May 10, 2018

Documents:

Meeting Agenda

Meeting Minutes

Read-Aheads and Presentations

- *Re-Analysis Existing Data Collected During Population Monitoring of RGSM 2009-2016 Performance Work Statement [not included]*
- *Template for Detailing Work Group Charges*
- *Consolidated Panel Recommendations*
- *Approval of 1st Task for Review of the Collaborative Program Fish Monitoring Program for the RGSM: A Proposal for a CPUE Metrics and Methodologies Workshop*
- *Scope of Work [not included]*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Workgroup
Meeting Agenda

May 10, 2018 9:00 AM – 12:00 PM
Location: Bureau of Reclamation – 555 Broadway Blvd NE #100

Conference Call Information:
Phone: (712) 451-0011 Passcode: 141544

9:00-9:10	Welcome, Introductions and Agenda Review ➢ **Decision**: Approve meeting agenda	*Rick Billings*
9:10-9:20	Review of March 14, 2018 DAT meeting and October 4, 2017 PMW meeting. • Action items update ➢ **Decision**: Approve March 14, 2018 meeting minutes	*Jared Studyvin and Ashley Tanner*
9:20-10:00	Role of the Population Monitoring Workgroup • Responding to the Executive Committee request for objectives statements • Support of the MRGESCP needs • Support of the Biological Opinion	*Dave Wegner*
10:00-10:15	Adaptive management and the PMW (structure)	*Dave Wegner*
10:15-10:45	Prioritization of the panel recommendations	*Dave Wegner*
10:45-11:15	Role of the DAT in the short term	*Dave Wegner*
11:15-11:45	SOW for statistics support	*Dave Wegner*
11:45-11:55	Support needed from WEST for future PMW meetings	*Dave Wegner*
11:55-12:00	Closure and follow-ups	*Dave Wegner*

Middle Rio Grande Endangered Species Collaborative Program

Est. 2000

Population Monitoring Work Group (PMW)
Meeting Summary

May 10, 2018 9:00 AM – 12:00 PM
Location: Bureau of Reclamation – 555 Broadway Blvd NE #100

Decisions

- ✓ Disband the Data Analysis Team (DAT) and begin by canceling its scheduled meeting on May 11, 2018.

Action Items

WHO	NEW ACTION ITEMS	BY WHEN
Rick Billings	Send Dave Wegner the PMW directives	ASAP
Lana Mitchell	Send out a Doodle Poll to the PMW to determine the next PMW meeting	ASAP
Grace Haggerty	Send WEST (Lana Mitchell) the Charles Yackulic SOW for distribution to the group	ASAP
Ashley Tanner	Send consolidated Panel Recommendations to the PMW	ASAP
Rich Valdez	Send the supporting data for the Analysis for Recommendation E1	5/25/2018
Jared Studyvin, Ashley Tanner, and Mike Marcus	Review Rich Valdez' Analysis for Recommendation E3	5/28/2018
All	Review the Charles Yackulic SOW and provide feedback to Grace Haggerty	5/28/2018
Mick Porter	Send out manuscript for review	5/31/2018
Mike Marcus, Rick Billings, Ashley Tanner	Clean up and compile questions about the Population Estimation dataset.	6/8/2018

Next Meeting: To be determined via doodle poll

Role of DAT

- The PMW chair, Rick Billings, proposed to dissolve the DAT (a PMW subgroup) and put their work directly within the PMW. With the developing AM structure, groups like the PMW and DAT would come under AM, therefore it was unnecessary to put forth a group (DAT) which was not functioning well.
    - It was agreed that the DAT was not necessary as long as the PMW had people who could accomplish Task 2 (Attachment 3 – Approval of the 1st Task for Review of the Collaborative Program Fish Monitoring Program for the Rio Grande Silvery Minnow).
- ➢ Disband the DAT; begin by canceling the DAT meeting scheduled for the next day, May 11, 2018.

Review of the October 4, 2017 PMW Meeting

- Jared Studyvin gave a brief summary on the October discussion on fish sampling, zero-inflated bias in the population monitoring data, reanalyzing existing population monitoring data, and tasking a smaller group to do that (the DAT). A summary of the DAT March 14, 2018 meeting was given.
    - Rich Valdez added he had emailed the DAT sub group his preliminary analysis earlier and then issued a subsequent report dated April 15, 2018 for the sub groups' review.
    - Upon Dave Wegner's request, Rich V. gave a summary of the April 15, 2018 report to the sub group and a discussion took place.
    - A participant suggested the PMW review the analysis to understand the results. Another participant expressed that the statistical analysis would most likely not be understood by most in the PMW group and suggested that Jared S. and Ashley Tanner review the reports and analysis.
    - The question was asked, would this work answer a panel recommendation question? One answer given was yes, to gain the relationship of CPUE to abundance.
    - When this led to further discussion, the chair requested that this discussion be put on hold for now to give room for discussion on other agenda items.
- Ashley T. to send the consolidated Panel Recommendations to the work group
- Rich V. to send the supporting data for the Analysis for Recommendation E1
- Jared S., Ashley T., and Mike Marcus will review Rich V.'s Analysis for Recommendation E3

Adaptive Management (AM) and the PMW Structure

- Dave W. updated the PMW on some outcomes of the latest Executive Committee (EC) meeting on April 12, 2018. The AM Work Group will move past development and into implementation once they have a long-term plan, work plan, and peer review recommendations for which the EC approve. The AM Work Group is recommending a triennial study plan process, which works best when a program includes funding agencies that require out years for planning for placeholders. The triennial process prevents the science from being driven by the short-term, year-to-year planning. The EC requested all work groups review their group's function and objective to see which should be pulled in under the AM structure, directly under the EC, or disbanded.
    - The charge to the PMW is to have a discussion as to whether the group's objective and goals are valid today to the Program, and how would the PMW like to be under AM now and later.
    - There are several Biological Opinions (BOs) out there; relationships between U.S. Fish & Wildlife Service (USFWS) and other agencies that the PMW needs to be mindful of. The goal is to be sensitive of those relationships and others under the Program without jeopardizing their current relationships.
        - We can anticipate 404 permits that may require communication between U.S. Army Corps of Engineers (USACE) and other agencies.
        - Another unique condition is the relationship of agencies to such things as ASIR data. We have a lot of data for which we don't have funding or sufficient time to analyze. This group needs to pay attention to those recommendations that would be most effective to future management and appropriate for the PMW.
- This is the PMWs opportunity to form a charge that will be acknowledged by the EC as a formal work group under the AM. The Rio Grande Silvery Minnow (RGSM) is of large importance but the group could also extend their work.

- Rick B. will send Dave W. the PMW directives. No discussion took place on the PMW directives.

Contracting with Charles Yackulic

- Grace Haggerty presented the Draft Scope of Work for Technical Support from the U.S. Geological Service (sic); more specifically, a SOW for Charles Yackulic. Grace H. is requesting feedback to make sure the SOW meets the PMW work group's expectations. It was hoped the SOW would be submitted for a May 15 deadline but obviously will not meet it. Grace H. will present a work plan, but would not be able to obligate the full amount.
- Several observations were shared during the discussion:
    - There are other experts out there; however, Yackulic would have the shortest learning curve. The important thing being having a diversity of perspective and he would bring a good perspective that should benefit the Program.
    - Not knowing how much analysis would be required, it would be good to work with Yackulic or other statisticians to learn the application of statistics in fisheries management and to take some of the work burden off of him. The idea is to get as much exposure with Yackulic as the group can as a way to elevate the science.
    - The recommendations we have from the science panel defines analysis narrowly. It is recommended that a report be produced for each of those. However, the focus should be reporting results to the EC.
- Grace H. will send WEST the draft SOW for distribution to the PMW Work Group for review.

Additional Discussion

- An unplanned discussion started when a member suggested that in future meetings, time should be set aside to allow for analyses to be presented.
    - It was acknowledged that analysis was an exercise best done together as a transparent group. Making time for presenting analysis at meetings would also make it easier to course correct.
    - The idea is to give a report to the work group to review so that the group could provide appropriate feedback during a work group meeting.
    - The group was cautioned to not jump ahead of themselves; there was no analysis listed as a task for the next meeting.
    - It was suggested that for the next meeting, the work group revisit prioritization of the panel recommendations; there were 13 objectives that the PMW chose as having 1st priority, which are too many.
- There was a continued discussion. Mike Marcus added he was doing data characterization and could talk about turning on and off filters at the next meeting. Rich V. was asked if he could present on his reports and he said not likely on the second report. Jared S. was asked about his CPUE approach as compared to Rich V. It was again agreed that Jared S. should review the Rich V. reports rather than try a different CPUE combination.
- Mike M., Rick B., and Ashley T. will clean up and compile questions about the Population Estimation dataset.
- WEST to put out a doodle poll to determine the next PMW meeting in June.

Participants

Participant	Organization
Rick Billings	Albuquerque Bernalillo County Water Utility Authority
Eric Gonzales	U.S. Bureau of Reclamation
Grace Haggerty	New Mexico Interstate Stream Commission
Mike Marcus	Assessment Payers Association of the MRGCD
Lana Mitchell	Western Ecosystems Technology, Inc.
Michael Porter	U.S. Army Corps of Engineers
Dale Strickland	Western Ecosystems Technology, Inc.
Jared Studyvin	Western Ecosystems Technology, Inc.
Ashley Tanner	Western Ecosystems Technology, Inc.
Rich Valdez	SWCA Environmental Consultants
Dave Wegner	Western Ecosystems Technology, Inc.

Template for Detailing Workgroup Charges

Overall purpose:

Management/Science implications:

Deliverables:

Timeline to complete work:

Member roster:

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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	Complete - ASIR reported CPUE by gear type and age class in their 2017 Population Monitoring report.
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	
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	Complete - ASIR reported CPUE for larval fish only using the fine-mesh seine, and used the small-mesh seine for all other age classes.
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	Complete - ASIR excluded dry sites in their analyses.
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	

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	In progress - 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.
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	
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	

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	In progress - ASIR included some hydrological variables as covariates in their estimated desitiy models. More covariates of interest may be identified.
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	Comeplete - ASIR included a table in their 2017 Population Monitoring Report detailing assumptions, violation implications, violation risks, and mitigation precautions.
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	Complete - ASIR monitored 10 additional sites during the 2017 monitoring period and reported the results in their 2017 Population Monitoring report.

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	Complete - ASIR sampled replacement sites whenever the river was dry at a standard or additional site.
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	
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	

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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	
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	

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	

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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	

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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	

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	In progress - ASIR sampled at replacement sites when a fixed or additional site was found to be dry. They also added 10 additional sites in 2017.
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	

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	In progress - planning 2019 MRG Science Symposium

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	In progress - planning 2019 MRG Science Symposium and working towards an Adaptiveme Management Framework for the program.

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	In progress - SOWs developed through the Program now accommodate the cost of peer-reviewed publication.

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

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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	
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	
Noon et al. 2017	18	A3	Estimate age-specific survival rates	1	3	
Noon et al. 2017	19	A4	Estimate age-specific fecundities of wild fish.	1	3	
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	
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	In progress - the USFWS is in the very preliminary stages of assessing fish salvage. A portion of rescued fish are being brought back to the USFWS facilities for evaluation.

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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	In progress - the current iteration of the early life history SOW is aiming to identify spawning cues (specifically focused on temperature and photoperiod).
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	
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	In progress - the current iteration of the early life history SOW is aiming to identify spawning cues (specifically focused on temperature and photoperiod).
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	

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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	
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	
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	In progress - 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.
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		
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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		
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		
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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		
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		In progress - the high through-put markers SOW is currently in contracting.
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		
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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		In progress - the BioPark raises RGSM on natural foods as much as possible, and some outside. Unsure about accomodations at other facilities.
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		
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		
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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		In progress - the BioPark raises RGSM on natural foods as much as possible, and some outside. Unsure about accomodations at other facilities.
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		
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		
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		
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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	1	
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		
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		In progress - the broodstock from the Southwestern ARRC and the BioPark were genotyped, and fish to be released in the fall will be (or were?) genotyped. The high throughput makers SOW is currently in contracting.
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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		
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		
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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		
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	1	
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		
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		
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		

Panel Recommendations Summarized by Ashley Tanner, WEST Inc.

Report	Page Number	Recommendation Number	Recommendation	Panel Priority	MRGESCP Priority	Status
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		

Attachment 3

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

Executive Committee Action Requested:

- Approval to Conduct a Workshop on Catch-per-Unit-Effort (CPUE) Methodology used by the Current Rio Grande Silvery Minnow Population Monitoring Program (i.e., Task 1, see Appendix A).

Contents

Introduction

Background

This document was developed by the RGSM Population Monitoring workshop organizers at the request of the Executive Committee (EC) of the Middle Rio Grande Endangered Species Collaborative Program. The document outlines a proposed approach for evaluating and updating the fish monitoring plan for the Middle Rio Grande, New Mexico. This proposed approach helps to address issues identified in a scientific review of the Rio Grande silvery minnow (RGSM) population monitoring program and by the U.S. Fish and Wildlife Service (Service) in a letter dated March 23, 2012. The Service's letter recommended, as a step toward resolution, 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 proposed approach addresses the Service's recommendation as part of a broader effort to develop a fish monitoring plan.

Primary Goal

The primary goal of this proposed approach 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 will best meet the needs of the Collaborative Program and the Recovery Implementation Program (RIP). The EC of the Collaborative Program has expressed the need to reliably measure the effects of Middle Rio Grande 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 sufficient progress for the RIP. The proposed approach 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 these purposes and that is also reasonably attainable (i.e., reasonable expenditure).

Proposed Approach

The workshop organizers believe that three major steps are needed to achieve the stated goal:

- Task 1 focuses on addressing technical questions concerning use of CPUE in the current RGSM monitoring program (see detailed write-up of Task 1 in Appendix A). This task should be approved and implemented as soon as possible to provide sufficient time to identify and invite qualified scientists to participate in the workshop process and to plan and organize the workshop.
- Task 2 is a review of the current monitoring program including temporal and spatial aspects of sampling design, data collection protocols, and data analyses.
- Task 3 is the development of a formal 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 PVA models, etc.).

Overview of current fish population monitoring

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 catch-per-unit-effort (CPUE) and specifically the endangered Rio Grande silvery minnow began in 1993 and has been carried out annually except for 1989 (e.g., Dudley and Platania 2011). The current monitoring program continues to provide annual, as well as more or less monthly, CPUE estimates for each of three reaches of the Middle Rio Grande: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 a given sample site, and CPUE is computed for each species at each sample site as the pool of seine hauls expressed as the number of individuals per 100 m^2 (surface area) of water seined.

Outline of Actions by Task

The following is an outline of the three major tasks of this proposed approach with objectives and actions identified for each.

1. **Task 1. Conduct a Workshop on Catch-per-Unit-Effort (CPUE) Methodology used by the Current Rio Grande Silvery Minnow (RGSM) Population Monitoring Program (see Appendix A for details)**

Objectives:

- Evaluate statistical properties and interpretations of the current RGSM monitoring program, including precision and accuracy of CPUE.
- Discuss, evaluate, and reconcile areas of concern/disagreement over CPUE.
- Discuss and evaluate population estimation for RGSM and compare and correlate with CPUE,
- Identify and evaluate other methods for monitoring the RGSM, including methods used in other river systems.
- 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:

- 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.
- 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.
- Conduct a 3-day workshop that includes an introduction session with EC members (2-3 hr) followed by technical presentations, discussion, and draft report preparation.
- Prepare and present a report of the CPUE Workshop to the EC (report to be prepared jointly by workshop organizers and external scientists).

2. Task 2. Review Middle Rio Grande Fish Population Monitoring Plan

Objectives:

- Evaluate and refine sampling design, including statistical properties of spatial aspects (longitudinal locations of sample sites, habitats in which samples are taken) and temporal aspects (frequency of sampling, times of year when samples are taken).
- Evaluate and refine sampling methods, including gear types, sampling strategies, etc.
- Evaluate and refine data collection protocols, including types of data collected, recording methods, quality control, electronic storage, and data custody.
- Evaluate and refine data analyses.
- Identify other data needs for concurrent sampling during fish monitoring to support other studies (e.g., augmentation, fish movement, drying, genetics, adaptive management) as part of a programmatic monitoring program
- Evaluate how PVA may assist in refining monitoring.

Actions:

- Retain two or three external scientists with expertise in sampling design to participate in the workshop, evaluate and revise the fish monitoring plan, and prepare the workshop report.
- Conduct workshops and work sessions that address elements necessary for long-term fish population monitoring program development, including what other monitoring is needed that can be performed in conjunction with fish monitoring. Prepare and present a report to the EC as guidance to update the Fish Monitoring Plan for the Middle Rio Grande.

3. Task 3. Update the Collaborative Program Middle Rio Grande Fish Monitoring Plan

Objectives:

- Update the current Fish Monitoring Plan with revisions that may include sampling design, data collection, quality control, storage, and custody; cost estimates; and responsibilities.
- Define the metrics of interest for the initial phase of the Monitoring Plan (3 yrs), define how they will be calculated from the monitoring data, and document data precision and accuracy for the desired performance (such as precision and correlation with some "ground truth").
- Implement the updated Fish Monitoring Plan for a 3-year period for evaluation and refinement.
- Ensure that the needs of the Collaborative Program and the RIP are met with a monitoring program for RGSM sufficiently sensitive to:
  a. Detect changes in RGSM abundance with management actions;
  b. Provide reliable demographic recovery criteria for RGSM; and
  c. Provide reliable metrics for sufficient progress for the RIP.
  d. Utilize past data and analyses to be comparable to any proposed changes

Actions:

- Integrate the findings of Tasks 1 and 2 and update the Fish Monitoring Plan with emphasis on the RGSM.

  Implement and evaluate the Fish Monitoring Plan for meeting needs of the EC and the Service for monitoring species response(s) to management actions; demographic recovery criteria; and sufficient progress metrics.

Anticipated Time Schedule

An anticipated time schedule for this proposed approach is provided in Table 1. The following summarizes the schedule for each task and action.

Task 1: CPUE Workshop

- EC approval of Task 1 in July, 2012.
- Contract 2 or 3 external scientists that have the ability and time to participate in CPUE workshop.
- Independent data examination by external scientists and by Collaborative Program scientists to start as soon as data can be provided (the Program does not have the Population Estimation data at present, and some details are still missing from the Population Monitoring data). A reasonable period of time for this analysis is 3 months (Aug-Oct; given possible time conflicts of scientists and actual data analysis).
- Distribute pertinent existing reports concerning the population monitoring to all anticipated workshop participants at the same time that the data are made available.
- 3-day workshop by end of October 2012.
- Report to EC by December 2012.

Task 2: Review Monitoring Program

- Evaluate and refine aspects of fish monitoring program; workshops may be scheduled in January and February of 2013.

Task 3: Update the current Fish Monitoring Plan

- An updated draft RGSM Population Monitoring Plan will be vetted through the federal agencies and RIP so that it can be funded and implemented in FY2014.
- It is assumed that the current monitoring program will continue until a new or revised program is implemented, evaluated, and refined.

Table 1. Proposed time schedule for revision of the Fish Monitoring Plan.

Tasks	2012						2013					
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1. CPUE Workshop												
• EC Approval	X											
• Contract Scientists		X										
• Data Examination		X	X	X								
• 3-Day Workshop				X								
• Report to EC					X	X						
2. Evaluate Monitoring						X	X	X				
3.Update Plan								X	X	X	X	X

Estimated Costs

- The costs for Task 1 are estimated at $30,000 of federal funding (USFWS and Reclamation/CP) with cost share contributions from nonfederal signatories anticipated. The majority of this cost ($20-25,000) is for contracting external scientists' time and per diem. The costs for participation by the Collaborative Program participants or their contractors are not factored into this estimate.
- The costs of Tasks 2 and 3 are undetermined at this time. Each workshop for Task 2 is estimated to cost about the same as for Task 1 ($30,000).

Workshop Organizers

The CPUE Metrics and Methodologies workshop planners include:

- Rick Billings, Albuquerque-Bernalillo County Water Utility Authority
- Jim Brooks, U.S. Fish and Wildlife Service
- Michael Porter, U.S. Army Corps of Engineers
- Grace Haggerty, New Mexico Interstate Stream Commission
- Daniel Goodman, Montana State University
- Richard Valdez, SWCA
- Jason Remshardt, U.S. Fish and Wildlife Service

Literature Cited

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.

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.

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

Appendix A: Task 1 Description.

Task 1. Conduct a Workshop on Catch-per-Unit-Effort (CPUE) Methodology used in the Current Rio Grande Silvery Minnow (RGSM) Population Monitoring Program

This task is intended to explore and reconcile issues and concerns with using CPUE to monitor the RGSM. This task will accomplish the first necessary step in developing a better understanding of the current methodologies used to monitor the species and ways to improve and refine the monitoring program. This task will also begin to establish better communications among the scientists, managers, and the EC over the meaning and use of monitoring information. The workshop will also review methodologies for monitoring used in other river systems, as well as analytical methods that may help to improve a fish monitoring program for the Middle Rio Grande.

Objectives:

- Evaluate statistical properties and interpretations of the current RGSM monitoring program, including precision and accuracy of CPUE.
- Discuss, evaluate, and reconcile areas of concern/disagreement over CPUE.
- Discuss and evaluate population estimation for RGSM and compare and correlate with CPUE, with available population estimation data.
- Identify and evaluate other methods for monitoring the RGSM, including methods used in other river systems.
- Identify, discuss, and reconcile uses for CPUE, including recovery demographic criteria, sufficient progress metrics, and inputs and parameter estimates for Population Viability Analysis.

Actions:

- Retain 2-3 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.
- Distribute and provide for independent examination, existing pertinent reports and the existing monitoring data (and available population estimation data) to evaluate existing and potential precision and levels of detectable change in abundance of RGSM.
- Conduct a 3-day workshop, with EC members participating in a 2-hour introduction followed by technical presentations, discussion, and report preparation.
- Prepare and present a report of the CPUE Workshop to the EC (report to be prepared jointly by workshop organizers and external scientists).

Proposed Structure and Process:

- Workshop tentatively scheduled for 3 days in the last week of October, 2012. Draft agenda for the workshop (to be refined with the assistance of the external scientists) is:
    - Day 1—Morning: Presentation to EC of background, workshop objectives and EC/scientists dialogue/questions/comments.

- Day 1—Afternoon: Technical presentations and discussions on RGSM current monitoring.
- Day 2—Morning: Continuation of presentations and discussion of other methods used, data analyses, etc (to be further defined).
- Day 2—Afternoon: Discussion session (facilitated).
- Day 3—Morning: Technical presentations and discussion on demographic metrics for sufficient progress and recovery milestones (facilitated).
- Day 3—Afternoon: Report preparation by Participating Scientists.

- This workshop will involve a detailed evaluation of CPUE collection and analysis methodologies. It is recommended that primary attendees are scientists familiar with fish population monitoring in the MRG and that participating scientists are well prepared. A list of scientists will be developed jointly by the workshop organizers and the EC; that list will be used to form the discussion groups and to write the Workshop Report. A list of technical participants will be distributed to the EC for approval prior to the workshop. A cross section of knowledgeable scientists from the diverse agencies/entities is encouraged.
- Other attendees may participate as observers and be allowed to provide comments or questions only during specified comment/question periods, most likely at the end of each presentation and discussion session. This is done to ensure that the workshop stays on schedule with technical issues. However, this is a public meeting.
- Two to three scientists not currently involved in the Collaborative Program and with expertise in sampling methodologies/statistical analysis/CPUE monitoring for small-bodied river fishes will be contracted to participate in data examination, workshop participation, and report preparation. Availability will most likely be a determining factor in who is contracted. Prior to contracting with these individuals, their names and CVs will be provided to the EC members for approval.
- The contracted external scientists are not considered to be a science panel or peer reviewers but will participate as other scientists do in the workshop and will assist in drafting the Workshop Report on the last day of the meeting and following the workshop.
- A facilitator will be used to lead the workshop. The facilitator shall be experienced at leading technical workshops. One or two additional assistants may be requested to help with workshop materials, monitor and record discussion sessions, etc. The facilitator's contract may be with any of the EC members and the facilitator's name and CV will be provided to the EC for approval at the same time the information is provided to external scientists.
- The workshop organizers will remain in place to assist in selection and contracting the external scientists, setting up the workshop, and finalizing the Workshop Report. Technical editing and technical and administrative assistance will be provided by the Collaborative Program PMT and EC contributions.

Products/Outcomes:

- Workshop Report written by the workshop organizers and the external scientists to include:
  - Summary of CPUE issues as used in the MRG.

- Effectiveness of current program and CPUE to address Collaborative Program and RIP needs.
- Recommendation to the EC on continued use and refinement of CPUE.
- Other uses for CPUE (e.g., survival, recruitment).
- Recommendation to the EC for additional sampling methods for monitoring the RGSM.
- Provision for minority reports to document alternative views or opinions on content of report.

- Electronic and hard copies of workshop proceedings and presentations.
- Summary of discussion group dialogue.
- Proposed outline to help guide Tasks 2 and 3.

Appendix B: Suggested External Scientists (Preliminary)

The following are recommended scientists and a list of their qualifications who are not directly involved with the Collaborative Program and who could provide an objective evaluation of the RGSM monitoring program and data:

- Dr. Wayne Hubert (retired)
  - Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, WY
  - Lead author: Relative Abundance and Catch-per-Unit-Effort, Chapter 7 *in* Analysis and Interpretation of Freshwater Fisheries Data
- Dr. Ron Ryel
  - Department of Forest, Range, and Wildlife Sciences, Utah State University, Logan, UT
  - Teaches classes in Inventory, Monitoring and Assessment
- Dr. Brett Johnson
  - Associate Professor, Colorado State University, Ft. Collins, CO
  - Co-author: Predator-Prey Interactions, Chapter 16 *in* Analysis and Interpretation of Freshwater Fisheries Data
- Dr. Carl Walters
  - University of British Columbia, Vancouver, BC
- Dr. Josh Korman
  - Ecometrics, Vancouver, BC
- Dr. William Pine
  - University of Florida, Gainesville, FL
- Dr. Lewis Coggins
  - NOAA's Southeast Fisheries Science Center, National Marine Fisheries Service, Beaufort, NC
- Dr. Ray Hilborn
  - School of Aquatic and Fishery Sciences, University of Washington, Seattle, WA
- Dr. Mike C. Runge
  - US Geological Survey Patuxent Wildlife Research Center, Laurel, MD

Scientists will provide curriculum vitae to the Collaborative Program and the EC as part of the selection process for participating in the CPUE workshop.

Mary Fabrizio
Phaedra Budy
David Gale

Request for Executive Committee to Approve Task 2 of the Proposal for the CPUE Metrics and Methodologies Workshop submitted and approved on July 13, 2012 by the Executive Committee (provided as a read-ahead).

Task 2 describes a review of the Middle Rio Grande Fish Population Monitoring Plan following Task 1 (CPUE Workshop) that provides recommendations from external experts. The objectives of Task 2 are described in the above referenced document and attached to this request.

The Population Monitoring Workgroup recommends proceeding to Task 2 by evaluating and prioritizing the recommendations provided in Task 1. The workgroup proposes retaining the services of external scientists to work collaboratively with members of the workgroup in evaluating these recommendations.

The Population Monitoring Workgroup has completed Task 1 with presentation and delivery of the final report by the external scientists. Task 2 is expected to be completed by the end of calendar year 2016 and an update will be provided by the workgroup chair at the late summer/early fall EC meeting.

The following is excerpted from the July 13, 2012 CPUE proposal

2. Task 2. Review Middle Rio Grande Fish Population Monitoring Plan

Objectives:

- Evaluate and refine sampling design, including statistical properties of spatial aspects (longitudinal locations of sample sites, habitats in which samples are taken) and temporal aspects (frequency of sampling, times of year when samples are taken).
- Evaluate and refine sampling methods, including gear types, sampling strategies, etc.
- Evaluate and refine data collection protocols, including types of data collected, recording methods, quality control, electronic storage, and data custody.
- Evaluate and refine data analyses.
- Identify other data needs for concurrent sampling during fish monitoring to support other studies (e.g., augmentation, fish movement, drying, genetics, adaptive management) as part of a programmatic monitoring program
- Evaluate how PVA may assist in refining monitoring.

Actions:

- Retain two or three external scientists with expertise in sampling design to participate in the workshop, evaluate and revise the fish monitoring plan, and prepare the workshop report.
- Conduct workshops and work sessions that address elements necessary for long-term fish population monitoring program development, including what other monitoring is needed that can be performed in conjunction with fish monitoring. Prepare and present a report to the EC as guidance to update the Fish Monitoring Plan for the Middle Rio Grande.