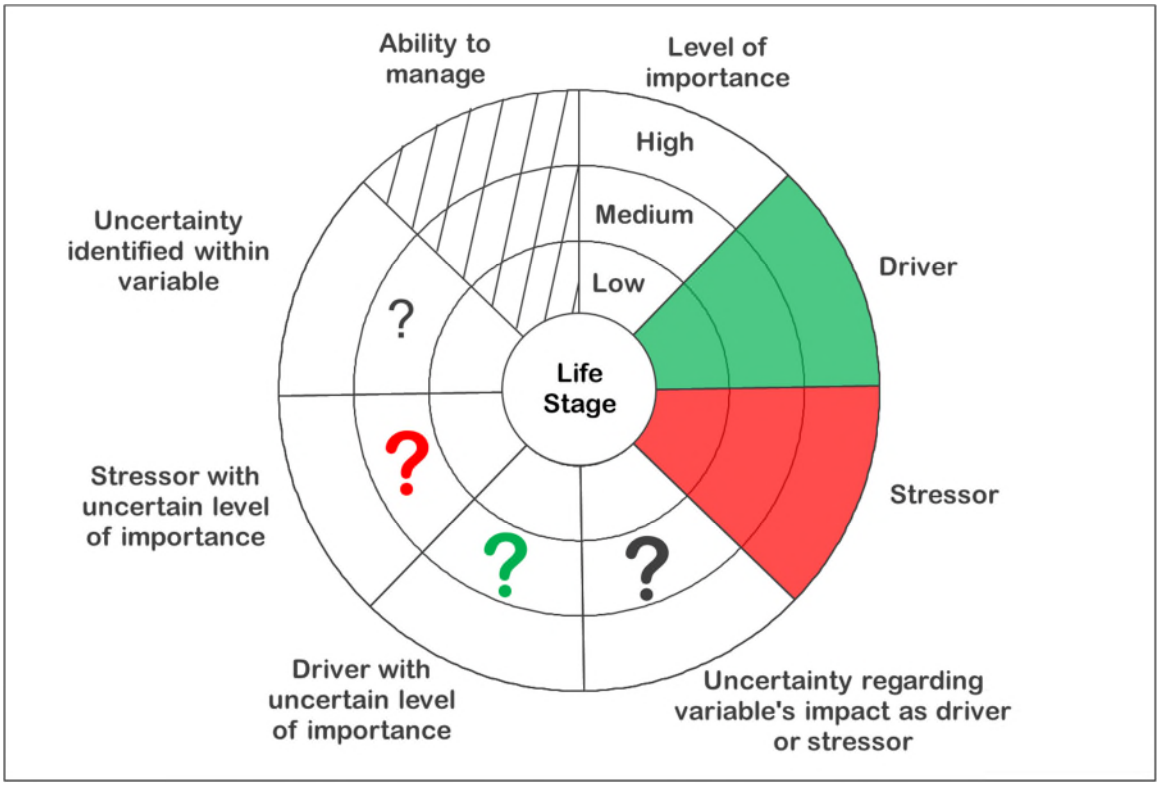


Figure C2. Avian Conceptual Ecological Model Legend

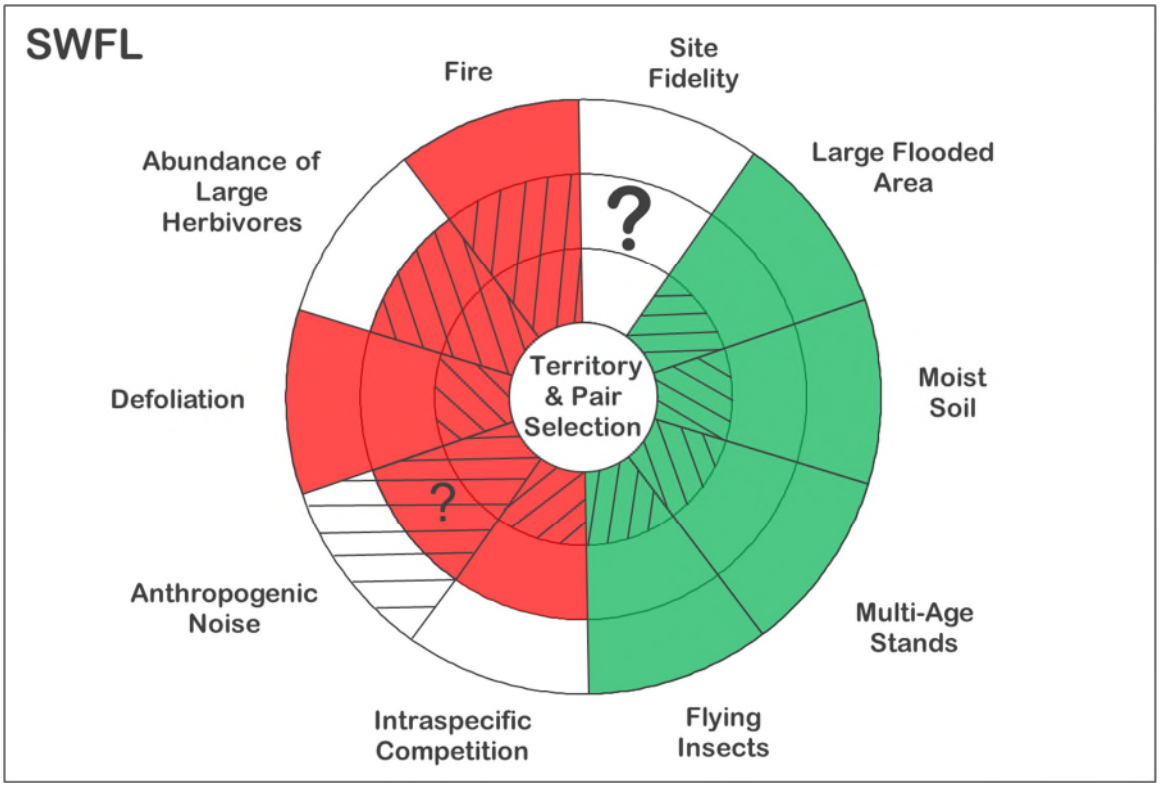


Figure C3. Southwestern Willow Flycatcher Territory and Pair Selection Life Stage.

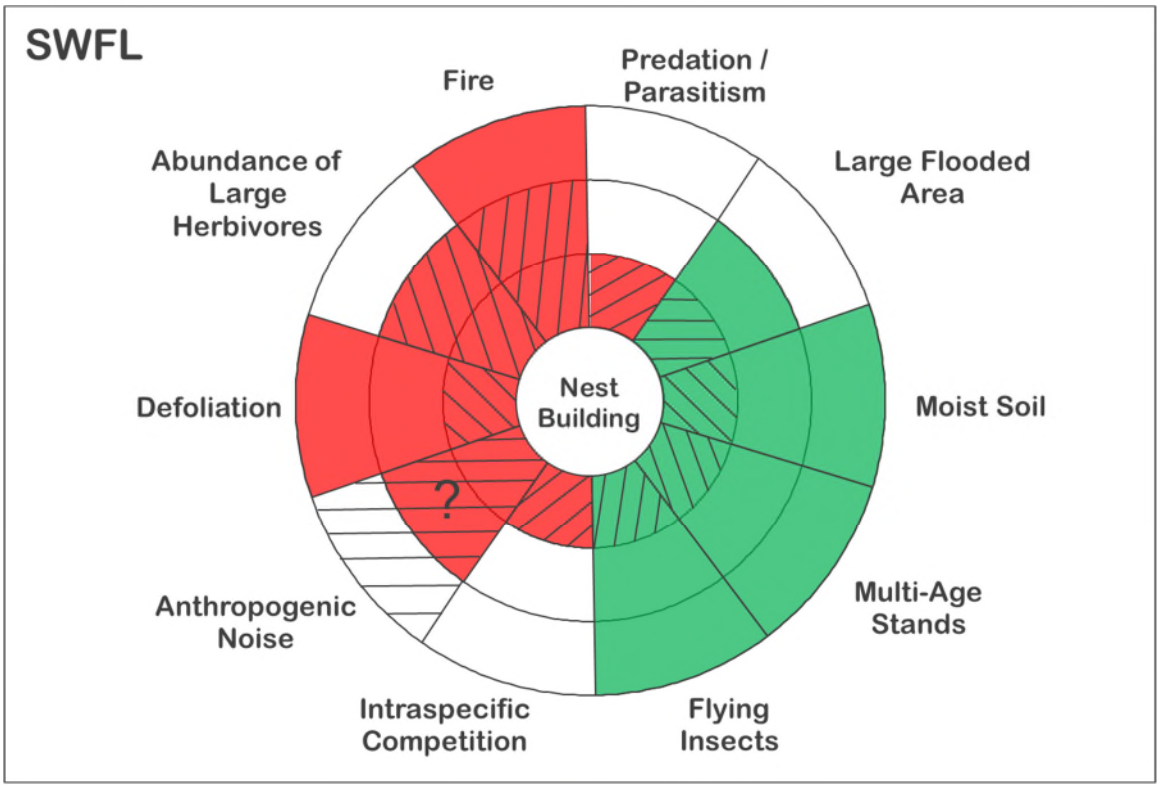


Figure C4. Southwestern Willow Flycatcher Nest Building Life Stage

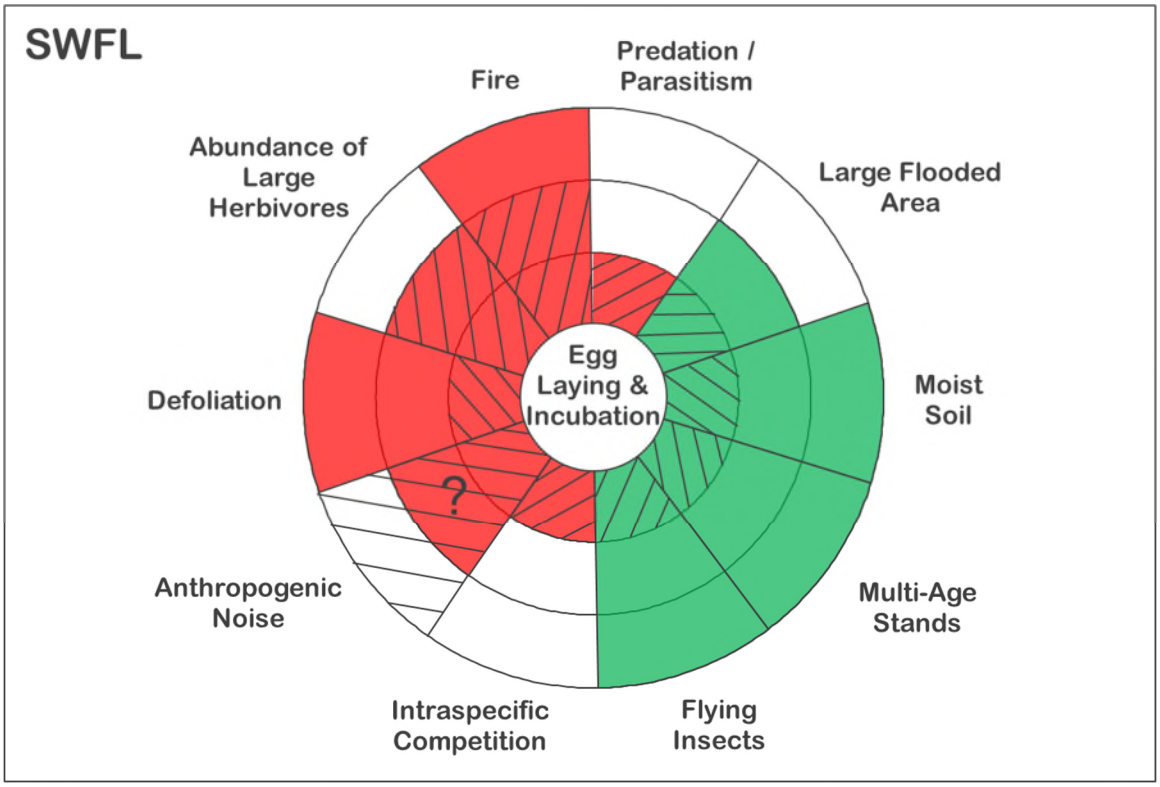


Figure C5. Southwestern Willow Flycatcher Egg Laying and Incubation Life Stage

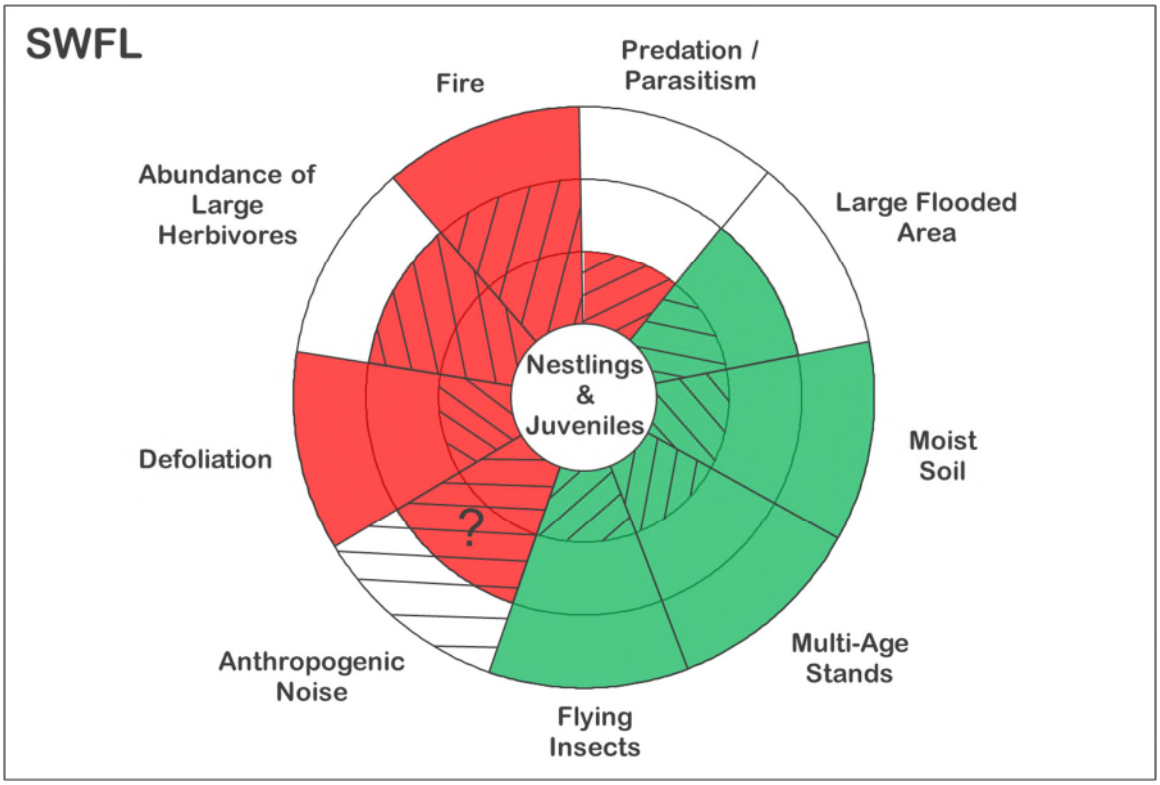


Figure C6. Southwestern Willow Flycatcher Nestlings and Juveniles Life Stage

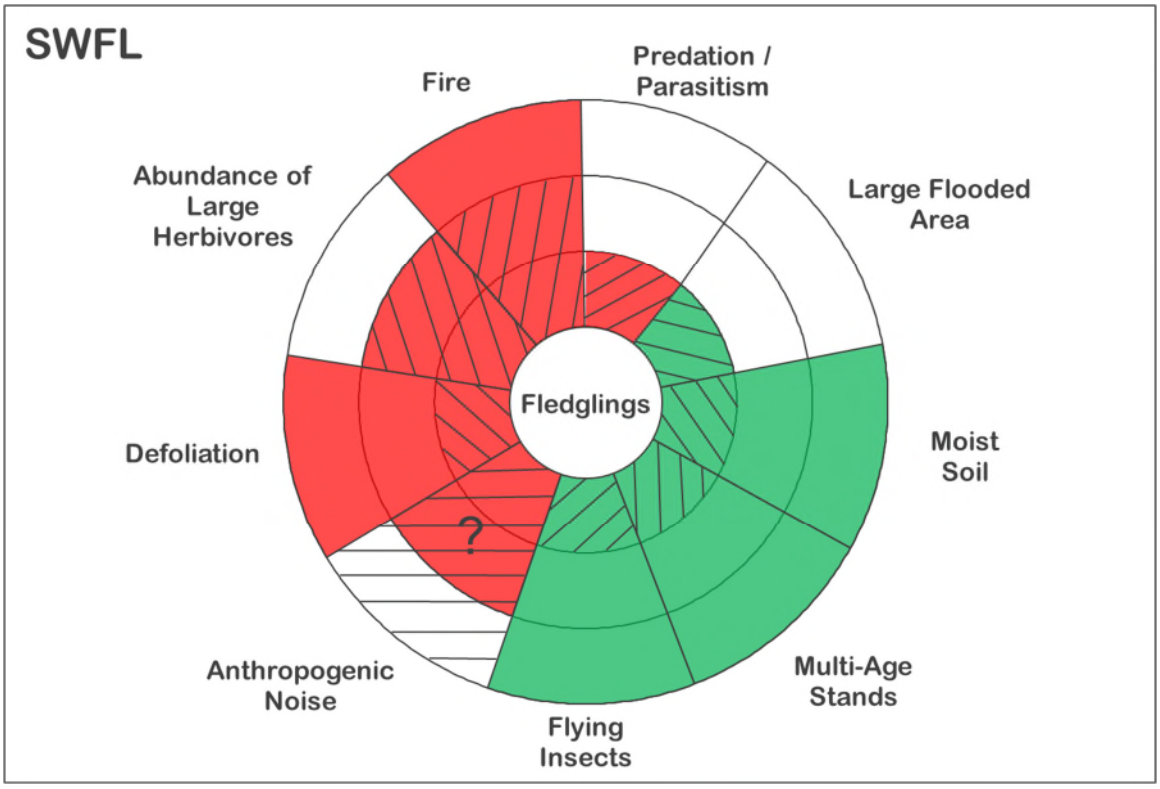


Figure C7. Southwestern Willow Flycatcher Fledglings Life Stage

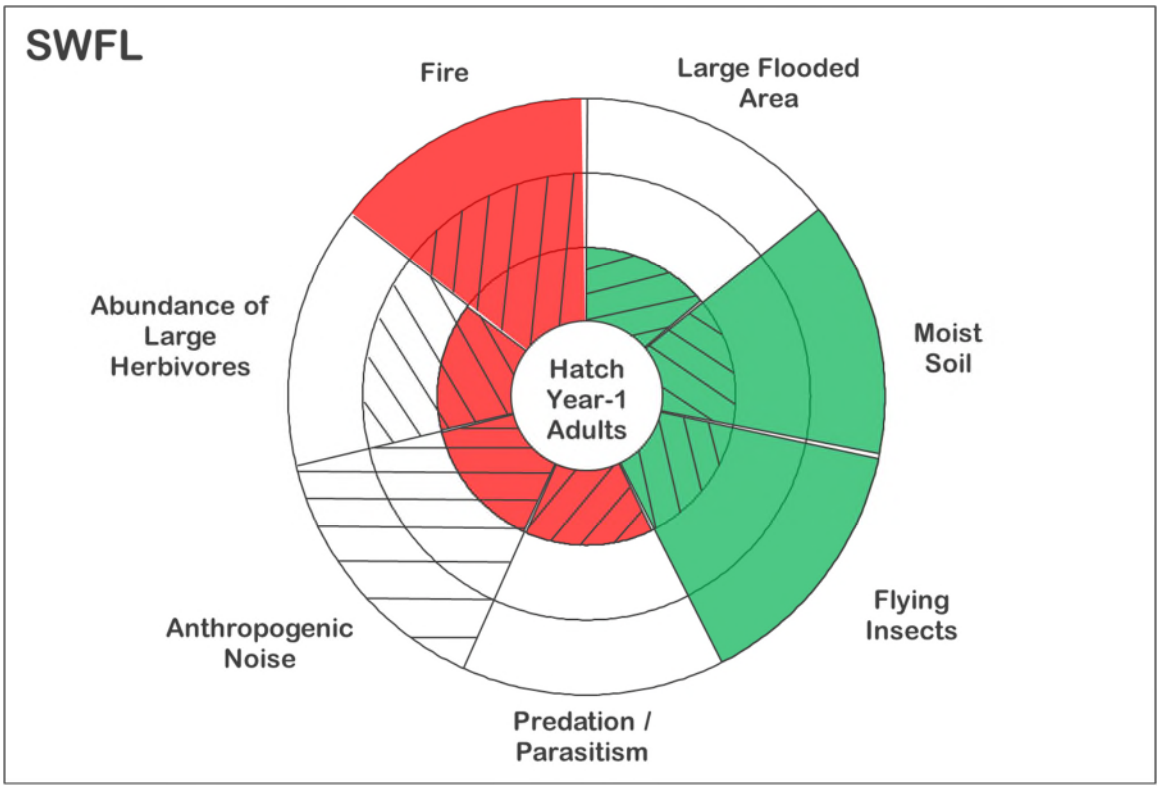


Figure C8. Southwestern Willow Flycatcher Hatch Year-1 Adults Life Stage

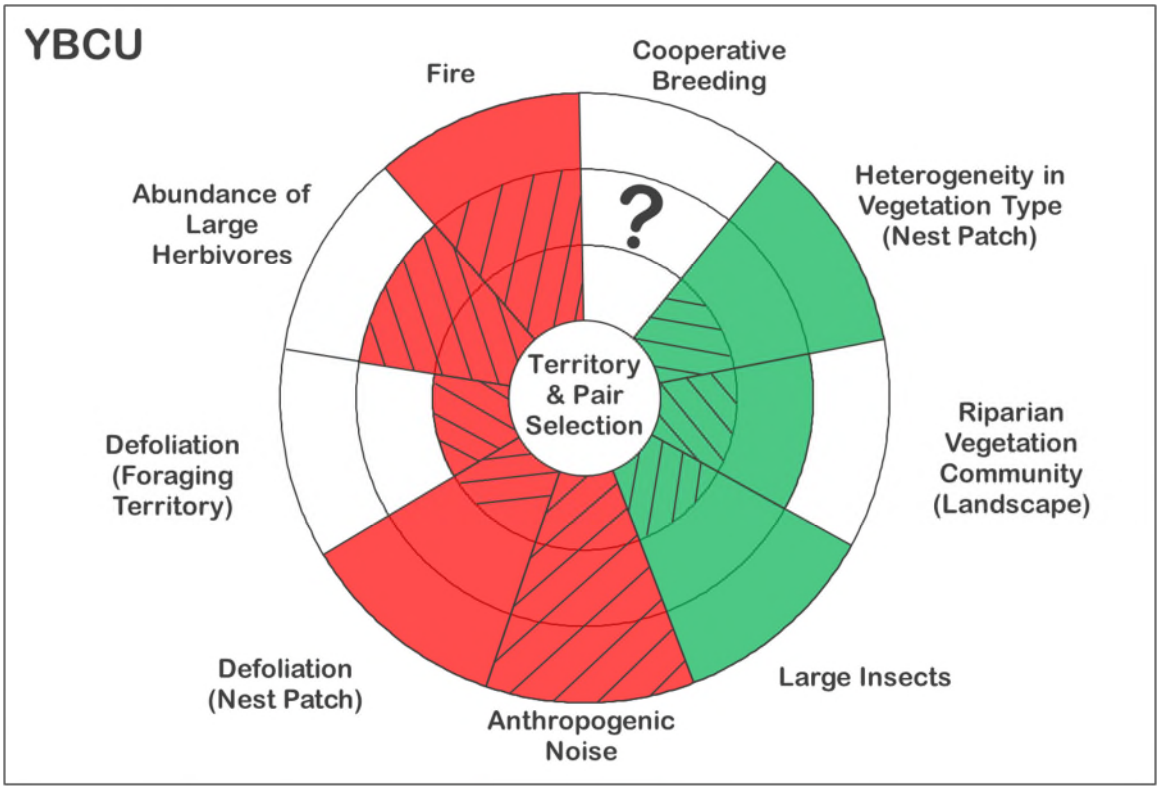


Figure C9. Yellow-Billed Cuckoo Territory and Pair Selection Life Stage

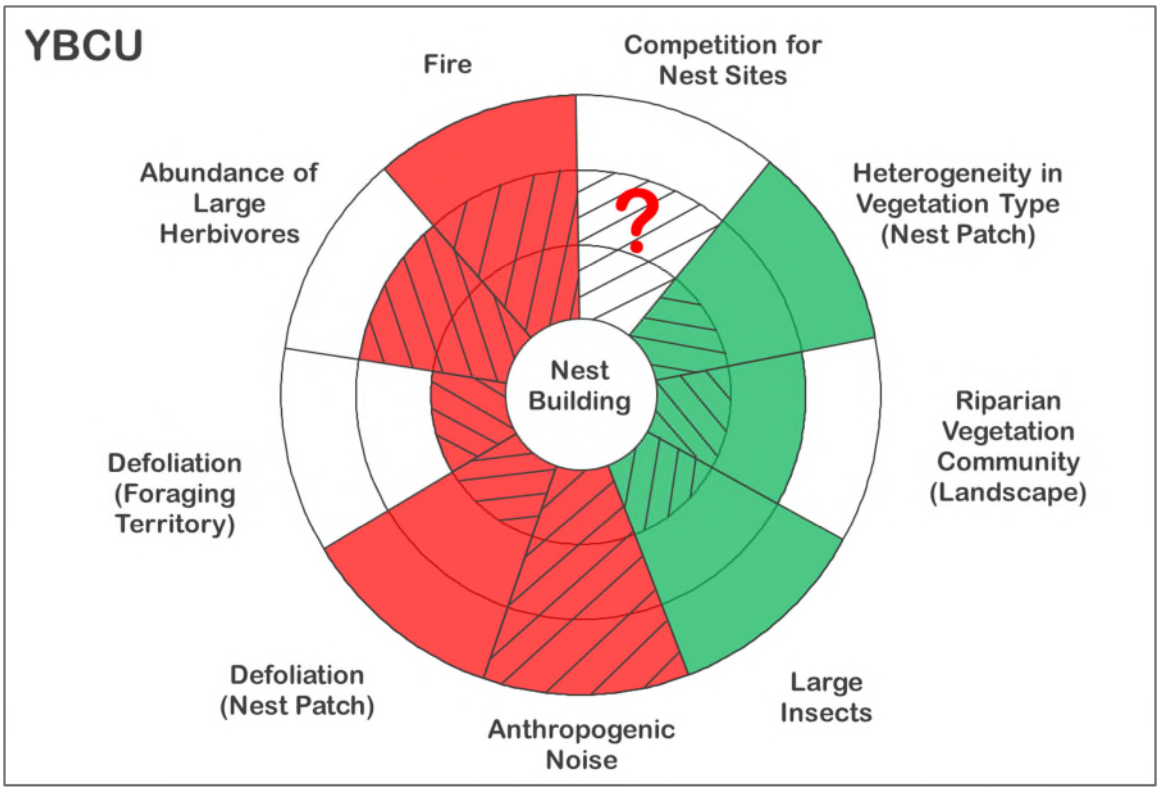


Figure C10. Yellow-Billed Cuckoo Nest Building Life Stage

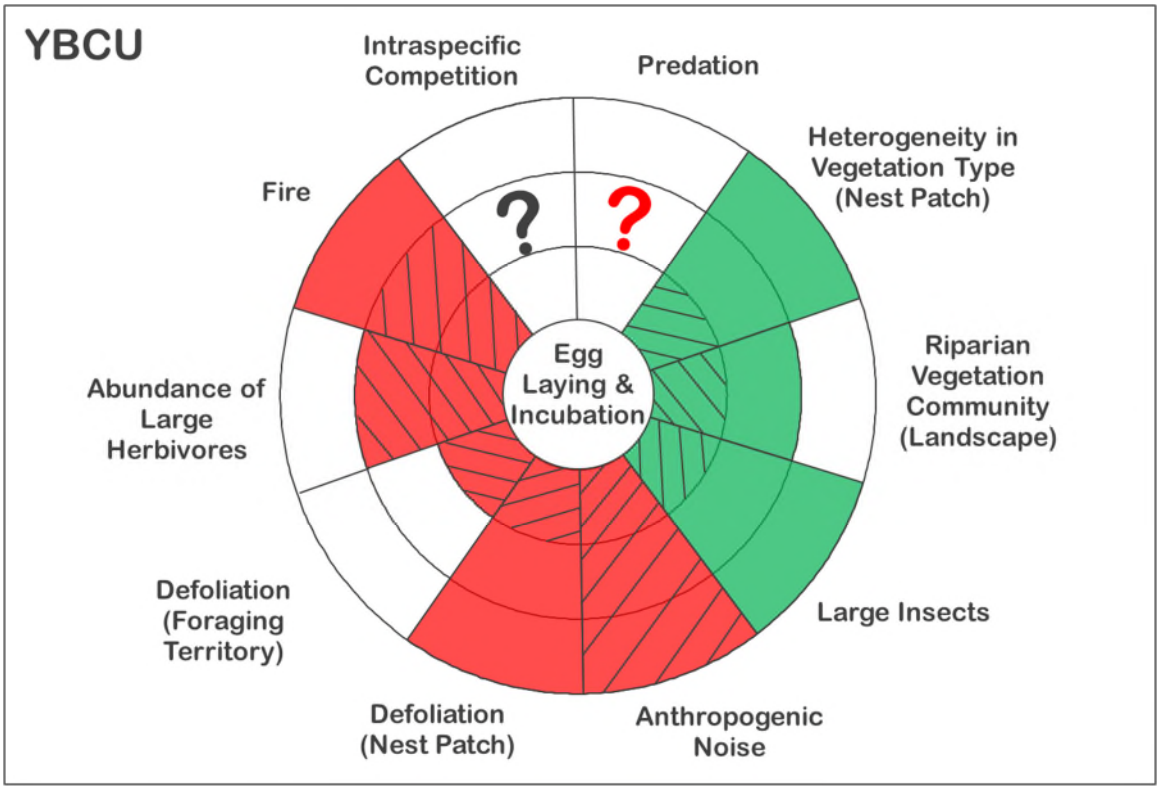


Figure C11. Yellow-Billed Cuckoo Egg Laying and Incubation Life Stage

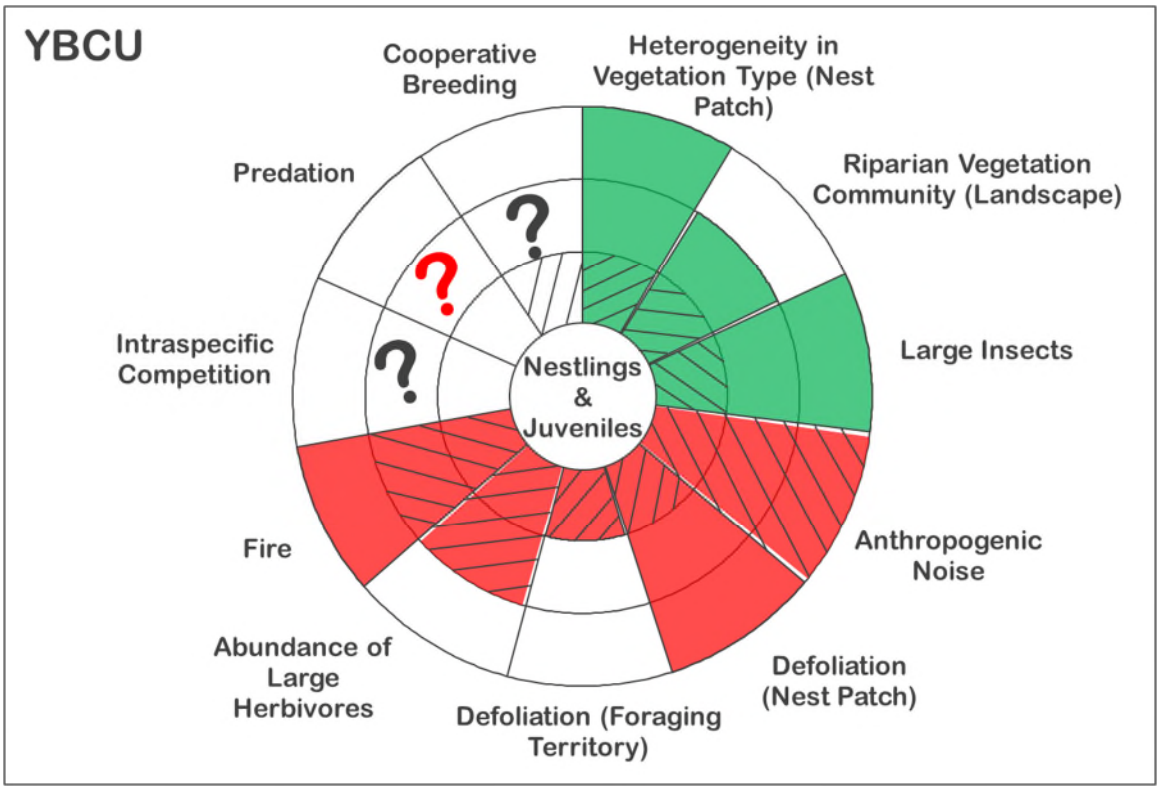


Figure C12. Yellow-Billed Cuckoo Nestlings and Juveniles Life Stage

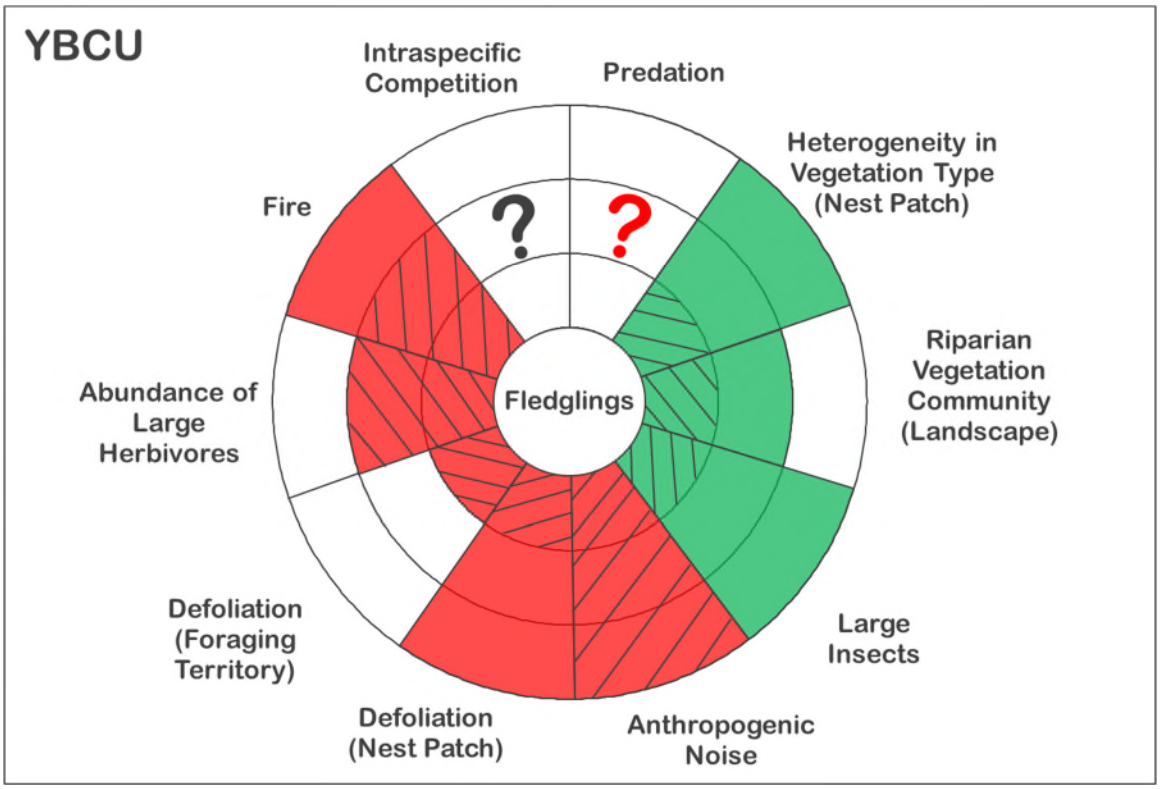


Figure C13. Yellow-Billed Cuckoo Fledglings Life Stage

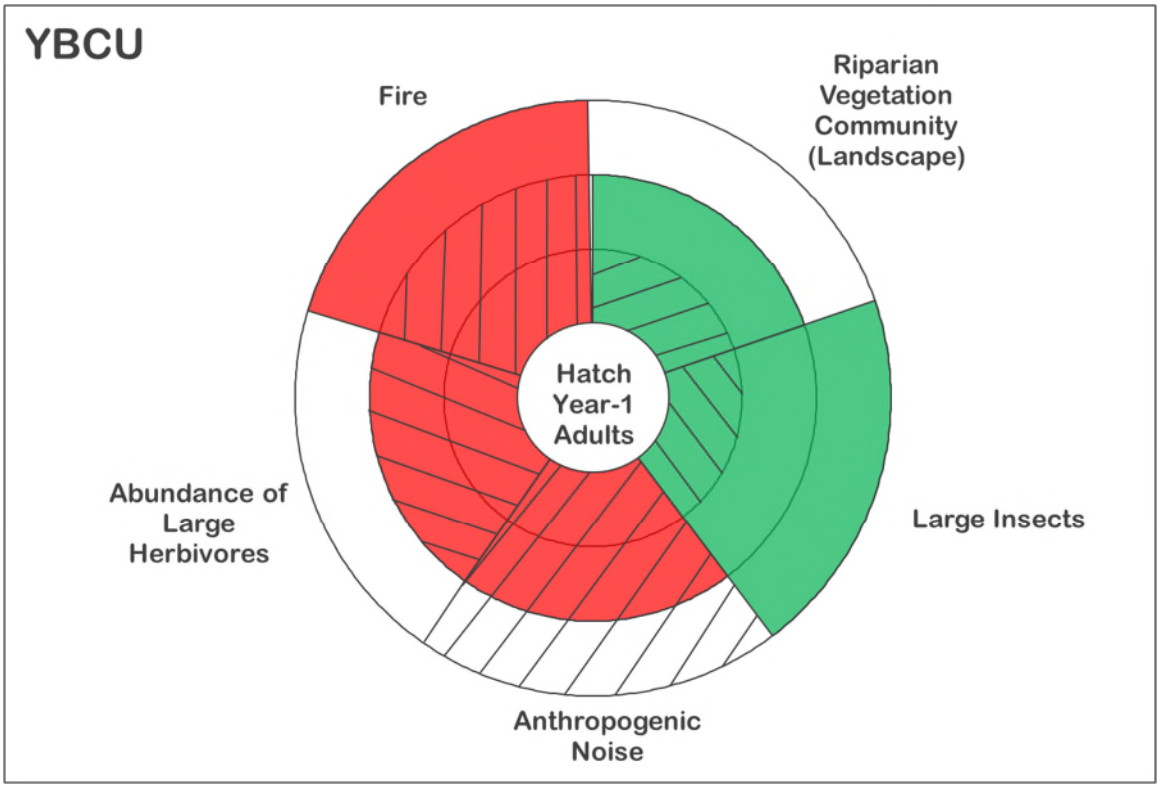


Figure C14. Yellow-Billed Cuckoo Hatch Year-1 Adults Life Stage

AVIAN CONCEPTUAL ECOLOGICAL MODELS LIFE STAGES DEFINITIONS

Migration and Overwintering

SWFL

Northbound Migration: SWFL are late spring migrants with arrival dates in Arizona as early as 3 May (Phillips et al. 1964) and from second week of May to mid-Jun in California (Small 1994). Captures during spring migration occurred in the central Rio Grande valley of New Mexico occurred between May 13 and June 8 with a peak in the first week of June, but varied by site and year (Yong and Finch 1997). Habitat used during spring migration is likely similar to that described for fall. In New Mexico, the willow flycatcher is known to migrate regularly along the Rio Grande (Yong and Finch 1997) and the Pecos River (Hubbard 1987), and occurs regularly as a migrant in the southwestern-most desert region and the eastern-most plains region of the state (Hubbard 1987). Migration requires high energy expenditures, exposure to predators, and successful foraging in unfamiliar areas. Therefore, migration is the period of highest mortality within the annual cycle of the flycatcher (Paxton et al. 2007). Willow Flycatchers of all subspecies sing during northward migration, perhaps to establish temporary territories for short-term defense of food resources.

Southbound Migration: Fall migration begins when adult birds depart from their breeding territories, generally in early to mid-August, but some birds may stay until mid-September if they fledged young late in the season (Phillips et al. 1964, Yong and Finch 1997). Unpaired males that fail to attract a mate and pairs that repeatedly lose nests to nest parasitism or predation may leave territories by early July. Fledglings leave the breeding areas a week or two after adults, likely because young birds' pre-basic molt occurs on breeding grounds (adding to the length of their stay), whereas adults delay pre-basic molt until they reach wintering grounds (Unitt 1987, Yong and Finch 1997). Habitat use during migration is similar to breeding habitat, including riparian woodlands with open overstory and dense mid- and low-stories, and adjacent agricultural fields, with close proximity to water. The highest capture rates in one study along the Middle Rio Grande occurred within willow habitat, followed by dense young cottonwood-Russian olive stands. Affinity for willow habitat and higher body mass recorded in this habitat is likely due to higher densities of arthropods (McCabe 1991, Yong and Finch 1997). Mass gain of recaptured birds suggest stopover to replenish fat stores during migration is necessary for this species (Yong and Finch 1997). In New Mexico, birds are known to migrate regularly along the Rio Grande (Yong and Finch 1997).

Overwinter: The Pacific lowlands of Costa Rica, as well as other regions of Central America seem to be the most important wintering grounds for the *extimus* subspecies based on genetic data (Paxton et al. 2011). On the wintering grounds, flycatchers use habitat with standing or slow-moving water and/or saturated soils, patches of trees, woody shrubs, seasonally inundated floodplains with emergent vegetation, pastures, and open areas, often within agricultural landscapes (Lynn et al. 2003, Schuetz et al. 2007). The presence of water or saturated soils seems to be more important than vegetative structure (Schuetz et al. 2007). Individuals defend territories throughout the winter and show high fidelity to wintering territories (Koronkiewcz et al. 2006, Sogge et al. 2007). Survivorship is thought to be high over the wintering period

(Koronkiewcz et al. 2006). Threats on the wintering grounds include human-driven disturbance, such as mining and logging, as well as grazing by domestic livestock (Schuetz et al. 2007)

YBCU

Migratory routes of western yellow-billed cuckoos are not well known because few specimens collected on wintering grounds have been assigned to western or eastern populations. Western cuckoos depart 2–3 weeks earlier than eastern cuckoos (Hughes 2020). Departures begin in early to late August with most birds gone by mid-September, though some may depart later (Hughes 2020, McNeil et al, 2011).

Most information on migratory routes is based on two birds fitted with geolocators. Both birds suggested a loop migrations route with distances between 9,500-9,900 km. The first recaptured bird migrated south through Central America to winter in portions of Bolivia, Brazil, Paraguay, and Argentina (Sechrist et al. 2012). The second bird passed through the Caribbean region, and wintered from mid-November to late April in the Gran Chaco of central South America, near the borders of Paraguay, Bolivia, and Argentina (McNeil et al. 2015).

Spring migration routes differed for both birds, the first bird migrated north through the Caribbean, and moved between New Mexico and Mexico at the end of summer in 2009 and again in 2010 before being recaptured at its breeding site. The second bird passed through Peru and Central America on its way north (McNeil et al. 2015). This bird also appeared to pause in southern Arizona or Sonora before and after migration, paralleling the first tracked bird. Data from these two birds show dynamic migration strategies, and suggest the monsoonal region may be important to the western population during the migratory stages of the life cycle.

Western cuckoos arrive on breeding grounds starting mid- to late May, 4–8 weeks later than eastern cuckoos occurring at same latitude (Franzreb and Laymon 1993). Considerable numbers are usually not present until early to mid-Jun, and transients continue to travel through late June to mid-July (Hughes 2020).
Little information exists for habitat use during migration. Western cuckoos may migrate north along greening riparian corridors and surrounding landscapes following monsoon precipitation (Wallace et al. 2013).

Territory and Mate Selection

This life cycle stage occurs upon the adult birds' arrival to the breeding ground where they must choose a mate and select a breeding territory. Birds choose a territory that can provide food, water, shelter, and nesting sites.

SWFL

Little information exists on SWFL pair selection. Studies on other Empidonax species indicate that pairs form using coordinated movements and sounds (Tarof and Ratcliffe 2000). Female SWFLs ultimately select the nest site.

YBCU

There is even less information on YBCU pair selection. Pairs may visit potential nest sites together frequently prior to building the nest.

Nest Building

Nest building occurs when a bird or a mated pair is actively building a nest before egg-laying begins. Nest building within the territory usually begins within a week or two after pair formation. Nest building is an energetically expensive activity for birds (Mainwaring and Hartley 2013).

SWFL

The female SWFL builds a nest over the course of 5-7 days without help from the male. The nest begins with a platform of grass or strips of vegetation, and the female weaves grass onto the surrounding vegetation to form a cup using her beak and her body.

YBCU

Both the male and female YBCU build the nest over the course of several days. The nest is placed on a horizontal branch or fork of a tree and is constructed from small twigs, pine needles, and similar material.

Egg-Laying and Incubation

Egg laying generally begins from mid-May through mid-June, depending on the geographic area and elevation. This life cycle stage begins when females are actively laying eggs followed by incubation until all eggs hatch. The energetic cost of egg production and incubation for female birds is poorly understood.

SWFL

SWFLs lay 3-4 eggs per clutch. Generally, one egg is laid per day with one day skipped, so the egg laying period takes between 4 and 5 days. Eggs hatch in 12-14 days, so the entire egg laying and incubation period is between 16 and 20 days, on average. Males do not assist with incubation.

YBCU

Cuckoo females can lay between 1-5 eggs in a clutch, but usually 2-3. Usually cuckoos lay one egg every other day, but females may wait up to 5 days between eggs. Eggs hatch in 9-11 days and male and female share incubation duties. Helper males may assist with incubation. YBCU start incubation as soon as the first egg is laid, often resulting in nestlings of different ages in the same nest. YBCU egg laying and incubation period can be quite variable, between 13-20 days.

Uncertainty: Colony incubation/helping. Who contributes to eggs, who contributes to incubation?

Nestlings

This is the life cycle stage that occurs from the time the first egg hatches until the young leave the nest. The nestling state is very energetically costly for flycatcher parents, who bring food to the nestlings up to

22 times per hour. This is a very vulnerable state for the nestlings, as they are very susceptible to predation, and for the adult parents as they are expending energy to forage and protect the nest.

SWFL

Female SWFL do the majority of brooding and feeding the young, but males do play a role in food provisioning. The nestling period lasts around 14-15 days.

YBCU

Growth is extremely rapid for YBCU nestlings – as short at 17 days from the start of incubation to fledging which is among the shortest of any bird species. Both parents brood and feed the young equally. Occasionally, a nonparent adult or "helper" bird will assist with caring for nestlings. YBCU nestlings have mostly fledged and start to venture away from the nest by day 8.

Fledglings

This life cycle stage occurs after young birds leave the nest, but before they are fully independent from the parents. Studies on fledgling survival for most bird species are lacking.

SWFL

SWFL young are capable of short (30 meter) flights at the time they leave the nest. SWFL young huddle together for 3-4 days after leaving the nest and remain on the adults' territory for around 14 days before dispersing.

YBCU

Cuckoo young leave the nest at 7-9 days and both parents and young leave the vicinity of the nest after one day.

Data Gap

What happens between fledgling and when they leave for full migration? Some indication may be vulnerable once they fledge, but no monitoring data.

Juveniles

This life cycle stage occurs after the young have left the parents' territory and no longer depend on their parents for food.

SWFL

For SWFLs, broods probably break up once the young enter this life cycle stage as flocking of immature SWFLs has not been reported.

YBCU

There is little information for cuckoos in this immature stage.

SOUTHWESTERN WILLOW FLYCATCHER AND YELLOW-BILLED CUCKOO CONCEPTUAL ECOLOGICAL MODEL GLOSSARY

Note that the size of the wedges on the life stage charts of the conceptual ecological models do not hold any significance. They are simply a product of the number of variables included in each life stage.

Abundance of Large Herbivores

This variable includes both domesticated animals, such as cattle, and wild animals, such as elk, beavers, and feral hogs. Grazing and browsing from domesticated and wild herbivores can negatively impact the success of restoration sites and SWFL and YBCU nesting sites by stripping trees, knocking down vegetation, compacting soil, and causing erosion. Additionally, a growing herbivore population can also attract more predators, which increases trails that negatively impact SWFL and YBCU habitat.

Stressful environmental conditions, such as drought, exacerbate the negative impact of grazing, even when there is no increase in the herbivore population.

Properly managed herbivore populations could provide some benefit by increasing soil nutrients. In the short term, the large herbivore population could negatively impact water quality by trampling vegetation at the water's edge, which often contains riparian plant species that are important for SWFL nesting habitat.

YBCU

Because YBCUs have long-distance vision and have large home ranges, they may benefit from edge effects near agricultural areas, which may have greater food availability.

Anthropogenic Noise

Anthropogenic noise can negatively impact SWFL and YBCU communication and nest success. This could hinder pair selection and, if the noise impact is too great, lead to nest abandonment. There are uncertainties related to the influence of the timing, duration, and constancy of noise, as well as distance from the noise source, affect the degree of impact. Introduced noise may be less critical once nestlings have fledged; however, the lack of monitoring after fledging has led to uncertainties around this.

SWFL

There is an unpublished study at the Bosque del Apache National Wildlife Refuge on the impact mowing has on nests. Observations revealed that SWFL adults were initially defensive but began following the mowers when insect activity increased.

YBCU

YBCUs have large territories, so they might communicate over long distances. This may mean that they are greatly impacted by noise.

There is published literature that indicates YBCU vocalization frequency overlaps with the frequency of constant traffic, which results in communication interference. YBCUs have been observed to avoid high-traffic areas, and may even select lower quality habitat in order to avoid traffic noise. (Goodwin and Shriver 2011)

Cooperative Breeding

YBCU are known to form colonies. Young juvenile males will act as "helper males" within a nest and help with feeding and incubation. A genetic study in Arizona found that eggs in the same nest had varied genetic parentage (McNiel 2015). There are many uncertainties around the degree to which colony size and cooperation contribute to nest success and to the genetic success of the population as a whole. Researchers may be overestimating the number of YBCU territories as a result of the colony nature of these birds.

Defoliation

Defoliation increases the predation risk and negatively impacts the microclimate needed for nest success. Causes of defoliation include the tamarisk leaf beetle, drought, fire, and tree senescence.

Defoliation that occurs during the breeding season will have different impacts than defoliation that occurs between seasons. During the breeding season, defoliation may cause failure of existing nests. Defoliation that occurs before territory selection decreases habitat availability, as, SWFL and YBCU pairs are less likely to build nests in the affected areas.

YBCU

Given the larger range of YBCU, defoliation effects on the species will be different at the nest patch scale compared to the larger foraging territory scale. Defoliation away from the nest patch and in the foraging territory will impact food availability. However, as the foraging territory of the YBCU is so large, impact may be minimal unless there is wide-spread defoliation. Defoliation of this magnitude can be caused by tamarisk leaf beetle, high intensity fire, drought, tree over-maturity, or overgrazing. If defoliation is localized, YBCUs can forage in other areas.

Fire

Depending on the intensity, fire can negatively impact riparian habitat, as it reduces short-term and long-term habitat availability. In the case of a catastrophic fire, sterilized soil may limit vegetation regrowth. In areas where the water table has been lowered due to water diversions, the historic riparian plant community may be unable to recover after a catastrophic fire and will transition to an upland or shrubland state. However, prescribed burns have been used to spur native plant rejuvenation and can produce post-fire soil benefits. Increase in leaf litter following defoliation can increase fire intensity. Non-native species and altered hydrology also alter fire behavior. More fire studies in riparian areas are needed.

Flying insects

SWFLs mainly prey on flying insects, such as mosquitoes. These insects require slow-moving and/or standing water. Thus, abundant standing water is required to provide adequate insect prey. Pesticide use, defoliation, drought, and other factors that dry out soil negatively impact insect populations.

Heterogeneity in vegetation type (nest patch)

YBCUs require a nest patch size of over five hectares with 50-75% mid-story cover that is 3-10 meters high. Canopy cover is critical at the nest patch scale. (USFWS 2014; Johnson 2020)

Intraspecific competition

There are many uncertainties around how much intraspecific competition affects SWFL and YBCU breeding success. A site's ecological carrying capacity may be dependent on food availability.

SWFL

SWFLs generally have a 20-40 meter foraging patch size. However, multiple SWFLs may use high quality habitat patches, creating a high population density. SWFL pairs tend to spread out when adequate habitat is available, or when new habitat patches become available on the landscape; possibly as a result of lower food availability during early patch establishment.

YBCU

YBCU may compete amongst each other for nest sites and food sources, and is the degree of competitive interactions is unknown. Competition may include intraspecific nest parasitism, which may be common in this species (McNiel 2015).

Proximity to Water

Large flooded areas result in low velocity flow of shallow depth underneath the nest. This contributes to the insect populations that make up the prey base for SWFL and YBCU, is beneficial for plant health, and facilitates the cooler microclimate needed for nest success.

Moist soil underneath the nest is vital for maintaining the microclimate needed for nest success. Additionally, moist soil boosts insect populations, plant health, and seed establishment.

SWFL

During migration, SWFLs have been observed to be attracted to large flooded areas.

Large Insects

YBCUs are opportunistic feeders that feed on large insects and small lizards. They require a large amount of food, especially when they are young. YBCU young grow rapidly and fledge in seven days. YBCUs may choose territory based on insect outbreaks. Pesticide use, drought, and defoliation negatively impact their prey base.

Multi-Age Stands

SWFL breeding pairs prefer multi-age vegetation stands with 50-75% mid-story cover and dense cover that is 3-6 meters high. Dense vegetation provides protection from predators and contributes to the cooler microclimate of the nest site.

Nest Parasitism & Nest Predation

SWFL and YBCU nest predators include snakes, raccoons, skunks, rodents, and other birds. Loss of vegetative cover, drought, and other stressors can lead to predation and parasitism. There are uncertainties around how much edge effects impact parasitism and predation.

SWFL

Cowbirds are known to parasitize SWFL nests. Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, not specific to the flycatcher. Data show that predation and parasitism balance out to about the same total combined level every year.

YBCU

YBCU tend to be quiet around their nests, so as not to attract predators. Loss of canopy cover, drought, and other stressors can increase predation risk.

Riparian Vegetation Community (Landscape)

YBCUs require large expanses of riparian habitat at the landscape level with a mosaic of different vegetation types for both the nest patch and the foraging areas. The estimated home-range size of the YBCU is between 62-91 hectares (Sechrist et al. 2013; Dillon and Moore 2020).

Site Fidelity

SWFL site fidelity can both negatively or positively influence reproductive success, depending on site health and other characteristics. There are uncertainties around the degree of SWFLs site fidelity and what might influence dispersal to another site.

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Appendix D. Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) Objectives and Strategies

PRELIMINARY COLLABORATIVE PROGRAM OBJECTIVES

These preliminary objectives are the starting point for conversation at the objectives workshop described in Section 3.2, Task A. They are not final and will be revised prior to adoption by the SAMC. The adopted objectives and strategies will help the Collaborative Program achieve its goals in addressing species needs. A revised Section 4.1 incorporating the adopted objectives will supersede this Appendix D.

Rio Grande Silvery Minnow

Objective A-1: Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.

Reclamation sponsors a population monitoring program to sample a minimum of 20 sites per year to document the presence or absence of marked and unmarked RGSM. This supports 1-A-1, 1-A-2, 2-A-1, and 2-A-2 recovery goals and criteria from the 2010 USFWS species recovery plan. This long-term monitoring effort provides indispensable data for evaluating the status of RGSM in the MRG.

> ***Strategy A-1a***: Continue to support this long-term monitoring effort, keeping it as a high-priority for the Collaborative Program. Explore additional applications of these data, if possible.
>
> ***Strategy A-1b***: Evaluate (temporarily) increasing the sample size and adding targeted sites to facilitate a statistically robust experimental design that addresses habitat use and informs habitat restoration efforts.

Objective A-2: Continue to support research into the life history of the RGSM to further inform management of the species.

Contributing to ongoing research of the life history of the species will help inform management decisions that benefit or reduce impacts to the species. The MRGESCP has developed a CEM useful for deriving questions about the RGSM's life history. This supports recovery goals 1, 2, and 3.

> ***Strategy A-2a***: Generate research proposals to address previous panel recommendations (Noon et al. 2016, Fraser et al. 2013, etc.) and CEMs uncertainties to better understand the life history of the RGSM.
>
> ***Strategy A-2b***: Track life history research using the AM Database to generate more timely management and study recommendations.

Objective A-3: Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.

Base flows are important in maintaining wetted habitat, which represents the overall carrying capacity for the RGSM in any given area of the MRG. The following strategies support 2-B-1 and 3-B-1 recovery criteria from the 2010 USFWS recovery plan.

> ***Strategy A-3a***: Review current research publications and develop hypotheses to address habitat availability during base flow periods (outside of spring runoff).
>
> ***Strategy A-3b***: Support development of models, such as a Population Viability Analysis, to analyze habitat availability during base flow periods.
>
> ***Strategy A-3c***: Clearly define assumptions/uncertainties involving minimum base flow, sufficient habitat and survival rates.

Objective A-4: Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.

The timing, duration and magnitude of spring runoff are important to RGSM reproduction and have been demonstrated to have a significantly positive correlation with the October population density. The following strategies support recovery criteria 2-B-2, 2-B-3, 3-B-2, and 3-B-3 from the 2010 USFWS recovery plan.

Strategy A-4a: Review current research publications and develop hypotheses to address nursery habitat availability during spring runoff.

Strategy A-4b: Support development of models to analyze habitat availability during spring runoff.

Strategy A-4c: Clearly define assumptions/uncertainties involving flow characteristics, sufficient habitat and recruitment rates.

Objective A-5: Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.

Habitat availability varies by reach and flow regime in the MRG and more research and modeling efforts are needed to help determine the best balance between water management and habitat restoration to support species recruitment and survival. The following strategies support recovery criteria 2-B-3, 2-B-4, 3-B-3, and 3-B-4 of the 2010 USFWS species recovery plan.

Strategy A-5a: Perform modeling to determine the amount of habitat needed in each reach during 1) spring runoff, 2) summer low flow periods, and 3) fall and winter base flow periods needed to support a self-sustaining population.

Strategy A-5b: Identify uncertainties related to recruitment of RGSM and perform literature reviews to develop research hypotheses on this topic.

Strategy A-5c: Identify uncertainties related to survival of RGSM and perform literature reviews to develop research hypotheses on this topic.

Strategy A-5d: Review new and existing research to identify specific metrics to measure habitat quality in supports of recruitment and survival of RGSM for a self-sustaining population in each reach. Recommend a habitat monitoring protocol to provide empirical data.

Southwestern Willow Flycatcher

Objective B-1: Continue monitoring for SWFL in designated critical habitat areas to track territories in the MRG management unit of the Rio Grande recovery unit.

SWFL territories and nests have been consistently found in the MRG management unit and the number of territories have increased in the last ten years. Continued contributions to monitoring in the MRG will help track species recovery. The following strategies support all recovery criteria listed in the 2002 USFWS species recovery plan.

Strategy B-1a: Ensure designated critical habitat areas in the MRG are monitored annually for SWFL territories to contribute to understanding species recovery.

Strategy B-1b: Analyze available monitoring data annually to ensure SWFL territories are not decreasing in the MRG management unit. If the number of territories are decreasing, review

habitat areas where territories have decreased to make recommendations for improving habitat to increase SWFL territories.

Objective B-2: Continue monitoring critical SWFL habitat and contribute to research on the impacts from non-native and exotic species on SWFL recovery.

Habitat requirements for the SWFL have been well documented, but impacts from the management of the non-native and exotic tamarisk on SWFL recovery are poorly understood. The following strategy supports recovery criteria 2-B from the 2002 USFWS species recovery plan.

Strategy B-2a: Perform literature reviews and recommend best management practices regarding non-native and exotic species to support SWFL and their habitat.

Objective B-3: Support large-scale restoration efforts to protect and expand SWFL habitat in the MRG.

Strategy B-3a: Annually map or update maps of SWFL habitat in the MRG management unit.

Strategy B-3b: Review habitat areas biennially and identify sites that can be expanded based on occupied territories to prioritize restoration efforts.

Yellow-Billed Cuckoo

Objective C-1: Contribute to research and understanding of habitat needs for the YBCU.

Critical habitat areas were proposed and revised by the USFWS in 2020. The area includes much of the MRG with the exception of the Albuquerque reach. More research is needed to determine habitat features needed to help prevent up-listing of the YBCU. There is not currently a recovery plan for this species.

Strategy C-1a: Perform literature reviews and make recommendations for research to better understand the habitat needs to support the YBCU.

Strategy C-1b: Annually map or update maps of YBCU habitat in the MRG. Make recommendations to support expansion of habitat to support the species.

New Mexico Meadow Jumping Mouse

Objective D-1: Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

There is currently one known population of NMMJM in the MRGESCP area, located at the Bosque del Apache National Wildlife Refuge. The biggest stressor to the species is habitat loss, typically a result of grazing, water management practices, drought, wildfire and other pressures. The following strategies support the findings in the 2014 USFWS recovery outline for the species.

Strategy D-1a: Provide a biennial assessment of opportunities to expand NMMJM habitat in the MRG to achieve a self-sustaining population.

Strategy D-1b: Perform literature reviews and pursue opportunities to support research to better understand the life history of the NMMJM, including movement behavior, to support habitat recommendations.

Pecos Sunflower

Objective E-1: Continue monitoring for PESU stands in the West-Central New Mexico Recovery Region and preserve habitat.

In the 2005 species recovery plan, the USFWS listed at least one potential core conservation area for an existing population of PESU within the West-Central New Mexico Recovery Region in the MRGESCP area – the La Joya State Waterfowl Management Area. The area around the La Joya Drain is of particular interest. Monitoring and maintenance in that area should consider how to improve habitat for PESU.

Strategy E-1a: Monitor one new area per year for PESU to see if species is present. Monitoring could occur simultaneously with other monitoring occurring for habitat restoration sites or site maintenance monitoring. Consider monitoring in newly restored habitat areas in the Lower Reach Plan, where habitat for PESU may be become suitable.

Strategy E-1b: Devise a list of potential ways to keep the La Joya Drain area perennial to continue to provide suitable habitat for the PESU.

Other Objectives and Strategies

Objective F-1: Monitor the status of other threatened species in the MRG.

The Collaborative Program will track the status of other species of concern in the MRG to prevent future listings or up-listings within the MRGESCP area.

Strategy F-1a: Review the biennial assessment from the NMDGF for status of various species in the MRGESCP area. Consider including protection measures for applicable threatened species in restoration efforts, where possible.

Strategy F-1b: Include an update on status of other threatened and endangered species at the Science Symposium.

Objective G-1: Support the establishment and maintenance of a Conservation Storage pool in Abiquiu Reservoir.

Efforts are underway to change authorizations at Abiquiu Reservoir so native Rio Grande water can be stored in addition to the already authorized San Juan-Chama water storage. The flexibility to store both San Juan-Chama and native Rio Grande water will provide options for managing water resources on the MRG.

Strategy G-1a: Provide monitoring data to support the environmental assessment process to establish the conservation storage pool.

Strategy G-1b: When possible, find available water to support the conservation storage pool to benefit species and habitat.

Appendix E. Consolidated Recovery Goals, Criteria, and Actions

RIO GRANDE SILVERY MINNOW RECOVERY PLAN, FIRST REVISION (USFWS 2010)

Recovery Goals

1. Prevent the extinction of the Rio Grande silvery minnow (RGSM) in the MRG in New Mexico.
2. Recover the RGSM to an extent sufficient to change its status on the List of Endangered and Threatened Wildlife from endangered to threatened (downlisting).
3. Recover the RGSM to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Recovery Criteria

1.A.1. Using the standard sampling protocol (Appendix E), and sampling at a minimum of 20 sites distributed throughout the MRG in New Mexico, document the presence of RGSM (all unmarked fish) at ¾ of all sites, per reach, sampled during October.

1.A.2. Annual reproduction in the MRG below Cochiti Reservoir, as indicated by the presence of young-of-year at ¾ of all sites, per reach, sampled during October.

1.B.1. A captive population of 50,000 to 100,000 fish with a composition and distribution (among facilities) consistent with the recommendations of the RGSM Genetics Management and Propagation Plan (USFWS 2007).

2.A.1. Using the standard sampling protocol (Appendix E), and sampling at a minimum of 20 sites distributed throughout the MRG in New Mexico, document for at least 5 consecutive years, an October catch per unit effort (CPUE) from all monitoring sites within each reach of > 5 fish/100 m^2.

2.A.2. Annual reproduction in the MRG below Cochiti Reservoir, as indicated by the presence of young-of-year from ¾ of the monitoring sites, per reach, for at least five consecutive years.

2.A.3. Two additional populations of RGSM, in the historical range of the species but outside the MRG of New Mexico, that each demonstrate (by quantitative analysis) a probability of extinction in the wild of less than 10 percent within 50 years.

2.B.1. Base flow within occupied habitat sufficient to generate survival rates necessary to achieve Criteria 2-A-1. Wetted habitat represents the overall carrying capacity of a particular area for RGSM and influences survival rates for the population. The amount and distribution of base flows necessary for recovery can be informed by a PVA.

2.B.2. Recruitment flows that generate population growth rates necessary to achieve Criteria 2-A-1.

2.B.3. Habitat of sufficient quantity and quality to generate recruitment and survival rates that meet Criteria 2-A-1. Quantity and quality will vary by site but each location is likely to need increased nursery habitat and overall channel complexity. These increases can be achieved through restoration, flow management, and removing impediments to river migration, such as giant cane in the Big Bend area.

2.B.4. Improve water quality within occupied areas and reintroduction sites to support recruitment and survival rates necessary to achieve Criteria 2-A-1.

3.A.1. Three populations of RGSM, in the historical range of the species, each of which demonstrate (using quantitative analysis) a probability of extinction in the wild of less than 10% within 100 years.

3.B.1. Base flows within occupied habitat sufficient to generate survival rates necessary to achieve Criteria 3-A-1.

3.B.2. Recruitment flows that generate population growth rates necessary to achieve Criteria 3-A-1.

3.B.3. Habitat of sufficient quantity and quality to generate recruitment and survival rates that meet Criteria 3-A-1.

3.B.4. Water quality within occupied areas and reintroduction sites to support survival rates of RGSM necessary to achieve Criteria 3-A-1.

Recovery Actions

1. Develop a thorough knowledge of the RGSM's life history, ecology, and behavior, and the current status of its habitat.
2. Restore, protect, and alter habitats as necessary to alleviate threats to the RGSM.
3. Ensure the survival of the RGSM in its current habitat and reestablish the species in suitable habitats within its historical range.
4. Implement and maintain an adaptive management program so that appropriate research and management activities are implemented in a timely manner to achieve recovery of the RGSM.
5. Design and implement a public awareness and education program.

FINAL RECOVERY PLAN SOUTHWESTERN WILLOW FLYCATCHER (USFWS 2002)

Recovery Goals

1. Recover the southwestern willow flycatcher (SWFL) to an extent sufficient to change its status on the List of Endangered and Threatened Wildlife from endangered to threatened (downlisting).
2. Recover the SWFL to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Recovery Criteria

1.A. Increase the total known population to a minimum of 1,950 territories (equating to approximately 3,900 individuals), geographically distributed to allow proper functioning as metapopulations, so that the SWFL is no longer in danger of extinction. *For reclassification to threatened status, these prescribed numbers and distributions must be reached as a minimum, and maintained over a five year period*.

1.B. Increase the total known population to a minimum of 1,500 territories (equating to approximately 3,000 individuals), geographically distributed among Management Units and Recovery Units, so that the SWFL is no longer in danger of extinction. *For reclassification to threatened status, these prescribed numbers and distributions must be reached as a minimum, and maintained over a three year period, and the habitats supporting these SWFL must be protected from threats and loss.*

2.A. Meet and maintain, at a minimum, the population levels and geographic distribution specified under reclassification to threatened Criterion 1.A.

2.B. Provide protection from threats and create/secure sufficient habitat to assure maintenance of these populations and/or habitats over time.

Recovery Actions

1. Increase and improve occupied, suitable, and potential breeding habitat;
2. Increase metapopulation stability;
3. Improve demographic parameters;
4. Minimize threats to wintering and migration habitat;
5. Survey and monitor;
6. Conduct research;
7. Provide public education and outreach;
8. Assure implementation of laws, policies, and agreements that benefit the SWFL;
9. Track recovery progress.

RECOVERY OUTLINE NEW MEXICO MEADOW JUMPING MOUSE (USFWS 2014)

Note: The goals and criteria are inferred from the Preliminary Recovery Strategy, and are not explicitly listed as such.

Recovery Goals

1. Establish the number and distribution of resilient populations to provide the needed levels of representation and redundancy (genetic and ecological diversity) for the species to demonstrate viability.

Recovery Criteria

1.A. To ensure viability, establish at least two resilient populations (where at least two existed historically) within each of eight identified geographic conservation areas.

Recovery Actions

1. Establish partnerships to design and install effective barriers or exclosures or change livestock management techniques (e.g., fencing, reconfiguration of grazing units, off-site water development, or changing the timing or duration of livestock use) to limit ungulate grazing and protect riparian habitats from damage.
2. Work cooperatively with stakeholders to maintain the required microhabitat components or modify or limit actions (e.g., bridge and road realignment projects, water use and management, stream restoration, and vegetation management) that preclude their development and restoration, in order to stabilize and expand current New Mexico meadow jumping mouse (NMMJM) populations.

3. Identify priority areas to reduce fuels to minimize the risk of severe wildland fire and identify techniques for post-fire stabilization in areas that burn.
4. Modify off-road vehicle use and manage dispersed recreation through fencing, signage, education, and timing of use.
5. Facilitate the natural expansion of NMMJM habitat through the management and restoration of beaver. In New Mexico, beaver can no longer be relocated or transplanted without written consent from all property owners, land management agencies, or other affected parties (e.g., irrigation districts) within an 8-kilometer (5-mile) radius of the proposed release site or connective waters (New Mexico Department of Game and Fish 2009, entire).
6. Complete an emergency contingency and salvage plan to capture NMMJMs and bring individuals into captivity in the event of severe wildland fire, post-fire flooding, or severe drought.
7. Establish a monitoring protocol to determine presence/absence or estimate the abundance of NMMJM populations.
8. Investigate the genetic diversity of populations to identify and address where long term management strategies may be needed to enhance their genetic integrity.
9. Formally evaluate whether assisted translocation or a captive breeding program for NMMJMs would be beneficial as a recovery option.
10. Conduct research on the critical aspects of NMMJM life history (e.g., reproduction, abundance, survival, movement behavior).

PECOS SUNFLOWER RECOVERY PLAN (USFWS 2005)

Recovery Goal

1. Removal from the Federal list of threatened and endangered species (delisting). Protect and manage in perpetuity significant, sustainable populations of Pecos sunflower (PESU) and habitat within its native range so that the protection of the Endangered Species Act is no longer required for the conservation and survival of the species.

Recovery Criteria

1.A. Identify and establish at least one core conservation area for PESU in each of four distinct recovery regions that would collectively, if protected, ensure the long-term survival of the species. Each core habitat must occur on wetlands that are not threatened by depletion of the contributing aquifer and have demonstrated a self-perpetuating stand of PESU of greater than 5000 individuals for a minimum of seven out of ten years. In addition to the core conservation area, each region should have at minimum one additional isolated stand of protected PESU with greater than 1600 individuals for at least seven out of ten years to protect against catastrophic loss of the regional population.

1.B. Assure long-term protection of designated core conservation areas and designated isolated stands in perpetuity through the implementation of appropriate management plans, conservation easements, or land acquisition.

Recovery Actions

1. Identify and establish core conservation areas and isolated stands.
2. Identify and address information gaps, compatible uses, and management actions regarding Pecos sunflower distribution, biology and aquifer stability.
3. Protect core conservation areas and isolated stands through landowner education, implementation of management plans, conservation easements, and land acquisition.
4. Monitor PESU conservation areas and management actions as needed to satisfy delisting criteria.

WESTERN YELLOW-BILLED CUCKOO CONSERVATION STRATEGY (USFWS 2020)

Note: This information is based off the latest proposal for revised critical habitat designation in the Federal Register (Feb. 2020, Vol. 85, No. 39)

Recovery Goal

1. The goal of our conservation strategy for the western yellow-billed cuckoo (YBCU) is to recover the species to the point where the protections of the Endangered Species Act are no longer necessary.

Recovery Criteria

1.A. Identify the specific areas within the western YBCU's range that provide essential physical and biological features (e.g., breeding habitat), without which range-wide resiliency, redundancy, and representation could not be achieved.

1.B. Identify the fundamental parameters of the species' biology and ecology based on well-accepted conservation-biology and ecological principles for conserving species and their habitats and more general riparian and avian conservation management prescriptions.

Recovery Actions

1. Designate critical habitat, focused on breeding habitat, which includes areas for nesting and foraging and also provides for dispersal habitat when breeding or food resources may not be optimal.
2. Include breeding habitat within three general habitat settings to allow for within-year and year-to-year movements to take advantage of any spatial and temporal changes in habitat resources and food abundance.
    a. Large river systems (mainstem rivers and their tributaries) in the southern and central portions of New Mexico, Arizona, and along the California border with Arizona (generally referred to as the Southwest);
    b. Locations within southern Arizona not associated with major river systems or their tributaries;
    c. Large river systems outside the Southwest (as identified in [a.] above) that occur in different ecological settings that are being consistently used as breeding areas by western yellow-billed cuckoo (such as areas in parts of California, Utah, Idaho, or Colorado).
3. Monitor population potential for:
    a. Maintaining its existing distribution;

b. Moving between areas depending on food, resource, and habitat availability;
c. Increasing the size of the population to a level where it can withstand potentially negative genetic or demographic impacts;
d. Maintaining its ability to withstand local- or unit-level environmental fluctuations or catastrophes.

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group
Charge Template

Approved by Science and Adaptive Management Committee (SAMC) on *DATE*.

Parent Committee

S&T Ad Hoc Groups are formed by and report to the SAMC.

Ad Hoc Group Charge

Detail the charge of the S&T Ad Hoc Group below, including specific tasks directed by the SAMC. Include the objectives addressed by those tasks.

Membership

A. Criteria for membership

Provide a list of qualifications and/or interests that members should possess in order to sit on the ad hoc group

B. Member List

List the proposed members of the S&T Ad Hoc Group here, including affiliation and job title. The total membership should take into account the expertise needed to carry out the group's charge, and the group should be kept at a manageable size in order to complete the task within the timeline detailed in this document.

Tasks and Deliverables

List the specific tasks the group is being directed to complete to fulfill their charge. Provide the deliverable(s) associated with each task. Tasks can be a concrete activity (e.g., data analysis, a scope of work, a model), but can also be process-oriented (e.g., develop options for addressing a hypothesis for the SAMC's consideration).

1. ***Task One Name***
   Details of task one

   Objective of Task One
   How will this task contribute to the group's overall charge?

   Deliverable(s):

2. ***Task Two Name***
   Details of task two

   Objective of Task Two
   How will this task contribute to the group's overall charge?

   Deliverable(s):

Add or delete numbers for additional tasks as needed.

Timeline and Reporting Scheduling

Complete the table below to note when tasks should be completed and deliverables submitted to the SAMC for review. The tasks in the table should match with those listed above. Each task should include reports to the SAMC.

Task	Subtask	Deliverable	To Be Completed By
Task one	Subtask 1A	Deliverable Name	Deadline
	Subtask 1B	Deliverable Name	Deadline
Task two		Deliverable Name	Deadline

Middle Rio Grande Endangered Species Collaborative Program
Executive Committee Charge to the
Population Monitoring Work Group
September 2018 Revised

1.0 Introduction

1.1 Background

The Population Monitoring Work Group (PMW) was established by the Executive Committee (EC) of the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) in 2012 to provide technical review and focused assessment and recommendations related to monitoring of fish populations in the Middle Rio Grande (MRG), New Mexico, as impacted by water management and river dynamics. This document updates and revises the charge to the PMW as the EC transitions to an adaptive management program. An overview of the fish monitoring program for the MRG is provided as Appendix A to this document.

In the original charge to the PMW[1], the EC tasked the group with evaluating and recommending refinement of the MRG Fish Population Monitoring Plan by implementing the following three major tasks:

- Task 1. Conduct a Workshop on Catch-per-Unit-Effort (CPUE) Methodology used by the Current Rio Grande Silvery Minnow (RGSM) Population Monitoring Program;
- Task 2. Review the Middle Rio Grande Fish Population Monitoring Plan; and
- Task 3. Update the Collaborative Program Middle Rio Grande Fish Monitoring Plan.

This document updates and revises the tasks and actions for evaluating and updating the fish monitoring plan. These tasks help to address issues identified in a scientific review of the Rio Grande silvery minnow (RGSM) population monitoring program, and as described by the U.S. Fish and Wildlife Service (USFWS) in a letter dated March 23, 2012. The Service's letter recommended that the EC host a facilitated science workshop to discuss outstanding issues over the use of catch-per-unit-effort (CPUE) for monitoring the RGSM.

Task 1 of this charge addressed the Service's recommendation as part of a broader effort to refine the fish monitoring plan. Under Task 1, an External Experts Panel was convened in a Population Monitoring Workshop conducted December 8-10, 2015 (Hubert et al. 2016). An Independent Science Panel was also convened February 1-2, 2017 (Noon et al. 2017), as part of U.S. Army Corps of Engineers project to develop an adaptive management framework for the MRG. These science panel reports provided a total of 41 recommendations, many of which apply to the fish monitoring program and help provide guidance to the PMW for evaluating and

[1] Approval of the 1st Task for Review of the Collaborative Program Fish Monitoring Program for the Rio Grande Silvery Minnow: A Proposal for a CPUE Metrics and Methodologies Workshop. Submitted to the Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program. July 13, 2012.

updating the fish monitoring plan.

1.2 Primary Goal and Program Needs

The primary goal of this charge is to evaluate and update the fish monitoring plan for the Middle Rio Grande. The focus of this plan shall be on the endangered Rio Grande silvery minnow, along with the identification and development of population demographic parameters that can be used to best meet the needs of the MRGESCP, the applicable biological opinions (BOs), and the species recovery plan.

The EC has expressed the need to reliably measure the effects of MRG water management actions and conservation measures on the RGSM, and the Service seeks to determine the best population demographic parameter(s) for gauging species recovery and for measuring incidental take in the applicable BOs. The fish monitoring plan shall meet the various needs of the MRGCESP, and specifically provide the following:

- Monthly and annual CPUE indices for RGSM to evaluate species response to management actions in the MRG;
- Annual CPUE indices for RGSM as a measure of incidental take, as required by the 2016 Biological Opinion (USFWS 2016);
- Annual CPUE indices for RGSM as a measure of recovery criteria, as specified in the 2010 Rio Grande Silvery Minnow Recovery Plan (USFWS 2010);
- Monthly and annual CPUE indices by fish species of the MRG, as needed, to evaluate management actions and interspecific interactions and competition with RGSM; and
- A quality assured/quality controlled (QA/QC) database containing all pertinent and measured data associated with field samples used to generate the appropriate CPUEs.

2.0 Approach

The approach of this charge is intended to resolve how the RGSM population monitoring program can provide a reliable, precise, and accurate measure of the status and trend of the species for the expressed needs in a manner that is reasonably attainable at a reasonable cost, and consistent with the MRGESCP adaptive management program.

2.1 Overview of Tasks

The following is an overview of the approach for implementing the three major tasks:

- Task 1 focused on addressing technical questions concerning use of CPUE in the current RGSM monitoring program. This task involved convening of a panel of external experts in a population monitoring workshop that responded to prior questions, discussed the current monitoring program, and provided recommendations for improving the monitoring plan.

- Task 2 is a review of the current monitoring program and database, including temporal and spatial aspects of sampling design, data collection protocols, and data analyses. This task involves an evaluation of the current plan and explores optional designs and methods. It also involves evaluating and addressing the recommendations of the two science panels in the context of refining the monitoring plan.

- Task 3 is the development of a final fish monitoring plan with details of sampling design (e.g., number and location of samples, frequency of sampling, gear types, etc.), data collection protocols (e.g., data to be collected, manner of storage, etc.), and analytical methods (e.g., CPUE computation, relationship of CPUE to population estimates, use in Population Viability Analysis [PVA] models, etc.).

2.2 Objectives and Actions by Task

The following are the objectives and actions associated with each of the three major tasks:

Task 1. Conduct a Workshop on Catch-per-Unit-Effort (CPUE) Methodology used by the Current Rio Grande Silvery Minnow (RGSM) Population Monitoring Program

Objectives:

1. Evaluate statistical properties and interpretations of the current RGSM monitoring program, including precision and accuracy of CPUE.

2. Discuss, evaluate, and reconcile areas of concern/disagreement over CPUE.

3. Discuss and evaluate population estimation for RGSM and compare and correlate with CPUE.

4. Identify and evaluate other methods for monitoring the RGSM, including methods used in other river systems.

5. Identify, discuss, and reconcile uses of CPUE for RGSM, including demographic recovery criteria, sufficient progress metrics, and inputs and parameter estimates for Population Viability Analysis.

Actions:

1. Retain two or three external scientists with expertise in CPUE, fish sampling design for small-bodied fishes, and other methodologies to participate in data examination, workshop presentation/interaction, and assist in preparing workshop report.

2. Distribute and provide for independent examination, the existing monitoring data (and available population estimation data) to evaluate existing and potential precision and levels of detectable change in abundance of RGSM.

3. Conduct a 3-day workshop that includes an introductory session with EC members followed by technical presentations, discussion, and draft report preparation.

4. Prepare and present a report of the CPUE Workshop to the EC (report to be prepared jointly by workshop organizers and external scientists).

Task 2. Review Middle Rio Grande Fish Population Monitoring Plan

Objectives:

1. Review and evaluate the current fish population monitoring plan, including sampling design, gear types and methods, data collection protocols, and computation of CPUE, with due consideration to the Hubert and Noon science panel recommendations, as well as other sources of pertinent information.

2. Identify other data needs for concurrent sampling during fish monitoring to support other information needs (e.g., augmentation, fish movement and passage, drying, genetics, habitat use, PVA) as part of a comprehensive fish monitoring program.

3. Determine the scientific and management needs of the fish monitoring program.

Actions:

1. Integrate and prioritize the Hubert and Noon science panel recommendations, with a focus on the following key areas:

    a. Identify and segregate recommendations that apply to the fish monitoring program from other topics (research, management, or institutional issues); and

    b. Prioritize recommendations related to the fish monitoring program and identify overlap or inconsistencies among the recommendations of the two science panels.

2. Obtain and evaluate all pertinent data that may be applicable to review of the fish monitoring program (e.g., ASIR data, egg surveys, fish salvage, floodplain collections, RGSM data collected outside of the monitoring program).

3. Retain two or three external scientists with expertise in sampling design and statistical analyses to evaluate and address the recommendations of the two science panels, as prioritized by the PMW, as well as other analyses that may contribute to a review of the current fish monitoring program.

4. Evaluate the current fish population monitoring plan for the following properties, with full consideration of the science panel recommendations:

    a. Statistical properties of spatial aspects (e.g., longitudinal locations of sample stations, habitats in which samples are taken) and temporal aspects (e.g., frequency of sampling, times of year when samples are taken);

    b. Gear types and sampling methods and strategies;

    c. Data collection protocols, including types of data collected, recording methods, quality control, electronic storage, and data custody; and

d. Computation of CPUE (e.g., by fish age, consideration of catchability, relationship to true abundance) and measures of precision.

5. Produce a report that integrates the findings of this task and highlights the aspects of the current monitoring plan that merit further consideration and refinement for updating the fish monitoring plan.

6. Identify and reaffirm the needs of the MRGESCP for the fish monitoring program to insure that it meets the needs of the stakeholders and the MRGESCP.

Task 3. Update the MRG Fish Population Monitoring Plan

Objectives:

1. Update the current fish monitoring program with revisions that may include sampling design, data collection, quality control, storage and custody, and costs.

2. Ensure that the needs of the MRGESCP are met with a monitoring program for RGSM sufficiently sensitive to:

    a. Detect changes in RGSM abundance with management actions;

    b. Provide reliable indices for applicable biological opinions;

    c. Provide reliable demographic recovery criteria for RGSM;

    d. Evaluate trends in all fish species and interspecific interactions and competition with the RGSM; and

    e. Provide a reliable database of catch information and associated data.

Actions:

1. Develop two or three alternative fish monitoring plans, including the current design, and evaluate each with respect to:

    a. Meeting the needs of the stakeholders and the MRGESCP.

    b. Fundamental sampling design (e.g., fixed sites, random sites, randomized block design, stratified block design);

    c. Sampling strategies (e.g., time and location of samples, number of samples, gear types, associated data collection); and

    d. Analytical methods (computation of CPUE and variance, means comparisons); and

    e. Evaluation of robustness, including effect of number of stations and samples on precision, change detection, trend and power (i.e., probability of Type I and II errors), and associated cost.

2. Provide alternative monitoring plans with associated precision and cost, ranked by suitability, to the Adaptive Management Committee, which will in turn recommend the most appropriate and cost-effective design for a fish population monitoring plan to the EC.

3.0 Schedule and Cost

3.1 Estimated Schedule

An anticipated time schedule for this approach is provided in Table 1. The following summarizes the schedule for each task and action:

Task 1: CPUE Workshop

- Task 1 was completed with a CPUE Workshop in December 2015 and a Final Report to the EC in April 2016 (Hubert et al. 2016).

Task 2: Review Monitoring Program

- Task 2 was initiated with integration and prioritization of the two science panel recommendations, which should be completed in September 2018.
- The ASIR fish population monitoring data were received in March 2018, and other pertinent data need to be assimilated by October 2018.
- Two external scientists/biostatisticians (Dr. Charles Yackulic of USGS and Shay Howlin of WEST) were contracted in August 2018, in anticipation that their services will be made available as necessary to complete Tasks 2 and 3.
- An evaluation of the current fish monitoring plan and the science panel recommendations is ongoing with a report provided to the EC in December 2018.

Task 3: Update the current Fish Monitoring Plan

- Alternative fish monitoring plans will be developed and evaluated by March 2019.
- Alternative plans will be ranked according to the most appropriate and cost-effective and provided to the Adaptive Management Committee for a recommended plan to the EC by July 2019.
- It is assumed that the current monitoring program will continue until a new or revised program is implemented, evaluated, and refined.

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Table 1. Estimated time schedule for revision of the fish population monitoring program.

Action	Progress	Completion Date
Task 1: CPUE Workshop		
1. Retain two or three external scientists	• Three external scientists were retained: Wayne Hubert, Mary Fabrizio, Robert Hughes	• August 2015
2. Distribute and provide existing monitoring data	• Reports, data, and questions were provided to the three scientists	• October 2015
3. Conduct a 3-day workshop	• 3-day workshop was held, Isleta, NM	• December 8-10, 2015
4. Prepare and present report of CPUE Workshop to the EC	• Final Report provided to EC	• April 2016
Task 2: Evaluate Current Monitoring Plan		
1. Integrate and prioritize science panel recommendations	• Ongoing	• September 2018
2. Obtain and evaluate all pertinent data	• ASIR data received • Other data needed	• March 2018 • October 2018
3. Retain two or three external scientists	• Dr. Charles Yackulic (USGS) and Shay Howlin (WEST) have been initially retained	• August 2018
4. Evaluate current fish monitoring plan, with consideration of science panel recommendations	• Ongoing	• December 2018
5. Produce a report that integrates the findings of this task	• Not begun	• December 2018
6. Identify and reaffirm needs of MRGESCP	• Initial survey of EC need for fish monitoring completed • May need to reaffirm	• March 2015 • October 2018
Task 3: Update Fish Monitoring Plan		
1. Develop two or three alternative monitoring plans	• Not begun	• March 2019
2. Provide alternative monitoring plans to the Adaptive Management Committee	• Not begun	• July 2019

3.2 Estimated Costs

- The costs for Task 1 were approximately $30,000 of federal funding (USFWS and Reclamation/CP) with cost share contributions from nonfederal signatories. The majority of this cost ($20-25,000) was for contracting external scientists' time and per diem. The costs for participation by the Collaborative Program participants or their contractors were not factored into this estimate.

- The costs of Tasks 2 and 3 are undetermined at this time. The principal cost will be for contracting external scientific/statistical expertise. The cost of PMW meeting participation will be cost share contributions from nonfederal signatories.

- The PMW is comprised of MRGESCP stakeholder representatives, whose involvement in the PMW is part of the stakeholder contribution to the Program.

Literature Cited

Hubert, W.A., M.C. Fabrizio, and R. Hughes. 2016. Summary of Findings by the External Expert Panelists: Rio Grande silvery minnow population monitoring workshop Isleta Casino and Resort, 8-10 December 2015. U.S. Bureau of Reclamation, Albuquerque, NM.

Noon, B., D. Hankin, T. Dunne, and G. Grossman. 2017. Independent Science Panel Findings Report: Rio Grande Silvery Minnow Key Scientific Uncertainties and Study Recommendations. Prepared for the U.S. Army Corps of Engineers, Albuquerque District on Behalf of the Middle Rio Grande Endangered Species Collaborative Program. Prepared by GeoSystems Analysis, Inc. Albuquerque, NM. June 2017. Contract No. W912PP-15-C-0008.

U.S. Fish and Wildlife Service (USFWS). 2010. Rio Grande Silvery Minnow *(Hybognathus amarus)* Recovery Plan, First Revision. Albuquerque, NM.

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Appendix A: Overview of the Fish Population Monitoring Program

The fishes of the Rio Grande between Velarde and Elephant Butte Reservoir and their habitat associations were first reported in 1987 (Platania 1993). Monitoring of the fish population with a catch-per-unit-effort (CPUE) index and specifically the endangered Rio Grande silvery minnow began in 1993 and has been carried out annually except for 1998. The current monitoring program continues to provide annual and monthly CPUE estimates for each of three reaches of the Middle Rio Grande, including the Angostura, Isleta, and San Acacia reaches. Sampling has generally been conducted at 15-20 sites for up to 10 months in a year. Fish are taken with multiple seine hauls at fixed sample stations, and CPUE is computed for each species as the pool of seine hauls by station and month. CPUE is expressed as the number of individuals per 100 m^2 of area seined (see Dudley et al. 2018).

The sampling design and statistical analysis for the fish monitoring program have evolved over time. The sampling design and methodology used to capture the fish and record associated information has differed with project objective. From 1993 to 1997, data were collected as part of ichthyofaunal surveys for specific localities in the MRG (e.g., Platania 1993; Bestgen and Platania 1991); to assess winter habitat use by the RGSM; and for project evaluations and fish habitat associations (Dudley and Platania 1997).

Sampling and data collection were first specifically designed for monitoring the RGSM population and the associated fish community starting in 1999 (Dudley and Platania 2002). From 1999 to 2001, the numbers of fish collected were recorded as the pool of up to 20 seine hauls for each of 17 stations, and CPUE was expressed by species as the number of fish/100 m^2 by station and month (i.e., "by-station CPUE"). Starting in 2002, up to 20 stations were sampled monthly and data were also available by individual seine haul for a "by-haul CPUE."

Various attempts have been made to institutionalize the fish monitoring plan. The original design and refinements in sampling design and statistical analysis can be traced with each annual report provided since 1993 (i.e., Platania 1993 to Dudley et al. 2018). In 2006, the MRGESCP (2006) assembled a Program Monitoring Plan and included, as Appendix A, a Rio Grande Fish Community Monitoring Plan that detailed monitoring methods, statistical analysis, and reporting. In 2018, following requested modifications of the ongoing monitoring plan by the PMW, Dudley et al. (2018) produced Appendix A to their annual report that described in detail the sampling design and analysis, as well as the recommended modifications.

Fish current fish monitoring plan for the MRG is described in Appendix A of Dudley et al. (2018). Some of the recommendations of the Hubert et al. (2016) and Noon et al. (2017) science panel reports have been incorporated into the current plan as an addition or addendum to be evaluated in the plan, but not as a permanent change. The current charge of the EC to the PMW is to evaluate and address the science panel reports and update the fish monitoring plan, as appropriate.

Literature Cited (Appendix A)

Bestgen, K.R., and S.P. Platania. 1991. Status and conservation of the Rio Grande silvery minnow, Hybognathus amarus. Southwestern Naturalist 36:225–232.

Dudley, R.K., and S.P. Platania. 1997. Habitat use of Rio Grande Silvery Minnow. Report to the New Mexico Department of Game and Fish, Santa Fe, and U.S. Bureau of Reclamation, Albuquerque, New Mexico.

Dudley, R.K., and S.P. Platania. 2002. Summary of Population Monitoring of Rio Grande silvery minnow (1994–2002). Report to New Mexico Ecological Services Field Office, Albuquerque, New Mexico.

Dudley, R.K. and S.P. Platania. 2011. Rio Grande silvery minnow population monitoring program results from September 2009 to October 2010. Report to the Middle Rio Grande Endangered Species Act Collaborative Program and the U.S. Bureau of Reclamation, Albuquerque, NM.

Dudley, R.K., S.P. Platania, and G.C. White. 2018. Rio Grande Silvery Minnow Population Monitoring During 2017: Draft Annual Report. A Middle Rio Grande Endangered Species Collaborative Program Funded Research Project. U.S. Bureau of Reclamation, Albuquerque, NM.

Hubert, W.A., M.C. Fabrizio, and R. Hughes. 2016. Summary of Findings by the External Expert Panelists: Rio Grande silvery minnow population monitoring workshop Isleta Casino and Resort, 8-10 December 2015. U.S. Bureau of Reclamation, Albuquerque, NM.

Noon, B., D. Hankin, T. Dunne, and G. Grossman. 2017. Independent Science Panel Findings Report: Rio Grande Silvery Minnow Key Scientific Uncertainties and Study Recommendations. Prepared for the U.S. Army Corps of Engineers, Albuquerque District on Behalf of the Middle Rio Grande Endangered Species Collaborative Program. Prepared by GeoSystems Analysis, Inc. Albuquerque, NM. June 2017. Contract No. W912PP-15-C-0008.

Platania, S.P. 1993. The fishes of the Rio Grande between Velarde and Elephant Butte Reservoir and their habitat associations. Report to the New Mexico Department of Game and Fish, Santa Fe, and U.S. Bureau of Reclamation (Albuquerque Projects Office), Albuquerque, NM.

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Charter for Habitat Restoration Work Group of the Middle Rio Grande Endangered Species Collaborative Program

Overview

The Middle Rio Grande Endangered Species Act Collaborative Program (Program) By-Laws, adopted by the Executive Committee (EC) on October 2, 2006, define the Program's organizational structure and discuss the various organizational units including the EC, Coordination Committee (CC), Program Manager (PM), Program Management Team (PMT), and work groups. The EC may establish work groups and designate members of work groups on its own initiative or on the recommendation of the CC when additional assistance or expertise is beneficial to accomplishing the goals of the Program. Upon approval of this charter, the Habitat Restoration Work Group (HRW) is established by the EC, and will serve at the pleasure of the governing body.

The HRW will operate with specific schedules, objectives, and scopes of work established by the EC. Methods for accomplishing the established activities will be identified by the HRW. The PM will assign a PMT liaison to support the HRW and ensure that objectives and work products are clearly identified, assigned work group tasks are completed, and schedules are met.

HRW Objectives

The purpose of the HRW is to help restore habitat in the Middle Rio Grande (MRG) in order to provide guidance and contribute to accomplishing Biological Opinion RPA elements R and S for the benefit of the listed species. The HRW will provide technical assistance, expertise and leadership to address specific Program tasks, primarily implementation of the Long Term Plan, to accomplish the goals of the Program. The HRW provides:

1. Coordination of long-term, MRG-wide, habitat restoration plans that actively integrate river function, riparian community and hydrology, resulting in improved habitats for endangered species that support the Biological Opinion RPA

2. Integration of HR activities with other Program-related activities, including other Program work groups and restoration efforts outside of the Program

3. A regular forum for meeting and discussing Program-related habitat restoration topics

4. Consistency in technical planning efforts over the duration of the Program

5. Technical assistance to others wanting to implement habitat restoration projects

6. A scientific framework for monitoring and assessing restoration projects

7. Support for conferences and publications that facilitate the exchange of information derived from HRW efforts

HRW Membership

Each EC member may appoint one voting member to the HRW. Each EC member may also appoint one or more alternate HRW members. As in the EC and the CC, the total membership of the standing HRW shall not exceed twenty (20).

Additional Participants
Participation in the HRW may vary depending on the subject matter and may include:

1. Additional personnel from agencies/entities that are signatories to the Program;
2. Professionals with expertise in the subject matter who do not represent Program signatories;
3. Contractors or other parties, including members of the public, with experience in the subject matter addressed by the HRW.

Ad Hoc Work Groups
If necessary to implement tasks in the long-term plan, and after providing notice to the EC, HRW may form and disband temporary ad-hoc groups of individuals with expertise and/or interest in the specialized subject. HRW will oversee ad-hoc work groups and be responsible for ensuring ad hoc work groups meet objectives and schedules, and will disband the work groups upon completion of the pre-determined objectives. The EC may appoint additional members to the ad-hoc groups including:

1. Professionals with expertise in the subject matter who may or may not be involved in the Program, and
2. Contractors or other parties, including members of the public, with experience in the subject matter addressed by the work group.

HRW Leaders
The HRW will elect two work group leaders, each serving for a term of one year with no more than two consecutive one-year terms. Any appointed member of the HRW may serve as work group leader. To the extent practical, one leader should represent a federal agency and one leader a non-federal agency to ensure broadest representation. At least one HRW leader will participate in each monthly PMT communication meeting, held the 4th Wednesday of each month, and at CC and EC meetings upon request.

HRW Meetings
The HRW will hold regular meetings on the third Tuesday of each month. The HRW may meet more or less frequently, if determined appropriate by the HRW leader(s), according to work assignments. Additional special meetings may be called by the work group leader(s) if needed to accomplish specific tasks. The PMT will post HRW meeting schedules, locations, and agendas on the Program website at least one week in advance of the meeting date. All meetings will be open to the public. The work group leaders will ensure that meeting summaries are kept that accurately reflect actions of the HRW. The PMT will ensure that meeting summaries are posted on the website within one week after they are final.

If a member cannot attend a meeting, the alternate should attend, or the member may send a written request or statement regarding agenda items of interest.

HRW Responsibilities and Scope of Work
The HRW is responsible for carrying out specific scopes of work established by the EC. The PMT liaison will assist the leaders to develop a HRW Annual Scope of Work and Schedule for submittal to, and approval by, the EC each year. The HRW Annual Scope of Work will contain objectives, tasks, schedules, and deliverables to be completed for that year. To the extent possible, the Annual Scope of Work will also identify ad hoc group(s), if any, and ad hoc group members. Any additional activities that may arise during the course of the year will be submitted to the EC. The continuing responsibilities and scope of work of the HRW are as follows:

Implementation of Long Term Plan (LTP) Activities via the RFP Process:

- Review LTP budget estimates and activities and recommend changes if needed
- Recommend priorities for focused HR activities
- Coordinate with other work groups and PMT to develop scopes of work (SOWs) that effectively integrate objectives
- Participate in evaluating proposals (TPEC process) and recommend TPEC membership (i.e. outside experts)
- Interface reach-specific restoration plans into master approach for MRG

Technical Review and Coordination:

- Provide technical input and assistance for work groups, projects, and Program assessment process
- Review contract and work group deliverables and provide feedback
- Conduct site visits
- Review and update habitat restoration plans
- Coordinate with other efforts (Program and non-Program) in the MRG
- Participate in joint quarterly meetings with other work groups
- Oversee ad-hoc HRW work groups

Monitoring and Assessment:

- Provide technical input and implement Program Monitoring Plan
- Develop and implement Adaptive Management Plan (consistent with the Program Monitoring Plan)
- Provide prior year project updates to PMT (i.e. assist with Annual Report)
- Participate in and recommend topics for annual forums
- Review Long Term Plan budget estimates and activities and recommend changes if needed
- Recommend experts to obtain input on technical issues
- Recommend research and monitoring needs

Other Technical Contributions:

- Carry out other work established or approved by the EC

Relationship of HRW to Other Organizational Units of the Program

The EC makes Program decisions. The EC establishes work groups. HRW products and recommendations are provided to the EC through the PMT, after discussion and review by the CC and the PMT. The CC will discuss all work products with their respective EC member.

The PM is the leader of the PMT. The PMT will provide a liaison to support the HRW and to ensure that assigned work group tasks are completed. The PMT reports to the EC. The EC may delegate certain decisions to the PMT, CC, or work groups.

Coordination between work groups occurs through the PMT, during monthly communication meetings, and at joint work group meetings. Joint work group meetings will be held when needed, such as when preparing for fiscal year activities and working collaboratively on specific projects.

Support to HRW
The PM will assign Program staff to support HRW so that the objectives and work products are clearly identified, assigned tasks are completed, schedules are met, and necessary support is provided as further identified in the PMT Charter. HRW leader(s) will be designated to work with the assigned staff to establish the Annual Scope of Work and Schedule.

The PMT will provide support for meetings of the HRW, including distribution of agendas and meeting materials, and distribution of meeting summaries. Final meeting summaries will be made available to the public via an established Program distribution network. The PM will provide HRW products subject to EC approval to the CC for review and discussion, and will assist the CC in developing recommendations to the EC.

HRW Recommendations
The HRW will make technically sound recommendations based on the best available science and professional judgment of the members. If a consensus recommendation is not reached, the voting procedure described below may be used.

Voting Procedures and Minority Reporting
When voting is required to provide recommendations, each voting member (member appointed by an EC member) is allowed one vote. Participants that are not voting members do not have a vote. Recommendations will be of the simple majority present. The minority, if they choose, may submit a minority report with the majority recommendation to the PM and the EC. The majority recommendation will note that a minority report has been filed.

Reporting Results and Communicating Recommendations
The HRW leaders will provide work products and recommendations to the EC through the PMT, after discussion and review by the CC. HRW leaders will report on HRW activities at each monthly communication meeting, and at CC and EC meetings upon request.

HRW Work Products
All final HRW products are subject to approval by the EC and, upon approval, the PMT will make them available to the public.

Annual Review of HRW
The PM, with input from the PMT, will review the accomplishments of HRW annually with respect to its objectives, schedule, and participation by members, and make recommendations to the EC regarding continuation or termination of the HRW, as well as changes in objectives, schedule, or membership.

Amendment of HRW Charter
This charter may be amended as deemed appropriate within the bounds of the By-Laws, with input from the HRW, and approval by the EC. At a minimum, the charter will be reviewed annually.

EC approved the foregoing Habitat Restoration Work Group Charter on 23 August 2007.

Charter for Science Work Group of the Middle Rio Grande Endangered Species Collaborative Program

Overview

The Middle Rio Grande Endangered Species Act Collaborative Program (Program) By-Laws, adopted by Executive Committee on October 2, 2006, define the organizational structure of the Program and discuss the various organizational units including the Executive Committee (EC), Coordination Committee (CC), Program Manager (PM), Program Management Team (PMT), and work groups. The EC may establish work groups and designate members of work groups on its own initiative or on the recommendation of the CC when additional assistance or expertise is beneficial to accomplishing the goals of the Program. Upon approval of this charter, the Science Work Group (ScW) is established by the EC, and will serve at the pleasure of the governing body.

ScW will operate with specific schedules, objectives, and scopes of work established by the EC. Methods for accomplishing the established activities will be identified by the ScW. The PM will assign a PMT liaison to support ScW and ensure that objectives and work products are clearly identified, assigned work group tasks are completed, and schedules are met.

Science Work Group Objectives

The purpose of the ScW is to provide scientific recommendations and technical assistance and expertise to the Program for the benefit of listed species in the Middle Rio Grande. The ScW will provide assistance and expertise to address specific Program tasks, primarily implementation of the Long Term Plan, to accomplish the goals of the Program. The ScW provides:

1. Recommendations for research and monitoring priorities
2. Support for adaptive management process
3. Technical review and coordination
4. Coordination and integration of long-term research and monitoring activities, including other Program work groups and activities outside of the Program
5. A regular forum for meeting and discussing Program-related research and monitoring
6. Consistency in technical planning efforts over the duration of the Program
7. Technical assistance to others wanting to implement research and monitoring projects
8. A framework for exchanging scientific information

Science Work Group Membership

Each EC member may appoint one voting member to the ScW. Each EC member may also appoint one or more alternate ScW members. As in the EC and the CC, the total membership of the standing ScW shall not exceed twenty (20).

Additional Participants to Science Work Group
Participation in the ScW may vary depending on the subject matter and may include:

1. Additional personnel from agencies/entities that are signatories to the Program
2. Professionals with expertise in the subject matter who do not represent Program signatories;
3. Contractors or other parties, including members of the public, with experience in the subject matter addressed by ScW.

Ad Hoc Work Groups
If necessary to implement tasks in the long-term plan, and after providing notice to the EC, ScW may form and disband temporary ad-hoc groups of individuals with expertise and/or interest in the specialized subject. ScW will oversee ad-hoc work groups and be responsible for ensuring ad hoc work groups meet objectives and schedules, and will disband the work groups upon completion of the pre-determined objectives. The EC may appoint additional members to the ad-hoc groups including:

1. Professionals with expertise in the subject matter who may or may not be involved in the Program, and
2. Contractors or other parties, including members of the public, with experience in the subject matter addressed by ScW.

Science Work Group Leaders
The ScW will elect two work group leaders, each serving for a term of one year with no more than two consecutive one-year terms. Any appointed member of the ScW may serve as a work group leader. To the extent practical, one leader should represent a federal agency and one leader a non-federal agency to ensure broadest representation. At least one ScW leader will participate in each monthly PMT communication meeting, held the 4th Wednesday of each month, and at CC and EC meetings upon request.

Science Work Group Meetings
The ScW will hold regular meetings on the first Tuesday of each month. ScW may meet more or less frequently, if determined appropriate by the work group leader(s), according to work assignments. Additional special meetings may be called by the work group leader, if needed, to accomplish specific tasks. The PMT will post ScW meeting schedules, locations, and agendas on the Program website at least one week in advance of the meeting date. All meetings will be open to the public. The work group leaders will ensure that meeting summaries are kept that accurately reflect actions of the ScW. The PMT will ensure meeting summaries are posted on the website within one week after they are final.

If a member cannot attend a meeting, the alternate should attend, or the member may send a written request or statement regarding agenda items of interest.

Science Work Group Responsibilities and Scope of Work
The ScW is responsible for carrying out specific scopes of work established by the EC. The PMT liaison will assist the leaders to develop a ScW Annual Scope of Work and Schedule for submittal to, and approval by, the EC each year. The ScW Annual Scope of Work will contain objectives, tasks, schedules, and deliverables to be completed for that year. To the extent possible, the Annual Scope of Work will also identify ad hoc group(s), if any, and ad hoc group members. Any additional activities that may arise during the course of the year will be submitted to the EC. The continuing responsibilities and scope of work of the ScW are as follows:

Implementation of Long Term Plan (LTP) Activities via the RFP Process:

- Review Science related LTP budget estimates and activities and recommend changes if needed
- Recommend priorities for research and monitoring activities
- Coordinate with other workgroups and PMT and develop scopes of work (SOWs)
- Participate in evaluating proposals (TPEC process) and recommend TPEC membership (i.e. outside experts)

Technical Review and Coordination:

- Provide technical input and assistance for work groups, projects, and Program assessment process
- Review contract and work group deliverables and provide feedback
- Participate in joint quarterly meetings with other work groups
- Oversee ad-hoc work groups
- Conduct site visits
- Review and update plans
- Coordinate with other efforts (Program and non-Program) in the Middle Rio Grande
- Oversee ad-hoc Science work groups

Monitoring and Assessment:

- Provide technical input and implement Program Monitoring Plan
- Develop and implement adaptive management plan
- Provide prior year project updates to PMT (i.e. assist with Annual Report)
- Participate in and recommend topics for annual forums
- Review Long Term Plan budget estimates and activities and recommend changes if needed
- Recommend experts to obtain input on technical issues
- Recommend research and monitoring needs

Other Technical Contributions:

- Carry out other work established or approved by the EC

Relationship of Science Work Group to Other Organizational Units of the Collaborative Program

The EC makes Program decisions. The EC establishes work groups. ScW products and recommendations are provided to the EC through the PMT, after discussion and review by the CC and the PMT. The CC will discuss all work products with their respective EC member.

The PM is the leader of the PMT. The PMT will provide a liaison to support the ScW and to ensure that assigned work group tasks are completed. The PMT reports to the EC. The EC may delegate certain decisions to the PMT, CC, or work groups.

Coordination between work groups occurs through the PMT, during monthly communication meetings, and at joint work group meetings. Joint work group meetings will be held when needed, such as preparing for fiscal year activities and working collaboratively on specific projects.

Support to Science Work Group
The PM will assign Program staff to support the ScW so that the objectives and work products are clearly identified, assigned tasks are completed, schedules are met, and necessary support is provided as further identified in the PMT Charter. ScW leader(s) will be designated to work with the assigned staff to establish the Annual Scope of Work and Schedule.

The PMT will provide support for meetings of the ScW, including distribution of agendas and meeting materials, and distribution of meeting summaries. Final meeting summaries will be made available to the public via an established Program distribution network. The PM will provide ScW products subject to EC approval to the CC for review and discussion, and will assist the CC in developing recommendations to the EC.

Science Work Group Recommendations
The ScW will make technically sound recommendations based on the best available science and professional judgment of the members. If a consensus recommendation is not reached, the voting procedure described below may be used.

Science Work Group Voting Procedures and Minority Reporting
When voting is required to provide recommendations, each voting member (member appointed by an EC member) is allowed one vote. Participants that are not voting members do not have a vote. Recommendations will be of the simple majority present. The minority, if they choose, may submit a minority report with the majority recommendation to the PM and the EC. The majority recommendation will note that a minority report has been filed.

Reporting Results and Communicating Recommendations
The ScW leaders will provide work products and recommendations to the EC through the PMT, after discussion and review by the CC. ScW leaders will report on ScW activities at each monthly communication meeting, and at CC and EC meetings upon request.

Science Work Products
All final ScW products are subject to approval by the EC and, upon approval, the PMT will make them available to the public.

Science Work Group Annual Review
The PM, with input from the PMT, will review the accomplishments of the ScW annually with respect to its objectives, schedule, and participation by members, and make recommendations to the EC regarding continuation or termination of the ScW, as well as changes in objectives, schedule, or membership.

Amendment of the Science Work Group Charter
This charter may be revised and amended as deemed appropriate within the bounds of the By-Laws, with input from the ScW and approval by the EC. At a minimum, the charter will be reviewed annually.

EC approved the foregoing Science Work Group Charter on 23 August 2007.

Charter for Species Water Management of the Middle Rio Grande Endangered Species Collaborative Program

Overview

The Middle Rio Grande Endangered Species Act Collaborative Program (Program) By-Laws, adopted by the Executive Committee (EC) on October 2, 2006, define the Program's organizational structure and discuss the various organizational units including the EC, Coordination Committee (CC), Program Manager (PM), Program Management Team (PMT), and work groups. The EC may establish work groups and designate members of work groups on its own initiative or on the recommendation of the CC when additional assistance or expertise is needed to accomplish the goals of the Program. Upon approval of this charter, the Species Water Management work group (SWM) is established by the EC, and will serve at the pleasure of the governing body.

SWM will operate with specific schedules, objectives, and scopes of work established by the EC. Methods for accomplishing the established activities will be identified by SWM. The PM will assign a PMT liaison to support SWM and ensure that objectives and work products are clearly identified, assigned work group tasks are completed, and schedules are met.

The Program seeks to develop and implement creative water use and development alternatives that will satisfy water needs for threatened and endangered species while protecting existing uses. Draft Program authorizing language (Sept. 9, 2005) assigns responsibility for water acquisition, administration, and management and low flow conveyance channel (LFCC) pumping activities to the U.S. Bureau of Reclamation (Reclamation), to be conducted at full federal expense.

SWM Objectives

The purpose of the SWM is to provide assistance and expertise to address specific Program tasks, primarily implementation of the Long Term Plan, that are needed to accomplish the goals of the program. The Program and SWM will work together with Reclamation to secure potential supplies of water and storage space and implement management strategies to meet Program goals. SWM will seek to identify and analyze the relative merits of potential water management alternatives to meet water supply and acquisition goals and assist with implementation of selected alternatives, including facilitating stakeholder interaction and supporting regulatory compliance activities.

SWM Membership

Each EC member may appoint one voting member to SWM. Each EC member may also appoint one or more alternate SWM members. As in the EC and the CC, the total membership of SWM shall not exceed twenty (20).

Additional SWM Participants

Participation in SWM may vary depending on the subject matter and may include:

1. Additional personnel from agencies/entities that are signatories to the Program;
2. Professionals with expertise in the subject matter who do not represent Program signatories;
3. Contractors or other parties, including members of the public, with experience in the subject matter addressed by SWM.

Ad Hoc Work Groups

If necessary to implement tasks in the long-term plan, and after providing notice to the EC, SWM may form and disband temporary ad-hoc groups of individuals with expertise and/or interest in the

specialized subject. SWM will oversee ad-hoc work groups and be responsible for ensuring ad hoc work groups meet objectives and schedules, and will disband the work groups upon completion of the pre-determined objectives. The EC may appoint additional members to the ad-hoc work groups, including:

1. Professionals with expertise in the subject matter who may or may not be involved in the Program, and
2. Contractors or other parties, including members of the public, with experience in the subject matter addressed by SWM.

SWM Leaders

SWM will elect two work group leaders, each serving for a term of one year with no more than two consecutive one-year terms. Any appointed member of SWM may serve as a work group leader. To the extent practical, one leader should represent a federal agency and one leader a non-federal agency to ensure broadest representation. At least one SWM leader will participate in each monthly PMT communication meeting, held the 4th Wednesday of each month, and at CC and EC meetings upon request.

SWM Meetings

SWM will meet monthly at a regularly scheduled time and place, as determined by the leaders in consultation with the members. SWM may meet more or less frequently if determined appropriate by the SWM leaders, according to work assignments. The leaders may call additional special meetings if needed to accomplish specific tasks. The PMT will post SWM meeting schedules, locations, and agendas on the Program website at least one week in advance of the meeting date. All meetings will be open to the public. The work group leaders will ensure meeting summaries are kept which accurately reflect actions of SWM. The PMT will ensure that meeting summaries are posted on the website within one week after they are final.

If a member cannot attend a meeting, the alternate should attend, or the member may send a written request or statement regarding agenda items of interest.

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<u>Implementation of Long Term Plan (LTP) Activities via the Request For Proposal (RFP) Process</u>:

- Review Long Term Plan budget estimates and activities and recommend changes if needed.
- Recommend priorities for research and monitoring activities
- Coordinate with other workgroups and PMT to develop scopes of work (SOWs) that effectively integrate objectives
- Participate in evaluating proposals (Technical Proposal Evaluation Committee [TPEC] process) and recommend TPEC membership (i.e. outside experts)
- Provide prior year project updates to PMT (i.e. assist with Annual Report)
- Provide annual report of accomplishments and progressions

Technical Review and Coordination:

- Provide technical input and assistance for other work groups, projects, and Program assessment process
- Review contract and SWM deliverables and provide feedback
- Participate in joint meetings with other work groups
- Oversee ad-hoc SWM workgroups
- Conduct site visits
- Review and update plans
- Coordinate with other efforts (Program and non-Program) in the Middle Rio Grande

Monitoring and Assessment:

- Provide technical input and assistance in implementing the Program Monitoring Plan
- Develop and assist in implementing the adaptive management plan
- Provide prior year project updates to PMT (i.e. assist with Annual Report)
- Participate in and recommend topics for annual forums
- Review LTP budget estimates and activities and recommend changes if needed
- Recommend experts to obtain input on technical issues
- Recommend research and monitoring needs

Water Storage and Management

- Work towards achieving water supplies, storage and management necessary to support the needs of the Program
- Evaluate the relative merits of water supply, storage, and management alternatives
- Assist Program in evaluating methods and tools to understand depletions
- Coordinate and assist with technical studies to support Reclamation's supplemental water program

Other Technical Contributions:

- Carry out other work established or approved by the Executive Committee

Relationship of SWM to Other Organizational Units of the Collaborative Program

The EC makes Program decisions. The EC establishes work groups. SWM products and recommendations are provided to the EC through the PMT, after discussion and review by the CC and the PMT. The CC will discuss all work products with their respective EC member.

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SWM will make technically sound recommendations based on the professional judgment of the members and best available science. If a consensus recommendation is not reached, the voting procedure described below may be used.

SWM Voting Procedures and Minority Reporting
When voting is required to provide recommendations, each voting member (member appointed by an EC member) is allowed one vote. Participants that are not voting members do not have a vote. Recommendations will be of the simple majority present. The minority, if they choose, may submit a minority report with the majority recommendation to the PM and the EC. The majority recommendation will note that a minority report has been filed.

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SWM Work Products

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Annual Review of SWM
The PM, with input from the PMT, will review the accomplishments of SWM annually with respect to its objectives, schedule, and participation by members, and make recommendations to the EC regarding continuation or termination of SWM, changes in objectives, schedule, or membership.

Amendment of SWM Charter
This charter may be amended as deemed appropriate within the bounds of the By-Laws, with input from SWM, and approval by the EC. At a minimum, the charter will be reviewed annually.

EC approved the foregoing Species Water Management Work Group Charter on 23 August 2007.

2020 Science & Adaptive Management Committee

EC-approved 2020 SAMC Membership and Areas of Expertise:

Mo Hobbs -- Aquatic Ecology
Thomas Archdeacon -- Aquatic Ecology
Dave Moore -- Terrestrial Ecology
Meaghan Conway -- Ecosystem Function
Ryan Gronewold -- Hydrology
Megan Friggens -- Climate Science
Ari Posner -- Geomorphology
Ara Winter -- Statistics & Modeling
Alan Hatch -- EC *ex officio*



SAMC Charter highlights

- ***Purpose***: The SAMC will coordinate the implementation of MRGESCP-related science initiatives and signatory efforts by defining and delegating tasks to Science and Technical (S&T) Ad Hoc Groups; compiling results from scientific studies, modeling, and monitoring efforts; and translating scientific findings into recommendations for best management alternatives in the Middle Rio Grande.
- ***Membership***: Up to 8 scientists including 4 specified subject matter experts in Aquatic Ecology, Terrestrial Ecology, Ecosystem Function and Hydrology; and up to 4 flexible subject matter experts; plus 1 *ex officio* EC member and 1 facilitator (PST Science Coordinator)

SAMC Preliminary Tasks for 2020-2021

- Orientation and review of S&AM Plan, CP Structure and AM Tools
- Introduction at the Science Symposium
- Organize MRGESCP Objectives Workshops – define objectives to address CP goals and guide scientific activities
- Analyze and dissect remainder of Population Monitoring Work Group tasks into manageable questions; Develop charges and convene Technical Ad Hoc Groups to address each
- Determine components of AM database requiring input from subject matter experts and organize workshops/ad hoc groups
- Help develop and update the Long-Term Plan

SAMC Challenges

- Science community
  - Building resource network
  - Inviting other experts to participate in critical conversations
  - Holding workshops to elicit feedback and buy-in and increase Program participation
  - Information infrastructure
- Using S.M.A.R.T. goals
  - Program objectives
  - Technical Ad Hoc Group charges

❖ ***Finding the right people and asking the right questions***

Middle Rio Grande Endangered Species Collaborative Program's

Draft Science & Adaptive Management Plan

27 October 2020

Program Support Team presentation to Executive Committee

Science & AM Plan and Long-Term Plan

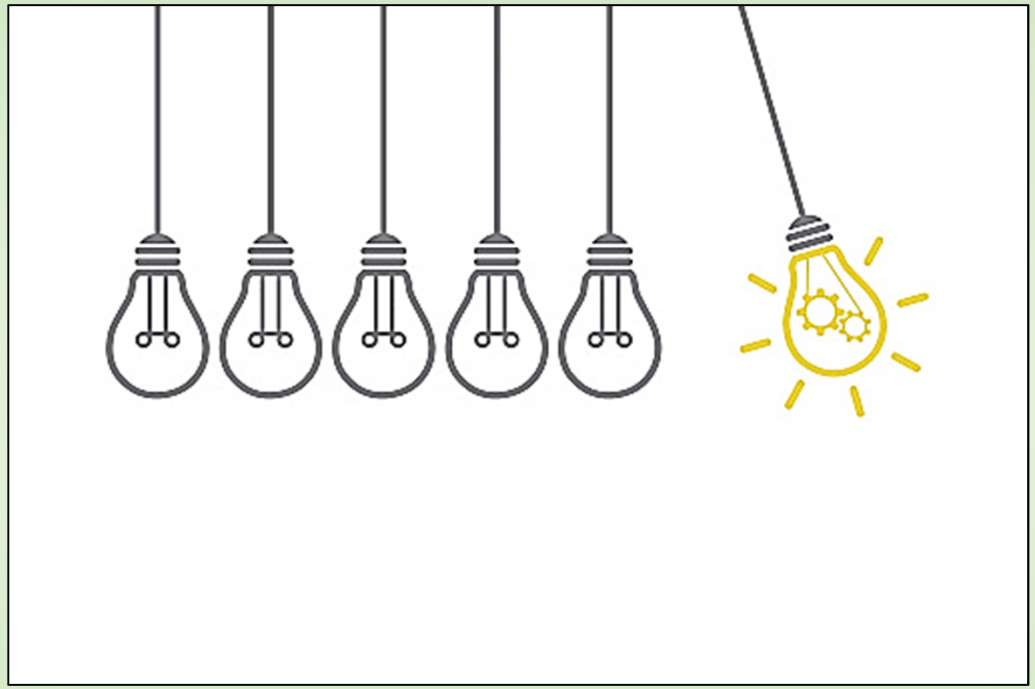
- Together, the Science & AM Plan and the Long-Term Plan provide the framework for implementation of the Collaborative Program's science and AM process.
  - The **Science & AM Plan** defines the MRGESCP's role and associated processes in providing science-based recommendations for management of the MRG. It describes the MRGESCP's science and AM process.
  - The **Long-Term Plan** is an evolving communication and planning tool that is generated by organizing scientific activities into periodic work plans (i.e., annual, biennial, triennial). It is heavily informed by the AM Database.

MRGESCP Science & Adaptive Management Plan – What's New?

I. Re-organization with the Science and Adaptive Management Committee

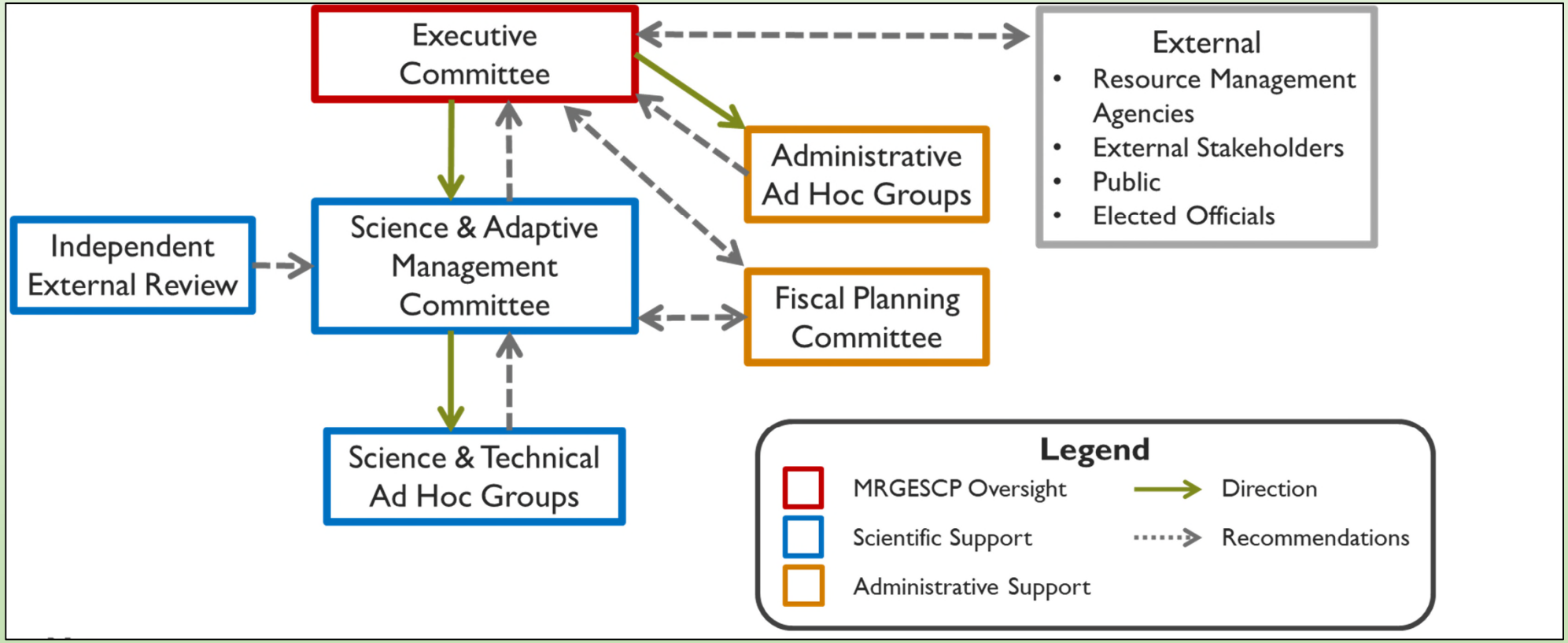
II. Construction of an Adaptive Management Database and Project Bank

III. Commitment to iterative learning



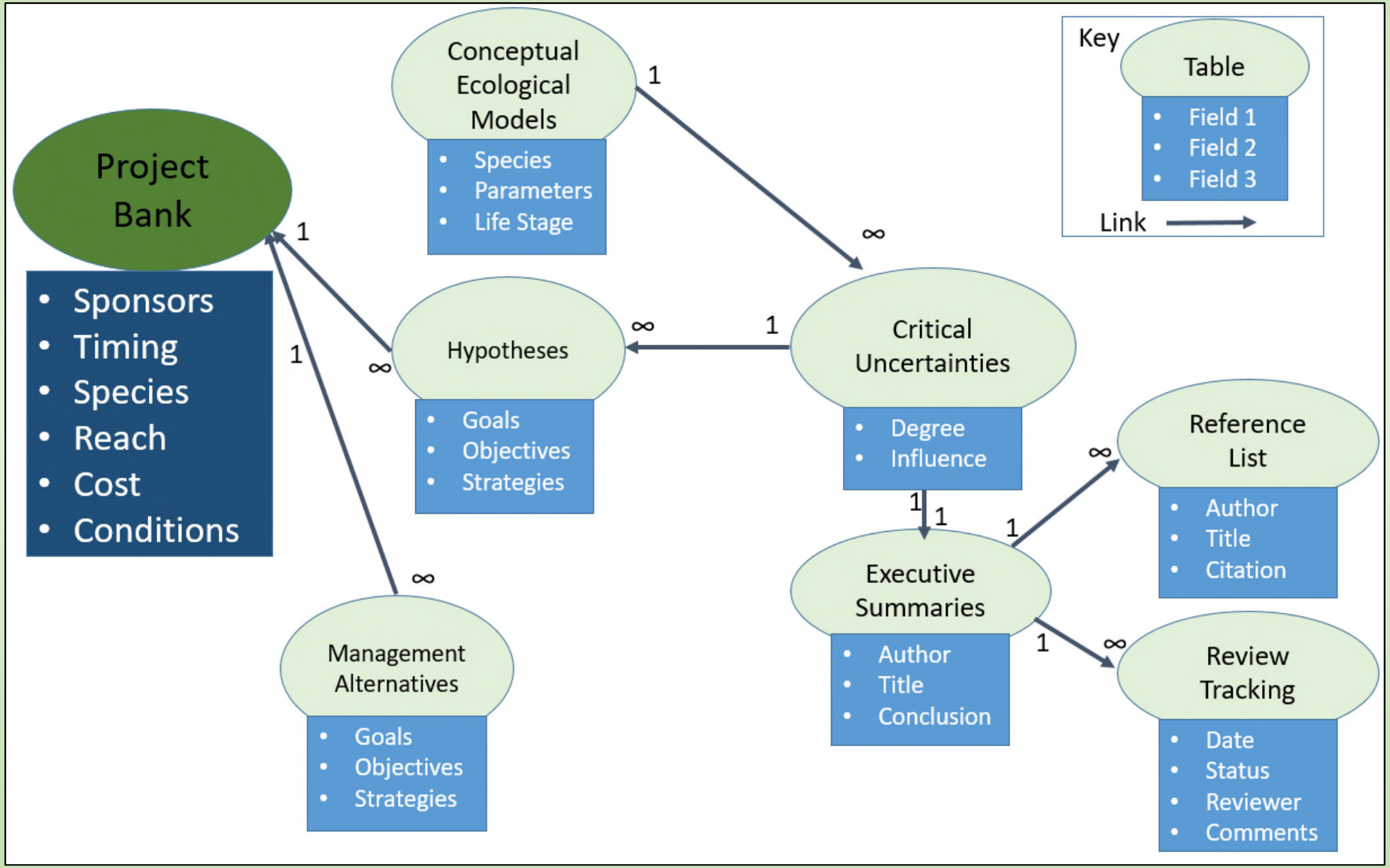
MRGESCP Science & Adaptive Management Plan – What's New?

I. Re-organization of the Collaborative Program's structure, with the Science and Adaptive Management Committee translating and relating scientific evidence to the Executive Committee.

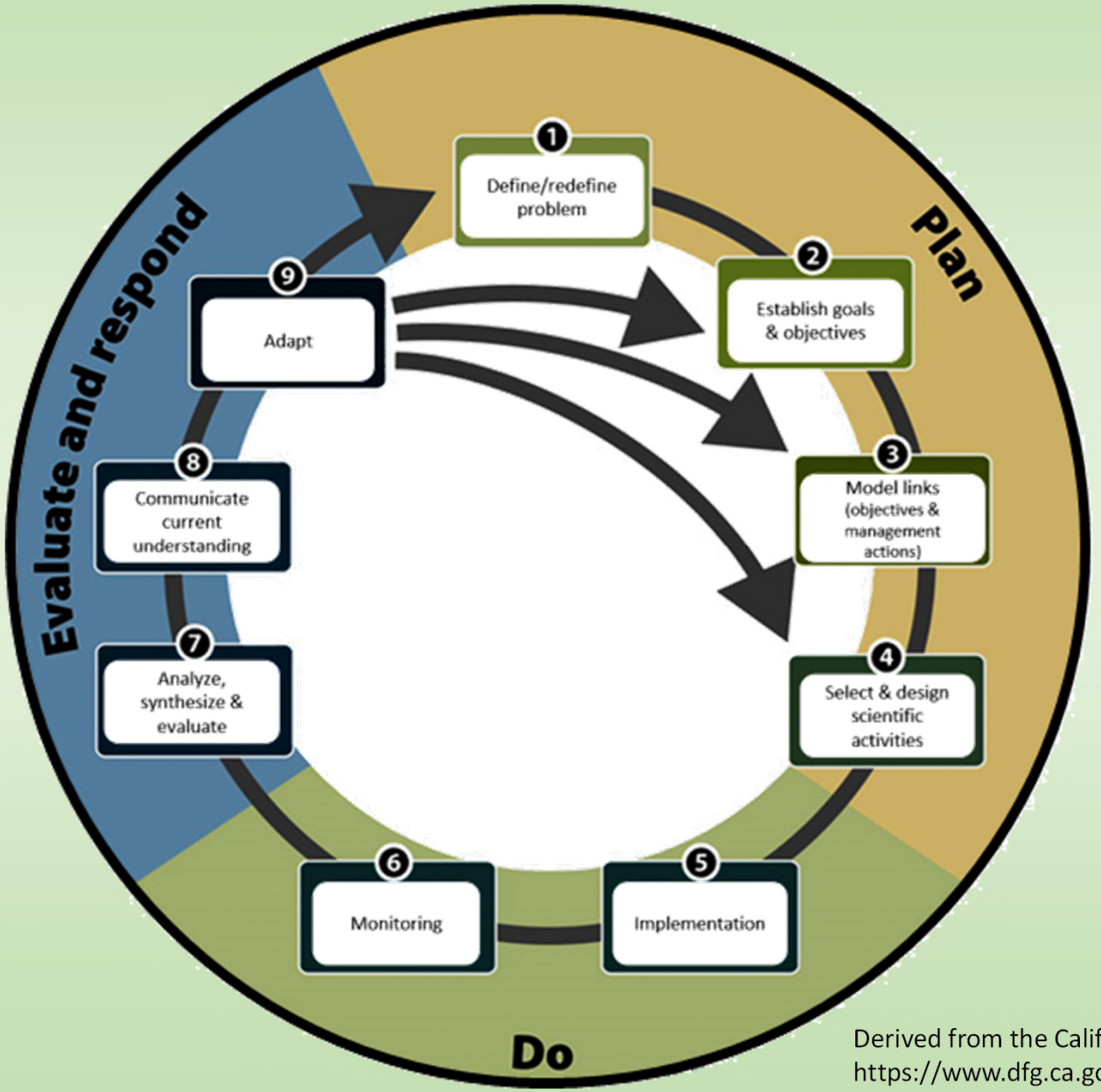


MRGESCP Science & Adaptive Management Plan – What's New?

II. Construction of an AM Database to store and disseminate accurate, up-to-date information on AM uncertainties, projects, and monitoring information, and to facilitate transparent prioritization and support informed decision making.



MRGESCP Science & Adaptive Management Plan – What's New?



III. Commitment to iterative learning through tracking, evaluating, and incorporating scientific evidence into Collaborative Program objectives, experimental designs and decision-support tools.

Derived from the California Department of Fish and Wildlife:
https://www.dfg.ca.gov/erp/adaptive_management.asp

MRGESCP Science & Adaptive Management Plan – What will the SAMC communicate to the EC?

- Summary of modifications to MRGESCP objectives and tools (e.g., CEMs) *with scientific justifications*.
- Recommended modifications to the Long-Term Plan *with scientific justifications*.
- Recommended management alternatives *with analysis and scientific justifications*.



Adaptive Management Database FAQ

- Who is developing the AM Database?

  The Program Support Team (PST) is building the AM Database and establishing the functional linkages that make it relational. Linkages can be reviewed and modified by Administrative and Technical Ad Hoc Groups.

- On what platform is the AM Database being developed?

  Initially, the AM Database is being formatted using MS Access (for convenience). Once formatting is complete, it can be transitioned to a SQL server (for stability).

- Who will manage and host the AM Database?

  During development, the PST will manage and host the AM Database. Once established, the Collaborative Program can decide between the Program Portal or a cloud-based hosting service. Scoping for these and additional options can be provided by the PST.

Science & Adaptive Management Process - Next Steps

- ✓**AMWG Review**: August 20, 2020 – September 17, 2020
- ✓**PST & AMWG Individual Review Meetings**: August 27, 2020 – September 17, 2020
- ✓**PST Revision:** September 17 – 29, 2020
- ✓**Revised Draft to the MRGESCP**: September 30, 2020 – October 7, 2020
- ✓**PST Revision & WEST Technical Editing**: October 8 – 16, 2020
- ➢**Final Draft S&AM Plan to EC for Review**: October 22, 2020 – December 2, 2020
- ➢**First SAMC Meeting**: November 2020
- ➢**Draft Long-Term Plan (LTP) Framework to the SAMC**: November 2020
- ➢**PST & EC Individual Review Meetings**: October 26, 2020 – November 18, 2020
- **PST Revision**: November 18, 2020 – December 4, 2020
- **Final S&AM Plan Draft to EC as Read Ahead**: Week of December 7, 2020
- **Next SAMC Mtg. / Planning Objectives Workshop**: Week of December 7, 2020
- **EC Meeting – Final S&AM Plan and LTP Approval**: December 17, 2020
- **Operational AM Database**: Spring 2021
- **LTP Update:** Late Spring/Summer 2021

MRGESCP Science & Adaptive Management Plan – What will the MRGESCP communicate?



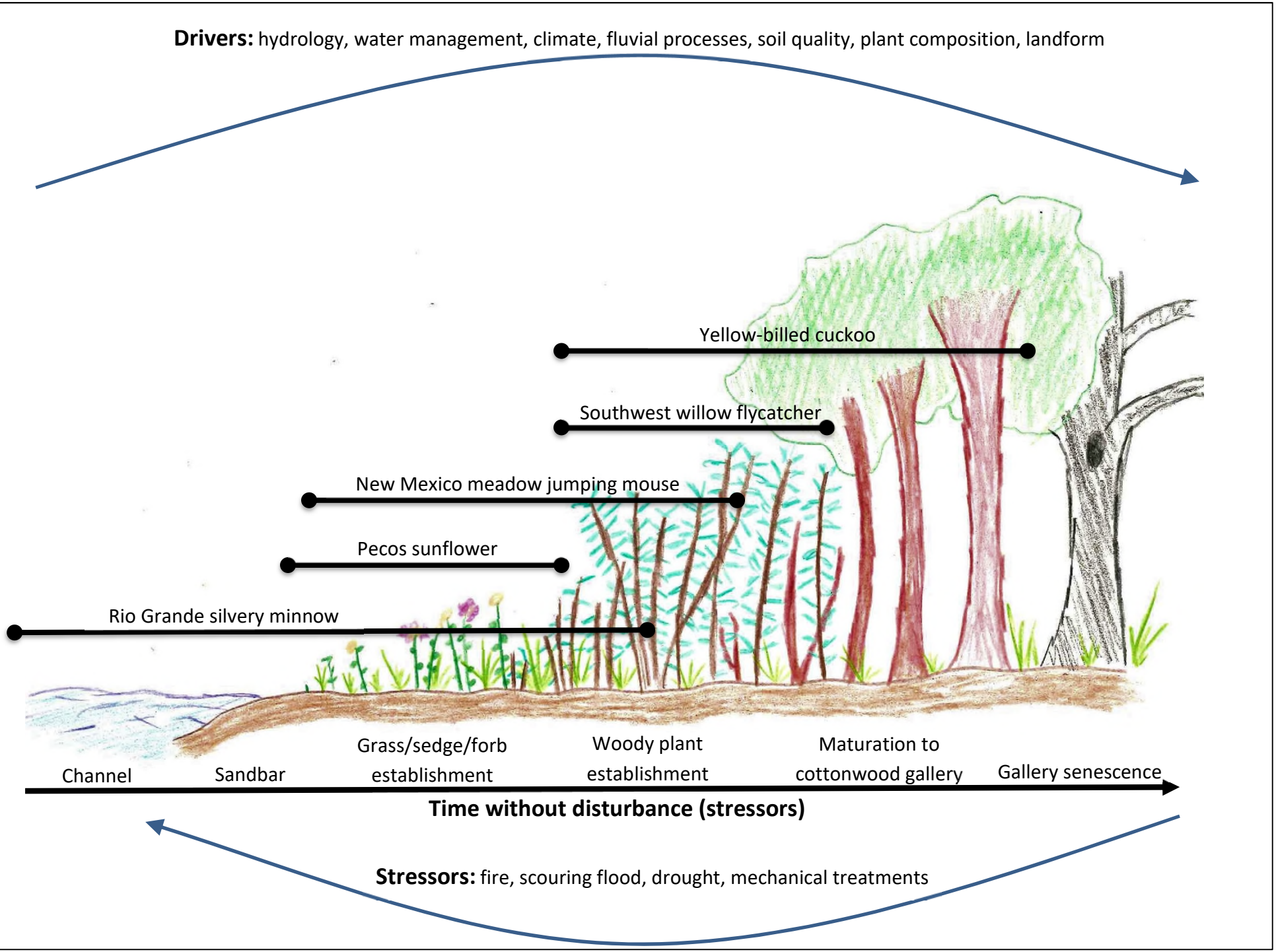
- Recommend studies and projects that reduce critical, management-relevant uncertainties (i.e., Long-Term Plan)
- Recommend adjustments to management actions backed by scientific evidence

Long-Term Plan

- LTP first iteration – December 2020
  - The Project Bank with linkages to draft objectives and identified uncertainties
  - Will not be prioritized
- LTP update – late Spring/early Summer 2021
  - Top-down from agreed upon objectives
  - Query-able using different filters

Long-Term Plan Linkages

- Objectives → Uncertainties → Projects
- Sortable and query-able by:
  - Project type
  - Project focus
  - Necessary physical conditions
  - Reaches
  - Authority
- Also query-able by:
  - Cost estimate
  - Temporal scale


Drivers: hydrology, water management, climate, fluvial processes, soil quality, plant composition, landform
Yellow-billed cuckoo
Southwest willow flycatcher
New Mexico meadow jumping mouse
Pecos sunflower
Rio Grande silvery minnow
Channel
Sandbar
Grass/sedge/forb establishment
Woody plant establishment
Maturation to cottonwood gallery
Gallery senescence
Time without disturbance (stressors)
Stressors: fire, scouring flood, drought, mechanical treatments

Middle Rio Grande System Conceptual Ecological Model

The Middle Rio Grande System Conceptual Ecological Model (MRG) features the succession of the MRG bosque, displays where each federally listed species may be found within the successional stages of the bosque, and depicts drivers and stressors of succession. **Drivers** are major forces that have large-scale influences on the system. Drivers can be anthropogenic or natural, but ultimately determine how the bosque progresses through succession. **Stressors** are the specific factors that set-back or reset succession, and can also anthropogenic or natural in nature.

The central line represents **time without disturbance (stressors)**. The ability of the bosque to transition between successional stages will be determined by not just drivers and stressors, but the time over which drivers and stressors impact the system. As more time passes between stressor events, the bosque will transition forward into different successional stages. When a stressor event takes place, the bosque may transition between its current stage and any lower stage depending on the intensity of the event.

This model is meant to serve as base model by which more detailed models will branch off. For example, a user interested in the Pecos sunflower may first view the systems model, click on the words “Pecos sunflower,” and be taken to more detailed, Pecos sunflower conceptual model that depicts how the Pecos sunflower interacts with its environment and the drivers and stressors of the system.

Science and Adaptive Management Committee Meeting

December 7, 2020

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *Draft MRGESCP 2021 Objectives Workshop: Pre-Workshop Survey [read-ahead, draft]*
- *Draft MRGESCP S&T Ad Hoc Group Charge Template [read-ahead, draft]*
- *Species CEMs (Appendices B and C from S&AM Plan) [read-ahead]*
- *Consolidated Caplan, Noon, Hubert, and Fraser Panel Recommendations [read-ahead, spreadsheet]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC) Meeting
December 7, 2020
9:00 AM–12:00 PM

Meeting Location: *Zoom*
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Meeting ID: 898-359-3120; Passcode: 1251
Call-In: +1-669-900-6833

Meeting Agenda

9:00 – 9:10	**Welcome and Agenda Review** Read-ahead: ☐ November 13, 2020 SAMC draft meeting minutes ✓ **Decision**: Approval of December 7, 2020 SAMC meeting ✓ **Decision**: Approval of November 13, 2020 SAMC meeting minutes	*Catherine Murphy, Program Support Team*
9:10 – 10:30	**Discuss Objectives Workshop** • Workshop timing: late January/early February 2021 • Review pre-workshop survey questions • Discuss workshop format and facilitation • Discuss call for participation Read-ahead: ☐ Pre-workshop survey ✓ **Decision**: Workshop format and sessions ➢ **Action Item**: PST will distribute pre-workshop survey to Program participants and compile results ➢ **Action Item**: PST will schedule objectives workshop	*Facilitated discussion*
10:30 – 10:40	**Break**	
10:40 –11:10	**Discuss Science & Technical (S&T) Ad Hoc Group charges** • Designing S.M.A.R.T. charges • Incorporating uncertainty into deliverables Read-ahead: ☐ S&T Ad Hoc Group charge template ✓ **Decision:** Approval of S&T Ad Hoc Group charge template	*Facilitated discussion*

11:10 – 11:40 **Discuss Adaptive Management (AM) Database** *Facilitated discussion*

- Representing critical uncertainties
  - Conceptual ecological models (CEMs)
  - Independent Science Panel recommendations
  - Linking to other elements

Read-aheads:

- ☐ Species CEMs (Appendices B and C from Science & AM Plan)
- ☐ Consolidated panel recommendations table
- ☐ Link to Shay Howlin presentation on AM Database

11:40 –12:00 **Meeting Summary and Action Items Review**

- **Next Meeting**: January 2021

12:00 **Adjourn**

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

December 7, 2020; 9:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of the November 13, 2020 SAMC meeting minutes
- ✓ Approval of the December 7, 2020 SAMC meeting agenda

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Send out Doodle Polls to schedule the next SAMC meeting and Objectives Workshop	12/7/2020
Megan Friggens	Send information on uncertainty to Catherine Murphy	12/7/2020
Michelle Tuineau, PST	Create a SAMC Work Page on the Program Portal	By next meeting
Catherine M.	Revise the pre-workshop survey and Science & Technical (S&T) Ad Hoc Group charge template and send them to the SAMC	12/11/2020
SAMC	Send feedback on the pre-workshop survey and S&T Ad Hoc Group charge template to Catherine M.	12/16/2020
Catherine M.	Discuss the pre-workshop survey and S&T Ad Hoc Group charge template during the SAMC update at the Executive Committee (EC) meeting	12/17/2020
PST	Distribute pre-workshop survey to Collaborative Program members and collect responses	1/21/2021
Thomas Archdeacon	Send Rio Grande Silvery Minnow (RGSM) rescue data to the PST for upload to the Program Portal	1/31/2021
Catherine M. & Shay Howlin	Populate the AM Database with the goals, objectives, and strategies, and build linkages between them	Ongoing
SAMC members	Provide suggestions to the PST for additional layers, and/or links to additional map tools and resources to include on the Portal	Ongoing

Next Meeting: January 2021

Meeting Summary

Welcome and Agenda Review

Catherine M., PST Science Coordinator and SAMC Facilitator, opened the meeting and led introductions. Catherine reviewed the November 13, 2020 minutes and December 7, 2020 agenda.

- ✓ **Decision**: The SAMC approved the November 13, 2020 SAMC meeting minutes
- ✓ **Decision**: The SAMC approved the December 7, 2020 SAMC meeting agenda

What Management Tools do the Signatories Have?

- A list of management tools needs to be incorporated into the Adaptive Management (AM) Database.
- It would be useful to talk to hydrologists at the U.S. Bureau of Reclamation (Reclamation) to get a better understanding of the tools.
- It is difficult to do altered water operations, like pulse releases. A big reason for this is the limited management flexibility around Cochiti Reservoir releases. The SAMC need to understand what the parameters are for releases at Cochiti Reservoir.
    - Cochiti Reservoir is authorized to hold San Juan Chama water at 12,000 surface acres; it is operated solely for flood control outside of that. There is no conservation storage or flexibility.
    - There is potential opportunity to manage Cochiti differently, but it takes an act of Congress to gain flexibility.
- The SAMC needs to think outside the box to modify management within constraints.
    - The water managers in the Collaborative Program have been enhancing the spring hydrograph without Cochiti through modifications at El Vado Reservoir, which is authorized to hold varying levels of water, unlike Cochiti Reservoir.
- The Minnow Action Team (MAT) discusses water operations. It would be good to bring in members like Carolyn Donnelly, Reclamation, and Nabil Shafike, U.S. Army Corps of Engineers (USACE), to describe the existing and potential tools available.
    - The MAT meetings are productive, but based on things happening that year. To improve long-term planning, it would be helpful to know the management parameters.
    - The SAMC needs to access the knowledge in the MAT, and the SAMC should help the MAT make more informed decisions.

Discuss Objectives Workshop

Catherine M. opened discussion on the Objectives Workshop by reviewing the pre-workshop survey (see survey). These were the main points of the discussion:

- Under the new Science & Adaptive Management Plan (S&AM Plan), the Program will use a hierarchical planning approach. This incorporates the strategic planning pyramid, so that goals (at the top) lead to objectives, which lead to strategies.
    - Everything ties back to the mission statement, to which the goals, objectives, and strategies should be linked. As the Program is operating under an adaptive management framework, the mission may be revised over time to better reflect Program operations and direction. If necessary, the SAMC will suggest revisions to the EC.
- The draft objectives included in the S&AM Plan appendix need to be revised to include measurable targets. Then, strategies to meet those measurable targets need to be developed.

- The survey will be translated to a Google Form, so people can easily give feedback on each objective and strategy.
- Who is able to attend the Objectives Workshop?
    - The workshop is open to the entire Collaborative Program.
    - Although there is no plan to limit the number of people at the workshop, the survey will give people a chance to contribute to the workshop without attending the workshop.
- Survey responses will be given on the Likert scale, which gives the SAMC qualitative data to analyze with sufficient responses, and allows for comparisons across years as the Program revises existing objectives, adopts new objectives, and completes objectives.
- Respondents will evaluate the objectives based on whether they align with the mission statement, support one or more goals, satisfy the definition of a S.M.A.R.T. (Specific, Measurable, Attainable, Relevant, Time-Bound) statement, and are a priority in the short term (five years).
- The challenge will be making the draft objectives measurable.
    - The survey will help identify objectives for which there is less agreement and/or that do not meet the S.M.A.R.T. requirements, so the Collaborative Program can focus in on them at the Objectives Workshop.
- The survey should include a space for people to comment or suggest changes.
- The objectives were written to tie into the recovery plans. There have been mixed feelings on this. As long as it is made clear that the Collaborative Program has no authority, it should be fine to connect objectives to recovery criteria.
- Catherine M. will discuss the survey at the next EC meeting before sending it out to the Collaborative Program.
- The Objectives Workshop will be scheduled for early February.
    - There will be two sessions: one focused on RGSM, and one on avian and other species
    - If needed, another Objectives Workshop can be scheduled.
- The objectives are heavily weighted toward biology, especially with the RGSM. There is not a lot mentioned on geomorphology or hydrology (water budget or status of gages). It would be good to emphasize those factors as well.
    - The objectives do not link to the panel recommendations, which would be a useful linkage to have. Some of the recommendations tee off each other, and the SAMC should try to preserve that information.
- There are a lot of objectives for the RGSM that could benefit the birds and other species, but those crosswalks aren't explored.

Other Questions:

Incorporating the Objectives into the AM Database

- All of the draft objectives and strategies will be in the AM Database. The objectives and strategies will be edited after the Objectives Workshop.
- Catherine will be working with Shay Howlin, PST, to connect the mission to the goals, the goals to the objectives, and the objectives to the strategies, in the AM Database.
    - Once projects are linked to strategies, they will have a pathway back to the objectives, goals, and mission.
- When sorting through the Project Bank, users can query to find out what objectives and goals each project connects to. This can be a powerful management tool.

Representing Uncertainty

- With regards to research, should the reduction of critical uncertainties be represented via relational pathways from the conceptual ecological models (CEMs) to uncertainties to hypotheses to projects?
    - This can be difficult with older projects as their descriptions are vague, and it is almost impossible to determine their research hypotheses.
    - The CEMs need work, but can be refined with this goal in mind.
    - There may be other ways to categorize research, as a lot of things don't fit into this format. The SAMC should explore other options.
    - Although old descriptions cannot be changed, new information can be collected through a form with the specific fields needed. That way, projects can be entered into the Project Bank pre-formatted.
- The independent science panel recommendations are the other source of uncertainties.
    - Catherine M. noted that the Program has funded three panel reports in the past five years which have not been addressed fully, and recommended that the Program focus on those before contracting out any new panels.
    - The SAMC will decide how to prioritize recommendations and S&T Ad Hoc Groups to work on them.
    - Some recommendations have been addressed, but there is not currently a way to show that.

- **Action Item**: The PST will send out a Doodle Poll to schedule the Objectives Workshop during the first two weeks of February
- **Action Item**: Catherine Murphy will revise the pre-workshop survey and send it to the SAMC
- **Action Item**: The SAMC will send feedback on the pre-workshop survey to Catherine Murphy
- **Action Item**: Catherine Murphy will discuss the pre-workshop survey during the SAMC update at the EC meeting
- **Action Item**: The PST will distribute the pre-workshop survey to Collaborative Program participants and collect responses
- **Action Item**: Catherine Murphy and Shay Howlin will populate the AM Database with goals, objectives, and strategies, and build linkages

Discuss Science & Technical (S&T) Ad Hoc Group charges

Catherine M. opened discussion on the S&T Ad Hoc Group charge template (see template). These were the main points of the discussion:

- The SAMC will come up with member lists and alternates with the help of the PST.
- The most important thing is coming up with the right questions to ask. Charges should be specific and measurable, with a deadline. They should be small enough to complete in the time frame.
- Catherine can come up with draft charges for SAMC review and revision.
- How is membership determined?
    - The SAMC will come up with the question first, then choose people who can best accomplish the work.
- What is the preferred size for groups?
    - Group size will vary, but should be no more than 10. 5-person groups are typically productive.
- The first S&T Ad Hoc Groups formed will likely be to address Population Monitoring Work Group (PMWG) tasks.

    - The PMWG is drafting a report for the EC. The report condenses down the group's work into a list of findings and list of recommendations.
- If the SAMC outlines the tasks for the S&T Ad Hoc Groups, that might be an unnecessary level of micro managing. Instead, there could be an iterative process, whereby the SAMC gives the group a question, the group develops an approach to answer the question, and the SAMC reviews the approach and refines it, if necessary, ensuring it aligns with the Collaborative Program's guiding principles.
    - The most important part of forming these ad hoc groups is narrowing the scope of each question, so a group fully understands its charge.
- Concerning the process for making up the S&T Ad Hoc Groups:
    - S&T Ad Hoc Groups will be formed to complete outstanding tasks from the PMWG, as determined by the SAMC.
    - Should the long-standing groups be asked to determine objectives and tasks for S&T Ad Hoc Groups?
        - Catherine is working with the PMWG to present to the SAMC by the end of the year to inform SAMC deliberations and decisions on how work should move forward.
    - Past group objectives have not been S.M.A.R.T. How does the SAMC ensure they are?
        - An iterative approach allows the SAMC to approve only S.M.A.R.T. objectives.
    - Other S&T Ad Hoc Groups will be formed by the SAMC from the list of members that participated in previous standing work groups, including the genetics group.

- **Action Item**: Catherine Murphy will revise the S&T Ad Hoc Group charge template and send it to the SAMC
- **Action Item**: The SAMC will send feedback on the S&T Ad Hoc Group charge template to Catherine Murphy
- **Action Item**: Catherine Murphy will discuss the S&T Ad Hoc Group charge template during the SAMC update at the EC meeting
- **Action Item**: Catherine Murphy will work with the PMWG chair for a presentation to the SAMC

Discuss Adaptive Management (AM) Database

Catherine M. opened discussion on the AM Database. These were the main points of the discussion:

- The CEMs are in different formats and stages of development. The SAMC needs to form S&T Ad Hoc Groups to fit them into the AM Database.
- The main difference between the avian and RGSM CEMs is how much basic life history is missing for the birds.
- The SAMC has to determine how to capture uncertainty in the CEMs and determine which uncertainties are reducible and which are not.
    - The SAMC needs to characterize data variability and report estimation error and bias.
- Shay H. and a WEST team are adding the relational links to the information in the AM Database.
    - The team is developing a user interface.
- Users will be able to generate summary reports.
- Suggestion to add a flowchart that depicts relationships in the database.

Prioritizing Uncertainties

- The SAMC needs to prioritize uncertainties from the CEMs and independent science panels.

- The SAMC decided to integrate the panel recommendations into the CEMs. They will find out where there is overlap or redundancy, produce one list of uncertainties, and use the top-down approach from the guiding principles to prioritize them.
- Have CEMs for the listed species been developed by other groups (outside MRG)?
    - There are other CEMs for the birds and RGSM, but they were not agreed upon for development of the Collaborative Program CEMs.
    - The Collaborative Program CEMs were agreed upon, but are meant to be iterative and changed to reflect current state of understanding about the life history, biology, and ecosystem relationships for each species.
- The Collaborative Program may need to produce two versions of each CEM depicting different levels of detail for different audiences: one that is an overview for managers and the public, and one more detailed for technical experts.
- There are a lot of assumptions built into CEMs that need to be explicitly stated.
    - Is there a way to represent those assumptions in the CEM?
        - Megan F. will send a presentation on uncertainty and vulnerability assessments; it discusses how to qualitatively and quantitatively describe uncertainty.
- Is there a document where the CEMs are laid out?
    - They are in an appendix of the Science & AM Plan.
    - Uncertainty in relationships is currently represented through color-coding.
- With the information currently available on the RGSM, contradictory hypotheses could be developed.
    - The supporting evidence for each hypothesis needs to be presented in a transparent manner.
- Managers need to know the uncertainty associated with their decisions. The SAMC needs to find a way to present what is not known and where there is disagreement based on different studies.
- Uncertainty should be incorporated into the S&T Ad Hoc Group charges. The groups will be asked to characterize the uncertainty and assumptions linked to their work products.

➢ **Action Item**: Megan Friggens will send information on uncertainty to Catherine Murphy

Long-Term Plan

- The Long-Term Plan (LTP) being developed is meant to help USACE secure funding. It will be updated next year to incorporate elements laid out in the S&AM Plan, such as newly adopted objectives and strategies and links to a list of prioritized projects, so it will be a more effective tool for both Program and signatory planning efforts.
- How should climate trends and forecasts be incorporated into the prioritization process for the projects?
    - The form to submit a project to the AM Database could include a question about climate change.
    - The form could also ask if an activity relates to the resilience/resistance transition, which is popular in AM strategies for climate change.

Other Topics

Cross-Disciplinary Communication

- How should the SAMC get managers, engineers, scientists, etc. speaking the same language?
    - You have to create projects that integrate different disciplines and force everyone to listen to each other.

    - Any activity that drives empathy and makes people see from other points of view helps communication.
- Reclamation is in the process of starting a width maintenance program that has the potential to link benefits among species.
    - In the Los Lunas area, there is a decrease of conveyance capacity in the active channel. Reclamation wants to increase capacity by removing vegetated islands and bars.
    - Reclamation has to differentiate between good habitat and habitat that has outgrown its effectiveness in order to optimize river widening for bird and RGSM habitat.
    - Reclamation wants to create a program that gets updated every year.
    - It will be a collaborative project between U.S. Fish and Wildlife Service (USFWS), USACE, New Mexico State, and others.
    - There is an opportunity for the Collaborative Program to help inform decisions.
- There are projects going on that can serve as examples for how the Collaborative Program can optimize activities. The SAMC should keep an eye out for examples.

Interactive Mapper

- Alyssa O'Brien, City of Albuquerque, Open Space Division, asked if the SAMC wanted to add a layer to the interactive mapper on the Portal that shows all the work being done in the system.
- A riparian vegetation map for the whole state is being developed and the layer is available for download.
- The fish release data from Thomas A., USFWS, can be added to the Portal.
- The SAMC should send any suggestions for layers to add to the mapper.
- If layers cannot be added, links to other map tools and resources can be provided via the Portal.

➢ **Action Item**: PST will upload fish release data to the Program Portal
➢ **Action Item**: SAMC members will provide suggestions to the PST for additional layers, and/or links to additional map tools and resources to include on the Portal

Closing Discussions

- Earlier, the SAMC discussed bringing in managers to present on the management tools they have.
    - Managers may be hesitant to tell the SAMC. Also, management tools change in response to conditions every year.
    - The SAMC may want to work with the MAT to get that information.
    - The SAMC has a lot of other activities to get through before reaching out to managers.
- Michelle T. looked into adding a platform for SAMC collaboration on the Portal.
    - Funding is limited, as the contract with U.S. Geological Survey (USGS) ends soon.
    - USGS can produce a password-protected page for SAMC documents. The PST will have to upload all documents.
    - A chat or forum function can be added if funding for development continues next year.

➢ **Action Item**: Michelle Tuineau will create a SAMC Work Page on the Portal

Announcement

- Cliff Dahm, one of the keynote speakers at the 2020 Science Symposium, has a lot of experience bridging science and management. He is willing to attend a SAMC meeting to speak on his experiences.

Meeting Participants

EC *Ex Officio* Member	Alan Hatch
Statistics/Modeling Expert	Ara Winter
Geomorphology Expert	Ari Posner
PST Science Coordinator and SAMC Facilitator	Catherine Murphy
Terrestrial Ecology Expert	David Moore
Ecosystem Function Expert	Meaghan Conway
Climate Science Expert	Megan Friggens
PST Project Coordinator	Michelle Tuineau
Aquatic Ecology Expert	Mo Hobbs
Hydrology Expert	Ryan Gronewold
Aquatic Ecology Expert	Thomas Archdeacon

MRGESCP SCIENCE AND ADAPTIVE MANAGEMENT COMMITTEE

JANUARY XX, 2021 OBJECTIVES WORKSHOP: PRE-WORKSHOP SURVEY

PURPOSE

The purposes of the objectives workshop are **1)** to align the Collaborative Program's planning objectives with its mission statement and goals and **2)** to appraise the objectives and associated strategies yearly with input from stakeholders and technical experts.

MRGESCP MISSION STATEMENT

The Middle Rio Grande Endangered Species Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management to the benefit and recovery of the listed species pursuant to the Endangered Species Act within the Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules, and regulations.



MRGESCP SPECIES

The Collaborative Program currently aids in the recovery of five species listed under the Endangered Species Act (ESA):

- ✓ Endangered Rio Grande silvery minnow (*Hybognathus amarus*; RGSM);
- ✓ Endangered southwestern willow flycatcher (*Empidonax traillii extimus*; SWFL);
- ✓ Endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; NMMJM);
- ✓ Threatened yellow-billed cuckoo (*Coccyzus americanus*; YBCU); and
- ✓ Threatened Pecos sunflower (*Helianthus paradoxus*; PESU).

MRGESCP Goals

- Establish and maintain a self-sustaining population of endangered RGSM distributed throughout the MRG.
- Maintain and protect the MRG recovery unit goals for endangered SWFL.
- Maintain and protect suitable threatened YBCU habitat in the MRG.
- Establish and maintain a self-sustaining endangered NMMJM population in the MRG.
- Maintain and protect the threatened PESU in the MRG.
- Avoid the future listing or up-listing of species in the MRGESCP area.
- Manage available water to meet the needs of endangered species and their habitat.

Designing S.M.A.R.T. Objectives

- ☐ **S**pecific – provide sufficient detail to pinpoint problems and opportunities
- ☐ **M**easureable – create a metric to quantify success
- ☐ **A**ttainable – define an objective that is challenging, but possible
- ☐ **R**elevant – ensure that the objective applies to a real-world problem
- ☐ **T**ime-bound – set a reasonable deadline

Pre-Workshop Survey Instructions

Your input is requested by January 7, 2021 on the following set of preliminary MRGESCP planning objectives (Appendix D from the 2020 Science & Adaptive Management Plan). Please provide a response for every item on the survey. Please refer to the information and definitions provided above and rate an objective and its associated strategies on the following scale:

1 – Strongly disagree 2 – Disagree 3 – Neutral 4 – Agree 5 – Strongly agree

Use the scale provided to evaluate <u>objectives</u> on the following attributes:

A. Aligns with MRGESCP Mission Statement.
B. Supports one or more MRGESCP Goals.
C. Satisfies the definition of a S.M.A.R.T. statement.
D. Addresses an issue considered to be a priority in the short-term (next 5 years).

Use the scale provided to evaluate <u>strategies</u> on the following attribute:

E. Describes methods and/or resources needed to accomplish the associated objective.

A worksheet is provided below to record your answers, but please feel free to provide additional feedback on the list using *Track Changes* to add comments, provide editorial markup or add your own suggested objectives and/or strategies. Return your completed survey to cmurphy@west-inc.com by 5 p.m. on Thursday, January 7, 2020.

Rio Grande Silvery Minnow

Objective A-1 A.____ B.____ C.____ D.____

Strategy A-1a E.____

Strategy A-1b E.____

Objective A-2 A.____ B.____ C.____ D.____

Strategy A-2a E.____

Strategy A-2b E.____

Objective A-3 A.____ B.____ C.____ D.____

Strategy A-3a E.____

Strategy A-3b E.____

Strategy A-3c E.____

Objective A-4 A.____ B.____ C.____ D.____

Strategy A-4a E.____

Strategy A-4b E.____

Strategy A-4c E.____

Objective A-5 A.____ B.____ C.____ D.____

Strategy A-5a E.____

Strategy A-5b E.____

Strategy A-5c E.____

Strategy A-5d E.____

Southwestern Willow Flycatcher

Objective B-1 A.____ B.____ C.____ D.____

Strategy B-1a E.____

Strategy B-1b E.____

Objective B-2 A.____ B.____ C.____ D.____

Strategy B-2a E.____

Objective B-3 A.____ B.____ C.____ D.____

Strategy B-3a E.____

Strategy B-3b E.____

Yellow-Billed Cuckoo

Objective C-1 A.____ B.____ C.____ D.____

Strategy C-1a E.____

Strategy C-1b E.____

New Mexico Meadow Jumping Mouse

Objective D-1 A.____ B.____ C.____ D.____

Strategy D-1a E.____

Strategy D-1b E.____

Pecos Sunflower

Objective E-1 A.____ B.____ C.____ D.____

Strategy E-1a E.____

Strategy E-1b E.____

Other Objectives and Strategies

Objective F-1 A.____ B.____ C.____ D.____

Strategy F-1a E.____

Strategy F-1b E.____

Objective G-1 A.____ B.____ C.____ D.____

Strategy G-1a E.____

Strategy G-1b E.____

PRELIMINARY COLLABORATIVE PROGRAM OBJECTIVES

Rio Grande Silvery Minnow

Objective A-1: Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.

Reclamation sponsors a population monitoring program to sample a minimum of 20 sites per year to document the presence or absence of marked and unmarked RGSM. This supports 1-A-1, 1-A-2, 2-A-1, and 2-A-2 recovery goals and criteria from the 2010 USFWS species recovery plan. This long-term monitoring effort provides indispensable data for evaluating the status of RGSM in the MRG.

> ***Strategy A-1a***: Continue to support this long-term monitoring effort, keeping it as a high-priority for the Collaborative Program. Explore additional applications of these data, if possible.
>
> ***Strategy A-1b***: Evaluate (temporarily) increasing the sample size and adding targeted sites to facilitate a statistically robust experimental design that addresses habitat use and informs habitat restoration efforts.

Objective A-2: Continue to support research into the life history of the RGSM to further inform management of the species.

Contributing to ongoing research of the life history of the species will help inform management decisions that benefit or reduce impacts to the species. The MRGESCP has developed a CEM useful for deriving questions about the RGSM's life history. This supports recovery goals 1, 2, and 3.

> ***Strategy A-2a***: Generate research proposals to address previous panel recommendations (Noon et al. 2016, Fraser et al. 2013, etc.) and CEMs uncertainties to better understand the life history of the RGSM.
>
> ***Strategy A-2b***: Track life history research using the AM Database to generate more timely management and study recommendations.

Objective A-3: Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.

Base flows are important in maintaining wetted habitat, which represents the overall carrying capacity for the RGSM in any given area of the MRG. The following strategies support 2-B-1 and 3-B-1 recovery criteria from the 2010 USFWS recovery plan.

> ***Strategy A-3a***: Review current research publications and develop hypotheses to address habitat availability during base flow periods (outside of spring runoff).
>
> ***Strategy A-3b***: Support development of models, such as a Population Viability Analysis, to analyze habitat availability during base flow periods.
>
> ***Strategy A-3c***: Clearly define assumptions/uncertainties involving minimum base flow, sufficient habitat and survival rates.

Objective A-4: Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.

The timing, duration and magnitude of spring runoff are important to RGSM reproduction and have been demonstrated to have a significantly positive correlation with the October population density. The following strategies support recovery criteria 2-B-2, 2-B-3, 3-B-2, and 3-B-3 from the 2010 USFWS recovery plan.

> ***Strategy A-4a***: Review current research publications and develop hypotheses to address nursery habitat availability during spring runoff.

Strategy A-4b: Support development of models to analyze habitat availability during spring runoff.

Strategy A-4c: Clearly define assumptions/uncertainties involving flow characteristics, sufficient habitat and recruitment rates.

Objective A-5: Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.

Habitat availability varies by reach and flow regime in the MRG and more research and modeling efforts are needed to help determine the best balance between water management and habitat restoration to support species recruitment and survival. The following strategies support recovery criteria 2-B-3, 2-B-4, 3-B-3, and 3-B-4 of the 2010 USFWS species recovery plan.

Strategy A-5a: Perform modeling to determine the amount of habitat needed in each reach during 1) spring runoff, 2) summer low flow periods, and 3) fall and winter base flow periods needed to support a self-sustaining population.

Strategy A-5b: Identify uncertainties related to recruitment of RGSM and perform literature reviews to develop research hypotheses on this topic.

Strategy A-5c: Identify uncertainties related to survival of RGSM and perform literature reviews to develop research hypotheses on this topic.

Strategy A-5d: Review new and existing research to identify specific metrics to measure habitat quality in supports of recruitment and survival of RGSM for a self-sustaining population in each reach. Recommend a habitat monitoring protocol to provide empirical data.

Southwestern Willow Flycatcher

Objective B-1: Continue monitoring for SWFL in designated critical habitat areas to track territories in the MRG management unit of the Rio Grande recovery unit.

SWFL territories and nests have been consistently found in the MRG management unit and the number of territories have increased in the last ten years. Continued contributions to monitoring in the MRG will help track species recovery. The following strategies support all recovery criteria listed in the 2002 USFWS species recovery plan.

Strategy B-1a: Ensure designated critical habitat areas in the MRG are monitored annually for SWFL territories to contribute to understanding species recovery.

Strategy B-1b: Analyze available monitoring data annually to ensure SWFL territories are not decreasing in the MRG management unit. If the number of territories are decreasing, review habitat areas where territories have decreased to make recommendations for improving habitat to increase SWFL territories.

Objective B-2: Continue monitoring critical SWFL habitat and contribute to research on the impacts from non-native and exotic species on SWFL recovery.

Habitat requirements for the SWFL have been well documented, but impacts from the management of the non-native and exotic tamarisk on SWFL recovery are poorly understood. The following strategy supports recovery criteria 2-B from the 2002 USFWS species recovery plan.

Strategy B-2a: Perform literature reviews and recommend best management practices regarding non-native and exotic species to support SWFL and their habitat.

Objective B-3: Support large-scale restoration efforts to protect and expand SWFL habitat in the MRG.

Strategy B-3a: Annually map or update maps of SWFL habitat in the MRG management unit.

Strategy B-3b: Review habitat areas biennially and identify sites that can be expanded based on occupied territories to prioritize restoration efforts.

Yellow-Billed Cuckoo

Objective C-1: Contribute to research and understanding of habitat needs for the YBCU.

Critical habitat areas were proposed and revised by the USFWS in 2020. The area includes much of the MRG with the exception of the Albuquerque reach. More research is needed to determine habitat features needed to help prevent up-listing of the YBCU. There is not currently a recovery plan for this species.

Strategy C-1a: Perform literature reviews and make recommendations for research to better understand the habitat needs to support the YBCU.

Strategy C-1b: Annually map or update maps of YBCU habitat in the MRG. Make recommendations to support expansion of habitat to support the species.

New Mexico Meadow Jumping Mouse

Objective D-1: Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

There is currently one known population of NMMJM in the MRGESCP area, located at the Bosque del Apache National Wildlife Refuge. The biggest stressor to the species is habitat loss, typically a result of grazing, water management practices, drought, wildfire and other pressures. The following strategies support the findings in the 2014 USFWS recovery outline for the species.

Strategy D-1a: Provide a biennial assessment of opportunities to expand NMMJM habitat in the MRG to achieve a self-sustaining population.

Strategy D-1b: Perform literature reviews and pursue opportunities to support research to better understand the life history of the NMMJM, including movement behavior, to support habitat recommendations.

Pecos Sunflower

Objective E-1: Continue monitoring for PESU stands in the West-Central New Mexico Recovery Region and preserve habitat.

In the 2005 species recovery plan, the USFWS listed at least one potential core conservation area for an existing population of PESU within the West-Central New Mexico Recovery Region in the MRGESCP area – the La Joya State Waterfowl Management Area. The area around the La Joya Drain is of particular interest. Monitoring and maintenance in that area should consider how to improve habitat for PESU.

Strategy E-1a: Monitor one new area per year for PESU to see if species is present. Monitoring could occur simultaneously with other monitoring occurring for habitat restoration sites or site maintenance monitoring. Consider monitoring in newly restored habitat areas in the Lower Reach Plan, where habitat for PESU may be become suitable.

Strategy E-1b: Devise a list of potential ways to keep the La Joya Drain area perennial to continue to provide suitable habitat for the PESU.

Other Objectives and Strategies

Objective F-1: Monitor the status of other threatened species in the MRG.

The Collaborative Program will track the status of other species of concern in the MRG to prevent future listings or up-listings within the MRGESCP area.

Strategy F-1a: Review the biennial assessment from the NMDGF for status of various species in the MRGESCP area. Consider including protection measures for applicable threatened species in restoration efforts, where possible.

Strategy F-1b: Include an update on status of other threatened and endangered species at the Science Symposium.

Objective G-1: Support the establishment and maintenance of a Conservation Storage pool in Abiquiu Reservoir.

Efforts are underway to change authorizations at Abiquiu Reservoir so native Rio Grande water can be stored in addition to the already authorized San Juan-Chama water storage. The flexibility to store both San Juan-Chama and native Rio Grande water will provide options for managing water resources on the MRG.

Strategy G-1a: Provide monitoring data to support the environmental assessment process to establish the conservation storage pool.

Strategy G-1b: When possible, find available water to support the conservation storage pool to benefit species and habitat.

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group
Charge Template

Approved by Science and Adaptive Management Committee (SAMC) on *DATE*.

Parent Committee

S&T Ad Hoc Groups are formed by and report to the SAMC.

Ad Hoc Group Charge

Detail the charge of the S&T Ad Hoc Group below, including specific tasks directed by the SAMC. Include the objectives addressed by those tasks.

Membership

A. Criteria for membership

Provide a list of qualifications and/or interests that members should possess in order to sit on the ad hoc group

B. Member List

List the proposed members of the S&T Ad Hoc Group here, including affiliation and job title. The total membership should take into account the expertise needed to carry out the group's charge, and the group should be kept at a manageable size in order to complete the task within the timeline detailed in this document.

Tasks and Deliverables

List the specific tasks the group is being directed to complete to fulfill their charge. Provide the deliverable(s) associated with each task. Tasks can be a concrete activity (e.g., data analysis, a scope of work, a model), but can also be process-oriented (e.g., develop options for addressing a hypothesis for the SAMC's consideration).

1. ***Task One Name***
   Details of task one

   Objective of Task One
   How will this task contribute to the group's overall charge?

   Deliverable(s):

2. ***Task Two Name***
   Details of task two

   Objective of Task Two
   How will this task contribute to the group's overall charge?

   Deliverable(s):

Add or delete numbers for additional tasks as needed.

Timeline and Reporting Scheduling

Complete the table below to note when tasks should be completed and deliverables submitted to the SAMC for review. The tasks in the table should match with those listed above. Each task should include reports to the SAMC.

Task	Subtask	Deliverable	To Be Completed By
Task one	Subtask 1A	Deliverable Name	Deadline
	Subtask 1B	Deliverable Name	Deadline
Task two		Deliverable Name	Deadline

Appendix B. Rio Grande Silvery Minnow Conceptual Ecological Model

RIO GRANDE SILVERY MINNOW LIFE HISTORY

The RGSM is a small-bodied member of the Cyprinid family, native to the Rio Grande basin. The RGSM once occurred throughout the Rio Grande Basin from the MRG (Rio Grande Reaches found in New Mexico) all the way to the Gulf of Mexico. Historically, it was also found in important tributaries such as the Rio Chama, Jemez River, and Pecos River (Sublette et al. 1990, Bestgen and Platania 1991, Horwitz et al. 2018). Currently, the RGSM only occupies approximately seven percent of its historic range (USFWS 2010, Mortensen et al. 2019). The majority of the current population is found in the 280km reach of the MRG between Cochiti Dam and Elephant Butte Reservoir, with a much smaller, experimental population introduced into a small portion of the Rio Grande near Big Bend, TX in 2008. Limited natural reproduction occurs within the MRG population, however the Big Bend population is not thought to be self-sustaining at this time (USFWS 2008, Edwards 2017). The contraction of the RGSM's range is mostly attributed to modifications in hydrology as a response to anthropogenic changes in water use and storage in the basin (USFWS 2016, 2018). The loss of RGSM habitat and the overall decline in abundance ultimately resulted in the species being listed as endangered under the ESA in 1994.

The life history for the RGSM is typical of similar small-bodied, riverine cyprinids that occupy lowland floodplain rivers of Western North America (Platania et al. 2020). Spawning begins in the spring during the freshet, just prior and during peak flows (typically mid-April to mid-May). The exact mechanism that initiates spawning is still unknown, but it is likely related to hydrologic and temperature cues (Dudley et al. 2018, USFWS 2018). RGSM are broadcast spawners and highly fecund; a single female may produce anywhere from 2,000 to 10,000 eggs (Caldwell et al. 2019). Eggs become semi-buoyant after fertilization and drift downstream while they incubate. Eggs incubation typically lasts for 24 to 48 hours and is highly temperature dependent (Platania 2000). The spawning strategy of the RGSM depends on reliable flows that are able to disperse eggs and larvae into slower moving, overbank and floodplain nursery habitats (Gonzales et al. 2014). Larvae hatch from their eggs at only 4mm standard length (SL) and on average, become free swimming four days later once they reach 5-10mm SL. Larvae are gape limited and known to eat algae, diatoms, small invertebrates, cyanobacteria, detritus, periphyton, seeds and pine pollen (Shirey et al. 2008, Magana 2009, Watson et al. 2009, Bixby and Burdett 2014). The larval life stage lasts until mid-July when they transition to juveniles (13-64 mm SL).

Juveniles primarily occupy in-channel habitats as floodplain habitats begin to recede with declining freshet flows. These habitats are notably deeper and in faster waters compared to larval habitat. Juvenile RGSM have a similar diet to that of larvae, as RGSM tend to be generalists. During the summer, it is common for portions of the MRG to dewater, leading to fragmentation of suitable RGSM habitats. When dewatering occurs, RGSM experience high levels of mortality due to a lack of suitable available habitat and stranding. Juveniles continue to grow through the summer and fall before transitioning into adults (35-90 mm SL) beginning in December.

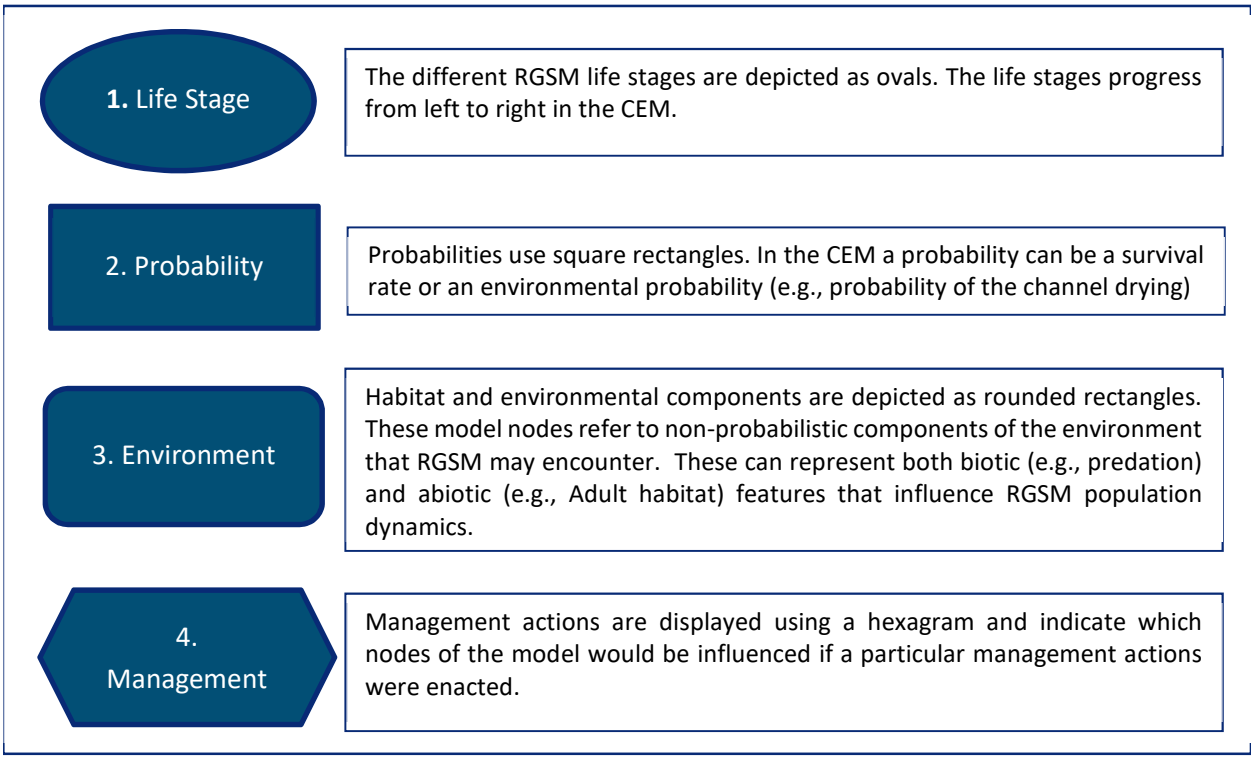
Adults have almost identical habitat use and diet as juveniles. During the winter RGSM occupy deeper, slower habitat with adequate cover where they can conserve energy (Platania and Dudley 2003). Sexual

maturity is often achieved in less than 12 months, thus fish hatched in the previous spring are able to contribute to the population during the following spawning season. The typical life span of RGSM in the MRG is two years, however individuals as old as five years have been observed (Dudley et al. 2018, Horwitz et al. 2018).

CONCEPTUAL ECOLOGICAL MODEL DESCRIPTION

The RGSM CEM describes and depicts the life history of RGSM and all the biotic and abiotic factors of the MRG that influence the RGSM population. With that in mind, a graphical representation of the RGSM life cycle was developed as the basis for the model (Figures 6 and 7). The CEM is a variation of an influence diagram, which documents relationships between model components using arrows. There are four types of model components in this CEM, each is presented by a different shaped node as shown in Box B1.

Box B1. Rio Grande Silvery Minnow Conceptual Ecological Model Components (Nodes)



Each CEM node is connected to at least one other node using arrows. The direction of the arrow indicates the direction of the influence in the relationship and flow of information. All arrows are unidirectional, meaning a single arrow can only represent a single relationship. The thickness of the arrow represents the importance that the parent node (origin) has on the child node (destination; Figure B2). The color of the arrow indicates the current level of understanding of that relationship as shown in Table B1. Black arrows in the model indicate life stage transitions.

Table B1. Arrows of Influence and Understanding Depicted in the Rio Grande Silvery Minnow Conceptual Ecological Model

Level of Understanding	Importance of Parent Node to Child Node	Understanding of Relationship
High		
Medium		
Low		

COMPONENT GROUPS

Ten categories that all the current model components fall under were defined to determine general patterns in the understanding of the factors that influence the RGSM. These categories also allow a focus on specific areas of future study. They are defined in Table B2.

In general, the CEM follows the life history of RGSM from adults in time step t, to adults in time step t+1. The CEM moves from left to right as adults in time step t spawn to create eggs, which then progress as larvae, juveniles, and finally adults in the next time step (t+1). Mortality is applied between each time step in the form of survival probabilities. Survival probabilities are informed by various child nodes in the lower portion of the model. A full description of each individual model component can be found in Table B3.

Table B2. Rio Grande Silvery Minnow Conceptual Ecological Model Component Groups

1. Life History	Life history nodes are either RGSM life stages or population vital rates. These components are the end points for most of the other components in the model and comprise the RGSM life cycle.
2. Food Availability	Food availability nodes represent food availability for the RGSM at its three different feeding life stages: larval, juvenile, and adult. Food availability directly influences age-specific survival rates.
3. Predation	Predation nodes represent the three most common predator categories: fish, avian, and invertebrate. RGSM are prey to a variety of other species in the MRG, and predation rates directly influence RGSM age-specific survival.
4. Hydrology	Hydrology is a large node because of its large influence and interconnectedness on the system. It influences the RGSM life cycle in the form of temperature, flow, and floodplain inundation. Most hydrologic components are related to flow (Q).
5. Geomorphology	Geomorphic nodes reflect the processes that shape the physical shape and environment of the river. These processes determine sediment scouring/deposition, overall river geometry, and other river hydraulics.
6. Habitat	Three types of habitat occupied by RGSM are defined as: larval, juvenile, and adult. In general, RGSM use a wider range of stream velocities and depths as they grow from larvae to adults. Habitat availability may directly influence age-specific survival rates.
7. Vegetation	Vegetation nodes refer to the diversity and density of vegetation that exists in the floodplains and main channel of the MRG. Vegetation helps determine floodplain inundation and overall river geometry.
8. Disease and Parasites	Hydrology is a large model component grouping because of its large influence and interconnectedness on the system. It influences the RGSM life cycle in the form of

	temperature, flow, and floodplain inundation. Most hydrologic components are related to flow (Q).
9. Genetics	The level of genetic diversity is the only model component in this grouping. Genetic diversity is informed by the density of adults present in the system and influences overall fecundity.
10. Photoperiod	The photoperiod model component may be a spawning cue and may only influences fecundity. Photoperiod is the change in the amount of daylight through the year.

CONCEPTUAL ECOLOGICAL MODEL SCALE

This CEM assumes specific spatial and temporal scales. Spatially, the extent of this model includes four reaches of the MRG, with a grain size equal to four separate reaches. This scale also means the model is spatially implicit at resolutions finer than reaches listed above. For example, fish occupying different parts of the same reach are assumed to experience the same mortality rates and have same access to habitat. The Northern Reach was described in Section 1.3 and shown in Figure 1 of the Science & AM Plan was excluded from the spatial scale of this CEM as RGSM do not exist in the Northern Reach. For the purposes of understanding the RGSM CEM spatial scale, the four reaches have been defined in Section 1.3 of the Science & AM Plan.

The current format of the CEM only depicts the direction, importance, and the current level of understanding of each relationship between model components. At this time, it is not possible to identify specific mechanisms for each relationship defined in the CEM. However, this model is intended as a tool to help managers and stakeholders identify the components and relationships that are most influential to the management of RGSM.

Temporally, the model operates with an annual time step. Although much of the biology of the RGSM occurs as finer spatial and temporal scales, little monitoring is done in order to build a useful system-wide model that can operate at those fine resolutions (e.g., 10km reaches or at a daily time step). The scale was chosen to reflect the current monitoring methods and population dynamic modeling efforts. The collection of transition schematics (Figures B1) were used to derive the graphical model (Figure B2).

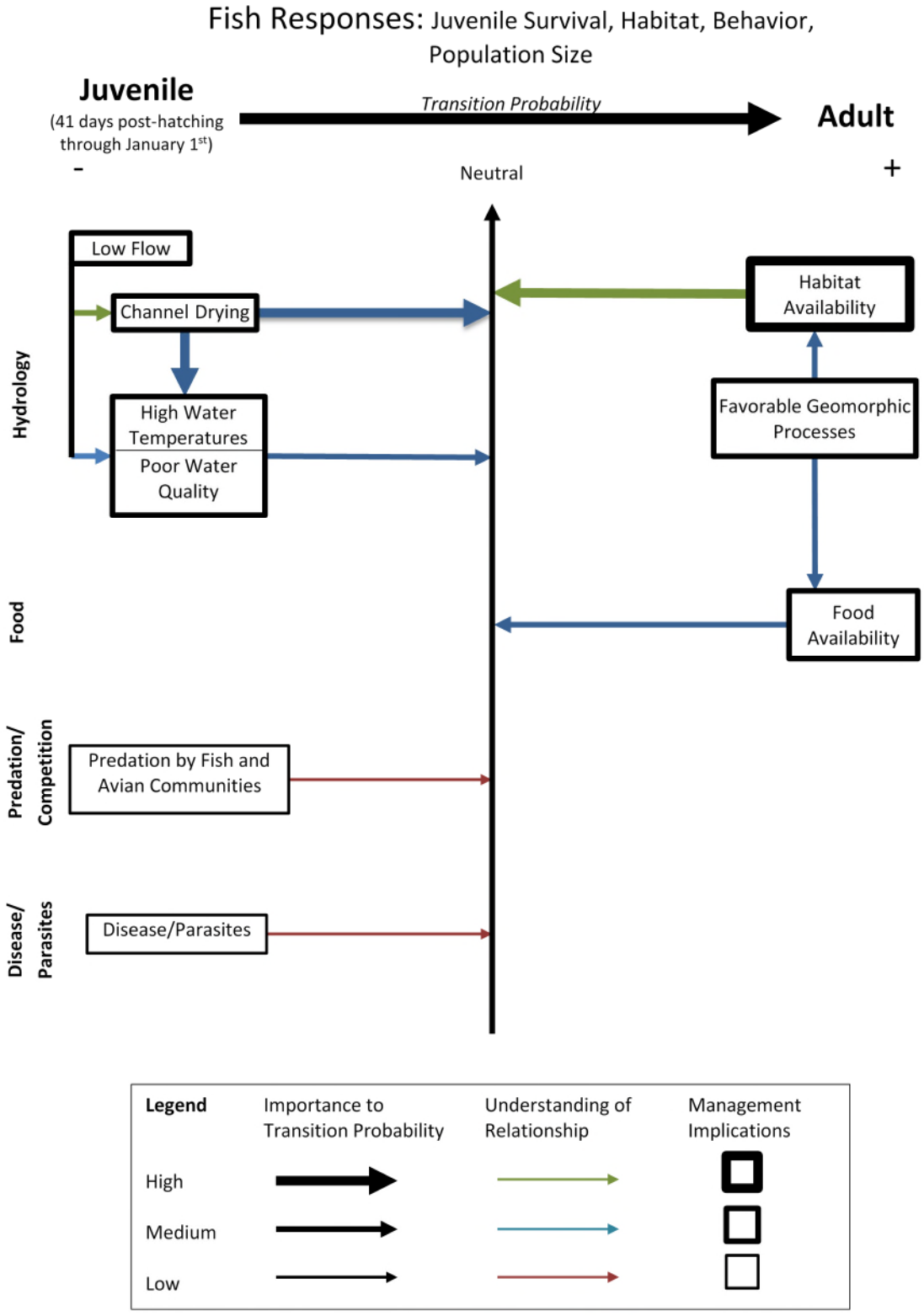


Figure B1. Rio Grande Silvery Minnow Life History Transition Schematics.

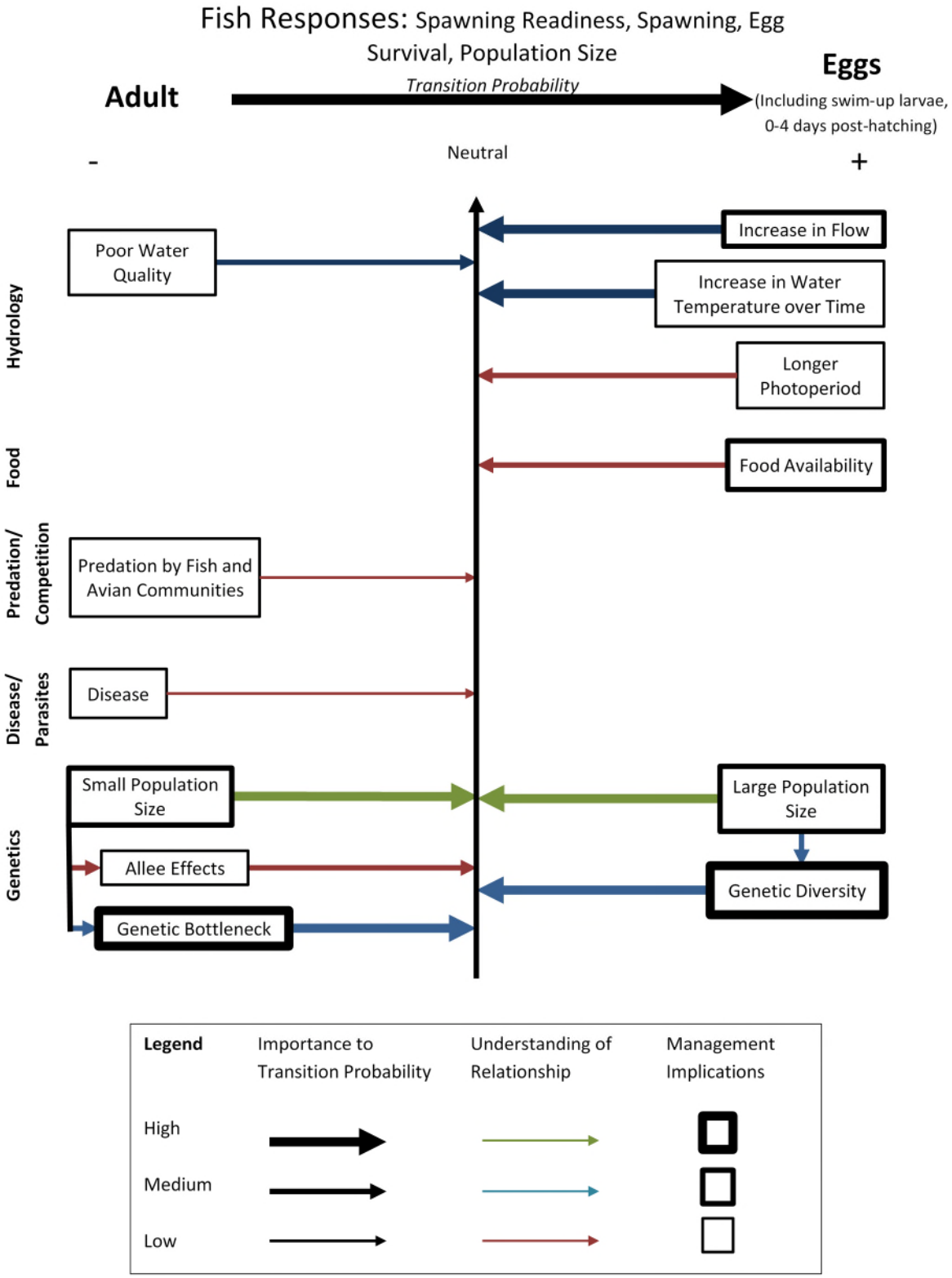


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

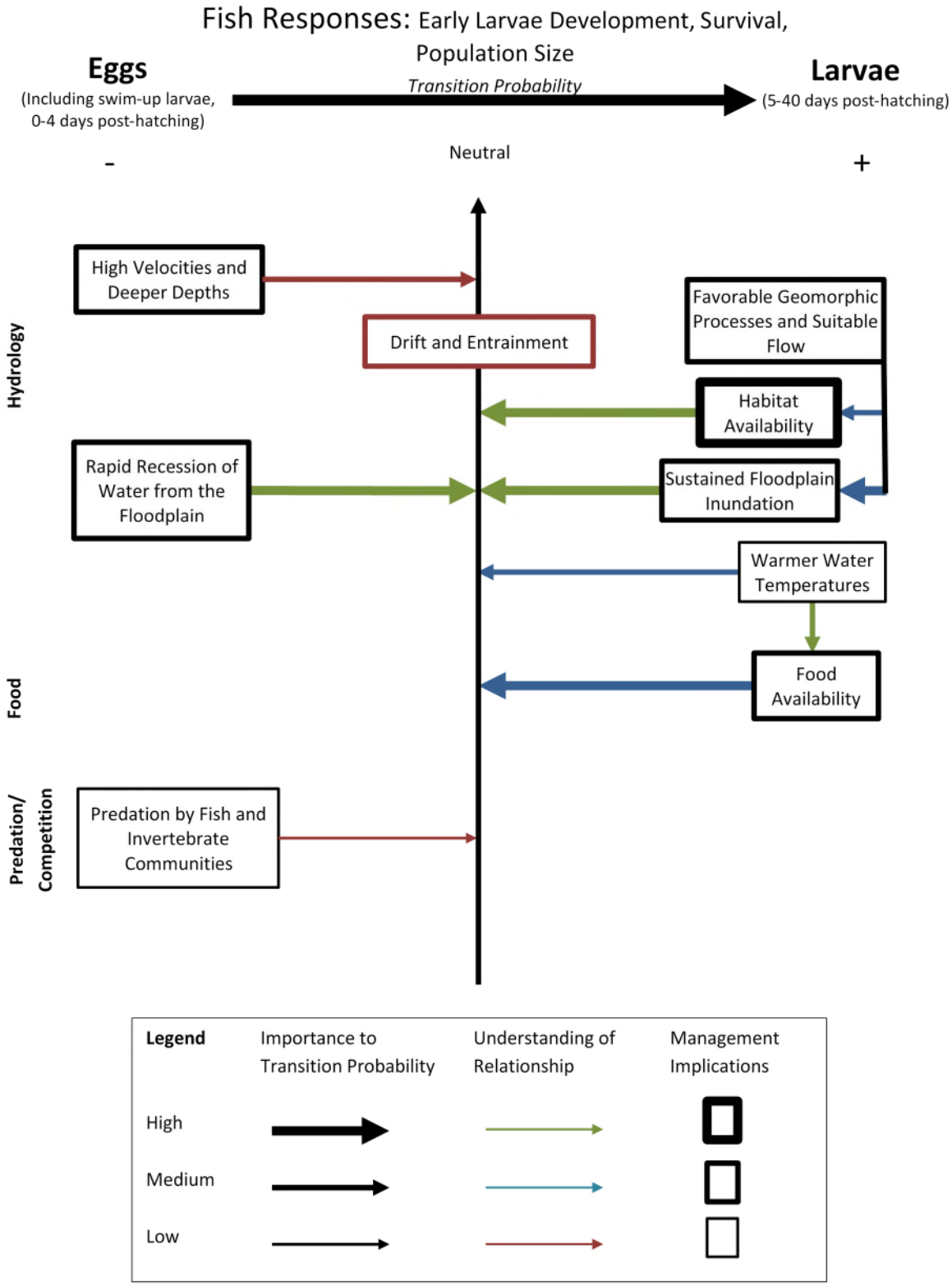


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

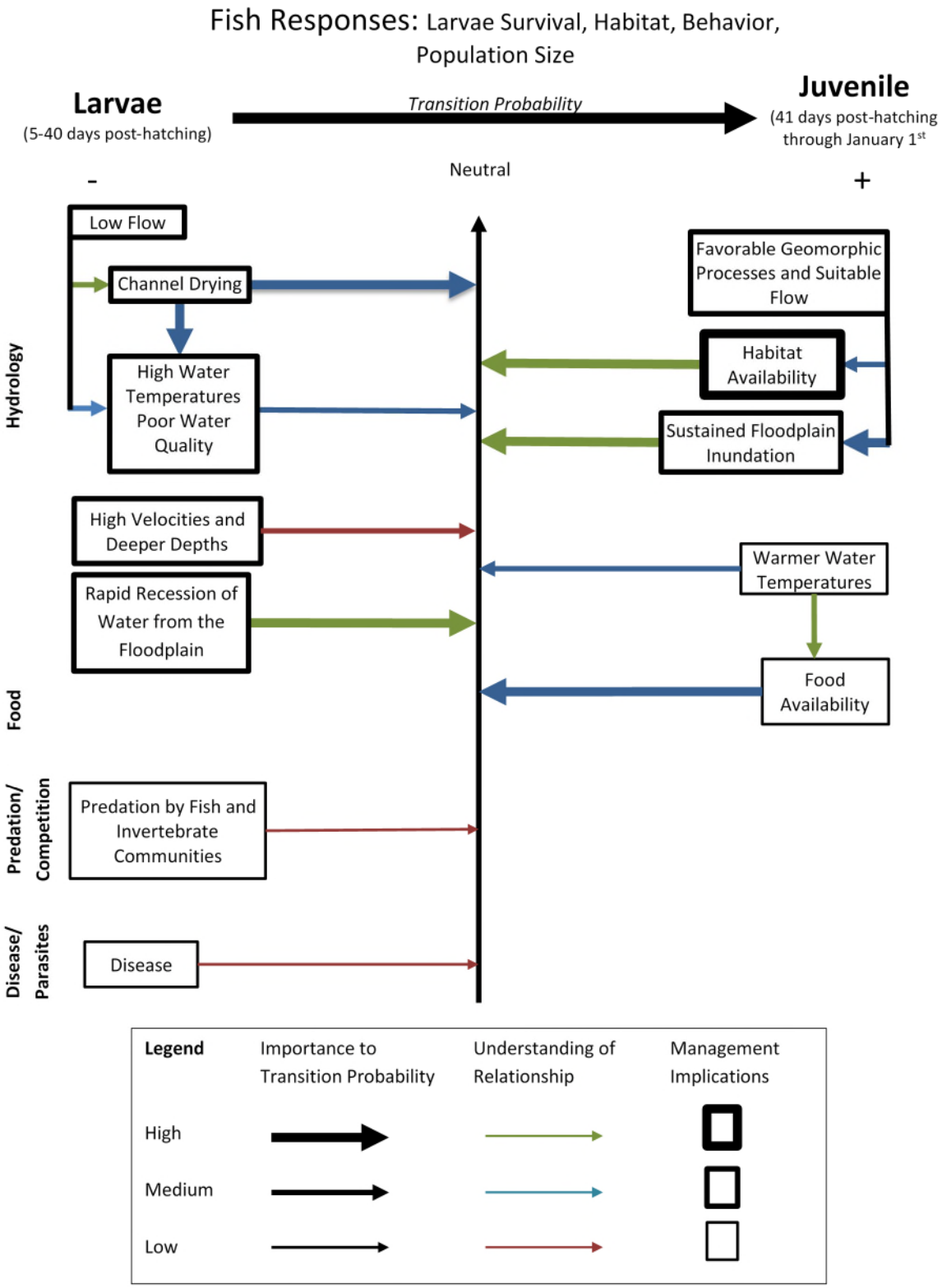


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

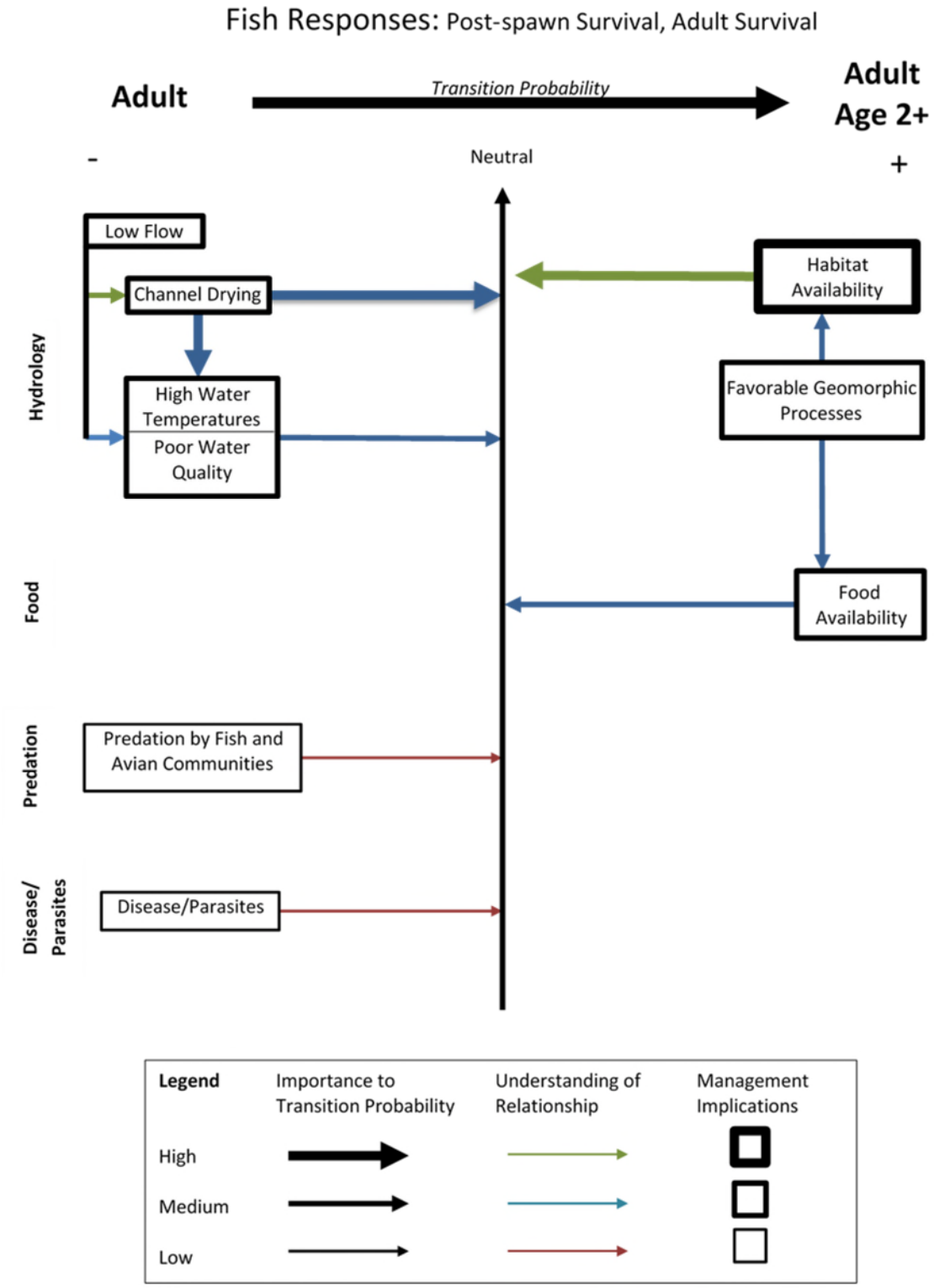


Figure B1 (continued). Rio Grande Silvery Minnow Life History Transition Schematics.

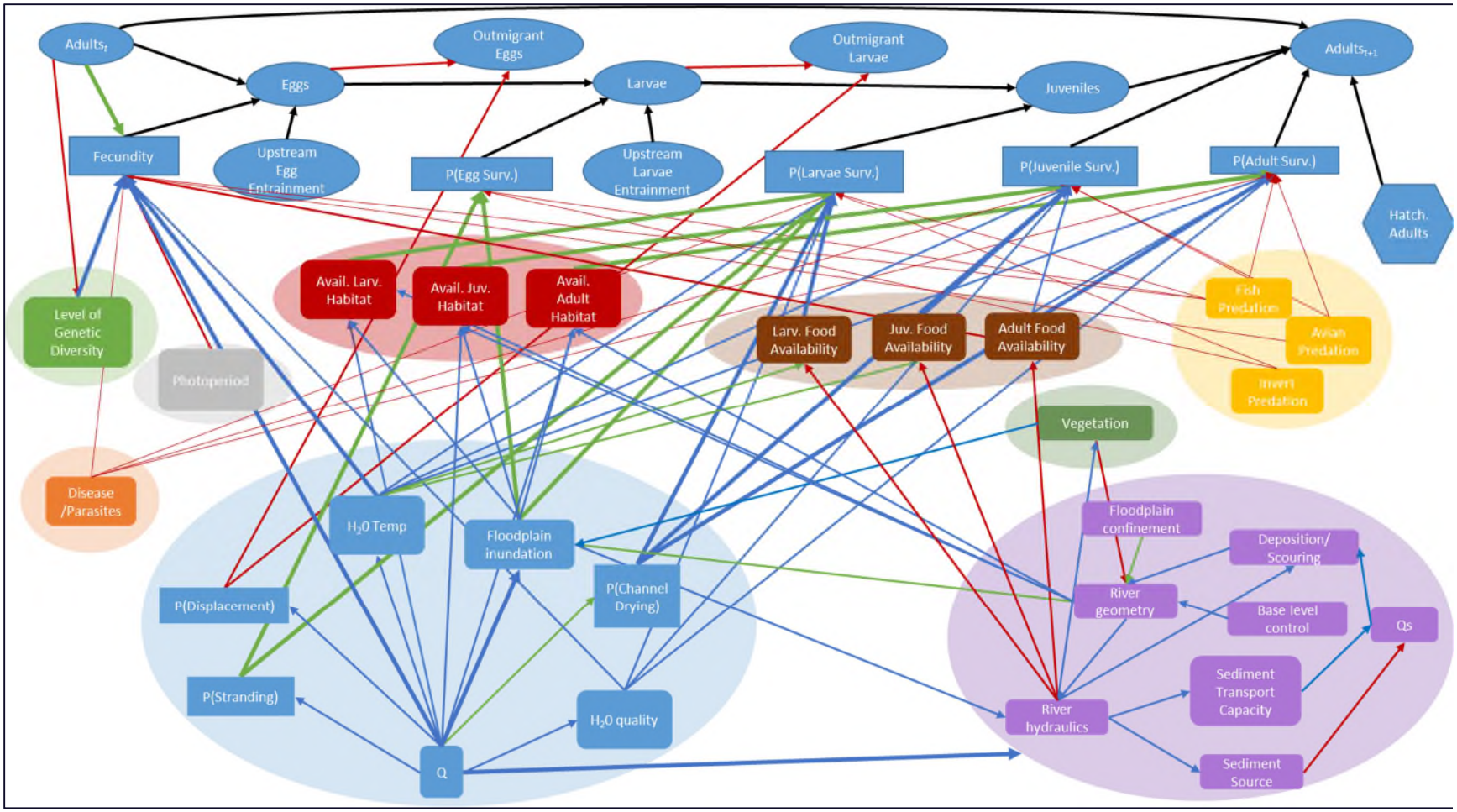


Figure B2. Graphical conceptual ecological model for the Rio Grande silvery minnow. Each model node is connected to at least one other node using arrows. The direction of the arrow indicates the direction of the influence in the relationship and flow of information. The thickness of the arrow represents the importance that the parent node (origin) has on the child node. The color of the arrow indicates the current level of understanding of that relationship (Red=low, Blue=Medium, Green=High). Black arrows indicate life stage transitions.

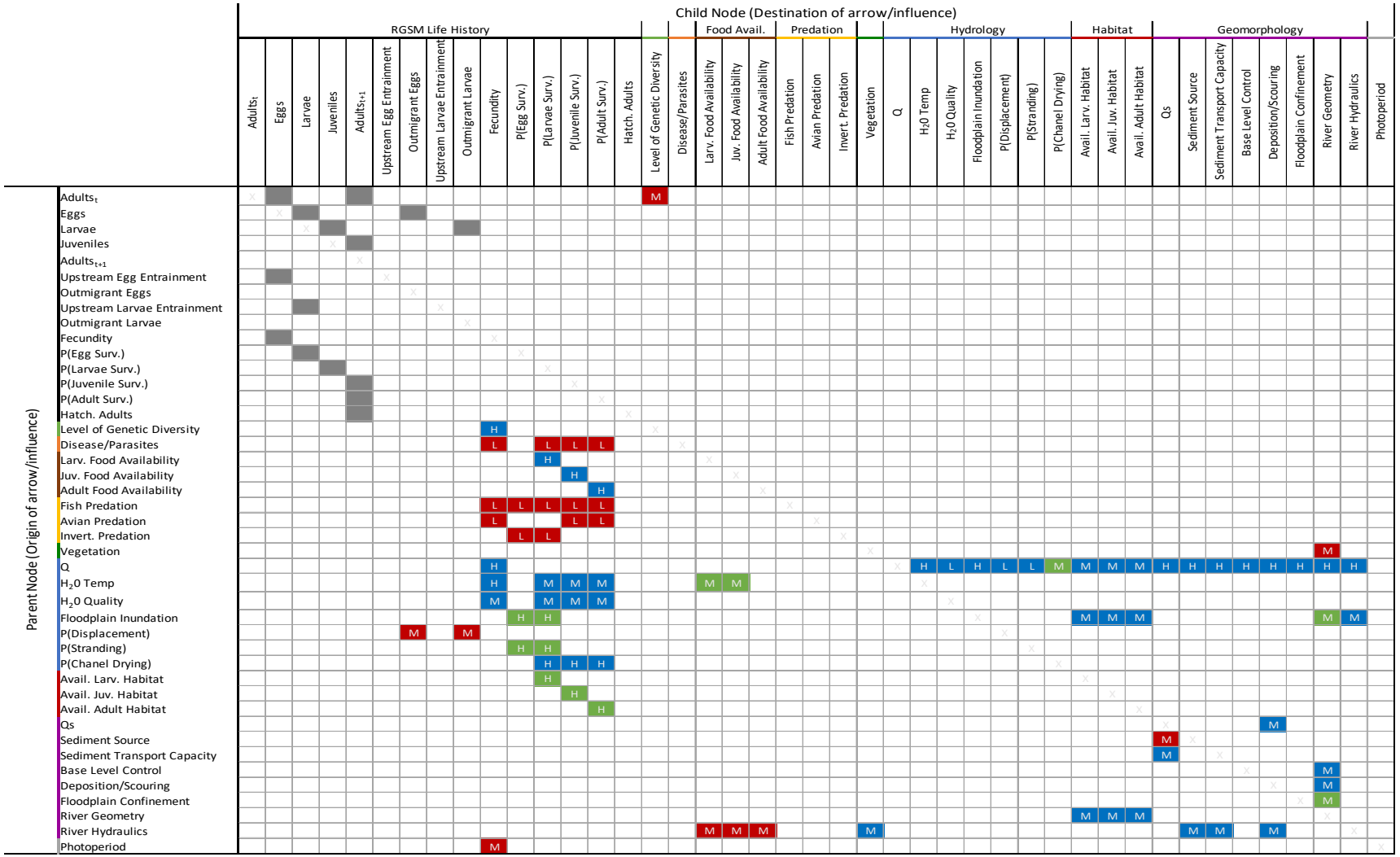


Figure B3. Conceptual ecological model (CEM) relationship matrix. The matrix describes every relationship (arrow) in the CEM. Rows indicate the component where the relationship originates and columns show the component where the relationship ends (e.g., direction of the CEM arrow). The color of the cell indicates level of understanding of that relationship (Red=low, Blue=medium, Green=high) and the letter in each cell indicates the importance that the parent node (origin) has on the child node (L=low, M=medium, H=high). Grey boxes indicate life history transitions and blank cells represent no relationship.

Table B3. Conceptual Ecological Model Component Descriptions

Component	Category	Description
$Adults_t$	Life History	Adult abundance at time step *t*. Adults are present year round in the MRG and are classified as individuals >35mm. The age structure of the adults is predominately made up of 1 and 2 year old fish, however a small segment of fish can live up to 5 years. All adults are considered sexually mature and available to spawn.
Eggs	Life History	Total number of eggs produced during spawning during time step *t*. calculated by applying the spawning success rate (*P(Spawning Success)*) to $Adults_t$.
Larvae	Life History	The number of larvae produced during time step *t*. calculated by applying the egg survival rate (*P(Egg Surv)*) to *Eggs*. Larvae are classified as individuals between 4 and 13mm standard length and can be found in the MRG between mid-April to mid-July.
Juveniles	Life History	The number of Juveniles produced during time step *t*. calculated by applying larval survival rate (*P(Larvae Surv.)*) to *Larvae*. They are classified as individuals between 13 and 64mm standard length and can be found in the MRG between mid-July to December.
$Adults_{t+1}$	Life History	Adult abundance at time step *t+1.* This group is comprised of both Juveniles that survive into adulthood as well as Adults from the previous time step *t*.
Upstream Egg Entrainment	Life History	The total number of eggs that are entrained from upstream reaches.
Out-migrant Eggs	Life History	The total number of eggs that disperse downstream out of the system/reach.
Upstream Larvae Entrainment	Life History	The total number of larvae that are entrained from upstream reaches.
Out-migrant Larvae	Life History	The total number of larvae that disperse downstream out of the system/reach.
Fecundity	Life History	The mean number of eggs produced by an individual RGSM.
P(Egg Survival)	Life History	The mean probability that an individual egg will survive to hatching during time step *t.*
P(Larvae Survival)	Life History	The mean probability that an individual larvae will survive to transition into the juvenile life stage during time step *t*.
P(Juvenile Survival)	Life History	The mean probability that an individual juvenile will survive to transition into the adult life stage during time step *t*.
P(Adult Survival)	Life History	The mean probability that an individual adult will survive to the next time step *t*.
Hatch. Adults	Life History	The number of hatchery origin adults stocked into the reach.
Level of Genetic Diversity	Genetics	The total amount of RGSM genetic diversity present in the MRG.
Disease/Parasites	Disease/Parasites	The prevalence of disease and parasites that can adversely affect survival rates of RGSM.
Larval Food Availability	Food Availability	The density of suitable diet items available for consumption by larval RGSM.
Juv. Food Availability	Food Availability	The density of suitable diet items available for consumption by juvenile RGSM.
Adult Food Availability	Food Availability	The density of suitable diet items available for consumption by Adult RGSM.
Fish Predation	Predation	The prevalence of fish that prey on RGSM.

Avian Predation	Predation	The prevalence of birds that prey on RGSM.
Invert. Predation	Predation	The prevalence of invertebrates that prey on RGSM.
Vegetation	Vegetation	The diversity and density of vegetation that can influence the geomorphic processes in the MRG.
Q	Hydrology	Discharge referring to the magnitude (in terms of peak discharge or volume of water), duration (how long does flood last), frequency (how often it occurs, what time of year it occurs), and time sequence (the occurrence of discharge events within a year or over multiple years/decades)
H_20 Temp	Hydrology	In-stream temperature.
H_20 Quality	Hydrology	General water quality.
Floodplain Inundation	Hydrology	The amount of floodplain habitat created during spring run off or during other water management activities.
P(Displacement)	Hydrology	The probability that high flows may displace and disperse eggs and larvae out of the system.
P(Stranding)	Hydrology	The probability that high flows that create floodplain habitat may recede too quickly and strand RGSM eggs and larvae in disconnected floodplains
P(Channel Drying)	Hydrology	The probability low flows may cause portions of the main channel to dry and fragment RGSM habitats.
Available Larval Habitat	Habitat	The total amount of RGSM larval habitat available to larval RGSM.
Available Juvenile Habitat	Habitat	The total amount of RGSM Juvenile habitat available to Juvenile RGSM.
Available Adult Habitat	Habitat	The total amount of RGSM Adult habitat available to Adult RGSM.
Qs	Geomorphology	Sediment load referring to the magnitude (peak concentration or load or volume of sediment), gradation of sediment, portion of sediment size class moving in suspension or as bed load (or in between), etc.
Sediment Source	Geomorphology	Where the transported sediment comes from (banks or beds of river, uniform or concentrated deposition sources from tributary inputs – e.g., fines from a tributary may coat a large section of a river, whereas coarser material deposits on the alluvial fan at the tributary confluence). The sources may be recent deposits, older deposits that have consolidated, or erosion of the bed or bank).
Sediment Transport Capacity	Geomorphology	The theoretical ability of the channel to move sediment of a given size class.
Base Level Control	Geomorphology	The influence of reservoir or in-stream channel features to cause backwater effects influencing river geometry and river hydraulics
Deposition/ Scouring	Geomorphology	The process of sediment being added or subtracted to a given cross section. This is dependent on grain size and both processes may occur at a given location (e.g., bank could be eroding while at the same time deposition is occurring on a bar opposite the erosion).
Floodplain Confinement	Geomorphology	The lateral constraint of the river from local geology or placement of engineered/spoil levees.
River Geometry	Geomorphology	The slope, width, mean depth, channel sinuosity, channel planform, cross section shape, wetted perimeter, XS area
River Hydraulics	Geomorphology	How fast the water is moving (velocity), depth of the water, force water applies at interfaces (shear stress, drag, water buoyancy, etc.)
Photoperiod	Photoperiod	The changes in day light duration during the spring time which may act as a spawning cue.

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Appendix C. Southwestern Willow Flycatcher and Yellow-Billed Cuckoo Conceptual Ecological Models

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Figure 6. Southwestern Willow Flycatcher Nestlings and Juveniles Life Stage
Figure 7. Southwestern Willow Flycatcher Fledglings Life Stage
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Figure 10. Yellow-Billed Cuckoo Nest Building Life Stage
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AVIAN SPECIES CONCEPTUAL ECOLOGICAL MODELS

The CEMs for the SWFL and the YBCU were developed in tandem and are very similar. Both were developed around the species' life cycle, and as both are neo-tropical migratory songbirds, the basic life stages are the same (Figure C1). With the exception of the Migration Southbound, Overwinter, and Migration Northbound, all other life stages are applicable to the MRG.

The avian species CEMs do not show relationships between variables in the way that the RGSM CEM does. Much uncertainty exists in both the SWFL's and the YBCU's basic life history. These knowledge gaps must be addressed before building a relational CEM like that of the RGSM.

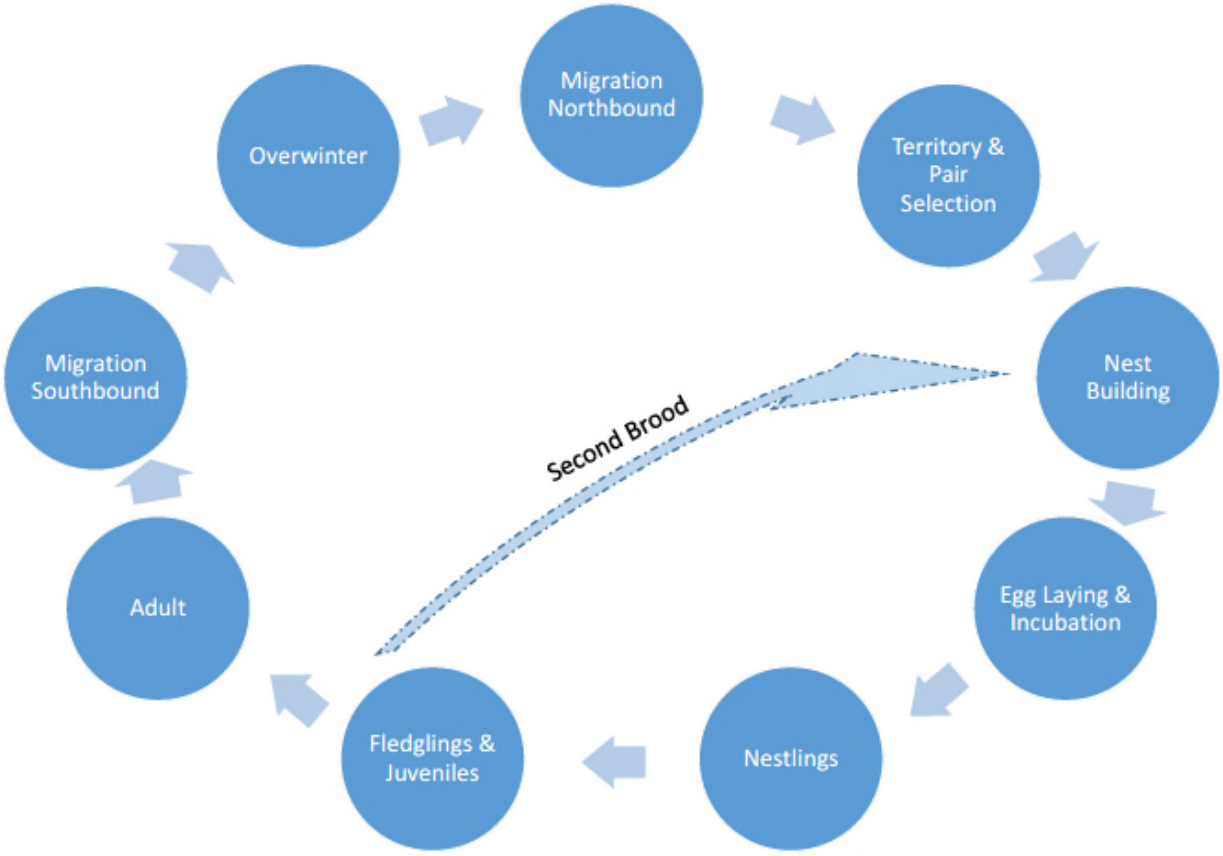


Figure C1. Basic Life Cycle for the Southwestern Willow Flycatcher and Yellow-Billed Cuckoo

Southwestern Willow Flycatcher Life History

The SWFL is a small perching bird of less than 15 centimeters long from bill to tail. It was listed as endangered in 1995 (Sogge et al. 2010). A primary reason for the species decline is the lost and degradation of its dense, native riparian habitat due to the anthropogenic modification of waterways

through channelization and damming, water diversions and groundwater pumping, and alterations to the riparian zone. It is one of four recognized subspecies of willow flycatcher. SWFLs overwinter in Mexico, Central America, and northern South America. They migrate north to breed in dense riparian habitats in the Southwest, including in the MRG (USFWS 2002).

The USFWS-designated critical habitat was revised in January 2013 to follow Recovery Plan goals, and identifies 1,975 stream kilometers in Arizona, New Mexico, southern California, Nevada, Utah, and Colorado that the species uses as breeding habitat (USFWS 2013). Their current range is similar to their historic range, but population numbers have declined due to the loss of suitable riparian habitat.

Northbound migrating SWFL arrive in the MRG in early May, and they select territories and mating pairs through the spring (USFWS 2002; Sogge 2010). Little information exists on SWFL pair selection. The female of the breeding pair ultimately chooses the nest site, looking for territory that can provide food, water, and shelter. SWFL breeding pairs prefer dense riparian habitat near or adjacent to surface water or with saturated soil, which are important both for creating a microclimate at the nest site and as habitat for their prey base of flying insects, such as mosquitoes(Sedgwick 2000; USFWS 2002; Sogge 2010). Generally, the nesting site is characterized by multi-age vegetation stands with 50-75 percent mid-story cover and dense cover that is 3-6 meters high (USFWS 2002). This dense vegetation provides protection from predators and contributes to the cooler microclimate of the nest site (Sedgwick 2000). The species also exhibit site fidelity, and breeding pairs have been observed returning to the same nesting site in subsequent years, even if the quality has degraded.

Within two weeks of pair selection, the female builds a cup-shaped nest over the course of 5-7 days without help from the male (USFWS 2002; Sedgwick 2020). Egg laying generally occurs from mid-May through mid-June. SWFLs lay 3-4 eggs per clutch over a span of 4-5 days. Eggs hatch in 12-14 days. Once hatched, the nestlings remain in the nest for 14-15 days before they fledge (leave the nest but are not fully independent from the parents). SWFL fledglings are capable of short flights (approximately 30 meters), and after leaving the nest, will remain in their parents' nesting territory for about 14 days before dispersing (Sedgwick 2020).

There is very little information on SWFL young of year once they have fledged and become juveniles, as surveys stop at that life stage. The life history of SWFL between fledging and leaving for the southern migration is a large data gap. Broods likely break up once they become juveniles as there have been no reports of flocking of immature SWFLs.

SWFLs sometimes have a second brood within a single breeding season. The likelihood of a second brood increases if the offspring from the first clutch fledge by late June or very early July. Re-nesting is common if the first nest is lost or abandoned. Clutch size decreases with each nest attempt. The proximity of the second nest to the first varies greatly, and could even be in the same plant or up to several kilometers away (USFWS 2002; Sedgwick 2020).

Migration south to their overwinter grounds begins sometime in mid-August through September, though due to survey efforts being focused around the breeding season, there is uncertainty around the exact timing of the migration and the factors that influence that timing (USFWS 2002)

Yellow-Billed Cuckoo Life History

The Western U.S. Distinct Population Segment (DPS) of the YBCU was listed as threatened under the ESA October 3, 2014 (USFWS 2014).[4] YBCU are medium-sized birds of about 30 centimeters in length. Their historic range was west of the Continental Divide, stretching from British Columbia down to northern Mexico. Today, the Western DPS of the YBCU's breeding habitat is along rivers in Arizona, California, and New Mexico (USFWS 2014; Hughes 2020). YBCU are riparian species and require large expanses of riparian habitat at the landscape level with a mosaic of different vegetation (Johnson 2009; Hughes 2020).

The species arrive at their breeding grounds in mid-late May to mid-June (Sechrist et al 2012; Hughes 2020). Little is known about pair selection (Johnson 2009). YBCU require a nest patch size of about five hectares with 50-75 percent mid-story cover that is 3-10 meters high. YBCU foraging territory is even larger, with individuals observed to have territories of 75-100 hectares (Johnson 2009; Dillon and Moore 2020).

At the nest patch scale, canopy cover is critical to provide protection and the microhabitat necessary for nest success. YBCU also prefer nest habitat in close proximity to water, especially if there is a low velocity flow of shallow depth underneath the nest. This also contributes to the nest microclimate, and provides habitat for an insect prey base. Both the male and female build the nest over the course of several days, which is located on a horizontal branch or fork of a tree (Hughes 2020).

While females can lay between 1-5 eggs per clutch, clutch size is usually 2-3 eggs. One egg is usually laid every other day, but females may wait up to five days between eggs. Eggs are incubated over 9-11 days. The duration of the egg laying and incubation period varies, between 13-20 days total. Both parents help with incubation (Hughes 2020). Additionally, pairs may have younger males that assist (USFWS 2014; Hughes 2020). The degree of contribution from colony incubation is a data gap, both in terms of level of effort and in terms of genetics. There are data showing that different males and females may genetically contribute to eggs in the same brood (McNeil 2015).

YBCU are opportunistic feeders. They mainly eat large insects, but also prey on small lizards and amphibians. They require a large amount of food, especially as nestlings. Both parents feed and brood the young equally, and nestlings transition to the fledgling stage by day 7-9. Once they become juveniles, both parents and the young leave the nest patch after a day. YBCU may lay second and even third clutches, sometimes with different partners (USFWS 2014).

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[4] The USFWS received a petition to delist the Western DPS, and there is currently a species status assessment underway with anticipated findings later in 2020

Like with SWFL, little is known about YBCU life history once the young reach the juvenile stage. The YBCU leave for their fall migration beginning in early-late August, with most birds departing by mid-September (Sechrist 2012; Hughes 2020).

AVIAN SPECIES CONCEPTUAL ECOLOGICAL MODEL DESCRIPTION

The two avian CEMs were developed were developed in tandem and both focused on life stages, with each depicted as a bulls-eye graphic divided into wedges. Each wedge represents a driver or stressor at that life stage for the species. A driver is a variable that is beneficial to the species at a specific life stage and contributes to species success. A stressor is a variable that negatively impacts the species at a specific life stage and contributes to species failure, including mortality. The bulls-eyes also depicts the level of importance of each variable, the ability to manage the variable, and if there are high level uncertainties related to the variable. The relative size of each variable's wedge is not indicative of any importance (Figure C2).

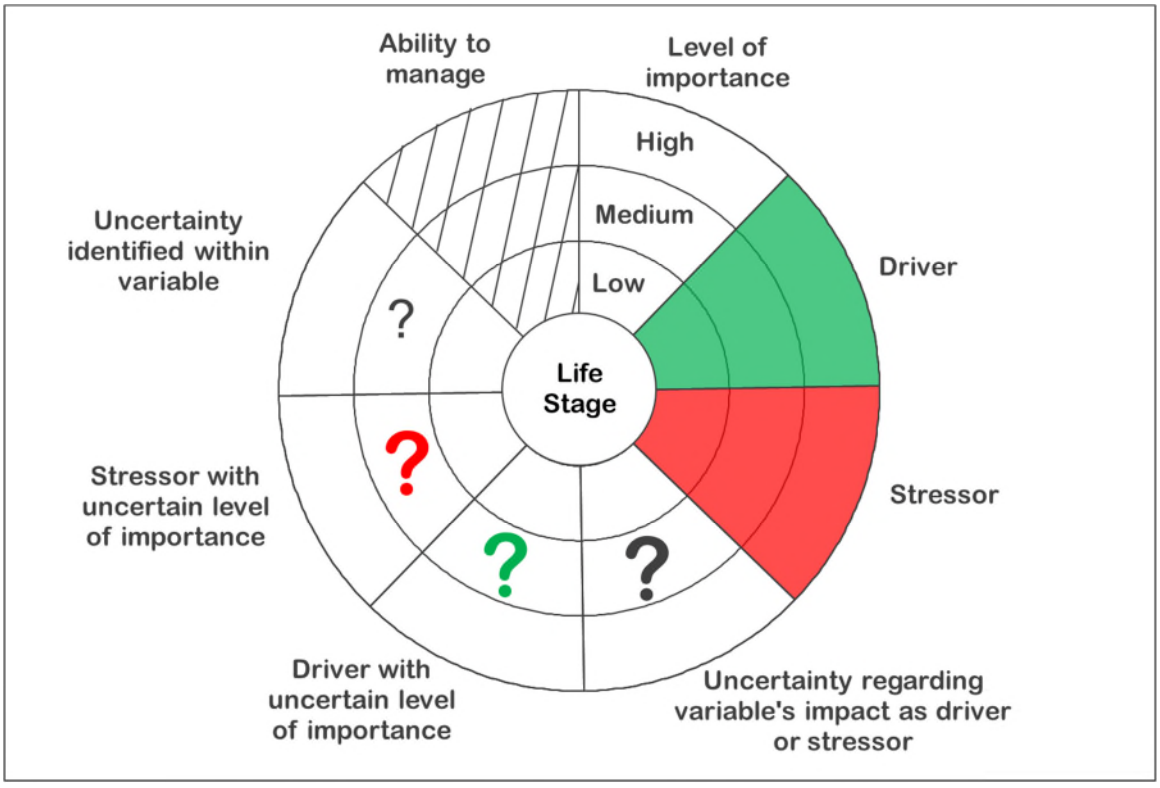


Figure C2. Avian Conceptual Ecological Model Legend

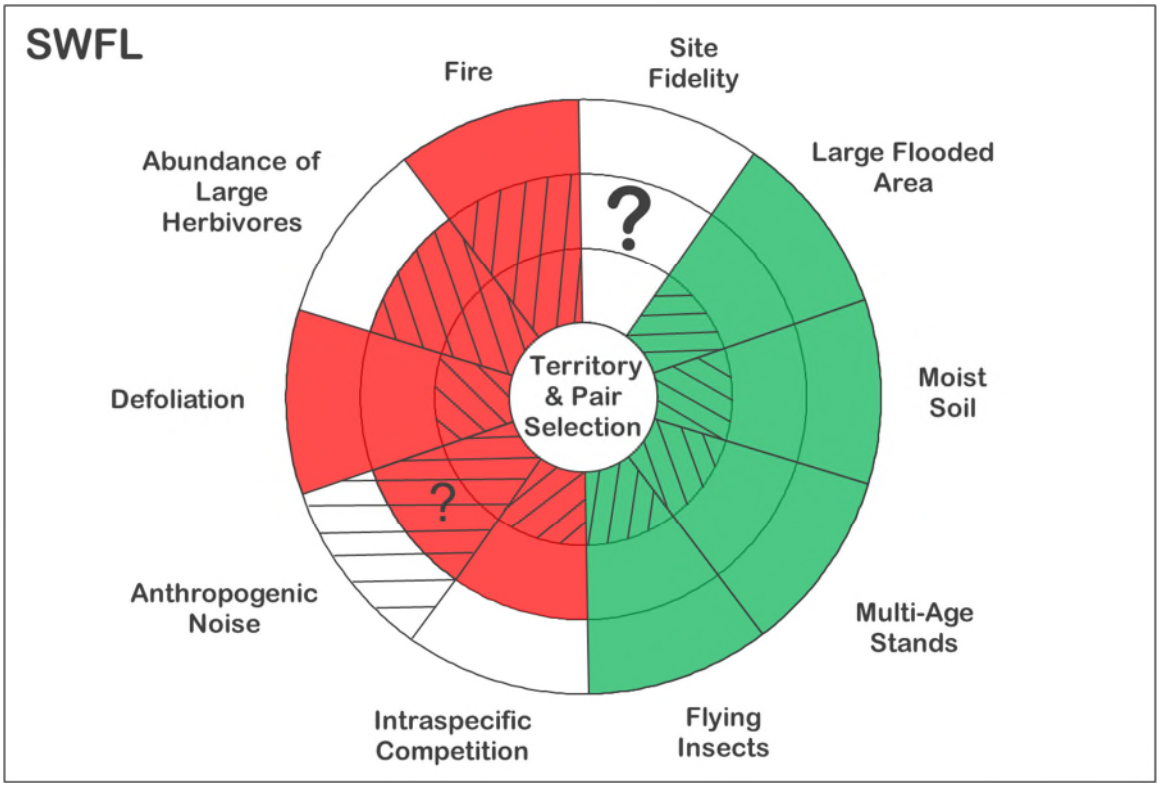


Figure C3. Southwestern Willow Flycatcher Territory and Pair Selection Life Stage.

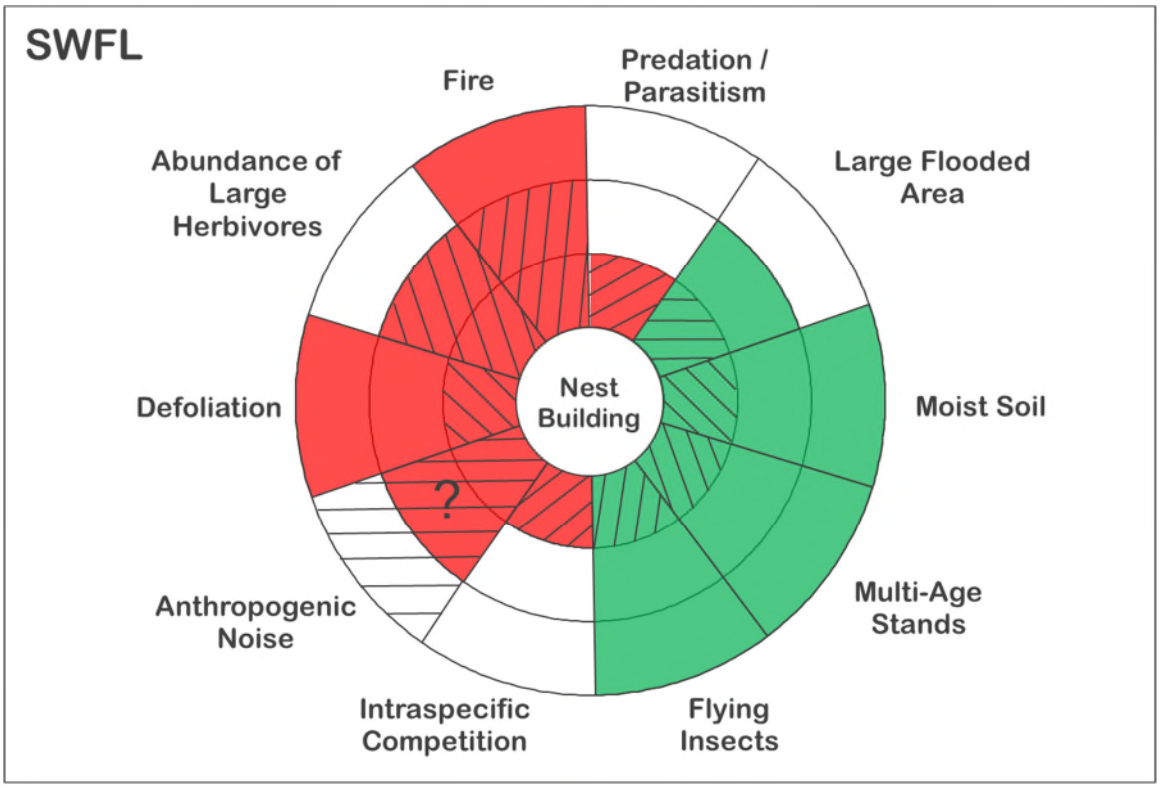


Figure C4. Southwestern Willow Flycatcher Nest Building Life Stage

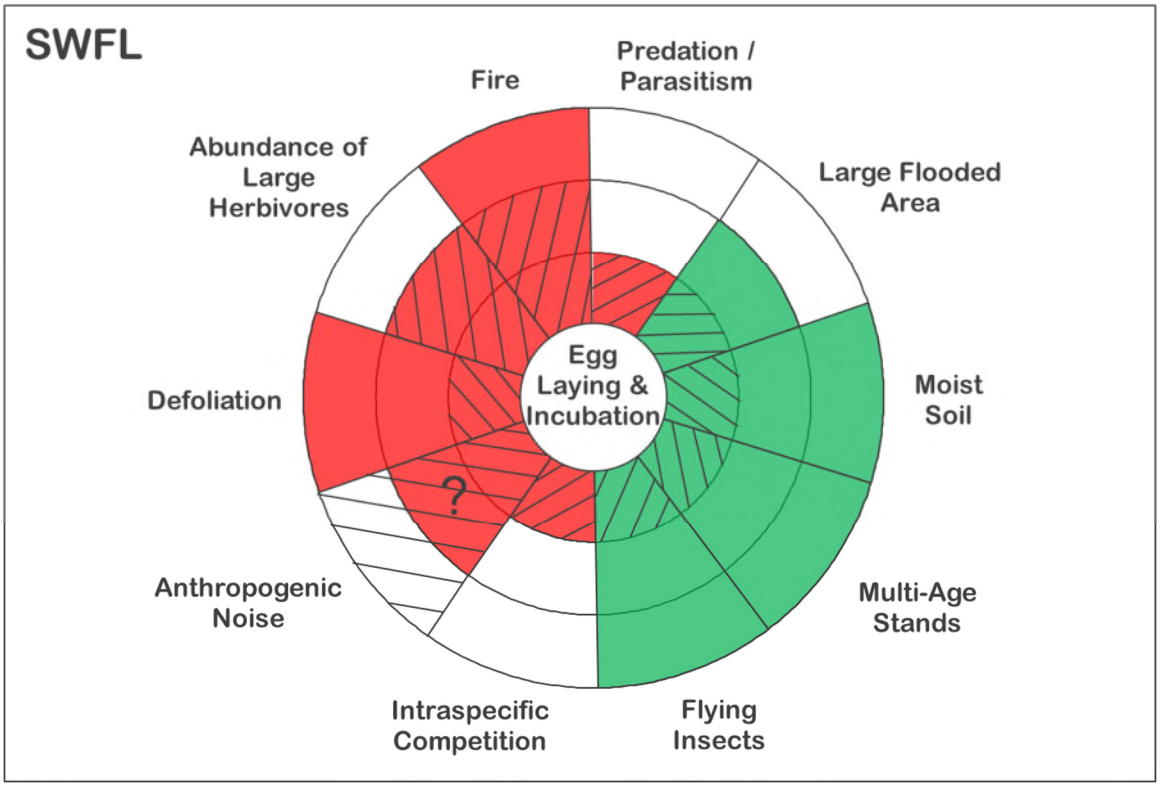


Figure C5. Southwestern Willow Flycatcher Egg Laying and Incubation Life Stage

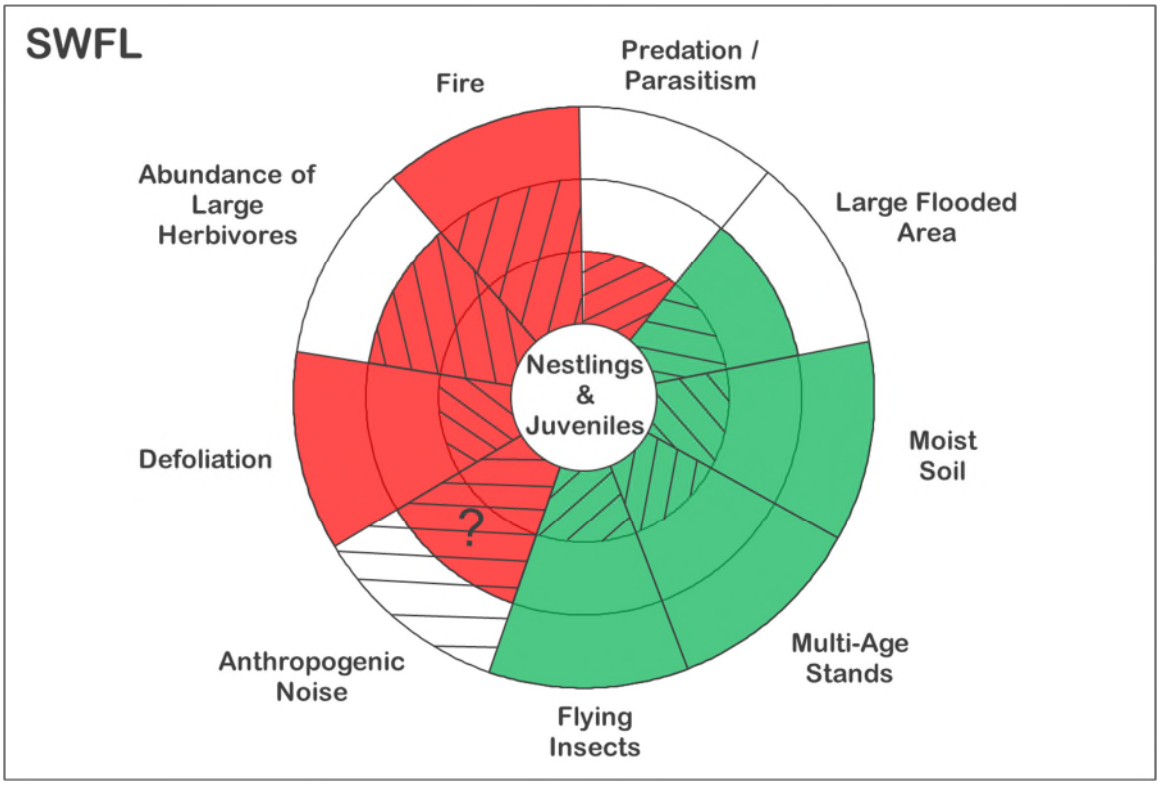


Figure C6. Southwestern Willow Flycatcher Nestlings and Juveniles Life Stage

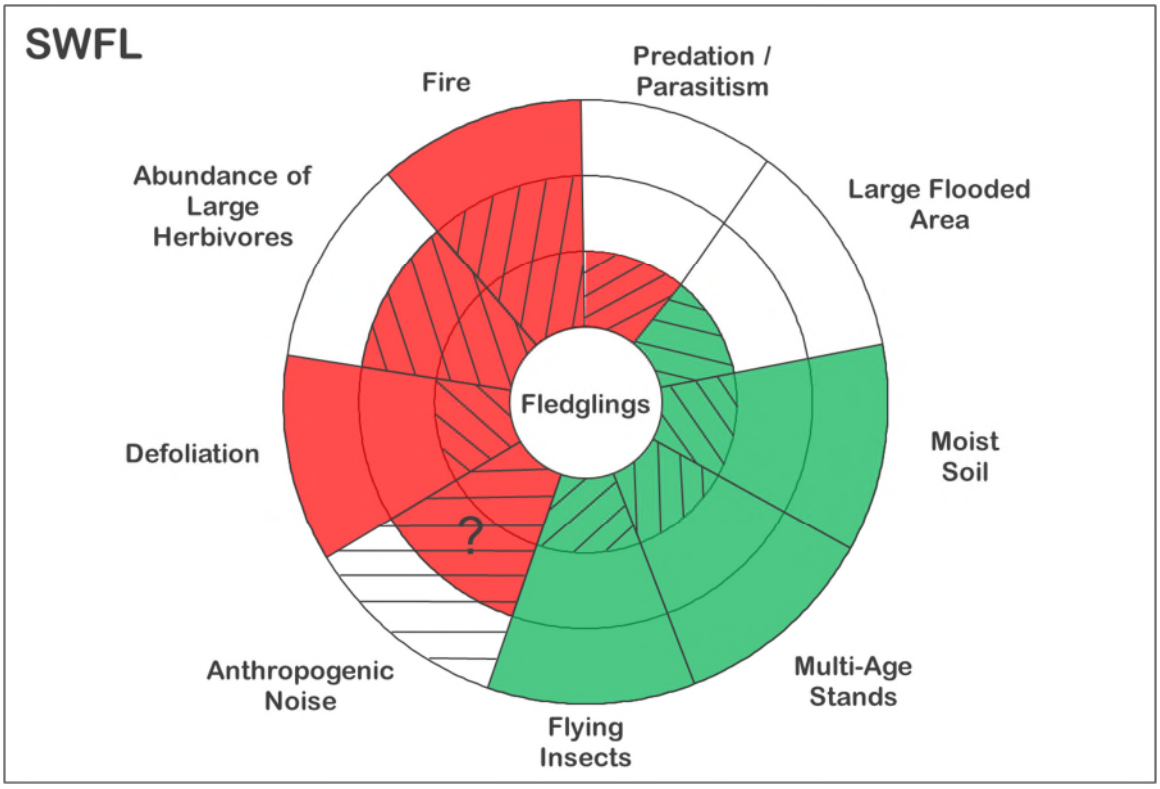


Figure C7. Southwestern Willow Flycatcher Fledglings Life Stage

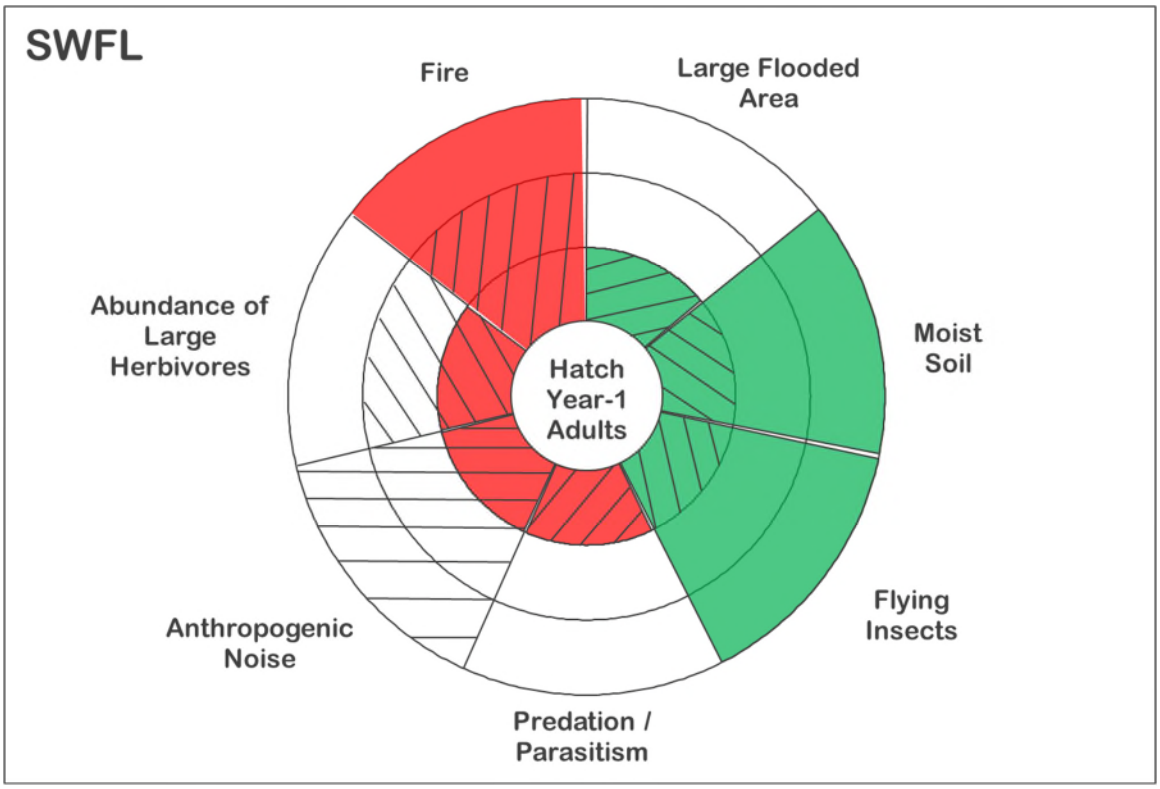


Figure C8. Southwestern Willow Flycatcher Hatch Year-1 Adults Life Stage

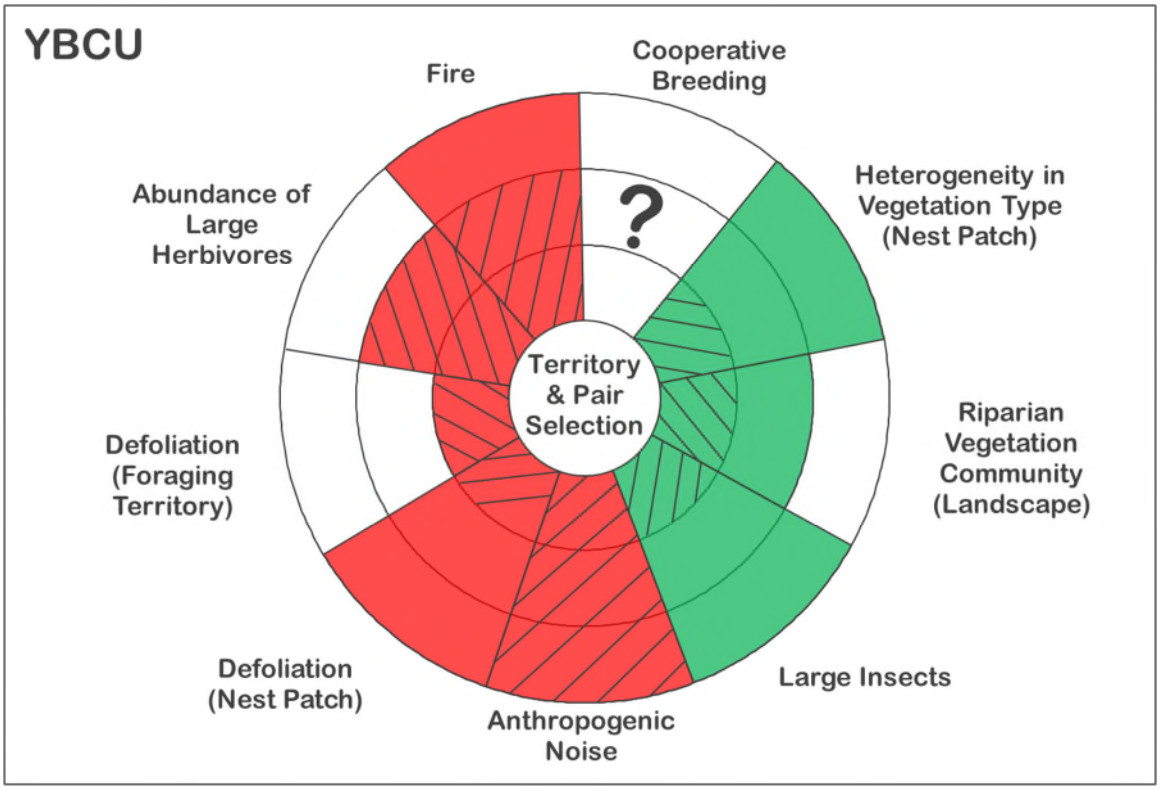


Figure C9. Yellow-Billed Cuckoo Territory and Pair Selection Life Stage

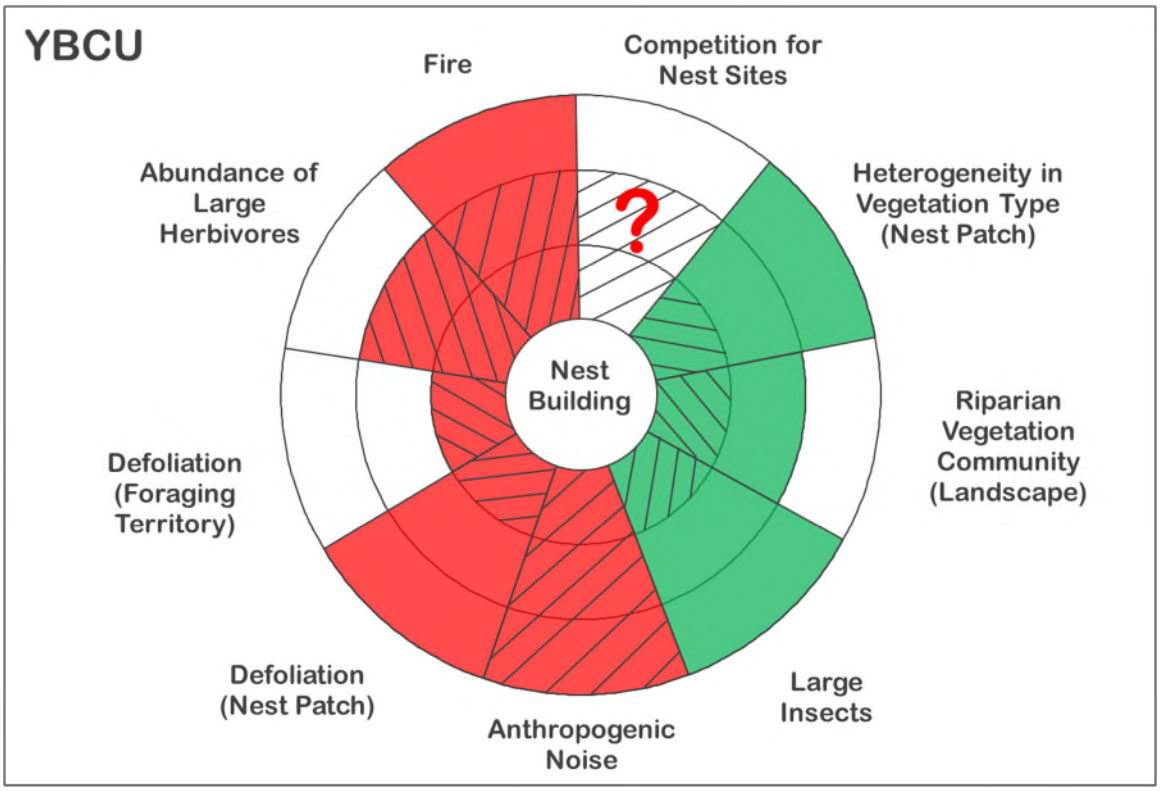


Figure C10. Yellow-Billed Cuckoo Nest Building Life Stage

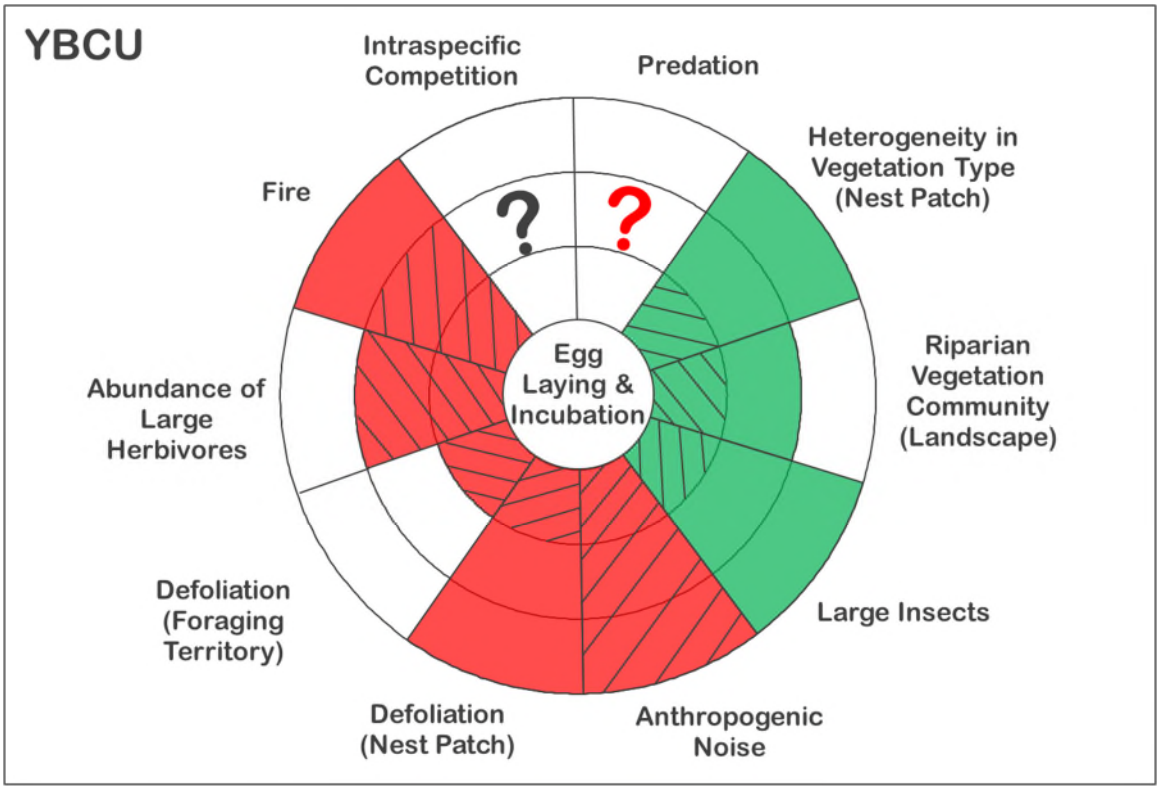


Figure C11. Yellow-Billed Cuckoo Egg Laying and Incubation Life Stage

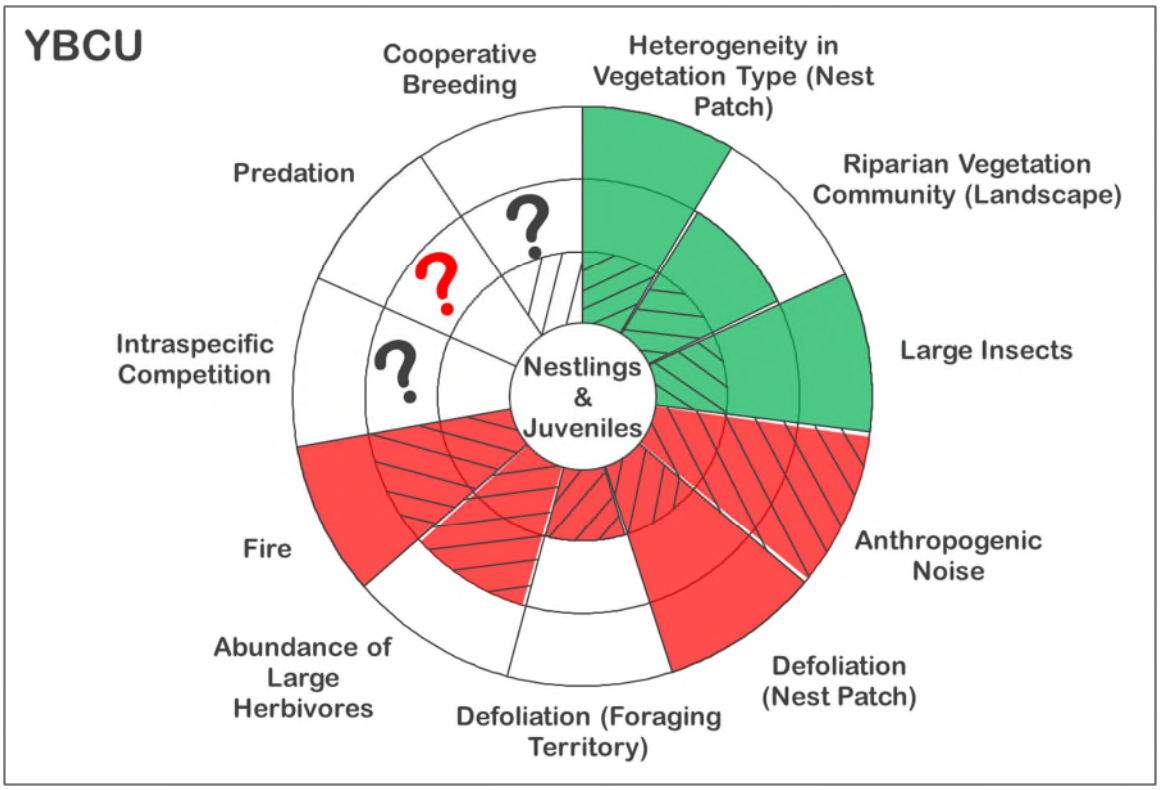


Figure C12. Yellow-Billed Cuckoo Nestlings and Juveniles Life Stage

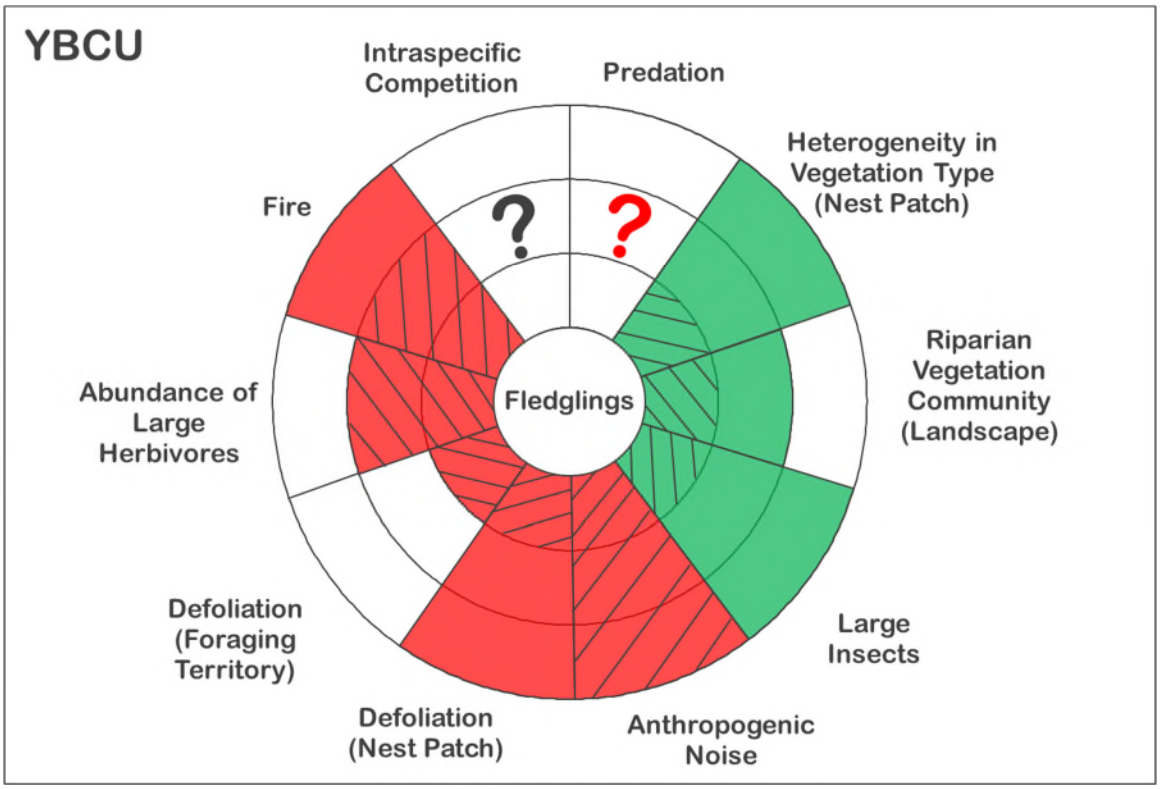


Figure C13. Yellow-Billed Cuckoo Fledglings Life Stage

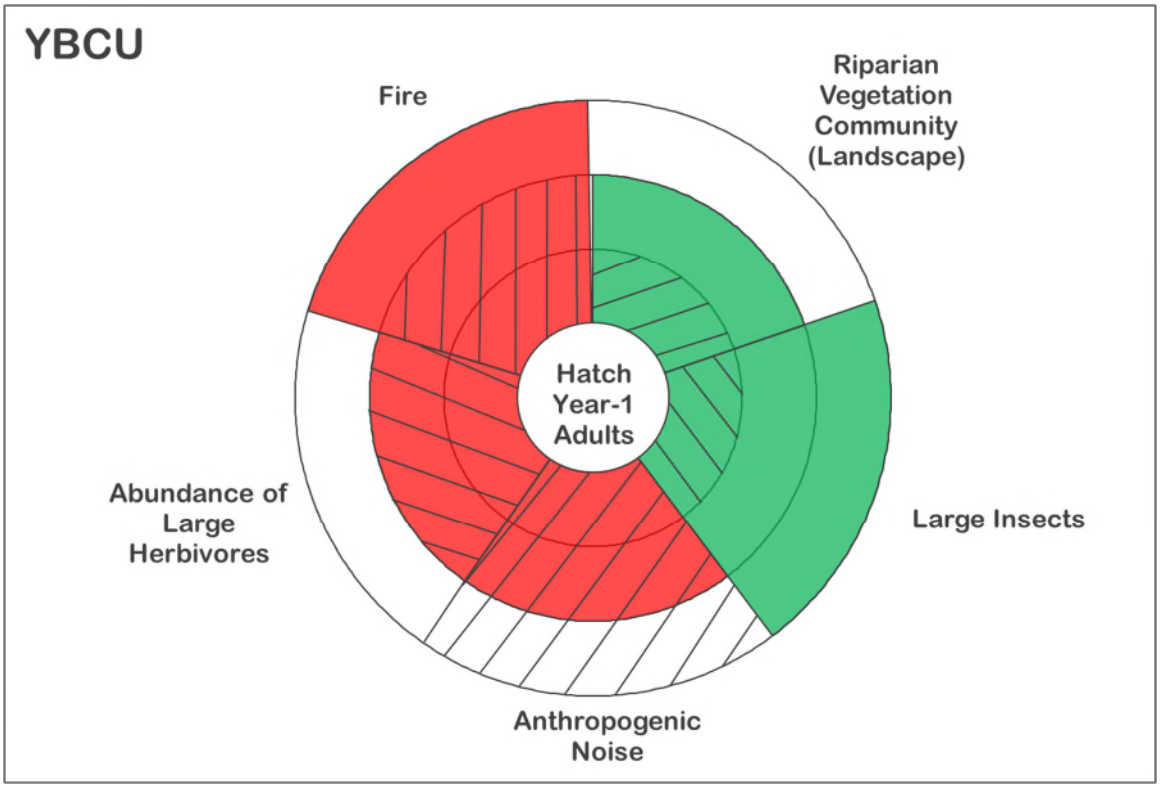


Figure C14. Yellow-Billed Cuckoo Hatch Year-1 Adults Life Stage

AVIAN CONCEPTUAL ECOLOGICAL MODELS LIFE STAGES DEFINITIONS

Migration and Overwintering

SWFL

Northbound Migration: SWFL are late spring migrants with arrival dates in Arizona as early as 3 May (Phillips et al. 1964) and from second week of May to mid-Jun in California (Small 1994). Captures during spring migration occurred in the central Rio Grande valley of New Mexico occurred between May 13 and June 8 with a peak in the first week of June, but varied by site and year (Yong and Finch 1997). Habitat used during spring migration is likely similar to that described for fall. In New Mexico, the willow flycatcher is known to migrate regularly along the Rio Grande (Yong and Finch 1997) and the Pecos River (Hubbard 1987), and occurs regularly as a migrant in the southwestern-most desert region and the eastern-most plains region of the state (Hubbard 1987). Migration requires high energy expenditures, exposure to predators, and successful foraging in unfamiliar areas. Therefore, migration is the period of highest mortality within the annual cycle of the flycatcher (Paxton et al. 2007). Willow Flycatchers of all subspecies sing during northward migration, perhaps to establish temporary territories for short-term defense of food resources.

Southbound Migration: Fall migration begins when adult birds depart from their breeding territories, generally in early to mid-August, but some birds may stay until mid-September if they fledged young late in the season (Phillips et al. 1964, Yong and Finch 1997). Unpaired males that fail to attract a mate and pairs that repeatedly lose nests to nest parasitism or predation may leave territories by early July. Fledglings leave the breeding areas a week or two after adults, likely because young birds' pre-basic molt occurs on breeding grounds (adding to the length of their stay), whereas adults delay pre-basic molt until they reach wintering grounds (Unitt 1987, Yong and Finch 1997). Habitat use during migration is similar to breeding habitat, including riparian woodlands with open overstory and dense mid- and low-stories, and adjacent agricultural fields, with close proximity to water. The highest capture rates in one study along the Middle Rio Grande occurred within willow habitat, followed by dense young cottonwood-Russian olive stands. Affinity for willow habitat and higher body mass recorded in this habitat is likely due to higher densities of arthropods (McCabe 1991, Yong and Finch 1997). Mass gain of recaptured birds suggest stopover to replenish fat stores during migration is necessary for this species (Yong and Finch 1997). In New Mexico, birds are known to migrate regularly along the Rio Grande (Yong and Finch 1997).

Overwinter: The Pacific lowlands of Costa Rica, as well as other regions of Central America seem to be the most important wintering grounds for the *extimus* subspecies based on genetic data (Paxton et al. 2011). On the wintering grounds, flycatchers use habitat with standing or slow-moving water and/or saturated soils, patches of trees, woody shrubs, seasonally inundated floodplains with emergent vegetation, pastures, and open areas, often within agricultural landscapes (Lynn et al. 2003, Schuetz et al. 2007). The presence of water or saturated soils seems to be more important than vegetative structure (Schuetz et al. 2007). Individuals defend territories throughout the winter and show high fidelity to wintering territories (Koronkiewcz et al. 2006, Sogge et al. 2007). Survivorship is thought to be high over the wintering period

(Koronkiewcz et al. 2006). Threats on the wintering grounds include human-driven disturbance, such as mining and logging, as well as grazing by domestic livestock (Schuetz et al. 2007)

YBCU

Migratory routes of western yellow-billed cuckoos are not well known because few specimens collected on wintering grounds have been assigned to western or eastern populations. Western cuckoos depart 2–3 weeks earlier than eastern cuckoos (Hughes 2020). Departures begin in early to late August with most birds gone by mid-September, though some may depart later (Hughes 2020, McNeil et al, 2011).

Most information on migratory routes is based on two birds fitted with geolocators. Both birds suggested a loop migrations route with distances between 9,500-9,900 km. The first recaptured bird migrated south through Central America to winter in portions of Bolivia, Brazil, Paraguay, and Argentina (Sechrist et al. 2012). The second bird passed through the Caribbean region, and wintered from mid-November to late April in the Gran Chaco of central South America, near the borders of Paraguay, Bolivia, and Argentina (McNeil et al. 2015).

Spring migration routes differed for both birds, the first bird migrated north through the Caribbean, and moved between New Mexico and Mexico at the end of summer in 2009 and again in 2010 before being recaptured at its breeding site. The second bird passed through Peru and Central America on its way north (McNeil et al. 2015). This bird also appeared to pause in southern Arizona or Sonora before and after migration, paralleling the first tracked bird. Data from these two birds show dynamic migration strategies, and suggest the monsoonal region may be important to the western population during the migratory stages of the life cycle.

Western cuckoos arrive on breeding grounds starting mid- to late May, 4–8 weeks later than eastern cuckoos occurring at same latitude (Franzreb and Laymon 1993). Considerable numbers are usually not present until early to mid-Jun, and transients continue to travel through late June to mid-July (Hughes 2020).
Little information exists for habitat use during migration. Western cuckoos may migrate north along greening riparian corridors and surrounding landscapes following monsoon precipitation (Wallace et al. 2013).

Territory and Mate Selection

This life cycle stage occurs upon the adult birds' arrival to the breeding ground where they must choose a mate and select a breeding territory. Birds choose a territory that can provide food, water, shelter, and nesting sites.

SWFL

Little information exists on SWFL pair selection. Studies on other Empidonax species indicate that pairs form using coordinated movements and sounds (Tarof and Ratcliffe 2000). Female SWFLs ultimately select the nest site.

YBCU

There is even less information on YBCU pair selection. Pairs may visit potential nest sites together frequently prior to building the nest.

Nest Building

Nest building occurs when a bird or a mated pair is actively building a nest before egg-laying begins. Nest building within the territory usually begins within a week or two after pair formation. Nest building is an energetically expensive activity for birds (Mainwaring and Hartley 2013).

SWFL

The female SWFL builds a nest over the course of 5-7 days without help from the male. The nest begins with a platform of grass or strips of vegetation, and the female weaves grass onto the surrounding vegetation to form a cup using her beak and her body.

YBCU

Both the male and female YBCU build the nest over the course of several days. The nest is placed on a horizontal branch or fork of a tree and is constructed from small twigs, pine needles, and similar material.

Egg-Laying and Incubation

Egg laying generally begins from mid-May through mid-June, depending on the geographic area and elevation. This life cycle stage begins when females are actively laying eggs followed by incubation until all eggs hatch. The energetic cost of egg production and incubation for female birds is poorly understood.

SWFL

SWFLs lay 3-4 eggs per clutch. Generally, one egg is laid per day with one day skipped, so the egg laying period takes between 4 and 5 days. Eggs hatch in 12-14 days, so the entire egg laying and incubation period is between 16 and 20 days, on average. Males do not assist with incubation.

YBCU

Cuckoo females can lay between 1-5 eggs in a clutch, but usually 2-3. Usually cuckoos lay one egg every other day, but females may wait up to 5 days between eggs. Eggs hatch in 9-11 days and male and female share incubation duties. Helper males may assist with incubation. YBCU start incubation as soon as the first egg is laid, often resulting in nestlings of different ages in the same nest. YBCU egg laying and incubation period can be quite variable, between 13-20 days.

Uncertainty: Colony incubation/helping. Who contributes to eggs, who contributes to incubation?

Nestlings

This is the life cycle stage that occurs from the time the first egg hatches until the young leave the nest. The nestling state is very energetically costly for flycatcher parents, who bring food to the nestlings up to

22 times per hour. This is a very vulnerable state for the nestlings, as they are very susceptible to predation, and for the adult parents as they are expending energy to forage and protect the nest.

SWFL

Female SWFL do the majority of brooding and feeding the young, but males do play a role in food provisioning. The nestling period lasts around 14-15 days.

YBCU

Growth is extremely rapid for YBCU nestlings – as short at 17 days from the start of incubation to fledging which is among the shortest of any bird species. Both parents brood and feed the young equally. Occasionally, a nonparent adult or "helper" bird will assist with caring for nestlings. YBCU nestlings have mostly fledged and start to venture away from the nest by day 8.

Fledglings

This life cycle stage occurs after young birds leave the nest, but before they are fully independent from the parents. Studies on fledgling survival for most bird species are lacking.

SWFL

SWFL young are capable of short (30 meter) flights at the time they leave the nest. SWFL young huddle together for 3-4 days after leaving the nest and remain on the adults' territory for around 14 days before dispersing.

YBCU

Cuckoo young leave the nest at 7-9 days and both parents and young leave the vicinity of the nest after one day.

Data Gap

What happens between fledgling and when they leave for full migration? Some indication may be vulnerable once they fledge, but no monitoring data.

Juveniles

This life cycle stage occurs after the young have left the parents' territory and no longer depend on their parents for food.

SWFL

For SWFLs, broods probably break up once the young enter this life cycle stage as flocking of immature SWFLs has not been reported.

YBCU

There is little information for cuckoos in this immature stage.

SOUTHWESTERN WILLOW FLYCATCHER AND YELLOW-BILLED CUCKOO CONCEPTUAL ECOLOGICAL MODEL GLOSSARY

Note that the size of the wedges on the life stage charts of the conceptual ecological models do not hold any significance. They are simply a product of the number of variables included in each life stage.

Abundance of Large Herbivores

This variable includes both domesticated animals, such as cattle, and wild animals, such as elk, beavers, and feral hogs. Grazing and browsing from domesticated and wild herbivores can negatively impact the success of restoration sites and SWFL and YBCU nesting sites by stripping trees, knocking down vegetation, compacting soil, and causing erosion. Additionally, a growing herbivore population can also attract more predators, which increases trails that negatively impact SWFL and YBCU habitat.

Stressful environmental conditions, such as drought, exacerbate the negative impact of grazing, even when there is no increase in the herbivore population.

Properly managed herbivore populations could provide some benefit by increasing soil nutrients. In the short term, the large herbivore population could negatively impact water quality by trampling vegetation at the water's edge, which often contains riparian plant species that are important for SWFL nesting habitat.

YBCU

Because YBCUs have long-distance vision and have large home ranges, they may benefit from edge effects near agricultural areas, which may have greater food availability.

Anthropogenic Noise

Anthropogenic noise can negatively impact SWFL and YBCU communication and nest success. This could hinder pair selection and, if the noise impact is too great, lead to nest abandonment. There are uncertainties related to the influence of the timing, duration, and constancy of noise, as well as distance from the noise source, affect the degree of impact. Introduced noise may be less critical once nestlings have fledged; however, the lack of monitoring after fledging has led to uncertainties around this.

SWFL

There is an unpublished study at the Bosque del Apache National Wildlife Refuge on the impact mowing has on nests. Observations revealed that SWFL adults were initially defensive but began following the mowers when insect activity increased.

YBCU

YBCUs have large territories, so they might communicate over long distances. This may mean that they are greatly impacted by noise.

There is published literature that indicates YBCU vocalization frequency overlaps with the frequency of constant traffic, which results in communication interference. YBCUs have been observed to avoid high-traffic areas, and may even select lower quality habitat in order to avoid traffic noise. (Goodwin and Shriver 2011)

Cooperative Breeding

YBCU are known to form colonies. Young juvenile males will act as "helper males" within a nest and help with feeding and incubation. A genetic study in Arizona found that eggs in the same nest had varied genetic parentage (McNiel 2015). There are many uncertainties around the degree to which colony size and cooperation contribute to nest success and to the genetic success of the population as a whole. Researchers may be overestimating the number of YBCU territories as a result of the colony nature of these birds.

Defoliation

Defoliation increases the predation risk and negatively impacts the microclimate needed for nest success. Causes of defoliation include the tamarisk leaf beetle, drought, fire, and tree senescence.

Defoliation that occurs during the breeding season will have different impacts than defoliation that occurs between seasons. During the breeding season, defoliation may cause failure of existing nests. Defoliation that occurs before territory selection decreases habitat availability, as, SWFL and YBCU pairs are less likely to build nests in the affected areas.

YBCU

Given the larger range of YBCU, defoliation effects on the species will be different at the nest patch scale compared to the larger foraging territory scale. Defoliation away from the nest patch and in the foraging territory will impact food availability. However, as the foraging territory of the YBCU is so large, impact may be minimal unless there is wide-spread defoliation. Defoliation of this magnitude can be caused by tamarisk leaf beetle, high intensity fire, drought, tree over-maturity, or overgrazing. If defoliation is localized, YBCUs can forage in other areas.

Fire

Depending on the intensity, fire can negatively impact riparian habitat, as it reduces short-term and long-term habitat availability. In the case of a catastrophic fire, sterilized soil may limit vegetation regrowth. In areas where the water table has been lowered due to water diversions, the historic riparian plant community may be unable to recover after a catastrophic fire and will transition to an upland or shrubland state. However, prescribed burns have been used to spur native plant rejuvenation and can produce post-fire soil benefits. Increase in leaf litter following defoliation can increase fire intensity. Non-native species and altered hydrology also alter fire behavior. More fire studies in riparian areas are needed.

Flying insects

SWFLs mainly prey on flying insects, such as mosquitoes. These insects require slow-moving and/or standing water. Thus, abundant standing water is required to provide adequate insect prey. Pesticide use, defoliation, drought, and other factors that dry out soil negatively impact insect populations.

Heterogeneity in vegetation type (nest patch)

YBCUs require a nest patch size of over five hectares with 50-75% mid-story cover that is 3-10 meters high. Canopy cover is critical at the nest patch scale. (USFWS 2014; Johnson 2020)

Intraspecific competition

There are many uncertainties around how much intraspecific competition affects SWFL and YBCU breeding success. A site's ecological carrying capacity may be dependent on food availability.

SWFL

SWFLs generally have a 20-40 meter foraging patch size. However, multiple SWFLs may use high quality habitat patches, creating a high population density. SWFL pairs tend to spread out when adequate habitat is available, or when new habitat patches become available on the landscape; possibly as a result of lower food availability during early patch establishment.

YBCU

YBCU may compete amongst each other for nest sites and food sources, and is the degree of competitive interactions is unknown. Competition may include intraspecific nest parasitism, which may be common in this species (McNiel 2015).

Proximity to Water

Large flooded areas result in low velocity flow of shallow depth underneath the nest. This contributes to the insect populations that make up the prey base for SWFL and YBCU, is beneficial for plant health, and facilitates the cooler microclimate needed for nest success.

Moist soil underneath the nest is vital for maintaining the microclimate needed for nest success. Additionally, moist soil boosts insect populations, plant health, and seed establishment.

SWFL

During migration, SWFLs have been observed to be attracted to large flooded areas.

Large Insects

YBCUs are opportunistic feeders that feed on large insects and small lizards. They require a large amount of food, especially when they are young. YBCU young grow rapidly and fledge in seven days. YBCUs may choose territory based on insect outbreaks. Pesticide use, drought, and defoliation negatively impact their prey base.

Multi-Age Stands

SWFL breeding pairs prefer multi-age vegetation stands with 50-75% mid-story cover and dense cover that is 3-6 meters high. Dense vegetation provides protection from predators and contributes to the cooler microclimate of the nest site.

Nest Parasitism & Nest Predation

SWFL and YBCU nest predators include snakes, raccoons, skunks, rodents, and other birds. Loss of vegetative cover, drought, and other stressors can lead to predation and parasitism. There are uncertainties around how much edge effects impact parasitism and predation.

SWFL

Cowbirds are known to parasitize SWFL nests. Cowbird abundance, and therefore parasitism, tends to be a function of habitat type and quality, and the availability of suitable hosts, not specific to the flycatcher. Data show that predation and parasitism balance out to about the same total combined level every year.

YBCU

YBCU tend to be quiet around their nests, so as not to attract predators. Loss of canopy cover, drought, and other stressors can increase predation risk.

Riparian Vegetation Community (Landscape)

YBCUs require large expanses of riparian habitat at the landscape level with a mosaic of different vegetation types for both the nest patch and the foraging areas. The estimated home-range size of the YBCU is between 62-91 hectares (Sechrist et al. 2013; Dillon and Moore 2020).

Site Fidelity

SWFL site fidelity can both negatively or positively influence reproductive success, depending on site health and other characteristics. There are uncertainties around the degree of SWFLs site fidelity and what might influence dispersal to another site.

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Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Original Priority	MRGESCP Current Priority	Comments	Status	Verification
Fraser et al. 2016	4	Reporting Rec. 1	Sometimes it is not clear how Ne estimators relate to purpose. The reports could improve the explanations for why certain approaches were adopted.	1	0			Osborne et al. report now using different estimators and explaining them (2017 report)	Osborne et al. 2017
Fraser et al. 2016	4	Reporting Rec. 2	Develop a biological relevant and realistic benchmark for critically low levels of genetic diversity. One possible way to set a benchmark would be to estimate the 95% confidence interval (CI) for genetic diversity (expected heterozygosity [He] and number of alleles [Na]) using all samples across time and space. If the diversity falls below the CI, then more aggressive management actions may be warranted.	1	0			Osborne et al. reported a 95% confidence interval in her 2017 report.	Osborne et al. 2017
Fraser et al. 2016	4	Reporting Rec. 3	There needs to be a clear statement of the hypothesis and predictions being tested. For example, a simple hypothesis is whether there is a difference in estimates of genetic diversity between the pre- and post-augmentation periods. If this is the case, one approach would be to use a linear model to compare the estimates pre- and post- augmentation. Although time should be included as a co-variate, there is no effect of augmentation on observed heterozygosity corrected for sample size (Hoc) ($t = 1.95$, $p = 0.071$).	2	0				
Fraser et al. 2016	4	Reporting Rec. 4	The authors need to redefine pre-augmentation (1987, 1999) and augmentation periods (post 1999) given the augmentation that took place in 2000 and 2001. They may not be able to conclude strongly whether genetic diversity of the natural spawning population has changed. However, the authors can say that augmentation has maintained genetic diversity throughout the augmentation period, with the provision that this conclusion is based on the nine microsatellite loci evaluated, which might not reflect genome-wide variation.	2	0				
Fraser et al. 2016	4	Reporting Rec. 5	Microsatellite loci may no longer be the most effective markers for the purpose as the cost of newer, genotyping-by-sequencing (GBS) approaches has become more affordable for largescale throughput of many individuals. The limitations of microsatellites relative to other genetic markers such as single nucleotide polymorphisms (SNPs), and trade-offs associated with different genetic markers in relation to RGSM genetic monitoring goals, are discussed in detail under Questions 2, 8, 9, 10, and 13 (particularly 13).	2	0			The high through-put markers SOW is currently in contracting.	Contracted in 2018
Fraser et al. 2016	4	Reporting Rec. 6	The Genetic Project PIs may also wish to examine genetic diversity / Ne variation over time using a piecewise regression as these can be used to find any breakpoints in the data; also referred to as segmented regression. If a breakpoint is identified say for pre- versus post-augmentation, then separate regressions can be run for each section. This approach can also identify points in time where there are temporal changes in genetic diversity.	3	0				

Fraser et al. 2016	16	Question 13 Rec. 1a	The panel therefore recommends that both neutral and adaptive genetic variation be monitored over time in RGSM in the future using a larger, more diverse set of genetic markers. Genotyping-by-sequencing (GBS) or related equivalent would provide more confident estimates of genome-wide neutral genetic variation (Nac, Ho) in RGSM because it would more likely represent the entire genome (for more information on GBS and related NGS approaches and their practical benefits for conservation genetics monitoring, see the review of Allendorf et al. 2010)...thus we recommend examining phenotypic variation for important life history traits (size/age maturity, growth rate), behavioral traits (anti-predator behavior, risking taking behavioral syndromes) and morphology (body shape as it relates to flow regime).	2	0			The high through-put markers SOW is currently in contracting.	Contracted in 2018
Fraser et al. 2016	17	Question 13 Rec. 1b	Sampling of floodplains should be considered and included where feasible to ensure that the genetic characteristics of RGSM are adequately represented in egg collection samples.	1	0			SOW description developed	2018
Fraser et al. 2016	18	Question 13 Rec. 2a	Conduct random sampling of annual egg collections from nature, to include not only the main channel but also the floodplains, for subsequent hatchery rearing (e.g., current collections only come from the main channel of the Rio Grande River, not on floodplains).	1	0			SOW description developed	2018
Fraser et al. 2016	18	Question 13 Rec. 2b	Rear RGSM in environmental conditions that resemble natural environmental conditions as much as possible. This will reduce relaxation of selection or non-random survival at egg/early life stages in relation to habitat selection/settlement, behavioral/physiological characteristics, anti-predator responses etc. Specific recommendations for RGSM hatcheries include: (i) early juvenile environmental enrichment that resembles critical floodplain habitat (temperature, substrate, flow, turbidity, pH, conductivity, food sources, natural daylight); and (ii) some exposure to natural predators, or at the very least, mimicking of predators to stimulate anti-predator conditioning.	1	0			The BioPark and Dexter raises RGSM on natural foods as much as possible, and some outside. Ponds at Los Lunas and in Dexter are exposed to predators. Will need additional documentation from the facilities to determine what the characteristics are at each facility (diatoms, predator exposure, other environmental conditions). Gut analysis and stable isotope analysis done as well. SOW description developed.	2018
Fraser et al. 2016	18	Question 13 Rec. 2c	RGSM live longer in captivity and the breeding program uses 4-year old fish as brood stock. By contrast, in the wild the breeding population is comprised largely of 1-year old fish. Thus, it will be prudent to evaluate the phenotypic effects of older brood-stock. Also, because larger fish have about 4x as many eggs as younger adults (10,000 vs. 2,500), and there is also likely higher variance in egg production among 4-year old fish compared to the variation in egg production among 1-year old fish. This could undermine efforts to equalize family sizes. Thus, using younger fish as brood stock will reduce the likelihood of un-intentional domestication selection, and also result in higher effective population sizes (due to reduced variance in egg production among females).	1	0			Dexter does not use 4 year old fish anymore; documented in their annual report. BioPark does not use 4 year old fish.	2017

Fraser et al. 2016	18	Question 13 Rec. 2d	Equalize contributions of different adults in the captive broodstock to new broods/lots as much as possible.	1	0			Not currently possible. Requires a change in spawning protocol. Communal spawning vs. pairwise spawning (having the SNP's developed will enable this to become a SOW).	
Fraser et al. 2016	18	Question 13 Rec. 2e	Rear RGSM so as to maintain the growth trajectories typical of wild-raised fish (i.e., Age 1 fish in captivity should exhibit the same range of sizes of Age 1 fish in the wild). At present, either faster growing individuals may be unintentionally selected for, or other fish phenotypes (e.g., size, condition, body shape) may not match natural sizes upon release.	1	0			First cut would be to have each facility provide fish length distributions for each age class of fish. Compare to lengths observed on the river. This could be a modifcation to current contracts. Additional phenotypic or behavioral comparisons would be a SOW.	
Fraser et al. 2016	19	Question 13 Rec. 2f	Rear RGSM on natural diet if possible; diet appears natural at early life stages, but diet appears supplemented in later life stages (pellet feed).	1	0			The BioPark, Dexter, and Los Lunas raise RGSM on natural foods as much as possible, and some outside.	Personal communication 2018
Fraser et al. 2016	19	Question 13 Rec. 2g	Minimize the duration in captivity as much as possible before release; domestication selection is reduced with less captive exposure (see Frankham 2008 and Fraser 2008).	1	0			Release is currently as early as possible. USFWS is currently examining the effectiveness of a February release.	February release study underway in 2018
Fraser et al. 2016	19	Question 13 Rec. 3a	Maximize the information gained from re-stocking efforts of hatchery-raised fish back into the river in order to test particular scientific hypotheses and inform adaptive management.	2	0			Being looked at in small pieces, but too large overall to address right now comprehensively.	
Fraser et al. 2016	19	Question 13 Rec. 3b	In addition (or alternatively if resources are limited), the genetics survey could focus on characterizing whether the year classes maintained in the hatcheries change over time in their genetic constitution as a consequence of differential mortality.	2	0			SOW description developed	2018
Fraser et al. 2016	20	Question 13 Rec. 3c	Monitoring of domestication selection could include DNA fingerprinting (GBS) of wild-caught egg collections. An investigation into whether non-random changes to genome-wide variation were occurring at successive early life stages relative to the same stages in the wild would provide evidence that the hatchery environment is resulting in domestication selection.	3	0			Not currently possible. Requires the SNP study to be complete.	
Fraser et al. 2016	23	Recommendation 1	A flow chart should be constructed for each year that gives detailed numbers for: eggs and dates taken, disposition of eggs/larvae to specific rearing sites, broodstock maintained, actual breeding strategy, disposition of eggs/larvae to specific rearing sites, pooling of larvae prior to stocking, stocking sites, source of juveniles, and dates. These data should be standardized and collected for each hatchery engaged in fish production and the data should be made available electronically to all interested parties. Deviations from planned methodologies (such as the inclusion of approximately 10,000 eggs from unplanned spawning in a broodstock tank) should be noted in the flow chart.	1	0			Could do a modification to contracting to add this to the reports. May require additional funds.	

Fraser et al. 2016	23	Recommendation 2	When deviations from planned methodologies result in the production of offspring, those offspring should not be released into the wild. Release of these offspring into the river could have a negative effect on the overall genetic diversity of the population. Providing flexibility in the next recovery permit should allow such surplus fish to be properly handled, whether used for research or held until natural death in the hatchery.	1	0			Dexter uses these fish for Big Bend population. Unsure about other facilities.	Personal communication 2018
Fraser et al. 2016	23	Recommendation 3	All broodstock and sufficient subset of the pre-release juveniles should be genotyped and the contribution of each broodstock individual determined. These results can be used to gain a more accurate, precise and biologically relevant estimate of Ne for each year class. This approach avoids the inherent assumptions and excessive variance associated with the Ne estimators currently employed. This should be done every year. Developing a high throughput method would facilitate more rapid genotyping.	1	0			The broodstock from Dexter and the BioPark were genotyped, and fish to be released in the fall will be genotyped. The high throughput makers SOW is currently in contracted.	Personal communication 2018
Fraser et al. 2016	24	Recommendation 4	The Genetics Management and Propagation Plan and/or the Augmentation Plan should have a detailed methodology as to what will be done should a drought lasting more than three/four years occurs or all four year classes of broodstock are lost to a major hatchery accident.	1	0			Wade Wilson sent the DRAFT RGSM Gentics Management and Propagation Plan out on August 9, 2018	9-Aug-18
Fraser et al. 2016	24	Recommendation 5	The Science Workgroup (led by the Program) and the Genetics Workgroup (led by the USFWS) should integrate the genetics data and the decision-making more carefully. Specifically, there should be more translation of the genetics research into the adaptive management process, hatchery broodstock practices, and the integration of the past 15 years of research (genetics and ecology combined).	1	0			Will be incorporated into the AM process.	
Fraser et al. 2016	24	Recommendation 6	A more stable, consistent funding stream for the genetics research (e.g. an extended funding cycle) would ensure that all critical, temporally important genetic studies are accomplished each year (e.g., broodstock genotyping, pre-release juvenile genotyping). Cost will vary depending on the analysis and goal. At the time of writing this report, the RGSM program can expect to require approximately $50-150/individual for GBS or RAD-seq if outsourced to a genomics facility (including individual sample preparation, but not including salary for a research associate for sample preparation, data filtering and data analysis); a minimum of 30-40 individuals per year is recommended. Other genetic assessments do not require the amount of genetic data generated from GBS; any parentage assignments of offspring generating from mixed matings in the hatchery, for example, would be expected to cost approximately $5-10/individual (not including personnel salaries), and so could be (and should be) conducted on larger numbers of individuals (1000s).	1	0			MRGESCP has been able to steadily fund RGSM genetics monitoring.	
Fraser et al. 2016	24	Recommendation 7	The use of only four year fish as broodstock may compromise the maintenance of genetic diversity because of the possibility of non-random, differential survival of individuals in the hatchery. Crosses should include younger fish. As a consequence of using younger fish as broodstock with lower fecundity, more fish will be needed to produce the quota of eggs and this will increase the effective number of breeders.	1	0			Dexter does not use 4 year old fish anymore; documented in their annual report. BioPark does not use 4 year old fish.	2017

Fraser et al. 2016	24	Recommendation 8	It will be useful to conduct an evaluation of whether domestication selection is occurring in the hatcheries. This could be done using an appropriate genetic analysis and/or measuring quantitative traits to assess phenotypic variation of each captive cohort during each year in captivity.	1	0			Pheotypic aspect discussed above and genetics aspect requires SNPs to be complete.	
Fraser et al. 2016	24	Recommendation 9	We recommend the use of the term “naturally spawned” in place of the term “wild” to refer to fish captured in the river that do not have an elastomeric tag; this assumes that all augmentation fish received a tag. It is likely that all fish captured in the wild have experienced some hatchery influence in their ancestry.	2	0			Dexter has adjusted their internal terminology.	Personal communication 2018
Fraser et al. 2016	25	Recommendation 10	If possible, the augmentation team should consider artificially spawning broodstock in a one female by one male mating scheme, all the while maintaining the same total number of broodstock adults spawned (or increasing this number). This would allow equalizing family size as families are combined.	2	0			Requires SNPs to be complete.	
Fraser et al. 2016	25	Recommendation 11	Relatedness should be calculated for broodstock prior to use to choose specific crosses that avoid inbreeding. If group spawning continues, relatedness estimates could be used to ensure that potential spawners in a group have low kinship.	2	0			Requires SNPs to be complete, as well as paired vs. communal spawning work.	
Fraser et al. 2016	25	Recommendation 12	To facilitate adaptive management, experimental studies comparing the survival and reproductive success of subsets of RGSM from different stocking strategies and hatchery facilities in nature would also shed light on the extent to which domestication selection is a concern in the recovery program.	2	0			USFWS is tagging fish from different facilities and also comparing fall vs. spring release strategies. This will be a 2-3 year study. Reproductive success would be a separate SOW that will be intensive/difficult to the monitor.	USFWS intiated February release study in 2018
Fraser et al. 2016	25	Recommendation 13	A study using next-generation sequencing technology (e.g., GBS, RAD-seq) should be done with pre-augmentation samples and post-augmentation year classes to determine how the genome as a whole has changed over time. At the time of writing this report, the RGSM program can expect to require approximately $50-150/individual for such an assessment (more for RAD-seq) if outsourced to a genomics facility (including individual sample preparation, but not including salary for a research associate for sample preparation, data filtering and data analysis); a minimum of 30-40 individuals per year is recommended.	2	0			The high through-put markers SOW is currently in contracting.	Contracted in 2018
Hubert et al. 2016	28	1	Separate the catch and effort data from the small-mesh seine and the fine-mesh seine into two data sets and compute separate CPUE indices for each gear type, as well as for individual age classes captured in each gear type.	Not given	1			ASIR reported CPUE by gear type and age class in their 2017 Population Monitoring report.	2017 Population Monitoring Report, 2017 SOW with BOR

Hubert et al. 2016	28	2	The CPUE from the small-mesh seine is primarily an index of the relative abundance of a single cohort of RGSM (i.e., the most recent cohort) that is recruited into the gear late in the summer and captured into the summer of the following year. The precision of the index can be improved by exclusion of older cohorts. A separate CPUE index can be computed for older cohorts. Consider the use of length-at-age data and frequency histograms to identify cohorts.	Not given	1			ASIR addressing this recommendation using 2 length/age classes - Age 0 and Age 1+	2017 Population Monitoring Report
Hubert et al. 2016	28	3	Only larval fish should be included in the computation of CPUE indices from the fine-mesh seine because of this gear's selectivity for this life stage.	Not given	1			ASIR reported CPUE for larval fish only using the fine-mesh seine, and used the small-mesh seine for all other age classes.	2017 Population Monitoring Report, 2017 SOW with BOR
Hubert et al. 2016	28	4	An aspect of the CPUE data that warrants attention is the treatment of zero catches in data analyses. Inclusion of dry sample sites as zero CPUE values when analyzing CPUE data for RGSM in the MRG should be avoided. Field data records and the database in which the RGSM CPUE data are stored allow dry sampling sites to be distinguished from sites that were sampled and no RGSM were caught. The problem arises during statistical analyses because the naughty naughts (observations of zeros at dry sampling sites) are treated in the same manner as the zero catches at fished sites where no RGSM are caught.	Not given	1			ASIR excluded dry sites in their analyses. Dry sites are replaced.	2017 Population Monitoring Report, 2017 SOW with BOR
Hubert et al. 2016	28	5	Survey designs should strive to minimize false zeros resulting from: (1) an inappropriate sampling design (e.g., sampling in mesohabitats avoided by RGSM) and (2) ineffective survey methods (e.g., insufficient sampling effort to detect an organism when it is present).	Not given	1 and 2			Preliminary analysis from Population Monitoring WG shows that rare mesohabitats are sampled at a higher proportion than they exist in the environment (Valdez 2018)	Valdez 2018
Hubert et al. 2016	29	6	The proportions of various mesohabitat types sampled are likely to bias CPUE indices because the catchability coefficient probably differs among mesohabitat types and RGSM are likely to be selective for specific mesohabitat types. We recommend that better understanding of the influence of mesohabitat type on CPUE be developed and used to account for variability in CPUE indices. Further, we recommend that estimation of mean site-specific CPUE be improved by addressing the variable number of mesohabitats that are sampled at any given site and the amount of sampling in each mesohabitat type. We recommend estimation of mean site-specific CPUE from individual seine hauls (which are distinguishable in the database as of 2006); mean CPUE at each site is then computed from the individual CPUEs at each of the 18-20 mesohabitat units sampled per site.	Not given	1 and 2			ASIR has reported CPUE by mesohabitat type in their 2016 and 2017 reports. Some additional efforts towards this recommendation have been made by the DAT (Valdez 2018)	2017 Population Monitoring Report, Valdez 2018
Hubert et al. 2016	29	7	Environmental factors (e.g., turbidity, water temperature, substrate size, depth, current velocity, and discharge) during sampling are likely to bias CPUE indices because of their influence on catchability. We recommend that better understanding of the influence of measurable environmental factors on the catchability of each seine type be developed and used to account for variability in CPUE indices.	Not given	3			Sampling is not conducted above a certain CFS.	

Hubert et al. 2016	29	8	Factors influencing detection and catchability of RGSM in seines need to be determined and incorporated into the sampling design to permit more robust estimation of CPUE.	Not given	1				
Hubert et al. 2016	29	9	Measures of CPUE for RGSM from the MRG are currently identified as recovery standards for the species. We recommend modification of recovery standards to be explicit regarding the gear, sampling design, sampling techniques, data analysis, and life stage, as well as protocols used to compute the CPUE index.	Not given	0				
Hubert et al. 2016	29	10	We recommend depiction of the relationship of hydrological covariates and estimates of the mean annual CPUE for RGSM derived from the mixture model. Those relationships should use the October data from 1993 to 2014. Further, we recommend that such analyses be repeated for catch data collected in 2006 to the present, but using the individual seine-haul approach to estimate CPUE.	Not given	1			ASIR included some hydrological variables as covariates in their estimated desitiy models. More covariates of interest may be identified. The HBO assesment by Utah State University will look at hydrological covariates and CPUE. No analysis is being conducted at the individual seine-haul level.	
Hubert et al. 2016	29	11	We recommend that the assumptions of the mixture models be fully defined and that the results of analyses be interpreted with consideration of the assumptions and the effects of the potential violation of assumptions.	Not given	1			ASIR included a table in their 2017 Population Monitoring Report detailing assumptions, violation implications, violation risks, and mitigation precautions.	2017 Population Monitoring Report, 2017 SOW with BOR
Hubert et al. 2016	29	12	A greater number of sampling sites would improve the accuracy and precision of status assessments and improve estimates of RGSM CPUE and spatial distribution, especially at the reach scale. A greater number of sampling sites in each of the three reaches would facilitate status and trend estimates at the reach scale. To make statistically rigorous reach-scale CPUE estimates, 20-50 sites per reach are recommended. A design with substantially more sites and longer site lengths should be more effective at detecting RGSM when they are at low densities or demonstrating patchy distributions.	Not given	1			ASIR monitored 10 additional sites during the 2017 monitoring period and reported the results in their 2017 Population Monitoring report.	2017 Population Monitoring Report, 2017 SOW with BOR
Hubert et al. 2016	29	13	When river flows decline so that dry sampling sites occur among the 20 fixed sites sampled by the Monitoring Program, the ability to make inference regarding CPUE of RGSM over the MRG is impaired. The current 20-fixed-site sampling is not adequate when dry sampling sites occur. An ancillary randomized sampling design is recommended at such times to be able to make inferences about RGSM abundance and distribution throughout the entire MRG. Such a random sampling design would entail sampling at many more sites over the length of the MRG. An ancillary design of this type would enhance the feasibility of assessing the abundance and distribution of RGSM in the MRG during years of low flows and when the species is likely to occur in low abundance.	Not given	0			ASIR sampled replacement sites whenever the river was dry at a standard or additional site.	2017 Population Monitoring Report, 2017 SOW with BOR
Hubert et al. 2016	30	14	Consider using key drivers of mesohabitat variability, such as current velocity, substrate size, and water depth at specific locations where seines are deployed, to replace the mesohabitat factor in the mixture models.	Not given	2			May be considered in the next SOW	

Hubert et al. 2016	30	16	Examine the historical availability of mesohabitats in the MRG relative to discharge. If these two measures can be linked, then annual or monthly discharge may provide a good surrogate of mesohabitat availability.	Not given	2				
Hubert et al. 2016	30	17	Evaluate alternatives to the parametric mixture model, in particular, Bayesian hierarchical models, for estimating annual CPUEs.	Not given	2				
Hubert et al. 2016	30	18	Use classification and regression trees, boosted regression trees, or random forests to examine relationships between hydrologic variables and CPUE for identifying thresholds above or below which CPUE exhibits changes.	Not given	1.5				
Hubert et al. 2016	30	19	Implement directed studies using different sampling designs, such as multi-year, multi-site, before-after-control-impact (BACI) designs to enhance understanding of the response of the population to changes in river discharge, habitat rehabilitation projects, and availability of mesohabitats.	Not given	3				
Hubert et al. 2016	30	21	Conduct stock-recruitment studies to determine how the abundance of fall recruits relates to the abundance of spring spawners. Investigate the effects of spring and summer discharges on the stock recruitment relationship to enhance understanding of the dynamics of RGSM. Implement a spring sampling protocol at spawning sites to estimate the number of spring spawners, and compare with October results for several years; such studies may provide useful data on RGSM population dynamics and limiting factors.	Not given	3				
Hubert et al. 2016	30	22	Complete a study of age-specific fecundity and survival rates based on pre-breeding (fall) population estimates, spring spawners, and hatchery supplementation. Results from this study could be used to estimate population recovery and extirpation potentials as a function of altered flow regimes and stocking.	Not given	3			Not completed in MRGESCP, however Caldwell et al. report (2018) addresses age-specific fecundity, but not survival.	Caldwell et al. 2018
Hubert et al. 2016	30	23	Consider genetic fingerprinting and epigenetic studies, including bar-coding and gene-expression, of presumed wild and hatchery fish to help determine hatchery contributions to the spring spawners and the long-term risks to the wild population.	Not given	0				
Hubert et al. 2016	30	24	Expand the analyses in Dudley et al. (2015) to assess flow regime and habitat fragmentation effects on RGSM occurrence and abundance and suggest preliminary flow regimes for rehabilitating the wild RGSM population.	Not given	3				
Hubert et al. 2016	31	Observation Beyond the Scope 1	Attention to long-term climate-change issues and integration with climate-change planning efforts was not evident to the expert panelists (from the readings or from discussions at the December workshop) regarding how the Cooperative Program and Monitoring Program plan to address markedly lower flows and higher water temperatures.	Not given	Not given				

Hubert et al. 2016	31	Observation BTS 2	The MRG lacks minimum instream flow requirements to assure recovery. A major element of discussion by program scientists and interested parties during the workshop focused on low-flow periods and the potential for survival of RGSM during those periods when portions of the MRG have no observed surface flows or when there is no measurable discharge at gaging stations. It became evident to the external panelists that there are no specified minimum instream flow requirements or guidelines for the MRG. Minimum instream flow requirements or guidelines would not only enhance the potential for recovery of the RGSM in the MRG, but they would enable the current 20-site design of the Monitoring Program to be used to assess continuously status and trends of the RGSM stock in the MRG.	Not given	Not given				
Hubert et al. 2016	31	Observation BTS 3	The Monitoring Program assesses relative abundance of the RGSM in October; the young-of-year fish encountered at this time are likely to include the progeny of hatchery fish that were stocked the previous year (in November), survived the winter, and successfully reproduced. As such, the Monitoring Program is measuring the ability of hatchery stocking to contribute to or maintain a population in the MRG. Understanding of the dynamics of the RGSM population and the effects of changes in water resources in the MRG is hindered by confounding of environmental and hatchery-fish effects. There is a need for Monitoring Program scientists to effectively disentangle the source of new recruits (Creel et al. 2015), in particular the relative contribution of hatchery-origin fish and naturally spawned wild fish. One suggestion is to apply individual-based models (IBMs) to simulate changes in the system (e.g., cessation of stocking, decreased discharge rates) and assess those effects on RGSM populations (see e.g., Rose et al. 2013a and b). IBMs are used to describe population outcomes by tracking the fate of the individual fish that compose the population. As such, these models allow individual fish to exhibit unique combinations of growth, survival, fecundity, and movement probabilities. Although this is a powerful approach for the study of animal populations, IBMs require large amounts of data. Thus, the feasibility of this approach will depend on the depth of knowledge of basic biological processes for RGSM in the 1186 MRG.	Not given	Not given				

Hubert et al. 2016	31	Observation BTS 4	In recent years, low RGSM abundance has led to salvaging fish from residual pools and the introduction of hatchery reared fish to supplement the RGSM population. This creates a dilemma of providing fish to preclude RGSM extinction versus creating a domesticated hatchery-dominated population ill equipped to survive the rigors of a highly stressed environment. Therefore, additional genetic fingerprinting and epigenetic studies of presumed wild, hatchery, and hatchery-originated progeny are needed to determine hatchery contributions to the spring spawners and the risks thereof to the wild population (Quinones et al. 2014; Trushenski et al. 2015; Carmichael et al. 2015)...The question of greatest concern here is the degree to which the population has become, or is becoming, a largely hatchery-derived population with reduced survivability in the face of climate change and other physical and chemical habitat alterations. This becomes of greatest concern when wild populations are naturally and anthropogenically constricted in numbers relative to the numbers of hatchery-origin fish added to the population. Because of such natural and anthropogenic pressures, the highly variable RGSM population likely will continue to be reduced and the wild population may be extirpated (Lawson 1993; Cowley 2006). Continuation of current hatchery augmentation practices should include a rigorous risk/benefit analysis	Not given	Not given			0	
Hubert et al. 2016	32	Observation BTS 5	Although not explicitly discussed during the December workshop, the current recovery plan and criteria for the RGSM (USFWS 2010) are based on the 20-fixed-site sampling protocol. Recovery criteria for the MRG include presence of unmarked and age-0 RGSM at 75% of all sites per reach in October; an October CPUE of >5 RGSM/100 m2 in all sites in a reach for five consecutive years; and age-0 RGSM in 75% of all sites in a reach for five consecutive years. To the degree that insufficient October flows limit sampling of all 20 sites, those recovery criteria cannot be met. In addition, the recovery plan implicitly assumes that genetic exchange is generally in a downstream direction, that the wild RGSM genetic composition has been preserved, and that unmarked fish have a wild genotype. However, those assumptions may be negated by ongoing hatchery practices as discussed above in Observation 4.	Not given	Not given			ASIR sampled at replacement sites when a fixed or additional site was found to be dry. They also added 10 additional sites in 2017.	2017 Population Monitoring Report, 2017 SOW with BOR

Hubert et al. 2016	32	Observation BTS 6	The analyses in Dudley et al. (2015) could lead to quantitative instream flow and habitat studies and be used to assess flow regime and habitat fragmentation effects on RGSM occurrence and abundance and then used to set preliminary system-wide instream flow criteria for rehabilitating RGSM. This is because current rehabilitation actions such as salvage, stocking of hatchery fish, and local flow and physical habitat manipulations have only local or temporary effects compared with the system-wide effects of major diversion dams and basin-scale land use (e.g., Wang et al. 2003; Hughes et al. 2005, 2014). Normalizing flow regimes, improving fish passage, and extensively lowering floodplains would help rehabilitate a species such as the RGSM (Williams et al. 1999; Tockner et al. 2000; Dudley et al. 2015; Novak et al. 2015); admittedly, such rehabilitation measures may be costly. Although portions of the MRG have experienced periods of natural drying and flooding historically, anthropogenic increases in the frequency or extent of drying and anthropogenic decreases in the frequency and extent of flooding, together with passage barriers, likely reduce the potential of wild RGSM to persist and flourish in the MRG (Hughes et al. 2005; Novak et al. 2015).	Not given	Not given				
Hubert et al. 2016	33	Observation BTS 7	During the workshop, the panelists noted that a number of organizations and agencies were engaged in research on RGSM in the MRG (i.e., US Fish & Wildlife Service, Bureau of Reclamation, and Army Corps of Engineers). However, the expert panelists did not identify whether formal procedures for sharing outcomes and results from these studies are in place, for example, via annual multi-day research review and discussion meetings with all Cooperative Program and Monitoring Program partners. In addition, models to describe the hydrodynamics of the MRG have been developed, but fish population studies do not appear to make use of these models. The water resource problems in the MRG are complex and water management actions affecting discharge and flow in the river affect the population of RGSM. An annual research review or similar activity may help to strengthen information exchange and advance scientific understanding of the issues in the MRG.	Not given	Not given			Planning 2019 MRG Science Symposium	

Hubert et al. 2016	33	Observation BTS 8	An adaptive management program may help to improve understanding of the relationship between management actions in the MRG and the status of the RGSM population. We understand that such an approach will soon be implemented for the MRG and encourage the Collaborative Program to pursue a rigorous adaptive management program. Adaptive management is typically viewed as a partnership between management agencies and agencies engaged in research to address critical uncertainties in the system. Partnerships are key because new knowledge about the system will be obtained only when research and management work hand-in-hand. In adaptive management, (1) the science problems must be defined in a clear manner that permits design of targeted investigations; (2) conceptual and simulation models are then used to investigate responses of the system to potential management interventions; (3) direct, purposeful manipulations are implemented and the response of the system measured in a statistically reliable manner; and (4) analyses and synthesis of outcomes are completed in a timely manner to support robust decision-making. Adaptive management in the MRG would benefit from a conceptual model of the system that integrates water use, hydrodynamics, and fish population responses. It is unclear if such a model exists, but it is imperative to develop such models to ensure that management manipulations will provide sufficient contrast and ensure a measurable result.	Not given	Not given			Planning 2019 MRG Science Symposium and working towards an Adaptiveme Management Framework for the program.	
Hubert et al. 2016	33	Observation BTS 9	In addition to adaptive management, Collaborative Program partners and collaborators may wish to consider other tools such as scenario planning (Baker et al. 2004; Hulse et al. 2004; Allen and Gunderson 2011; Rowland et al. 2014) and resilience building (NYC 2013; Norfolk 2014). Scenario planning may be an effective management approach when uncertainty about the system is high and factors that affect the system are not readily controlled (e.g., amount of snow pack available for replenishment of rivers). In this approach, alternative futures are explored with the goal of identifying improvements to current management actions. This may be a good strategy to pursue now, perhaps together with adaptive management. As uncertainty about the system declines (through learning derived from targeted research studies and adaptive management), we suggest implementing a resilience building approach. The approach is effective when driving factors remain uncontrollable and system uncertainty is low. Many coastal cities have adopted this approach in the face of rising sea levels (e.g., New York City [NYC 2013] and Norfolk, VA [Norfolk 2014]).	Not given	Not given				

Hubert et al. 2016	33	Observation BTS 10	The research done on the RGSM warrants publication in high-level peer reviewed journals. The Expert Panel was provided 14 documents to help it prepare for the December workshop. Of those 14, only 2 were published in, or submitted to, a peer-reviewed journal by a member of the Program; however, the results and interpretations included in the annual reports should be published in journals. Similarly, the Expert Panelists were shown agency reports at the Workshop that were not included in the preselected workshop reading materials that likely had received thorough agency review, but apparently had not yet been submitted for journal publication. In the scientific world, peer-reviewed journal publication is the standard by which research is judged. Publishing in such journals would add increased scientific credibility to the Collaborative Program, and funding the time needed to prepare and revise journal manuscripts should be included in the research grants of the Monitoring Program.	Not given	Not given			SOWs developed through the Program now accommodate the cost of peer-reviewed publication.	
Noon et al. 2017	17	A1	Clarify the relationship between the annual catch-per-unit-effort and true population size by estimating catchability.	1	1		Same as Caplan et al. 2018 - RGSM 1		
Noon et al. 2017	18	A2	Determine the key, age-specific, life history sensitivities of the RGSM (that is, use eigenanalysis methods to determine which vital rates [survival and/or reproduction] most affect rathes of population change.	1	3		Same as Caplan et al. 2018 - RGSM 2		
Noon et al. 2017	18	A3	Estimate age-specific survival rates	1	3		Same as Caplan et al. 2018 - RGSM 3		
Noon et al. 2017	19	A4	Estimate age-specific fecundities of wild fish.	1	3		Same as Caplan et al. 2018 - RGSM 4	Age-specific fecundities were determined for captive fish. Published in the North American Journal of Aquaculture in 2019.	Caldwell et al. 2019
Noon et al. 2017	19	A5	Using statistical modeling, estimate the relationships between RGSM demographic rates and A.) hydrological factors (flow magnitude and duration, summer drying of the channel); and B.) abiotic environmental factors (temperature, turbidity, salinity); and C.) biotic factors (predation, completion, prey availability).	1	3		Same as Caplan et al. 2018 - RGSM 5		
Noon et al. 2017	20	A6	Evaluate the existence and strength of any density-dependent factors that may be limiting population growth.	2	Not given				
Noon et al. 2017	20	A7	Model the potential effects of hatchery augmentation on population dynamics and the significance of hatchery fish to achieving recorvery objectives.	Not given	Not given				
Noon et al. 2017	20	A8	Determine if the collection and translocation of salvage fish during summery drying periods contributes signficantly to population dynamics.	Not given	Not given			The USFWS is in the very preliminary stages of assessing survival post-fish salvage. A portion of rescued fish are being brought back to the USFWS facilities for evaluation.	2018
Noon et al. 2017	21	B1	Development and deplyment of "vertically-intergrating" Moore egg collectors	1	Not given				

Noon et al. 2017	21	B2	Improved assessments of relations between possible environmental cues that trigger spawning activity.	1	Not given			Temperature degree days and photoperiod SOW currently addresses a few potential environmental cues.	SOW developed in 2018
Noon et al. 2017	21	B3	Establish size-specific fecundities of natural-spawning RGSM.	2	Not given				
Noon et al. 2017	22	C	Clarify the detail of annular mark formation on otoliths and firmly establish the longevity of RGSM	2	Not given			SWCA currently addressing this for larval fish only (to get hatch date).	2018
Noon et al. 2017	22	D1	Estimate the spatial extent and hyrdaulic quality used by RGSM for key life-stages (spawining, larval rearing, juvenile and adult survival). Estimate how these habitats are distributed in the river channel and floodplain in each MRG reach under a range of discharges and seasonal flow regimes.	Not given	Not given				
Noon et al. 2017	23	D2	Establish the proximate trigger(s) for spawning by evaluating the effects of flow velocity, temperature, rate of increase in flow velocity, or some combination of these factors.	Not given	Not given			Temperature degree days and photoperiod SOW currently addresses a few potential environmental cues.	SOW developed in 2018
Noon et al. 2017	23	D3	Determine the roles and relative contributions to fish production (age 0 recruitment and survival of all age-classes) of channel and floodplain habitat in a reach of channel and floodplain typical of the MRG.	Not given	Not given				
Noon et al. 2017	24	D4	What is the management potential for fish production (recruitment and survival of age 0 fish) in each reach of the MRG if the annual peak flow, and thus the nature and range of available habitats, is permanently limited below historic levels of availability.	Not given	3				
Noon et al. 2017	24	E1	Establish the age composition of the RGSM population, including A.) application of distribution seperation methods to estimate age composition, and B.) gear selection study.	1	Not given			Horowitz et al. 2018 addressed age composition, and some additional work done by Valdez (2018)	
Noon et al. 2017	25	E2	Determine how the vertical and horizontal distribution of RGSM eggs in the MRG mainstream channel varies as a function of flow and location?	1	Not given			M.Porter (?)	
Noon et al. 2017	25	E3	Calculate revised CPUE values as mesohabitat-specific levels and do not combine across mesohabitat types. The meso-habitat specific CPUE calculated for the most abundadnt high density mesohabitat type should be used for assessment of trend in abundance of the RGSM population at the October sampling date.	2	2			ASIR has reported CPUE by mesohabitat type in their 2016 and 2017 reports. Some additional efforts towards this recommendation have been made by the DAT.	2017 Population Monitoring Report, 2017 SOW with BOR
Caplan et al. 2018	23	NMMJM1	Where are the NMMJM populations located?	1					
Caplan et al. 2018	25	NMMJM2	What is the genetic variation within and between NMMJM populations?	1					
Caplan et al. 2018	27	NMMJM3	How do non-invasive survey methods compare to trapping?	2					
Caplan et al. 2018	28	NMMJM4	What are the attributes for foraging, day nesting, maternal nesting, and hibernation habitat in the MRG?	2					
Caplan et al. 2018	30	NMMJM5	What are the population dynamics for the NMMJM?	2					

Caplan et al. 2018	35	SWFL1	What site selection and prioritization procedures contribute to the successful restoration of SWFL breeding habitats along the MRG?	1				In contract with USACE, Tetra Tech is identifying sites suitable for SWFL restoration in the MRG based on a large suite of factors.	Currently under contract in 2019
Caplan et al. 2018	41	SWFL2	What are the impacts of the tamarisk beetle (Diorhabda) on SWFLs and suitable SWFL breeding habitats in the MRG?	2					
Caplan et al. 2018	41	SWFL3	Which unoccupied and occupied suitable SWFL breeding habitats in the MRG are most threatened by Diorhabda in the near- and long-term?	2					
Caplan et al. 2018	46	SWFL4	What are the sizes, distributions, and trends of SWFL breeding populations along the Angustora Reach?	2					
Caplan et al. 2018	48	SWFL5	What is the connectivity among SWFL populations in the MRG?	3					
Caplan et al. 2018	56	YBCU1	Which abiotic and biotic variables predict suitable YBCU breeding habitats in the MRG across multiple spatial and temporal scales?	1					
Caplan et al. 2018	59	YBCU2	What are YBCU breeding population sizes, distributions, and trends in the MRG?	2				SOW written to assess the genetics of the YBCU to help better determine the distribution of the endangered sub-species.	Will be contracted as a grant in 2019 or 2020
Caplan et al. 2018	61	YBCU3	How similar are the YBCU and the SWFL in their breeding habitat requirements in the MRG?	2					
Caplan et al. 2018	64	YBCU4	What are the spatial behavior patterns of YBCUs that breed in the MRG within and among years?	2					
Caplan et al. 2018	74	RGSM1	What are the key age-specific fecundity and survival rates (e.g., life-history sensitivities) that have the greatest impacts on RGSM population growth?	1			Same as Noon et al. 2017 A1		
Caplan et al. 2018	75	RGSM2	What are the age-specific survival rates, and their variances, of RGSM?	1			Same as Noon et al. 2017 A2		
Caplan et al. 2018	78	RGSM3	What are the age-specific fecundities, and their variances, of RGSM?	1			Same as Noon et al. 2017 A3		
Caplan et al. 2018	80	RGSM4	Can the relationship between the annual CPUE index and true population size be better characterized?	1			Same as Noon et al. 2017 A4		
Caplan et al. 2018	83	RGSM5	What is the relationship between RGSM demographic rates and : A) hydrologic factors; B) abiotic environmental factors; and C) biotic factors in the MRG?	1			Same as Noon et al. 2017 A5		

Science and Adaptive Management Committee Meeting

January 13, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *2021 MRGESCP Work Plan [read-ahead, spreadsheet]*
- *Draft MRGESCP S&T Ad Hoc Group Charge RGSM Population Monitoring Summary Report Ad Hoc [read-ahead, draft]*
- *Draft MRGESCP S&T Ad Hoc Group Charge RGSM Population Modeling Ad Hoc [read-ahead, draft]*
- *PMWG Update to the EC [read-ahead]*
- *Summary of Proposed Actions: Genetics Subgroup Flowchart [read-ahead]*
- *AM Relational Database Excerpt – Compiled Independent Science Panel Recommendations [read-ahead, spreadsheet, not included]*
- *Assessing the Assessment – Four Corners Adaptation Forum [presentation]*
- *Revised MRGESCP Draft S&T Ad Hoc Group Charge PMWG Summary Report Ad Hoc Group [follow-up, draft]*
- *Revised MRGESCP Draft S&T Ad Hoc Group Charge RGSM Population Model Ad Hoc Group [follow-up, draft]*
- *MRG Width Maintenance Program [presentation, not included]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC) Meeting
January 13, 2021
1:00 PM–4:00 PM

Meeting Location: *Zoom*
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Meeting ID: 898-359-3120; Passcode: 1251
Call-In: +1-669-900-6833

Meeting Agenda

1:00 – 1:10 **Welcome and Agenda Review** — *Catherine Murphy, Program Support Team*

- ✓ **Decision**: Approve January 13, 2021 meeting agenda
- ✓ **Decision**: Approve December 7, 2020 meeting minutes

Read-ahead:
- ☐ December 7, 2020 meeting minutes

1:10 – 2:00 **2021 Work Plan** — *Facilitated discussion*

- Review 2021 MRGESCP Work Plan and discuss priority tasks for January-March 2021
- EC requested Science & Technical (S&T) Ad Hoc Groups:
  - Population Monitoring Work Group (PMWG) summary report completion (Lead: Rich Valdez)
  - RGSM Population Monitoring modeling small group (Lead: Charles Yackulic)
- Other outstanding efforts:
  - RGSM Genetics work

Read-aheads:
- ☐ 2021 MRGESCP Work Plan
- ☐ Draft S&T Ad Hoc group charges (2)
- ☐ R_Valdez PMWG Update to EC 2020_12_07
- ☐ Summary of Proposed Actions - RGSM Genetics small group

- ✓ **Decision**: Review and approve draft charges for PMWG report and PM modeling S&T Ad Hoc Groups
- ➢ **Action Item**: Invite Genetics small group rep(s) to next SAMC meeting Re: reassessment of priority questions
- ➢ **Action Item**: Review proposed S&T Ad Hoc Groups based on priority work plan tasks

2:00 – 2:20	**Discuss Objectives Workshop (February 2021)** • Applying the Program Objectives as guiding principles • Discuss workshop sessions and facilitation • Review available pre-workshop survey responses • Discuss revisions to S.M.A.R.T. statements ✓ **Decision:** Workshop format and session facilitation	*Facilitated discussion*
2:20 – 2:30	**Break**	
2:30 –2:50	**Discuss Uncertainty in Adaptive Management (AM)** • Discuss categorization and incorporation of Independent Science Panel recommendations • Assessing and characterizing uncertainty – M. Friggens • Capturing uncertainty/error/assumptions in Ad Hoc deliverables • Incorporating uncertainty/predictability into conceptual ecological models (CEMs) and other models Read-aheads: ☐ Excel spreadsheet of compiled ISP recommendations with Type of Action Recommended label ☐ Uncertainty Four Corners presentation	*Facilitated discussion*

2:50 – 3:10	**Incorporating Climate Science**
	• Overview
	  o Areas of concern for the Middle Rio Grande
	  o Opportunities
	• Discussion on how to incorporate into project prioritization
		Facilitated discussion

3:10 – 3:25	**Opportunities for Collaboration** • U.S. Bureau of Reclamation's width maintenance program • City of Albuquerque's habitat restoration site • Others? ➢ **Action Item**: Invite Colleen McRoberts to present to the SAMC on the habitat restoration project	*Ari Posner PST*
3:25 –3:45	**Odds, Ends and Announcements** • Geospatial Mapper data layer requests – (A. O'Brien, T. Archdeacon, others?) • Announcement: MRGESCP management tools – WRDA USACE authorization to start 5-year study Re: deviations to Cochiti Dam operations • Other?	*Open topics discussion*
3:45 –4:00	**Meeting Summary and Action Items Review**	

- **Decision:** Next meeting date - February XX, 2021

4:00 **Adjourn**

Ongoing Discussion

Potential Topics for S&T Ad Hoc Groups

This section is provided to support future SAMC deliberations and decisions around tasking S&T Ad Hoc Groups. During the December 7, 2020 meeting, the following questions and/or activities were mentioned as potential future tasks.

- Developing a list of potential management actions and areas of management flexibility. This includes liaising with the Minnow Action Team (MAT) to gather that information.
- Completing outstanding PMWG tasks, such as:
  - Finalizing the PMWG summary report
  - Continuing work on the RGSM population model
- Completing other outstanding work from sunsetted work groups, including:
  - Addressing existing panel recommendations (prioritization to be determined by the SAMC)
  - Incomplete scopes of work
  - RGSM genetics next-steps from development of RGSM High-Throughput Markers
- Continue working on CEMS, including:
  - Integrating panel recommendations into the CEMs
  - Building the linkages necessary to incorporate CEMs into the AM Database
  - Developing less-detailed "public" versions of CEMs
- Investigating options for U.S. Bureau of Reclamation's width maintenance program in order to inform discussions by the SAMC and Executive Committee on potential recommendations for implementation

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

January 13, 2021; 1:00 PM–4:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of January 13, 2021 SAMC meeting agenda
- ✓ Approval of December 7, 2020 SAMC meeting minutes

Action Items:

WHO	ACTION ITEM	BY WHEN
Ari Posner	Send presentation on the U.S. Bureau of Reclamation's width maintenance program to the Program Support Team (PST)	1/13/2021
PST	Send out a Doodle Poll to schedule the February SAMC meeting	1/15/2021
Catherine Murphy	Revise the Population Monitoring Work Group (PMWG) Summary Report Science & Technical (S&T) Ad Hoc Group Charge and send to the Executive Committee (EC)	1/15/2021
Catherine M.	Revise the Rio Grande silvery minnow (RGSM) Population Model S&T Ad Hoc Group Charge and send to the EC	1/15/2021
Catherine M.	Contact Rich Valdez to confirm membership of the PMWG Summary Report S&T Ad Hoc Group	1/15/2021
SAMC members	Fill out the Pre-Objectives Workshops survey	1/21/2021
Catherine M.	Invite Rich V. to the February SAMC meeting to discuss expectations for the PMWG summary report	February/March meeting
Catherine M.	Draft a S&T Ad Hoc Group charge for incorporating genetic factors into the RGSM conceptual ecological model (CEM)	February/March meeting
Catherine M.	Invite Wade Wilson to the February SAMC meeting to discuss incorporating genetic factors into the RGSM CEM	February/March meeting
PST	Create a template for assessing and quantifying uncertainty for deliverables to SAMC	February/March meeting
PST	Update status of independent science panel recommendations and send to SAMC	February/March meeting
PST	Invite Colleen McRoberts to attend the February SAMC meeting to discuss the City of Albuquerque's habitat restoration project	February/March meeting
Catherine M., Debbie L., and Megan F.	Catherine M., Debbie Lee, and Megan Friggens will discuss plans for the Scenarios Workshop	End of February

Next Meeting: February/March 2021

Meeting Summary

Welcome and Agenda Review

Catherine M., Program Support Team (PST) Science Coordinator and SAMC Facilitator, opened the meeting and reviewed the January 13, 2021 meeting agenda and December 7, 2020 meeting minutes.

- ✓ **Decision**: The SAMC approved the December 7, 2020 SAMC meeting minutes
- ✓ **Decision**: The SAMC approved the January 13, 2021 SAMC meeting agenda

2021 Work Plan

Review 2021 MRGESCP Work Plan and discuss priority tasks for January-March 2021

- The Executive Committee (EC) approved the Collaborative Program's 2021 Work Plan at its December meeting.
    - Tasks associated with transitioning to a new PST may be included in the 2021 Work Plan, as the current Program and Science Support contract will end in September 2021.
- The 2021 Work Plan is split into 8 tasks (see plan). The SAMC will help complete tasks in the ways described below:
    - Task 1 – Updating the objectives
        - Hold the Objectives Workshops and make updates to the Science & Adaptive Management (S&AM) Plan and Long-Term Plan (LTP).
    - Task 2 – Tasking Science & Technical (S&T) Ad Hoc Groups
    - Task 3 – Conceptual Ecological Models (CEMs)
        - Identify uncertainties in the CEMs, integrate them into the Adaptive Management (AM) Database, and link uncertainties to project ideas.
        - Develop models for the Pecos Sunflower and New Mexico meadow jumping mouse.
    - Task 4 – Improving science communication
        - Improve processes around communication (e.g., peer review, scope of work process, topical executive summary process).
    - Task 5 – Planning for using adaptive science
        - Hold a forecasting and scenario planning workshop.
    - Task 6 – Updating the LTP
        - Assist with the Project Bank in the AM Database.
    - Task 7 & 8 – Administrative tasks
        - Determine how the SAMC will coordinate/work with the Fiscal Planning Committee.
        - Link scientific findings from the annual summary report to guiding principles.
- Work can be delegated to S&T Ad Hoc Groups and the PST.
- The administrative side of the Collaborative Program needs to be developed, to coordinate with the SAMC.

EC requested S&T Ad Hoc Groups:

- The EC requested the SAMC charge two S&T Ad Hoc Groups to complete follow-up work from the sunsetted Population Monitoring Work Group (PMWG): the PMWG Summary Report Ad Hoc Group and the Rio Grande silvery minnow (RGSM) Population Model Ad Hoc Group.
    - PMWG Summary Report Ad Hoc Group (see charge):
        - Group Lead: Rich Valdez, SWCA Environmental Consultants, former chair of the PMWG

        - The group needs additional time to complete the summary report. The deadline set is March 2021.
        - The SAMC will review the summary report to ensure it contains contrasting viewpoints with supporting evidence, and relevant findings and recommendations.
        - SAMC members made the following suggestions to the draft charge:
            - Clarify in the charge that the summary report is on PMWG Tasks 1 and 2. Task 3 was not initiated.
            - Revise the charge to state that different viewpoints should be documented.
            - Define the original Tasks 1–3 in the charge.
            - Add deliverables of 1-page summaries/fact sheets and brief presentations.
            - Use "findings and recommendations" consistently throughout the charge.
        - The final summary report is due on **March 18, 2021**. Rich V. plans to submit the draft report by **March 1, 2021**. The SAMC will need to review, suggest changes, and approve the final version within that time.
        - Rich V. will attend a SAMC meeting to discuss what is expected in the report.
        - Will there be an opportunity to talk to Rich V. about the review?
            - We can schedule a meeting with Rich V., if needed, or he and Catherine can have those conversations.
        - It would be easier to submit comments on the report in a comment matrix.
        - Catherine M. will reach out to Rich V. to discuss membership.
    - <u>RGSM Population Modeling Ad Hoc Group (see charge):</u>
        - Group Lead: Charles Yackulic, U.S. Geological Survey
        - Charles Y. conducted expert elicitation for modeling scenarios.
        - The original group of individuals will continue the work as an ad hoc group.
            - Mo Hobbs and Thomas Archdeacon are members of the group.
        - Charles Y.'s contract ends in June/July and will need support until then.
        - The SAMC suggested adding deliverables of 1-page summaries/fact sheets and brief presentations to the charge.
- The first S&T Ad Hoc Group charges will be sent to the EC for review. The SAMC will take any comments under consideration.
- The SAMC agreed that SAMC members will not be leads for S&T Ad Hoc Groups. This should be added to the SAMC description in the S&AM Plan when it is revised.
- The charges for all ad hoc groups should ask the groups to characterize the uncertainty and assumptions in their work products.
- With all ad hoc groups, it will be important to ensure members are presenting findings to the right people to get appropriate feedback. That could be in the form of brown bag seminars or small meetings between experts.
    - Peer Review Process:
        - The SAMC needs to develop and refine a peer review process.
        - The process has multiple levels, from minor in-group review to independent science panels, with many steps between.
        - It is important to develop appropriate levels of review for different types of products/deliverables and to determine who should direct the reviews.
        - The SAMC may function as an editorial board to find appropriate and critical reviewers.
        - The SAMC needs to establish a minimum set of steps for review to make sure group members check all the right places for information.

- How do we reach out for S&T Ad Hoc Group membership?
    - Moving forward, if there is a core group working on a problem, we can bring in additional people with fresh perspectives.
    - The PST or SAMC members can reach out to appropriate individuals to assess interest in ad hoc membership, as needed.
- Follow-up work from the sunsetted RGSM Genetics Work Group
    - Ad Hoc groups are formed around questions or tasks, not individuals. Genetics questions need to be prioritized based on scientific urgency and relationship to RGSM uncertainties.
    - The SAMC can ask previous group members to identify issues to focus on, which will likely include follow-up work from the SNP panels.
    - To engage the group in another way, the SAMC can task a genetics ad hoc group with incorporating genetic elements into the RGSM CEM.
        - Wade Wilson, U.S. Fish & Wildlife Service (USFWS), is already working on this task, which will help link genetics issues to critical uncertainties.
    - This process can also be applied to the avian CEMs, if appropriate data are available.
    - Wade W. will be invited to a SAMC meeting to discuss applying genetics to the RGSM CEM.
- Additional Ad Hoc Group Tasks
    - Identify critical uncertainties from the avian CEMs.
        - The information in the CEMs needs to be formatted for the AM Database.

- **Action Item**: Catherine Murphy will revise the PMWG Summary Report S&T Ad Hoc Group Charge and send to the Executive Committee
- **Action Item**: Catherine Murphy will revise the RGSM Population Model S&T Ad Hoc Group Charge and send to the Executive Committee
- **Action Item**: Catherine Murphy will contact Rich Valdez to confirm membership of the PMWG Summary Report S&T Ad Hoc Group
- **Action Item**: Catherine Murphy will invite Rich Valdez to the February SAMC meeting to discuss expectations for the PMWG summary report
- **Action Item**: Catherine Murphy will draft a S&T Ad Hoc Group charge for incorporating genetic factors into the RGSM CEM
- **Action Item**: Catherine Murphy will invite Wade Wilson to the February SAMC meeting to discuss incorporating genetic factors into the RGSM CEM

Discuss Objectives Workshop (February 2021)

Melissa Welsch, PST, revised some preliminary objectives to be S.M.A.R.T. (Specific, Measurable, Attainable, Relevant, Time-Bound). She advises the following for revising objectives and strategies:

- Activities should be manageable by the SAMC and show incremental progress.
- Focus on expanding on verbs (e.g., "support research.")
- Identify specific ways to accomplish objectives/strategies.
- Add timelines and deliverables to objectives/strategies.
- Include one-page reports and short presentations as deliverables to the SAMC.
    - Shorter, simpler communication will be easier to complete, and will summarize pertinent information for the SAMC.

- **Action Item**: The SAMC will fill out the Pre-Objectives Workshop survey

Discuss Uncertainty in Adaptive Management (AM)

- There are many types of uncertainties associated with the Program (e.g., knowledge gaps in CEMs, reducible/irreducible variabilities, confidence/error/bias of model estimators and parameters). All are called uncertainty, but it would help to be more specific.
- Taylor Higgins, PST, categorized the independent science panel recommendations in a spreadsheet (see spreadsheet).
    - Taylor H. added the types of actions proposed in each recommendation (e.g., reporting, analytical, new data collection, modify protocol).
- Some recommendations have been addressed, but the list has not been updated.
- How do we deal with recommendations that are not well supported by the science?
    - The SAMC should avoid making changes without providing justification. If a recommendation is ignored, there will be evidence to support that conclusion.
    - An ad hoc group may need to be tasked with updating the status of each recommendation and deciding if it should be ignored or prioritized, with justification.
- Suggestion to create a template that outlines the types of uncertainty, so groups preparing deliverables can check off which uncertainties were addressed.
- Asking for confidence level may be easier. Uncertainty is harder for people to characterize than their confidence level.
- The uncertainty four corners presentation was very straightforward but is narrower than what is needed; a template would work better.

- **Action Item**: The PST will update the status of independent science panel recommendations and send to SAMC
- **Action Item**: The PST will create a template for assessing and quantifying uncertainty for deliverables to SAMC

Incorporating Climate Science

- Question from 50-Year Water Plan Dialogue: What water share will climate change take?
    - This is not being accounted for in current water plans.
    - What can the Collaborative Program do to start incorporating that question?
        - This directly contributes to scenario planning and forecasting.
- Megan Friggens will be consulted on development of the Scenarios Workshop.
- Suggestion to include questions related to climate change/future scenarios in deliverables.

- **Action Item**: Catherine Murphy, Debbie Lee, and Megan Friggens will discuss plans for the Scenarios Workshop

Opportunities for Collaboration

U.S. Bureau of Reclamation's width maintenance program

- Ari Posner, U.S. Bureau of Reclamation (Reclamation), gave an update on the program:
    - Background: The river was channelized in the 50s/60s; the channel was cleared and jetty jacks were built to stabilize the banks. Reclamation maintained the channel through vegetation removal through the early 90s, but stopped when the southwestern willow flycatcher was listed. Since then, vegetation has overgrown. In some places, when there is flooding, water goes over bank at lower discharges. Water deliverers are interested in maintaining water conveyance.
    - Reclamation plans to enter the active channel to clear vegetation, widen the channel, possibly build a pilot channel, etc.

    - Reclamation is coming up with 5–10 year plan to work through system to maintain conveyance capacity, while optimizing vegetation to reduce senescent stands.
    - Widening the channel decreases velocity in the river. This activity is one of the few that overlaps river management/conveyance goals and habitat goals.
    - Reclamation does not view the project as its sole responsibility; the project needs to be done in partnership with USFWS, U.S. Army Corps of Engineers, New Mexico Interstate Stream Commission (NMISC), and Middle Rio Grande Conservancy District.
    - This is a pilot program, and Reclamation does not know the impacts it will have. The intent is to use the project to monitor changes in the river to inform other projects.
- How can the Collaborative Program contribute to the width maintenance program?
    - The Collaborative Program can help with monitoring and determining benefits to species and habitat.
    - It is hard to measure response to widening the channel, as the response (change in spawning habitat) will not occur at the same time and place. Suggestion to look at particle retention as a surrogate to quantify impacts from the activity.
        - Reclamation plans to do 2D numerical modelling, which can include particle tracking.
    - Ari P. will send a draft slideshow on the proposed width maintenance program to the SAMC (not for public distribution).
    - What is the timeline of implementation?
        - The width maintenance program is at a very early stage.
    - The Collaborative Program can provide input on how to optimize implementation vis-à-vis habitat and how to monitor impacts/benefits.

➢ **Action Item**: Ari Posner will send draft presentation on Reclamation's width maintenance program to the PST

City of Albuquerque's habitat restoration site

- Colleen McRoberts, City of Albuquerque, will be invited to the next SAMC meeting to present on the habitat restoration project.

➢ **Action Item**: The PST will invite Colleen McRoberts to attend the February SAMC meeting to discuss the habitat restoration project

Odds, Ends and Announcements

- There will be no more development on the Portal, including additional interactive mapper layers.
- Trevor Birt, NMISC, suggested forming S&T Ad Hoc Groups that include University of New Mexico (UNM) students.
    - A UNM professor reached out to Trevor about getting hands-on experience for students.
    - Trevor had several ideas for groups, including a GIS-related one.
    - The SAMC should start working with Trevor B. on questions for students to work on.
- Mo Hobbs will be stepping away from the SAMC towards the end of May.

➢ **Action Item**: The PST will send out a Doodle Poll to schedule the February SAMC meeting

Meeting Participants

Alan Hatch	EC *Ex Officio* Member
Ara Winter	Statistics/Modeling Expert
Ari Posner	Geomorphology Expert
Catherine Murphy	Program Support Team, SAMC Facilitator
David Moore	Terrestrial Ecology Expert
Debbie Lee	Program Support Team
Meaghan Conway	Ecosystem Function Expert
Megan Friggens	Climate Science Expert
Melissa Welsch	Program Support Team
Michelle Tuineau	Program Support Team
Mo Hobbs	Aquatic Ecology Expert
Ryan Gronewold	Hydrology Expert
Thomas Archdeacon	Aquatic Ecology Expert

2021
Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) Work Plan

Tasks

1	Update MRGESCP Objectives
2	Task Science & Technical Ad Hoc Groups
3	Utilitze Conceptual Ecological Models
4	Improve Science Communication
5	Plan for the Future of Adaptive Science
6	Develop and update the Long-Term Plan
7	Implement new MRGESCP organizational structure
8	Administrative tasks

TASK	SUBTASK	EC	AAH	SAMC	S&T	FPC	PST	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
	Executive Committee (EC) meeting	X								X				X			X		X
	Science & Adaptive Management Committee (SAMC) meeting			X				X	X		X	X				X	X	X	
	Fiscal Planning Committee (FPC) meeting					X			X			X			X			X	
1a	Convene an Objectives Workshop for each species			X			X		X										
1b	Report objectives and their implications for science initiatives to the EC for review and approval			X			X			X	X	X	X	X					
1c	Integrate objectives and strategies into the Adaptive Management (AM) Database						X					X	X						
2a	Identify critical carry-over work from past MRGESCP efforts, including panel recommendations, and begin breaking large issues into specific questions			X	X			X	X	X	X	X	X	X	X	X	X	X	X
2b	Form Science & Technical (S&T) Ad Hoc groups to address specific questions			X	X			X	X	X	X	X	X	X	X	X	X	X	X
2c	Task S&T Ad Hoc Group to finalize Population Monitoring Work Group work in a summary report			X	X			X	X	X									
3a	Assess status of identified critical uncertainties				X			X	X	X	X	X	X	X	X	X	X	X	X
3b	Link uncertainties to appropriate elements in the AM Database			X	X			X	X	X	X	X	X	X	X	X	X	X	X
3c	Integrate Rio Grande silvery minnow, yellow-billed cuckoo, and southwestern willow flycatcher conceptual ecological models (CEM) into the AM Database by converting schematics into graphical models and individual relationships				X		X	X	X	X	X	X	X	X					
3d	Populate the Project Bank with past and current projects. Specify research hypotheses, where appropriate			X			X	X	X	X									
3e	Develop CEMs for New Mexico meadow jumping mouse and Pecos sunflower				X						X	X	X	X	X	X	X	X	X
4a	Define the peer review process, including both internal reviews and external reviews			X			X	X	X	X									
4b	Revise the scope of work process to incorporate the Science & AM (S&AM) Plan elements			X			X	X	X										
4c	Refine the topical Executive Summary writing and review processes			X			X	X	X										
4d	Provide training on the AM Database application	X		X	X	X	X									X	X		
5a	Organize and convene Scenario Planning Workshop to consider ecosystem trends and forecasts			X						X	X	X	X						
5b	Develop decsion trees and action plans for various scenarios			X	X						X	X	X	X	X				
5c	Update the S&AM Plan				X							X	X	X					
6a	Develop an administrative schedule					X	X		X	X									
6b	Populate the Long-Term Plan with a scientific activities list from the AM Database as aligned with guiding principles			X	X		X				X	X	X	X					
6c	Update the Long-Term Plan	X		X								X	X	X					
7a	Update and adopt By-laws to reflect new MRGESCP structure and operations	X	X					X	X	X	X	X	X	X					
7b	Draft and adopt a new Memorandum of Agreement	X	X					X	X	X									
7c	Develop processes for SAMC and FPC coordination on Collaborative Program recommendations			X		X				X	X								
8a	Maintain and update the Program Portal						X	X	X	X	X	X	X	X	X	X	X	X	X
8b	Draft and approve FY20 Annual Report	X					X	X	X	X	X	X	X	X					
8c	Develop schedule for input into signatory priority activities					X			X	X	X								

TASK	SUBTASK	EC	AAH	SAMC	S&T	FPC	PST	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21
8d	Develop a format for a concise Annual Report						X							X	X				
8e	Begin drafting FY21 Annual Report						X							X	X	X	X	X	X
8f	Develop annual summary report			X			X							X	X	X	X		
8g	Compile and report on FY21 Non-federal Cost Share	X					X										X	X	X
8h	Develop and approve 2022 Annual Work Plan	X					X											X	X
8i	Update the MRGESCP contact lists to reflect changes to the new structure	X					X	X	X										

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Rio Grande Silvery Minnow Population Monitoring Summary Report Ad Hoc

Approved by Science and Adaptive Management Committee (SAMC) on January XX, 2021**.**

Parent Committee
Science and Adaptive Management Committee

Ad Hoc Group Charge
Summarize findings from Rio Grande silvery minnow (RGSM) Population Monitoring Work Group Tasks 1-3 (2012-2020) and provide the SAMC with specific recommendations and remaining critical uncertainties.

Membership

A. Criteria for membership
Member of RGSM Population Monitoring Work Group (PMWG) familiar with group accomplishments and recommendations.

B. Member List
Lead: Rich Valdez, PhD (Former Chair PMWG), others?...

Iterative Task Development

- The summary report of findings directly addresses RGSM **Objective A-1**: Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.
- Recommendations provided will inform EC decisions and guide formation of new S&T Ad Hoc groups around prioritized critical uncertainties.
- Drafting of the report is currently underway.

Tasks and Deliverables

1. ***Delivery of Report***
   Summarize findings from PMWG Tasks 1-3 (2012-2020) and provide the SAMC with specific recommendations and remaining critical uncertainties. Provide supporting evidence for recommendations and clearly define all assumptions. Critical uncertainties should be presented as research hypotheses and may be accompanied by recommended experimental approaches, if desired.

   Objective of Task One
   This charge has one associated task: Delivery of report.

   Deliverable(s): Summary Report

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Delivery of report	Review	DRAFT Summary Report to SAMC	March XX, 2021
	Submit	FINAL Summary Report to EC	March XX, 2021

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Rio Grande Silvery Minnow Population Modeling Ad Hoc

Approved by Science and Adaptive Management Committee (SAMC) on January XX, 2021**.**

Parent Committee
Science and Adaptive Management Committee

Ad Hoc Group Charge
Develop an integrated population model for the Rio Grande silvery minnow (RGSM) using population monitoring data to predict RGSM responses to different factors, including stocking, salvage, spring flows, low summer flows and intermittency.

Membership

A. Criteria for membership
Familiarity with river conditions and habitat needs of RGSM in the MRG, knowledge of fisheries science and/or population dynamics.

B. Member List
Charles Yackulic (Lead), Rich Valdez, Mo Hobbs, Thomas Archdeacon, Joel Lusk, Eric Gonzales, and Mick Porter (if available), others?

Iterative Task Development

1. This modeling effort will directly or indirectly inform three RGSM Objectives:
   - **Objective A-3**: Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.
   - **Objective A-4**: Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.
   - **Objective A-5**: Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.
2. To better define linkages to these objectives, please describe in greater detail the specific RGSM responses and factors being modeled.
3. To ensure appropriate application of the model, please describe the methods of development, as well as associated model assumptions and estimation error and/or bias.
4. Describe the knowledge gaps and critical uncertainties that reduce the accuracy or precision of the parameter estimates.

Tasks and Deliverables

1. ***Expert Elicitation***
   Refine model parameters using a process of subject matter expert elicitation. Document methodologies, assumptions and supporting evidence.

   Objective of Task One

Improve model performance and applicability by harnessing the institutional knowledge of subject matter experts, where data may not exist.

Deliverable(s): Report on expert elicitation process and findings in a brown bag seminar format.

2. ***Application of Integrated Population Model for RGSM in the MRG***
   Describe decision support using the integrated population model (IPM). What questions does the model help to answer? How much error is associated with an estimate? Do the model outputs inform other decision support tools? What critical information is needed to improve the model estimates?

   Objective of Task Two
   Demonstrate the utility of the IPM and bridge the gap between the abstract modeling exercise and practical management application.

   Deliverable(s): Presentation of the IPM framework, model outputs and decision support scenarios as a brown bag seminar and accompanying one to two page fact sheet.

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Expert Elicitation		Report methods and findings in a brown bag seminar	March 2021?
Application of IPM		Decision support brown bag and fact sheet	June 2021?

Population Monitoring Work Group (PMWG) Update
To the Executive Committee
Richard A. Valdez, Ph.D.
Chair, Population Monitoring Workgroup
December 17, 2020

One of the most important aspects of the Middle Rio Grande Endangered Species Collaborative Program is the ability to confidently monitor key resources. In 2012, the Executive Committee (EC) formed and convened the Population Monitoring Workgroup (PMWG) to evaluate the fish monitoring plan for the Middle Rio Grande, with a focus on the Rio Grande silvery minnow. The EC charged the workgroup with three tasks. Task 1 was a workshop with external scientists and signatory technical representatives designed to evaluate the CPUE index and sampling methods. The workshop was held in December 2015, with a report and presentation to the EC by Dr. Wayne Hubert in 2016. Task 2 is an evaluation of the sampling design, methods, protocols, and analyses that is the primary subject of a status report currently in development. Task 3 is to be initiated at the completion of Task 2, and would evaluate refinements to the monitoring plan.

The draft status report for Tasks 1 and 2 is currently in development and review by the PMWG. The report evaluates the monitoring program, and is designed to inform the EC and the SAMC about the strengths and weaknesses of the program, especially as it describes the status and trends of the silvery minnow. Basic questions about the sampling design and methodologies are posed and addressed in the report with responses that also identify critical uncertainties. The results of this report are designed to be incorporated by the SAMC into the new adaptive management plan. This Status Report is expected to be completed about March 1, and a Summary of Findings and Recommendations will be presented to the EC at the March webinar.

Members of the workgroup are also involved in a project to help develop a Rio Grande silvery minnow population model. Dr. Charles Yackulic of the USGS has been retained by the New Mexico Interstate Stream Commission to develop an integrated model that uses the population monitoring data to predict responses by the silvery minnow to different factors, such as stocking, salvage, spring flows, and low summer flows and intermittency. Six members of the workgroup are currently serving as Subject Matter Experts with Dr. Yackulic to help parameterize the model through an elicitation process. This small modeling group will need to continue to meet virtually with Dr. Yackulic, possibly through the end of his contract period in June 2021.

Summary of Proposed Actions: Genetics Subgroup Flowchart

Categories of actions:

- Compile and conduct additional analyses with existing data (immediate and low cost)
- Standardize hatchery techniques (immediate to short term and mostly low cost)
- Literature search to support planning (immediate and low cost)
- Research and studies (start with next FY that new contracts can be issued; pilot studies at low to moderate cost; larger studies at moderate to high cost)

Flowchart

- *Existing data*: what can be done with it, implemented immediately
    - Q1-2; Q11: Develop techniques to establish critically low diversity thresholds across years (using available data and 95% confidence intervals)
    - Q1-6: use existing data from monitoring reports to examine genetic diversity / N_e variation over time using a piecewise regression.
    - Q3-3: conduct additional genetic analyses on the existing data; analysis by reach differentiation (genetics and survival)
        - Intent: to help characterize the biology of RGSM in different river reaches and to refute/confirm that augmentation has homogenized the species; aggregating the existing data could be a first step to determining if there is any new reach-specific information that can be gleamed from work that has already been done.
    - Q5-5: Survival in the river (treating fish as marked recapture); compare survival from hatchery fish
    - Q13-12: Length and weight data for fish in river versus hatchery – only looking at young-of-year;
        - Refer to: age and growth study(s) for other comparisons; monitoring data;
        - To do: plot on growth rates of wild spawned fish versus hatchery fish (time, length, weight data)
- *Hatchery Techniques*
    - Paired spawning – equalize family sizes, appropriate number of pairs
    - Natural food source, natural rearing techniques
    - Developing protocols for experiments with, or disposal of fish produced outside standardized breeding protocols*

  * Suggest we NOT call fish produced outside standardized breeding protocols “surplus”. We were informed that there are no surplus fish, any fish not needed for the Rio Grande are available for the Big Bend experimental population.
    - Developing standardized forms and nomenclature

- *Literature Search*
    - R4-8H: Evaluate the extent of domestication selection is occurring in the hatcheries.
        - start with literature review; evaluating domestication selection need not rely exclusively on genetics; behavioral and morphological traits could also be used to evaluate selection.
    - R4-10M: There are several resources on PIT tagging mortality that could be searched for information before tissue samples be taken with the current tagging process (to immediately begin collecting data).
        - Refer to: Thomas Archdeacon, Jason Remshardt, the Los Lunas Silvery Minnow Refugium (LLSMR), mainstream literature, etc.
    - R4-2H: literature search to support the development of the contingency plans and addressing of surplus fish
        - Refer to: FWS protocols, other programs, etc.

- R4-4H: literature search and summary of what we have done and what others have done in years with little to no wild fish; relates to the development of contingency plans

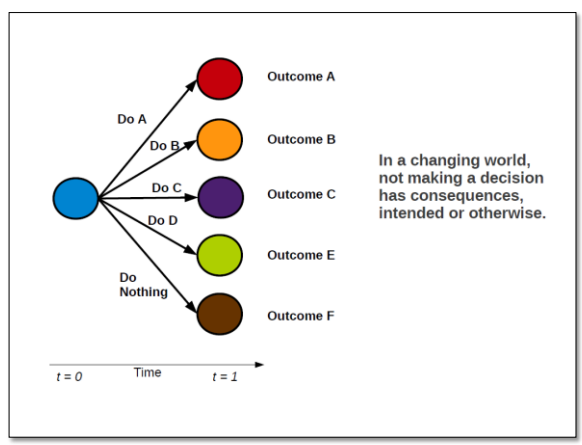
- *Research and/or Studies:*
  - Q1-5: Pilot Study #1: Develop larger scale, rapid throughput genetic methods; separate effort/contract required to run side-by-side for comparison to the microsatellites; scope to be developed for pilot project
  - Q3-5: Pilot Study #2: Assess whether different MRG reaches may have more natural spawning, rearing, retention, and recruitment than other reaches to assess whether habitat rather than augmentation stocking is more affecting the relatively low abundance of naturally spawned fish relative to hatchery spawned fish (Ryman-Laikre effect: having a large proportion of hatchery fish derived from a low number of breeders depresses the effective population size).
  - Q5-1 and Q7-3: a separate study to look at parentage and genetic diversity over time by different families;
  - Q8-3: evaluate the power of the existing markers to identify the number of parents and sibship relationships
  - Q13-6 and Q13-8: comparative genetics study on the eggs collected from the floodplain versus main channel.
  - Q13-12: Studies on growth rates of wild spawned fish; compare hatchery fish versus wild fish data
  - Q13-15: implement experimentation with controls to assess performance (survival, reproductive success) and assist real-time, adaptive management decision-making on a short-term basis
    - Intent: determine if fish from different facilities outperform others; compare techniques, cultures, etc. to determine if changes in process are warranted.
  - Q13-17: monitor same broodstock over multiple years (to test them repeatedly) to see how genetic expression might change in response to confinement, handling, hatchery conditions, etc.
    - Intent: (1) are we changing the organisms by keeping them in a hatchery setting year after year after year? and (2) do fish with certain genotypes disproportionately survive better through time?
  - Q15-1: Techniques to improve rapid analysis (genetics results)
    - Potentially modify contracts to specify "X number of samples to be delivered by Y date." Then the Program can select a lab/contractor based on capability of meeting the specified need.
  - Q16-1: Recognize problems before stocking - *related to timing of results of genetic analysis
  - R4-11bM and R4-10M: have an experimental study of paired spawning versus communal
    - Intent: to show how powerful the genetic markers are in estimating relatedness (to ensure that potential spawners in a group have low relatedness);
    - Approach: could be accomplished at one of the hatcheries
  - R4-12M: have a new study on marked fish and follow success by hatchery, stocking strategy, etc.
- *Identified Compiling Data Needs*
  - Q13-15: performance of fish from different hatcheries (survival, reproduction, etc.)
    - Refer to/Use: (1) 2016 BioPark and Dexter release information from Santa Ana site; (2) the 24-hour cage study (2014 or 2015); previous "soft-release" stocking practices;
    - Intentions: compare techniques, cultures, etc. to determine if changes in process are warranted.

ASSESSING THE ASSESSMENT

Megan Friggens
Four Corners Adaptation Forum
Durango CO
August 29th-30th



Uncertainties related to knowledge gaps or variability can act as a significant barrier to implementing actions in natural resource management



Uncertainties in Assessments

- Arise in identification and modeling sensitivities, levels of exposure, and adaptive capacity
- Combining various sources of data may magnify or reduce overall uncertainty
- A good assessment needs to recognize uncertainty and remain flexible to new information that may become available

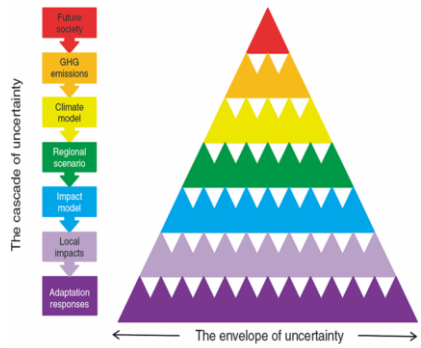


Figure 1: Robust adaptation to climate change, from Wilby and Dessai (2010)

Sources of Uncertainty in Assessments

Underlying Data

- Knowledge gaps
- Quantifiable errors in the data
- Uncertain futures (e.g. projections of human behavior)
- Unknown unknowns

Methodology

- Ambiguously defined concepts or terminology
- Approach for quantifying vulnerability

Other uncertainties exist when translating assessment outputs into adaptation options

How to deal with uncertainty

- Qualitatively describe
- Quantify by calculating a range of measures
- Quantify through models

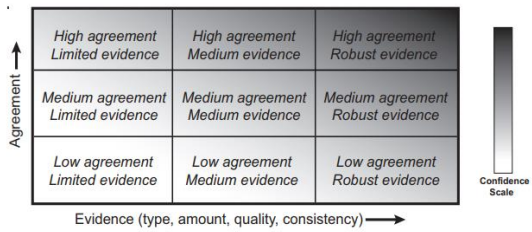


Figure 1: A depiction of evidence and agreement statements and their relationship to confidence. Confidence increases towards the top-right corner as suggested by the increasing strength of shading. Generally, evidence is most robust when there are multiple, consistent independent lines of high-quality evidence.

IPCC guidelines

Uncertainty in Four Corner Assessments

- Knowledge uncertainty and gaps (Not all data spatially explicit)
- We are not creating new information therefore assessment products are subject to measures taken to reduce uncertainty by data authors
- Where choice exists, we make "best" decision as to what to include in these assessment versions



We want to include as much information about the uncertainties inherent in assessments as possible

- Describe data uncertainties
- Address primary approaches for managing scientific uncertainty (Rouse and Norton 2010):
  - Identify source
  - Reduce uncertainty where possible
  - Acknowledge and manage residual or unavoidable uncertainty
- Assess need for additional measures in FC Assessments

http://www.tandfonline.com/doi/pdf/10.1080/14486563.2010.9725252?needAccess=true

Assess the Indicators

High Confidence ⟶ Low Confidence

[Data] We have enough information to measure indicator

[Process] We understand or can accurately measure relationship between indicator and focal resource

[Process] We understand or can accurately measure outcome of indicator for focal resource

Assess the Vulnerability Elements

High Confidence ⟶ Low Confidence

[Model] The vulnerability measures (Exposure, Sensitivity and Adaptive Capacity) provide meaningful information

Management actions can be undertaken to reduce Impact, Sensitivity or Adaptive capacity

By the end of today



- We cannot know all possible outcomes
- This does not mean we are without useful information
- Not making a decision has implications just as making a decision
- During this breakout session, we begin to engage the scientific uncertainty

  ->The acknowledgement step
- This is the first step towards thinking about adaptation strategies in light of uncertainties and may highlight need for additional measures of uncertainty

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Draft Science & Technical (S&T) Ad Hoc Group Charge
Population Monitoring Work Group Summary Report Ad Hoc Group

Approved by Science and Adaptive Management Committee (SAMC) on _____ XX, 2021.

Parent Committee

Science and Adaptive Management Committee

Ad Hoc Group Charge

Summarize findings and recommendations from the Population Monitoring Work Group (PMWG) Tasks 1-2 (2012–2020), and provide the SAMC with specific recommendations and remaining critical uncertainties.

In 2012, the Executive Committee tasked the PMWG with the following tasks:

> *PMWG Task 1. Conduct a Workshop on Catch-per-Unit-Effort (CPUE) Methodology used by the Current Rio Grande Silvery Minnow (RGSM) Population Monitoring Program*
>
> *PMWG Task 2. Review Middle Rio Grande Fish Population Monitoring Plan*

A third task evaluating refinements to the monitoring plan would have been initiated upon completion of Task 2, and thus, will not be included in this charge.

Membership

A. Criteria for Membership

Member of Population Monitoring Work Group (PMWG) familiar with group accomplishments and recommendations.

B. Member List

Rich Valdez (Lead), SWCA Environmental Consultants,
Thomas Archdeacon, U.S. Fish and Wildlife Service,
Andy Dean, U.S. Fish and Wildlife Service,
Eric Gonzalez, U.S. Bureau of Reclamation,
Grace Haggerty, New Mexico Interstate Stream Commission,
Mo Hobbs, Albuquerque Bernalillo County Water Utility Authority,
Joel Lusk, U.S. Fish and Wildlife Service,
Mike Marcus, Assessment Payers Association, Middle Rio Grande Conservancy District,
Anne Marken, Middle Rio Grande Conservancy District,
Mick Porter, U.S. Army Corps of Engineers,
Charles Yackulic, U.S. Geological Survey.

Iterative Task Development

- The summary report of findings directly addresses RGSM **Objective A-1**: Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.

- Recommendations provided will inform EC decisions and guide formation of new S&T Ad Hoc groups around prioritized critical uncertainties.
- Drafting of the report is currently underway.

Tasks and Deliverables

1. ***Delivery of Report***
   The S&T Ad Hoc Group will develop a summary report of the PMWG efforts (2012-2020) from PMWG Tasks 1 and 2. The report shall:
   - Summarize findings and recommendations, as well as remaining critical uncertainties.
   - Provide supporting evidence for findings and recommendations
   - Document opposing viewpoints (supported by evidence) among group members
   - Clearly define all assumptions.
   - Present critical uncertainties as research hypotheses. These may be accompanied by recommended experimental approaches, if desired.

   Objective of Task One
   This charge has one associated task: Delivery of report.

   Recommendations provided will inform EC decisions and guide formation of new S&T Ad Hoc groups around prioritized critical uncertainties.

   Deliverable(s): Draft Summary Report, Summarized list of findings and recommendations (one to two pages).

2. ***Presentation of Findings and Recommendations***
   The S&T Ad Hoc Group will present a summary of the findings and recommendations documented in the PMWG summary report.

   Objective of Task Two
   A presentation will more effectively communicate the findings and recommendations of the PMWG summary report to the SAMC.

   Deliverable(s):
   - A 1–2 page summary brief of the PMWG findings and recommendations
   - A PowerPoint presentation to the SAMC of the PMWG findings and recommendations

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Delivery of report	Review	DRAFT Summary Report to SAMC	March 1, 2021
	Review	DRAFT List of findings and recommendations	March 1, 2021
	Submit	FINAL Summary Report to EC	March 18, 2021
Presentation of Findings and Recommendations	Summary brief	1-2 page summary brief of PMWG findings and recommendations to SAMC and EC	March 18, 2021
	Presentation	PowerPoint presentation to the SAMC	March SAMC meeting

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Draft Science & Technical (S&T) Ad Hoc Group Charge
Rio Grande Silvery Minnow Population Model Ad Hoc Group

Approved by Science and Adaptive Management Committee (SAMC) on _____ XX, 2021.

Parent Committee

Science and Adaptive Management Committee

Ad Hoc Group Charge

Communicate and relate to MRGESCP Objectives the relevant findings/outputs resulting from the development of an Integrated Population Model (IPM) for the Rio Grande silvery minnow (RGSM) that uses population monitoring data to predict RGSM responses to different factors.

Membership

A. Criteria for membership

Familiarity with river conditions and habitat needs of RGSM in the Middle Rio Grande (MRG), knowledge of fisheries science and/or population dynamics.

B. Member List

Charles Yackulic (Lead), U.S. Geological Survey,
Rich Valdez, SWCA Environmental Consultants
Mo Hobbs, Albuquerque Bernalillo County Water Utility Authority
Thomas Archdeacon, U.S. Fish and Wildlife Service
Joel Lusk, U.S. Bureau of Reclamation
Eric Gonzales, U.S. Bureau of Reclamation
Mick Porter, U.S. Army Corps of Engineers

Iterative Task Development

1. This modeling effort will directly or indirectly inform three RGSM Objectives:
   - **Objective A-3**: Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.
   - **Objective A-4**: Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.
   - **Objective A-5**: Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.
2. To better define linkages to these objectives, please describe in greater detail the specific RGSM responses and factors being modeled.
3. To ensure appropriate application of the model, please describe the methods of development, as well as associated model assumptions and estimation error and/or bias.
4. Describe the knowledge gaps, quantifiable error, and critical uncertainties that influence the accuracy or precision of the parameter estimates.

Tasks and Deliverables

1. ***Expert Elicitation***
   Refine model parameters using a process of subject matter expert elicitation. Document methodologies, assumptions and supporting evidence.

   Objective of Task One
   Improve model performance and applicability by harnessing the institutional knowledge of subject matter experts, where empirical data may not exist.

   Deliverable(s): Report on expert elicitation process and findings in a brown bag seminar format.

2. ***Application of Integrated Population Model for RGSM in the MRG***
   Describe decision support using the IPM. What questions does the model help to answer? How much error is associated with an estimate? Do the model outputs inform other decision support tools? What critical information is needed to improve the model estimates?

   Objective of Task Two
   Demonstrate the utility of the IPM and bridge the gap between the abstract modeling exercise and practical management application.

   Deliverable(s):
   - Presentation of the IPM framework, model outputs and decision support scenarios as a brown bag seminar
   - One-to-two page fact sheet

3. ***Completed IPM (at the discretion of the contracting officer)***
   If given permission by the contracting officer (N.M. Interstate Stream Commission), the Collaborative Program will be given access to the completed IPM.

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Expert Elicitation		Report methods and findings in a brown bag seminar	March 2021
Application of IPM	Summary brief	1-2 page fact sheet	June 2021
	Oral presentation	Brown bag presentation	June 2021

Science and Adaptive Management Committee Meeting

March 3, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

Review of the MRG Fish Monitoring Plan Status Report of the PMWG to the EC [read-ahead, not included]

MRGESCP 2021 Objectives Workshop Summary [read-ahead]

MRGESCP 2021 Objectives Workshop SAMC Revision Summary [follow-up]

Draft MRGESCP S&T Ad Hoc Group Charge RGSM Genetics Ad Hoc [follow-up, draft]

Review of the MRG Fish Monitoring Plan Status Report of the PMWG to the EC [presentation, not included]

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC) Meeting
March 3, 2021
1:00 PM–4:00 PM

Meeting Location: *Zoom*
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Meeting ID: 898-359-3120; Passcode: 1251
Call-In: +1-669-900-6833

Meeting Agenda

1:00 – 1:10	**Welcome, Introductions and Agenda Review** ✓ **Decision**: Approve March 3, 2021 meeting agenda ✓ **Decision**: Approve January 13, 2021 meeting minutes	*Catherine Murphy, Program Support Team (PST)*
1:10 – 2:10	**Invited guest discussions** • Alyssa O'Brien and Colleen McRoberts – City of Albuquerque Open Space Division: CABQ habitat restoration site • Wade Wilson – U.S. Fish and Wildlife Service Southwestern Native Aquatic Resources and Recovery Center: Ad hoc group to add Rio Grande silvery minnow (RGSM) genetics elements to conceptual ecological model (CEM) • Rich Valdez - SWCA Environmental Consultants: RGSM Population Monitoring Ad Hoc Group Summary Report	*Group discussion*
2:10 – 2:40	**Science & Technical Ad Hoc Groups** • Discuss recommendation of RGSM Population Monitoring summary report • Update on RGSM Population Modeling Ad Hoc Group – lead Charles Yackulic, U.S. Geological Survey • Propose and discuss additional ad hoc group(s) o Adding level of uncertainty to avian CEMs o Others? Read-ahead: ☐ RGSM Population Monitoring Summary Report – Executive Summary ✓ **Decision:** Approve RGSM Population Monitoring summary report findings and recommendations for EC presentation	*Facilitated discussion*

- ➢ **Action:** C. Murphy will prepare SAMC recommendations for RGSM Pop. Mon. summary report

2:40 – 2:50 **Break**

2:50 – 3:50 **2021 Objectives Revisions from Workshop** *Facilitated discussion*

- Discuss utilization of objectives in AM relational database and development of Long-Term Plan
- Review, modify and approve revisions for MRGESCP Objectives
- Choose a strategy proposed during the workshops for potential development into an S&T Ad Hoc charge

Read-ahead:

- ☐ Compiled MRGESCP Objectives Workshop results

- ✓ **Decision**: Approve revisions for MRGESCP Objectives
- ➢ **Action**: C. Murphy will finalize list of objectives to present for EC approval
- ➢ **Action**: C. Murphy will draft an ad hoc charge for the strategy chosen from the Objectives Workshops

3:50 –4:00 **Meeting Summary and Action Items Review** *PST*

- ✓ **Decision:** Set SAMC meeting dates through 2021

4:00 **Adjourn**

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

March 3, 2021; 1:00 PM–4:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of March 3, 2021 SAMC meeting agenda
- ✓ Approval of January 13, 2021 SAMC meeting minutes

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Send Rich Valdez's Population Monitoring Work Group (PMWG) presentation to the SAMC	3/3/2021
SAMC	Submit comments on the PMWG presentation to Catherine Murphy	3/8/2021
PST	Send out the revised MRGESCP objectives	3/4/2021
SAMC	Submit revisions for the remaining MRGESCP objectives to Catherine M.	3/10/2021
PST	Send out a draft Science & Technical (S&T) Ad Hoc Group charge for incorporating genetics/augmentation into the Rio Grande silvery minnow conceptual ecological model	3/4/2021
SAMC	Review the charge and submit comments to Catherine M.	3/15/ 2021
PST	Send out a Doodle Poll to schedule a monthly SAMC meeting date	3/4/2021
SAMC	Fill out the Doodle Poll and notify the PST of any recurring obligations	3/8/2021

Next Meeting: April 2021

Meeting Summary

Welcome, Introductions, and Agenda Review

Catherine M., PST Science Coordinator and SAMC Facilitator, opened the meeting and led introductions. Catherine M. reviewed the March 3, 2021 meeting agenda and January 13, 2021 meeting minutes.

- ✓ **Decision**: The SAMC approved the January 13, 2021 SAMC meeting minutes
- ✓ **Decision**: The SAMC approved the March 3, 2021 SAMC meeting agenda

Invited Guest Discussions

Alyssa O'Brien and Colleen McRoberts, City of Albuquerque (CoA) Open Space Division, presented on several CoA projects. Main points are below:

- The CoA owns the Candelaria Nature Preserve and is in the process of getting a resource management plan approved by the City Council for the 170-acre parcel of land.
    - This land has implications for the wildlife along the Rio Grande, as 70-80 acres of farm fields will be turned into restored wildlife habitat.
    - The CoA is working with the Department of Transportation to widen existing wetlands to about 22 acres in the area.
- The CoA will purchase the Poole property in the San Antonio Oxbow (Oxbow) for a major public open space. There is a bluff area overlooking the Oxbow covered in fourwing saltbush, but it has important implications for the transitional zone for wildlife.
    - It will add an additional buffer for Oxbow, which is one of the only connected wetlands in the area.
    - The CoA has a FEMA grant of 1 million dollars from the Department of Homeland Security to treat 470 acres.
    - The CoA is currently taking requests for proposals for a project plan and prescription for the area.*
    - The CoA will work with the Ciudad Soil & Water Conservation District to employ a youth corps on ancestral lands (ex. Rocky Mountain Youth Corps) to implement the prescription, which will include targeting invasive species, mulching, planting, and reestablishing trails.
- The CoA will also look at creating new interpretive signage, improving river access, and developing informational kiosks.
- This summer, the CoA will work with University of New Mexico (UNM) students to do targeted monitoring, specifically around identifying invasive species.
    - This will help with the reassessment and reorganization of the Bosque Action Plan, a management plan developed in 1993. The new plan will last 5 years.
- The Bosque Montaño swale project will take place on the west side of the river, near the Bosque School, and will incorporate the Bosque Ecosystem Monitoring Program (BEMP). The CoA will work with UNM and BEMP to plant poles (e.g., cottonwood) and create a swale closer to the water table. The swale will be two-thirds acre.
    - There will be 93,000 cubic feet of soil available for distribution from this project.

Comments:

- Are cottonwoods primarily what will be planted? Cottonwoods are not good habitat for southwestern willow flycatchers (SWFL) and yellow-billed cuckoos. Willows are preferable.
    - There is no planting plan yet. The CoA is seeking input on which species to plant.*
    - The CoA has willow swales in other areas, particularly near outfalls.

        - Willow swales near outfalls attract SWFL because there is water.
- When swales are disconnected from the river, such as at the Rhodes property, there is a lot of salt accumulation and plants do not do well.
    - The planned CoA swale is fairly close to the river.
- How can the MRGESCP help?
    - Providing input and best management practices/recommendations.*
    - Suggestions for plants that would be beneficial to key species.*
    - Possibly use the Candelaria Nature Preserve for Pecos sunflower planting.*
- If a geodatabase is created, it can be incorporated into the geospatial mapper on the Program Portal.

Wade Wilson, U.S. Fish and Wildlife Service Southwestern Native Aquatic Resources and Recovery Center, presented on the genetics elements added to the RGSM CEM (see slides). Comments are below:

- Wade W. will share the presentation with Thomas Archdeacon, aquatic ecology expert on the SAMC, who was not present at the meeting.
- The RGSM CEM needs to be more complicated to capture everything going on.
- Each arrow on the graphical model is a relationship between a factor and a biotic response or another factor. Relationships are either known or uncertainties. Uncertainties need to be studied more if they are reducible.
- Each arrow will be a row in a table in the Adaptive Management Relational Database (AMRDB).
- The genetics components/relationships added can be linked to different projects.
- What is the next step?
    - To create a S&T Ad Hoc Group, led by Wade W., charged with further development on the RGSM CEM.
    - Catherine M. is working on the group's charge.
- Who picks the members of the ad hoc group?
    - The SAMC can send an initial list to Wade W., and Wade W. can recommend adding/removing members.

Rich Valdez, SWCA Environmental Consultants and former chair of the Population Monitoring Work Group (PMWG), presented on the RGSM Population Monitoring Ad Hoc Group Summary Report (see slides). Main points are below:

- The PMWG put together a summary report on its activities before being disbanded at the December Executive Committee (EC) meeting. Rich V. presented the findings and recommendations from this report to the SAMC.
- The report is being finalized and Rich V. is addressing the comments received. The final version will be provided to the SAMC for review before submitting to the EC.
- The PMWG was charged with three tasks: 1) conduct a workshop on catch-per-unit methodology, 2) review the Middle Rio Grande (MRG) fish monitoring plan (FMP), and 3) update the MRG FMP.
    - Task 2 is the focus of the summary report.
- Rich V. briefly showed the list of preliminary findings from the summary report (see slides).
- The long-term and consistent nature of the data from the FMP, starting in 1993, is its inherent value.
- There have been four science panels dealing with the RGSM. Recommendations from those science panels have been incorporated into the summary report.

- Rich V. listed the preliminary recommendations (see slides). The 15 recommendations will be narrowed down based on all comments received. Recommendations were split into three categories: modifications to sampling design or methodology, modeling and analyses to resolve uncertainty, additional evaluations for future monitoring.
    - Comments on modifications to sampling design or methodology recommendations:
        - #2 Comment - In terms of the 60 sites recommended, the value added diminishes relative to cost after 60 sites.
            - Monitoring over 20 sites improves precision, but returns start to diminish between 50-60 sites. This will need to be looked at further before sites are added.
            - When presenting this to the EC, phrase it so the value added is clear. Hone in on which things are important as far as next steps, so there is a translation from science to management.
        - At U.S. Bureau of Reclamation (Reclamation), there is a perception that a lot of money is already being spent on monitoring. Getting additional funding could be difficult.
            - There is another recommendation to evaluate the sampling design to look at trade-offs (e.g., doing more sampling in October versus other months).
        - Reclamation is also looking into bed material sampling and considering how to capture coarsening over time. In sampling, there may be opportunities to consider geomorphology.
    - Comments on modeling and analyses to resolve uncertainty recommendations:
        - Given how much work has been done to optimize sampling design (in terms of workshops, science panels, etc.), it may be difficult to make any changes.
            - No science panels set up mock sampling designs to address this.
    - Comments on additional evaluations for future monitoring recommendations:
        - #12 Comment – More 2D models are being developed with available data, which can represent in-channel features. Getting data to calibrate those models is important.

Closing comments:

- Suggestion to begin the presentation to the EC with the last slide, which summarizes the PMWG's determinations.
- Suggestion to reword the last bullet to specify uncertainties that cannot be resolved through monitoring.
- The SAMC will come up with a list of ad hoc groups that can get at the issues presented by the PWMG. Rich V. can advise on that list.*
- The SAMC will review the final report and prepare a list of recommendations, which includes potential ad hoc groups, for presentation to the EC.
- The SAMC will review Rich V's slides and send comments to Catherine M.
- The presentation could include more about what was learned and what was done right.
- As a reminder, the MRGESCP does not make management decisions, but can provide recommendations to those who do.

- **Action Item**: The PST will send Rich Valdez's PMWG presentation to the SAMC
- **Action Item**: The SAMC will submit comments on the PMWG presentation to Catherine Murphy

Science & Technical Ad Hoc Groups

Catherine M. briefly reviewed the S&T Ad Hoc Groups to be created. Main points below:

- The PST will send out the draft S&T Ad Hoc Group charge for incorporating genetics/augmentation into the RGSM CEM for review.
- Catherine M. contacted Charles Yackulic, U.S. Geological Survey, about the RGSM Population Modeling Ad Hoc Group. Catherine M. read his response email to the SAMC.
    - Charles Y. is making suggested changes to the model, including adding age class and salvage data, and incorporating results from expert elicitation results. He will report to the small group in the near future.
- Proposal for a group to add the level of uncertainty in relationships between drivers/stressors and biotic responses in the avian CEMs. The original group can be reconvened to flesh out the CEMs, with the purpose of putting them in a format that can be incorporated into the AMRDB.

➢ **Action Item**: The PST will send out a draft S&T Ad Hoc Group charge for incorporating genetics/augmentation into the RGSM CEM

➢ **Action Item**: The SAMC will review the charge and submit comments to Catherine Murphy

2021 Objectives Revisions from Workshop

The SAMC reviewed the revised objectives and made changes. Main points are below:

- The SAMC were mindful that objectives were on the same level in terms of hierarchy and detail, and that they were not strategies.
- Objective A-1 comments:
    - Response to the question of whether this sub-objective should be its own objective: Understand the limits of the long-term monitoring data. If there is high uncertainty in the analysis and results, then the next step is to find out how to resolve that uncertainty, and identify research that can help reduce that uncertainty.
        - It is specific about reducing uncertainty, so it should be an objective.
        - It is not only related to the RGSM. There is avian data as well.
        - It is more of a scientific consideration for all data, and could be part of a checklist of whether data is appropriate for the question being asked.
        - This issue may be addressed by an S&T Ad Hoc Group.
    - For some there is a huge distinction between CPUE and abundance.
        - Can ‘population’ be used as a catchall for abundance and CPUE?
            - Ultimately, abundance is what you want to know, whether you get there or not.
    - Should it be standard to specify reaches in objectives by reach?
        - RGSM objective groups were adamant about specifying reaches, as management and hydraulics change across reach. This is less important for birds.
    - Projects in the Project Bank will be prioritized based on links to MRGESCP objectives and other elements.
- Objective A-2 comments:
    - Change ‘research’ to ‘increase understanding of.’
    - Take out ‘seven’, in case there are additional life history traits.
        - Each of the seven life history traits could be part of a strategy.

    - The qualifier 'increase the probability of recovery' may not need to be included if it is inherent in the Science & Adaptive Management Plan.
    - Cut out 'scientific tools' as it is vague.
- Objective A-3 comments:
    - Add in 'of RGSM.'
    - There was some debate about using 'self-sustaining' during the Objectives Workshop. The group decided everything the MRGESCP does should be under the umbrella of recovery and opted not to use the term.
    - Revise to "Determine the relationship between base flow and the survival and recruitment…"
        - Flow needs can vary, so it is better to add in 'relationship.'
- Objective A-4 comments:
    - Catherine M.'s suggestion's
        - Replace 'support' with 'evaluate.'
        - Remove 'at least one research/modeling effort per year' and 'on an annual basis' to be consistent with other objectives.
            - Groups decided to make objectives broader and strategies S.M.A.R.T.er.
    - Replace 'optimal' with 'suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph)' as suggested at the Objectives Workshop.
    - The Objective Workshop group wanted to acknowledge the lack of flexibility in the system and included 'constraints and opportunities.'
    - There was discussion about using 'evaluate' versus 'research/modeling.' The SAMC decided to use 'evaluate.'
- Objective A-5 comments:
    - There was a suggested way to combine both parts of the objective: Refine existing research and modeling efforts to develop a range of options for increasing available habitat quality and quantity at life-stage limiting flow regimes.
        - This implies we already understand the quantity and quality of available habitat.
        - A-5.1 deals with trying to understand the quantity and quality of habitat available at different flow regimes.
            - One of the strategies could focus on better understanding this.
    - A-5.2 is dependent on A-5.1.
    - It is better to keep the objective broad and not limited to low flows. This objective deals with a physical manifestation of flows on the ground versus the spring hydrograph.
    - If objective statements are combined, we could add a strategy for dealing with refugia at life-stage limiting flow.
    - The second objective was developed from discussion about the first, so separating them may result in something being lost.
    - The SAMC decided to approve the original statements.
- Objective B-1 comments:
    - Remove 'designated critical habitat' as suggested at the Objective Workshop. Monitoring should occur wherever SWFL are present.
    - Specifics about monitoring will be in the strategies.
- Objective B-2 comments:
    - The objective should not overlap with the monitoring objective. Instead, it should focus on determining habitat availability within the MRG.
- Objective B-3 comments:

    - Southwestern willow flycatcher do not move around much. As a result, foraging and nesting habitat is nearly identical.
        - For the most part, the goal is to provide breeding habitat.
        - Suggestion to change to 'optimal breeding habitat' and take out '(i.e., migratory, foraging and nesting).'
- Objective C-1 comments:
    - Leave in qualifiers '(i.e., migratory, foraging and nesting)' for the yellow-billed cuckoo (YBCU) because they move around a lot over a large area. Emphasis should be on the importance of foraging habitat.
        - 'Migratory' can be taken out.
    - Add 'on landscape and microhabitat levels' as they have such a large range.
    - During the Objective Workshop, someone asked whether there should be an additional YBCU objective on improving understanding of its life history.
        - This might be captured in the third statement.
- Objective G-1 comments:
    - Suggestion to delete this objective as there is not anything specific the MRGESCP can do to support the conservation pool at the Abiquiu Reservoir.
    - Instead, the objective was broadened to support of all efforts that enhance operational flexibility for water managers in support of species.
- SAMC members will review the remaining objectives and send comments to Catherine M.

- **Action Item**: The PST will send out the revised MRGESCP objectives
- **Action Item**: The SAMC will submit revisions for the remaining MRGESCP objectives to Catherine Murphy

Odds, Ends, and Announcements

- The SAMC will schedule a monthly meeting date for the rest of the year, to make it easier for members to schedule ahead.

- **Action Item**: The PST will send out a Doodle Poll to schedule a monthly SAMC meeting date
- **Action Item**: The SAMC will fill out the Doodle Poll and notify the PST of any recurring obligations

*Requests for SAMC input are highlighted blue.

Meeting Participants

Alan Hatch	EC *Ex Officio* Member
Alyssa O'Brien	City of Albuquerque Open Space Division
Ari Posner	Geomorphology Expert
Catherine Murphy	Program Support Team, SAMC Facilitator
Colleen McRoberts	City of Albuquerque Open Space Division
David Moore	Terrestrial Ecology Expert
Debbie Lee	Program Support Team
Meaghan Conway	Ecosystem Function Expert
Melissa Welsch	Program Support Team
Michelle Tuineau	Program Support Team
Mo Hobbs	Aquatic Ecology Expert
Rich Valdez	SWCA Environmental Consultants
Ryan Gronewold	Hydrology Expert
Wade Wilson	Southwestern Native Aquatic Resources and Recovery Center

RGSM Objective A-1

Original statement: *Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.*

Revised statement:

Estimate the abundance of augmented and wild born RGSM populations in the Angostura, Isleta, and San Acacia reaches from year to year.

- Key questions/takeaways:
  - Relationship of CPUE and abundance?
  - How does mesohabitat availability change at different discharges?
  - Monitoring data may be too coarse to answer more specific analysis questions (i.e. drying and summer survival).
- Sub-objective: Understand the limits of the long-term monitoring data. If there is high uncertainty in the analysis and results, then the next step is to find out how to resolve that uncertainty, and identify research that can help reduce that uncertainty.

Breakout Group: Alison Hutson, Casey Ish, Stephen Zipper, Ryan Gronewold, Charles Yackulic, Debra Hill, Hector Garcia

A-1 Notes:

- The group questioned whether some analysis questions were in the bounds of what the data could answer.
- The original statement is relevant to the goal of having a self-sustaining RGSM population, but it could be more relevant to each reach.
- The monitoring data is year-to-year, but when doing an analysis, may want to look at specific years.
- There is a challenge in the relationship between CPUE and abundance. CPUE is 100 m^2, and amount of water in river can change.
- The group discussed analysis a lot. The other objectives better address impacts of habitat availability or flow variables on the RGSM population.
- This is a broad, coarse dataset. You can see how it's impacted each year based on big variables, but for different types of research, the data may be too coarse and need to be refined.
  - Need to understand limits of data.

A-1 Comments:

- Does abundance refer to relative abundance (CPUE) or total population estimate?
  - Ideally, abundance (CPUE) but relative abundance can be used if there are challenges.
- Looking at catchability of RGSM under different conditions may help address mesohabitat availability change at different discharges. How depth and velocity change catchability may help interpret data from different reaches.
  - This can apply to strategies at the reach level.
- Add uncertainty and looking at biases to capture noise in data.
  - The Sub-objective is related to this.

RGSM Objective A-2

Original statement: *Continue to support research into the life history of the RGSM to further inform management of the species.*

Revised statement:

Research how the seven life history traits of the RGSM change over time and space, and use the results to update the scientific tools to inform management of the species in a way that increases the probability of recovery.

- The 7 life history traits are links to the fitness of the species.
- Fitness: ability of an organism (or population) to survive and reproduce in the environment

Comments from Chat Window:

10:42:52 From Grace Haggerty New Mexico Interstate Stream Commission to Everyone: Can the 7 life history traits be listed in the statement? You need to communicate with non biologists.
10:43:42 From Ari Posner BOR to Everyone: could you talk about how those change over time and space
10:47:27 From Mick Porter - USACE to Everyone: nice framework for looking at the RGSM

Notes by Julie:

S: Contributing to research to understand the seven life history traits and how we can affect them so we can increase the probability of recovery. R: Life history traits are what will be used to inform the conceptual models/population viability analysis. We have to understand these to be able to know how we can affect them (good or bad). How and where can we affect them - management? Length of life – question: can we affect that positive? M: measure within each of the traits (e.g., measure what our practices are doing, what is/how are we affecting their growth pattern, offspring). R: to further inform management of the species

Fitting this into a SMART goal is tough because objectives seem to be meant to be broad, whereas SMART may fit strategies better.

Debated measurement criterion:

- M is hard – how do you measure success?
    - If you have a bad year, do you fail?
    - When we don't put any money to this goal, do we fail?
- Measure should be based on the science and not the administration: We need to know what happens during failure years – why is it failing in this trait? If we can pin down where – there is always something to learn.

Debated the word support – what does support mean?

- Financial – the Program doesn't have a budget, the signatories do, so we don't use this as a measure of support
- The Program is a science-based organization and sharing information – scientifically, and collaborating around resources to get work done
- Use the results of work completed to feed into the tools (conceptual models, PVA)
- If you had all the money in the world and all the power you needed, what would you do scientifically?

Breakout Group: Nathan Schroeder, Anne Marken, Liza Yazzie, Maya Pinon, Reynalden Delgarito, Julie Dickey

A-2 Notes:

- The objective could not hit every SMART letter, but strategies can.
- Decided to focus on research instead of supporting research. The Program is already supporting research and it is difficult to measure support.
- Made the objective specific to seven life history traits, which are measurable.
    - No traits are completely unknown.
- To be relevant for management, we need to know how traits are changing over space and time, and whether we can affect them.
- Life history traits are size at birth; growth pattern; age and size at maturity; number, size, and sex ratio of offspring; age- and size-specific reproductive investment; age- and size-specific mortality; and length of life.

A-2 Comments:

- Do growth rates change in different areas (e.g., Albuquerque and San Antonio)?
    - That needs to be answered with the strategies.
    - Traits are likely different in different reaches due to variability in water availability, food resources, temperature, etc.
- Many efforts are already addressing this objective; they may be included in the strategies.
- You need to focus temporal and spatial scale to fit the species you are working with.

RGSM Objective A-3

Original statement: *Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.*

Revised statement:
Determine the base flow needed for survival and recruitment in the Middle Rio Grande.

Suggested Strategies:

- Review current research publications and develop hypotheses to determine the relationship between base flow (outside of spring runoff) and habitat quality (suitability) and availability. (1 year)
- Support development of models, such as integrated population models, habitat suitability models, and hydrologic models, to analyze seasonal and minimal habitat availability during base flow periods by reach, in consideration of variable annual water supply. (1-3 years, depending on model)
- Collect field measurements of habitat, flow, and population data to validate and refine modeling efforts, including routine monitoring and experimental manipulations. (ongoing with annual evaluation, following the AM cycle)

- Clearly define assumptions and uncertainties involving minimum base flow, habitat quality and availability, and a self-sustaining population (including survival rate, recruitment, etc.) as defined by the USFWS in the RGSM Recovery Plan. (ongoing with annual evaluation, following the AM cycle)

Breakout Group: Ara Winter, Ashlee Rudolph, Mark Kelly, Mike Marcus, Rich Valdez, Alyssa O'Brien, Guilherme Dias, Debbie Lee

A-3 Notes:

- The statement was too long, shortened to make it more SMART.
- Developed a basic objective and added detail to strategies.
- Expanded on what base flow means in strategies.
- The group discussed what a self-sustaining population is. Decided to defer to the USFWS definition.
- The objective does not split by reach, as self-sustaining population applies to all MRG, but analyses can split by reach.
- Four SMART strategies were developed, three from preliminary, one new.

A-3 Comments:

- Making objectives SMART can make them convoluted. Detail can be added to strategies instead.
- Self-sustaining is difficult to define. Need further discussion to make it consistent in all objectives.
    - Definition should be decided in collaboration with USFWS.
- The SAMC will pull from different approaches to revising objective statements to standardize the process.
- Base flow could be zero in portions of the Rio Grande at certain times of year. Is base flow equivalent to environmental flow or desired flow?
    - Base flow is tied to the hydrological objective in the 2016 BO that identifies two strategies: production and survival strategy. Base flow is part of survival strategy.

RGSM Objective A-4

Original statement: *Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.*

Revised statement:

Evaluate at least one research/modeling effort per year to inform suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph), given system constraints and opportunities, needed to cue spawning and recruitment for the population.

Suggested Strategies:

- Determine thresholds for each component of the hydrograph based on river conditions (previous, current, forecast).
- Use spawning cues and recruitment conditions determined in Obj A-2, and quality/quantity of habitat determined by Obj A-5.
- Management options – identify policy constraints, volume, etc. based on river conditions (previous, current, forecast).
- Consider management and river conditions by reach to refine recommendations.
- Low flow years: specify magnitude threshold with decision point for recommending allocation of resources based on severity of river conditions.
- Opportunities for storing water from spring runoff as potential conservation tool.
- Jiggle (reach specific) –design study to assess the success of this management action; follow-up to compare/contrast.

Comments from Chat Window:
11:39:51 From Mick Porter - USACE to Everyone: "suitable environmental flow" is probably more useful than "optimal"

Breakout Group: Catherine Murphy, Ari Posner, Grace Haggerty, Dale Strickland, Eric Gonzalez, Carolyn Donnelly, Ryan Gronewald

A-4 Notes:

- Will likely drop “support” and go straight to verbs that are more active.
- Wanted to put a measurable target to hold the Program accountable. At least one effort per year will help us continue addressing the shape of the hydrograph.
- We can apply what we have learned to science the next year.
- The objective is focused on the spring hydrograph (timing, duration, magnitude) but info from other objectives (spawning cues, recruitment conditions) is needed.
    - This was captured in a strategy for incorporating information.
- Another strategy for determining thresholds for each component of the hydrograph (timing, duration, magnitude). We need to determine ideal peaks for each.
- The group included constraints and opportunities in the objective to tie in policy and river conditions.
- The group wanted a more measurable response for time scale, removed species recruitment rates.
- Reach specificity is in strategies versus objective.
- For other strategy, wanted to look at low flow years in particular to create decision point for resource allocation recommendations.
- Another strategy is a study to assess the success of the jiggle.
    - The jiggle is reach-specific, which makes for a good strategy.

A-4 Comments:

- A group is working to shape the hydrograph using Charles Yackulic’s model.

RGSM Objective A-5

Original statement: *Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.*

Revised statements:

A-5a Refine existing research and modeling efforts to understand the quantity and quality of habitat available at different flow regimes by 2030.

A-5b Develop a range of options for increasing habitat availability and refugia at life stage limiting flow regimes for all life stages by 2030.

Suggested A5a Strategies:

- Support ongoing hydraulic modeling efforts to quantify available habitat.
- Obtain remote sensing data to add to modeling efforts (there is a need for this at low flows?), including coordinated ground truthing
- Include ground truthing of x sites to measure depth, velocity, river width, and transects to measure flow, (potentially adding to existing effort).

Suggested A5b Strategies:

- Investigate potential strategies for returning agricultural water to increase habitat refugia.
- Investigate strategies to create floodplain structures that increase habitat complexity.
- Support projects (ISARO) to combine low flow conveyance channels to maintain summer flows.

Notes by Melissa:

- Mick brought up the flow relationship with the Central gage and how BR does a LIDAR survey in winter but not at lower flow times. If LIDAR done at different times of the year could see the bottom of the river and compare flow rate when bank full and when single thread
- There was discussion about the depths, velocities, microflows, and what the underwater habitat is like in lower flow scenarios
- Quantina mentioned that minnows were found using outfalls. Megan said the outfalls she sampled recently just had 2 year olds, this led to acknowledgment that different reaches had different flow dynamics
- The discussion of the LIDAR possibilities and the outfall results led to the formation of strategies that were more detail-oriented than the strategies

Breakout Group: Meaghan Conway, Mick Porter, Megan Osborne, Quantina Martine, Andy Dean, Nathan Schroeder, Cynthia Naha

A-5 Notes:

- First thing group did was change “needed” to “available”.
- The group discussed existing efforts going on.
    - Utah State and Colorado State.

  - Instead of contributing to research, decided to acknowledge the research and modeling out there.
- There is a good understanding of recruitment but less of survival, especially for low flow modeling.
- Group discussed limitation of how fish use habitat versus how we catch them.
- We need to figure out how available habitat area changes as flow changes from bank flow to single threaded channel.
- Group discussed constraints of water availability, and how to manage within mandates.
- Most discussion was around modeling habitat availability at low flows, for survival rather than recruitment.

A-5 Comments:

- Is the 2nd bullet under A-5a “obtain remote sensing data" referencing physical habitat or occurrence of fish relative to habitat?
  - One of the challenges and points of interest is looking at habitat availability at low flows.
  - Reclamation flies the river during winter (flows at 400 to 800 cfs). Cannot use Lidar in winter because of turbidity, but if we wait until low flow (single thread), can use Lidar to look at topography that would be inundated at higher flow. Want to use Lidar topography and model as if inundated to determine habitat.
    - Suggestion to add fish sampling component.
    - That captures one element in time, but things change. Are you trying to get a percentage?
      - The Lidar can help with hydraulic model of habitat as flows go up and down. It would provide relative amounts.
    - Is it possible to do measurements from photos?
      - The aerial photo can give info on river width, but we need Lidar for Bathymetry. Could also use drones.
      - Lidar enables 2D models versus 1D models, more spatial representation of depth and velocity.
    - Need to be aware that the river changes year-to-year and under different flows.
    - Suggestion to use underwater vehicles, but need at least a foot of water. Vehicles measure water quality parameters as well.

Day 1 - Closing Discussion:

- Workshop attendees may be called on for feedback as the SAMC works on objectives.
- Suggestion for change to Objective A-3: use “survival and recruitment” instead of “self-sustaining population” (similar to A-4), as it ties more into an objective format. The Program goal already specifies a self-sustaining population of RGSM.
  - This appropriate change should affect other objectives.
- Can Objective A-1 address the question of what a self-sustaining population is?
  - Is that something the monitoring data can address?
    - The objective should help us achieve a self-sustaining population.
    - The data just gives you the numbers, but does not tell you why. So many parameters affect CPUE.

  - A statement on self-sustaining population would make it is easier to tailor objectives.
  - Self-sustaining is a recovery term. If there is an objective that aims to achieve that, it enters into recovery plan territory.
- There needs to be an objective that addresses the genetic effects of augmentation.
  - The objective could be to determine the effect of augmentation on the RGSM population.
  - Could possibly add other species management efforts, like fish rescue.
  - Suggestion to shift the focus of A-1 objective to general species management, which would include those aspects.

RGSM New Objective? Or add this under A-1?

Original statement: *NA*

Suggested statement:

Monitor/Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM genetic diversity.

OR

Monitor/Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM population viability.

SWFL Objective B-1

Original statement: *Continue monitoring for SWFL in designated critical habitat areas to track territories in the MRG management unit of the Rio Grande recovery unit.*

Revised statement:
Monitor for SWFL in designated critical habitat in the MRG management unit of the Rio Grande recovery unit.

Suggested Strategies:

- Conduct annual SWFL surveys in designated critical habitat areas to track territories in the MRG management unit.
- Conduct annual SWFL nest monitoring in designated critical habitat areas to track population dynamics in the MRG management unit.
- Develop a tiered strategy for surveys at varying levels of effort to account for years when the full effort cannot be implemented, to prioritize "core" populations and ensure that every site in the MRG is surveyed at least once every three years. (within a year)
- Analyze available survey data annually to ensure SWFL territories are not decreasing in the MRG management unit. If the number of territories are decreasing, review habitat areas where territories have decreased to make recommendations for improving habitat to increase SWFL territories.
- Analyze available nest monitoring data annually to determine limiting factors to SWFL population growth and sustainability.

Breakout Group: Dave Moore, Ari Posner, Eric Gonzales, Maya Pinon, Debbie Lee

B-1 Notes:

- The group broadened the objective and included additional strategies.
- Monitoring is not just tracking territories, but determining how birds are doing in nesting attempts relative to habitat.
- Revised statement changed to "monitor" instead of "continue monitoring," as funding is on-and-off. Surveys are not always done throughout the MRG.
- The group included strategies to conduct annual SWFL surveys and nest monitoring in designated territories.
- Another strategy included for taking surveys at different levels of effort to ensure core populations are still monitored when the full effort cannot be made.
    - Previous efforts have been able to monitor the entire MRG, but not recently.
    - We always want a general grasp on the population.
    - USFWS is shifting towards a full survey every three years when funding is not available.
- We need to analyze annual survey data to ensure SWFL territories are not decreasing, and make recommendations to improve habitat if they are.
- We need to analyze nest monitoring to determine limiting factors to SWFL population growth.
    - Limiting factor are mostly habitat-related, but there are sometimes other factors (e.g., cowbird parasitism)

B-1 Comments:

- The Program is not in the 2016 BO, and should not be as connected to what happens in the BO. Suggestion for the Program to return to looking at the species in the Program area versus just the MRG.
    - One of the Program strategies could be to figure out what other monitoring is occurring for the SWFL to determine how other units are doing. As climate changes, we may need to look outside the MRG to find habitat.
- We need to consider focusing habitat areas in more than one place, and think more strategically about spreading the birds out. It is not easy but beneficial.
    - It is better now that it was before, 90% of the population used to be in one area. Now, populations are growing in other areas.
    - SWFL do not like to travel far, they prefer hopping close by.
- The objective is too narrow. Science takes place outside of designated critical habitat. For example, there are SWFL at the Pueblos that should be monitored.
    - The Program's jurisdiction does not meet the Pueblos, but under the new Science & Adaptive Management Plan, the Program will focus on using science to inform management. The Program's science is not limited by jurisdictional lines.

SWFL Objective B-2

Original statement: *Continue monitoring critical SWFL habitat and contribute to research on the impacts from non-native and exotic species on SWFL recovery.*

Revised statements:

Monitor available SWFL habitat to determine habitat availability within the MRG.

- This objective informs Objective B-3.

Suggested Strategies:

- Every 3-4 years, determine the availability of suitable, moderately suitable, and unsuitable SWFL habitat patches in the MRG management unit.
- Every 3-4 years, ground truth vegetation remote sensing models and refine models.
- Maintain and update Hink & Ohmart maps on the Program Portal as new data is acquired.

Comments from Chat Window:

10:53:06 From Meaghan Conway to Everyone: https://nhnm.unm.edu/riparian/nmripmap
10:56:18 From Meaghan Conway to Everyone: The project summary should link to a document with and overview of the methods used to create the map

Breakout Group: Dave Moore, Ari Posner, Eric Gonzales, Maya Pinon, Debbie Lee

B-2 Notes:

- The group decided native and exotic species were an issue to all listed species and the health of the whole riparian system.
    - The group created a new objective to address this.

- Objective B-2 was revised to specify monitor for SWFL habitat availability to inform restoration activities in the MRG.

SWFL New Objective

Original statement: *NA*

Suggested statement:

Determine the impacts from non-native vegetation on listed species' habitat availability and population dynamics.

Suggested Strategies:

- Maintain and update Hink & Ohmart maps on the Program Portal as new data is acquired.
- Research the relationship of non-native vegetation on lited species' habitat availability.
- Research the relationship of non-native vegetation on listed species' population dynamics.
- Make management recommendations to minimize and mitigate negative impacts from non-native species to the listed species in the MRG.

New Objective Notes:

- The new objective was spawned from Objective B-2.
- A strategy was included to determine the distribution of non-native vegetation and overlap of vegetation with listed species' habitat.
- Another strategy included to investigate potential interactions between listed species and non-native vegetation.

New Objective Comments:

- Heritage New Mexico is developing a riparian habitat vegetation map that is available for download. The MRG area is done, and lists native, non-native, mixed.
    - There is overlap with the Hink and Ohmart map.
    - What was methodology for putting the map together?
        - Satellite data, Lidar, ground-truthing, classification modelling, vegetation height model.
    - The biggest gap in data was underneath the top of the canopy. That data is tough to get with aerial imagery.

SWFL Objective B-3

Original statement*: Support large-scale restoration efforts to protect and expand SWFL habitat in the MRG.*

Revised statements:

B-3a Characterize optimal habitat (i.e., migratory, foraging and nesting) conditions in currently occupied SWFL locations to inform restoration.

B-3b Manage successional processes that maintain existing SWFL habitat (i.e., migratory, foraging and nesting) in the Program Area.

Suggested Strategies:

- Determine factors that cause habitat loss, accounting for successional processes
- Maintenance and adaptive management…
- Develop record of past activities and findings for reference (success vs. failure) and planning (modeling)

B-3c Expand SWFL habitat (i.e., migratory, foraging and nesting) through restoration efforts in the Program Area.

Suggested Strategies:

- Investigate opportunities to expand spatial scale for study/recovery
- Invite San Juan Conservation District? and others to present brown bags seminars on SWFL conservation for information exchange.
- Identify water availability and resources for creating SWFL habitat.

Note: Look at how habitat overlaps with other species (e.g., YBCU, NMMJM, others).

Comments from Chat Window:

11:06:03 From Hector Garcia to Everyone: Through the years the birds have also selected what we humans would say is not good habitat. So statistics tells us preferred but the bird has the final say. Key is how many HR projects have we done, how many have the right veg structure, and how many have birds nested in? Success is NOT only bird is using, providing the appropriate veg structure is success to us HR builders.

Breakout Group: Mo Hobbs, Meaghan Conway, Grace Haggerty, Amy Erickson, Andy Dean, Catherine Murphy

B-3 Notes:

- The group had a similar conversation as others to determine whether to use “MRG” or “Program area.”
- The strategies developed for the first objective could look at specific habitat for specific life history needs.

- The first objective focused on locations SWFL occupy. Currently, some restoration occurs in areas SWFL do not occupy. We want to know the ideal environmental triggers for SWFL habitat restoration.
- The group also wanted to look at habitat overlap with other species.
- The objectives are focused on expanding habitat and knowing when habitat is successful.

B-3 Comments:

- How do the objectives overlap with the other SWFL objectives?
    - There is some overlap with habitat mapping, but the objectives need to be laid out and consolidated, if possible.
- Various studies have been done on characterizing optimal habitat; that data needs to be brought in.
    - Objective 1 should focus on incorporating that information into useful activities moving forward. The verb in the objective needs to change.
    - Past SWFL studies used various methods.
        - If we knew how we wanted to analyze data, could methods be standardized?
            - Making recommendations for what data should be collected and how would be a good thing.

YBCU Objective C-1

Original statement*: Contribute to research and understanding of habitat needs for the YBCU.*

Revised statements:

C-1a Characterize optimal habitat (i.e., migratory, foraging and nesting) conditions in currently occupied YBCU locations to inform restoration.

Suggested Strategies:

- Strengthen understanding of effects from stressors and drivers (e.g., anthropogenic activities, vegetation structure/species, patch size, and prey abundance) on all life stages?

C-1b Determine successional processes that maintain existing YBCU habitat (i.e., migratory, foraging and nesting) in the Program Area.

C-1c Intensify/expand monitoring program/effort for YBCU.

Suggested Strategies:

- Increase use of tracking technology, etc.
- Determine YBCU habitat use outside of areas used by SWFL?

Next Steps: Protect existing habitat; Outreach concerning seasonal foraging area use for YBCU (promote recommended land-use practices: no-till, organic, noise reduction).

Comments from Chat Window:
11:10:30 From Grace Haggerty New Mexico Interstate Stream Commission to Everyone: Vicky may have had some recommendations not considered here. Genetics and possibly modeling efforts.
11:12:15 From Ari Posner BOR to Everyone: Do we have a strong understanding of their life-history?
11:34:18 From David Moore - BOR to Everyone: Ari - cuckoo life history? Somewhat. Knowledge of habitat requirements is not great.
11:35:25 From Ari Posner BOR to Everyone: Yes, I was thinking we need an objective to improve understanding of the Cuckoo life-history/develop an ecological model.
11:36:03 From Debbie Lee to Everyone: The Program did develop a CEM for YBCU life history, but there are a lot of uncertainties embedded in there.

Breakout Group: Mo Hobbs, Meaghan Conway, Grace Haggerty, Amy Erickson, Andy Dean, Catherine Murphy

C-1 Notes:

- The group changed vague wording, and copied a lot from the previous objective.
- One strategy is to strengthen understanding of stressors and drivers identified in the YBCU conceptual ecological model.
- As less is known about this species, there is a focus on expanding monitoring.
- SWFL and YBCU habitat overlap but the YBCU has a much larger territory.

C-1 Comments:

- Birds have selected habitat that we would not deem good. The key is determining how many habitat restoration projects have been done, how many have the right vegetation structures, and how have nested birds.
    - That may be captured in the first YBCU objective.
- We know a lot less about YBCU, and we have been trying to figure out more about them for years.
    - We are starting from a lower knowledge base than the SWFL.
- We may want to look to things Vicky Ryan recommended. She advocated for a modeling effort and discussed genetics.
    - The genetics conversation was probably related to eastern versus western YBCU. The conversation has largely been put to rest.
    - The conversation came up again last year when the USFWS was considering whether to continue to list the Western YBCU.
- How many other entities are working with the YBCU like NM?
    - NM has been extremely proactive and are in the top tier of research related to the species.
    - We need comparable data from other locations.
    - We are only six years out from listing, and more information is still being discovered. YBCU are being found in unexpected places.

NMMJM Objective D-1

Original statement: *Contribute to efforts to expand habitat and preserve existing habitat in the MRG.*

Revised statements:

D-1a Initiate and support NMMJM monitoring efforts to identify relevant habitat features, potential additional habitat, and existing populations.

D-1b Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

Suggested Strategies:

- Expand on existing vegetation/habitat monitoring efforts to include vegetation characteristics relevant to NMMJM (e.g. herbaceous vegetation).
- Analyze monitoring data to determine potential habitat.
- Identify and survey potential NMMJM habitat in the MRG.

Comments from Chat Window:

08:06:52 From Hector Garcia to Everyone: Hector: the key on the mouse and the sunflower is that it impacts mainly the reach below SADD, which is a key to the minnow and birds. So if you look at ecosystem as a whole it is good to have a combo of species.

11:29:19 From Debbie Lee to Everyone: NMMJM potential strategies - Evaluate efficacy of non-invasive survey methodologies. Develop potential strategies for reintroduction

11:32:42 From David Moore - BOR to Everyone: Hector, at one point there was talk about refining Frey's NMMJM habitat map for Reclamation lands. Did that ever happen?

Breakout Group: Megan Friggens, Hector Garcia, Alyssa O'Brien, Ondrea Hummel, Jenny Davis, Melissa Welsch

D-1 Notes:

- The NMMJM and PESU are not often spotlighted.
- The original objective is jumping ahead, and we may need to focus on monitoring efforts instead.
- We need to address the first objective and get basic data before contributing to efforts in Objective 2.

D-1 Comments:

- We need people to help create conceptual ecological models for the NMMJM and PESU.
- Is Strategy C related to identifying potential habitat that NMMJM can be transferred into, or are we still looking for where PESU are?
    - It could likely be both.
    - There have been recent discoveries in places we did not know before within the last few years.
    - There is still a lot unknown about where NMMJM occur.
    - The NMMJM and PESU inhabit areas that are not right on the riverbank. Surveys may not be capturing them well.

  - This issue came up during a 2016 workshop with Jennifer Frey. One potential strategy identified was to look at the NMMJM's historic range, and do some concentrated surveys.
  - NMMJM are very specific in habitat requirements. Previous efforts looked in areas with suitable habitat, and they were not found.
  - There have not yet been reintroduction efforts.
- Would any suitable habitat be considered for NMMJM reintroduction?
  - The process would likely be heavily scrutinized by the USFWS.
  - The habitat is so specific for the NMMJM, it is not repeatable.
  - Jennifer Frey previously did a study, and Reclamation were not comfortable with how far she went with habitat determination. We are back at step 1 with the NMMJM. No one is surveying for the mouse except USFWS.
  - This discussion could be encompassed in a Strategy D "explore potential options for NMMJM reintroduction if suitable habitat is found."
- Another potential strategy could be to evaluate the efficacy of non-invasive survey methodologies. This was discussed at the previous workshop.

PESU Objective E-1

Original statement: *Continue monitoring for PESU stands in the West-Central New Mexico Recovery Region and preserve habitat.*

Revised statements:

E-1a Continue and expand monitoring and surveying for PESU stands in the West-Central New Mexico Recovery Region.

E-1b Preserve and expand existing habitat stands in the West-Central New Mexico Recovery Region.

Suggested Strategies:

- Coordinate existing monitoring and surveying efforts through data sharing efforts
- Expand on existing monitoring efforts to determine PESU habitat indicators/requirements
- Collect seeds from appropriate existing populations to establish a seedbank

Comments from Chat Window:

08:06:52 From Hector Garcia to Everyone: Hector: the key on the mouse and the sunflower is that it impacts mainly the reach below SADD, which is a key to the minnow and birds. So if you look at ecosystem as a whole it is good to have a combo of species.

11:36:05 From Grace Haggerty New Mexico Interstate Stream Commission to Everyone: There was a great video of Pecos sunflower effort outside the Rio Grande. Can someone remind of that?

11:37:22 From Debbie Lee to Everyone: FWS mapping PESU: https://youtu.be/g2ewLn2tpZY

11:38:42 From Debra Hill to Everyone: Sarah_Yates@fws.gov Sunflower lead

11:39:21 From Grace Haggerty New Mexico Interstate Stream Commission to Everyone: Contact Gina Della Russo on the Rhodes Property work on the Pecos Sunflower. Save our Bosque Task Force.
11:42:09 From Meaghan Conway to Everyone : The film I saw was called Saving Beauty , the YouTube link no longer works so it may have only been temporarily available.
11:43:50 From Debbie Lee to Everyone: Found Saving Beauty: https://www.savingbeautyfilm.com/film#:~:text=The%20Pecos%20Sunflower%2C%20listed%20as,into%20a%20sea%20of%20gold
11:46:46 From Meaghan Conway to Everyone: Yes, that's it, thanks Debbie

Breakout Group: Megan Friggens, Hector Garcia, Alyssa O'Brien, Ondrea Hummel, Jenny Davis, Melissa Welsch

E-1 Notes:

- This objective was heavily informed by survey responses.
- We need more basic information to make informed decisions on the PESU.
- One strategy for seed collection; there was a lot of discussion on planting, and how it can be fairly easy to do.

E-1 Comments:

- There is a known population at La Joya and on the Rhodes' property. The La Joya population is naturally occurring and the Rhodes population was planted. Surveys were done at La Joya in 2018, and at the Rhodes' property in 2017.
- There is a lead person at USFWS who can coordinate PESU efforts, Sarah Yates (Sarah_Yates@fws.gov).
- Seed collection gives the Program an opportunity for hands-on participation.
- We could potentially meet recovery goals easily.
- There is a video on mapping the PESU at Bitter Lake on Youtube: https://youtu.be/g2ewLn2tpZY.
- Contact Gina Della Russo, Save our Bosque Task Force, on the PESU Rhodes' Property work.

OTHER Objective F-1

Original statement: *Monitor the status of other threatened species in the MRG.*

Revised statement:
Monitor core habitat trends in the MRG for general and specific indications of decline.

Suggested Strategies:

- Review the biennial assessment from the NMDGF for status of various species in the MRGESCP area. Consider including protection measures for applicable species in restoration efforts, where possible.
- Include other monitoring efforts of (i.e. monitoring migratory bird trends, habitat monitoring) in the MRGESCP database.
- Compile a database of habitat and biological surveys within the MRG and update annually

Breakout Group: Ryan Gronewold, Mark Kelly, Lawrence Abeita, Trevor Birt, Casey Ish, Debra Hill

F-1 Notes:

- Decided to look more at the overall ecosystem health, instead of focusing on specific species or type of habitat.
- There is overlap with other objectives, specifically the new objective.
- The first two strategies are remnants of the originals. Strategy C is new.
    - There is overlap with other objectives in terms of looking at the Hink and Ohmart surveys and updating the conceptual ecological models.
- This objective can likely be combined with the new objective.

F-1 Comments:

- Habitat is different for different species. We may want to identify the indicators for decline in the MRG (e.g., flow, tree coverage, sediment transfer). Or, are we just watching species that may be at risk of becoming listed.
    - We want to get to a point of watching at risk species.
    - The objective is considered the state of habitat in the MRG instead of habitat for specific species. MRG habitat could be addressed with vegetation surveys, for example. We want to see how things are changing over time, and establish the AM Relational Database to see trends.
    - Ecosystem may be a better word to use. That would open up the objective to broader future studies.
- There is an existing monitoring effort with bird surveys by Hawks Aloft. Unsure of entire area of coverage and there have been funding issues.
- Are trends referring to climate change or general trends?
    - General trends.

OTHER Objective G-1

Original statement: *Support the establishment and maintenance of a Conservation Storage pool in Abiquiu Reservoir status of other threatened species in the MRG.*

Revised statement:

Support the establishment and maintenance of a Conservation Storage pool in Abiquiu Reservoir that enhances the operational flexibility of water managers to support species.

Suggested Strategies:

- Provide monitoring data to support the environmental assessment process to establish the conservation storage pool.
- When possible, find available water to support the conservation storage pool to benefit species and habitat.
- Compile/present monitoring data for various species/habitat uses to advise on annual storage volumes.

Comments from Chat Window:
11:51:18 From Ari Posner BOR to Everyone: Investigate the potential benefit of...
11:54:18 From Hector Garcia to Everyone: Change environmental assessment to compliance
11:58:40 From Hector Garcia to Everyone: To add to Grace's comments of other water there can be "support to changes/updates to the Compact"

Breakout Group: Ryan Gronewold, Mark Kelly, Lawrence Abeita, Trevor Birt, Casey Ish, Debra Hill

G-1 Notes:

- The objective is specific to the effort by the ABCWUA, in coordination with USACE, to establish and maintain a conservation storage pool in Abiquiu Reservoir.
- Abiquiu Reservoir is authorized for 200,000 acre-feet of water storage.
    - That storage space is mostly owned by ABCWUA.
    - Previously, the reservoir was only authorized for San Juan Chama water. The only place you could store native runoff was at El Vado.
- Legislation passed in September 2020 that allows for native Rio Grande storage at Abiquiu Reservoir.
    - That storage could potentially be useful to for water management in the MRG, including for listed species.
- There are several hurdles to get through before storing native water.
    - Needs a storage permit.
    - NEPA compliance.
    - Needs approval from Rio Grande Compact Commission.
- The group struggled with how the Program can help the objective.

G-1 Comments:

- The Program can provide the scientific justification for the storage pool. That way, there will not be a need to do additional studies to show that.
- Suggestion to change the objective to “Investigate the potential impacts and benefits of…”
- What monitoring data is the strategy referring to?
    - Any data that can be used to show the benefit of the action.
    - Suggestion to use “data” instead of “monitoring.”
- There are a ton of data, models, and reports that show the potential benefit of storing water at Abiquiu. For example, you could have one longer peak instead of two small peaks in the spring.
    - We could make a strong case for having continuous high flows versus spotty high flows for the RGSM.
    - This objective could be linked back to the RGSM objective on the hydrograph.
- This is the only objective related to water management. We need to go back to other water issues (e.g., Cochiti deviation, El Vado modification, working with Colorado to distribute flows differently) to address adaptive management.
    - The group talked about ways to acquire or mange water in the system, but unsure what Program role should be. It is good to get people thinking about it.
    - As the Program shows success and informs adaptive management, people may be less rigid.
- We may want to be less specific to Abiquiu. It may be better to concentrate on smaller things to do for water management, rather than a big agency-centric effort.

MRGESCP Objectives Workshop, Feb. 10-11, 2021
SAMC Revision Summary

Below is a list of the draft MRGESCP planning objective statements revised first during the 2021 Objectives Workshops and subsequently by the Science and Adaptive Management Committee (SAMC). Once revisions are complete, the objectives will be recommended to the Executive Committee for use in updating the Science and Adaptive Management Plan, Adaptive Management Relational Database, and Long-Term Plan for the MRGESCP.

Workshop Attendees (Day 1 - RGSM)	**Workshop Attendees (Day 2 – Avian/Other)**
Alison Hutson, NMISC	Alyssa O'Brien, City of ABQ Open Space
Alyssa O'Brien, City of ABQ Open Space	Amy Erickson, Audubon Southwest
Andy Dean, USFWS ES Office	Andy Dean, USFWS ES Office
Anne Marken, MRGCD	Ari Posner, USBR
Ara Winter, BEMP	Casey Ish, MRGCD Conservation Program
Ari Posner, USBR	Dave Moore, USBR Technical Service Center
Ashlee Rudolph, USBR	Debra Hill, USFWS
Carolyn Donnelly, USBR	Eric Gonzales, USBR
Casey Ish, MRGCD Conservation Program	Grace Haggerty, NMISC
Charles Yackulic, USGS	Hector Garcia, USBR
Cynthia Naha, Santo Domingo Pueblo	Jenny Davis, USFWS
Dale Strickland, WEST, Inc.	Lawrence Abeita, BIA
Debra Hill, USFWS	Liza Yazzie, Realty Specialist, USBR
Eric Gonzales, USBR	Mark Kelly, ABCWUA
Grace Haggerty, NMISC	Maya Pinon, Rep. Deb Haaland--NM01
Guilherme Dias, UNM Department of Biology	Meaghan Conway, NMDGF
Hector Garcia, USBR	Megan Friggens, USFS Rocky Mountain Research Station
Liza Yazzie, Realty Specialist, USBR	Mo Hobbs, ABCWUA
Mark Kelly, ABCWUA	Ondrea Hummel, Tetra Tech
Maya Pinon, Rep. Deb Haaland--NM01	Ryan Gronewold, USACE
Meaghan Conway, NMDGF	Trevor Birt, NMISC
Megan Osborne, UNM	*Catherine Murphy, PST*
Mick Porter, USACE	*Debbie Lee, PST*
Mike Marcus, MRG Water Advocates Board	*Melissa Welsch, PST*
Mo Hobbs, ABCWUA	*Michelle Tuineau, PST*
Nate Caswell, USFWS New Mexico FWCO	
Nathan Schroeder, Pueblo of Santa Ana	
Quantina Martine, Audubon Southwest	
Reynalden Delgarito, USACE	
Rich Valdez, SWCA, representing NMISC	
Ryan Gronewold, USACE	
Steve Zipper, SWCA	
Thomas Archdeacon, USFWS-NMFWCO	
Catherine Murphy, PST	
Debbie Lee, PST	
Julie Dickey, PST	
Melissa Welsch, PST	
Michelle Tuineau, PST	

RGSM Objective A-1

Original statement: *Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.*

Revised statement: ***Estimate the abundance of augmented and wild born RGSM populations in the Angostura, Isleta, and San Acacia reaches from year to year.***

RGSM Objective A-2

Original statement: *Continue to support research into the life history of the RGSM to further inform management of the species.*

Revised statement: ***Increase understanding of how the life history traits of the RGSM change over time and space, to better inform management of the species and increase the probability of recovery.***

RGSM Objective A-3

Original statement: *Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.*

Revised statement: ***Determine the relationships between base flow and survival and recruitment of RGSM in the Middle Rio Grande.***

RGSM Objective A-4

Original statement: *Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.*

Revised statement: ***Evaluate suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph), given system constraints and opportunities, needed to cue spawning and recruitment for the RGSM population.***

RGSM Objective A-5

Original statement: *Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.*

Revised statements:

A-5.1) Refine existing research and modeling efforts to understand the quantity and quality of habitat available at different flow regimes by 2030.

A-5.2) Develop a range of options for increasing habitat availability and refugia at life stage limiting flow regimes for all life stages by 2030.

RGSM Objective A-6

Original statement: *NA*

Suggested statement:
Monitor/Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM genetic diversity.

OR

Monitor/Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM population viability.

SWFL Objective B-1

Original statement: *Continue monitoring for SWFL in designated critical habitat areas to track territories in the MRG management unit of the Rio Grande recovery unit.*

Revised statement: ***Monitor for SWFL in the MRG management unit of the Rio Grande recovery unit.***

SWFL Objective B-2

Original statement: *Continue monitoring critical SWFL habitat and contribute to research on the impacts from non-native and exotic species on SWFL recovery.*

Revised statement: ***Determine SWFL habitat availability within the MRG.***

SWFL Objective B-3

Original statement*: Support large-scale restoration efforts to protect and expand SWFL habitat in the MRG.*

Revised statements:
B-3.1) Characterize optimal breeding habitat conditions in currently occupied SWFL locations to inform restoration.

B-3.2) Manage successional processes that maintain existing SWFL breeding habitat in the Program Area.

B-3.3) Expand SWFL breeding habitat through restoration efforts in the Program Area.

Other Objective H-1

Original statement: *NA*

Suggested statement:

Determine the impacts from non-native vegetation on listed species' habitat availability and population dynamics.

YBCU Objective C-1

Original statement*: Contribute to research and understanding of habitat needs for the YBCU.*

Revised statements:

C-1.1) Characterize optimal habitat (i.e., foraging and nesting) conditions on landscape and microhabitat levels in currently occupied YBCU locations to inform restoration.

C-1.2) Determine successional processes that maintain existing YBCU habitat (i.e., foraging and nesting) in the Program Area.

C-1.3) Intensify/expand monitoring program/effort for YBCU.

NMMJM Objective D-1

Original statement: *Contribute to efforts to expand habitat and preserve existing habitat in the MRG.*

Revised statements:

D-1.1) Initiate and support NMMJM monitoring efforts to identify relevant habitat features, potential additional habitat, and existing populations.

D-1.2) Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

PESU Objective E-1

Original statement: *Continue monitoring for PESU stands in the West-Central New Mexico Recovery Region and preserve habitat.*

Revised statements:

E-1.1) Continue and expand monitoring and surveying for PESU stands in the West-Central New Mexico Recovery Region.

E-1.2) Preserve and expand existing habitat stands in the West-Central New Mexico Recovery Region.

OTHER Objective F-1

Original statement: *Monitor the status of other threatened species in the MRG.*

Revised statement: ***Monitor ecosystem trends in the MRG for general and specific indications of decline.***

OTHER Objective G-1

Original statement: *Support the establishment and maintenance of a Conservation Storage pool in Abiquiu Reservoir status of other threatened species in the MRG.*

Revised statement: ***Support efforts to enhance the operational flexibility of water managers to support species.***

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Rio Grande Silvery Minnow Genetics Ad Hoc

Approved by Science and Adaptive Management Committee (SAMC) on _____, *2021*.

Parent Committee
Science and Adaptive Management Committee.

Ad Hoc Group Charge
Identify a series of genetic components that inform, and are informed by, the life history characteristics of the Rio Grande silvery minnow (RGSM) and its environmental influences in the Middle Rio Grande (MRG). Incorporate these components into the conceptual ecological model (CEM) for the RGSM, found in Appendix B of the MRGESCP 2020 Science and Adaptive Management Plan (WEST 2020).

Membership

A. Criteria for membership

- Knowledge of RGSM genetics, life history and ecology within the Middle Rio Grande;
- Familiarity with MRGESCP Science and Adaptive Management Plan (WEST 2020), RGSM Genetics and Propagation Plan (CABQ et al. 2018a), and RGSM Augmentation Plan (CABQ et al. 2018b).

B. Member List

Wade Wilson (Lead), U.S. Fish and Wildlife Service,
Alison Hutson, New Mexico Interstate Stream Commission,
Kathy Lang, City of Albuquerque BioPark,
Dana Price (?), U.S. Army Corps of Engineers,
Michael Porter (?), U.S. Army Corps of Engineers,
Megan Osborne (?), University of New Mexico
Others?

Iterative Task Development

Background
Work being conducted on RGSM genetics guides and informs the propagation and augmentation plans. Thus, this work is also integral to our understanding of population dynamics. Any representation of RGSM population-level responses to environmental influences, therefore, should also include factors that affect the augmented species' genetic integrity and diversity. As such a representation, the conceptual ecological model for RGSM currently fails to capture the full suite of threats to recovery of the species. The task described below will remedy these omissions and help to inform adaptive management strategies for RGSM recovery.

Specifically, this task addresses Recommendation 5 from the Fraser et al. Independent Science Panel on RGSM Genetics (AFWE&I 2016):

> *"The Science Workgroup (led by the Program) and the Genetics Workgroup (led by the USFWS) should integrate the genetics data and the decision-making more carefully. Specifically, there should be more translation of the genetics research into the adaptive*

management process, hatchery broodstock practices, and the integration of the past 15 years of research (genetics and ecology combined)."

The SAMC requests that you review the draft task, deliverables and schedule below and provide feedback to begin the iterative process of task development.

Tasks and Deliverables

Task 1: Add genetics components to RGSM CEM

Identify a series of genetic components that inform, and are informed by, the life history characteristics of the RGSM and its environmental influences in the Middle Rio Grande. Incorporate these components into the conceptual ecological model (CEM) for the RGSM, found in Appendix B of the MRGESCP 2020 Science and Adaptive Management Plan (WEST 2020).

Objective of Task 1:
Incorporation of genetic components into the RGSM CEM will facilitate additional linkages to Collaborative Program Objectives and RGSM recovery criteria.

Deliverable:
1) Schematic of RGSM CEM (provided by PST) modified to include genetic components and relationships with other components and life stages.
2) Presentation of modified schematic to SAMC, followed by discussion.

Task 2: Characterize relationships among RGSM CEM components

Indicate the level of influence and level of uncertainty for each relationship between pairs of components in the RGSM CEM.

Objective of Task 2:
Characterization of relationships with the added genetic components in the RGSM CEM will help to identify critical uncertainties for further study.

Deliverable:
Table of individual relationships between pairs of components in the RGSM CEM (provided by PST) with levels of influence and uncertainty characterized as High, Medium or Low.

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Task1: Add components to RGSM CEM	NA	Modified schematic of RGSM CEM	TBD
		Presentation to SAMC	TBD
Task 2: Characterize relationships	NA	Modified table of relationships in RGSM CEM	TBD

References:

Amec Foster Wheeler Environment & Infrastructure, Inc. 2016. Final Summary Report: Expert Peer Review of the Middle Rio Grande Endangered Species Collaborative Program's Rio Grande Silvery Minnow Genetics Project. Prepared for the U.S. Bureau of Reclamation, Albuquerque, NM.

City of Albuquerque, New Mexico Interstate Stream Commission, US Fish and Wildlife Service, and University of New Mexico. 2018. Rio Grande Silvery Minnow Genetics Management and Propagation Plan 2018-2022. City of Albuquerque BioPark, Albuquerque, NM.

City of Albuquerque, New Mexico Interstate Stream Commission, University of New Mexico, US Bureau of Reclamation, and US Fish and Wildlife Service. 2018. Rio Grande Silvery Minnow Annual Augmentation Plan 2018-2022. City of Albuquerque BioPark, Albuquerque, NM.

Western EcoSystems Technology, Inc. 2020. Middle Rio Grande Endangered Species Collaborative Program Science and Adaptive Management Plan. Prepared for the Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program, Albuquerque, NM. 98 pp.

Science and Adaptive Management Committee Meeting

April 22, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *MRGESCP S&T Ad Hoc Group Charge SWFL and YBCU Conceptual Ecological Model Refinement Ad Hoc [read-ahead, draft]*
- *MRGESCP S&T Ad Hoc Group Charge RGSM Conceptual Ecological Model/Genetics Refinement Ad Hoc [read-ahead, draft]*
- *MRGESCP 2021 Science Planning Objectives Presented for EC Review on 25 March 2021 [read-ahead]*
- *Draft LTP Reporting Template [read-ahead, draft, spreadsheet]*
- *Review of the MRG Fish Monitoring Program [read-ahead, draft, not included]*
- *MRGESCP 2021 Science Objectives [presentation]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC) Meeting
April 22, 2021
8:00 AM–12:00 PM

Meeting Location: *Zoom*
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Meeting ID: 898-359-3120; Passcode: 1251
Call-In: +1-669-900-6833

Meeting Agenda

***Meeting Objectives*:**

- Approve new Science & Technical (S&T) Ad Hoc Groups to be formed
- Finalize science objectives
- Identify strategies for further development
- Learn about tracking relationships among science objectives, science strategies, uncertainties, and activities using the Adaptive Management Relational Database (AMRDB)
- Hear presentation on the Rio Grande silvery minnow (RGSM) Population Monitoring Work Group (PMWG) Ad Hoc Group's summary report and decide on next steps
- Discuss 2021 Middle Rio Grande (MRG) Habitat Restoration (HR) planning direction and proposed workshop
- Provide feedback on the AMRDB and the Long-Term Plan (LTP)

8:00 – 8:10	**Welcome, Meeting Objectives, and Agenda Review** Read-ahead: ☐ Draft March 3, 2021 meeting minutes ✓ **Decision**: Approve April 22, 2021 meeting agenda ✓ **Decision**: Approve March 3, 2021 meeting minutes	*Catherine Murphy, Program Support Team (PST)*
8:10 – 8:40	**Science & Technical Ad Hoc Groups** • Update on existing S&T Ad Hoc Groups • Upcoming ad hoc group(s) o Add level of uncertainty to southwestern willow flycatcher (SWFL) and yellow-billed cuckoo (YBCU) conceptual ecological models (CEMs) o Formulate questions to incorporate climate change into future research planning Read-aheads: ☐ Draft charge for adding level of uncertainty to SWFL and YBCU CEMs	*Catherine Murphy, PST*

	☐ Draft charge for incorporating genetic components into the RGSM CEM ✓ **Decision:** SAMC approval of RGSM CEM Genetics Development Ad Hoc Group charge ✓ **Decision:** SAMC approval of Avian CEM Development Ad Hoc Group charge ➢ **Action:** PST will draft S&T Ad Hoc Group charges for each SAMC-approved group and email them to the SAMC for review and approval ➢ **Action:** SAMC will review draft charges, submit comments to the Science Coordinator, and submit approval to the PST via email ➢ **Action:** Upon SAMC approval of charges, PST will contact the nominated group leads and work with the recommended S&T ad hoc group members to begin meeting to carry out assigned tasks	
8:40 – 9:10	**2021 Science Objectives and Strategy Development** • Update on Executive Committee (EC) meeting • Discuss strategies proposed during the workshops for further development by potential S&T Ad Hoc Groups • Presentation on use of science objectives in Adaptive Management Relational Database Read-ahead: ☐ 2021 Science Objectives with Strategies ✓ **Decision**: Identify one or more strategies for S&T Ad Hoc Group charge development ✓ **Decision**: Finalize 2021 Science Objectives for EC approval ✓ **Decision**: Identify one or more strategies for additional development by S&T Ad Hoc Groups ➢ **Action**: PST will draft S&T Ad Hoc Group charge(s) for the chosen strategies for SAMC review	*Facilitated discussion*
9:10 – 9:40	**Adaptive Management Relational Database (AMRDB)** • Discuss development of the Long-Term Plan (LTP) using AMRDB • Next step: Project prioritization strategy for the LTP Read-ahead: ☐ Draft LTP reporting template ➢ **Action:** PST will classify existing project descriptions to address LTP attribute requirements	*Catherine Murphy, PST*
9:40 – 9:50	**Break**	

9:50 – 10:50	**RGSM PMWG Summary Report S&T Ad Hoc Group – Invited Discussion** • Presentation of revised RGSM Population Monitoring Work Group summary report • Summarize specific areas of disagreement and potential remedies • Discussion of findings and recommendations Read-ahead: ☐ RGSM PMWG Summary Report ➢ **Action:** Submit comments on report to PST by May 15	*Rich Valdez, SWCA Environmental Consultants*
10:50 – 11:50	**2021 MRGESCP Approach to Standardizing Habitat Restoration (HR)** • Discuss requests by City of Albuquerque Open Space and Albuquerque Bernalillo County Water Utility Authority for technical assistance with HR • Discuss request for standardized data collection for MRG HR monitoring and previous efforts to date • Discuss the benefits of a broader monitoring program • Discuss potential HR workshop and format ➢ **Decision:** Host a workshop to organize HR efforts within the MRG ➢ **Action:** PST will draft an HR workshop plan for SAMC review	*Facilitated discussion*
11:50 –12:00	**Meeting Summary and Action Items Review** ➢ **Next SAMC meeting:** Thursday, May 27, 2021, 8am-noon	*PST*
12:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

April 22, 2021; 8:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of April 22, 2021 SAMC meeting agenda
- ✓ Approval of March 3, 2021 SAMC meeting minutes

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Provide comment forms for review of future Science & Technical (S&T) Ad Hoc Group documents	Ongoing
PST	Draft a S&T Ad Hoc Group charge for formulating questions to incorporate climate change into future research planning, and send to the SAMC for review and approval	4/30/21
PST	Add detail to the charges for the Rio Grande silvery minnow (RGSM) and avian conceptual ecological model (CEM) ad hoc groups to clarify the scope of their tasks, and send to the SAMC for review and approval	4/30/21
PST	Following SAMC review and approval, contact the nominated CEM ad hoc group leads and work with members to begin meeting and carrying out tasks	5/7/21
PST	Send out suggested science strategies for immediate development and a poll for SAMC review	4/30/21
SAMC	Review and prioritize science strategies by responding to poll	5/7/21
PST	Classify existing project descriptions to address Long-Term Plan requirements	5/7/21
PST and Rich Valdez	Incorporate preliminary SAMC feedback into the Population Monitoring Work Group (PMWG) summary report and send the draft to PMWG members with a comment matrix for findings, assumptions and recommendations	4/28/21
PMWG members	Submit a completed comment matrix for the PMWG summary report to PST	5/5/21
SAMC	Submit comments on the summary report to PST	5/21/2021
PST	Draft a habitat restoration (HR) workshop plan for SAMC review	5/20/2021

Next Meeting: May 27, 2021

Meeting Summary

Welcome, Meeting Objectives, and Agenda Review

Catherine M., PST Science Coordinator and SAMC Facilitator, opened the meeting and led introductions. Catherine M. reviewed the April 22, 2021 meeting agenda and objectives and March 3, 2021 meeting minutes. The meeting agenda was amended. Summary points are below:

- The charge for incorporating genetic components into the RGSM CEM is still in draft form.
- Wade Wilson, U.S Fish & Wildlife Service, requested the opportunity to make changes to group membership and deliverable dates.
- The SAMC will review and approve the charge over email.
- The SAMC requested comment forms for reviewing future S&T Ad Hoc Group documents.
    - These forms could be added to the SAMC work page on the Portal.

✓ **Decision**: The SAMC approved the March 3, 2021 SAMC meeting minutes
✓ **Decision**: The SAMC approved the April 22, 2021 SAMC meeting agenda
➢ **Action Item**: The PST will provide comment forms for review of future S&T Ad Hoc Group documents

Science & Technical Ad Hoc Groups

Catherine M. gave an update on current and proposed S&T Ad Hoc Groups. Summary points are below:

- Rich V., SWCA Environmental Consultants, will share the findings and recommendations from the RGSM summary report during a later agenda topic.
- Charles Yackulic, U.S. Geological Survey, will complete the RGSM model in the summer.
- Wade W. is assembling a group to work on the RGSM CEM.
- The PST produced a draft charge for characterizing the level of uncertainty in the avian CEMs.
    - The CEMs will be standardized and added to the Adaptive Management Relational Database (AMRDB) in table form.

Comments:

- The charge for the avian CEMs S&T Ad Hoc Group is vague. It is not clear whether the groups will provide professional judgement or data analysis to characterize uncertainty.
    - Species experts will provide only their best professional judgement, as was used to develop the CEMs originally.
- The first step should be to get the models under same structure.
    - Although the RGSM and avian model schematics look different, they are similar in table form. The avian CEMs currently do not characterize the level of uncertainty, which is what the S&T Ad Hoc Group will add.
- The charge should be updated to include the information discussed. This will help define the scope of the charge.
    - The PST will add the table formats of the CEMs to the CEM S&T Ad Hoc Group charges and explain in the charges how the tables will be used to address uncertainties.
- The CEMs are not finalized once in the AMRDB; they will be updated as new data comes in. Now, the PST is working to get all the data in before content development ends in June and the design team begins working on building the database infrastructure.

Summary points for additional updates are below:

- Catherine M. and Debbie Lee, Program Manager have been discussing a list of questions suggested by Megan Friggens that relate to future planning and climate change and can be included in all future project descriptions. The SAMC can charge an S&T Ad Hoc Group with developing the list of questions.
    - S&T Ad Hoc Groups seem to have more defined scopes and deliverables. This group will have an umbrella effect on other efforts.
    - The PST will produce a draft charge for SAMC review.
    - U.S. Army Corps of Engineers (USACE) has a leading climate scientist who may be able to support this effort. USACE also incorporates climate change into every study and has developed tools for predicting how it will affect the future.
- The PST will wait for Wade W.'s input on the RGSM CEM ad hoc group charge before sending it to the SAMC for approval.

Comments:

- Both CEM Ad Hoc Group charges are vague and have unclear scopes and tasks.
    - The PST will add detail to the charges to clarify the scope of their tasks, and send to the SAMC for review and approval.
    - Scopes should be narrow, so deliverables can be developed in an achievable and useful timeframe, and for groups to end once their charges have been fulfilled.
- What role does the SAMC play in S&T Ad Hoc Group deliverables? Does the SAMC direct a group to address a knowledge gap, or does the SAMC develop strategies for addressing the knowledge gap through iterative task development with the group?
    - It depends on the topic, but it is up to the SAMC to decide on a case-by-case basis.
    - The SAMC uses the deliverables that come from S&T Ad Hoc Groups to provide recommendations with justifications to the Executive Committee (EC).
    - The relationship between an S&T Ad Hoc Group and the SAMC could range from direct SAMC involvement with each task to SAMC review of deliverables only.

- **Action Item**: The PST will add detail to the charges for the RGSM and avian CEM ad hoc groups to clarify the scope of their tasks, and send to the SAMC for review and approval
- **Action Item**: Following SAMC review and approval, the PST will contact the nominated CEM ad hoc group leads and work with members to begin meeting and carrying out tasks
- **Action Item**: The PST will draft a S&T Ad Hoc Group charge for formulating questions to incorporate climate change into future research planning, and send to the SAMC for review and approval

2021 Science Objectives and Strategy Development

Catherine M. discussed the science objectives and strategies. Summary points are below:

- The objectives will be referred to as "science objectives" to avoid confusion and address EC feedback.
- The science objectives were presented to the EC for review. The EC had no comments and the science objectives will be up for approval at the July EC meeting.
- The SAMC can use the science objectives to develop strategies. Catherine M. sent a document with the science objectives and preliminary science strategies. Catherine M. highlighted the strategies that are ready for implementation, as they are primarily desk exercises utilizing existing data.

    - Field efforts will need more time and resources to implement.
- Some science objective statements had multiple parts. To enter these more easily into the AMRDB, the PST is considering renumbering these to be sequential instead of hierarchical.
- The PST will compile the strategies and set up a poll for SAMC review.
    - The poll results will guide conversation at the next meeting.

- **Action Item**: The PST will send out the suggested science strategies for future development and a poll for SAMC review
- **Action Item**: The SAMC will review and prioritize science strategies by responding to poll

Adaptive Management Relational Database (AMRDB)

Catherine M. discussed science planning with the AMRDB (see presentation). Summary points are below:

- The Science & Adaptive Management (S&AM) Plan outlines the process for the MRGESCP, while the Long-Term Plan lays out implementation of the S&AM Plan.
- As the science objectives evolve, both plans will be updated. The cycle of updates drives adaptive management in the MRGESCP.
- Science objectives will be linked to projects in the AMRDB, which enables transparent prioritization for long-term planning.
    - The SAMC is responsible for developing the transparent and standardized prioritization process.
    - By entering the relevant information into the AMRDB, the SAMC can develop an algorithm for assessing the linkages of each project. For example, a project that links to multiple objectives, strategies, and critical uncertainties would merit higher priority.
- Two types of users of the AMRDB have been identified: scientific users and administrative users. There are different queries for both types.
    - Users can generate reports from query results; one example of a report is the Long-Term Plan.
- The AMRDB will capture the activities already being done in service of the Collaborative Program's mission and add value to them by linking them to MRGESCP science objectives, strategies, uncertainties, etc.
- There are five categories for all activities in the AMRDB: habitat assessments & modeling, species management & recovery, population management & modeling, program management & administration, field & laboratory experiments.
    - HR would be considered a field experiment. It is a manipulation of the physical environment and pre- and post-project monitoring should be done.

        Comments:

        - A scientific experiment has a null hypothesis before it begins. Existing HR efforts cannot be treated like experiments. It makes sense to prioritize treating HR projects as experiments moving forward.
        - An experiment requires pre-project baseline data for comparison, but mostly occurs is post-project monitoring.
        - Restoration should follow a more scientific, question-driven process than it does now.
    - MRGESCP members have repeatedly asked for a way to improve HR and show success. The only way to address those requests is to design HR projects that look more like experiments moving forward. The SAMC needs to support those efforts.

        - More rigorous monitoring costs money, but MRGESCP members may be able to collaborate on these efforts.
- The SAMC should be considering how to use the connections in the AMRDB to recommend priority projects to the EC.
    - The group needs to come up with a weighted scoring method.

Comments:

- Is there a way to develop a proposal via the AMRDB?
    - The AMRDB stores all the proposals that have been developed and will score them based on linkages. This will help managers choose projects to fund.
    - New proposals should come from addressing the science objectives and strategies.
    - The AMRDB will also document scientific uncertainties and relationships among variables in the CEMs. You could develop a proposal to address a big uncertainty that improves understanding of many relationships in a CEM.
- Is there a way to classify the importance of an uncertainty?
    - Many uncertainties come from the CEMs. Species experts need to judge whether uncertainties are critical and reducible.

RGSM PMWG Summary Report S&T Ad Hoc Group – Invited Discussion

Rich V. presented an update on the PMWG summary report. Summary points are below:

- The summary report was written as an assignment by the EC, to be provided to the SAMC and EC for approval. The set of recommendations in the report can be addressed by Science & Technical Ad hoc Groups.
- The PMWG was tasked with 1) Conducting a workshop on catch-per-unit-effort (CPUE), 2) Reviewing the Fish Monitoring Plan (FMP), and 3) Updating the FMP. The PMWG did not address Task 3 before it was sunsetted by the EC in December 2020.
- As part of Task 1, the Hubert science panel conducted a workshop and provided a report. The PMWG identified 22 recommendations and sent a letter to the U.S. Bureau of Reclamation (Reclamation) requesting that they be implemented. Eight recommendations were implemented and are currently part of the FMP.
- 20 seine hauls are conducted at 20 sites each month to calculate CPUE by site. The average CPUE is an average of all sites.
- The FMP implemented a recommendation for using alternative sites when standard sites dry.
    - Replacement sites were selected through a generalized random tessellation stratified system to prevent bias.

Comments:

- How many of the analyses of the science panels were sanctioned by the PMWG?
    - Two sets of analyses were done by members of the PMWG. A modeling process was also initiated with Charles Y.
- Do the 20 seine hauls overlap?
    - They do not. Each seine haul is taken for distinct, separate mesohabitats. Researchers are trying to characterize density across the full spectrum of mesohabitats.
- Are the data available for each seine haul?
    - Data are available by seine haul starting in 2020.
- Are the lengths of the seine hauls predetermined?
    - They try to keep seine hauls to under 20-30 meters long. The beach seine is 10 feet wide by 6 feet tall.

- What does a dry site refer to?
    - A dry site is one that is dry between April and November, when sampling occurs. There is no accounting for when sites dry between sampling.
- How do you account for the availability of different mesohabitats?
    - One of the PMWG's recommendations is to account for the variability in mesohabitat availability.
    - Charles Y.'s model has made adjustments for capture probability by mesohabitat.

Summary points continued:

- Data from the FMP are used often in recovery plans (including as a census), in the 2016 Biological Opinion (BO) incident take statement, for determining augmentation targets, for evaluating BO compliance, for environmental analyses, for estimating population parameters in various models, etc.
- The PMWG findings were consolidated to four basic findings: 1) The FMP has provided 26 years of monitoring, 2) The current FMP provides monthly data for estimated population parameters, 3) Sampling design and methodology are not necessarily suited for evaluating species responses to management actions, 4) A complete redesign of the FMP is not warranted.

    Comments:

    - The FMP data might be appropriate to address certain management questions, but that would be rare.
    - How was it determined that a redesign is not warranted? Was that consensus?
        - The PMWG could not reach consensus about any finding or recommendation. Based on the intention and results of the FMP, it seems to be functioning well.
    - The 20 standard sites are located downstream of where water management is occurring. The FMP, therefore, reflects the response to cumulative actions occurring upstream.
        - CPUE is driven by volume of the flow of the river, which is not a function of water operations. It is hard to tie CPUE to management actions.
- There are key scientific assumptions in the FMP that need to be acknowledged: 1) The mean October CPUE index represents the overall density of RGSM in the river and 2) The year-to-year changes in CPUE reflect the effects of river flow on the population due to management actions. There are recommendations to address both assumptions. The FMP assumes CPUE is a reflection of what is going on in river.

    Comments:

    - Assumption 1 is inherent to any sampling program.
        - Yes, but you can evaluate the representation of the sampling design.
    - Is it safe to say that access to the floodplain is what affects CPUE each year?
        - That is one hypothesis.
    - This puts too much emphasis on management actions. In a dry year, the snowmelt is just not available.
        - Any alternative language to represent that is welcome.
    - CPUE is used for incidental take estimates, etc., so it is already assumed that it reflects management actions.
        - The mechanisms behind this correlation need to be better understood.
    - Even if there is disagreement on the findings, it is important to put them forward. The SAMC can decide to take them to the EC or put them to rest.

- There were six objectives listed under PMWG task 2. Rich V. posed 18 fundamental questions for these objectives with responses and critical uncertainties. Some questions were answered by the PMWG. The remaining questions led to 11 recommendations.
    - The recommendations are on Table 3 of the PMWG Summary Report, which consolidates and summarizes the information presented in the report.
- The 11 recommendations are split into Category 1 (involve additional field work) and Category 2 (no field work).
    - Category 1 Summary:
        - Rec 1 – Continue implementing the FMP with recommendations from the Hubert science panel.
        - Rec 2 – Supplement the FMP with additional sites in October when the September CPUE is low.
            - Comment: Does this bias results?
                - Results with additional sites are presented separately.
        - Rec 3 – Evaluate the use of other sampling gears in addition to beach seines.
            - The group is divided. Some believe beach seines are adequate, others believe the fish population is not being adequately represented in sampling.
        - Rec 4 – Resolve the relationship between CPUE and total abundance.
        - Rec 5 – Determine mesohabitat measurements to improve hydraulic habitat models.
    - Category 2 Summary:
        - Rec 6 – Refine the FMP to optimize precision, representativeness, and demographic data parameters.
            - Existing data could be used to simulate different sampling designs.
        - Rec 7 – Compare other analytical methods against the mixture model for calculation of CPUE.
            - The PMWG is divided. Some believe the mixture model is adequate, others believe it should be reevaluated. Both science panels recommended that the mixture model be evaluated further.
        - Rec 8 – Develop a library of customizable experimental designs for assessing management actions.
        - Rec 9 – Develop integrated population models.
            - Charles Y. is developing a model, but additional models may be needed.
        - Rec 10 – Draft a FMP for approval by the SAMC and EC.
        - Rec 11 – Evaluate the recommendations of all four RGSM science panels (PAP 2005, Adkins 2012, Hubert 2016, and Noon 2017).

<u>Comments:</u>

- What are the recommendations in Rec 11 being evaluated for?
    - The science panels made separate recommendations for the FMP. These should be compiled and cross-matched to find any overlap.
    - The PST is compiling this information in the AMRDB.
- Has there been any thought into developing a FMP that assesses management actions?
    - The PMWG did not discuss this much. Charles Y. and Rich V. determined that it is not possible to monitor the effect of one management action with the FMP, but the integrated model may be used to determine effects. Rec 9 addresses this.
- Is there a distinction between large-scale and small-scale management actions?

    - There is no distinction yet, but it should be made in Rec 8.
- Are there specific strategies for Rec 4?
    - In other programs, CPUE is often compared to a mark-recapture estimate, which is completely independent of CPUE.
        - Long-term mark-recapture method is not feasible for RGSM because it is small and short-lived. Short-term mark-recapture is possible.
    - It may also be possible to block off part of river and do depletion estimates.
- Is Rec 8 referring to designs for additional monitoring and not using the existing FMP?
    - These additional monitoring efforts are separate from the FMP and targeted at specific actions or projects. They would be implemented as needed and more short-term in scope.
    - Assessments could be done by the organization carrying out the activity, instead of by the U.S. Fish and Wildlife Service (USFWS), but USFWS permitting would be needed for some activities.
    - There is no design that fits every need, but there can be customizable generic designs.
- Thomas Archdeacon submitted comments on the PMWG summary report. The comments and the discussion around them are summarized below:
    - 1) The group largely did not provide input until the report was in draft form.
        - There were 29 meetings of the PMWG over eight years. Rich V. went through notes and presentations from each meeting and presented the topics from them in the report.
    - 2) The analyses in the report were not done together or agreed upon. There are unresolved issues with non-peer reviewed citations in the report.
        - Rich V. has indicated whether a reference was peer reviewed or not.
        - Many analyses were done by PMWG members for group purposes and were not peer-reviewed. All analyses were sent to the PMWG and open for comment. Comments were incorporated into the analyses and are reflected in the PMWG summary report.
    - 3) There is no documentation of areas of disagreement in the PMWG.
        - More work needs to be done to clarify where there was disagreement.
        - Scientific justification for different opinions needs to be provided by PMWG members.
        - A table summarizing disagreement could be part of the appendix.
        - Request to match recommendations with their respective science panel(s).
            - Some do not reflect science panel recommendations exactly. Rich V. can cite the science panels associated with recommendations.
    - 4) Peer reviewed work was either not included or called “preliminary”.
        - Rich V. updated works that were marked “preliminary”.
- Non-consensus needs to be reflected in the document.
    - The other PMWG members should review the findings and recommendations, vote on them and explain their reasoning.
    - The directive should come from the SAMC instead of Rich V.

- **Action Item**: Rich Valdez and the PST will incorporate preliminary SAMC feedback into the PMWG summary report and send the draft to PMWG members with a comment matrix for findings, assumptions and recommendations
- **Action Item**: PMWG members will submit completed comment matrices for the PMWG summary report to Catherine Murphy

- **Action Item**: The SAMC will submit comments on the summary report to the PST

2021 MRGESCP Approach to Standardized Monitoring for Habitat Restoration (HR)

Catherine M. opened discussion on HR (see presentation). Summary points are below:

- The PST received a request to address the idea of a standardized protocol for monitoring HR in the MRG.
    - There is no one-size-fits-all way to address all needs for HR, but there are things that can be done to address larger ecosystem-level or reach-level questions.
    - There are examples in other areas of larger monitoring schemes that expand on the inferences made from individual HR projects.
- The PST is developing a draft HR Monitoring Plan for the Middle Rio Grande (MRG).
- Some benefits of participating in a broader monitoring program include addressing larger questions, providing context for evaluating success at the site level, sharing findings and lessons learned, technical assistance with sampling design, and linking HR projects with CEMs, recovery criteria, and science objectives.
- As a potential lead-in for a workshop on HR, the SAMC could host a series of webinars on past and ongoing HR.
    - Webinars could be split into terrestrial, aquatic, and floodplain restoration activities. Signatories would be invited to speak on their HR projects in the spring and summer, before a workshop in August.
- The preliminary questions for the HR webinars ask about HR objectives, location and status, target species, biotic and abiotic metrics, the definition of success and targets, control sites, pre- and post-project monitoring, and lessons learned.
- Proposed workshop format: overview, summary of presentations, presentations on proposed/future projects, group discussion/activity to identify common objectives, define appropriate metrics, and generate reach-level context questions.
- The three types of monitoring for HR are construction monitoring, performance monitoring, and monitoring to support adaptive management.

Comments:

- The need for standardized monitoring has been identified for a while. Suggestion to focus on monitoring instead of construction and design at the webinars. Explain what worked and what did not. There is opportunity to learn from what was done.
- Where is known information on HR projects compiled?
    - There have been robust efforts to compile aquatic HR information in the MRG. GeoSystems Analysis, Reclamation, and USACE each have HR databases. NMISC compiled them into one geo-spatial database (RioRestore), which is hosted on the Program Portal.
    - There are many construction specifics in those databases. The webinars should focus on getting ideas for a monitoring plan across sites.

- **Action Item**: The PST will draft a HR workshop plan for SAMC review

Meeting Participants

Alan Hatch	EC *Ex Officio* Member
Ara Winter	Statistics/Modeling Expert
Ari Posner	Geomorphology Expert
Catherine Murphy	Program Support Team, SAMC Facilitator
David Moore	Terrestrial Ecology Expert
Debbie Lee	Program Support Team
Meaghan Conway	Ecosystem Function Expert
Megan Friggens	Climate Science Expert
Melissa Welsch	Program Support Team
Michelle Tuineau	Program Support Team
Rich Valdez	SWCA Environmental Consultants
Ryan Gronewold	Hydrology Expert

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Southwestern Willow Flycatcher and Yellow-billed Cuckoo
Conceptual Ecological Model Refinement Ad Hoc

Approved by Science and Adaptive Management Committee (SAMC) on _____, *2021*.

Parent Committee
Science and Adaptive Management Committee.

Ad Hoc Group Charge
Describe the level of scientific uncertainty for each relationship characterized in the Middle Rio Grande (MRG) conceptual ecological models for the southwestern willow flycatcher (*Empidonax trailii extimus*; SWFL) and yellow-billed cuckoo (*Coccyzus americanus*; YBCU). The CEMs can be found in Appendix C of the MRGESCP 2020 Science and Adaptive Management Plan (WEST 2020), tabular versions of which will be provided for assigning uncertainty to each relationship between a driver or stressor and a life stage response.

Membership

A. Criteria for membership

- Knowledge of SWFL and/or YBCU life history and ecology within the MRG;
- Familiarity with MRGESCP Science and Adaptive Management Plan (WEST 2020) and avian CEM development.

B. Member List

Amy Erickson, (Lead) Audubon New Mexico,
Meaghan Conway, NM Department of Game and Fish,
Dave Moore, Bureau of Reclamation Technical Service Center,
Ondrea Hummel, TetraTech,
Vicky Ryan, U.S. Fish & Wildlife Service,
Others?

Iterative Task Development

Background
Life stage-based CEMs are being developed for each of the five species under the purview of the MRGESCP. In order to aid in the prioritizing of research and conservation efforts, each relationship between a driver or stressor variable and a life-stage response is characterized by importance to recovery of the species, ability to manage and scientific uncertainty. The current models for SWFL and YBCU provide designations for level of importance and ability to manage, but not for level of scientific uncertainty about these relationships. The task described below will remedy these omissions and help to inform adaptive management strategies for SWFL and YBCU recovery.

This task will help to prioritize and address Critical Uncertainties SWFL2, SWFL3, SWFL5, YBCU1 and YBCU5 identified in the *Middle Rio Grande Adaptive Management Framework: Identifying Critical Scientific Uncertainties* (Caplan et al. 2018):

- SWFL2: The impact of the tamarisk beetle (*Diorhabda*) on SWFL breeding habitats in the MRG.

- SWFL3: SWFL breeding population sizes, distributions, and trends along the Angostura Reach.
- SWFL5: The abiotic and biotic variables that predict suitable and unsuitable SWFL habitats across multiple spatial and temporal scales in the MRG.
- YBCU1: The abiotic and biotic variables that predict suitable YBCU breeding habitats in the MRG across multiple spatial and temporal scales.
- YBCU5: The timing and availability of YBCU prey in the MRG and which factors influence both.

The SAMC requests that you review the draft task, deliverables and schedule below and provide feedback and questions to begin the iterative process of task development.

Tasks and Deliverables

Task 1: Characterize level of scientific uncertainty in SWFL and YBCU CEMs
Characterize the level of scientific uncertainty (i.e., High, Medium, or Low) for each relationship characterized in the MRG CEMs for the SWFL and YBCU. The CEMs can be found in Appendix C of the MRGESCP 2020 Science and Adaptive Management Plan (WEST 2020), tabular versions of which will be provided by the Program Support Team for assigning uncertainty to each relationship between a driver or stressor and a life stage response.

Objective of Task 1:
Characterizing the scientific uncertainty for each relationship between a driver or stressor variable and a life-stage response in the CEMs will help prioritize research and conservation efforts.

Deliverable:
1) Table format of each CEM with levels of scientific uncertainty (i.e., High, Medium, or Low) assigned to each relationship (i.e., row in the table) between a driver or stressor variable and a life stage response.
2) Identification of any areas of disagreement, if applicable, as well as any comments on accuracy of tabular conversion of the original CEMs.

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Task1: Characterize scientific uncertainty in SWFL and YBCU CEMs	NA	Modified table of SWFL CEM; modified table of YBCU CEM	TBD
		Presentation to SAMC	TBD

References:

Caplan, T., D. Lee, G. Wilde, H. Walker, and J. Frey 2018. Middle Rio Grande Adaptive Management Framework: Identifying Critical Scientific Uncertainties. Prepared for U.S. Army Corps of Engineers Albuquerque District on behalf of the Middle Rio Grande Endangered Species Collaborative Program. Prepared by GeoSystems Analysis, Inc. Albuquerque, New Mexico.

Western EcoSystems Technology, Inc. 2020. Middle Rio Grande Endangered Species Collaborative Program Science and Adaptive Management Plan. Prepared for the Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program, Albuquerque, NM. 98 pp.

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Rio Grande Silvery Minnow Conceptual Ecological Model/Genetics Ad Hoc

Approved by Science and Adaptive Management Committee (SAMC) on _____*2021*.

Parent Committee
Science and Adaptive Management Committee.

Ad Hoc Group Charge
Identify a series of genetic components that inform, and are informed by, the life history characteristics of the Rio Grande silvery minnow (RGSM), propagation and augmentation of the species, and environmental influences in the Middle Rio Grande (MRG). Incorporate these components into the conceptual ecological model (CEM) for the RGSM, found in Appendix B of the MRGESCP 2020 Science and Adaptive Management Plan (WEST 2020).

Membership

A. Criteria for membership

- Knowledge of RGSM genetics, life history and ecology within the Middle Rio Grande;
- Familiarity with MRGESCP Science and Adaptive Management Plan (WEST 2020), RGSM Genetics and Propagation Plan (CABQ et al. 2018a), and RGSM Augmentation Plan (CABQ et al. 2018b).

B. Member List

Wade Wilson (Lead), U.S. Fish and Wildlife Service, *Accepted*
Alison Hutson, New Mexico Interstate Stream Commission,
Kathy Lang, City of Albuquerque BioPark,
Megan Osborne, University of New Mexico,
Tom Turner, University of New Mexico,
Dana Price, U.S. Army Corps of Engineers,
Michael Porter, U.S. Army Corps of Engineers

Iterative Task Development

Background
RGSM genetic data guides and informs the propagation and augmentation plans. Thus, this work is also integral to our understanding of population dynamics. Any representation of RGSM population-level responses to environmental influences, therefore, should also include factors that affect the augmented species' genetic integrity and diversity. The current conceptual ecological model for RGSM currently fails to capture the full suite of threats to recovery of the species. The task described below will remedy these omissions and help to inform adaptive management strategies for RGSM recovery.

Specifically, this task addresses Recommendation 5 from the Fraser et al. Independent Science Panel on RGSM Genetics (AFWE&I 2016):

> *"The Science Workgroup (led by the Program) and the Genetics Workgroup (led by the USFWS) should integrate the genetics data and the decision-making more carefully. Specifically, there should be more translation of the genetics research into the adaptive*

management process, hatchery broodstock practices, and the integration of the past 15 years of research (genetics and ecology combined)."

The SAMC requests that you review the draft task, deliverables, and schedule below and provide feedback to begin the iterative process of task development.

Tasks and Deliverables

Task 1: Add genetics components to RGSM CEM

Identify a series of genetic components that inform, and are informed by, the life history characteristics of the RGSM and its environmental influences in the Middle Rio Grande. Incorporate these components into the conceptual ecological model (CEM) for the RGSM, found in Appendix B of the MRGESCP 2020 Science and Adaptive Management Plan (WEST 2020).

Objective of Task 1:
Incorporate genetic components into the RGSM CEM to facilitate additional linkages to Collaborative Program Objectives and RGSM recovery criteria.

Deliverable:
1) Schematic of RGSM CEM (provided by PST) modified to include genetic components and relationships with other components and life stages.
2) Presentation of modified schematic to SAMC, followed by discussion.

Task 2: Characterize relationships among RGSM CEM components

Indicate the level of influence and level of uncertainty for each relationship between pairs of components in the RGSM CEM.

Objective of Task 2:
Characterize the relationships with the added genetic components in the RGSM CEM to identify critical uncertainties for further study.

Deliverable:
Table of individual relationships between pairs of components in the RGSM CEM (provided by PST) with levels of influence (on RGSM population dynamics) and uncertainty characterized as High, Medium or Low.

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Task1: Add genetic components to RGSM CEM	NA	Modified schematic of RGSM CEM	May 21, 2021
		Presentation to SAMC	June SAMC meeting
Task 2: Characterize relationships	NA	Modified table of relationships in RGSM CEM	May 21, 2021

References:

Amec Foster Wheeler Environment & Infrastructure, Inc. 2016. Final Summary Report: Expert Peer Review of the Middle Rio Grande Endangered Species Collaborative Program's Rio Grande Silvery Minnow Genetics Project. Prepared for the U.S. Bureau of Reclamation, Albuquerque, NM.

City of Albuquerque, New Mexico Interstate Stream Commission, US Fish and Wildlife Service, and University of New Mexico. 2018. Rio Grande Silvery Minnow Genetics Management and Propagation Plan 2018-2022. City of Albuquerque BioPark, Albuquerque, NM.

City of Albuquerque, New Mexico Interstate Stream Commission, University of New Mexico, US Bureau of Reclamation, and US Fish and Wildlife Service. 2018. Rio Grande Silvery Minnow Annual Augmentation Plan 2018-2022. City of Albuquerque BioPark, Albuquerque, NM.

Western EcoSystems Technology, Inc. 2020. Middle Rio Grande Endangered Species Collaborative Program Science and Adaptive Management Plan. Prepared for the Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program, Albuquerque, NM. 98 pp.

MRGESCP 2021 Science Planning Objectives
Presented for Executive Committee review on 25 March 2021

Below is the list of MRGESCP scientific planning objective statements drafted at the February 10-11, 2021 Objectives Workshops and revised by the Science and Adaptive Management Committee (SAMC). These statements are presented to the Executive Committee for review and the final revision will inform recommended updates to the EC-approved Science and Adaptive Management Plan, Adaptive Management Relational Database, and Long-Term Plan for the MRGESCP.

Workshop Attendees (Day 1 - RGSM)	**Workshop Attendees (Day 2 – Avian/Other)**
Alison Hutson, NMISC	Alyssa O'Brien, City of ABQ Open Space
Alyssa O'Brien, City of ABQ Open Space	Amy Erickson, Audubon Southwest
Andy Dean, USFWS ES Office	Andy Dean, USFWS ES Office
Anne Marken, MRGCD	Ari Posner, USBR
Ara Winter, BEMP	Casey Ish, MRGCD Conservation Program
Ari Posner, USBR	Dave Moore, USBR Technical Service Center
Ashlee Rudolph, USBR	Debra Hill, USFWS
Carolyn Donnelly, USBR	Eric Gonzales, USBR
Casey Ish, MRGCD Conservation Program	Grace Haggerty, NMISC
Charles Yackulic, USGS	Hector Garcia, USBR
Cynthia Naha, Santo Domingo Pueblo	Jenny Davis, USFWS
Dale Strickland, WEST, Inc.	Lawrence Abeita, BIA
Debra Hill, USFWS	Liza Yazzie, Realty Specialist, USBR
Eric Gonzales, USBR	Mark Kelly, ABCWUA
Grace Haggerty, NMISC	Maya Pinon, Rep. Deb Haaland--NM01
Guilherme Dias, UNM Department of Biology	Meaghan Conway, NMDGF
Hector Garcia, USBR	Megan Friggens, USFS Rocky Mountain Research Station
Liza Yazzie, Realty Specialist, USBR	Mo Hobbs, ABCWUA
Mark Kelly, ABCWUA	Ondrea Hummel, Tetra Tech
Maya Pinon, Rep. Deb Haaland--NM01	Ryan Gronewold, USACE
Meaghan Conway, NMDGF	Trevor Birt, NMISC
Megan Osborne, UNM	*Catherine Murphy, PST*
Mick Porter, USACE	*Debbie Lee, PST*
Mike Marcus, MRG Water Advocates Board	*Melissa Welsch, PST*
Mo Hobbs, ABCWUA	*Michelle Tuineau, PST*
Nate Caswell, USFWS New Mexico FWCO	
Nathan Schroeder, Pueblo of Santa Ana	
Quantina Martine, Audubon Southwest	
Reynalden Delgarito, USACE	
Rich Valdez, SWCA, representing NMISC	
Ryan Gronewold, USACE	
Steve Zipper, SWCA	
Thomas Archdeacon, USFWS-NMFWCO	
Catherine Murphy, PST	
Debbie Lee, PST	
Julie Dickey, PST	
Melissa Welsch, PST	
Michelle Tuineau, PST	

RGSM Objective A-1

Original statement: *Analyze available monitoring data for the RGSM from Cochiti Reservoir to Elephant Butte Reservoir to track population trends in the MRG.*

Revised statement: ***Estimate the abundance of augmented and wild born RGSM populations in the Angostura, Isleta, and San Acacia reaches from year to year.***

RGSM Objective A-2

Original statement: *Continue to support research into the life history of the RGSM to further inform management of the species.*

Revised statement: ***Increase understanding of how the life history traits of the RGSM change over time and space, to better inform management of the species and increase the probability of recovery.***

RGSM Objective A-3

Original statement: *Support research and modeling efforts to determine how much base flow is needed to produce sufficient habitat to support species survival rates necessary to achieve a self-sustaining population in each reach.*

Revised statement: ***Determine the relationships between base flow and survival and recruitment of RGSM in the Middle Rio Grande.***

RGSM Objective A-4

Original statement: *Support research and modeling efforts to determine timing, duration, and magnitude of flows needed to produce sufficient habitat in support of species recruitment rates for a self-sustaining population in each reach.*

Revised statement: ***Determine suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph) needed to cue spawning and recruitment for the RGSM population, given system constraints and opportunities.***

RGSM Objective A-5

Original statement: *Contribute to research and modeling efforts to better understand the quantity and quality of habitat needed at different flow regimes to support recruitment and survival of RGSM.*

Revised statements:

A-5.1) Refine existing research and modeling efforts to understand the quantity and quality of habitat available at different flow regimes.

A-5.2) Develop a range of options for increasing habitat availability and refugia at life stage-limiting flow regimes for all life stages.

RGSM Objective A-6

Original statement: *NA*

Proposed statements:

A-6.1) **Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM genetic diversity.**

A-6.2) **Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM population viability.**

SWFL Objective B-1

Original statement: *Continue monitoring for SWFL in designated critical habitat areas to track territories in the MRG management unit of the Rio Grande recovery unit.*

Revised statement: ***Monitor for SWFL in the MRG management unit of the Rio Grande recovery unit.***

SWFL Objective B-2

Original statement: *Continue monitoring critical SWFL habitat and contribute to research on the impacts from non-native and exotic species on SWFL recovery.*

Revised statement: ***Determine habitat availability for SWFL within the MRG.***

SWFL Objective B-3

Original statement*: Support large-scale restoration efforts to protect and expand SWFL habitat in the MRG.*

Revised statements:

B-3.1) Characterize optimal breeding habitat conditions in currently occupied SWFL locations to inform restoration.

B-3.2) Manage successional processes that maintain existing SWFL breeding habitat in the Program Area.

B-3.3) Expand SWFL breeding habitat through restoration efforts in the Program Area.

YBCU Objective C-1

Original statement*: Contribute to research and understanding of habitat needs for the YBCU.*

Revised statements:

C-1.1) Characterize optimal habitat (i.e., foraging and nesting) conditions on landscape and microhabitat levels in currently occupied YBCU locations to inform habitat mapping and restoration efforts.

C-1.2) Determine successional processes that promote optimal YBCU habitat (i.e., foraging and nesting) in the Program Area.

C-1.3) Expand monitoring efforts for YBCU.

NMMJM Objective D-1

Original statement: *Contribute to efforts to expand habitat and preserve existing habitat in the MRG.*

Revised statements:

D-1.1) Initiate and support NMMJM monitoring efforts to locate existing populations, identify relevant habitat features, and identify potentially suitable unoccupied habitat..

D-1.2) Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

PESU Objective E-1

Original statement: *Continue monitoring for PESU stands in the West-Central New Mexico Recovery Region and preserve habitat.*

Revised statements:

E-1.1) Continue and expand monitoring and surveying for PESU stands in the West-Central New Mexico Recovery Region.

E-1.2) Preserve and expand existing habitat stands in the West-Central New Mexico Recovery Region.

OTHER Objective F-1

Original statement: *Monitor the status of other threatened species in the MRG.*

Revised statement: ***Monitor trends in ecosystem function in the MRG for indications of decline (e.g., changes in vegetation structure and composition, population trends in other special status species, etc.).***

OTHER Objective G-1

Original statement: *Support the establishment and maintenance of a Conservation Storage pool in Abiquiu Reservoir status of other threatened species in the MRG.*

Revised statement: ***Support efforts to enhance the operational flexibility of water managers to support species.***

OTHER Objective H-1

Original statement: *NA*

Proposed statement: ***Determine the impacts from non-native vegetation on listed species' habitat availability and population dynamics.***

					Type of Program Activity					Project Focus							Hydrologic Conditions			Reach						Authority					
Science Objective	Science Strategy	Project	Hypothesis	Uncertainty	Habitat Assessments & Modeling	Species Management & Recovery	Population Monitoring & Modeling	Program Management & Administration	Field & Laboratory Experiments	NMMJM	PESU	RGSM	SWFL	YBCU	Other	MRG Ecosystem	Wet Year	Average Year	Dry Year	Northern	Cochiti	Angostura	Isleta	San Acacia	Not Applicable	2016 MRG	BDD	ABCWUA	USACE B2B	CoA General Plan	RGSM Prop Plan
Objective A1	Strategy 1.1	Project 1		RGSM1			X					X					X	X				X	X			RPMX					
		Project 2						X							X				X			X	X			RPMX					
		Project 3			X							X										X				RPMX		RPMX			
Objective F1	Strategy 1.1	Project 4			X											X	X	X	X	X						RPMX		RPMX			
		Project 5					X						X							X												
Objective B3	Strategy 3.2	Project 6	Hypothesis 3-A	SWFL3					X				X				X	X	X				X								
		Project 7						X		X														X						Action X	
		Project 8						X							X										X					Action X	
		Project 9					X						X	X								X	X	X							
Objective C1	Strategy 1.2	Project 10	Hypothesis 2-A	YBCU1					X					X			X	X	X			X	X	X							
		Project 11				X							X	X					X			X	X	X							
		Project 12		NMMJM1	X					X								X						X							
Objective E1	Strategy 1.3	Project 13	Hypothesis 1-C	PESU1					X		X													X							

					Type of Program Activity					Project Focus						Hydrologic Conditions			Reach					Authority					
Science Objective	**Science Strategy**	**Project**	**Hypothesis**	**Uncertainty**	**Habitat Assessments & Modeling**	**Species Management & Recovery**	**Population Monitoring & Modeling**	**Program Management & Administration**	**Field & Laboratory Experiments**	**NMMJM**	**PESU**	**RGSM**	**SWFL**	**YBCU**	**MRG Ecosystem**	**Wet Year**	**Average Year**	**Dry Year**	**Northern**	**Cochiti**	**Angostura**	**Isleta**	**San Acacia**	**2016 MRG**	**BDD**	**ABCWUA**	**USACE B2B**	**CoA General Plan**	**RGSM Propagation Plan**
Objective B1	Strategy 1.1	2019 SWFL Surveys					X						X									X	X	RPMX					
Objective C1	Strategy 1.3	2019 YBCU Surveys					X							X								X	X	RPMX					
		City of Albuquerque Aquatic Conservation Facility Rearing and Breeding Operations and Maintenance				X						X												RPMX		RPMX			
Objective A1	Strategy 1.1	Evaluation of Rio Grande Silvery Minnow Population Model Alternatives	Current mixture model is most suitable for computing RGSM CPUE.	RGSM4; RGSM13			X					X												RPMX		RPMX			
		Otolith Validation Study	Using otoliths to determine age of wild larvae is feasible.	Length at age in larval development					X			X																	
		Otolith Age Comparison by Reach	Growth trajectories of wild-captured larval RGSM do not differ across three reaches of the Rio Grande.	Environmental factors impacting larval development					X			X				X	X				X	X	X						
		Candelaria Nature Preserve Wildlife Inventory				X									X						X							Action X	
		Candelaria Nature Preserve Hydrology and Soils			X										X						X							Action X	
		Habitat Restoration in the Isleta and San Acacia Reaches							X			X	X	X	X			X				X	X						
		Los Lunas Habitat Restoration Project Monitoring							X																				

Project ID	(Coding for species, hierarchy)					
Date Entered						
Project Name						
Project Category	(See annual report)					
Objective Link						
Uncertainty Link						
Hypothesis Link						
Project Focus	NMMJM	PESU	RGSM	SWFL	YBCU	MRG Ecosystem
Reach(es)	Northern	Cochiti	Angostura	Isleta	San Acacia	
Temporal Scale						
Hydrology Conditions	High	Medium	Low			
Biotic Presence	NMMJM	PESU	RGSM	SWFL	YBCU	
Type of Program Activity	Habitat Assessments & Modeling	Species Management & Recovery	Population Monitoring & Modeling	Program Management & Administration	Field & Laboratory Experiments	
Contribute to CP Operations/Admin/	Y/N					
Authority Links	2016 MRG	BDD	ABCWUA	USACE B2B	etc.	
Total Cost	Estimated	Actual				
Annual Cost	By year					
Short Description						
SOW Link						
Contracted	Yes	No				
Contracting Period	Starting FY	Ending FY				
Anticipated Completion						
Contracting Agency						
Contract Number						
Point of Contact						
Contractor						
Partner Organizations						
Deliverable Deadlines						
Links to report/data						
Findings Publication	Report	Peer review article				
Presentation to Program	Y/N					
Findings Incorporated in Database	Y/N					
Findings Incorporated into CEMs	Y/N					
Notes	Notes Types as diff values					

Middle Rio Grande Endangered Species Collaborative Program

2021 Science Objectives

22 April 2021

Science & Adaptive Management Committee Meeting

DRAFT 2021 Science Objectives - RGSM



Objective A-1: Estimate the abundance of augmented and wild born RGSM populations in the Angostura, Isleta, and San Acacia reaches from year to year.

Objective A-2: Increase understanding of how the life history traits of the RGSM change over time and space, to better inform management of the species and increase the probability of recovery.

Objective A-3: Determine the relationships between base flow and survival and recruitment of RGSM in the Middle Rio Grande.

Objective A-4: Determine suitable environmental flow (i.e., timing, duration and magnitude of spring hydrograph) needed to cue spawning and recruitment for the RGSM population, given system constraints and opportunities.

DRAFT 2021 Science Objectives - RGSM



Objective A-5:

A-5.1: Refine existing research and modeling efforts to understand the quantity and quality of habitat available at different flow regimes.

A-5.2: Develop a range of options for increasing habitat availability and refugia at life stage-limiting flow regimes for all life stages.

Objective A-6:

A-6.1: Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM genetic diversity.

A-6.2: Evaluate the effects of species management (i.e., propagation, augmentation, rescue/salvage) on RGSM population viability.

DRAFT 2021 Science Objectives - SWFL



Objective B-1: Monitor for SWFL in the MRG management unit of the Rio Grande recovery unit.

Objective B-2: Determine habitat availability for SWFL within the MRG.

Objective B-3:

B-3.1: Characterize optimal breeding habitat conditions in currently occupied SWFL locations to inform restoration.

B-3.2: Manage successional processes that maintain existing SWFL breeding habitat in the Program Area.

B-3.3: Expand SWFL breeding habitat through restoration efforts in the Program Area.

DRAFT 2021 Science Objectives - YBCU



<u>Objective C-1</u>:

C-1.1: Characterize optimal habitat (i.e., foraging and nesting) conditions on landscape and microhabitat levels in currently occupied YBCU locations to inform habitat mapping and restoration efforts.

C-1.2: Determine successional processes that promote optimal YBCU habitat (i.e., foraging and nesting) in the Program Area.

C-1.3: Expand monitoring efforts for YBCU.

DRAFT 2021 Science Objectives - NMMJM



<u>Objective D-1</u>:

D-1.1: Initiate and support NMMJM monitoring efforts to locate existing populations, identify relevant habitat features, and identify potentially suitable unoccupied habitat.

D-1.2: Contribute to efforts to expand habitat and preserve existing habitat in the MRG.

DRAFT 2021 Science Objectives - PESU



<u>Objective E-1</u>:

E-1.1: Continue and expand monitoring and surveying for PESU stands in the West-Central New Mexico Recovery Region.

E-1.2: Preserve and expand existing habitat stands in the West-Central New Mexico Recovery Region.

DRAFT 2021 Science Objectives - OTHER



Objective F-1: Monitor trends in ecosystem function in the MRG for indications of decline (e.g., changes in vegetation structure and composition, population trends in other special status species, etc.).

Objective G-1: Support efforts to enhance the operational flexibility of water managers to support species.

Objective H-1: Determine the impacts from non-native vegetation on listed species' habitat availability and population dynamics.

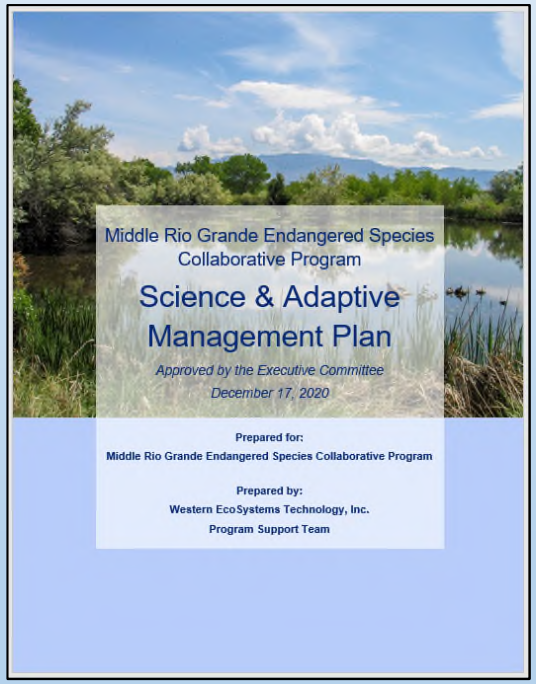
Middle Rio Grande Endangered Species Collaborative Program

Science Planning with the AM Relational Database

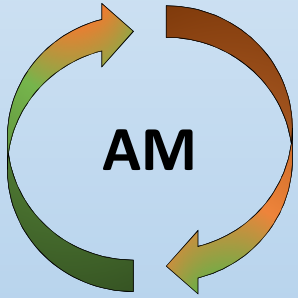
22 April 2021

Science & Adaptive Management Committee Meeting

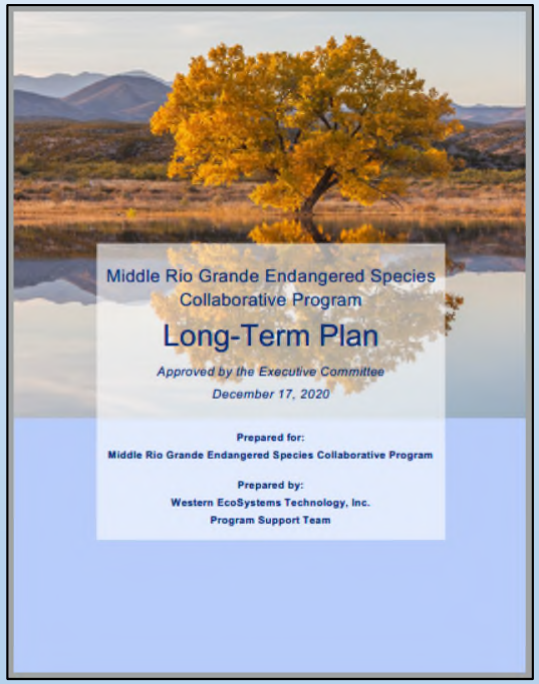
Science & Adaptive Management Process



Science Objectives



Management Recommendations

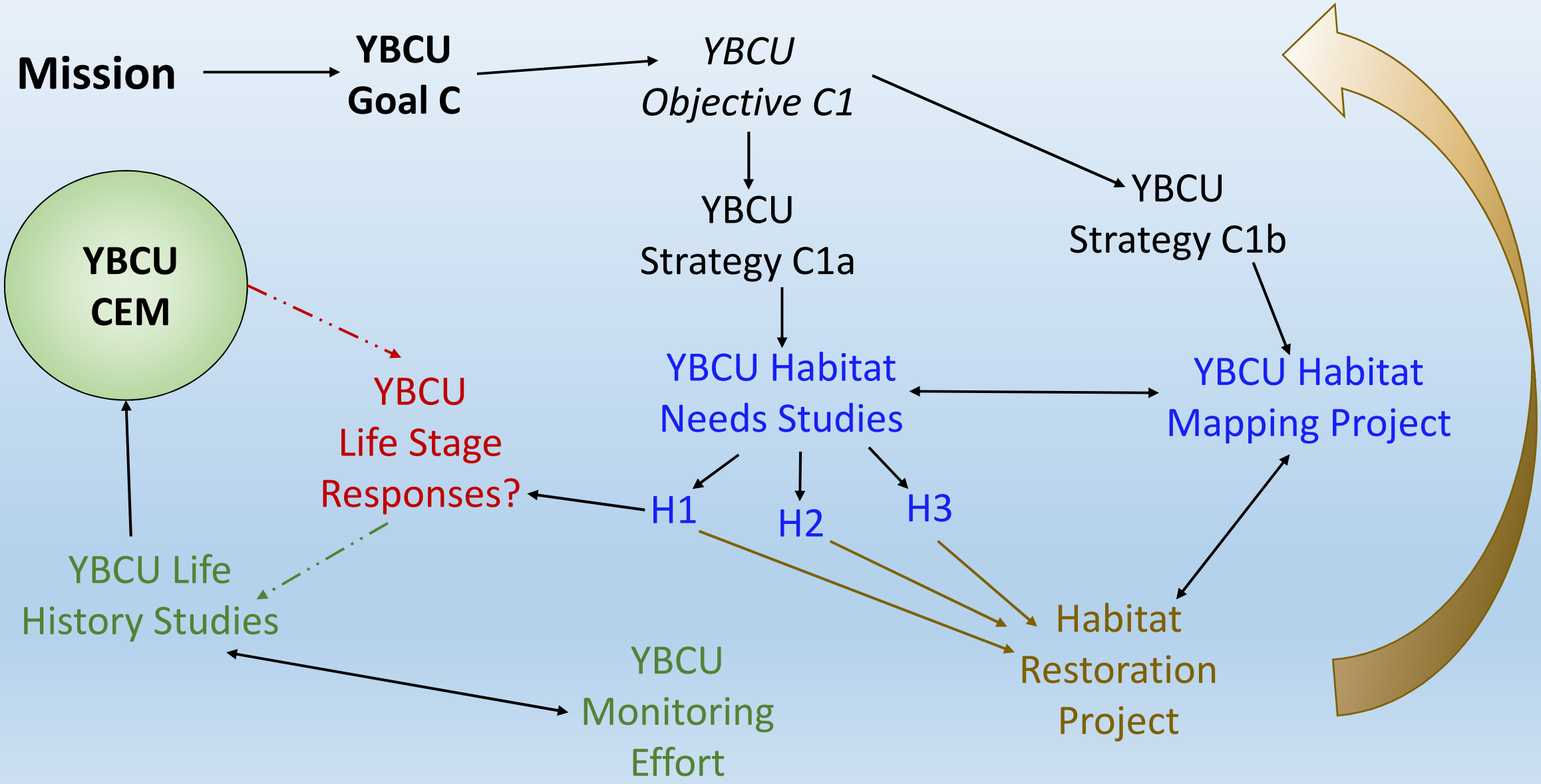


Science & Adaptive Management Process

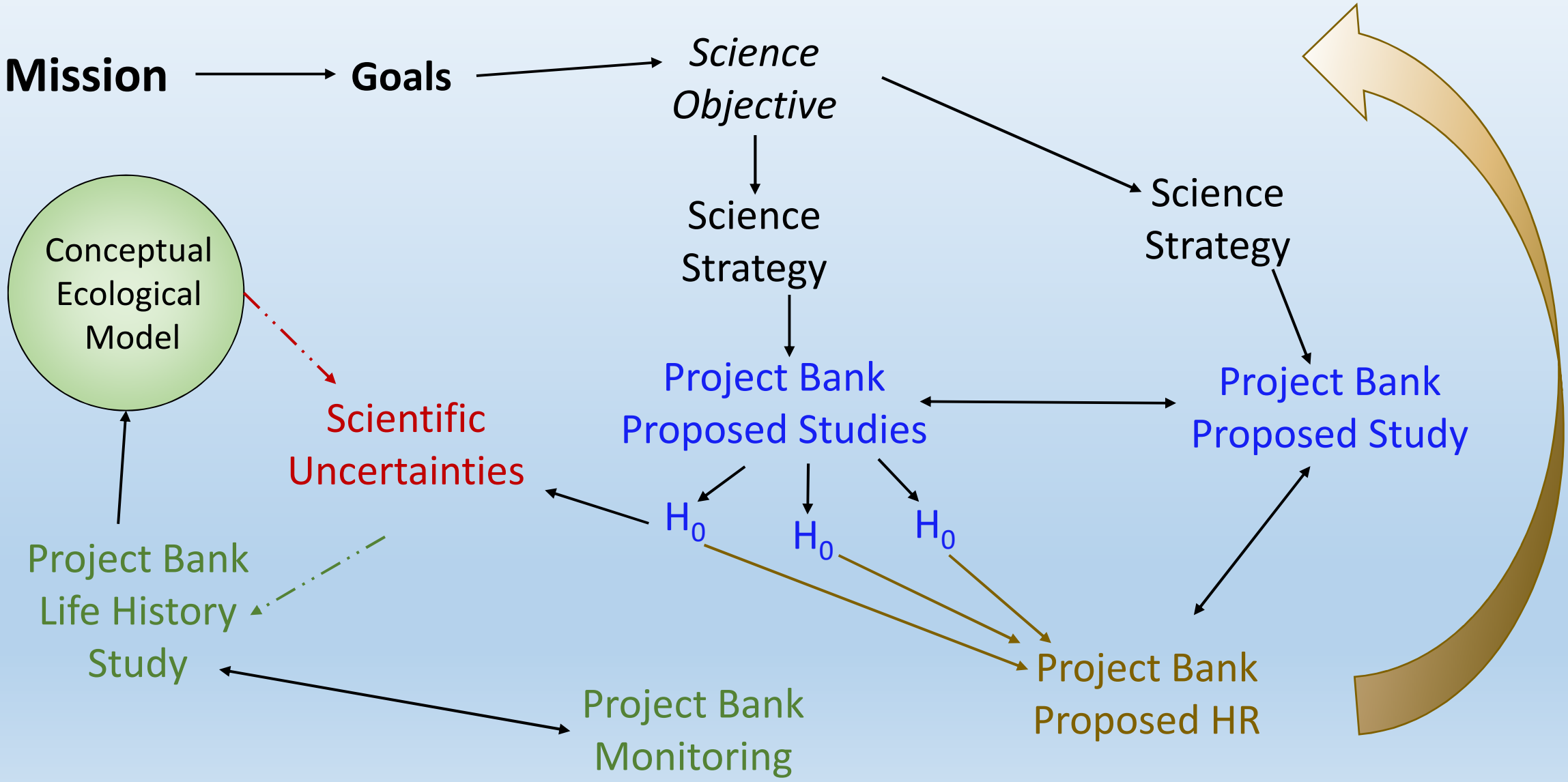
Science Objectives Workshop – February 10-11, 2021

- ✓Purpose:
  - ❖Align the Collaborative Program's scientific planning objectives with its mission statement and goals.
  - ❖Appraise the objectives and associated strategies yearly with input from stakeholders and technical experts.
- ✓40 participants representing ~20 organizations/offices
- ✓Revised/drafted 23 objective statements to address MRGESCP goals
- ✓Reviewed by EC; ready for integration into AM Relational Database
- Suggested strategies will be assessed by SAMC and further developed by Science & Technical ad hoc groups
- Science objectives are being linked to projects to enable transparent prioritization for long-term planning

Science & Adaptive Management pathways – YBCU example

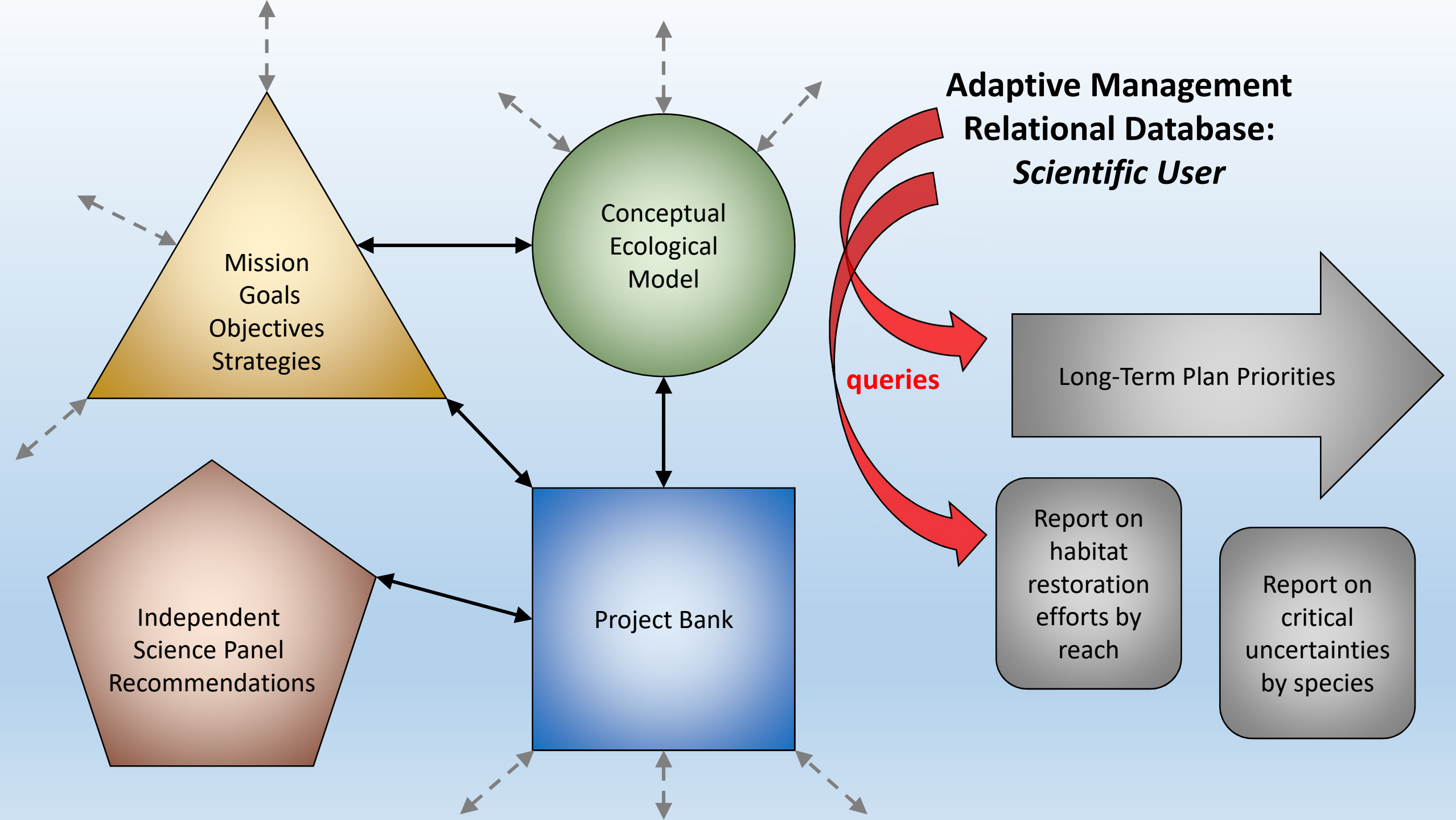


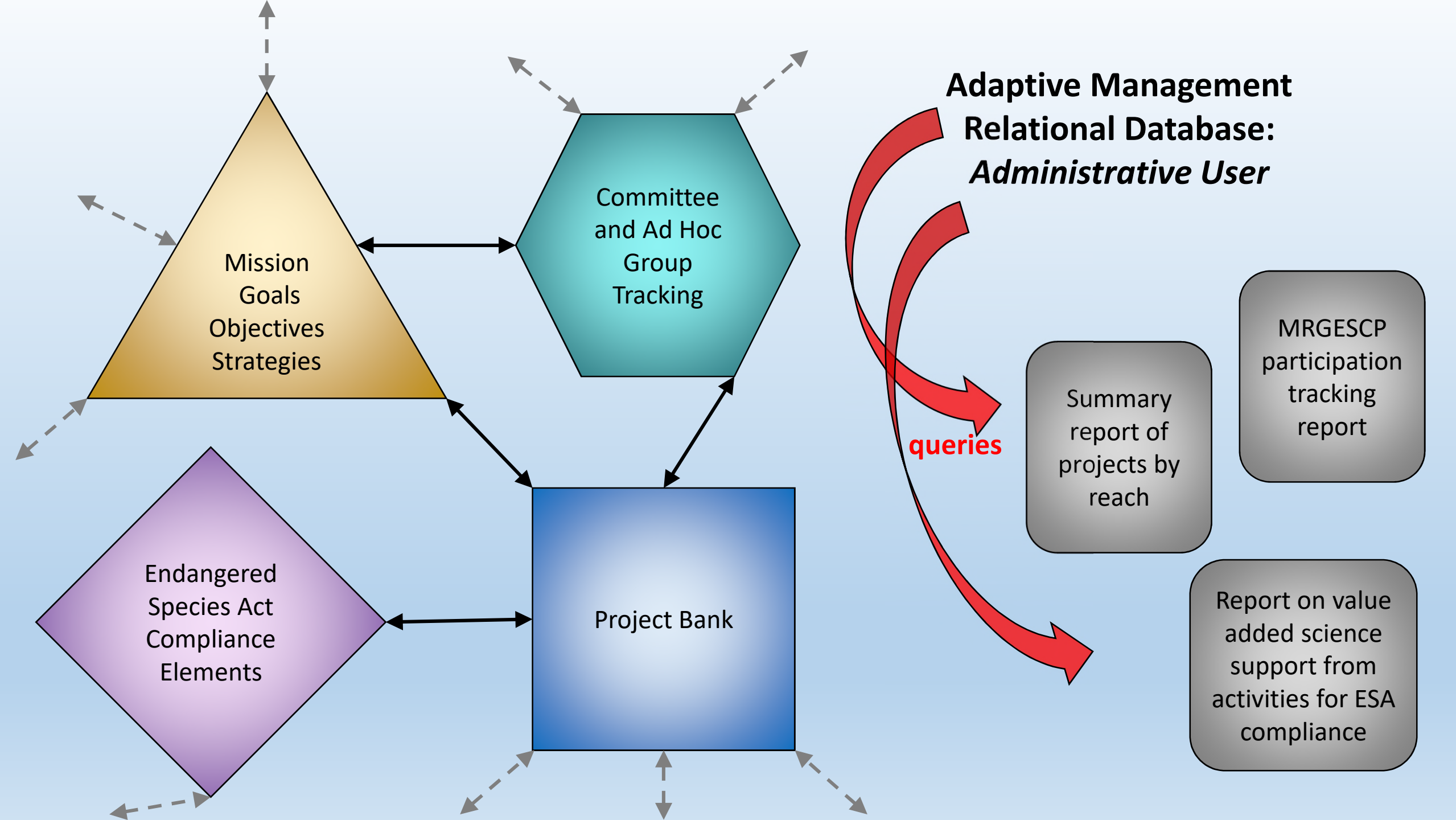
Science & Adaptive Management pathways – AMRDB tables



Adaptive Management Relational Database

- User – a Collaborative Program participant wishing to search for information and generate reports on MRGESCP activities (completed, ongoing, proposed), and to relate activities to science and adaptive management initiatives.
  - Scientific user – a user with scientific or technical queries, such as:
    - Track progress being made on critical uncertainties
    - Summarize scientific investigations by reach, species or type
    - Determine how a particular project supports the science objectives
  - Administrative user – a user with administrative queries, such as:
    - Track participation in MRGESCP ad hoc groups and committees
    - Quickly summarize projects by reach, species or type
    - Evaluate science support gained from carrying out activities for ESA compliance


Adaptive Management
Relational Database:
Scientific User
Mission
Goals
Objectives
Strategies
Conceptual
Ecological
Model
queries
Long-Term Plan Priorities
Report on
habitat
restoration
efforts by
reach
Report on
critical
uncertainties
by species
Independent
Science Panel
Recommendations
Project Bank


Adaptive Management
Relational Database:
Administrative User
Mission
Goals
Objectives
Strategies
Committee
and Ad Hoc
Group
Tracking
Endangered
Species Act
Compliance
Elements
Project Bank
queries
Summary
report of
projects by
reach
MRGESCP
participation
tracking
report
Report on value
added science
support from
activities for ESA
compliance

Example of report: Long-Term Plan

					Type of Program Activity					Project Focus						
Science Objective	Science Strategy	Project	Hypothesis	Uncertainty	Habitat Assessments & Modeling	Species Management & Recovery	Population Monitoring & Modeling	Program Management & Administration	Field & Laboratory Experiments	NMMJM	PESU	RGSM	SWFL	YBCU	Other	MRG Ecosyster
Objective A1	Strategy 1.1	Project 1		RGSM1			X					X				
		Project 2						X							X	
		Project 3			X							X				
Objective F1	Strategy 1.1	Project 4			X											X
		Project 5					X						X			
Objective B3	Strategy 3.2	Project 6	Hypothesis 3-A	SWFL3					X				X			
		Project 7						X		X						
		Project 8						X							X	
		Project 9					X						X	X		
Objective C1	Strategy 1.2	Project 10	Hypothesis 2-A	YBCU1					X					X		
		Project 11				X							X	X		
		Project 12		NMMJM1	X					X						
Objective E1	Strategy 1.3	Project 13	Hypothesis 1-C	PESU1					X		X					

Middle Rio Grande Endangered Species Collaborative Program

Habitat Restoration Monitoring Plan for the MRG

22 April 2021

Science & Adaptive Management Committee Meeting

MRG Habitat Restoration Monitoring Plan

Benefits of a broader monitoring program:

- Address reach-level (or larger) questions,
- Provide context necessary for properly evaluating HR success at the site-level,
- Share findings and lessons learned,
- Technical assistance with design, protocols and analysis,
- Link individual projects with CEMs, species-monitoring, Recovery criteria and Program science objectives

MRG Habitat Restoration Monitoring Plan

Host series of webinars on past/ongoing HR efforts to inform and lead up to a workshop:

May	June	July	August	September
Terrestrial HR Webinars - invited speakers: - COA - Santa Ana - MRGCD	Aquatic HR Webinars - invited speakers: - ABCWUA - NMISC - USBR - USACE	Floodplain HR Webinars - invited speakers: - BEMP - BDD - Sandia	HR Workshop - A. Rudolph - G. Haggerty - NMDGF	Synthesize findings - Commonalities - Standards - Reach level questions

MRG Habitat Restoration Monitoring Plan

Questions for HR webinar slide template:

1. What is your organization's objective regarding habitat restoration?
2. Where is your HR project located and what is the current status (proposed, ongoing, complete)?
3. For which target species are you restoring or creating habitat?
4. What biotic and abiotic metrics do you measure?
5. How do you define success for your project? What are the target metrics?
6. Does your project design include a control site for comparison?
7. Do your HR projects include pre- and post-construction monitoring?
8. Can you share any lessons learned (from planning, construction or monitoring) regarding successes, failures or unexpected outcomes?

MRG Habitat Restoration Monitoring Plan

Format of workshop could include:

- Overview – purpose, goals and benefits
- Summary of presentations on past/ongoing HR projects from webinar series
- Presentations on proposed/future HR efforts
- Group discussion/activity to identify common HR objectives, define appropriate metrics and generate reach-level context questions

MRG Habitat Restoration Monitoring Plan

Next Step: Consider three types of restoration monitoring:

(1) to determine whether a particular project was completed as specified in the restoration plan (construction monitoring)

(2) to evaluate the performance of a restoration project relative to the project objectives (performance monitoring)

(3) to learn from the restoration effort in structured ways to enhance the effectiveness of restoration efforts over the long-term (monitoring to support adaptive management)

Science and Adaptive Management Committee Meeting

May 27, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *MRG AM Framework: Identifying Critical Scientific Uncertainties [read-ahead, not included]*
- *Responses to PMWG Summary Report Findings and Recommendations [read-ahead, not included]*
- *Climate Change Questions [read-ahead]*
- *Information on Department of Defense Climate Assessment Tool [read-ahead]*
- *HR Planning and Monitoring Considerations [read-ahead, draft]*
- *Science Coordinator Update [presentation]*
- *The SAMC's Role in the MRGESCP's AM Efforts [presentation]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC) Meeting
May 27, 2021
8:00 AM–12:00 PM

Meeting Location: *Zoom*
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Meeting ID: 898-359-3120; Passcode: 1251
Call-In: +1-669-900-6833

Meeting Agenda

***Meeting Objectives*:**

- Hear presentation on SAMC roles and expectations, with opportunities for SAMC members to help develop the adaptive management processes for the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
- Discuss data sources for Adaptive Management Relational Database (AMRDB)
- Discuss reviews, findings and recommendations from Rio Grande silvery minnow (RGSM) Population Monitoring Work Group (PMWG) Ad Hoc Group's summary report, and determine next steps
- Receive progress updates on Science & Technical (S&T) Ad Hoc Groups
- Discuss incorporation of climate change factors into MRGESCP science initiatives and choose Science Strategies for development in 2021
- Discuss revisions to the proposed workshop on 2021 Middle Rio Grande (MRG) Habitat Restoration (HR) Monitoring, and development of a standardized HR monitoring protocol

8:00 – 8:10	**Welcome, Meeting Objectives, and Agenda Review** ✓ **Decision**: Approve May 27, 2021 meeting agenda ✓ **Decision**: Approve April 22, 2021 meeting minutes Read-ahead: ☐ Draft April 22, 2021 meeting minutes	*Catherine Murphy, Program Support Team (PST)*
8:10 – 8:40	**SAMC Role in MRGESCP Adaptive Management Efforts** • SAMC member roles and expectations • Upcoming tasks • Group discussion	*Debbie Lee, PST*

8:40 – 9:10	**Incorporate Findings and Recommendations into the Adaptive Management Relational Database (AMRDB)** • MRGESCP data sources and incorporation of information into the AMRDB • Discuss key tables within AMRDB and their functions Read-aheads: ☐ Middle Rio Grande Adaptive Management Framework: Identifying Critical Scientific Uncertainties (Caplan et al. 2018) – Tables 3, 4, 5 and 6 (pages 32, 52, 67, and 85, respectively)	*Catherine Murphy, PST*
9:10 – 10:10	**Review of Findings and Recommendations from RGSM PMWG Summary Report S&T Ad Hoc Group** • Ad Hoc Group feedback on findings and recommendations comment matrix and report review history • SAMC reviews of the summary report • Next steps prior to July EC meeting Read-ahead: ☐ Responses to PMWG Summary Report Findings and Recommendations comment matrix ✓ **Decision**: Approve next steps in preparing recommendations to EC ➢ **Action:** SAMC will consider PMWG findings and recommendations and provide feedback on the comment matrix ➢ **Action:** PST will draft a cover memo from the SAMC to the EC regarding PMWG findings and recommendations for SAMC review	*Facilitated discussion*
10:10 – 10:20	**Break**	
10:20 – 10:40	**Update on Science & Technical Ad Hoc Groups** • RGSM Population Modeling Ad Hoc Group • RGSM Conceptual Ecological Model/Genetics Ad Hoc • Southwestern Willow Flycatcher and Yellow-billed Cuckoo Conceptual Ecological Model Refinement Ad Hoc • Results of SAMC poll on Science Strategies ✓ **Decision**: Choose Science Strategies for ad hoc development ➢ **Action:** PST will draft ad hoc charges for chosen Science Strategies	*Catherine Murphy, PST*

10:40 – 10:50	**Follow-up on Climate Change in Science Initiatives** • Discuss read-ahead materials on climate change • Potential incorporation of climate change questions in project development Read-aheads: ☐ Climate change questions suggested by Megan Friggens for project proposals ☐ Information on Department of Defense Climate Assessment Tool provided by Ryan Gronewold ✓ **Decision:** Include climate questions when collecting project proposals? If yes, what questions? ➢ **Action:** PST will add climate questions to the project data entry form and related AMRDB tables	*Catherine Murphy, PST*
10:50 – 11:50	**2021 MRGESCP Approach to Standardizing Habitat Restoration (HR) Monitoring** • Proposed approach for developing a standardized monitoring plan for HR within the MRG • Draft template for HR considerations • Revised HR workshop and format Read-aheads: ☐ DRAFT template for HR considerations ✓ **Decision:** Host a workshop to organize HR efforts within the MRG ➢ **Action:** PST will plan a HR workshop hosted by the SAMC ➢ **Action:** PST will finalize HR planning template and promote its use within the MRGESCP	*Facilitated discussion*
11:50 –12:00	**Meeting Summary and Action Items Review** ➢ **Next SAMC meeting:** Thursday, June 24, 2021, 8am-noon	*PST*
12:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

May 27, 2021; 8:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of May 27, 2021 SAMC meeting agenda
- ✓ Approval of April 22, 2021 SAMC meeting minutes
- ✓ Approval of next steps on Population Monitoring Work Group (PMWG) summary report

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST) and Ari Posner	Discuss how to incorporate management actions into the SAMC's discussions of uncertainty and influence on species, and add the topic to a future meeting agenda	June 11, 2021
PST and Rich Valdez	Compile the review history of the PMWG summary report	June 14, 2021
PST	Individually contact PMWG members to request reviews of the summary report findings and recommendations	May 28, 2021
PST	Contact absent SAMC members to discuss the next steps on the PMWG summary report	June 4, 2021
SAMC	Provide feedback on the PMWG summary report findings and recommendations via a comment matrix	June 11, 2021
SAMC	Discuss and provide the SAMC's synthesis, findings, and recommendations from the PMWG summary report to the Executive Committee (EC)	June 24, 2021
PST	Draft a cover memo from the SAMC to the EC in coordination with R. Valdez. regarding the PMWG summary report for SAMC review	July 10, 2021
PST	Revise the criteria for ranking science strategies based on SAMC discussion	June 17, 2021
PST	Schedule and support the upcoming Rio Grande silvery minnow (RGSM) conceptual ecological model (CEM) ad hoc group meeting	June
PST	Schedule and support the upcoming avian CEM ad hoc group meeting	June
SAMC	Develop the New Mexico meadow jumping mouse (NMMJM) Science Strategy D-1.1a	June 17, 2021

PST	Revise climate questions based on SAMC discussion and add them to the project data entry form and related Adaptive Management Relational Database (AMRDB) tables	June 17, 2021
PST	Revise the habitat restoration planning template based on discussion for review at the next meeting	June 17, 2021
PST	Send out pre-workshop survey on HR planning considerations to the MRGESCP to help guide workshop discussion	July 30, 2021
SAMC	Suggest any individuals to invite to participate in the HR workshop	June 24, 2021
SAMC and PST	Develop a plan for the HR workshop to the EC for approval	July 14,2021
PST	Plan a HR workshop hosted by the SAMC	August/September

Next Meeting: June 24, 2021

Meeting Summary

Welcome, Meeting Objectives, and Agenda Review

Catherine Murphy, PST Science Coordinator and SAMC Facilitator, opened the meeting and led introductions. Catherine M. reviewed the May 27, 2021 meeting agenda and objectives, and April 22, 2021 meeting minutes.

- ✓ **Decision**: The SAMC approved the May 27, 2021 SAMC meeting agenda
- ✓ **Decision**: The SAMC approved the April 22, 2021 SAMC meeting minutes

SAMC Role in MRGESCP Adaptive Management Efforts

Debbie Lee presented on the role of the SAMC in the MRGESCP's adaptive management (AM) efforts (see presentation). Summary points are below:

- A diagram from the U.S. Agency for International Development shows a framework for collaborating, learning, and adapting that can be applied to the MRGESCP. The SAMC plays a role in collaborating, learning, adapting, culture, and processes.
- The SAMC is a synthesizer and translator of science. It helps to build trust in the scientific process.
- To generate that trust, the SAMC ensures methodologies are unbiased and objective, processes for decision-making are transparent, and findings are clearly communicated and well documented.
- By informing and documenting AM, the SAMC is shifting the culture of the MRGESCP from reactive to proactive.
- The SAMC will help develop an AM process that uses a strategic approach for prioritizing and recommending projects, assist with development and utilization of the AMRDB, and update AM tools, such as conceptual ecological models.
- The next steps for the SAMC are developing science strategies to meet the science objectives and linking strategies to scientific uncertainties via the Project Bank.
- The SAMC will inform the development of standardized processes for peer review (including citations and references), prioritization of studies, AM recommendations, how to communicate scientific findings, development of project ideas, and updating MRGESCP plans and AM tools.

- After a Science & Technical (S&T) Ad Hoc Group finishes its work, the SAMC has multiple options for next steps on the S&T's deliverables.
- The PST will communicate with individual SAMC members between meetings, draft and document processes, track progress on work product deliverables, and communicate between the SAMC and other groups.

Comments:

- Are science and AM treated separately or together in the SAMC?
    - Science is integral to AM. AM informs decision-making through the iterative learning cycle, which is updated with scientific findings. Therefore, scientific studies need to address management questions.
- The management piece was not mentioned in the presentation.
    - The MRGESCP is moving from a cost share-focus to a signatory contributions-focus. These contributions are findings (from implemented projects) that are reported to the MRGESCP and incorporated into the AMRDB to inform management recommendations. Findings can be linked to management, and can be used to inform future recommendations from the SAMC to the EC.
    - Signatories carry out their activities based on their own authorities and the MRGESCP carries out its own activities. The overlap between the two is where signatories share information and data, and the MRGESCP provides scientifically justified recommendations. The degree of overlap will vary among individual signatories.
- Two ways to approach science and AM: 1) Use science to resolve uncertainties within CEMs and improve understanding of species natural history to inform management decisions and 2) Evaluate management actions with regard to MRGESCP goals and species response. There is concern that the iterative process of evaluating management activities could be lost when science is primarily focusing on basic research and natural history.
    - The RGSM CEM Ad Hoc Group is addressing management by adding propagation, augmentation, and genetic factors to the RGSM CEM. This may need to occur for the other CEMs as well.
    - Management actions and how they influence species needs to be mapped out. The system is complicated and difficult to map out.
        - This topic will be added to a future SAMC meeting agenda and Ari Posner, SAMC, will contribute to the conversation beforehand.
    - Signatories collect data around management actions and these activities have been included in the AMRDB via annual reports.

➢ **Action Item**: The PST and A. Posner will discuss how to incorporate management questions into the SAMC's discussions of uncertainty and influence on species, and add the topic to a future meeting agenda

Incorporating Findings and Recommendations into the AMRDB

C. Murphy presented on the information sources used to build the AMRDB and how to incorporate scientific findings and recommendations (see presentation). Summary points are below:

- The SAMC tasks ad hoc groups, compiles and translates results, and communicates and revisits recommendations to the EC. These processes are documented in the AMRDB.
- Sources for the AMRDB include recovery plans, biological opinions, independent science panel recommendations, MRGESCP annual reports, S&T Ad Hoc Group findings, and more.

- Within the AMRDB, the Project Bank acts as the hub of wheel with pathways leading to all other elements (e.g., science strategies, research hypotheses, critical uncertainties, science panel recommendations, CEMs, project findings, etc.).
- To contribute to the MRGESCP, signatories need to submit project findings, which can be used to develop management recommendations that address management actions. Changing a management action based on a recommendation is AM. This cycle can also be used to inform recovery criteria and goals.
- The findings and recommendations from the PMWG summary report will be added to AMRDB.

Comments:

- It is logical and useful to put all this information in one place.
- The controversial area of the AMRDB will be the critical uncertainties, as with the PMWG summary report. There may be disagreement over whether items are considered "critical".
    - The SAMC needs to determine when CEMs are updated, which includes determining when sufficient evidence demonstrates that an uncertainty has been reduced.
        - The SAMC can review study designs, methods, and analyses to determine if they are sound.
        - The review process should be applied transparently and consistently.
- More things are known about the critical uncertainties in the AMRDB than are being shared with the Program. Additionally, knowing more about some uncertainties may not help better manage a species or system.
- Although recommendations and uncertainties from previous science panels should not be discounted, the critical piece missing so far has been findings.
    - Findings need to be reviewed and deliberated by the SAMC.
    - Regardless of their areas of expertise, all SAMC members should be able to scientifically evaluate whether research methods are sound, whether findings are supported, and whether findings can inform recommendations and/or understanding of an ecosystem.

Review of Findings and Recommendations from RGSM PMWG Summary Report S&T Ad Hoc Group

C. Murphy opened discussion on the findings and recommendations from the PMWG summary report (see presentation). Summary points are below:

- Two members of the PMWG Summary Report Ad Hoc Group submitted comments via the comment matrix (see read-ahead).
- Rich Valdez, SWCA Environmental Consultants, chair of the PMWG Summary Report Ad Hoc Group, is compiling the review history of the PMWG summary report.
- The PST will reach out one more time to individual members of the PMWG Summary Report Ad Hoc Group to garner additional responses.
- The SAMC will carry out these next steps on the findings and recommendations from the PMWG summary report: review the PMWG summary report via the comment matrix, decide which recommendations to endorse, draft and finalize a memo to the EC in coordination with R. Valdez, and form ad hoc groups to continue PMWG Task 3 (refinements to the fish monitoring plan), as needed.
    - The memo should be finalized by July 16th, to be sent as an EC read-ahead.
    - The message from the SAMC and R. Valdez should be unified and clear.

Comments:

- How will R. Valdez present the findings given the disagreements that exist?

    - R. Valdez is not charged with reconciling disagreements. R. Valdez will present the report as is. The comment matrix was meant to document all comments with justifications to be shared with the MRGESCP.
    - The SAMC will evaluate the list of findings and recommendations to decide next steps, with scientific justification.
- The SAMC will not be able to avoid contradicting R. Valdez's presentation to the EC.
    - R. Valdez produced a list of items to inform next steps for the PMWG's work. The role of the SAMC is to evaluate the list with all the feedback received and determine which items move forward and what the associated next steps should be. For example, the SAMC could form ad hoc groups to address them. The SAMC then proposes its plan to the EC.
    - The SAMC could also choose to rank the list to prioritize the items.
- Adding SMART goal elements to the findings and recommendations would make them less vague.
    - It would also make it easier to form ad hoc groups around them.
- The SAMC should think at the level of the EC when reviewing the findings and recommendations in the comment matrix.
    - Next steps for higher-ranking items will be presented as priority to the EC.

- **Decision**: The SAMC approved next steps on the PMWG summary report
- **Action Item**: The PST and R. Valdez will compile the review history of the PMWG summary report
- **Action Item**: The PST will individually contact PMWG members to request reviews of the summary report findings and recommendations
- **Action Item**: The PST will contact absent SAMC members to discuss the next steps on the PMWG summary report
- **Action Item**: The SAMC will provide feedback on the PMWG summary report findings and recommendations via a comment matrix
- **Action Item**: The SAMC will discuss and provide the SAMC's synthesis, findings, and recommendations from the PMWG summary report to the Executive Committee (EC)
- **Action Item**: The PST will draft a cover memo from the SAMC to the EC in coordination with R. Valdez regarding the PMWG summary report for SAMC review

Update on S&T Ad Hoc Groups

C. Murphy gave an update on the S&T Ad Hoc Groups (see presentation). Summary points are below:

- RGSM Population Modeling Ad Hoc – Charles Yackulic (lead), U.S. Geological Survey, will check-in in June/July.
- RGSM CEM/Genetics Ad Hoc
    - Wade Wilson (lead), U.S. Fish & Wildlife Service (USFWS), has assembled the following group members: Eric Gonzales (U.S. Bureau of Reclamation), Jane Rogosch (Texas Tech University, Megan Osborne (University of New Mexico), and Manuel Ulibarri (USFWS).
    - The first meeting was on May 19, 2021.
    - Former members of the Genetics Work Group and the Science Work Group that developed the RGSM CEM will be invited to review this S&T Ad Hoc Group's deliverables.
- Avian CEM Refinement Ad Hoc

    - The PST reached out to potential members and the following group was assembled: Amy Erickson (lead; Audubon Southwest), Ondrea Hummel (TetraTech), Jenny Davis (USFWS), Dave Moore (U.S. Bureau of Reclamation), and Meaghan Conway (New Mexico Department of Game and Fish).
    - The group's task is primarily a desk exercise. They are working to add level of uncertainty to the variable relationships in the SWFL and YBCU CEMs.
    - The group asked to push back the June 30th deadline and will hold at least one virtual meeting.
        - To accommodate field season, the group may set a new deadline upon meeting, which will be sent to the SAMC for approval.
- Results of the SAMC Poll on Science Strategies
    - Five SAMC members filled out the poll and ranked science strategies based on their own criteria.
    - One additional purpose of the poll was to determine criteria for prioritization.
    - Top criteria were feasibility, level of effort, achievable measurable outcomes, reasonable timeline, already in progress (being done by an organization and awaiting results), modification to existing protocol, related to multiple aspects of ecosystem, and suited to the MRGESCP.
    - The SAMC may be able to use the exercise to develop weighted criteria for prioritization of science strategies and other MRGESCP products.
    - The SAMC will develop one or two science strategies initially to frame the process before tasking S&T Ad Hoc Groups to develop the others.
        - The SAMC will develop NMMJM Science Strategy D-1.1a: Expand on existing vegetation/habitat monitoring efforts to include vegetation characteristics relevant to NMMJM (e.g. herbaceous vegetation).
    - The SAMC has two steps on the science strategies: 1) developing/refining science strategies with SMART goals for each science objective and 2) proposing project ideas based on the science strategies to populate the Project Bank.

Comments:

- Before using the poll exercise to develop weighted criteria, the group needs to account for any lack of context that affected their responses.
    - The criterion "need more information" could be added.
- Other suggested criteria:
    - Whether an item addresses a critical uncertainty and how important that uncertainty is, or addresses a science panel recommendation.
    - "Hierarchy" or "dependence," for items that address things we need to know before any next steps.
    - "Bang for buck," for items that address bigger uncertainties and provide more information.
        - The AMRDB links related projects, which together can account for larger uncertainties that influence others.
    - Whether an item addresses a knowledge gap about fundamental life history, like where a species occurs.
    - Whether an item is related to management actions.
        - There is limited information to connect management actions. There needs to be more work on this.
- A comparative matrix could be used to develop weighted criteria.

- Does the SAMC need to come up with a template for getting the information needed for the AMRDB?
    - The PST is developing a template. Old information has been retrofitted for the AMRDB, but future proposals should be formatted to easily integrate into the Project Bank.

- **Action Item**: The PST will schedule and support the upcoming RGSM CEM ad hoc group meeting
- **Action Item**: The PST will schedule and support the upcoming avian CEM ad hoc group meeting
- **Action Item**: The PST will revise the criteria for ranking science strategies based on SAMC discussion
- **Action Item**: The SAMC will Develop the NMMJM Science Strategy D-1.1a

Follow-up on Climate Change in Science Initiatives

C. Murphy opened a follow-up discussion on incorporating climate change questions into project development. Summary points are below:

- C. Murphy presented Department of Defense (DoD) climate assessment tool fact sheet (see read-ahead).
    - The actual tool is not accessible to non-DoD users.
    - The DoD identified criteria to consider for climate change.
    - The tool uses a spatial scale to change the resolution depending on the size of the installation you are managing. It is applied from the broadest overall DoD level to the site level.
    - By applying the tool to all applications, the DoD is collecting standardized information that can be used to plan for the future.
- C. Murphy presented potential climate change questions for project proposal provided by Megan Friggens (see read-ahead).
    - M. Friggens included specific and generic question streams.

Comments:

- The specific questions can help guide responses more. Responders may not be able to think of the ways their projects are addressing climate change without guiding questions. Responders could also add elements to their projects to address climate change after reading the questions.
- Suggestion to split out the species traits (physiological) versus the ecosystem effects in the first specific question.
- Suggestion to talk about drought directly in the questions. Example: Does your research consider the potential for ongoing drought?
    - The questions can be tailored more to the Middle Rio Grande (MRG).
    - The absence of water would have dramatic impacts and we need to prepare for that possibility. We should be planning for the worst-case scenario.
    - This concept applies directly to the efforts within the MRGESCP to incorporate forecasting and scenario planning.
- There has been pushback on forecasting and scenario planning as it is perceived as difficult, but it is integral to AM to consider all potential conditions.
- The handbook *Climate-Smart Conservation* (National Wildlife Federation et al. 2014) discusses scenario-based planning using a four-quadrant matrix displaying plausible future scenarios.
    - A similar approach can be applied to the MRG based on temperature, water, snowmelt, precipitation, etc. The MRGESCP could plan for science activities under different condition sets.

- Two approaches should be done for incorporating scenario planning: 1) Characterize science activities for different conditions and 2) Develop an emergency action plan under different conditions (e.g., conditions for the jiggle).
- Under certain conditions, water management may have little impact on the RGSM population and species management. That should be kept in mind when scenario planning.
    - All opportunities for flexibility in the management of the system are not fully documented. The MRGESCP can get some of that information from individual signatories and the Minnow Action Team.
    - The MRGESCP needs to document why management decisions are made in order to inform future recommendations.

➢ **Action Item**: The PST will revise the climate questions based on SAMC discussion and add them to the project data entry form and related AMRDB tables

2021 MRGESCP Approach to Standardizing HR Monitoring

C. Murphy opened discussion on holding a HR workshop aimed at standardizing HR in the MRG. Summary points are below:

- Based on previous feedback from the SAMC, the PST compiled a list of considerations for people doing future HR projects (see read-ahead).
- SAMC members were asked if they view HR as a management action, management tool, or field experiment.
    - Members viewed HR differently, as either a tool, a tool and an experiment, or all three.
        - Although HR is often used as a management tool, it can be an experiment with pre- and post-construction data collection and comparison with control sites.
- To be able to show whether HR is successful, success needs to be defined before HR begins.
- The list of considerations includes restoration targets, including spatial scale, temporal scale, biotic response, targeted species of concern, targeted invasive species, and ecosystem goods and services.
    - Ecosystem goods and services encapsulates other benefits of HR ancillary to the project's intended goals, as well as non-site-specific benefits that affect the larger ecosystem.
- The list also includes restoration goals, monitoring goals, and project planning considerations.
    - The scope of monitoring goals can either be construction monitoring, performance monitoring, or monitoring to support AM. The scope determines the level of monitoring needed.
    - Benefits of different monitoring goals should be considered.
    - Organizations may not have the resources to monitor in support of AM, but if there is interest, the MRGESCP can help coordinate.
- The HR workshop would be organized by the PST and hosted by the SAMC.
- Workshops serve dual purposes of addressing the main topic and giving all of the MRGESCP the opportunity to get involved.
- The workshop would invite HR site managers to explain how they define success and what data they are collecting. That would lead to a group discussion on how to demonstrate HR success through data collection and monitoring, metrics of HR success, and on measuring less expensive metrics that inform the larger ecological picture.
- To help guide workshop discussion, the PST will send out a pre-workshop survey on HR planning considerations to the MRGESCP.

- The SAMC should suggest any people who would be interested in participating in the HR workshop.

Comments:

- It is a good idea to ask HR site builders to consider how they fit into the bigger HR picture for that species. The SAMC connects to this more through the CEMs and critical uncertainties, as the SAMC can use those to link an HR site to the larger picture.
    - Suggestion to ask questions that are tailored to fit projects into the larger picture. This could help them think through the design and monitoring of the site in a way that connect to other sites.
- What is the purpose of the considerations template?
    - The overall goal of this effort is to set up each HR site for success.
    - The template can serve as a checklist of things to consider and HR builders can ask the MRGESCP for help with design, monitoring and analysis.
    - It can also encourage the idea of measuring inexpensive metrics that holistically contribute to the larger understanding of the ecosystem.
    - The SAMC can help determine alternative/additional response and environmental metrics that would be useful to HR site builders and the larger ecological picture.
        - The Bosque Ecosystem Monitoring Program (BEMP) has developed a variety of rapid protocols and variables that could be applied to HR projects.
- People have questions about the appropriate level of monitoring and the common denominator monitoring that is most/least useful. A workshop where people can discuss that would be helpful.

- **Action Item**: The PST will revise the habitat restoration planning template based on discussion for review at the next meeting
- **Action Item**: The PST will send out a pre-workshop survey on HR planning considerations to the MRGESCP to help guide workshop discussion
- **Action Item**: The SAMC will suggest individuals external to the MRGESCP to invite to participate in the HR workshop
- **Action Item**: The SAMC and PST will develop a plan for the HR workshop to be up for EC approval
- **Action Item**: The PST will plan a HR workshop hosted by the SAMC

Meeting Participants

Alan Hatch	EC *Ex Officio* Member
Ara Winter	Statistics/Modeling Expert
Ari Posner	Geomorphology Expert
Catherine Murphy	Program Support Team, SAMC Facilitator
Debbie Lee	Program Support Team
Meaghan Conway	Ecosystem Function Expert
Megan Friggens	Climate Science Expert
Melissa Welsch	Program Support Team
Michelle Tuineau	Program Support Team
Thomas Archdeacon	Aquatic Ecology Expert

The following are proposed question streams intended to collect information about climate change engagement from Collaborative Program participants submitting project/study ideas for the Adaptive Management Relational Database Project Bank. We want to capture studies that explicitly address climate change, but also those that will contribute important knowledge, but may not list climate change or adaptive planning as a research objective.

Specific question stream:

1. Does this project address climate change issues?
2. If yes, please select all that apply:

   ☐Basic research that increases knowledge of existing climate related drivers in ecosystems and populations (physiological models/studies, habitat suitability, hydrology, etc.)

   ☐Projecting or assessing future climate change impacts (e.g. hydrological, changes to species' range or niche, predicting disturbance interactions)

   ☐Applied research to inform adaptive management

   ☐Applied research that measures success of adaptive management actions

   ☐Development of software or applications to increase research and manager access to climate change information

   ☐Other

Generic alternative:

1. Does this project address issues relating to climate change impacts?

   ☐Directly? If Yes, please specify:

   ☐Indirectly? If Yes, please specify:

2. Will results of this project help inform climate change adaptation?

   If Yes, please specify:

DoD Climate Assessment Tool

WHAT IS THE DoD CLIMATE ASSESSMENT TOOL?

A CAC-enabled, web-based collection of scientific climate data to support research, analysis, and decision making about exposure to historical extreme weather and reasonably foreseeable climate effects.

WHAT IS THE PURPOSE OF THE CLIMATE TOOL?

Enables Military Departments and their installation personnel to deliver consistent exposure assessments and identify regions or installations for additional climate-related studies.

HOW WILL THE TOOL SUPPORT ANALYSIS AND DECISION MAKING?

The tool uses data from past extreme weather events (e.g., hurricanes, tornado tracks) and the effects of future changes in sea levels, riverine flooding, drought, heat, land degradation, energy demand, and wildfires to produce hazard indicators. The data supports a screening-level assessment of installation vulnerability expressed as a combination of exposure (designated by the tool) and sensitivity. This high-level assessment is useful for long-term planning and informed decision making. In the report accompanying the tool, an example installation illustrates the concept of sensitivity with different types of military assets (e.g., airfields, piers, training and testing areas).

The Climate Assessment Tool provides an important component towards understanding an installation's vulnerability to climate-related hazards. Other crucial vulnerability considerations include validating climate-related impacts through additional site-specific analysis; determining potential mission impacts; and conducting detailed engineering studies to assess which adaptation strategies may be effective to reduce risk. Using the Climate Assessment Tool as part of a comprehensive analysis will help the Department determine where best to apply resources to improve climate adaptation and resiliency.

Vulnerability is determined by three components—**exposure**, **sensitivity**, and **adaptive capacity**:



Exposure is the degree to which an installation, due to its location, may be susceptible to a climate or weather phenomenon (e.g., Is the installation located in a flood-prone region?)



Sensitivity is the degree to which an installation could be affected by a climate or weather phenomenon (e.g., Are assets located in flood hazard areas? Are assets already elevated above the flood hazard area? How much damage could be caused to important assets?)



Adaptive capacity is an installation's existing ability to address the potential impacts (e.g., Can important assets be relocated out of the flood hazard area? Do redundant capabilities exist to cover the most important installation functions?)

DoD Climate Assessment Tool Use To Date

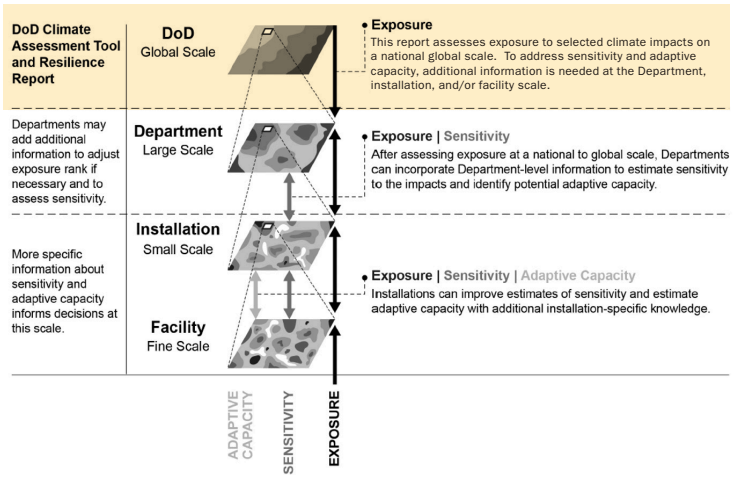
- Number of installation users is growing with currently over 300 users
- Rate of use for site assessments has increased sevenfold; 180 completed in the first year, 1210 completed in the last three months
- Data included in the Secretary of Defense's Advana Dashboard, a centralized data and analytics platform providing DoD users with data and tools to support policy and decision making
- DoD energy and sustainability teams beginning to use the tool's exposure information for decisionmaking

Climate Assessment Tool Users	Impacts on Decision Making
Installation-level Planners and Engineers	■ Analyze an installation's exposure or susceptibility to climate and extreme weather events. ■ Use this information to help inform planning and land use recommendations, and support resilient design, engineering, and construction. ■ Add separate geographic information system (GIS) layers (e.g., flooding) available for Military Department-specific GIS systems used at the installation level.
Military Department Headquarters	■ Identify regions or installations for focused attention, such as performing detailed studies to determine mission impacts and strategies to mitigate exposure.
DoD Leadership	■ Compare exposure across the Department to answer questions from Congress. ■ Inform investment and policy decisions.

Below are examples of how the tool provides installation-specific data and mapping, as well as visualization of global trends.

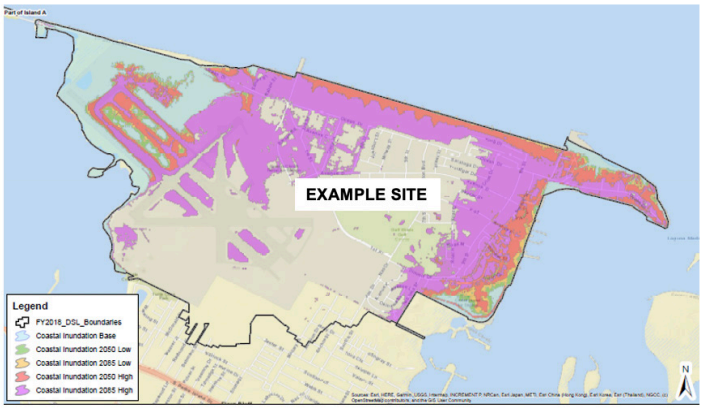
Variation between DoD Global and Installation-specific Assessments and Reporting

Climate exposure occurs on different scales. On a global scale, trends such as hurricanes, warming global average temperatures, and changing sea level are evident. More apparent at smaller scales are impacts such as soil moisture, precipitation effects, temperature effects, and local relative sea-level rise that can affect ecosystems and social systems important to how installations and facilities function.



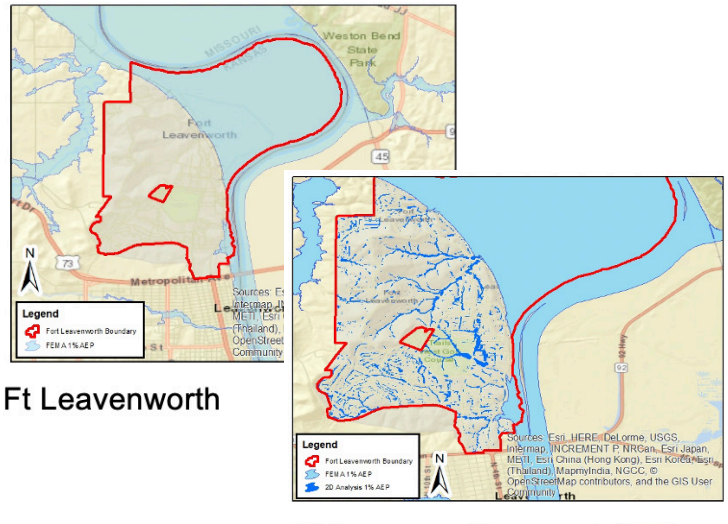
Installation-level Flood Mapping

GIS shapefiles are available for local, installation-level mapping of coastal and riverine flooding. The maps provide planners and engineers with the percent of installation area inundated.



Installation-level Flood Mapping

The tool provides flood plain maps using a combination of Federal Emergency Management Agency and U.S. Army Corps of Engineers data to depict the flooding exposure on tributaries and rivers.

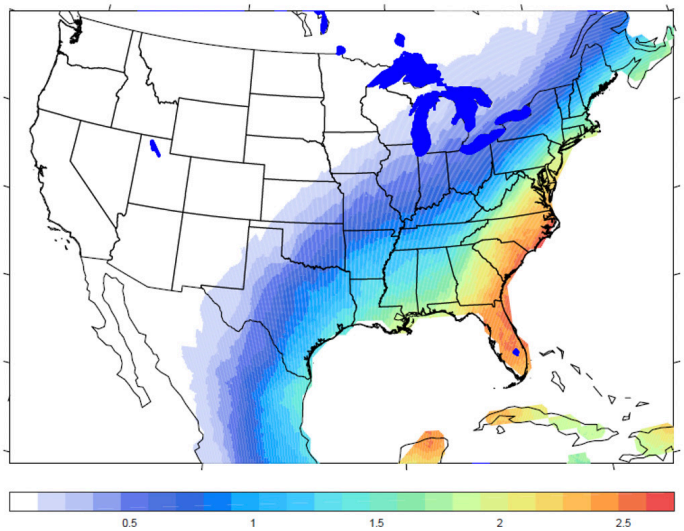


Ft Leavenworth

Ft Leavenworth merged

Historical Extreme Weather Events across the United States

The tool incorporates historical data on landfalling tropical storms between 1948 and 2018 across the United States into an extreme weather indicator.



The Climate Assessment Tool will generate reports at the Military Department or installation level to help DoD understand and manage exposure from climate-related hazards.

Department of Defense Climate Exposure Report: Summary of exposure information for 1391 global DoD installations and related sites. Contains examples of resilience measures and rough order magnitude of costs. The report enhances DoD leadership awareness of climate exposure and supports adaptation planning.

Military Department Summary Report: High-level exposure analysis and report for each Military Department.

Middle Rio Grande Endangered Species Collaborative Program

Habitat Restoration Planning and Monitoring Considerations

Desired Restoration Targets (select all that apply)

Spatial Scale: ☐Range ☐Basin ☐Reach ☐Site

Temporal Scale: ☐≥1 Year ☐2-5 Years ☐6-10 Years ☐>10 Years

Biotic Response: ☐Ecosystem ☐Terrestrial ☐Riparian ☐Aquatic

☐*Threatened/Endangered/Species of Concern:*

☐RGSM ☐SWFL ☐YBCU ☐NMMJM ☐PESU

☐Other _____

☐*Invasive/Non-Native Species:* List _____

Ecosystem Goods and Services (benefits obtained from functional ecosystems):

☐*Goods (products obtained from ecosystems)*:

☐Food, Fiber, Fuel ☐Genetic Resources ☐Biochemicals

☐Fresh Water Other_____

☐*Regulating Services (benefits from regulation of ecosystem processes):*

☐Invasion resistance ☐Herbivory ☐Pollinator Support ☐Seed Dispersal

☐Climate Regulation ☐Pest Regulation ☐Disease Regulation

☐Natural Hazard Protection ☐Erosion Control ☐Water Purification

☐Air Purification Other_____

☐*Supporting Services (services necessary for production of all other ecosystem services):*

☐Primary Production ☐Establishment of Habitat ☐Nutrient Cycling

☐Soil Amendment ☐Biomass Production Other_____

☐*Cultural Services (non-material benefits to humans):*

☐Spiritual ☐Educational ☐Recreational ☐Aesthetic

☐Knowledge Systems Other_____

Desired Restoration Goals

Goal Statement 1: _____

_____

Goal Statement 2: _____

_____

Desired Monitoring Goals (select all that apply)

Scope:

☐Construction Monitoring -- to determine whether a particular project was completed as specified in the restoration plan

☐Performance Monitoring -- to evaluate the performance of a restoration project relative to the project objectives

☐Monitoring to support adaptive management -- to learn from the restoration effort in structured ways to enhance the effectiveness of restoration efforts over the long-term.

Benefit:

☐Satisfy Endangered Species Act requirement or recommendation

☐Establish desired habitat features

☐Collect data necessary to properly evaluate HR success at the site-level

☐Account for restoration benefits and ecosystem services beyond the site-level targets of the project

☐Evaluate impacts from acute disturbances such as wildfires

☐Evaluate impacts from chronic disturbances such as invasive species or climate change

☐Inform/Improve restoration best practices by defining what works and what doesn't

☐Provide region-wide insights beyond the temporal and spatial scale of individual projects and the MRG

Other_____

Project Planning Considerations (select all that apply):

Factors that influence site selection:

☐Property Acquisition ☐Access ☐Proximity to _____

☐Existing Data ☐Landscape Features ☐Habitat Features ☐Site Maturity

☐Species Presence ☐Species Absence ☐Experimental Design

☐Other _____

Factors that influence monitoring investment:

☐Time Constraint ☐Funding ☐Manpower ☐Expertise ☐Logistics

☐Equipment ☐Data Management ☐Ability to Partner

☐Other _____

Project-specific questions:

How is the habitat used by the target species (ex., reproduction, refuge, feeding)?

How do you define success for your project?

Which habitat features are you modifying?

What biotic and abiotic response metrics will you measure?

At what spatial and temporal scales do these metrics respond?

How do you expect the habitat to change over time?

Are you comparing your site to a control site?

Are you comparing your site to a reference site?

Middle Rio Grande Endangered Species Collaborative Program

Science & Adaptive Management Committee Meeting

MAY 27, 2021

SCIENCE COORDINATOR UPDATE

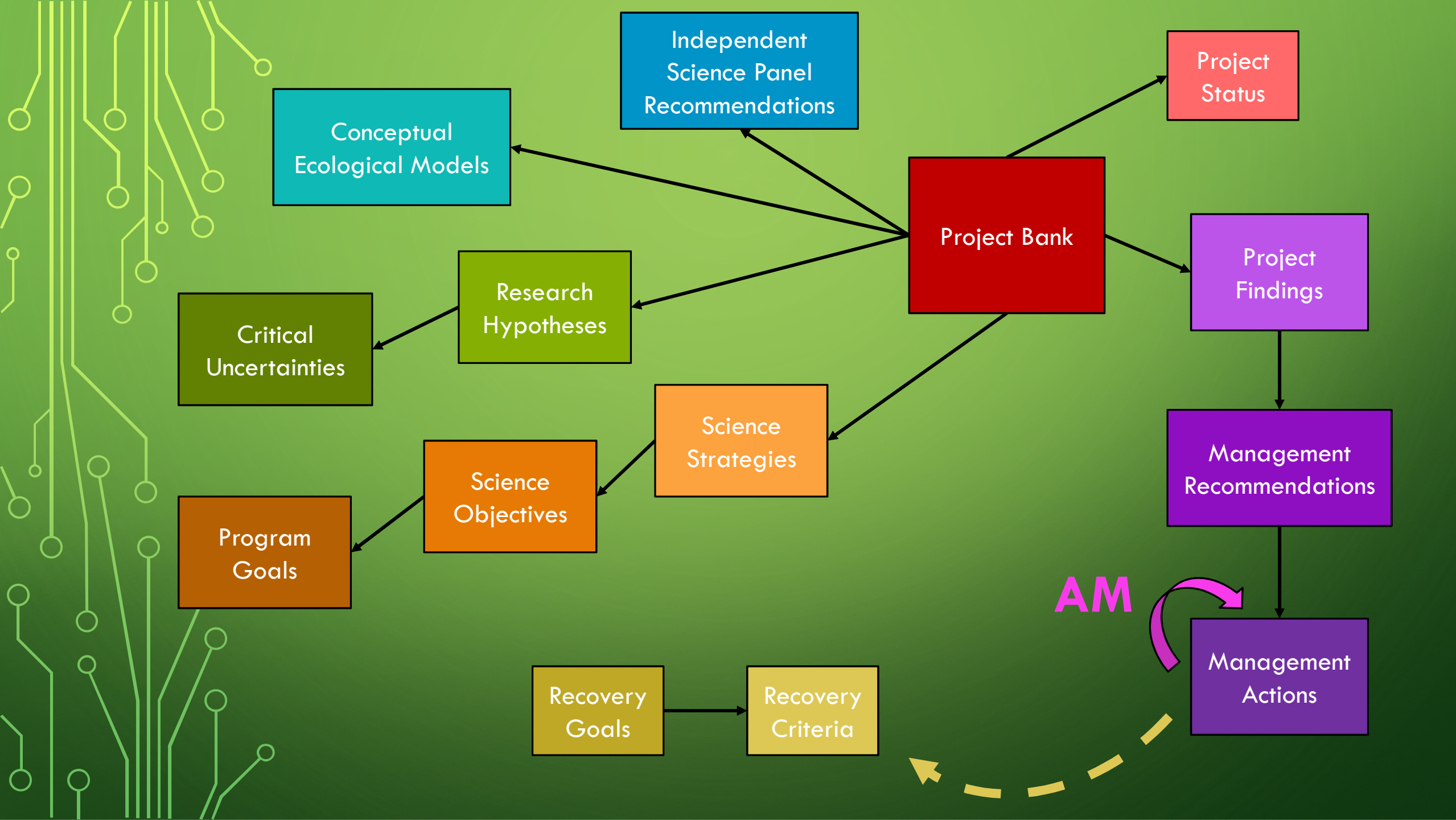
Per S&AM Plan, SAMC responsibilities include:
- tasking ad hoc groups,
- compiling and translating results,
- communicating and revisiting recommendations to EC.

The tool to document this process is the Adaptive Management Relational Database (AMRDB).

Discussion:
- Existing information sources used to build AMRDB
- Incorporate scientific findings and recommendations

Existing information sources used to build AMRDB:

- USFWS species recovery plans, critical habitat designations and biological opinions
- Independent Science Panel recommendations (e.g., Fraser et al. 2016, Hubert et al. 2016, Noon et al. 2017)
- MRGESCP annual reports
- MRG Adaptive Management Framework: Identifying Critical Scientific Uncertainties (Caplan et al. 2018) – primarily Tables 3, 4, 5 and 6
- Science & Technical Ad Hoc Group findings


Independent Science Panel Recommendations
Project Status
Conceptual Ecological Models
Project Bank
Project Findings
Research Hypotheses
Critical Uncertainties
Science Strategies
Management Recommendations
Science Objectives
Program Goals
AM
Management Actions
Recovery Goals
Recovery Criteria

Existing information sources used to build AMRDB:

- USFWS species recovery plans, critical habitat designations and biological opinions
- Independent Science Panel recommendations (e.g., Fraser et al. 2016, Hubert et al. 2016, Noon et al. 2017)
- MRGESCP annual reports
- MRG Adaptive Management Framework: Identifying Critical Scientific Uncertainties (Caplan et al. 2018) – primarily Tables 3, 4, 5 and 6
- Science & Technical Ad Hoc Group findings

Table 3. Study framework attributes for critical scientific uncertainties for the New Mexico Meadow Jumping Mouse.

Uncertainty Statement/Study Question	Management Relevance	Study Type	Measurement Attributes	Temporal and/or Spatial Scale	Study Design Considerations	Priority
Where are MRG populations located?	• Few reliable surveys done • Essential for population identification and protection • Opportunity to research habitat selection and population dynamics if a large, sustainable population is discovered	Field surveys: • Historical sites (where there is potential habitat) • Priority potential habitat Model development: • Inform screening criteria to map potential habitat at different scales • Prioritize field survey areas	Field studies: • Detection/Non-Detection with habitat data (soil moisture; herbaceous/shrub layer composition, density, height; tree canopy cover) Modeling: • Probability of Occurrence • Relative Occurrence Rate • Habitat Suitability Index (HSI)	• Multi-year • All MRG reaches	• Access/landownership issues • Permitting requirements • Distribution and habitat difficult to model • Vegetation type and microhabitat dependent • Need info on spatial habitat requirements for modeling	Level 1
What is the genetic variation within and between populations?	Level of inbreeding due to: • Isolation • Small population size Relationships among persisting populations to manage: • Inbreeding depression • Translocations • Captive breeding program • Habitat restoration for population connectivity and gene flow	Genetic analysis: • Fine-grained evaluation of genetic health (inbreeding) • Estimate contemporary gene flow among populations • Estimate evolutionary divergence of populations	• Inbreeding • Gene flow • Divergence • Relatedness	Range-wide: • Population comparisons • Identify potential source populations for translocation/captive breeding programs	• Difficult to obtain adequate sample sizes • Need surveys to identify all current populations • Invasive methods discouraged given small population size • Weigh risks/benefits of invasive methods	Level 1
How do *Invasive survey methods* (trapping, telemetry) compare to *Non-invasive methods* (e.g., models, remote cameras, track plates)?	Invasive: • Serious risk to the health of captured animals • Damage to sampled habitats • Some populations too small Non-invasive: • Develop reliable detection methods • Other uses (population trend monitoring and size estimation, habitat selection)	• Field surveys	• Detection rate • Effort required to document at a site if present • Biological (non-target species, competitors, predators), Environmental (habitat quality), and Surveyor (expertise) factors that influence detection • Sources of bias and error rates • Flexibility and efficacy of method	• Multi-year Non-invasive: • Develop different techniques • Different studies for each technique • Test in multiple populations • Represent array of situations	• The only currently known population in the MRG (BdANWR) is very small • Difficult to obtain adequate sample sizes • Invasive methods discouraged per small size and high risk of extinction • Conduct in other, larger populations with low threats	Level 2
What are the attributes for foraging, day nesting, maternal nesting, and hibernation habitats in the MRG?	• Very little known • Current habitat selection info (use vs availability) based on a single study of radio-collared individuals at BdANWR • Specific habitat uses and relations vary within and across ecotypes • Must fully understand habitat relations to understand threats, or develop conservation/mitigation measures	• Resource selection study design • Field study using telemetry • Explore non-invasive detection methods (e.g., combo of fine scale spatial models and using detections from remote cameras)	Dependent variable: • Occurrence: preferably as corrected by detection probability Independent variables: • Soil moisture, type • Herbaceous/Shrub layer composition, density, height • Tree canopy cover, woody debris, hydrology, vegetation community	• Multi-year • Include several reaches • Different, discrete studies in each area to better understand the range of variation in habitat attributes	• Only currently known population in the MRG (BdANWR) is very small • Difficult to obtain adequate sample sizes • Invasive methods discouraged given small population, high risk of extinction	Level 3



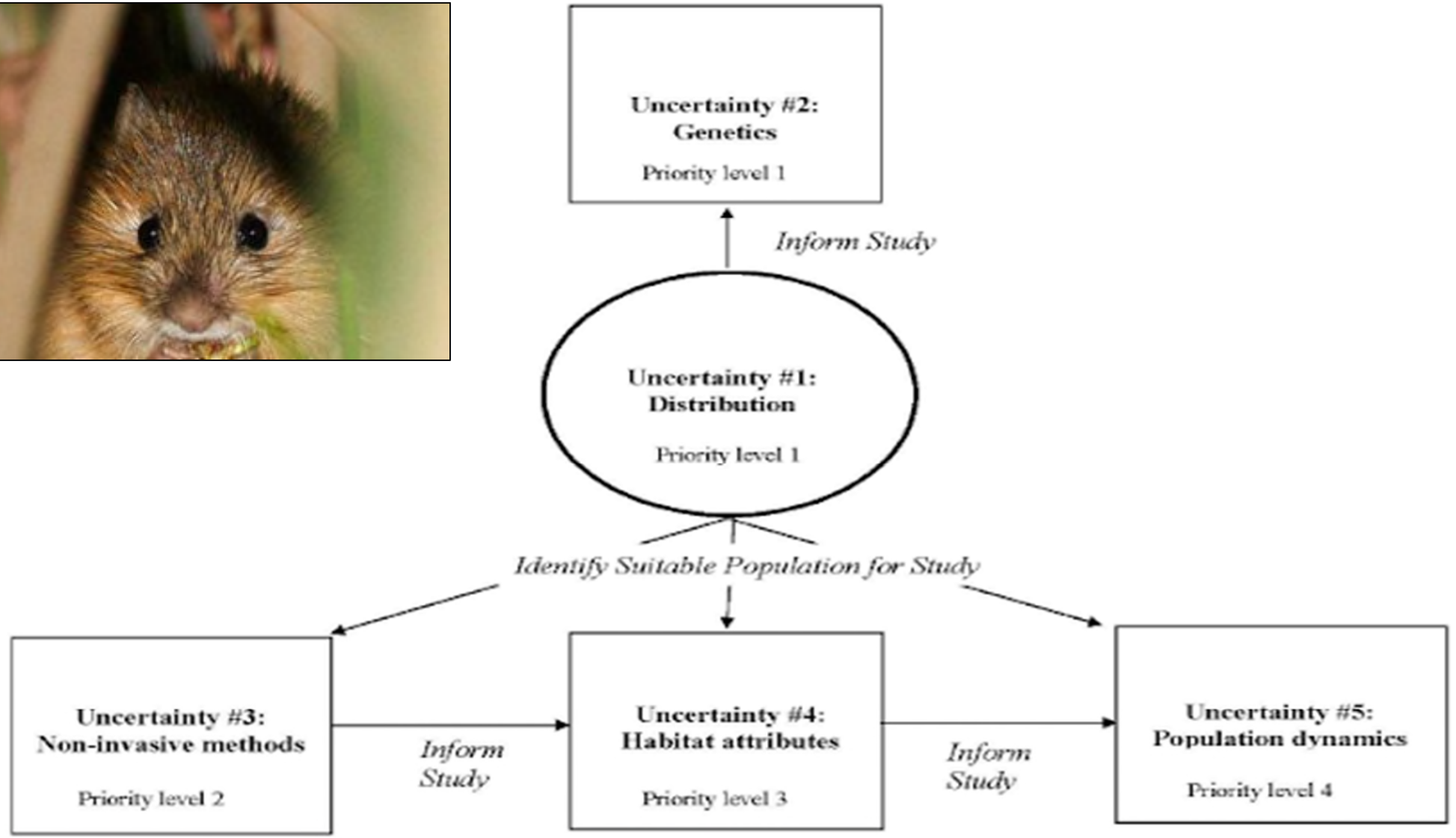
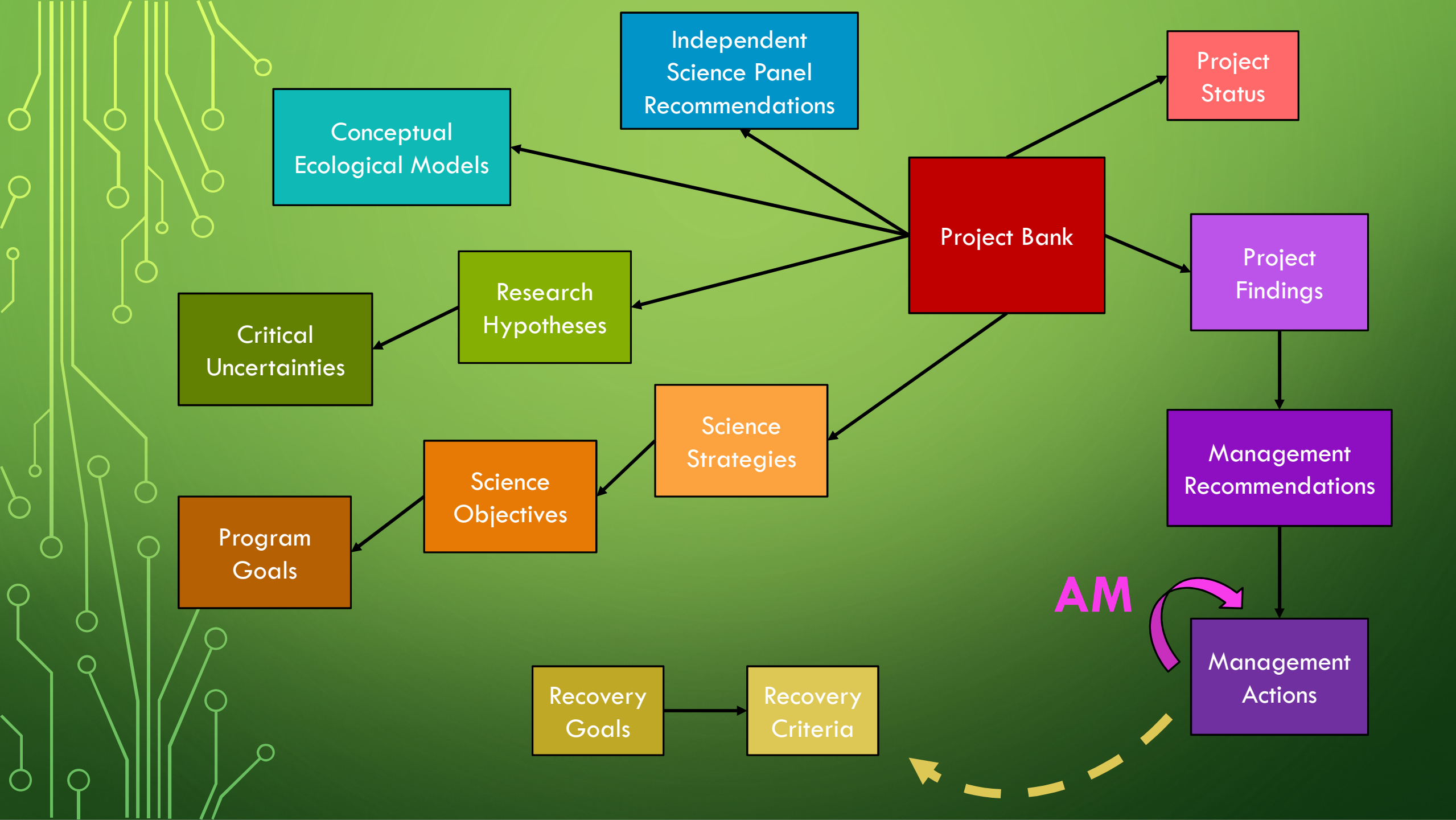


Figure 4. Relationships among critical scientific uncertainties influencing management and recovery of the New Mexico Meadow Jumping Mouse in the Middle Rio Grande, New Mexico.


Independent Science Panel Recommendations
Project Status
Conceptual Ecological Models
Project Bank
Project Findings
Research Hypotheses
Critical Uncertainties
Science Strategies
Management Recommendations
Science Objectives
Program Goals
AM
Management Actions
Recovery Goals
Recovery Criteria

Review of Findings and Recommendations from RGSM PMWG Summary Report S&T Ad Hoc Group

- Ad Hoc Group feedback on findings and recommendations comment matrix and report review history
- SAMC reviews of the summary report
- Next steps prior to July EC meeting:

- Decide which recommendations to endorse (use matrix)
- Draft memo to EC – coordinate message with R. Valdez at June SAMC meeting
- Review and finalize memo for July EC meeting
- Form Ad Hoc Groups for PMWG Task 3 (refinements)

BREAK

Update on Science & Technical Ad Hoc Groups



- RGSM Population Modeling Ad Hoc Group
  - Charles Yackulic (USGS) – Lead
  - Expecting model update in June
- RGSM Conceptual Ecological Model/Genetics Ad Hoc
- Southwestern Willow Flycatcher and Yellow-billed Cuckoo Conceptual Ecological Model Refinement Ad Hoc

Update on Science & Technical Ad Hoc Groups

- RGSM Population Modeling Ad Hoc Group
- RGSM Conceptual Ecological Model/Genetics Ad Hoc

  Wade Wilson (USFWS) - Lead,
  Eric Gonzales (USBR),
  Jane Rogosch (TX Tech Univ.),
  Megan Osborne (UNM),
  Manuel Ulibarri (USFWS)
  First meeting: May 19, 2021; Next meeting: TBD June



- Southwestern Willow Flycatcher and Yellow-billed Cuckoo Conceptual Ecological Model Refinement Ad Hoc

Update on Science & Technical Ad Hoc Groups

- RGSM Population Modeling Ad Hoc Group
- RGSM Conceptual Ecological Model/Genetics Ad Hoc
- Southwestern Willow Flycatcher and Yellow-billed Cuckoo Conceptual Ecological Model Refinement Ad Hoc

Amy Erickson (Audubon) - Lead,
Ondrea Hummel (TetraTech),
Jenny Davis (USFWS),
Dave Moore (USBR),
Meaghan Conway (NMDGF)





SAMC Ranking of Science Strategies

	Member 1	Member 2	Member 3	Member 4	Member 5
RGSM A-4	2		4	1	1
SWFL B-1	5		1		2
SWFL B-3	1	1	6	2	5
NMMJM D-1	3	2	2	3	3
PESU E-1	4	3	3		4
OTHER F-1	6	6	6		
OTHER H-1b	7	4	5		
OTHER H-1c	8	5	7		

Criteria used in rankings:

Feasibility

Level of effort

Achievable measurable outcomes

Reasonable timeline

Already in progress

Modification to existing protocol

Related to multiple aspects of ecosystem

Suited to MRGESCP

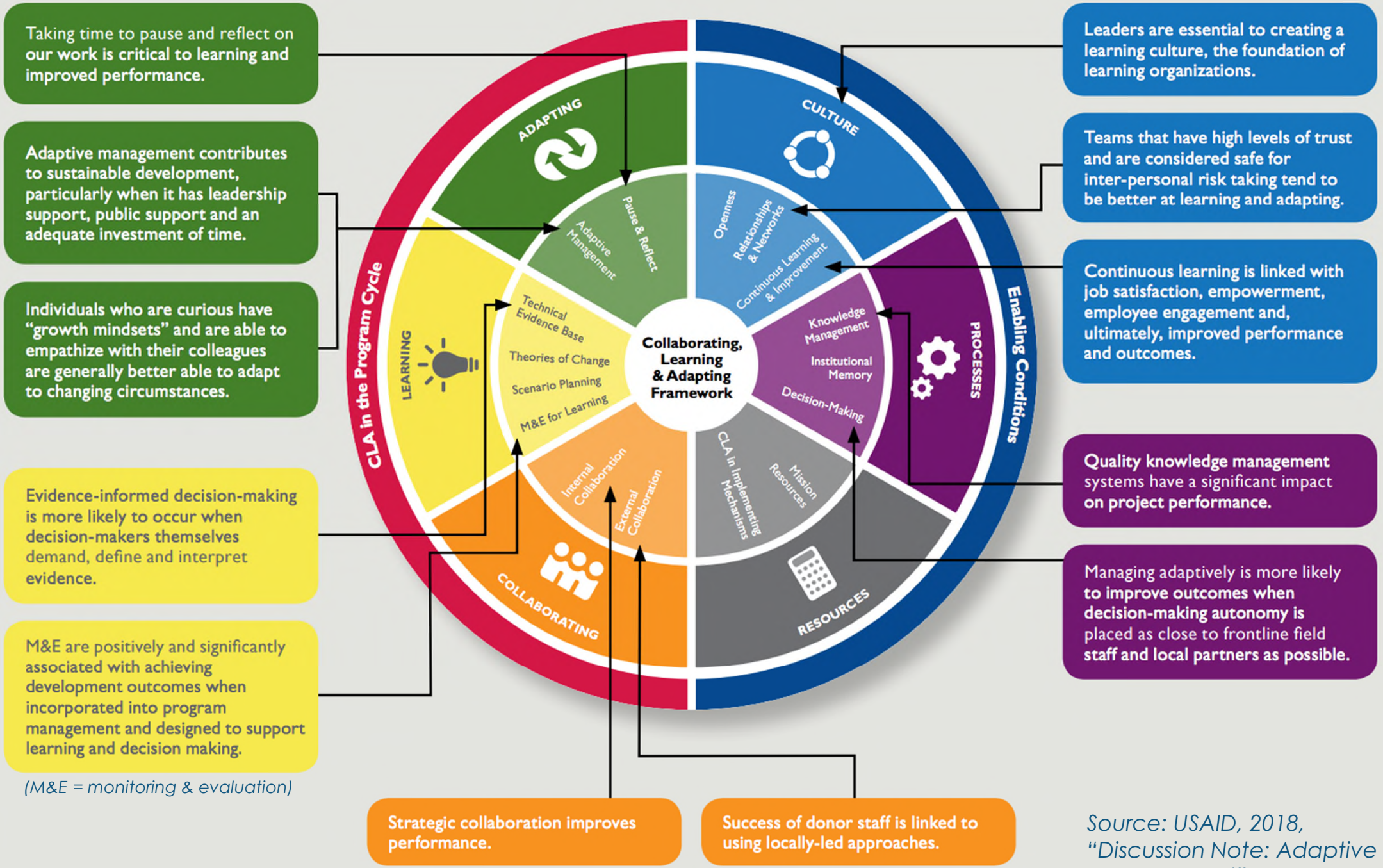
The SAMC's Role in the Collaborative Program's Adaptive Management Efforts

SCIENCE AND ADAPTIVE MANAGEMENT COMMITTEE

MAY 27, 2021

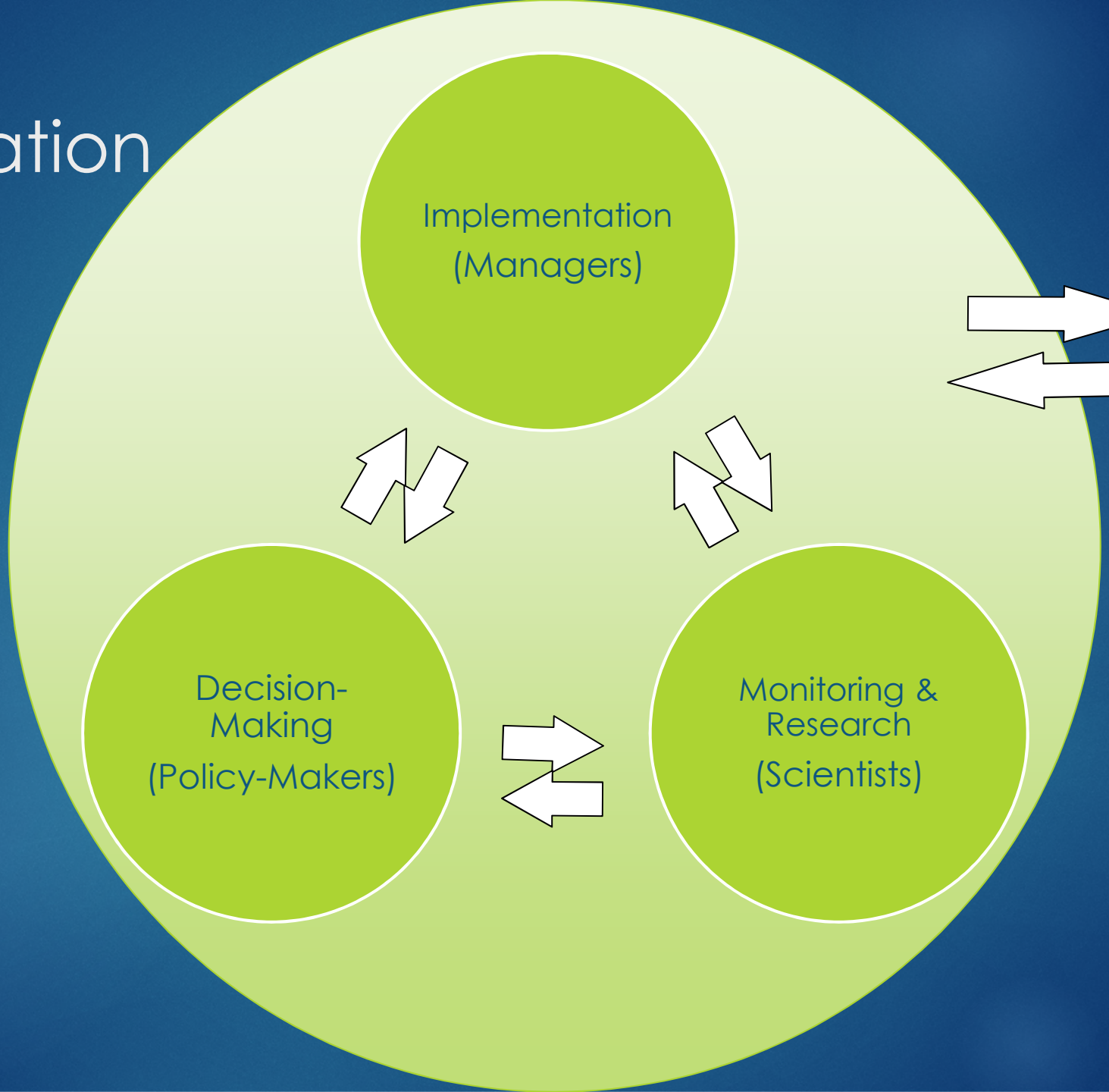
Adaptive Management …

- Is a collaborative process
- Is a structured decision-making process:
  - Making decisions based on clearly articulated fundamental objectives,
  - Recognizing the role of scientific predictions in decisions,
  - Dealing explicitly with uncertainty, and
  - Responding transparently to societal values in decision making.
- Requires clear ground rules on roles, responsibilities, and communication norms
- Fails without *good faith* participation



Source: USAID, 2018, "Discussion Note: Adaptive Management"

Science Communication Triangle



- Public
- External Stakeholders
- Legislatures
- Etc.

The SAMC…

- Science synthesizer and translator
  - To the Executive Committee
  - To other scientists/disciplines
- Ensures good scientific practice
- Ensures all have equal access to data and information required for discussions
- Ensures a common understanding
- Creates trust in the Program's scientific process, and the science it promotes

Creating trust in the science

- Unbiased and objective science
- Transparent process and decision-making
- Clear documentation
- Clear, concise, and complete communication

- Structured decision-making for:
  - Determining the best available science
  - Evaluating new scientific findings and determining how to apply new information
  - Interpreting scientific findings to better inform management activities

Implementing Adaptive Management

- FROM:
  - Reactive
  - Ad hoc
  - Project-specific
  - Localized spatial scale
  - Short-term
- TO:
  - Planned
  - Standardized protocols and procedures
  - Putting projects into the larger system-wide context
  - Planning for long-term
  - Documented

AM Process

- Top-down approach to develop and prioritize scientific projects
  - Standardized, unbiased
  - Addressing reducible critical uncertainties
  - Management-relevant
  - Hypothesis-driven
- AM Relational Database
  - Central repository of information on relationships among objectives, strategies, uncertainties, projects
- Conceptual Ecological Models
  - Document the current state of understanding on the relationships among drivers, stressors, and species response in the ecosystem

MRGESCP Guiding Principles

- **Mission:**

  The Middle Rio Grande Endangered Species Collaborative Program provides a collaborative forum to support scientific analysis and implementation of adaptive management to the benefit and recovery of the listed species pursuant to the Endangered Species Act within the Program Area, and to protect existing and future water uses while complying with applicable state, federal and tribal laws, rules, and regulations.

- **Goals:**
  - Establish and maintain a self-sustaining population of endangered RGSM distributed throughout the MRG.
  - Maintain and protect the MRG recovery unit goals for endangered SWFL.
  - Maintain and protect suitable threatened YBCU habitat in the MRG.
  - Establish and maintain a self-sustaining endangered NMMJM population in the MRG.
  - Maintain and protect the threatened PESU in the MRG.
  - Avoid the future listing or up-listing of species in the Collaborative Program area.
  - Manage available water to meet the needs of endangered species and their habitat.
- **Science Objectives**

Strategies

- Developed from the objectives
- Used to develop project ideas to go into the AM Relational Database Project Bank

Scientific Uncertainties

- Linked to strategies via the Project Bank
- Identified from:
  - Murray et al. (2011) AM Plan version 1
  - Peer review reports
  - Caplan et al. (2018) AM Framework
  - Conceptual ecological models

Standardized Processes to Develop

- Internal and external peer review
  - Document review
- Prioritization of proposed projects (based on links to objectives, uncertainties, and management relevance)
- Recommendations to EC (documenting evidence for and against)
- Citations and references
- Science communication
- Updates to S&AM Plan, LTP, CEMs, AMRDB
- Project idea development (questions for consideration, including monitoring protocols)

S&T Ad Hoc Group Deliverable Next Steps

- Peer review of deliverables by other Program subject matter experts
- Synthesize and deliberate on findings and recommendations
- Identify the key findings to bring to the EC
- Determine areas of SAMC agreement and disagreement
- Deliberate on recommendations to bring to the EC
- Draft cover memo summarizing key findings and recommendations, with dissenting opinions documented
- Incorporate findings into the CEMs, highlighting areas of uncertainties that still need to be addressed
- Input uncertainties into AMRDB, and develop testable hypotheses
- Populate Project Bank with proposed science activities to test hypotheses

The PST will:

- Be reaching out to SAMC members in-between meetings for input on work products, for help thinking through processes, to get general feedback and questions, and to prep for meetings
- Take the lead in developing and documenting the processes, with SAMC input
- Keep track of deadlines and work product deliverables in the Program work plan and Long-Term Plan, and work to ensure the SAMC meets critical milestones
- Communicate between the SAMC and the EC/FPC on progress, areas for input, and the development of related processes and procedures

Science and Adaptive Management Committee Meeting

June 24, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *Draft HR Pre-Workshop Questionnaire [read-ahead, draft]*
- *Revised Criteria for SAMC Rankings [read-ahead, draft]*
- *Summary of PMWG Review of Findings, Assumptions, Recommendations for PMWG Report [read-ahead, spreadsheet, not included]*
- *Review of the MRG Fish Monitoring Program [presentation, not included]*
- *Revised HR Pre-Workshop Questionnaire with SAMC Feedback [follow-up, draft]*
- *Revised Criteria for SAMC Rankings for SAMC Review [follow-up, draft]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC) Meeting
June 24, 2021
8:00 AM–12:00 PM

Meeting Location: *Zoom*
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Meeting ID: 898-359-3120; Passcode: 1251
Call-In: +1-669-900-6833

Meeting Agenda

***Meeting Objectives*:**

- Receive progress updates on Science & Technical (S&T) Ad Hoc Groups
- Review findings and recommendations from Rio Grande silvery minnow (RGSM) Population Monitoring Work Group (PMWG) Ad Hoc Group's summary report and frame memo to Executive Committee (EC)
- Discuss revised ranking criteria for science strategies
- Discuss revisions to the proposed workshop on 2021 Middle Rio Grande (MRG) Effective Monitoring for Habitat Restoration (HR) and pre-workshop survey

8:00 – 8:10	**Welcome, Meeting Objectives, and Agenda Review** ✓ **Decision**: Approve June 24, 2021 meeting agenda ✓ **Decision**: Approve May 27, 2021 meeting minutes Read-ahead: ☐ Draft May 27, 2021 meeting minutes	*Catherine Murphy, Program Support Team (PST)*
8:10 – 8:30	**S&T Ad Hoc Group progress updates** • RGSM Population Modeling – C. Yackulic • RGSM Conceptual Ecological Model /Genetics Development – W. Wilson • Avian Conceptual Ecological Model Refinement – A. Erickson • RGSM PMWG Summary Report – R. Valdez	*Catherine Murphy, PST*

8:30 – 10:00	**RGSM PMWG Summary Report Ad Hoc Group findings and recommendations** • Discuss any changes to summary report • Review each report finding and recommendation Read-ahead: ☐ Compiled comment matrix (Summary_PMWG Review of Findings, Assumptions, Recommendations--PMWG Report.xlsx)	*Group discussion with Rich Valdez*
10:00 – 10:10	**Break**	
10:10 – 10:40	**RGSM PMWG Summary Report Ad Hoc Group findings and recommendations (*continued*)** • Discuss report findings and recommendations • Outline recommendations memo to EC • Discuss presentation to EC ✓ **Decision**: SAMC recommendations to EC regarding RGSM PMWG report ➢ **Action:** PST will draft the memo containing SAMC recommendations to the EC (*for SAMC review*) ✓ **Decision**: Format and present SAMC recommendations to EC at July meeting ➢ **Action:** PST will work with R. Valdez to draft presentation to EC (*for SAMC review*)	*Group discussion with Rich Valdez*
10:40 – 11:10	**Ranking Criteria for Science Strategies** • Review revisions to ranking criteria • Definitions and types of criteria • Discuss weighted scoring and ranking methods Read-ahead: ☐ Revised criteria for SAMC rankings – comparative matrix ✓ **Decision**: Choose ranking/scoring method ➢ **Action:** PST will incorporate changes and send comparative matrix of science strategies for SAMC members to complete	*Facilitated discussion*

11:10 – 11:50	**2021 MRGESCP Effective Monitoring for Habitat Restoration (HR) Workshop** • Discuss revised HR considerations for pre-workshop survey • Discuss HR workshop and format Read-ahead: ☐ DRAFT HR pre-workshop questionnaire ✓ **Decision:** Workshop date and SAMC assignments during workshop ➢ **Action:** PST will finalize and distribute pre-workshop survey, compile results and plan workshop	*Facilitated discussion*
11:50 –12:00	**Meeting Summary and Action Items Review** ➢ **Next SAMC meeting:** Thursday Aug. 26, 2021, 8am-noon	*PST*
12:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

June 24, 2021; 8:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of June 24, 2021 SAMC meeting agenda
- ✓ Approval of May 27, 2021 SAMC meeting minutes

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Update the SAMC meeting calendar invite to every other month	6/28/2021
PST	Reach out to absent SAMC members to discuss meeting topics and next steps	7/9/2021
PST	Revise the SAMC memo to the Executive Committee (EC) regarding the Population Monitoring Work Group (PMWG) summary report based on discussion and send it to the SAMC for review	7/6/2021
SAMC	Review the PMWG summary report memo	7/9/2021
SAMC	Offer any language changes to the executive summary, findings, recommendations and/or key scientific assumptions in the PMWG summary report to clarify them for managers	7/9/2021
Rich Valdez and PST	Finalize the presentation to the EC on the PMWG summary report	7/21/2021
SAMC	Provide additional feedback on the ranking criteria for projects	7/9/2021
PST	Incorporate changes to the ranking criteria	7/16/2021
PST	Revise the habitat restoration (HR) pre-workshop questionnaire based on discussion and send it to the SAMC for review	6/28/2021
SAMC	Provide comments on the HR pre-workshop questionnaire	7/16/2021
PST	Finalize and distribute the HR pre-workshop questionnaire to the Collaborative Program, compile results, and plan the Habitat Restoration Workshop	7/21/2021

Next Meeting: August 26, 2021, 8 AM - noon

Meeting Summary

Welcome, Meeting Objectives, and Agenda Review

Catherine Murphy, PST Science Coordinator and SAMC Facilitator, opened the meeting and led introductions. Catherine M. reviewed the June 24, 2021 meeting agenda and objectives, and May 27, 2021 meeting minutes. Catherine M. announced that SAMC meetings would move from monthly to every other month. The time between meetings will be used to contact SAMC members to discuss SAMC activities. SAMC members were also invited to contact the PST to distribute information between meetings.

- ✓ **Decision**: The SAMC approved the June 24, 2021 SAMC meeting agenda
- ✓ **Decision**: The SAMC approved the May 27, 2021 SAMC meeting minutes
- ➢ **Action Item**: The PST will update the SAMC meeting calendar invite to every other month
- ➢ **Action Item**: The PST will reach out to absent SAMC members to discuss meeting topics and next steps

S&T Ad Hoc Group Progress Updates

Catherine M. announced progress updates for the Science & Technical (S&T) Ad Hoc Groups. Summary points are below:

- Rio Grande silvery minnow (RGSM) Population Modeling Ad Hoc Group
  - Charles Yackulic (lead), U.S. Geological Survey, has been in contact with group members to get feedback on the model. He will not have results to share until later this year. New Mexico Interstate Stream Commission intends to fund him through next year.
- RGSM Conceptual Ecological Model (CEM)/Genetics Ad Hoc Group and Avian CEM Refinement Ad Hoc Group
  - Both groups have been productive. At its second meeting, the RGSM CEM/Genetics Ad Hoc Group (led by Wade Wilson, U.S. Fish & Wildlife Service [USFWS]), finished adding components to the RGSM CEM and defining them. The group is now reviewing the added components and forming relationships between variables. Its third meeting will be in mid-July. The Avian Ad Hoc Group (led by Amy Erickson, Audubon New Mexico) met once, and another meeting is being scheduled.
- RGSM PMWG Summary Report Ad Hoc Group
  - The PST is compiling all comments on the summary report into one version. Rich Valdez (lead), SWCA Environmental Consultants, will incorporate SAMC comments and produce a final report in mid-July. SAMC members were asked to focus reviews on the executive summary and findings sections, and to ensure the report is scientifically valid and makes sense to a broad audience.

RGSM PMWG Summary Report Ad Hoc Group Findings and Recommendations

Catherine M. opened discussion on the RGSM PMWG summary report, the SAMC memo, and presentation to the EC. Summary points are below:

RGSM PWMG Summary Report Discussion:

- Rich V. reported there have been no changes to the RGSM PMWG summary report since the most recent version.

- Task 3 of the PMWG was to refine the U.S. Bureau of Reclamation's (Reclamation) Fish Monitoring Program (FMP). In 2017, the PMWG made recommendations to modify the FMP based on the Hubert et al. independent science panel, and Reclamation adopted a subset of the recommendations. The PMWG was working to further refine the FMP, but did not complete this task before disbanding. To reflect this, the RGSM PMWG summary report will be revised to state that Task 3 was partially completed.

SAMC Comment:

- ☐ Has there been a difference in catch-per-unit-effort (CPUE) since the recommendations were implemented?
  - Changing the number of sites sampled has the biggest effect on CPUE. The FMP increased from 20 to 30 sites sampled. Two estimates are now produced, one for 20 sites and one for 30 sites. These values are usually close, but the difference between them is affected by the number of fish in the system. There is a question of whether more sites may improve the CPUE estimate.
  - Although there is a desire to improve the CPUE estimate, it is a reality that there are fewer places to sample due to the fish being in decline and the system losing water. The FMP is working well without additional changes.

- Rich V. also discussed the Population Estimation Program (PEP):
  - The PEP occurred from 2008-2011, and the summary report was provided in 2012.
  - The objectives of the PEP were to:
    1. Refine and implement methods that provide statistically robust population estimates of RGSM (2005-2011)
    2. Provide a population estimate of RGSM based on fish densities stratified by mesohabitat for 20 sampling units (2008-2011)
    3. Develop site occupancy rates for RGSM populations over time (2005-2011)
    4. Calculate a population estimate of RGSM using population monitoring data, controlling for mesohabitat, and compare this value to that generated in Objective #2 (2008-2011)
  - In the FMP, a seine is dragged through the river to collect fish and CPUE is calculated as number of fish per 100 square meters. In the PEP, an area of habitat is encircled and a depletion estimator is used to calculate the number of RGSM. The value is used to estimate the number of RGSM per mesohabitat type, and the total abundance of RGSM in the river is estimated by adding together abundance in all mesohabitats.
  - The 2012 PEP report stated:
    - A strong correlation between the PEP and FMP estimates is unlikely to persist over time
    - Estimating population size using FMP data is highly questionable and would likely lead to less accurate results.
    - The population estimation and site occupancy studies performed provide objective and statistically defensible estimates of RGSM abundance and distribution, and can help accurately gauge recovery of RGSM.
  - As a way to assess the FMP CPUE, the PEP can be repeated and the resulting abundance estimate compared to CPUE.
  - The FMP data were not meant to address all questions relating to RGSM population size. The PEP data may be the more appropriate set to address many of them.

- The same questions about RGSM population have been asked for years. If the same questions are being asked, the SAMC needs to determine which questions are critical, if the questions can be answered, and which dataset is appropriate to answer each question.
    - The right data may come from the FMP, the PEP, or a unique study. Coming up with a hypothesis for each question and determining which dataset is suited to each, are the next steps for these outstanding RGSM population questions.

SAMC Comment:

- ☐ It has been a decade since the PEP was done, and river and climate conditions have changed. It would be a good idea to redo the PEP and get results to the EC.

- Re-surveying the EC:
    - In 2012, the PMWG surveyed the EC on the FMP. The results indicated a disconnect between what the FMP actually does and what the managers expect it to do.
        - The managers considered monitoring species response to management actions to be very important, and rated the FMP poorly in that regard. The FMP was designed to monitor long-term trends, not the species response to an action. The capabilities and limitations of the FMP data need to be communicated to the EC. In addition, future questions about "management actions" should specify the exact actions to which they are referring.
    - The SAMC will resurvey the EC on the FMP and PEP. The questions should be written in layman's terms to ensure everyone is on the same page when answering. For example, "population estimate of RGSM" can be written as "total number of RGSM in the river."
    - The management relevance of each question should be included.
    - The questions may become very important for decision-making and management in the near future.
- There is a question of whether the RGSM population is made up mostly of hatchery fish. Charles Y. is working to answer that question with the integrated population model.
    - The genetic monitoring program is also addressing this issue by determining the genetic impact of augmented fish on the population.
- Reviews of the PMWG summary report (see comment matrix):
    - Rich V. is not charged with reconciling all comments. The comments will be documented for future reference.
    - Many of the comments on the PWMG summary report can be addressed be redoing the PEP.
    - Grace Haggerty (N.M. Interstate Stream Commission), Joel Lusk (Reclamation), and Thomas Archdeacon (USFWS) provided public comments on the report findings, assumptions, and recommendations.
    - Commenters misunderstood the report assumptions as additional findings. The assumptions included are statements that must be accepted at face value to be able to address the issues in the report. All scientific assessments involve making assumptions, some of which can be independently tested, if questioned.
        - The assumptions may need to be reworded to clarify them for managers.
    - Recommendation comments:
        - Rec 2 – Lots of disagreement. No RGSM were found in 2012 and there was a lot of discussion after. Additional sampling sites were proposed to augment a low

CPUE. In 2017, 10 additional sites were included, which helps address this issue. This recommendation can be dropped entirely.

- Rec 3 – The question has existed for some time. The core of the FMP will not change, as it is a long-term dataset. Gear type is set for the FMP. Supplemental questions may be answered using different gear types.
- Rec 4 – Should be reworded so "resolve" is not used. Joel L. commented that the abundance information is not required by any action agency. Agencies use the FMP CPUE data in place of a population estimate (provided by the PEP), with the assumption that the values are correlated (*see Key Scientific Assumption #1*). The 2012 PEP report stated the lack of a robust comparison between the values (i.e., few sample years). The PEP needs to be repeated to compare population estimates between the FMP and PEP and determine whether the original correlation has persisted through time.

SAMC Comment:

☐ The mixture model (referred to in Rec 7) may need to be broken down more clearly for managers. The estimate would be more defensible with improved understanding.

- Rec 8 – The intent was to design experiments for monitoring response to management actions, as the FMP data cannot be used for that purpose. Given the amount of pushback, this rec may need to be taken off.
- Rec 11 – This is being addressed with the Adaptive Management Relational Database (AMRDB) and may not need to be included on the list.

SAMC Memo to the EC Discussion:

- The SAMC is the filter between the science and the EC. The SAMC synthesizes and communicates recommendations based on an understanding of science and MRGESCP needs.
- The SAMC takes results from S&T Ad Hoc Groups and provides consensus recommendations for next steps to the EC.
    - If no consensus is reached, multiple opinions are documented and the EC makes the final decision.
- Catherine M. presented a template for the SAMC memo on the RGSM PMWG summary report. The memo supplements the report and proposes next steps for the report's findings and recommendations, in consideration of adaptive management. The memo covers background information, a summary of MRGESCP reviews of the FMP, and SAMC-recommended next steps.
- Several reviews of various aspects of the FMP have been carried out by and through the MRGESCP in the past. These include the Science Work Group reviews, the 2012 PEP report, and independent science panels.
    - The reviews varied in scope and purpose, but they converged around the same types of questions about how the FMP data is used.

SAMC Comment:

☐ List the reanalysis of the Hydrobiological Objective in the 2016 Middle Rio Grande Biological Opinion as another important review of the FMP (Budy and Walsworth 2019).

- There is disagreement regarding the application of FMP data to address MRGESCP needs. The MRGESCP needs to be more specific about its needs, and the scientists need to better

communicate which are the appropriate methodologies and data to address each of those needs.

- The memo should be solution-focused, should acknowledge the limitations of the FMP data, and should define next steps.
- As the same essential questions tend be asked often in the MRGESCP, Catherine M. suggests refining the questions with plain language, coming up with hypotheses that address each one, and determining the appropriate data to answer each of them.
    - The list of essential questions should be regularly reviewed and estimates routinely updated as part of a quality control strategy for the FMP and PEP.
    - This process would be performed by S&T Ad Hoc Groups.
    - An example of an essential question is "How well does the FMP CPUE index track the PEP total abundance estimator?"

SAMC Comment:

- ☐ There is uncertainty about the number and size of RGSM in the Albuquerque Reach. The river in this reach is deeper and catchability is lower. The current sampling methods may reflect a lower number of fish than are present. The implications of this number are huge for how the river is managed. The clear question should be, "Are there more fish in the Albuquerque Reach than indicated by the FMP?" not "Is seining appropriate?"

- During the previous EC survey on the FMP, managers were asked about their needs but scientists were not asked whether those needs could be sufficiently met by the FMP. We need to guide the expectations of the managers.
    - The new survey could have the scientists respond to the needs of the managers.
    - Surveys could be periodically performed to ensure that the MRGESCP is responsive to the important management questions.

SAMC Comments:

- ☐ How are the S&T Ad Hoc Groups different from the former PMWG?
    - Tasks will be divided among individual groups instead of all assigned to one group.
- ☐ Is the SAMC asking for permission from the EC to carry out next steps?
    - The PMWG was originally tasked by the EC, so results should be presented directly to them. The EC is being asked to approve the SAMC-recommended next steps.

- **Action Item**: The PST will revise the SAMC memo to the EC regarding the PMWG summary report based on discussion and send it to the SAMC for review
- **Action Item**: The SAMC will review the memo about the PMWG summary report
- **Action Item**: The SAMC will offer any language changes to the executive summary, findings, recommendations and/or key scientific assumptions in the PMWG summary report to clarify them for managers
- **Action Item**: Rich V. and the PST will finalize the presentation to the EC on the PMWG summary report

Ranking Criteria for Science Strategies

Catherine M. opened discussion on criteria for ranking Science Strategies (see criteria). Summary points are below:

- The SAMC will help objectively rank the proposed studies and activities in the Project Bank.
- The Project Bank is the hub of the AMRDB and each project links to different elements, such as Science Strategies, independent science panel recommendations, and uncertainties.
- The AMRDB can be used to generate a Linkage Score, a completely objective value that tallies up the number of linkages a project has. The SAMC can produce a SMART (Specific, Measurable, Attainable, Relevant, Time-bound) Score that reflects how well a project is scoped (i.e., if it is feasible, has a reasonable timeline, has well-defined metrics, has a clear hypothesis).
    - An additional risk and resiliency score is in discussion. The score would reflect whether a project is informing risk management and/or planning for future scenarios, such as impacts from climate change.
- Catherine M. mapped out some types of projects (e.g., well-scoped, has dependent projects, ongoing) for a straw man demonstration of the scores. For example, a study with a very broad scope may have a low SMART Score but a high Linkage Score because it connects to many AMRDB elements.
    - Combined, the two scores help level the playing field for projects.
- Linkage and SMART Score criteria could be weighted, if desired.
    - The SAMC is asked to provide any feedback on weighting scores.
- The score criteria (and weights) can be evaluated and changed each year, if necessary, as an adaptive measure.
- The scores will be used to generate the Long-Term Plan.

➢ **Action Item**: The SAMC will provide additional feedback on the ranking criteria for projects
➢ **Action Item**: The PST will incorporate changes to the ranking criteria

2021 MRGESCP Effective Monitoring for Habitat Restoration (HR) Workshop

Debbie Lee, Program Manager with the Program Support Team, opened discussion on the HR Workshop (see HR Workshop questionnaire). Summary points are below:

- The PST revised the HR Workshop questionnaire template based on SAMC discussion and tailored it down to key items, including restoration goals, metrics of success, length of project, and purpose of monitoring.
- The template will be used to plan the HR Workshop.
- The PST will present a plan for the HR Workshop to the EC in July. Both the EC and SAMC will back the event.
- The workshop will be planned for late August/September.
- The PST posted a Collaborative Poll on the Program Portal related to HR and there have been several responses. Results will be posted in the June newsletter.
- The SAMC was asked to provide feedback on the questionnaire template.
- The PST will be making infographics with the questionnaire responses, including tables for multiple-choice questions and word clouds for long answers.
- The purpose of the questionnaire and infographics is to spark conversation, and to get an idea of the range of approaches to HR.

SAMC Comment:

☐ Questionnaire respondents may have a difficult time filling it out if they have multiple projects and types of projects.
    - The PST will work on restructuring the template to address this issue.

- **Action Item**: The PST will revise the pre-workshop questionnaire based on discussion and send it to the SAMC for review
- **Action Item**: The SAMC will provide comments on the pre-workshop questionnaire
- **Action Item**: The PST will finalize and distribute the pre-workshop questionnaire to the Collaborative Program, compile results, and plan the Habitat Restoration Workshop

Closing Remarks

Catherine M. opened discussion on the role of the SAMC and any expectations members may have. Summary points are below:

- There is uncertainty regarding what will happen to SAMC products. Adaptive management is a cycle, and SAMC work may stall out along the way. There is not a sense of value of SAMC work without seeing the cycle play out.
    - Alan Hatch, EC *ex officio* member, believes the contributions of the SAMC are valuable to the EC.
- There is worry about SAMC engagement with less frequent meetings.
    - With less frequent meetings, the PST will have more time to prepare between meetings, facilitate S&T Ad Hoc Group meetings, and contact SAMC members between meetings.

Meeting Participants

Alan Hatch	EC *Ex Officio* Member
Ara Winter	Statistics/Modeling Expert
Catherine Murphy	Program Support Team, SAMC Facilitator
Debbie Lee	Program Support Team
Megan Friggens	Climate Science Expert
Melissa Welsch	Program Support Team
Michelle Tuineau	Program Support Team
Rich Valdez	SWCA Environmental Consultants
Ryan Gronewold	Hydrology Expert

Middle Rio Grande Endangered Species Collaborative Program
Habitat Restoration Pre-Workshop Questionnaire

1. When your agency does habitat restoration, what are your restoration goals? (*check all that apply*)

   ☐ Create habitat for one or more listed species
   ☐ Improve water/habitat quality
   ☐ Improve overall ecosystem health
   ☐ Provide/Improve recreational/green space
   ☐ Other:
   _____

2. What are your metrics of restoration success for each of your goals? (*check all that apply*)

   ☐ Target species presence
   ☐ Target species density
   ☐ Species richness
   ☐ Establishment of native species
   ☐ Percent canopy cover
   ☐ Water depth
   ☐ Floodplain inundation
   ☐ Soil moisture level
   ☐ Habitat score
   ☐ Other _____

3. Generally, how long do you expect to maintain a restoration project? (*check one*)

   ☐ No maintenance
   ☐ <1 year
   ☐ 1-5 years
   ☐ 5-10 years
   ☐ 10-20 years
   ☐ Indefinitely

4. Please characterize how you collect data for habitat restoration projects:

   a. What variables do you measure pre-construction?

   b. What variables do you measure post-construction?

   c. How many measurements/samples are taken and from where?

   d. How frequently are measurements/samples taken and for how long?

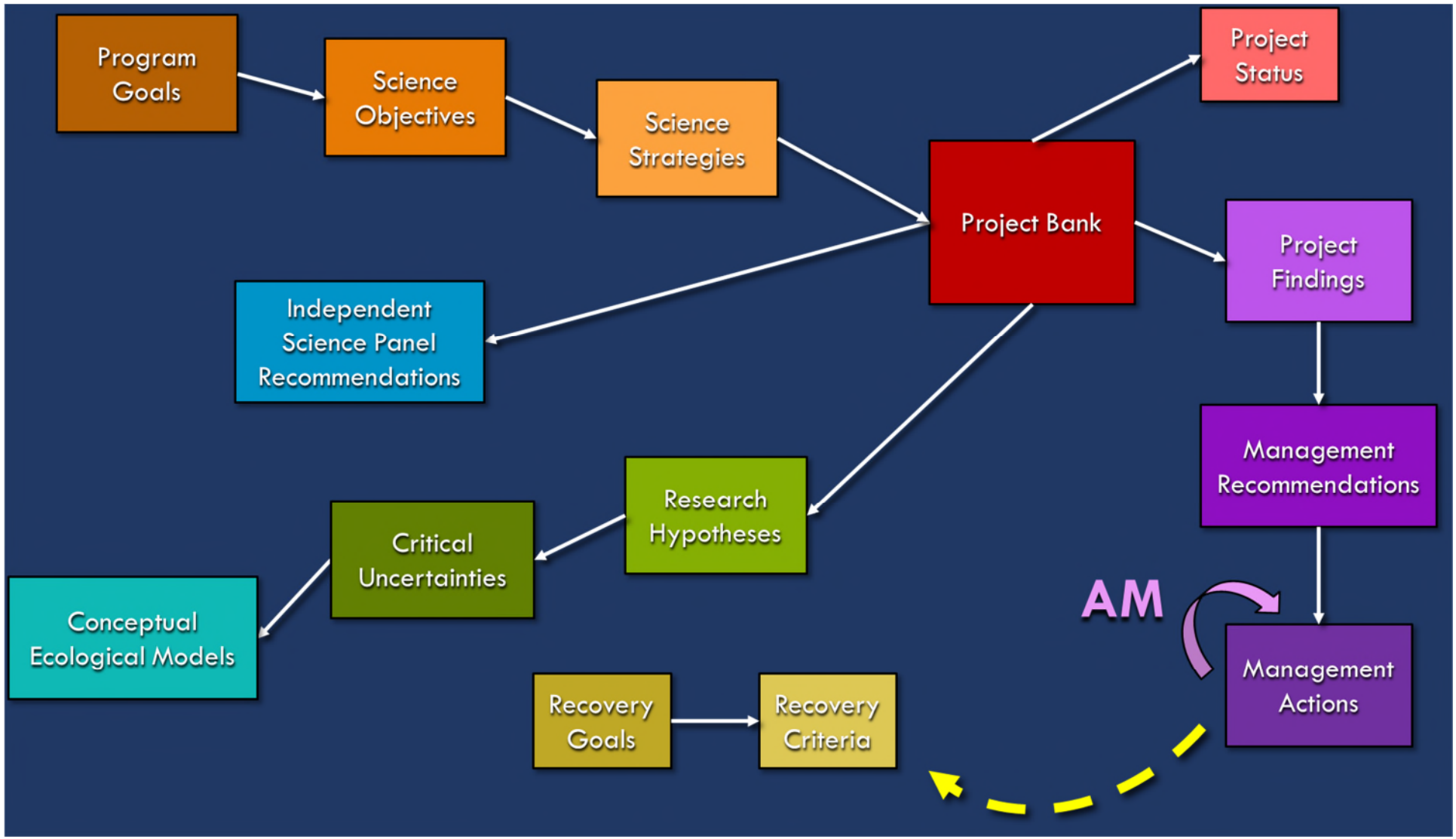
5. What are your monitoring goals? (check all that apply)

   ☐ Satisfy Endangered Species Act requirement or recommendation
   ☐ Confirm the establishment of desired habitat features
   ☐ Collect data necessary to properly evaluate habitat restoration success at the site-level
   ☐ Document recovery progress after acute disturbance (such as wildfire)
   ☐ Document recovery progress after chronic disturbance (such as invasive species, climate change)
   ☐ Inform/improve restoration best practices by defining what works and what does not
   ☐ Provide region-wide insights beyond the temporal and spatial scale of individual projects
   ☐ Other:
   _____

CRITERIA	Type[1]	Weight	ITEM 1 Well-scoped	ITEM 2 Vague	ITEM 3 Has dependents	ITEM 4 Ongoing
Addresses a Science Objective and Strategy	L	1.0	1	0	2	1
Addresses an Independent Science Panel Recommendation	L	1.0	0	1	1	0
Reduces a Critical Uncertainty	L	1.0	1	0	1	0
Addresses a Management Concern	L	1.0	2	1	2	1
Outcomes inform other projects (conditional, hierarchical, etc.)	L	1.0	1	0	4	1
Linkage Tally	**L**		**5**	**2**	**10**	**4**
Specific – Hypothesis or objective is clearly articulated	S	0.3	5	0	5	5
Measureable – Targets and methods are robust and appropriate	S	0.3	5	2	5	5
Attainable – Activity is feasible and outcomes are achievable	S	0.2	5	3	4	5
Relevant – Activity is within the purview of the MRGESCP	S	0.1	5	4	4	5
Time-bound – Timeline is defined and reasonable	S	0.1	4	1	5	5
S.M.A.R.T. Score[2]	**S**		**4.9**	**1.7**	**4.7**	**5.0**
Informs risk management, mitigation or avoidance	R	0.6	2	0	1	1
Informs planning for future scenarios or conditions	R	0.4	4	0	2	1
Risk and Resiliency Score[2]	**R**		**2.8**	**0**	**1.4**	**1.0**
TOTAL						

[1]Linkage, S.M.A.R.T., Risk and Resiliency

[2]0 - Insufficient Information, 1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree


Program Goals
Science Objectives
Science Strategies
Project Bank
Project Status
Project Findings
Management Recommendations
Management Actions
AM
Independent Science Panel Recommendations
Research Hypotheses
Critical Uncertainties
Conceptual Ecological Models
Recovery Goals
Recovery Criteria

Middle Rio Grande Endangered Species Collaborative Program
Habitat Restoration Pre-Workshop Questionnaire

Please answer the following questions with respect to your agency's most recent habitat restoration project (completed, ongoing or planned):

1. What are/were the restoration goals for your habitat restoration project? (*check all that apply*)

   ☐ Create habitat for one or more listed species
   ☐ Improve water/habitat quality
   ☐ Improve overall ecosystem health
   ☐ Provide/Improve recreational/green space
   ☐ Other:
   _____

2. What are the metrics of success for each of your restoration goals? (*check all that apply*)

   ☐ Target species presence
   ☐ Target species density
   ☐ Species richness
   ☐ Establishment of native species
   ☐ Percent canopy cover
   ☐ Water depth
   ☐ Floodplain inundation
   ☐ Soil moisture level
   ☐ Habitat score
   ☐ Other _____

3. How long do you expect the restoration project to be maintained? (*check one*)

   ☐ No maintenance
   ☐ <1 year
   ☐ 1-5 years
   ☐ 5-10 years
   ☐ 10-20 years
   ☐ Indefinitely

4. Please characterize how data are/were collected for your habitat restoration project:

   a. What variables are measured pre-construction?

   b. What variables are measured post-construction?

   c. How many measurements/samples are taken and from where?

   d. How frequently are measurements/samples taken and for how long?

5. What are your monitoring goals? (check all that apply)

   ☐ Satisfy Endangered Species Act requirement or recommendation
   ☐ Confirm the establishment of desired habitat features
   ☐ Collect data necessary to properly evaluate habitat restoration success at the site-level
   ☐ Document recovery progress after acute disturbance (such as wildfire)
   ☐ Document recovery progress after chronic disturbance (such as invasive species, climate change)
   ☐ Inform/improve restoration best practices by defining what works and what does not
   ☐ Provide region-wide insights beyond the temporal and spatial scale of individual projects
   ☐ Other:
   _____

MRGESCP Science & Adaptive Management Committee

Dear SAMC members,

Please see the below proposed ranking criteria and scoring method for projects to be included in the MRGESCP Long-Term Plan update. We discussed potential methods during the May and June SAMC meetings, but because of the light attendance, I wanted to give you all time to digest this and provide feedback. We will discuss the criteria and the need to score/rank projects and strategies during our individual check-in calls with each of you.

The criteria below are based on your feedback from the May meeting and include three parts: a Linkage Score, a S.M.A.R.T. Score, and a Risk and Resiliency Score (tentative).

- The Linkage Score is a count of the linkages a project has to important features (in the AM Relational Database – schematic provided below), such as Science Strategies, Independent Science Panel recommendations, Critical Uncertainties, Management Actions and other projects (e.g., projects that are contingent on the findings from this project). The Linkage Score is supposed to indicate how well a project addresses needs within the Collaborative Program.
- The S.M.A.R.T. Score is a weighted score given by the SAMC based on how well the project scope meets the five S.M.A.R.T. criteria. Weights in the table below are only suggestions and can be eliminated if all criteria are considered equally important. The 1-5 score is also only a suggestion, so please provide an alternative, if you have something better.
- The Risk and Resiliency Score is an attempt to incorporate a forward-looking element into the ranking method. Projects that address climate change or risk management, or projects that build resiliency would score points here. If you don't think that is something we should include, please suggest changes accordingly.

Please be ready to discuss any questions and suggestions you have on the ranking criteria, three types of scores and the scoring method during our check-in call with you. You may also provide written comments to me (cmurphy@west-inc.com) on or before July 9, 2021. We'll revise and send out for group review on July 16, 2021.

Many thanks for your help,

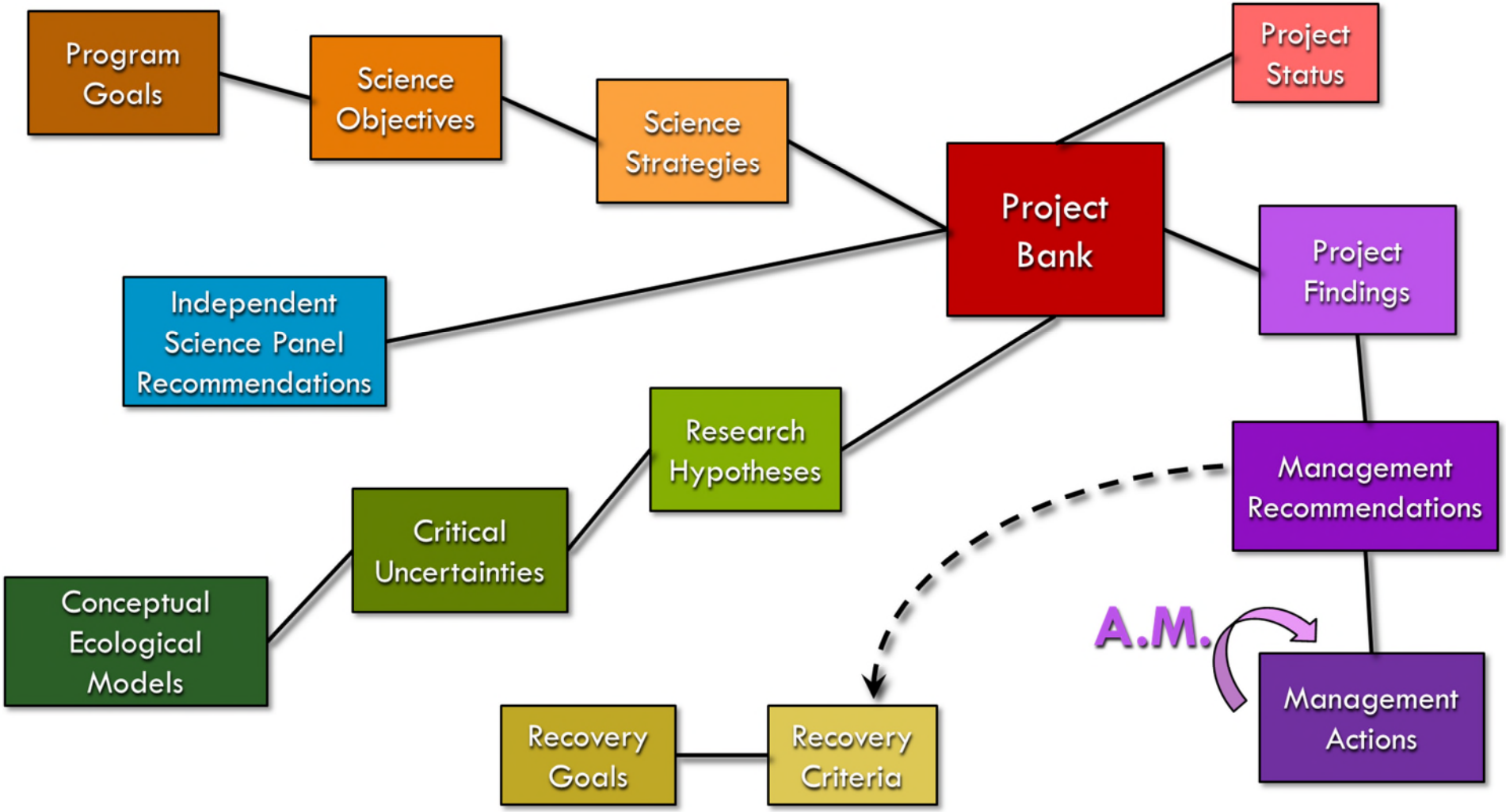
Catherine

Work cell (612) 900-4459

CRITERIA	Type[1]	Weight	ITEM 1 Well-scoped	ITEM 2 Vague	ITEM 3 Has dependents	ITEM 4 Ongoing
Addresses a Science Objective and Strategy	L	1.0	1	0	2	1
Addresses an Independent Science Panel Recommendation	L	1.0	0	1	1	0
Reduces a Critical Uncertainty	L	1.0	1	0	1	0
Addresses a Management Concern	L	1.0	2	1	2	1
Outcomes inform other projects (conditional, hierarchical, etc.)	L	1.0	1	0	4	1
Linkage Tally	**L**		**5**	**2**	**10**	**4**
Specific – Hypothesis or objective is clearly articulated	S	0.3	5	0	5	5
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Attainable – Activity is feasible and outcomes are achievable	S	0.2	5	3	4	5
Relevant – Activity is within the purview of the MRGESCP	S	0.1	5	4	4	5
Time-bound – Timeline is defined and reasonable	S	0.1	4	1	5	5
S.M.A.R.T. Score[2]	**S**		**4.9**	**1.7**	**4.7**	**5.0**
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TOTAL						

[1]Linkage, S.M.A.R.T., Risk and Resiliency

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Project Status
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Project Findings
Independent Science Panel Recommendations
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Critical Uncertainties
Conceptual Ecological Models
A.M.
Management Actions
Recovery Goals
Recovery Criteria

Science and Adaptive Management Committee Meeting

August 26, 2021

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *Draft RGSM Population Research Ad Hoc Group Charge [read-ahead, draft]*
- *Draft MRG HR Guidance Ad Hoc Group Charge [read-ahead, draft]*
- *Draft HR Workshop Agenda [read-ahead, draft]*
- *2021 HR Workshop Questionnaire Results [presentation]*
- *Draft Peer Review Process [presentation]*
- *Revised RGSM Population Research Ad Hoc Group Charge [follow-up]*
- *Revised MRG HR Guidance Ad Hoc Group Charge [follow-up]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
August 26, 2021
8:00 AM – 12:00 PM

Location: Zoom
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09

Meeting Agenda

Meeting Objectives:

- *Discuss document peer review process for the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP).*
- *Discuss using habitat restoration (HR) to inform adaptive management.*
- *Discuss the role of the SAMC at the August 31, 2021 HR Workshop.*
- *Discuss Science & Technical (S&T) Ad Hoc Group charges for Executive Committee-approved next steps from the SAMC memo on the Population Monitoring Work Group (PMWG) Summary Report.*
- *Evaluate SAMC progress and discuss expectations.*

8:00 – 8:05	**Welcome, Introductions, and Agenda Review** Read-Ahead: ☐ Draft August 2021 Meeting Agenda ✓ **Decision**: Approval of August 2021 Agenda	*Catherine Murphy, Program Support Team (PST)*
8:05 – 8:10	**June Meeting Minutes and Actions Item Review** Read-Ahead: ☐ Draft June 2021 Meeting Minutes ✓ **Decision**: Approval of June 2021 Minutes	*Catherine Murphy, PST*
8:10 – 8:20	**Update from July Executive Committee Meeting**	*Catherine Murphy, PST*
8:20 – 8:40	**Current Science & Technical Ad Hoc Group Updates** • Avian Conceptual Ecological Models (CEMs) • Rio Grande Silvery Minnow (RGSM) CEM • RGSM Integrated Population Model • RGSM Population Monitoring Work Group Summary Report	*Catherine Murphy, PST*
8:40 -8:50	**Proposed Science & Technical Ad Hoc Groups** • RGSM Hypothesis Development (*per SAMC memo*)	*Catherine Murphy, PST*

- Guidance to address HR Workshop questions

➢ **Action Item**: PST will revise charges as necessary and convene approved S&T Ad Hoc Groups

Read-Aheads:
- ☐ Draft S&T Ad Hoc Group Charge for RGSM Population Research Questions Ad Hoc
- ☐ Draft S&T Ad Hoc Group Charge for Middle Rio Grande HR Guidance Ad Hoc

8:50 – 9:50	**Document Review Considerations** • Draft Internal and External Review Process • Citation standards and reviewer considerations for S&T Ad Hoc Group work products ➢ **Action Item**: SAMC members will provide PST additional considerations for a MRGESCP peer review process	*Debbie Lee, PST* *Thomas Archdeacon, U.S. Fish and Wildlife Service*
9:50 – 10:00	**Break**	
10:00 – 11:00	**HR to Inform Adaptive Management** • Data Collection • Data Analysis and Interpretation • Modeling • Model Results and Interpretation • Thresholds/Recommendations for Action	*Ari Posner, U.S. Bureau of Reclamation*
11:00 – 11:30	**HR Workshop: August 31, 2021** • Pre-workshop survey results • Role of SAMC members and PST • Next steps from HR Workshop Read-Ahead: ☐ Draft HR Workshop Agenda	*Catherine Murphy, PST*
11:30 – 11:45	**"Collaboratory" Workshop** • Workshop overview and communication focus • Tying into MRGESCP adaptive management cycle	*Debbie Lee, PST*
11:45 – 11:55	**SAMC Informal Evaluation** • Level of engagement • What is working? Not working? • Feedback and recommendations • MRGESCP Annual Evaluation	*Catherine Murphy, PST* *Debbie Lee, PST*

11:55 – 12:00 **Action Items and Next Steps** *Catherine Murphy, PST*

- **Next Meeting**: October 28, 2021 (possibly move to following week)

12:00 **Adjourn**

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Science and Adaptive Management Committee (SAMC)
Meeting Minutes

August 26, 2021; 8:00 AM–12:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of August 26, 2021 SAMC meeting agenda with amendments
- ✓ Approval of June 24, 2021 SAMC meeting minutes

Action Items:

WHO	ACTION ITEM	BY WHEN
Program Support Team (PST)	Send out a Doodle Poll to reschedule the next SAMC meeting for the week of November 1	8/31/2021
PST	Send out the Habitat Restoration (HR) Workshop agenda	8/27/2021
PST	Revise the HR Workshop presentation based on SAMC discussion	8/30/2021
PST	Send Rio Grande silvery minnow (RGSM) Hypotheses Development Ad Hoc Group and Middle Rio Grande (MRG) HR Guidance Ad Hoc Group(s) charges with revisions with the SAMC meeting follow-up	8/30/2021
SAMC	Suggest potential members for the RGSM Hypotheses Development Ad Hoc Group	9/3/2021
SAMC	Send any further revisions on the Science & Technical (S&T) Ad Hoc Group charges	9/3/2021
PST	Schedule MRG HR Guidance Ad Hoc Group(s) meeting(s)	9/16/2021
PST	Schedule RGSM Hypotheses Development Ad Hoc Group meeting	9/19/2021
SAMC	Provide additional considerations for the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) peer review process as outlined in the meeting presentation	9/3/2021

Next Meeting: First week of November

Meeting Summary

Welcome, Meeting Objectives, and Agenda Review

Catherine Murphy, PST Science Coordinator and SAMC Facilitator, opened the meeting and led introductions. Catherine M. reviewed the August 26, 2021 meeting agenda and objectives, and made the following amendments: remove the update from the Population Monitoring Work Group (PMWG) Summary Report Ad Hoc, as it was sunsetted, and remove Thomas Archdeacon from the peer review discussion, as he is not present due to a scheduling conflict. In addition, the guests invited by Ari Posner to speak on HR will not be present, so the SAMC will discuss HR amongst themselves.

- ✓ **Decision**: Approval of the August 26, 2021 SAMC meeting agenda with amendments

June Meeting Minutes and Actions Item Review

Catherine M. and Debbie Lee, PST, reviewed the June 24, 2021 meeting minutes and action items.

- ✓ **Decision**: Approval of the June 24, 2021 SAMC meeting minutes

Update from July Executive Committee Meeting

Catherine M. and Debbie L. gave an update on the July 28, 2021 Executive Committee (EC) meeting. Summary points are below:

- There were 10 decision points and all were approved by the EC.
- Rich Valdez, SWCA Environmental Consultants, presented on the findings and recommendations from the PMWG Summary Report. The EC approved the next steps proposed in the SAMC's memo. The SAMC will form S&T Ad Hoc Groups to carry out next steps.
    - Repeating the Population Estimation Program (PEP) was proposed in the SAMC memo. Catherine M. asked Rob Dudley, American Southwest Ichthyological Researchers and Museum of Southwestern Biology (Fishes), UNM, about the PEP at his Collaborative Seminar on RGSM population monitoring. If the PEP was repeated, Rob D. believes the population estimate would track the estimate from the Population Monitoring Program. The PEP is unlikely to be repeated, but it is an available tool, should future resources be allotted to address the uncertainty of abundance estimates.
- The EC approved the HR Workshop.
- The EC approved the revised By-Laws. There will be minor changes made to the SAMC Charter to reflect revisions.

Current Science & Technical Ad Hoc Group Updates

Catherine M. gave an update on the current S&T Ad Hoc Groups. Summary points are below:

- S&T Ad Hoc Groups have been given flexibility in their timelines, but it is important they finish their work in a timely manner. Catherine M. suggests the deadlines stated in the charges apply to either finishing a deliverable or giving a progress report to the SAMC. Based on the progress report, the SAMC can decide if an S&T Ad Hoc Group should continue or sunset.
- Avian Conceptual Ecological Model (CEM) Ad Hoc – The group filled in the level of uncertainty in relationships between variables in the avian CEMs. The group is now adding information such as which relationships are important for HR and for answering life questions. The group also generated additional references, which adds scientific validity. There will be a summary of the group's deliverable at the next SAMC meeting.

- RGSM Genetics/CEM Ad Hoc – The group is adding genetics/captive propagation components to the RGSM CEM model. They have completed approximately half of their tasks. Wade Wilson (lead), U.S. Fish & Wildlife Service (USFWS), will give a progress report at the next SAMC meeting.
- RGSM Population Model Ad Hoc – Charles Yackulic (lead), U.S. Geological Survey, continues to work on the Integrated Population Model and is incorporating the information from the expert elicitation group exercise. How he will present progress on the model within the terms of his contract is currently being determined.

Proposed Science & Technical Ad Hoc Groups

Catherine M. discussed the proposed S&T Ad Hoc Groups (see draft RGSM Population Research Questions Ad Hoc Charge and MRG HR Guidance Ad Hoc Charge). Summary points are below:

- RGSM Hypotheses Development Ad Hoc (name changed from RGSM Population Research Questions Ad Hoc) – Proposed in the SAMC memo on the PMWG Summary Report. The group will review, translate, and refine recommendations from the PMWG Summary Report into specific questions with clear and testable hypotheses. New people are encouraged to join the group to bring in fresh perspectives, in addition to former PMWG members, who are most familiar with the topics.
    - Suggestions for members: Beck Bixby (University of New Mexico), Andy Dean (USFWS), Eric Gonzales (U.S. Bureau of Reclamation [Reclamation]), Matt Wunder (New Mexico Department of Game & Fish), and Joel Lusk (Reclamation).
    - The membership criteria were revised to state, "Seeking a diverse range of perspectives, including individuals with an outside perspective to the original PMWG."
    - The PMWG Summary Report has a list of four findings and eight recommendations (Valdez 2021). Not all recommendations need to be developed into hypotheses.
    - RE: Evaluating recommendations for hypothesis development
        - Some recommendations need robust reasoning for completing (ex. #6). Recommendations need to be evaluated based on research potential and reasoning provided if they are not recommended for further development.
        - If a recommendation cannot be addressed, it is best left open, so it can be addressed in the future, should resources and/or new approaches become available.
    - RE: Communication with the SAMC
        - The group will give regular progress reports for SAMC input.
    - RE: Tasks 1 and 2 in the Ad Hoc Charge
        - Task 1 prescreens the recommendations before hypotheses are formed in Task 2. Reorder Tasks 1 and 2, so that developing hypotheses for the recommendations will inform the screening process. New Task 1 will be to translate all recommendations into questions with hypotheses. New Task 2 will be to review each hypothesis and outline any study considerations needed to scope a project to address it, where appropriate.
    - RE: Task deadlines
        - The group will give an update on hypotheses after Task 1 and the SAMC will assign a deadline for Task 2, based on the list from Task 1.
- MRG HR Guidance Ad Hoc – *Discussion moved to later in meeting*.

- **Action Item**: The PST will send RGSM Hypotheses Development Ad Hoc Group and MRG HR Guidance Ad Hoc Group(s) charges with revisions with the SAMC meeting follow-up
- **Action Item**: The SAMC will suggest potential members for the RGSM Hypotheses Development Ad Hoc Group
- **Action Item**: The SAMC will send any further revisions on the S&T Ad Hoc Group charges
- **Action Item**: The PST will schedule MRG HR Guidance Ad Hoc Group(s) meeting(s)
- **Action Item**: The PST will schedule RGSM Hypotheses Development Ad Hoc Group meeting

Document Review Considerations

Debbie L. presented on a proposed peer review process (see Draft Peer Review Process presentation). Summary points are below:

- Peer review is a spectrum; there are different categories and types of peer review to meet different needs. Types include statistical, editorial, contextual, and programmatic. Categories are listed below:
    - Internal Administrative Review – For MRGESCP documents (ex. By-Laws, Long-Term Plan). Reviewed by signatories. Low time commitment and low cost.
    - Internal Scientific Review – For S&T Ad Hoc Group work products and science & adaptive management (AM) tools (ex. CEMs, scopes of work). Needs expert reviewers, which can include the SAMC or external reviewers. Low time commitment and low cost.
    - External Expert Review – For important administrative/scientific documents and models with medium-to-high level of contention (ex. Science & AM Plan, population viability analysis). SAMC recommends reviews and the EC approves. Requires expert reviewers that are external to the MRGESCP and paid. Reviews are generally remotely administered. The result could be individual comment forms or a panel report. Medium cost and time commitment.
    - Independent Science Panel (ISP) – For important scientific issues with high level of contention that need programmatic review (ex. Hubert panel, Noon panel). SAMC recommends reviews and the EC approves. Needs expert reviewers that are external and paid. Reviews are in-person and multi-day. The result is a panel report. High cost and greatest time commitment.
- The processes for internal and external scientific review and panel report next steps are laid out in the Draft Peer Review Process presentation (slides 7-11).
- The PST will write a section on peer review for the Science & Adaptive Management (S&AM) Plan, with more details in an appendix.

Summary points for questions/comments/responses are below:

- RE: Presenting panel recommendations and findings
    - The full MRGESCP should be included when presenting panel recommendations and findings, such as with a public seminar.
- RE: Reviewing MRGESCP comments on panel reports
    - In step 8 of the Panel Report Next Steps (slide 11 of the Draft Peer Review Process presentation), the panel contractor documents MRGESCP comments. There may need to be another step for the MRGESCP to review and accept changes. There needs to be documented justification for accepting or rejecting comments.
    - It is not always possible to satisfy every comment on a document. That is the reason a public comment review matrix has been used for S&T Ad Hoc Groups.

    - There could be an intermediary SAMC review before the full MRGESCP sees a panel report. The SAMC can identify areas of high contention or potential confusion and coordinate with the ISP on revisions.
        - The PST will add a step into the peer review process for the SAMC to do the first contextual review of panel reports.
- RE: Internal versus external reviews
    - Internal reviews are much more nimble, responsive, and low cost. External expert reviews can cost between $3,000-7,000 per reviewer. An ISP can cost between $75,000-100,000. There should be a high bar for ISPs.
    - The cost difference between the review categories should be more apparent on the comparison chart. Dollar signs could be added to each category or Debbie L. could add cost ranges.
- RE: External experts
    - If we consistently need to looked outside the MRGESCP for expert review, that is a red flag that we need additional expertise in the MRGSCP (ex. New Mexico Meadow jumping mouse expert).
- RE: PMWG Summary Report addendum
    - For the PMWG Summary Report, when there was a lack of consensus, the report moved forward with differing opinions reflected in an addendum. The report carries more weight than an addendum. It may be better to include differing opinions in the report.
    - We have moved away from standing workgroups and the S&T Ad Hoc Group tasks are more specific, so there are fewer areas of disagreement.

➢ **Action Item**: The SAMC will provide additional considerations for the MRGESCP peer review process as outlined in the meeting presentation

HR Workshop: August 31, 2021

Catherine M. opened discussion on the HR workshop and reviewed the event agenda (see Draft HR Workshop Agenda and 2021 HR Workshop Questionnaire Results presentation). Summary points are below:

- The HR Workshop is scheduled for August 31, 2021 from 1:00 – 4:00 PM.
- The objectives of the HR Workshop are to discuss defining restoration goals and success, documenting HR project success, and choosing metrics for measuring success.
    - These may not be covered fully at the HR Workshop, but a list of questions and issues will be generated for the MRG HR Guidance Ad Hoc Group to address.
- The HR Workshop will start with a presentation on defining HR success, which includes results from the pre-workshop questionnaire, before moving to break out groups, and closing with report outs from the break out groups.
- Break Out Groups:
    - SAMC members will moderate break out rooms and PST members will record notes. Discussions in break out rooms will be summarized for presentation to the entire HR Workshop.
    - The SAMC will use the set of questions below to moderate break out room discussion. Participants will answer round-robin style.
        1. Name, affiliation, and role in HR.
        2. How do you define success/performance for HR?

3. What do you measure to document success/performance?
4. Is anything preventing you from collecting the data you want?
5. Share a positive or negative experience with HR.

- Pre-Workshop Questionnaire results are summarized on the 2021 HR Workshop Questionnaire Results presentation. Respondents were asked to answer all questions with respect to their organization's most recent HR project.
- The outcome of the HR Workshop will be a list of questions, issues, and challenges to send to the MRG HR Guidance Ad Hoc Group. The group will match them up with available resources or recommend next steps for addressing them.
- This upcoming HR Workshop is set up to be the first in a series. Future iterations of HR Workshops could form around more specific topics, such as habitat for individual species.
- After the HR Workshop, the MRG HR Guidance Ad Hoc Group Charge will be updated.
- During the break out groups, the PST will note any participants who contribute heavily to discussions and would be good nominees for the MRG HR Guidance Ad Hoc Group.

Summary points for questions/comments/responses are below:

- RE: HR workshop schedule
  - It would be better to hold off on the HR success presentation until after the break out groups to prevent bias in responses. The results from the Pre-Workshop Questionnaire can still be presented early, but save topics like the Bosque Ecosystem Monitoring Program resources for the end of the HR Workshop.
- RE: Combining organization members into the same break out groups
  - People may learn less if they are in break out groups with people they work with. Spreading them out can help share different perspectives.
- RE: Dividing break out groups by species
  - The purpose of the HR Workshop is to define restoration goals and success, but not for a specific project or species. The conversation should stay broad.
  - Reclamation's MRG Width Maintenance Program combines riparian and aquatic issues. It would be helpful for others to discuss their projects in a broad, overlapping way.
- RE: Broad HR questions
  - Examples of broad questions: How many times should we be sampling? Are we using metrics that make sense?
  - How success of a project is defined should determine the metrics used and frequency of data collection.
  - When it comes to HR monitoring, researchers look for species presence at the site and any impact on population.
- RE: Changes to break out room questions
  - Remove the question on sharing a positive or negative experience. Responses could get too negative.
  - In Question 4, suggestion to ask where the water for HR is coming from.
    - This would be too contentious.
  - Change Question 3 to "What is your approach to project design?" to elicit information on monitoring, site selection, data collection, duration, etc.
  - Change Question 4 to "What support or resources would help you measure success?" to keep discussion positive.
    - Focus on expectations and how we can help meet them.

- **Action Item**: The PST will send out the HR Workshop agenda
- **Action Item**: The PST will revise the HR Workshop presentation based on SAMC discussion

HR to Inform Adaptive Management

Ari Posner discussed HR that informs AM. Summary points are below:

- The ideal format for exploring HR that informs AM is an S&T Ad Hoc Group. Related issues may rise out of the HR Workshop, and the SAMC can task an S&T Ad Hoc Group with addressing them.
- The MRG HR Guidance Ad Hoc Charge includes a task for reaching out for related HR resources. It may be more fruitful to synthesize what is being done in the MRG.
    - The task was not intended to exclude or ignore data resources within the MRG. Catherine M. will revise the charge to make this clear.
- The August newsletter will include a section on conservation and planning support tools. There will also be a Resources page on the Portal with links to these tools and any other provided.

"Collaboratory" Workshop

Debbie L. discussed the proposed Collaboratory Workshop for inclusion in the S&AM Plan operating schedule. Summary points are below:

- MRGESCP participants want to make sure the science being done is management relevant and timely. The PST developed an idea for a biennial workshop to relate scientific results/findings to management needs.
- Participants at the workshop can also bring awareness to any ongoing or upcoming projects that may have been omitted from discussions.
- At the workshop, participants will discuss the MRGESCP's focus for the next two years corresponding to managers' needs. Feedback gained through workshop discussions will be used to revise the MRGESCP's science objectives and strategies.
- The Collaboratory Workshop and Science Symposium will alternate every year. The Science Symposium will help document scientific progress, and the Collaboratory Workshop will strengthen management relevance of the science program.

SAMC Informal Evaluation

Catherine M. discussed the SAMC evaluation. Summary points are below:

- The EC approved an annual self-evaluation for the MRGESCP. Evaluation is an important part of AM.
- The SAMC members will evaluate their own experience and participation on the SAMC, as well as the support provided by the PST. Feedback will help improve both the SAMC and MRGESCP.
- The formal evaluation will be implemented after the EC approves the process. This is currently projected to be in October.

Closing Items

- The next SAMC meeting was originally scheduled the same week as the next EC meeting. Therefore, the October SAMC meeting will be rescheduled for the first week of November.

- **Action Item**: The PST will send out a Doodle Poll to reschedule the next SAMC meeting for the week of November 1

Meeting Participants

Alan Hatch	EC *Ex Officio* Member
Ara Winter	Statistics/Modeling Expert
Ari Posner	Geomorphology Expert
Catherine Murphy	Program Support Team, SAMC Facilitator
Dale Strickland	Program Support Team
Debbie Lee	Program Support Team
Meaghan Conway	Ecosystem Function Expert
Megan Friggens	Climate Science Expert
Michelle Tuineau	Program Support Team
Mo Hobbs	Aquatic Ecology Expert
Ryan Gronewold	Hydrology Expert

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Rio Grande Silvery Minnow Population Research Questions Ad Hoc

Approved by Science and Adaptive Management Committee (SAMC) on *August 26, 2021*.

Parent Committee
Science and Adaptive Management Committee.

Ad Hoc Group Charge
Review, translate and refine recommendations from the Rio Grande Silvery Minnow (RGSM) Population Monitoring Work Group (PMWG) status report (Valdez 2021) into specific questions with clear and testable hypotheses. If a hypothesis cannot be generated, provide an explanation and cite relevant literature.

Membership

A. Criteria for membership

- Knowledge of RGSM life history and ecology within the Middle Rio Grande (MRG);
- Familiarity with MRG Fish Monitoring Program (FMP).

B. Member List

_____, (Lead) Affiliation,
_____, Affiliation,
_____, Affiliation,
_____, Affiliation,
_____, Affiliation.

Iterative Task Development

Background
The recent report entitled, "Review of the Middle Rio Grande Fish Monitoring Program" (Valdez 2021) summarizes the findings that resulted from activities of the RGSM PMWG from 2012-2020 and provides eight recommendations. The report concludes that the MRG Fish Monitoring Program, in its current form, fulfills its intended purposes, but that use of the data outside of those purposes should be assessed separately. To that end, in July 2021 the MRGESCP Executive Committee (EC) approved additional scientific review and, where justified, further refinement of the report's recommendation statements, listed here:

1. *Continue to implement FMP, as conducted during 2017-2020 that includes the recommendations of the Hubert et al. (2016) science panel.*
2. *Evaluate the use of other fish sampling gears, in addition to beach seines, to inform and possibly supplement the current FMP.*
3. *Re-evaluate the relationship of CPUE to total abundance of RGSM.*
4. *Characterize the physical parameters of principal mesohabitat types to inform fish population models and hydraulic habitat models.*
5. *Refine the current monitoring plan to optimize precision and representation of the October CPUE at acceptable program costs.*
6. *Evaluate and compare other analytical methods against the mixture model and determine if other methods are more suitable for computing RGSM CPUE.*

7. *Develop and regularly evaluate integrated population models to help identify and reconcile complex influences on monitoring.*
8. *Draft a clear and concise MRG Fish Monitoring Plan for review and approval by the SAMC and the EC.*

The Valdez (2021) status report serves as a starting place for the tasks detailed below. Additional resources and support will be provided by the MRGESCP Program Support Team, as needed, to expedite this work.

The SAMC requests that you review the draft tasks, deliverables and schedule below and provide feedback and questions to begin the iterative process of task development.

Tasks and Deliverables

Task 1: Review each recommendation statement for scientific validity, technical accuracy, and management relevance.
Review of each statement should include an updated literature review (i.e., beyond that provided in the status report, if applicable). Cite any relevant evidence supporting or refuting the need for additional investigation of the topic.

Objective of Task 1:
A thorough and current review of each recommendation ensures that the best available science will be applied at all decision points. This supports adaptive management as outlined in the MRGESCP Science and Adaptive Management Plan (WEST 2020).

Deliverable:
1. Completed review comment matrix for the eight report recommendation statements (form provided by PST).

Task 2: Translate all recommendation statements that are deemed valid, accurate and relevant from Task 1 into specific questions with clear and testable hypotheses.
Using the context and evidence garnered in Task 1 regarding each uncertainty, translate each recommendation statement into a clearly articulated research hypothesis. Clarify and refine the language used, if needed. Some statements may warrant multiple hypotheses. If a hypothesis cannot be generated, provide a brief explanation and cite relevant literature.

Objective of Task 2:
Clearly articulated research hypotheses designate important influences and identify key response metrics, steps necessary for designing studies and communicating effectively.

Deliverable:
2. List of research hypotheses generated from each recommendation statement, or brief justification for no hypothesis. Provide all relevant citations of literature, where applicable.

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Task 1: Review each recommendation statement for scientific validity, technical accuracy, and management relevance	NA	Completed review comment matrix	TBD
Task 2: Translate all recommendation statements that are deemed valid, accurate and relevant from Task 1 into specific questions with clear and testable hypotheses	NA	List of research hypotheses generated from each recommendation statement	TBD
		Presentation to SAMC	TBD

References:

Valdez, R. A. 2021. Review of the Middle Rio Grande Fish Monitoring Program: Status Report of The Population Monitoring Workgroup, Richard A. Valdez, Ph.D. Workgroup Chair (2019-2020). Prepared for the Executive Committee of The Middle Rio Grande Endangered Species Collaborative Program, Albuquerque, New Mexico. Final. July 20, 2021. 63pp.

Western EcoSystems Technology, Inc. 2020. Middle Rio Grande Endangered Species Collaborative Program Science and Adaptive Management Plan. Prepared for the Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program, Albuquerque, NM. 98 pp.

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Middle Rio Grande Habitat Restoration Guidance Ad Hoc

Approved by Science and Adaptive Management Committee (SAMC) on *August 26, 2021*.

Parent Committee
Science and Adaptive Management Committee.

Ad Hoc Group Charge
Review the challenges and questions that resulted from breakout group discussions during the recent Middle Rio Grande (MRG) habitat restoration workshop, identify resources to address each and provide guidance on best practices, where applicable.

Membership

A. Criteria for membership

- Knowledge of the ecology, dynamics and habitat features of the MRG;
- Familiarity with habitat restoration planning, construction, monitoring and maintenance.

B. Member List

_____, (Lead) Affiliation,
_____, Affiliation,
_____, Affiliation,
_____, Affiliation,
_____, Affiliation.

Iterative Task Development

Background
On August 31, 2021, the MRGESCP hosted a workshop to initiate discussions about the variety of approaches to habitat restoration within the reaches of the Middle Rio Grande. The workshop focused on linking site performance to restoration goals and specified the following objectives:

- Discuss how to define success around HR projects.
- Discuss how to document HR project success.
- Discuss metrics for measuring HR project success

The workshop involved facilitated breakout discussions, which identified differences in approaches, common elements among approaches, and most importantly, a list of challenges and questions with which participants requested guidance. Challenges and questions from the breakout groups were consolidated by workshop moderators and listed here:

- *Challenge 1*
- *Challenge 2*
- *Question 1*
- *Question 2*

The SAMC requests that you review the draft tasks, deliverables and schedule below and provide feedback and questions to begin the iterative process of task development.

Tasks and Deliverables

Task 1: Identify resources and provide guidance for each of the challenges and questions from habitat restoration workshop breakout group discussions.
Identify resources with regionally relevant best practices and effective metrics for demonstrating habitat restoration site performance. Review the challenges and questions from the habitat restoration workshop breakout discussions and match each with the appropriate resources.

Objective of Task 1:
Matching questions and challenges related to habitat restoration efforts in the MRG with available resources will help to identify novel questions that may require independent investigation (i.e., those for which existing resources are insufficient).

Deliverable:
1. Completed review/guidance matrix for the workshop challenges and questions (form provided by PST).

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Task 1: Identify resources and provide guidance for each of the challenges and questions from habitat restoration workshop breakout group discussions	NA	Completed review/guidance matrix	TBD
		Presentation to SAMC	TBD

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Habitat Restoration (HR) Workshop
August 31, 2021
1:00 PM – 4:00 PM

Location: Zoom
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09

DRAFT Workshop Agenda

Workshop Objectives:

- *Discuss how to define success around HR projects.*
- *Discuss how to document HR project success.*
- *Discuss metrics for measuring HR project success.*

1:00 – 1:10	**Welcome, Introductions, and Agenda Review** • Ground Rules • Workshop objectives	*Catherine Murphy, Program Support Team (PST)*
1:10 – 1:25	**Presentation: Defining HR Success** • Results of pre-workshop questionnaire • What to expect when you're restoring: Setting multiple restoration endpoints • True measures of success: Choosing informative indicators • Resources and best practices from the Bosque Ecosystem Monitoring Program (BEMP)	*Catherine Murphy, PST* *Ara Winter, UNM*
1:25 – 1:30	**Introduction to Break Out Groups** • Zoom logistics • Questions for break out group discussions	*Catherine Murphy, PST*
1:30 – 3:00 *(with break)*	**Break Out Groups** • How do you define success for your HR projects? • What do you measure to document success? • What are your data collection constraints?	*Facilitated discussions*
3:00 – 3:50	**Report Out from Break Out Groups** • Different strokes for different folks • Common threads • Challenges, questions and considerations	*Break out group notetakers* *Facilitated discussion*
3:50 – 4:00	**Next Steps** • SAMC Science & Technical Ad Hoc Group(s)	*Catherine Murphy, PST*
4:00	**Adjourn**	

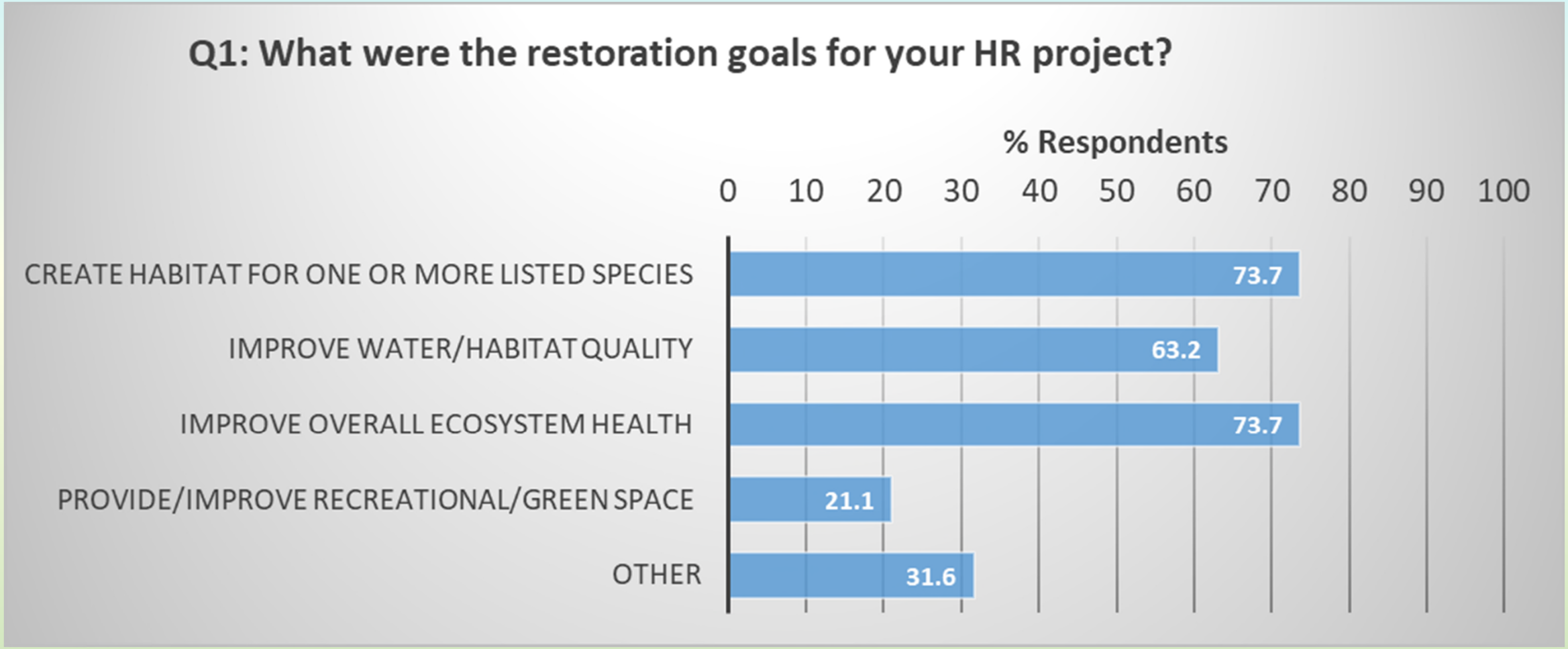
Middle Rio Grande Endangered Species Collaborative Program

2021 Habitat Restoration Workshop

Questionnaire Results

Pre-workshop Questionnaire Results Summary

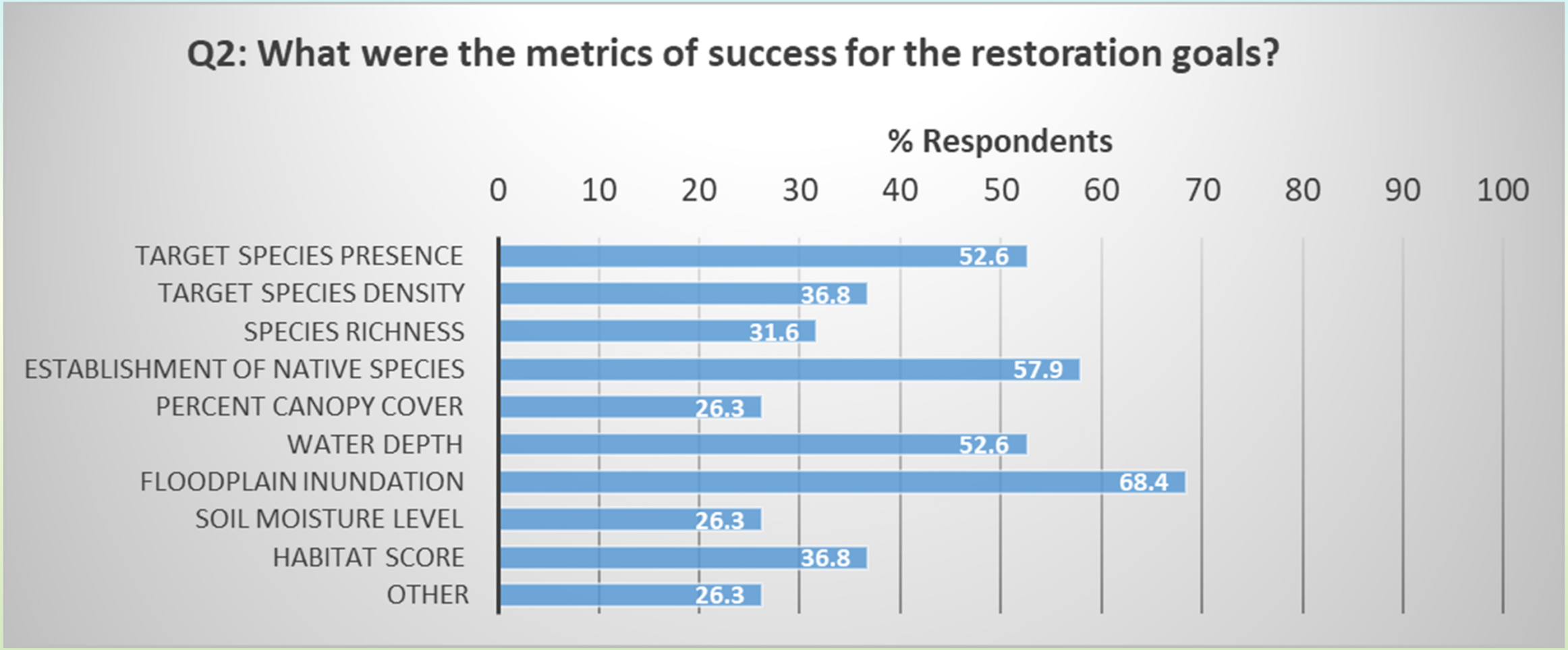
With respect to your agency's most recent habitat restoration project…



***Other**: Create overwintering habitat for native fish; Quantify habitat quality and restoration site performance; Improve water flow or efficiency; Create overwintering habitat for native fish; Long-term monitoring; Improve floodplain connectivity for flood mitigation*

Pre-workshop Questionnaire Results Summary

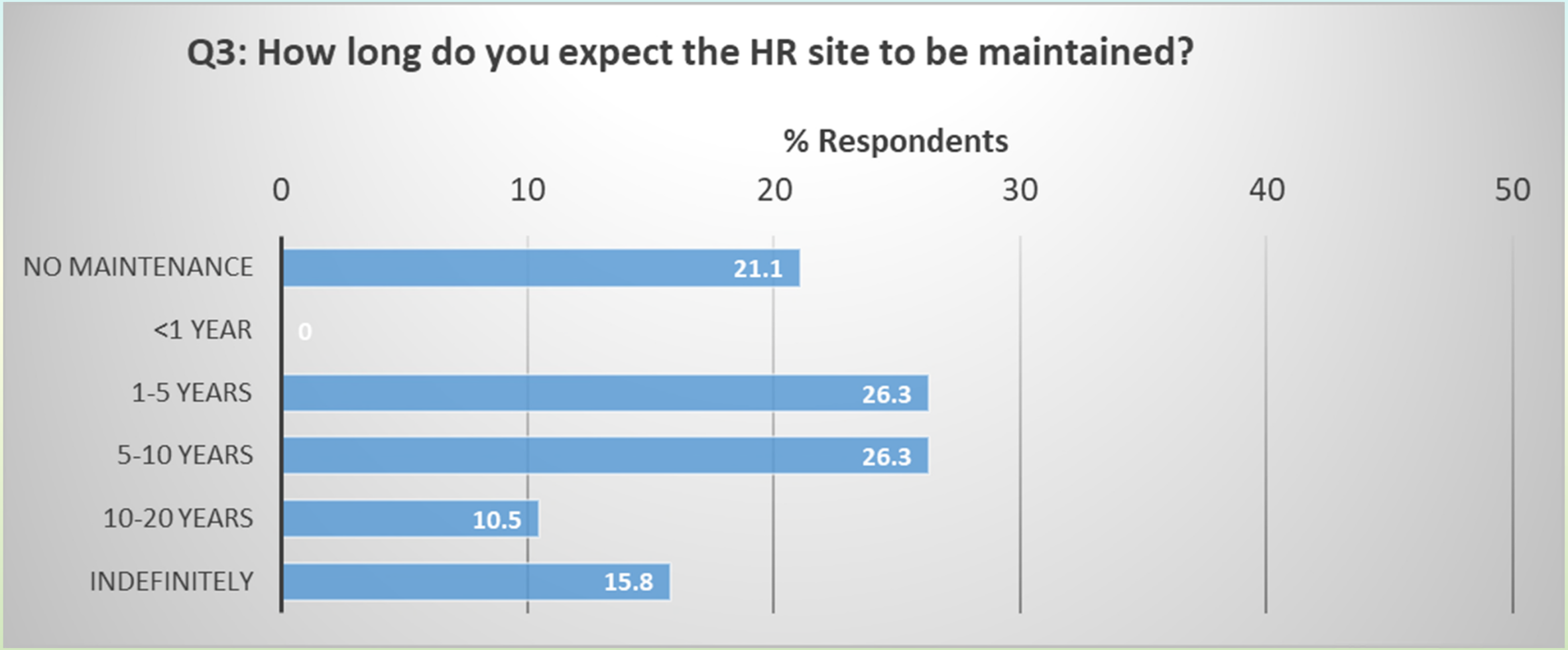
With respect to your agency's most recent habitat restoration project…



***Other**: Increase in habitat complexity; Spatial/Temporal duration of inundation; Good vs. bad habitat; Improved food resources for grazers; Water velocity; Water quality with wetland filtration; Discharge during inundation; Non-native plant cover*

Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…



Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…

Q4. Please characterize how data were collected for your HR project:

a. What variables were measured pre-construction?

AVIAN	*VEG*	*CHANNEL*	*FLOODPLAIN*	*WATER*
# Nests	Sp. richness	Geomorphology	Inundation area	Water table depth
Sp. richness	Canopy cover/diameter	Hydraulics	Topography	Temperature
Surveys	Canopy layer	Profile	Hydraulics	Water quality
Community	Native/Non	Thalweg	Habitat features	Bathymetry
OTHER	Aerial cover	Slope		
Invertebrates	Survival	Stream bed		
Algae	Presence	Habitat features		
T&E Species	Height	Sand bank height		

Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…

Q4. Please characterize how data were collected for your HR project:

b. What variables were measured post-construction?

Hydraulics + Hydrology; Channel geomorphology; River braiding;

Change in topography/bathymetry; Depth, velocity, substrate, cover, inundation flow;

Establishment of native plants; Use of wetland/pond by dragonflies;

Algal parameters, invertebrate parameters; Fish presence;

Same as pre-construction (for direct comparison);

Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…

Q4. Please characterize how data were collected for your HR project:

c. How many measurements/samples were taken and from where?

Pre = Post; Multiple during inundation; Enough to characterize changes;

Cross sections across/adjacent to site; Cross sections at bends and riffles;

Topographic surveys around features; Measurements from selected sites;

Numerous measurements for all variables made within project footprint using a GPS;

Divided individual project sites into discreet "map units" based habitat features

Throughout site: 2 point count routes, 30 veg transects, 12 piezometers, 6 hemispheric photo stations;

>3 Profiles within treatment area;

Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…

Q4. Please characterize how data were collected for your HR project:

d. How frequently were measurements/samples taken and for how long?

Annually, multiple measurements over similar discharge; Annually for XX years;

Annually as required by permits; Yearly after spring runoff;

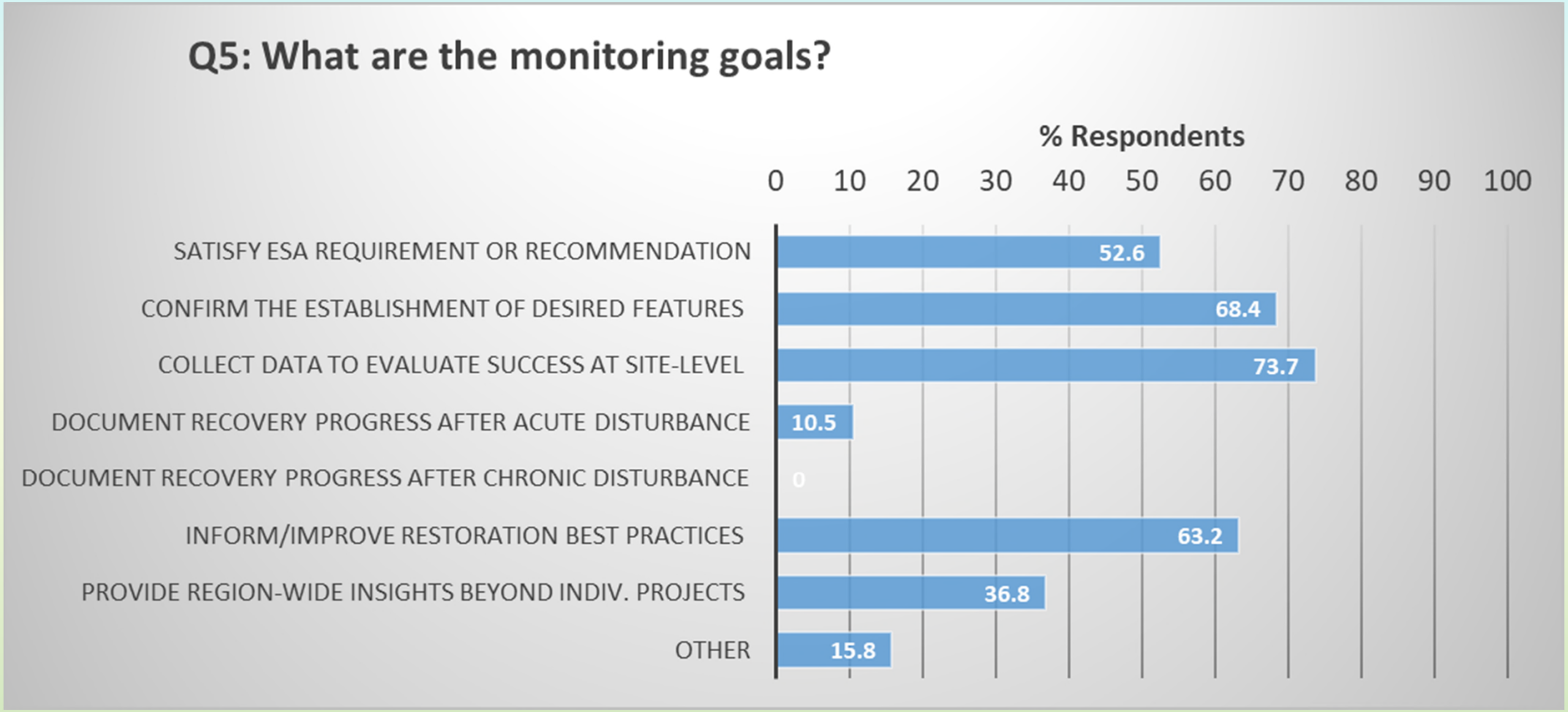
1-2 times per year (depending on hydrology) for XX years; Quarterly for at least XX years;
Monthly; Weekly during May and June;

After runoff events (spring and/or monsoon); Measurements are seasonal and depend on inundation;

Before/After treatment; Minimum for statistically important information

Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…



***Other**: Compare HR projects; Provide quantitative metrics for A.M. decision-making at site; Describe and document habitat used by fish species, esp. RGSM (depth, velocity, substrate, cover)*

Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…

Q6. Please list questions or issues you have regarding your HR project:

***Issues**:*

…the same restoration approach is applied in widely divergent habitats

…need more consistent monitoring and long-term maintenance of projects

…site longevity

…lack of ongoing funding

…community's knowledge of modeling limitations and best practices

…best techniques to use for the suite of listed species

…scale of projects relative to scale of ecological impacts

Pre-workshop Questionnaire Results Summary

With respect to your agency's most recent habitat restoration project…

Q6. Please list questions or issues you have regarding your HR project:

***Questions**:*

What type/degree of change at a site triggers maintenance/re-working?

How long does it take to establish an "egg bank" in a newly excavated site for invertebrates?

Is it possible to excavate more sites that inundate at <1,000 cfs?

What is the relative contribution of the site to RGSM habitat within the reach?

Draft Peer Review Process

Science & Adaptive Management Committee

August 26, 2021

Categories and Types of Peer Review

Types of Peer Review

- Statistical review
- Editorial review
- Contextual review
- Programmatic review

Categories of Peer Review

- Internal Administrative Review
- Internal Scientific Review
- External Expert Review
- Independent Science Panel

Types of Review

REVIEW TYPE	DEFINITION
Content Review	Checking a document for completeness and accuracy of the content
Statistical Review	Evaluating study or sampling design and appropriateness of statistical methods
Editorial Review	Evaluating a document s style, grammar, formatting, and references
Contextual Review	Evaluating a document s relevance to the Collaborative Program and/or management
Programmatic Review	Evaluating the entirety of a program with respect to effectiveness, efficiency, and relevance

Categories of Peer Review: Internal

	BEING REVIEWED	EXAMPLES	CONSIDERATIONS
Internal Administrative Review	• MRGESCP-authored documents • Governance documents	• By-Laws • Annual Report • Long-Term Plan • Science & Adaptive Management Plan	• Reviewed by all signatories • Contributes to MRGESCP operations • Individual comment forms
Internal Scientific Review	• S&T Ad Hoc Group work products • Science and AM tools • Organization's request for MRGESCP review	• Conceptual ecological models • Scientific reports • Scopes of work • Study plans	• Expert reviewers • May be done by the SAMC • May include external reviewers if additional expertise is needed • Individual comment forms

Categories of Peer Review: External

	BEING REVIEWED	EXAMPLES	CONSIDERATIONS
External Expert Review	• Important document or model • Medium-to-high level of contention • May be administrative or scientific review	• Science & Adaptive Management Plan • Population viability analysis	• SAMC recommends & EC approves • Expert reviewers • Administered remotely • Individual comment forms or a panel report
Independent Science Panel	• Big, important issues • High level of contention • Programmatic review • May be administrative or scientific review	• Hubert panel • Noon panel • Fraser panel	• SAMC recommends & EC approves • Expert reviewers • In person, multi-day • Presentations from MRGESCP experts • Panel report

Comparing Categories of Review

	INTERNAL ADMINISTRATIVE REVIEW	INTERNAL SCIENTIFIC REVIEW	EXTERNAL EXPERT REVIEW	INDEPENDENT SCIENCE PANEL
Time commitment	Low	Low	Medium	High
Clear charge to reviewers	X	X	X	X
Expert reviewers		X	X	X
External reviewers		If needed	X	X
SAMC recs & EC approves			X	X
Paid reviewers			X	X
Contracting needs			X	X
Panel report			If needed	X
In-person				X

Internal Scientific Review Process

Internal Scientific Review Process

1. SAMC tasks a S&T Ad Hoc Group
   - Include need for deliverable review in group's charge, with proposed reviewers
2. PST undertakes a citation and reference review
3. *(If need for deliverable review)* Reviewers are given their charge for the review, including what type of review
   - Review comments with justification are documented, including how addressed or responded to by S&T
4. SAMC review
   - Next steps
   - Documents consensus/non-consensus with scientific justification
5. Input into SAMIS
   - Findings
   - Evidence-based disagreements are noted as scientific uncertainties
6. If appropriate, recommendations to the EC with scientific justifications

External Scientific Review Process

External Scientific Review Process

1. The SAMC recommends a topic or work product to the EC for an external expert review or ISP, with justification
   - All SAMC members agree on the need, or documents non-consensus
     - *To be developed: a decision support matrix*
   - SAMC communicates to the FPC on the need for a budget estimate and funding options
   - Presents a proposed written charge to the EC for consideration and approval
2. EC agrees on the need, and approves holding an external expert review or ISP
3. Funding entity contracts review/ISP
4. Contractor works with SAMC to identify and vet reviewers
   - *To be developed: Process for determining reviewer qualifications and vetting process*
5. Contractor carries out review/ISP

Panel Report Next Steps

6. Panel provides comment forms (external expert review only) or develops draft report
7. Comment period for draft panel report open to MRGESCP experts
8. Contractor documents MRGESCP comments and how they are addressed
9. Panel finalizes draft report
10. Presentation of recommendations and findings to the MRGESCP
    - *To be determined:* Who should the audience be for the presentation? SAMC? EC? Both? Open to the full MRGESCP?
11. The SAMC synthesizes the findings from the panel report, and submits a cover memo to the EC with its recommended next steps.
12. Findings, recommendations, and comments documented in SAMIS

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Rio Grande Silvery Minnow Hypotheses Development Ad Hoc

Revised by Science and Adaptive Management Committee (SAMC) on *August 26, 2021*.

Parent Committee
Science and Adaptive Management Committee.

Ad Hoc Group Charge
Review, translate and refine recommendations from the Rio Grande Silvery Minnow (RGSM) Population Monitoring Work Group (PMWG) status report (Valdez 2021) into specific questions with clear and testable hypotheses. If a hypothesis cannot be generated, provide an explanation and cite relevant literature.

Membership

A. Criteria for membership

- Knowledge of RGSM life history and ecology within the Middle Rio Grande (MRG);
- Familiarity with MRG Fish Monitoring Program (FMP);
- Group should include a diverse range of perspectives, beyond those of the original Population Monitoring Workgroup.

B. Nominee List

_____, (Lead) Affiliation,
Becky Bixby, University of New Mexico, *nominated,*
Andy Dean, U. S. Fish & Wildlife Service, *nominated,*
Eric Gonzales, U. S. Bureau of Reclamation, *nominated,*
Matt Wunder, New Mexico Dept. of Game and Fish, *nominated,*
Joel Lusk, U. S. Bureau of Reclamation, *nominated.*

Iterative Task Development

Background
The recent report entitled, "Review of the Middle Rio Grande Fish Monitoring Program" (Valdez 2021) summarizes the findings that resulted from activities of the RGSM PMWG from 2012-2020 and provides eight recommendations. The report concludes that the MRG Fish Monitoring Program, in its current form, fulfills its intended purposes, but that use of the data outside of those purposes should be assessed separately. To that end, in July 2021 the MRGESCP Executive Committee (EC) approved additional scientific review and, where justified, further refinement of the report's recommendation statements, listed here:

1. *Continue to implement FMP, as conducted during 2017-2020 that includes the recommendations of the Hubert et al. (2016) science panel.*
2. *Evaluate the use of other fish sampling gears, in addition to beach seines, to inform and possibly supplement the current FMP.*
3. *Re-evaluate the relationship of CPUE to total abundance of RGSM.*
4. *Characterize the physical parameters of principal mesohabitat types to inform fish population models and hydraulic habitat models.*

5. *Refine the current monitoring plan to optimize precision and representation of the October CPUE at acceptable program costs.*
6. *Evaluate and compare other analytical methods against the mixture model and determine if other methods are more suitable for computing RGSM CPUE.*
7. *Develop and regularly evaluate integrated population models to help identify and reconcile complex influences on monitoring.*
8. *Draft a clear and concise MRG Fish Monitoring Plan for review and approval by the SAMC and the EC.*

The Valdez (2021) status report serves as a starting place for the tasks detailed below. Additional resources and support will be provided by the MRGESCP Program Support Team, as needed, to expedite this work.

The SAMC requests that you review the draft tasks, deliverables and schedule below and provide feedback and questions to begin the iterative process of task development.

Tasks and Deliverables

Task 1: Translate all recommendation statements into specific questions with clear and testable hypotheses.
Translate each recommendation statement into a clearly articulated research hypothesis. Clarify and refine the language used, if needed. Some statements may warrant multiple hypotheses. If a hypothesis cannot be generated, provide a brief explanation and cite relevant literature.

Objective of Task 1:
Clearly articulated research hypotheses will help to identify important influences, as well as key response metrics and steps necessary for designing studies and communicating findings effectively.

Deliverable:
1. List of research hypotheses generated from each recommendation statement, or brief justification for no hypothesis. Provide all relevant citations of literature, where applicable.

Task 2: Review each hypothesis from Task 1 for scientific validity, technical accuracy, and management relevance.
Review of each statement should include an updated literature review (i.e., beyond that provided in the status report, if applicable). Cite any relevant evidence supporting or refuting the need for additional investigation of the topic. As part of this review, include any study considerations required to scope a project to address the hypothesis.

Objective of Task 2:
A thorough and current review of each recommendation ensures that the best available science will be applied at all decision points. This supports adaptive management as outlined in the MRGESCP Science and Adaptive Management Plan (WEST 2020).

Deliverable:

2. Completed review comment matrix for the hypotheses generated from report recommendation statements selected in Task 1 (form provided by PST).

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Task 1: Translate all recommendation statements into specific questions with clear and testable hypotheses	Progress updates to SAMC	List of research hypotheses generated from the recommendation statements	TBD
Task 2: Review each hypothesis from Task 1 for scientific validity, technical accuracy, and management relevance	NA	Completed review comment matrix	TBD
		Presentation to SAMC	TBD

References:

Valdez, R. A. 2021. Review of the Middle Rio Grande Fish Monitoring Program: Status Report of The Population Monitoring Workgroup, Richard A. Valdez, Ph.D. Workgroup Chair (2019-2020). Prepared for the Executive Committee of The Middle Rio Grande Endangered Species Collaborative Program, Albuquerque, New Mexico. Final. July 20, 2021. 63pp.

Western EcoSystems Technology, Inc. 2020. Middle Rio Grande Endangered Species Collaborative Program Science and Adaptive Management Plan. Prepared for the Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program, Albuquerque, NM. 98 pp.

Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Middle Rio Grande Habitat Restoration General Guidance Ad Hoc

Revised by Science and Adaptive Management Committee (SAMC) on *August 26, 2021*.

Parent Committee
Science and Adaptive Management Committee.

Ad Hoc Group Charge
Review the challenges and questions that resulted from breakout group discussions during the recent Middle Rio Grande (MRG) habitat restoration workshop, identify resources to address each and provide guidance on best practices, where applicable.

Membership

A. Criteria for membership

- Knowledge of the ecology, dynamics and habitat features of the MRG;
- Familiarity with habitat restoration planning, construction, monitoring and maintenance.

B. Member List

_____, (Lead) Affiliation,
_____, Affiliation,
_____, Affiliation,
_____, Affiliation,
_____, Affiliation.

Iterative Task Development

Background
On August 31, 2021, the MRGESCP hosted a workshop to initiate discussions about the variety of approaches to habitat restoration within the reaches of the Middle Rio Grande. The workshop focused on linking site performance to restoration goals and specified the following objectives:

- Discuss how to define success around habitat restoration projects.
- Discuss how to document habitat restoration project success.
- Discuss metrics for measuring habitat restoration project success

The workshop involved facilitated breakout discussions, which identified differences in approaches, common elements among approaches, and most importantly, a list of challenges and questions with which participants requested guidance. Challenges and questions from the breakout groups were consolidated by workshop moderators and listed here:

- *Challenge 1*
- *Challenge 2*
- *Question 1*
- *Question 2*

The SAMC requests that you review the draft tasks, deliverables and schedule below and provide feedback and questions to begin the iterative process of task development.

Tasks and Deliverables

Task 1: Identify resources and provide guidance for each of the challenges and questions from habitat restoration workshop breakout group discussions.

a. Synthesize habitat restoration work conducted within the MRG and translate findings into guidance.

b. Identify resources with regionally relevant best practices and effective metrics for demonstrating habitat restoration site performance.

c. Review the challenges and questions from the habitat restoration workshop breakout discussions and match each with the appropriate resources.

Objective of Task 1:
Matching questions and challenges related to habitat restoration efforts in the MRG with available resources will help to identify novel questions that may require independent investigation (i.e., those for which existing resources are insufficient).

Deliverable:

1. Completed review/guidance matrix for the workshop challenges and questions (form provided by PST).

Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Task 1: Identify resources and provide guidance for each of the challenges and questions from habitat restoration workshop breakout group discussions	NA	Completed review/guidance matrix	TBD
		Presentation to SAMC	TBD

POPULATION MONITORING WORK GROUP MEETINGS

Population Monitoring Work Group Meeting

October 22, 2020

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

Draft Review of MRG Fish Population Monitoring Plan [read-ahead, draft, not included]

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Work Group (PMWG)
October 22, 2020
1:00 PM – 4:15 PM

Zoom Information:
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Code: 1251; Call-In: +1-669-900-6833; Meeting ID: 898-359-3120

Meeting Agenda

1:00 – 1:15	**Welcome, Intros, Agenda, Meeting Notes** ➢ **Decision:** Approval of Sep 30, 2020 meeting minutes ➢ **Decision:** Approval of Oct 22, 2020 meeting agenda Read aheads: ☐ September 30, 2020 PMWG meeting minutes	*PMWG Chair*
1:15 – 2:20	**Report to Executive Committee (EC) on Current Fish Monitoring Program (FMP)** **Task 2 Objectives – Open Discussion:** 1. Evaluate and Refine Sampling Design 2. Evaluate and Refine Sampling Methods 3. Evaluate and Refine Data Collection Protocols 4. Evaluate and Refine Data Analyses	*Rich Valdez, Mike Marcus, Mo Hobbs*
2:20 – 2:30	**Break**	
2:30 – 3:30	**Report from Small Group on Flow Modeling Scenarios** • Discussion from Oct 7, 2020 Meeting • Strategy for Developing Flow Scenarios and Parameters Read aheads: ☐ Strategy for Consensus on Flow Scenarios	*Charles Yackulic*
3:30 – 4:00	**Report to EC on Current FMP** **Task 2 Objectives – Open Discussion (continued):** 5. Identify Other Data Needs for Concurrent Sampling 6. Evaluate How Modeling May Assist in Refining Monitoring 7. Additional Data That Help to Inform Monitoring Read aheads: ☐ PMWG Task 2 Status Report-Draft 1.1	*Rich Valdez, Mike Marcus, Mo Hobbs*
4:00 – 4:15	**Wrap-Up** • Announcements • Action Items • Next Meeting	*PMWG Chair*
4:15	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Work Group (PMWG)
Meeting Minutes

October 22, 2020; 1:00 PM–4:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of October 22, 2020 PMWG meeting agenda
- ✓ Approval of September 30, 2020 PMWG meeting minutes

Action Items:

Who	What	By When
Program Support Team (PST)	Schedule the November 18, 2020 PMWG meeting	10/23/2020
Charles Yackulic	Send the expert elicitation spreadsheet to the Flow Scenarios Small Group for feedback	10/29/2020
Charles Y.	Send the expert elicitation spreadsheet to the full PMWG	11/2/2020
PMWG	Return completed expert elicitation spreadsheets to Charles Y.	11/13/2020
Rich Valdez	Begin evaluating the implementation of panel recommendations into the Fish Monitoring Program (FMP) and the resulting impact on monitoring results	11/18/2020
Mike Marcus	Send Mo Hobbs and Eric Gonzales the report on dry sites	10/26/2020
Rich V.	Send the PMWG the draft status report and preliminary verbal report for review	Week of November 9th
PMWG	Send comments on the reports to Rich V.	12/7/2020

Next Meeting: November 18, 2020; 9:00 AM – 12:00 PM

Meeting Summary

Welcome, Intros, Agenda, Meeting Notes

Rich V., SWCA Environmental Consultants and PMWG chair, opened the meeting and Debbie L., PST, introduced the meeting attendees. Rich V. reviewed the October 22nd meeting agenda and September 30th meeting minutes.

- ✓ **Decision**: Approval of October 22, 2020 PMWG meeting agenda
- ✓ **Decision**: Approval of September 30, 2020 PMWG minutes

Report to Executive Committee (EC) on Current Fish Monitoring Program (FMP)
Task 2 Objectives – Open Discussion:
1. Evaluate and Refine Sampling Design
2. Evaluate and Refine Sampling Methods
3. Evaluate and Refine Data Collection Protocols
4. Evaluate and Refine Data Analyses

The PMWG discussed the draft report for the EC summarizing PMWG accomplishments and progress on Task 2. These were the main points made during the discussion:

- The report to the EC is a status report on Task 2. While Task 2 has not been completed, the report will get the EC up-to-date on progress to date.
- The group was sent a preliminary draft of the report.
    - Some written comments were provided to Rich V.
    - An introduction was written, which identifies the primary goals and objectives under the tasks assigned to the PMWG.
    - A section is set aside for what was done to implement and complete Task 1.
        - Mike Marcus and Mo Hobbs worked to consolidate recommendations from Task 1 and include them in the report.
    - Rich V. is working on the section regarding implementation of and progress on Task 2.
    - In the original charge, there were six objectives under Task 2. The PMWG decided to add an objective about additional data that inform monitoring.
- What is the general sense on the report so far?
    - Task 2 is not measurable as written: the language "evaluate and refine" is not specific about the end goal. What are we trying to refine to and evaluate for? There may be an issue with continuing to work to achieve Task 2 when the goal is ambiguous.
        - There have been multiple Rio Grande silvery minnow (RGSM)-related studies (e.g., gear-type studies, floodplain monitoring, etc.). If those are put first in Task 2, that gives us some information to compare the FMP to. This allows us to evaluate the pros and cons of the FMP as compared to other techniques, like fyke nets. This gives us a better basis for evaluation. Only if there are significant gaps should we decide how to refine the FMP.
    - Question was raised about the relevance of Task 2, which was originally approved by the EC eight years ago. Suggestion to consider the bigger picture and what is needed to inform the Collaborative Program's science and adaptive management efforts.
    - Another way to approach this report is to consider the 2014 survey of the EC prior to the Hubert workshop (included in the preliminary Task 2 report). EC members were asked what they needed to know and how well the FMP met those needs. Some of the

needs identified as most important by EC members were believed to have been the least thoroughly addressed. For example, although EC members believed it was important for the FMP to evaluate species response to management actions, they did not believe the FMP was meeting that need well. Our efforts should help the FMP better meet the needs of the EC.
    - The FMP was not designed to meet all the needs listed on the table. We need to figure out if our end goal is to change the FMP (and possibly lose trend data) or create a new monitoring program that meets the needs.
    - Members of the EC might not have accurate or complete opinions on how the FMP is meeting the surveyed needs. There is questionable disparity between some of the responses.
    - Technical experts within the Program are supposed to give the EC confidence in the results of the FMP data and how well those data can address their questions.
- We are trying to manage a fish in one of the most highly altered water systems in the West. Much of the management occurs without consideration of ecology or biology. We have to accept that before dealing with the problem. The problem will not go away with just improving the FMP. We need to consider how to manage water to improve conditions for RGSM.
- This group has opportunities for making progress. The data gaps identified through Charles Y.'s work offer areas for moving forward. Refining methods in the FMP may not lead us anywhere.
- If members of the PWMG believe the primary goal of the group needs to change, they should include that in their edits of the report and the group can discuss it.
- There is enough information associated with the FMP to address the objectives under Task 2 in a status report to the EC. The EC originally asked the PMWG to evaluate the FMP and we should complete the request.
    - It is good to give an update on what the PMWG has been doing, but the primary goal may have changed. We need to show that we are moving forward. We need to consider how to refine the goal so that it has value today.
- Should we revise the assignment from the EC?
    - The Collaborative Program does not have the same EC members. The current EC members did not assign tasks to the PMWG and we do not know if they agree with them.
    - We should advise on the direction PMWG work should go and tell the EC how we can help.
    - There have been many studies evaluating the FMP. We should focus on summarizing and evaluating the FMP. Leave refinement for a subsequent step after speaking with the EC.
- Do we need to re-survey the EC?
    - We do not need to ask the EC for direction. We can summarize the things that have been done and shape future tasks. We have the knowledge to tell the EC where there are uncertainties in monitoring and what studies to design to address them.
- What is the goal of showing the 2014 EC survey?
    - A thread can be drawn between the EC's opinions, the recommendations from the science panels, and evaluation of the current FMP. We may not be able to

reconcile the needs and how well the needs are being addressed, but the survey points out areas to focus on.

- There have been studies addressing these needs. We can educate the EC on the challenges that have been overcome and where progress has been made.
- The report addresses two things 1) the information that has been gathered in the last eight years 2) how much of that information has been communicated to the managers. The more important aspect of the report is summarizing the science and communicating it as a message to the EC.
- The EC survey was done prior to CPUE workshop and was meant to inform what should be discussed at the workshop. There are conflicts in the responses, but at the time, the EC knew very little about the FMP.
- The survey results acknowledge that the EC was involved with the PMWG tasks and would not hurt to include. Maybe we could do a survey after the report, to see how responses have changed since 2014.
- The scientists in the PMWG have a better understanding of how well the FMP meets the surveyed needs than the EC members. They would have a better sense of how things have improved and could provide insight in the report.

Report from Small Group on Flow Modeling Scenarios

Discussion from Oct 7, 2020 meeting

Strategy for developing flow scenarios and parameters

Charles Y. reported on the Flow Scenarios Small Group meeting on October 7th. These are the main points from the discussion:

- The group is setting up an expert elicitation process for getting input from the PMWG in the absence of sufficient data related to flow and habitat availability.
- Program members have their own understanding about certain quantities and relationships regarding RGSM habitat and flow scenarios. There may not be representative data for this yet. With expert elicitation, we can make best guesses now and use actual estimates when understanding improves in the future.
- Through this process, Charles Y. is looking to develop a synthetic covariate for predicting spawning success in different reaches and years based on hydrographs.
- Going through the expert elicitation process will also help characterize good or bad hydrographs with regards to producing RGSM. This will help people create criteria that can be used to optimize use given an amount of water in the river.
- We can go through similar exercises to elucidate relationships between extent of drying and survival and speed of drying and survival.
- Charles Y. is in the process of developing spreadsheets to share with the PMWG. Members can come up with their best guesses for manipulating a hydrograph. At a later meeting, we can discuss responses.
- The goal is not to reach a single consensus but to highlight agreement and disagreement.
- What is the model's relationship to the Utah State University (USU) model?
    - This model is distinct from the USU model because it will use knowledge from experts. This will help tease out relationships that have not been addressed before. For example, the relationship between the extent and duration of flow.
    - We do not expect very different results from the USU model, but we may be able to identify how to shape a hydrograph with a given water amount to benefit the RGSM.
    - The model will help with planning, especially during difficult water years.

- Are you thinking year-round or focusing on a particular season first?
    - Charles Y. wants to develop something year-round.
    - There are more questions he needs to ask first, for example:
        - Given the geomorphic change in the last 20 years, has there been reach-level change in the relationship between discharge and larval habitat?
            - The consensus at the U.S. Bureau of Reclamation is that there has been significant geomorphic change, especially in the Isleta Reach. The change coincides with keeping the river wet for the RGSM, which has led to vegetation growth. In addition, river/channel maintenance used to occur in the 1980s. Some have considered doing this maintenance again to gauge response.
        - What potential exists for changing the relationship between discharge and larval habitat through restoration activities?
- Charles Y. shared a spreadsheet with an example of the format for expert elicitation.
    - PMWG members will manipulate a hydrograph to reflect the amount of larval habitat at different flows.
    - Members will enter a highest reasonable value, a lowest reasonable value, their confidence, and lastly, their best guess.
- Charles Y. will continue to develop the spreadsheet and send it to the Flow Scenarios Small Group for feedback. The spreadsheet will then be sent to the larger PMWG.
- The next PMWG meeting will be scheduled for November 18, 2020 from 9:00 AM to 12:00 PM and will cover responses to the expert elicitation.

- **Action Item**: Charles Yackulic will send the expert elicitation spreadsheet to the Flow Scenarios Small Group for feedback
- **Action Item**: Charles will send the expert elicitation spreadsheet to the full PMWG
- **Action Item**: The PMWG will return completed expert elicitation spreadsheets to Charles Yackulic
- **Action Item**: The PST will Schedule the November 18, 2020 PMWG meeting

Report to EC on Current FMP
Task 2 Objectives – Open Discussion (continued):
5. Identify Other Data Needs for Concurrent Sampling
6. Evaluate How Modeling May Assist in Refining Monitoring
7. Additional Data That Help to Inform Monitoring

The PMWG group continued to discuss the Task 2 report to the EC. These are the main points from the discussion:

- Mike Marcus and Mo Hobbs began evaluating progress on the recommendations from the Hubert et al. and Noon et al. science panels. They put together a preliminary table of recommendations and progress.
    - The utility of the recommendations table is to track what has been done. There are ways to house this data in one easily accessible spot. The information is not easy to digest, but this is a great start to synthesizing things.
- Is this report an update on PMWG or on Task 2? We may want to make it shorter. There is a lot of information in the report for the EC to digest.

    - The full report will be longer than the summarized version given to the EC. There will be a 2-3 page executive summary.
- Recommendations from the Hubert et al. panel were incorporated into the FMP. This is the 4th year since recommendations were incorporated and we need to evaluate the effect on the FMP.
    - For example, 20 additional monitoring sites were added to the FMP and the results have not been evaluated.
    - Rich V. will begin evaluating the impact of implemented recommendations on the FMP.
    - Mike Marcus will send the report on dry sites to Eric Gonzales and Mo Hobbs.

- **Action Item**: Rich Valdez will begin evaluating the implementation of panel recommendations into the Fish Monitoring Program and the resulting impact on monitoring results
- **Action Item**: Mike Marcus will send Mo Hobbs and Eric Gonzales the report on dry sites
- **Action Item**: Rich Valdez will send the PMWG the draft status report and preliminary verbal report for review
- **Action Item**: The PMWG will send comments on the reports to Rich Valdez

Meeting Participants

Participant	Organization
Andy Dean	U.S. Fish and Wildlife Service
Anne Marken	Middle Rio Grande Conservancy District
Catherine Murphy	Program Support Team
Charles Yackulic	U.S. Geological Survey
Debbie Lee	Program Support Team
Eric Gonzalez	U.S. Bureau of Reclamation
Grace Haggerty	New Mexico Interstate Stream Commission
Michelle Tuineau	Program Support Team
Mick Porter	U.S. Army Corps of Engineers
Mike Marcus	Assessment Payers Association of the Middle Rio Grande Conservancy District
Mo Hobbs	Albuquerque Bernalillo County Water Utility Authority
Rich Valdez	SWCA Environmental Consultants
Thomas Archdeacon	U.S. Fish and Wildlife Service

Population Monitoring Work Group Meeting

December 1, 2020

Documents:

Agenda

Minutes

Read-Aheads, Presentations, and Follow-Up Documents

- *RGSM Expert Elicitation Form [read-ahead, spreadsheet]*
- *Process-Based Recruitment Prediction [read-ahead]*
- *Expert Elicitation Responses [presentation]*
- *Draft PMWG Report Findings and Recommendations [follow-up, draft, spreadsheet]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Work Group (PMWG)
December 1, 2020
9:00 AM – 12:00 PM

Zoom Information:
https://west-inc.zoom.us/j/8983593120?pwd=bU54V3NGeG93bXVlSlJFcEIzcE9wZz09
Code: 1251; Call-In: +1-669-900-6833; Meeting ID: 898-359-3120

Meeting Agenda

9:00 – 9:15	**Welcome, Intros, Agenda, Meeting Notes** ➢ **Decision:** Approval of Oct 22, 2020 meeting minutes ➢ **Decision:** Approval of Nov 18, 2020 meeting agenda Read aheads: ☐ October 22, 2020 PMWG meeting minutes	*PMWG Chair*
9:15 – 9:30	**Update—Report to EC on Fish Monitoring Program**	*Rich Valdez*
9:30 – 10:30	**Expert Elicitation—Integrated Model** • Review and Discussion of Forms Completed by PMWG • Role of Expert Elicitation in Model Development Read aheads: ☐ Expert Elicitation Forms (sent 11/5/2020)	*Charles Yackulic*
10:30 – 10:45	**Break**	
10:45 – 11:45	**Expert Elicitation—Integrated Model (continued)** • Review and Discussion of Forms Completed by PMWG • Role of Expert Elicitation in Model Development Read aheads: ☐ Expert Elicitation Forms (sent 11/5/2020)	*Charles Yackulic*
11:45 – 12:00	**Wrap-Up** • Announcements • Action Items • Next Meeting	*PMWG Chair*
12:00	**Adjourn**	

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Work Group (PMWG)
Meeting Minutes

December 1, 2020; 2:00 PM–5:00 PM
Location: Zoom Meeting

Decisions:

- ✓ Approval of December 1, 2020 PMWG meeting agenda
- ✓ Approval of October 22, 2020 PMWG meeting minutes

Action Items:

Who	What	By When
Catherine Murphy and Rich Valdez	Discuss the best option for summarizing the status report to the Executive Committee (EC)	12/2/2020
Rich V.	Send the summary of findings and list of recommendations from the draft status report to PMWG members for feedback	12/3/2020
PMWG members	Provide comments on the summary of findings and list of recommendations from the draft status report	12/8/2020
Rich V.	Send the draft status report to PMWG members for review	12/15/2020
Rich V.	Present progress on the draft status report to the EC	12/17/2020
PMWG members who submitted expert elicitation forms	Review previous expert elicitation responses and send final versions to Charles Yackulic	12/18/2020
Program Support Team (PST)	*Schedule a meeting in January to discuss results of the expert elicitation	Before January
Charles Y.	Synthesize the expert elicitation responses and incorporate them into the population model	January meeting

*The January meeting will be scheduled by the PST, with guidance from the Science and Adaptive Management Committee (SAMC). The small group of PMWG members working on the population model will request to continue their work as a Science & Technical Ad Hoc Group under the SAMC.

Meeting Summary

Welcome, Intros, Agenda, Meeting Notes
Rich V., SWCA Environmental Consultants and PMWG chair, opened the meeting and Michelle Tuineau, PST, introduced the meeting attendees. Rich V. reviewed the December 1, 2020 meeting agenda and October 22, 2020 meeting minutes.

- ✓ **Decision**: Approval of December 1, 2020 PMWG meeting agenda
- ✓ **Decision**: Approval of October 22, 2020 PMWG minutes

Update—Report to EC on Fish Monitoring Program:
Rich V. updated the group on the progress of the PMWG report to the EC:

- Rich V. put together an executive summary that provides an overview of the PMWG findings and list of recommendations.
    - Rich V. will send out the draft findings and list of recommendations to the PMWG before the EC meeting on December 17th. The findings and recommendations, once finalized, will be presented to the EC at a later meeting.
- Rich V. will send the draft PMWG report to the PMWG for feedback.
- The PMWG report will be 30–35 pages long.
    - Catherine Murphy and Rich V. will discuss summarizing the PWMG report further for the EC.

- ➢ **Action Item**: Rich Valdez will send the findings and list of recommendations from the draft PMWG report to PMWG members for feedback
- ➢ **Action Item**: PMWG members will provide comments on the findings and list of recommendations from the draft PMWG report
- ➢ **Action Item**: Rich Valdez will send the draft PMWG report to PMWG members for review
- ➢ **Action Item**: Rich Valdez will present progress on the draft PMWG report to the EC
- ➢ **Action Item**: Catherine Murphy and Rich Valdez will discuss the best option for presenting the PMWG report to the EC

Expert Elicitation—Integrated Model
Review and Discussion of Forms Completed by PMWG
Role of Expert Elicitation in Model Development
Charles Y., U.S. Geological Survey, discussed the responses to the expert elicitation form (see expert elicitation form for questions and slideshow for responses). He presented anonymized and summarized responses, which the PWMG reviewed and discussed in detail. Rather than coming to agreement, PMWG members were asked to explain their thinking processes. PMWG members who filled out expert elicitation forms were asked to review and adjust their responses (where appropriate) post-discussion, and send them to Charles Y. by December 18, 2020. Charles Y. will analyze the final responses and use them to inform the Rio Grande silvery minnow (RGSM) population model before the next RGSM Population Modeling Ad Hoc Group meeting (pending SAMC approval).

- ➢ **Action Item**: PMWG members who submitted expert elicitation forms will review their previous responses and send final versions to Charles Yackulic
- ➢ **Action Item**: Charles Yackulic will synthesize the expert elicitation responses and incorporate them into the RGSM population model

- **Action Item**: The PST will schedule a meeting in January to discuss results of the expert elicitation

Announcements

- The final PMWG report to the EC will likely take until next year to finalize.
- Rich V. will solicit feedback on what to present to the EC at the December 17th meeting next week.
- Catherine M. discussed the future of the PMWG and its role in the Collaborative Program:
    - The EC will sunset all standing science and technical work groups as of the December 17th meeting, with the purpose of transitioning the Collaborative Program to a new structure that includes the SAMC.
    - Under the new structure, the SAMC will form and provide oversight for Science & Technical (S&T) Ad Hoc Groups. The new structure is more efficient for addressing problems because smaller groups will work on smaller problems/questions in a shorter time frame.
    - Products developed under the new structure will be in the correct format to enter into the Adaptive Management (AM) Database, with the appropriate linkages between objectives, hypotheses, and scientific activities.
        - This ensures all the work being done is incorporated into Program tools, so the Program can inform decision making.
    - The RGSM Population Modeling Ad Hoc Group is an example of how one of these smaller ad hoc groups will work. The work of the population modeling group will continue in that format.
    - The PMWG report to the EC will summarize the work done, findings from the work, and how those findings should be applied in the future.
    - How do we continue meetings for the population model and PMWG report next year?
        - The groups can continue to meet, but will not receive PST support unless they are S&T Ad Hoc Groups created by the SAMC with formal charges.

Meeting Participants

Participant	Organization
Ashlee Rudolph	U.S. Bureau of Reclamation
Catherine Murphy	Program Support Team
Charles Yackulic	U.S. Geological Survey
Grace Haggerty	New Mexico Interstate Stream Commission
Joel Lusk	U.S. Bureau of Reclamation
Michelle Tuineau	Program Support Team
Mickey Porter	U.S. Army Corps of Engineers
Mo Hobbs	Albuquerque Bernalillo County Water Utility Authority
Rich Valdez	SWCA Environmental Consultants
Thomas Archdeacon	U.S. Fish and Wildlife Service

Thank you for agreeing to participate in this exercise!

The results of this exercise will be incorporated into the population model allowing us to evaluate questions related to both monitoring and management. Specifically, the information derived from your participation in this exercise will help: 1) constrain the population model where direct monitoring data does not provide enough information, 2) to develop a covariate to predict recruitment that integrates knowledge from various ongoing studies and is semi-mechanistic or process based (i.e., that attempts to link flow to recruitment based on our understanding of the various processes required to produce juveniles from adults), which will be used for the model, but also may provide clues on how flows should be designed to maximize Rio Grande silvery minnow production for a given seasonal flow amount, and 3) Inform our understanding of the degree to which monitoring data are reducing uncertainty in key parameters.

You will be asked to estimate, to the best of your ability, parameter values (e.g., survival rates) and relationships (e.g., the relative amount of larval habitat at different discharges). I understand that you may have more refined understanding of some parameters or relationships and less of an understanding of other parameters or relationships - that's okay! We are going through this exercise as a group and you don't have to get everything "right" the first time. The exercise may take over an hour to complete, but should not be overly onerous. This exercise is being carried out because there is does not appear to be sufficient data to determine the quantities. If there are data to support your responses, please use them. But if you are not aware of data, please use your best professional judgment based on your understanding of the system and the species.

The keys to this process are that you: 1) Complete all parts of this worksheet and return to me by the evening of Nov. 13 (a completed worksheet on time is more helpful than a "correct" worksheet that is never returned!), 2) Meet with the rest of the group on Nov. 18 to discuss our answers to questions, and 3) modify your initial worksheet based on the group discussion and return to me a second time.

What will make this exercise a success is if you: 1) Complete the exercise a first time before our group meeting. Treat this as an openbook exercise and keep track of keep figures/graphs/references that you use in formulating your answers - be prepared to share these with the group, 2) Share your reasoning (and figures) with others and listen to their reasoning, and 3) Update/change your answers based on our interactions as a group.

The various sheets in this workbook are numbered in the order they should be addressed. The next sheet (0_EX1) provides a worked example, afterwhich your input begins. At the end of the exercise, there is a progress tab that identifies whether you provided all the necessary information and whether there are any logical errors. Please try to address these errors before sending in to me.

A NOTE ON DISCHARGE

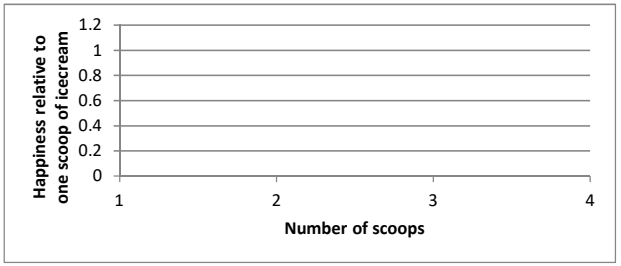
When determining relationships between discharge and various quantities, assume discharge is measured at the Angostura gage for the Angostura river segment, and San Acacia gage for the Isleta and San Acacia river segments.

Email me at cyackulic@usgs if you have any questions and also return workbooks to this email address.

PART A: In the following, worksheets you will encounter something that looks like this. Read through the comments 1 - 10 (click on the purple corners) and then scroll down to PART B.

Description: Can you have too much ice cream? Estimate how much more (or less happy) each additional ice cream scoop makes you. Assume the ice cream is free, your favorite flavor, and the size of a tennis ball, but you must eat all of it.

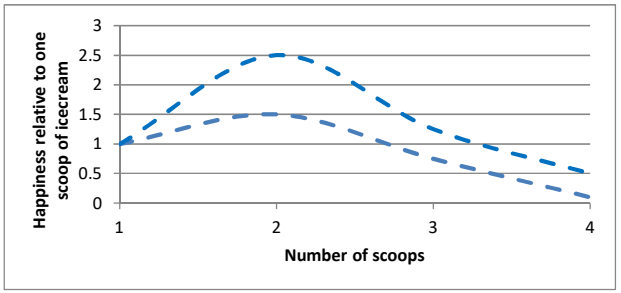
	Scoops of Ice cream	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
1	1	1	NA		1
2					
3					
4					



upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1
0	0	1
0	0	1

PART B: To begin with you will fill in values for column B, column C and column D. Note that the first two flags have turned green. Read through the comments on rows 17 - 19 to understand the logic behind the entries, then proceed to Part C.

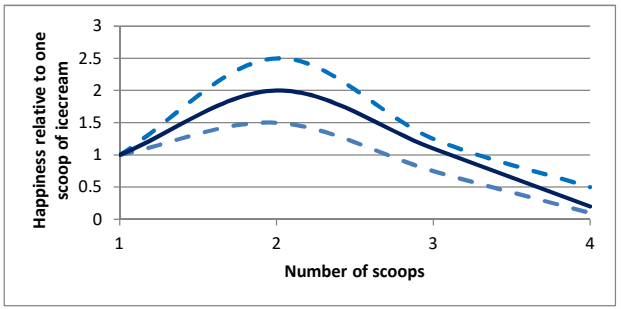
	Scoops of Ice cream	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
1	1	1	NA		1
2	1.5	2.5	90		
3	0.75	1.25	90		
4	0.1	0.5	90		



upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
1	1	0
1	1	0
1	1	0

PART C: We're done with this worksheet! A new line has been added and all flags are green!

	Scoops of Ice cream	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
1	1	1	NA		1
2	1.5	2.5	90		2
3	0.75	1.25	90		1.1
4	0.1	0.5	90		0.2



upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
1	1	1
1	1	1
1	1	1

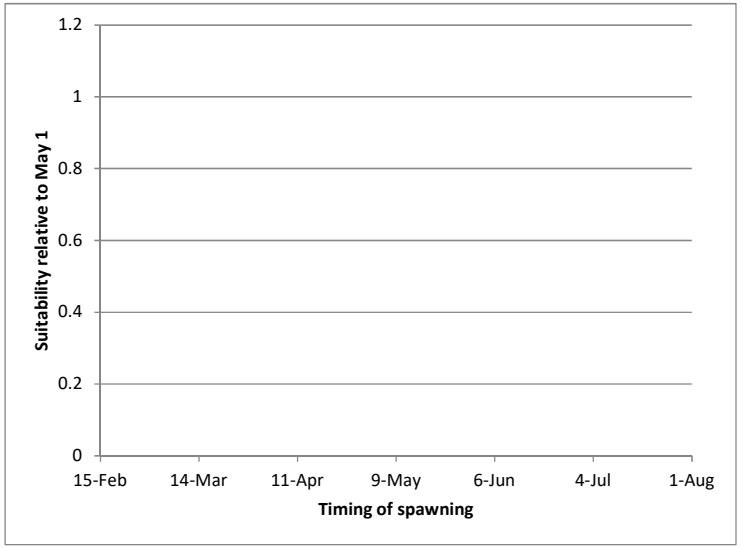
Description: It appears to be well agreed that RGSM are not strictly synchronous in their spawning, particularly in years when water (and thus larval habitat) are readily available. We are interested in quantifying the proportion of individuals that might be expected to lay eggs at different times throughout the spring and early summer when water (and any cue for spawning are not limiting). We choose as a reference, May 1st, and fix its values to 1 and then ask experts to quantify how much more, or less likely, an individual RGSM is to produce eggs on other days relative to May 1st. For example, a value of 1.5 indicates and individual would be 50% more likely to produce eggs relative to May 1st, whereas a value of 0.1 indicates an individual would only be 10% change as likely to produce eggs as on May 1st.

It is important for experts to keep in mind:

1)The function being estimated is based on when eggs are produced and may differ from back-calculated hatch dates if larval habitat availability (and thus survival) differs substantially.

2)We are focusing on the timing of egg-laying when cues are not limiting (i.e., in wet years).

Date	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
2-Mar					0	0	1
12-Mar					0	0	1
22-Mar					0	0	1
1-Apr					0	0	1
11-Apr					0	0	1
21-Apr					0	0	1
1-May	1	1	NA	1			
11-May					0	0	1
21-May					0	0	1
31-May					0	0	1
10-Jun					0	0	1
20-Jun					0	0	1
30-Jun					0	0	1



Description: Evidence from low-flow years suggests that many individuals delay egg-laying (even though they are sufficiently mature) until there is a cue to lay eggs. If this cue occurs early in the reproductive season, we expect that egg-laying will be largely unaffected, however, if this cue does not occur until later in the season, we expect there may be large numbers of egg laid shortly after the cue. Based on evidence from recent "jiggles" we assume that raising flow by 100 cfs for a single day is a sufficient cue, however there is less clarity over the minimum flow at which such a cue is required to induce egg-laying (e.g., clearly in years when flow is 150 cfs a cue is needed and in years when flows are greater than 2000 cfs no cue is needed, but where is the breakpoint in baseflows when a cue would be required).

Questions	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
What is the maximum base flow (in units of cfs) for which a cue of a 1-day increase of 100 cfs or more is required to induce spawning? (Same question reworded - what is the minumum flow for which a 1-day increase of 100 cfs or more is NOT necessary to cue reproduction?)					0	0	1

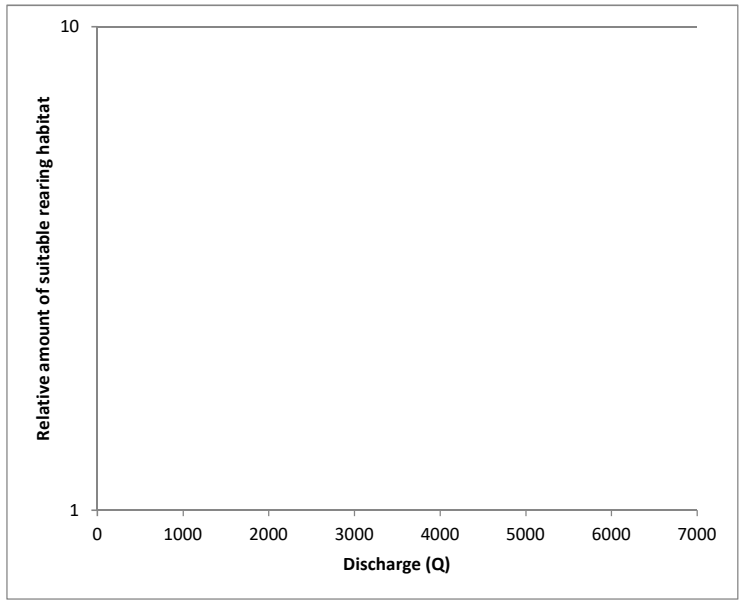
Relationship between discharge and larval habitat in the Angostura reach - present day

Description: It is well established that the flows required to overbank the channel vary in each of the three major river segments (and have changed over time) and that overbanking should generally lead to substantial increases in larval habitat, however there is some debate about how reach-wide (as opposed to in smaller segments of river) larval habitat availability varies with discharge.

The goal of this exercise is to estimate how much larval habitat is available at a given flow relative to the amount of habitat available at 500 cfs in that same reach. 500 cfs was chosen as a reference point as the channel is generally full at this discharge, but has not overbanked. Importantly, experts are asked only to focus on larval habitat availability without consideration of duration.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5				
50				
100				
150				
200				
250				
500	1	1	NA	1
1000				
1500				
2000				
2500				
3000				
4000				
5000				
6000				
7000				

(or more)



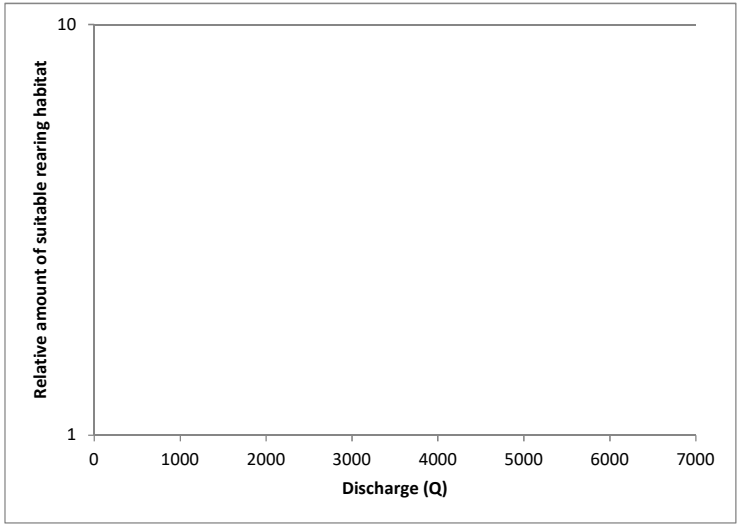
upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1

Relationship between discharge and larval habitat in the Angostura reach - Two decades ago (2000)

Description: It is well established that the flows required to overbank the channel vary in each of the three major river segments (and have changed over time) and that overbanking should generally lead to substantial increases in larval habitat, however there is some debate about how reach-wide (as opposed to in smaller segments of river) larval habitat availability varies with discharge.

The goal of this exercise is to estimate how much larval habitat was available 20 years ago at a given flow relative to the amount of habitat available at 500 cfs in that same reach. 500 cfs was chosen as a reference point as the channel is generally full at this discharge, but has not overbanked. For this analysis, we assume that larval habitat availability has not changed significantly at a discharge of 500 cfs, but may have changed at other discharges.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
5					0	0	1
50					0	0	1
100					0	0	1
150					0	0	1
200					0	0	1
250					0	0	1
500	1	1	NA	1			
1000					0	0	1
1500					0	0	1
2000					0	0	1
2500					0	0	1
3000					0	0	1
4000					0	0	1
5000					0	0	1
6000					0	0	1
7000 (or more)					0	0	1

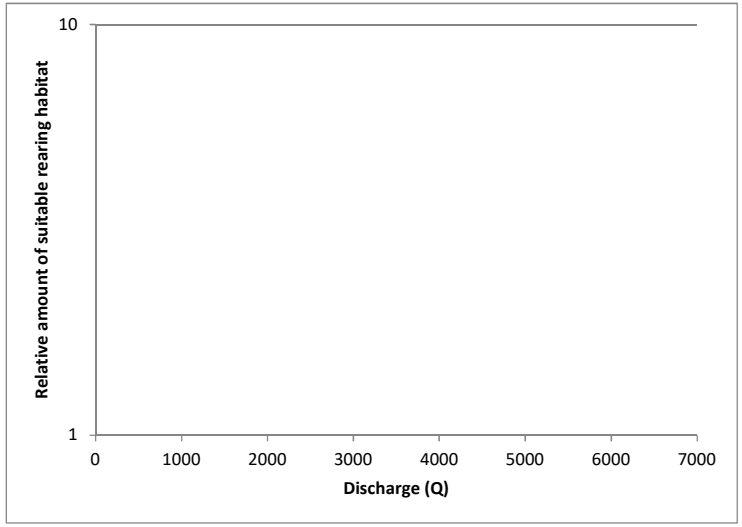


Relationship between discharge and larval habitat in the Isleta reach - present day

Description: It is well established that the flows required to overbank the channel vary in each of the three major river segments (and have changed over time) and that overbanking should generally lead to substantial increases in larval habitat, however there is some debate about how reach-wide (as opposed to in smaller segments of river) larval habitat availability varies with discharge.

The goal of this exercise is to estimate how much larval habitat is available at a given flow relative to the amount of habitat available at 500 cfs in that same reach. 500 cfs was chosen as a reference point as the channel is generally full at this discharge, but has not overbanked. Importantly, experts are asked only to focus on larval habitat availability without consideration of duration.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
5					0	0	1
50					0	0	1
100					0	0	1
150					0	0	1
200					0	0	1
250					0	0	1
500	1	1	NA	1			
1000					0	0	1
1500					0	0	1
2000					0	0	1
2500					0	0	1
3000					0	0	1
4000					0	0	1
5000					0	0	1
6000					0	0	1
7000 (or more)					0	0	1

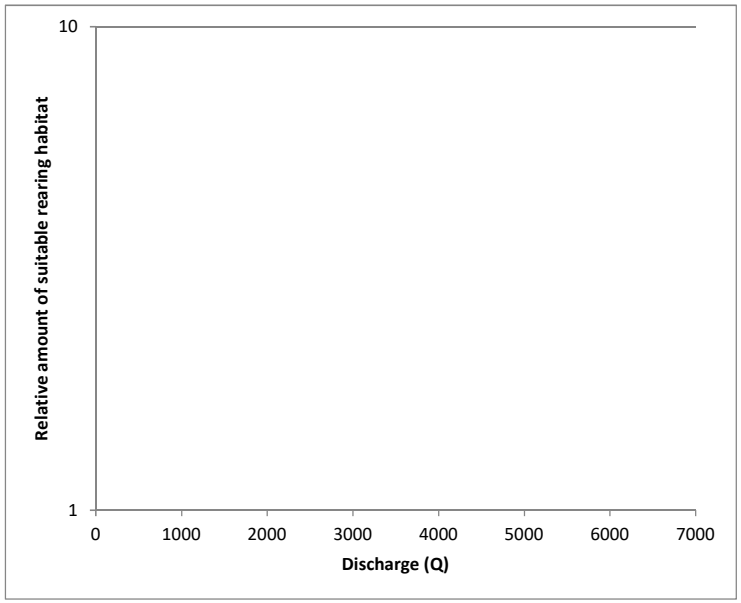


Relationship between discharge and larval habitat in the Isleta reach - Two decades ago (2000)

Description: It is well established that the flows required to overbank the channel vary in each of the three major river segments (and have changed over time) and that overbanking should generally lead to substantial increases in larval habitat, however there is some debate about how reach-wide (as opposed to in smaller segments of river) larval habitat availability varies with discharge.
The goal of this exercise is to estimate how much larval habitat was available 20 years ago at a given flow relative to the amount of habitat available at 500 cfs in that same reach. 500 cfs was chosen as a reference point as the channel is generally full at this discharge, but has not overbanked. For this analysis, we assume that larval habitat availability has not changed significantly at a discharge of 500 cfs, but may have changed at other discharges.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5				
50				
100				
150				
200				
250				
500	1	1	NA	1
1000				
1500				
2000				
2500				
3000				
4000				
5000				
6000				
7000				

(or more)



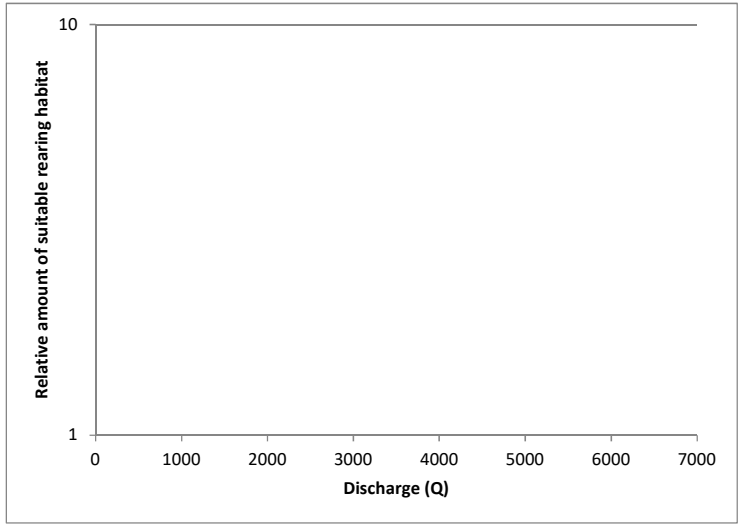
upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1

Relationship between discharge and larval habitat in the San Acacia reach - present day

Description: It is well established that the flows required to overbank the channel vary in each of the three major river segments (and have changed over time) and that overbanking should generally lead to substantial increases in larval habitat, however there is some debate about how reach-wide (as opposed to in smaller segments of river) larval habitat availability varies with discharge.

The goal of this exercise is to estimate how much larval habitat is available at a given flow relative to the amount of habitat available at 500 cfs in that same reach. 500 cfs was chosen as a reference point as the channel is generally full at this discharge, but has not overbanked. Importantly, experts are asked only to focus on larval habitat availability without consideration of duration.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
5					0	0	1
50					0	0	1
100					0	0	1
150					0	0	1
200					0	0	1
250					0	0	1
500	1	1	NA	1			
1000					0	0	1
1500					0	0	1
2000					0	0	1
2500					0	0	1
3000					0	0	1
4000					0	0	1
5000					0	0	1
6000					0	0	1
7000 (or more)					0	0	1

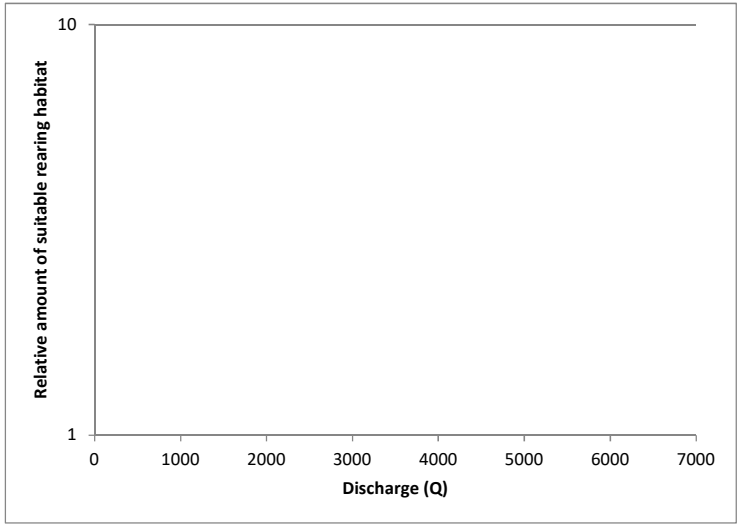


Relationship between discharge and larval habitat in the San Acacia reach - Two decades ago (2000)

Description: It is well established that the flows required to overbank the channel vary in each of the three major river segments (and have changed over time) and that overbanking should generally lead to substantial increases in larval habitat, however there is some debate about how reach-wide (as opposed to in smaller segments of river) larval habitat availability varies with discharge.

The goal of this exercise is to estimate how much larval habitat was available 20 years ago at a given flow relative to the amount of habitat available at 500 cfs in that same reach. 500 cfs was chosen as a reference point as the channel is generally full at this discharge, but has not overbanked. For this analysis, we assume that larval habitat availability has not changed significantly at a discharge of 500 cfs, but may have changed at other discharges.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
5					0	0	1
50					0	0	1
100					0	0	1
150					0	0	1
200					0	0	1
250					0	0	1
500	1	1	NA	1			
1000					0	0	1
1500					0	0	1
2000					0	0	1
2500					0	0	1
3000					0	0	1
4000					0	0	1
5000					0	0	1
6000					0	0	1
7000 (or more)					0	0	1



Description: We assume that larvae derived from eggs laid on a given day require larval habitat for a particular amount of time until they are capable of persisting in less specialized habitat. We ask experts to estimate this quantity keeping in mind that we are focused only on the duration required for individuals derived from eggs laid on a single day.

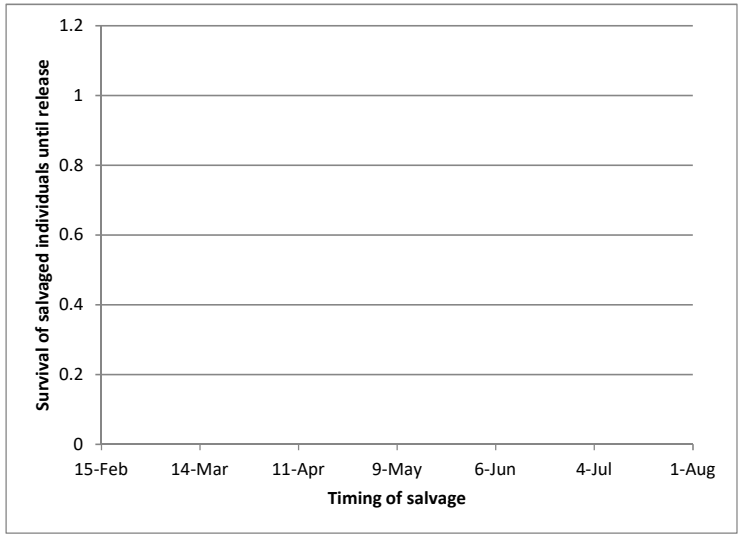
Questions	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
For how many days after egg-laying is larval habitat required before individuals can survive reasonably in less specialized habitat?					0	0	1

Description: Some proportion of Rio Grande Silvery Minnow move out as drying occurs, but this quantity is hard to estimate from existing data. Values for the upper CI, lower CI and best guess should be between 0 and 1.

Questions	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
What proportion of individuals are expected to successfully move out of a drying area in the absence of salvage, under typical drying rates (i.e., less than 6 km a day)? (answers should be between 0 and 1)					0	0	1

Description: It has been hypothesized that survival of salvaged individuals may depend on the timing of when they are salvaged. (Keep in mind that we are **not** concerned here about individuals that are not caught by the seines used during salvage, but rather the survival of individuals removed from drying pools and released in wetted areas.) Upper CI, lower CI and means should be between 0 and 1.

Date	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
15-Mar				
1-Apr				
15-Apr				
1-May				
15-May				
1-Jun				
15-Jun				
1-Jul				

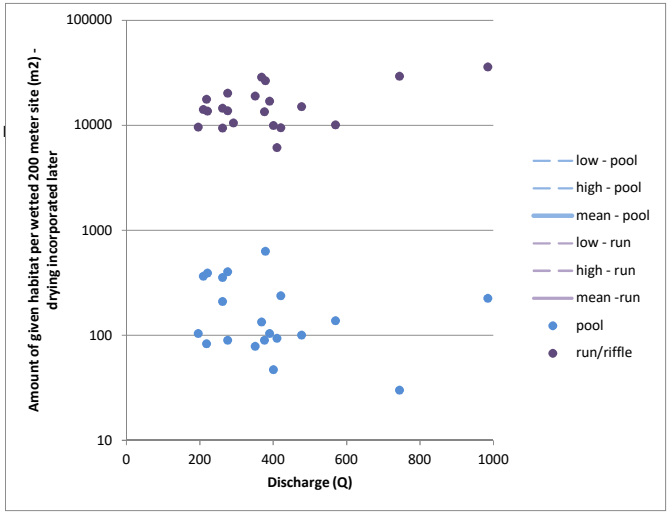


upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1

Angostura - Run/Riffle and pool habitat vs. discharge

Description: Interpreting catch and effort data in terms of reach abundances requires estimating the availability of run/riffle and pool habitat at different discharges. For this sheet, we include available data in the graph and as raw data. Experts should be aware that these data are from a few 200 m sites and may not represent an average 200 m site. Rather than asking experts to estimate the amount of habitat per 200 m site, we are asking them to estimate river width at various discharges and the proportion of pools at different discharges. These quantities can be combined to determine areas of the two major habitat types (if you are interested in these calculations, move the figure and look at the columns underneath). Also, note that the y-axis is on a log scale, that river width is in meters, and that proportion of pool habitat should be between 0 and 1.

	River width (m)				Proportion pool habitat (0 to 1)			
Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5								
50								
100								
150								
200								
250								
500								
1000								



River width flags			% pool flags		
upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1

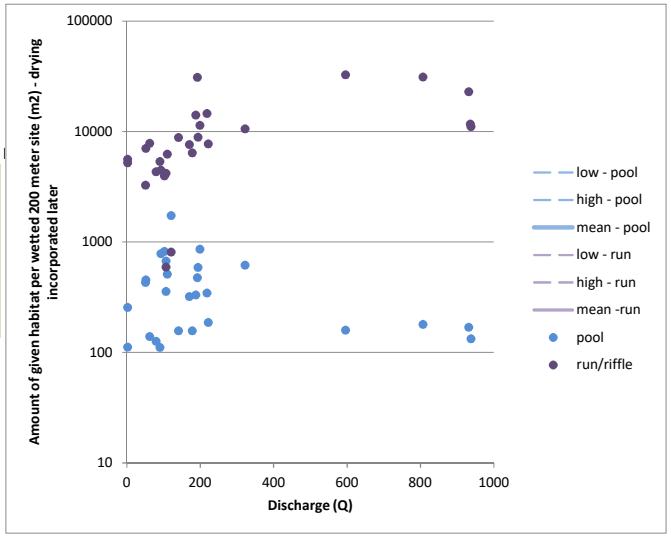
Available data

Q	pool	run/riffle
196	104.2	9593
210	366.3	14171
218	83.43	17781
221	391.1	13648
262	356	14602
262	210.6	9425
276	404.4	13811
276	89.71	20230
292	0	10533
351	78.56	19073
368	133.6	28748
376	89.79	13438
379	631.2	26582
390	104.3	16960
401	47.07	9983
410	93.97	6153
421	238.9	9478
477	100.4	15037
570	138	10112
744	30.15	29338
985	224.9	36081
1020	316.3	38039

Isleta - Run/Riffle and pool habitat vs. discharge

Description: Interpreting catch and effort data in terms of reach abundances requires estimating the availability of run/riffle and pool habitat at different discharges. For this sheet, we include available data in the graph and as raw data. Experts should be aware that these data are from a few 200 m sites and may not represent an average 200 m site. Rather than asking experts to estimate the amount of habitat per 200 m site, we are asking them to estimate river width at various discharges and the proportion of pools at different discharges. These quantities can be combined to determine areas of the two major habitat types (if you are interested in these calculations, move the figure and look at the columns underneath). Also, note that the y-axis is on a log scale, that river width is in meters, and that proportion of pool habitat should be between 0 and 1.

	River width (m)				Proportion pool habitat (0 to 1)			
Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5								
50								
100								
150								
200								
250								
500								
1000								



River width flags			% pool flags		
upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1

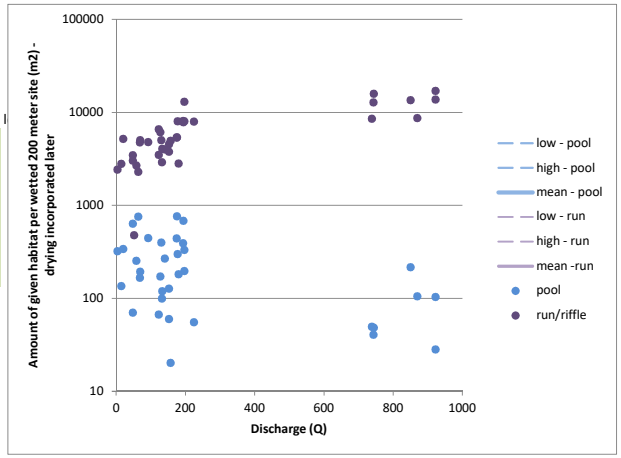
Available data

Q	pool	run/riffle
2	256	5201.2
2	112	5617.3
51	430	3278
52	454	7025.6
62	139	7820.8
80	126	4343.2
90	111	5369.4
93	784	4489.2
102	821	3973.2
107	671	592.18
107	358	4192.5
110	513	6246.5
121	1740	809.57
141	157	8814.6
170	322	7635.6
178	157	6432.2
188	331	14062
192	474	30996
194	588	8899.2
199	864	11363
218	346	14611
222	187	7756.8
322	618	10611
596	159	32590
807	180	31295
932	169	22946
936	0	11683
938	133	11086

San Acacia - Run/Riffle and pool habitat vs. discharge

Description: Interpreting catch and effort data in terms of reach abundances requires estimating the availability of run/riffle and pool habitat at different discharges. For this sheet, we include available data in the graph and as raw data. Experts should be aware that these data are from a few 200 m sites and may not represent an average 200 m site. Rather than asking experts to estimate the amount of habitat per 200 m site, we are asking them to estimate river width at various discharges and the proportion of pools at different discharges. These quantities can be combined to determine areas of the two major habitat types (if you are interested in these calculations, move the figure and look at the columns underneath). Also, note that the y-axis is on a log scale, that river width is in meters, and that proportion of pool habitat should be between 0 and 1.

	River width (m)				Proportion pool habitat (0 to 1)			
Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5								
50								
100								
150								
200								
250								
500								
1000								



River width flags			% pool flags		
upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI	upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1
0	0	1	0	0	1

Available data

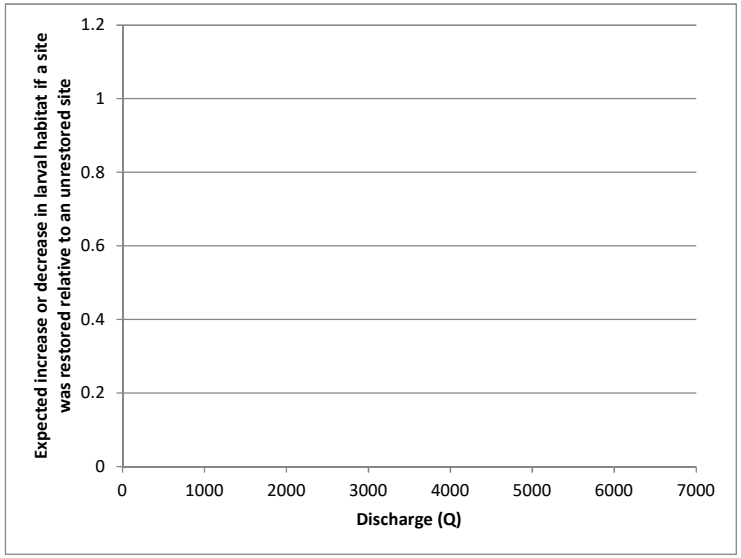
Q	pool	run/riffle
3	322.2	2431
15	135.7	2815
20	341.3	5204
47	639.2	3470
48	70.23	3047
51	0	480.8
58	255.4	2696
64	758.8	2306
69	167.6	4778
70	194.2	5058
92	447.6	4822
123	67.43	3494
123	0	6590
127	173.2	6167
130	400.4	5040
132	100	2928
133	120	4078
140	268.4	4028
152	60.18	4561
152	128.2	3783
157	20.33	4969
174	445	5365
175	768.8	5432
177	300.4	8059
180	182.1	2829
193	395.1	8096
194	685.2	7899
197	333.6	13043
197	197.5	8087
224	55.51	7978
738	49.89	8574
743	40.97	12900
744	48.62	15987
850	216.7	13646
869	105.9	8704
922	103.8	17153
922	28.37	13758

Angostura - restoration

Description: In an average 200 m site within this river reach, how much does restoration increase or decrease larval habitat availability at each discharge relative to an unrestored site. (So if you think restoration does not affect larval habitat availability at a particular discharge you would choose a value of 1, whereas a value of 0.9 would mean you had decreased larval habitat availability by 10% and a value of 1.1 would mean you had increased larval habitat availability at that discharge by 10%). Focus on a site for these calculations as we can easily scale to the reach later - in other words, there may be a large effect within sites, but if only a few sites are restored the overall effect may still be modest.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5				
50				
100				
150				
200				
250				
500				
1000				
1500				
2000				
2500				
3000				
4000				
5000				
6000				
7000				

(or more)

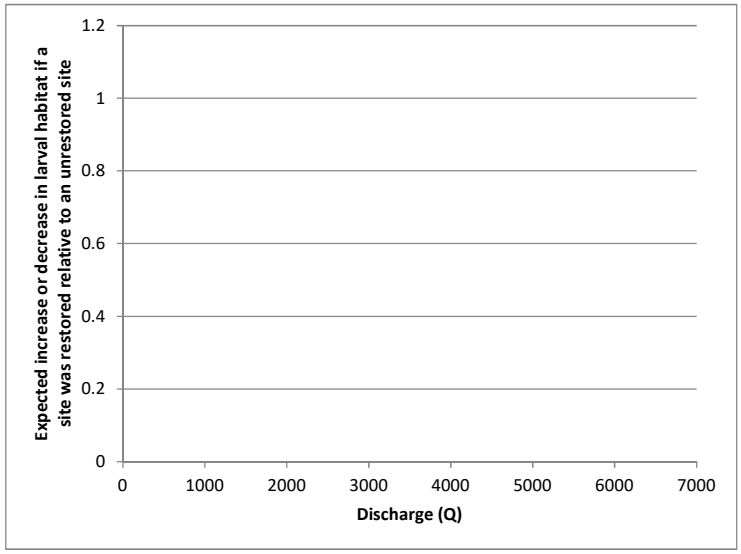


upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1

Isleta -restoration

Description: In an average 200 m site within this river reach, how much does restoration increase or decrease larval habitat availability at each discharge relative to an unrestored site. (So if you think restoration does not affect larval habitat availability at a particular discharge you would choose a value of 1, whereas a value of 0.9 would mean you had decreased larval habitat availability by 10% and a value of 1.1 would mean you had increased larval habitat availability at that discharge by 10%). Focus on a site for these calculations as we can easily scale to the reach later - in other words, there may be a large effect within sites, but if only a few sites are restored the overall effect may still be modest.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5				
50				
100				
150				
200				
250				
500				
1000				
1500				
2000				
2500				
3000				
4000				
5000				
6000				
7000 (or more)				

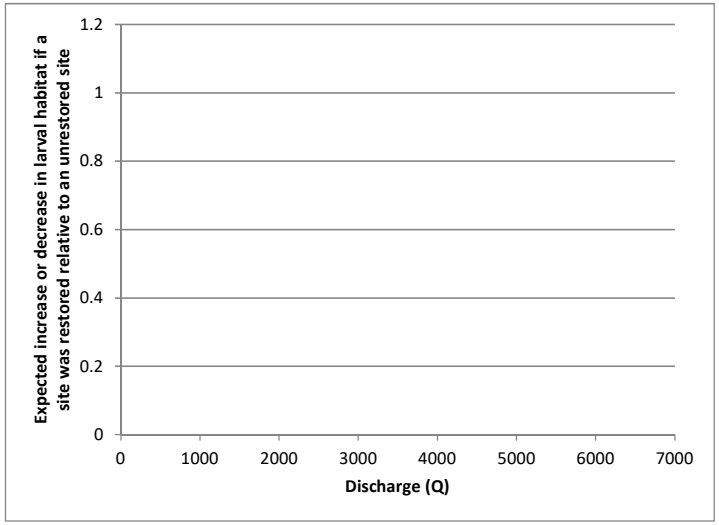


upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1

San Acacia - restoration

Description: In an average 200 m site within this river reach, how much does restoration increase or decrease larval habitat availability at each discharge relative to an unrestored site. (So if you think restoration does not affect larval habitat availability at a particular discharge you would choose a value of 1, whereas a value of 0.9 would mean you had decreased larval habitat availability by 10% and a value of 1.1 would mean you had increased larval habitat availability at that discharge by 10%). Focus on a site for these calculations as we can easily scale to the reach later - in other words, there may be a large effect within sites, but if only a few sites are restored the overall effect may still be modest.

Discharge - Q (cfs)	lower CI	upper CI	probability truth is within your lower and upper CI (not graphed)	best guess (mean)
5				
50				
100				
150				
200				
250				
500				
1000				
1500				
2000				
2500				
3000				
4000				
5000				
6000				
7000 (or more)				



upper CI > lower CI	95 >= CI >= 50	upper CI >= mean >=lower CI
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1

Sheet	% filled out	Flags
1	0%	24
2	0%	2
3a	0%	30
3b	0%	30
3c	0%	30
3d	0%	30
3e	0%	30
3f	0%	30
4	0%	2
5a	0%	2
5b	0%	16
6a	0%	32
6b	0%	32
6c	0%	32
7a	0%	32
7b	0%	32
7c	0%	32

PROCESS-BASED RECRUITMENT PREDICTION

While not the sole purpose of this exercise, many worksheets are focused on quantities related to understanding and predicting recruitment. The goal of this exercise is to build a covariate that incorporates insights arising from a variety of ongoing research projects focused on various aspects of early life history in Rio Grande silvery minnow. As these projects are ongoing, we expect that our understanding of these quantities may change over time and that this covariate could be updated accordingly. Specifically, we are interested in four aspects of early life history:

1) timing of egg laying,
2) necessary cues for egg laying,
3) availability of larval habitat, and
4) the duration of time after egg-laying when larval habitat is required.

Expert elicitation will yield the following functions:

1) Timing will be characterized by a function, τ_d, which describes the proportion of eggs laid on a particular day (under the assumption that conditions are good enough that a cue was not required). Note that the sum of τ_d over all days in the spring/summer will sum to 1.
2) The cue analysis will yield a single parameter, κ, indicating the discharge under which a cue of a 100 cfs increase in flow is required to cue egg laying.
3) The larval habitat analysis will yield functions, γ, describing how discharge is related to relative larval habitat availability for a given river segment and time period (for now we ignore subscripts).
4) The duration, δ, after egg-laying for which larval habitat is required for a given cohort to have reasonable survival.

Given the functions/parameters described above, a year's hydrograph will be analyzed by:

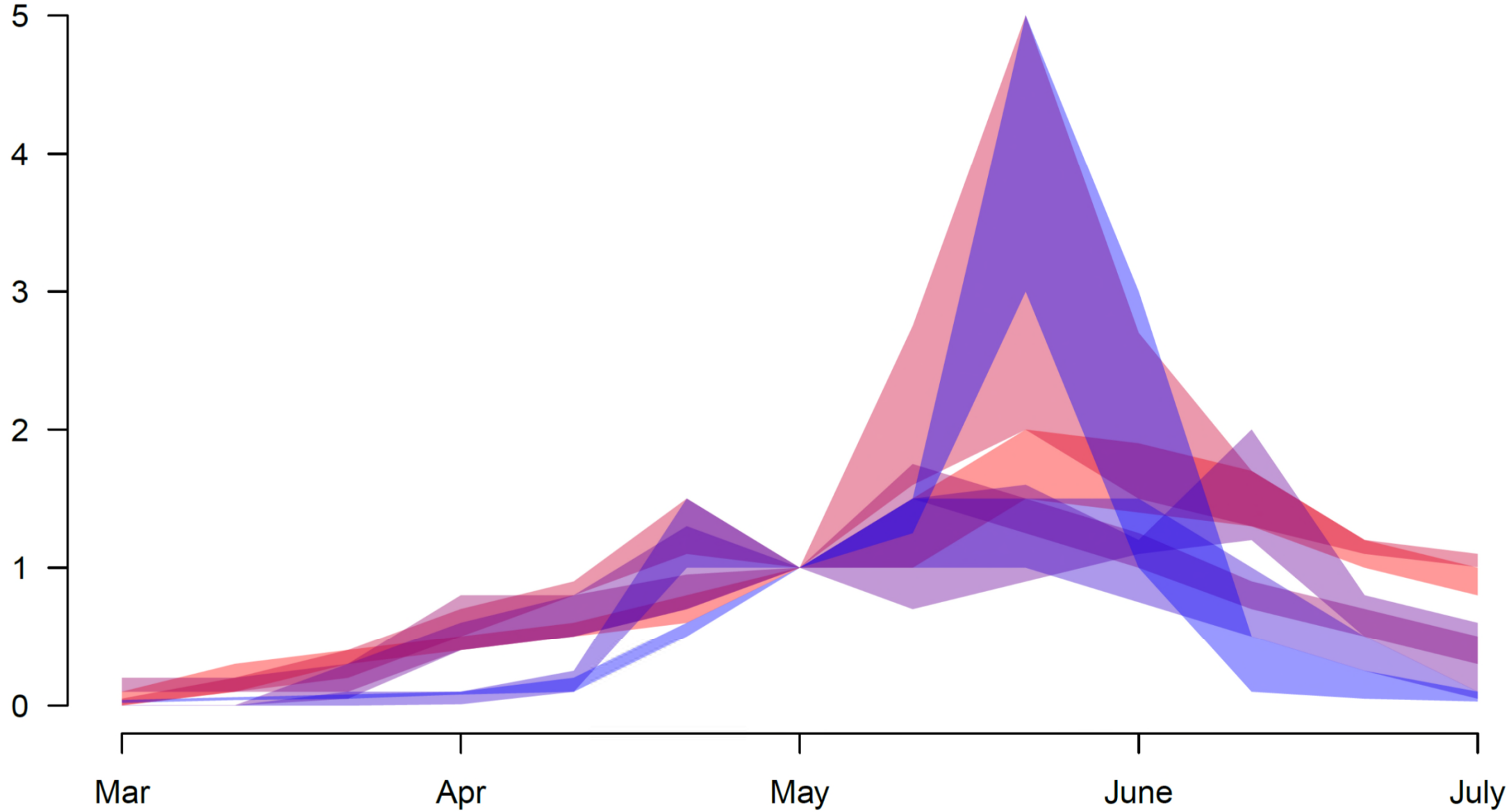
1) Calculating the first day of the reproductive season in that year, *y*, and segment, S, when either discharge was greater than κ, or the change in discharge from the day before was 100 cfs or greater, we refer to this day as $d^*_{S,y}$.
2) Calculating the following quantity meant to represent the cumulative amount of larval habitat, ***L***, for a given river segment, S, and year, y:

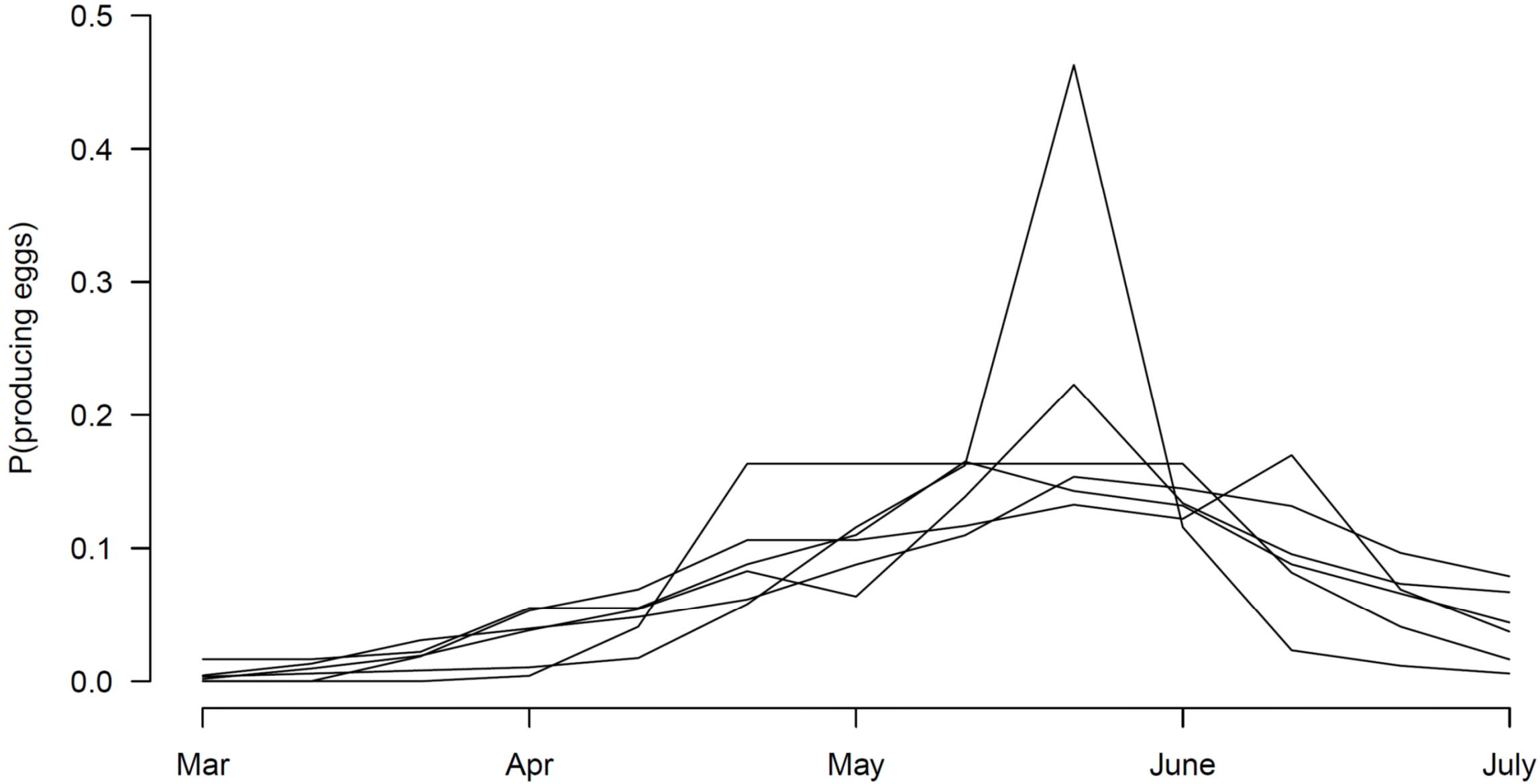
$$L_{S,y} = \min\left\{\gamma\left(Q_{d^*_{S,y}}\right), \gamma\left(Q_{d^*_{S,y}+1}\right), \dots, \gamma\left(Q_{d^*_{S,y}+\delta}\right)\right\} \sum_{d=1}^{d^*_{S,y}} \tau_d + \sum_{d=d^*_{S,y}}^{D} \tau_d \min\{\gamma(Q_d), \gamma(Q_{d+1}), \dots, \gamma(Q_{d+\delta})\}$$

Which suggests an underlying model based on a couple key hypotheses:

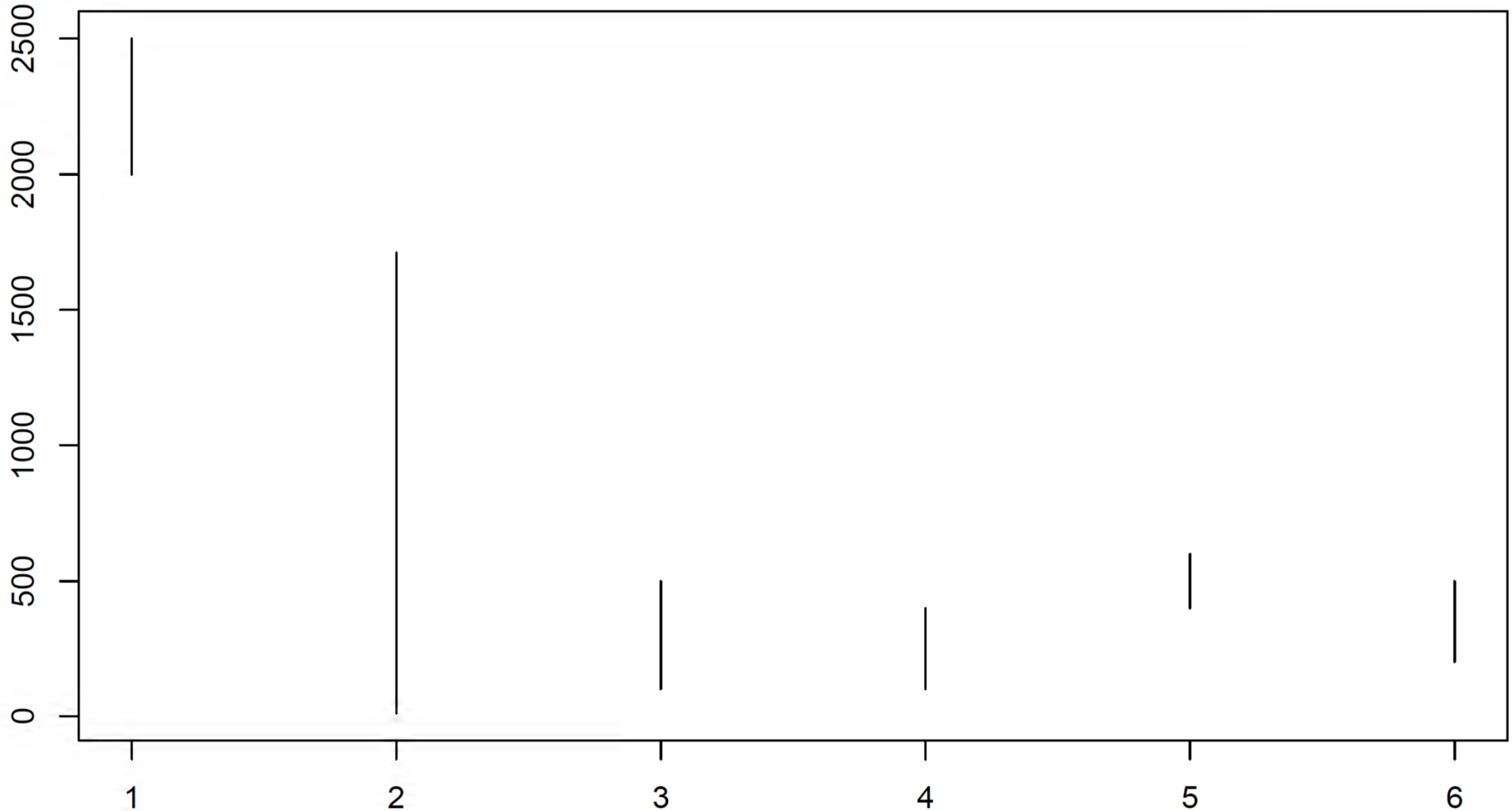
a) Individual females develop eggs with a schedule described by τ_d. In good years, eggs are laid as soon as females develop eggs.
b) In years when flows are below κ, females wait until a change in flow of 100 cfs or more and will produce eggs once that occurs.
c) Once eggs are laid, there relative success in producing juveniles is determined by the minimum amount of larval habitat over the duration of time when they require this habitat, δ.

Question 1

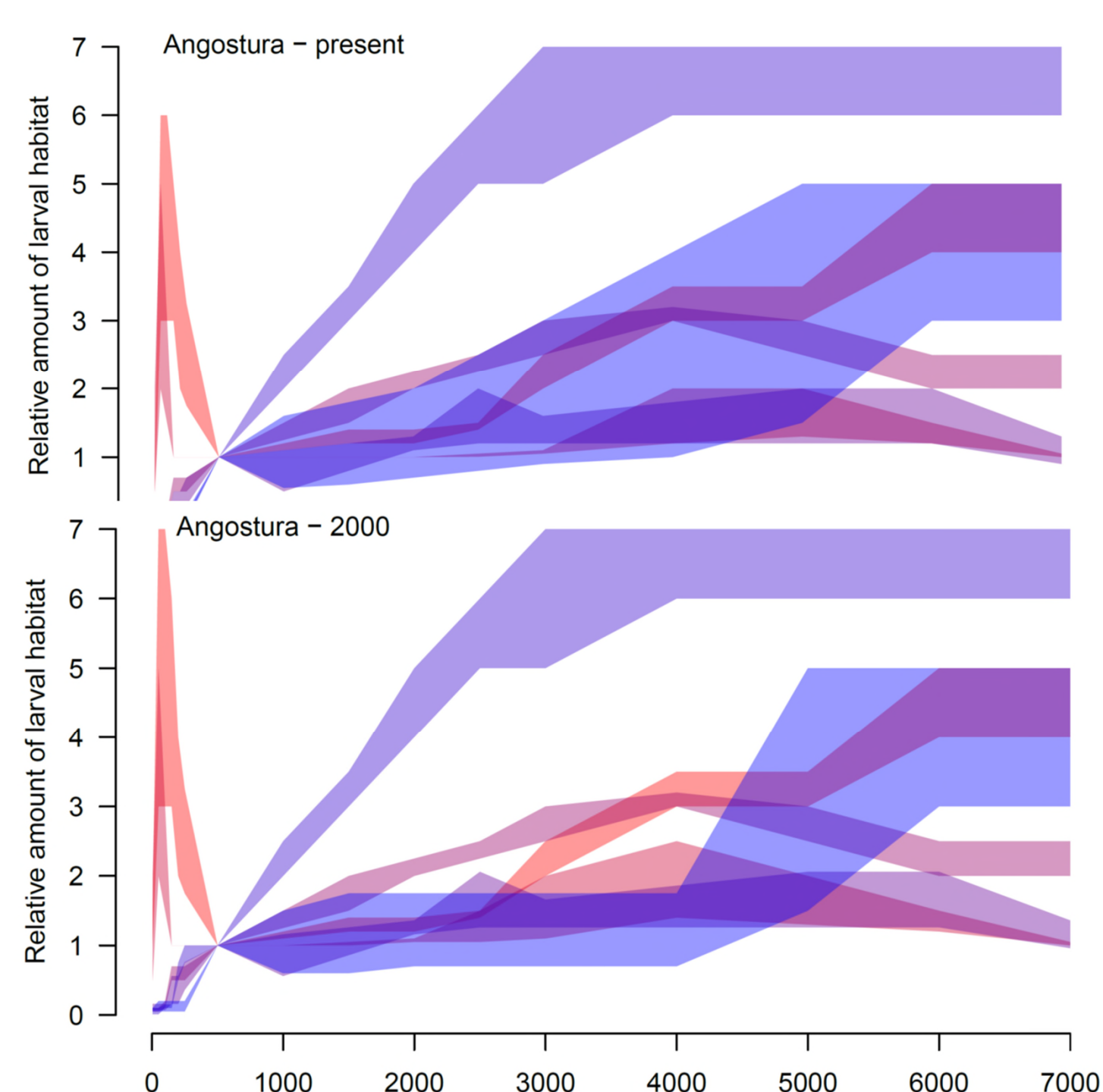

5
4
3
2
1
0
Mar
Apr
May
June
July

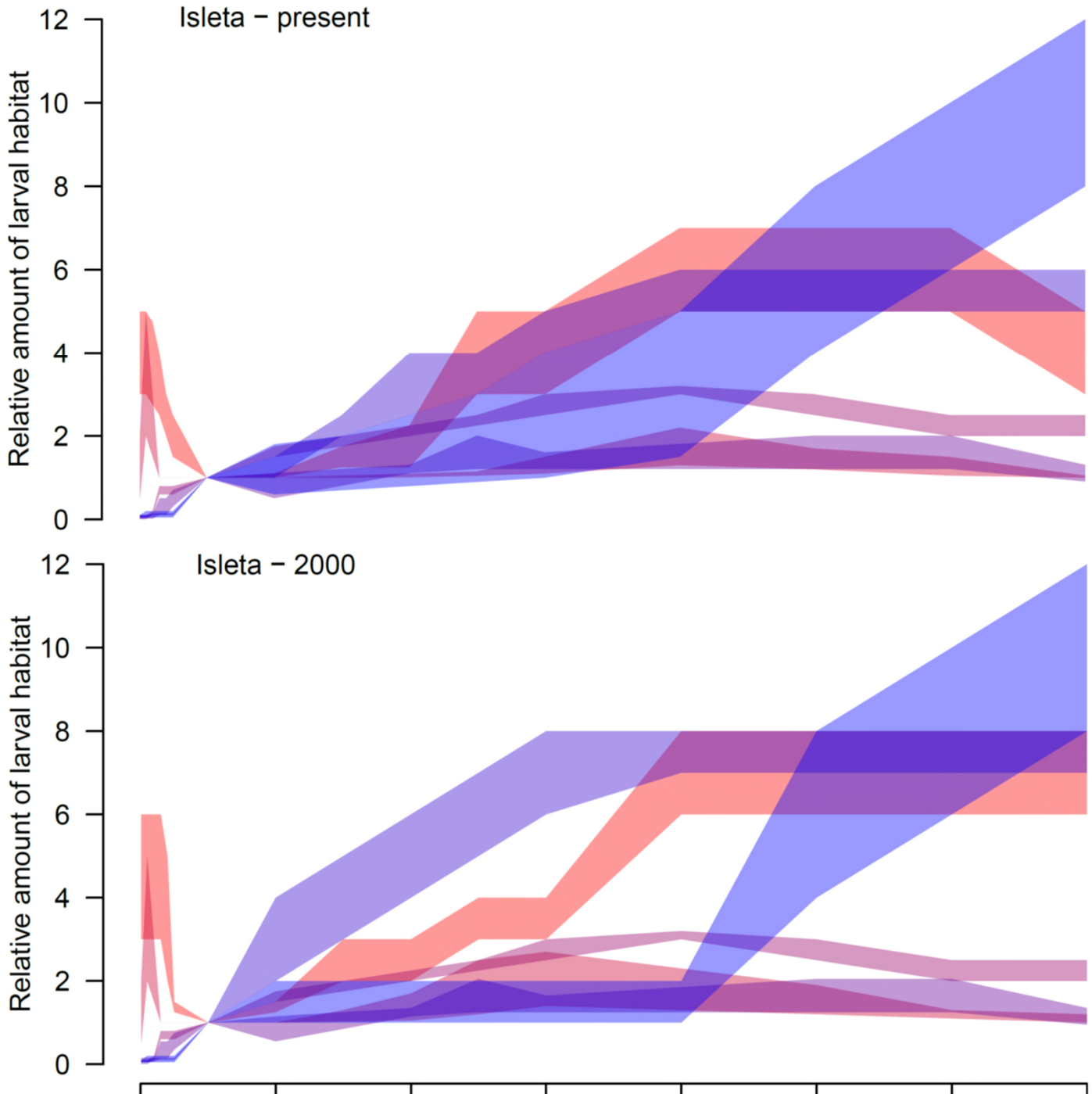

0.5
0.4
0.3
0.2
0.1
0.0
P(producing eggs)
Mar
Apr
May
June
July

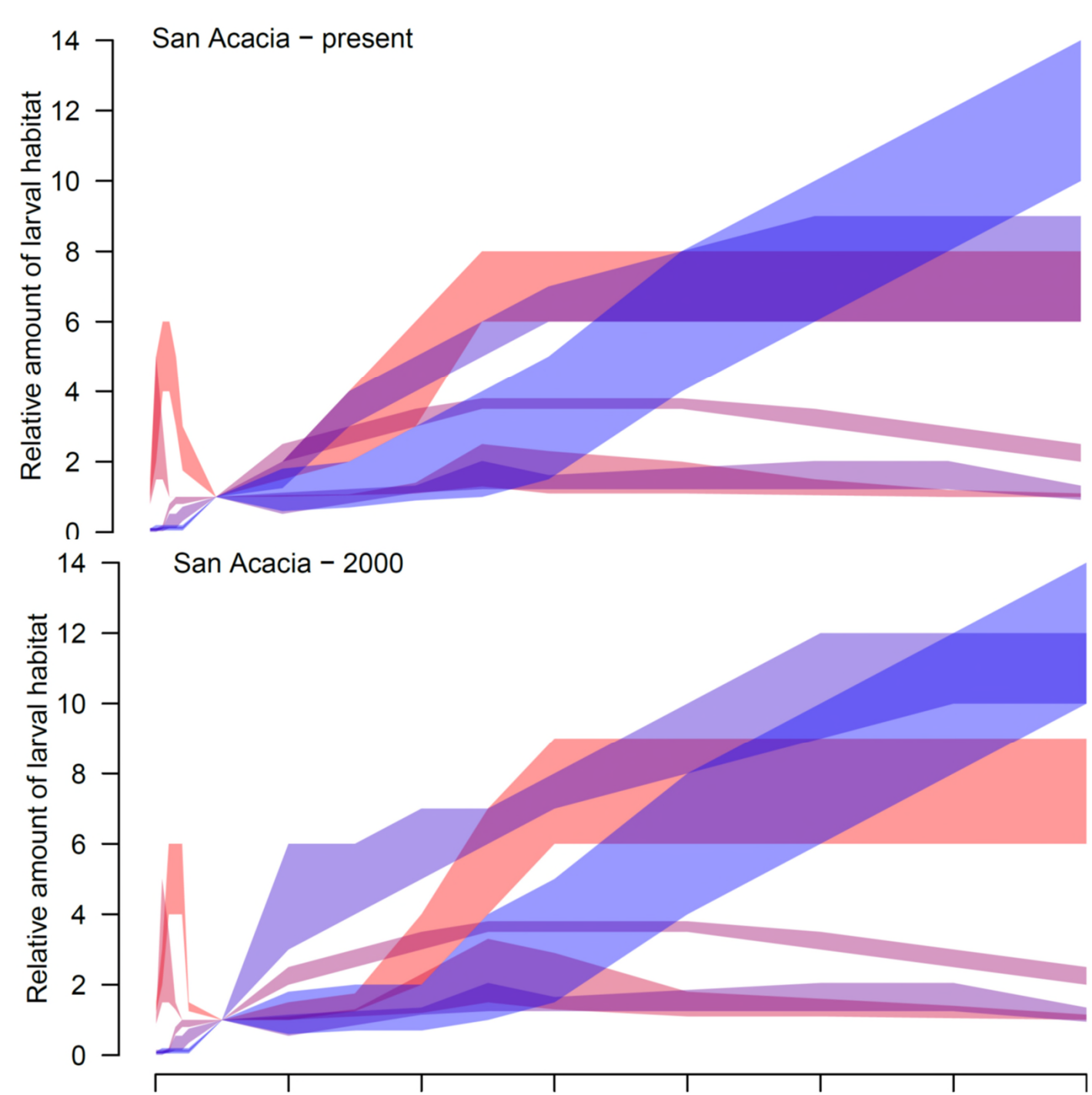
Question 2


0
500
1000
1500
2000
2500
1
2
3
4
5
6

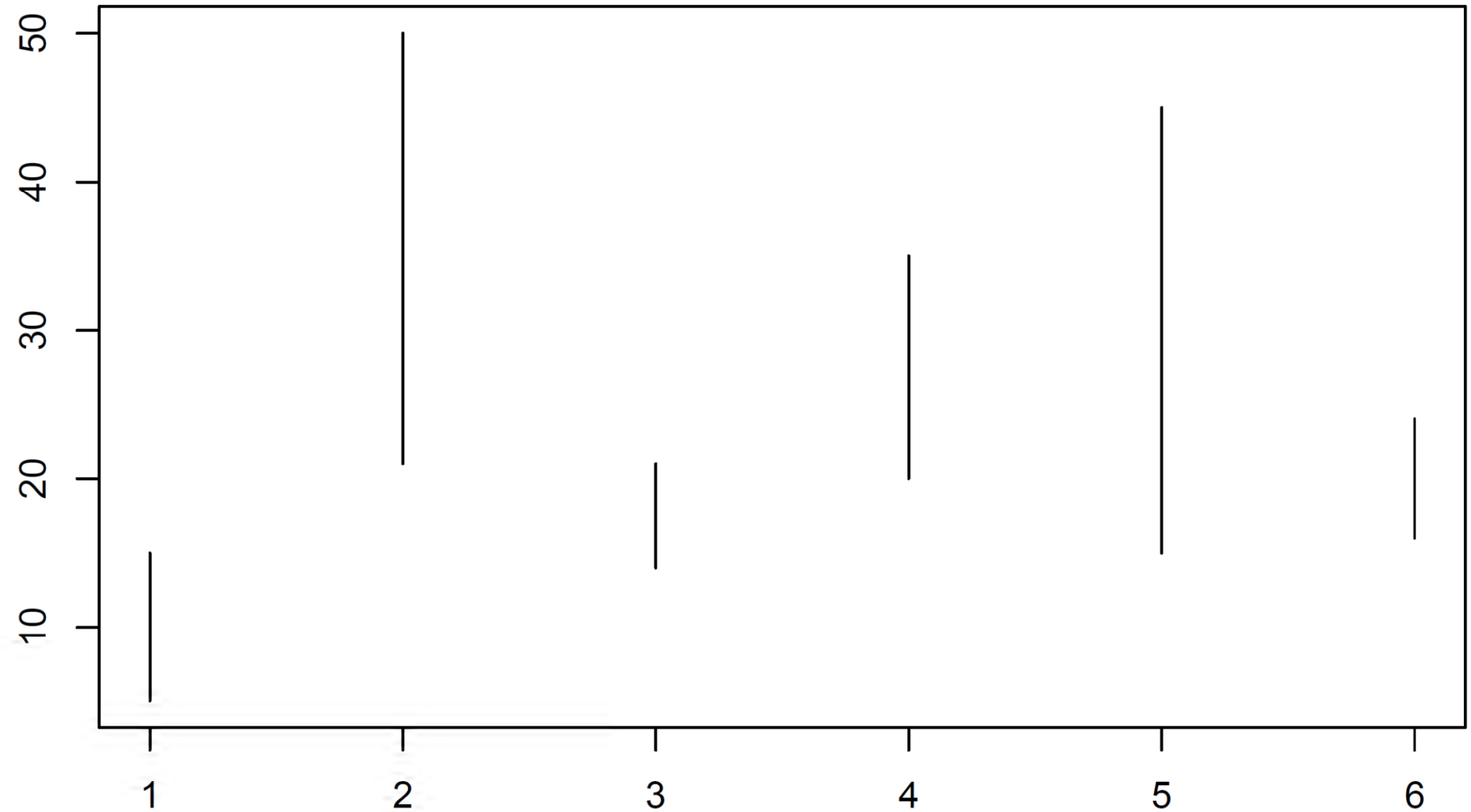
Question 3


Angostura − present
Relative amount of larval habitat
7
6
5
4
3
2
1
Angostura − 2000
Relative amount of larval habitat
7
6
5
4
3
2
1
0
0
1000
2000
3000
4000
5000
6000
7000

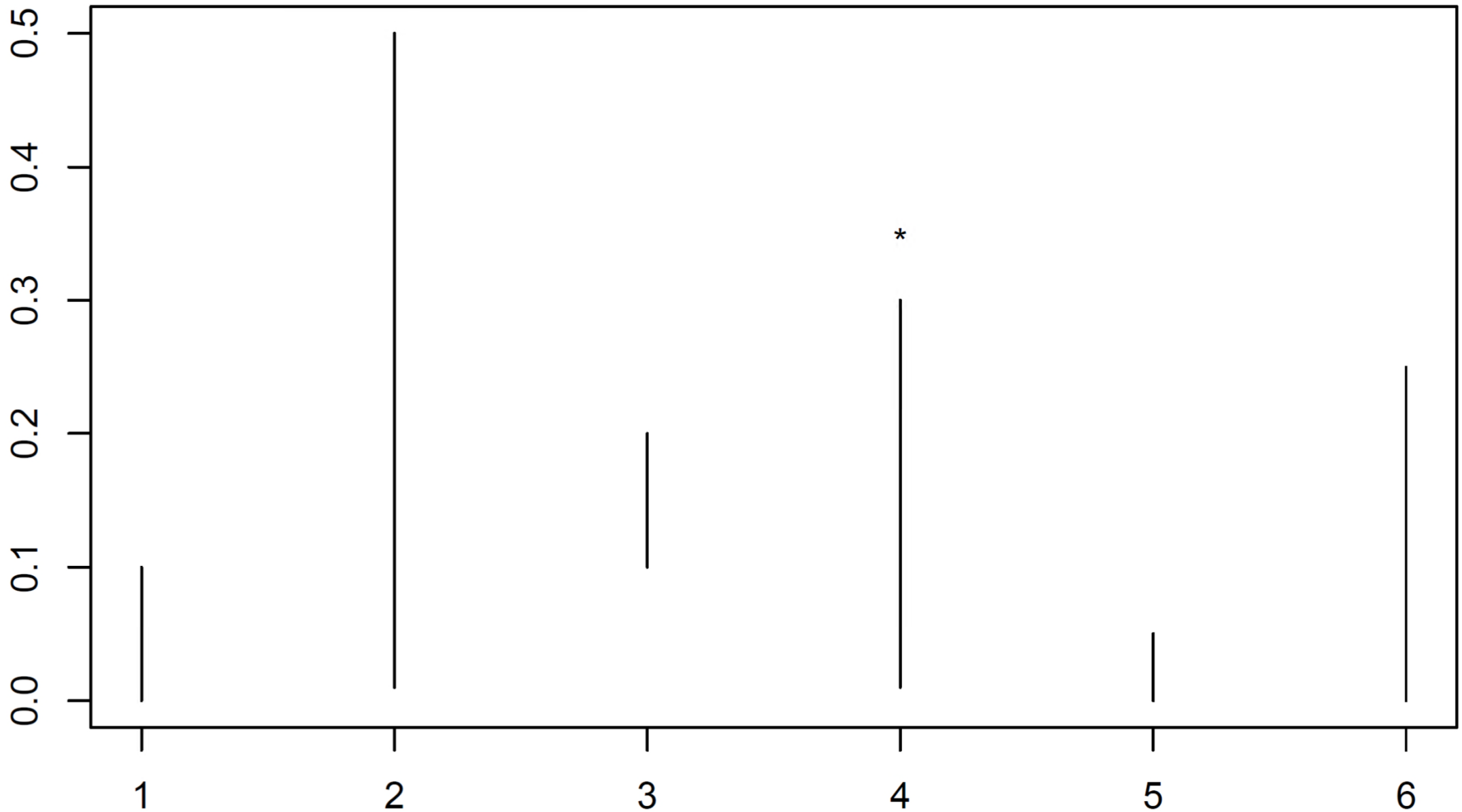

Isleta − present
Relative amount of larval habitat
0
2
4
6
8
10
12
Isleta − 2000
Relative amount of larval habitat
0
2
4
6
8
10
12

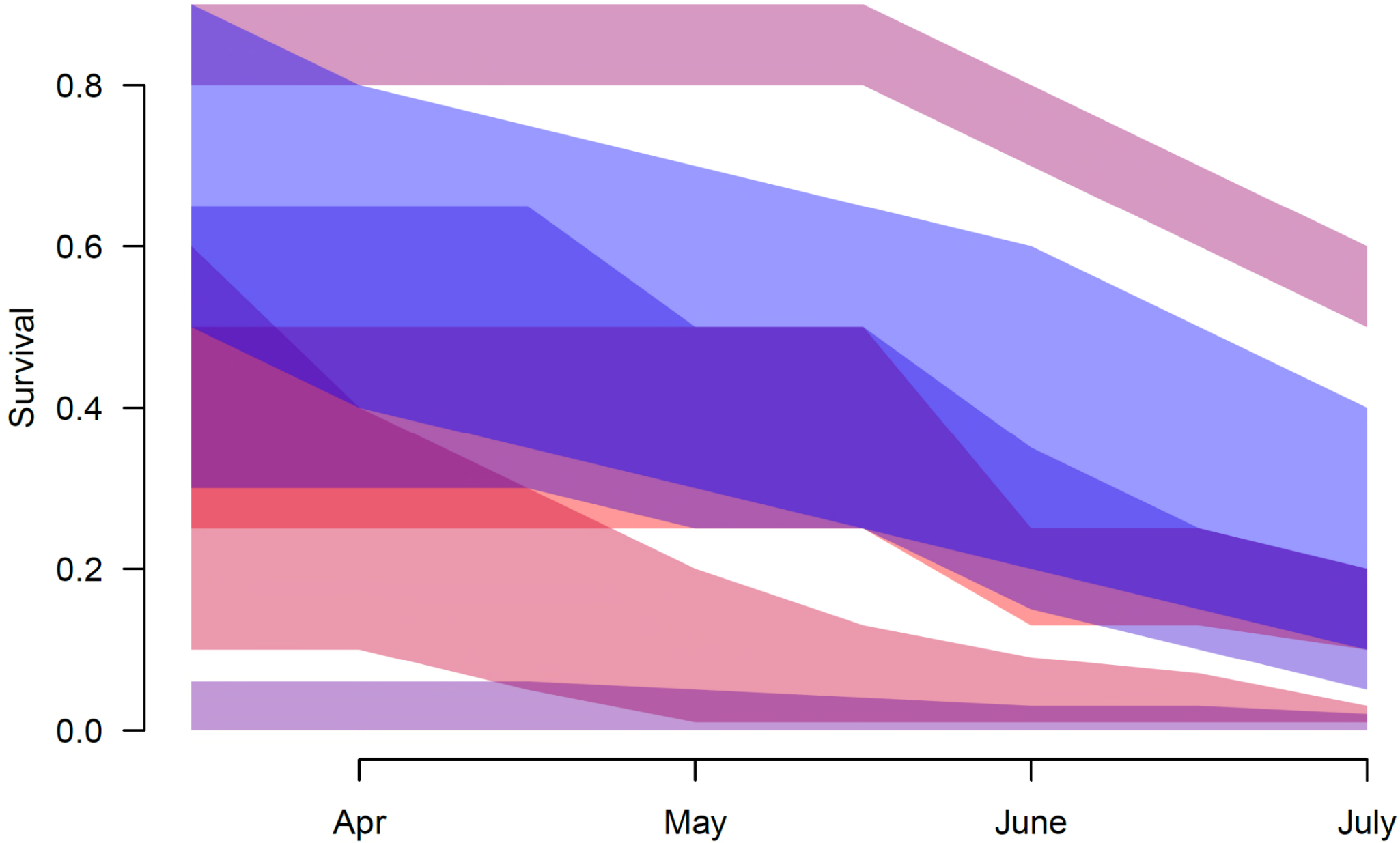

San Acacia − present
Relative amount of larval habitat
0
2
4
6
8
10
12
14
San Acacia − 2000
Relative amount of larval habitat
0
2
4
6
8
10
12
14

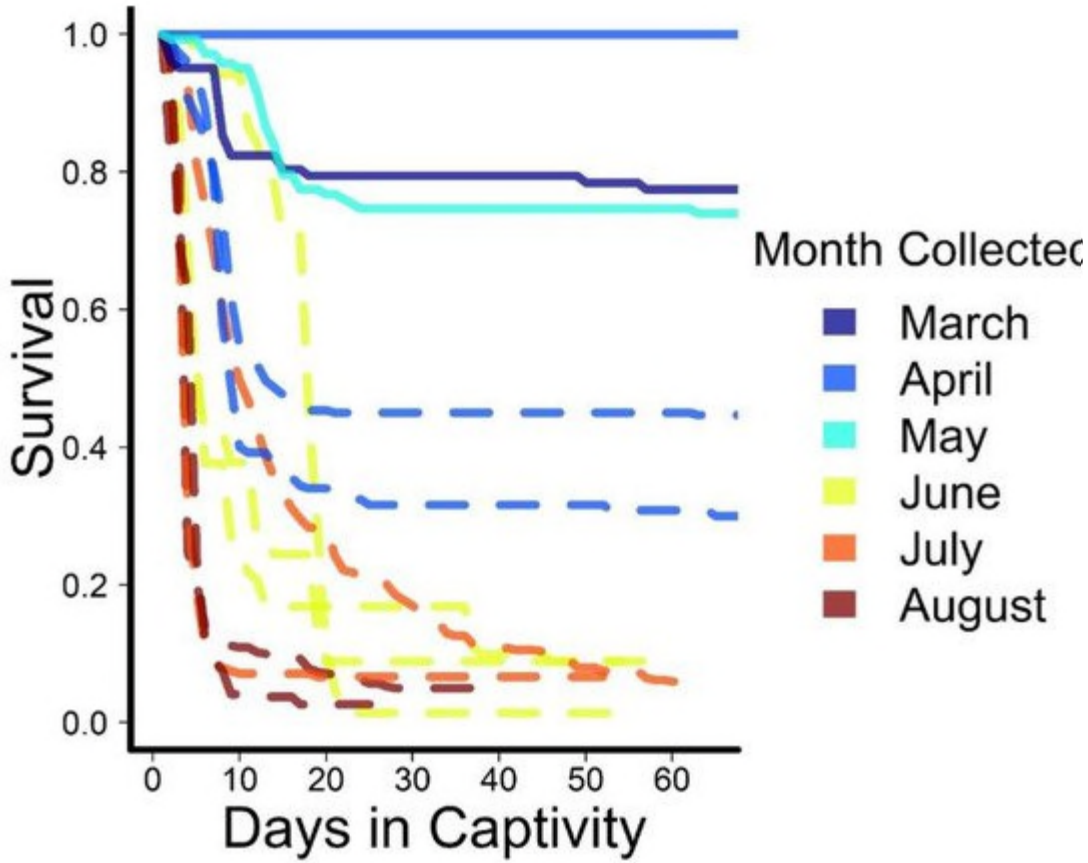
Question 4

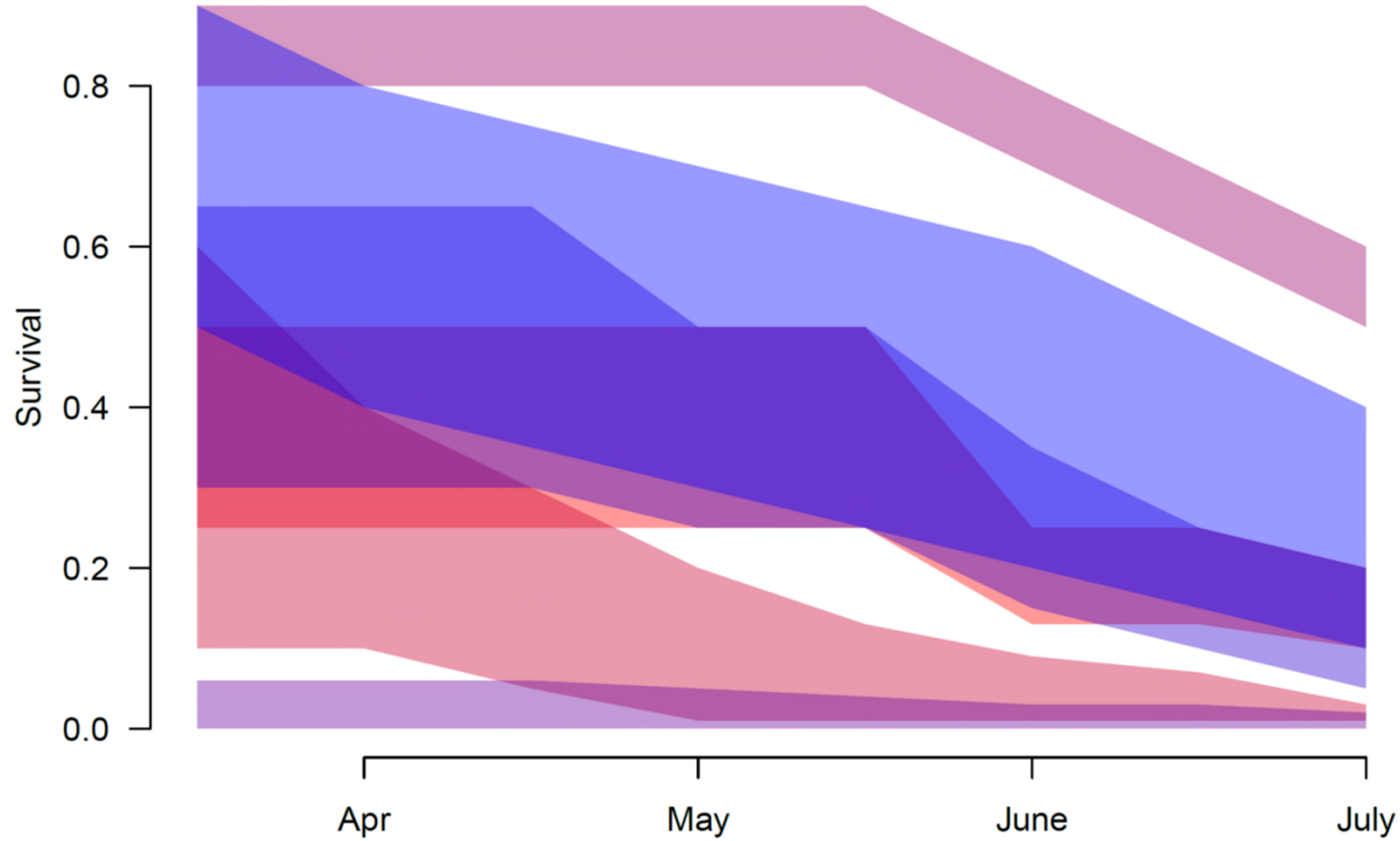

50
40
30
20
10
1
2
3
4
5
6

Question 5

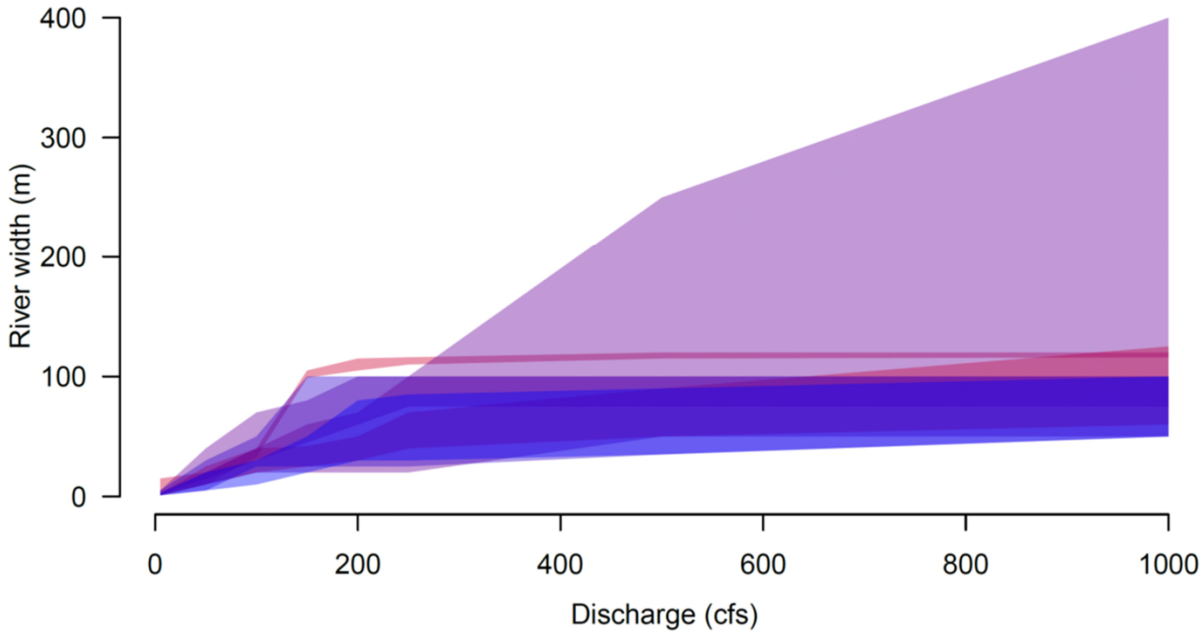

0.0
0.1
0.2
0.3
0.4
0.5
1
2
3
4
5
6
*

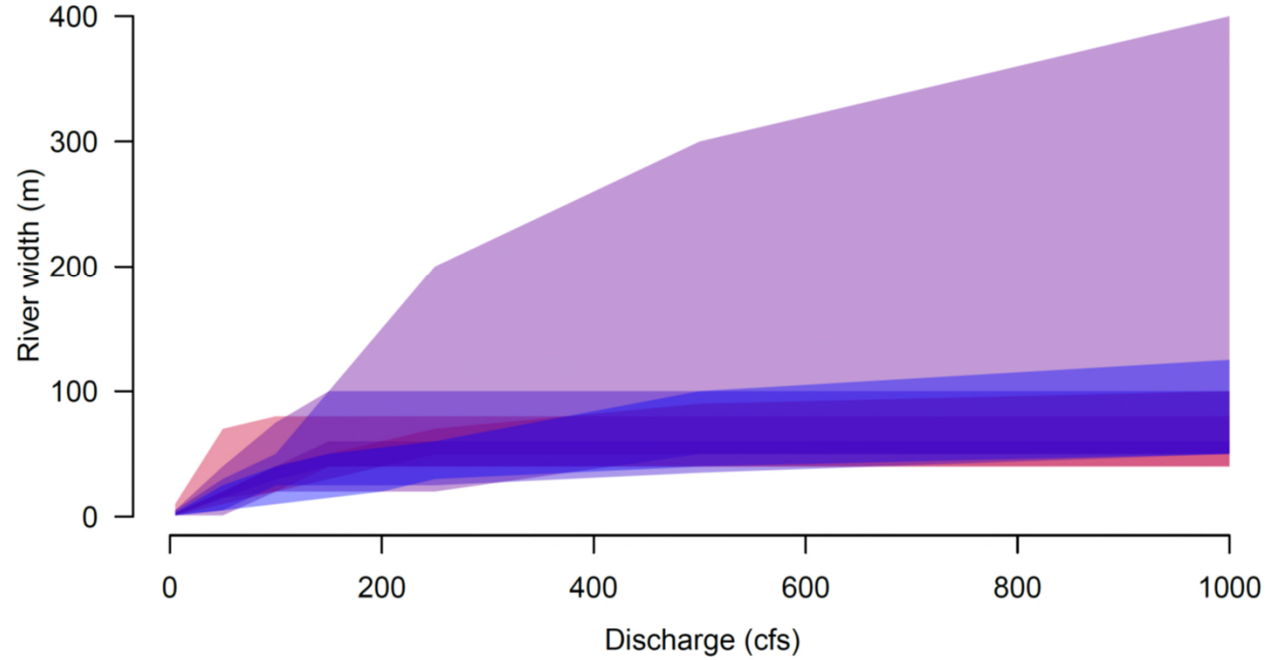

Survival
0.8
0.6
0.4
0.2
0.0
Apr
May
June
July

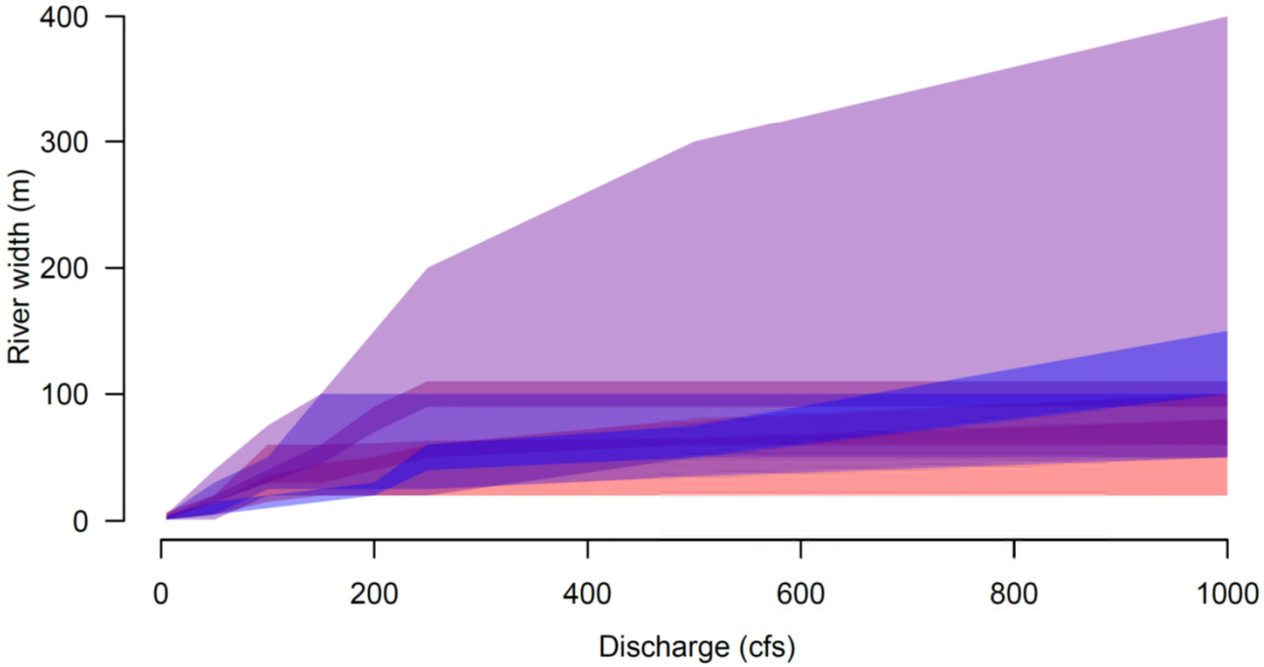

Survival
1.0
0.8
0.6
0.4
0.2
0.0
0
10
20
30
40
50
60
Days in Captivity
Month Collected
March
April
May
June
July
August

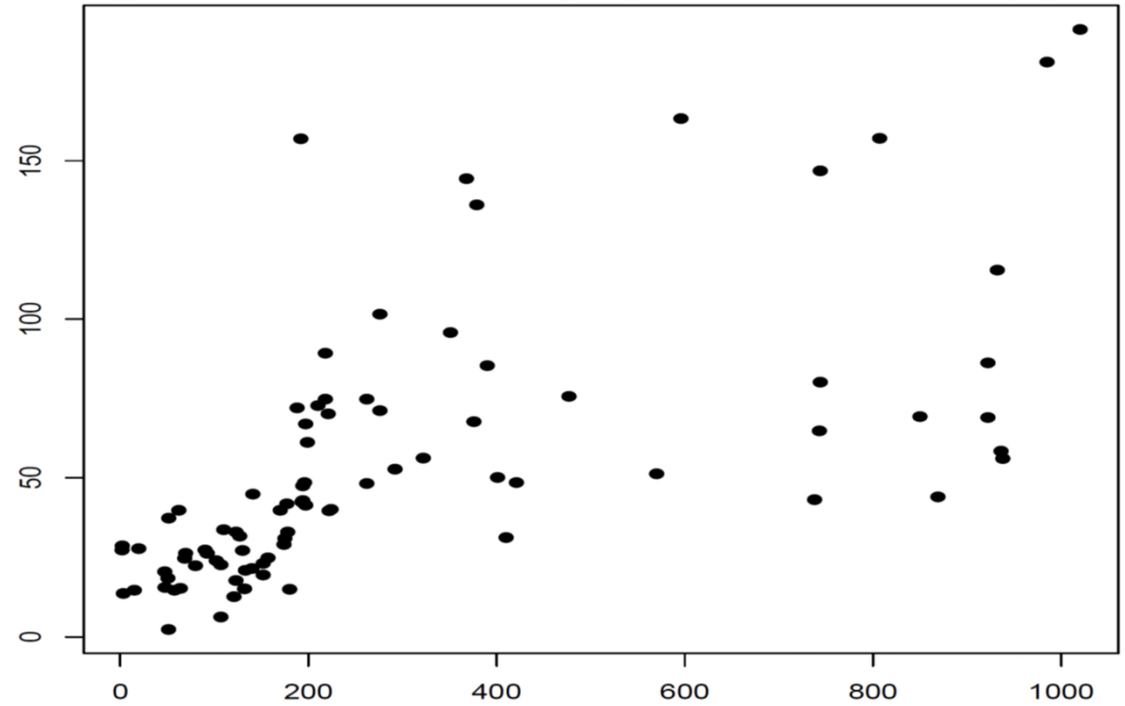

Survival
0.8
0.6
0.4
0.2
0.0
Apr
May
June
July

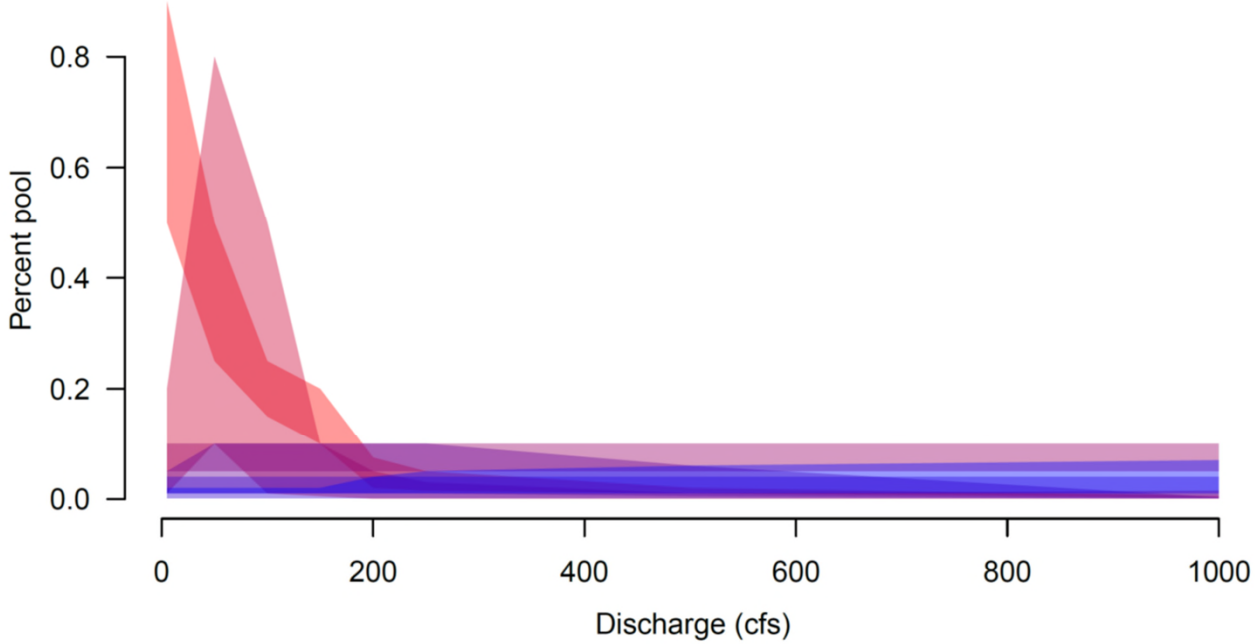
Question 6

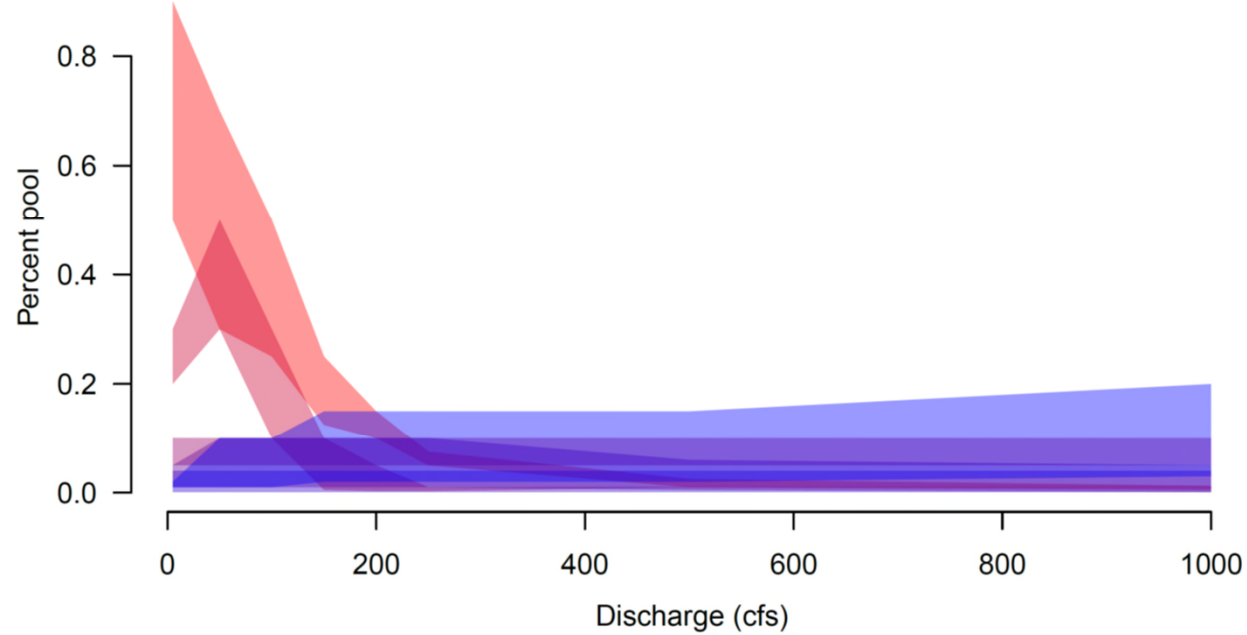

River width (m)
0
100
200
300
400
0
200
400
600
800
1000
Discharge (cfs)

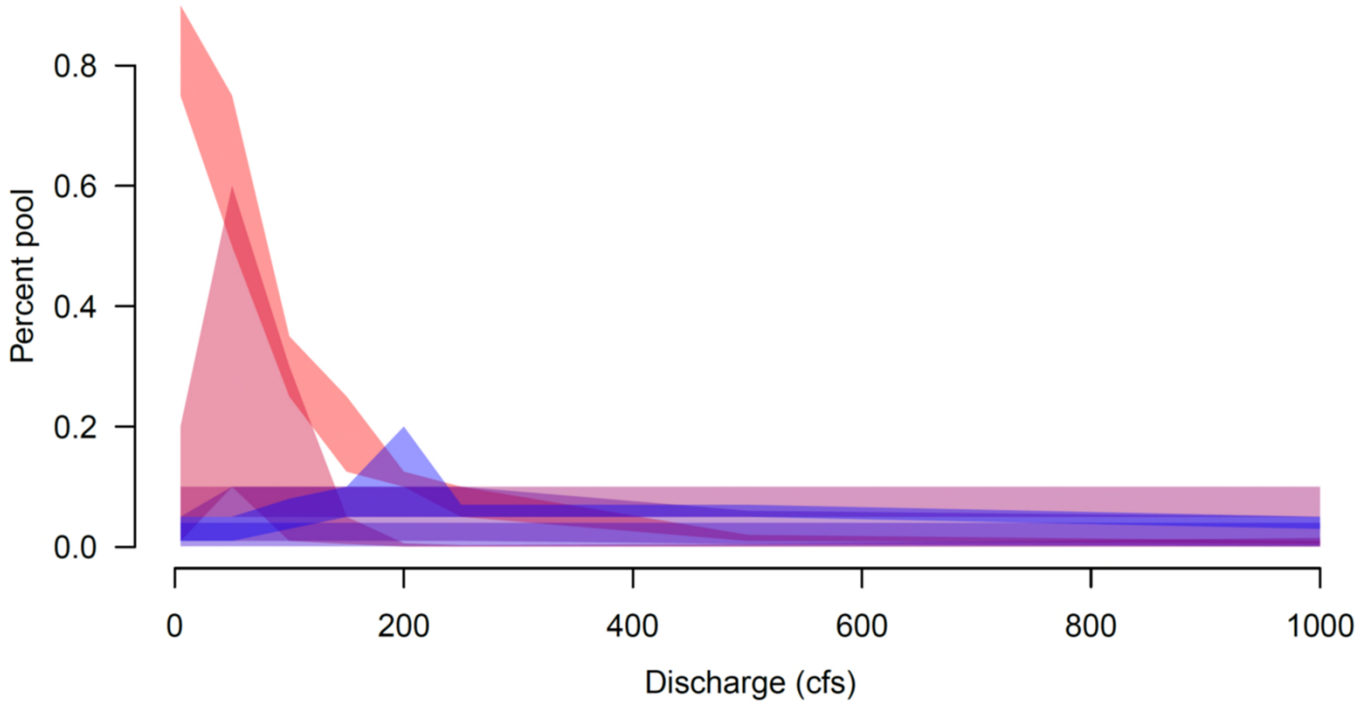

River width (m)
0
100
200
300
400
0
200
400
600
800
1000
Discharge (cfs)

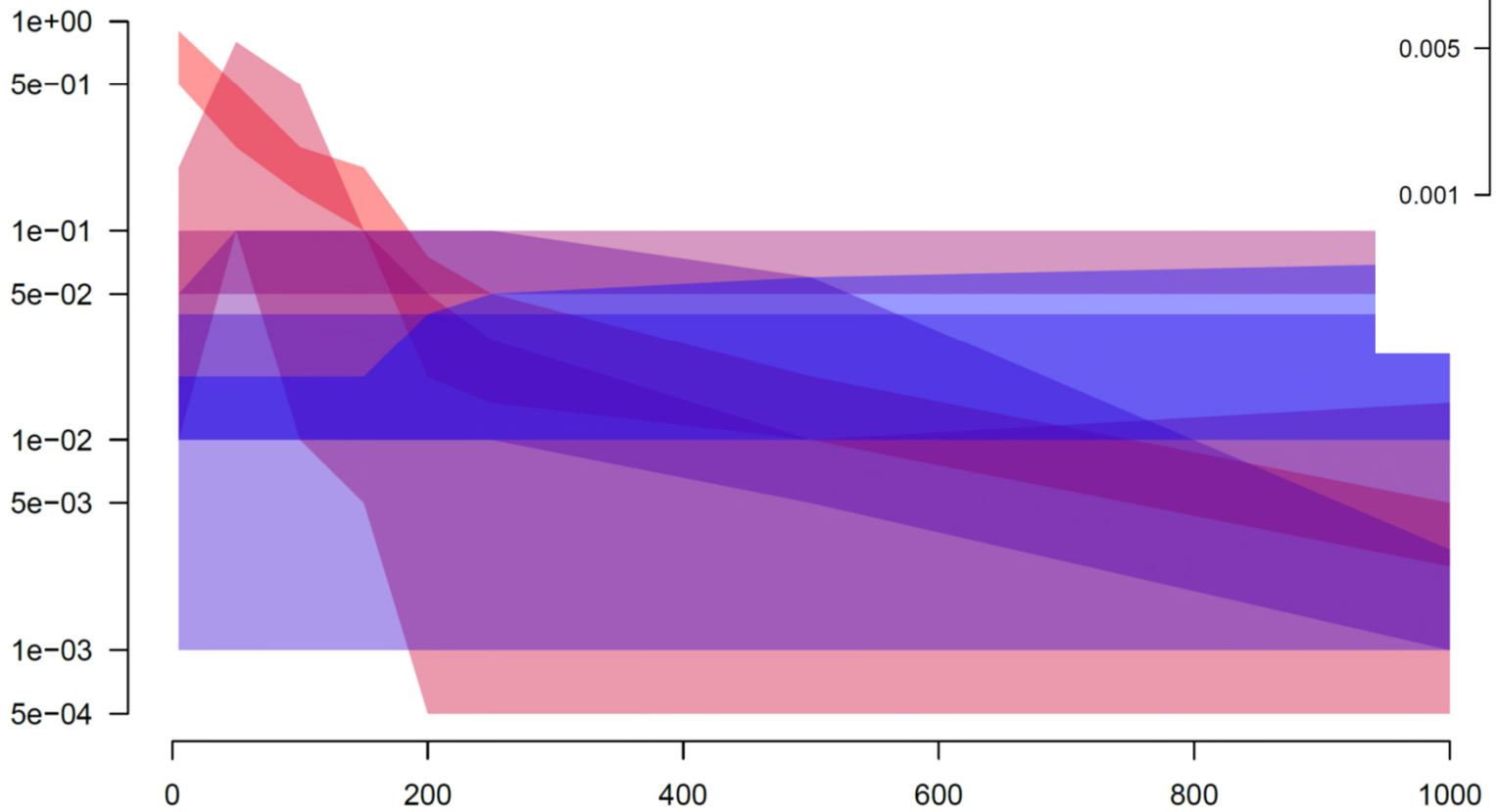

River width (m)
0
100
200
300
400
0
200
400
600
800
1000
Discharge (cfs)

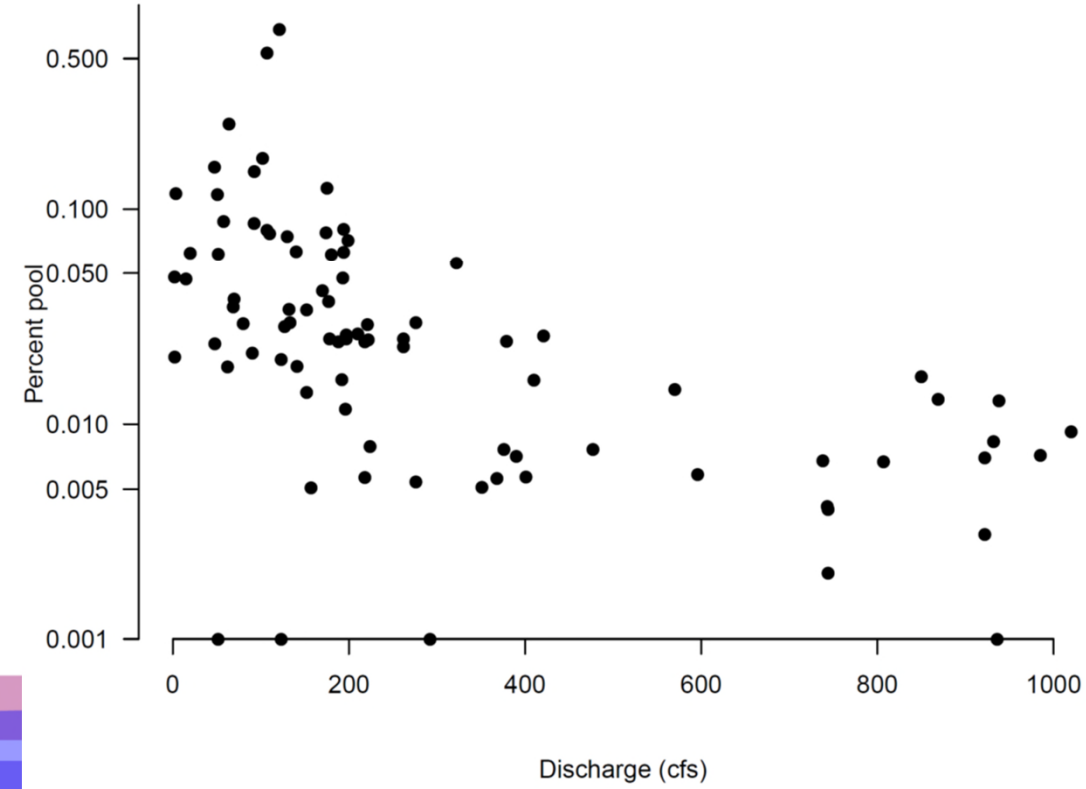

0
50
100
150
0
200
400
600
800
1000


Percent pool
0.0
0.2
0.4
0.6
0.8
0
200
400
600
800
1000
Discharge (cfs)

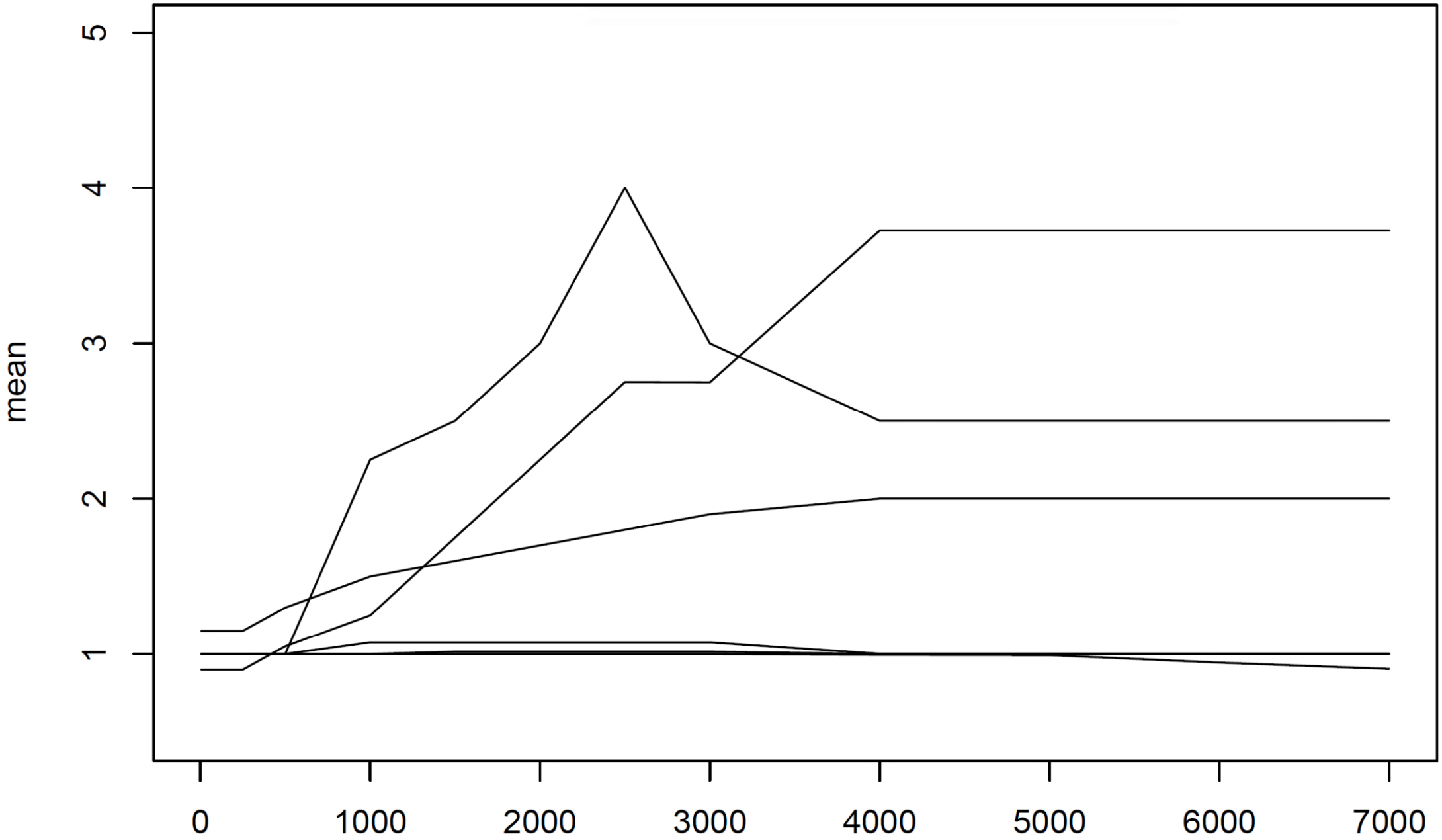

Percent pool
0.0
0.2
0.4
0.6
0.8
0
200
400
600
800
1000
Discharge (cfs)


Percent pool
0.0
0.2
0.4
0.6
0.8
0
200
400
600
800
1000
Discharge (cfs)


1e+00
5e−01
1e−01
5e−02
1e−02
5e−03
1e−03
5e−04
0
200
400
600
800
1000


0.500
0.100
0.050
0.010
0.005
0.001
Percent pool
0
200
400
600
800
1000
Discharge (cfs)

Question 7


mean
1
2
3
4
5
0
1000
2000
3000
4000
5000
6000
7000

To: Population Monitoring Workgroup
From: Rich Valdez, Chair
Subject: Comments on Findings and Recommendations of the PMWG Report to the Executive Committee
Date: December 2, 2020

- The Draft PMWG Report to the EC is near completion, and preliminary Findings and Recommendations have been developed.
- Included in this workbook are two worksheets, one for Findings and one for Recommendations.
- Please review each worksheet and provide comments as requested in the column headings.
    - Column A: contains the written Findings or Recommendations--do not edit or alter these.
    - Column B: if you agree with the statement as written in column A, write "Agree" and provide reason(s).
    - Column C: if you generally agree with the statement in column A, provide comment or recommended rewording.
    - Column D: if you disagree with the statement as written in column A, write "Disagree" and provide reason(s).
    - Column E: if you disagree with the statement in column A, provide alternative language and analysis.
    - **Please provide succinct language.**
- These Findings and Recommendations will be presented to the Executive Committee of the MRG Collaborative Program on December 17, 20
- Please provide comments back to Rich Valdez by COB on Tuesday, December 8, 2020, so that this information can be sent to the EC as a rea
- Thank you.

Findings	If You Agree, Write "Agree" and Provide Reason(s)	If You Generally Agree, Provide Comment or Recommended Rewording	If You Disagree, Write "Disagree" and Provide Reason(s)	If You Disagree, Provide Alternative Language and Analysis
• **Role of Fish Monitoring in the MRG**. Data from the fish monitoring program are used for a variety of program-related functions, including (1) annual October census of RGSM abundance, (2) criteria for the RGSM recovery plan, (3) criteria for the incidental take statement (ITS) of the 2016 Biological Opinion (BiOp), (4) guidance to determine augmentation (stocking) targets for RGSM, (5) criteria for compliance with the 2016 BiOp for river operations and maintenance, (6) environmental flow analyses, and (7) modeling species viability and relationships to hydrology.				
• **Value of Ongoing Long-Term Monitoring Program**. The 26-year program provides a valuable long-term record of the CPUE index from data collected in a systematic and consistent manner since 2002, with fewer samples taken less frequently prior to 2002. Annual monitoring of the RGSM is necessary as the species is short-lived with high inter-annual variability in abundance.				
• **CPUE is a Suitable Index**. CPUE is a suitable index for measuring relative density of the RGSM. Other methods such as mark-recapture or depletion have not been evaluated, but could be difficult, expensive, and possibly ineffective because of the small size and short-lived nature of the RGSM. Further, the relationship of CPUE to abundance of RGSM in the MRG is unresolved.				
• **Sampling Design is Suitable for Trends**. The current sampling design is suitable to characterize the trend of the RGSM population (i.e., increase or decrease, and about by how much) and for estimating important demographic parameters, such as survival, recruitment, and fish growth.				
• **Low CPUE Precision Precludes Measuring Response to Management Actions**. The low precision (i.e., high variability) of CPUE, especially at low RGSM abundances, precludes using this index to measure response to specific management actions.				
• **Diminishing Return of Precision**. Precision of the CPUE may be improved by increasing the number of sites sampled monthly from 20 to 60, but does not improve substantially with more than 60 sites (diminishing return). Increasing the number of sites from 20 to 60 would involve additional cost and may not provide sufficient precision to measure response (significant change in the fish population as measured by CPUE) to specific management actions.				
• **Inherent Variability May Limit Precision**. The inherent variabilities of the RGSM population and flow and habitat of the MRG may limit our ability to obtain precise estimates of CPUE. The RGSM lives in schools of individuals that may or may not be sampled with a particular seine haul, and the river habitat is a shifting sand-bed system with variable flow that produces different conditions with every sampling event.				
• **Strong Empirical Evidence Needed Before Changing Monitoring**. Changes to the monitoring program may improve precision or reduce costs, but no change should be implemented without strong empirical evidence that an alternative sampling design and methodology will provide more accurate and precise estimates of CPUE at improved cost.				

Recommendations	If You Agree, Write "Agree" and Provide Reason(s)	If You Generally Agree, Provide Comment or Recommended Rewording	If You Disagree, Write "Disagree" and Provide Reason(s)	If You Disagree, Provide Alternative Language and Analysis
1. **Continue to implement the current fish monitoring program** annually with consideration for the recommendations listed below.				
2. **Discontinue "additional sites"** requested by the PMWG in 2017, as the three years of data (2017-2019) show no statistically significant difference in CPUE or variance with an increase of ten sites. Use these and other data instead to simulate effect of up to 60 or more sites, as described in recommendation #7 below.				
3. **Continue to use "replacement sites"** when dry sites are encountered, as described in the Replacement Sites Protocol (Reclamation, 2017b).				
4. **Design and implement a sampling protocol to augment the current fish monitoring program in October** when CPUE for RGSM in September is <2.0. Increased sampling is necessary for a more reliable CPUE when apparent abundance of RGSM is low.				
5. **Resolve the relationship of CPUE to total abundance of RGSM in the MRG** by deriving independent population estimates simultaneous to estimates of CPUE. Evaluate other population estimators including small scale, short-term mark-recapture methods.				
6. **Resolve the significance of large-size RGSM not captured during monitoring** to annual CPUE and reproductive potential. Large RGSM are captured in floodplains with fyke nets and in irrigation returns with electrofishing, but few are apparently included in the annual census.				
7. **Determine from simulation with empirical data if measuring response of RGSM to specific management actions in the MRG is feasible** with the current sampling design and existing resource and sample variability. Use various analytical techniques (e.g., bootstrap, power analysis, modeling) to evaluate numbers of seine hauls and sites to determine maximum precision of CPUE as variance, coefficient of variation, and change detection.				
8. **Implement Task 3 by developing and evaluating two or three alternative sampling designs** through simulation with empirical data to help determine if an alternative design would provide more accurate and precise estimates or indices of RGSM abundance at improved program costs. Evaluate increased numbers of sample sites, random vs nonrandom sites, different gear types and methodologies, selected mesohabitat types with highest CPUE, and limiting sampling to October as a necessary census period. Estimate costs for each alternative.				
9. **Continue to evaluate and implement the recommendations of the Hubert et al. (2016) and Noon et al. (2017) science panels**.				
10. **Continue to use integrated population modeling** to better understand complex relationships associated with CPUE and RGSM population dynamics, such as prior year class strength, age-specific survival, individual growth, and the effect of stocked fish and hydrological variables.				