

- 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 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 in its study schedule and may require a no-additional-cost extension to complete. This project is co-sponsored by the National Park Service Glen Canyon National Recreation Area (via Colorado Plateau Cooperative Ecosystem Studies Unit program, FY 2007 and 2008-09) and indirectly, for species common to both projects, through a similar 4-year project covering the cypriniform fish larvae of the Middle Rio Grande, recently funded by the Bureau of Reclamation (via the Cooperative Ecosystem Studies Unit Program, FY 2009).
- 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 2008 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings: Most of FY 2008 was spent rearing still needed developmental study series of fish larvae, illustrating the morphological development of selected fish, working on draft computer-interactive keys (cyprinid and family-level), and once again seeking co-sponsorship support for the final year of the project to replace support expected from the San Juan River Basin Recovery Program (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 well behind its original study schedule.

Task 1: Acquisition of specimens needed for developmental study—

All developmental study series needed to complement holdings in the LFL Collection now have been acquired or reared except for completion of the golden shiner and brassy minnow series. Golden shiner broodstock continued to spawn periodically in their holding tank, but reared larvae failed to feed and survive beyond yolk absorption. Efforts to overcome this problem will continue. Captive brassy minnow broodstock were artificially spawned by Sean Seal and graduate student Jeff Falke for use in Falke's research, but, except for some embryos and recently hatched larvae, progeny were insufficient for preparation of a formalin-preserved series for developmental study. Several juveniles remaining after Falke's study are being reared to a larger size needed for illustration. An attempt will be made in FY 2009 to again spawn and rear brassy minnow to complete the reared study series.

Several rearing efforts begun in FY 2007 were successfully carried to completion in FY 2008. Rearing of reidside shiner and Utah chub continued through December 2007 and April 2008, respectively, culminating with the preservation of complete developmental study series. Longnose dace continued to periodically spawn in a simulated-stream trough, thereby providing eggs for multiple rearings ending with completion of reared developmental series in June 2008. Red shiner broodstock acquired from graduate student Michelle McGree in October 2007 continued to periodically spawn in aquaria, providing eggs for the rearing and preservation of needed protolarvae and mesolarvae.

Creek chub adults and naturally spawned eggs were collected from Spring Creek in mid-May and mid-June 2008. The adults were stripped in the field for artificially fertilized eggs. Larvae were successfully reared through October 2008, providing a complete series of reared specimens to complement holdings in the LFL Collection.

Sand shiner broodstock were collected locally from Spring Creek and the South Platte River in late March 2008, and ultimately commenced spawning in August in a simulated-stream trough. Multiple batches of eggs were collected from gravel in the trough and reared to provide needed protolarvae and mesolarvae. Some larvae will continue to be reared until December to make the reared series more complete and supplement wild-caught specimens in the LFL Collection.

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

Our illustrator, C. Lynn Bjork, completed 18 more three-view drawings in FY 2008: three of Utah chub (later metalarva–lmt, recently transformed juvenile–jv, and later juvenile–ljev), five of creek chub (recently hatched protolarva–pr, later protolarva–lpr, and recently transformed flexion mesolarva–fm, rjv, and ljev), four of longnose dace (pr, lpr, fm, and recently transformed metalarva–mt), one of speckled dace (pr), three of reidside shiner (pr, lpr, and fm), and two of sand shiner (pr and lpr). She has now completed 54 of 72 (6 optional) new drawings originally scheduled to be completed by the end of FY 2008. This task is well behind schedule with 18 drawings (5 optional) remaining to be prepared in FY 2009, some of which await the acquisition or rearing of still-needed specimens.

Except for existing information that has already been prepared for prior investigations and publications, and morphometric and meristic analyses conducted on some drawing specimens, we have not yet begun acquisition, summary, and comparison of descriptive data (e.g., meristics, morphometrics, size relative to state of development, gut morphology, and pigmentation patterns), or assemblage of species accounts. Most of this work, which was originally scheduled to be completed by the end of FY 2008, has now been deferred to FY 2009.

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 has been prepared and work was initiated on the key for cyprinid larvae using existing data for some species.

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

All work on the guide manuscript has been deferred to FY 2009. The second annual progress report for this project was submitted to the Recovery Program in early November. 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 AFS-ELHS Larval Fish Conference in Kiel, Germany, in August 2008.

VII. Recommendations: We recommend that the Recovery Program continue to sponsor the project through FY 2009 and, if needed, grant a no-cost extension in FY 2010 to complete the project.

VIII. Project Status: On track but still well behind schedule for completion in FY 2009.

IX. FY 2008 Budget Status

A. Funds Provided: \$58,275 (\$12,567 + \$45,708 carried over from FY 2007) (+ \$15,000 from co-sponsor NPS-Glen Canyon National Recreation Area)

B. Funds Expended: \$48,782 (+\$8,261 from co-sponsor NPS)

C. Difference: \$9,493 (+\$6,739 from co-sponsor NPS)

Explanation: See Section VI regarding FY 2008 tasks to be completed).

D. Percent of the FY 2008 work completed, and projected costs to complete: 24% (84% including carried-over work from FY 2007), \$9,493 (55%, \$6,739 from NPS)

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

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

XI. Signed: Darrel E. Snyder November 13, 2008
Principal Investigator Date

Signed: Kevin R. Bestgen November 13, 2008
Principal Investigator Date