

Humpback chub *(Gila cypha)*

5-Year Review: Summary and Evaluation



**U.S. Fish and Wildlife Service
Upper Colorado River Endangered Fish Recovery Program
Denver, Colorado**

2011

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5-YEAR REVIEW
Humpback chub/*Gila cypha*

1.0 GENERAL INFORMATION

1.1 Purpose of 5-year Reviews

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing as endangered or threatened is based on the species' status considering the five threat factors described in section 4(a)(1) of the Act. These same five factors are considered in any subsequent reclassification or delisting decisions. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process including public review and comment.

1.2 Reviewers

Lead Regional Office: Mountain-Prairie Region (6)

Mike Thabault, Assistant Regional Director-Ecological Services, 303/236-4210

Bridget Fahey, Chief of Endangered Species, 303/236-4258

Seth Willey, Regional Recovery Coordinator, 303/236-4257

Lead Field Office:

Upper Colorado River Endangered Fish Recovery Program

Thomas Chart, Program Director, 303/969-7322, ext. 226

Cooperating Field Offices:

Ecological Services Field Office, Grand Junction, Colorado

Al Pfister, Assistant Field Supervisor, 970/243-2778

Colorado River Fisheries Program, Grand Junction, Colorado

To Be Announced, Field Supervisor, 970/245-9319, ext.19

Ecological Services Field Office, Salt Lake City, Utah

Larry Crist, Field Supervisor, 801/975-3330, ext. 126

Ecological Services Field Office, Cheyenne, Wyoming

Mark Sattelberg, Field Supervisor, 307/772-2374, ext. 34

Arizona Fishery Resources Office, Whiteriver, Arizona
Stewart Jacks, Field Supervisor, 928/338-4288

Lower Colorado River Coordinator, Phoenix, Arizona
Sam Spiller, Coordinator, 602/242-0210, ext. 240

Ecological Services Field Office, Phoenix, Arizona
Steve Spangle, Field Supervisor, 602/242-0210, ext. 244

California-Nevada Ecological Services Field Office, Reno, Nevada
Ted Koch, Field Supervisor, 775/861-6331

Cooperating Regional Office(s):

Southwest Region (2)
Michelle Shaughnessy, Assistant Regional Director-Ecological Services,
505/248-6646
Susan Jacobsen, Chief of Endangered Species, 505/248-6641
Wendy Brown, Regional Recovery Coordinator, 505/248-6664

Pacific Southwest Region (8)
Larry Rabin, Deputy Division Chief for Listing, Recovery, and Environmental
Contaminants, 916/414-6464

1.3 Methodology Used to Complete the Review

On April 18, 2007, we published a Notice of Review in the *Federal Register* (72 FR 19549) soliciting any new information on the humpback chub that may have a bearing on its classification as endangered or threatened. Less than 20 people/agencies provided comments. All substantive comments and issues raised were considered. This 5-year review was primarily written by the Upper Colorado River Endangered Fish Recovery Program Office with substantive contributions and review by cooperating field and regional offices. It summarizes and evaluates information provided in the recovery goals, current scientific research, and surveys related to the species. All pertinent literature and documents on file at the Upper Colorado River Endangered Fish Recovery Program Office were used for this review (see References section below for cited documents). Interviews with individuals familiar with humpback chub were conducted as needed to clarify or obtain specific information.

1.4 Background

1.4.1 FR Notice Citation Announcing Initiation of This Review:
72 FR 19549 April 18, 2007.

1.4.2 Listing History

Original Listing

FR notice: 38 FR 106

Date listed: June 4, 1973

Entity listed: Chub, humpback; *Gila cypha*

Classification: Endangered, rangewide

1.4.3 Associated Rulemakings

59 FR 13374; March 21, 1994 - Critical Habitat Designated

66 FR 58748; November 23, 2001 - Reopening of Public Comment on Draft Recovery Goals for Four Endangered Fishes of the Colorado River Basin

67 FR 55270 55271; August 28, 2002 - Notice of Availability of Recovery Goals for Four Endangered Fishes of the Colorado River Basin

1.4.4 Review History: Historic 5-year reviews for all species, including the humpback chub were initiated by the Service's Washington, D.C., office in 1979, 1985, and 1991 (44 FR 29566, May 21, 1979; 50 FR 29901, July 22, 1985; 56 FR 56882, November 6, 1991). The species' status also was considered in the 1990 recovery plan and 2002 recovery goals (Service 1990; 2002).

1.4.5 Species' Recovery Priority Number at Start of 5-year Review: The humpback chub has a high recovery priority number of 2C. Species with a high priority rank (1, 1C, 2, 2C) are those that are the most threatened and have the highest potential for recovery. The "C" identifies that there is the potential for conflicts between needed recovery actions and economic activities.

Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict	
High	High	Monotypic Genus	1	1C	
		Species	2	2C*	
		Subspecies/DPS	3	3C	
	Low	Low	Monotypic Genus	4	4C
			Species	5	5C
			Subspecies/DPS	6	6C
Moderate	High	Monotypic Genus	7	7C	
		Species	8	8C	
		Subspecies/DPS	9	9C	
	Low	Low	Monotypic Genus	10	10C
			Species	11	11C
			Subspecies/DPS	12	12C
Low	High	Monotypic Genus	13	13C	
		Species	14	14C	
		Subspecies/DPS	15	15C	
	Low	Low	Monotypic Genus	16	16C
			Species	17	17C
			Subspecies/DPS	18	18C

The above ranking system for determining Recovery Priority Numbers was established in 1983 (48 FR 43098, September 21, 1983, as corrected in 48 FR 51985, November 15, 1983).

1.4.6 Recovery Plan

Name of plan or outline: Humpback chub (*Gila cypha*) Recovery Goals: amendment and supplement to the Humpback Chub Recovery Plan.

Date approved: August 1, 2002

Dates of previous revisions, if applicable: September 19, 1990

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment Policy

This section of the 5-year review is not applicable to this species because the humpback chub was not listed as a distinct population segment nor is there relevant new information for this species regarding the application of the distinct population segment policy.

2.2 Recovery Criteria

Recovery plans provide guidance to the Service, States, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was finalized may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress toward fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

There are three programs in the Colorado River Basin working to recover or conserve humpback chub populations: The Upper Colorado River Endangered Species Recovery Program and two conservation programs, the Glen Canyon Dam Adaptive Management Program and the Lower Colorado River Multi-Species Conservation Program. Each program has its own website that contains information about its respective program, projects and reports that were used to analyze the status of humpback chub.

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes
 No

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

Yes
 No

We recommend revising the Service's 2002 Humpback Chub Recovery Goals to incorporate new information on population dynamics. More specifically, the as-written Recovery Goal requirement that these populations always display positive recruitment (i.e., recruitment that is greater than adult mortality) contradicts the best available information that indicates these populations have and likely will experience fluctuations.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

Yes
 No

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

The current status of humpback chub is endangered. Only the downlisting criteria are considered in this 5-year status review to determine if status can be changed (downlisted) to threatened. The downlisting criteria consider both the demographics of humpback chub and criteria that address the threats to the species. Analysis of each criterion is provided in italics directly below the criterion. Recovery of the species is considered basin wide, where extant populations exist (including five populations in the the upper basin recovery unit and the Grand Canyon population in the lower basin recovery unit). The downlist recovery criteria are from the recovery goals (Service 2002), Section 5.3 Objective, Measurable Recovery Criteria (pp. 42–46):

DEMOGRAPHIC DOWNLISTING CRITERIA FOR HUMPBACK CHUB

Historic abundance of the humpback chub is unknown, but is surmised from various reports and collections that indicate the species currently occupies about 68% of its historic habitat of about 756 km of river. Six self-sustaining populations of humpback chub are known to exist. Each of these populations consists of a discrete reproducing group of fish, with independent

stock-recruitment dynamics, and is geographically separated from other populations. Five of the populations occur in the upper basin recovery unit: 1) Black Rocks, Colorado River, Colorado; 2) Westwater Canyon, Colorado River, Utah; 3) Yampa Canyon, Yampa River, Colorado; 4) Desolation/Gray Canyons, Green River, Utah; and 5) Cataract Canyon, Colorado River, Utah (Service 1990). The only population in the lower basin recovery unit occurs in the mainstem Colorado River in Marble and Grand Canyons and the Little Colorado River.

Upper Basin Recovery Unit Criterion 1a: Each of the five self-sustaining populations is maintained over a 5-year period, starting with the first point estimate acceptable to the Service, such that the trend in adult (age-4+; ≥ 200 mm TL) point estimates does not decline significantly.

Status of Upper Basin Recovery Unit Criterion 1a. *This criterion has not been met.*
Population models measure a variety of parameters, including probability of capture; these parameters provide a level of certainty and reliability to the Service for these estimates in determining acceptance. As a result, we can accept these estimates but do not consider the populations to be self-sustaining. A significant decline appears from the first adult abundance estimate to the most recent estimate for the populations in Black Rocks, Westwater Canyon and Desolation/Gray Canyons (FIGURE 1); 400 wild young-of-year Gila species were taken into captivity from the Yampa River population and 25 adults from Desolation/Gray population have been brought into captivity to preserve their genetic uniqueness (as recommended, Finney 2006 and Badame 2008, respectively). Populations occurring in Yampa and Cataract Canyons are too small to monitor through mark-recapture analysis; therefore, catch-per-unit-effort information has been recommended to track the status for at least the Cataract Canyon population; juvenile and adult Gila spp. are monitored as a component of the fish community during nonnative fish removal for the Yampa River population.

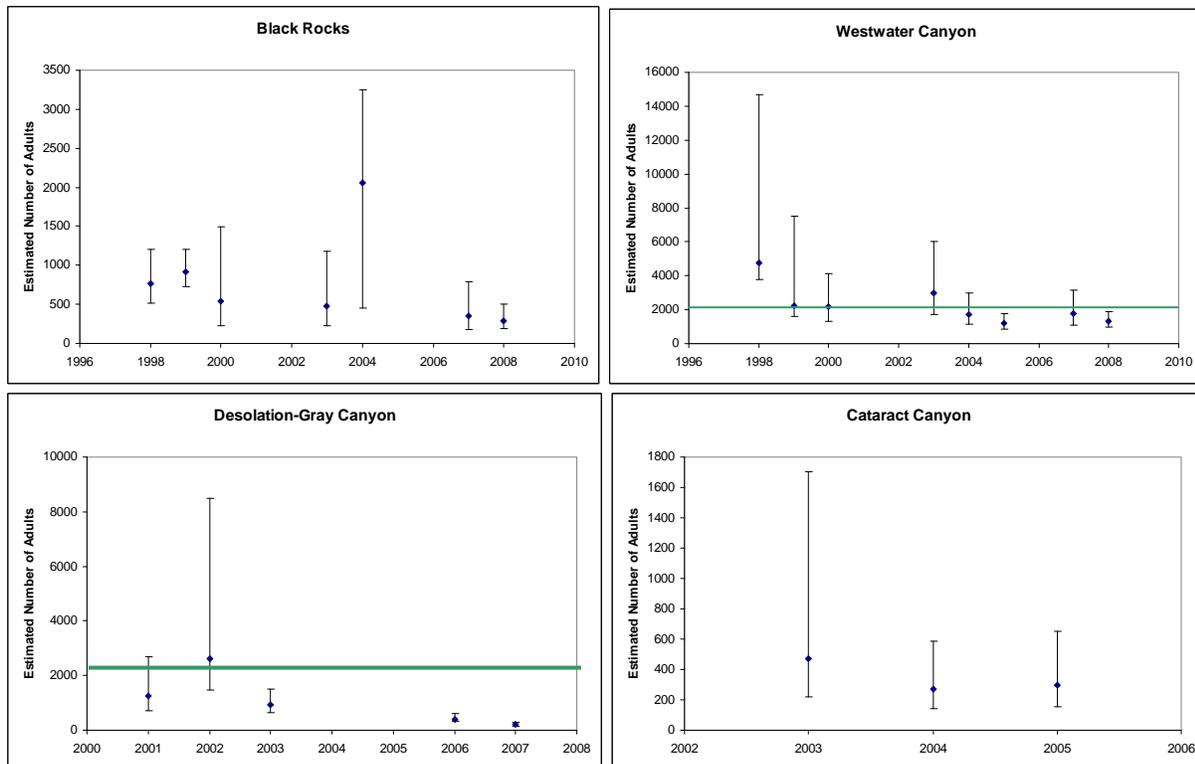


FIGURE 1. Estimated numbers of humpback chub adults (≥ 200 -mm TL) in 4 of 5 populations of the Upper Colorado River Basin. Error bars are 95% confidence intervals. The line at 2,100 represents the minimum viable population number; for core populations they need to exceed this level. Data from Black Rocks (McAda 2003a; 2007), Westwater Canyon (Elverud 2008), Desolation/Gray Canyons (P. Badame, Utah Division of Wildlife Resources, pers. comm.), and Cataract Canyon (Badame 2008).

Upper Basin Recovery Unit Criterion 1b: Each of the five self-sustaining populations is maintained over a 5-year period, such that mean estimated recruitment of age-3 (150 to 199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality.

Status of Upper Basin Recovery Unit Criterion 1b. *This criterion has not been met. We do not consider these populations to be self-sustaining, likely as a result of poor recruitment. Too few juveniles are collected during population estimate sampling do to gear type being more selective for adults, i.e., larger fish; and other gear used to select juveniles has had limited success.*

Upper Basin Recovery Unit Criterion 2. One of the 5 populations (e.g., Black Rocks/Westwater Canyon or Desolation/Grey Canyons) is maintained as a core population such that each point estimate exceeds 2,100 adults (Note: 2,100 is the estimated MVP number for a self-sustaining population).

Status of Upper Basin Recovery Unit Criterion 2. *This criterion has not been met. A presumable core population of humpback chub at either Westwater Canyon/Black Rocks or Desolation/Grey Canyon does not exceed the 2,100 adults necessary to meet the criterion (FIGURE 1).*

Lower Basin Recovery Unit Criterion 1a: The Grand Canyon population is maintained as a core over a 5-year period, starting with the first point estimate acceptable to the Service, such that the trend in adult (age-4+; ≥ 200 mm TL) point estimates does not decline significantly.

Status of Lower Basin Recovery Unit Criterion 1a. *This criterion has been partially met.*

Population estimates for humpback chub in Grand Canyon are based on an age-structured mark-recapture (ASMR) analysis that uses capture histories from PIT-tagged fish starting in 1989 (FIGURE 2). These estimates are based on models that incorporate uncertainty in age assignment and a mortality rate of 0.13 for age-4+ fish (≥ 200 mm TL; Coggins et al. 2006a; 2006b; Coggins 2008; Coggins and Walters 2009). Earliest estimates are based on small numbers of marks and recaptures and have wider confidence intervals than more recent estimates. These estimates show a decline in the population with the lowest estimate of between about 4,600 and 5,300 age-4+ fish in 2001. Recent estimates suggest that the population of adults may be stabilizing and improving after more than a decade of decline (U.S. Geological Survey 2006; 2007). Between 2001 and 2008, the numbers of adults appear to have increased to an estimated 7,650 adults. The ASMR analysis provides a level of certainty and reliability to the Service for these estimates in determining acceptance. As a result, we can accept these estimates for as far back as they are calculated and consider the population to be self-sustaining.

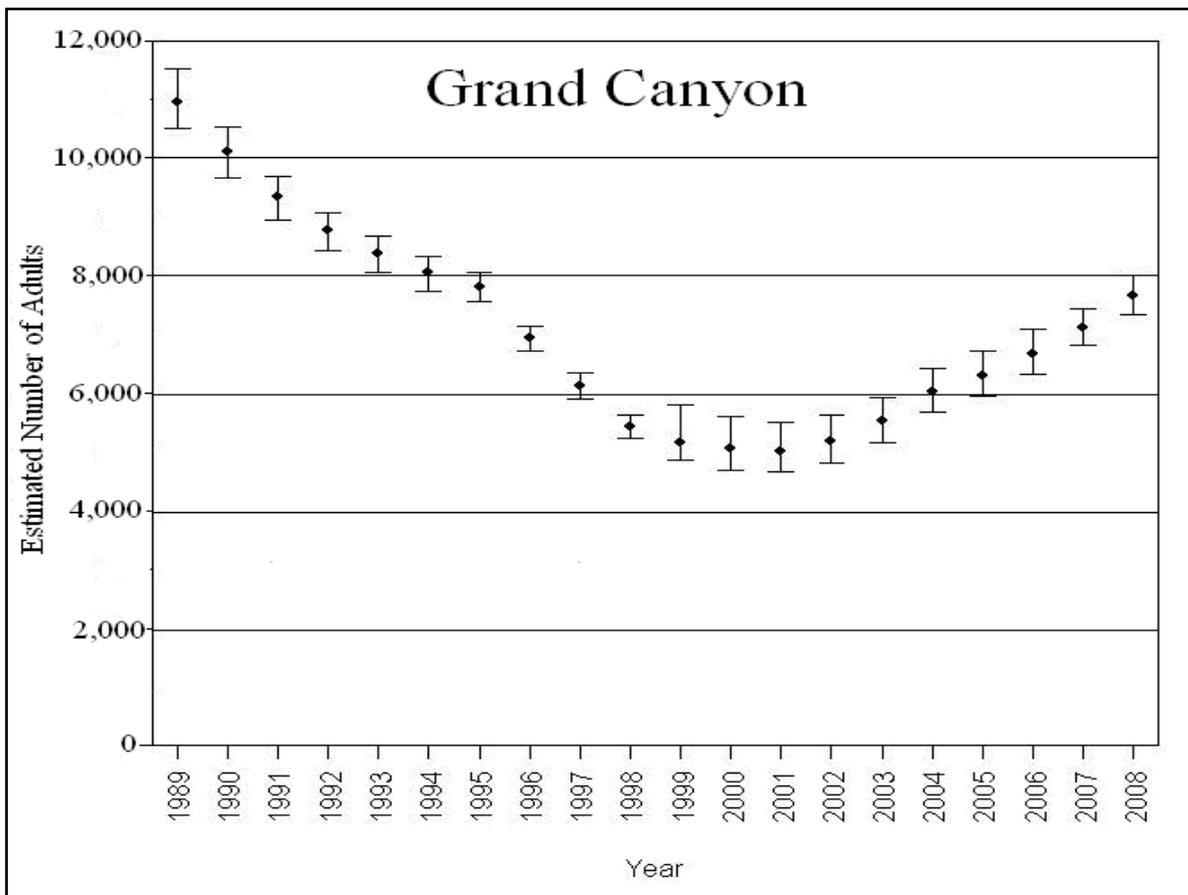


FIGURE 2. Estimated numbers of humpback chub adults (≥ 200 -mm TL) in the Grand Canyon population of the Lower Colorado River System. Error bars are a range of estimates from Monte Carlo simulations (Coggins and Walters 2009.)

Lower Basin Recovery Unit Criterion 1b: The Grand Canyon population is maintained as a core over a 5-year period, starting with the first point estimate acceptable to the Service, such that mean estimated recruitment of age-3 (150 to 199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality.

Status of Lower Basin Recovery Unit Criterion 1b. *This criterion has been partially met. In 2005, scientists also detected more juveniles (age-1 to age-3+) and young-of-year than previous years indicating good future recruitment. The increase in adult abundance appears to be driven by a gradual increase in recruitment since the mid to late 1990s. However, simulation results suggest that this apparent gradual increase in recruitment is quite possibly an artifact of ageing error causing recent strong cohorts to be incorrectly assigned to earlier brood-years.*

Lower Basin Recovery Unit Criterion 1c: The Grand Canyon population is maintained as a core over a 5-year period, starting with the first point estimate acceptable to the Service, such that each core population point estimate exceeds 2,100 adults (MVP).

Status of Lower Basin Recovery Unit Criterion 1c. *This criterion has been met. The estimate of adults in this population has never been below 4,600. A population of 7,650 means this core population exceeds the MVP of 2,100. We can accept these estimates for as far back as they are calculated and consider the population to be self-sustaining.*

RECOVERY FACTOR DOWNLISTING CRITERIA FOR HUMPBACK CHUB TO MINIMIZE OR REMOVE THREATS TO THE SPECIES

UPPER BASIN RECOVERY UNIT

Factor A—Adequate habitat and range for recovered populations provided.

Streamflow regulation and associated habitat modification are primary threats to humpback chub populations. Reservoir inundation, cold-water releases from dams, streamflow alteration, changes in channel geomorphology, and modification of sediment transport have impacted habitat of the native Colorado River fishes, including the humpback chub. Dams were considered a major threat to the humpback chub at the time of listing; however, construction of new dams affecting occupied habitat ceased nearly 4 decades ago. Changes in channel geomorphology of habitat occupied by humpback chub are not extensive because most habitat occurs in rocky canyon-confined reaches with low susceptibility to geomorphic modification.

Maintenance of streamflow is important to the ecological integrity of large western rivers. Flow recommendations have been developed for some river systems in the Upper Colorado River Basin that identify and describe flows with the necessary magnitude, frequency, duration, and timing to benefit the endangered fish species (Modde et al. 1999; McAda 2003; Muth et al. 2000).

Criterion 1. Flow regimes to benefit humpback chub populations in the upper Colorado, Green, and Yampa Rivers should be identified, implemented, evaluated, and revised, such that:

- a. Adequate spawning habitat and appropriate spawning cues (e.g., flow patterns and water temperatures) are available to maintain self-sustaining populations, as reflected by downlisting demographic criteria.
- b. Adequate nursery habitat is available to maintain self-sustaining populations, as reflected by downlisting demographic criteria.
- c. Adequate juvenile and adult habitat (e.g., cover, resting, and feeding areas) is available to maintain self-sustaining populations, as reflected by downlisting demographic criteria.

Status of Criterion 1. *Criterion 1 has been partially met. Flow recommendations have been developed for the Green River (Muth et al. 2000); Yampa River (Modde et al. 1999), and upper Colorado River (McAda 2003b). These flow recommendations are primarily for Colorado pikeminnow and razorback sucker, but are believed to benefit the humpback chub in sections below the reaches of interest. These flow recommendations are still being evaluated and modified annually through adaptive management.*

Factor B—Protection from overutilization for commercial, recreational, scientific, or educational purposes.

Overutilization of humpback chub for commercial, recreational, scientific, or educational purposes is not currently considered a threat to the species. Humpback chub have no commercial or recreational value and are not sought by commercial fishermen or anglers. Collection of humpback chub for scientific or educational purposes is regulated by the Service under the Act.

Criterion 2. Overutilization of humpback chub for commercial, recreational, scientific, or educational purposes reevaluated and, if necessary, actions identified to ensure adequate protection.

Status of Criterion 2. *Criterion 2 has been met. No commercial or recreational activities exist. Educational activities are minimal and do not threaten humpback chub. Scientifically, reduced survival of adult humpback chub as a result of handling has not been proven, and delayed mortality due to sampling has not been demonstrated.*

Factor C—Adequate protection from diseases and predation.

Diseases and parasites currently are not considered to be significant in the decline of the humpback chub in the upper basin.

The threat of predation by nonnative fishes on humpback chub has been recognized in two populations in the upper basin. Channel catfish (*Ictalurus punctatus*) are the principal predator of humpback chub in Desolation/Gray Canyons (Chart and Lentsch 2000) and Yampa Canyon (Upper Colorado River Endangered Fish Recovery Program 1999). Control of the release and escapement of nonnative fishes into the mainstem, floodplain, and tributaries is a necessary management action to stop the introduction of new fish species into occupied habitats and to thwart periodic escapement of highly predaceous nonnatives from riverside features. Annual flooding of the river can inundate riverside ponds potentially containing large numbers of green sunfish (*Lepomis cyanellus*), black bullhead (*Ameiurus melas*), largemouth bass (*Micropterus salmoides*), and other nonnative fishes that may escape to the river during high flows (Valdez and Wick 1983). Three management actions are identified to reduce the threat of nonnative fishes: high spring flows, nonnative fish control strategies, stocking agreements. Active control programs should be implemented or continued (as needed) for problematic nonnative fishes in Yampa Canyon and Desolation/Gray Canyons.

Criterion 3. Effects of diseases and parasites on humpback chub populations should be reevaluated and, if necessary, actions identified to ensure adequate protection.

Status of Criterion 3. *Criterion 3 has not been met. The effects of disease and parasites on humpback chub populations have not been re-evaluated.*

Criterion 4. Procedures should be developed, implemented, evaluated, and revised for stocking nonnative fish species in the Upper Colorado River Basin to minimize negative interactions between nonnative fishes and humpback chub.

Status of Criterion 4. *Criterion 4 has been met. Procedures were developed in 1996 and modified in 2009 (Service 1996; 2009). The Procedures distinguish between stocking nonnative salmonids and non-salmonids and have specific requirements for stocking locations related to their proximity to critical habitat.*

Criterion 5. Channel catfish control programs should be developed and implemented to identify levels of control that would minimize predation on humpback chub in Yampa Canyon and Desolation/Gray Canyons.

Status of Criterion 5. *Criterion 5 has been partially met. A level of control of channel catfish has been identified, but superceded by actions to remove or minimize predation and competition effects of small mouth bass (Fuller 2006; Haines and Modde 2007). The level of channel catfish control needs to be evaluated and reviewed.*

Factor D—Adequate existing regulatory mechanisms.

Implementation of regulatory mechanisms is necessary for recovery of the humpback chub and to ensure long-term conservation of the species. After removal from the list of species protected by the Act, the humpback chub and its habitat will continue to receive consideration and some

protection through the following Federal laws and related state statutes: National Environmental Policy Act; Clean Water Act; Organic Act; and Fish and Wildlife Coordination Act.

The need for conservation plans and agreements was identified to provide reasonable assurances that recovered humpback chub populations will be maintained.

Criterion 6. Regulatory mechanisms determined adequate for legal protection of adequate habitat are identified.

Status of Criterion 6. Criterion 6 has been partially met. Filing for legal rights to protect water for fish would be junior to the legal rights of others who have already claimed water for irrigation and power. Utah is currently reviewing the water rights from Flaming Gorge and how they may be modified for fish protection. Other legal options that could be employed are leasing water (Steamboat Reservoir) or contractual commitments (Wolford and Elkhead Reservoirs). In addition, 60,000 acre-feet on the upper Colorado River from the Historic Users Pool (reservoir projects built prior to the Recovery Program, i.e., 1988) are used to maintain river flows in the 15-mile reach (from Palisade to the confluence of the Gunnison River) as written in a programmatic biological opinion.

Criterion 7. Elements of conservation plans identified that are necessary to provide for the long-term management and protection of humpback chub populations.

Status of Criterion 7. Criterion 7 has not been met. Conservation plans and the necessary elements have not been developed.

Factor E—Other natural or manmade factors for which protection has been provided.

Humpback chub, bonytail (*Gila elegans*), and roundtail chub (*Gila robusta*) are sympatric Colorado River mainstem species with substantial evidence of introgressive hybridization (Dowling and DeMarais 1993).

The potential role of pesticides and pollutants in suppressing populations of *Gila* were discussed by Wick et al. (1981). Potential spills of hazardous materials threaten some populations of humpback chub. All States have hazardous-materials spills emergency-response plans that provide a quick cleanup response to accidental spills.

Criterion 8. State and Federal hazardous-materials spills emergency-response plans should be reviewed and modified to ensure adequate protection for humpback chub populations from hazardous-materials spills.

Status of Criterion 8. Criterion 8 has not been met. The hazardous-materials spills emergency-response plans have not been reviewed or modified.

Criterion 9. Measures should be identified to minimize the risk of hazardous-materials spills in Black Rocks and Westwater Canyon from transport of materials along the adjacent railway.

Status of Criterion 9. *Criterion 9 has not been met. No measures have been identified to minimize the risk of hazardous materials spills in Black Rocks and Westwater Canyon from materials transported along railway.*

Criterion 10. Locations of all petroleum-product pipelines within the 100-year floodplain of critical habitat should be identified and the need for emergency shut-off valves assessed.

Status of Criterion 10. *Criterion 10 has been partially met. Although some progress has been made in locating all petroleum-product pipelines, determination of emergency shut off valves has not been assessed. New pipelines crossing rivers are required to have shut-off valves.*

LOWER BASIN RECOVERY UNIT

Factor A—Adequate habitat and range for recovered populations provided.

An Environmental Impact Statement in 1995, with a Record of Decision in 1996, established releases from Glen Canyon Dam that will be evaluated through adaptive management to protect resources of the Colorado River through Grand Canyon (U.S. Department of the Interior 1995).

Criterion 1. Life stages and habitats of humpback chub in the mainstem Colorado River should be identified and the relationship between individuals in the mainstem and the Little Colorado River should be determined.

Status of Criterion 1. *Criterion 1 has been met. Greatest movement of humpback chub has been reported from Grand Canyon, primarily because adults from the mainstem annually ascend the Little Colorado River to spawn (Valdez and Ryel 1995; Paukert et al. 2006). Average movement of 401 PIT-tagged fish marked in the mainstem and recaptured in the Little Colorado River was 7.2 km (range, 0.08 to 34.1 km). However, most of these fish returned to the mainstem with remarkable fidelity to mainstem locales. Of 60 PIT-tagged fish consecutively captured in the mainstem, then the Little Colorado River, and again in the mainstem, 54 (90%) returned to within 2 km of their original mainstem locale; 31 (52%) were recaptured within 0.5 km; and 10 (17%) were recaptured within 0.1 km. No significant difference in movements was noted between male and female humpback chub. Fish moving from the mainstem to the Little Colorado River and back to the mainstem tended to be larger fish than those remaining in the Little Colorado River (81% were >300 mm TL). Paukert et al. (2006) found similar fidelity with several fish moving more than 154 km throughout Grand Canyon between capture and recapture.*

Criterion 2. Operations of Glen Canyon Dam to benefit humpback chub in the Colorado River through Grand Canyon should be continued and a flow regime to benefit humpback chub in the Little Colorado River should be identified, implemented, evaluated, and revised, such that:

- a. Adequate spawning habitat and appropriate spawning cues (e.g., flow patterns and water temperatures) are available to maintain a self-sustaining population, as reflected by downlisting demographic criteria in section 5.3.1.1.2.
- b. Adequate nursery habitat is available to maintain a self-sustaining population, as reflected by downlisting demographic criteria in section 5.3.1.1.2.
- c. Adequate juvenile and adult habitat (e.g., cover, resting, and feeding areas) is available to maintain a self-sustaining population, as reflected by downlisting demographic criteria in section 5.3.1.1.2.

Status of Criterion 2. *Criterion 2 has been partially met. In 2008, the Service issued a new biological opinion on the operation of Glen Canyon Dam. That opinion replaced the 1995 opinion and determined that implementation of the March 2008 high flow test and the 5-year implementation of Modified Low Fluctuating Flows with steady releases in September and October was not likely to jeopardize the continued existence of the humpback chub and was not likely to destroy or adversely modify designated critical habitat. The 2008 biological opinion contained conservation measures that include: 1) a reconsultation trigger if the population of adult humpback chub (≥ 200 mm TL) in Grand Canyon declines significantly, or, if in any single year, based on the ASMR model (Coggins 2008), the population drops below 3,500 adult fish within the 95% confidence interval; 2) development of a Comprehensive Plan for the Management and Conservation of Humpback Chub in Grand Canyon; 3) humpback chub translocations; 4) implementation of nonnative fish control; 5) humpback chub nearshore ecology study; 6) monthly flow transition study; 7) creation of a humpback chub refuge population; and 8) initiation of a Little Colorado River watershed plan. As the result of a lawsuit filed by the Grand Canyon Trust, a Federal Court Judge ruled that the 2008 opinion was a departure from the Service's prior position and ordered the Service to revise the opinion by October 31, 2009. The opinion was adequately explained and the conservation measures in the opinion were accepted by the court on March 30, 2011.*

The Little Colorado River Watershed Coordinating Council was formed in 2007 to help coordinate water management activities within the Little Colorado River. The Council has a Water Quality Improvement Grants program that provides interested parties with Federal grants to improve water quality in the Little Colorado River watershed.

Criterion 3. Effects and feasibility of a temperature control device for Glen Canyon Dam to increase water temperatures in the mainstem Colorado River through Grand

Canyon that would allow for range expansion of humpback chub should be determined.

Status of Criterion 3. *Criterion 3 has been met. A risk assessment and scoping environmental assessment for a temperature control device on the penstocks at Glen Canyon Dam have been completed (U.S. Bureau of Reclamation 2004).*

Factor B—Protection from overutilization for commercial, recreational, scientific, or educational purposes.

Overutilization of humpback chub for commercial, recreational, scientific, or educational purposes is not currently considered a threat to the species. Humpback chub have no commercial or recreational value and are not sought by commercial fishermen or anglers. Collection of humpback chub for scientific or educational purposes is regulated by the Service under the Act.

Criterion 4. Overutilization of humpback chub for commercial, recreational, scientific or educational purposes should be reevaluated and, if necessary, actions identified to ensure adequate protection.

Status of Criterion 4. *Criterion 4 has been met. No commercial, recreational or educational activities exist. Scientifically, reduced survival of adult humpback chub as a result of handling has not been proven, and delayed mortality due to sampling has not been demonstrated. Hunt (2008) concluded trammel netting as a sampling technique should be avoided at temperatures at or above 20°C. The effects appeared much worse for hatchery-produced razorback sucker and bonytail than for wild roundtail chub. It's assumed that wild humpback chub would be similar to wild roundtail chub.*

Factor C—Adequate protection from diseases and predation.

Meretsky et al. (2000) hypothesized that an observed decline in condition of adult humpback chub in Grand Canyon was a result of recent infestation by the internal Asian tapeworm (*Bothriocephalus acheilognathi*).

Criterion 5. An Asian tapeworm control program should be developed and implemented in the Little Colorado River to identify levels of control that will minimize the negative effects of parasitism on the humpback chub population.

Status of Criterion 5. *Recovery Factor Criterion 5 has been met. Ward (2007) developed protocols for treating humpback chub for Asian tapeworm. Arizona Game and Fish Department is implementing those protocols (Clark et al. 2008).*

*The threat of predation by nonnative fishes on humpback chub has been recognized in Grand Canyon population. Brown trout (*Salmo trutta*), channel catfish, black bullhead, and rainbow trout (*Oncorhynchus mykiss*) have been identified as principal predators of juvenile humpback chub, with estimates that*

suggest loss of complete year classes to predation (Marsh and Douglas 1997; Valdez and Ryel 1997). Studies from the lower Colorado River through Grand Canyon (Hoffnagle et al. 1999; Valdez et al. 2001) showed reductions in densities of small-bodied species of fish (e.g., fathead minnow [Pimephales promelas], red shiner [Cyprinella lutrensis], plains killifish [Fundulus zebrinus]) following high flows. High releases from Glen Canyon Dam in 1996 (Hoffnagle et al. 1999; Valdez et al. 2001) and in 2000 (Trammell et al. 2001) significantly reduced numbers of red shiner, fathead minnow, and plains killifish with no decline in native species. A strong year class of humpback chub in Grand Canyon in 1993 followed high early spring-runoff flows from the Little Colorado River, and was attributed to cleansing of spawning gravels and short-term reduction in nonnative fishes (Gorman 1994).

- Criterion 6.** Procedures should be developed, implemented, evaluated, and revised for stocking and to minimize escapement of nonnative fish species into the Colorado River and its tributaries through Grand Canyon to minimize negative interactions between nonnative fishes and humpback chub.

Status of Criterion 6. *Criterion 6 has not been met. No procedures have been developed.*

- Criterion 7.** Rainbow trout, channel catfish, black bullhead, and common carp control programs should be developed and implemented to identify levels of control that will minimize predation on humpback chub in the Little Colorado River.

Status of Criterion 7. *Criterion 7 has been partially met. The percentage of nonnative fishes in the Little Colorado River remains at low levels (Ward and Persons 2007). The number of fathead minnows has increased since 1994, although trends are difficult to assess due to high variability in catch rate between years. Ward and Persons (2007) concluded, if the mainstem Colorado River continues to be warm, fathead minnow and red shiner may be able to become established in the mainstem and invade the Little Colorado River between flood events much more quickly. Black bullhead and channel catfish catch rates have been highly variable in recent years, although they have been increasing since 2002. Common carp do not show any trends; however, adult common carp are not very susceptible to capture in hoop nets.*

- Criterion 8.** Brown trout and rainbow trout control programs should be developed and implemented to identify levels of control that will minimize predation on humpback chub in the Colorado River through Grand Canyon.

Status of Criterion 8. *Criterion 8 has been partially met. Mechanical removal of brown trout and rainbow trout around the confluence occurred from 2003-2008. Although a declining catch rate was identified over the 5-year period an identified level of control has not been determined.*

Factor D—Adequate existing regulatory mechanisms.

Implementation of regulatory mechanisms is necessary for recovery of the humpback chub and to ensure long-term conservation of the species. After removal from the list of species protected by the Act, the humpback chub and its habitat will continue to receive consideration and some protection through the following Federal laws and related state statutes: National Environmental Policy Act; Clean Water Act; Organic Act; and Fish and Wildlife Coordination Act.

The need for conservation plans and agreements was identified to provide reasonable assurances that recovered humpback chub populations will be maintained.

Criterion 9. Mechanisms determined adequate for legal protection of adequate habitat in the mainstem Colorado River through Grand Canyon and the Little Colorado River should be developed.

***Status of Criterion 9. Criterion 9 has been met.** The Grand Canyon Protection Act along with “law of the river,” including interstate compacts, provide flows through Grand Canyon to deliver to lower basin states and benefit the ecosystem overall. The Glen Canyon Dam Adaptive Management Work Group through its Technical Work Group and the biological opinion for the reoperation of Glen Canyon Dam is the mechanism in which these flows are protected and provided.*

A Little Colorado River watershed study is a basin-wide effort to define the problems, identify solutions and options related to protecting and increasing water supplies, preserve/enhance a more natural environment, and improve the health of the watershed. There are multiple jurisdictions over the water resources that are working to develop a coordinated management plan to optimize the water resources to meet the water needs.

Criterion 10. Elements of conservation plans are identified that are necessary to provide for the long-term management and protection of humpback chub populations.

***Status of Criterion 10. Criterion 10 has not been met.** Conservation plans and the necessary elements have not been developed.*

Factor E—Other natural or manmade factors for which protection has been provided.

The potential role of pesticides and pollutants in suppressing populations of *Gila* were discussed by Wick et al. (1981). Potential spills of hazardous materials threaten some populations of humpback chub. All States have hazardous-materials spills emergency-response plans that provide a quick cleanup response to accidental spills. A preventive measure may include filtration systems in case of accidental spills of hazardous materials at the Cameron bridge crossing above occupied habitats.

Criterion 11. State and Federal hazardous-materials spills emergency-response plans should be reviewed and modified to ensure adequate protection for humpback chub populations from hazardous-materials spills.

Status of Criterion 11. *Criterion 11 has not been met.* *The hazardous-materials spills emergency-response plans have not been reviewed or modified.*

Criterion 12. Measures should be identified to minimize the risk of hazardous-materials spills from transport of materials along U.S. Highway 89 at and near the two Cameron bridges spanning the Little Colorado River.

Status of Criterion 12. *Criterion 12 has not been met.* *No measures have been identified to minimize the risk of hazardous materials spills in along U.S. Highway 89 and near the Cameron bridge spanning the Little Colorado River from materials transported along roadway.*

2.3 Synthesis

Recovery is based on reduction or removal of threats and improvement of the status of a species during the period in which it is listed, and not just from the time a listed species is proposed for reclassification. Environmental conditions and the structure of populations change over time, and threats recognized at listing or in subsequent recovery plans may no longer be directly applicable when reclassification is considered. Management actions and tasks identified for listed species are expected to minimize or remove threats and improve the species' status.

Recovery is achieved when management actions and associated tasks have been implemented and/or completed to allow genetically and demographically viable, self-sustaining populations to thrive under minimal ongoing management and investment of resources. Achievement of recovery does not mandate returning a species to all or a significant portion of its historic range, nor does it mandate establishing populations in all possible habitats, or everywhere the species can be established or reestablished.

At the time of listing, habitat losses were documented but the threats to humpback chub were poorly understood and distribution and abundance of the species were not well known. The decline of the species was probably a combination of threats, including direct loss of habitat and changes in flow and temperature. In addition, interaction with nonnative fish may have had a decimating effect in waters not affected by dams. Humpback chub is adapted to life in deep, canyon-bound reaches of the Green, Colorado, and Little Colorado Rivers.

Recovery of humpback chub is considered basinwide with the basin being separated into an upper basin and lower basin recovery unit. The analysis above of the demographic criteria has shown: 1 of the 6 downlisting demographic sub-criteria has been met, 2 have been partially met, and 3 have not been met (TABLE 1). From the above list of recovery factor downlisting criteria in the upper basin: 2 of the 10 have been met; 4 have been partially met, and 4 have not been met. In the lower basin: 2 of the 12 downlisting recovery factor criteria

have been met; 6 have been partially met, and 4 have not been met. Although the category “has been partially met” is identified, this is only to reflect that some progress is being made on that particular criterion. Since the majority of demographic (5 out of 6) and recovery factor downlisting criteria (4 out of 22) have not been met, no change in the endangered status of humpback chub is recommended. The definition of endangered applies here until the demographic criteria are met and the threats minimized or removed.

TABLE 1. Summary of the downlisting demographic and recovery factor criteria by recovery unit basin and a determination if the criteria have been met, partially met or not met for analyzing whether humpback chub can be downlisted.

CRITERIA FOR DOWNLISTING	HAS BEEN MET	HAS BEEN PARTIALLY MET	HAS NOT BEEN MET
Demographic			
Upper Colorado River Subbasin			1a, 1b, 2
Lower Colorado River Subbasin	1c	1a, 1b	
Upper Basin Recovery Factors			
Recovery Factor A		1	
Recovery Factor B	2		
Recovery Factor C	4	5	3
Recovery Factor D		6	7
Recovery Factor E		10	8, 9
Lower Basin Recovery Factors			
Recovery Factor A	1, 3	2	
Recovery Factor B	4		
Recovery Factor C	5	7, 8	6
Recovery Factor D	9		10
Recovery Factor E			11, 12

3.0 RESULTS

3.1 Recommended Classification

X No change is needed

3.2 New Recovery Priority Number: We do not recommend a change in the Recovery Priority Number. The degree of threat is high, with a high degree of recovery potential representing a species, which falls under the 2C category for a recovery priority number according to the “Endangered and threatened species listing and recovery priority guidance” (48 FR 43098).

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

The Upper Colorado River Endangered Fish Recovery Program along with the Glen Canyon Dam Adaptive Management Program (a conservation program to restore the Grand Canyon ecosystem) continue working to meet the recovery factor criteria to minimize or remove threats to the humpback chub in their respective recovery units. These programs develop annual work plans through adaptive management (Recovery Implementation Program Recovery Action Plan and Annual Budget and Work Plan, respectively), to minimize and remove threats to the humpback chub and thus achieve the recovery factor criteria. By meeting these recovery factor criteria, the demographics of the species should improve. The improvement in demographics is evidenced by the lower basin having 75% (8 out of 12) of the recovery factor criteria met or partially met, along with an increasing trend in adult abundance. In particular, the nonnative fish control actions that have been taken and the increased water temperatures as a result of lower Lake Powell levels have improved the status of the species in the lower basin recovery unit.

The recovery goals are currently being revised based on new information since their publication in 2002. Subsequently, the recovery plans will be revised.

Uncertainty surrounding the effects of climate change to the humpback chub should be considered for each of the threats as those impacts are realized. For example, the potential for alteration of flows in the basin as a result of climate change should at least be mentioned in the recovery goals. Climate change could have large impacts on the basin’s aquatic ecosystem, resulting in (but not limited to):

- Change in the timing of peak flows due to altered snowmelt patterns;
- Change in runoff peaks due to increased inter-annual variation in snowpack formation; and
- Change in water temperatures due to altered air temperatures.

Not only would climate change affect the ecology of the species because of the factors listed above, but it also would greatly affect the management of the programs through changes in politics and economics, such as:

- Greater evaporation losses in the larger reservoirs may reduce flexibility of operations; and
- Drier conditions in the basin may cause irrigators to call on their water rights more often or request more water rights.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Humpback chub*

Current Classification:

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
 Uplist to Endangered
 Delist
 No change needed

Review Conducted By: Upper Colorado River Endangered Fish Recovery Program Office

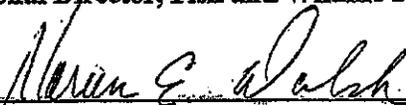
FIELD OFFICE APPROVAL:

Thomas E. Chart, Program Director, Fish and Wildlife Service
Upper Colorado River Endangered Fish Recovery Program Office

Approve  Date 1/22/2011
Thomas E. Chart, Program Director

REGIONAL OFFICE APPROVAL:

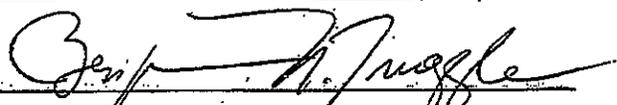
Steve Guertin, Regional Director, Mountain-Prairie Region (6)
Lead Regional Director, Fish and Wildlife Service

Approve  Date 2/15/2011

OTHER REGIONAL OFFICES (within range of species)

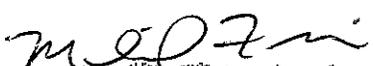
Dr. Benjamin Tuggle, Regional Director, Southwest Region (2)
Cooperating Regional Director, Fish and Wildlife Service

Concur Do Not Concur

Signature  Date 7/22/11

Michael Fris, Assistant Regional Director, Pacific Southwest Region (8)
Cooperating Assistant Regional Director, Ecological Services

Concur Do Not Concur

Signature  Date 8/12/11