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In Reply Refer To:
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November 9, 2010

Memorandum

To: Regional Director, Bureau of Reclamation, Salt Lake City, Utah

From: Field Supervisor

Subject: Reinitiation of the 2009 Biological Opinion on the Continued Operations of Glen Canyon Dam without Mechanical Removal of Nonnative Fish in 2010 from the Colorado River, Grand Canyon, Arizona

Thank you for your request for formal consultation with the U.S. Fish and Wildlife Service (FWS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). This reinitiated consultation has resulted after meeting with Native American communities and with the Glen Canyon Dam Adaptive Management Program (GCDAMP) members. Due to cultural and religious concerns regarding the taking of life associated with mechanical removal of nonnative fishes as a conservation measure, it was decided that the two nonnative removal trips scheduled for May and June 2010 would be cancelled. This resulted in a modification to your proposed action and on March 5, 2010, you sent us a memorandum asking us to reinitiate consultation on the October 2009 Supplement to the Biological Opinion (2009 Opinion). We agreed to reinitiate formal consultation pending a final Biological Assessment. We received your April 30, 2010 Biological Assessment on May 3, 2010.

At issue are impacts that may result from the cancellation of two nonnative removal trips in a 9.4 mile reach of the Colorado River and the associated the continued operation of Glen Canyon Dam (GCD), Coconino County, Arizona. The proposed action also includes the continuation of other conservation measures outlined in the 2008 Opinion and commitments made in the Glen Canyon Dam Adaptive Management Program Biennial Budget and Work Plan – Fiscal Years 2010-2011. The proposed action may affect the humpback chub (*Gila cypha*) and its critical habitat and critical habitat for the razorback sucker (*Xyrauchen texanus*). Although razorback sucker critical habitat was not addressed in the formal consultation portion of the 2008 Opinion (see Consultation History section), it is addressed here, at Reclamation's request. All other effect determinations remain the same: razorback sucker, Kanab ambersnail (*Oxyloma haydeni kanabensis*) and the southwestern willow flycatcher (*Empidonax trailli extimus*). No additional effects are anticipated to these three species, and they are not addressed further.

This biological opinion is based on information provided in the April 30, 2010, Biological Assessment, the August 2009 GCD Adaptive Management Program Biennial Budget and Work Plan – Fiscal Years 2010-2011, telephone conversations and meetings between our staffs, and other sources of information. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, effects of the action, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

In keeping with our trust responsibilities to American Indian Tribes, we have provided for participation of the Bureau of Indian Affairs in this consultation and, by copy of this biological opinion, are notifying the following Tribes of its completion: the Chemehuevi Indian Tribe, Havasupai Tribe, Hopi Tribe, Hualapai Tribe, Kaibab Band of Paiute Indians, Navajo Nation, Pueblo of Zuni (Zuni), and San Juan Southern Paiute Tribe. We also encourage you to coordinate with the Arizona Game and Fish Department (AGFD).

Consultation History

- February 27, 2008 - We issued a biological opinion on the operation of experimental flows from Glen Canyon Dam for the period 2008-2012 (2008 Opinion). Included in the biological opinion were conservation measures, including nonnative fish control, which originated in the 2007 Final Biological Opinion for the Proposed Adoption of Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead.
- April 29, 2009 - In association with a response from the Federation of Fly Fishers (Mark Steffen) regarding concerns from people about poisoning and electrocuting nonnative fish, the Zuni (Kurt Dongoske) recommended to the GCD Adaptive Management Work Group (AMWG) that as the Grand Canyon Monitoring and Research Center (GCMRC) develops fish control, the GCMRC also consult with the Tribes. The Zuni (Kurt Dongoske) further stated (June 22, 2009) to the GCD Technical Work Group (TWG) that they would prefer to see both trips of the 2010 mechanical removal project not done because of their objection to the taking of life in the location where the removal takes place, and wanted the funding to be reallocated to other, more useful programs.
- May 26, 2009 - The District Court of Arizona, in response to a lawsuit brought by the Grand Canyon Trust, ordered the FWS to reevaluate the conclusion in the 2008 Opinion that the Modified Low Fluctuating Flow (MLFF) does not violate the Act. The Court Ordered the FWS to provide an analysis and a reasoned basis for its conclusions in the 2008 Opinion and to include an analysis of how MLFF affects critical habitat and the functionality of critical habitat for recovery purposes.

- June 30, 2009 - The Zuni, by letter (from Governor Norman Cooyate) to Bureau of Reclamation (Reclamation) (Regional Director Larry Walkoviak), stated that the Zuni had previously expressed concerns about planned mechanical removal actions for 2010 and 2011 because the Zuni objects to the killing of thousands of rainbow trout (*Oncorhynchus mykiss*) at the LCR and Colorado River confluence. This letter further states that because the Zuni's concerns were not given due deliberation by the AMWG or TWG, that the Zuni was submitting to Reclamation a detailed account of their concerns.
- July 6, 2009 - The Zuni, by letters (from Governor Cooyate) to the GCMRC (Chief John Hamill) and FWS (Lower Colorado River Coordinator Sam Spiller), stated similar concerns as provided in their June 30, 2009 letter.
- August 4, 2009 - Reclamation, by letter (from Anamarie Gold for Regional Director Walkoviak) to the Zuni (Governor Cooyate), stated that Reclamation, FWS, and GCMRC take the concerns of the Zuni very seriously, would like to arrange a government-to-government consultation regarding proposed mechanical removal of nonnative fish from the Colorado River. Zuni further requested that the three agencies acknowledge that the confluence of the Colorado and Little Colorado Rivers is a sacred site to the Zuni as defined by Executive Order 13007. Finally, they stated that the location where the mechanical removal is proposed is potentially eligible for the National Register of Historic Places for its associative values to the Zuni.
- September 15, 2009 - A consultation meeting occurred between the Zuni and Department of the Interior (Assistant Secretary's Office for Water and Science, Reclamation, GCMRC, FWS, and National Park Service). The consultation meeting generally produced the following: explanation of Zuni's concerns and agencies' respective actions and concerns; agreement to develop three analyses that would address questions regarding concerns expressed by the Zuni. These analyses would be provided to support further resolution of the concerns; and a stated willingness to continue to meet to mutually resolve these concerns.
- October 29, 2009 - A revised biological opinion was issued in response to the May 2009 order (2009 Supplemental Opinion).
- January 8, 2010 - The Assistant Secretary's Office for Water and Science, by email (from Deputy Assistant Secretary Deanna Archuleta) to the Zuni (Governor Cooyate and other Zuni representatives), sent three analyses in response to questions raised at the September 15, 2009 meeting for use in discussions on January 13, 2010, and thereafter in future government-to-government consultation. These analyses contained information regarding scientific investigations on the relationship between native and nonnative fish to provide a foundation for nonnative fish control developed by the GCMRC, and options developed by the FWS for moving the area of mechanical removal to other locations along the Colorado River.
- March 5, 2010 - Reclamation requested reinitiation of formal consultation to accommodate a modification of the 5-year experimental nonnative fish removal efforts planned for May and June 2010.

- June 29, 2010 - The District Court of Arizona ruled that the 2009 Supplemental Opinion adequately explained the FWS conclusion that the proposed action is not likely to neither jeopardize the humpback chub nor adversely modify its critical habitat. However, the incidental take portion of the 2009 Supplemental Opinion was remanded back to the FWS, and addressed in separate documentation.
- August 5, 2010 – Assistant Secretary Anne Castle and Regional Director Larry Walkoviak met with Governor Coeoyate and the Pueblo of Zuni Tribal Council. The consultation meeting reviewed Zuni’s concerns, including additional concerns about the consultation process, and agreement to continue to develop analyses that would address questions regarding concerns expressed by the Zuni. All parties expressed a continued willingness to continue to meet to mutually resolve these concerns.
- September 1, 2010 - In response to the June 29 District Court of Arizona order remanding the incidental take statement to FWS, a revised incidental take statement and biological opinion were issued (Reissuance of the 2009 Supplemental Opinion).
- October 14, 2010 – A draft biological opinion evaluating the cancellation of nonnative mechanical removal in 2010 was sent to Reclamation for review.
- November 1, 2010 – Reclamation responded to our draft biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action for this reinitiation of formal consultation lasts for a 13-month period of Glen Canyon Dam operations under the MLFF procedures described in the 2008 and 2009 Opinions. Some of the conservation measures found in those opinions have been modified. The modified primary change and the focus of this consultation is the cancellation of two nonnative removal trips scheduled for May and June 2010. This reinitiated consultation only evaluates the dam operations and associated conservation measures between March 5, 2010 and April 30, 2011 with an emphasis on the cancellation of mechanical removal of nonnative fishes. All other aspects of the proposed action remain the same as described in the 2009 Supplemental opinion described above. Conservation measures such as parasite monitoring, potential razorback sucker augmentation, and the monthly flow transition study as described in the 2008 and 2009 Opinions, will likely not occur during this 13-month period but is planned for the future. Other conservation measures, such as the Nearshore Ecology Study and the Fall Steady Flow Plan are proceeding. Because the high flow test conservation measure already occurred in March of 2008, it is not addressed in this consultation. The flows for this consultation, which have been addressed in earlier biological opinions, will occur as follows: flows from March – August 2010 will occur under the MLFF strategy, September-October 2010 will consist of steady flows, and November 2010 through April 30, 2011 will return to MLFF which is the preferred alternative as described in the 1996 Record of Decision on Glen Canyon Dam Operations.

Ongoing operations of GCD includes the GCDAMP which assesses the effects of current operations on downstream resources and uses the results to develop recommendations for

modifying dam operations and other resource management and conservation actions. The GCDAMP also provides for long-term monitoring and research activities to evaluate the operations of GCD and other management actions. Many of the conservation measures listed below have been ongoing through the GCDAMP at various levels. These conservation measures are designed to, and have resulted in, conservation benefits to downstream resources, including the humpback chub. The following conservation measures are expected to occur during the 13-month proposed action.

Conservation Measures

Humpback Chub Consultation Trigger – In the 2008 and 2009 Biological Opinions, Reclamation and FWS agreed to define a reinitiation trigger for humpback chub that would be exceeded if the population of adult humpback chub (≥ 200 millimeter [mm] total length [TL]) in Grand Canyon declines significantly, or, if in any single year, based on the age-structured mark recapture model (ASMR; Coggins 2007), the population drops below 3,500 adult fish within the 95 percent confidence interval. However, in the September 1, 2010 Reissuance of the 2009 Supplemental Opinion, the FWS adopted the reinitiation trigger to a more conservative 6,000 adult humpback chub because that was the number of adult humpback chub estimated in the action area when we received the biological assessment for this project. Conversely, if the population of humpback chub expands significantly, FWS and Reclamation will consider the potential for reinitiation of consultation to determine if steady flows continue to be necessary. Standard reinitiation triggers apply as found in 50 CFR 402.14.

Comprehensive Plan for the Management and Conservation of Humpback Chub in Grand Canyon – Reclamation has been a primary contributor to the development of the GCDAMP's Comprehensive Plan for the Management and Conservation of Humpback Chub in Grand Canyon. Reclamation has committed to continue to work with GCDAMP cooperators to develop a comprehensive approach to management of humpback chub. Reclamation has committed to specific conservation measures, but will also consider funding and implementing other actions not identified here.

Humpback Chub Translocation – In coordination with other Department of the Interior (DOI) GCDAMP participants and through the GCDAMP, Reclamation is assisting the National Park Service (NPS) and the GCDAMP in funding and implementation of translocation of humpback chub into tributaries of the Colorado River in Marble and Grand Canyons. Nonnative control in these tributaries is an essential precursor to translocation, so Reclamation is helping to fund control of both cold- and warm-water nonnative fish in tributaries, as well as efforts to translocate humpback chub into these tributaries. Havasu, Shinumo, and Bright Angel creeks are initially targeted for translocation, although other tributaries may be considered. Reclamation has worked with FWS, NPS, and other cooperators to develop translocation plans for each of these streams, utilizing existing information available such as reports from SWCA and Grand Canyon Wildlands (2009) and Valdez et al. (2000). These plans will consider and utilize genetic assessments, identify legal requirements, jurisdictional issues, and methods, and assess needs for nonnative control, monitoring and other logistics, as well as an implementation schedule, funding sources, and permitting. For the 5- year period of the proposed action, 2008-2012, Reclamation and the AMP will continue to monitor humpback chub in the reach of the Little Colorado River above Chute Falls, and will fund additional translocations above Chute Falls as deemed necessary by FWS.

Nonnative Fish Control – There are no plans to implement this conservation measure during the 13-month period of this project, but Reclamation continues to coordinate with Native American tribes and other GCDAMP members to address concerns about future nonnative fish control efforts.

Humpback Chub Nearshore Ecology Study – In coordination with other DOI GCDAMP participants and through the GCDAMP, Reclamation has implemented a Nearshore Ecology Study that will relate river flow variables to ecological attributes of nearshore habitats (velocity, depth, temperature, productivity, etc.) and the relative importance of such habitat conditions to important life stages of native and nonnative fishes. This study will incorporate planned science activities for evaluating the high flow test on nearshore habitats as well as a 5-year period of steady flow releases in September and October. A research plan has been completed and the study is underway.

Monthly Flow Transition Study – There are no plans to implement this conservation measure during the life of this project, but longer-term studies are planned as part of the Nearshore Ecology Study and Fall Steady Flow Plan.

Humpback Chub Translocation and Refuge – In the Shortage Guidelines biological opinion, Reclamation committed to assist FWS in maintenance of a humpback chub refuge population at a Federal hatchery or other appropriate facility by providing funding to assist in annual maintenance. In case of a catastrophic loss of the Grand Canyon population of humpback chub, a humpback chub refuge will provide a permanent source of sufficient numbers of genetically representative stock for repatriating the species. This action would also be an important step toward attaining recovery.

Little Colorado River Watershed Planning – Reclamation will continue its efforts to help other stakeholders in the Little Colorado River watershed develop watershed planning efforts. However, no activities are planned under this conservation measure during the consultation period.

Action Area

The action area is the same as described in the 2008 and 2009 Biological Opinions and includes the Colorado River corridor from Glen Canyon Dam in Coconino County, Arizona, downstream to river mile (RM) 235 near Bridge Canyon Rapid. The action affects the aquatic community of the Colorado River, including perennial reaches of major tributaries; however the focus is on the 9.4 mile stretch around the Little Colorado River confluence.

STATUS OF THE SPECIES AND CRITICAL HABITAT

The status of the humpback chub throughout its range remains much the same as in the 2008, 2009, and Reissuance of the 2009 Biological Opinions. We provide a summarized update of the information on the Grand Canyon population of humpback chub in the Environmental Baseline section of this reinitiated Biological Opinion.

There are six populations of humpback chub in the Colorado River basin; five in the upper basin, and one in the lower basin. The status of the five populations of humpback chub located above Glen Canyon Dam in the Upper Colorado River Basin has changed little since the 2009 Opinion.

These populations include three in the Colorado River: at Cataract Canyon, Utah; Black Rocks, Colorado; and Westwater Canyon, Utah; one in the Green River in Desolation and Grey canyons, Utah; and one in the Yampa River in Yampa Canyon in Dinosaur National Monument, Colorado.

As reported in the previous Biological Opinions, mark-recapture methods have been used since the late 1980s to assess trends in adult abundance and recruitment of the LCR aggregation of humpback chub, the primary aggregation constituting the Grand Canyon population, and the only population in the lower Colorado River basin. These estimates indicate that the adult population in the LCR declined through the 1980s, stabilized around 2000 and began to increase, and has been increasing since (Coggins et al. 2006, Coggins 2008a, Coggins and Walters 2009).

Although Coggins and Walters (2009) caution that the age-structured mark recapture model (ASMR) has limited capability to provide abundance estimates, and that the most important finding in their report is that the population trend in humpback chub is increasing, they conclude that “considering a range of assumed natural mortality-rates and magnitude of ageing error, it is unlikely that there are currently less than 6,000 adults or more than 10,000 adults” and specifically estimate that the current adult (age 4 years or more) population is approximately 7,650 fish. This is an increase from the 2006 estimate of 5,300-6,700 fish (Coggins 2008a).

Translocation and monitoring of juvenile humpback chub from near the mouth of the LCR upstream to above Chute Falls was undertaken as a conservation measure beginning with the 2002 Biological Opinion. In 2008, 299 juvenile humpback chub were translocated to this reach, and an additional 194 were moved in 2009. The purposes of the conservation measure are to extend the range of the species upstream in the LCR into reaches previously unoccupied (presumably due to the presence of the waterfalls), to improve the survivorship of juvenile humpback chub by moving juveniles to areas of the LCR with better nursery habitats, and to obtain information on the life history of the species. Van Haverbeke et al. 2010 report that mark-recapture results suggest that most translocated humpback chub eventually descend below Chute Falls. In the summer of 2006, 255 (standard error [SE] = 11) humpback chub greater than 150 mm were estimated to be above Chute Falls. But by summer of 2007 only 76 (SE = 3) in that same size class remained, and by summer of 2008 only 37 (SE = 5) humpback chub \geq 200 mm remained. There was a noted increase in the number of humpback chub in the lower reach immediately below Chute Falls supporting the conclusion that the fish moved below the falls. Humpback chub translocated above the falls also experienced higher growth rates than individuals below the falls.

Humpback Chub Critical Habitat

As described in the 2008 and 2009 Biological Opinions, critical habitat for humpback chub was designated in 1994 (59 FR 13374; U.S. Fish and Wildlife Service 1994). Seven reaches of the Colorado River system were designated for a total river length of 379 miles in the Yampa, Green, Colorado, and Little Colorado rivers in Arizona, Colorado and Utah.

The term “conservation,” as defined in Section 3(3) of the Act, means: “the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary.” Therefore, in the case of critical habitat, conservation represents the areas required to recover a species to the point of delisting (i.e., the species is recovered and is removed from the list of endangered

and threatened species). In this context, critical habitat preserves options for a species' eventual recovery.

In our analysis of the effects of the action on critical habitat, we consider whether the proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we evaluated whether the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species (see p. 4-34, U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998). To determine this, in the 2009 Biological Opinion, we analyzed whether the proposed action will adversely modify any of those physical or biological features that were the basis for determining the habitat to be critical. The physical or biological features that determine critical habitat are known as the primary constituent elements (PCEs). We also evaluated the current condition of all designated critical habitat units, and the PCEs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat units in recovery must also be defined.

Recovery for the humpback chub is defined by the draft FWS Humpback Chub Recovery Goals (U.S. Fish and Wildlife Service 2002a, 2009). Although there have been challenges to the draft recovery goals because they lacked estimates of time and cost for recovery, the courts have not faulted the recovery goals in any other respect. Thus, the FWS and the GCDAMP, and the Upper Colorado River Endangered Fish Recovery Program (the program that addresses conservation of all of the upper Colorado River basin populations of humpback chub) continue to utilize the underlying science in the draft Recovery Goals. We believe the draft Recovery Goals provide measureable recovery criteria because they are based on the best available scientific information, we re-evaluated and updated in 2009, and are structured to attain a balance between reasonably achievable criteria (which include an acceptable level of uncertainty) and ensuring the viability of the species beyond delisting.

We summarize the Recovery Goal demographic criteria for downlisting as follows (population demographics which must be met in order to achieve downlisting):

Upper basin recovery unit

Each of the five self-sustaining populations is maintained over a 5-year period, starting with the first point estimate acceptable to the FWS, such that:

- the trend in adult (age 4+; ≥ 200 mm TL) point estimates does not decline significantly, and
- mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
- One of the five 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 Minimum Viable Population [MVP]).

Lower basin recovery unit

The Grand Canyon population is maintained as a core over a 5-year period, starting with the first point estimate acceptable to the FWS, such that:

- the trend in adult (age 4+; ≥ 200 mm TL) point estimates does not decline significantly, and

- mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
- each core population point estimate exceeds 2,100 adults (MVP).

The Recovery Goal demographic criteria for delisting are listed below. Demographic criteria for delisting (population demographics in both recovery units must be met in order to achieve delisting)

Upper basin recovery unit

Each of the five self-sustaining populations is maintained over a 3-year period beyond downlisting, starting with the first point estimate acceptable to the FWS, such that:

- the trend in adult (age 4+; ≥ 200 mm TL) point estimates does not decline significantly, and
- mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
- two of the five populations (e.g., Black Rocks/Westwater Canyon and Desolation/Grey Canyons) are maintained as core populations such that each point estimate exceeds 2,100 adults (MVP).

Lower basin recovery unit

The Grand Canyon population is maintained as a core over a 3-year period beyond downlisting, starting with the first point estimate acceptable to the FWS such that:

- the trend in adult (age 4+; ≥ 200 mm TL) point estimates does not decline significantly, and
- mean estimated recruitment of age-3 (150–199 mm TL) naturally produced fish equals or exceeds mean annual adult mortality, and
- each core population point estimate exceeds 2,100 adults (MVP).

The draft Recovery Goals consist of actions to improve habitat and minimize threats rangewide, which will ultimately be measured by the successful status and trend (i.e. the demographic state) of the population of the humpback chub. In the 2009 Supplemental Opinion and the 2009 Reissuance of the 2009 Supplemental Opinion, we evaluated the contribution toward recovery of each critical habitat unit by examining how the PCEs are, or are not, serving to achieve the demographic criteria. In some cases, population-dynamics information is not statistically adequate to evaluate the demographic goal as defined in the draft Recovery Goals. In those cases, we relied on available data to make an informed, although a somewhat less scientifically rigorous evaluation of the PCE/critical habitat unit.

Primary Constituent Elements (PCEs)

In accordance with section 3(5) (A) (i) of the Act and regulations at 50 CFR 424.12, in determining which areas to propose as critical habitat, we are required to base critical habitat determinations on the best scientific data available and to consider those physical and biological features (referred to as primary constituent elements or PCEs) that are essential to the conservation of the species, and that may require special management considerations and protection. These include, but are not limited to: space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing (or development) of

offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. The general PCEs are summarized below.

Water--Consists of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) (W1) that is delivered in sufficient quantity to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species (W2).

Physical Habitat--This includes areas of the Colorado River system that are inhabited by fish or are potentially habitable for use in spawning (P1), nursery (P2), feeding (P3), or corridors between these areas (P4). In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide spawning, nursery, feeding, and rearing habitats, or access to these habitats.

Biological Environment--Food supply (B1), predation (B2), and competition (B3) are important elements of the biological environment and are considered components of this constituent element. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered a normal component of this environment, are out of balance due to introduced fish species in some areas.

The PCEs are all integrally related and must be considered together. For example, the quality of water and quantity of water (PCE W1 and W2) affect the food base (PCE B3) directly because changes in water chemistry, turbidity, temperature, and flow volume all affect the type and quantity of organisms that can occur in the habitat and that are available for food. Likewise, river flows and the river hydrograph have a significant effect on the types of physical habitat available. Changes in flows and sediment loads caused by dams may have affected the quality of nearshore habitats utilized as nursery areas for young humpback chub. Increasingly, the most significant PCE seems to be the biological environment, and in particular PCEs B2 and B3, predation and competition from nonnative fish species.

Razorback Sucker Critical Habitat

Critical habitat was designated in 15 river reaches in the historical range of the razorback sucker on March 21, 1994 (FR 59 13375; U.S. Fish and Wildlife Service 1994). Critical habitat includes portions of the Colorado, Duchesne, Green, Gunnison, San Juan, White, and Yampa rivers in the Upper Colorado River Basin, and the Colorado, Gila, Salt, and Verde rivers in the Lower Colorado River Basin. The general PCEs for razorback sucker are the same as for the humpback chub. These consist of water of an adequate quantity (W2) and of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) (W1) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for the species; physical habitat, that includes areas of the Colorado River system that are inhabited by fish or potentially habitable for use in spawning (P1), nursery (P2), feeding (P3), and rearing (P4), or corridors between these areas; and biological environment, food supply (B1), predation (B2), and competition (B3). Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation, although considered a normal component of this environment, is out of balance due to introduced fish species in some areas. This is also true of competition from nonnative fish species. Information

on razorback sucker use of riverine habitat available from the Upper Basin indicates the species has variable habitat requirements, with adults in rivers using deep runs, eddies, backwaters, and flooded off-channel environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter (U.S. Fish and Wildlife Service 2002b).

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

A. Status of the humpback chub and its critical habitat and razorback sucker critical habitat within the action area

The status of the humpback chub in the action area has improved in the past 10 years. We refer to the 2008 and 2009 Opinions for a complete picture of the status of humpback chub in Marble and Grand Canyons, and provide the following updated summary. Coggins and Walters (2009) concluded that the status and trend of the humpback chub in the LCR (the LCR Inflow aggregation) utilizing the ASMR model continues to increase, and is currently between 6,000 and 10,000 adults (age 4 years or more), most likely approximately 7,650 fish. This is an increase from the 2006 estimate of 5,300-6,700, and an increase of about 50 percent since 2001 (Coggins 2008a, Coggins and Walters 2009). Reclamation, through the GCDAMP continues to provide funding for monitoring and research of humpback chub in the mainstem Colorado River, and in the Little Colorado River, including the area above Chute Falls. These projects constitute the GCDAMP's monitoring of humpback chub in its primary spawning tributary in the action area and provide an annual assessment of the humpback chub population in the tributary and the mainstem.

As stated in previous Biological Opinions on the operations of Glen Canyon Dam, Reclamation's actions continue to have adverse affects to humpback chub and its critical habitat. Razorback sucker critical habitat in the Grand Canyon is similar to humpback chub critical habitat and is exposed to the same stressors. PCEs W1 (water quality), W2 (hydrologic regime), P1 (spawning habitat), P2 (nursery habitat), P3 (feeding area), B1 (food supply), B2 (predation), and B3 (competition) are all functioning but at risk. However, the implementation of the conservation measures has significantly advanced the population status of humpback chub in Grand Canyon and presented the opportunity for assessing the potential for razorback sucker re-establishment. Reclamation has recently (September 2010) implemented an evaluation of the potential for razorback sucker habitat in the lower Grand Canyon, as a conservation measure of the 2007 Biological Opinion for the Shortage Guidelines.

Implementation of MLFF by Reclamation through the GCDAMP includes related monitoring, research, management actions, and conservation measures designed to benefit the species. Another factor likely contributing to the continued increase in humpback chub numbers is the periodic steady flow releases and warmer mainstem river temperatures, as flow releases and

water temperatures are closely linked. All humpback chub abundances for size classes < 100 mm increased during the low summer steady flow period of 2000 compared to previous years (Trammell et al. 2002). Coggins and Walters (2009) noted that the low summer steady flow conducted during the summer of 2000 (primarily a low flow of 8,000 cfs from June to September; see Ralston and Warring 2008), which warmed the mainstem river, may have resulted in increased recruitment of the 1999, 2000, and possibly 1998 brood years. Andersen et al. (2010) describe three conditions that likely lead to the overwinter survival of young-of-year (y-o-y) humpback chub: 1) the warmest water temperatures in the mainstem in many years following the closure of Glen Canyon Dam; 2) rainbow trout numbers were at their lowest in over 10 years; and 3) Glen Canyon Dam fluctuations were constrained in 2006 and 2007 (compared to 2005) due to low reservoir levels. It is also estimated that between 65–80% of all humpback chub in the population are subjected to handling stress, passive integrated transponder (PIT) tagging, and monitoring, but it is not known what impact this is having on the population.

In our 2008 and 2009 Biological Opinions, we concluded that the proposed action does not jeopardize the continued existence of the humpback chub, or result in destruction or adverse modification of its critical habitat. This was in contrast to our 1995 Final Biological Opinion on the Operation of Glen Canyon Dam (1995 Opinion) that concluded that Reclamation's implementation of MLFF would jeopardize the continued existence of the species, and destroy or adversely modify its critical habitat and the critical habitat for razorback sucker (U.S. Fish and Wildlife Service 1995). Our rationales for those conclusions are presented in those biological opinions.

In the 2009 Supplemental Opinion, we concluded that critical habitat in Reach 6, the LCR, will remain functional and continue to serve the intended conservation and recovery role for the humpback chub. MLFF was expected to have minimal effect on PCEs of this unit, and some PCEs of critical habitat will be improved by the proposed action and conservation measures. The W1 and W2 PCEs of Reach 6 were expected to benefit from Reclamation's efforts to address watershed planning for the LCR, and projects in the Humpback Chub Comprehensive Plan provide protective measures for PCEs in Reach 6, such as watershed planning to protect flows, and spill prevention planning for the U.S. Highway 89 Cameron Bridge spanning the Little Colorado River. PCEs B2 and B3 of Reach 6 were expected to benefit from efforts to control nonnative species, and perhaps from the cooling effect that MLFF has on the mainstem, which may suppress warm-water nonnative species.

The PCEs of Reach 7 (Marble and Grand Canyons) were expected to be directly affected by MLFF. The Recovery Goals include the need to identify the role of the mainstem Colorado River and its habitats in meeting the demographic goal of recovery, as well as the need to define humpback chub habitat use in the mainstem to best identify and provide flow regimes that are necessary for all life stages of humpback chub to support a recovered Grand Canyon population. Reclamation is now operating the dam using adaptive management via the GCDAMP, and the steady flow component of the proposed action, the Nearshore Ecology Study, and GCMRC's Fall Steady Flow Plan will directly address the recovery need of defining flow needs for Reach 7 to meet recovery, along with the suite of related ongoing monitoring and research by the GCDAMP (U.S. Bureau of Reclamation and U.S. Geological Survey 2009).

Critical habitat for razorback sucker in the action area is present from the Paria River confluence to Hoover Dam (U.S. Fish and Wildlife Service 1994). Habitat suitability for razorback sucker in

the action area remains in question. Reclamation's efforts to evaluate the potential for razorback sucker habitat and suitability for augmentation will address this need. If suitable habitat exists, species augmentation could result in an expansion of the range of the species and an improvement in its status.

Limited spawning habitat may be available for razorback suckers in Grand Canyon. Spawning in Grand Canyon has never been documented, but post-dam cool temperatures likely limit spawning. In general, spawning in rivers occurs over bars of cobble, gravel, and sand substrates during spring runoff at widely ranging flows and water temperatures. Young razorback suckers require nursery environments with quiet, warm, shallow water such as tributary mouths, backwaters, or inundated floodplains in rivers (Valdez 1996, U.S. Fish and Wildlife Service 2002c). These habitats are very rare in Grand Canyon, and although they may have been historically more common following large flood events. The geology of the area, especially in steep canyon-bound reaches, would limit floodplain development, regardless of flow regime. A project initiated by Reclamation in September 2010, is designed to evaluate habitat potential of razorback sucker in lower Grand Canyon and to identify possible and existing linkages with the reproducing population in Lake Mead. Razorback sucker are not known to be in the action area, but some individuals may be using the extreme lower end of the canyon and the Lake Mead inflow.

B. Factors affecting the species environment and critical habitat within the action area

The GCDAMP has been operating since 1997, implementing the adaptive management program requirement of the 1996 Record of Decision. The GCDAMP is part of Reclamation's proposed action in that Reclamation provides funding to the GCDAMP for research, monitoring, and management actions that provide a significant benefit to many resources in Grand Canyon, including conservation benefits to endangered species. Some of these programs are off site such as Reclamation's funding the establishment of a humpback chub refuge at the Dexter National Fish Hatchery operated by the Fish and Wildlife Service in Dexter, New Mexico. The framework of the adaptive management program and the history of actions the GCDAMP have taken to benefit listed species, particularly humpback chub and Kanab ambersnail, as described in detail in the 2008 Opinion.

One of the most significant limiting factors to humpback chub spawning and recruitment in the mainstem is water temperature. Since closure of the dam and filling of Lake Powell, water temperatures in the mainstem Colorado River at the LCR inflow have been about 8-10 °C on average (Valdez and Ryel 1995) regardless of volume. There is differential warming of those releases as they pass downstream that is dependent on season and volume of the release. In summer months, release water warms as it passes downstream; in winter cooling of dam releases can occur. Water temperature downstream from Glen Canyon Dam is affected by release temperature, which is a function of reservoir elevation, temperature and volume of inflow, and air temperature. Downstream warming of the river is also a function of release volumes and volume fluctuations. Warming is also along a longitudinal gradient that varies with air temperature, such that warming increases as water moves downstream and more so in the hotter months than in cooler months (Wright et al. 2008). During the summer months, the effect of increasing monthly releases to meet electricity demand (within the constraints of MLFF) has a significant effect on temperature. Lower release volume results in greater downstream warming (Wright et al. 2008). This was most evident during the 2000 low summer steady flow. Releases

during the summer months (June 1 – September 1) were limited to 8,000 cfs, and mainstem temperatures warmed somewhat more than at higher releases. The mainstem water temperature at the LCR inflow in June 2000 was 13.3 °C; release temperature at the dam was 9.5 °C, so releases had warmed 3.8 °C; June temperatures for the previous six years at the LCR inflow ranged from 10.3 °C to 11.8 °C and had warmed an average of 2.3 °C (Vernieu 2000). Possible effects of warm releases can be gleaned from low reservoir elevation in 2005 that resulted in a release temperature of nearly 14°C in November 2005. Concurrent with these warm releases in 2004 and 2005, numbers of flannelmouth suckers and bluehead suckers increased dramatically, although a similar increase in warmwater nonnative fish was not seen.

Thus Reclamation's action, by structuring monthly release volume to generate hydropower under a fluctuating regime, has a cooling effect on downstream water temperature, which likely results in, or contributes to, mortality to humpback chub eggs and juvenile fish due to cold temperatures (Hamman 1982, Marsh 1985), or death of juvenile humpback chub from cold shock or increased predation due to limited swimming ability associated with cold water temperatures (Berry 1988, Berry and Pimentel 1985, Lopher and Clarkson 1994, Valdez and Ryel 1995, Marsh and Douglas 1997, Robinson et al. 1998, Clarkson and Childs 2000, Ward et al. 2002).

Nonnatives are among the greatest threat to native fishes throughout the west (Minckley and Deacon 1991). In Grand Canyon, nonnative brown trout (*Salmo trutta*), channel catfish (*Ictalurus punctatus*), black bullhead (*Ameiurus melas*), and rainbow trout have been identified as principal predators of young humpback chub, with consumption estimates that suggest loss of complete year classes to predation (Marsh and Douglas 1997, Valdez and Ryel 1997, Hilwig et al. 2010); many of these fish were in the system before the construction of Glen Canyon Dam. The AGFD regulates sport fishing of trout at Lees Ferry and other sport fishing opportunities occur in the action area. Rainbow trout consumption rates are likely low, but the population effect is relatively high because of the large number of rainbow trout in the action area. Beginning in 2006, as part of the continuing effort to enhance native fish populations and restore natural ecosystem values, NPS began a 5-year effort to reduce the population of brown and rainbow trout from Bright Angel Creek during their October-January spawning season.

Valdez and Ryel (1997) also suggested that common carp could be a significant predator of incubating humpback chub eggs in the LCR. In addition, at least two species of crayfish, the red swamp crayfish (*Procambaris clarki*) and the northern or virile crayfish (*Orconectes virilis*) occur in the action area. It is not clear how much of an impact crayfish are having on the aquatic community. In general, crayfish appear to negatively impact native fishes and aquatic habitats through habitat alteration by burrowing into stream banks and removing aquatic vegetation, resulting in decreases in vegetative cover and increases in turbidity (Lodge et al. 1994, Fernandez and Rosen 1996). Crayfish also prey on fish eggs and larvae (Inman et al. 1998), and alter the abundance and structure of aquatic vegetation by grazing, which reduces food and cover for fish (Fernandez and Rosen 1996).

As discussed in all of the previous consultations involving Glen Canyon Dam, predation and competition from nonnative fish species constitutes a serious threat to humpback chub critical habitat (Minckley 1991, Mueller 1999, Hilwig et al. 2009, others). Primary constituent elements B2 (predation), and B3 (competition) and are the most affected by the Colorado River conditions. Yard et al. (2008) presented some preliminary results indicating that the 2003-2006 removal of rainbow and brown trout contributed significantly to reduce predation losses of

juvenile humpback chub. Nonnative removal has been identified by several authors as a likely cause of improved status of humpback chub (Andersen 2009, Coggins and Walters 2009, Van Haverbeke and Stone 2009). However, population modeling indicates the improvement in humpback chub status and trend was also due to increased recruitment in the mid to late 1990s (Coggins and Walters 2009), prior to implementation of nonnative fish control, incidence of warmer water temperatures, the 2000 low steady summer flow experiment, or the 2004 high flow test.

Nonnative removal was conducted in the Colorado River – LCR confluence area between 2003 and 2006, and again in May of 2009. During the 2003-2004 mechanical removal effort, an estimated 12,169 y-o-y and juvenile humpback chub would have fallen prey to rainbow and brown trout if the removal efforts had not taken place. The four-year effort from 2003 to 2006 proved to be very effective in removing nonnative fishes. In 2007, at the request of Reclamation, the GCMRC convened a workshop with scientific experts for the purpose of identifying scientifically credible, long-term experiments for the GCDAMP. Their recommendations included “... continuing mechanical removal of both coldwater and warm-water nonnative fish near the confluence of the LCR and mainstem.” The purpose of the removal was to limit the numbers of rainbow trout in the area of the confluence. For these reasons, Reclamation incorporated into the project description mainstem nonnative fish control as a conservation measure of their 2008 Biological Assessment. Nonnative fish control, as a conservation measure, was a significant consideration in the FWS’ 2008 and 2009 Opinions. Reclamation is currently engaging with Native American tribes through government-to-government consultation, and with other GCDAMP members to discuss and consider additional measures for achieving future nonnative fish control to comply with previous biological opinions.

It is interesting to note that during the 2007-2008 period when nonnative removal was not conducted, both rainbow trout and humpback chub increased considerably (Hilwig et al. 2010). The reason for this is unknown, but a plausible hypothesis is that the warmer water during that period was responsible for the humpback chub increase, while the rainbow trout trended toward carrying capacity after four years of removal. Regardless of the reasons, we know that the two-year cessation of nonnative removal did not drive the humpback chub population downward.

The abundance of nonnative rainbow trout in the LCR – Colorado River confluence has increased in the short time since the February 2008 Opinion was completed (Figure 1) and the 2009 cohort of rainbow trout is about the same size as the 2008 cohort. The 2008 rainbow trout cohort was one of the largest documented since the monitoring efforts began 1991 (Makinster et al. 2009a, 2009b). Mainstem fish monitoring detected increases in nonnative rainbow trout in the LCR inflow reach of the Colorado River in 2008, prompting a removal trip in May of 2009. An estimated 2,300 to 3,300 rainbow trout were in the LCR reach prior to the 2009 removal. AGFD removed 1,873 rainbow trout during the May 2009 removal trip, which is about the same abundance encountered in February of 2003. Makinster et al. (2009b) estimate that between 500 and 1,500 rainbow trout remained in this reach at the end of the field work. This indicates that rainbow trout are likely increasing throughout Marble Canyon; in addition, AGFD found more rainbow trout in the control reach upstream of the removal reach than had previously been detected. Current management goals include maintaining trout abundance in the Little Colorado River reach at 10 to 20 percent of January 2003 rainbow trout abundance (approximately 600 to 1,200 rainbow trout). Coggins (2008b) evaluated length frequency distributions of rainbow trout captured during electrofishing from Glen Canyon Dam to RM 56 during 1991 through 2004 and

concluded that Lees Ferry is the primary spawning site, as the juvenile size class of rainbow trout are largely absent from collections downstream of RM 10. Unlike the situation in 2003, however, the four native fish species occurring in Grand and Marble canyons (flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*C. discobolus*), speckled dace (*Rhinichthys osculus*), and humpback chub) are still very abundant in the LCR inflow reach (Makinster et al. 2009b), in part, we believe, as a result of the steady flows and warmer water in the mainstem. However, the warmer water may also come with costs, such as the expansion of predatory warm-water nonnative fishes. For example, New Zealand mudsnail, a nonnative species which can significantly alter native aquatic communities, increased appreciably during the 2000 steady flow period (Yard and Blinn 2001) but appears to have decreased significantly as a result of the March 2008 high flow test according to preliminary observations.

The proposed action will affect razorback sucker critical habitat in Grand and Marble Canyons in the same ways it affects humpback chub critical habitat, primarily by cooling water temperatures, providing for the presence of high numbers of cold-water predators, and dewatering effects on nearshore habitats from daily fluctuations in flow. Razorback suckers have always been rare in the action area, and the ability of the Glen and Grand Canyon reaches of the Colorado River to fully provide the PCEs is uncertain, even historically. Razorback suckers historically migrated as adults to spawn, often over long-distances, thus their historical presence in Grand Canyon may have been as a movement corridor.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

This biological opinion evaluates a 13-month subset of Reclamation's proposed operations for Glen Canyon Dam scheduled for 2008-2012 under the MLFF, which included a completed March 2008 high flow test, steady flow releases in the months of September and October, and the conservation measures stated above. Many of the effects are expected to be similar to the effects described in the 2009 Supplemental Opinion. However, the nonnative trout removal effort planned for 2010, deemed to be critical to the ongoing maintenance of the humpback chub population, did not occur this year. Cancelling this effort precluded the constraint on trout abundance in the Little Colorado River reach to 10 to 20 percent of January 2003 target levels (approximately 600 to 1,200 rainbow trout).

Young-of-year and other age classes of humpback chub will continue to enter the mainstem Colorado River from the Little Colorado River. The young fish will encounter a number of stressors affecting their survival, including suboptimal water temperatures, predatory and competitive nonnative fish, and unstable shoreline habitat associated with fluctuating flows. The FWS has identified for some time that the MLFF has adverse affects to humpback chub (U.S. Fish and Wildlife Service 1995); however, more recent information also indicates that the status

of humpback chub has been improving during the implementation of the MLFF and Adaptive Management Program.

Water temperature, long identified as an important factor of the physical ecosystem for humpback chub in the mainstem, will continue to be a limiting factor with predictions of cool to cold releases during the 13-month life of the project. Humpback chub in the mainstem are not likely to encounter temperatures of 16-22 °C needed for successful spawning, egg incubation, and survival of young, impacting the quality of water - PCE W1. Releases under the MLFF will increase for hydropower production during months when power demand is greatest (summer during June-August and winter from December-February). Increasing releases and fluctuations this winter will not further influence water temperatures because air temperatures and release water temperatures will already be cold. During the summer months, the effect of increasing monthly releases to meet electricity demand (within the constraints of MLFF) will affect temperature. Lower release volume results in greater downstream warming (Wright et al. 2008). Reclamation's action, by structuring monthly release volume to generate hydropower under a fluctuating regime, will have a cooling effect on downstream water temperature, which likely will result in, or contribute to, mortality to humpback chub eggs and juvenile fish due to cold temperatures (Hamman 1982, Marsh 1985), or death of juvenile humpback chub from cold shock or increased predation due to cold shock (Berry 1988, Berry and Pimentel 1985, Luper and Clarkson 1994, Valdez and Ryel 1995, Marsh and Douglas 1997, Robinson et al. 1998, Clarkson and Childs 2000, Ward et al. 2002). These same flows may benefit humpback chub by disadvantaging warm-water nonnative fish species that prey on, and compete with, humpback chub including common species such as channel catfish, bullheads, common carp, rainbow trout, and brown trout, as well as potential invaders, such as largemouth bass, smallmouth bass, and green sunfish (Valdez and Speas 2007).

Steady flows during September and October are expected to cause backwater and other nearshore habitat used by young humpback chub to become more hydraulically stable, with potentially warmer water temperatures than would exist under regular MLFF operations. These changes could improve conditions for survival and growth of young-of-year and juvenile humpback chub, by providing more persistent suitable habitat (depth and velocity over preferred substrates) (W1 and W2), protection, and increased productivity of algal and invertebrate prey items for use by humpback chub (P1 and P2). The steady flows and warmer waters will likely benefit a number of nonnative fishes as well, including channel catfish, fathead minnows, brown trout and most notably rainbow trout, and impact the biological environment of the critical habitat (B1, B2, and B3). Korman and Campana (2009) found that, for rainbow trout in Lee Ferry, growth appeared to increase during stable flows, based on evidence of a distinctive line on the otolith (inner ear bone) representing increased growth that corresponded to juvenile trout's increased use of immediate shoreline areas on Sundays (the only day of the week with steady flows), where higher water temperatures and lower velocities provided better growing conditions. We expect these same conditions to occur during the 2010-2011 timeframe as well.

Although rainbow trout are believed to have only a limited ability to successfully prey on adult humpback chub, given their high numbers, rainbow trout are likely to have a significant, negative impact on the y-o-y and juvenile humpback chub. The unmitigated numbers of rainbow trout in the LCR stretch of the Colorado River, where density-dependent constraints may limit food and space availability, will negatively impact the critical habitat's ability to protect the essential biological environment of food supply (B1), predation (B2), and competition (B3).

Without the two nonnative removal trips occurring during 2010, we expect significant losses of humpback chub. In our 2008 Opinion, we noted that because Reclamation predicts that dam releases will be cool to cold between 2008 and 2012, control of nonnative trout may be particularly important.

The exact number humpback chub that may be protected by nonnative removal depends on the efficiency rate of the electrofishing efforts in the field. Even if the nonnative mechanical removal (by electrofishing) were to experience a low efficiency rate, it is estimated that predation on humpback chub would be reduced by 10-14%. If mechanical removal rates experience an average efficiency rate, predation on humpback chub would be reduced by 41-70%, and if high efficiency field efforts were to occur, predation rates could be reduced by 49-85%. Reclamation estimates, based on GCMRC data, that the canceling of two mechanical removal trips could result in the loss of 1,000 to 24,000 mostly y-o-y and age 1- humpback chub. The average loss of humpback chub across variable predation and immigration rates will be 10,817 juvenile and y-o-y fish. Given the strong year class of the Lees Ferry rainbow trout fishery during 2008 and 2009, we anticipate high numbers of adult rainbow trout in the LCR reach from the natal source of the Lee Ferry reach.

There have been some concerns expressed about the value of the nonnative fish control measures and the killing of aquatic life in sacred areas of the Grand Canyon (see Zuni letters). Nevertheless, it is well established that nonnative fish are among the greatest threats to native fishes (Clarkson et al. 2005, Minckley and Deacon 1991, Miller 1961). Immigration of trout into the LCR reach is not restricted and is expected to continue to occur during the life of this project from both the Lee Ferry reach and downstream sources. Our best assessment indicates that given the high numbers of rainbow trout in the mainstem, the nonnative fish control strategy is a major factor in the fate of young-of-year humpback chub, and the absence of the conservation measure in 2010 will have significant adverse effects on the status of young humpback chub. It is not known what the full effect of the cancellation of a single year of nonnative mechanical removal will be for future age classes. The cancellation of one year's effort will not likely preclude this or other future conservation opportunities, and given the strong humpback chub numbers of adults in the project area, we believe the population will remain secure during the 13-month life of the project. Yet given the uncertainty of the GCDAMP's ability to use this conservation measure in the future, we could begin to see a reversal in the upward trend in humpback chub numbers. Although we cannot verify the numbers of humpback chub, especially those between 50 and 125 mm that will be consumed by trout, we adopt the estimate of 10,817 fish as identified in the BA, acknowledging that the figure could be higher or lower. We adopt this estimate because it constitutes the best science available to us. Other ongoing stressors, which cannot be quantified, such as humpback chub response to thermal shock from cold water, displacement from fluctuating flows, and the competition for resources will continue to result in lethal and nonlethal affects to young chub.

While the MLFF affects the PCEs of razorback sucker critical habitat in similar ways as it does humpback chub critical habitat, razorback sucker PCEs may not be provided sufficiently regardless of the Glen Canyon Dam flow regime. Steady flows in September and October will support PCE W1 and W2. However, even under flows of optimum quantity, the physical features for spawning, nursery, and juvenile stages would be inadequate without suitable temperature ranges to make those habitats viable. It is unclear if the necessary PCEs of critical habitat for razorback suckers are present in Grand Canyon, or even if they were historically.

Based on the rarity of razorback suckers in the action area, and the apparent lack of suitable habitat, the proposed action is not expected to further diminish the conservation contribution from this stretch of river.

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. Since a significant portion of the action area is on Federal lands, any legal actions occurring in the future would likely be considered Federal actions, and would be subject to additional section 7 consultation. The cumulative effects have not changed from the 2008 or 2009 Opinions.

CONCLUSION

After reviewing the current status of the humpback chub and its critical habitat and the critical habitat of the razorback sucker, the environmental baseline for the action area, the effects of the proposed Glen Canyon Dam operations with the cancellation of the scheduled mechanical removal of nonnative fish in 2010, and the cumulative effects, it is our biological opinion that the proposed action, is not likely to jeopardize the continued existence of the humpback chub and is not likely to destroy or adversely modify designated critical habitat for the humpback chub or the razorback sucker.

We present these conclusions for the following reasons:

- The loss of approximately 10,000 y-o-y and juvenile humpback chub is not expected to result in jeopardy because the project is short-lived.
- Predation will significantly affect recruitment of y-o-y and juvenile humpback chub and the cessation of nonnative fish removal will cause an increase in mortality of many thousands of fish in these age classes. However, the demographics of this long-lived species normally show that the survival in the adult age class is the most important parameter influencing long-term population persistence. Populations of long-lived species are only minimally sensitive to juvenile mortality so long as high mortality rates are limited to only occasional cohorts. Indeed, it is likely that, under natural conditions, humpback chub have historically experienced occasional losses of entire cohorts due to natural stochastic events such as floods or drought. Thus, while we believe that control of nonnative predators is an important management tool that should be continued, we do not believe that cessation for a single year will significantly affect long-term population persistence.
- As stated in the 2009 Supplemental Opinion, the Grand Canyon population of humpback chub has improved to approximately 7,650 adult fish (age 4+) (an increase of 1,650 since the 2008 Opinion). This is similar to the number of adult fish thought to be present in Grand Canyon in 1995, and is nearing or has met the draft demographic recovery goal for this population (U.S. Fish and Wildlife Service 2009). However, the status of the species overall is reduced from what it was in 1995 because of declines in populations in the

upper basin as of September 2009, due primarily to the proliferation of nonnative fishes that prey on and compete with humpback chub in those upper basin populations.

- Data collection associated with the ASMR model will provide information on humpback chub spawning, external parasite loads, and predation frequency, as well as important information on aspects of humpback chub critical habitat in the LCR, including relative abundance and distribution of nonnative fish in the lower 8.45 miles of the LCR. Thus, we will gain more knowledge over the life of this action and will be able to adjust management if necessary.
- Although the nonnative removal effort will not occur this year, the GCDAMP has improved our understanding of the balance needed between flows, water temperature, nonnative abundance, and other features to allow for more effective management to reverse the decline in humpback chub numbers and improve the primary constituent elements. Many of the actions suspected of benefiting the humpback chub population, with the exception of warmer release water and nonnative removal will continue during the 13-month life of this project. Population modeling indicates the improvement in humpback chub status and trend was due to increased recruitment in the mid to late 1990s (Coggins and Walters 2009), prior to implementation of nonnative fish control, incidence of warmer water temperatures, the 2000 low steady summer flow experiment, or the 2004 high flow test.
- We believe humpback chub critical habitat in Reach 6, the LCR, will remain functional and continue to serve the intended conservation and recovery role for the humpback chub. MLFF should have minimal effect on PCEs of this unit, and some PCEs of critical habitat will be protected by the proposed action. For example, ponding of the confluence area which may provide a benefit by slowing current velocity in the LCR and reducing passive or active emigration from the LCR, thereby increasing the residence time of juvenile humpback chub in the LCR where they have higher survival rates.
- The PCEs of Reach 7 for humpback chub and PCEs in the mainstem for razorback sucker will be directly and negatively affected by the proposed action, but long-term conservation goals will not be precluded. Reclamation operates the dam using adaptive management, and through the GCDAMP, the steady flow component of the proposed action, the Nearshore Ecology Study, and other actions for conservation are expected to sustain the existing primary constituent elements.
- The proposed action will not permanently destroy the quality or function of migratory habitat for razorback sucker critical habitat.
- The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any conservation measures that were incorporated into the project design.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act 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 (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) 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, the 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 Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by Reclamation so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If the Reclamation (1) fails to assume and implement the terms and conditions or (2) fails to require the (applicant) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Reclamation must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement. [50 CFR 402.14(i) (3)].

AMOUNT OR EXTENT OF TAKE

Incidental take is expected to be in the form of harm, harass, kill, etc., as stated in the 2009 Supplemental Opinion. Impacts to or loss of fish from cold shock or stranding, as well as indirect mortality from increased predation rates by nonnative fish predators are expected to occur. The incidental take in the 2009 Supplemental Opinion was not quantified and has since been challenged (CV-07-8-64-PHX-DGC). The 2009 Supplemental Opinion anticipated that there would not be a decline in the overall number of adult humpback chub, and a reinitiation trigger was established to determine that take would be exceeded 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 2008a), the population drops below 3,500 adult fish within the 95 percent confidence interval. Since that incidental take statement was judged to be invalid and has been remanded back to the FWS, we have removed it from consideration. In the September 1, 2010 Court Ordered Opinion, instead of adopting the 3,500 adult fish conservation measure as a means of determining when take would have been exceeded during the five-year life of that program, we determined that since the adult humpback chub population within the action area is likely to remain stable or increase from the 2007 estimate of approximately 6,000 adults, incidental take would be exceeded if the number of adult humpback chub dropped below 6,000. If monitoring detects a decrease in the adult chub population below the 6,000 estimate that is not attributable to other factors (such as a parasites or diseases), that decrease is reasonably indicative of higher than expected levels of juvenile mortality caused by the proposed action.

However, for this 2010 Biological Opinion, we anticipate that between 1,000 and 24,000 y-o-y or juvenile humpback chub will be lost to predation by trout as a result of the modified proposed

action during this 13-month period. We adopt the incidental take estimate provided in the April 2010 BA, of 10,817 humpback chub for this 13-month period. Even with the occurrence of other lethal and nonlethal stressors from suboptimal water temperatures and unstable shoreline habitat associated with fluctuating flows, except for September and October, we do not anticipate that incidental take will exceed the 24,000 estimate.

EFFECT OF THE TAKE

In this biological opinion, the FWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

REASONABLE AND PRUDENT MEASURES and TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures (RPM), described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The following RPM and term and condition for Humpback Chub were issued in the 2009 Opinion, and are repeated here:

1. Monitor the effects of the proposed action on humpback chub and its habitat to document levels of incidental take and report the findings to the FWS. Reclamation shall work in collaboration with the GCDAMP participants including GCMRC and other cooperators to complete this monitoring.

The following term and condition will implement this RPM:

- a. Reclamation, in collaboration with the GCDAMP participants including the GCMRC and other cooperators, shall submit a written report to the FWS annually documenting activities of the proposed action for the year, and any documented take. The report will include a discussion of the progress of the implementation of Reclamation's conservation measures included in the proposed action.

Two new RPMs and terms and conditions are included in this 2010 Opinion.

2. Reclamation, in collaboration with the GCDAMP participants including the NPS, GCMRC, the Tribes, and other interested cooperators, shall develop a strategy of alternatives for mechanical removal of nonnative fishes.

The following terms and conditions will implement this RPM:

- a. Resume nonnative control at the mouth of the LCR in 2011. Attempt to implement the program in a manner compatible with the interests of Tribes and other interested stakeholders.

AND/OR

b. Work with interested Tribes and other parties, expeditiously, to develop options that would move nonnative removal outside of LCR confluence tribal sacred areas in 2011, with the goal that nonnative removal of trout in sacred areas will be reserved for use only to ensure the upper incidental take level is not exceeded.

3. Reclamation, in collaboration with the GCDAMP participants including the NPS, GCMRC, the Tribes, and other interested cooperators, shall develop a strategy of other alternatives to advantage humpback chub in the action area.

The following term and condition will implement this RPM:

- a. Assess the potential to adjust flows during the 2011 water year to disadvantage reproduction of rainbow trout.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. Reclamation must immediately provide an explanation of the causes of the taking and review with the Arizona Ecological Services Office the need for possible modification of the reasonable and prudent measures.

Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species, initial notification must be made to the FWS's Law Enforcement Office, 2450 W. Broadway Rd, Suite 113, Mesa, Arizona, 85202, telephone: 480/967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care and in handling dead specimens to preserve the biological material in the best possible state.

CONSERVATION RECOMMENDATIONS

Section 7(a) (1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. FWS recommends that Reclamation continue working with FWS to implement other activities that will achieve the revised recovery goals for humpback chub, and continue to work with us on developing a recovery program for the Grand Canyon population of humpback chub. We also recommend that Reclamation utilize the Comprehensive Plan for Management and Conservation of Humpback Chub in Grand Canyon and work with the FWS, NPS, and other interested parties including the GCDAMP to determine what actions remain to be accomplished

and develop funding sources that would be provided to accomplish recovery. This should include review of the 2008 through 2012 steady flows results to develop future steady flow scenarios that may benefit the humpback chub and associated ecosystem values, consistent with the Grand Canyon Protection Act.

In order for the FWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the FWS requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the reinitiation of the Glen Canyon Dam operations with the cancellation of the two mechanical nonnative removal fish trips. As provided in 50 CFR 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. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The FWS appreciates Reclamation's efforts to identify and minimize effects to listed species from this project. For further information please contact Debra Bills (x239) or Steve Spangle (x244). Please refer to the consultation number 22410-F-1993-F-167R2 in future correspondence concerning this project.

/s/ Debra Bills for

Steven L. Spangle

cc: Project Leader, Arizona Fish and Wildlife Conservation Office, Flagstaff, AZ

Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
 Director, Environmental Programs, Bureau of Indian Affairs, Phoenix, AZ
 Chemehuevi Indian Tribe, Chemehuevi Valley, CA
 Havasupai Tribe, Supai, AZ
 Hopi Tribe, Kykotsmovi, AZ
 Hualapai Tribe, Peach Springs, AZ
 Kaibab Band of Paiute Indians, Pipe Springs, AZ
 Navajo Nation, Window Rock, AZ
 Pueblo of Zuni, Zuni, NM
 San Juan Southern Paiute Tribe, Tuba City, AZ

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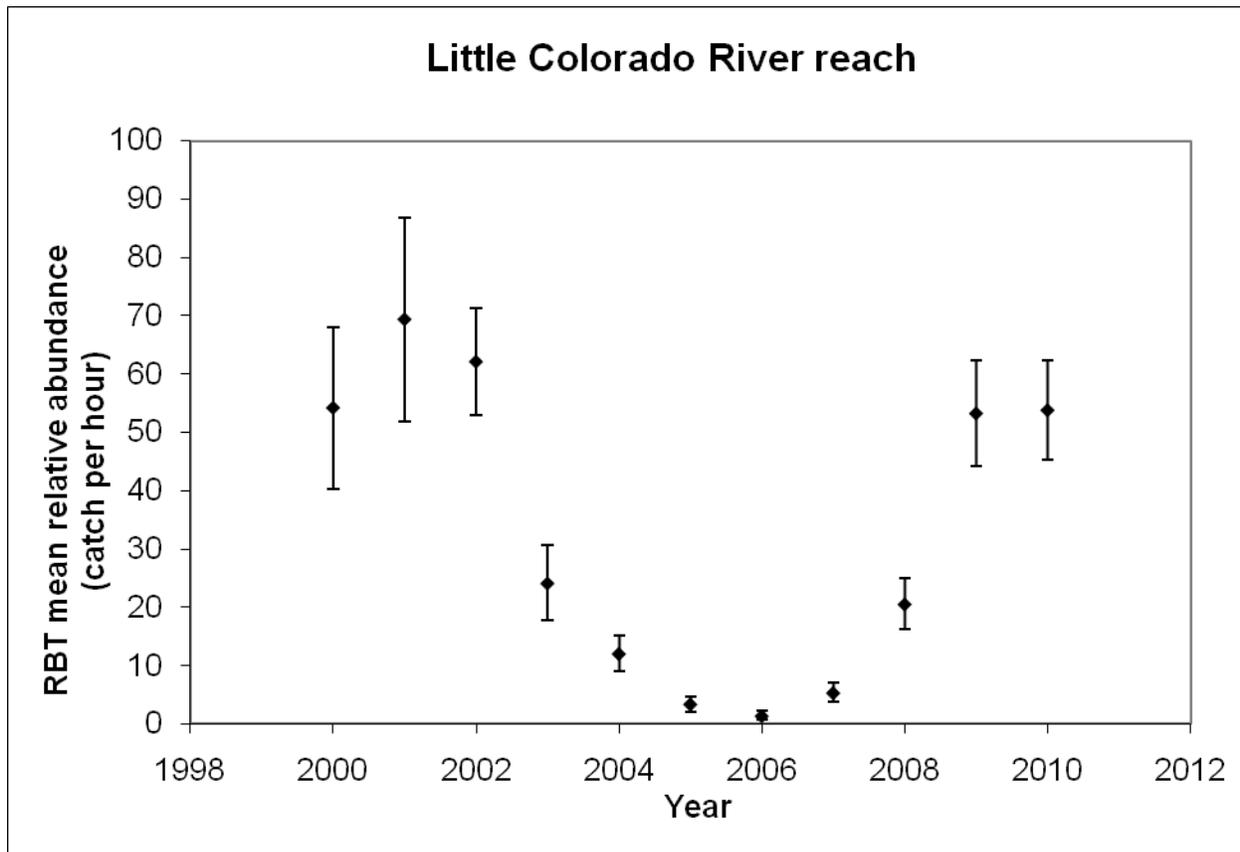


Figure 1. Rainbow trout mean relative abundance in the Little Colorado reach between 2000 and 2010 (from GCMRC files 2010).

USGS/GCMRC Biology Program Updates
TWG meeting 29 June 2010