

- I. Project Title: Guide to Cyprinid Larvae and Early Juveniles of the Upper Colorado River Basin with Computer-Interactive Key.
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- III. Project Summary: This four-year project will improve the ability of Recovery Program and other researchers to accurately identify cyprinid larvae and early juveniles from the UCRB. Objectives are to: (1) fully document their morphological development, (2) verify existing and uncover new diagnostic criteria, (3) assemble a computer-interactive key, and (4) prepare a manuscript guide, similar to our recently updated guide for UCRB catostomids, all by the end of FY 2009. Although funded late in FY 2006, we arranged for the preservation of a few needed developmental series, attempted to rear others, and prepared 19 three-view drawings by the end of September.
- 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, publication, presentation, and reporting 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 2006 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:
- Task 1: Acquisition of specimens needed for developmental study—
We reviewed and organized our holdings of reference and prior study series of bonytail, humpback chub, and roundtail chub. Reference and study series for most other species in the LFL Collection were already organized for reference and study, but many of these are old and will need to be supplemented as needed with additional specimens from voucher collections in the LFL Collection or from other sources. The Museum of Southwestern Biology in Albuquerque, NM, and the Aquatic Research Center of the Indiana Biological Survey, Bloomington, IN, were contacted about possible loans of developmental series, but neither had series of needed species. Other museums and collections will be contacted in FY 2007.

We arranged for preservation of a few needed developmental series from hatcheries or other researchers. A full developmental series of bonytail and series of recently hatched Colorado pikeminnow were requested from Dexter National Fish Hatchery (NFH), NM. Neither Willow Beach NFH, AZ, nor CDOW's Native Aquatic Species Restoration Facility in Alamosa, were rearing other needed species. Jeffrey Falke and Michelle McGree, both CSU graduate students, agreed to preserve a developmental series of brassy minnow and series of late embryos and recently hatched red shiner, respectively, which they planned to rear for other purposes, but only Michelle was successful this year.

Sean Seal, LFL Research Associate, accepted responsibility for setting up LFL spawning and rearing facilities and acquiring and spawning ripe brood stock for culture of other needed developmental series. Speckled dace, presumably in prespawning condition, were collected and transported (under appropriate state permits) to us from Muddy Creek in Wyoming by Robert Compton of the University of Wyoming. LFL staff collected potential brood stock of creek chub, sand shiner, red shiner, brassy minnow, and longnose dace, but efforts to laboratory spawn these fish, sometimes even with hormone injection, were unsuccessful. Speckled dace are still being maintained in hopes of bringing them into spawning condition this winter or next spring. For most needed species, this is a set-back, and we will need to begin anew next spring. A series of late embryos and early larvae of fathead minnow was successfully reared from fertilized eggs provided by Aquatic BioSystems of Fort Collins.

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

From specimens of five species on hand or recently reared, we selected representative specimens for three-view drawings by LFL illustrator, C. Lynn Bjork. By the end of September, she had prepared 19 of 29 new drawings originally scheduled for FY 2006 and 72 total planned for our species accounts: four drawings of bonytail (recently transformed stages of each, a protolarva–rpr, flexion mesolarva–fm, metalarva–rmt, and juvenile–rjv), three of Colorado pikeminnow (rpr, a later protolarva–lpr, and fm), five of fathead minnow (rpr, fm, rmt, rjv, and a later juvenile–lrv), five of sand shiner (a recently transformed stage of a postflexion mesolarva–pm, rmt, a later metalarva–lmt, rjv, and lrv), and two of red shiner (rpr and lpr). The remaining 48 of 120 drawings needed for our 15 species-account descriptions were previously prepared for prior investigations and publications.

Except for existing information that has already been prepared for prior investigations and publications, 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. About one-third of that work was originally scheduled for FY 2006, but has now been deferred to subsequent years.

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. About 25% of this task was originally scheduled for FY 2006 and must be deferred to subsequent years.

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

No descriptive data from this project was available for presentation at the 2006 annual meeting of the American Fisheries Society Larval Fish Conference which was held in Lake Placid, NY in September. However, posters on similar guides and keys for UCRB catostomid larvae and selected Gila River Basin cypriniform larvae were presented and discussed with other attending larval fish biologists. Also, inquiries were made with several attendees regarding possible availability of already preserved developmental series of needed species (but to no avail).

Some initial work on the guide manuscript (about 25%) was originally scheduled for FY 2006, but has had to be deferred to subsequent years. No progress reports were required (this first one, is due at the beginning of FY 2007).

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 it found sufficient funds to cover the full budget for those first two years. As a result much of the work originally planned for FY 2006 (and the funding for it) must to be carried over into subsequent years, but we still expect to complete the project by the end of FY 2009.

The Recovery Program has informed us that it cannot assure continued funding for the project in FY 2008 and 2009, and that it expects us to continue pursuing co-sponsors to fund or help fund work in the last two years of the project. Accordingly, in FY 2007, and possibly early in FY 2008, we will need to resume efforts to secure co-sponsors and funding for FY 2008 and 2009. We will again pursue support through the San Juan River Recovery Implementation Program and the National Park Service Colorado Plateau Cooperative Ecosystems Study Unit (CP-CESU) Program via Glen Canyon National Recreation Area (Mark Anderson). Among other possibilities, we will also consider applications for grants through the National Science Foundation's Partnerships for Enhancing Expertise in Taxonomy (PEET) Competition and the Bureau of Reclamation's Activities to Avoid Jeopardy Program (probably not until early in 2008 for FY 2008 funds unless funding for FY 2007 can be carried over to subsequent years). Note, however, that time spent pursuing co-sponsors was not planned as part of the project and will likely further delay work on the project itself.

- VII. Recommendations: We recommend that project funds for FY 2006 and 2007 that remain at the end of FY 2007 be carried over to FY 2008 to cover delayed work, that budgets and work scheduled for FY 2008 and FY 2009 be adjusted at that time for delays (discussed above) that have or will cascade through the project, and 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 about a half year behind schedule, and those delays will cascade through the next three years, it is still on-track for completion by the end of FY 2009.

IX. FY 2006 Budget Status

A. Funds Provided: \$93,270 (+ \$91,930 for FY 2007, \$185,200 total)

B. Funds Expended: \$52,600 (as of end of FY 2006)

A. Difference: \$40,670 (+ \$91,930 for FY 2007, \$132,600 total)

Explanation: See discussion at end of Section VI, Accomplishments. . . .

B. Percent of the FY 2006 work completed, and projected costs to complete:

~56%, \$40,670 (+ \$91,930 for FY 2007, \$132,600 total)

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

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

XI. Signed: Darrel E. Snyder November 8, 2006
Principal Investigator Date

Signed: Kevin R. Bestgen November 8, 2006
Principal Investigator Date