COLORADO RIVER RECOVERY PROGRAM **RECOVERY PROGRAM**
FY 2002 ANNUAL PROJECT REPORT **PROJECT NUMBER: 70**

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 acknowledgment 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, 5-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.

Yampa and Little Snake Rivers: I.B.3.d., I.C.3.d., I.D.2.d
White River: I.B., I.C.4, I.D.1.
Colorado Mainstem: I.A.5.[a,b,c,d,h], I.B.2, I.B.3.d, I.B.4.[a,b]
Gunnison River: I.B.4, I.C.1.a, I.C.2

VI. Accomplishment of FY 2002 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Changes to the existing instream flow filings (Case Nos. 5-95CW296 & 5-95CW297 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, CDOW, 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 CWCB is also providing and protecting water to the Redlands Fish Passage via a contract with Reclamation and the Service

The State of Colorado continues to meet Recovery Goals and maintain Sufficient Progress for the Recovery Program. CDOW continues its research into new instream flow protection methods and recommendations. FY 2001-2 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 CWCB, 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:

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

j) on the Yampa River, pending completion of a programmatic biological opinion; and

k) 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 1 year and may therefore delay new instream flow recommendations to the CWCB.

IX. FY 2002 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 2002 was performed by the CDOW. Their in-kind contribution to the Recovery Program was significantly greater than that of the CWCB.

D. % of FY 2002 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 Aongoing@. 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 June 2002 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: 12/10/2002

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 2002
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 streamflows 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 equation. 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, 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 intent of this study is to develop and validate a methodology for determining instream flow recommendations for warm water fish communities in Colorado (Anderson and Stewart 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.

The study goal was amended in 1999 to submit instream flow recommendations to the Colorado Water Conservation Board (CWCB) for the Yampa River and Colorado River in the 15-Mile Reach. This assignment was made following a decision by the CWCB to withdraw the 1995 water rights filings for the two rivers instead of defending the filings in water court. 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)]. The CWCB at that time felt the 1995 recommendations had become too controversial due to lack of support from the Service. A tentative date for instream flow recommendations was set, but that date has been moved back a year due to difficulties with contract administration and flow recommendations are expected to be submitted in August 2003.

The CWCB also expressed a desire to have a more standardized approach for instream flow filings for rivers having endangered fish concerns. Up to now, all flow study concerning endangered fish have used different methodologies. The lack of consistency was viewed by the CWCB as troublesome. By using the same methodology for both the Yampa and the Colorado River, it was thought that some of the scientific and social difficulties could be avoided. Also, this study will provide guidance and recommendations for the design and evaluation of future flow studies.

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 except for the Duffy stations on the Yampa River. Much attention was given to the large increase in smallmouth bass composition at Duffy in 2001. Reduction in total fish density from earlier years (1998 and 1999) on the Yampa River were explained by suggesting a reduced carrying capacity due to very low summer flows. Density estimates were higher in 2001 at the Corn Lake and Clifton stations on the Colorado River than in 2000. It was suggested that fish abundance estimates in 2000 were biased low that year.

Lily Park on the Yampa River was sampled only in 2000 and 2001. Fishery characteristics were somewhat different between years and grossly different from Sevens and Duffy stations. The observed differences in species composition, density, and sizes between Yampa sites appear to be a function of differences in meso-habitat availability (gradient, substrate particle size, riffle/run ratios) rather than differences in predatory pressure, temperature or water quality. The between years differences appears to be related to lower flows in 2000 and 2001. Flannelmouth sucker density at Lily Park was very similar to the Colorado River, and it is excepted that medi-run habitat composition will also be similar.

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. In general on the Yampa, there is a lack of fish under 30 cm, and higher mean lengths for virtually all species at Duffy and Sevens.

Habitat analysis completed on the Duffy and Corn Lake sites found very large differences in habitat composition between these two stations. 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 1,200 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 species composition and density appear explainable by difference in habitat availability, and predation on the Yampa River impacted size structure.

Riffle habitat is rare at Duffy but abundant at Corn Lake and suggests a direct relationship between riffle habitat availability and bluehead sucker density at these sites. Also the difference in riffle habitat availability between the two sites suggests macroinvertebrate production would also be much different. It was suggested that abundant and stable riffle habitat at Corn Lake provides abundant macroinvertebrate forage which likely explains higher fish densities in the 15-Mile Reach compared to Duffy.

Shallower low velocity pool habitats are very common at Duffy and rare at Corn Lake at flows common in the base flow period. 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. Roundtail chub are rare at Duffy in spite of pool habitat availability, but chub are probably near carrying capacity at Corn Lake and Clifton. 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 habitats are much more common at the Lily Park site compared to the other two Yampa sites.

The low flows observed in 2000 and 2001 provide empirical data in regard to justifying instream flow recommendations. 2001 was the last year fish sampling will be conducted for this project. The next step is to determine a relationship between fish density and habitat availability and use it to model habitat over a range of flows. Habitat suitability indices will be based on density data obtained during the study period.

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.**

- **Large differences were found in species composition at Duffy between 2001 and the three prior years. It was concluded that low flows of 2000 and 2001 facilitated the large increase in smallmouth bass observed in 2001. It would be interesting to monitor the three Yampa River sites for the new few years and it was recommended that management take that responsibility at the end of this project.**

- **The 2-D flow modeling clearly produces excellent habitat mapping results and is absolutely necessary for this project to develop biologically justified instream flow recommendations for the Yampa and Colorado Rivers.**

- **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.**

- **A new contract was finalized in November 2001. 2-D modeling results are due by June 20, 2002.**

- **Spatial analysis will be conducted in the 2002/2003 fiscal year. Habitat suitability indices will be determined for the native species and used to model habitat availability versus flow. The strength of the correlations between habitat and density will be used as biological justifications for the flow recommendations.**

- **Ironically, at the time of this reporting (May 2002), the state is experiencing a very poor snow pack and runoff and stream flow conditions are forecast to be near record lows. Since this is an instream flow study, it was be highly appropriate to sample fish during severe drought conditions. However the opportunity to sample fish this fiscal year is limited and flow recommendations will not be postponed. Efforts will be made to see if sampling can be accomplished on the Yampa and the Colorado Rivers in the fall of 2002.**

- **Radio telemetry work will be processed in 2002/2003. The telemetry work completed so far provides valuable data on habitat use and movement of bluehead sucker, flannelmouth sucker and roundtail chub.**

- **It is recommended that the principle investigator become trained in hydrology principles and computer processing aspects of 2-D modeling. Most of the delays and unexpected hassles have been related to administering contracts. The trade off is that fish sampling fieldwork will have to be sacrificed in order for the researcher to become proficient and perform the 2-D work himself.**

- **It is recommended that a large block of time be allotted in 2002/2003 for consultation with DOW and CWCB senior staff to determine if and when 2-D modeling should be applied in fish management and future flow studies. If there is large demand for this approach then this project should add a training component to its objectives.**