

**Project Title**

Small-bodied fishes monitoring in the San Juan River

**Bureau of Reclamation Agreement Number:**

R19AC00022

**Reclamation Agreement Term**

April 25, 2019 – December 31, 2023

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*Note: Recovery Program FY23 scopes of work are drafted in May 2022. They often are revised before final Program approval and may subsequently be revised again in response to changing Program needs. Program participants also recognize the need and allow for some flexibility in scopes of work to accommodate new information and changing hydrological conditions.*

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**Lead Agency:**

New Mexico Department of Game and Fish

**Principal Investigator:**

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Category:

- Ongoing project
- Ongoing-revised project
- Requested new project
- Unsolicited proposal

Expected Funding Source:

- Annual funds
- Capital funds
- Other [explain]

**Relationship to LRP:**

Element 4 – Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions  
 Task 4.1.1.2 Conduct larval, juvenile, and adult fish sampling to determine if reproduction is occurring, locate spawning and nursery areas, gauge extent of annual reproduction, and identify distribution of fish.

**Study Background/Rationale and Hypotheses:**

The San Juan River Basin Recovery Implementation Program (SJRIP) Long-Range Plan specifies that monitoring and evaluation of fish is a necessary element for assessing the recovery of federally endangered Colorado Pikeminnow *Ptychocheilus lucius* and Razorback Sucker *Xyrauchen texanus* in the San Juan River (Element 4; SJRIP 2016). Task 4.1.1.2 of the SJRIP's Long-Range Plan specifies the need for juvenile and small-bodied fishes (SBF) monitoring to determine if reproduction is occurring, locate nursery areas, and to gauge the extent of annual reproduction. Data collected during annual SBF monitoring is used to assess recovery of Colorado Pikeminnow and Razorback Sucker, as well as evaluate the influences of SJRIP management actions on the river's fish community as a whole (Gido and Propst 2012; Franssen et al. 2015; Zeigler and Ruhl 2017).

### **Study Goals, Objectives, End Product(s):**

#### Goal

The goal of SBF monitoring is to quantitatively assess the effects of management actions on survival of post-larval early life stages of native and nonnative fishes and their recruitment into subsequent life stages and use this information to recommend appropriate modifications to recovery strategies for Colorado Pikeminnow and Razorback Sucker in the San Juan River (SJRIP 2012).

#### Objectives

1. Annually document occurrence and density of native and nonnative age-0/small-bodied fishes in the San Juan River.
2. Document mesohabitat use by age-0 Colorado Pikeminnow, Razorback Sucker, and Roundtail Chub, as well as other native and nonnative fishes in the primary channel, secondary channels, and backwaters.
3. Obtain data that will aid in the evaluation of the responses of native and nonnative fishes to different flow regimes and other management actions.
4. Track trends in native and nonnative fish populations.
5. Characterize patterns of mesohabitat use by native and nonnative small-bodied fishes.

#### End Product

An annual report will provide a summation of data obtained in FY2023, a synthesis of data across years to document and assess species populations' trends and a summary of mesohabitat associations. Separate data summaries and analyses will also be conducted for any wild age-0 Colorado Pikeminnow and Razorback Sucker. All data collected will be recorded on electronic spreadsheets and provided to USFWS Program Office by the principal investigator, along with the annual final report, by June 30, 2024.

### **Study Area:**

The San Juan River will be sampled from River Mile (RM) 180.6 (Animas River confluence) downstream to RM 3.0 (Clay Hills Crossing, UT) in late-August to early September 2023.

### **Study Methods/Approach:**

Small-bodied fishes monitoring is designed to sample habitats which have the greatest likelihood of supporting age-0 large-bodied fishes and all age classes of small-bodied fishes. Sampling will occur at designated 3-mile intervals in the primary channel, and at all secondary (less than 20% of total flow) and

zero velocity channels (i.e., backwaters and embayments;  $\geq 30 \text{ m}^2$ ) when encountered (SJRIP 2012). Sample reaches will be approximately 200 m long (measured along the shoreline) at primary channel sample sites and, depending upon the extent of surface water, 100 – 200 m long at secondary and zero velocity channel sample sites.

In the fall of 2012, six secondary channels were modified during the Phase I River Ecosystem Restoration Initiative (RERI) habitat restoration efforts through excavation of sediment and removal of nonnative plants. These channels are located at RM 132.2, 132.0, 130.7A, 130.7B, 128.6, and 127.2. An additional channel located at RM 136.5 was restored during Phase II habitat restoration efforts in 2014. These restoration sites will be visited during annual SBF monitoring and sampled if flowing following the protocols described below.

River mile, geographic coordinates (UTM NAD83), and water quality parameters (dissolved oxygen, conductivity, and temperature) will be recorded at each sampling site. All mesohabitats (e.g., riffle, run, pool) present within a site (except large zero velocity channels) will be sampled in rough proportion to their availability using a 3.0 x 1.8 m (3.0 mm heavy duty Delta untreated mesh) drag seine. Seine hauls will be made in at least eight different mesohabitats at each site. However, if habitat heterogeneity is low at a site, as few as five seine hauls will be made. At least two seine hauls, one across the mouth and one parallel to its long axis will be made at each large zero velocity channel unless the mouth is too narrow, in which case only one seine haul, parallel to its long axis, will be made.

All captured fishes will be identified to species, enumerated, and up to 25 age-0 and age-1+ will be measured. All fish that are not individually measured will be recorded by age class (age-0 or age-1+) and minimum and maximum TL will be recorded for those fishes. Any captured endangered or rare species (i.e., Colorado Pikeminnow, Razorback Sucker, and Roundtail Chub *Gila robusta*) will be measured for both standard and total length (mm SL, TL), weighed (g), and, if  $\geq 130 \text{ mm}$ , injected with a 12 mm passive integrated transponder (PIT) tag. All native fishes will be released and nonnative fishes removed from the river. Fishes too small to easily identify in the field will be fixed in 10% solution of formalin and returned to the laboratory for identification. Tissue samples (fin clip) will be collected from any juvenile ( $\leq 300 \text{ mm TL}$ ) Razorback Sucker captured during SBF monitoring for genetic analysis. Fin clips will be stored in individually labeled centrifuge tubes that contain 95% ethanol.

Following each seine haul, the sampled width and length of each mesohabitat will be measured to the nearest 0.1 m and recorded. The depth and dominant substrate at five generalized locations, and any cover (e.g., boulders, debris piles, large woody debris) associated with the mesohabitat will also be recorded. Retained specimens and tissue samples will be identified and measured (TL and SL) in the laboratory to the nearest 0.1 mm and accessioned to the University of New Mexico Museum of Southwest Biology (MSB), Division of Fishes.

After data collection, all original field notes will be checked for errors and missing data. Data will be entered into Excel spreadsheets with a similar template as a project specific database. All entered data will be cross-checked with the original field notes by a different biologist. Data from the Excel

spreadsheets will be imported into the database. Specific conditions for each data field in the database prevent the entry of incorrect data and typographical errors. Database queries will be used to identify and rectify any additional errors. Following the submission of the final report original field notes will be deposited at MSB Division of Fishes.

Analyses will be based on density (i.e., catch-per-unit-effort, CPUE) of individual species, calculated by seine haul, as the number of fish captured per square meter sampled (width x length). To account for the significant number of zeros and highly skewed data, density for each species will be analyzed using a Delta-GLM approach which combines two separate components: (1) a logistic model estimating the probability of presence ( $CPUE_{0/1}$ ) fitted using a GLM with a binomial distribution and logit link, and (2) a model for CPUE only when the species is present ( $CPUE^+$ ) fitted using a GLM with a lognormal distribution (Fletcher et al. 2005; Acou et al. 2011; Vasconcelos et al. 2013). The predicted density,  $E(CPUE)$ , is then obtained by (3) multiplying the response variables predicted by the binomial and lognormal models for each individual seine haul. This approach models the two aspects of the data (i.e., presence/absence and positive density) separately, allowing for evaluation of how covariates influence the two separate processes. Furthermore, the approach is much simpler and easier to interpret than other methods such as mixture models (Fletcher et al. 2005). Calculation of density will be limited to those species which have greater than 3% of all seine hauls (2003 – 2021) with at least one capture.

Several models using a combination of covariates will be used in both the logistic and positive lognormal model. Both abiotic (i.e., channel type and habitat type) and biotic (i.e., density of nonnatives) covariates will be investigated for their use in each model. The negative log-likelihood from both models will be combined to calculate Akaike's Information Criterion with a correction for finite sample sizes ( $AIC_c$ ). The combined model with the lowest  $AIC_c$  will then be used to model the final binomial and lognormal models for each species. Residual plots will be examined to ensure that the final positive lognormal model meets the assumptions of normally distributed and equal variance residuals.

Final binomial, log-normal, and Delta-GLM models will be assessed for goodness-of-fit and predictive capability. The predictive accuracy for the binomial model will be tested using the Area Under the Curve (AUC) of the Receiver Operating Characteristic (ROC). The ROC analysis involves plotting the proportion of known presences predicted against the proportion of known absences predicted (Peterson et al. 2008). The values of the AUC of the ROC curve range from 0.5 to 1.0 with 0.5 indicating no fit and a 1.0 a perfect fit (Fielding and Bell 1997). For the positive lognormal and Delta-GLM models, a linear regression between observed (x-axis) and predicted (y-axis) CPUE will be used to test predictive ability. The coefficient of determination ( $R^2$ ) of this relationship shows the proportion of the linear variation in y (predicted values) explained by the variation in x (observed values), the intercept of this linear regression model describes bias, and the slope describes consistency.

Data collected from the six RERI and the Phase II secondary channels will be reported for each year since these channels were restored. Information for the RERI and Phase II secondary channels will include if the channel was sampled, reasoning for why it was not sampled, and number of endangered, native, and nonnative species captured.

An annual report will provide a summation of data obtained in FY2023, a synthesis of data across years to document/assess species populations' trends, and a summary of mesohabitat associations. Separate data summaries and analyses will also be conducted for any wild age-0 CPM and RBS, if needed. All data collected will be recorded on electronic spreadsheets and provided to USFWS Program Office by the principal investigator, along with the annual final report, by 30 June 2024.

**Task Description, Deliverables and Schedule:**

Description

- Task 1. Sample small-bodied fishes in the San Juan River (late August-early September)
- Task 2. Input and analyze data
- Task 3. Write and finalize annual report

Schedule

- Task 1: 2023
- Task 2: 2023
- Task 3: 2023 and 2024

**Budget Summary:**

FY Year	<i>New Mexico Dept Game and Fish</i>
2023	\$98,754.30
Total	\$98,754.30

**Reviewers:**

Recovery Program Staff and Biology Committee

**References:**

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