Status and Management Strategy for Humpback Chub in Grand Canyon

Report of the Humpback Chub Ad Hoc Committee to the
Adaptive Management Work Group of the
Glen Canyon Dam Adaptive Management Program

April 29, 2003

1.0 INTRODUCTION

1.1 Background

The Grand Canyon Monitoring and Research Center (GCMRC) reported a continuing decline in the Grand Canyon population of humpback chub (*Gila cypha*) in 2002. Cause for the decline is unknown, but stock synthesis models indicate a lower recruitment for most of the previous 10 years. On February 5, 2003, a motion was made that: *"The Adaptive Management Work Group is very concerned about the status of humpback chub and other native fish in the Colorado River Ecosystem. We recommend that the Secretary place a high priority on protecting and enhancing native fish populations in the Colorado River ecosystem…"*

On January 29, 2003, the Glen Canyon Dam Adaptive Management Work Group (AMWG) identified the Humpback Chub Ad Hoc Committee and directed that the committee "… will consider actions to implement a comprehensive research and management program for the HBC (humpback chub) … (and make) a recommendation to the AMWG …." The motion that was approved further indicated that the Ad Hoc Committee would consist of AMWG, TWG (Technical Work Group), and GCMRC, and science advisors which would again develop recommendations and report to AMWG at a special session. Meetings of the Ad Hoc Committee were held February 12, March 12, April 1, 21, and 22, 2003. Conference calls were held April 16 and 25, 2003. Committee members are listed in Table A-1.

1.2 Charge to the Ad Hoc Committee

The Humpback Chub Ad Hoc Committee will consider actions to implement a comprehensive research and management program for the humpback chub. They will meet in preparation for making a recommendation to the AMWG.

2.0 STATUS OF HUMPBACK CHUB IN THE COLORADO RIVER BASIN

2.1 Status of Humpback Chub Population Grand Canyon and Cause for Decline

An overview of the status and trend of the Grand Canyon population of humpback chub was prepared by GCMRC for the AMWG on April 22, 2003. That report stated that recent analyses of historical data on humpback chub in Grand Canyon have caused

considerable concern, because of uncertainties about the current size of the population and the strong probability that the population has been declining steadily for at least a decade. The most recent assessment model indicates that the spawning population is probably somewhere between 2,000 and 4,000 age-4 and older fish. A different estimate, using the "Supertag" assessment model, resulted in an estimate of 1,100-1,200 adults in 2001. Estimates of the LCR spawning population for 1992-1995 were 2,000-4,700 adults (Douglas and Marsh 1996). The assessment model also determined a lower level of recruitment (i.e., fish reaching maturity at age-4) over the last decade. The GCMRC report also stated that if recruitment continues to be stable at an average of the 1995-98 rate, the population will likely stabilize at 1,000-3,000 adults.

2.2 Status of Humpback Chub Populations in the Upper Colorado River Basin

There are currently six self-sustaining populations of humpback chub in the Colorado River Basin, including one in Grand Canyon and five in the upper basin. A report from the Director's Office of the Upper Colorado River Recovery Program (UCRRP) (April 2003) provided a status of population estimates with numbers that reflect the best currently available point estimates of the mean number of adults.

The six populations were described as follows (sources need to be documented for these estimates):

1. Yampa Canyon: Population small, about 400, based on model using 1998-2000 data. Effort is being expanded in 2003 to develop a more precise estimate.
2. Desolation/Gray Canyon: Estimates from 2001 and 2002 were 1,500 and 1,700, respectively.
3. Black Rocks Canyon: About 1,000.
4. Westwater Canyon: 2,200-4,700 based on 3 sampling sites in 1998-2000; effort is being expanded in 2003.
5. Cataract Canyon: About 500; a mark-recapture effort will be investigated in 2003 (this effort was scheduled to begin in 2002 but was postponed due to low flows).
6. Grand Canyon: Between 2,000 and 4000. Efforts are underway to improve the precision of this estimate.

Recovery goals exist for the humpback chub in the Colorado River Basin, and include all six populations (U.S. Fish and Wildlife Service 2002). The Recovery Goals provide guidance on recovery of the species, basin-wide, and identify site-specific management actions, and objective, measurable criteria for achieving recovery. The Recovery Goals identify actions necessary to conserve and recover the Grand Canyon population of humpback chub, as well as the role of the Grand Canyon population in recovery of the species.

In regard to developing proposals, such as those attached to this report, a coordinated effort in regard to developing broad nonnative fish stocking procedures; the

UCRRP developed procedures in the mid-90's with goals potentially similar to these potential needs in mind. Also, a Recovery goal that is not identified in any of the current attached proposed projects is under Factor D – Adequate regulatory mechanisms: #9. Mechanisms determined for legal protection of adequate habitat in mainstem Colorado River through the Grand Canyon and the Little Colorado River. This may be determined later, and much of it is probably already under Federal lands or could be included in future conservation plans that also need to be developed under Factor D.

2.3 Programs in the Colorado River Basin that Contribute to Humpback Chub Conservation

The Glen Canyon Dam Adaptive Management Program (GCDAMP). The GCDAMP is a conservation program that was established by the Secretary of the Interior in 1996 following the Record of Decision regarding the Environmental Impact Statement regarding operation of Glen Canyon Dam (1995). The Adaptive Management Work Group is an approved Federal Advisory Committee Act committee to provide recommendations to the Secretary of the Interior regarding operation of Glen Canyon Dam and other measures to protect and/or enhance the Colorado River Ecosystem through Grand Canyon (i.e. mainstem Colorado River and its tributaries from Glen Canyon Dam downstream to Lake Mead National Recreation Area). The GCDAMP consists of a diverse group of stakeholders, including State and Federal agencies, water users, energy distributors, environmental groups, recreation interests, and American Indian tribes, that direct coordinated scientific studies conducted by the GCMRC of the U.S. Geological Survey. The GCDAMP addresses the elements of the EIS on the operation of Glen Canyon Dam as well as the reasonable and prudent alternatives contained in a jeopardy biological opinion for the humpback chub and razorback sucker in Grand Canyon. This adaptive management program takes findings of the GCMRC as information for dam reoperations and conservation of the endangered fishes.

Upper Colorado River Recovery Program (UCRRP): The UCRRP is a recovery program that was initiated under a Cooperative Agreement signed by the Secretary of the Interior on January 22, 1988, as a coordinated effort of State and Federal agencies, water users, energy distributors, and environmental groups to recover the four endangered fishes in the upper basin downstream to Glen Canyon Dam, excluding the San Juan River (U.S. Department of the Interior 1987; Wydoski and Hamill 1991; Evans 1993). It functions under the general principles of adaptive management and consists of seven program elements, including instream flow protection; habitat restoration; reduction of nonnative fish and sportfish impacts; propagation and genetics management, research, monitoring, and data management; information and education; and program management. As stated in the governing document of the UCRRP (U.S. Department of the Interior 1987), the goal is to recover the endangered fishes while water development proceeds in compliance with State and Federal laws, including the Endangered Species Act (ESA), State water law, interstate compacts, and Federal trust responsibilities to American Indian tribes. Funding for the UCRRP will continue through 2011 under legislation passed in October 2000 (P.L. 106-392); Congress will review the UCRRP to determine if funding should be authorized beyond 2011.

Recovery Implementation Plan Scientific Workgroup (RIPSWG): In 1999, the U.S. Fish and Wildlife Service (USFWS), Region 2, convened a group of biologists, formally named the Scientific Workgroup, to develop a Recovery Implementation Plan for the native fishes of the Lower Colorado River Basin from Glen Canyon Dam to the Gulf of California (Mexico). Primary emphasis was to be placed on recovery of bonytail, humpback chub, Colorado pikeminnow, and razorback sucker. The RIPSWG met regularly initially but then less frequently in subsequent years. The RIPSWG has begun more frequent meetings and this summer is scheduled to submit a draft management plan for the Lower Colorado River Basin to the USFWS Regional Director for the Southwest Region. A Comprehensive Action Plan for humpback chub in Grand Canyon would likely be wholly incorporated into the management plan that the RIPSWG is at this time developing.

Lower Colorado River Multi-Species Conservation Program (LCR-MSCP): This LCR-MSCP was established in response to compliance needs associated with water and power entities in Arizona, California and Nevada. The LCR-MSCP plans to work toward the recovery of listed species, including the razorback sucker, bonytail, and humpback chub, while accommodating current water diversions and power production. In return for implementing this program, the LCR-MSCP stakeholders are seeking incidental take authorization under the ESA from the USFWS to allow for implementation of covered activities and conservation measures over the next 50 years. The planning area encompasses Lake Mead to its full pool elevation of 1229 feet, which at this elevation, the inflow area of the Colorado River is influenced by the reservoir as far upstream as Separation Rapids (River Mile [RM] 239.5) (this is about 37 river miles upstream of Grand Wash Cliffs [RM 276.5], the western boundary of the AMWG program in the Grand Canyon and thus creates a geographic overlap]. The LCR-MSCP has tentatively identified the need to support the AMWG program for humpback chub as follows: "Provide $10,000/year for 50 years (total: $500,000) to the Glen Canyon Dam Adaptive Management Workgroup to support implementation of planned, but unfunded, species conservation measures and, as appropriate, to fund species conservation measures in the lower canyon of the Colorado River upstream of Lake Mead."

3.0 THREATS TO HUMPBACK CHUB

Threats to humpback chub in Grand Canyon were identified by the Ad Hoc Committee, and correspond to threats identified in the Humpback Chub Recovery Goals by listing factor (U.S. Fish and Wildlife Service 2002). The following summarizes past and/or current threats to the humpback chub in Grand Canyon by listing factor:

Listing Factor A.—The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

1. Habitat affected by streamflow regulation
    - extreme daily flow fluctuations destabilize habitat, especially for young fish
2. Flows necessary for all life stages

- high summer/fall base flows inundate juvenile rearing habitat

3. Cold water temperature
    - cold hypolimnetic releases inhibit egg hatching and larval survival
    - cause thermal shock of fish <50 mm TL descending from seasonally warmed tributaries
    - enhance reproduction/survival of trout, predators of humpback chub

Listing Factor B.─Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

4. Handling for scientific studies
    - repeated capture and marking (PIT tagging) may lead to delayed mortality

Listing Factor C.─Disease or Predation

5. Asian tapeworm, *Lernaea* anchor copepod
    - Asian tapeworm currently at a high incidence of infestation in the Little Colorado River (LCR) (about 90% of large juveniles and adults are infested); require cyclopoid copepod as intermediate host, require 20 C to mature and reproduce; severe infestation can impact gut, lead to death
    - *Lernaea* anchor copepod; require 20°C to mature and reproduce; usually does not lead to death, although anchor wounds may fester and infect
    - Note: whirling disease and intestinal nematodes are not found in humpback chub, but could become problematic for trout in the tailwater fishery with water temperatures of about 18°C +
6. Escape of nonnative fish into the Colorado River and its tributaries in Grand Canyon
    - Numerous potential predators and competitors of humpback chub occupy various tributaries and can invade Grand Canyon, given suitable conditions
7. Predation by nonnative warm water fish species
    - Channel catfish and black bullhead are known predators of humpback chub
    - Common carp may consume large numbers of incubating eggs
    - Red shiners and fathead minnows compete with young native fish in nursery habitats
8. Predation by nonnative cold water fish species
    - Brown trout and rainbow trout are known predators of humpback chub

Listing Factor D.─The Inadequacy of Existing Regulatory Mechanisms

9. Protection of habitat and flow
    - Long-term legal protection of habitat and flow is necessary for long-term conservation of humpback chub
10. Need for Conservation Plans

- Recovery Goals call for Conservation Plans to be implemented at the time of delisting to assure continued and long-term conservation of humpback chub

Listing Factor E.─Other Natural or Manmade Factors Affecting Its Continued Existence

11. Non-source pollutants in the LCR watershed
    - A number of potential sources of hazardous materials exist in the LCR watershed. Collectively, these affect water quality in occupied and critical habitat in the LCR and could affect reproduction and survival of all life stages of humpback chub
12. Hazardous materials spills at the Cameron Bridges
    - A spill from an overturned tanker truck at one of the Cameron Bridges could become transported downstream to occupied and critical habitat, resulting in possible losses of all ages of humpback chub at the only spawning location for the species in Grand Canyon

4.0 STRATEGIES FOR IMPROVING CONDITIONS FOR HUMPBACK CHUB

The fundamental strategy for improving conditions for humpback chub in Grand Canyon is to eliminate or minimize threats to the species. Threats to the species and corresponding recommended management actions are provided in Table 1.

Of the 12 threats previously identified, addressing some requires more immediate attention than others. The immediate threats to humpback chub in Grand Canyon and current actions are linked to the following:

- Flow regimes from dam releases: The effects of dam releases are not fully understood, but a program of experimental flows continues to gather information under adaptive management.

- Water temperature: Effects of cold water releases are known to inhibit mainstem reproduction, swimming ability, and growth of humpback chub. A risk assessment is currently being conducted by Bureau of Reclamation for a temperature control device on Glen Canyon Dam. If environmental compliance proceeds on schedule, a temperature control device (TCD) could be in place by spring of 2007 to provide a tool for warming downstream releases. Meantime, some aspects of experimental flows (i.e., low steady releases) provide for some longitudinal and near-shore warming that may benefit survival and growth of humpback chub.

- Predators: Predator control was implemented in 2003 for rainbow trout and brown trout in the mainstem near the LCR inflow and for brown trout in Bright Angel Creek. These efforts should be

continued, since predation is perceived as a major threat to humpback chub in Grand Canyon.

- Hazardous materials spills: The risk of hazardous materials spills continues to loom over the LCR. Immediate actions are needed to implement a plan to minimize the risk and for cleanup.

- Parasites: Asian tapeworms and *Lernaea* anchor copepods are the two parasites of most concern for humpback chub; investigations should continue to assess extent of infestation, risk of warmer water from a TCD, and possibly treatment for reducing infestation to the population.

Table 1. Threats to humpback chub in Grand Canyon and corresponding recommended comprehensive management actions.

Threat	Management Action	Time Line for Implementation
1. Habitat affected by streamflow regulation	Program of experimental flows	On-going
2. Flows necessary for all life stages	Program of experimental flows	On-going
3. Cold water temperature	Temperature Control Device	Risk Assessment FY 2003 NEPA FY 2005 Construction FY2006-07
4. Handling for scientific studies	Identify redundancy in sampling	Evaluation in FY 2004
5. Asian tapeworm, *Lernaea* anchor copepod	Survey population; identify minimization strategies	FY 2005
6. Escape of nonnative fish into the Colorado River and its tributaries	Invasive Species Management Plan	FY 2006
7. Predation by nonnative warm water fish species	Removal of nonnative fish from the LCR	FY 2004-2007
8. Predation by nonnative cold water fish species	Mechanical removal of trout from mainstem	FY 2003-2007
9. Protection of habitat and flow		
10. Need for Conservation Plans	Develop comprehensive plan	FY 2007
11. Non-source pollutants in the LCR watershed	Pollution Control Plan for LCR	FY 2005
12. Hazardous materials spills at the Cameron Bridges	Emergency Response Plan for LCR Bridges	FY 2005

5.0 SPECIFIC OPTIONS AND ACTIONS TO ACCOMPLISH STRATEGY

The most significant management actions for humpback chub in Grand Canyon are construction and operation of a TCD and nonnative fish control. If constructed, the TCD would minimize the effect of cold water temperature that continues to inhibit mainstem spawning, survival, and growth of humpback chub. Nonnative fish control would reduce predation and competion by other nonnative fish species. Important management actions also include flow management, sediment/turbidity augmentation, and parasite control.

Anticipated positive and negative impacts of a TCD need to be identified (e.g., reproductive success by humpback chub in mainstem, enhanced survival and growth of young, expansion of nonnative fish populations, invasion of new nonnative species, expanded infestation of Asian tapeworm and *Lernaea* anchor copepods). Additionally, potential impacts of warmed releases on other resources need to be identified and monitored, if necessary. Monitoring must be sufficient and sensitive enough to detect anticipated, as well as unexpected responses.

The ad hoc group developed a number of proposed projects to address threats to humpback chub, included as Appendix B, and a timeline chart, included as Appendix C. Potential completion of a TCD on Glen Canyon Dam in spring 2007 would create a major landmark in terms of management actions, research, and monitoring. Management actions that need to be implemented near term include:

1. Expand nonnative control efforts to tributaries and continue/expand mainstem efforts (pre-requisite to #3)
    a. Bright Angel, Shinumo, Paria River
    b. Continue mainstem electrofishing (post-2004)
    c. These efforts reduce contribution of predators to the mainstem and prepare tributaries for translocation of young humpback chub from the LCR

2. Get broodstock humpback chub into captivity to be ready to effectively reproduce fish; assess need for broodstock development for research, refugia, and supplementation.
    a. resolve genetics question: are Willow Beach fish suitable and do they represent wild population genetics? (pre-requisite to #2 – 2005)
    b. evaluate Willow Beach humpback chub genetics (pre-requisite to #2C – 2003)
    c. start producing humpback chub at Willow Beach for research purposes (2004)
    d. evaluate feasibility of using grow-out facility using wild caught young-of-year humpback chub

3. Expand range of existing humpback chub population to other Grand Canyon tributaries; develop and implement strategy for creation of refugia as a short-term safeguard until the range of humpback chub is expanded into the mainstem through temperature, flows, and nonnative control.
   a. coordinate with tribal interests
4. Use dam operations to disadvantage nonnative fish and assist native fish
   a. continue winter fluctuations to constrain trout recruitment (post-2004; assess 2003 results to improve effeciveness of flow)
   b. determine time of year when humpback chub leave the LCR for the mainstem (2004?; need to assess backwater/nearshore fish abundance during monitoring)
   c. April-May passive discharge of LCR humpback chub larval fish
   d. determine effect of potential warming on nonnative fish

5. Develop TCD experimental operations plan (2003)
   a. part of TCD NEPA compliance document

6. Develop LCR/mainstem population estimates of humpback chub

7. Manage turbidity sufficient to stress nonnative salmonids
   a. evaluate feasibility of turbidity experiment (2003)

8. Address impact of parasites
   a. pre-TCD assessment of infestation (threat assessment; refer to Rebecca Cole presentation)
   b. potential treatment of fish

9. Implement spill management prevention at Cameron Bridge

6.0 IMPLICATIONS TO OTHER RESOURCES FROM IMPLEMENTATION

Implementation of management actions to benefit the humpback chub may impact other resources in Grand Canyon. These impacts may occur as a result of redirected efforts and funding of humpback chub research and monitoring. Implementation of these management actions must be done consistent with the mission and research plan of the GCDAMP. Management actions recommended in this report are intended to complement and support the mission of GCDAMP, but it is also recognized that implementing a part or all of these management actions will likely require additional funding. The AMWG is urged to take necessary actions to insure implementation of those management actions identified in this report as important.

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APPENDIX A:

Table A-1. Members and attendees of the Humpback Chub Ad Hoc Committee.

Name	Affiliation	Address
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APPENDIX B: List of Proposals