

Project Title

Literature review and data synthesis to inform nonnative fish management in the San Juan River (Phase 1)

Bureau of Reclamation Agreement Number:

[if applicable & known]

Reclamation Agreement Term

[Sep. 16, 2019 – Sep. 30, 2024]

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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Category:

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

Expected Funding Source:

- Annual funds
- Capital funds
- Other *[explain]*

Relationship to LRP:

This SOW contributes to Element 3 of the LRP and the following goals, actions, and tasks:

1. Element 3-Management of Nonnative Aquatic Species
 - a. Goal 3.1-Control problematic nonnative fishes

- i. Action 3.1.1-Develop, implement, and evaluate the most effective strategies for reducing problematic nonnative fish
 1. Task 3.1.1.1-Develop and implement a nonnative fish adaptive management plan. Conduct an evaluation and assessment of nonnative fish activities and review the plan.

Study Background/Rationale and Hypotheses:

Establishment and proliferation of nonnative fishes is thought to hinder recovery of endangered fishes. Mechanical removal efforts are implemented in rivers throughout the Colorado River basin in attempts to suppress nonnative fishes (Tyus and Saunders 2000), but with limited documented success both in terms of surpassing nonnative fish and positive responses by native fish (Mueller 2005; Franssen et al. 2014; Pennock et al. 2018). Because these removal programs are both costly and time consuming, the San Juan River Basin Recovery Implementation Program (SJRIP) has decided to take a 3-5 year hiatus from extensive use of electrofishing to remove nonnative fish and use the time and cost savings to investigate potential new ways to increase removal efficiency. For instance, approximately \$4.6 million was spent on mechanical removal efforts from 2011-2021 in the San Juan River (USFWS 2011-2021), but it remains unclear whether removal efforts have resulted in native fish population increases (Franssen et al. 2014).

Mechanical removal of nonnative fishes to aid recovery of endangered fishes in the San Juan River has been ongoing since the late 1990s with variable effort over time (Franssen et al. 2014; Pennock et al. 2018). An evaluation of the mechanical removal program on the San Juan River using data up to 2015 determined size structure is being reduced but exploitation rates are much lower than those predicted necessary to crash the population (Pennock et al. 2018). In 2020 and 2021, biologists experimented with removal efforts during winter when flow and turbidity were lower to increase catch and removal rates. However, removal rates did not noticeably increase (Davenport and Furr 2021), and remained less than those predicted necessary to crash the population (e.g., Pennock et al. 2018). Thus, there is a need to investigate the potential for other removal techniques or management options to substantially suppress Channel Catfish *Ictalurus punctatus* in the San Juan River.

The SJRIP nonnative fish management subgroup outlined potential scope of work ideas that could inform development of a 3-5 year plan to increase the efficiency of nonnative fish management in the San Juan River. Following those outlined ideas, we propose to conduct a literature review of Channel Catfish capture and control methods, seasonal movements, and reproductive ecology throughout their range. We will also review and summarize relevant Colorado River Basin-specific Channel Catfish studies. Information gleaned from this review will be coupled with a synthesis of existing San Juan River studies. Our review and synthesis will benefit managers by identifying alternative capture methods that could increase the efficiency of nonnative fish management in the San Juan River. Given the existing data and information learned from the literature review, we will work with the nonnative fish management subgroup to identify future analyses that would allow us to address priority topics, including spatial and temporal movement patterns, and changes in recruitment, population abundance, growth, and age structure over time.

Study Goals, Objectives, End Product(s):

- 1) Perform a literature review on Channel Catfish capture methods and seasonal movements throughout their range, including review and summarize of relevant Colorado River Basin-specific Channel Catfish studies.
- 2) Perform a data synthesis of existing San Juan River Channel Catfish data to answer priority topics.
 - a. Spatial and temporal movement patterns
 - b. Changes in recruitment, population abundance, growth, and age structure over time

Study Area:

We will utilize existing data on Channel Catfish collected from the San Juan River in New Mexico, Colorado, and Utah.

Study Methods/Approach:

Literature review-Our literature review will follow the recommendations of the nonnative fish management subgroup and focus on the outline below:

1. A review and concise description of Channel Catfish capture methods used in the Colorado River basin, Missouri River basin, and other places where the species is present. The review will include:
 - a. Methods used in recreational, research, commercial, and control capture efforts
 - b. Catch rates for each method
2. A review and concise description of Channel Catfish seasonal movements in other river basins
3. A concise re-communication of the removal methods outlined in the SJRIP's 2010 Nonnative Workshop
4. A concise description of the Tyus and Saunders (1996) report from the upper Colorado River basin that would be useful to the SJRIP
5. A concise description of what was found in nonnative species interaction by Brooks (2000s) – catfish telemetry work
6. A concise history (timeline, summary of the purpose of effort, and results) of nonnative fish removal in the San Juan River
7. Reproductive ecology of Channel Catfish across their range
 - a. Optimal temperatures for spawning and development (e.g., spawning, embryo hatching times)
 - b. Attending parent and larval behavior (e.g., duration, post guarding behavior of larvae)
 - c. Minimum size and age of maturation and spawning
 - d. Size fecundity relationships

Data synthesis-Our data synthesis will assess whether the existing San Juan River Channel Catfish data can address the following topics outlined by the nonnative fish management subgroup:

1. Channel Catfish movement patterns (spatial and temporal)
2. Changes in recruitment through time
3. Population abundance dynamics

4. Growth and age structure across years
5. Links between spawning observations (larval data) and juvenile observations (small-bodied data) in San Juan River and environmental conditions

The nonnative fish management subgroup also requested a review and analysis of Channel Catfish removal exploitation rates and spawning onset. Estimates of removal exploitation rates using current removal methods (i.e., raft electrofishing) were determined by Pennock et al. (2018) for intensive removal and by Davenport and Furr (2021) for winter removal. Investigation of the timing of Channel Catfish spawning is being proposed in another new scope of work (PIs: Clark Barkalow, Diver, and Grey).

To address *Data-synthesis tasks*, we will assess the suitability of existing catfish data in the San Juan River for potential future analyses. This will include compiling data from the Program Office and other offices involved in data collection and organizing the data into datasets relevant to priority topics. Once data are compiled, we will assess whether existing datasets can be used to address priority topics with input and discussion with the nonnative fish management subgroup on potential future analyses. We will participate in nonnative fish management subgroup meetings throughout the project.

Task Description, Deliverables and Schedule:

Task Description: Casey Pennock (PI) will be in charge of overall project management, lead the literature review, and data synthesis. Timothy Walsworth will assist with data synthesis (Co-PI). A research assistant will assist with the literature review and data synthesis.

Deliverables:

An oral report will be given at the SJRIP Annual Biology Committee Meeting in February 2024. At the completion of the project a final report and copies of all datasets will be delivered to the SJRIP.

Schedule:

Task	Oct 2022-Mar 2023	Apr 2023-Sep 2023	Feb2024	Mar 2024
Conduct review				
Acquire data & QA/QC				
Data synthesis				
Presentation to BC				
Submit final report				

Budget Summary:

FY Year	Utah State University	Total
2023	\$126,034.15	\$126,034.15
Total	\$126,034.15	\$126,034.15

This grant would go through the Cooperative Ecosystems Study Unit (CESU) agreement in place with Utah State University which allows a 17.5% overhead rate.

Reviewers:

San Juan River Basin Recovery Implementation Program Biology Committee

References:

- Davenport, S. R., and W. Furr. 2021. Channel Catfish management on the San Juan River 2020 and 2021. Final Report submitted to the San Juan River Basin Recovery Implementation Program.
- Franssen, N. R., J. E. Davis, D. W. Ryden, and K. B. Gido. 2014. Fish community responses to nonnative fish removal in a large southwestern river. *Fisheries* 39:352-363.
- Mueller, G. A. 2005. Predatory fish removal and native fish recovery in the Colorado River mainstem: What have we learned? *Fisheries* 30:10-19.
- Pennock, C. A., S. L. Durst, B. R. Duran, B. A. Hines, C. N. Cathcart, J. E. Davis, B. J. Schleicher, and N. R. Franssen. 2018. Predicted and observed responses of a nonnative Channel Catfish population following managed removal to aid the recovery of endangered fishes. *North American Journal of Fisheries Management* 38:565-578.
- Tyus, H. M., and J. F. Saunders III. 2000. Nonnative fish control and endangered fish recovery: lessons from the Colorado River. *Fisheries* 25:17-24.
- U.S. Fish and Wildlife Service (USFWS). 2011-2021. Annual budget and work plan. San Juan River Basin Recovery Implementation Program. <https://www.fws.gov/southwest/sjrip/budgets.cfm>