# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:
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December 19, 2008

Memorandum

To: Deputy State Director, Bureau of Land Management, Colorado State Office, Resources and Fire, Lakewood, Colorado

From: Acting Western Colorado Supervisor, Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Peter S. Gelatt

Subject: Programmatic Biological Opinion for Water Depletions Associated with Bureau of Land Management's Fluid Mineral Program within the Upper Colorado River Basin in Colorado.

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), this transmits the U.S. Fish and Wildlife Service's (Service) final biological opinion for impacts to the four endangered Colorado River fish species (Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), bonytail chub (*Gila elegans*), and humpback chub (*Gila cypha*)) and their critical habitats from water depletions associated with Bureau of Land Managements's (BLM) Fluid Mineral Program authorized by BLM within the upper Colorado River basin in Colorado. For the purposes of this biological opinion, the area of consideration within the upper Colorado River basin includes all tributaries ultimately draining into the Colorado River within western Colorado except the San Juan River.

This biological opinion is in response to your May 20, 2008, correspondence requesting initiation of consultation for the subject project. The Service concurs that the proposed project is likely to adversely affect the Colorado pikeminnow, razorback sucker, bonytail chub, and humpback chub. Likewise, the project is also likely to adversely affect designated critical habitats for these endangered fish along the Green, Yampa, White, Colorado, and Gunnison Rivers.

Oil and gas activities typically require the use of various amounts of water. This consultation only addresses the effects of water depletions on the endangered Colorado River fishes and does not include other direct or indirect impacts to the four listed fish species. Any projects that involve potential water quality or habitat impacts are not covered under this programmatic biological opinion. A separate section 7 consultation will be required for any such project.

**Consultation History**

Implementation of the Endangered Species Act in the Colorado River Basin started with section 7 consultation on Bureau of Reclamation projects in the late 1970's. At this time, the Service determined that a jeopardy situation existed for the subject endangered fishes. Subsequently, the Act was amended to direct Federal Agencies to work with State and local agencies to resolve water resource issues in concert with conservation of endangered species.

In 1984, the Department of the Interior, Colorado, Wyoming, Utah, water users, and environmental groups formed a coordinating committee to discuss a process to recover the endangered fishes while new and existing water development proceeds in the Upper Colorado River Basin in compliance with Federal and State law and interstate compacts. After four years of negotiations, the Recovery Implementation Program for the Endangered Fish Species in the Upper Colorado River Basin was developed.

On January 21-22, 1988, the Secretary of the Interior; Governors of Wyoming, Colorado, and Utah; and the Administrator of the Western Area Power Administration (WAPA) cosigned a Cooperative Agreement to implement the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (USFWS 1987). Current participants in the Recovery Program include: the Service, Bureau of Reclamation, Western Area Power Administration, Colorado, Utah, Wyoming, Environmental Defense Fund, The Nature Conservancy, Colorado Water Congress, Utah Water Users Association, Wyoming Water Development Association, and the Colorado River Energy Distributors Association.

The Recovery Program was intended to be the reasonable and prudent alternative to avoid jeopardy to the endangered fishes by depletions from the Upper Colorado River Basin. The goal of the Recovery Program is to recover the listed species while providing for new and existing water development in the Upper Colorado River Basin. All participants agreed to cooperatively work toward 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. Each signatory assumed certain responsibilities in implementing the Recovery Program.

In order to further define and clarify the process in the Recovery Program, a section 7 agreement was implemented on October 15, 1993, by the Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP) which identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner. Included in the Recovery Program was the requirement that a depletion fee would be paid to offset the effects of the depletions by helping to support the Recovery Program. The funds are received by the Service's designated agent, the National Fish and Wildlife Foundation, and used for acquisition of water rights (or directly-related activities) to meet the instream flow needs of the endangered fishes or to support other recovery activities for the endangered fishes described in the RIPRAP.

In May 1994, BLM Colorado prepared a Programmatic biological assessment (1994 PBA) that addressed water-depleting activities in the Colorado River Basin. In response to the 1994 PBA, the Service issued a biological opinion (1994 BO) on June 13, 1994 (USFWS 1994), which determined that water depletions from the Colorado River Basin would jeopardize the continued existence of the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker and result in the destruction or adverse modification of their critical habitats. The 1994 BO included reasonable and prudent alternatives developed by the Service to allow BLM to authorize projects with resultant water depletions of less than 125 acre-feet.

The 1994 PBA and 1994 BO were written to remain in effect until a total depletion threshold of 1,417 acre-feet of new depletions is reached. The threshold for historic depletions is 1,588 acre-feet. As of January 2008, BLM has depleted or authorized the depletion of approximately 1,354 acre-feet of new depletions under the 1994 PBA and 1,019 acre-feet of historic depletions. The 1994 consultation did not fully account for fluid mineral activities and their associated water depletions; however these activities were not excluded from the consultation. The 1994 BO was amended March 2, 2000 and September 27, 2005. The BLM has paid depletion fees on an annual basis for projects covered by the 1994 consultation.

In January 2007, the Glenwood Springs Field Office of the BLM prepared a biological assessment for the Resource Management Plan Amendment, Roan Plateau Planning Area (Roan BA) that among other things, addressed water-depleting activities within the planning area including those associated with fluid mineral development. In response to the Roan BA, the Service issued a memo dated February 7, 2007, which concurred with BLM's determination that, water depletions from the Colorado River Basin would adversely affect the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker and their critical habitats. Because the average annual depletion was less than 125 acre-feet (83.6 acre-feet/year), these depletions were addressed by the 1994 small water depletions BO.

On December 20, 1999, the Service issued the final programmatic biological opinion for Bureau of Reclamation's Operations and Depletions, Other Depletions, and Funding and Implementation of Recovery Program Actions in the Upper Colorado River above the Confluence with the Gunnison River (Colorado River PBO). The Service has determined that projects that fit under the umbrella of the Colorado River PBO would avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletion impacts. Projects fit under the umbrella of the Colorado River PBO if they deplete water from the Colorado River above the confluence with the Gunnison River; the water user signs a Recovery Agreement; the project sponsors make a one-time monetary contribution for water depletions greater than 100 acre-feet to help fund their share of the costs of recovery actions.

On January 10, 2005, the Service issued the final programmatic biological opinion on the *Management Plan for Endangered Fishes in the Yampa River Basin* (Yampa River PBO). The Service has determined that projects that fit under the umbrella of the Yampa River PBO would avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletion impacts to the Yampa River basin. Projects fit under the umbrella of the Yampa River PBO if they deplete water from the Yampa River above the confluence with the Green River; the water user signs a Recovery Agreement for projects greater than 100 acre-feet; the project sponsors make a one-time monetary contribution for water depletions greater than 100 acre-feet to help fund their share of the costs of recovery actions.

# BIOLOGICAL OPINION

## DESCRIPTION OF THE PROPOSED ACTION

Across western Colorado, public lands administered by the BLM encompass 28 percent (7,189,639 acres) of the land area. These lands are administered by eight BLM administrative units/Field Offices within western Colorado. The BLM is also responsible for the administration of fluid mineral development under land managed by the U.S. Forest Service. The U.S. Forest Service approves the surface use plan associated with mineral extraction for these lands.

The proposed action consists of water use associated with ongoing and projected fluid mineral development as administered by the BLM in Colorado. Fluid mineral development projections are based on the Reasonable Foreseeable Development (RFD) scenarios of fluid mineral activity across western Colorado for the next 15-20 years. For purposes of analysis, all drilling is assumed to occur within the smaller 15-year time frame to ensure the capture of possible higher annual activity levels. The assumptions used to arrive at the RFD's for each Field Office were based on current development trends, downspacing of drilling units, maturing oil and gas fields, predicted energy needs for the future, and the overall professional opinion of BLM Field Office and State Office Geologists and Petroleum Engineers, as well as private industry professionals. This activity includes all Federal natural gas wells, oil wells, and coalbed methane natural gas wells, including split estate lands where the Federal government holds the mineral rights but not the surface rights. The programmatic biological assessment (PBA) (BLM 2008) for this project contains RFD estimates for the number of new wells to be drilled within each BLM Field Office (PBA Table 3).

Water depletions analyzed for this consultation are composed of:

- Water used for access road dust abatement, including roads used for geophysical exploration
- Water used for hydrostatic testing of newly constructed pipelines
- Water used to drill and complete wells (drilling and fracing fluids)
- Water associated with connected Federal actions (e.g., BLM authorization of a pipeline, road, or utility line across public lands that is connected to the action of developing privately owned fluid mineral estate located on private lands)

The PBA contains estimates for the amount of water that would be used for each of these activities. The amount of water that would be used for dust abatement (spraying water on dirt roads) is estimated to be 0.1 acre-feet per well per year. Hydrostatic pipeline testing is projected to use 0.11 acre-feet per well for associated gathering and distribution pipelines. The amount of water that would be used to drill and complete each well would vary by field office and would depend on the depth of the well and the ability of the operators in the area to use produced water (water from oil or gas wells) and reuse water for completion (fracing). If new information leads to more precise estimates of water use by any activity covered in this biological opinion, the updated, more accurate consumption estimates should be used to calculate water depletions from that point forward. Reinitiation of consultation would not be necessary to update water consumption estimates as long as both the BLM and the Service agree upon the revised consumption estimates and this is noted in the administrative record for the consultation.

For the White River Field Office based in Meeker, it is assumed that the average depletion amount per well would be: [(drilling and completion) = 2.41 acre-feet] + [(dust abatement) = 0.10 acre-feet] + [(hydrostatic pipeline testing) = 0.11 acre-feet] = **2.62** acre-feet/well. Due to a high amount of frac-water recycling, in the Glenwood Springs Field Office it is assumed that the average depletion amount per well would be: [(drilling and completion) = 0.56 acre-feet] + [(dust abatement) = 0.10 acre-feet] + [(hydrostatic pipeline testing) = 0.11 acre-feet] = **0.77** acre-feet/well. For areas covered in this consultation that are managed by the San Juan Public Lands Center (excludes the San Juan River basin), which includes numerous coal bed methane (CBM) wells, BLM estimates that an average of 0.90 acre-feet of Colorado River Basin water would be used during the drilling and completion of a single well. This figure was derived from the estimate that a CBM well would require an average of 0.5 acre-feet/well, while conventional gas development would average 1.2 acre-feet/well. The combined average CBM and conventional well depletion amount for areas managed by the San Juan Public Lands Center is then calculated as follows: [(drilling and completion)=0.90 acre-feet] + [(dust abatement)=0.10 acre-feet] + [(hydrostatic pipeline testing)=0.11 acre-feet] = **1.11** acre-feet/well.

It is recognized that individual wells may require the use of more or less water than shown above, but these figures have been calculated as reasonable depletion estimates per well drilled. These per-well depletion figures were then combined in the PBA with the RFD scenarios for each BLM field office to produce an estimate of how much total water would be depleted within each field office, which totals to 4,046 acre-feet/year for Federal wells in western Colorado. (Additionally, approximately 1,052 acre-feet/year would be used for private wells.) Because water depletions are based largely on the drilling and completion of a well, which is a one-time event, these depletions are not additive year after year. Thus, the running total amount of water that would be depleted is not expected to exceed 4,046 acre-feet/year (e.g., year-2 depletions would **not** be 4,046 + 4,046 = 8092 acre-feet/year).

Within the upper Colorado River Basin, water would be depleted from individual sub-basins to varying degrees. The PBA provides the following water depletion estimates in acre-feet/year for Federal wells (rounded to the nearest whole number):

| | |
|---|---|
| Yampa River Basin = | 369 |
| Green River in Colorado = | 0 |
| White River Basin = | 3,227 |
| Colorado River Basin = | 379 |
| Gunnison River Basin = | 16 |
| Dolores River Basin = | 54 |
| Total = | 4.046 |

The BLM State Office will track all projects that result in water depletions from the upper Colorado River Basin. The BLM will complete and submit a log of all water depleting projects by river sub-basin to the Service by October 31 of each year. The logs showing depletion amounts resulting from wells drilled will be used to track compliance with the threshold depletion amount.

**Conservation Measures**

Conservation measures are actions that the action agency and applicant agree to implement to minimize negative effects of the action and to further the recovery of the species under review. The beneficial effects of conservation measures were taken into consideration for determining both jeopardy and incidental take analyses. The BLM agrees to incorporate the following conservation measures as a condition of any water-use authorized for fluid mineral development:

- Water may be extracted directly out of the Colorado, Gunnison, White, Yampa, or Green Rivers, which all have occupied and critical habitat for the four endangered Colorado River fish. The eight western slope BLM Field Offices/Administrative Units have committed to implement the following measures to minimize direct impacts to federally listed species from pumping water directly out of these rivers:

    1. The best method to avoid entrainment is to pump from off-channel locations (e.g., ponds, lakes, and diversion ditches), not directly connected to the mainstem rivers even during high spring flows.

    2. If the pump head must be located in the river channel where larval fish are known to occur (generally within Designated Critical Habitat), the following measures apply:

        a. Do not situate the pump in a low-flow or no-flow area as these habitats tend to concentrate larval fishes. Instead place the pump into fast moving/riffle habitat.

        b. Restrict the amount of pumping, to the greatest extent possible, during that period of the year when larval fish may be present (June 1 to August 15).

        c. Avoid pumping, to the greatest extent possible during the pre-dawn hours (two hours prior to sunrise) as larval fish drift studies indicate that this is a period of greatest daily activity.

    3. Screen all pump intakes with ¼ inch or finer mesh material.

    4. Report any fish impinged on any intake screens to the Service at (970) 243-2778 or the Colorado Division of Wildlife's Northwest Region, 711 Independent Avenue, Grand Junction, Colorado, 81505, (970) 255-6100, or Colorado Division of Wildlife's Southwest Region, 415 Turner Drive, Durango, Colorado, 81303, (970) 375-6700.

    The above conservation measures (1-4) will be implemented via the BLM working with the individual companies, their sub-contractors and industry representative groups to inform and educate on-the-ground personnel of the need to implement these conservation measures. In addition, these conservation measures will be added to all Applications for Permit to Drill (APD's) as a condition of approval (COA) prior to commencement of development activity.

- As a means of offsetting the impacts associated with the proposed action, the BLM proposes to secure a one-time contribution from an industry representative group in the form of a monetary payment to the National Fish and Wildlife Foundation on behalf of the Recovery Program in the current amount of $18.29 per acre-foot of the project's average annual depletion. These funds are used by the Upper Colorado River Endangered Fish Recovery Program to contribute to the recovery of endangered fish through habitat restoration, propagation and genetics management, instream flow identification and protection, program management, nonnative fish management, research and monitoring, and public education (Upper Colorado River Endangered Fish Recovery Program 2006).

- Water depletion in the Colorado and Yampa River sub-basins has been addressed in previous programmatic biological opinions. These opinions require water users to sign Recovery Agreements that state that the water users will not interfere with the implementation of recovery actions and the Service will provide ESA compliance. The BLM will ensure Recovery Agreements are signed by individual operators, or on the behalf of individual operators via industry representative groups.

The following excerpts from the Cooperative Agreement to implement the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (USFWS 1987) are pertinent to this consultation because they summarize portions of the Recovery Program that address depletion impacts, section 7 consultation, and project proponent responsibilities:

> 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 the elements) will result in a one-time contribution to be paid to the Service by water project proponents in the amount of $10.00 per acre-feet based on the average annual depletion of the project . . . . This figure will be adjusted annually for inflation [the FY-2009 figure is $18.29 per acre-feet].

It is important to note that these provisions of the Recovery Program were based on appropriate legal protection of the instream flow needs of the endangered Colorado River fishes. The Recovery Program further states:

> . . . it is necessary to protect and manage sufficient habitat to support self-sustaining populations of these species. One way to accomplish this is to provide long term protection of the habitat by acquiring or appropriating water rights to ensure instream flows . . . . Since this program sets in place a mechanism and a commitment to assure that the instream flows are protected under State law, <u>the Service will consider these elements under section 7 consultation as offsetting project depletion impacts</u>.

Thus, the Service has determined that project depletion impacts can be offset by (a) the water project proponent's one-time contribution to the Recovery Program in the amount of $18.29 per acre-foot of the project's average annual depletion, and (b) appropriate legal protection of instream flows pursuant to State law, and accomplishment of activities necessary to recover the endangered fishes as specified under the Recovery Implementation Program Recovery Action Plan.

The BLM has committed to offset the impacts of the proposed action by soliciting a one-time payment from an industry representative group. At the time of this consultation, BLM has identified an average annual depletion of 4,046 acre-feet per year (averaged over the next 15 years) associated with the proposed action. For Fiscal Year 2009 (October 1, 2008, to September 30, 2009), the depletion charge is $18.29 per acre-foot. Thus, based on the calculated average annual depletion, a one-time payment of $74,001.34 will be required to offset the depletions caused by the proposed action through 2024.

This amount will be provided to the Service's designated agent, the National Wildlife Foundation. The balance will be paid by the industry representative group. The funds will be used to support recovery activities for the Colorado River endangered fishes. The one-time payment will be made to the National Fish and Wildlife Foundation.

National Fish and Wildlife Foundation
Attn: Donna McNamara, Finance Department
1133 15th Street, NW, Suite 1100
Washington, D.C. 20005

The payment will be accompanied by a cover letter that identifies the project and biological opinion number ES/GJ-6-CO-08-F-0006, that requires the payment, the amount of payment enclosed, check number, and the following notation on the check – "Upper Colorado Fish Recovery Program, NA.1104". The cover letter also shall identify the name and address of the payer, the name and address of the Federal agency responsible for authorizing the project, and the address of the Service office issuing the biological opinion. This information will be used by the Foundation to notify the BLM, the lead Federal agency, and the Service that payment has been received. The Foundation is to send notices of receipt to these entities within 5 working days of its receipt of payment.

Recovery Agreements (Appendix A) are also required for depletions within the Colorado and Yampa River Basins as specified in the Colorado River and Yampa River PBOs. Individual operators or industry representative groups on behalf of individual operators will sign Recovery Agreements as appropriate.

## STATUS OF THE SPECIES AND CRITICAL HABITAT

### Colorado Pikeminnow

The pikeminnow is the largest cyprinid (member of the minnow family, Cyprinidae) native to North America and it evolved as the top predator in the Colorado River system. It is an elongated pike-like fish that once grew as large as 1.8 meters (6 feet) in length and weighed nearly 45 kilograms (100 pounds) (Behnke and Benson 1983); such fish were estimated to be 45-55 years old (Osmundson et al. 1997). Today, fish rarely exceed 1 meter (approximately 3 feet) in length or weigh more than 8 kilograms (18 pounds). The mouth of this species is large and nearly horizontal with long slender pharyngeal teeth (located in the throat), adapted for grasping and holding prey. The diet of pikeminnow longer than 80 to 100 millimeters (3 or 4 inches) consists almost entirely of other fishes (Vanicek and Kramer 1969). Young Colorado pikeminnow feed on insects and plankton. Adults are strongly counter-shaded with a dark, olive back, and a white belly. Young are silvery and usually have a dark, wedge-shaped spot at the base of the caudal fin. The common name for this species was changed from Colorado squawfish by the American Fisheries Society (Nelson et al. 1998).

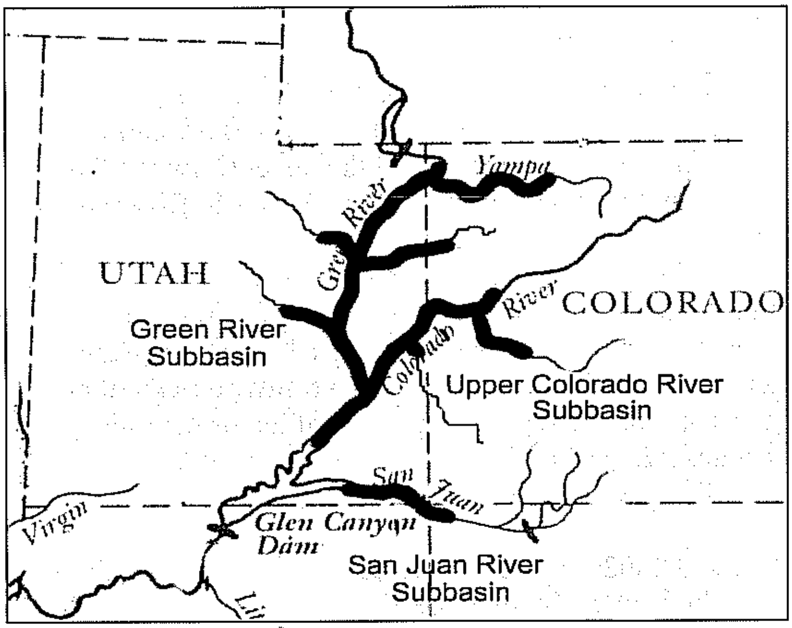
Status and Distribution

Based on early fish collection records, archaeological finds, and other observations, the pikeminnow was once found throughout warm water reaches of the entire Colorado River Basin down to the Gulf of California, including reaches of the upper Colorado River and its major tributaries, the Green River and its major tributaries, the San Juan River and some of its tributaries, and the Gila River system in Arizona (Seethaler 1978, Platania 1990). Pikeminnow apparently were never found in colder, headwater areas. Seethaler (1978) indicates that the species was abundant in suitable habitat throughout the entire Colorado River Basin prior to the 1850s. By the 1970s they were extirpated from the entire lower basin (downstream of Glen Canyon Dam) and from portions of the upper basin as a result of major alterations to the riverine environment. Having lost approximately 75-80 percent of its former range, the pikeminnow was federally listed as an endangered species in 1967 under the Endangered Species Preservation Act of 1966 (USFWS 1967, Miller 1961, Moyle 1976, Tyus 1991, Osmundson and Burnham 1998).

The Recovery Plan (USFWS 2002a, Table 1) provides a summary of habitat occupied by wild Colorado pikeminnow in the Upper Colorado River Basin and limits to its distribution.

| River | Occupied Habitat | Limits to Distribution |
|---|---|---|
| **Green River Subbasin** | | |
| 1. Green River | Lodore Canyon to Colorado River confluence (580 km) | Cold releases from Flaming Gorge Dam have been warmed and species has naturally expanded upstream into Lodore Canyon; species distributed continuously downstream to Colorado River confluence |
| 1a. Yampa River | Craig, Colorado, to Green River confluence (227 km) | Present distribution similar to historic |
| 1b. Little Snake River | Wyoming to Yampa River confluence (80 km) | Habitat is marginal; flows are reduced; historic distribution unknown |
| 1c. White River | Taylor Draw Dam to Green River confluence (100 km) | Upstream distribution blocked by Taylor Draw Dam |
| 1d. Price River | Lower 143 km above Green River confluence | Streamflow reduced; barriers occur above current distribution |
| 1e. Duchesne River | Lower 10 km above Green River confluence | Streamflow reduced; barriers occur above current distribution |
| **Upper Colorado River Subbasin** | | |
| 2. Upper Colorado River | Palisade, Colorado, to Lake Powell inflow (298 km) | Passage by Grand Valley Diversion completed in 1998; Price-Stubb and Government Highline diversion dams restrict upstream distribution; Lake Powell inflow defines downstream distribution |
| 2a. Gunnison River | Lower 54 km above Colorado River confluence | Redlands Fishway allowed passage in 1996; upstream distribution is limited by Hartland Diversion Dam and possibly cold-water releases from the Aspinall Unit |
| 2b. Dolores River | Lower 2 km above Green River confluence | Streamflow altered; no barriers in potential historic habitat |
| **San Juan River Subbasin** | | |
| 3. San Juan River | Shiprock, New Mexico, to Lake Powell inflow (241 km) | Irrigation diversions block upstream movement; Lake Powell defines downstream distribution |

The map below of wild Colorado pikeminnow in the Colorado River basin was reproduced from the Colorado Pikeminnow Recovery Goals (USFWS 2002a, Figure 1).




Estimates of abundance summed for the three Colorado pikeminnow populations range from about 6,600 to 8,900 wild adults. Estimates of subadults are not currently available for all populations. Estimates of adults for the three subbasins are: Green River, 6,000–8,000; upper Colorado River, 600–900 [includes some subadults]; and San Juan River, 19–50 (USFWS 2002a).

A more recent report on the status of Colorado pikeminnow in the Green River Basin (Bestgen et al. 2007) presented population estimates for adult (>450 mm total length (TL)) and recruit-sized (400 – 449 mm TL) Colorado pikeminnow. The report suggested that numbers of adult pikeminnow declined in the Green River Basin from 3,300 in 2001 to 2,142 in 2003, a reduction of 35 percent. The 2003 population estimates for Colorado pikeminnow were: Yampa River, 224 adults; White River, 407 adults and zero recruits (approximately 44 recruits were estimated for each year in 2000-2001); mainstem Green River (from the confluence with the Yampa River to the confluence with the Colorado River), 1511 adults and 284 recruits.

The species was extirpated from the Lower Colorado River Basin in the 1970's but has been reintroduced into the Gila River subbasin where it exists in small numbers in the Verde River (USFWS 2002a).

Threats to the Species

Because the pikeminnow was designated as endangered prior to passage of the Endangered Species Act of 1973, a formal listing package identifying threats was not prepared. The pikeminnow recovery goals (USFWS 2002a) summarize threats to the species as follows: stream regulation, habitat modification, competition with and predation by nonnative fish, and pesticides and pollutants.

Major declines in pikeminnow populations occurred in the lower Colorado River Basin during the dam-building era of the 1930s through the 1960s. Behnke and Benson (1983) summarized the decline of the natural ecosystem, pointing out that dams, impoundments, and water use practices drastically modified the river's natural hydrology and channel characteristics throughout the Colorado River Basin. Dams on the main stem fragmented the river ecosystem into a series of disjunct segments, blocked native fish migrations, reduced water temperatures downstream of dams, created lake habitat, and provided conditions that allow competitive and predatory nonnative fishes to thrive both within the impounded reservoirs and in the modified river segments that connect them. The highly modified flow regime in the lower basin coupled with the introduction of nonnative fishes decimated populations of native fish.

In the upper Colorado River Basin, declines in pikeminnow populations occurred primarily after the 1960s, when the following dams were constructed: Glen Canyon Dam on the main stem Colorado River, Flaming Gorge Dam on the Green River, Navajo Dam on the San Juan River, and the Aspinall Unit dams on the Gunnison River. Some native fish populations in the upper basin have managed to persist, while others are nearly extirpated. River reaches where native fish have declined more slowly, more closely resemble pre-dam hydrologic regimes, where adequate habitat for all life phases still exists, and where migration corridors allow connectivity among habitats used during the various life phases.

Stream flow regulation, which includes mainstem dams, cause the following adverse effects to the Colorado pikeminnow and its habitat:

- block migration corridors,
- changes in flow patterns, reduced peak flows and increased base flows,
- release cold water, making temperature regimes less than optimal,
- change river habitat into lake habitat, and
- retain sediment that is important for forming and maintaining backwater habitats

In the Upper Basin, 435 miles of Colorado pikeminnow habitat has been lost by reservoir inundation from Flaming Forge Reservoir on the Green River, Lake Powell on the Colorado River, and Navajo Reservoir on the San Juan River. Cold water releases from these dams have eliminated suitable habitat for native fishes, including Colorado pikeminnow, from river reaches downstream for approximately 50 miles below Flaming Gorge Dam and Navajo Dam. In addition to main stem dams, many dams and water diversion structures occur in and upstream from critical habitat that reduce flows and alter flow patterns, which adversely affect critical habitat. Diversion structures in critical habitat divert fish into canals and pipes where the fish are permanently lost to the river system. It is unknown how many endangered fish are lost in irrigation systems, but in some years, in some river reaches, majority of the river flow is diverted into unscreened canals.

At least 67 species of nonnative fishes have been introduced into the Colorado River Basin during the last 100 years (Tyus et al. 1982, Carlson and Muth 1989, Minckley and Deacon 1991, Tyus and Saunders 1996). Tyus et al. (1982) reported that 42 nonnative fish species have become established in the upper basin, and Minckley (1985) reported that 37 nonnative fish species have become established in the lower basin. Many of these species were intentionally introduced as game or forage fishes, whereas others were unintentionally introduced with game species or passively as bait fish.

Pikeminnow in the upper Colorado River Basin live with about 20 species of warm-water nonnative fishes (Tyus et al. 1982, Lentsch et al. 1996) that are potential predators, competitors, and vectors for parasites and disease. Researchers believe that nonnative fish species limit the success of pikeminnow recruitment (Bestgen 1997, Bestgen et al. 1997, McAda and Ryel 1999). Osmundson (1987) documented predation by black bullhead (*Ameiurus melas*), green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), and black crappie (*Pomoxis nigromaculatus*) as a significant mortality factor for YOY and yearling pikeminnow stocked in riverside ponds along the upper Colorado River. Adult red shiners (*Cyprinella lutrensis*) are known predators of larval native fish in backwaters of the upper basin (Ruppert et al. 1993). High spatial overlap in habitat use has been documented among young pikeminnow, red shiner, sand shiner (*Notropis stramineus*), and fathead minnow (*Pimephales promelas*). In laboratory experiments on behavioral interactions, Karp and Tyus (1990) observed that red shiner, fathead minnow, and green sunfish shared activity schedules and space with young pikeminnow and exhibited antagonistic behaviors to smaller pikeminnow. They hypothesized that pikeminnow may be at a competitive disadvantage in an environment that is resource limited. Data collected by Osmundson and Kaeding (1991) indicated that during low water years, nonnative minnows capable of preying on or competing with larval endangered fishes greatly increased in numbers.

Channel catfish (*Ictalurus punctatus*) has been identified as a threat to juvenile, subadult, and adult pikeminnow. Channel catfish were first introduced in the upper Colorado River Basin in 1892 (Tyus and Nikirk 1990) and are now considered common to abundant throughout much of the upper basin (Tyus et al. 1982, Nelson et al. 1995). The species is one of the most prolific predators in the upper basin and, among the nonnative fishes, is thought to have the greatest adverse effect on endangered fishes due to predation on juveniles and resource overlap with subadults and adults (Hawkins and Nesler 1991, Lentsch et al. 1996, Tyus and Saunders 1996). Predation upon stocked juvenile Colorado pikeminnow by adult channel catfish has been documented in the San Juan River (Jackson 2005). Stocked juvenile and adult pikeminnow that have preyed on channel catfish have died from choking on the pectoral spines (McAda 1983, Pimental et al. 1985, Ryden and Smith 2002, Lapahie 2003). Although mechanical removal (electrofishing, seining) of channel catfish began in 1995, intensive efforts (10 trips/year) did not begin until 2001. Mechanical removal has not yet led to a positive population response in pikeminnow (Davis 2003); however, because the pikeminnow population is so low, documenting a population response would be extremely difficult.

Threats from pesticides and pollutants include accidental spills of petroleum products and hazardous materials; discharge of pollutants from uranium mill tailings; and high selenium concentration in the water and food chain (USFWS 2002a). Accidental spills of hazardous material into critical habitat, particularly when considering water of sufficient quality as a primary constituent element, can cause immediate mortality when lethal toxicity levels are exceeded. Pollutants from uranium mill tailings cause high levels of ammonia that exceed water quality standards. High selenium levels may adversely affect reproduction and recruitment (Stephens et al. 1992; Stephens and Waddell 1998; Osmundson et al. 2000).

Recovery

Colorado pikeminnow will be considered eligible to be reclassified from federally endangered to threatened when naturally self-sustaining populations are being maintained in the following areas (USFWS 2002a):

- ✓ The Green River from its confluence with the Colorado River to its confluence with the Yampa River, the lower 137 miles of the Yampa River, and the lower 150 miles of the White River. The population estimate for the Green River subbasin must exceed 2,600 adults (2,600 is the estimated minimum viable population needed to ensure long-term genetic and demographic viability).

- ✓ The Colorado River from Palisade, Colorado, to Lake Powell. At least 700 adults (number based on inferences about carrying capacity) must be maintained in the upper Colorado River subbasin.

- ✓ The San Juan River from Lake Powell upstream to the confluence of the Animas River. A target number of 1,000 age-5+ fish (number based on estimated survival of stocked fish and inferences about carrying capacity) must be established through augmentation and/or natural reproduction in the San Juan River subbasin.

This fish species will be eligible for removal from the Federal endangered species list when all of the following conditions have been met:

- ✓ Self-sustaining populations exist in the areas of the Green and Colorado Rivers identified above. A self-sustaining population of at least 800 adults must also exist in the San Juan River unless the Colorado River population is maintained above 1,000 adults.

- ✓ A population exists and habitat has been protected either in the Salt River or in the Verde River.

- ✓ The threat of significant "fragmentation" of the population has been removed. (fragmentation refers to separation between fish populations caused by geographical distance or by physical barriers.)

- ✓ Essential habitats, including primary migration routes, required stream flows and necessary water quality, have been legally protected.

- ✓ Other identifiable threats that could significantly affect the population have been removed.

<u>Life History</u>

The life history phases that appear to be most limiting for pikeminnow populations include spawning, egg hatching, development of larvae, and the first year of life. These phases of pikeminnow development are tied closely to specific habitat requirements. Natural spawning of pikeminnow is initiated on the descending limb of the annual hydrograph as water temperatures approach the range of 16 °C (60.8 °F) to 20 °C (68 °F) (Vanicek and Kramer 1969, Hamman 1981, Haynes et al. 1984, Tyus 1990, McAda and Kaeding 1991). Temperature at initiation of spawning varies by river. In the Green River, spawning begins as temperatures exceed 20-23 °C

(68-73 °F); in the Yampa River, 16-23 °C (61-68 °F) (Bestgen et al. 1998); in the Colorado River, 18-22 °C (64-72 °F) (McAda and Kaeding 1991); in the San Juan River temperatures were estimated to be 16-22 °C (61-72 °F). Spawning, both in the hatchery and under natural riverine conditions, generally occurs in a 2-month period between late June and late August. However, sustained high flows during wet years may suppress river temperatures and extend spawning into September (McAda and Kaeding 1991). Conversely, during low flow years, when the water warms earlier, spawning may commence in mid-June.

Temperature also has an effect on egg development and hatching success. In the laboratory, egg development was tested at five temperatures and hatching success was found to be highest at 20 °C (68 °F), and lower at 25 °C (77 °F). Mortality was 100 percent at 5, 10, 15, and 30°C (41, 50, 59, and 86 °F). In addition, larval abnormalities were twice as high at 25 °C (77 °F) than at 20 °C (68 °F) (Marsh 1985). Experimental tests of temperature preference of yearling (Black and Bulkley 1985a) and adult (Bulkley et al. 1981) pikeminnow indicated that 25 °C (77 °F) was the most preferred temperature for both life phases. Additional experiments indicated that optimum growth of yearlings also occurs at temperatures near 25 °C (77 °F) (Black and Bulkley 1985b). Although no such tests were conducted using adults, the tests with yearlings supported the conclusions of Jobling (1981) that the final thermal preference of 25 °C (77 °F) provides a good indication of optimum growth temperature for all life phases.

Males become sexually mature earlier and at a smaller size than do females, though all are mature by about age 7 and 500 millimeters (20 inches) in length (Vanicek and Kramer 1969, Seethaler 1978, Hamman 1981). Hatchery-reared males became sexually mature at 4 years of age and females at 5 years. After about 10 years of age, female pikeminnow typically grow to larger sizes than males (Osmundson 2002b). Average fecundity of 24, 9-year old females was 77,400 (range, 57,766-113,341) or 55,533 eggs/kg, and average fecundity of 9 ten-year old females was 66,185 (range, 11,977-91,040) or 45,451 eggs/kg (Hamman 1986).

Most information on pikeminnow reproduction has been gathered from spawning sites on the lower 20 miles (12.2 kilometers) of the Yampa River and in Gray Canyon on the Green River (Tyus and McAda 1984, Tyus 1985, Wick et al. 1985, Tyus 1990). Pikeminnow spawn after peak runoff subsides. Spawning is probably triggered by several interacting variables such as day length, temperature, flow level, and perhaps substrate characteristics. Known spawning sites in the Yampa River are characterized by riffles or shallow runs with well-washed coarse substrate (cobble containing relatively deep interstitial voids (for egg deposition)) in association with deep pools or areas of slow non-turbulent flow used as staging areas by adults (Lamarra et al. 1985, Tyus 1990). Recent investigations at a spawning site in the San Juan River by Bliesner and Lamarra (1995) and at one site in the upper Colorado River (USFWS unpublished data) indicate a similar association of habitats. The most unique feature at the sites used for spawning, in comparison with otherwise similar sites nearby, is the lack of embeddedness of the cobble substrate and the depth to which the rocks are devoid of fine sediments; this appears consistent at the sites in all three rivers (Lamarra et al. 1985, Bliesner and Lamarra 1995).

Collections of larvae and young-of-year (YOY) downstream of known spawning sites in the Green, Yampa, and San Juan Rivers demonstrate that downstream drift of larval pikeminnow occurs following hatching (Haynes et al. 1984, Nesler et al. 1988, Tyus 1990, Tyus and Haines 1991, Platania 1990, Ryden 2003a). Studies on the Green and Colorado Rivers found that YOY used backwaters almost exclusively (Holden 2000). During their first year of life, pikeminnow prefer warm, turbid, relatively deep (averaging 0.4 meters [1.3 feet]) backwater areas of zero velocity (Tyus and Haines 1991). After about 1 year, young are rarely found in such habitats, although juveniles and subadults are often located in large deep backwaters during spring runoff (USFWS, unpublished data; Osmundson and Burnham 1998). Studies indicate that significant recruitment of Colorado pikeminnow may not occur every year, but occurs in episodic intervals of several years (Osmundson and Burnham 1998).

Pikeminnow often migrate considerable distances to spawn in the Green and Yampa Rivers (Miller et al. 1982, Archer et al. 1986, Tyus and McAda 1984, Tyus 1985, Tyus 1990), and similar movement has been noted in the main stem San Juan River. A fish captured and tagged in the San Juan arm of Lake Powell in April 1987, was recaptured in the San Juan River approximately 80 miles upstream in September 1987 (Platania 1990). Ryden and Ahlm (1996) report that a pikeminnow captured at river mile (RM) 74.8 (between Bluff and Mexican Hat) made a 50-60 mile migration during the spawning season in 1994, before returning to within 0.4 river miles of its original capture location. In the Green River system, adult Colorado pikeminnow converge to reproduce at two known spawning areas, Yampa Canyon in the lower Yampa River and Gray Canyon in the Green River (Tyus and McAda 1984; Tyus 1985; Tyus 1990; Tyus 1991; Irving and Modde 2000). Rates of movement for individuals are not precisely known, but 2 individuals made the approximately 400 km migration from the White River below Taylor Draw Dam to the Yampa River spawning area in less than 2 weeks. Bestgen et al. (2007) state that adults migrate up to 745 river kilometers round-trip to spawning areas in Yampa Canyon and in Desolation–Gray Canyon.

Although migratory behavior has been documented for pikeminnow in the San Juan River (Platania 1990, Ryden and Ahlm 1996), of 13 radio-tagged fish tracked from 1991 to 1994, 12 were classified as sedentary and only one as migratory (Ryden and Ahlm 1996). In contrast to pikeminnow in the Green and Yampa Rivers, the majority of pikeminnow in the San Juan River reside near the area in which they spawn (Ryden and Ahlm 1996, Miller and Ptacek 2000). During their study, Ryden and Ahlm (1996) found that pikeminnow in the San Juan River aggregated at the mouth of the Mancos River prior to spawning, a behavior not documented in other rivers in the upper Colorado River Basin. Information on radio-tagged adult pikeminnow during the fall suggests that pikeminnow seek out deep water areas in the Colorado River (Miller et al. 1982, Osmundson and Kaeding 1989), as do many other riverine species. Pools, runs, and other deep water areas, especially in upstream reaches, are important winter habitats for pikeminnow (Osmundson et al. 1995).

Very little information is available on the influence of turbidity on the endangered Colorado River fishes. Osmundson and Kaeding (1989) found that turbidity allows use of relatively shallow habitats ostensibly by providing adults with cover; this allows foraging and resting in areas otherwise exposed to avian or terrestrial predators. Tyus and Haines (1991) found that young pikeminnow in the Green River preferred backwaters that were turbid. Clear conditions in these shallow waters might expose young fish to predation from wading birds or exotic, sight-feeding, piscivorous fish. It is unknown whether the river was as turbid historically as it is today. For now, it is assumed that these endemic fishes evolved under conditions of high turbidity. Therefore, the retention of these highly turbid conditions is probably an important factor in maintaining the ability of these fish to compete with nonnatives that may not have evolved under similar conditions.

Critical Habitat

Critical habitat was designated in 1994 within the 100-year floodplain of the Colorado pikeminnow's historical range in the following area of the upper Colorado River (59 FR 13374). Colorado pikeminnow now only occur in the upper Colorado River Basin (upstream of Lee Ferry just below the Glen Canyon Dam). Most of Lake Powell is not suitable habitat for Colorado pikeminnow and is not designated critical habitat. The total designated miles is 1,148 and represents 29 percent of the historical habitat for the species.

Colorado, Moffat County. The Yampa River and its 100-year floodplain from the State Highway 394 bridge in T. 6 N., R. 91 W., section 1 (6th Principal Meridian) to the confluence with the Green River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian).

Utah, Uintah, Carbon, Grand, Emery, Wayne, and San Juan Counties; and Colorado, Moffat County. The Green River and its 100-year floodplain from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the confluence with the Colorado River in T. 30 S., R. 19 E., section 7 (Salt Lake Meridian).

Colorado, Rio Blanco County; and Utah, Uintah County. The White River and its 100-year floodplain from Rio Blanco Lake Dam in T. 1 N., R. 96 W., section 6 (6th Principal Meridian) to the confluence with the Green River in T. 9 S., R. 20 E., section 4 (Salt Lake Meridian).

Colorado, Delta and Mesa Counties. The Gunnison River and its 100-year floodplain from the confluence with the Uncompahgre River in T. 15 S., R. 96 W., section 11 (6th Principal Meridian) to the confluence with the Colorado River in T. 1 S., R. 1 W., section 22 (Ute Meridian).

Colorado, Mesa and Garfield Counties; and Utah, Grand, San Juan, Wayne, and Garfield Counties. The Colorado River and its 100-year floodplain from the Colorado River Bridge at exit 90 north off Interstate 70 in T. 6 S., R. 93 W., section 16 (6th Principal Meridian) to North Wash, including the Dirty Devil arm of Lake Powell up to the full pool elevation, in T. 33 S., R. 14 E., section 29 (Salt Lake Meridian).

New Mexico, San Juan County; and Utah, San Juan County. The San Juan River and its 100-year floodplain from the State Route 371 Bridge in T. 29 N., R. 13 W., section 17 (New Mexico Meridian) to Neskahai Canyon in the San Juan arm of Lake Powell in T. 41 S., R. 11 E., section 26 (Salt Lake Meridian) up to the full pool elevation.

The Service identified water, physical habitat, and the biological environment as primary constituent elements of critical habitat. This includes a quantity of water of sufficient quality that is delivered to specific habitats in accordance with a hydrologic regime that is required for the particular life stage for the species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide access to spawning, nursery, feeding, and rearing habitats, are included. Food supply, predation, and competition are important elements of the biological environment.

**Razorback Sucker**

Like all suckers (family *Catostomidae*, meaning "down mouth"), the razorback sucker has a ventral mouth with thick lips covered with papillae and no scales on its head. In general, suckers are bottom browsers, sucking up or scraping off small invertebrates, algae, and organic matter with their fleshy, protrusible lips (Moyle 1976). The razorback sucker is the only sucker with an abrupt sharp-edged dorsal keel behind its head. The keel becomes more massive with age. The head and keel are dark, the back is olive-colored, the sides are brownish or reddish, and the abdomen is yellowish white (Sublette et al. 1990). Adults often exceed 3 kilograms (6 pounds) in weight and 600 millimeters (2 feet) in length. Like pikeminnow, razorback suckers may live 40-plus years. The diet consists primarily of algae, plant debris, and aquatic insect larvae (Sublette et al. 1990).

Status and Distribution

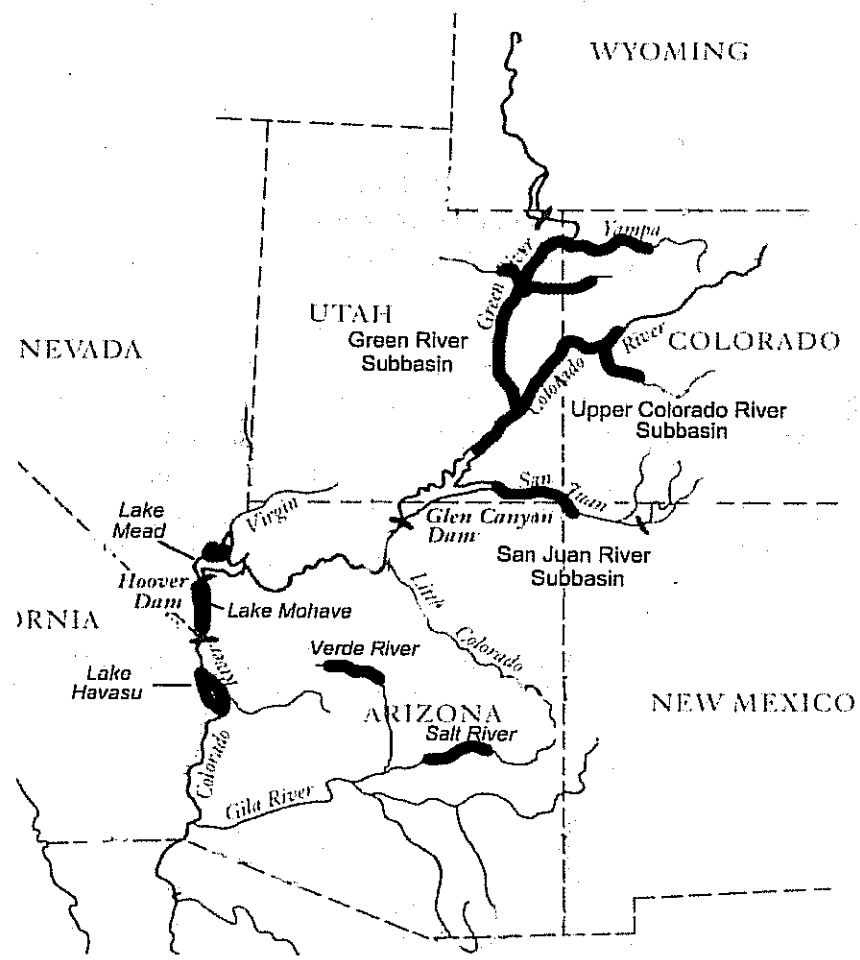
On March 14, 1989, the Service was petitioned to conduct a status review of the razorback sucker. Subsequently, the razorback sucker was designated as endangered under a final rule published on October 23, 1991 (56 FR 54957). The final rule stated "Little evidence of natural recruitment has been found in the past 30 years, and numbers of adult fish captured in the last 10 years demonstrate a downward trend relative to historic abundance. Significant changes have occurred in razorback sucker habitat through diversion and depletion of water, introduction of nonnative fishes, and construction and operation of dams" (56 FR 54957). Recruitment of razorback suckers to the population continues to be a problem.

Historically, razorback suckers were found in the main stem Colorado River and major tributaries in Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, and in Mexico (Ellis 1914; Minckley 1983). Bestgen (1990) reported that this species was once so numerous that it was commonly used as food by early settlers and that a commercially marketable quantity was caught in Arizona as recently as 1949. In the upper Colorado River Basin, razorback suckers were reported to be very abundant in the Green River near Green River, Utah, in the late 1800s (Jordan 1891). An account in Osmundson and Kaeding (1989) reported that residents living along the Colorado River near Clifton, Colorado, observed several thousand razorback suckers during spring runoff in the 1930s and early 1940s. In the San Juan River drainage, the first razorback sucker from the river was documented in 1988 (Platania 1990); however, Platania and Young (1989) relayed historical accounts of alleged razorback suckers ascending the Animas River to Durango, Colorado, around the turn of the century.

The Recovery Plan (USFWS 2002b, Table 1) provides a summary of habitat occupied by the razorback sucker and limits to its distribution.

| River | Occupied Habitat | Limits to Distribution |
|---|---|---|
| **Green River Subbasin** | | |
| Green River | Lodore Canyon to Colorado River confluence (580 km); population being augmented | Cold-water releases from Flaming Gorge Dam previously restricted range, but warmed releases may allow for range expansion |
| Yampa River | Craig, Colorado, to Green River confluence (227 km) | Present in low numbers in historic habitat |
| White River | Taylor Draw Dam to Green River confluence (100 km) | Found in low numbers; upstream distribution blocked by Taylor Draw Dam |
| Duchesne River | Lower 2 km above Green River confluence | Found as small aggregations during spring runoff at mouth |
| **Upper Colorado River Subbasin** | | |
| Upper Colorado River | Palisade, Colorado, to Lake Powell inflow (29 8 km); population being augmented | Found in low numbers; passage by Grand Valley Diversion completed in 1998; Price-Stubb and Government Highline diversion dams restrict upstream distribution; Lake Powell inflow defines downstream distribution |
| Gunnison River | Lower 54 km above Colorado River confluence; population being reestablished through stocking. | Wild population considered extirpated from the river, but fish are being stocked in the lower 54 km above the Colorado River confluence to reestablish the population; Redlands Fishway allows passage since 1996; upstream distribution limited by Hartland Diversion Dam and possibly cold-water releases from the Aspinall Unit |
| **San Juan River Subbasin** | | |
| San Juan River | Shiprock, New Mexico, to Lake Powell inflow (241 km); population being reestablished through stocking | Wild population considered extirpated from the river, but fish are being stocked between Shiprock, NM and Lake Powell inflow (241 km) to reestablish the population; diversion structures block upstream movement; Lake Powell defines downstream distribution |
| **Lower Colorado River Subbasin** | | |
| Lake Mohave | Potential lake-wide distribution; population being augmented | Found only in reservoir |
| Lake Mead | Potential lake-wide distribution | Found only in reservoir but may extend upstream into lower Grand Canyon; cold-water releases from Glen Canyon Dam prevent expansion into upper Grand Canyon |
| Lower Colorado River | Lake Havasu to Davis Dam (96 km) | Stocked fish have not remained in Lake Havasu, but have populated the river between the reservoir and Davis Dam; fish spawned and produced larvae in 2000 and 2001 |
| **Gila River Subbasin** | | |
| Verde River | Limited distribution of hatchery stocks | |
| Salt River | Limited distribution of hatchery stocks | |

The map below of wild or stocked razorback sucker in the Colorado River basin was reproduced from the Razorback Sucker Recovery Goals (USFWS 2002b, Figure 1).




Currently, the largest concentration of razorback sucker remaining in the Colorado River Basin is in Lake Mohave on the border of Arizona and California. Estimates of the wild stock in Lake Mohave have fallen precipitously in recent years from 60,000 as late as 1991, to 25,000 in 1993 (Marsh 1993; Holden 1994), to about 9,000 in 2000 (USFWS 2002b). Until recently, efforts to introduce young razorback sucker into Lake Mohave have failed because of predation by nonnative species (Minckley et al. 1991, Clarkson et al. 1993; Burke 1994). While limited numbers of razorback suckers persist in other locations in the Lower Colorado River, they are considered rare or incidental and may be continuing to decline.

In the Upper Colorado River Basin, above Glen Canyon Dam, razorback suckers are found in limited numbers in both lentic (lake-like) and riverine environments. Small numbers of razorback suckers have been found in Lake Powell at the mouths of the Dirty Devil, San Juan and Colorado Rivers. The largest populations of razorback suckers in the upper basin are found in the upper Green and lower Yampa Rivers (Tyus 1987). Lanigan and Tyus (1989) estimated a population of 948 adults in the upper Green River. Eight years later, the population was estimated at 524 adults and the population was characterized as stable or declining slowly with some evidence of recruitment (Modde et al. 1996). In the Colorado River, most razorback suckers occur in the Grand Valley area near Grand Junction, Colorado; however, they are increasingly rare. More recent accounts are less encouraging on the status of the razorback sucker in the Upper Colorado River Basin, "Less than 100 wild adults are estimated to still occur in the middle Green River of Utah and Colorado, and wild populations are considered gone from the Gunnison, Colorado, and San Juan Rivers" (UCREFRP 2006).

Scientifically documented records of wild razorback sucker adults in the San Juan River are limited to two fish captured in a riverside pond near Bluff, Utah in 1976, and one fish captured in the river in 1988, also near Bluff (Platania 1990). Large numbers were anecdotally reported from a drained pond near Bluff in 1976, but no specimens were preserved to verify the species. No wild razorback suckers were found during the 7-year research period (1991-1997) on the San Juan River (Holden 1999). However, hatchery-reared razorback sucker, especially fish greater than 350 millimeters (13.8 inches), introduced into the San Juan River in the 1990s have survived and reproduced, as evidenced by recapture data and collection of larval fish (Ryden 2000b). Until 2003, there was very limited evidence indicating natural recruitment to any population of razorback sucker in the Colorado River system (Bestgen 1990, Platania 1990, Platania et al. 1991, Tyus 1987, McCarthy and Minckley 1987, Osmundson and Kaeding 1989, Modde et al. 1996). In 2003, two juvenile (age-2) razorback sucker (9.8 and 10.6 inches) thought to be wild-produced from stocked fish were collected in the lower San Juan River (Ryden 2004a).

Razorback suckers are being reintroduced into the Colorado, Gunnison, Green, and San Juan Rivers, and lakes Havasu and Mohave; see Baseline for more details.

Recovery

Objective, measurable criteria for recovery of razorback sucker in the Colorado River Basin are presented for each of two recovery units (i.e., the upper basin, including the Green River, upper Colorado River, and San Juan River subbasins; and the lower basin, including the mainstem and its tributaries from Glen Canyon Dam downstream to the southerly International Boundary with Mexico) because of different recovery or conservation programs and to address unique threats and site-specific management actions/tasks necessary to minimize or remove those threats. Recovery of the species is considered necessary in both the upper and lower basins because of the present status of populations and existing information on razorback sucker biology. Self-sustaining populations will need to be established through augmentation. These recovery criteria will need to be reevaluated and revised after self-sustaining populations are established and there is improved understanding of razorback sucker biology.

Downlisting can occur if, over a 5-year period: (1) genetically and demographically viable, self-sustaining populations are maintained in the Green River subbasin and **EITHER** in the upper Colorado River subbasin or the San Juan River subbasin such that — (a) the trend in adult point estimates for each of the two populations does not decline significantly, and (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each of the two populations, and (c) each point estimate for each of the two populations exceeds 5,800 adults (5,800 is the estimated minimum viable population needed to ensure long-term genetic and demographic viability); (2) a genetic refuge is maintained in Lake Mohave of the lower basin recovery unit; (3) two genetically and demographically viable, self-sustaining populations are maintained in the lower basin recovery unit (e.g., mainstem and/or tributaries) such that — (a) the trend in adult point estimates for each population does not decline significantly, and (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each population, and (c) each point estimate for each population exceeds 5,800 adults; and (4) when certain site-specific management tasks to minimize or remove threats have been identified, developed, and implemented.

Delisting can occur if the same criteria are maintained over a 3-year period beyond downlisting and necessary levels of protection are attained (USFWS 2002b).

Threats to the Species

A marked decline in populations of razorback suckers can be attributed to construction of dams and reservoirs, introduction of nonnative fishes, and removal of large quantities of water from the Colorado River system. Dams on the main stem Colorado River and its major tributaries have fragmented populations and blocked migration routes. Dams also have drastically altered flows, water temperatures, and channel geomorphology. These changes have modified habitats in many areas so that they are no longer suitable for breeding, feeding, or sheltering. Major changes in species composition have occurred due to the introduction of nonnative fishes, many of which have thrived due to man-induced changes to the natural riverine system. Habitat has been significantly degraded to a point where it impairs the essential life history functions of razorback sucker, such as reproduction and recruitment into the adult population. The threats to razorback sucker are essentially the same threats identified for Colorado pikeminnow.

The razorback sucker recovery goals identified streamflow regulation, habitat modification, predation by nonnative fish species, and pesticides and pollutants as the primary threats to the species (USFWS 2002b). Within the upper Colorado River Basin, recovery efforts include the capture and removal of razorback suckers from all known locations for genetic analyses and development of brood stocks. In the short term, augmentation (stocking) may be the only means to prevent the extirpation of razorback sucker in the upper Colorado River Basin. However, in the long term it is expected that natural reproduction and recruitment will occur. A genetics management plan and augmentation plan have been written for the razorback sucker (Crist and Ryden 2003, Ryden 2003a).

Many species of nonnative fishes occur in occupied habitat of the razorback sucker. These nonnative fishes are predators, competitors, and vectors of parasites and diseases (Tyus et al. 1982, Lentsch et al. 1996, Pacey and Marsh 1999, Marsh et al. 2001). Many researchers believe that nonnative species are a major cause for the lack of recruitment and that nonnative fish are the most important biological threat to the razorback sucker (e.g., McAda and Wydoski 1980, Minckley 1983, Tyus 1987, USFWS 1998a, Muth et al. 2000). There are reports of predation of razorback sucker eggs and larvae by common carp (*Cyprinus carpio*), channel catfish, smallmouth bass (*Micropterus dolomieui*), largemouth bass, bluegill (*Lepomis macrochirus*), green sunfish, and red-ear sunfish (*Lepomis microlophus*) (Jonez and Sumner 1954, Marsh and Langhorst 1988, Langhorst 1989). Marsh and Langhorst (1988) found higher growth rates in larval razorback sucker in the absence of predators in Lake Mohave, and Marsh and Brooks (1989) reported that channel catfish and flathead catfish were major predators of stocked razorback sucker in the Gila River. Juvenile razorback sucker stocked in isolated coves along the Colorado River in California suffered extensive predation by channel catfish and largemouth bass (Langhorst 1989). Predation upon a recently-stocked razorback sucker by an adult channel catfish was documented in the San Juan River (Jackson 2005). Aggressive behavior between channel catfish and adult razorback sucker has been inferred from the presence of distinct bite marks on the dorsal keels of four razorback suckers that match the bite characteristics of channel catfish (Ryden 2004a).

Lentsch et al. (1996) identified six species of nonnative fishes in the upper Colorado River Basin as threats to razorback sucker: red shiner, common carp, sand shiner, fathead minnow, channel catfish, and green sunfish. Smaller fish, such as adult red shiner, are known predators of larval native fish (Ruppert et al. 1993). Large predators, such as walleye (*Stizostedion vitreum*), northern pike, and striped bass (*Morone saxatilis*), also pose a threat to subadult and adult razorback sucker (Tyus and Beard 1990).

Life History

McAda and Wydoski (1980) and Tyus (1987) reported springtime aggregations of razorback suckers in off-channel habitats and tributaries; such aggregations are believed to be associated with reproductive activities. Tyus and Karp (1990) and Osmundson and Kaeding (1991) reported off-channel habitats to be much warmer than the main stem river and that razorback suckers presumably moved to these areas for feeding, resting, sexual maturation, spawning, and other activities associated with their reproductive cycle. Reduction in spring peak flows eliminates or reduces the frequency of inundation of off-channel habitats. The absence of these seasonally flooded riverine habitats is believed to be a limiting factor in the successful recruitment of razorback suckers in their native environment (Tyus and Karp 1989; Osmundson and Kaeding 1991). Wydoski and Wick (1998) identified starvation of larval razorback suckers due to low zooplankton densities in the main channel and loss of floodplain habitats which provide adequate zooplankton densities for larval food as one of the most important factors limiting recruitment. Tyus and Karp (1990) and Modde and Wick (1997) suggested that use of warmer, more productive flooded habitats by adult razorback suckers during the breeding season is related to temperature preferences (23–25 °C; Bulkley and Pimental 1983) and abundance of appropriate foods (Jonez and Sumner 1954; Vanicek 1967; Marsh 1987; Wolz and Shiozawa 1995; Modde 1997; Wydoski and Wick 1998).

While razorback suckers have never been directly observed spawning in turbid riverine environments within the upper Colorado River Basin, captures of ripe specimens, both males and females, have been recorded in the Yampa, Green, Colorado, and San Juan Rivers (Valdez et al. 1982, McAda and Wydoski 1980, Tyus 1987, Osmundson and Kaeding 1989, Tyus and Karp 1989, Tyus and Karp 1990, Osmundson and Kaeding 1991, Platania 1990, Ryden 2000b, Jackson 2003, Ryden 2005). Sexually mature razorback suckers are generally collected on the ascending limb of the hydrograph from mid-April through June and are associated with coarse gravel substrates. Because of the relatively steep gradient in the San Juan River and lack of a wide flood plain, razorback sucker are likely spawning in low velocity, turbid, main channel habitats. Aggregations of ripe adults have only been documented in a few locations.

Both sexes mature as early as age four (McAda and Wydoski 1980). Fecundity, based on ovarian egg counts, ranges from 75,000-144,000 eggs (Minckley 1983). McAda and Wydoski (1980) reported an average fecundity (N=10) of 46,740 eggs/fish (27,614–76,576). Several males attend each female; no nest is built. The adhesive eggs drift to the bottom and hatch there (Sublette et al. 1990). Marsh (1985) reported that, in laboratory experiments, the percentage of egg hatch was greatest at 20 °C (68 °F) and all embryos died at incubation temperatures of 5, 10, and 30 °C (41, 50, and 86 °F).

Because young and juvenile razorback suckers are rarely encountered, their habitat requirements in the wild are not well known, particularly in native riverine environments. However, it is assumed that low-velocity backwaters and side channels are important for YOY and juveniles, as it is to the early life stages of most riverine fish. Prior to construction of large main stem dams and the suppression of spring peak flows, low velocity, off-channel habitats (seasonally flooded bottomlands and shorelines) were commonly available throughout the upper Colorado River Basin (Tyus and Karp 1989, Osmundson and Kaeding 1991). Modde (1996) found that on the Green River, larval razorback suckers entered flooded bottomlands that are connected to the main channel during high flow. However, as mentioned earlier, because of the relatively steep gradient of the San Juan River and the lack of a wide flood plain, flooded bottomlands are probably much less important in this system than are other low velocity habitats such as backwaters and secondary channels (Ryden, 2004a).

Spring migrations by adult razorback suckers were associated with spawning in historic accounts (Jordan 1891; Hubbs and Miller 1953; Sigler and Miller 1963; Vanicek 1967) and a variety of local and long-distance movements and habitat-use patterns have been subsequently documented. Spawning migrations (one-way movements of 30.4–106.0 km) observed by Tyus and Karp (1990) included movements between the Ouray and Jensen areas of the Green River and between the Jensen area and the lower Yampa River. Initial movement of adult razorback suckers to spawning sites was influenced primarily by increases in river discharge and secondarily by increases in water temperature (Tyus and Karp 1990; Modde and Wick 1997; Modde and Irving 1998). Flow and temperature cues may serve to effectively congregate razorback suckers at spawning sites, thus increasing reproductive efficiency and success. Reduction in spring peak flows may hinder the ability of razorback suckers to form spawning aggregations, because spawning cues are reduced (Modde and Irving 1998).

A few domestic-reared razorback suckers released into the wild have exhibited long-distance dispersals. One individual released into the Gunnison River was recaptured 3.5 years later 90 miles up the Green River, having traveled a minimum distance of 228 river miles. Another individual released into the Gunnison River was recaptured 205 river miles downstream in the Colorado River only 6.5 months later (Burdick 2003).

Outside of the spawning season, adult razorback suckers occupy a variety of shoreline and main channel habitats including slow runs, shallow to deep pools, backwaters, eddies, and other relatively slow velocity areas associated with sand substrates (Tyus 1987, Tyus and Karp 1989, Osmundson and Kaeding 1989, Valdez and Masslich 1989, Osmundson and Kaeding 1991, Tyus and Karp 1990).

Critical Habitat

Critical habitat was designated in 1994 within the 100-year floodplain of the razorback sucker's historical range in the following areas of the upper Colorado River (59 FR 13374). The primary constituent elements are the same as critical habitat for Colorado pikeminnow described previously. We designated 15 reaches of the Colorado River system as critical habitat for the razorback sucker. These reaches total 1,724 miles as measured along the center line of the river within the subject reaches. The designation represents approximately 49 percent of the historical habitat for the species and includes reaches of the Green, Yampa, Duchesne, Colorado, White, Gunnison and San Juan Rivers.

> The Yampa River and its 100-year floodplain from the mouth of Cross Mountain Canyon (T. 6 N., R. 98 W., section 23, 6th Principal Meridian) to the confluence with the Green River.
>
> The Green River and its 100-year floodplain from the confluence with the Yampa River to the confluence with the Colorado River.
>
> The White River and its 100-year floodplain from the boundary of the Uintah and Ouray Indian Reservation at river mile 18 (T. 9 S., R. 22 E., section 21, Salt Lake Meridian) to the confluence with the Green River.
>
> The Duchesne River and its 100-year floodplain from river mile 2.5 (T. 4 S., R. 3 E., section 30, Salt Lake Meridian) to the confluence with the Green River.
>
> The Gunnison River and its 100-year floodplain from the confluence with the Uncompahgre River to Redlands Diversion Dam (T. 1 S., R. 1 W., section 27, Ute Meridian).
>
> The Colorado River and its 100-year floodplain from Colorado River Bridge in Rifle at exit 90 north off Interstate 70 (T. 6 S., R. 93 W., section 16, 6th Principal Meridian) to full pool elevation, upstream of North Wash, and including the Dirty Devil arm of Lake Powell (T. 33 S., R. 14 E., section 29, Salt Lake Meridian).
>
> The San Juan River and its 100-year floodplain from the Hogback Diversion (T. 29 N., R. 16 W., section 9, New Mexico Meridian) to the full pool elevation at the mouth of Neskahai Canyon on the San Juan arm of Lake Powell (T. 41 S., R. 11 E., section 26, Salt Lake Meridian).

The primary constituent elements of critical habitat are the same as those described earlier for pikeminnow.

**Humpback Chub**

The humpback chub is a medium-sized fish (up to 20 inches) in the minnow family that can live 30 years. The adults have a pronounced dorsal hump, a narrow flattened head, a fleshy snout with an inferior-subterminal mouth, and small eyes. It has silvery sides with a brown or olive colored back.

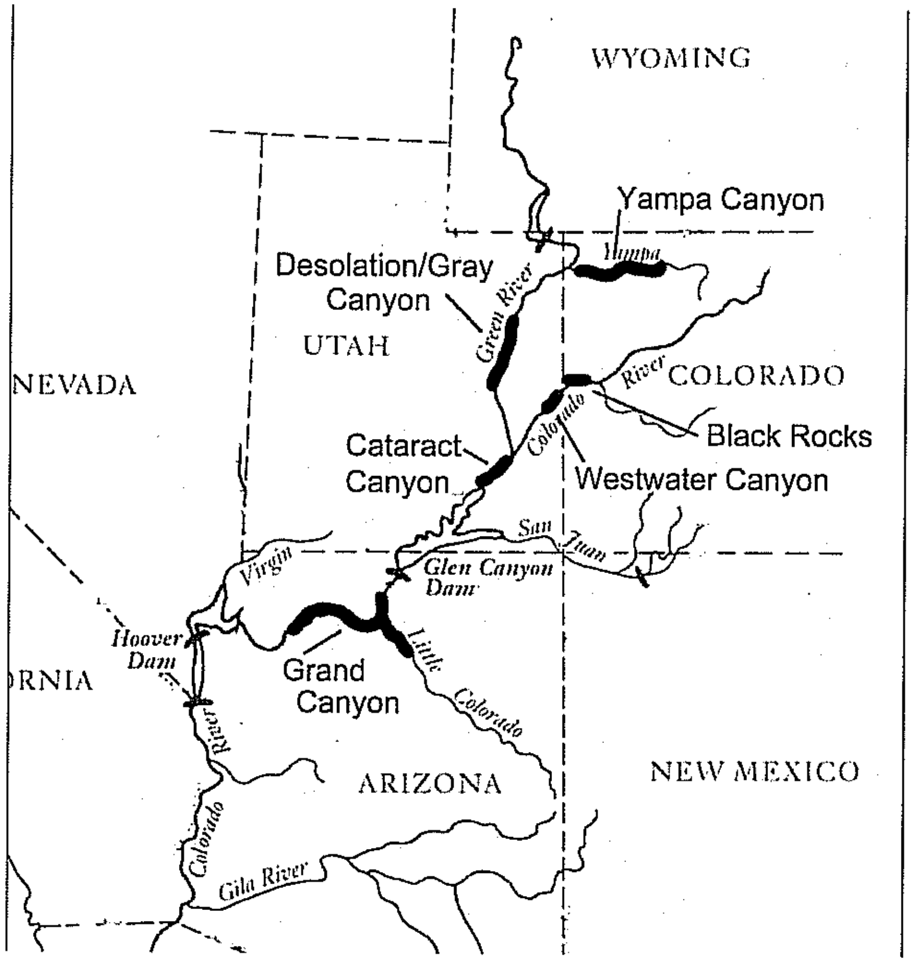
<u>Status and Distribution</u>

The humpback chub is endemic to the Colorado River Basin. Humpback chub remains have been dated to about 4000 B.C., but the fish was not described as a species until the 1940s (Miller 1946), presumably because of its restricted distribution in remote white water canyons (USFWS

1990a). Because of this, its original distribution is not known. The humpback chub was listed as endangered on March 11, 1967.

Failure to recognize *Gila cypha* as a species until 1946 complicated interpretation of the historic distribution of humpback chubs (Douglas et al. 1989, 1998). Until the 1950s, the humpback chub was known only from Grand Canyon. During surveys in the 1950s and 1960s humpback chub were also found in the Green River (Holden and Stalnaker 1970, Vanicek et al. 1970). Best available information indicates that before Flaming Gorge Dam, humpback chubs were distributed in canyon regions throughout much of the Green River, from the present site of Flaming Gorge Reservoir downstream through Desolation and Gray canyons (Vanicek 1967, Holden and Stalnaker 1975). Historic collection records of humpback chub also exist from the Yampa and White Rivers (Holden and Stalnaker 1975, Miller et al. 1982b, Sigler and Miller 1963, Tyus 1998) and the Colorado River near Moab (Sigler and Miller 1963).

The map below of the distribution of humpback chub in the Colorado River basin was reproduced from the Humpback Chub Recovery Goals (USFWS 2002c, Figure 1).




Today the largest populations of this species occur in the Little Colorado and Colorado Rivers in the Grand Canyon, and in Black Rocks and Westwater Canyon in the upper Colorado River. Other populations have been reported in De Beque Canyon of the Colorado River, Desolation and Gray Canyons of the Green River, Yampa and Whirlpool Canyons in Dinosaur National

Monument (USFWS 1990a). One individual was recently captured in the Gunnison River (Burdick 1995).

Monitoring humpback chub populations is ongoing and sampling protocols and reliability of population estimates are being assessed by the Service and cooperating entities. The humpback chub recovery goals (USFWS 2002c) provided the following preliminary population estimates for adults in the six primary populations:

> Black Rocks, Colorado River, Colorado -- 900–1,500
> Westwater Canyon, Colorado River, Utah -- 2,000–5,000
> Yampa Canyon, Yampa River, Colorado -- 400–600
> Desolation/Gray Canyons, Green River, Utah -- 1,500
> Cataract Canyon, Colorado River, Utah -- 500
> Grand Canyon, Colorado River and Little Colorado River, Arizona -- 2,000–4,700

Low numbers of humpback chub have been captured in Whirlpool Canyon and Split Mountain Canyon on the Green River in Dinosaur National Monument; however, these fish were considered part of the Yampa River population in the Recovery Goals (USFWS 2002c), and not separate populations.

Recovery

Recovery goals for the humpback chub (USFWS 2002c) were approved on August 1, 2002. According to these recovery goals, downlisting can be considered if, over a 5-year period:

✓ the trend in adult (age 4+; > 200 mm total length) point estimates for each of the six extant populations does not decline significantly; and

✓ mean estimated recruitment of age-3 (150–199 mm total length) naturally produced fish equals or exceeds mean annual adult mortality for each of the six extant populations; and

✓ two genetically and demographically viable, self-sustaining core populations are maintained, such that each point estimate for each core population exceeds 2,100 adults (2,100 is the estimated minimum viable population needed to ensure long-term genetic and demographic viability); and

✓ certain site-specific management tasks to minimize or remove threats have been identified, developed, and implemented.

Delisting can be considered if, over a 3-year period beyond downlisting:

✓ the trend in adult point estimates for each of the six extant populations does not decline significantly; and

✓ mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each of the six extant populations; and

- ✓ three genetically and demographically viable, self-sustaining core populations are maintained, such that each point estimate for each core population exceeds 2,100 adults; and

- ✓ certain site-specific management tasks to minimize or remove threats have been finalized and implemented, and necessary levels of protection are attained.

Threats to the Species

Although historic data are limited, the apparent range-wide decline in humpback chubs is likely due to a combination of factors including alteration of river habitats by reservoir inundation, changes in stream discharge and temperature, competition with and predation by introduced fish species, and other factors such as changes in food resources resulting from stream alterations (USFWS 1990a).

The primary threats to humpback chub are stream flow regulation and habitat modification (affecting constituent elements: water and physical habitat); competition with and predation by nonnative fishes; parasitism; hybridization with other native *Gila* species; and pesticides and pollutants (USFWS 2002c) (all affecting constituent element: biological environment). The existing habitat, altered by these threats, has been modified to the extent that it impairs essential behavior patterns, such as breeding, feeding, and sheltering. The threats to humpback chub in relation to flow regulation and habitat modification, predation by nonnative fishes, and pesticides and pollutants are essentially the same threats identified for Colorado pikeminnow.

The humpback chub population in the Grand Canyon is threatened by predation from nonnative trout in the Colorado River below Glen Canyon Dam. This population is also threatened by the Asian tapeworm reported in humpback chub in the Little Colorado River (USFWS 2002c). No Asian tapeworms have been reported in the upper basin populations. In Grand Canyon, brown trout (*Salmo trutta*), channel catfish (*Ictalurus punctatus*), black bullhead (*Ameiurus melas*), and rainbow trout (*Oncorhynchus mykiss*) have been identified as principal predators of juvenile humpback chub, with consumption estimates that suggest loss of complete year classes to predation (Marsh and Douglas 1997; Valdez and Ryel 1997). Valdez and Ryel (1997) also suggested that common carp (*Cyprinus carpio*) could be a significant predator of incubating humpback chub eggs in the lower Colorado River. In the upper basin, Chart and Lentsch (2000) identified channel catfish as the principal predator of humpback chub in Desolation and Gray Canyons. The Upper Colorado River Recovery Plan identified channel catfish as the principal predator of humpback chub in Yampa Canyon and is pursuing development and implementation of a control program (USFWS 2002c).

Survival rates are extremely low and believed to be less than 1 in 1,000 to 2 years of age. Low water temperatures and predation are believed to be the primary factors. Valdez and Ryel (1995) estimate that 250,000 young humpback chub are consumed by brown trout, rainbow trout, and channel catfish.

Hybridization with roundtail chub (*Gila robusta*) and bonytail, where they occur with humpback chub, is recognized as a threat to humpback chub. A larger proportion of roundtail chub have been found in Black Rocks and Westwater Canyon during low flow years (Kaeding et al. 1990, Chart and Lentsch 2000), which increase the chances for hybridization.

Life History

Unlike Colorado pikeminnow and razorback sucker, which are known to make extended migrations of up to several hundred miles to spawning areas in the Green and Yampa Rivers, humpback chubs in the Green River do not appear to make extensive migrations (Karp and Tyus 1990). Generally, humpback chub show fidelity for canyon reaches and move very little (Miller et al. 1982; Valdez and Clemmer 1982; Archer et al. 1985; Burdick and Kaeding 1985; Kaeding et al. 1990; Chart and Lentsch 1999a; Chart and Lentsch 1999b). Movements of adult humpback chub in Black Rocks on the Colorado River were essentially restricted to a 1-mile reach. These results were based on the recapture of Carlin-tagged fish and radiotelemetry studies conducted from 1979 to 1981 (Valdez et al. 1982) and 1983 to 1989 (Archer et al. 1985; Kaeding et al. 1990). However, a few fish have moved between Black Rocks and Westwater Canyon, a distance of 14 miles (Valdez and Clemmer 1982, Kaeding et al. 1990, Chart and Lentsch 1999a).

Tyus and Karp (1991) found that in the Yampa and Green Rivers in Dinosaur National Monument, humpback chubs spawn during spring and early summer following peak flows at water temperatures of about 20 °C. They estimated that the spawning period for humpback chub ranges from May into July, with spawning occurring earlier in low-flow years and later in high-flow years; spawning was thought to occur only during a 4–5 week period (Karp and Tyus 1990). Similar to the Yampa and Green Rivers, peak hatch of *Gila* larvae in Westwater Canyon on the Colorado River appears to occur on the descending limb of the hydrograph following spring runoff at maximum daily water temperatures of approximately 20 to 21 °C (Chart and Lentsch 1999a). Tyus and Karp (1989) reported that humpback chubs occupy and spawn in and near shoreline eddy habitats and that spring peak flows were important for reproductive success because availability of these habitats is greatest during spring runoff.

High spring flows that simulate the magnitude and timing of the natural hydrograph provide a number of benefits to humpback chubs in the Yampa and Green Rivers. Bankfull and overbank flows provide allochthonous energy input to the system in the form of terrestrial organic matter and insects that are utilized as food. High spring flows clean spawning substrates of fine sediments and provide physical cues for spawning. High flows also form large recirculating eddies used by adult fish. High spring flows (50 percent exceedance or greater) have been implicated in limiting the abundance and reproduction of some nonnative fish species under certain conditions (Chart and Lentsch 1999a, 1999b) and have been correlated with increased recruitment of humpback chubs (Chart and Lentsch 1999b).

In the Green River and upper Colorado River, humpback chubs spawned in spring and summer as flows declined shortly after the spring peak (Valdez and Clemmer 1982; Valdez et al. 1982; Kaeding and Zimmerman 1983; Tyus and Karp 1989; Karp and Tyus 1990; Chart and Lentsch 1999a, 1999b). Similar spawning patterns were reported from Grand Canyon (Kaeding and Zimmerman 1983; Valdez and Ryel 1995, 1997). Little is known about spawning habitats and behavior of humpback chub. Although humpback chub are believed to broadcast eggs over mid-channel cobble and gravel bars, spawning in the wild has not been observed for this species. Gorman and Stone (1999) reported that ripe male humpback chubs in the Little Colorado River aggregated in areas of complex habitat structure (i.e., matrix of large boulders and travertine masses combined with chutes, runs, and eddies, 0.5–2.0 m deep) and were associated with deposits of clean gravel.

Muth et al. (2000) summarized flow and temperature needs of humpback chub in the Green River subbasin as:

> "...The habitat requirements of the humpback chub are incompletely understood. It is known that fish spawn on the descending limb of the spring hydrograph at temperatures greater than 17 °C. Rather than migrate, adults congregate in near-shore eddies during spring and spawn locally. They are believed to be broadcast spawners over gravel and cobble substrates. Young humpback chubs typically use low-velocity shoreline habitats, including eddies and backwaters, that are more prevalent under base-flow conditions. After reaching approximately 40-50 mm TL, juveniles move into deeper and higher-velocity habitats in the main channel.
>
> Increased recruitment of humpback chubs in Desolation and Gray Canyons was correlated with moderate to high water years from 1982 to 1986 and in 1993 and 1995. Long, warm growing seasons, which stimulate fish growth and a low abundance of competing and predatory nonnative fishes also have been implicated as potential factors that increase the survival of young humpback chubs.
>
> High spring flows increase the availability of the large eddy habitats utilized by adult fish. High spring flows also maintain the complex shoreline habitats that are used as nursery habitat by young fish during subsequent base flows. Low-velocity nursery habitats that are used by young fish are warmer and more productive at low base flows."

Newly hatched larvae average 6.3–7.5 mm TL (Snyder 1981, Behnke and Benson 1983, Muth 1990), and 1-month-old fish are approximately 20 mm long (Hamman 1982). Unlike Colorado pikeminnow and razorback sucker, no evidence exists of long-distance larval drift (Miller and Hubert 1990; Robinson et al. 1998). Upon emergence from spawning gravels, humpback chub larvae remain in the vicinity of bottom surfaces (Marsh 1985) near spawning areas (Chart and Lentsch 1999a).

Backwaters, eddies, and runs have been reported as common capture locations for young-of-year humpback chub (Valdez and Clemmer 1982). These data indicate that in Black Rocks and Westwater Canyon, young utilize shallow areas. Habitat suitability index curves developed by Valdez et al. (1990) indicate young-of-year prefer average depths of 2.1 feet with a maximum of 5.1 feet. Average velocities were reported at 0.2 feet per second. In the Grand Canyon, nearly all fish smaller than 100 mm TL were captured near shore, whereas most fish larger than this were captured in offshore habitats (Valdez and Ryel 1995).

Valdez et al. (1982) and Wick et al. (1981) found adult humpback chub in Black Rocks and Westwater Canyons in water averaging 50 feet in depth with a maximum depth of 92 feet. In these localities, humpback chub were associated with large boulders and steep cliffs. Valdez and Ryell (1997) captured or located adults most often in large recirculating eddies.

Critical Habitat

Critical habitat was designated for the humpback chub along seven river reaches totaling 379 miles on March 21, 1994 (59 FR 13374). Designated critical habitat makes up about 28 percent of the species' original range and occurs in both the Upper and Lower Colorado River Basins. Although humpback chub life history and habitat use differs greatly from the other endangered Colorado River fish, the Service determined that the primary constituent elements (water, physical habitat, and biological environment) of their critical habitat were the same. Critical habitat was designated in the following areas:

- The Yampa River within Dinosaur National Monument in Colorado,
- The Green River from its confluence with the Yampa River downstream to the southern boundary of Dinosaur National Monument (including the canyon reaches of Whirlpool and Split Mountain), and the Green River within Desolation and Gray Canyons,
- The Colorado River in Utah from Black Rocks to Fish Ford and from Brown Betty Rapid River to Imperial Canyon, and in Arizona from Nautiloid Canyon to Granite Park.
- The Little Colorado River in Arizona from river mile 8 to the confluence with the Colorado River

Yampa Canyon has not been affected by stream flow regulation like Split Mountain, Desolation, and Gray Canyons on the Green River. However, Yampa Canyon has recently been invaded by high numbers of smallmouth bass changing the biological environment of critical habitat.

**Bonytail**

Bonytail are medium-sized fish (up to 22 inches) in the minnow family that can live 50 years. Adult bonytail are gray or olive colored on the back with silvery sides and a white belly. The adult bonytail has an elongated body with a long, thin caudal peduncle. The head is small and compressed compared to the rest of the body. The mouth is slightly overhung by the snout and there is a smooth low hump behind the head that is not as pronounced as the hump on a humpback chub.

Status and Distribution

The bonytail is endemic to the Colorado River Basin and was historically common to abundant in warm-water reaches of larger rivers of the basin from Mexico to Wyoming. The species experienced a dramatic, but poorly documented, decline starting in about 1950, following construction of several mainstem dams, introduction of nonnative fishes, poor land-use practices, and degraded water quality (USFWS 2002d).

The bonytail is the rarest native fish in the Colorado River. Little is known about its specific habitat requirements or cause of decline, because the bonytail was extirpated from most of its historic range prior to extensive fishery surveys. It was listed as endangered on April 23, 1980.

Currently, no self-sustaining populations of bonytail are known to exist in the wild, and very few individuals have been caught anywhere within the basin. Since 1977, only 11 wild adults have been reported from the upper basin (Valdez et al. 1994).

Formerly reported as widespread and abundant in mainstem rivers (Jordan and Evermann 1896), its populations have been greatly reduced. Remnant populations presently occur in the wild in low numbers in Lake Mohave and several fish have been captured in Lake Powell and Lake Havasu (USFWS 2002d). The last known riverine area where bonytail were common was the Green River in Dinosaur National Monument, where Vanicek (1967) and Holden and Stalnaker (1970) collected 91 specimens during 1962-1966. From 1977 to 1983, no bonytail were collected from the Colorado or Gunnison Rivers in Colorado or Utah (Wick et al. 1981, Valdez et al. 1982; Miller et al. 1984). However, in 1984, a single bonytail was collected from Black Rocks on the Colorado River (Kaeding et al. 1986). Several suspected bonytail were captured in Cataract Canyon in 1985-1987 (Valdez 1990).

Bonytail were extirpated between Flaming Gorge Dam and the Yampa River, primarily because of rotenone poisoning and cold-water releases from the dam (USFWS 2002c). Surveys from 1964 to 1966 found large numbers of bonytail in the Green River in Dinosaur National Monument downstream of the Yampa River confluence (Vanicek and Kramer 1969). Surveys from 1967 to 1973 found far fewer bonytail (Holden and Stalnaker 1975). Few bonytail have been captured after this period, and the last recorded capture in the Green River was in 1985 (USFWS 2002d). Bonytail are so rare that it is currently not possible to conduct population estimates.

The map below of the recent distribution of wild bonytail in the Colorado River basin was reproduced from the Bonytail Recovery Goals (USFWS 2002d, Fig. 1).

Approximately 130,000 hatchery-produced $F_1$ and $F_2$ fish were released into Lake Mohave between 1981 and 1987 as part of an effort by the Service to prevent extinction and promote eventual recovery of the species. Younger bonytail of adult size and spawning ability have been collected from the reservoir in the 1990s along with the old adults of the founder population. It is unknown whether these younger adults are from the original stockings or a result of natural reproduction. Releases of hatchery-reared adults into riverine reaches in the upper basin have resulted in low survival (Chart and Cranney 1991), with no evidence of reproduction or recruitment.

Current stocking plans for bonytail identify the middle Green River and the Yampa River in Dinosaur National Monument as the highest priority for stocking in Colorado and the plan calls for 2,665 fish to be stocked per year over the next six years (Nesler et al. 2003). Between 1998 and 2003, the number of bonytail stocked in the Green River subbasin was 189,438 fish, with the majority of the fish being juveniles at the time of stocking. The only known bonytail that presently occur in the Yampa River are the individuals recently reintroduced at Echo Park, near the confluence with the Green River. In July of 2000 approximately 5,000 juveniles (5 to 10 cm) were stocked.

Recovery

Recovery goals for the bonytail (USFWS 2002d) were approved on August 1, 2002. According to these recovery goals, downlisting can be considered if, over a 5-year period:

- ✓ genetically and demographically viable, self-sustaining populations are maintained in the Green River subbasin and upper Colorado River subbasin such that (a) the trend in adult (age 4+; > 250 mm TL) point estimates for each of the two populations does not decline significantly, and (b) mean estimated recruitment of age-3 (150–249 mm TL) naturally produced fish equals or exceeds mean annual adult mortality for each of the two populations, and (c) each point estimate for each of the two populations exceeds 4,400 adults (4,400 is the estimated minimum viable population needed to ensure long-term genetic and demographic viability); and

- ✓ a genetic refuge is maintained in a suitable location (e.g., Lake Mohave, Lake Havasu) in the lower basin recovery unit; and

- ✓ two genetically and demographically viable, self-sustaining populations are maintained in the lower basin recovery unit (e.g., mainstem and/or tributaries) such that (a) the trend in adult point estimates for each population does not decline significantly, and (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each population, and (c) each point estimate for each population exceeds 4,400 adults; and

- ✓ certain site-specific management tasks to minimize or remove threats have been identified, developed, and implemented.

Delisting can be considered if, over a 3-year period beyond downlisting:

- ✓ genetically and demographically viable, self-sustaining populations are maintained in the Green River subbasin and upper Colorado River subbasin such that (a) the trend in adult point estimates for each of the two populations does not decline significantly, and (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each of the two populations, and (c) each point estimate for each of the two populations exceeds 4,400 adults; and
- ✓ a genetic refuge is maintained in the lower basin recovery unit; and
- ✓ two genetically and demographically viable, self-sustaining populations are maintained in the lower basin recovery unit such that (a) the trend in adult point estimates for each population does not decline significantly, and (b) mean estimated recruitment of age-3 naturally produced fish equals or exceeds mean annual adult mortality for each population, and (c) each point estimate for each population exceeds 4,400 adults; and
- ✓ certain site-specific management tasks to minimize or remove threats have been finalized and implemented, and necessary levels of protection are attained.

Threats to the Species

The primary threats to bonytail are stream flow regulation and habitat modification (affecting constituent elements: water and physical habitat); competition with and predation by nonnative fishes; hybridization with other native *Gila* species; and pesticides and pollutants (USFWS 2002d) (affecting constituent element: biological environment). The existing habitat, altered by these threats, has been modified to the extent that it impairs essential behavior patterns, such as breeding, feeding, and sheltering. The threats to bonytail in relation to flow regulation and habitat modification, predation by nonnative fishes, and pesticides and pollutants are essentially the same threats identified for Colorado pikeminnow. Threats to bonytail in relation to hybridization are essentially the same threats identified for humpback chub.

Life History

The bonytail is considered a species that is adapted to mainstem rivers, where it has been observed in pools and eddies (Vanicek 1967; Minckley 1973). Of five specimens captured most recently in the upper basin, four were captured in deep, swift, rocky canyons (Yampa Canyon, Black Rocks, Cataract Canyon, and Coal Creek Rapid), but the fifth was taken in Lake Powell. Since 1974, all bonytails captured in the lower basin were caught in reservoirs. It has been suggested that the large fins and streamlined body of the bonytail is an adaptation to torrential flows (Miller 1946).

Little is known of the food habits of the bonytail. McDonald and Dotson (1960) reported that *"Colorado chub"* were largely omnivorous with a diet of terrestrial insects, plant matter, and fish. Several chubs were observed feeding on floating masses of debris washed by heavy rainfall. Vanicek (1967) reported that *"Colorado chubs"* fed mainly on terrestrial insects (mostly adult beetles and grasshoppers), plant debris, leaves, stems, and woody fragments.

Spawning of bonytail has never been observed in a river, but ripe fish were collected in Dinosaur National Monument during late June and early July suggesting that spawning occurred at water temperatures of about 18 °C (Vanicek and Kramer 1969). Similar to other closely related *Gila* species, bonytail probably spawn in rivers in spring over rocky substrates; spawning has been observed in reservoirs over rocky shoals and shorelines. It has been recently hypothesized that flooded bottomlands may provide important bonytail nursery habitat.

In the Green River, Vanicek (1967) reported that bonytails were generally found in pools and eddies in the absence of, although occasionally adjacent to, strong current and at varying depths generally over silt and silt-boulder substrates. Adult bonytail captured in Cataract, Desolation, and Gray Canyons were sympatric with humpback chub in shoreline eddies among emergent boulders and cobble, and adjacent to swift current (Valdez 1990). The diet of the bonytail is presumed similar to that of the humpback chub (USFWS percent2002d).

Although sufficient information on physical processes that affect bonytail habitats was not available to recommend specific flow and temperature regimes in the Green River to benefit this species, Muth et al. (2000) concluded that flow and temperature recommendations made for Colorado pikeminnow, razorback sucker, and humpback chub would presumably benefit bonytail and would not limit their its future recovery potential. The species is being reintroduced into the Colorado, Green, and Yampa Rivers, and into Lake Havasu and Lake Mojave.

<u>Critical Habitat</u>

A total of 499 km (312 miles) of river, representing about 14% of the species' historic range, has been designated as critical habitat for the bonytail in the following sections of the Colorado River Upper Basin (59 FR 13374).

The Yampa River within Dinosaur National Monument in Colorado.

The Green River (Whirlpool and Split Mountain) from the confluence with the Yampa River to the southern boundary of Dinosaur National Monument.

The Green River (Desolation and Gray Canyons) from Sumner's Amphitheater in T. 12 S., R. 18 E., section 5 (Salt Lake Meridian) to Swasey's Rapid (river mile 12) in T. 20 S., R. 16 E., section 3 (Salt Lake Meridian).

The Colorado River from Black Rocks (river mile 137) in T. 10 S., R. 104 W., section 25 (6th Principal Meridian) to Fish Ford in T. 21 S., R. 24 E., section 35 (Salt Lake Meridian).

The Colorado River from Brown Betty Rapid in T. 30 S., R. 18 E., section 34 (Salt Lake Meridian) to Imperial Canyon in T. 31 S., R. 17 E., section 28 (Salt Lake Meridian).

The Colorado River from Hoover Dam to Davis Dam including Lake Mohave up to its full pool elevation.

The Colorado River from the northern boundary of Havasu National Wildlife Refuge to Parker Dam, including Lake Havasu up to its full pool elevation.

The Service has identified water, physical habitat, and the biological environment as the primary constituent elements of bonytail critical habitat (59 FR 13374). Water includes a quantity of water of sufficient quality delivered to a specific location in accordance with a hydrologic regime required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment. Recent information collected by the Recovery Program suggests that floodplain habitats may be more important to the survival and recovery of the bonytail than the Service originally thought.

The Green River sections of critical habitat (Whirlpool, Split Mountain, Desolation, and Gray Canyons) have been affected by stream flow regulation. Yampa Canyon flows, on the other hand, have not been affected by upstream dams. However, Yampa Canyon has recently been invaded by high numbers of smallmouth bass changing the biological environment of critical habitat.

## ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, and private actions and other human activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal section 7 consultation; and the impact of State or private actions contemporaneous with the consultation process.

The action area is defined at 50 CFR 402 to mean "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the purposes of this consultation, the action area has been defined to include BLM lands in western Colorado, or private lands underlain by Federal minerals, that ultimately drain into the Colorado River, excluding the San Juan River basin, and those river reaches in Utah that are downstream of these lands (to Lake Powell) that are occupied by any of the four endangered fish species. The environmental baseline will focus on conditions within Colorado where the impacts of water depletions would be greatest. Thus, the environmental baseline will emphasize conditions within the Yampa, White, Colorado (upstream from the Utah border), and Gunnison Rivers, more so than those in the Green River or Utah portion of the Colorado River.

### Colorado pikeminnow

The Colorado pikeminnow is a year-round resident of the Yampa and Green Rivers, and occurs seasonally in the Little Snake River (Marsh et al. 1991; Wick et al. 1991). Spawning habitat in the Yampa River below the confluence with the Little Snake River is one of the known spawning sites in the Green River subbasin and has been identified as important habitat for Colorado pikeminnow (Bestgen et al. 1998, Tyus 1990). The estimate of adult Colorado pikeminnow associated with the spawning site in Yampa Canyon in the lower 32 km of the Yampa River is approximately 1,400 fish. The estimate for the Three Fords spawning site in Gray Canyon in the lower Green River is approximately 1,000 adults (Crowl and Bouwes 1998). Because some Colorado pikeminnow from the Green River migrate into the Yampa River to spawn, the

Colorado pikeminnow in the Yampa River are considered part of the Green River subbasin population. The Yampa River spawning area consistently produces more larvae than the spawning area in the lower Green River (Bestgen et al. 1998).

As stated in the Status of the Species section, more recent data presented by Bestgen et al. (2007) indicates that numbers of adult pikeminnow declined in the Green River Basin from 3,300 in 2001 to 2,142 in 2003, a reduction of 35 percent. According to the authors, it was difficult to ascertain whether the decline was from anthropogenic or natural causes, or some combination of the two. The most recent (2003) population estimate for the Yampa River is 224 adults; no recruits were found in the Yampa River because larvae drift downstream to the Green River for growth and development.

The White River provides 168 river kilometers of quality in-channel habitat that is utilized by adult and juvenile Colorado pikeminnow (Martinez et al. 1994). Although spawning sites are unknown on the White River, some of the highest catch rates for adult Colorado pikeminnow have been from the White River immediately below Taylor Draw Dam near Rangely, Colorado. Radio-tagged adults were found to move out of the White River to spawn in the Green and Yampa Rivers before returning again to the White River (Lentsch et al. 2000). Adult abundance estimates in the White River declined from 1,100 animals in 2000 to 407 animals in 2003 and recruit-sized estimates declined from 45 animals in 2001 to zero in 2003 (Bestgen et al. 2007).

Osmundson and Burnham (1998) estimated the population of adult and subadult Colorado pikeminnow in the Colorado River (from Palisade to the confluence with the Green River) to be 600-650 individuals during 1991-1994. The population estimate for the Colorado River increased to an average of 742 for the next three-year sampling period, 1998-2000 (Osmundson 2002b). Estimates of wild adult (> 450 mm) Colorado pikeminnow in the upper Colorado River (from Palisade, Colorado to Lake Powell) averaged approximately 750 fish during the 2003-2005 surveys (D. Osmundson, Fisheries Biologist, USFWS, unpublished data, 2008). There are no specific population estimates for Colorado pikeminnow in the Gunnison River and no specific population estimates for this species above Palisade on the mainstem Colorado River; few wild pikeminnow are likely to be found in these reaches. However, since fish passage was constructed in 1996 at the Redlands Diversion Dam on the Gunnison River, 81 Colorado pikeminnow have used the passage and reproduction has recently been documented upstream of the fish passage (UCREFRP 2007).

The Colorado River in the Grand Valley area near Grand Junction is occupied year round by Colorado pikeminnow. A 15-mile reach in this section of river between the Grand Valley Diversion and the confluence with the Gunnison River has been identified as important habitat for Colorado pikeminnow. Pikeminnow are known to spawn within this reach and larval pikeminnow have been found within and just downstream of this reach. The 10 miles below this reach are also important and have been classified as a "Young of the Year Nursery Area" by the Basin Biology Subcommittee (USFWS 1984).

The Colorado pikeminnow population has been augmented by stocking both in the Colorado and Gunnison Rivers. The integrated stocking plan (Nesler et al. 2003) calls for 1,125 age 3+ fish to be stocked into each of two river reaches for 8 successive years: 1) Colorado River (Rifle to De Beque Canyon), and 2) Gunnison River (Hartland to Redland dams). During the period from 2000 through 2004, over 2,800 Colorado pikeminnow were stocked into the upper Colorado

River. During 2003-2004, approximately 2,250 Colorado pikeminnow were stocked into the Gunnison River. During 2005 surveys, recaptures of these stocked pikeminnow in both reaches led to an estimate of 185 remaining individuals, or 3.6 percent of those that were stocked (D. Osmundson, Fisheries Biologist, USFWS, pers. comm. 2008). Most, if not all, pikeminnow ultimately moved downstream and out of the upper Colorado and Gunnison River reaches where they were stocked (D. Osmundson, Fisheries Biologist, USFWS, pers. comm. 2008). Despite the goals of the integrated stocking plan, no further Colorado pikeminnow stocking has taken place since 2004. In the Green River, Colorado pikeminnow were only stocked in 1999 when 36 were released.

Razorback sucker

Prior to 1991, the last confirmed documentation of a razorback sucker juvenile in the Upper Basin was a capture in the Colorado River near Moab, Utah (Taba et al. 1965). In 1991, two early juvenile razorback suckers were collected in the lower Green River near Hell Roaring Canyon (Gutermuth et al. 1994). Between 1992 and 1995 larval razorback suckers were collected in the middle and lower Green River and within the Colorado River inflow to Lake Powell (Muth 1995).

No current population estimates of razorback sucker in the upper Colorado or Yampa Rivers are available due to low numbers captured in recent years. The lower Yampa River provides adult habitat, spawning habitat, and potential nursery areas occur downstream in the Green River (USFWS 1998a). Modde and Smith (1995) reported that adult razorback suckers were collected between RM 13 and RM 0.1 of the Yampa River, but just one juvenile. The single fish (389 mm) was collected at RM 39 in June 1994. Razorback suckers are rarely found upstream as far as the confluence with the Little Snake River (McAda and Wydoski 1980, Lanigan and Tyus 1989). Tyus and Karp (1990) located concentrations of ripe razorback suckers at the mouth of the Yampa River during the spring in 1987-1989. Ripe fish were captured in runs associated with bars of cobble, gravel, and sand substrates in water averaging 0.63 m deep and mean velocity of 0.74 m/s.

Osmundson and Kaeding (1991) reported that the number of razorback sucker captures in the Grand Junction area has declined dramatically since 1974. Between 1984 and 1990, intensive collecting effort captured only 12 individuals in the Grand Valley (Osmundson and Kaeding 1991). In 1991 and 1992, 28 adult razorback suckers were collected from isolated ponds adjacent to the Colorado River near De Beque, Colorado (Burdick 1992). No young razorback suckers have been collected in recent times in the Colorado River. The wild population of razorback sucker is considered extirpated from the Gunnison River (Burdick and Bonar 1997).

The population is being augmented by stocking both in the Colorado and Gunnison Rivers. Nearly 50,000 juvenile, sub-adult, and adult razorback sucker were stocked in both the Upper Colorado (approximately 31,500) and Gunnison (approximately 18,500) Rivers in Colorado between 1994 and 2001. However, despite regular sampling, only 84 of these fish were recaptured 6 months or more following stocking (Burdick 2003). Many of the stocked fish were less than 200 mm; Burdick (2003) determined that it may be futile to stock individuals of this size or smaller due to their very low survival rate. Since fish passage was constructed in 1996 at the Redlands Diversion Dam on the Gunnison River (after 80 years of blocked fish passage), 20 razorback suckers have used the passage and reproduction has recently been documented upstream of the diversion dam (McAda 2003, UCREFRP 2007). Sampling for larval fish was done in the Gunnison River for the first time in 2002; 8 larval razorback suckers were collected that year (Osmundson 2002a), 7 were collected in 2003, and 2 were collected in 2005.

Twenty radio-tagged razorback suckers were also stocked in 1994 into historical habitat in the upper Colorado River between De Beque and Rifle. This is above the Price-Stubb Diversion Dam near Palisade, which at that time was a barrier to upstream fish passage. Twenty razorback suckers were also stocked into the Gunnison River near Delta in 1994, and five more in 1995. Unfortunately, post-stocking survival for all of these stocked fish was less than anticipated, with mortality possibly as high as 85 percent within approximately one year (Burdick and Bonar 1997).

The integrated stocking plan (Nesler et al. 2003) calls for 3,310 age 2+ fish to be stocked into each of 3 river reaches in Colorado for 6 successive years: 1) Colorado River (Rifle to De Beque Canyon), 2) Colorado River (Palisade to Stateline), and 3) Gunnison River (Hartland to Redland dams). Additionally, 19,860 razorback suckers are to be stocked into the Green River each year, split between the middle and lower reaches.

After the release of the integrated stocking plan (Nesler et al. 2003), the numbers of razorback suckers stocked into each river has been relatively high, although the stocking targets have not always been met. Combining all years from 1995 through 2007, the total number of razorback suckers stocked into each of the main rivers approximately totals: Green River = 75,300; Colorado River = 63,500; Gunnison River = 27,300 (T. Francis, in litt. 2008). Recapture rates of these stocked fish are typically quite low. River-wide and localized sampling efforts from 2000 to 2004 recaptured only approximately 1 percent of the razorback suckers stocked into the Colorado River prior to sampling, and approximately 8 percent of the razorback suckers stocked into the Green River prior to sampling. Some of these razorbacks, however, have persisted and have been captured 4 years after stocking and fish from earlier stocking efforts have been recaptured up to 9 years after stocking (UCREFRP 2006). Additionally, some of these stocked fish have moved long distances; razorbacks stocked in the Green River have been captured in the Colorado River and some stocked in the Gunnison River have been captured in the Green River (UCREFRP 2006). Stocked razorback suckers have also been recaptured or observed in reproductive condition at spawning sites in the Green and San Juan Rivers, larval razorbacks have been captured in the Green, Gunnison, Colorado, and San Juan Rivers, and razorback larvae are surviving through the first year based on the capture of juveniles in the Green and San Juan Rivers (UCREFRP 2007).

Humpback chub

Two populations of humpback chub are found in the upper Colorado River—Black Rocks, a 1-mile long reach just upstream from the Colorado-Utah state line, and Westwater Canyon, not far below the state line, that is an 18-mile long canyon–bound reach of rapids, deep pools, and violent eddies. The two populations are generally considered to be distinct because they are separated by about 11 miles, but movement between the two populations has been documented (McAda 2003). Chart and Lentsch (1999a) sampled Westwater Canyon during 1993-1996 and estimated the humpback chub population to be 6,985 adults. The average adult population size for Black Rocks during 1998-2000 was estimated to be about 740 individuals (McAda 2002).

Between 1986 and 1989, Karp and Tyus (1990) collected 130 humpback chubs from Yampa Canyon and indicated that a small but reproducing population was present. Continuing captures of juveniles and adults within Dinosaur National Monument indicate that a population persists in Yampa Canyon (USFWS 2006). Small numbers of humpback chub also have been reported in Cross Mountain Canyon on the Yampa River and in the Little Snake River about 10 km upstream of its confluence with the Yampa River (Wick et al. 1981; Hawkins et al. 1996).

Recent population estimates put the approximate number of humpback chub in the combined Westwater-Black Rocks population at 3,000 adults, Desolation-Gray Canyons at 1,000 adults, and a few hundred adults each in Cataract Canyon and Yampa Canyon populations (UCREFRP 2007).

The integrated stocking plan (Nesler et al. 2003) does not call for any captive rearing or stocking of humpback chub in Utah or Colorado.

Bonytail

The only known bonytail that presently occur in western Colorado are those that have been stocked. Experimental stocking of bonytail began in the Colorado River in 1996 and in the Green River in 1998. Combining all years from 1996 through 2007, the number of bonytail stocked into the Colorado River totals approximately 47,700, and into the Green River the total is approximately 63,800 (T. Francis, in litt., 2008).

Bonytail were also recently reintroduced in the Yampa River at Echo Park, near the confluence with the Green River. In July of 2000 approximately 5,000 juveniles (5 to 10 cm) were stocked. The integrated stocking plan (Nesler et al. 2003) calls for 2,665 age 2+ fish to be stocked into each of 5 river reaches for 6 successive years: 1) Colorado River (RM 110.5), 2) Colorado River (Palisade to Loma), 3) Middle Green/Yampa Rivers (Dinosaur N.P.), 4) Middle Green River (RM 302-249), and 5) Lower Green River (RM 120-249). Bonytail stocking has occurred close to or at these levels since that time (Francis 2008).

Relatively few hatchery-produced bonytail have been recaptured from the Green or Colorado Rivers since the integrated stocking plan was implemented. Despite thousands of released fish, only about two dozen bonytail have been recaptured from the Green River (through 2004), and only about three dozen have been recaptured from the Colorado River (through 2004). None of the recaptured bonytail from either river were recaptured more than a full year after stocking (T. Francis, in litt. 2008).

Changes in fish passage

Fish passage structures were installed at the Price-Stubb Diversion Dam in the Colorado River above Palisade in the summer of 2008. Fish passage structures and a fish trap had also been installed a few years earlier at the Government Diversion Dam, approximately 5 miles further upstream. Endangered fish may now move upstream beyond Palisade and reach the upper end of critical habitat at Rifle; however, none have been found in the Government Diversion Dam trap to date.

Water depletions and changes in the timing and magnitude of flows

Typical of rivers in the Southwest, the Colorado River and its tributaries were originally characterized by large spring snowmelt peak flows, low summer and winter base flows, and high-magnitude, short-duration summer and fall storm events. However, during the twentieth century, over 140 main-stem and tributary dams and reservoirs have been installed in the Colorado River Basin. As a result, the Colorado River basin is one of the most tightly controlled water supplies in the world (Bestgen et al. 2007). Peak spring-time flood flows have typically been reduced and late summer-time minimum flows have been elevated resulting in a generally flatter hydrograph.

Major upstream dams altering flows on the Colorado River as it flows through critical habitat include Granby, Dillon, Green Mountain, Williams Fork, and Ruedi. Major upstream dams altering flows through critical habitat on the Gunnison River include Blue Mesa, Morrow Point, Crystal and Taylor Park. Additionally, flows through critical habitat along the Yampa River are affected by reservoirs such as Elkhead, Steamboat, and Stagecoach, and flows through critical habitat along the White River are affected by Taylor Draw Dam. Taylor Draw Dam, installed within the White River itself, also lacks fish passage facilities and is an absolute barrier to any upstream fish movement.

Osmundson and Kaeding (1991) showed that average peak runoff along the Colorado River near Cameo in recent times (1954-1989) had declined by 44 percent from earlier times (1902-1942), which preceded the construction of major dams (but also included a portion of the 20th century that is considered to have been relatively wet). Similarly, Pitlick et al. (1999) found that peak flows on the Gunnison River declined 38 percent after construction of the large Blue Mesa (1966) and Morrow Point (1968) Dams. Average annual flows did not change, however, demonstrating that the change in average peak flow was not due to differing precipitation amounts. Flooding streamflows were reduced over 40 percent in the White River downstream from Taylor Draw Dam, which was constructed in 1984 (Lentsh et al. 2000).

Not only do dams change the timing and magnitude of river flows, but they also allow for trans-mountain water diversions via tunnels through the Continental Divide. There are 19 points where water is diverted out of the Colorado and Gunnison River basins into the South Platte, Arkansas, and Rio Grand River basins. Unlike some water diversions where a percentage of return flows can be expected (e.g., irrigation), trans-mountain diversions are forever lost from the Colorado River system. During the 5-year period from 1986-1990, these trans-mountain diversions ranged from approximately 226,000 to 422,000 acre-feet of water (McAda 2003). In 1986, a reasonably wet year, the trans-mountain diversions were approximately 5 percent of the total water that ultimately flowed out of, or would have flowed out of, the state in the Colorado River. However, in 1989 and 1990, relatively dry years, approximately 12 percent-13 percent of the water entering the upper Colorado River watershed (above the state-line) was diverted out of the system to Front-Range users. There is also a trans-mountain water diversion from the headwaters of the Little Snake River, a tributary to the Yampa River, where 15,800 acre-feet of water is removed annually to augment the municipal water supply for the City of Cheyenne, Wyoming.

Considering trans-mountain diversions along with other water projects, the Green and Colorado Rivers have been depleted approximately 20 percent (at Green River) and 32 percent (at Cisco), respectively (Holden 1999). In the Yampa River Basin, depletions are estimated to average about 125,000 annually in Colorado and roughly 43,000 acre-feet per year in Wyoming. In total, these depletions represent about 10 percent of the average annual undepleted yield of the Yampa River at its confluence with the Green River (~1.7 million acre-feet). Projections of water demand through the year 2045 indicate that additional depletions will bring the basin-wide total to about 221,000 acre-feet or about 13 percent of the average annual undepleted yield of the Yampa River. The White River annual water depletions amount to between 8 percent and 12 percent, although with return flows, water consumption totals approximately 5 percent (Lentsh et al. 2000).

These depletions have likely contributed to the decline in pikeminnow and razorback sucker populations (USFWS 1998a). To the extent that water is exported out of the basin or consumptively used (e.g., evaporation from fields, irrigation canals, reservoir surface, road surfaces), it is not available to maintain flows within the river. Maintenance of streamflow is essential to the ecological integrity of large western rivers (USFWS 1998a).

Flow Recommendations

Within Colorado, flow recommendations have been developed for reaches within endangered fish critical habitat along the Yampa River (USFWS 2005), three reaches of the Colorado River (Osmundson and Kaeding 1991, Osmundson et al. 1995, Osmundson 2001, McAda 2003), and the Gunnison River (McAda 2003). Flow recommendations have not been completed for the White River. Recommended flows vary by season and by water availability for a given year (e.g., flow recommendations are reduced for drought years). In general, spring flows recommended for dry years provide small peaks used as spawning cues by endangered fish, but contribute little to habitat maintenance; spring flows recommended for average years promote scouring of cobble and gravel bars and provide localized flooding of short duration; and spring flows for wet years promote wide-spread scouring of cobble and gravel bars, flushing of side channels, removal of encroaching vegetation, and inundation of floodplain habitats (McAda 2003).

For the Yampa River, the Service recommends that summer flows not drop below 93 cfs (at Maybell) with any greater frequency, magnitude, or duration than has occurred historically (1916-1995). Historically, flows have dropped below 93 cfs approximately 38 percent of the years of record with an average duration of about 9 days. Winter flows are typically somewhat higher; these should not drop below 124 cfs beyond what has occurred historically. The Service has established a water augmentation protocol and entered into agreements with other governmental agencies to provide the recommended flows in 90 percent of the years, and partially satisfy the flow recommendation during the driest 10 percent of years. Water from the recently expanded Elkhead Reservoir will be used to meet these goals. Water would be delivered at a rate of 50 cfs until augmented water flow at Maybell surpasses flow recommendations. During drought years, water would be delivered at a rate of 33 cfs (USFWS 2005).

For the Palisade-to-Rifle reach along the Colorado River, Osmundson (2001) recommended that base-flow levels be between 1,600 and 2,500 cfs as measured at the USGS gage at Cameo (09095500). However, due to the need to provide the recommended base flows in the 15-mile reach, provide minimum flows through the De Beque Canyon, and allow local diversion canals to continue operating, additional water must pass by the Cameo gage. Given this, the mean monthly recommended base flow levels range as high as 3,280 cfs (above average and wet years during August-October) and as low as 1,555 cfs (dry years during November-March). Mean monthly flows in excess of 3,280 cfs at Cameo during August-March is considered detrimental to endangered fish habitat and Osmundson (2001) recommended that it be stored in upstream reservoirs if possible. Since 2001 when the flow recommendations were established, baseline flows (monthly means) have never exceeded 3,280 cfs (data through 2007-09). However, from 2001-2007, baseline flows fell below 1,555 cfs for at least 1 month in every year except 2006. During the drought of 2002, mean monthly base line flows were below 1,555 every month from August-March, with February, 2003, averaging the lowest flows at 1,073 cfs (USGS Surface-Water Monthly Statistics at http://nwis.waterdata.usgs.gov/co/nwis).

Osmundson (2001) recommended that peak flows at the Cameo gage reach 25,000 cfs during wet years (wettest 25 percent, or 5 in 20 years) and reach 14,400 cfs during dry years (driest 20%, or 4 in 20 years). Intermediate peak flows were recommended for years of intermediate precipitation; mean monthly flows for each month were provided as well. Peak flows during wet years should be maintained for at least 3 weeks to give razorback sucker larvae adequate time to feed and grow in flooded bottomlands before being compelled to migrate to the main channel. Since 2001 when the flow recommendations were established, daily mean peak flows at the Cameo gage have ranged from 4,260 cfs, during the drought of 2002, to 22,500 cfs in 2008 (USGS Surface-Water for Colorado: Peak Streamflow and Daily Data at http://nwis.waterdata.usgs.gov/co/nwis).

As stated previously, one of the most important reaches within the Colorado River for Colorado pikeminnow and razorback sucker is the 15-mile reach within the Grand Valley. It has experienced major agricultural water depletions for many years and during late summer and early fall this reach can be severely dewatered. Water depletions in the 15-mile reach have been identified as a limiting factor for Colorado pikeminnow. Osmundson et al. (1995) provided recommendations for summer flows through the 15-mile reach. They state that in years with above average winter precipitation levels, a flow of 1,630 cfs is recommended for summer months. In years of somewhat below average precipitation, when the ideal flow of 1,630 cfs would be difficult to meet, the recommendation could be relaxed to 1,240 cfs. In years of drought (20 percent lowest precipitation years), when even 1,240 cfs would be difficult to meet, flows should not fall below 810 cfs. The assumption and hope is that at this low level the fish that remain in the reach can wait out the dry period until more favorable conditions return with the end of the irrigation season. Mean monthly flows have, nevertheless, dropped below 810 cfs for at least one of the summer-time months during 7 of the last 17 years (1991-2007). The lowest monthly mean occurred during the drought of 2002 when only 115 cfs flowed through the 15-mile reach in August of that year (USGS Surface-Water Monthly Statistics at http://nwis.waterdata.usgs.gov/co/nwis).

Numerous approaches are being taken to restore flows in the 15-mile reach immediately upstream of from the confluence of the Gunnison River to levels recommended by the Service. The Bureau of Reclamation has made available 5,000 acre-feet of water annually plus an additional 5,000 acre-feet in four of every five years from Ruedi Reservoir to augment flows in the 15-mile reach during July, August, and September. In addition, water is available from the lease of 10,825 acre-feet/year of water from Ruedi Reservoir and permanent commitment of 10,825 acre-feet/year from East and West slope water users. The East and West slope commitments were secured in 2000 by a Memoranda of Agreement (MOA) with the Colorado River Water Conservation District (CRWCD) and Denver Water for delivery of 5,412 acre-feet of water from Wolford Mountain Reservoir and 5,412 acre-feet from Williams Fork Reservoir, respectively. By 2009, CRWCD and Denver Water will have a plan in place to permanently replace the water now being delivered by Wolford and Williams Fork reservoirs. Additional water is being provided through an MOA with CRWCD for delivery of up to 6,000 acre-feet of water from Wolford Mountain Reservoir.

Osmundson and Kaeding (1991) stated that the availability of good winter habitat has probably not been a limiting factor for adult Colorado pikeminnow or razorback sucker in the upper Colorado River. Unlike spring flows, recent (1954-1989) mean monthly winter flows have increased to approximately 112 percent to 134 percent of historic flows (1902-1942). It is not apparent that these increased winter flows have had any negative effects on the endangered fishes. Given this, Osmundson and Kaeding (1991) recommended that mean monthly winter flows through the 15-mile reach simply not drop below historic levels, averaging approximately 1,470 cfs. From 1996 through 2006 mean monthly winter flows have averaged higher than historic levels, with flows dropping somewhat below historic flows on occasion (USGS Surface-Water Monthly Statistics at http://nwis.waterdata.usgs.gov/co/nwis).

Flow recommendations during spring run-off call for high spring flows that are critical for shaping the river channel, determining substrate composition, and influencing the abundance of various species for the remainder of the year. Recommended peak flows (1-day average) in the 15-mile reach are: 1) 20,500 to 23,500 cfs in at least 1 of 4 years, 2) greater than 23,500 cfs in at least 1 of 4 years, and 3) 14,800 cfs to 20,500 cfs to occur no more often than 2 of 4 years. See Osmundson and Kaeding (1991) for more details, including state-line peak flow and 15-mile reach mean monthly flow recommendations. Osmundson et al. (1995) updated the minimum recommended peak flows to be greater than 12,900 cfs rather than 14,800 in 2 of 4 years. Since the publication of the spring flow recommendations in 1991, peak 1-day average flows through the 15-mile reach have been below 12,900 cfs approximately one third of the years through 2006 and these targets have not been met (USGS Surface-Water for Colorado: Peak Streamflow at http://nwis.waterdata.usgs.gov/co/nwis).

Peak flow recommendations for the Colorado River at the USGS gage near the Colorado-Utah state line (09163500) were provided by McAda (2003). Flow recommendations vary by hydrologic category; summarized excerpts are presented here. During wet years, instantaneous peak flow should fall between 39,300 and 69,800 cfs, should exceed 35,000 cfs for 30-35 days, and should exceed 18,500 cfs for 80-100 days. During dry years, instantaneous peak flows should range between 5000-12,100 cfs. Intermediate peak flows are recommended for the four hydrologic categories between wet and dry. From 2003-2006, peak flows have ranged between 9,450-31,000 cfs (USGS Surface-Water for Colorado: Peak Streamflow at http://nwis.waterdata.usgs.gov/co/nwis).

Baseflow recommendations for the Colorado River at the USGS gage near the Colorado-Utah state line (09163500) were also provided by McAda (2003). The base-flow period begins after spring runoff is completed and continues through initiation of spring runoff the following year. A minimum flow of 3,000-6,000 cfs should be maintained at the state-line USGS gage (09152500) in wet years. During dry years, flows should remain above 1,800 cfs, which will make backwaters available for young-of-the-year Colorado pikeminnow, although not at a maximum number or surface area. Intermediate base flow levels are recommended for the four hydrologic categories between wet and dry. From 2003 to 2008, flows at this gage dropped below 1,800 cfs in 2003 and 2004 (USGS Surface-Water for Colorado: Daily Data at http://nwis.waterdata.usgs.gov/co/nwis)

Flow recommendations for the Gunnison River apply to the USGS gage at Whitewater (09152500), which is within critical habitat for the Colorado pikeminnow and razorback sucker. Detailed flow recommendations can be found in McAda (2003); summarized excerpts are presented here. During wet years, peak flow should fall between 15,000 and 23,000 cfs for 1 day, should exceed 14,350 cfs for 15–25 days, and should exceed 8,070 cfs for 60-100 days. During dry years, flows should peak between 900-4,000 cfs for a day. Intermediate peak flows are recommended for the four hydrologic categories between wet and dry. From 2003-2006, peak flows have ranged between 3,790-12,300 cfs (USGS Surface-Water for Colorado: Peak Streamflow at http://nwis.waterdata.usgs.gov/co/nwis).

Similarly, baseflow recommendations for the Gunnison River are provided by McAda (2003). A minimum flow of at least 1,050 cfs should be maintained at the USGS gage (09152500) in all but dry and moderately dry years. This flow maximizes the amount of pool habitat in the Gunnison River, which is preferred by adult Colorado pikeminnow and razorback sucker. Also, flows exceeding 950 cfs prevent fine sediments from settling in riffles, which might smother eggs and larvae of endangered fishes. Additionally, flow of 1,050 cfs roughly corresponds to providing a minimum of 300 cfs downstream from Redlands Diversion Dam (based on senior water rights of 750 cfs) and provides access for migrating fish to the fishway there. During dry and moderately dry years, flows may decrease below 1,050 cfs after the Colorado pikeminnow migration period and only after consultation with Service biologists. The 2.5-mile reach downstream from Redlands Diversion Dam could experience severe dewatering at this level and endangered fish may be forced to leave this reach of critical habitat. From 2003 to 2008, flows at this gage have dropped below 1050 cfs in 3 of the 6 years (USGS Surface-Water for Colorado: Daily Data at http://nwis.waterdata.usgs.gov/co/nwis)

Official flow recommendations have not been finalized for critical habitat along the White River, which was designated for the Colorado pikeminnow. However, Haines et al. (2004) made a preliminary recommendation that base flow patterns remain at current levels in order to maintain habitat for the Colorado pikeminnow. They stated that between 1923-1997, baseflow (August through October) discharge in the White River has only dropped below 200 cfs 5 percent of the time at the USGS Watson Gage (09306500), and below 150 cfs 1 percent of the time. They found that to provide for fish passage over riffles, flows greater than 300 cfs are apparently needed. To maintain riffle productivity during base flow periods, flows of 400-500 cfs are needed, and if flows fall below 161 cfs, riffle habitat declines rapidly. From 1985 to 2007, mean monthly flows at the Watson gage have occasionally fallen below 200 cfs, with the lowest monthly mean occurring during July of 2002 at 73 cfs (USGS Surface-Water: Monthly Statistics at http://nwis.waterdata.usgs.gov/nwis).

EFFECTS OF THE ACTION

Effects to Endangered Species

The project would adversely affect Colorado pikeminnow, razorback sucker, humpback chub, and bonytail by reducing the amount of water in the river systems upon which they depend over the next 15 years, by the following approximate amounts:

| | | | |
|---|---|---|---|
| Colorado River Basin | 379 acre-feet/year | Yampa River Basin | 369 acre-feet/year |
| Gunnison River Basin | 16 acre-feet /year | White River Basin | 3,227 acre-feet/year |
| Dolores River Basin | 54 acre-feet/year | Green River in Colorado | 0 acre-feet/year |

The effects to the species primarily result from the effects of the action upon their habitats. In general, the proposed action would adversely affect the listed fishes by reducing the amount of water available to them, increasing the likelihood of water quality issues, increasing their vulnerability to predation, and reducing their breeding opportunities by shrinking the amount of breeding habitat within their range.

Removing water from these rivers would change the natural hydrological regime that creates and maintains important fish habitats, such as spawning habitats, and reduces the frequency and duration of availability of these habitats to the endangered fishes. The reduction of available habitats will directly affect individuals by decreasing reproductive potential and foraging and sheltering opportunities. Many of the habitats required for breeding become severely diminished when flows are reduced. As a result, individual fish within the action area may not be able to find a place to breed or will deposit eggs in less than optimal habitats more prone to failure or predation. In addition, reduction in flow rates lessens the ability of the river to inundate bottomland, a source of nutrient supply for fish productivity. Water depletions also exacerbate competition and predation by nonnative fishes by altering flow and temperature regimes that favor nonnatives.

The proposed project would affect the physical condition of habitat for the listed fish by resulting in a reduction of water. Because drilling, pipeline construction, dust abatement, and associated activities occur year-round, water use for these activities would occur in all seasons. However, in general the primary challenge in meeting recommended flows for endangered fish comes during spring run-off and late summer periods of low flow. Water use during the spring months would contribute to the cumulative reduction in high spring flows, which are essential for creating and maintaining complex channel geomorphology and suitable spawning substrates, creating and providing access to off-channel habitats, and stimulating spawning migrations. Adequate summer and winter flows are important for providing a sufficient quantity of preferred habitats for duration and at a frequency necessary to support all life stages of these endangered fishes. To the extent that the project will reduce flows, particularly peak flows and baseline flows in dry years, the ability of the river to provide these functions will be reduced. This reduction of water affects habitat availability and habitat quality.

To the extent that it would reduce flows and contribute to further habitat alteration, the project may contribute to an increase in nonnative fish populations. The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the establishment of nonnative fishes. Endangered fishes within the action area are likely to experience increased competition and predation as a result.

The potential exists for water intake structures placed on any of the occupied river reaches including the Colorado, Green, Gunnison, White, and Yampa Rivers to result in direct mortality to eggs, larvae, young-of-the-year, and juvenile life stages. Endangered larval fish are very small (<0.5 inches total length) and incapable of directed swimming from the time of hatching through the first 2-4 weeks of their life. Depending on the water year, larval fish may be present in occupied habitats from as early as April 1 to as late as August 31 (earlier in dry years; later in wet years). Young of the year endangered fish are most susceptible to entrainment from pumping water directly out of occupied river drainages. However, entrainment of larval and young fish of any of the four endangered species is not expected to be a common occurrence. Most or all spawning sites in the Yampa River are protected within Dinosaur National Monument. Along the Colorado River, spawning sites within the 15-mile reach and rearing locations downstream are away from the areas of concentrated drilling for oil and gas. The occupied portion of the Gunnison River is also away from current active drilling sites and proven oil and gas fields (http://cogcc.state.co.us/infosys/Maps). Although a substantial amount of oil and gas activity occurs near the White River, presumably along with associated water extraction and pumping, spawning has not been documented for any of the endangered fishes within the White River. Although water for drilling and completion activities could be pumped from, or downstream of, known spawning sites in Colorado, and trucked to drilling sites or used for dust abatement on gas field access roads, it is far more likely it be extracted within areas of high oil and gas potential that are further upstream. In addition, the conservation measures described in the project description outline methods to reduce pumping effects to young endangered fish where they may be found.

Effects to Critical Habitat

The Service identified water, physical habitat, and the biological environment as primary constituent elements of critical habitat. This includes a quantity of water of sufficient quality that is delivered to specific habitats in accordance with a hydrologic regime that is required for the particular life stage for the species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide access to spawning, nursery, feeding, and rearing habitats, are included. Food supply, predation, and competition are important elements of the biological environment.

*Water Quantity & Physical Habitat*

Water depletions cause discrete, identifiable, additive, adverse impacts to critical habitat of the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail. The proposed action would result in new depletions of water from critical habitats for one or more of these four endangered fish species along the Colorado, Gunnison, White, Green, and Yampa Rivers. The depletions are likely to reduce the quantity of water delivered to specific habitats important for particular life stages of these species.

*Water Quality*

This biological opinion is limited to addressing depletions of water quantity; however, changes in water quantity affect water quality, which is a primary constituent element of critical habitat. Most projects covered by this opinion would remove water before it enters downstream river segments where the fish currently reside, therefore, depletions could reduce the dilution effect provided by this relatively clean water. This may result in an increase in heavy metal, selenium, salts, polycyclic aromatic hydrocarbons, pesticides, and other contaminant concentrations in the Colorado River and its main-stem tributaries (USFWS 1999). An increase in contaminant concentrations in the river would likely result in an increase in the bioaccumulation of these contaminants in the food chain which could adversely affect the endangered fishes, particularly the predatory Colorado pikeminnow. Selenium may be of particular concern due to its effects on fish reproduction and its tendency to concentrate in low velocity areas that are important habitats for Colorado pikeminnow and razorback suckers. Selenium concentrations are most worrisome in the Gunnison River and the Colorado River below its confluence with the Gunnison River due to return irrigation flows (Osmundson et al. 2000). The Recovery Program is intended to offset some water quality impacts associated with flow reductions (USFWS 1987). These impacts include changes in temperature, salinity and turbidity, as well as the reduced dilution factor associated with depletions. However, the Recovery Program is not intended to offset any point or nonpoint discharges of pollutants, such discharges will have to be offset or avoided by other means. This would include discharges of irrigation water with elevated levels of selenium.

*Biological Environment*

The modification of flow regimes, water temperatures, sediment levels, and other habitat alterations caused by water depletions has likely contributed to the establishment of nonnative fishes. To the extent that it would reduce flows and contribute to further habitat alteration, the project may contribute to an increase in nonnative fish populations. Endangered fishes could experience increased competition and predation as a result.

Species and Critical Habitat Response to the Proposed Action

In most cases, the project would not substantially impact the ability for the flow recommendations through critical habitat to be met. In the Yampa River, the Service has developed an augmentation protocol to meet base-flow (summer-fall-winter) recommendations with water releases from upstream reservoirs (USFWS 2005). The anticipated 369 acre-feet/year of water depleted from the Yampa River for this project would equate to approximately 1 acre-feet/day. As stated above, most water use for oil and gas extraction activities would likely be withdrawn on a year-round basis. An average of 1 acre-feet/day equates to an approximate reduction in river flows of 0.5 cfs (base-flows typically remain above 100 cfs). The augmentation protocol, which would provide 50 cfs of water (33 cfs during drought conditions), should be able to meet base flow recommendations in the Yampa River despite the 0.5 cfs of water consumed for anticipated oil and gas activities during base-flow months.

During spring peak flows, however, the augmentation protocol does not call for reservoir releases to meet specified target flows. Therefore, water depletions from this project during peak flows (May-June) would likely lessen peak flows through critical habitat by 0.5 cfs. Nevertheless, given that peak flows through critical habitat (near Maybell) are typically 5,000 to 20,000 cfs (USGS Surface-Water for Colorado: Peak Streamflow at http://nwis.waterdata.usgs.gov/co/nwis), this relatively small flow reduction would likely not change any of the important effects of flood flows (e.g., cobble bar construction; scouring of fine sediment from the interstitial spaces within the cobble so it is suitable for spawning; flushing sediments from backwaters; maintaining channel complexity; overbank flows to provide nursery habitat; spawning initiation). Therefore, the depletions caused by the proposed project, with implementation of the augmentation protocol to meet flow recommendations, are not expected to impact the survival or recovery of the endangered fish in the Yampa River.

The anticipated 379 acre-feet/year of water that would be depleted from the Colorado River for this project is similar to the amount that would be depleted from the Yampa River—it equates to an approximate reduction in river flows of 0.5 cfs. As with the Yampa River, agreements have been made to provide water for endangered fish in the Colorado River. A multi-party agreement involving the Grand Valley Irrigation Company, Grand Valley Power Plant, Orchard Mesa Irrigation District and Grand Valley Water Users Association and Bureau of Reclamation was reached that has made up to 30,000 acre-feet of water available to endangered fish each year. The water will be used to boost flows in the Colorado River in the 15-mile reach between Palisade and the Gunnison River confluence. In addition, the Bureau of Reclamation has made 31,650 acre-feet of water available for release from Ruedi Reservoir to increase flows in this same part of the Colorado River. Although recommended flows through endangered fish critical habitat along the Colorado River have not always been achieved in the past, agreements are in place to provide the recommended water. Additionally, even if the water consumed by the projects' activities was not replaced by upstream dam releases, the reduction in flows of 0.5 cfs likely would not result in a large reduction in the suitability of endangered fish habitat in the Colorado River. A flow of 0.5 cfs represents less than one tenth of one percent of the smallest recommended flow in the Colorado River—flows through the 15-mile reach during a dry year should be at least 810 cfs. Recommended flows in other seasons and through other segments of the Colorado River (state-line and Palisade-to-Rifle) are all larger; thus, 0.5 cfs is an even smaller percentage of those recommended flows.

Only a very small amount of water is projected to be depleted from the Gunnison River for project activities—16 acre-feet/year. This equates to a reduction of approximately 0.02 cfs in river flows, a tiny proportion of actual flows. Additionally, the provision of adequate flows for endangered fish in the Gunnison River is taking place as part of the Aspinall Unit consultation, which involves Bureau of Reclamation re-operation of the Aspinall Unit, affecting instream flows in the Gunnison River.

According to the biological assessment for this project, no fluid mineral activity is currently being conducted, nor is any projected, in the Colorado portion of the Green River Basin, which drains the extreme northwest corner of Colorado.

In the Dolores River Basin, 54 acre-feet/year is projected to be depleted for future Federal fluid mineral activities. This equates to a reduction in flows of approximately 0.07 cfs. To attempt to put this in perspective, the lowest mean monthly flows for the Dolores River near its confluence with the

Colorado River (USGS Gage 09180000 near Cisco) occur November through February and range from 140 cfs to 165 cfs, on average (averaged from 2000 through 2007; USGS Surface-Water: Monthly Statistics at http://waterdata.usgs.gov/nwis). A flow reduction of 0.07 cfs would reduce a flow of 140 cfs by less than one tenth of one percent. Although Colorado pikeminnow may use the lower 2 km of the Dolores River (USFWS 2002a), no other endangered fish are documented to use the Dolores River (USFWS 2002b, 2002c, 2002d) and the Dolores River was not included in the designation of critical habitat for any of the four endangered fish in the Upper Colorado River Basin.

The largest depletions associated with this project would come from the White River where 3,227 acre-feet/year are projected to be used for Federal mineral fluid activity over the next 15 years. This equates to an average reduction in flows of approximately 4.4 cfs throughout the year. Although the White River is not known to be used regularly by the other endangered fish, it is important to the Colorado pikeminnow. As stated above, official flow recommendations have not been established for pikeminnow critical habitat along the White River. However, traditional baseflows have remained above 150 cfs in 99 percent of the years since 1923 (Haines et al. 2004). A flow of 4.4 cfs is approximately 3 percent of 150 cfs. A flow reduction due to fluid mineral extraction activities of 4.4 cfs during low flow periods, particularly in dry years, would likely reduce available riffle productivity somewhat and may lessen the ability of Colorado pikeminnow to pass through shallow riffle sections (Haines et al. 2004). This modest flow reduction could also lead to a slight increase in water temperatures in the White River, although probably not in the section directly below Taylor Draw Dam due to the cooling effect of deep water in Kenney Reservoir. A flow reduction of 4.4 cfs would have less of an effect on spring flood flows as it would be a much smaller portion of the overall flow at that time (less than 0.3 percent), which typically peaks between 1500 cfs and 8000 cfs near Watson, Utah (USGS Surface water for Utah: Peak Streamflow at http://nwis.waterdata.usgs.gov/ut/nwis/peak).

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Reasonably foreseeable future activities that may affect river-related resources in the area include oil and gas exploration and development, irrigation, urban development, industrial development, recreational activities such as angling, and activities associated with the Upper Colorado River Endangered Fish Recovery Program. Implementation of these projects may affect both water quantity and quality.

Cumulative effects to these endangered fish species would likely include the following types of impacts:

- Changes in land use patterns that would further fragment, modify, or destroy potential spawning sites or designated critical habitat;
- Shoreline recreational activities and encroachment of human development that would remove upland or riparian/wetland vegetation and potentially degrade water quality;

- Competition with, and predation by, exotic fish species introduced by anglers or other sources.
- Non-Federal fluid mineral development. Various reasonable foreseeable development scenarios project that 880 wells to access private minerals may be drilled annually during the next 15 years in western Colorado (excluding the San Juan River Basin). The drilling and production of these private minerals are estimated to require 1,052 acre-feet/year from the primary basins draining this area.
- Water depletions for activities other than fluid mineral development, including the construction of ponds, reservoirs, ditches, and water diversion structures for activities such as irrigation, stock watering, power production, municipal use, and industrial needs.

The development and extraction of oil from oil shale in northwestern Colorado could also require large amounts of water. However, the quantity of water that would be required is unknown at this time and the extraction of oil from shale rock has not yet been shown to be economically viable. Thus, this activity cannot be considered reasonably certain to occur, at least not over the 15-year life-span of this biological opinion.

CONCLUSION

After reviewing the current status of the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the Project, as described in this biological opinion, is not likely to jeopardize the continued existence of the Colorado pikeminnow, razorback sucker, humpback chub, or bonytail and the proposed project is not likely to destroy or adversely modify designated critical habitat for any of these fish. This conclusion is based, in part, on the project description which includes the payment of depletion fees by the project proponents and/ or their representative group. These fees help to offset the effects of the water depletions by supporting the Recovery Program in implementing recovery actions as outlined in the RIPRAP. Additionally, the depletions associated with the proposed action are a small portion of the flows in each of the respective rivers and are not of sufficient magnitude that they would jeopardize the survival and recovery of the listed fish, nor adversely modify their critical habitat.

**INCIDENTAL TAKE STATEMENT**

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury of listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7 (o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Colorado pikeminnow, humpback chub, bonytail, and razorback sucker are harmed from the reduction of water in their habitats resulting from the project in the following manner--1) habitat conditions may be rendered unsuitable for breeding because reduced flows would impact habitat formulation and maintenance as described in the biological opinion, 2) habitat conditions may be rendered unsuitable for nursery, feeding, and rearing habitats due to a reduced inundation of oxbows, backwaters, and other areas in the 100-year floodplain, 3) baseflow habitat conditions may be compromised due to a reduction in available habitat and potentially higher water temperatures, and 4) individuals using habitats diminished by the proposed water depletions could be more susceptible to predation and competition from nonnative fish;

Estimating the number of individuals of these species that would be taken as a result of water depletions is difficult to quantify for the following reasons--1) determining whether an individual forwent breeding as a result of water depletions versus natural causes would be extremely difficult; 2) finding a dead or injured listed fish would be difficult, due to the large size of the project area and because carcasses are subject to scavenging; 3) natural fluctuations in river flows and species abundance may mask project effects; and 4) effects that reduce fecundity are difficult to detect or quantify.

According to Service policy, as stated in the Endangered Species Consultation Handbook (Handbook)(USFWS 1998b), some detectable measure of effect should be provided, such as the relative occurrence of the species or a surrogate species in the local community, or amount of habitat used by the species, to serve as a measure for take. Take also may be expressed as a change in habitat characteristics affecting the species, such as water quality or flow (Handbook, pp. 4-47). Because estimating the number of individuals of the four listed fishes that could be taken by the water depletions addressed in this biological opinion is difficult for the reasons stated above, we have developed a surrogate measure to estimate the amount of anticipate take to listed fish in the form of harm. The surrogate we are using is the reduction of water that would occur from the proposed action. We exempt all take in the form of harm that would occur from the depletion of water from the occupied habitats listed above. Water depletions above the amounts addressed in this biological opinion would exceed the anticipated level of incidental take and are not exempt from the prohibitions of section 9 of the ESA.

The implementation of the Recovery Program is intended to minimize impacts of water depletions and, therefore, the actions implemented by the Recovery Program serve as reasonable and prudent measures for minimizing the take that results from this project's water depletions. Any amount of water withdrawal above this level would exceed the anticipated level of incidental take.

## REINITIATION NOTICE

This concludes formal consultation on the proposed project. As provided in 50 CFR sec. 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded, 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion,

3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action.

The RIPRAP is expected to result in a positive population response for the four endangered fishes in the Upper Colorado River Basin. If a positive population response for any of these species is not realized, as measured by the criteria outlined in the RIPRAP, this would be considered new information that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion. Therefore, reinitiation of section 7 consultation would be required for all projects dependent on the Recovery Program, including this project.

Projects that fall under the umbrella of the Colorado River PBO have the following specific reinitiation criteria.

a. The amount or extent of take specified in the incidental take statement for the Colorado River PBO is exceeded. The Service has determined that no incidental take, including harm, is anticipated to occur as a result of the depletions contemplated in this opinion because of the implementation of recovery actions. The implementation of the recovery actions contained in the Colorado River PBO will further decrease the likelihood of any take caused by depletion impacts.

b. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in the Colorado River PBO. In preparing the Colorado River PBO, the Service describes the positive and negative effects of the action it anticipates and considered in the section of the opinion entitled "Effects of the Action." New information would include, but is not limited to, not achieving a "positive response" or a significant decline in population, as described in Appendix D of the Colorado River PBO. Significant decline shall mean a decline in excess of normal variations in population (Appendix D). The current population estimate of adult Colorado pikeminnow in the Colorado River is 600 individuals, with a confidence interval of ± 250. Therefore, with the criteria established in Appendix D, a negative population response would trigger reinitiation if the population declined to 350 adults. The Service has developed recovery goals for the four endangered fishes (USFWS 2002a-d). If a population meets or exceeds the numeric goal for that species, it will be considered to exhibit a positive response. The Service retains the authority to determine whether a significant decline in population has occurred, but will consult with the Recovery Program's Biology Committee prior to making its determination. In the event of a significant population decline, the Service is to first rely on the Recovery Program to take actions to correct the decline. If nonflow recovery actions have not been implemented, the Service will assess the impacts of not completing these actions prior to reexamining any flow related issues.

New information would also include the lack of a positive population response by the year 2015 or when new depletions reach 50,000 acre-feet/year. According to the criteria outlined in Appendix D of the Colorado River PBO, a positive response would require the adult Colorado pikeminnow population estimate to be 1,100 individuals (±250) in the Colorado River (Rifle, Colorado to the confluence with the Green River). When the population estimate increases above 1,100, a new population baseline is established at the higher population level.

c. The Recovery Action Plan actions listed as part of the proposed action in the Colorado River PBO are not implemented within the required time frames. This would be considered a change in the action subject to consultation; section 7 regulations (50 CFR 402.16 (c)) state that reinitiation of consultation is required if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion. The Recovery Action Plan is an adaptive management plan because additional information, changing priorities, and the development of the States' entitlement may require modification of the Recovery Action Plan. Therefore, the Recovery Action Plan is reviewed annually and updated and changed when necessary and the required time frames include changes in timing approved by means of the normal procedures of the Recovery Program, as explained in the description of the proposed action. In 2003 and every 2 years thereafter, for the life of the Recovery Program, the Service and Recovery Program will review implementation of the Recovery Action Plan actions to determine timely compliance with applicable schedules.

d. The Service lists new species or designates new or additional critical habitat, where the level or pattern of depletions covered under the Colorado River PBO may have an adverse impact on the newly listed species or habitat. If the species or habitat may be adversely affected by depletions, the Service will reinitiate consultation on the Colorado River PBO as required by its section 7 regulations. The Service will first determine whether the Recovery Program can avoid such impact or can be amended to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for such depletion impacts. If the Recovery Program can avoid the likelihood of jeopardy and/or adverse modification of critical habitat no additional recovery actions for individual projects would be required, if the avoidance actions are already included in the Recovery Action Plan. If the Recovery Program is not likely to avoid the likelihood of jeopardy and/or adverse modification of critical habitat then the Service will reinitiate consultation and develop reasonable and prudent alternatives/measures, as appropriate.

For purposes of any future reinitiation of consultation, depletions have been divided into two categories.

Category 1:

a) existing depletions, both Federal and non-Federal as described in the Colorado River PBO project description, from the Upper Colorado River Basin above the confluence with the Gunnison River that had actually occurred on or before September 30, 1995 (average annual depletion of approximately 1 million acre-feet/year);

b) depletions associated with the total 154,645 acre-feet/year volume of Green Mountain Reservoir, including power pool (which includes but is not limited to all of the 20,000 acre-feet contract pool and historic user's pool), the Colorado Big-Thompson replacement pool; and

c) depletions associated with Ruedi Reservoir including Round I sales of 7,850 acre-feet, Round II sales of 6,135 acre-feet/year as discussed in the Service's biological opinion to Reclamation dated May 26, 1995, and as amended on January 6, 1999, and the Fryingpan Arkansas Project replacement pool as governed by the operating principles for Ruedi Reservoir but excluding 21,650 acre-feet of the marketable yield.

Category 1 depletions shall remain as Category 1 depletions regardless of any subsequent change, exchange, or abandonment of the water rights resulting in such depletions. Category 1 depletions associated with existing facilities may be transferred to other facilities and remain in Category 1 so long as there is no increase in the amount of total depletions attributable to existing depletions. However, section 7 consultation is still required for Category 1 depletion projects when a new Federal action occurs which may affect endangered species except as provided by the criteria established for individual consultation under the umbrella of the Colorado River PBO. Reinitiation of this consultation will be required if the water users fail to provide 10,825 acre-feet/year on a permanent basis.

Category 2:

Category 2 is defined as all new depletions up to 120,000 acre-feet/year, this includes all depletions not included in Category 1 that occur after 1995 regardless of whether section 7 consultation has been completed. This category is further divided into two 60,000 acre-feet/year blocks of depletions.

The recovery actions are intended to avoid the likelihood of jeopardy and/or adverse modification of critical habitat and to result in a positive response as described in Appendix D of the Colorado River PBO for both 60,000 acre-feet blocks of depletions in Category 2. However, prior to depletions occurring in the second block, the Service will review the Recovery Program's progress and adequacy of the species response to the Recovery Action Plan actions. According to the criteria outlined in Appendix D, a positive response would require the adult Colorado pikeminnow population estimate to be maintained at approximately 1,100 individuals in the Colorado River (Rifle, Colorado to the confluence with the Green River), unless the criteria in Appendix D is changed because of new information. If the adult Colorado pikeminnow population is maintained at approximately 1,100 adults or whatever is determined to be the recovery goal in the Colorado River, a new population baseline would be established to determine a positive or negative population response.

When population estimates for wild adult humpback chub are finalized, they will also be used to determine population response. As outlined in Appendix D, Colorado pikeminnow and humpback chub population estimates will serve as surrogates for razorback sucker and bonytail to assess the status of their populations for 10 years. Recovery goals for all four species were completed August 1, 2002 (USFWS 2002a-d). If a population meets or exceeds the numeric goal for that species, it will be considered to exhibit a positive response. However, short of reaching a specific recovery goal, trends in certain population indices provide an interim assessment of a species' progress toward recovery. This review will begin when actual depletion levels from the first depletion block reach 50,000 acre-feet/year or the year 2015, whichever comes first.

Calculation of actual depletions is to be accomplished using Cameo gage records and State Division of Water Resources data (Appendix B of the Colorado River PBO). The review will include a determination if all the recovery actions have been satisfactorily completed, that all ongoing recovery actions are continuing, and the status of the endangered fish species. If it is determined that the recovery actions have all been completed and the status of all four endangered fish species has improved (based on criteria in Appendix D), then the Service intends that the Colorado River PBO would remain in effect for new depletions up to 120,000 acre-feet/year (total of both 60,000 acre-feet blocks of Category 2 depletions).

Monitoring, as explained in Appendix D of the Colorado River PBO, will be ongoing to determine if a population estimate of 1,100 (± one confidence interval) adult Colorado pikeminnow is maintained. If it is not maintained, this would be considered new information and section 7 would have to be reinitiated. Population baselines will be adjusted as population estimates change. If the adult Colorado pikeminnow population estimates increase, a new population baseline will be established to determine a positive or negative population response. If the population estimate for Colorado pikeminnow in the year 2015 is greater than 1,100 adults, then the higher number will be used to establish a new population baseline. These numeric values may be revised as new information becomes available. Revisions will be made to Appendix D of the Colorado River PBO as needed.

If the 50,000 acre-foot or 2015 review indicates that either the recovery actions have not been completed or the status of all four fish species has not sufficiently improved, the Service intends to reinitiate consultation on the Recovery Program to specify additional measures to be taken by the Recovery Program to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletions associated with the second 60,000 acre-feet/year block. Any additional measures will be evaluated every 5 years. If other measures are determined by the Service or the Recovery Program to be needed for recovery prior to the review, they can be added to the Recovery Action Plan according to standard procedures, outlined in that plan. If the Recovery Program is unable to complete those actions which the Service has determined to be required for the second 60,000 acre-feet/year, consultation on projects with a Federal nexus may be reinitiated in accordance with ESA regulations and this opinion's reinitiation requirements. The Service may also reinitiate consultation on the Recovery Program if fish populations do not improve according to the criteria in Appendix D or if any positive response achieved prior to the 50,000 acre-foot or the year 2015 is not maintained. Once a positive response is achieved, failure to maintain it will be considered a negative response.

If the Service reinitiates consultation, it will first provide information on the status of the species and recommendations for improving population numbers to the Recovery Program. The Service will reinitiate consultation with individual projects only if the Recovery Program does not implement recovery actions to improve the status of the listed fish species. The Service will reinitiate consultation first on Category 2 projects and second on Category 1 projects. The Service will only reinitiate consultations on Category 1 depletions if Category 2 depletion impacts are offset to the full extent of the capability of the covered projects as determined by the Service, and the likelihood of jeopardy to the listed fishes and/or adverse modification of critical habitat still cannot be avoided. The Service intends to reinitiate consultations simultaneously on all depletions within the applicable category.

Projects that fall under the umbrella of the Yampa River PBO have the following specific reinitiation criteria.

1. The amount or extent of take specified in the incidental take statement for that opinion is exceeded. The implementation of the Recovery actions contained in that opinion will further decrease the likelihood of take caused by water depletion impacts.

2. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion. In preparing this opinion, the Service describes the positive and negative effects of the action it anticipates and considered in the section of the opinion entitled "EFFECTS OF THE ACTION." New information would include, but is not limited to, not achieving one or more response criteria that will be developed as part of the terms and conditions to minimize incidental take. The Service retains the authority to determine whether a significant decline in population has occurred, but will consult with the Recovery Program's Biology Committee prior to making its determination. In the event that one or more population criteria have not been achieved, the Service is to first rely on the Recovery Program to take timely actions to correct the deficiency.

3. The section 7 regulations (50 CFR 402.16 (c)) state that reinitiation of consultation is required if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion. It would be considered a change in the action subject to consultation if the Recovery Action Plan items listed as part of the proposed action (Green River Action Plan: Yampa and Little Snake Rivers) in the Yampa biological opinion are not implemented within the required timeframes. Also, the analysis for that biological opinion assumed implementation of the Green River Mainstem Action Plan of the RIPRAP because the Colorado pikeminnow and razorback sucker that occur in the Yampa River use the Green River and are considered one population. The essential elements of the Green River Plan are as follows: 1) provide and protect instream flows; 2) restore floodplain habitat; 3) reduce impacts of nonnative fishes; 4) augment or restore populations; and 5) monitor populations and conduct research to support recovery actions. The analysis for the non-jeopardy determination of the Yampa Plan that includes about 53,000 acre-feet/year of new water depletions from the Yampa River Basin relies on the Recovery Program to provide and protect flows on the Green River. Specifically, the analysis for that biological opinion assumed operation of Flaming Gorge Dam to meet the flow recommendations according to the Record of Decision on the Flaming Gorge Dam Operations environmental impact statement (EIS).

   The Service recognizes that the RIPRAP is an adaptive management plan that is modified according to additional information and changing priorities. The plan is reviewed annually and updated when necessary. The required timeframes include changes in timing approved by means of normal procedures of the Recovery Program. In 2006, and every 2 years thereafter, for the life of the Recovery Program, the Service and the Recovery Program will review implementation of the RIPRAP actions to determine timely compliance with applicable schedules.

Also, the analysis for that biological opinion assumed impacts to peak flows based on anticipated future uses of water, if water is used in a substantially different timing regime that adversely affects endangered fishes in a way not considered in that opinion, then reinitiation of consultation is required. The Recovery Program will monitor all new water projects that deplete more than 100 acre-feet/year to determine their impacts to peak flows on the Yampa River. In addition, the Recovery Program will monitor projects individually depleting 100 AF/year or less in cumulative increments of 3,000 acre-feet/year to determine their impacts to peak flows.

4. The Service lists new species or designates new or additional critical habitat, where the level or pattern of depletions covered under this opinion may have an adverse impact on the newly listed species or habitat. If the species or habitat may be adversely affected by depletions, the Service will reinitiate consultation on the programmatic biological opinion as required by its section 7 regulations. The Service will first determine whether the Recovery Program can avoid such impact or can be amended to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for such depletion impacts. If the Recovery Program can avoid the likelihood of jeopardy and/or adverse modification of critical habitat no additional recovery actions for individual projects would be required, if the avoidance actions are included in the Recovery Action Plan. If the Recovery Program is not likely to avoid the likelihood of jeopardy and/or adverse modification of critical habitat then the Service will reinitiate consultation and develop reasonable and prudent alternatives.

If the annual assessment indicates that either the recovery actions specified in the Yampa and Colorado River opinions have not been completed or that the status of all four fish species has not sufficiently improved, the Service intends to reinitiate consultation on these opinions to specify additional measures to be taken by the Recovery Program to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletions. If other measures are determined by the Service or the Recovery Program to be needed for recovery prior to the review, they can be added to the Recovery Action Plan according to standard procedures, outlined in that plan. If the Recovery Program is unable to complete those actions which the Service has determined to be required, consultation on projects with a Federal nexus may be reinitiated in accordance with ESA regulations and those opinion's reinitiation requirements. The Service may also reinitiate consultation on the Recovery Program if fish populations do not improve according to the population response criteria to be developed within one year of the issuance of the biological opinion on the Program. Failure to maintain a positive response, whenever achieved, will be considered a negative response and subject to reinitiation.

If the Service reinitiates consultation, it will first provide information on the status of the species and recommendations for improving population numbers to the Recovery Program. Only if the Recovery Program does not implement recovery actions to improve the status of the species, will the Service reinitiate consultation with individual projects. The Service intends to reinitiate consultations simultaneously on all depletions.

All individual consultations conducted under the Yampa and Colorado River programmatic opinions contain language requesting the applicable Federal agency to retain sufficient authority to reinitiate consultation should reinitiation become necessary. The BLM will retain regulatory authority over the oil and gas activities that are permitted by BLM and which are involved in this consultation. Non-Federal entities that have signed recovery agreements and that rely on the Recovery Program to avoid the likelihood of jeopardy and/or adverse modification of critical habitat by depletion impacts related to their projects will agree, by means of Recovery Agreements, to participate during reinitiated consultations in finding solutions to the problem which triggered the reinitiation of consultation.

Thank you for you cooperation in the formulation of this opinion and your interest in conserving endangered species.

CClayton:BLMFluidMineralsProgramPBO.doc:121908

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# RECOVERY AGREEMENT

This RECOVERY AGREEMENT is entered into this ___ day of ___________, ________, by and between the United States Fish and Wildlife Service (Service) and (name of water user) ___________________________________(Water User).

WHEREAS, in 1988, the Secretary of Interior, the Governors of Wyoming, Colorado and Utah, and the Administrator of the Western Area Power Administration signed a Cooperative Agreement to implement the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program); and

WHEREAS, the Recovery Program is intended to recover the endangered fish while providing for water development in the Upper Basin to proceed in compliance with state law, interstate compacts and the ESA; and

WHEREAS, the Colorado Water Congress has passed a resolution supporting the Recovery Program; and

WHEREAS, on December 20, 1999, the Service issued a programmatic biological opinion (1999 Opinion) concluding that implementation of specified elements of the Recovery Action Plan (Recovery Elements), along with existing and a specified amount of new depletions, are not likely to jeopardize the continued existence of the endangered fish or adversely modify their critical habitat in the Colorado River subbasin within Colorado, exclusive of the Gunnison River subbasin; and

WHEREAS, the 1999 Opinion in the section entitled "Reinitiation Notice" divided depletions into Category 1 or Category 2 for reinitiation purposes; and

WHEREAS, on January 10, 2005, the Service issued a programmatic biological opinion (2005 Opinion) on the *Management Plan for Endangered Fishes in the Yampa River Basin* concluding that implementation of specified elements of the Recovery Action Plan (Recovery Elements), along with existing and a specified amount of new depletions, are not likely to jeopardize the continued existence of the endangered fish or adversely modify their critical habitat in the Yampa River subbasin and Green River subbasin downstream of the Yampa River confluence; and

WHEREAS, Water User is the choose one: owner/operator/contractor of (name of water project or projects) ___________________________________ (Water Project), which causes or will cause depletions to the Colorado River subbasin within Colorado, exclusive of the Gunnison River subbasin, and/or to the Yampa River subbasin; and

WHEREAS, Water User desires certainty that its depletions can occur consistent with section 7 and section 9 of the Endangered Species Act (ESA); and

WHEREAS, the Service desires a commitment from Water User to the Recovery Program so that the Program can actually be implemented to recover the endangered fish and to carry out the Recovery Elements.

NOW THEREFORE, Water User and the Service agree as follows[1]:

1. The Service agrees that implementation of the Recovery Elements specified in the 1999 and 2005 Opinions will avoid the likelihood of jeopardy and adverse modification under section 7 of the ESA, for depletion impacts caused by Water User's Water Project. Any consultations under section 7 regarding Water Project's depletions are to be governed by the provisions of the 1999 and 2005 Opinions. The Service agrees that, except as provided in the 1999 and 2005 Opinions, no other measure or action shall be required or imposed on Water Project to comply with section 7 or section 9 of the ESA with regard to Water Project's depletion impacts or other impacts covered by the 1999 and 2005 Opinions. Water User is entitled to rely on this Agreement in making the commitment described in paragraph 2.

2. Water User agrees not to take any action which would probably prevent the implementation of the Recovery Elements. To the extent implementing the Recovery Elements requires active cooperation by Water User, Water User agrees to take reasonable actions required to implement those Recovery Elements. Water User will not be required to take any action that would violate its decrees or the statutory authorization for Water Project, or any applicable limits on Water User's legal authority. Water User will not be precluded from undertaking good faith negotiations over terms and conditions applicable to implementation of the Recovery Elements.

3. If the Service believes that Water User has violated paragraph 2 of this Recovery Agreement, the Service shall notify both Water User and the Management Committee of the Recovery Program. Water User and the Management Committee shall have a reasonable opportunity to comment to the Service regarding the existence of a violation and to recommend remedies, if appropriate. The Service will consider the comments of Water User and the comments and recommendations of the Management Committee, but retains the authority to determine the existence of a violation. If the Service reasonably determines that a violation has occurred and will not be remedied by Water User despite an opportunity to do so, the Service may request reinitiation of consultation on Water Project without reinitiating other consultations as would otherwise be required by the "Reinitiation Notice" section of the 1999 and 2005 Opinions. In that event, the Water Project's depletions would be excluded from the depletions covered by 1999 and/or 2005 Opinions and the protection provided by the Incidental Take Statement(s).

4. Nothing in this Recovery Agreement shall be deemed to affect the authorized purposes of Water User's Water Project or The Service's statutory authority.

5. The signing of this Recovery Agreement does not constitute any admission by Water User regarding the application of the ESA to the depletions of Water User's Water Project. The signing of this Recovery Agreement does not constitute any agreement by either party as to whether the flow recommendations described in the 1999 and 2005 Opinions are biologically or hydrologically necessary to recover the endangered fish.

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[1]Individual Recovery Agreement may be changed to fit specific circumstances.

6. This Recovery Agreement shall be in effect until one of the following occurs.

a. The Service removes the listed species in the Upper Colorado River Basin from the endangered or threatened species list and determines that the Recovery Elements are no longer needed to prevent the species from being relisted under the ESA; or

b. The Service determines that the Recovery Elements are no longer needed to recover or offset the likelihood of jeopardy to the listed species in the Upper Colorado River Basin; or

c. The Service declares that the endangered fish in the Upper Colorado River Basin are extinct; or

d. Federal legislation is passed or Federal regulatory action is taken that negates the need for [or eliminates] the Recovery Program.

7. Water User may withdraw from this Recovery Agreement upon written notice to the Service. If Water User withdraws, the Service may request reinitiation of consultation on Water Project without reinitiating other consultations as would otherwise be required by the "Reinitiation Notice" section of the 1999 and 2005 Opinions.

______________________________ ____________

Water User Representative Date

______________________________ ____________

Western Colorado Supervisor Date
U.S. Fish and Wildlife Service