**Note to PMWG:**

**This document is being provided to you at this time to help guide the Open Discussion of the upcoming September 30, 2020 Meeting. The items identified in this document are intended to initiate a conversation, and are not a comprehensive synthesis of information.**

**Please review the document and familiarize yourself with the six objectives provided in the original charge from the Executive Committee. Feel free to add bullets to the existing list to help stimulate the conversation with your ideas.**

**No comments are requested at this time, but this document will be the foundation for the PMWG Report to the EC in December, 2020. Formal reviews of the document will be done by the PMWG to help finalize the Report.**

**Thank you for your continued participation in the PMWG,**

**Rich Valdez**

**PMWG Chair**

**Review of Middle Rio Grande Fish Population Monitoring Plan**

**Report to the Executive Committee**

**By**

**The Population Monitoring Workgroup**

**Draft 1.0**

**September 23, 2020**

**Executive Summary**

Fishes of the Middle Rio Grande (MRG) have been monitored annually since 1993, with a focus on the endangered Rio Grande silvery minnow. Sampling is done for four to nine months annually, and the mean catch-per-unit-effort (CPUE) for October is used as a census index for the population. In 2012, the Executive Committee convened the Population Monitoring Workgroup (PMWG) to evaluate and update the fish monitoring plan under three tasks. Task 1 was completed in 2016 with a CPUE workshop involving external scientists. Task 2 is an evaluation of the current monitoring program and is the subject of this report. Task 3 is a revision and refinement of the fish monitoring plan and has not been initiated. **The rest of the Executive Summary will be completed with this report.**

**1.0 Introduction**

The Executive Committee (EC) of the Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) requested the formation of a Population Monitoring Workgroup (PMWG) for the purpose of evaluating and updating the fish monitoring plan for the Middle Rio Grande (MRG). The PMWG was convened in 2012 to conduct a scientific review of the monitoring program, with a focus on the endangered Rio Grande silvery minnow (RGSM), as recommended in a letter dated March 23, 2012, by the U.S. Fish and Wildlife Service (Service). A description of the goals and tasks for the PMWG were reviewed and approved by the EC on July 13, 2012 (PMWG, 2012).

***1.1 Primary Goal***

The primary goal for the PMWG is to evaluate and update the fish monitoring plan for the MRG, with a focus on the RGSM, along with the identification and development of population demographic parameters that will best meet the needs of the Collaborative Program. The EC has expressed the need to reliably measure the effects of MRG water management actions and conservation measures on the RGSM, and the Service seeks to determine the best population demographic parameter(s) for gauging species recovery. 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 to describe a plan that is reasonably attainable at reasonable cost.

***1.2 Principal Tasks***

The PMWG was charged with addressing the following three principal tasks:

* Task 1 focuses on addressing technical questions concerning use of CPUE in the current RGSM monitoring program. An expert panel was convened in a CPUE workshop in December 2015, and a Final Report was submitted in 2016 (Hubert et al., 2016), marking the completion of this task.
* Task 2 is a review of the current monitoring program including temporal and spatial aspects of sampling design, data collection protocols, and data analyses. The PMWG requested and received approval from the EC to initiate this task on July 12, 2016. The report contained in this document is the final report on Task 2.
* 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.). This task has not yet been initiated.

**2.0 Evaluation of Task 2 Objectives**

This report addresses Task 2 of the charge from the EC to the PMWG. The following summarizes the six objectives identified as part of Task 2. Descriptions of the sampling design, methods, and data analyses are from Dudley et al. (2020):

1. ***Evaluate and Refine Sampling Design***.

* Fish have been monitored annually since 1993, except for 1989.
* Sampling since 2004 has been done for nine months, in February, December, and monthly from April to October of each year.
* Twenty stations are sampled in 151 miles of the MRG from the Angostura Diversion Dam (RM 209.9) to just upstream of Elephant Butte Reservoir (RM 58.5), including five in the Angostura reach, six in the Isleta reach, and eight in the San Acacia reach. Thirty additional stations (ten per reach) are sampled in November to evaluate the effect of additional stations, as requested by the PMWG starting in 2017.
* Additional intensive sampling is conducted in November for characterizing sampling variation at each of the 20 stations, by sampling once daily for four days (N=80 samples) at the same or similar mesohabitat locations.
* **Provide evaluation of Sampling Design.**

1. ***Evaluate and Refine Sampling Methods***.

* Twenty discrete mesohabitats are sampled at each of the 20 stations.
* Fish are collected with a 3.1 m x 1.8 m small-mesh seine (ca. 4.8 mm) in every month sampled, and with a 1.2 m x 1.2 m fine-mesh seine (ca. 1.6 mm) for larval fish (two samples per site) from April to October.
* RGSM are each measured as standard length, and identified to age-class, based on age-length relationships by sampling month.
* Water quality metrics are recorded at each site, along with digital photographs of river conditions.
* For intensive sampling, fish are held in submerged mesh pens during consecutive samples.
* **Provide evaluation of Sampling Methods.**

1. ***Evaluate and Refine Data Collection Protocols***.

* Data are recorded in the field…
* **Provide evaluation of Data Collection Protocols.**

1. ***Evaluate and Refine Data Analyses***.

* Numbers of fish captured in the 20 mesohabitats are pooled and divided by the sum of all areas seined to compute CPUE as the numbers of fish per 100 m2 for the station.
* The mean October CPUE is computed as the average of the CPUEs for the 20 stations, and not as the average of the CPUEs for each seine haul.
* A mixture model is used to compute mean CPUE and to resolve two issues with the data: (1) seine haul data contain many zeros (many seine hauls with no fish) resulting in a CPUE with a negative binomial distribution that is not resolved through transformation; and (2) CPUE values have a wide range (0-1,000+) and the residuals (error term) exhibit an inconstant variance, resulting in the condition of heteroscedasticity.
* **Provide evaluation of Data Analyses.**

1. ***Identify Other Data Needs for Concurrent Sampling***.

* **Identify and provide evaluation of Other Data Needs.**

1. ***Evaluate How PVA May Assist in Refining Monitoring***.

* Two PVA models were constructed for the RGSM (Miller, 2012; Goodman, 2009), but neither has been evaluated as part of Task 2.
* A biometrician from the USGS was contracted in 2018 to initiate an Integrated RGSM Population Model to evaluate management actions and science panel recommendations (Yackulic 2018).
* **Provide evaluation of how PVA May Assist in Refining Monitoring.**

**3.0 Summary and Recommendations**

**To be written after section 2.0 is completed.**

**Literature Cited**

Dudley, R.K., S.P. Platania, and G.C. White. 2020. Rio Grande Silvery Minnow Population Monitoring During 2019. A U.S. Bureau of Reclamation Funded Research Program. U.S. Bureau of Reclamation, Albuquerque, NM.

Hubert, W.A., M.C. Fabrizio, and R. Hughes. 2016. Summary of findings by the External Expert Panelists: Rio Grande silvery minnow population monitoring workshop Isleta Casino and Resort, 8‐10 December 2015. U.S. Bureau of Reclamation, Albuquerque, NM.

Population Monitoring Workgroup (PMWG). 2012. 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, Albuquerque, NM.

Yackulic, C.B. 2018. Developing an integrated population model for Rio Grande silvery minnow in the Middle Rio Grande. U.S. Geological Survey, Southwest Biological Science Center, Flagstaff, AZ.