

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 their morphological development, (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, but if all goes well, we hope to catch up and still complete it by the end of 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 2007 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Most of FY 2007 was spent making arrangements for and acquiring needed developmental study series of fish larvae, illustrating the morphological development of selected fish, and, as a necessary, but unscheduled and unbudgeted task, seeking co-sponsorship support for the final two years of project. As a result of the latter, the late

start of the project in FY 2006, specimen acquisition and rearing problems, and certain other delays, the project currently remains well behind its original study schedule.

Task 1: Acquisition of specimens needed for developmental study—

Much time was spent exploring potential sources for and acquiring needed developmental series of formalin-preserved study specimens. Arrangements were made for fish collecting, holding and transporting, and importing permits from Colorado, Wyoming, and Utah; the assistance of many biologists in those states and at selected hatcheries; and animal care and use approvals to hold, hormone-inject, and rear fish on campus.

Catherine Sykes and Manuel Ulibarri of Dexter National Fish Hatchery (New Mexico) agreed to preserve fresh developmental series of bonytail and Colorado pikeminnow in 2006 to complete and supplement study series available in the LFL Collection. Those series were received in February 2007. Arrangements for the rearing and preservation of at least an early-stage series of speckled dace initially by Mike Childs and later by David Ward of Bubbling Ponds Fish Hatchery (Arizona Game and Fish Department) fell through because of personnel moves and logistics.

As in 2006, Colorado State University graduate students Michelle McGree and Jeff Falke continued to maintain and try to spawn laboratory stocks of red shiner and brassy minnow, respectively, but again, only Michelle was successful. Michelle provided LFL with red shiner embryos and recently hatched larvae, but we were only able to rear them to first feeding. The red shiner brood stock has been transferred to LFL to try again this winter or spring.

For the rearing of golden shiner, late juveniles and adults were contributed by Outlaw Bait and Tackle of Colorado Springs in February 2007. Larger adults were selected as brood stock, placed in circular tanks with increasing water temperature, and hormone injected, but failed to respond to the injections. Beginning in late April, the fish spawned several times without injection. Eggs and larvae were removed to rearing chambers but, like the red shiners, we were only able to rear them to first feeding.

To secure reproductively ready brood stock, naturally spawned eggs, or artificially fertilized eggs for rearing seven additional species, Sean Seal, and other lab staff conducted 45 sampling events on 24 days between March 2 and August 18, 2007. Eggs of common carp were collected locally and successfully reared. Eggs of speckled dace collected by Robert Compton and Koreen Zelasko in McKinney Creek, Wyoming, were artificially fertilized on site and successfully reared. Some adult speckled dace also were brought back and maintained in our indoor rearing facilities with fish collected last year from Muddy Creek, Wyoming. However, except for one very limited event in 2006, we were unable to get the speckled dace to spawn under laboratory conditions. Creek chub eggs and adults were also taken from McKinney Creek, but the fish had apparently already spawned and were in poor condition, and the attempt to artificially fertilize their eggs failed. Creek chub were also collected locally and returned to the lab on two occasions. The first batch was injected with hormones to induce spawning, but failed. Some fish in the second batch were already ripe and eggs were successfully stripped and fertilized, but most eggs died in a laboratory mishap. Only eggs that had been removed earlier for closer observation survived to provide a series of embryos and early larvae. Eggs of Utah chub were artificially fertilized on site by Sean Seal and Lynn Bjork from

fish collected from Joe's Valley Reservoir, Utah, by Justin Hart and crew of the Utah Division of Wildlife Resources. The eggs were transferred to the laboratory where they hatched and the larvae were successfully reared to provide a complete developmental series. Adult Utah chub from Joe's Valley Reservoir, and also earlier from Utah's Scofield Reservoir, were transported to the lab as back-up brood stock. Redside shiner adults collected by Justin and crew from Scofield Reservoir were also brought to the lab where they spawned in a circular tank. The eggs were removed, hatched, and successfully reared to provide a full developmental series to complete and supplement existing study specimens. Adult longnose dace were collected locally by Sean and Douglas Falconi and brought to our rearing facilities where they have spawned periodically in a trough. The resulting eggs and larvae were successfully reared providing a nearly complete developmental series, although additional formalin-preserved specimens are desired for morphometric and meristic analyses. Sand shiner, for which we need only the earliest larvae, was the only targeted species we failed to collect as reproductively ready brood stock or fertilized eggs.

We had planned to complete acquisition of needed study specimens in FY 2007 and do now have adequate formalin-preserved study series for illustration and morphometric and meristic analyses of most of the 15 species covered by this project. However, we still need a complete formalin-preserved developmental series of brassy minnow, all but the earliest stages of golden shiner and creek chub, the embryos and earliest larvae of sand shiner, more first-feeding red shiners, and additional specimens of various stages to supplement the longnose dace series.

Task 2: Description and illustration of eggs, larvae, and early juveniles of UCRB cyprinids—

Our illustrator, C. Lynn Bjork completed 15 three-view drawings in FY 2007: five of red shiner (recently transformed postflexion mesolarva–pm, recently transformed metalarva–mt, later metalarva–lmt, recently transformed juvenile–jv, and later juvenile–ljv), seven of common carp (recently hatched protolarva–pr, later protolarva–lpr, recently transformed flexion mesolarva–fm, pm, mt, lmt, and jv), three of Utah chub (pr, pm, and mt), and one of golden shiner (pr). She has now completed 34 of 58 new drawings originally scheduled to be completed by the end of FY 2007 and 72 by the end of FY 2008. This task is well behind schedule with 38 drawings remaining to be prepared in FY 2008, some of which require the 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 in 2007, we had 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 that was scheduled for completion by the end of FY 2007 has now been deferred to FY 2008 and early FY 2009.

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

Except for the foundation laid in the preparation of computer-interactive keys for prior investigations and publications, we had not yet begun work on the computer-

interactive key, in part because the needed data was not yet in hand. All work on the key has now been deferred entirely to late FY 2008 and FY 2009.

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

A project-related poster on “Taxonomic analysis of early juvenile *Gila* from Yampa Canyon, Dinosaur National Park” by Snyder, Bestgen, Davis, and Finney was presented at the annual meeting of the Desert Fishes Council (DFC) in Death Valley National Park in November 2006. The principal investigator also attended but did not present any project results at the annual Recovery Program researcher’s meeting in Grand Junction in January 2007 (the poster presented at DFC had been previously presented at the 2006 researcher’s meeting). Many contacts useful to this project were made during both meetings. Although planned, the principal investigator was unable to participate in the annual AFS-ELHS Larval Fish Conference which was held in St Johns, Newfoundland, in July 2007. The first annual progress report for this project was prepared and submitted to the Recovery Program in November 2006. All work on the guide manuscript has now been deferred entirely to FY 2008 and FY 2009.

Delays and future funding—

FY 2006 work on this project was significantly delayed by extensive, but unsuccessful, efforts to secure additional sponsors for at least the first two years of the project and uncertainty about even Recovery Program funding until FY 2006 was half over in early spring, when the Recovery Program found sufficient funds to cover the full budget for the first two years. However, the Recovery Program informed us that it could not assure continued funding for the project in FY 2008 and 2009, and that we were expected to continue pursuing co-sponsors to fund or help fund work in the last two years of the project. Accordingly, in FY 2007, we resumed our efforts to secure co-sponsors and funding for FY 2008 and 2009, supplanting in the process considerable FY 2007 research time and budget, and further delaying progress on the project. We successfully requested and received co-sponsorship support in the amount of \$15,000 for both FY 2007 and FY 2008 from the National Park Service (NPS) Glen Canyon National Recreation Area (Mark Anderson) via the Colorado Plateau Cooperative Ecosystems Study Unit program (CP-CESU). (See “Explanation” below in Section IX-C regarding use of FY 2007 NPS funds to displacement of Recovery Program funds from FY 2007 to FY 2009.) We also again pursued co-sponsorship of the project by the San Juan River Recovery Implementation Program (SJRRIP) and, with the assistance of the Recovery Program director’s office, thought we had secured support in the amount of \$50,000 for FY 2008. With support from these co-sponsors and a successful FY 2008-09 SOW submission to the Recovery Program for the remaining project budget, we thought our project was fully funded. We now understand that expected FY 2008 support was not approved by the SJRRIP, and it appears that we may once again have to devote considerable project time to securing support by additional co-sponsors. If so, the project will be further delayed and completion of the project might need to be extended beyond 2009.

VII. Recommendations:

We recommend that the Recovery Program continue to sponsor the project through FY 2009 to the greatest extent possible.

VIII. Project Status:

Although this ongoing project is well behind schedule at its half-way point, if all goes well in the remaining two years (including resolution of funding problems if necessary), we hope to catch up and get the project on-track for scheduled completion by the end of FY 2009.

IX. FY 2007 Budget Status

- A. Funds Provided: \$91,927 (+ \$93,270 for FY 2006; \$185,197 total)
- B. Funds Expended: \$46,219 (+ \$40,670 carried over from FY 2006 and \$52,600 expended in FY 2006; \$139,489 total)
- C. Difference: \$45,708
Explanation: The NPS Glen Canyon National Recreation Area via the CP-CESU program agreed to co-sponsor the project with \$15,000 in both FY 2007 and FY 2008. However, as accounted for in the FY 2008-09 SOW for this project, because we were already fully funded for FY 2007 by the Recovery Program and FY 2007 funds from NPS had to be expended in that fiscal year, we intend to carry over instead \$15,000 of FY 2006-07 Recovery Program funding to FY 2009. The remaining difference above, \$30,708 (what would have remained without displacement of funds by NPS support), will be carried over to FY 2008 to cover the portion of originally scheduled and budgeted tasks that were not completed in FY 2007 (See Section VI).
- D. Percent of the FY 2007 work completed, and projected costs to complete: 67%, \$30,708 (+ \$15,000 deferred to FY 2009 work as explained above).
- E. Recovery Program funds spent for publication charges: \$0

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

XI. Signed: Darrel E. Snyder November 8, 2007
Principal Investigator Date

Signed: Kevin R. Bestgen November 8, 2007
Principal Investigator Date