RECOVERY PROGRAM

FY 2020-2021 SCOPE OF WORK for:

Assessment of larval Colorado pikeminnow presence and survival in low velocity habitats in the middle Green River

Reclamation Agreement number: _R19AP00059 (UDWR) & TBD (FWS-GRBFWCO)_

Note: Recovery Program FY20-21 scopes of work are drafted in May 2019. 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 (especially in nonnative fish management projects) and changing hydrological conditions.

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Category: __X__ Ongoing project
__ Requested new project
__ Unsolicited proposal

Expected Funding Source: __X__ Annual funds
__ Capital funds
__ Other [explain]

I. Title of Proposal: Assessment of larval Colorado pikeminnow presence and survival in low velocity habitats in the middle Green River

II. Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).
III.A. Reduce negative interactions between nonnative and endangered fishes.
III.A.2. Identify and implement viable active control measures.
III.A.2.c. Implement and evaluate the effectiveness of viable active control measures.
III.A.2.f. Develop control program for removal of small nonnative cyprinids in backwaters and other low velocity habitats.

GREEN RIVER ACTION PLAN: MAINSTEM

III. Reduce impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).
III.A.4. Develop and implement control programs for nonnative fishes in river reaches occupied by the endangered fishes to identify require levels of control.
III.A.4.b.(2) Small nonnative cyprinids from backwaters and other low-velocity habitats in the middle Green River.

III. Study Background/Rationale and Hypotheses:

Fall Interagency Standardized Monitoring Program (ISMP) sampling of age-0 Colorado pikeminnow (CPM) has been conducted annually since the mid-1980s to assess the abundance and distribution of young fish (USFWS 1987). Since 1994, these surveys have shown a reduction in the abundance of age-0 CPM in the alluvial section of the Green River between Split Mountain and Desolation Canyon (Breen et al. 2011). Other studies monitoring the upstream abundance of larval CPM drifting from the Yampa Canyon spawning site during the same time suggest that larval fish production has not decreased from previous levels when age-0 CPM were more abundant in this reach (Bestgen et al. 1998, 2006; Bestgen and Hill 2016). Several possibilities exist for why age-0 CPM are not captured as frequently as they once were, including an increase in nonnative predatory fishes, nonnative competitors, and habitat alterations (e.g., Breen and Jones 2019). Other researchers have investigated environmental conditions such as changes in habitat related to flow and temperature. For example, analysis of available data obtained from 1979–2012 demonstrates that larger Colorado pikeminnow year-class production occurs in the middle Green River when mean August–September base flow levels were 1,700–3,800 cfs (Bestgen and Hill 2016). This study seeks to monitor the arrival and entrainment of larval CPM into backwaters in the middle Green River and investigate the possible influence nonnative fishes may have on age-0 CPM as they arrive and grow in backwater habitats.

Preliminary data collected from 2009–2010 (pilot-level project) and 2012 (full experimental design implemented) have provided valuable insights on age-0 CPM recruitment dynamics in the middle Green River nursery reach (Breen and Jones 2019). More specifically, we have been able to estimate transport abundances for the Split Mountain drift net site and compare those to the Echo Park site upstream, confirming that Colorado pikeminnow larvae are arriving in the nursery reach. We have also been able to document larvae arriving in backwater habitats, successfully deplete those areas of nonnative fish (≥ 90%) before implementing a variety of blocking treatments, and track the occupancy of those habitats through the summer.
Furthermore, following the development of an improved study design (i.e., adequate experimental replication in 2012) to assess blocking treatment effects on age-0 CPM survival in backwater habitats, we determined that backwaters blocked with ½ inch mesh block nets significantly increase small-bodied fish survival. Additionally, we hypothesized that competition for resources in nursery habitats is less of an important factor than predation, thus improving probability of survival. However, unlike the excellent Colorado pikeminnow year classes observed during 2009–2010 sampling for this project, 2012 hydrology did not favor CPM recruitment. Therefore, continuing this work in future years will build a more robust dataset, allowing for comparisons across years with different hydrologic regimes.

IV. Study Goals, Objectives, End Product(s):

Goal:

Increase survival and growth of larval CPM in middle Green River backwaters via reduction of nonnative fishes.

Objectives:

1. Estimate transport abundance of CPM larvae arriving at the upstream extent of the nursery reach (Split Mtn. drift site).
2. Document densities of larval CPM in backwaters as the season progresses.
3. Reduce densities of nonnative fish, particularly cyprinids, in backwater habitats before and after arrival of CPM larvae.
4. Determine success of manipulating backwaters to increase CPM larval survival in backwaters from Red Wash to the Ouray Refuge by removing and excluding nonnative fish followed by the use of various blocking treatments.
5. Assess small-bodied fish community effects from removing nonnative fishes from backwaters.

End product:

1. Documentation of relative abundance of larval CPM spawned in the Yampa River arriving in the Ouray reach.
2. Expected persistence time of larval CPM without any treatment.
3. Determination of whether blocking backwaters depleted of nonnatives is a successful method for increasing the survival and growth of larval CPM in the Ouray reach of the middle Green River.

New task explanation:

Following the completion of a report summarizing the first three years of data collected for this project, Breen and Jones (2019) hypothesized that predation by nonnative piscivores coming from riverine habitats is a significant threat to small-bodied fishes in backwater nursery areas. As such, an evaluation of diel movement in and out of backwaters by deploying fine mesh
directional fyke nets at the mouth of select backwaters every other week following larval drift of native fishes was recommended. In addition to determining changes in the fish community over time, this will allow us to better understand the dynamics and extent of nonnative fishes moving between riverine and backwater habitats to forage on native fishes; to be verified by gastric lavage (e.g., Breen and Ruetz 2006) or dissection to investigate stomach contents). A preliminary investigation was supported by the UCRRP Biology Committee (March 4-5, 2019 Biology Committee meeting) to gather data in order to develop a more comprehensive study in future years; new task 5 for this project.

V. Study Area:

The study area encompasses the middle Green River from Split Mountain boat ramp (RM 319.5) to the Duchesne River confluence (RM 247.9).

VI. Study Methods/Approach:

Our first focus will be to determine the abundance of larval CPM drifting into the study reach and arriving in backwater habitats. This will be accomplished by drift netting upstream of Jensen, Utah and seining all backwaters along the Ouray National Wildlife Refuge and selected backwaters from Red Wash to the Duchesne River. We will not sample backwaters selected for manipulation (see below), as they will be intensively sampled throughout the summer.

Drift net sampling will be initiated at the Split Mountain boat ramp/campground area within 24-hrs after Colorado State University Larval Fish Lab (LFL) field sampling indicates a pulse of CPM larval drift at Echo Park. Previous work indicated that there is approximately a one day lag time between pulses of larvae at Echo Park and Split Mountain in low discharge years (Bestgen et al. 1998). Sampling will target times of higher drift and will be coordinated with LFL personnel. Previous work showed that samples collected in the two sites were most consistent with one another when more larvae were available and the sites were sampled during the same pulse event (Bestgen et al. 1998; Breen and Jones 2019). We will also attempt to coordinate drift net activities with turbidity events detected by the LFL site upstream. We propose more limited drift net collections than the Echo Park site because our objective is only to confirm arrival of larval drift at Split Mountain in similar numbers as in Echo Park. The Echo Park site will still document extent and timing of the entire drift period, whereas the Split Mountain site will confirm that those drift events are continuing downstream and in similar numbers. One drawback to the methodology proposed for Split Mountain will be the possibility of missing drift events if the larvae are present at lower densities over a longer time. This has been observed in years with lower flow and less turbidity (Bestgen and Hill 2016; Breen and Jones 2019).

The sampling design will duplicate that of LFL, namely three nets will be set near shore for 1-2 hours daily at dawn. Nets will be attached to steel frames and deployed in water 0.5-1 m in depth. Flow meters in the net mouth and deployment times will be used to compute the volume of water sampled. Samples will be preserved in ethanol and placed in containers for later sample identification, measurement for length, and enumeration, by both USFWS and LFL.

The other aspect of monitoring will be seining backwaters at Ouray National Wildlife Refuge
during late July and early August. This will be done to gather data comparable to that collected from 1990-1996 (Day et al. 1999). All backwaters will be seined on Ouray National Wildlife Refuge, and selected backwaters from Red Wash to the confluence with the Duchesne River, as feasible. The goal of the Ouray sampling is to collect data that can be used to compare larval densities to previous studies conducted during years with higher CPM recruitment and to increase the odds in detecting the presence of larvae. As mentioned previously, backwaters targeted for nonnative depletions will not be sampled during this portion of the work. Seine hauls will be taken at three transects perpendicular to the axis of the backwater, similar to ISMP sampling. For small backwaters, the entire backwater will be seined. Deep backwaters will be seined parallel to shore. The work by Day et al. (1999) sampled as many as 84 backwaters on the Ouray NWR using this methodology. Depending on overall total length and ability to verify species at sampling time, larval CPM will be identified and released, if possible, or preserved in ethanol for identification in Vernal, and subsequently sent to LFL for verification. If field crews encounter abundant, putative CPM the sampling protocol may be adjusted to minimize mortality (as was the case in 2010; Breen and Jones 2019). Backwater habitat measurements and metrics for catch-per-unit-effort will also be collected after seining to prevent disturbing fish. The objective of this sampling regime is to verify larval CPM are arriving in nursery habitats in numbers comparable to past data from the 1980s to early 1990s and comparable to drift samples upstream in Echo Park. Data currently being collected involve the early stages of drift and fall juvenile counts, and these data indicate there continues to be low recruitment of individuals from the time of drift into fall. If numbers of larvae arriving have declined, determining the point of loss will involve investigating mortality upstream during drift from Echo Park to Split Mountain. Comparable numbers of larvae in this study reach to numbers observed in upper study reaches will allow us to focus efforts on mortality in nursery habitats, after the drift.

The second component of this project is to reduce nonnative fish abundance in nursery habitats to determine the effect on larval CPM survival. Several key results were apparent from our 2010 data (Hedrick et al. 2010) that warranted changes to this portion of our study. Observations were as follows: (1) fish community composition was similar for each of three backwater treatment types, primarily consisting of red shiners, sand shiners, and fathead minnows; (2) we observed more carp in control backwaters, suggesting that we successfully excluded larger fish with blocking treatments; (3) small-bodied nonnative cyprinids were more abundant in blocked backwaters than controls; and (4) the study design was not robust enough to test for statistical differences in backwater blocking treatments and their effect on the survival of age-0 CPM. Although 2010 data was not statistically robust, it appeared that smaller fish were surviving in backwaters blocked by smallest mesh size because there was a lack of predation in those backwaters (Hedrick et al. 2010). Furthermore, as the level of exclusion increased, larval CPM abundance also increased (¼-inch mesh blocking treatments containing the greatest abundance; Hedrick et al. 2010), suggesting that by blocking backwaters, we are increasing YOY CPM survival by decreasing predation from larger fish.

In 2012, the study was repeated with a robust study design (i.e., sufficient replication of each backwater treatment type) to effectively measure depletion, monitor the fish community temporally, and measure survival of age-0 CPM (Skorupski et al. 2012). Results demonstrated that all backwaters were successfully depleted of nonnative fishes by >90% and numbers remained suppressed for 1.5 months in the three different treatment types (backwaters blocked
with ¼-inch mesh block nets, backwaters blocked with ½-inch mesh block nets, and unblocked backwaters). Although 2012 demonstrated backwaters can be successfully depleted and blocking backwaters can reduce the size of cyprinids, the survival of age-0 CPM could not be evaluated because larval abundance was limited due to drought conditions. However, further analyses conducted for a final report summarizing all sampling completed for this project provided several important conclusions and recommendations by analyzing other native species as a surrogate to CPM (Breen and Jones 2019). Most importantly, ½-inch mesh block net treatments had a significant positive effect on native fish survival throughout summer. Moreover, control backwaters contained the lowest abundance of all species, suggesting that predation by nonnative piscivores coming from riverine habitats is a significant threat to small-bodied fishes and blocking treatments positively affect survival in nursery areas (native and nonnative fish). Finally, despite higher abundance of small-bodied nonnative fishes in ¼-inch and ½-inch mesh blocking treatments in 2012, age-0 native fishes were also more abundant (½-inch mesh treatments containing the highest abundance), suggesting that competition for resources in nursery habitats is less of an important factor than predation, and has less of an impact on survival.

Based on final recommendations by Breen and Jones (2019), backwaters for this portion of the study will include two treatments, both of which will be initially closed off and depleted of nonnatives: six control backwaters that will not be blocked after initial depletions and six backwaters blocked by ½-inch mesh nets. Blocking will be accomplished using ½-inch mesh nets reinforced with chicken wire to protect them from beaver damage, thus allowing for some small-bodied fish movement. Depletions will initially occur before arrival of larval CPM. We will sample all backwaters following the ISMP sampling protocol (USFWS 1987) every two weeks after initial depletions to determine levels of nonnative fish encroachment through time. However, we will monitor backwaters weekly during other projects to ensure that the block nets remain intact. During this investigation, habitat information identified by ISMP protocols will be collected, as well as information on backwater temperature using temperature loggers. We will enumerate nonnatives and take a sub-sample to determine average total length of nonnative species in addition to total lengths for all native fish collected. Backwater and seine haul dimensions will be recorded.

Given that unblocked backwaters contained the lowest abundance of all species, suggesting that predation is a significant threat to survival of small-bodied fishes in nursery areas, Breen and Jones (2019) recommended an additional complimentary investigation. Specifically, they recommended an evaluation of diel movement in and out of backwaters by deploying fine mesh directional fyke nets at the mouth of select backwaters following larval entainment of native fishes. Therefore, we will conduct a small-scale preliminary study to gather initial data in order to recommend a more comprehensive study in future years if warranted. For this task, four backwaters will be selected for installation of directional fyke nets consisting of a 50 ft adjustable lead and 25 ft adjustable wings (i.e., removable panels) to completely close off a given backwater habitat. Fyke net panels will be adjusted to either capture fishes attempting to enter or attempting to leave a backwater (i.e., nets will be positioned to detect movement from only one direction). Fyke nets will be set on two consecutive days during crepuscular time periods, every other week once backwater blocking treatments are in place (see above). More specifically, nets will first be set in early morning and then pulled/reset before dark to determine fish movement during daylight hours, and then pulled early the next morning to
determine nighttime movements. Study backwaters for this task may change as needed over the course of the summer during preliminary sampling. Additionally, we will evaluate stomach contents of nonnative piscivores captured during this study either by gastric lavage (e.g., Breen and Ruetz 2006) or dissection to assess predation on age-0 native fishes in backwater nursery habitats.

VII. Task Description and Schedule:

Task 1. Determine abundance of larval CPM present in drift at Split Mountain and arriving in backwaters in the Ouray reach.

Task 2. Deplete nonnative fish in backwaters prior to larval CPM drift and apply backwater blocking treatments.

Task 3. Determine fish community composition in manipulated and control backwaters throughout the summer base flow period.

Task 4. Data analysis and reporting.

Task 5. Fyke-netting backwaters to determine predation effects.

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VIII. Deliverables, Due Dates, and Budget by Fiscal Year:

FY 2020-2024
Program annual reports due each November.
Project data will be submitted to the Recovery Program Database Manager by January.

IX. Budget Summary:

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X. Reviewers:
XI. References:


