

- I. Project Title: **Guide to Cyprinid Larvae and Early Juveniles of the Upper Colorado River Basin with Computer-Interactive Key.**
- II. Principal Investigator(s): Darrel E. Snyder and Kevin R. Bestgen (Project Manager)
mail — Larval Fish Laboratory (LFL), Colorado State University (CSU),
1474 Campus Delivery, Fort Collins, CO 80523-1474
e-mail — Darrel.Snyder@ColoState.edu and Kevin.Bestgen@ColoState.edu
phone — (970) 491-5295 (DES), and (970) 491-1848 (KRB)
fax — (970) 491-5091
- III. Project Summary: This originally four-year project will improve the ability of (Upper Colorado River Endangered Fish) Recovery Program and other researchers to accurately identify cyprinid larvae and early juveniles collected from the Upper Colorado River Basin (UCRB). Objectives are to: (1) well document morphological development of each species, (2) verify existing and find new diagnostic criteria, (3) assemble a computer-interactive key, and (4) prepare a manuscript guide, similar to our recently updated guide for UCRB catostomids. The project remains significantly behind schedule and has been extended for a fifth year to the end of FY 2010 at no additional cost to the Recovery Program. It has been co-sponsored by the National Park Service Glen Canyon National Recreation Area (NPS-GLCA; via Colorado Plateau Cooperative Ecosystem Studies Unit Program, FY 2007 and 2008–09) and indirectly by the Bureau of Reclamation (USBR; via the Cooperative Ecosystem Studies Unit Program, FY 2009) for four species common to both this and a similar, recently funded guide to the cypriniform fish larvae of the Middle Rio Grande (MRG; scheduled for completion in FY 2012).
- IV. Study Schedule:
Task 1: Acquisition of specimens needed for developmental study—FY 2006-2007.
Task 2: Description and illustration of eggs, larvae, and early juveniles—FY 2006-2008.
Task 3: Preparation of computer-interactive key—FY 2006-2009.
Task 4: Synthesis, reporting, presentation, and publication of results—FY 2006-2009.
- V. Relationship to RIPRAP: This project is related to General Recovery Program Support Action Plan items V.B (conduct research to acquire needed life history information) and V.C (develop and enhance scientific techniques required to complete recovery actions).
- VI. Accomplishments of FY 2009 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings: Most of FY 2009 was spent rearing still needed developmental study series of fish larvae; illustrating the morphological development of selected fish; doing morphometric, meristic, morphological, and pigment-pattern analyses; assembling species accounts; and concluding contractual arrangements for the USBR-MRG project which indirectly covers remaining support needed for this project (an unscheduled and unbudgeted task). As a result of the late start of the project in FY 2006, continued efforts to secure co-sponsor funding during portions of the first three years of this project,

continued difficulty in rearing certain species for needed developmental study series, and other logistical delays, the project remains behind its original study schedule and a request for a no-cost extension to the end of FY 2010 was approved.

Task 1: Acquisition of specimens needed for developmental study—

The last specimens in reared series of creek chub and longnose dace were preserved in October 2008 and sand shiner in January 2009. Only acquisition or rearing of brassy minnow and golden shiner developmental study series remained to be completed in the remainder of FY 2009.

Captive brassy minnow brood stock had been artificially spawned by Sean Seal and graduate student Jeff Falke in 2008 but, except for some embryos, recently hatched larvae, and larger juveniles (reared through mid-December), most progeny were required for Falke's research. However, enough additional larvae and early juveniles to complement and fill remaining gaps in LFL Collection holdings were collected in summer 2008 and 2009 by Sean Seal from a Colorado Division of Wildlife pond-rearing effort managed by Ryan Fitzpatrick on the CSU foothills campus.

Current LFL Collection holdings of golden shiner consist mostly of alcohol-preserved larvae, some of which were used for an earlier description of the larvae (Snyder and Snyder 1977), but which are faded and not in sufficiently good condition for current descriptive purposes. Our holdings also include a local formalin-preserved collection of larvae (6–10 mm TL), but some normally diagnostic pigment characters are lacking or incomplete. An ongoing effort to ascertain availability of formalin-preserved, larvae and early juveniles in selected museum and research collections across the country has yet to reveal any holdings of specimens in sufficiently good condition for our purposes. In FY 2009, golden shiner brood stock (acquired in 2007) continued to spawn periodically in their holding tank, but again efforts to rear larvae beyond yolk absorption failed. Attempts to pond-rear golden shiner were thwarted by loss of most remaining brood stock (heron predation?) and disappearance of lab-spawned eggs from screened buckets that were placed in the pond. An effort will be made in fall 2009 and perhaps spring 2010 to collect needed golden shiner specimens from lakes near Fort Collins.

Task 2: Description and illustration of larvae and early juveniles—

Our illustrator, C. Lynn Bjork, completed 9 more three-view drawings in FY 2009: one of sand shiner (flexion mesolarva, completing the set of eight drawings) and the full set of eight for brassy minnow. She has now completed 63 of 72 (6 optional) new drawings originally scheduled to be completed by the end of FY 2008. Three drawings of golden shiner larvae await acquisition of still needed specimens. Because of extreme similarity in the appearance of recently transformed and later juvenile carp, we will use an existing lateral-view-only drawing of a later juvenile rather than prepare a new three-view illustration. The remaining five drawings were optional, intended to replace previously published but less detailed three-view drawings of creek chub and longnose dace, and may not be completed for this guide.

Considerable progress was made in conducting needed morphometric, meristic, morphological, and pigment-pattern analyses and the assembling of species accounts during FY2009. Still, more than half that work remains to be done in FY 2010.

Task 3. Preparation of computer-interactive key to the larvae and early juveniles of UCRB cyprinids—

A draft computer-interactive key to families of fish larvae had been prepared and work was initiated on the key for cyprinid larvae using existing data for some species in FY 2007 and 2008. Little additional work was done on either key during FY 2009.

Task 4. Synthesis, publication, presentation, and reporting of results—

Some progress was made in preparation of portions of the guide manuscript during FY 2009, but most remains to be completed. Inquiries were made with some possible outlets for publication in the event publication through the Colorado Division of Wildlife is not feasible. A project-related poster paper on a draft computer-interactive key to families of fish larvae in fresh waters of the United States and Canada (including those of the Upper Colorado River Basin) was presented at the annual Recovery Program Researchers' Meeting in Grand Junction, 13–14 January, and the annual meeting of the Colorado-Wyoming Chapter of the American Fisheries Society (AFS) in Loveland, Colorado, 23–26 February. A second poster, entitled “Larvae and Early Juveniles of Three Small, Non-native Cyprinids Common to the Upper Colorado River Basin: *Cyprinella lutrensis*, *Notropis stramineus*, and *Pimephales promelas*” was also presented at those meetings, as well as the annual AFS-Early Life History Section Larval Fish Conference in Portland, Oregon, 22–27 July. Our third annual project report was submitted to the Recovery Program on 13 November 2008 and a co-sponsor final report was submitted to the NPS-GLCA on 31 March 2009.

VII. Recommendations: Consider provision for guide publication in Program Guidance.

VIII. Project Status: On track for completion by the end of FY 2010.

IX. FY 2009 Budget Status

- A. Funds Provided: \$21,431 (\$15,771 + \$5,660 carried over from FY 2008) (+ \$6,739 remaining for FY 2009 from co-sponsor NPS-GLCA and \$50,000 as part of USBR-MRG project).
- B. Funds Expended: \$21,431 (+\$6,739 from co-sponsor NPS-GLCA and ~\$15,000 as part of USBR-MRG project).
- C. Difference: \$0 (+ ~\$35,000 as part of USBR-MRG project).
Explanation: See Section VI regarding tasks to be completed in FY 2010).
- D. Percent of the FY 2009 work completed, and projected costs to complete: 55%, ~\$35,000 to complete (as part of USBR-MRG project).
- E. Recovery Program funds spent for publication charges: \$0

X. Status of Data Submission (Where applicable): Not applicable.

XI. Signed: Darrel E. Snyder November 12, 2009
Principal Investigator Date

Signed: Kevin R. Bestgen November 12, 2009
Principal Investigator Date