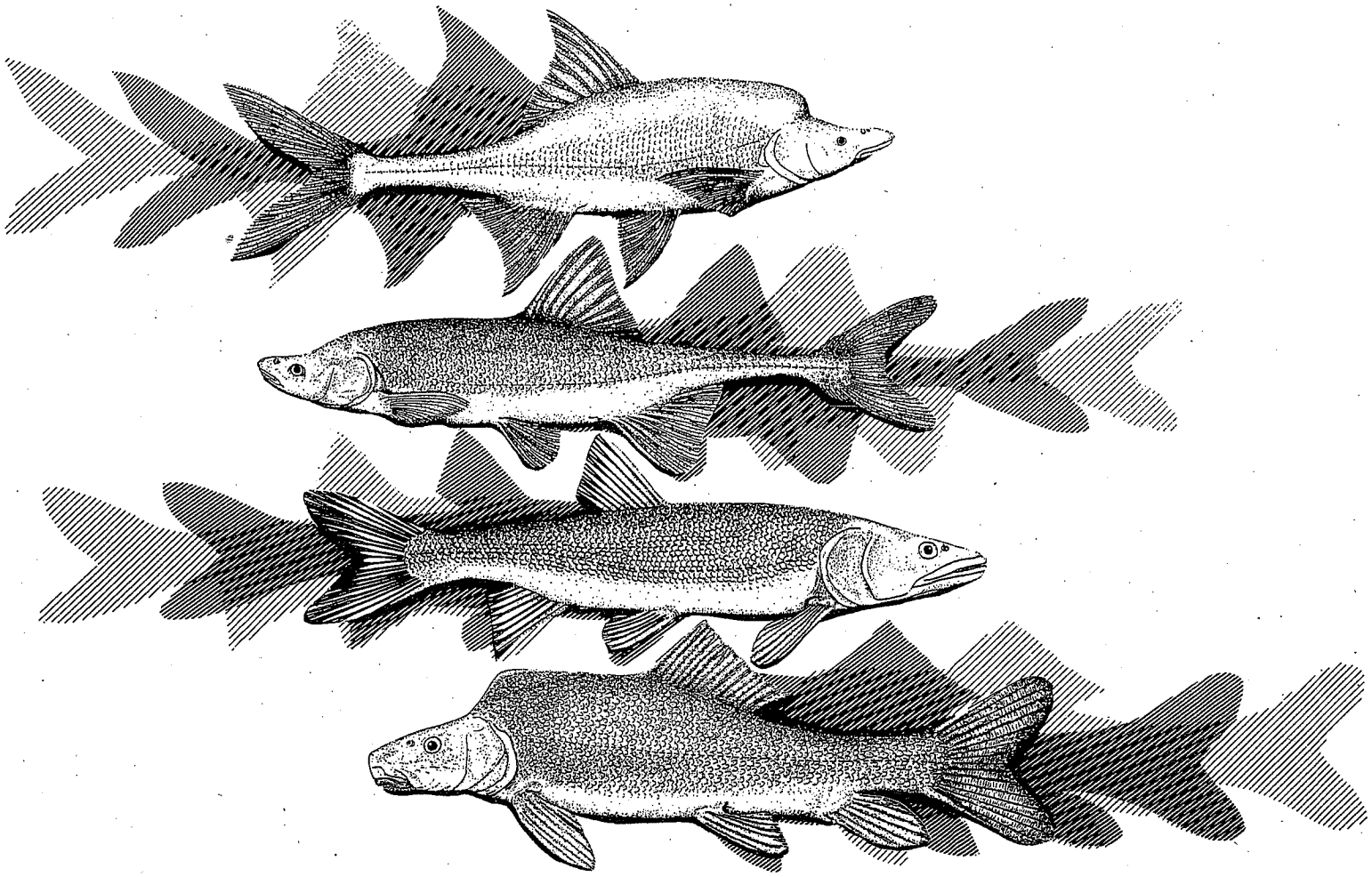

FINAL

RECOVERY IMPLEMENTATION PROGRAM FOR ENDANGERED FISH SPECIES IN THE UPPER COLORADO RIVER BASIN

United States Department of the Interior
Fish and Wildlife Service
Region 6, Denver, Colorado

September 29, 1987

Acknowledgment

The Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) represents the culmination of over 3 years of intense discussions, data analysis, and negotiations by representatives of the Fish and Wildlife Service; Bureau of Reclamation; the States of Colorado, Utah, and Wyoming; and environmental and water development interests. The principal credit for preparing this document belongs to the Recovery Implementation Task Group, a working group of the Upper Colorado River Basin Coordinating Committee (Coordinating Committee). Members of the Task Group included:

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Colorado Wildlife Federation
Barry Saunders, State of Utah
Butch Slawson, Rocky Mountain Oil and Gas Association

The issues faced by the Task Group were sensitive, complex, and of major importance to the water and fishery resource in the Upper Colorado River Basin. The Task Group's professionalism and perseverance were the key factors that brought the process to an effective conclusion.

Valuable contributions to the document were also provided by: Jim Bennett, Colorado Division of Wildlife; Nancy Chu and John Hamill, Fish and Wildlife Service; Robert Wigington, The Nature Conservancy; and Margot Zallen, Regional Solicitor's Office, Department of the Interior. Much of the technical information that formed a basis for the Recovery Program was provided by the Biological and Hydrological Subcommittees of the Coordinating Committee. The efforts of the subcommittees to sort through and synthesize extensive amounts of data greatly improved the quality of the Recovery Program. Finally, Frank Dunkle, Fish and Wildlife Service, deserves much personal credit for establishing the Coordinating Committee and creating an atmosphere of cooperation amongst the participants.

The Fish and Wildlife Service extends its sincere thanks and appreciation to these and the numerous other individuals who contributed to the Recovery Program. While a major job still remains, we believe that the efforts of the past 4 years have greatly enhanced the recovery prospects of the Colorado River endangered fishes.

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1.0 INTRODUCTION

1.1 PURPOSE

This document provides the framework upon which recovery of three species of endangered fish and the management of a fourth fish species in the Upper Colorado River Basin (1) is to be based and the concrete steps that are to be implemented as part of a comprehensive program for all four species, herein referred to as the recovery program. Three species, the Colorado squawfish, humpback chub, and bonytail chub, have been listed as endangered by the Secretary of the Interior under the Endangered Species Act of 1973. The fourth species, the razorback sucker, is a candidate for Federal listing under this Act. The ultimate goal of this recovery program in the upper basin is to recover and delist the three endangered species and to manage the razorback so it would not need the protection of the Endangered Species Act.

This recovery program was developed as part of a cooperative effort that involved many of the agencies and organizations that have an interest in how the Upper Colorado River Basin and its resources are managed. Representatives from the States of Colorado, Utah, and Wyoming; the U.S. Bureau of Reclamation; the U.S. Fish and Wildlife Service; water development interests; and environmental organizations participated.

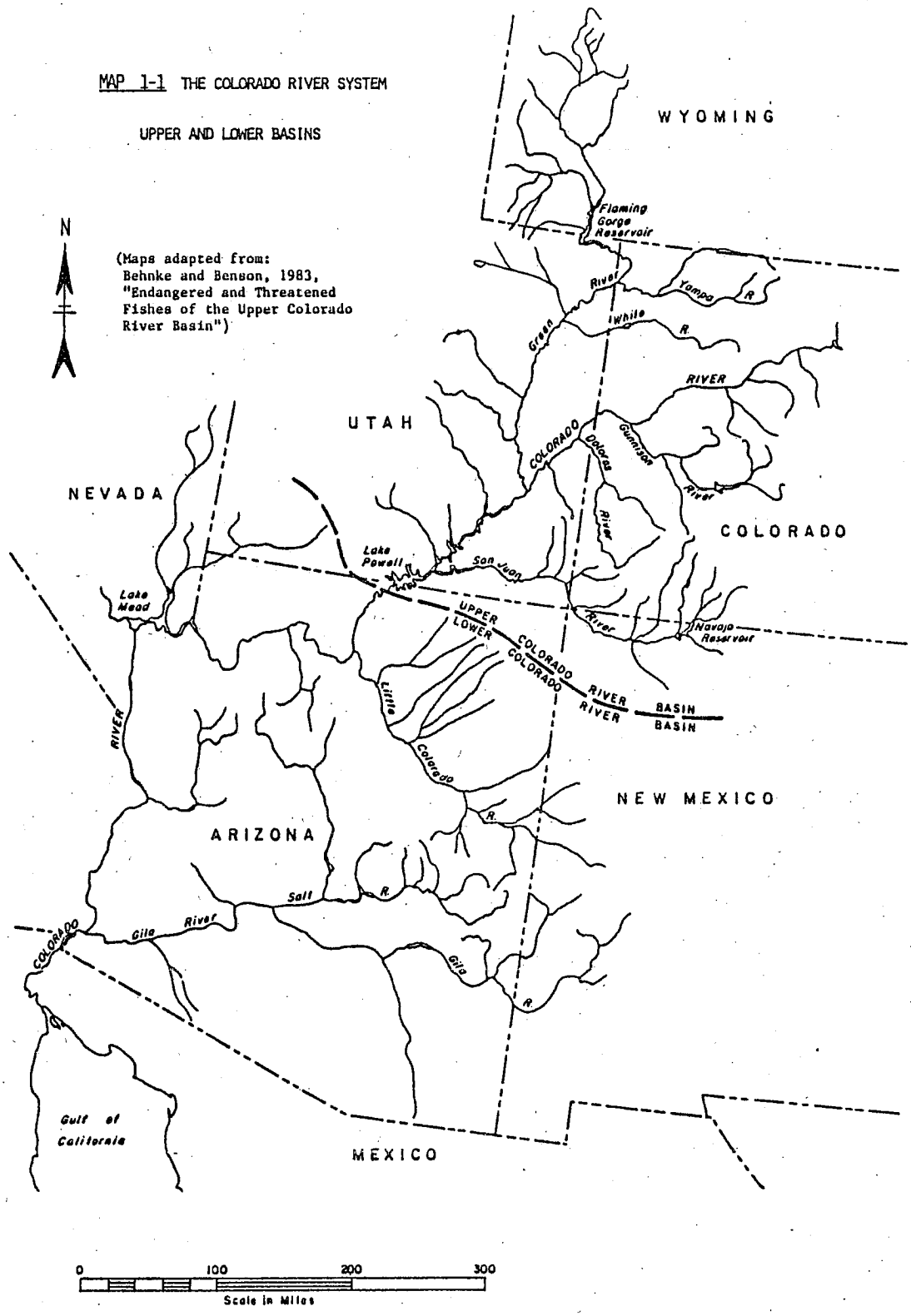
The States of Colorado, Wyoming, and Utah play a key role in determining how the river system's water resources are developed and have a corresponding interest in legal requirements that could constrain water resource development. At the same time, the States historically have been responsible for management of fish and wildlife resources, including threatened or endangered species that occur within their territories. Similarly, the U.S. Bureau of Reclamation (Reclamation) is a pivotal player. It is responsible for operation of a number of Federal reservoirs on the system, ranging from large reservoirs that are used to regulate deliveries under a set of interstate compacts to smaller reservoirs that were constructed to ensure a continuing supply of water for beneficial use. In addition, all Federal agencies are bound by the requirements of the Endangered Species Act.

The U.S. Fish and Wildlife Service (Service), through the Secretary of the Interior, is responsible for administering the Endangered Species Act. In carrying out its responsibilities, the Service is responsible for the protection and recovery of endangered species (Endangered Species Act, 16 U.S.C. 1531 et seq.), including three fish species of the Colorado River system. The Service also has responsibilities for the razorback sucker under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661) and the Fish and Wildlife Act [16 U.S.C. 742f(a)(4)]. The Service provided the organizational focus needed to develop this program in furtherance of its duties under these Acts.

(1) This program applies to the Upper Colorado River Basin above Glen Canyon Dam, excluding the San Juan River which is addressed in the Fish and Wildlife Service's recovery plans for the endangered fishes. The Colorado River Compact division point is at Lee Ferry, Arizona, below Glen Canyon Dam (see Map 1-1).

MAP 1-1 THE COLORADO RIVER SYSTEM

UPPER AND LOWER BASINS



Representatives of non-Federal water resource development organizations also participated in this process. The water resource organizations participated in a search for a practical and meaningful program to manage and recover these fish species in a manner that does not disrupt State water rights systems, interstate compacts, and court decrees that allocate rights to use Colorado River water among the States.

In addition, a number of national and Statewide conservation organizations participated in this process. The conservation organizations were interested both in assuring preservation of the rare and endangered fish species and their habitat and assuring that a realistic recovery program would be implemented in an effective and prompt manner.

Each of these interests participated extensively in the drafting of this program. Each is committed to the successful implementation of a recovery program that will provide for recovery of the endangered fish species, consistent with Federal law and all applicable State laws and systems for water resource development and use.

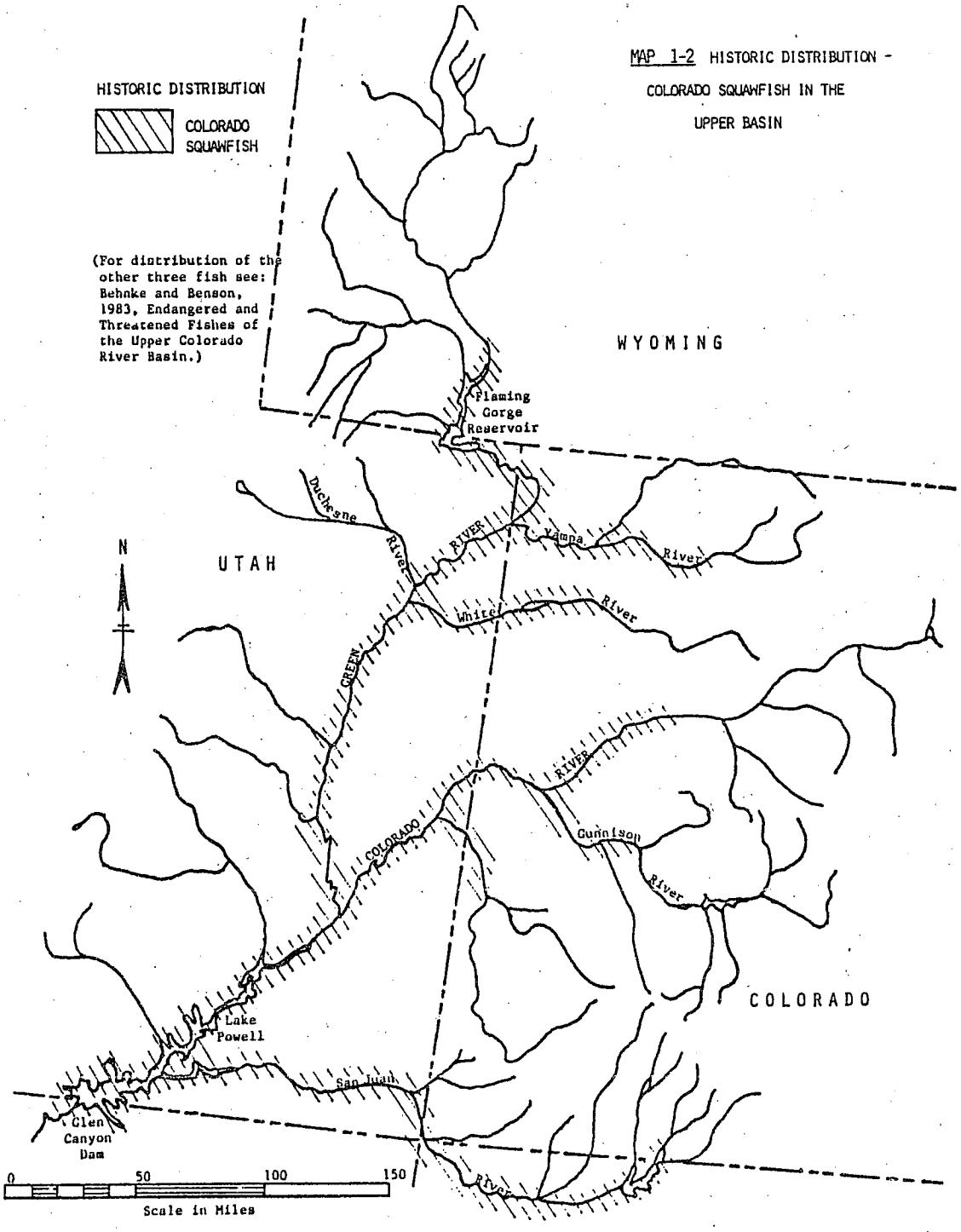
1.2 BACKGROUND

Three fish species that inhabit the Colorado River have been federally listed as endangered: the Colorado squawfish, the bonytail chub, and the humpback chub. The razorback sucker is not listed at this time but has been identified by the Secretary of the Interior (Secretary) as a candidate for listing. For the purposes of simplifying references, all four species are collectively referred to as rare in this document, and measures to manage the razorback sucker are described generically as conservation or recovery activities.

While each of the four species was once abundant in the Upper Colorado River Basin (see Map 1-2), they have been declining in number and are threatened with extinction from their natural habitat (see Map 1-3). A number of factors account for the current status of these species, ranging from habitat reduction or alteration to introduction of nonnative species (see Appendix 6.1). The Fish and Wildlife Service has maintained since 1978 that a jeopardy situation exists because of habitat loss and other factors and because of the declining numbers of the endangered fish due to these factors. It has concluded that actions must be taken to offset these factors. The Service has described this conclusion through Section 7 of the Endangered Species Act in over 100 biological opinions on project impacts on the endangered fishes in the upper basin.

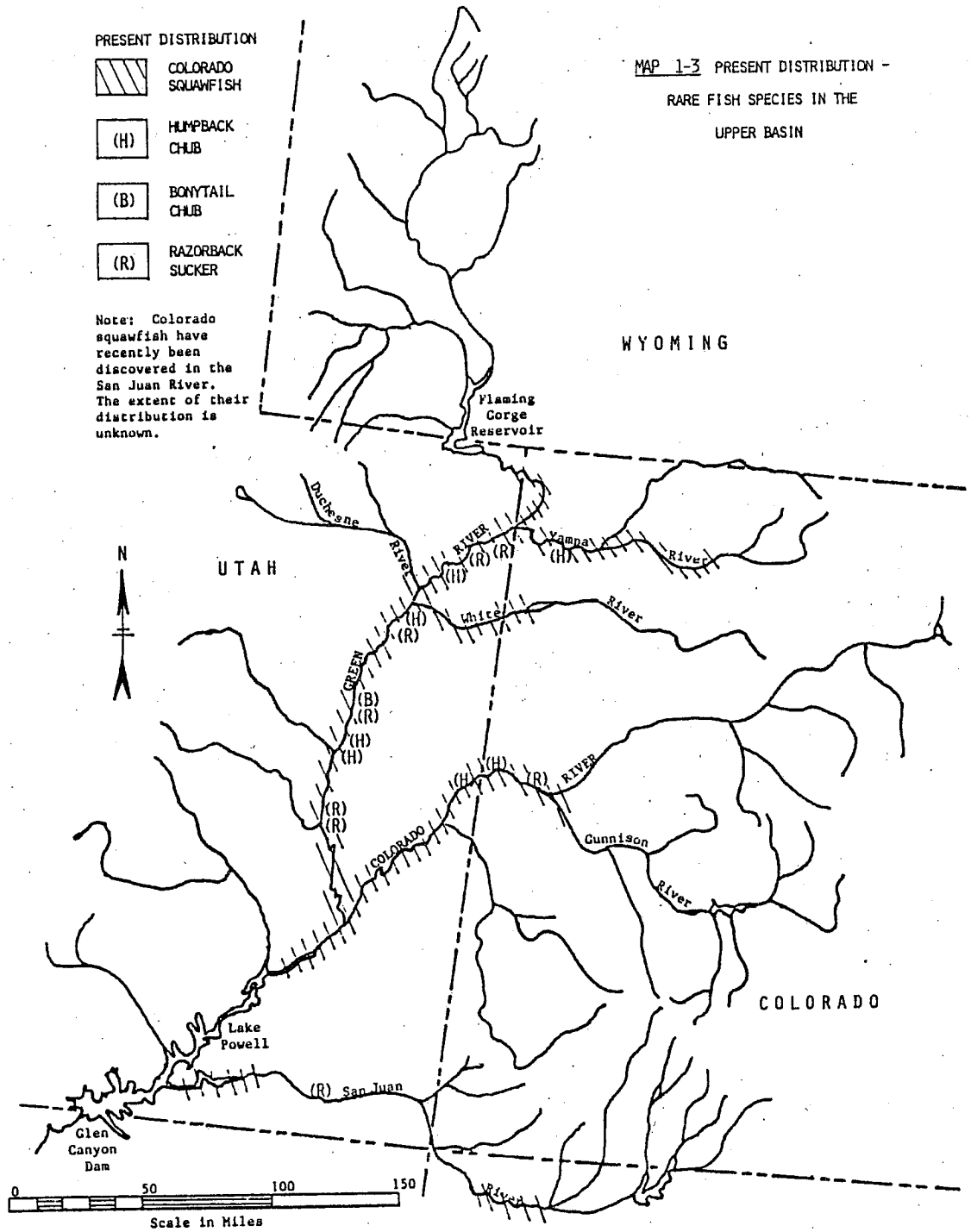
Protection and recovery of these species to offset some of these factors will require resolution of a broad set of potentially difficult issues. First, these fish species are found in two States in the upper basin (Colorado and Utah), and at least one, the Colorado squawfish, is migratory. Second, protection of these species' habitat necessitates maintenance of some level of instream flows, yet the relationship between State water rights systems and Federal responsibilities in this area is a sensitive one. Finally, improving the status of these rare fish will require an increase in population abundance and survival, and improvement and maintenance of sufficient habitat to support all four species.

UPPER COLORADO RIVER BASIN



MAP 1-2 HISTORIC DISTRIBUTION - COLORADO SQUAWFISH IN THE UPPER BASIN

UPPER COLORADO RIVER BASIN



MAP 1-3 PRESENT DISTRIBUTION - RARE FISH SPECIES IN THE UPPER BASIN

The protection of endangered fish species of the Upper Colorado River Basin under Section 7 of the Endangered Species Act threatened to embroil all interested parties in a confrontation between resource protection and resource development. The parties recognized that such a confrontation was unlikely to result in progress toward recovery of the listed species and could lend a measure of uncertainty to future water resource development in the upper basin. As a result, the parties endeavored to accommodate their competing demands through discussion and negotiation.

The forum for these discussions was the Upper Colorado River Basin Coordinating Committee (Coordinating Committee). The Coordinating Committee was formally established in late summer 1984 by a Memorandum of Understanding among the Service, Reclamation, and the States of Colorado, Wyoming, and Utah. The memorandum also established a technical steering committee and subcommittees which were responsible for compiling and assessing data and for making final recommendations to the Coordinating Committee. Representatives of water users and water development proponents, as well as of conservation organizations, were members of these committees.

The Coordinating Committee's formal charge was a narrow one. Recognizing that earlier consultations under Section 7 of the Endangered Species Act had found that new water projects would likely jeopardize the continued existence of the listed fish species, this committee was to identify reasonable and prudent alternatives that would preserve the species while permitting new water development to proceed in the upper basin. However, during their discussions, the parties concluded that both the biological requirements of the four species and the hydrology and management of the Upper Colorado River Basin are exceedingly complex. They also concluded that a systematic approach was needed in order to achieve the committee's fundamental objective of accommodating rare fish species conservation with continued water resource development in the upper basin. This would best be achieved through a concerted and cooperative effort to recover all four species. As a consequence, the parties determined that a comprehensive program is needed to implement a broad range of measures designed not only to preserve the listed species but to ensure their full recovery and eventual delisting under the Endangered Species Act.

1.3 SUMMARY

The recommendations that are outlined in this document represent the consensus of the participants and encompass a range of conservation elements that have been determined to be necessary to protect and recover the Upper Colorado River Basin's rare fish species. It must be noted, however, that the program elements set out below are part of a comprehensive and integrated package, and the successful recovery of the species will depend upon full implementation of each element.

There are five principal elements or tasks in this recovery program: (a) habitat management; (b) habitat development and maintenance; (c) native fish stocking; (d) nonnative species and sportfishing; and (e) research, data management, and monitoring. It is realized that the situation in the upper basin is exceedingly complex and that there is insufficient knowledge to determine precise needs. However, there is consensus among all parties that full implementation is necessary. Each element is briefly described here

along with a review of the new institutional and financial arrangements that will be necessary to ensure that implementation of these elements is carried out in an efficient and effective manner.

Institutional Arrangements--It is anticipated that a Recovery Implementation Committee (Implementation Committee) will be created immediately and charged with overseeing the development and implementation of specific recommendations for each of the recovery elements. This committee will be composed of representatives from Federal agencies, the three States, water development interests, and conservation organizations. Under this program, it is expected that all parties will implement the Implementation Committee's recommendations as legally appropriate. However, this program cannot, and does not in any way, diminish or detract from or add to the Secretary's ultimate responsibility for administering the Endangered Species Act. Nor is it intended to affect the authorities and responsibilities of the States to manage and administer their water and wildlife resources.

Recovery Elements--The recovery program contains five principal elements, summarized in the following section. Each element will be implemented and evaluated on an ongoing basis to determine its effectiveness toward recovery and to provide a balanced contribution from all activities.

This program establishes a unique approach for protecting instream flows for rare fish species' habitat. First, a new fund will be created to be used for acquisition of water rights and other property interests. Second, the Implementation Committee will be responsible for seeing that the Service expeditiously determines flow requirements. The Implementation Committee will make final recommendations on strategies for establishing instream flows after consultation with State and other experts. It is expected that the Service will carry out the Implementation Committee's recommendations on flow acquisition but will do so by working with the State agencies that are responsible for instream flow protection. Under this program, water rights will be appropriated, acquired, and administered pursuant to State law. Reclamation will assist in meeting instream flow requirements for the rare fish through the refined operations of Flaming Gorge, Blue Mesa, and Ruedi Reservoirs in a manner consistent with all applicable laws.

Because the recovery program is intended to provide water rights for instream flows for rare fish, the Service will consider this approach under Section 7 consultation as offsetting depletion impacts. Through this approach, depletion impacts of proposed water and water-related projects would not likely jeopardize endangered species if the program is implemented and project proponents participate in and contribute toward conservation measures under this program. Nondepletion impacts (direct impacts) of water projects such as those caused by construction, inundation, or temperature modifications resulting from reservoir releases will, however, still be subject to implementation of alternatives or recommendations to offset such impacts pursuant to Section 7 of the Endangered Species Act.

While flow protection is important to the maintenance of rare fish habitat, development and enhancement of nonflow habitat techniques will also contribute to a balanced approach to the species' recovery. The habitat development component of this program envisions that habitat management techniques will be thoroughly tested in the field to assess their effectiveness. Those habitat management techniques that are determined to be useful to recovery will then

be employed at suitable locations in the upper basin. One approach that is particularly promising is construction of grow-out (rearing) ponds, where fry and young-of-the-year could be reared under conditions closely similar to those that exist in the wild and from which they can be released into suitable habitat within their historic range in the upper basin.

Species management techniques also will be implemented as part of this comprehensive program. The agencies will thoroughly investigate how artificially reared rare fish stocks can be used in the recovery program. If it is determined that hatchery-reared fish will contribute to recovery, production of hatchery-reared stocks will be initiated. Because the bonytail chub is on the verge of extinction, it will be immediately reintroduced into the wild to attempt to improve its status and to permit more careful study of its habitat requirements. Stocking and management of nonnative species will also be carefully monitored and controlled through a cooperative effort between the State wildlife agencies and the Service to minimize negative interactions between these species and the rare native species.

Finally, it is recognized that there is a need for coordinated research and monitoring efforts among the agencies. Thus, this program establishes a mechanism for assessing population trends for the rare species and for coordinating and prioritizing all research and monitoring efforts.

Funding--Several sources of funding will be needed to finance the recovery program, including funds from the Federal government, the States of Colorado, Utah, and Wyoming, power and water users, and private donations. Funding will be used to finance both annual operations and capital expenditures associated with the recovery program. The annual operating cost of the recovery program is estimated at $2.3 million which will cover activities such as monitoring, research, species and habitat management, acquisition feasibility studies, additional annual flow acquisition expenditures, information and education, and program management.

In addition to the annual budget, a minimum of $15 million will be needed from Congress to be used under advisement of the Implementation Committee for acquisition of water rights to provide flows for rare species ($10 million) and for other critical capital expenditures ($5 million).

New water project proponents involved in Section 7 consultation will also contribute financially to the recovery program. Project proponents will make a one-time contribution of $10 per acre-foot based on the estimated average annual depletion of the project. Existing and future Reclamation projects will be exempt from the depletion charge, since they will refine operations to provide water for rare species and contribute financially to the program.

1.4 IMPLEMENTATION

The recovery program summarized in this document is an integrated, cooperative, comprehensive, and ambitious effort to recover the rare fish species in a manner which is compatible with all Federal and State laws and all private development projects. Each component of this program is necessary and feasible. However, this program is not intended as a precedent that is to be applied in other river basins or other situations.

The primary impetus for developing this recovery program was to provide a mechanism to resolve the Section 7 conflict in the upper basin (see Section 4.1). Implementation and success of this program is based upon the following objectives:

a. Support and participation by all affected parties;
b. Establishment of an effective working committee;
c. Availability of adequate funding to implement all elements (including provision of congressional funds);
d. Implementation within the framework of all existing State and Federal laws;
e. Sufficient period of time to implement and test the process; and
f. Full implementation of all program elements.

Effective and continued progress will be dependent upon meeting these objectives and will need to be assessed periodically to ensure the success of this recovery program.

2.0 RECOVERY GOALS

The ultimate goal of the recovery program in the upper basin is to recover and delist the three endangered species and to manage the razorback sucker so it would not need the protection of the Endangered Species Act.

The Fish and Wildlife Service has developed recovery goals for the federally listed species, the Colorado squawfish, humpback chub, and bonytail chub. These are described in the Service's current recovery plans for the individual species and briefly summarized in Table 2-1. These recovery plans, developed under Section 4(f) of the Endangered Species Act, provide a biological and research-oriented approach to species recovery and include a recommendation for detailed management and site-specific implementation plans. This recovery program provides for the coordinated implementation of these recovery plans for the upper basin.

As described in the current recovery plans, the Service's primary recovery goals for the Colorado squawfish and humpback chub are to restore and maintain self-sustaining populations of both species and sufficient habitat to support these populations. Because of the critical population status of the bonytail chub in the upper basin, the immediate goal for this species is to prevent its extinction.

While the razorback sucker is not listed as endangered or threatened, the Secretary has identified this species as a candidate for listing and is responsible for managing it under the Fish and Wildlife Coordination Act. Because of its current status in the upper basin, it is desirable to consider and provide for the management of the razorback sucker. This program also provides for meeting the management goals of the razorback sucker in the upper basin.

TABLE 2-1 RECOVERY GOALS

Species	Recovery/Management Goals
Colorado Squawfish(1)	Maintain and protect self-sustaining populations and natural habitat;
Humpback Chub(1)	Maintain or establish and protect five self-sustaining populations, natural habitat, and two refugia;
Bonytail Chub(1)	Prevent immediate extinction; Establish and protect six self-sustaining populations and natural habitat;
Razorback Sucker	Establish and protect self-sustaining populations and natural habitat.

(1) Colorado Squawfish Recovery Plan, 1978.
Humpback Chub Recovery Plan, 1979.
Bonytail Chub Recovery Plan, 1984.
(All recovery plans are under revision)

These recovery goals are general, because there is insufficient information about these species to adequately define the parameters of self-sustaining, viable populations for any of them. As the recovery program proceeds, the following measures will be implemented to provide additional indications of population trends to help determine and refine these goals:

a. Measurement of the effect of the recovery activities through a systematic and periodic monitoring program; and

b. Redefinition and quantification of the recovery goals for each of the species.

Field testing of the recovery elements will help refine specific recovery goals. Interim timeframes will be developed by the Implementation Committee to ensure that recovery measures are implemented and periodically evaluated and the program modified accordingly.

Since the recovery plans refer to species recovery in both the upper and lower basins, these goals also apply to both basins, until revised for the upper basin, through implementation of this recovery program. However, the goal of this program for the three endangered species is recovery and delisting in the upper basin. In general, this would be accomplished when the habitat necessary to maintain self-sustaining populations has been determined and provisions are in place to maintain and protect that habitat and these species. The Implementation Committee will be expected to revise these goals for the upper basin as the program develops. Attainment of these goals will result in recovery and delisting of the listed species in the upper basin.

To provide an adequate period to accomplish this objective, 15 years has been specified as the initial timeframe for completion of the recovery program in the upper basin. This program does not include any recovery actions for these species in the lower basin or on the San Juan River.

3.0 INSTITUTIONAL ARRANGEMENTS

3.1 INTRODUCTION

The recovery program described in this document provides a framework for identifying and implementing a broad range of measures to aid in the recovery of four fish species in the Upper Colorado River Basin. Recovery in the upper basin will involve a massive, long-term program of 15 years and will succeed only with the close cooperation of all affected parties. For this reason, the recovery program will be carried out by the Service and a Recovery Implementation Committee made up of representatives of several Federal agencies, three States, water development interests, and conservation organizations. Each of the Federal, State, and private parties identified in this document has an important role to play in ensuring implementation of the recovery program.

3.2 COOPERATIVE AGREEMENT

The Secretary of the Interior and the Governors of the three upper basin States will execute a Cooperative Agreement endorsing and adopting this program and establishing a high-level Recovery Implementation Committee charged with overseeing implementation of the program by the Service. That document will incorporate the terms, objectives, and undertakings of this program and will commit each party to its timely implementation. The Cooperative Agreement will be executed under the statutory authority of the Endangered Species Act and other appropriate Federal and State laws.

Beyond the role of the Secretary and the Governors, it is apparent that a commitment on the part of conservation organizations and water development associations will be required. For that reason, interested water development associations and conservation organizations will, concurrent with execution of the Cooperative Agreement, enter into a Supporting Resolution that sets out the respective parties' expectations and responsibilities for the program's provisions.

3.3 RECOVERY IMPLEMENTATION COMMITTEE

The Cooperative Agreement will establish a new Implementation Committee pursuant to Sections 2 and 4 of the Endangered Species Act as well as other applicable laws. This Committee will have more responsibility with management than recovery teams which are generally biological and research-oriented groups. The Implementation Committee will operate by consensus and will be responsible for overseeing the implementation of this program by the Service. For example, the Implementation Committee will be responsible for reviewing instream flow needs provided by the Service and for recommending how best to secure interests in property to protect those flows. Similarly, the Implementation Committee will be responsible for assessing how public education, hatcheries, passageways, and other measures can contribute to recovery, guiding the research effort, and coordinating all activities.

It is expected that the first assignment of the Implementation Committee will be to review existing activities to further specify roles, responsibilities, funding, and staffing needs. The Implementation Committee will also recommend annual budget priorities and expenditures for the recovery program budget which will be administered by the Service.

Under this program, it is assumed that all implementing parties will carry out the Implementation Committee's recommendations if, in the parties' independent judgment, the recommendations are justified. If any party finds the recommendations are not justified, they will report their position to the Implementation Committee in writing. However, the authority of this Implementation Committee cannot, and does not in any way, diminish, detract from, or add to the authority and responsibilities of the States or Federal government. In addition, each party will need to assess whether its expectations are being met. If any party determines not to participate, they will be requested to report their reasons for withdrawal to the Implementation Committee in writing. The Implementation Committee will be given sufficient time to resolve any problems.

It is recommended the Implementation Committee consist of the following representatives of the major participants in the drafting or implementation of this program. The following represent major participants in both areas and will represent the cosigners of the Cooperative Agreement:

a. The Regional Director for Region 6, U.S. Fish and Wildlife Service;

b. The Regional Director of the Upper Colorado Region, U.S. Bureau of Reclamation; and

c. Representatives (one each) appointed by the Governors of Colorado, Utah, and Wyoming.

Though they have not participated in the drafting of this document, Western Area Power Administration is recommended as a member of this Implementation Committee because of its relationship to Reclamation and program revenues. The following will represent the Department of Energy on the Implementation Committee, if they choose to be a cosigner of the Cooperative Agreement:

d. The Area Manager of Western Area Power Administration.

It is also recommended that the following nongovernment parties, who are major participants in the drafting and implementation of this program, serve on the Implementation Committee. These parties are not cosigners of the Cooperative Agreement but will have entered into a Supporting Resolution.

e. One representative of water development interests (who have executed an agreement in support of the program) to be selected by the Service from a list of nominees submitted by water development interests in Colorado, Utah, and Wyoming; and

f. One representative of conservation organizations (who have executed an agreement in support of this program) to be selected by the Service from a list of nominees submitted by conservation organizations with offices in Colorado, Utah, or Wyoming.

In addition, other agencies may participate if they execute an agreement in support of this program. Other agencies (National Park Service, Bureau of Land Management, National Forest Service, etc.) will participate or observe as appropriate.

The Implementation Committee will select its own chairperson. In addition, the Implementation Committee will include two nonvoting members. The first will be appointed by the Secretary as an observer to provide a direct liaison between the Implementation Committee and the Secretary. The second, a Program Director (Service employee) will be appointed by the Regional Director of the Fish and Wildlife Service upon consultation with the Implementation Committee. The Program Director will serve as the staff person to the Implementation Committee (see Table 3-1).

Recognizing the many competing demands upon the Implementation Committee members' time, this Implementation Committee may establish a management group or technical working groups as needed to provide guidance and assistance to the Implementation Committee or its subgroups. Such groups may be responsible for, among other things, coordination of all research pertaining to the rare fish species of the Upper Colorado River Basin or carrying out management activities of the Implementation Committee, as appropriate.

TABLE 3-1 PROGRAM RESPONSIBILITIES

Implementation Committee	- Oversight forum for major participants.
Secretarial Observer	- Liaison between the Secretary and the Implementation Committee.
Program Director	- Staff assistance to the Service and Implementation Committee.
Management/Technical Groups	- Assistance to the Implementation Committee.

4.0 RECOVERY ELEMENTS

This section describes the initial steps that will be taken to protect and recover the rare species in the upper basin. The recovery program will include the following five elements:

a. Habitat management;
b. Habitat development and maintenance;
c. Stocking of native fish species;
d. Nonnative species and sportfishing management; and
e. Research, monitoring, and data management.

Full implementation of these elements will form the basis for the 15-year recovery program. As other information is developed, it will be incorporated into the program, and additional activities will be defined, modified, prioritized, and initiated on a timely basis. It is not expected that the success of this program will be solely dependent upon any one of these elements, but on the successful interrelationships between all elements.

4.1 HABITAT MANAGEMENT

The four rare fishes, historically located throughout much of the upper and lower basins (see Map 1-2 for upper basin distribution of the squawfish), have become restricted in distribution and abundance because of obstructions to migration, changes in flow regime, and other physical and biological factors (see Map 1-3). To provide for their recovery (see Section 2.0), it is necessary to protect and manage sufficient habitat to support self-sustaining populations of these species. One way of accomplishing this is to provide for effective long-term protection of the habitat by acquiring or appropriating water rights to ensure instream flows.

The Implementation Committee will play a central role in ensuring that flow requirements are identified, that all reasonable means of providing those flows are examined, and that the appropriate Federal and State agencies work cooperatively and expeditiously to establish and protect flows. The water needed to provide flows for rare fish will be appropriated or acquired from a number of sources in a manner consistent with all State laws. To accommodate flow needs, the following mechanism has been developed to provide the assurances that this program can and will be successful.

4.1.1 Principles for Implementation of Habitat Flow Needs

The management and implementation of instream flows to support recovery activities is based upon four fundamental principles.

a. Provision and maintenance of instream flows at certain times, locations, and in certain quantities is necessary to protect and recover rare fish species and habitat in the Upper Colorado River Basin (see Section 4.1.5).

b. Water for instream flows will be provided as part of this comprehensive recovery program that addresses the upper basin and the fish species' habitat needs as a system.

c. Recovery and protection of rare species is to be a cooperative effort between the Federal government, the States, water and power users, and conservationists. This means, among other things, that the cost of providing instream flows and other recovery activities will be shared by these parties (see Section 5.0).

d. Water rights for instream flows established under this process will be appropriated, or acquired, and administered pursuant to State law and will, therefore, be legally protected as any water right under State laws. Where water rights for instream flow cannot be obtained, they will be protected through contracts or administrative agreements with holders of appropriated water rights.

Implementation of these principles will require a coordinated effort among all parties. One of the Implementation Committee's central duties will be to make recommendations to the Secretary and to the appropriate State agencies on maintenance of instream flows, as defined through the following processes.

4.1.2 Determining Habitat Flow Needs

Instream flow needs are based upon the habitat requirements of rare fish species at various life stages (Appendix 6.1). The Instream Flow Incremental Methodology provides a useful framework for relating flow to maintenance of specific habitat needs. However, it is recognized that questions and uncertainties remain in efforts to correlate fish populations and habitat needs with instream flows. This is the reason for the unique approach described in this document. Under this program, research will continue, and new information will continually be integrated into the process for determining instream flows to assist in answering these questions and uncertainties.

Instream flow requirements for the four rare fish species will be established through the following sequence of events:

a. Sensitive reaches requiring specific instream flows will be identified by the Fish and Wildlife Service in consultation with the States and other appropriate parties. The Service will review and update the initial river reach prioritization document previously prepared by the Biology Subcommittee (Appendix 6.3) and will recommend revisions to the Implementation Committee, as necessary.

b. The Service, in consultation with the States, will be responsible for further prioritizing those sensitive reaches to reflect (a) the reaches' biological significance, and (b) the timing of water development or other activities that might affect those sensitive areas. The purpose of this prioritization is to identify those reaches where the Implementation Committee should focus its time and resources in ensuring provision of instream flows for the four rare fish species.

c. The Service will develop a prioritized work plan for identifying habitat needs including instream flow and other requirements, for the sensitive reaches. For example, the Service may determine that additional or new instream flow information is needed on an important river segment and that this work should receive a high priority. The Service will submit to the Implementation Committee, for its review

and comment, a completed work plan within 6 months after the Implementation Committee is established by execution of the Cooperative Agreement between the Secretary and the States.

d. Following the Implementation Committee's concurrence with the work plan, the Service, in coordination with appropriate parties, will quantify the habitat needed for recovery of the rare species within the Upper Colorado River and Green River subbasins and will determine the flow levels which may provide that habitat or a range of habitat over various flow regimes.

e. After determining appropriate flow needs, the Service will recommend these flows to the Implementation Committee for use in implementing the recommendations, as described in the following section.

4.1.3 Implementation of Habitat Flow Needs

Following identification of instream flow needs, the following process will be initiated:

a. Once instream flow needs have been identified, the Implementation Committee will request from staff of the appropriate State agencies (e.g., the Colorado Water Conservation Board) and other Implementation Committee members recommendations on alternative means for providing the desired instream flows. An array of alternatives will be provided by these parties to the Implementation Committee, along with estimates of costs, methods of implementation, timeframes, and procedural requirements.

b. The Implementation Committee will review the available alternatives (see Section 4.14), prepare recommendations, and request the Secretary to implement the Implementation Committee's recommendations. The Implementation Committee will subsequently monitor the efforts of all parties to ensure that the desired instream flows are achieved.

c. The success of this recovery program is contingent upon the provision of water rights for instream flows that satisfy the requirements of the Endangered Species Act, pursuant to State law. The manner in which this will be implemented is described below.

1. ADMINISTRATION OF INSTREAM FLOWS IN COLORADO: The State of Colorado has in place a law that allows for the appropriation and acquisition of water rights to preserve the natural environment to a reasonable degree [Colo. Rev. Stat. 37-92-102(3)]. Instream flows for stream segments within the State of Colorado, including those supplied by Ruedi and Blue Mesa Reservoirs for instream purposes, will be appropriated and acquired by the Colorado Water Conservation Board pursuant to the procedural and substantive requirements of State law. The Secretary will recommend the appropriation and acquisition of instream flow water rights, and the ways and means of doing so, to the Colorado Water Conservation Board.

It is anticipated that the Secretary and the Board will execute an agreement to better define their respective responsibilities under

this program. Such an agreement will provide that the Secretary and the Board will work together in good faith to carry out the terms of this program.

2. ADMINISTRATION OF INSTREAM FLOWS IN UTAH: There are several mechanisms in place in Utah which might be used to protect instream flows. The 1986 Legislature passed a law which gives the Division of Wildlife Resources limited authority to acquire water for protection of public fisheries (with legislative approval). Under this authority, the Division of Wildlife Resources can hold an instream flow right which would be administered by the State Engineer under the water rights system. Also, an opportunity exists to protect specified instream flows in critical reaches by contract or administrative agreement with holders of appropriate water rights (similar to agreements on the Bonneville Unit, Central Utah Project).

   It is anticipated that the Secretary will inform the State of Utah where specific flows are required to support recovery of endangered fishes and arrangements will be made, consistent with State law, to protect the necessary instream flows. It is anticipated that the Secretary and the State of Utah will execute an agreement to better define their respective responsibilities under this program. Such an agreement will provide that the Secretary and the State of Utah will work together in good faith to carry out the terms of this program.

3. The Secretary will not attempt to acquire water rights under this program by condemnation nor acquire rights from other than willing sellers.

4. Once water rights for instream flows are appropriated or acquired for a specific reach of stream, they will be administered by the respective State Engineers pursuant to State law.

5. The ownership of any water rights which are acquired by the Secretary under this program will be transferred to the appropriate State agency on the condition that such water rights will be held only for the protection of the required instream flows. In the event this condition is not met, the ownership of such instream flow rights will revert to the Secretary.

d. In some cases, the Implementation Committee may wish to take advantage of an unexpected development, such as the offer for sale or donation of a water right that is needed to provide instream flows on a certain river reach. In such cases, the Implementation Committee may recommend eliminating some or all of steps a through e, Section 4.1.2.

e. The Secretary's responsibilities in this Section (4.1.3) may be delegated to the Service.

4.1.4 Potential Sources of Water

Identification of instream flow needs and potential sources of water to meet those needs will be conducted on a site-specific basis. Table 4-1 indicates where various sources of water may be most important.

TABLE 4-1. POTENTIAL SOURCES OF WATER BY RIVER REACH

River	Source
Green	Refinement of operation at Flaming Gorge Acquisition of water rights on Yampa River
Colorado	Refinement of operation at Blue Mesa, Ruedi Withholding of water at Ruedi Acquisition of water rights Acquisition of existing storage water
Yampa/White	Acquisition of water rights Acquisition of existing storage water

In the case where instream flow needs are identified, the States and others involved in the process will consider a variety of sources for meeting instream flow needs. For example, the sources may include, where appropriate:

a. Allocation and release of water from existing and new storage projects;

b. Refinement in operation of existing and new reservoirs;

c. Purchase or lease of agricultural water for use during dry years and compensation to irrigators for crop losses;

d. Implementation of agricultural water conservation and salinity control projects and conversion of water conserved to instream flows;

e. Conversion of existing consumptive and conditional rights to instream flow rights;

f. Changing the point of diversion for senior water rights to downstream locations;

g. Federal or State filings on nontributary ground water that could be pumped and put into the streams; and

h. Original appropriation of instream flows in surface streams.

4.1.5 Section 7 Consultation

The mechanism described in the preceding sections is intended to provide the means to protect and manage the stream habitat of the endangered fishes by offsetting some of the factors that led to the present status of these fish. Success of this part of the recovery program is based upon numerous underlying assumptions, as follows:

a. rapid determination of flow needs;
b. sufficient funds to purchase water rights;
c. availability of water rights;
d. protection of instream flows;
e. provision of flows by Reclamation projects; and
f. continued participation and support by all parties.

Effective and continued progress will be dependent upon whether these assumptions are being met through periodic assessment by each party. In evaluating proposed water resource development projects during future Section 7 consultations, the following approach will be used (2) (see Map 4-1 for place names, locations, etc.):

a. Obtaining, administering, and protecting instream flows are defined as recovery activities under this program. Since this program sets in place a mechanism and commitment to ensure that these instream flows are protected under State law, the Service will consider these elements under Section 7 consultation as offsetting project depletion impacts. Therefore, project-related depletion impacts in all river reaches would not likely jeopardize endangered species. Depletion impacts include flow reductions and corresponding changes in temperature, salinity, and turbidity. This agreement is contingent upon program implementation and project proponents contributing to the recovery program.

   As a means of avoiding jeopardy, a one-time contribution will be based on the average annual depletion of a project, as determined in Section 7 consultation, at the rate of $10 per acre-foot, to be adjusted annually for inflation (see Section 5.3.4). This contribution will be used to support any element of this recovery program.

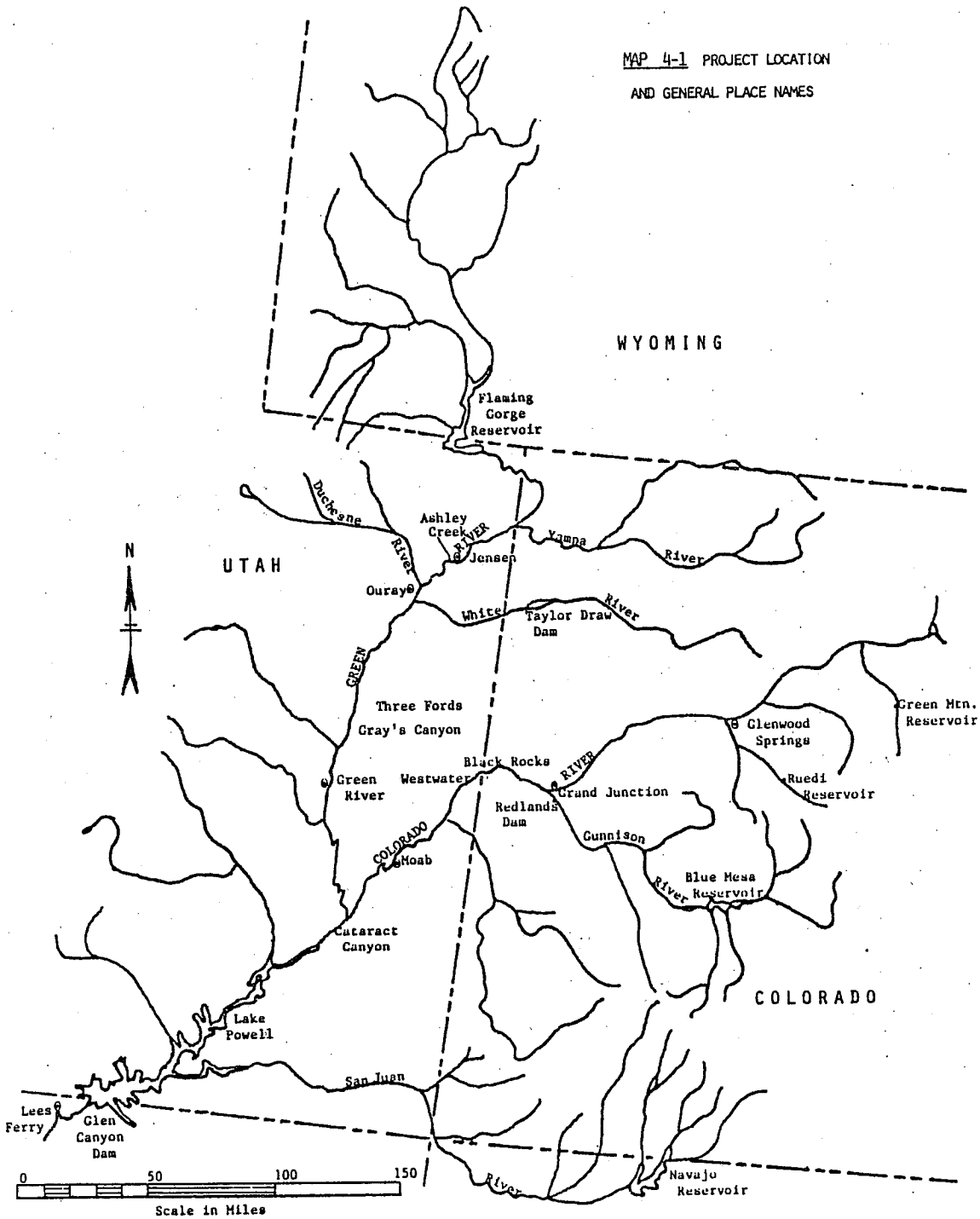
b. Section 7 consultations will be conducted to assess a proposed project's nondepletion impacts (i.e., direct impacts, such as obstructions to migration routes, alteration of physical occupied habitat, construction, inundation, or temperature modification from reservoir releases, etc.), if any, to an endangered fish species or its habitat. Where jeopardy is found, the Secretary will, whenever possible, suggest reasonable and prudent alternatives.

   1. There are certain river reaches that are known at this time to be extremely important to the protection and recovery of these fish (see Table 4-2) for which the recovery program does not offer any offsetting mechanism to direct impacts under Section 7. Proposed actions which would result in direct impacts to these areas would likely result in a situation for which no reasonable and prudent alternatives exist.

   2. In the event that future findings and data confirm that other river reaches are of high priority to the protection and recovery of the endangered fish species, the Implementation Committee will recommend whether those river reaches should be added to this list per Section 4.1.2.

(2) Section 7 consultation does not apply to the razorback (unless or until it becomes listed).

UPPER COLORADO RIVER BASIN



MAP 4-1 PROJECT LOCATION AND GENERAL PLACE NAMES

TABLE 4-2 KNOWN REACHES OF CONCERN

River	Reach	Reason
Colorado	Black Rocks (RM 135-136)(1)	Humpback spawning area Possible bonytail habitat
	Westwater (RM 116-124)	Humpback habitat
Green	Gray Canyon/Three Fords (RM 148-160)	Squawfish spawning area Humpback habitat Possible bonytail habitat
Yampa	(RM 0-56)	Squawfish spawning area Humpback habitat and spawning area Possible bonytail habitat
White	(RM 0-21)	Squawfish high concentration area

(1) RM denotes river mile

c. Currently, there is uncertainty as to what extent depletions occurring in or near occupied habitat may adversely affect habitat quantity or quality and thus affect endangered species. If the Service determines through consultation that one project or a set of projects will result in impacts that will seriously affect the species, the Service will so report to the project proponent, lead agency, and Implementation Committee. The Service and Implementation Committee will identify measures, including the purchase of water through the recovery process, that must be taken to offset these impacts, and these measures will be given immediate attention.

4.1.6. Federal Reservoirs

The water resource development projects constructed in the upper basin by Reclamation may have significantly and adversely affected the river system's rare fish species. In addition to the mechanism described in the preceding sections, there are ways to support essential habitat areas through the refined operation of these reservoirs to reduce or eliminate those adverse impacts and contribute to recovery in a manner consistent with all applicable laws. Reclamation is consulting with the Service pursuant to Section 7 of the Endangered Species Act on the impacts of all its projects, including the projects discussed below. Though the final alternatives for these projects will be determined through Section 7, it is anticipated that the biological opinions will recommend alternatives consistent with those discussed below. Appropriate NEPA compliance will be required.

4.1.6.1. Ruedi Reservoir

The Bureau of Reclamation constructed and operates the Green Mountain Reservoir on the Blue River and the Ruedi Reservoir on the Fryingpan River. They have consulted with the Service under Section 7 of the Endangered Species Act to assess impacts of sales of water from these reservoirs on occupied fish habitat downstream. To compensate for depletions associated with these

projects and to contribute toward the conservation of listed fish, Reclamation, through the consultation process, has agreed to the proposal to set aside a block of water from sale at Ruedi Reservoir and to refine Ruedi operations, as described below:

a. Five thousand acre-feet will be withheld from sale at Ruedi Reservoir and will be made available for rare fish flows, as necessary. The Service, in discussions with Reclamation, the State, and the Implementation Committee, will determine when the reserved water will be needed for endangered fish flows. However, the water withheld for fish flows will be treated as if it were subject to contract to an industrial user, including shortages. It will not be subject to reduction in cases of shortage unless and until Reclamation determines there exists a delivery demand for 40,000 acre-feet of water under contract from Ruedi Reservoir.

b. An additional 5,000 acre-feet will be provided in the months of July-September through refined operations at Ruedi. The release pattern for this water will be determined by the Service (in discussions with Reclamation, the State, and the Implementation Committee) and will be established by June 15 of each year for inclusion in the annual operating plan. Reclamation has agreed that this 5,000 acre-feet will be provided, through refined operations of the Ruedi Reservoir, on an average of 4 out of 5 years.

c. It is expected that Reclamation will implement other measures, that developed jointly with the Service through Section 7 consultation, that are deemed appropriate to offset project impacts or gather information that will assist in determining habitat needs (e.g., studies on winter habitat needs, assistance on developing grow-out ponds, etc.).

d. Reclamation and the Service will cooperate in establishing an instream flow right, pursuant to State laws, to guarantee the delivery of any flow releases through fish habitat (see Section 4.1.3). Due consideration will be given to the Fryingpan River trout fishery and Ruedi Reservoir recreation impacts in the development of a release schedule for the endangered fish flows.

4.1.6.2. Flaming Gorge Reservoir

Operations of the Flaming Gorge Dam have changed the flow regime in the Upper Green River and have impacted spawning and recruitment of Colorado squawfish. In the summer of 1985 and 1986, releases from Flaming Gorge were managed to provide flow variances no greater than those that occurred in 1980. This was done to determine if 1985 and 1986 recruitment would be comparable to the recruitment levels that occurred under 1980 flows. In 1986-87, Reclamation and the Service studied the attenuation of water flows, velocities, and temperatures between the dam and downstream monitoring locations under different release patterns. The results of these studies will be used by the Service in completing a Section 7 biological opinion on Flaming Gorge operations.

In order to reduce or eliminate the adverse effects of Flaming Gorge's existing operation on endangered fish species, Reclamation and the Service will undertake the following measures:

a. In water years 1987 through 1988, Reclamation will coordinate with the Service and appropriate States to develop an annual flow release schedule within the operating plan for Flaming Gorge. The objective will be to provide flow variances during the appropriate spawning period that are no greater than what occurred in 1980. Different release patterns could be adopted upon discussion with the Service for testing or if new information supports a different discharge pattern. Operation of the reservoir at other times of the year will also take into account the needs of these fish species.

   Reclamation and the Service will make every effort to complete Section 7 consultation on operation of Flaming Gorge during 1989. The parties will develop a release schedule that treats conservation of endangered fish species as a firm constraint on release patterns from Flaming Gorge. Upon completion of consultation, Reclamation will adopt alternatives or recommendations jointly developed with the Service.

b. Reclamation will conduct studies of the range of operational criteria that could be used for regulation of the reservoir in order to maintain beneficial flow/temperature requirements for endangered fishes. Operational studies may include the impacts of reregulation of the Green River below Flaming Gorge Reservoir.

4.1.6.3. Blue Mesa Reservoir

Operations of the Blue Mesa Unit on the Gunnison River, initiated in 1967, have changed the flow regime on the Colorado River which supports one of only two known spawning populations of humpback chub and is important habitat for the Colorado squawfish. Reclamation and the Service are presently conducting studies in the Colorado River below the confluence with the Gunnison to determine fish and habitat needs and determine project impacts. This information will be used in Section 7 consultation with Reclamation and other agencies. The Service and Reclamation will complete Section 7 consultation on the annual operation of Blue Mesa upon completion of the Flaming Gorge consultation.

In order to reduce or eliminate any adverse impacts from the operations of the Blue Mesa unit, Reclamation and the Service will undertake the following measures:

a. They will continue to conduct studies to determine rare fish flow needs on the Colorado River. The Service will make every effort to conclude field studies to determine flow needs by the fall of 1987. The Service and Reclamation will enter into Section 7 consultation on Blue Mesa when consultation on Flaming Gorge is completed or at any earlier date. Reclamation will adopt the alternatives or recommendations jointly developed with the Service, upon completion of the consultation process, and after discussion with the State.

b. In the interim period until consultation is completed, Reclamation has committed to assist in meeting a 2,000 cfs minimum flow below the confluence of the Gunnison and Colorado Rivers an average of 9 out of 10 years. Preliminary studies have been done to attempt to assess the impact of Blue Mesa on the rare fish habitat and to determine Blue Mesa's ability to offset these impacts and to contribute to the recovery program. Any preliminary flow regime necessarily will be subject to refinement as additional scientific information is accumulated but provides a basis for determining whether Blue Mesa could assist in meeting flow needs in the interim period.

c. Reclamation and the Service will cooperate with the Implementation Committee in establishing an instream flow right, pursuant to State laws, to guarantee the delivery of any flow releases through fish habitat (see Section 4.1.3).

4.2 HABITAT DEVELOPMENT AND MAINTENANCE

Alteration and loss of habitat have contributed to the decline of the four Colorado River fishes. Recovery of these species may be aided by assessing the quantity and quality of habitat needed for recovery and by developing or enhancing habitat through management techniques, such as instream flows, creation of backwaters, or other nonflow activities, etc. The use of any of these management techniques will also be considered in relation to the successful implementation of other habitat management techniques to provide a balanced contribution from each. Initially, the habitat development and enhancement techniques described in this chapter will be applied experimentally to determine if the rare fishes will use developed habitat and if such techniques contribute to recovery. Appropriate permits and NEPA compliance will be required.

Habitat management techniques will be tested in a variety of habitat types, including backwaters, spawning habitat, grow-out (rearing) areas (see Section 4.3.2), or will be used to open new habitat through the construction of fish passages and jetties. Testing should address the questions of quantity of specific habitats needed and the problems associated with habitat quality. For instance, if lack of backwater habitat is contributing to the low numbers of young-of-the-year squawfish, then increasing the quantity of backwaters may increase the abundance of young squawfish. Likewise, if lack of habitat quality is the problem, the focus should be on improving, in selected locations, the quality of existing backwaters and spawning habitat by improving flows, water temperature, water chemistry and turbidity, decreasing the numbers of predatory fish, etc. The role of changing flows in creating important ephemeral backwater habitat must also be determined.

4.2.1 Backwaters

Young-of-the-year Colorado squawfish are most often found in backwaters, since backwaters provide nursery and feeding habitat. Backwaters can be created by manipulating river flow to retain the characteristics typical of the river system. Regulation structures such as Flaming Gorge can be operated to control river flow and temperature to maximize the quantity and quality of backwaters in certain river reaches during periods when they are most critical

to the fishes. As part of a 3-year study, and in conjunction with the Service, Reclamation is examining the relationship between releases from Flaming Gorge and the downstream formation of useful backwaters for larval squawfish (see Section 4.1.6.3).

Backwater habitat also can be developed artificially: (a) by connecting existing gravel pits or ponds to the river, or (b) by physical construction to simulate the depth, velocity, and substrate characteristics found in naturally occurring backwaters.

4.2.2 Spawning Habitat

Usable spawning areas are essential to the continued existence and the recovery of all four Colorado River fishes. Confirmed and suspected spawning areas of the Colorado squawfish and the humpback chub have been located. Some information is available on natural spawning habitat for the razorback sucker, but none is available for the bonytail chub in the upper basin.

Management of spawning habitat for the squawfish and other species could include: (a) improving access to existing spawning areas in river segments that apparently are not being used (e.g., by developing fish passage structures - see Section 4.2.4); (b) reintroducing eggs or larvae into unoccupied, but suitable, spawning habitat; (c) modifying instream characteristics to create spawning habitat; or (d) constructing spawning habitat within the natural stream channel or in modified side channels (also see Section 4.3.2).

4.2.3 Habitat Created by Jetties

Jetties redirect flow by increasing velocity and deepening the channel at the end of the jetty. Eddies are formed upstream and downstream of the structure, causing deposition of sediments due to decreased stream velocity. It is believed that adult squawfish over-winter in the Yampa in bends of the river which, like jetties, create increased water velocity and deepened channels. It is possible, therefore, that jetties could be constructed to simulate this habitat.

The development of jetties, however, may have a negative effect by enhancing habitat for nonnative predatory fish that use the same types of pools. Jetties should not be constructed in spawning areas or in areas that might be occupied by young squawfish subject to predation.

As the first step in evaluating the use of jetties, studies should be performed to determine the extent of use of existing jetty-created habitat by both squawfish and nonnatives and to monitor the interactions between squawfish and the nonnative species.

4.2.4 Fish Passage Facilities

Colorado squawfish are known to migrate up to 200 miles to utilize habitat essential to different life stages during different times of the year. Dams in the Upper Colorado River Basin, such as Flaming Gorge Dam on the Green River and Taylor Draw Dam on the White River, have blocked the passage of

migrating Colorado squawfish along natural migration routes contributing to the loss of historic habitat. Less is known about the extent and range of movements of the other three species.

Fish passageways have been used successfully for certain species in other river systems, for example, the northern squawfish. However, it is not known whether the Colorado squawfish will use passage facilities, since none has been tested in the upper basin.

Successful passageways could provide a means for reestablishing squawfish in parts of their former historic range. For example, installation of passageways could make available 40 miles of historic habitat above the Redlands diversion on the Gunnison River, 15 miles of habitat on the Colorado River upstream from Palisades, or 50 miles of habitat above the Taylor Draw Dam on the White River.

Below the recently completed Taylor Draw Dam, Colorado squawfish still congregate in their natural attempt to migrate upstream. Natural migrations no longer occur at other older structures. If passage facilities prove effective for the squawfish, installations at Taylor Draw or other dams may be warranted (see Section 4.3.4). Chances of success may be increased by introducing hatchery-reared rare fishes above or below passage facilities or building facilities at dams where the rare fish are staging for natural migration. However, reservoirs also provide habitat for many nonnative species. Interrelationships between the rare and nonnative species must be closely examined (see Section 4.4) to determine the impact from fish passage development.

No passage facility has been constructed in the Upper Colorado River Basin. However, the Service has some funding available through Section 7 and has conducted a feasibility study on a prototype fish passage facility at the Redlands Water and Power Company diversion dam on the Gunnison River.

4.2.5 Selected Course of Action

a. The Service and States will perform research as identified in the Research Program (Appendix 6.2) to determine if and how development and maintenance of habitat for the rare fish species (backwaters, jetties, grow-out ponds (see Section 4.3.2), fish passages, and spawning habitat) will contribute to the recovery of the rare Colorado River fishes. These studies will include testing the management options described in this section to determine their usefulness to recruitment and their contribution to recovery. The following stipulations will be applied.

    1. Testing and implementation of management techniques will not be conducted in confirmed spawning and nursery areas or in river reaches which, if modified, might adversely affect use of confirmed spawning or nursery areas; and

    2. The genetic integrity of wild populations must be protected when using hatchery-reared experimental animals.

b. The Service will (1) conduct studies to determine the desirability of passing Colorado squawfish over the Taylor Draw Dam, and (2) prepare a report on the biological merits of constructing a fish passage at Redlands.

4.3 STOCKING OF RARE FISH SPECIES

Colorado squawfish and humpback chub are reproducing in the upper basin, but their long-term reproductive success is unknown. The bonytail chub appears to be in imminent danger of extinction since it has been found in insufficient numbers to effectively support a viable population; only five individuals have been captured in the upper basin in the past few years, all from the Colorado and Green Rivers. Hybridization is suspected of being a problem among the various species of chub. Recent data indicate that the razorback sucker is very rare, and its population is limited to a small number of very old adult fish; successful recruitment in the wild has never been documented.

Research with hatchery-reared fish may provide a method to effectively increase rare fish populations to the level where deductions can be drawn about their habitat needs and biological interactions and thus eventually provide a mechanism to enhance their recovery. However, numerous factors that affect the survival of any fish species, such as prey abundance, predation, disease, habitat quality, or quantity, may also affect the survival of introduced hatchery-reared fish. For example, 5 years of stocking the razorback sucker in stretches of the lower basin has not resulted in any significant documented poststocking survival, though 1986 field data indicate an increase in return. In comparison, it has taken considerable genetic coaxing through countless generations of more domesticated species like the rainbow trout to produce fishes that are suitable for modified or new habitat or to meet a variety of management needs, including survival in the wild, fast growth, and even increased reproductivity.

The introduction of nonnative species has also led to the establishment of viable populations that may prey upon or compete with the rare fish species (see Section 4.4). Rare fishes of various ages/sizes should be stocked and monitored to discern whether competition, predation, imprinting, homing, survival, etc., are critical factors to the species' success. Grow-out ponds may be an effective way of accomplishing several of these multifaceted goals.

All four species have been raised successfully in hatchery facilities in the lower or upper basins and stocked in numerous areas in both basins. Stocking success is low to unknown. There are presently hatchery and/or wild populations of squawfish, humpback chub, razorback sucker, and bonytail chub that can be used to rear sufficient numbers in hatcheries for research or limited reintroduction. However, there is concern over genetic and disease problems relating to these fish. The existing hatchery populations consist of a few individuals that are relatively old and inbred. Efforts must be made to improve and maintain genetically healthy and viable hatchery populations. Asian tapeworms had occurred in these stocks and has also been found in the upper basin populations of some of these fish.

4.3.1 Hatchery Research

A hatchery program should be conducted to determine: (a) whether hatchery-reared populations will survive over the long term after being stocked into the wild; and (b) whether there are hatchery capabilities to raise needed quantities of rare species. If results show that healthy, genetically viable hatchery-reared fish will survive and reproduce successfully over the long term in the wild, a hatchery production program will be designed and implemented (see Section 4.3.4).

Research will include controlled and monitored introductions of individuals of rare species from a hatchery or from grow-out ponds (see Section 4.3.2) to perform studies on migration behavior, imprinting/homing, spawning, long-term survival and reproduction, interaction with wild populations, age of introduction, etc.

In addition, fish culture research is needed to determine appropriate hatchery loading densities, water requirements, water quality, and feeding rates for the rare fish. An effort should be made to take advantage of the multiyear research and production that has occurred in the Service's Dexter and Willow Beach hatcheries (also see Section 4.3.3).

4.3.2 Rearing Areas (Grow-out Ponds)

Rearing areas for fry and young-of-the-year could be artificially created through the use of grow-out ponds instead of hatcheries to accelerate growth and increase survival. Such areas could be developed by altering existing ponds. For example, in gravel pits near Grand Junction, Colorado squawfish have been raised in 1 year to a size that would take 3 years in the wild. The Service is also successfully raising razorback suckers in grow-out ponds.

Sources of larval fish may include: (a) fertilized eggs, fry, and young-of-the-year, obtained from hatcheries; (b) adult fish captured from the wild; (c) eggs and milt obtained from wild adult fish; or (d) hatchery-stocked adult females and reintroduced milt from wild males. Predatory fish occurring in these ponds would be removed prior to stocking of the rare species. After the fish have been reared to the desired size, they would be released into the nearby river through a channel. Different sizes of marked fish could be released from the grow-out ponds to determine the relationship between size of introduced fish and survival in the upper basin.

4.3.3 Hatchery Capabilities

Existing hatchery facilities will be evaluated to determine if they can provide the number of hatchery-reared fish needed for the research program. The numbers and ages of hatchery-reared rare fishes needed to conduct research are listed in Appendix 6.4. These facilities must be capable of raising disease-free, genetically healthy rare fish. If sufficient capability is not available, modification of an existing hatchery facility could be feasible. However, grow-out ponds may significantly reduce the need and costs for hatchery facilities, since grow-out ponds would create habitat for the rearing of rare fishes while decreasing the need for rearing ponds at a hatchery.

To maintain a genetically healthy hatchery stock that is needed to complete hatchery-related research, it is necessary immediately to obtain: (a) a limited number of wild individuals of the rare fishes as hatchery broodstock; or (b) milt from wild males which would be used to fertilize eggs of female broodstock in the hatchery. The latter method is preferable, since wild individuals should remain in their natural environment. Genetic studies may be needed on all species to test for variation among wild individuals from the different subbasins.

Refugia for all four species should be maintained in more than one hatchery as a safeguard against disease and possible extinction. The bonytail may benefit the most from a hatchery refugium, since it is presently on the verge of extinction in the upper basin. Because the immediate goal is to prevent extinction of the bonytail, major emphasis should be placed upon stocking of bonytails in conjunction with a continuing habitat analysis and major population monitoring and research effort.

4.3.4 Hatchery Production Program

If the research program confirms that hatchery-reared fish will survive and reproduce successfully in the wild, then a hatchery production program should be implemented. At that time, additional hatchery facilities may be needed to produce individuals for reintroduction into the wild (see Section 5.4 Capital Funds). If introductions prove successful, there is a possibility that hatchery-reared individuals could augment existing populations, inhabit historic habitat, or expand the present range of these species.

4.3.5 Selected Course of Action

a. The Service will use existing facilities and capabilities at Dexter (New Mexico) and Willow Beach (Arizona) National Fish Hatcheries or other facilities (if necessary) to raise the target number of rare fishes needed for the research program, unless or until grow-out ponds can meet these needs. Existing hatchery facilities must be capable of rearing disease-free, genetically viable and healthy fish eggs, larvae, and juveniles.

b. Hatchery broodstocks for the bonytail chub, the Colorado squawfish, or the razorback sucker must be enlarged by capture of wild individuals or preferably by introduction of wild gametes (eggs and milt) into the broodstocks for upper basin fish. A broodstock for the humpback chub will also be developed. Two or more refugia for each species are recommended.

c. Procedures for producing the rare species in hatcheries for the research program will be developed by the Service. This will include details on:

   1. Maintenance of genetic diversity;
   2. Collection and transport of gametes or adults from the wild to the hatchery facility;
   3. Procedures for spawning at the hatchery;
   4. Location of fish stocks;
   5. Details on research projects; and
   6. Method of transport and release to the wild.

d. The bonytail chub will be reintroduced immediately into the upper basin to improve the status of the species and to provide adequate numbers to study habitat needs. The following stipulations are included:

   1. Suitable sites in the upper basin will be located;
   2. Reintroduced individuals should be disease-free;
   3. Stocking should occur in areas which will reduce the possibility of hybridization with the humpback and roundtail chub;
   4. Reintroduced species will be marked and monitored to assist in collecting habitat and life history data; and
   5. Hatchery stocks will be augmented with new genetic material before future reintroductions are attempted.

e. Consideration will be given to supplementing existing populations of the razorback sucker, humpback chub, and squawfish where studies conclude that it would help promote self-sustaining populations. The following stipulations apply:

   1. Reintroductions should be undertaken using hatchery-reared fish or fish reared in grow-out pond situations;
   2. Research pertaining to reintroductions of hatchery-reared fishes will not be conducted in confirmed spawning areas; and
   3. Extreme caution will be used to protect the genetic integrity of wild populations when introducing hatchery-reared fishes into the various subbasins.

4.4 NONNATIVE SPECIES AND SPORTFISHING

Since the late 1800's, over 40 species of fishes have been stocked into upper basin rivers and tributaries. Many of these species have been successful because of the changes in the river system that favor these nonnative fishes. Nonnative fish species are successfully reproducing and are in many cases, out-reproducing native fish due largely to better adaptation to present environmental conditions. Presently, nonnative (exotic) species comprise over 65 percent of the fish species found in the upper basin. Over 30 different nonnative species have become established in the present range of the four rare fish. Federal and State agencies continue to participate in the raising and stocking of some salmonid species, though trout are not considered to be a direct competitor. The States also stock a few other nonnative fish in the upper Colorado River (Appendix 6.5.1).

There are 14 fishes native to the upper basin, including 6 endemic to the Colorado River system. Three of the endemic species are federally listed as endangered, and one is a candidate species (Appendix 6.5.2). These four species are the focus of this program.

Though difficult to fully assess, competition with, and predation from, nonnative species has played a role in the decline of these rare fishes, particularly for the squawfish and razorback sucker. The rigorous nature of the humpback chub habitat appears to allow them a competitive advantage over nonnative species. The situation with the bonytail remains unclear.

Nonnative fishes directly or indirectly compete with native species for available resources, such as food and space. The northern pike, for example, appears to occupy a similar niche as the squawfish in the upper Green River. Channel catfish, fathead minnow, various shiners, largemouth bass, and the green sunfish may also compete for habitat. Data indicate direct competition between young squawfish and the redside shiner in nursery areas, and predation from largemouth bass and green sunfish upon young Colorado squawfish is also documented. Predation data is also available on razorback suckers.

Backwaters, the same habitat type important to young-of-the-year and juvenile squawfish, are often dominated by nonnative species. These nonnative fishes also thrive in gravel pit ponds, manmade side channels, etc., where water is warmer and food is more abundant, the same attributes that attract young squawfish. When these resources are limited, predation and competition result.

4.4.1 Control of Nonnative Fish

Management of river flows may prove to be the most useful method to provide an advantage to native species. For example, during the flow years of 1983 and 1984, native fishes reproduced successfully, while nonnative reproduction appeared to be reduced from previous years.

Stocking of most introduced species has been greatly reduced in recent years. Further curtailment of stocking and reduction or elimination of some nonnative species have also been suggested as options to reduce some negative impacts to rare fish. This will likely have a limited impact, however, because most of these nonnative species are successfully reproducing in the wild. Control of stocking or use of live bait of any competing or depredating nonnative species may be most useful, since it would reduce population augmentation, except from the wild. Elimination or removal of nonnative species would require a massive effort, although the treatment of selected reaches may be feasible, e.g., in grow-out pond situations (see Section 4.3.4).

Further study on the role of competition and predation between nonnative and rare species is necessary to further identify nonnative species of concern, the extent of the problem, and potential solutions.

4.4.2 Sportfishing

The primary reason for introducing some of these nonnative species is to create and support sportfishing for both warm and cold water species. Some of these nonnative sport species may also compete with or prey upon rare species. The relationships between these species and the rare fish will be studied, as mentioned in the preceding section.

Though there is minimal overlap between cold water fish species (particularly salmonids) and rare species habitat, management for sport fish can also displace native fishes. For example, releases of colder water from reservoirs, such as Flaming Gorge, have created habitat for cold water sport fishes rather than for native fishes. This may be a factor below any major dam or diversion structure, e.g., Flaming Gorge and others. Where feasible, fish passages and warmer water releases have been recommended to offset some impacts of sport fish management in areas where rare fish currently occur.

A less obvious impact of sportfishing on native fishes may be the result of take by angling or seining for bait. Colorado squawfish and humpback chub captures by anglers have been documented since 1979 by the Colorado Division of Wildlife (Colorado) and Utah Division of Wildlife Resources (Utah) and since 1980 by the Colorado River Fisheries Project (Fisheries Project). The Fisheries Project and Utah have reported 33 Colorado squawfish captures and 6 humpback chub captures by fishermen. Through studies, Colorado has captured 29 Colorado squawfish (1979-85) and 30 humpback chub (1979-82) by angling. These reported captures may represent only a fraction of the total captures of rare fishes by anglers each year; many are returned alive. In addition, humpback chub and Colorado squawfish are prone to ingest live bait used by anglers for catfish as well as artificial spoons or lures. It may be appropriate to restrict uses of baits entirely, since hook removal from the fish can cause mortality. The State of Colorado, in coordination with the Service, has revised its sportfishing regulations to offset some of these problems.

These data indicate that squawfish readily take a lure. This may provide an opportunity to experiment with a sportfishery for squawfish now or after their recovery (and delisting) to enhance the acceptance by the general public of this species and its habitat needs, providing this activity does not detract from the recovery program. Squawfish provided an important source of food for early settlers and natives in this area. Hatcheries, as well as natural reproduction (if recovered), could produce sufficient numbers of squawfish to support a sportfishery in addition to meeting other stocking needs. The goal of creating a sportfishery may be accomplished through various means but will be dependent upon the biological and legal status of the species until the species is recovered. The Service and the State of Colorado are pursuing this option incidental to this program.

4.4.3 Selected Course of Action

a. Stocking of nonnative species will be confined to areas where absence of potential conflict with rare or endangered species can be demonstrated. This includes augmentation of existing populations of nonsalmonid fishes and introductions of new populations of all nonnative fish species that compete with or prey upon rare species. The States and the Service will develop procedures, including studies, for reviewing and for resolving disagreements with any proposed introductions into the upper basin drainage.

b. The Service and the States will determine the impact from competition and/or predation by nonnative fishes on the rare fishes (see Section 6.2). If competition and predation from any nonnative species is determined, the States and the Service will assess the feasibility of selectively removing those nonnative species from areas considered to be essential to listed species, such as grow-out ponds, spawning, or nursery sites. If necessary and feasible, this activity will be implemented as soon as possible.

c. State sportfishing practices and regulations will be reviewed for compliance with Federal law and impact on rare species. If the Service and States determine that conflicts exist, such activities as permanent or seasonal angling closures and restrictions on seining will be implemented by the States, where appropriate.

1. A 2-year to 4-year creel survey will be conducted by the States to document the extent of incidental taking and to aid in determining where permanent or seasonal closures or other restrictions may be needed to prevent or reduce incidental mortalities. Among the areas that have been recommended for study, the following deserve immediate attention:

   (a) Black Rocks (RM 135-136) on Colorado River;
   (b) Westwater (RM 116-124) on Colorado River;
   (c) Grays Canyon/Three Fords (RM 148-157) on Green River;
   (d) Yampa Canyon (RM 0-56) on Yampa River; and
   (e) White River (RM 0-21, 104-109).

2. Regulations should be adopted and enforced by the States of Colorado and Utah that prohibit seining in and below all confirmed and suspected spawning areas, young-of-the-year habitat, and juvenile nursery areas, to prevent incidental mortalities to rare fish species.

3. The Service will determine acceptable levels of incidental take of endangered species in relation to angling to be used in defining the above-noted restrictions.

d. A multifaceted information and education program will be implemented immediately by Federal and State management personnel (3). Specific measures will be needed to inform and educate the general public and may include:

   1. Education at the time fishing licenses are purchased, including identification of rare fishes and information on penalties for destroying the endangered fishes;

   2. Increased contact with anglers by Federal and State game management and enforcement personnel while they are in the process of fishing; and

   3. Posting of signs at higher concentration angler use areas.

e. A rigorous enforcement program will be implemented by Federal and State game management agencies to minimize incidental taking of endangered fishes.

4.5 RESEARCH, MONITORING, AND DATA MANAGEMENT

Well-defined research, monitoring, and data management programs will be an integral part of the rare fish management and recovery program and will constitute integral parts of each recovery element. Research programs will be pursued to identify criteria for recovery, test the effectiveness of management and recovery strategies, and examine and evaluate the needs of the fish. Monitoring is needed to track population status and trends and to

(3) Public relations is important to acceptance and implementation of the whole recovery program and should be given primary consideration.

define the overall success of the recovery program. A data management system is needed to provide timely analysis of research program data, to allow analysis and reporting of monitoring program data, and to generally be an information resource for directing management and recovery activities. Appropriate Federal and State permits will be required.

4.5.1 Research

Research needs and priorities are included in the attached tables (Appendix 6.2). Proposed projects were categorized as: (a) monitoring, (b) life history/habitat, (c) testing of management approaches, and (d) institutional or administrative actions. Activities in these categories have been prioritized numerically from a high of 1 to a low of 5 according to their contribution toward achieving recovery goals for the rare Colorado River fishes and, in some cases, their importance in Section 7 consultation. Monetary, manpower, and time constraints were not considered in determining priorities and will need to be factored into the recovery program by the Implementation Committee.

Detailed study plans for each project will be developed. Criteria will be developed for each research project to evaluate success and to determine a project's contribution to recovery. The program should remain dynamic, with periodic review and refinement by the Implementation Committee.

4.5.2 Monitoring

Monitoring is defined as an ongoing program to determine the status and population trends of rare species. In the past, monitoring has not been distinguished from research, and it has been difficult to define the status and trends of rare species populations. The monitoring program is distinct from the research program, which may include similar types of data collection but which will be more focused on specific reaches, management strategies, etc. An initial set of priorities has been identified for the monitoring program (see Table 4.3). Standardized methods must be used by all groups so that spatial and temporal trends can be identified.

4.5.3 Data Management

Federal, State, and private agencies have collected extensive amounts of data on the life history, behavior characteristics, and habitat requirements of rare fish in the Upper Colorado River Basin. The status and quality of these data are quite variable, and improved management and analysis of these data are priority management concerns. Research activities using existing data, to assess matters such as effect of flow and temperature on nonnative fish and refining the definition of sensitive areas are listed in the research priorities table (Appendix 6.2). A centralized data management system should be established to: (a) make the best possible use of existing data and (b) ensure a coordinated and effective data management and analysis effort in the future. Such a system is key to conducting cost-effective research and monitoring programs, and its development should be given initial high priority in the recovery program.

TABLE 4-3 PRIORITIES FOR MONITORING PROGRAM

Priority	Activity
1	- Define and quantify key terms: recovery, viable, self-sustaining, recruitment, criteria for success, etc.
	- Define standard data collection methods for long-term monitoring program for squawfish young-of-the-year.
	- Monitor fall squawfish young-of-year abundance (index).
	- Define standardized monitoring program for juvenile and adult rare fishes; define role in long-term monitoring effort.
	- Monitor known or suspected humpback populations.
2	- Monitor known or suspected bonytail populations.
	- Develop field methods to identify chub species.
3	- Monitor habitat availability trends (remote sensing, field validation). (1)
	- Environmental contaminant survey. (2)

(1) This activity should be subordinated to research efforts (Appendix 6.2) in defining habitat requirements and in determining if habitat is limiting.
(2) Coordinate with Geological Survey monitoring programs, as needed, after demonstration of contaminants that may be a problem.

The ultimate role of monitoring is tracking progress toward recovery. One of the high priority efforts recommended is to quantify recovery goals (see Section 2.0). Measurement of key parameters vital to addressing success and progress of the recovery program will be included in the monitoring program. This will be carried out by appropriate parties and evaluated by the Implementation Committee.

4.5.4 Selected Course of Action

a. All monitoring, research, and data management activities will be coordinated by the Implementation Committee. The Implementation Committee will:

1. Assign data management responsibilities;
2. Assign monitoring responsibilities;
3. Assign responsibility for high priority research activities; and
4. Define a process for periodic review and management of monitoring, research, and data management activities.

b. The Service, in coordination with the States and private interests, will establish a common data management framework, as follows:

1. Develop a central clearinghouse for common data base; and
2. Define a data management system that includes:
   (a) format and responsibility for data input;
   (b) a program for data access by outside parties;
   (c) a computer system to be used to handle data (e.g., dBase III, SPSS);
   (d) a quality control/quality assurance system; and
   (e) documentation of the above.

c. The Service and the States, in coordination with the Implementation Committee, will establish a long-term monitoring program for evaluating the status and trends of rare fish populations.

d. The Service, in coordination with the States, will develop a detailed work plan for high-priority research activities to be approved by the Implementation Committee that defines each activity:

   1. Potential contribution to preservation and recovery of rare fish or habitats;
   2. Criteria for evaluation of potential contribution to recovery;
   3. Coordination among research tasks;
   4. Measures of progress and criteria for success in management strategy tests (e.g., passageways, stocking, etc.);
   5. Data management and analysis programs for specific research activities; and
   6. Products and schedules.

e. The Service, in coordination with the States and private parties, will initiate a research program to analyze the existing data base (see research priorities, Appendix 6.2).

5.0 FUNDING OF THE RECOVERY PROGRAM

5.1 INTRODUCTION

One of the basic principles of this recovery program is that protection and recovery is a cooperative responsibility. This specifically applies to funding of the recovery program. The estimated expenditures for the 15-year recovery program are divided into two areas, the annual operating budget and capital funds. Several sources of funding will be needed to finance both annual operations and capital expenditures associated with the recovery program, including funds from the Federal government, States, power and water users, and private donations.

5.2 ANNUAL RECOVERY PROGRAM BUDGET

The elements described in this document are considered necessary for the protection and recovery of the rare fishes (see Section 4.0), and the estimated annual operating costs of these program elements are shown in Table 5-1. This budget is based upon fiscal knowledge gained from present and past activities conducted by the Service, Reclamation, and the States.

In order to achieve recovery in 15 years, this level of funding will be needed on an annual basis and should be escalated annually to adjust for inflation. An inflation factor will be calculated on an annual basis using the composite of the Consumer Price Index and instituted upon implementation of the program.

The projected annual allocation of funds (see Table 5-1) will be implemented after a period of transition which reflects ongoing programs. For example, Reclamation is committed to providing approximately $1,500,000 per year for fiscal years '87 and '88 to the recovery effort. All studies being conducted by Reclamation, the Service, or the States are included in the proposed recovery program. The Implementation Committee will review allocation of these funds in light of overall program needs and make recommendations to Reclamation, the States, and the Service concerning future allocation in accordance with the priorities established by the Implementation Committee.

5.3 ANNUAL FUNDING SOURCES

Funding reliability is critical to the success of this program to ensure that the program is conducted on a continuous basis and that high-priority recovery elements are funded every year. The annual funding sources proposed to finance recovery activities from the operating budget (Table 5-1) are shown in Table 5-2. Support for annual recovery activities will primarily depend upon existing and new government sources.

These funding levels do not significantly differ from the amounts that have been obligated to the studies and other recovery activities conducted by the Service, Reclamation, and the States since the late 1970's. However, the availability of future funding from governmental sources is subject to the authorization and appropriation by the State legislative and Federal governmental bodies, as described in the following subsections.

TABLE 5-1 PROJECTED ANNUAL COSTS OF RECOVERY PROGRAM

			Annual
1.	Program Management		$ 100,000
2.	Habitat Management		1,000,000
	Defining Flow Needs	200,000 (1)	
	Obtaining Flows	800,000 (1)	
3.	Habitat Development (Backwaters, jetties, monitoring, etc.)	315,000 (1)	400,000
	Construct Experimental Fish Passage	(2)	
	Stocking	60,000	
	Monitoring	25,000	
4.	Stocking of Native Fishes		245,000
	Hatchery Work (Grow-out ponds)	200,000	
	Planning	5,000	
	Reintroductions and Monitoring	40,000	
5.	Nonnative Control and Sportfishing Control		105,000
	Studies	40,000	
	Regulatory Review	15,000	
	Information/Public Relations (3)	50,000	
	Law Enforcement	(Ongoing)	
6.	Research, Monitoring, Data Management		450,000
	Data Management	50,000	
	Research	175,000	
	Monitoring	200,000	
	Data Analysis	25,000	
	TOTAL (4)		$2,300,000

(1) Capital funds will be augmented from these budget categories as determined by the Implementation Committee (also see Section 5.4).
(2) Partial funding already available.
(3) May apply to whole program (see Section 5.3.5).
(4) Additional expenditures within the categories above will be based on the availability of funds provided by water project proponents (see Section 5.3.4).

TABLE 5-2 ANNUAL FUNDING SOURCES
TO SUPPORT THE ANNUAL RECOVERY PROGRAM

Sources	Amount
U.S. Fish & Wildlife Service	$ 600,000
U.S. Bureau of Reclamation	$1,500,000 (1)
State of Colorado	$ 104,000
State of Utah	$ 73,000
State of Wyoming	$ 23,000
TOTAL	$2,300,000 (2)

(1) From operation and maintenance fund, Colorado River Storage Projects.

(2) In addition to the sources shown in Table 5-2, donations and contributions from water project proponents are expected to be an additional sources of funds for the recovery program (see Section 5.3.4).

5.3.1 U.S. Fish and Wildlife Service

The Service is presently contributing approximately $600,000 per year to the recovery program from recovery funding and Endangered Species Act Section 6 funds allocated to the States. The Service has averaged over $300,000 annually since 1979, in addition to routine administrative costs, for a total of at least $2.4 million. As part of its continuing obligations to the conservation of listed species, the $600,000 level of funding from the Service will continue in the future, even though it may be budgeted from different sources.

5.3.2 U.S. Bureau of Reclamation

The Upper Colorado Region of the Bureau of Reclamation has provided funds for studies to define basic habitat requirements of the rare species and the impacts of Federal water and power project operations on those species. The cost of these studies has averaged $600,000 annually since 1979, for a total of $4.8 million, and has been partially funded as a Storage Project operation and maintenance expense.

As authorized by the Colorado River Storage Project Act, Reclamation is studying Flaming Gorge and Wayne Aspinall Units as to the effects of their operation on the protection and recovery of the Colorado River endangered fish. Reclamation is authorized to make operational studies which include research and monitoring activities funded from power revenues (Section 5 of the Colorado River Storage Project Act). Reclamation is also authorized to construct (specific) facilities and to purchase land and water rights. Congressional appropriations will be necessary for these latter purposes under authority of Section 5 or 8 of that Act. The combined contribution from power revenues and congressional appropriations will not exceed $1.5 million annually (adjusted for inflation). Because of this ongoing contribution by the Upper Colorado River Region of Reclamation, no depletion charges for existing or future Reclamation projects will be collected as part of the Section 7 consultation process.

5.3.3 State Funding

The States of Colorado and Utah have been participating with the Service and Reclamation in data collection and other studies in the upper basin over the past few years. Under this program, Colorado, Utah, and Wyoming will contribute a total of $200,000 per year to the rare species recovery program. Recovery of rare species will benefit the States by avoiding Section 7 conflicts between water resources development and conservation of rare fish species. As in the past, the States and other participants may provide in-kind services in lieu of financial contribution to support the recovery program if these services reflect the Implementation Committee's established priorities.

5.3.4 Water Project Contribution

Contributions by proponents of non-Federal water projects will provide an additional source of funding. All future Section 7 consultations completed after approval and implementation of this program (establishment of the Implementation Committee, provision of congressional funding, and initiation of elements) will result in a one-time contribution to be paid to the Service by water project proponents in the amount of $10 per acre-foot based on the average annual depletion by each project. Credit on future application of the $10 contribution will be given to efforts resulting in successful water conservation by an existing project, not to exceed the total amount of water conserved by that project. The $10 per acre-foot amount was based upon the amount of undeveloped water that is expected to be developed over the life of the recovery program and is comparable to the amount previously collected. This figure will be adjusted annually for inflation (based upon the composite Consumer Price Index).

Funding of conservation measures will be specified in each biological opinion on a water project which causes a depletion and will be included in the stipulations of any permits issued. Concurrently with the completion of the Federal action which initiated consultation, e.g., at the time of authorization or approval of funding, completion of NEPA, issuance of a 404 permit, etc., 10 percent of the total contribution will be provided. The balance of the financial contribution will be guaranteed through bonding or contract (included in the permit stipulations) and due at the time the construction commences. Since the no-jeopardy conclusion will be based on this measure, failure to make the agreed-upon financial contribution at the agreed-upon time will void the project's biological opinion and permit. This agreement may be specified in a separate contract with the project proponent and the Service.

Funds from these contributions will be applied equally to flow acquisition and to other recovery activities as they become available. However, the Implementation Committee may recommend other priorities and apply these funds to the most urgent needs. Due to uncertainties associated with the timing of water project development and the depletion impacts of specific water projects, neither the timing nor the total amount of funding from water projects can be accurately predicted. For example, the Service is involved in or anticipates approximately seven consultations over the next year for a minimum depletion of approximately 80,000 acre-feet. There are no other estimates for future depletions at this time (see Appendix 6.6.1).

5.3.5 Conservation Organization Contribution

The conservation community will contribute to the implementation of the Recovery Program by participating on the Implementation Committee and its technical committees and will play a major role in public understanding and acceptance of this program as an in-kind service. However, donations will be accepted from environmental organizations as described in Section 5.3.6.

5.3.6 Private Donation

The Service may accept donations of funds or other assets from private parties, including conservation groups. Private parties wishing to donate water rights to provide instream flows for rare species must inform the Implementation Committee to ensure that water right acquisitions are consistent with the established priorities.

5.4 ESTABLISHMENT OF CAPITAL FUNDS

In addition to the annual costs identified in Table 5-1, capital expenditures will be necessary for flow acquisition, fish passages, hatcheries, and possibly other, as yet unidentified, items. Two capital funds are needed through congressional appropriations. One of the funds will be for a minimum of $10 million for purchase of water rights to establish instream flows for rare species pursuant to the procedures defined in Section 4.1 of this document.

Establishment of this fund up front is critical to this program, as it will ensure that the Service can acquire water rights when and where they are needed to provide instream flows for rare fish species. Since revenue accruing in the Land and Water Conservation Fund may be appropriated for such acquisition, the Service will immediately place flow acquisition for this program on the land and water priority list for this fund. This flow acquisition fund will also receive funding annually from the operating budget (see Section 5.2).

The size of this fund is not based on an appraisal of the necessary water rights because: (a) it may be some time before flow requirements are finalized and the necessary water rights identified pursuant to the recovery program, and (b) the price of the necessary water rights will depend on highly variable market factors. In addition, annual payments may be required to lease some water rights.

Table 5-3 WATER RIGHTS ACQUISITION COMPARISON

Cost per Acre-foot	Number of Acre-feet $10.0 Million Will Buy	Number of cfs for 30 Days
$ 100	100,000	1,667
250	40,000	667
500	20,000	334
1000	10,000	167

For the purposes of illustration only, the above table shows how much water could be purchased outright for $10 million at prices of $100, $250, $500, and $1,000 per acre-foot of yield.

Additional amounts of water may also be purchased with funds from the annual allocation for water rights acquisition. To maximize the use of these funds, possibilities exist for acquiring greater amounts of water for instream uses with the $10 million fund (and annual budget) through other transactions involving the acquisition of the conditional rights to develop water, trade of direct flow water rights for water in storage, possible sale or lease of water rights for use downstream of the instream use, and the donation of water rights.

This capital fund should contribute substantially toward meeting instream flow needs. Moreover, some habitat on the Green River and Colorado River may be protected without the purchase of water rights through refinement of release schedules and perfection of water rights from Ruedi, Blue Mesa, and Flaming Gorge Reservoirs (see Table 4-2).

In addition to the flow acquisition fund, $5 million will be needed from Congress which will be used to initiate other recovery construction elements, including capital investments needed for hatcheries, additional fish passages, changing the location of the diversion structure of a water right, and other structures or habitat modification actions. It is unknown what the exact cost of these types of projects may be, though it has been estimated that a new hatchery may cost up to $8 million. A simple fish passage structure at the Redlands Diversion was determined to cost up to $1 million; larger structures will be more costly. The results of research and management activities in the first and second year of this program will determine the exact needs and associated costs. Establishment of this fund at the beginning of the recovery period will ensure adequate funding to meet expected needs.

The $15 million fund congressional appropriation is expected to be comparable to the recovery funds contributed from the private and State sector. Over the 15-year period of this recovery program, the States of Colorado, Utah, and Wyoming may contribute approximately $3.0 million. In addition, the water development community may contribute a maximum of $9-10 million through Section 7 of the Endangered Species Act. This figure is based upon the amount of water that remains to be developed in the upper basin (excluding Arizona and New Mexico) that has not yet been consulted upon under the Endangered Species Act. This total figure assumes that the full acre-foot figure will be developed during the 15-year recovery period.

5.5 ADMINISTRATION OF RECOVERY FUNDS

All identified funds will be used in accordance with the priorities established in the recovery program under an annual workplan prepared by the Recovery Implementation Committee. The Committee will recommend priorities and oversee spending and allocation of all program funds.

Annual funding will be provided by each of the designated annual funding sources (Table 5-2) prior to the beginning of each calender year, unless otherwise agreed to (e.g., see Section 5.3.4 for water developer contributions). When appropriated, capital funds will be disbursed at the direction of the Service acting on the recommendations of the Implementation Committee.

Annual funds will be administered directly by the agencies (Federal, State, etc.) responsible for the funds, according to their individual administrative regulations and procedures. The Program Director (Service) will be responsible for maintaining records, through a formal tracking system, showing distribution and expenditures of all annual and capital funds expended under the workplan by each funding source. An annual accounting will be provided to the Committee at the beginning of each calendar year, identifying funds to be earmarked by each funding source for program activities for the upcoming year. In addition, an accounting of funds expended during the preceding year will be provided at the end of each calendar year.

All multiyear, contributed, or donated funds accruing to the recovery program, regardless of source, will be placed in interest-bearing accounts, such as those administered by the Fish and Wildlife Foundation, until such time as they are utilized in accordance with the annual operating budget approved by the Implementation Committee. The Fish and Wildlife Service will be responsible for administering and accounting for these program funds. Separate accounts will be established for the annual operating funds and the capital funds to be appropriated by Congress. Interest accruing to these accounts will be used to support recovery activities.

5.6 ANNUAL BUDGET REVIEW

Funding of the recovery program until the species are recovered and delisted is essential. While it is recognized that the availability of funds from each source will be subject to legislative action, the respective parties are accountable for contributing their portion of the funds needed to achieve the purposes of this recovery program. The Implementation Committee will annually assess funding requirements and the contributions expected from all sources (including an accounting of in-kind services) and will recommend whether the net effect of any shortfall would make it impossible to carry out the recovery program.

It is expected that the Implementation Committee also will annually review progress toward recovery and will recommend adjustments to the operating budget to reflect changing needs and priorities. In addition, if the Implementation Committee determines that the financial estimates and contributions from all sources are not sufficient to carry out this program, the Implementation Committee may recommend how and from what source additional revenues may be acquired.

APPENDICES 6.0

APPENDIX 6.1 BACKGROUND AND LIFE HISTORY INFORMATION

6.1.1 Colorado squawfish

The Colorado squawfish (Ptychocheilus lucius) was listed as endangered by the U.S. Fish and Wildlife Service (Service) in the Endangered Species List published by the Federal Register on March 11, 1967 (Vol. 32 (43):40001). Full protection under the Endangered Species Act of 1973 came upon its listing in the Federal Register on January 4, 1974 (Vol. 39 (3):1175). It is also designated as endangered by the State of Colorado and protected by the State of Utah.

Although the specific name lucius means "pike," the Colorado squawfish belongs to the large and diverse minnow family, Cyprinidae. As an adult, it is a voracious predator and the top native carnivore in the Colorado River system. Maximum weights exceeding 80 pounds, and lengths of nearly 6 feet have been recorded; however, specimens weighing more than 15 pounds have rarely been found since 1970. Their substantial size and migratory behavior won for them the vernacular name of "white salmon of the Colorado." Originally found throughout the Colorado River Basin from Green River, Wyoming, to the Gulf of California, it is now confined to upper basin main stem rivers and larger tributaries.

The squawfish is adapted to a watershed known for its variable flow, high silt load, and turbulence. Young-of-the-year, juveniles, and subadults are captured in shallow backwater areas with silt and sand substrates and little or no current. Older, larger squawfish prefer deeper, moving water, and mature adults have been known to migrate some 200 river miles up or downstream to reach spawning sites on the Colorado, Green, or Yampa Rivers. Although their temperature preference in nature has not been established, evidence from the Lower Colorado River Basin, where water temperatures often exceed 35°C, suggests broad thermal limits for the Colorado squawfish.

The absolute cause for the decline of the Colorado squawfish is unknown but is probably related to a combination of factors including direct loss of habitat, changes in flow regimen, blockage of migration routes, water temperature changes, and interactions with introduced fish species.

According to the draft Service Recovery Plan (1987), the Colorado squawfish will be eligible for downlisting to threatened status when naturally reproducing populations are introduced and maintained in lower basin sites and maintained in the following upper basin reaches:

- the Green River from its confluence with the Colorado River upstream to Echo Park;
- the lower 150 river miles of the Yampa River;
- the lower 150 river miles of the White River;
- the Colorado River from Palisade downstream to Lake Powell.

Delisting would be considered when these criteria were met and when these habitats, migration routes, essential flow, and water quality parameters were legally protected.

6.1.2 Humpback chub

The humpback chub (Gila cypha) was a member of the original list of endangered species prepared by the Office of Endangered Species in 1964. It, too, was afforded protection by the Endangered Species Act of 1973 (Federal Register January 4, 1974, Vol. 39 (3):1175). It is designated as endangered by the State of Colorado and protected by the State of Utah.

The humpback chub was first described in 1946 based upon fish collected from Grand Canyon and other locations. Reexamination of earlier records and preserved specimens confirmed that some fish previously described as bonytails were actually humpback chub, a taxonomic error in identification that may have occurred frequently throughout the past. Humpbacks are medium-sized (12-16 inches as adults) freshwater minnows, members of the family Cyprinidae. It has a pronounced dorsal hump that arises over the location of the gills and rounds to the area of the dorsal fin. The fish's body tapers abruptly to the tail which flares into a deeply forked (caudal) fin. It is generally believed that these adaptations aid the animal in negotiating turbulent water. The historic distribution included large, whitewater canyons on the Colorado River system including the main stem Colorado and four of its tributaries: the Green, Yampa, White, and Little Colorado Rivers. Recent collections from remote canyon reaches of these tributaries and from the main stem Colorado River are sporadic, with concentrations in small reaches of any given canyon.

The humpback chub has been found associated with fast currents and deep water, over substrates of sand, silt, boulder, and bedrock. Spawning occurs between April and July, depending on water temperature, and probably takes place in or near the resident canyon area. Despite a subterminal mouth, humpback chubs are opportunistic omnivores, reportedly even able to feed at the water's surface.

A combination of factors has been blamed for the decline of this fish: stream alteration (dams, irrigation, dewatering, and channelization), competition with and predation from introduced fish species, pollution and eutrophication, parasitism, changes in food base, and fishing pressure. Hybridization with congeneric chubs has also been suggested as an adverse factor.

To consider downlisting to threatened, the draft Service Recovery Plan (1987) calls for two refugia and a minimum of five self-sustaining populations in:

- Black Rocks - Westwater canyons on the Colorado River;
- Gray Canyon on the Green River;
- the Green and Yampa Rivers inside Dinosaur National Monument;
- Little Colorado River.

Delisting would be considered when the five self-sustaining populations and two refugia are maintained and their habitats (flow characteristics and water quality parameters) are legally protected.

6.1.3 Bonytail

The bonytail (Gila elegans) was listed by the U.S. Fish and Wildlife Service as an endangered species on April 23, 1980. It was listed without critical

habitat because reproducing populations were unknown, and the threat of extinction appeared imminent. It is listed as endangered in Colorado and protected in Utah.

The bonytail is a member of the minnow family, Cyprinidae, and is generally similar to the humpback chub. It is larger (up to 20 inches long), has a more streamlined shape, a narrower caudal peduncle, and a smoother dorsal hump.

Originally found throughout the Colorado River main stem and larger tributaries, the bonytail is now very rare in the upper basin; five individuals have been captured (and released) from the Green and Colorado Rivers. Nowhere has reproductive success been documented. Spawning in hatcheries begins at water temperatures of 20°C, and eggs hatch from 4 to 7 days after fertilization. In nature, bonytails seem to prefer eddys and pools rather than swift current. They are omnivorous.

The decline of the bonytail in the lower basin was attributed to: flow depletions due to loss of vegetation (overgrazing), depletions of ground water, dams, irrigation, mining, and introduction of nonnative species. Lower basin bonytails lost their riverine habitat and now exist as remnant, senile populations in lakes Havasu and Mohave. As with the humpback chub, hybridization with other Gila received a share of the blame for the bonytail's decline.

The immediate goal of the Service's draft Recovery Plan (1987) is to prevent extinction of the species.

6.1.4 Razorback sucker

The proposal to list the razorback sucker (Xyrauchen texanus) as threatened was prepared in 1978 but later withdrawn. It is currently a Service Category II (candidate) species and is listed as endangered by the State of Colorado and protected by the State of Utah.

The razorback sucker is the only member of its genus and is a member of the sucker family, Catostomidae. Adult razorbacks are now found sporadically in major upper basin tributaries: the Green (below Flaming Gorge), Yampa, Colorado, Gunnison, and San Juan Rivers. The species was once common from Green River, Wyoming, to the Gulf of California. It has fleshy lips on the underside of its head in typical sucker fashion. And, as its name suggests, it also has a sharp-edge keel on its dorsal surface.

Razorback suckers have been observed spawning in reservoirs, but no reproductive success has been documented. Recently, aggregations of "ripe" razorbacks were encountered in the Green River, Ashley Creek area. Hopefully, continued survey work and research will reveal more about the razorback's habitat requirements.

As with the previously discussed species, the causes for the decline of the razorback sucker include dams and impoundments; principally, land and water-use practices, changing flow regimes, and river channel characteristics that eliminate preferred backwater habitats.

Since the razorback sucker is not federally listed, no recovery goals exist. However, the Colorado River Endangered Fishes Recovery Team and the Upper Colorado River Biological Subcommittee (see Appendix 6.2 for names) have repeatedly recommended that the razorback sucker, for the purposes of planning and budgeting "recovery research and monitoring," be treated like the other three endangered fishes.

References:

Information and further references for all four fish can be found in the Service's recovery plans and final reports of agency and contractor field studies. A formal list of references containing background and information used in this document can be obtained from the U.S. Fish and Wildlife Service, located in Denver:

U.S. Fish and Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, Colorado 80225

APPENDIX 6.2 UPPER COLORADO RIVER BASIN RARE FISHES RESEARCH PRIORITIZATION

The following material has been prepared by the Upper Colorado River Basin Biological Subcommittee (see names attached) in response to a request by the Implementation Task Group to identify and prioritize research needs for the rare Colorado River fishes. Proposed recovery activities presented in various documents prepared by the Subcommittee, the U.S. Fish and Wildlife Service, State wildlife agencies, the Colorado River Fishes Recovery Team, universities, conservation groups, and private water development groups were reviewed and summarized in this document.

These proposed activities were categorized in Table 6-2.1 under monitoring (I), life history (II), management-applicable (III), and administrative (IV) tasks. They were then prioritized numerically from a high of 1 to a low of 5. Table 6-2.2 arrays projects by priority (1-5) and group (I-IV), estimates the time required to complete each task (1-3, 4-6, or 7-10 years), and applies FTE's or man-months of manpower required. Monetary, manpower, and time constraints were not considered in this prioritization process.

The Subcommittee evaluated and ranked these tasks solely upon their value toward achieving recovery goals for the rare Colorado River fishes (in some cases their importance in Section 7 consultation was also considered). Successful completion of tasks identified in this document will contribute toward our ability to better manage the rare fishes and their habitat. Improved management of the Colorado River resources will aid in achieving tangible progress toward the recovery of these rare fishes in their natural habitat.

It should be recognized that some tasks are interrelated. To reduce costs and maximize results, some tasks may need to be performed concurrently or may be incorporated within another task. Although activities identified in this document were grouped under specific categories, this does not imply that one category has greater importance than the other. Prioritization of tasks was established across categories based upon the individual merit of each individual activity.

This document should not be considered inclusive, but rather the Subcommittee's best judgment of programs and their relative priority to each other that should be addressed to maximize efficiency and progress toward recovery goals. This document should remain dynamic, with periodic review and refinement. As new information becomes available, priorities and tasks may be revised and modified accordingly.

It is recommended that funding for the arrayed priorities be allocated by the Recovery Committee, with biological input to administer a comprehensive, integrated effort that will lead to recovery of these fishes. Funding should not be limited to those activities that deliver the "biggest bang for the bucks" or to delete or limit activities (e.g., monitoring) that deliver less tangible and immediate results. All activities should be considered as part of an integrated package on which future biological decisions are based within the total recovery effort.

Participants in the Upper Colorado River Basin Biological Subcommittee:

Jim Bennett, Subcommittee Chairman
State of Colorado
William Burleigh, U.S. Bureau of Reclamation
Max Haegele, U.S. Bureau of Reclamation
Reed Harris, U.S. Bureau of Reclamation
Lynn Kaeding, U.S. Fish and Wildlife Service
Tom Nesler, State of Colorado
Tom Pitts, Colorado Water Congress
Carse Pustmueller, National Audubon Society
Colorado Wildlife Federation
Randy Radant, State of Utah
Butch Slawson, Rocky Mountain Oil and Gas Association
Mike Stone, State of Wyoming
Bob Taylor, Denver Water Department
Harold Tyus, U.S. Fish and Wildlife Service

TABLE 6-2.1: RESEARCH CATEGORIZATION AND PRIORITIZATION

Priority (1-5)	MONITORING (I)	LIFE HISTORY/HABITAT (II)	MANAGEMENT-APPLICABLE (III)	ADMINISTRATIVE (IV)
(1)	--Monitor fall CSF YOY abundance (index) --Standardized monitoring program for juvenile and adult endangered fishes	--Conduct standardized, intensive surveys for larval CSF; determine relationship to YOY abundance, recruitment --Refine habitat/flow model(s) --Validate habitat/flow model(s) --Determine the range, distribution, abundance, etc. for razorback sucker --Evaluate taxonomic status of Gila complex; recommended future course of action	--Design of passage structure --Assess the effects of flow fluctuations on the survival of endangered fishes --Evaluate effectiveness of hatchery program in contributing to recovery (biological) --Evaluate use of grow-out ponds --Assess feasibility of constructing fish passages; recommend course of action	--I&E effort on endangered fishes (to solve people problems, including a CSF sport fishery) --Define, quantify key terms: Recovery, viable, self-sustaining, recruitment, criteria for success (fish passage), etc. --Form a basinwide panel (oversight committee) to review, coordinate basin research, quality control --Establish an annual upper basin research budget & manpower commitment --Determine if implemented efforts will contribute to preservation/recovery of species --Stop stocking of nonnative fishes that adversely affect rare fishes --Determine if States' fishing regulation conflict with recovery --Stock bonytails into Green River, monitor habitat use --Standardize data collection, management

Priority (1-5)	MONITORING (I)	LIFE HISTORY/HABITAT (II)	MANAGEMENT-APPLICABLE (III)	ADMINISTRATIVE (IV)
(2)	--Monitor known or suspected HBC and bonytail populations	--Develop aging techniques for adult endangered fishes --Develop flow criteria to protect geomorphology, habitats --Field, lab tests to determine if competition with nongame/exotic fishes affects endangered fishes' abundance, distribution --Gain understanding of Gila hybridization (including G. elegans) --Develop field methods to identify Gila spp. --Evaluate flow/temperature effects on exotic fishes --Test flow/temperature effects on on exotic fishes --Refine and validate "Sensitive Reaches"--all species	--Hatchery feasibility for CSF, HBC, razorback sucker, bonytail (institutional)	
(3)	--Monitor habitat availability trends (remote sensing, field validation) --Environmental contaminant survey	--Bioassays on warranted contaminants, identified in (3)(I) --Continue, expand radio-tracking studies to HBC, razorback sucker, bonytail --Develop taxonomic key/technique for razorback sucker larvae	--Evaluate fish screen to avoid entrapment, etc. --Investigate factors affecting CSF spawning, as related to physical habitat manipulation --Manipulate habitat, assess/ field test habitat enhancement	--Evaluate migration routes and identify potential barrier to migration for rare fishes --Identify physico-chemical, biologic reasons for extirpation --Assess riparian condition relative to endangered fishes

Priority (1-5)	MONITORING (I)	LIFE HISTORY/HABITAT (II)	MANAGEMENT-APPLICABLE (III)	ADMINISTRATIVE (IV)
(4)		--Develop marking techniques for CSF larvae --Field study downstream transport, habitat use by larval endangered fishes --Data assessment to study downstream transport, habitat use by larval endangered fishes --Investigate influence of temperatures, salinity, sediments, turbidity on endangered fishes' eggs/larvae --Locate, describe physical spawning micro-habitat for rare fishes --Estimate the importance of parasitic infestation on endangered fishes --Determine habitat needs for bonytail		--Develop protective criteria for bonytail habitat --Stock, monitor a reestablished Green River HBC population
(5)			--Remove exotic fishes from ecosystem --Feasibility of CSF experimental sportfishery --Habitat Management handbook	

October, 1985

The following are amendments and additions to the Biological Subcommittee's "Research List" (9/85):

a) Consensus among Subcommittee members suggested a total cost per man-month of about $4,800. This value was multiplied by the estimate of man-months per year to achieve the (1985) dollar estimates of annual project costs displayed at the right-hand edge of each project time line in Table 6-2.2. These figures include permanent and temporary personal services, travel, operating and indirect costs only. Projects for which no ideas about costs existed were assigned "?", and carried through this summary process as special cases, but do not show up in column or row cost estimates or sums.

   For purposes of this process, the equipment of upper basin researchers was inventoried and purchase prices were estimated. The start-up costs were estimated at $90,000-$100,000 for equipment, and a 5-year useful life was assigned. Therefore, a $100,000 initial investment in equipment would have to be supplemented with an annual $20,000 upkeep and replacement budget to maintain a useful equipment arsenal for upper basin researchers. (The potential effects of inflation were not considered.)

b) Also appended is a summary table (Table 6-2.3) displaying the (1985) dollars and their relative proportion of research projects by priority (1-5) and group (I-IV). Note that projects assigned a "?" are displayed by group and priority category, but did not contribute to any column or row total.

TABLE 6-2.2: PROPOSED RESEARCH TIMEFRAMES AND COST

PRIORITY	GROUP	"RESEARCH" COMPONENT	TIMEFRAME (YEARS) 1-3	4-6	7-10		MAN-MONTH PER YEAR
(1)	I	--Monitor fall CSF YOY abundance (index)				$ 48,000	10
		--Standardized monitoring program for juvenile and adult endangered fishes				72,000	15
	II	--Conduct standardized, intensive surveys for larval CSF; determine relationship to YOY abundance, recruitment				172,800	36
		--Refine habitat/flow model(s)				57,600	12
		--Validate habitat/flow model(s)				115,200	24
		--Determine the range, distribution, abundance, etc. for razorback sucker	57,600				12
		--Evaluate taxonomic status of Gila complex	15,000				9
	III	--Design of passage structure				57,600	
		--Assess the effects of flow fluctuations on the survival of endangered fishes		96,000			20
		--Evaluate effectiveness of hatchery program in contributing to recovery (biological)				86,400	18
		--Evaluate use of grow-out ponds	50,000				18
		--Assess feasibility of constructing fish passages	6,000				6
	(IV)	--I&E effort on endangered fishes (to solve people problems)				28,800	6
		--Define, quantify key terms: Recovery, viable, self-sustaining, recruitment, criteria for success (fish passage), etc.	$28,800				6

TABLE 6-2.2 (continued)

PRIORITY	GROUP	"RESEARCH" COMPONENT	TIMEFRAME (YEARS) 1-3	4-6	7-10	MAN-MONTH PER YEAR
	(IV)	--Form a basinwide panel (oversight committee) to review, coordinate basin research, quality control	$ 4,800			1
		--Establish an annual, upper basin research budget & manpower commitment			$ 9,600	2
		--Determine if implemented efforts will contribute to preservation/recovery of species			19,200	4
		--Stop stocking of nonnative fishes that adversely affect rare fishes			4,800	1
		--Determine if States' fishing regulations conflict with recovery			4,800	1
		--Stock bonytails into Green River, monitor habitat use		86,400		18
		--Standardize data collection, management			24,000	5
(2)	(I)	--Monitor known or suspected HBC and bonytail populations			96,000	20
	(II)	--Develop aging techniques for adult endangered fishes	28,800			6
		--Develop flow criteria to protect geomorphology, habitats		28,800		6
		--Field, lab tests to determine if competition with nongame/exotic fishes affects endangered fishes' abundance, distribution		115,200		24

TABLE 6-2.2 (continued)

PRIORITY	GROUP	"RESEARCH" COMPONENT	TIMEFRAME (YEARS) 1-3	4-6	7-10	MAN-MONTH PER YEAR
	(II)	--Gain understanding of Gila hybridization (including G. elegans)	----------	75,000		24
		--Develop field methods to identify Gila spp.	---------- ?			--
		--Evaluate flow/temperature effects on exotic fishes	---------- $57,600			12
		--Test flow/temperature effects on exotic fishes	----------		115,200	24
		--Refine and validate "Sensitive Reaches"--all species	----------		172,800	36
	(III)	--Hatchery feasibility for CSF, HBC, razorback sucker, bonytail (institutional)	---------- 9,600			2
(3)	(I)	--Monitor habitat availability trends (remote sensing, field validation)	----------		28,800	6
		--Environmental contaminant survey	---------- $57,600			12
	(II)	--Bioassays on warranted contaminants, identified in (3) I	---------- ?			?
		--Continue, expand radio-tracking studies to HBC, razorback sucker, bonytail	----------	$96,000		20
		--Develop taxonomic key/technique for razorback larvae	---------- $28,800			6
	(III)	--Evaluate fish screen to avoid entrapment, etc.	---------- $57,600			12

TABLE 6-2.2 (continued)

PRIORITY	GROUP	"RESEARCH" COMPONENT	TIMEFRAME (YEARS) 1-3	4-6	7-10	MAN-MONTH PER YEAR
	(III)	--Investigate factors affecting CSF spawning, as related to physical habitat manipulation	$57,600			12
		--Manipulate habitat, assess/ field test habitat enhancement		$57,600		12
	(IV)	--Evaluate migration routes and identify potential barrier to migration for rare fishes	9,600			2
		--Identify physico-chemical, biologic reasons for extirpation	14,400			3
		--Assess riparian conditions relative to endangered fishes	57,600			12
(4)	(II)	--Develop marking techniques for CSF larvae	14,400			3
		--Field study downstream transport, habitat use by larval endangered fishes	38,400			8
		--Data assessment to study downstream transport, habitat use by larval endangered fishes	19,200			4
		--Investigate influence of temperatures, salinity, sediments, turbidity on endangered fishes' eggs/larvae	57,600			12
		--Locate, describe physical spawning micro-habitat for rare fishes	57,600			12
		--Estimate the importance of parasitic infestation on endangered fishes	14,400			3
		--Determine habitat needs for bonytail	14,400			3

TABLE 6-2.2 (continued)

PRIORITY	GROUP	"RESEARCH" COMPONENT	TIMEFRAME (YEARS) 1-3	4-6	7-10	MAN-MONTH PER YEAR
	(IV)	--Develop protective criteria for bonytail habitat	----------	?		?
		--Stock, monitor a reestablished Green River HBC population	----------	----------	?	?
(5)	(III)	--Remove exotic fishes from ecosystem ecosystem	----------	----------	?	?
		--Feasibility of CSF experimental sportfishery	----------	$ 9,600		2
		--Habitat Management handbook	----------	$57,600		12

Cost per project-year, includes temporary and permanent personal services, travel, operating and indirect costs only.

Table 6-2.3

Summary of Budget
Projections from "Research Prioritization List"

PRIORITY	GROUP I		II		III		IV		TOTAL	
	$	%	$	%	$	%	$	%	$	%
(1)	120,000.	11.5	418,200.	40.0	296,000.	28.3	211,200.	20.2	1,045,400.	
(2)	96,000.	13.7	593,400.	84.9	9,600.	1.4	-------	0	699,000.	(1-?)
(3)	86,400.	18.6	124,800.	26.8	172,800.	37.1	81,600.	17.5	465,600.	(1-?)
(4)	------	0	216,000.	100	------	0	------	0	216,000.	(2-?)
(5)	------	0	-------	0	67,200.	100	------	0	67,200.	(1-?)
TOTAL	302,400.	12.1	1,352,400	54.2	545,600.	21.9	292,800.	11.7	2,493,200.	100%
(?'s)	(0)		(2)		(1)		(2)		(5)	

APPENDIX 6.3 UPPER COLORADO RIVER BASIN RARE FISHES RIVER REACH PRIORITIZATION

Table 6-3.1 provides a river reach prioritization of the Green and Colorado subbasins for the four rare Colorado River fishes. Table 6-3.2 provides a time-of-year and river mile comparison for each life stage of the four fish by river reach. This information was developed by the Upper Colorado River Basin Biological Subcommittee. Priorities were established largely from information presented in the "Rare and Endangered Colorado River Fishes Sensitive Areas" document (September 1984), prepared by the Upper Basin Biological Subcommittee. River reaches used by these rare fishes were ranked from 1 (highest priority) to 3 (lowest) according to their recognized importance for each species. The corresponding time periods when they are most important is noted.

Important reaches for the bonytail and Colorado squawfish migration corridors were handled as special cases because they did not fit into the general format; migration routes for the razorback sucker, bonytail chub, or humpback chub remain to be delineated. River reaches identified in these special cases are considered to be among the highest priority tasks. Historic, unoccupied habitats were not listed but are considered important for research, and to the eventual recovery of these fishes. The controlled stocking and monitoring of presently uninhabited reaches can offer insight into habitat use, interspecific relationships, etc. For example, the recovery plan for the squawfish identifies "primary habitats" that have been cut off from the remainder of the ecosystem (e.g., White River above Taylor Draw Dam), but are considered important to recovery.

The Subcommittee emphasizes that each life stage of a species is critical and a habitat continuum must be present between each life stage if the species is to survive. Priorities are not implied nor should any be assumed either within or between species for the same ranking. Likewise, because of the uniqueness of each subbasin, the Subcommittee believes it is not proper to weigh priorities in one subbasin against priorities of the other subbasin. The Subcommittee strongly recommends against taking this approach.

River reaches ranked as priority 1 or 2 are considered essential to species conservation; however, conclusions should not be reached that areas of lower ranking may be less critical to species recovery. This information is intended to provide the reader with an analysis based on current information of important river reaches so decisions can be made to initiate recovery actions. As additional data are gathered, new high-priority areas may be identified and old ones refined. Incorporation of new data may require periodic adjustment or refinement in river management.

At this time, the "Rare and Endangered Colorado River Fishes Sensitive Areas" document requires review. New data will allow the application of more discriminating criteria and for refinement of the research list. Perhaps a similar, annual review would be appropriate.

TABLE 6-3.1

Prioritization of Upper Colorado River Basin
Endangered Fishes Sensitive Reaches

October 21, 1985

Yampa - Green Sub-basin	Colorado Sub-basin
PRIORITY 1	
Colorado Squawfish	
High concentration areas	High concentration areas
--GREEN RIVER a. Sand Wash - Yampa River (211-345)	--COLORADO RIVER a. Westwater - Loma (125-154)
--WHITE RIVER a. Confluence - Mt. Fuel Bridge (0-21)	
Confirmed spawning areas	Confirmed spawning areas
--GREEN RIVER a. Three Fords (148-157)	
--YAMPA RIVER a. Yampa Canyon (4-31)	
YOY high density nursery areas	YOY high density nursery areas
--GREEN RIVER a. Lower Green-Gray Canyon (0-160) b. Ouray-Jensen (200-290)	--COLORADO RIVER a. Upper Professor Valley (70-80)
Juvenile high concentration areas	Juvenile high concentration areas
--GREEN RIVER a. Confluence - Gunnison Butte (0-131)	

Humpback chub

High concentration areas

--GREEN RIVER
a. Gray Canyon (146-154)

--YAMPA RIVER
a. Yampa Canyon (18-24)

High concentration areas

--COLORADO RIVER
a. Black Rocks (135-136)
b. Westwater Canyon (116-124)

Confirmed spawning areas

Confirmed spawning areas

--COLORADO RIVER
a. Black Rocks (135-136)

Razorback sucker

Confirmed spawning areas

--GREEN RIVER
a. Ashley Creek-Split Mt. (299-307)
b. Echo Park (344-345)

--ASHLEY CREEK
a. Mouth (0.-0.5)

--DUCHESNE RIVER
a. Mouth (0.-2.5)

Confirmed spawning areas

--COLORADO RIVER
a. Clifton (179)

Concentration areas

--GREEN RIVER
a. Confluence of Duchesne (247)
b. Ashley Creek-Island Park (298-308)

Concentration areas

--COLORADO RIVER
a. Grand Junction-Clifton (163-180)

Bonytail

Rather than identifying "Sensitive habitat" for the bonytail the last known collection sites, re-introduction sites, and recent capture locations should be considered Priority 1 river reaches for this species.

--YAMPA RIVER
a. Inside DNM
b. Yampa Canyon (0-28)

--GREEN RIVER
a. Gray Canyon (160)

--COLORADO RIVER
a. Black Rocks (136-136)

PRIORITY 2

Colorado squawfish

Concentration areas

--GREEN RIVER
a. Ruby Ranch-Gunnison Butte (93-131)

--YAMPA RIVER
a. Little Snake-Juniper Canyon (51-89)
b. Juniper Canyon-Round Bottom (91-124)

Suspected spawning areas

--GREEN RIVER
a. Labyrinth Canyon (38-66)
b. Labyrinth Canyon (99-115)
c. Tusher Wash (124-129)
d. Desolation Canyon (180-210)
e. Split Mt. (310-342)

--YAMPA RIVER
a. Mouth-Warm Springs (0-4)

YOY nursery areas

--GREEN RIVER
a. Confluence to Echo Park (0-345)

Juvenile concentration areas

--GREEN RIVER
a. Sand Wash-Split Mt. (211-320)

--WHITE RIVER
a. Confluence-Ignacio (0-59)

Concentration areas

--COLORADO RIVER
a. Big Bend-Onion Draw (71-86)

Suspected spawning areas

--COLORADO RIVER
a. Cataract Canyon (-18 to -14)[a]
b. Loma-Black Rocks (135-145)
c. Clifton-Grand Junction (170-180)

YOY nursery areas

--COLORADO RIVER
a. Green confluence-Moab (0-60)
b. Dolores River-Westwater (90-110)
c. Loma (140-150)
d. Downstream from Gunnison (70-160)

Juvenile concentration areas

--COLORADO RIVER
a. Hite-Cataract Canyon (-48 to -16)[a]
b. Potash-Dolores River (47-86)

[a]Negative values denote river-miles below confluence of Green-Colorado

Humpback chub

Concentration areas

--GREEN RIVER
a. Whirlpool Canyon (342)
b. Confluence of White River (~240)
c. Gray Canyon (171)

--YAMPA RIVER
a. Cross Mt. (~54)

Concentration areas

--COLORADO RIVER
a. Moab (~70)
b. Cataract Canyon (-11)[a]

Suspected spawning areas

--GREEN RIVER
a. Gray Canyon (146-171)

--YAMPA RIVER
a. Yampa Canyon (18-24)

Suspected spawning areas

--COLORADO RIVER
a. Westwater Canyon (111-125)

Razorback sucker

Suspected spawning areas

--GREEN RIVER
a. Labyrinth Canyon (90-110)
b. Split Mt. (307-328)
c. Island Park (325-335)

Suspected spawning areas

PRIORITY 3

Colorado squawfish

Distribution minus concentration areas

--GREEN RIVER
a. (0-93)
b. (131-211)
c. (345-364)

--WHITE RIVER
a. (21-156)

--YAMPA RIVER
a. (0-51)
b. (89-91)
c. (124-140)

Distribution minus concentration areas

--COLORADO RIVER
a. (-16-71)[a]
b. (86-125)
c. (154-185)

--GUNNISON RIVER
a. (0-33)

YOY distribution areas

--GREEN RIVER
a. Green River (0-345)

--YAMPA RIVER
a. Yampa River (0-21)

YOY distribution areas

--COLORADO RIVER
a. Cataract Canyon - Clifton (-16-180)[a]

Razorback sucker

Distribution minus concentration areas

--GREEN RIVER
a. (0-120)
b. (213-246)
c. (248-298)
d. (299-308)

Distribution minus concentration areas

--COLORADO RIVER
a. (-16 to 5)[a]
b. (40-70)
c. (140-163)
d. (180-220)

Distribution minus concentration areas

--DUCHESNE RIVER
a. (0-4)

Distribution minus concentration areas

PRIORITY 4

This category contains all historic, un-occupied habitats for Colorado squawfish, humpback chub, bonytail and razorback sucker.

SPECIAL CASE

Migration routes

--GREEN RIVER
a. Confluence - Gates of Lodore (0-364)

--WHITE RIVER
a. Confluence - Meeker (0-156)

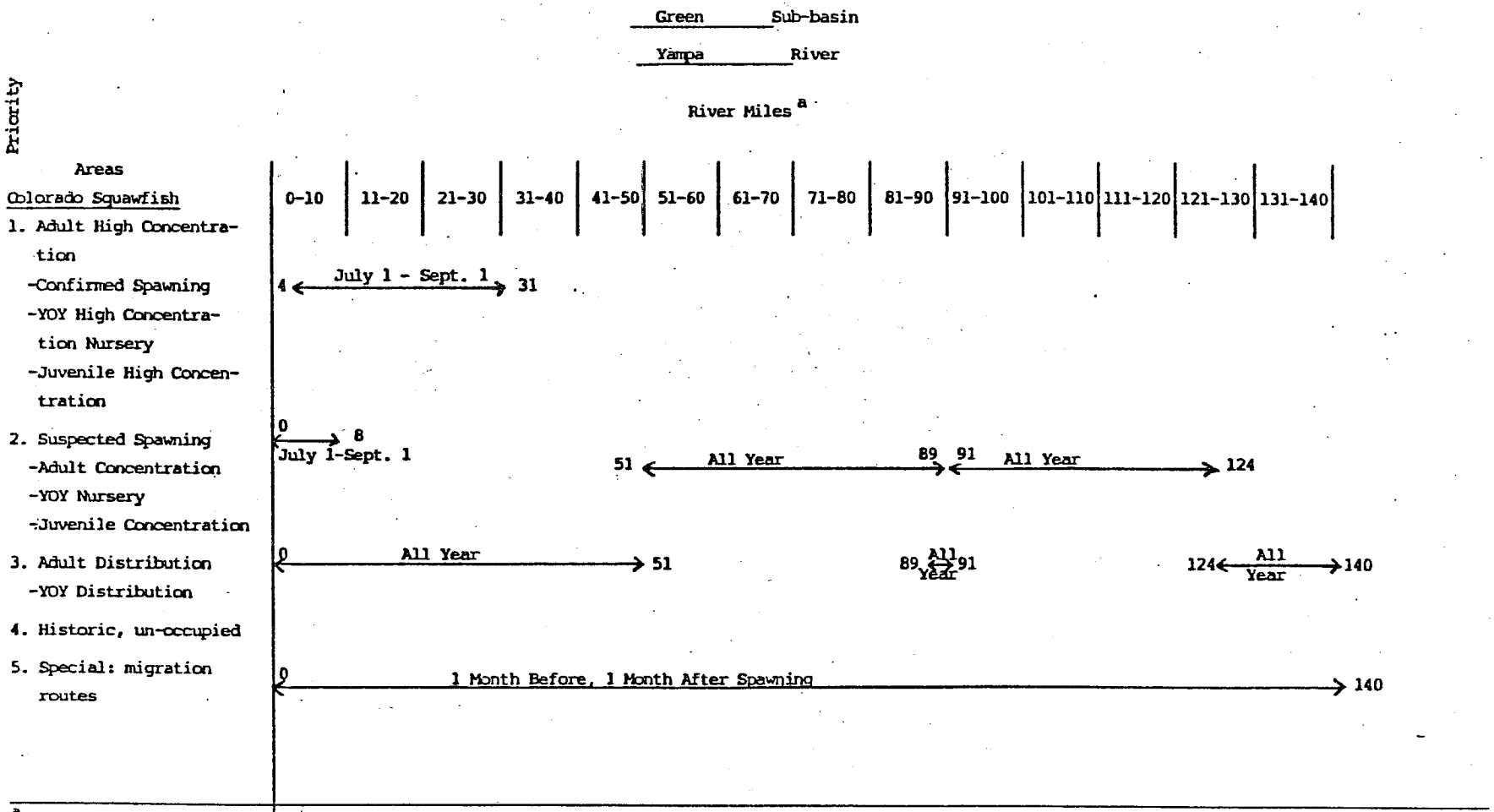
--YAMPA RIVER
a. Confluence - Rifle (0-140)

Migration routes

--COLORADO RIVER
a. Lake Powell - Palisade (-16-188)[a]

Migration routes for razorback sucker, bonytail or humpback chub remain to be delineated.

TABLE 6-3.2: IMPORTANT RIVER REACHES BY LIFE STAGE AND TIME-OF-YEAR



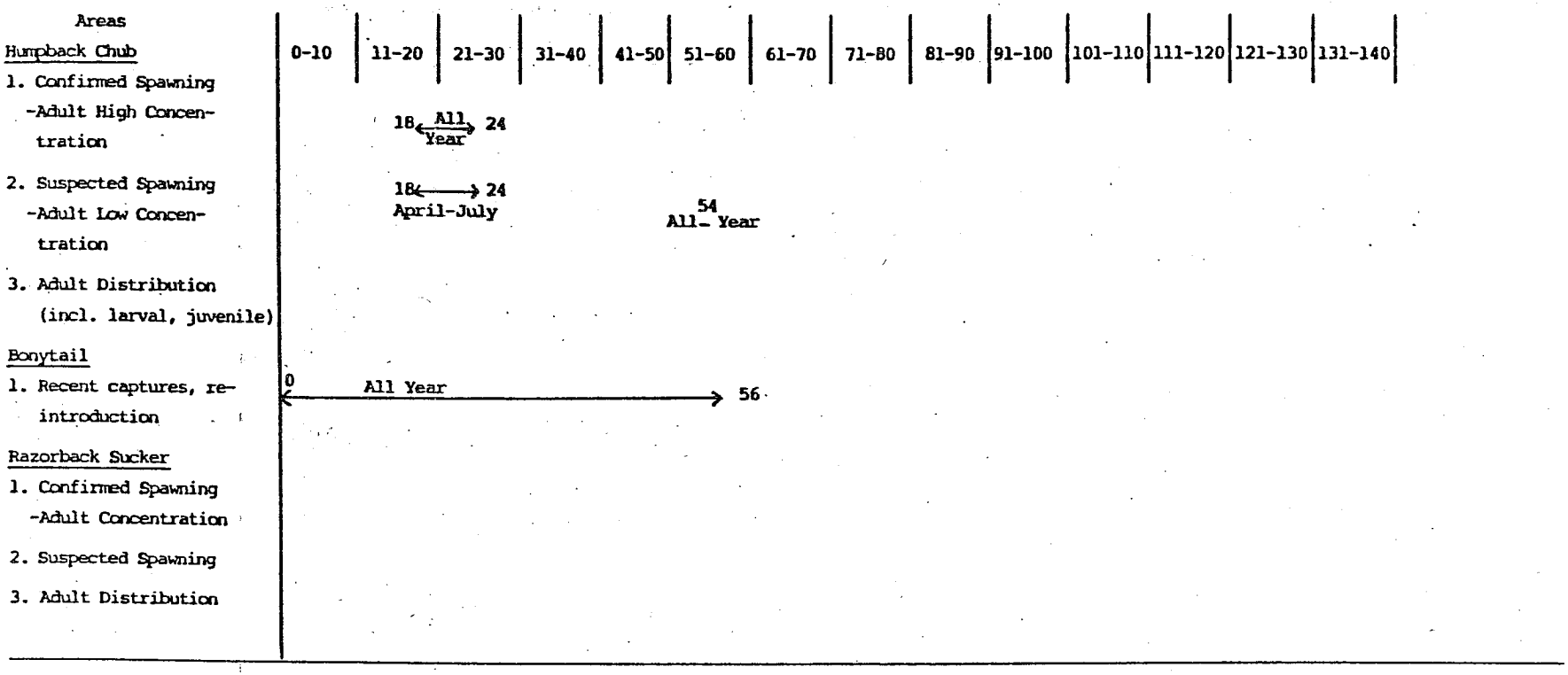
[a] Months when river reach is important to a particular life stage.

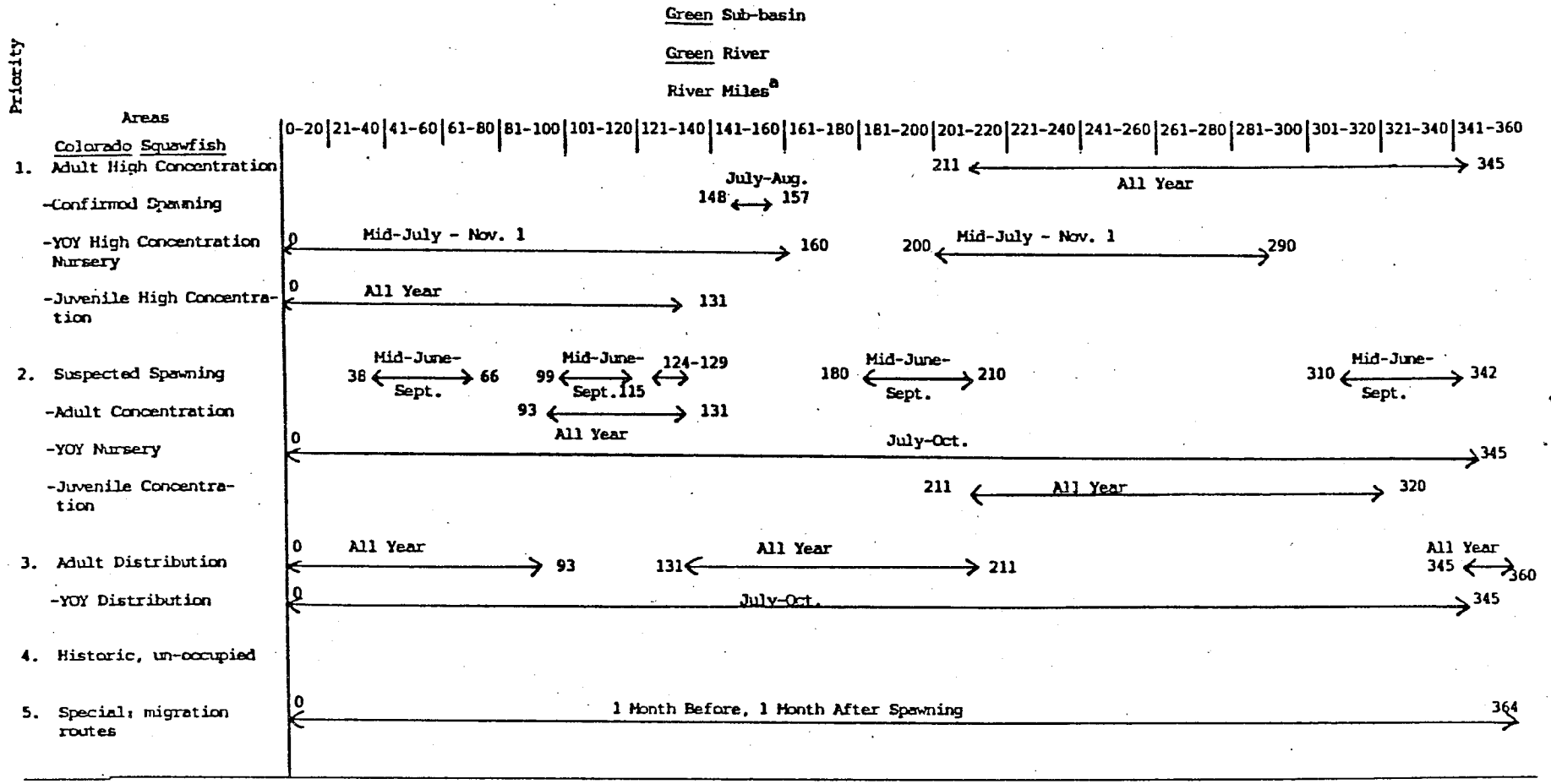
[b] Negative river miles denote reaches below confluence of Green-Colorado.

Green Sub-basin

Yampa River

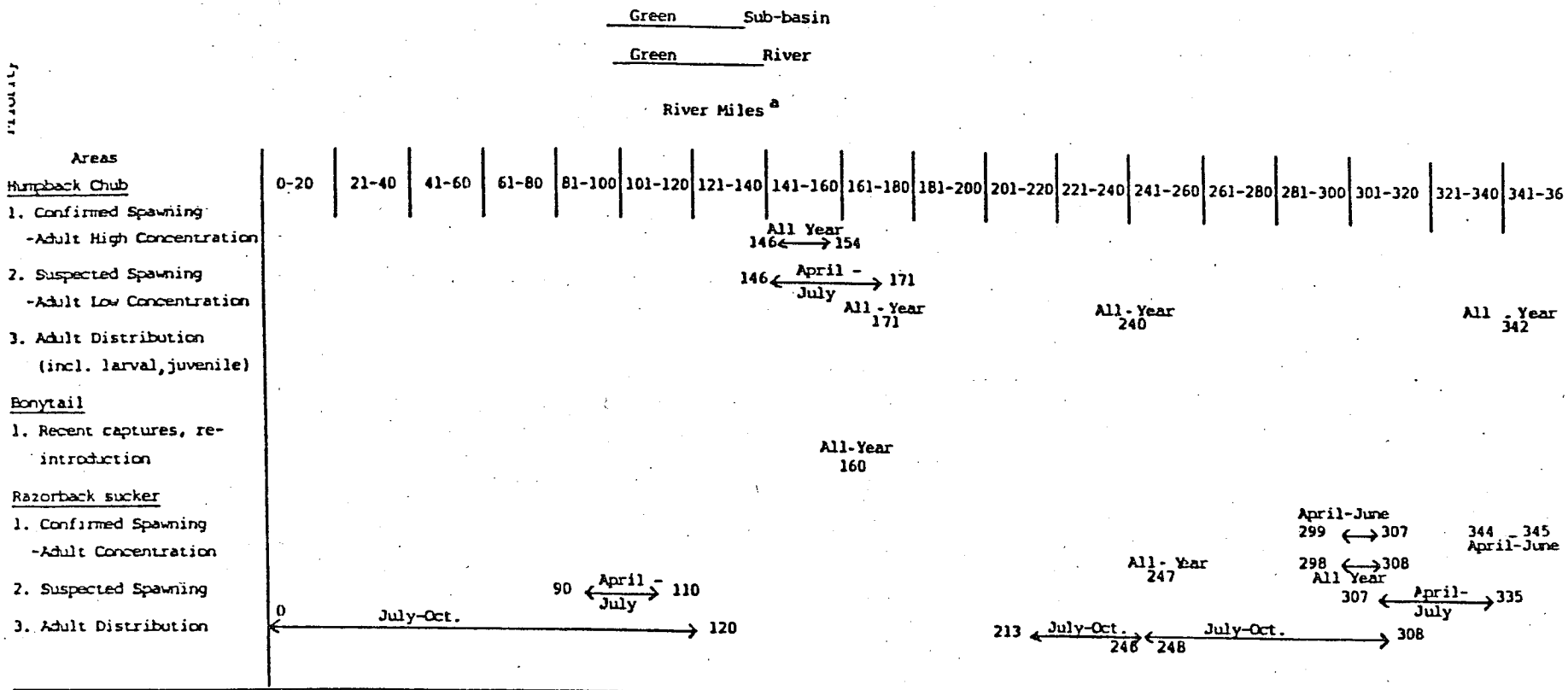
River Miles [a]

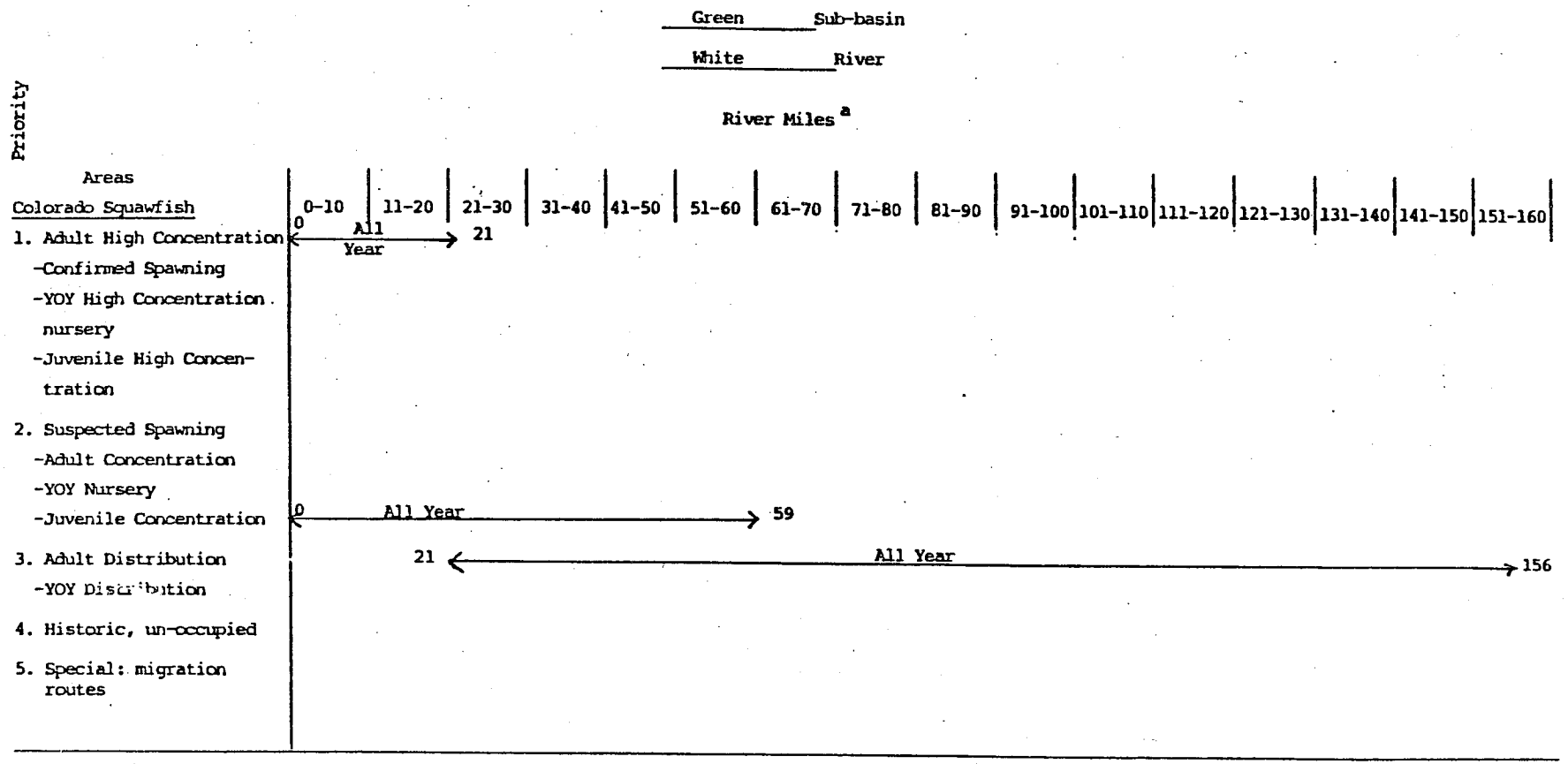




[a] Months when river reach is important to a particular life stage.

[b] Negative river miles denote reaches below confluence of Green-Colorado.


Green Sub-basin
Green River
River Miles a
Areas
Humpback Chub
1. Confirmed Spawning
-Adult High Concentration
2. Suspected Spawning
-Adult Low Concentration
3. Adult Distribution
(incl. larval, juvenile)
Bonytail
1. Recent captures, re-introduction
Razorback sucker
1. Confirmed Spawning
-Adult Concentration
2. Suspected Spawning
3. Adult Distribution
0-20
21-40
41-60
61-80
81-100
101-120
121-140
141-160
161-180
181-200
201-220
221-240
241-260
261-280
281-300
301-320
321-340
341-36
All Year
146 ⟷ 154
146 ⟷ April - July ⟷ 171
All-Year 171
All-Year 240
All-Year 342
All-Year 160
April-June
299 ⟷ 307
344 - 345 April-June
All-Year 247
298 ⟷ 308
All Year
307 ⟷ April-July ⟷ 335
90 ⟷ April - July ⟷ 110
0 ⟷ July-Oct. ⟷ 120
213 ⟷ July-Oct. 246 ⟷ 248 July-Oct. ⟷ 308



[a]Months when river reach is important to a particular life stage.

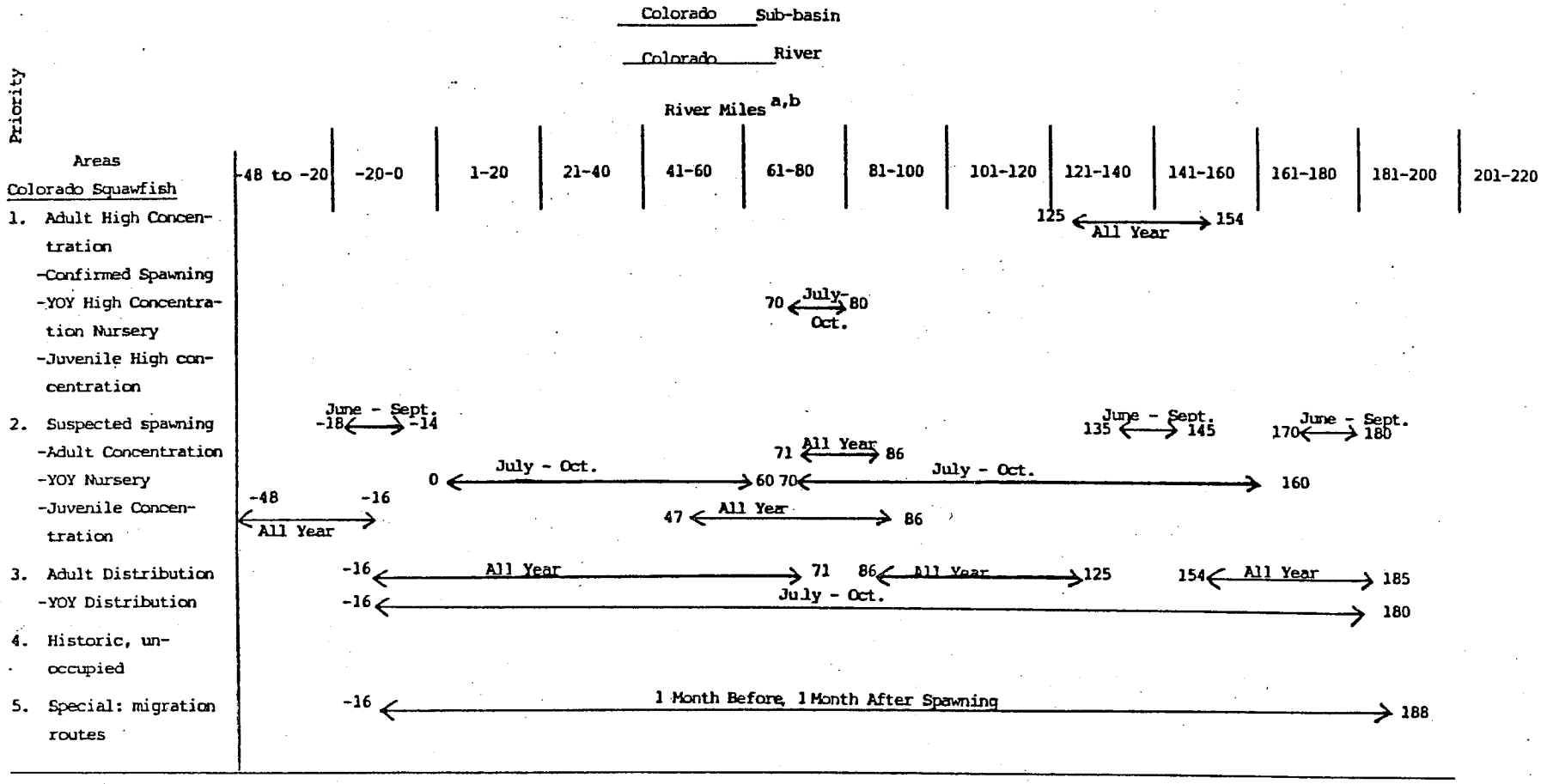
[b]Negative river miles denote reaches below confluence of Green-Colorado.

Green Sub-basin

White River

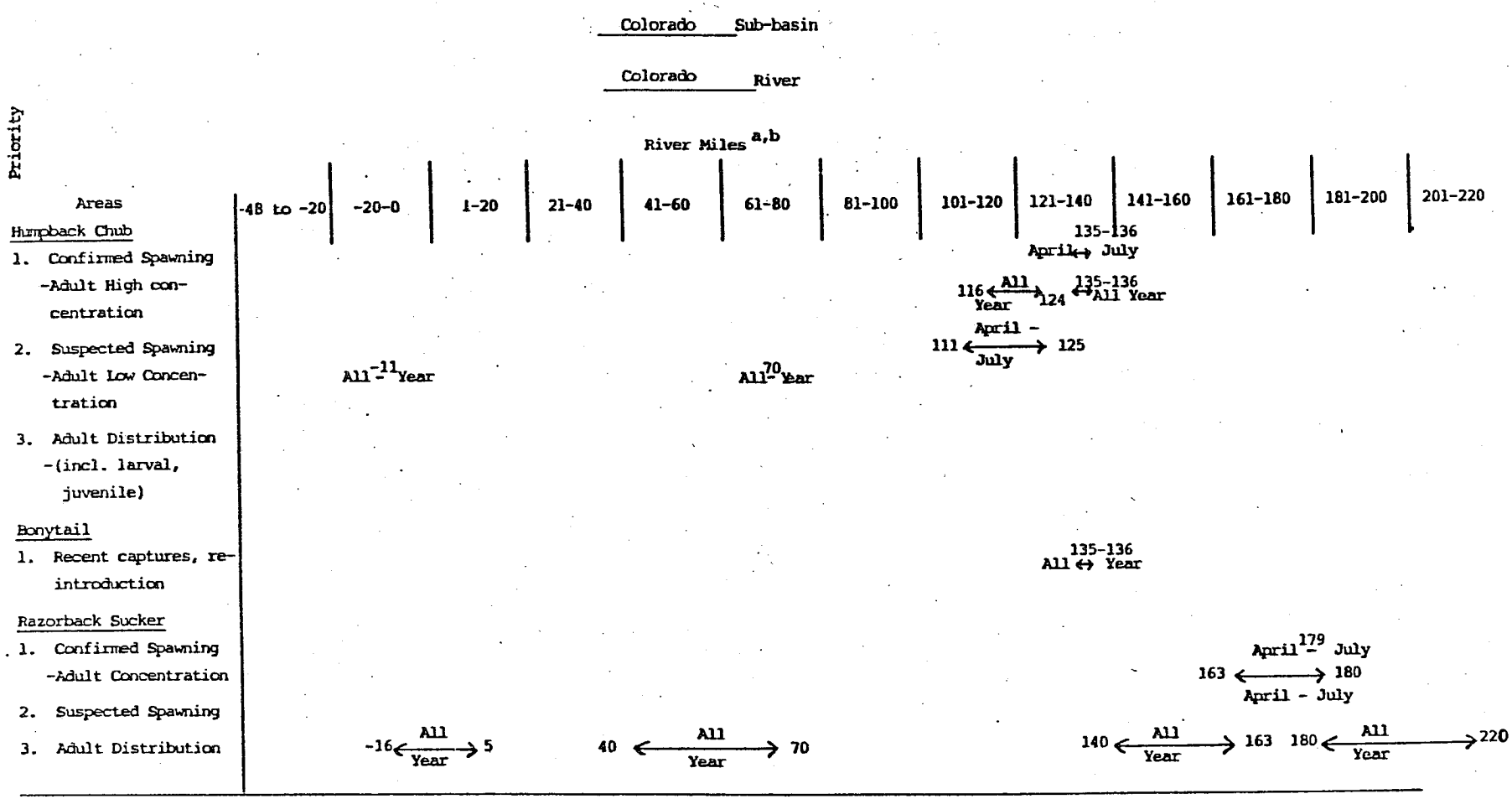
River Miles[a]

Areas	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120	121-130	131-140	141-150	151-160
Humpback Chub																
1. Confirmed Spawning -Adult High Concentration																
2. Suspected Spawning Adult Low Concentration																
3. Adult Distribution (incl. larval, juvenile)																
Bonytail																
1. Recent Captures, re-introduction																
Razorback Sucker																
1. Confirmed Spawning -Adult Concentration																
2. Suspected Spawning																
3. Adult Distribution																



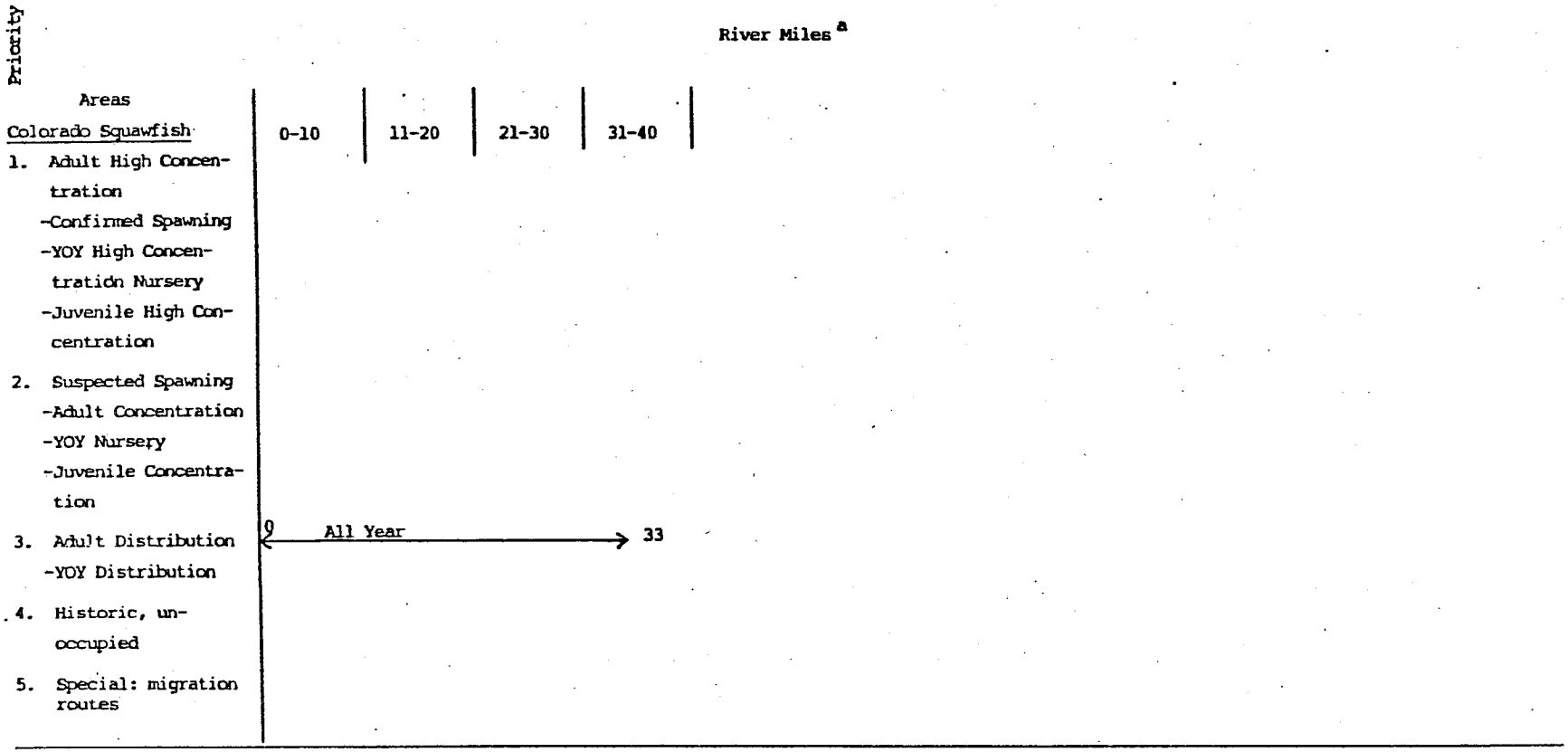
[a] Months when river reach is important to a particular life stage.

[b] Negative river miles denote reaches below confluence of Green-Colorado.


Colorado Sub-basin
Colorado River
River Miles a,b
Priority
Areas
-48 to -20
-20-0
1-20
21-40
41-60
61-80
81-100
101-120
121-140
141-160
161-180
181-200
201-220
Humpback Chub
1. Confirmed Spawning -Adult High concentration
2. Suspected Spawning -Adult Low Concentration
3. Adult Distribution -(incl. larval, juvenile)
Bonytail
1. Recent captures, reintroduction
Razorback Sucker
1. Confirmed Spawning -Adult Concentration
2. Suspected Spawning
3. Adult Distribution
135-136 April ↔ July
116 All Year 124
135-136 ↔ All Year
April - July 111 125
All -11 Year
All 70 Year
135-136 All ↔ Year
April 179 - July 163 180 April - July
-16 All Year 5
40 All Year 70
140 All Year 163
180 All Year 220

Colorado Sub-basin

Gunnison River



[a]Months when river reach is important to a particular life stage.

[b]Negative River miles denote reaches below confluence of Green-Colorado.

Colorado Sub-basin

Gunnison River

Priority

River Miles[a]

Areas	0-10	11-20	21-30	31-40
Humpback Chub				
1. Confirmed Spawning -Adult High Concentration				
2. Suspected Spawning -Adult Low Concentration				
3. Adult Distribution (inc. larval, juvenile)				
Bonytail				
1. Recent captures, re-introduction				
Razorback Sucker				
1. Confirmed Spawning -Adult Concentration				
2. Suspected Spawning				
3. Adult Distribution				

[a]Months when river reach is important to a particular life stage

[b]Negative River miles denote reaches below confluence of Green-Colorado.

TABLE 6.4

HATCHERY RESEARCH AND PRODUCTION NEEDS

Table 1. Estimated numbers (x 1000) of Colorado River endangered fishes required for upper Colorado River Basin studies and reintroductions (f=fry; y=young of the year; j=juveniles; a=adults)

Study topic	Rating P-G[a]	Year 1	2	3	4	5	6	7	8	9	10	11	12	13	14
Colorado Squawfish															
Passageways	1-III	20f	20f	20f	20f	20f 5a	5a	5a	5a	5a	5a				
Hatchery (biological)[b]	1-III	1,000f	1,000f	1,000f	1,000f	1,000f									
Hatchery (institution)[c]	2-III				220f	220f	220f								
Competition	2- II				100y	100y	100y	100y	100y						
Bioassays	3- II							20y	20y						
Habitat Improvement[d]	3-III							100y	100y	100y	100y	100y			
Entrainment	3-III							10f	10f	10f					
								10y	10y	10y					
Turb/temp/salinity	4- II									40y	40y	40y			
Larval drift/habitat use	4- II									100f	100f	100f			
Reintroduction/fishery[e]	N.R.						250y	250y	250y	250y	250y	250y	250y	250y	250y
Totals	Fry	1,020f	1,020f	1,020f	1,670f	1,670f	650f	10f	10f	110f	100f	100f			
	YOY				100y	100y	350y	480y	480y	400y	390y	390y	250y	250y	250y
	Adults					5a	5a	5a	5a	5a	5a				
Humpback Chub															
Hatchery (biological)[b]	1-III	150f	150f	150f											
Hatchery (institution)[c]	2-III				110f	110f	110f								
Hybridization	2- II				1j	1j									
Competition	2- II				20y	20y	20y	20y	20y						
Radio tracking	3- II							.02a	.02a	.02a					
Bioassays	3- II							20y	20y						
Habitat improvement[d]	3-III							100y	100y	100y	100y	100y			
Temp/salinity	4- II									20y	20y				
Reintroduction[e]	N.R.							125y	125y	125y	125y	125y	125y	125y	125y
Totals	Fry	150f	150f	150f	110f	110f	110f								
	YOY				20y	20y	20y	265y	265y	245y	245y	225y	125y	125y	125y
	Juvenile				1j	1j									
	Adult							.02a	.02a	.02a					
Bonytail															
Hatchery (biological)[f]	1- I	0.2y 0.1j 1.7a	200j	200y	200y	200y									
Hatchery (institution)[c]	2-III				100f	100f	100f								
Taxonomy/hybrid/ident	2- II				2j	1j	1j								
Bioassays	3- II							20y	20y						
Habitat improvement[d]	3-III							20y	20y	20y	20y	20y			
Radio tracking	3- II							.02a	.02a	.02a					
Reintroduction	N.R.							125y	125y	125y	125y	125y	125y	125y	125y
Totals	Fry				100f	100f	100f								
	YOY	0.2y		200y	200y	200y		165y	165y	145y	145y	145y	125y	125y	125y
	Juvenile	0.1j	200j		2j	1j	1j								
	Adult	1.4a						.02a	.02a	.02a					
Razorback Sucker															
Hatchery (biological)[b]	1-III	500f	500f	500f	500f	500f									
Passageways	1-III	20f	20f	20f	20f	20f	5a	5a							
				5a	5a	5a									
Hatchery (institution)[c]	2-III				220f	220f	220f								
Reintroduction[e]	N.R.							250y	250y	250y	250y	250y	250y	250y	250y
Totals	Fry	520f	520f	520f	1,170f	1,170f	650f								
	YOY							250y	250y	250y	250y	250y	250y	250y	250y
	Adults			5a	5a	5a	5a	5a							

[a]Priority (P) Group (G) classification based on BSC Research prioritization document (9-85)

[b]Includes survival, recruitment, spawning, imprinting-homing, migration behavior, stocking success/life stage, aging techniques

[c]Includes culture technique research, disease testing, genetic variability analyses

[d]Includes growout ponds, backwaters, spawning areas for CSF, flow/temp manipulations for HBC and BT

[e]Refers to production phase of recovery plans (versus research phase), time line is not necessarily certain for start or duration. N.R.=no rating

[f]Based on fish immediately available from California and Dexter NFH and proposed BT production at Dexter

(This document was prepared by the Upper Colorado River Biological Subcommittee.)

APPENDIX 6.5 FISH SPECIES IN THE UPPER COLORADO RIVER BASIN

6.5.1 List of Nonnative Fish Species Introduced into the Upper Basin: Distribution in Habitat of Rare Fish

Family/Scientific Name	Common Name		Range Distribution		
			Whole	Partial	Outside
Clupeidae					
Dorosoma petenense	Threadfin shad	(r)		LC	
Salmonidae					
Oncorhynchus kisutch	Coho salmon	(r)			X
Oncorhynchus nerka	Sockeye salmon	(r)			X
Salmo clarki	Cutthroat trout	(s)		X	
Salmo gairdneri	Rainbow trout	(s)	X		
Salmo trutta	Brown trout	(s)	X		
Salvelinus fontinalis	Brook trout				X
Salvelinus namaycush	Lake trout	(r)			X
Esocidae					
Esox lucius	Northern pike			X	
Cyprinidae					
Cyprinus carpio	Carp		A		
Gila atraria	Utah chub			X	
Gila copei	Leatherside chub				X
Hybognathus hankinsoni	Brassy minnow			X	
Hybognathus placitus	Plain's minnow			X	
Notropis lutrensis	Red shiner		A		
Notropis stramineus	Sand shiner		C		
Pimephales promelas	Fathead minnow		C		
Rhinichthys cataractae	Longnose dace				X
Richardsonius balteatus	Redside shiner			C	
Semotilus atromaculatus	Creek chub			X	
Catostomidae					
Catostomus ardens	Utah sucker			X	
Catostomus catostomus	Longnose sucker				X
Catostomus commersoni	White sucker			X	

(r)= Restricted to reservoirs
(s)= Presently being stocked
A = Abundant
C = Common
LC = Locally common
X = Rare or incidental

Family/Scientific Name	Common Name	Range Distribution		
		Whole	Partial	Outside
Ictaluridae				
Ictalurus melas	Black bullhead	X		
Ictalurus natalis	Yellow bullhead (r)		LC	
Ictalurus punctatus	Channel catfish (s)	A		
Cyprinodontidae				
Fundulus sciadicus	Plain's topminnow			X
Fundulus zebrinus	Rio Grande killfish		X	
Poeciliidae				
Gambusia affinis	Mosquito fish		X	
Percichthyidae				
Morone chrysops	White bass		X	
Morone saxatilis	Striped bass (r)		LC	
Centrarchidae				
Lepomis cyanellus	Green sunfish	LC		
Lepomis macrochirus	Bluegill (s)		X	
Micropterus dolomieui	Smallmouth bass (s)		LC	
Micropterus salmoides	Largemouth bass (s)		X	
Pomoxis annularis	White crappie			X
Pomoxis nigromaculatus	Black crappie (s)		LC	
Percidae				
Etheostoma exile	Iowa darter			X
Etheostoma nigrum	Johnny darter (r)			X
Perca flavescens	Yellow perch			X
Stizostedion vitreum	Walleye		LC	

(r)= Restricted to reservoirs
(s)= Presently being stocked
A = Abundant
C = Common
LC = Locally common
X = Rare or incidental

Reference:

Carlson, C.A., W.H. Miller, and H.M. Tyus. 1982. Fishes of the Upper Colorado River System: Present and Future. Annu. Conf. Am. Fish. Soc., Proc.

6.5.2 List of Native Fish Species

Family and Genus	Species	Common Name	Endemic/Status
SALMONIDAE			
Salmo	clarki pleuriticus	Colorado River cutthroat trout	
Prosopium	williamsoni	Rocky Mountain whitefish	
CYPRINIDAE			
Ptychocheilus	lucius	Colorado squawfish	yes (E)
Gila	cypha	Humpback chub	yes (E)
Gila	elegans	Bonytail chub	yes (E)
Gila	robusta	Roundtail chub	yes
Rhinichthys	osculus yarrowi	Speckled dace	
Rhinichthys	osculus thermalis	Kendall Warm Springs dace	yes (E)
CATOSTOMIDAE			
Xyrauchen	texanus	Razorback sucker	yes (Cand.)
Catostomus	latipinnis	Flannelmouth sucker	yes
Catostomus	discobolus	Bluehead mountain sucker	
Catostomus	platyrhynchus	Mountain sucker	
COTTIDAE			
Cottus	bairdi	Mottled sculpin	
Cottus	beldingi	Paiute sculpin	

Note: Status refers to Federal status

APPENDIX 6.6 WATER RESOURCE PROJECTS AND SECTION 7 CONSULTATION

6.6.1 Section 7 Consultation Status

I. Past Consultation Status:

The Service has completed 111 consultations on water-related projects in the Upper Basin from 1977 through August 1987: 102 no jeop (50 "Windy Gap" type*); 9 jeop. A complete list may be obtained from the Service.

Total Depletion 1,211,954 acre-feet (net annual average)

II. Present Consultation Status:

The Service is involved in or currently expects to be involved in at least 7 consultations through fall 1987.

PROJECT	AGENCY	LOCATION	DEPLETION**
Denver Water Project	COE	Colorado River, CO	54,400
Burnt Mountain Ski Area	FS	Colorado River, CO	115
Rock Creek Diversion	BLM	Green River, UT	120
Sandstone Project	COE	Yampa River, CO	26,100
Grand Junction Uranium Mill	DOI	Colorado River, CO	unkn.
Union Park Project	FERC	Gunnison, CO	unkn.
Collbran Project, Big Meadows Dam	BR	Colorado River, CO	2

Total Known Depletion 80,737 acre-feet (estimated - actual future depletion amount is unknown)

* Windy Gap-type include project contributions to offset project impacts
** all depletion estimates based upon net annual average

Note: The Service cannot predict future depletions since in most cases the Service is not notified by Federal agencies about potential projects until Section 7 consultation is required.

Reference:

U.S. Fish and Wildlife Service. 1987. Denver, Co.

6.6.2 Funding for Conservation Measures Provided by Water Projects Proponents

I. FUNDS RECEIVED AND EXPENDED, 1981 TO 1987	$ 718,201	
II. FUNDS RECEIVED AND AVAILABLE FOR USE	$ 413,842**	

III. FUTURE FUNDING COMMITMENTS

FUNDS TO BE SUBMITTED

Taylor Draw Reservoir (CO/COR)	$ 120,000	
Rock Creek Diversion (UT/BLM)	1,791	
	$ 121,791	

FUNDS EXPECTED WHEN DEPLETIONS INITIATED OR PERMITS ISSUED

Black Butte Mine (WY/OSM)	$ 1,641	
Chevron Phosphate (WY/BLM)	156,660	
Homestake Diversion (CO/FS)	221,000	
Kemmerer Mine (WY/OSM)	1,179	
Mobil/Parachute Project (CO/BLM) (partial)	48,914	**
South Haystack Mine (WY/OSM)	1,430	
Union/Parachute Creek (CO/COE) (partial	34,463	**
Subtotal	$ 465,287	

FUNDS POSSIBLE - REMAINDER OF PARTIAL FUNDING

GCC (CO/BLM)	$ 914,517	
Mobil/Parachute Project (CO/BLM)	253,962	
Pacific Shale Project (Sohio) (CO/BLM)	307,878	
Union/Parachute Creek (CO/COE)	179,036	
Subtotal	$1,655,393	

FUNDS NOT LIKELY (PROJECTS ON HOLD)

Colony Shale Oil (CO/COE)	$ 90,000	
Cottonwood Creek Res. (UT/BLM)	30,500	
Paraho-Ute Project (UT/COE)	77,000	
Ridges Subdivision (CO/HUD)	14,000	
White River Dam (UT/BLM)	1,440,000	
Subtotal	$1,651,500	
TOTAL	$ 3,901,165	

* (State/Federal Agency)
** Funds obligated to Redlands Fish Passage (design and construction)