

Middle Rio Grande Endangered Species Collaborative Program Fiscal Year 2020 Annual Report



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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

Table of Contents

Acronyms & Abbreviations **Executive Summary** The Middle Rio Grande Endangered Spe Background Area of Interest **Guiding Principles Signatories** Governance **Organizational Structure FY20** Accomplishments 2019 Science Symposium **Conceptual Ecological Models Draft Science & Adaptive Managen Program Goals Revised Program Structure** Introduction to FY20 Signatory Activities **FY20 Signatory Activities Species Management & Recovery Population Monitoring & Modeling**

Habitat Assessment & Modeling Field & Laboratory Experiments Program Management & Administr

	3
	5
cies Collaborative Program	6
	6
	6
	7
	7
	8
	8
	9
	9
	10
nent Plan	10
	10
	10
i de la construcción de la constru	12
	13
	13
	17
	23
	27
ration	32

Acronyms & Abbreviations

Acronyms/Abbreviations	Definition
2016 MRG B0	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	vellow-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)



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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

7

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



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.

13

Photo: View of the 'jiggle' from the Isleta Diversion Dam, Credit: Catherine Murphy, Program Support Team



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

