

I. Project Title: Identification and Curation of Larval and Juvenile Fish by Colorado State University Larval Fish Laboratory.

II. Bureau of Reclamation Agreement Number(s): R14AP00001

Project/Grant Period: Start date (Mo/Day/Yr): 10/01/14
End date: (Mo/Day/Yr): 09/30/18
Reporting period end date: 09/30/18
Is this the final report? Yes _____ No X

III. Principal Investigator(s): Kevin R. Bestgen (Project Manager), Darrel E. Snyder, and Sean C. Seal

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IV. Abstract: This ongoing project supports Larval Fish Laboratory (LFL) taxonomic, analytical, and curatorial services for specific Recovery Program projects, and as time allows, other incidentally requested taxonomic services and consultation (Task 1). It also provides for ongoing curation (maintenance and management) of the LFL Collection, including controlled access to and use of collection holdings and data by UCRB and other researchers (Task 2).

V. Study Schedule: Ongoing project since 1995. Collections from the following projects are identified, processed, and curated annually with the resultant data provided to the principal investigator as soon as logistically possible after the collections are received:

- Project 22F, LFL—preliminarily identified drift-net and light-trap samples from the lower Yampa, Middle-Green, and White Rivers to assess the larval abundance of Colorado Pikeminnow and Razorback Sucker (Task 1a);
- Project 138, Utah Division of Wildlife resources, Vernal and Moab offices—Interagency Standardized Monitoring Program sample identification/verification as needed;
- Project 158, Utah Division of Wildlife Resources (UDWR) and U. S. Fish and Wildlife Service (USFWS), Vernal offices—drift and backwater samples from the Middle-Green River to help assess factors contributing to the decline of age-0

- Colorado Pikeminnow and simultaneously collected ISMP samples (Task 1b—backlog, study suspended in 2013);
- Project 160, UDWR, Moab—light-trap samples for age-0 razorback sucker and seine samples from the lower Green River (Task 1c);
- Project 163, USFWS, Grand Junction—samples associated with Gunnison River fish community monitoring (Task 1e);
- Project FR-164, USFWS, Vernal—samples associated with Green River Larval Trigger Study Plan monitoring in floodplain wetlands (Task 1f); and
- Project FR-165, UDWR, Vernal— samples associated with Green River Larval Trigger Study Plan monitoring in Stewart Lake floodplain (Task 1g).

This project also supports work for Project 161, LFL— analysis of otoliths from age-0 smallmouth bass taken in the Colorado River (Task 1d), but no analysis was needed or funded for 2014 and beyond. Incidental taxonomic services and consultation on early life-stage taxonomy, sampling techniques, and collection handling are addressed as needed and time allows (also Task 1). General collection maintenance activities (e.g., fluid level and container checks) are conducted annually; other maintenance and management concerns, including National Park Service inventory checks of cross-catalogued holdings are addressed as needed and newly deposited and backlog collections are cataloged as time permits (Task 2). Responses to requests for loans, collection use, or information on collection holdings are provided as needed (also Task 2).

VI. Relationship to RIPRAP: This project is related to General Recovery Program Support Action Plan V (monitor populations and habitat and conduct research to support recovery actions—research, monitoring, and data management). Identification and processing of collections for Projects 22F, 138, 158, 160, 163, FR-164, and FR-165 and otolith analyses for Project 161 contribute to Tasks V.A (measure and document population and habitat parameters to determine status and biological response to recovery actions) and V.B (conduct research to acquire needed life history information). An additional task added for 2018 was statistical analysis of data, mainly for Grand Junction FWS, and was grouped under this project to streamline the process for transferring and receiving funding. The remainder of this project specifically addresses Task V.E (provide for long-term care, cataloging, and accessibility of preserved specimens) and, in that preserved specimens are the ultimate natural history database, contributes to Task V.A.1 (conduct interagency data management program to compile, manage, and maintain all research and monitoring data collected by the Recovery Program).

VII. Accomplishments of FY 2018 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1, Taxonomic Services—The following preserved collections were processed. Task 1a (Project 22F): in 2017, 210 Yampa River drift net samples (495 lots-2,751 specimens) and 26 Green River drift net samples (38 lots-76 specimens). Also, in 2017,

153 razorback sucker light-trap samples (622 lots-5,999 specimens) were taken from the middle Green River.

Project 138: no samples were received for FY2017.

Task 1b (Project 158): no samples were received, suspended in 2013.

Task 1c (Project 160): in 2017, 112 light-trap (340 lots-11,322 specimens) and 22 seine (47 lots- X specimens, awaiting verification) samples were taken in the lower Green River. There were 75 Colorado River light-trap (252 lots-7,489 specimens) and 12 seine (28 lots- X specimens, awaiting verification) samples taken and processed. Additional 10 light-trap (31 lots-293 specimens) and 4 seine (5 lots-7 specimens) samples were taken at the Scott Matheson Wetlands Preserve. Lastly, 29 light-trap (162 lots-7,244 specimens) and 11 seine (27 lots-204 specimens) samples were taken in Lake Powell.

Task 1e (Project 163): in 2017, 105 Colorado River dip net (250 lots-957 specimens and 187 Gunnison River dip net (604 lots-3,617 specimens) samples were processed.

Task 1g (Project FR-165): in 2017, 77 light-trap (172 lots-952 specimens) samples were taken in Stewart Lake.

All processed specimens have been cataloged and shelved as part of the LFL Collection and the collection data forwarded to the responsible principal investigators (PIs) for analysis and reporting except for Task 1c.

Shortcomings— Task 1c is awaiting further verification before completion.

Task 2, Ongoing Collection Maintenance and Management—We: (1) added, as of 30 September, a total of 4,580 lots of fish (119,578 specimens) from UCRB collections or investigations to the cataloged collection (Appendix A), (2) made collection holdings and selected data available to UCRB researchers and other interested parties, and inventory checks requested by the NPS, (3) responded to incidental requests from UCRB researchers for taxonomic assistance or consultation on larval-fish sampling and collection handling matters, (4) corrected incidentally found errors in our catalog database, (5) updated and tested the latest version of our collection database and management program software called *Specify 6*, and (6) conducted an annual fluid level and condition check of our holdings. As of 30 September 2018, we maintain and manage 140,381 lots of cataloged fish (4,430,195 specimens) collected from the UCRB or used for UCRB Recovery Program investigations. These holdings represent almost 96% of all LFL cataloged lots (just over 97% of all cataloged specimens). We also completed analysis of smallmouth bass otoliths collected in 2017 from the Dolores River by Colorado Parks and Wildlife.

No significant progress was made in FY 2018 towards plans for housing the LFL Collection and other natural history collections on campus together as a university natural history museum. The museum facility awaits adequate development-grant funding.

- VIII. Additional noteworthy observations: Reports of such observations are appropriately deferred to the PI's to whom the processed collection data has been submitted.

IX. Recommendations: We recommend continued annual support of Project 15 with sufficient funds for processing newly preserved collections covered by this project, incidental taxonomic services and consultation, and on-going maintenance and management (curation) of all UCRB specimens held by LFL.

X. Project Status: On-track and ongoing.

XI. FY 2018 Budget Status

A. Funds Provided: \$240,722

B. Funds Expended: \$215,789

C. Difference: \$24,933

Explanation: Additional work remains to accomplish 2018 tasks; see Section VII.

D. Percent of FY 2018 work completed and projected costs to complete: about 90% of work completed; funds are sufficient to complete tasks.

E. Recovery Program funds spent for publication charges: \$0

XII. Status of Data Submission (Where applicable): 2018 collection data for Project 22F (Task 1a) was internally submitted to Kevin Bestgen. 2017 collection data for Project 160 (Task 1c) will be submitted to respective PI's as soon as it is completed. 2017 collection data for Project 163 (Task 1e) was submitted to respective PI's. 2017 collection data for Project FR-165 (Task 1g) was submitted to respective PI's.

XIII. Signed: Kevin Bestgen
Principal Investigator Date: 5 December 2018

Signed: Sean C. Seal
Principal Investigator Date:

APPENDIX A:

Study-year sets of Upper Colorado River Basin collection-species lots cataloged as part of the Colorado State University Larval Fish Laboratory Collection from October 1, 2017 through September 30, 2018 (4,580 lots; 119,578 specimens).

Catalog No.	Field Numbers	Description of Sample Sets
141779-1823	LFL-98CO-119-F04.1, F12 to F24	98 SN & EF, ISMP Evaluation, Colorado R, CO
141824-2685	LFL-16GR-LW001 to LW069	16 SN, Green R, Lodore-Whirlpool, CO, UT
142686-3180	LFL-17YA-621A1 to 8143	17 Larvae, DR, Yampa R, Echo Pk,DNM, CO
143181-3218	LFL-17GR-7241 to 8132	17 Larvae, DR, Green R, Echo Pk,DNM, CO
143219-3840	FWS/V-17RZ-001 to 147	17 Larvae, RZ LT, Green R, UT
143841-3877	(non-UCRB collection)	
143878-4481	FWS/GJ-17GU-001 to 187	17 Larvae, DN, Gunnison R, CO
144482-4731	FWS/GJ-17CO-001 to 105	17 Larvae, DN, Colorado R, CO
144732-4777	FWS/V-17RZ-SL1 to SL6	17 LT, Green R, Stewart Lake RZ Eval, UT
144778-5573	LFL-17GR-LW001 to LW069	17 SN, Green R, Lodore-Whirlpool, CO, UT
145574-5583	FWS/V-17GR-JB01 to JB06	17 SN, Green R, Johnson Bottom, UT
145584-5604	MF/FWS-17ER-001 to 006, COY, L73, L77	17 LT & SN, Escalante R, UT
145605-5648	LFL-08HYHA-001 to 032	08 BM Cultured Series, CO
145649-5666	LFL-09HYHA-001 to 011	09 BM Cultured Series, CO
145667-5705, 145707	LFL-08NOST-001 to 038, 040	08 SS Cultured Series, CO
145706	LFL-07CLP-814	07 DN, Cache la Poudre R, SS, CO
145708	LFL-07SC-427A	07 EL, Spring Creek, SS, CO
145709	LFL-07CLP-830B	07 DN, Cache la Poudre R, SS, CO
145710	LFL-07CLP-831C	07 EL, Cache la Poudre R, SS, CO
145711-5799	LFL-07GIAT-001 to 080, B1, B2	07 UC Cultured Series, CO

Catalog No.	Field Numbers	Description of Sample Sets
145800-5971	UDWR-17GR-SL001 to SL072, SLCH1 to SLCH5	17 LT, Green R, Stewart Lake Eval, UT
145972-6000	LFL-07SEAT-001 to 029	07 CR Cultured Series, CO
146001	LFL07SC-510A	07 DN, Spring Ck, CR, CO
146002-6004	LFL-07MK-613A1 to 613A3	07, McKinney Ck, CR, WY
146005-6006	LFL-07SC-808A	07 DN, Spring Ck, CR, CO
146007	LFL-07SC-809C	07 SN, Spring Ck, CR, CO
146008-6012	LFL-07SC-815A to 815B	07 DN, Spring Ck, CR, CO
146013-6057	LFL-08SEAT-001 to 111	08 CR Cultured Series, CO
146058-6108	(non-UCRB collection)	
146109-6132	LFL-06PIPR-A01 to A11	06 FH Cultured Series, CO
146133-6135	LFL-06CLP-7131 to 7133	06 Cache la Poudre R, FH, CO
146136-6196	LFL-07RIBA-001 to 058, B1, B2	07 RD Cultured Series, CO
146197-6216	LFL-07RHCA-001 to 021	07 LD Cultured Series, CO
146217	LFL-07CLP-511B	07 Cache la Poudre R, LD, CO
146218-6229	LFL-08RHCA-001 to 012	08 LD Cultured Series, CO
146230-6250	LFL-07CYCA-001 to 021	07 CP Cultured Series, CO
146251-6301	LFL-07NTCR-001 to 048, B1 to B3	07 GD Cultured Series, CO
146302	LFL-09RM-1118	09 SN, Rolland Moore, GD, CO
146303-6310	TFCF-10NTCR-4131 to 5142	10 LT & DN, Tracy Fish Collection Facility, GD, CA
146311-6320	LFL-07RHOS-001 to 010	07 SD Cultured Series, CO
146321-6322	LFL-06MC-SD01	06 Muddy Creek, SD, WY
146323-6388	(non-UCRB collection)	
146389-6422		GD Study Series, CO
146423-6473	(non-UCRB collection)	
146474-6506		FH Study Series, CO

Catalog No.	Field Numbers	Description of Sample Sets
146507-6654	(non-UCRB collection)	
146655-6712		LD Study Series, CO