

I. Project Title: Colorado's Instream Flow Protection

II. Principal Investigator:

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III. Project Summary:

The purpose of this activity is to continue obtaining instream flow protection as necessary for the endangered fishes of the Upper Colorado River Basin. It entails detailed coordination between Recovery Program agencies as well as other interested parties, water users and environmental interests. All protection is done in accordance with Colorado water law, including instream flow rules and regulations as applicable.

IV. Study Schedule:

Although target dates were identified in the 1999 RIPRAP, the withdrawal of the 1995 instream flow filings on the Colorado and Yampa Rivers resulted in changes to these dates (with the acknowledgement of Recovery Program members and Committees). Much of the initial project has been deferred until FY 2002 - FY 2004. In FY 2004 the instream flow issues will be revisited to determine if there is a need for instream flow filings on the Colorado and Yampa Rivers.

V. Relationship to RIPRAP:

Evaluate need for instream flow water rights, assess legal and physical availability of water, assess compact considerations, five-year periodic review of progress to determine if instream flow filings are necessary.

Evaluate how identified flows will be legally protected, then appropriate and adjudicate in water court if necessary.

Colorado River Action Plan:

Mainstem Colorado River: I.A.4.a,b,c; I.A.5.a,b,c,d; I.B.2; I.B.3; and I.B.4.a,b.

Gunnison River: I.B.1; I.B.2; I.B.3; I.B.4; I.C.1; I.C.2.

Green River Action Plan:

Yampa and Little Snake Rivers: I.B.3; I.C.3; I.D.2.

White River: I.B; I.C.2; I.C.3; I.C.4; I.D.1.

VI. Accomplishment of FY 2001 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Changes to the existing instream flow filings (Case Nos. 5-95CW296 & 595CW297 on the Colorado River, and Case Nos. 6-95CW155 & 6-95CW156 on the Yampa River) occurred at the January and May 1999 CWCB meetings. As a result of concerns expressed by the Service and other Program participants, the CWCB withdrew the baseflow and recovery flow instream flow filings on the Colorado and Yampa rivers. The Colorado Division of Wildlife staff has been instructed to develop new flow recommendation methods and to make new flow recommendations when appropriate. This process will likely be completed in FY 2003. Until the new flow recommendations are submitted and approved, the CWCB will review CDOW activities and the performance of the PBO activities and determine the need for future instream flow protection. The CWCB staff continues to work with the Attorney General's Office, Board Members, Colorado Division of Wildlife, USFWS and Recovery Program participants to stay current with Recovery Program needs. The CWCB participates in providing and protecting water to the 15-Mile Reach through contract deliveries from several upstream reservoirs.

The State of Colorado continues to meet Recovery Goals and maintain Sufficient Progress for the Recovery Program. The Colorado Division of Wildlife continues its research into new instream flow protection methods and recommendations. FY 2001 tasks included fish sampling and habitat mapping and modeling. Excerpts from the CDOW annual progress report are provided in the Appendix.

VII. Recommendations:

It is recommended that the State of Colorado continue to participate in all activities concerning flow protection for the endangered fish in the Upper Colorado River basin.

VIII. Project Status:

Much of this project is on hold.

Since withdrawal of the recovery flow and base flow filings on the Colorado and Yampa Rivers by the Colorado Water Conservation Board, there has been much discussion and uncertainty regarding future instream flow filings for endangered fish in Colorado. Meanwhile a programmatic biological opinion has been developed for the 15-Mile Reach, and other programmatic opinions are expected, including one on the Yampa River. The Implementation Committee approved the Management Committee's recommended approach to defer instream flow filings:

- a) on the Colorado River, for 5 years, contingent upon implementation of the programmatic biological opinion;

- b) on the Yampa River, pending completion of a programmatic biological opinion; and
- c) on the Gunnison River, pending outcome of the Aspinall biological opinion and, if needed, a programmatic biological opinion on the Gunnison River.

The State of Colorado has had considerable participation in the development of the 15-Mile Reach PBO. The CWCB continues to participate in Recovery Program activities such as Coordinated Reservoir Operations, HUP Management efforts and the Coordinated Facilities Study that evaluate alternatives to instream flow appropriations for protection of water for endangered fish.

The CDOW remains focused on studying appropriate methodologies for instream flow recommendations and protection. Due to contracting difficulties, some of the 2-D modeling has been delayed one year and may therefore delay new instream flow recommendations to the CWCB.

IX. FY 2001 Budget Status

- A. Funds Provided: \$12,000 in-kind services, CWCB
- B. Funds Expended: \$ 1,000
- C. Difference: \$11,000

The majority of the work in FY 2001 was performed by the CDOW. Their in-kind contribution to the Recovery Program was significantly greater than that of the CWCB.

D. % of FY 2001 work completed, projected costs to complete:

Specific percentages are difficult to provide due to the indeterminate nature of this issue. At this time, the objective of this element should be considered “ongoing”. Flow protection will be continued by the State of Colorado and other Recovery Program members in compliance with the Cooperative Agreement.

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

X. Status of Data Submission:

The Colorado Division of Wildlife publishes an annual progress report on their investigation of an appropriate standard methodology for instream flow recommendations and protection. Excerpts from the July 2001 Progress Report from the Colorado Division of Wildlife are included in the Appendix. The full report can be obtained from the CDOW office in Grand Junction.

XI. Signature: D. Randolph Seaholm

Date: 1/17/2002

APPENDIX

Colorado Division of Wildlife Instream Flow Methodology Efforts Regarding Endangered Fishes of the Upper Colorado River Basin

Title: Riverine Fish Flow Investigations (Job Progress Report)

Date: June 30, 2001

Principal Investigator: Rick Anderson

Included below are the table of contents and selected sections from the original report. The complete report can be obtained from the Colorado Division of Wildlife.

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INTRODUCTION

Habitat loss is one of the single greatest causes of declines in populations of native fishes in North America (Williams et al. 1989). The need to preserve minimum stream flows was recognized by the state of Colorado by the passage of Senate Bill 97 in 1973. Espegren (1998) states that most instream flow water right filings in Colorado have been for protecting minimum flow for cold water (headwater) habitats. The most common methodologies used in Colorado are the R2Cross method (Nehring 1979) and Instream Flow Incremental Methodology (IFIM) (Bovee 1982). IFIM estimates the amount of usable habitat for fish as a function of discharge by combining habitat suitability curves with the hydraulic model. The habitat component of the model has received much criticism because of assumptions implicit with using suitability curves and assumptions of positive relationships between habitat availability and fish abundance. Validation of these assumptions have been obstacles for successfully using IFIM to model minimum flow impacts on large warm water rivers of the west slope (Rose and Hahn 1989).

Currently there is no standardized approach to establish minimum flow needs on warm water river sections, and the use of sophisticated models appear to be required in high profile situations (Espegren 1998). Warm water fish assemblages appear to require a more intensive approach to instream flow modeling compared to cold water fish communities. Warm water river reaches tend to be lower gradient and have higher channel complexity and sediment loads. Warm water fish populations tend to have higher species diversity. Also habitat suitability curves derived from microhabitat observations do not adequately describe habitat use for many warm water species. A broader community-level perspective, as opposed to an indicator species approach, may be required to protect all habitats of a functioning warm water stream ecosystem.

Instream flow techniques require integration of two processes that combine detailed knowledge of habitat requirements (by species and life stage), and the availability of necessary habitats. Both the collection and analysis of these data bases have been very labor intensive. Recent advances in surveying technique (e.g. G.P.S.) and computer capabilities (G.I.S.) allow for collection and processing of much larger databases. Also, two-dimensional (2-D) flow models may have potential for application in instream flow studies (Leclerc et al., 1995; Bovee, 1996). In theory, 2-D models offer a significant improvement over one-dimensional (1-D) modeling by increasing spatial resolution, allowing for highly accurate quantification of physical habitat availability. A spatially explicit flow model may eliminate the need for microhabitat suitability

curves used by IFIM, and also improve biological resolution of the method. Presently, however 2-D modeling is not widely used for fishery applications and is still an unknown commodity as far as its practicality for instream flow assessment.

The original intent of this study was to develop and validate a methodology for determining instream flow recommendations for warm water fish communities in Colorado (Anderson 1999). This is to be accomplished by determining relationships between habitat availability and flow using a 2-D flow model to simulate meso-habitat diversity and abundance over a range of low flows on several sections of three different rivers. Also fish population and species' life history data will be collected within each of the study sites to provide habitat use and preference data to determine relationships between base flows and habitat availability for native fish species of warm water riverine fish communities.

A new study goal was added in 1999 to submit instream flow recommendations for the Yampa River and Colorado River in the 15-Mile Reach to the Colorado Water Conservation Board (CWCB), with biological justifications for a water right filings in those rivers, by August 2002. The CWCB withdrew water rights filings made in 1995 for these rivers. The 1995 filings were based on recommendations made by the U. S. Fish and Wildlife Service (USFWS) in regard to recovery of endangered fish species [Modde and Smith (1995) and Osmundson et al. (1995)]. In a more recent study Modde et al. (1999) used an inflection point method to assess minimum stream flow needs for Colorado pikeminnow (*Ptychocheilus lucius*) on the Yampa River. Even though the intent of these studies was the same, to determine stream flow requirements for endangered fish, the methods in each study were different. The CWCB expressed a desire to have a more standardized approach for instream flow filings and it is hoped that recommendations using this approach will be acceptable to agencies involved with endangered species recovery.

Study Objectives:

- 1). Model fish habitat availability on warm water sections of three rivers (Yampa, Colorado and Dolores) using the established methods (1-D models) and evaluate the practicality of using 2-D flow models to quantify fish habitat.
- 2). Determine community structure, density and biomass for fish assemblages for river reaches listed above.
- 3). Test for relationships between habitat availability and fish abundance.

- 4). Develop and validate methodologies that use 1-D and 2-D flow models for the Division of Wildlife to use for minimum instream flow recommendations for the warm water sections of the Yampa and Colorado Rivers.

SUMMARY

Electrofishing results in 2000 for species composition and size structure of fish over 15 cm were similar and consistent with earlier years at all stations. But total fish density was somewhat lower than in earlier years (1998 and 1999) on the Yampa River and also lower at the Corn Lake station on the Colorado River. It was suggested that the lower fish abundance in 2000 could be an effect of the lower base flows experienced that year.

A third station was added to the Yampa River in 2000 at Lily Park. This site had grossly different fishery characteristics compared to Sevens and Duffy stations. The observed differences in species composition, density, and sizes between Yampa sites appear to be more related to differences in meso-habitat availability (gradient, substrate particle size, riffle/run ratios) than to differences in predatory pressure, temperature or water quality.

Large differences were observed between the Yampa and Colorado River fisheries. The Colorado River has a different species composition, size structure and much higher total fish and native fish densities. Large predator fish were rare in the 15-Mile Reach and all size and age-groups were present. In contrast predator fish are common in the Yampa and obviously impacts that community. On the Yampa there is a lack of fish under 30 cm, and higher mean lengths for virtually all species at Duffy and Sevens. Even at Lily Park where flannelmouth sucker were abundant, none were sampled under 28 cm.

Habitat analysis completed on the Duffy and Corn Lake sites found very large differences in habitat composition between these two locations. Stream width and therefore total wetted area (habitat potential) at most flows of interest were higher at Duffy than at Corn Lake. Habitat diversity peaked at 1400 cfs at Corn Lake and 180 cfs at Duffy. This is a function of greatly differing channel morphology between the sites. Most of the differences in fish populations appear explainable by difference in habitat availability, even though predation was an influence on the Yampa River.

Riffle habitat is rare at Duffy but abundant at Corn Lake and suggests a direct relationship between habitat availability and bluehead sucker density at these sites. Also the difference in riffle

habitat availability between the two sites suggests macroinvertebrates production would also be much different. It was suggested that abundant and stable riffle habitat at Corn Lake provides an abundant macroinvertebrate forage and this helps explain the much higher fish density in the 15-Mile Reach compared to Duffy.

Shallower low velocity pool habitats are very common at Duffy and rare at Corn Lake. This is reflected in the fish community at these two sites. Duffy is primarily composed of non-native species that prefer pools habitats like white suckers and smallmouth bass and these fish are very rare at Corn Lake. The percent of roundtail chub in the population is similar to pool habitat availability at Corn Lake, but at Duffy in spite of pool habitat availability, chub are rare due to obvious predation.

Run habitats increase with increasing flows at Duffy, but runs decrease as flow increases at Corn Lake. Flannelmouth sucker is a native species associated with deeper runs and are rare at Duffy but numerous at Corn Lake. We believe that future habitat analysis will confirm that run habitat is also more common at the Lily Park site compared to the other two Yampa sites.

The low flows observed in 2000 provide empirical data in regard to justifying instream flow recommendations. One more year of fish sampling will be conducted for this project. This will provide an opportunity to see if fish densities remain at the 2000 level, drop lower, or return to the 1998 and 1999 levels. A relationship between fish density and habitat availability has always been an undocumented assumption of instream flow studies, and this data will help identify this relationship. Given the level of interest in this project, increased efforts will be made for mapping fish distribution and abundance. Fish maps (polygons) will be made so that meso-habitat suitability can be determined in each of the study sites.

CONCLUSIONS and RECOMMENDATIONS

- Large differences were found in habitat and species composition between Duffy on the Yampa River and Corn Lake in the 15-Mile Reach of the Colorado River.
- It is believed that the fishery is near the physical habitat carrying capacity in the 15-Mile Reach and in the Dolores River, but predation is impacting density on the Yampa River.
- The 2-D flow modeling clearly produces excellent habitat mapping results and is absolutely necessary for this project to develop instream flow recommendations for the Yampa and Colorado Rivers. Stewart (2000) summarizes the 2-D modeling work completed at this time.
- A contract to continue 2-D modeling was not approved in 2000 resulting in a one-year delay in making instream flow recommendations for the Colorado River and the Yampa.
- Attempts to start a new contract are in process. An RFP (Request for Proposal) was announced in an open competitive bidding and the RFP was awarded to a contractor. At this time approval for the contract has not been given by DNR, but anticipate that it will be so that work can resume on July 1, 2001.
- Radio telemetry work will continue in 2001 given approval to contract the field work via a purchase order. The telemetry work completed so far provides valuable data on habitat use and movement of bluehead sucker, flannelmouth sucker and roundtail chub.