Colorado River Aquatic Resource Investigations

Federal Aid Project F-273-R19

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Job Progress Report

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The results of the research investigations contained in this report represent work of the authors and may or may not have been implemented as Colorado Parks & Wildlife policy by the Director or the Wildlife Commission.

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Project Title: Colorado River Aquatic Resources Investigations

Period Covered: July 1, 2011 through June 30, 2012

Project Objective: To document the relative distribution and abundance of the mottled sculpin *Cottus bairdi* and the aquatic invertebrate fauna of the Colorado River in Middle Park, Colorado in 2010 and compare the results with historical data and records compiled over the past 25-40 years, prior to the construction and operation of Windy Gap Dam in 1983.

Job No. 1 Colorado River Aquatic Invertebrate Investigations

Job Objective: Document the relative abundance and distribution of the aquatic invertebrate fauna of the upper Colorado River between the confluence with the Blue River and Windy Gap Dam west of Granby, Colorado.

Progress: This field work for Job No.1 was completed in early summer of 2011. The literature review, data analysis and writing of the first draft of the final report were completed in early July 2011. However, due to the high profile nature of the study the first draft was rigorously reviewed by four Colorado Parks and Wildlife supervisory staff members between early July and late August 2011, before the final report was officially released to the public and other interested parties on September 1, 2011.

Job No. 2. Colorado River Mottled Sculpin Population Studies

Job Objective: Document the relative abundance and distribution of the mottled sculpin *Cottus bairdi* in the upper Colorado River basin from the upstream end of Gore Canyon to the upstream end of the Fraser River Canyon near Tabernash, Colorado, including Willow Creek and the Fraser, Colorado and Williams Fork rivers, upstream and downstream of the mainstem impoundments (Granby, Windy Gap, Williams Fork and Willow Creek reservoirs).

The segment objectives for the 2011 field season were three-fold and as follows:

1. Conduct field investigations to document the microhabitat requirements for successful spawning, egg incubation and hatching by the sculpin *Cottus bairdi* in Colorado. Potential study streams could include Arapaho Creek, Willow Creek, and the Colorado, Fraser and Williams Fork rivers upstream and downstream of the mainstem reservoirs on these five streams in Middle Park as well as segments of the Dolores and Gunnison rivers downstream of the mainstem dams on those two rivers.

2. Document the approximate water temperature that triggers the onset of spawning activity among mottled sculpins in Arapaho Creek, Willow Creek, and the Colorado, Fraser and Williams Fork rivers in Middle Park as well as the Dolores River below McPhee Dam and the Gunnison River below Crystal Dam downstream of the confluence with the Smith Fork of the Gunnison River.

3. Document the approximate time duration (days) and temperature units (˚C) from spawning through incubation and hatching until dispersal of sculpin fry from the nest(s) for as many streams as possible listed in segment Objective 2.

Progress: The study of the spawning, egg incubation and hatching of the mottled sculpin *Cottus bairdi* requires being able to safely get into the stream and locate nesting sites through underwater observation. Male mottled sculpin build nests within and beneath rocks and boulders in high gradient riffles and then perform mating displays to attract females into the nest for spawning. After fertilization of the eggs, the males fan the egg clutches and guard the nest against predators for 4-6 weeks during the egg incubation and hatching period, until the sculpin fry disperse from the nest. Underwater location and observation of mottled sculpin reproductive activity can be accomplished through the use of hand-held periscopes or by underwater snorkeling in dry suits or wet suits

The snowpack during the winter of 2011-2012 approached 500% of normal in the Colorado River basin. Consequently, the subsequent snowmelt and spring-summer discharge levels of the Colorado River and its tributaries in 2011 in Grand County approached some of the highest levels ever recorded since the monitoring of stream discharge began more than a century ago. The data in Table 1 summarizes spring-summer discharge levels for some of the near-record high and record low water years between 1905 and 2012.

Table 1 Comparison of mean monthly discharge levels (ft^3/s) for the Colorado River below Windy Gap Dam for April through August for the years 1905, 1906, 1907, 1977, 1984, 2001, 2002, 2010 and 2011.

Year	April	May	June	July	August
1905	550	1785	4137	1265	437
1906	691	2159	3213	1532	491
1907	863	1714	4393	2749	701
1977	153	207	228	175	107
1984	827	2326	3037	1334	292
2001	154	123	180	243	124
2002	120	149	195	120	74
2010	196	468	1211	321	162
2011	707	1910	3792	2459	673

The exceptionally high spring-summer discharge levels throughout the upper Colorado River basin between April and August 2011 precluded the possibility of safely conducting any field work on this study. Since there was no work completed on this job in the upper Colorado

River basin, it made no sense to initiate any studies of mottled sculpins in the Dolores and lower Gunnison River basins for comparative purposes.

Job No. 3 Technical Assistance

Job Objective: Provide information and assistance to aquatic biologists, aquatic researchers and managers that can be accommodated within the time limits and constraints required to successfully complete the job objectives outlined for Jobs 1 and 2.

Period Covered: July 1, 2011 through June 30, 2012.

Segment Objectives:

1. Assist in collection of naturally spawned wild rainbow trout fry from spawning channels on the Cap K Ranch and transplanting to a fishless pond for rearing through the summer and fall of 2011. Probable time period – Mid July 2011. Duration: 1 Day.

2. Assist in the collection, identification and preparation for PCR testing of aquatic oligochaetes transplanted into Placer Creek (a Rio Grande cutthroat trout core conservation stream), Costilla County, Colorado in 2010 to assess the population structure and reproductive success of the *Tubifex tubifex* one year after the transplant. Probable time period – late summer or early fall 2011. Duration-1 week.

3. Assist in electrofishing operations on the Rio Grande, Mineral County, Colorado to derive trout population estimates and trout population response(s) to stream habitat improvement projects on a 3.7 mile reach of the river. Probable time period- October 2011. Duration- 1 week.

4. Assist is electrofishing operations on the Cap K Ranch and the Fryingpan River to collect brook trout males and brown trout females for spawning to create tiger trout hybrids and conduct population estimates on three ponds to assess the survival and growth of Hofer rainbow trout and tiger trout stocked to control brook trout reproduction. Probable time period- late October-early November 2011. Duration-1 week.

Progress: Technical assistance in the field was provided for all of the aforementioned projects and studies within the time frame outlined in the four segment objectives. The data collected for each of the projects was maintained by the aquatic field biologists or aquatic researchers that were responsible for the studies.

Job No. 4: Professional Publications

Job Objective: Prepare manuscripts for professional publication on a variety of subjects.

Segment Objective 1. Prepare a manuscript for publication on the potential role of various strains or lineages of *Tubifex tubifex* worms for ameliorating or eliminating the impacts of whirling disease in coldwater lake and stream ecosystems in salmonid habitats in Colorado.

Progress: This manuscript has been completed, submitted to the Journal of Aquatic Animal Health (JAAH) for publication. It has been reviewed by JAAH editors, revised as per the suggestions, and re-submitted for publication. We are currently awaiting the response from the editor.

Segment Objective 2. Prepare a manuscript for publication on the reproductive success, growth rates and longevity of pure Hofer strain rainbow trout stocked into private ponds and assess their resistance to infection by *Myxobolus cerebralis (Mc)* compared to brook and brown trout occurring in sympatry with the Hofer trout.

Progress: We have received the results of genetic testing of young-of-the-year wild rainbow trout fry collections on the Cap K Ranch for 2009, 2010 and 2011 indicating pure Hofer strain rainbow trout fry have been produced each year since 2009. Plans and collections are in progress to obtain one additional year of documentation of reproductive success by Hofer strain rainbow trout on the Cap Ranch in 2012. Likewise, one additional year of assessment of the levels of infection by *Mc* among brook, brown and strains of Cap K and Hofer rainbow trout will be collected in 2012, prior to manuscript preparation.

Segment Objective 3. Prepare a manuscript for publication assessing the relative vulnerability of populations of lineage III *Tubifex tubifex* worms to infection by *Myxobolus cerebralis (Mc)* from major river basins across Colorado compared to *Tubifex tubifex* worms belonging to lineages I, V and VI that are not susceptible to the *Mc* parasite.

Progress: This manuscript is largely complete but awaiting final statistical analyses by Dr. Paul Lukacs (associate professor of statistics at the University of Montana - Missoula, MT) after inclusion of additional data for two additional years of experimental exposures.

Segment Objective 4. Prepare a manuscript for publication that documents the relative abundance and longitudinal occurrence(s) of aquatic macro-invertebrate fauna of the upper Colorado River basin in Grand County, Colorado in 2010 compared to that observed in 1980-1981 prior to the construction and operation of Windy Gap Dam in 1983.

Progress: This manuscript has been written and is currently being reviewed by Dr. Boris Kondratieff (Colorado State University professor) for publication. No decision has yet been made as to which journal this manuscript should be submitted for publication.

Segment Objective 5. Prepare a manuscript for publication that documents the relative abundance and longitudinal occurrence of the mottled sculpin *Cottus bairdi* in the upper Colorado River basin in Grand County, Colorado in 2010 upstream and downstream of man-made impoundments in the basin.

Progress: Preparation of this manuscript will begin once GIS-based maps have been developed on the occurrence of mottled sculpin throughout the Colorado, White, Yampa, Gunnison, Dolores, Animas, and San Juan river basins have been generated. These maps are important for comparison purposes and demonstrating just how common these fish are throughout all of the drainage basins in Colorado west of the Continental Divide as well as showing where they no longer occur in Grand County on the upper Colorado River downstream of mainstem impoundments.