

1.0 Introduction

1.1 Organization

The Bureau of Reclamation, Upper Colorado Region (Reclamation) has prepared this environmental assessment (EA) to analyze and disclose the environmental consequences of specific actions designed to develop further scientific information regarding native and non-native fishes in the Colorado River and take actions to control non-native fish in the Colorado River as part of the Glen Canyon Dam Adaptive Management Program (GCDAMP) downstream from Glen Canyon Dam within Glen Canyon National Recreation Area (GCNRA) and Grand Canyon National Park (GCNP), Coconino County, Arizona (Figure 1). This EA analyzes potential effects of implementing the proposed action or alternatives to that action.

This EA describes the current environmental conditions in Glen, Marble, and Grand Canyons downstream from Glen Canyon Dam, and discloses the direct, indirect, and cumulative environmental impacts that could result from the proposed action and alternatives. It describes how the proposed action is designed to control non-native fish species, in particular rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), that have been found to prey on native aquatic species, in the Colorado River in GCNP and GCNRA, and the impacts that would result from the proposed action.

This EA assists in ensuring compliance with the National Environmental Policy Act (NEPA) and in determining whether significant impacts would result from the proposed action or alternatives, in compliance with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), the Council on Environmental Quality regulations for implementing NEPA (40 CFR 1500-1508), and the Department of the Interior regulations implementing NEPA (43 CFR Part 46). If the responsible official determines that there are significant impacts to the human environment based on the analysis presented in this EA, then an environmental impact statement (EIS) may be prepared for the project. If not, a finding of no significant impact (FONSI) may be signed for the EA approving an alternative that may be the proposed action or another alternative. The EA is organized into five chapters.

- *Introduction:* The section includes information on the purpose of and need for the project, the history of the project, and the agency's proposal for achieving the purpose and need. This section also details how the public was notified of the proposal.
- *Description of Alternatives:* This section provides a detailed description of the proposal. One action alternative was developed based on issues raised by the public, other agencies and tribes, and through a Structured Decision Making (SDM) Project to evaluate various potential methods of controlling non-native fish in the Grand Canyon (SDM Project). This section also describes mitigation relative to the proposed action, and monitoring that may be required by Reclamation or the cooperating agencies.

- *Affected Environment and Environmental Consequences:* This section describes the environmental effects of implementing the proposed action compared to the effects of taking no action.
- *Consultation and Coordination:* This section describes agencies consulted during the development of the EA and meetings to facilitate consultation and coordination.
- *References Cited and Appendices:* The appendices provide more detailed information to support the analyses presented in the EA: Appendix A: Non-Native Fish Management below the Glen Canyon Dam, Report from a Structured Decision Making Project; Appendix B: Research and Monitoring Plan in Support of the Environmental Assessment Non-Native Fish Control Downstream from Glen Canyon Dam; Appendix C: Biological Assessment for Non-native Fish Control Downstream from Glen Canyon Dam; Appendix D: Supplement to Biological Assessments for Development and Implementation of a Protocol for High-Flow Experimental Releases and Non-native Fish Control Downstream from Glen Canyon Dam, Arizona, 2011 through 2020; Appendix E: Final Biological Opinion on the Operation of Glen Canyon Dam including High Flow Experiments and Non-Native Fish Control.

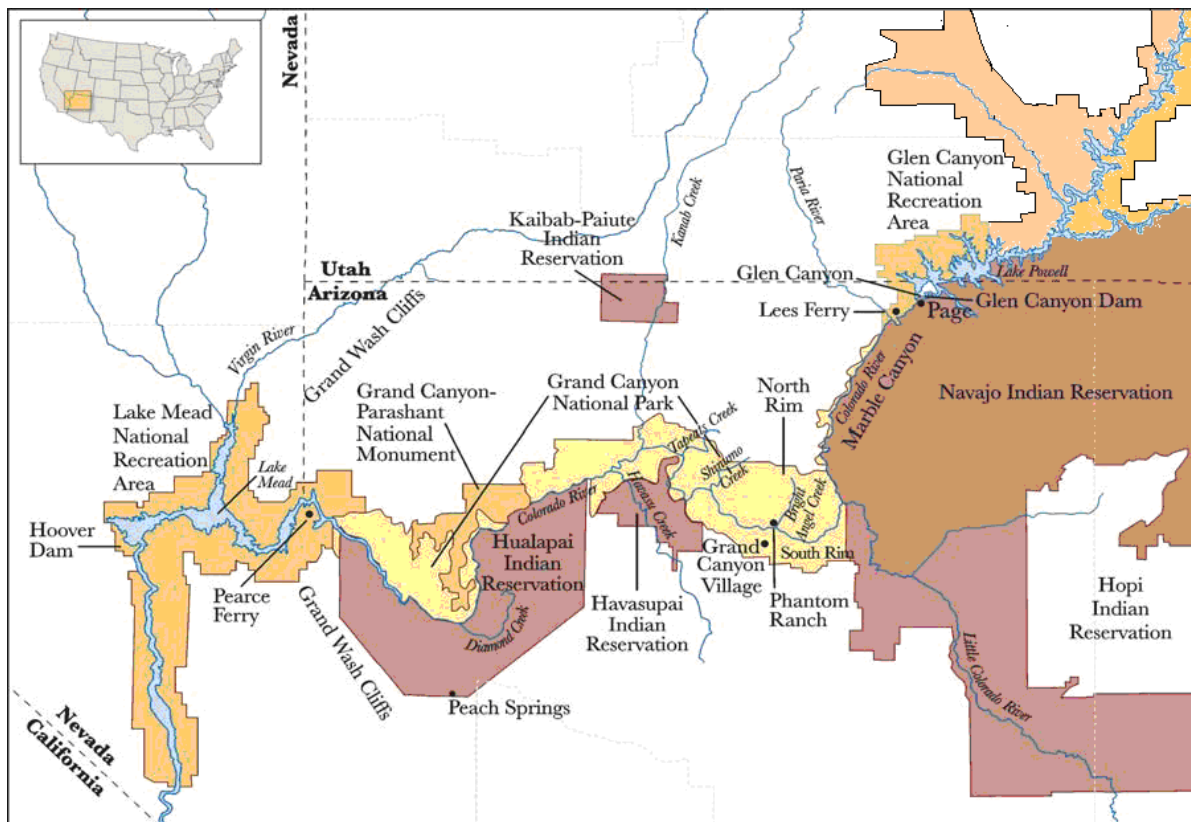


Figure 1. Map of the region that includes the Action Area (courtesy of the U.S. Geological Survey).

1.2 Purpose of and Need for Action

The federal action analyzed in this Environmental Assessment is the control of non-native fish in the Colorado River downstream from Glen Canyon Dam within GCNRA and GCNP, Coconino County, Arizona. The purpose of the action is to gain additional scientific information and to reduce the negative impacts of competition and predation by non-native fish on the endangered humpback chub (*Gila cypha*) and its critical habitat in the Grand Canyon. The need for this action is to add to scientific information as part of an adaptive management program and to continue to fulfill the conservation measures and terms and conditions identified in U.S. Fish and Wildlife Service (USFWS) biological opinions, to contribute to the recovery of humpback chub by helping to maintain high juvenile survival and recruitment rates resulting in a stable adult population, and to address concerns expressed by American Indian Tribes over the killing of fish in the Grand Canyon, a location of cultural, religious, and historical importance to a number of tribes. This action is being conducted through the Glen Canyon Dam Adaptive Management Program.

Reclamation proposes that this action extend to 2020. Starting the action promptly addresses several purposes including: the importance and need for implementing non-native fish control activities as soon as possible in order to address the ongoing threat to the humpback chub; the need to offset possible adverse effects of conducting High Flow Experiments (HFEs) through 2020, described in other sections of this document; as well as the need to address a number of cultural and socioeconomic concerns and issues that are further described in other sections of this EA. The 10-year length of the proposed action would allow for sufficient time to evaluate a number of research questions associated with non-native fish control, and would provide any needed mitigation for humpback chub or other native fish associated with the proposed action of implementing a High Flow Experiment Protocol, a separate but related action being evaluated in a separate EA.

1.3 Proposed Action

Reclamation proposes to, if necessary, reduce the numbers of non-native fish in the Colorado River downstream from Glen Canyon Dam, Arizona that prey on and compete with endangered humpback chub to meet the requirements of several U.S. Fish and Wildlife Service Endangered Species Act (ESA) section 7 biological opinions concerning the effects of dam operations on the endangered humpback chub. The area of emphasis for reducing numbers of non-native fishes is the confluence of the Colorado and Little Colorado rivers, from river mile (RM) 56 to 66¹ because this area contains the greatest abundance of humpback chub in the lower Colorado River, and impacts from non-native fish, trout species in particular, to humpback chub are greatest in this reach of the river. In order to achieve this reduction, the proposed action, in coordination with related actions, includes reducing emigration of rainbow trout and brown trout from source populations in Glen and Grand Canyon. Non-native fish, predominantly rainbow trout, would be removed from the Paria River to Badger Creek reach (PBR reach, RM 1 to RM 8) using boat-mounted electrofishing. Non-native fish would also be removed from the LCR reach, (RM 56 to 66) using the same

¹ River miles are as measured from Lees Ferry, which is RM 0.

methods, but only if monitoring and modeling data indicate that a trigger has been reached as defined in the 2011 U.S. Fish and Wildlife Service Final Biological Opinion on the Operation of Glen Canyon Dam including High Flow Experiments and Non-Native Fish Control (U.S. Fish and Wildlife Service 2011). Fish that are removed would be kept alive and stocked into waters as sport fish in areas that have approved stocking plans, or would be euthanized for later beneficial use identified through continued tribal consultation. As detailed above, the proposed action would take place within GCNRA and GCNP, Coconino County, Arizona, for a 10-year period from 2011-2020. The 10-year length of the proposed action would allow for sufficient time to evaluate a number of research questions associated with non-native fish control, and would provide any needed mitigation for humpback chub or other native fish associated with the proposed action of implementing a High Flow Experiment Protocol, a separate but related action being evaluated in a separate EA.

1.3.1 *Operation of Glen Canyon Dam*

Implementation of non-native fish control would be done in concert with existing coordinated river operations. Since 1970, the annual volume of water released from Glen Canyon Dam has been made according to the provisions of the Criteria for Coordinated Long-Range Operations of Colorado River Reservoirs (LROC) that includes a minimum objective release of 8.23 million acre-feet (maf). The Interim Guidelines for Lower Basin Shortages and the Coordinated Reservoir Operations adopted in 2007 (2007 Colorado River Interim Guidelines) implements relevant provisions of the LROC for an interim period through 2026. The 2007 Colorado River Interim Guidelines allow Reclamation to modify operations by allowing for potential annual releases both greater than and less than the minimum objective release under certain conditions. A more thorough description of Reclamation's process for determining and implementing annual release volumes is available in the 2007 Final Environmental Impact Statement (Reclamation 2007), the 2007 Record of Decision (ROD; U.S. Department of the Interior 2007), and 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 (2007 Interim Guidelines Opinion; U.S. Fish and Wildlife Service 2007).

The proposed action would be implemented within the framework of continued operation of Glen Canyon Dam under the Modified Low Fluctuating Flow (MLFF; U.S. Department of the Interior 1996) and all applicable prior decisions, with the potential inclusion of a protocol for high-flow experimental releases from Glen Canyon Dam for the same 10-year period, 2011–2020. Annual² releases would continue in accordance with prior decisions, including the 2007 Colorado River Interim Guidelines, and including steady flows as identified in the U.S. Fish and Wildlife Service (USFWS) 2008 Final Biological Opinion on the Operation of Glen Canyon Dam (2008 Opinion; U.S. Fish and Wildlife Service 2008) and the USFWS 2009 Supplement to the 2008 Final Biological Opinion on the Operation of Glen Canyon Dam (2009 Supplement; U.S. Fish and Wildlife Service 2009).

² 'Annual' in the context of water releases means within the water year, October 1 through September 30, rather than the calendar year.

HFEs may also be implemented during the 10-year period of the proposed action as defined in the Development and Implementation of a Protocol for High-Flow Experimental Releases from Glen Canyon Dam, Arizona, 2011 through 2020 Environmental Assessment (HFE Protocol EA; Bureau of Reclamation 2011) depending on the outcome of that NEPA analysis. The HFE Protocol under consideration allows for high flow events during fall (October-November) and spring (March-April) HFE implementation periods. HFEs could range in magnitude and duration from 31,500 cfs to 45,000 cfs and from 1 to 96 hours. The magnitude and duration of an HFE would be in part determined by a model to match existing sediment conditions to the HFE. High flow events under the HFE protocol could potentially require more water than what is scheduled for monthly release through the coordinated operating process. Such adjustments, however, would only be made to the extent they do not interfere with or impact implementation of the 2007 Colorado River Interim Guidelines as contemplated in the 2007 Record of Decision. In order to conduct these high flow events as prescribed by the HFE protocol, reallocation of monthly releases within a water year from Glen Canyon Dam may be necessary. If Reclamation determines that it is not possible to achieve the high flow event within the monthly release volume projected for October-November or March-April, Reclamation would adjust the projected monthly release volumes as necessary for the following December through February period, or May through August period, respectively while ensuring that the annual volume is not affected, nor are water deliveries under the 2007 Colorado River Interim Guidelines. A more complete description of these potential experiments is provided in the HFE Protocol EA.

Although not assessed in this EA, both flow and non-flow control mechanisms that target limiting recruitment of rainbow trout in Lees Ferry would continue to be evaluated through adaptive management. Flow actions might be more economical and effective over the long-term at mitigating the effects of trout on humpback chub. Both flow and non-flow experiments focused on the Lees Ferry reach may be conducted in order to experiment with these actions in reducing recruitment of trout in Lees Ferry, and ultimately the size of the Lees Ferry trout population. This could both reduce numbers of rainbow trout that move downstream into important areas for native fish, and result in improved conditions of the trout fishery in Lees Ferry (e.g. fewer, larger fish). Additional environmental compliance may be necessary for these experiments.

1.4 Background

Reclamation proposes to control non-native fish in the Colorado River downstream from Glen Canyon Dam to ensure that its operation of Glen Canyon Dam does not jeopardize the continued existence of endangered native humpback chub. Non-native fish have long been identified as a threat to native aquatic biota (Cambray 2003; Clarkson et al. 2005), and as a specific threat to native fish in the Colorado River and its tributaries in Grand Canyon (Marsh and Douglas 1996; Minckley 1991). Since passage of the Endangered Species Act of 1973 (ESA) and its implementing regulations at 50 CFR 402, Reclamation has consulted with the USFWS to ensure that its operations of Glen Canyon Dam do not jeopardize the continued existence of the endangered endemic Colorado River “big river” fishes, the humpback chub, razorback sucker (*Xyrauchen texanus*), Colorado pikeminnow (*Ptychocheilus lucius*), and bonytail (*Gila elegans*) or destroy or adversely modify their

designated critical habitats. This analysis concentrates on the humpback chub because it is the only one of these species that currently occurs in the project area. The Colorado pikeminnow and bonytail are no longer found in this part of the Colorado River and are not included in this assessment. The razorback sucker would be unaffected by this action because it is absent from the action area and unlikely to occupy the area in the reasonably foreseeable future (this is explained in more detail in Appendix C).

Critical habitat for the Colorado big river fishes was designated by the USFWS in 1994 (50 CFR 17) and includes areas within Marble and Grand canyons. For humpback chub, critical habitat extends for 175 miles of the Colorado River from Nautiloid Canyon (RM 34) to Granite Park (RM 209) and the lower 8 miles of the Little Colorado River (LCR). Critical habitat for razorback sucker in the action area consists of the Colorado River from the Paria River confluence (RM 1) to the Grand Wash Cliffs near Pearce Ferry (RM 277). These reaches of designated critical habitat lie within the boundaries of GCNP and are managed by the National Park Service (NPS). The reach of the Colorado River from RM 30 to RM 75 is a principal nursery area for humpback chub (Figure 2), and it is the reach of river downstream from Lees Ferry that has the highest densities of young humpback chub, and thus impacts of predation and competition by non-native fishes are greatest in this reach. The USFWS critical habitat designation did not include the reach of the Colorado River from RM 30-34, although this area is currently known to be an area of warm springs where humpback chub spawn and apparently recruit (Valdez and Ryel 1995; Andersen et al. 2010).

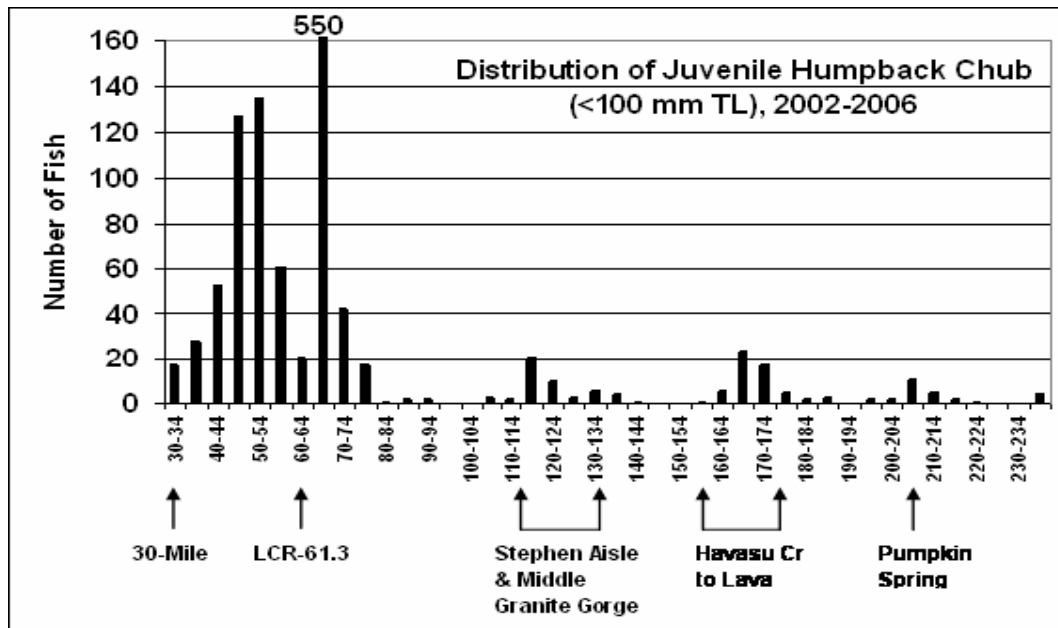


Figure 2. Distribution of juvenile humpback chub<100 mm TL caught during 2002-2006 by 5-mile increments from RM 30 to RM 240. Principal humpback chub aggregations are indicated (data from Ackerman 2008).

The USFWS identified the need for controlling non-native fish species in the recovery goals

for the humpback chub (U.S. Fish and Wildlife Service 2002a)³. The focus of non-native fish control in the recovery goals is on controlling the proliferation and spread of non-native fish species that prey on and compete with humpback chub in the mainstem Colorado River. The Recovery Goals identify the need to develop, implement, evaluate, and revise (as necessary through adaptive management) procedures for stocking and other sport fish management actions to minimize out-migration of non-native fish species into the Colorado River and its tributaries through the Grand Canyon, and to develop and implement levels of control for rainbow trout, brown trout, and warm water non-native fish species, to minimize negative interactions between non-native fishes and humpback chub (U.S. Fish and Wildlife Service 2002a).

In prior ESA section 7 consultations on the operation of Glen Canyon Dam, Reclamation and the USFWS have agreed that controlling the numbers of non-native fish that compete with and prey on the endangered fish through the GCDAMP would serve as a conservation measure for Reclamation's dam operations planned through the year 2012. Non-native fish control was identified as a conservation measure in the 2008 Opinion (U.S. Fish and Wildlife Service 2008), the 2009 Supplement (U.S. Fish and Wildlife Service 2009), and the 2010 Reissuance of the Incidental Take Statement on the 2009 Supplemental Biological Opinion on the Operation of Glen Canyon Dam 2008-2012 (2010 ITS; U.S. Fish and Wildlife Service 2010a). Control of non-native fish species in Marble and Grand Canyons through the GCDAMP is also part of the conservation measures identified in the 2007 Interim Guidelines Opinion (U.S. Fish and Wildlife Service 2007). A fourth biological opinion on the cancellation of non-native fish removal trips in 2010, 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 (2010 Cancellation Opinion; U.S. Fish and Wildlife Service 2010b), required as a term and condition that Reclamation:

“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.” (U.S. Fish and Wildlife Service 2010b).

Also, implementation of non-native fish control through the GCDAMP by physical removal is part of the proposed action for the operating biological opinion on Glen Canyon Dam operations, the 2011 USFWS Final Biological Opinion on the Operation of Glen Canyon

³ In 2006, a U.S. District Court ruling set aside the recovery goals, essentially because they lacked time and cost estimates for recovery. The court did not fault the recovery goals as deficient in any other respect. USFWS is in the process of updating the recovery plan and goals for the humpback chub.

Dam including High Flow Experiments and Non-Native Fish Control (2011 Opinion; U.S. Fish and Wildlife Service 2011). The 2011 Opinion replaced all prior biological opinions on the operation of Glen Canyon Dam, including the 2008 Opinion, 2009 Supplement, 2010 ITS, and 2010 Cancellation Opinion.

A panel of independent scientists convened by the U.S. Geological Survey (USGS) also concluded that non-native fish control should continue to be implemented for conservation of humpback chub in Grand Canyon (U.S. Geological Survey 2008). Rainbow trout and brown trout are not native to the Colorado River Basin and were introduced into the region by federal and state agencies as sport fish before and after the 1963 completion of Glen Canyon Dam (e.g., the Arizona Game and Fish Department (AZGFD) stocked rainbow trout at Lees Ferry as recently as 1998). These trout species are the principal competitors and predators of humpback chub, as well as the other native Colorado River fishes, in Grand Canyon (Douglas and Marsh 1996; Valdez and Ryel 1995; Yard et al. 2011). Other species of fish, including the channel catfish (*Ictalurus punctatus*), black bullhead (*Ameiurus melas*), and green sunfish (*Lepomis cyanellus*) also prey upon and compete with the native fishes.

Recent investigations show that negative impacts from trout on native fish are occurring near the confluence of the Colorado and Little Colorado rivers (RM 56-66), where rainbow trout and brown trout co-inhabit the area with the native fish, humpback chub, flannelmouth sucker, bluehead sucker, and speckled dace. The trout species eat juvenile humpback chub and other native fishes and also compete with them for food and space (Yard et al. 2011). This area of the Colorado River supports the largest aggregation of humpback chub in Grand Canyon, and nearshore habitats in the area (talus, vegetated shorelines, and backwaters) are used as nursery areas by young humpback chub originating from the LCR. Wright and Kennedy (2011) found an apparent link between abundances of rainbow trout and humpback chub adult population numbers in Grand Canyon. When rainbow trout populations are large, humpback chub populations generally decline, potentially due to a combination of increased competition and predation, although changes in other ecosystem variables, such as water temperature or flow, could also be responsible for these trends (Coggins 2008a; Coggins and Walters 2009; Coggins and Yard 2010; Coggins et al. 2011; Wright and Kennedy 2011; Yard et al. 2011), and currently populations of both species are high (S. Vanderkoi, GCMRC, pers. comm., 2011). Also, the Grand Canyon population of humpback chub began to improve under the MLFF and prior to many actions and changes in the ecosystem, including removal of non-native fish and warmer river temperatures, beginning approximately in the late 1990s (Coggins and Walters 2009; Yard et al. 2011).

The source of rainbow trout in the LCR reach is not known with certainty, although available data indicate they likely originate in the Lees Ferry reach (first 15 miles below the dam). Brown trout spawn primarily in Bright Angel Creek and are most abundant in the mainstem Colorado River near this tributary (RM 88; Liebfried et al. 2003, 2006). Korman et al. (2010) noted that rainbow trout mortality in Lees Ferry and their emigration from Lees Ferry appear to be density dependent. An important aspect of this action is the need to reduce numbers of rainbow trout and brown trout near the confluence of the Colorado and Little Colorado rivers by reducing the numbers of trout emigrating from these population sources in the Lees Ferry and Bright Angel Creek.

Non-native fish control was previously tested as an experiment from 2003 to 2006 (see Section 1.9; Coggins et al. 2011; Yard et al. 2011). During this time, a removal and related mitigation program was implemented in the mainstem Colorado River at the Little Colorado River confluence (LCR reach). Flows from Glen Canyon Dam designed to reduce recruitment of trout in Lees Ferry were also tested from 2003-2005. Then, as now, removal of non-native fish was focused in the LCR reach because of high numbers of both non-native fishes and native fishes, including the majority of humpback chub in Grand Canyon (Valdez and Ryel 1995; Coggins and Walters 2009). No removal was conducted in the LCR (or is proposed now) because densities of non-native fish in the LCR itself are very low, too low to warrant removal efforts (Valdez and Ryel 1995; Van Haverbeke and Stone 2009). Tribes had expressed concern over non-native fish control when it was first proposed in 2002. Consultation between these tribes, Reclamation, NPS, and the USGS resulted, at that time, in the identification of a beneficial human use that served to mitigate the tribes' concerns for the experimental action. Fish removed were emulsified and used as fertilizer in the Hualapai tribal gardens. The program was effective at reducing numbers of trout and in meeting tribal concerns, although the program was conducted at a time when the trout population was undergoing a natural system-wide decline (Coggins et al. 2011). One removal trip was also conducted in 2009, which prompted concerns from various tribes and ultimately led to preparation of this EA.

As part of the Annual Work Plan of the GCDAMP for Fiscal Year 2010-2011, one or two river trips to remove non-native fish were included and tentatively scheduled for May-June 2010 and 2011. Some tribal representatives to the GCDAMP expressed concern and asked for government-to-government consultation regarding the killing of non-native fish in the vicinity of the confluence of the Little Colorado and Colorado rivers, a location of cultural, religious, and historical importance. The Pueblo of Zuni, in a letter dated June 30, 2009, expressed the Zuni Tribe's concerns with the "taking of life" associated with removal, and stated that the Zuni's believed that the Bureau of Reclamation and the United States Fish and Wildlife Service had failed to consult with the Zuni Tribe concerning this management action, and the Zuni Tribe's request to initiate formal consultation with the Bureau of Reclamation on this issue. After careful consideration of the issues, the Assistant Secretary of the Interior for Water and Science decided to cancel the two planned removal trips in 2010 and Reclamation reinitiated consultation with the U.S. Fish and Wildlife Service on cancelling removal. The Assistant Secretary and other DOI representatives have since conducted numerous meetings with tribal representatives in an effort to find suitable means of addressing the tribal concerns (see Section 1.12).

Reclamation is serving as the lead federal agency in this action because it has operational authority over Glen Canyon Dam and has agreed to address non-native fish control through the GCDAMP pursuant to the terms of the biological opinions issued by the USFWS (U.S. Fish and Wildlife Service 2007, 2008, 2009, 2010a, 2010b). However, Reclamation's legal authority does not include direct management of Colorado River fishes. That authority rests with the NPS, the federal agency responsible for managing natural and cultural resources

within GCNRA and GCNP, and the AGFD, the state agency responsible for managing sport fish in the state of Arizona⁴.

1.5 Structured Decision Making Project⁵

Reclamation partnered with the USGS Patuxent Wildlife Research Center to conduct a Structured Decision Making (SDM) Project on non-native fish management below the Glen Canyon Dam as part of the process in developing this EA. The purpose of the SDM Project was to use a structured approach to develop and provide substantive input from the cooperating agencies and tribes to Reclamation in the NEPA process concerning management of non-native fish below Glen Canyon Dam. The SDM Project provided an opportunity for the cooperating agencies and tribes to participate in defining objectives for non-native fish control, as well as in developing and evaluating potential alternatives for non-native fish control with regard to their performance in meeting objectives.

Two workshops were held near Phoenix, Arizona, on October 18-20 and on November 8-10, 2010. At these workshops, a diverse set of objectives for the project were defined, a set of alternatives (“hybrid portfolios”) was developed, and participants assessed alternatives against the array of objectives. Multi-criteria decision analysis methods were then employed to examine the trade-offs inherent in the problem, and allowed the participating agencies and Tribes to express their individual judgments about how those trade-offs should best be managed in selecting a preferred alternative. Subsequent work refined that analysis. The project served to enlist the cooperating agencies in alternative development and analysis. The final report is provided as an appendix to this EA (Appendix A; Runge et al. 2011) and has been utilized to formulate, analyze, and select alternatives for analysis in this EA were indicated.

The SDM Project was used to assist Reclamation and the cooperating agencies in identifying, developing, and analyzing alternatives as part of the NEPA process. The alternatives considered in the SDM Project were complex, multi-faceted approaches, some with adaptive components. The alternatives were built up from the simplest components and identified several layers of complexity. At the simplest level, the alternatives consist of action elements, which are specific and detailed aspects of on-the-ground actions. Action elements that are related can be combined into single strategies that focus on a particular method for

⁴ Because the two park units are not under exclusive federal jurisdiction, state law applies to the management of fish within their boundaries, but only to the extent that it has not been preempted by federal statute, federal regulation, or lawful federal administrative action. In accordance with 43 C.F.R part 24, the NPS must consult with the AGFD before taking certain administrative actions to manage fish within the park units.

⁵ The use of the phrase “Structured Decision Making” refers to a process utilized by the U.S. Geological Survey to assess and proceed through a complex set of analyses and resource considerations. In this instance the outcome of the SDM process is not a “decision”; as the SDM process in this instance was utilized as an *input* to the NEPA process. Accordingly, the SDM process does not represent a final agency action and serves in this instance as a method to ensure that the decision agency (Reclamation) had received input from the entities participating in the SDM effort. As described in Appendix A, SDM was used to “provide a forum for the diverse cooperating agencies and Tribes to discuss, expand, and articulate their respective values, to develop and evaluate a broad set of potential management alternatives, and to indicate how they would individually prefer to manage the inherent trade-offs in this management problem.”

addressing some aspect of non-native fish control (e.g. mechanical removal of non-native fish at the confluence of the Little Colorado River). The single strategies can also be combined into hybrid portfolios. These hybrid portfolios are the alternatives for long-term non-native fish control, and were evaluated in the SDM Project.

The hybrid portfolios created in the SDM Project were each evaluated by the cooperating agencies and tribes that participated in the SDM Project. These hybrid portfolios essentially serve as NEPA alternatives. The evaluation process is described in detail in the SDM Project report in Appendix A. That process used multi-criteria decision analysis methods to evaluate the performance and impacts of the proposed hybrid portfolios against objectives for the undertaking, and the objectives were derived from the perspective of the cooperating agencies and tribes in the process (defined further in Appendix A). At the second workshop, 20 hybrid portfolios were included in the analysis, and objective weights were elicited from the cooperating agency and tribal representatives to rate the alternatives against the objectives.

A number of portfolios were eliminated from further consideration at that point because their ability to meet objectives was poor and they did not meet the purpose and need. Others were eliminated because they were not well developed and they could not be evaluated. Two high-ranking portfolios, both of which involved sediment augmentation (Randle et al. 2007; discussed further below) were eliminated from further consideration due to cost and because they did not satisfy the purpose and need for the action because the ecological impacts require more detailed analysis than could be developed in time to be evaluated in this EA, and similarly, construction would take a number of years precluding implementation within the timeframe necessary to meet the need for this action. An additional seven hybrid portfolios were created and a total of 13 portfolios were carried forward for final analysis. The final analysis resulted in a ranking of the 5 top-performing hybrid portfolios, performance being measured against the objectives and using methods described in the “Affected Environment and Environmental Consequences” section and in the SDM Project report (Appendix A, section 6). The top-performing hybrid portfolio was selected as the proposed action. The proposed action was then analyzed in this EA against the no action alternative. The “No Action” alternative was also fully analyzed in the SDM Project, and was not in the top five hybrid portfolios at the end of the SDM evaluation. In this way, Reclamation used the SDM Project to help develop analysis of potential alternatives in the NEPA process.

1.6 Selected Legal Authorities

The Secretary of the Interior (Secretary) was authorized to “construct, operate, and maintain” Glen Canyon Dam by the Colorado River Storage Project Act of 1956 (CRSPA; 43 U.S.C. § 620):

“... for the purposes, among others, of regulating the flow of the Colorado River, storing water for beneficial consumptive use, making it possible for the States of the Upper Basin to utilize, consistently with the provisions of the Colorado River Compact, the apportionments made to and among them in the Colorado River Compact and the Upper Colorado River Basin Compact, respectively, providing for

the reclamation of arid and semiarid land, for the control of floods, and for the generation of hydroelectric power, as an incident of the foregoing purposes,..."

The CRSPA, as well as a number of Federal statutes and legislative authorities, affect the manner in which Glen Canyon Dam is operated and the manner in which water is apportioned to the seven basin states and Mexico. These authorities are collectively known as the "Law of the River," which is a collection of Federal and State statutes, interstate compacts, court decisions and decrees, an international treaty with Mexico, and criteria and regulations adopted by the Secretary.

An important function and purpose of Glen Canyon Dam is to generate hydroelectric power. Water released from Lake Powell through the dam's eight hydroelectric turbines generates power marketed by Western Area Power Administration (Western). From the time of the dam's completion in 1963 to 1990, the dam's daily operations were primarily undertaken to maximize generation of hydroelectric power in accordance with Section 7 of the CRSPA, which requires hydroelectric powerplants to be operated "so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates."

In the early 1980s, Reclamation undertook the Uprate and Rewind Program to increase powerplant capacity at Glen Canyon Dam. As part of an Environmental Assessment and Finding of No Significant Impact (FONSI; Reclamation 1982), Reclamation agreed to not use the increased capacity until completion of a more comprehensive study on the impacts of historic and current dam operations. The Glen Canyon Dam Environmental Studies (GCES) Phases I and II were conducted from 1982 to 1995 to evaluate the effect of the uprate and rewind and dam operations on downstream resources. The GCES concluded that dam operations were adversely affecting natural and recreational resources and that modified operations would better protect those resources (Reclamation 1988). These studies also brought forth concerns about the effects of dam operations on the resources of GCNP and GCNRA and highlighted the need to evaluate the effects on species listed pursuant to the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. § 1531 et seq.). As a result of these studies, Reclamation agreed to maximum authorized releases of 31,500 cfs, and the potential of 33,200 cfs that resulted from the uprate and rewind was not implemented.

In 1992 Congress enacted, and President George H.W. Bush signed into law, the Grand Canyon Protection Act (GCPA), title XVIII, §§ 1801-1809 of the Reclamation Projects Authorization and Adjustment Act of 1992, Pub. L. No. 102-575, 106 Stat. 4600, 4669. Congress enacted the GCPA to provide further direction to the Secretary to address the detrimental effects of dam operations on downstream resources. Section 1802(a) of the GCPA provides that:

The Secretary shall operate Glen Canyon Dam in accordance with the additional criteria and operating plans specified in section 1804 and exercise other authorities under existing law in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use.

At the same time Congress directed the Secretary to implement the GCPA in compliance with other specified provisions of federal law applicable to the operation of Glen Canyon Dam. Section 1802(b) of the GCPA states:

The Secretary shall implement this section in a manner fully consistent with and subject to the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in *Arizona v. California*, and the provisions of the Colorado River Storage Project Act of 1956 and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development, and exportation of the waters of the Colorado River Basin.

Similarly, Section 1806 of GCPA states that:

Nothing in this title [GCPA] is intended to affect in any way—

- (1) The allocations of water secured to the Colorado Basin States by any compact, law, or decree; or
- (2) Any Federal environmental law, including the Endangered Species Act (16 U.S.C. 1531 et seq.).

Finally, the GCPA emphasized the Secretary's authority and responsibility to manage and administer Grand Canyon National Park and Glen Canyon National Recreation Area in accordance with the so-called NPS Organic Act and other laws applicable to units of the national park system. Section 1802(c) states:

Nothing in this title alters the purposes for which the Grand Canyon National Park or the Glen Canyon National Recreation Area were established or affects the authority and responsibility of the Secretary with respect to the management and administration of the Grand Canyon National Park or the Glen Canyon National Recreation Area, including natural and cultural resources and visitor use, under laws applicable to those areas, including, but not limited to, the Act of August 25, 1916 (39 Stat. 535) as amended and supplemented.

Section 1804(a) of the GCPA required completion of an EIS evaluating alternative operating criteria, consistent with existing law, that would determine how the dam would be operated consistent with the purposes for which the dam was authorized and the goals for protection of GCNP and GCNRA. The Operation of Glen Canyon Dam Final Environmental Impact Statement was completed in March 1995 (Reclamation 1995) with the preferred alternative, called the MLFF Alternative, selected by the Secretary of the Interior as the required operating regime for Glen Canyon Dam. As articulated in the Record of Decision, issued on October 9, 1996 (Department of the Interior 1996). The goal of selecting a preferred alternative was not to maximize benefits for the most resources, but rather to find an alternative dam operating plan that would permit recovery and long-term sustainability of downstream resources while limiting hydropower capability and flexibility only to the extent

necessary to achieve recovery and long-term sustainability (Department of the Interior 1996).

The final EIS hypothesized that high flows were important for restoring ecological integrity and identified these as beach-habitat building flows and habitat maintenance flows. Additionally, the 1995 Final Biological Opinion on the Operation of Glen Canyon Dam (U.S. Fish and Wildlife Service 1995) identified a program of experimental flows as an element of the Reasonable and Prudent Alternative that included provisions for high-volume dam flows termed “beach-habitat building flows” (BHBFs) and “habitat maintenance flows” (HMFs). BHBFs were releases that exceeded the powerplant capacity and were designed to build sandbars and beaches, and HMFs were releases up to powerplant capacity designed to maintain these sand features. These actions were also discussed in the EIS and the Record of Decision. This biological opinion was replaced by the 2008 Opinion (U.S. Fish and Wildlife Service 2008), which was subsequently supplemented in 2009 (U.S. Fish and Wildlife Service 2009). A more complete history of high-flow releases is provided in section 1.5 of this EA.

Section 1805 of the GCPA directs the Secretary to undertake research and monitoring to determine if dam operations are actually achieving the resource-protection objectives of the Final EIS and Record of Decision, i.e., mitigating adverse impacts and protecting and improving the natural, cultural, and recreational values for which GCNP and GCNRA were established. These provisions of the GCPA were incorporated into the 1996 Record of Decision and led to the establishment of the Glen Canyon Dam Adaptive Management Program (GCDAMP; www.gcdamp.gov). The GCDAMP includes the Adaptive Management Work Group, a chartered Federal Advisory Committee to the Secretary, and the Grand Canyon Monitoring and Research Center (GCMRC), a research branch of the GCDAMP under the U.S. Geological Survey (USGS). Monitoring and research conducted by these organizations since 1996 have improved the understanding of riverine geomorphology and how dam operations might assist in the conservation of sand and other natural and cultural resources below the dam.

Since 1999, the Colorado River Basin has experienced prolonged and historic drought conditions; this period represents the driest period in over one hundred years of streamflow recordkeeping. In response to several years of below-normal runoff and declining reservoir conditions and at the direction of the Secretary, Reclamation completed a Final EIS and Record of Decision in 2007 on the 2007 Colorado River Interim Guidelines (Bureau of Reclamation 2007; U.S. Department of the Interior 2007). These 2007 Colorado River Interim Guidelines were adopted in December 2007 and are scheduled to be in effect through September 2026 to provide better operational management of Lake Powell and Lake Mead. The provisions of the 1995 EIS and 1996 Record of Decision that led to MLFF, as well as the 2007 EIS and Record of Decision that proposed adoption of interim guidelines and coordinated operations, establish the foundation for the no action and proposed action alternatives defined in this EA.

Section 7(a)(2) of the Endangered Species Act (ESA) requires federal agencies to consult with agencies designated by the Secretaries of Commerce and the Interior to insure that a proposed agency action is unlikely to jeopardize an endangered or threatened species. The

USFWS and the National Marine Fisheries Service administer the ESA. Once a consultation process is complete, a written biological opinion is issued, which may suggest alternative actions to protect a jeopardized species or its critical habitat. USFWS also administers the FWCA which enables USFWS to provide planning and assistance and recommendations to support conservation of fish and wildlife resources.

1.7 Related Actions, Projects, Plans and Documents

Related actions, projects, plans, and documents are identified in this EA in order to better understand other ongoing activities that may individually or cumulatively influence, relate to, or affect the proposed action. These actions, project, plans, and documents are related to ongoing activities of state and federal agencies, as well as American Indian Tribes. There are relatively few actions that cumulatively impact the affected environment because the location of the proposed action is the Colorado River in Glen, Marble, and Grand Canyons, almost entirely in national parks, GCNP and GCNRA.

1.7.1 1995 Glen Canyon Dam Environmental Impact Statement and Record of Decision

The action proposed in this EA is tiered from two Reclamation EISs and these documents are incorporated by reference: the 1995 EIS on the operation of Glen Canyon Dam (Bureau of Reclamation 1995) and the associated 1996 Record of Decision (U.S. Department of the Interior 1996); and the 2007 Colorado River Interim Guidelines EIS (Bureau of Reclamation 2007) and the associated 2007 ROD (U.S. Department of the Interior 2007). The 1996 Record of Decision implemented the MLFF to govern releases from Lake Powell at monthly, daily, and hourly increments. The 2007 ROD governs annual water year releases from Lake Powell in coordination with Lake Mead. There is also an ongoing program of experimental releases from Glen Canyon Dam in effect from 2008 through 2012, under an EA and FONSI (Bureau of Reclamation 2008).

1.7.2 High Flow Experiment Protocol Environmental Assessment

In a concurrent NEPA process, Reclamation is preparing an EA to evaluate implementation of a protocol for conducting HFEs at Glen Canyon Dam for the purposes of sediment management in Grand Canyon. The protocol would be implemented over a period of up to 10 years, from 2011 through 2020. The HFE Protocol, if implemented, would be a multi-year, multi-experimental approach using short-duration, high-volume releases from Glen Canyon Dam in the channel of the Colorado River downstream of the dam. The purposes of the HFE Protocol are: 1) to develop and implement a protocol that determines when and under what conditions to conduct experimental high volume releases, and 2) to evaluate the effectiveness of these experimental releases in conserving sediment to benefit downstream resources in Glen, Marble, and Grand Canyons without affecting annual releases from Glen Canyon Dam under the 2007 Colorado River Interim Guidelines.

High-flow releases have been one mechanism that have historically been used to comply with the Grand Canyon Protection Act to restore beaches and associated resource values in Grand Canyon. However, past Spring HFEs have had demonstrated effects on some non-

native fish species in Grand Canyon, and future HFEs could have similar effects (Wright and Kennedy 2011). Specifically, high flow releases may lead to increased rainbow trout populations, perhaps depending on the time of year of the HFE (Korman et al. 2010, Wright and Kennedy 2011). In turn, this may increase the threat to humpback chub from predation and competition from increased numbers of non-native fish (Wright and Kennedy 2011). Non-native fish control alternatives should be developed that would allow effective control of trout while enhancing conditions for humpback chub in consideration of the potential effects of increased HFE occurrence on trout abundance. Accordingly, this EA takes into account the potential effects of HFEs in the context of no action and the proposed action, and analyzes a 10-year period of implementation of non-native fish control to correspond with the 10-year period of the proposed action in the HFE Protocol EA.

1.7.3 Other Agency Actions, Projects, Plans, and Documents

The NPS actively manages resources within GCNP and GCNRA. Of importance to this EA is the GCNP and GCNRA ongoing effort related to native fish management. NPS is in the process of developing a Native Fish Plan for GCNP and the Colorado River in GCNRA. Management goals for native fisheries in Glen Canyon and Grand Canyon are being developed to achieve a “natural condition,” or the condition of resources that would occur in the absence of human dominance over the landscape (NPS Management Policies 2006). In general, the NPS seeks to restore native fish communities and naturally functioning ecosystems. The overall goals of the Native Fish Plan include:

- Restore populations of native fish to a level that approximates natural conditions, and prevent adverse modification to their habitat (including critical habitat for ESA-listed species).
- Restore self-sustaining populations of extirpated fish species, including Colorado pikeminnow, razorback sucker, bonytail, and roundtail chub (*Gila robusta*), to the extent feasible within GCNP.
- Minimize the impacts of the recreational trout fishery in the Lees Ferry reach to downstream native fisheries in GCNP.

Specific actions underway include:

- Translocation of humpback chub to Shinumo Creek and Havasu Creek: juvenile humpback chub have been translocated from the Little Colorado River to Shinumo Creek. Plans are in place to make additional translocations of humpback chub to Havasu Creek. These translocations are a conservation measure of the 2008 Opinion, the 2009 Supplement, and the operating biological opinion, the 2011 Opinion (U.S. Fish and Wildlife Service 2008, 2009, 2011).
- Non-native fish are being removed from Bright Angel and Shinumo Creeks to restore and enhance the native fish community in Bright Angel Creek and to reduce predation and competition on endangered humpback chub from non-native fish. Non-

native fish (rainbow and brown trout) are being removed from Shinumo Creek in conjunction with translocation to minimize predation upon newly translocated humpback chub and reduce potential competitive interactions. NPS removed from Bright Angel Creek 525 brown trout from 2006-2007, and 454 rainbow trout and 594 brown trout from 2010-2011 using a combination of a fish weir trap and electrofishing; NPS also removed 1,220 rainbow trout and one brown trout from Shinumo Creek in 2009, and 929 rainbow trout in 2010. These efforts are a conservation measure of the 2008 Opinion, the 2009 Supplement, and the 2011 Opinion (U.S. Fish and Wildlife Service 2008, 2009).

In addition to the above, the following are related actions identified by the NPS. The NPS is a cooperating agency in this EA and all actions identified in this document are being coordinated with that agency.

- GCNRA General Management Plan (GMP): The recreation area's 1979 GMP set an objective to manage the Lees Ferry and Colorado River corridor below the Glen Canyon Dam to "give primary emphasis to historical interpretation and access to recreational pursuits on the Colorado River" (NPS 1979).
- General Management Plan (GMP): The park's 1995 GMP set as an objective the management of the Colorado River corridor through Grand Canyon National Park to protect and preserve the resource in a wild and primitive condition (National Park Service 1995).
- Grand Canyon National Park Resource Management Plan (RMP) (1997): The RMP is the primary resource stewardship action plan that provides long-term guidance and protection for natural, cultural and recreational resources of GCNP (National Park Service 1997).
- Colorado River Management Plan (CRMP): The CRMP management objectives emphasize managing river recreation to minimize impacts to resources while providing a quality river visitor experience. The Colorado River corridor will be managed to provide a wilderness-type experience in which visitors can intimately relate to the majesty of the Grand Canyon and its natural and cultural resources. Visitors traveling through the canyon on the Colorado River will have the opportunity for a variety of personal outdoor experiences, ranging from solitary to social, with little influence from the modern world. The Colorado River corridor will be protected and preserved in a wild and primitive condition. To ensure these salient objectives are met, the NPS must determine, through a research, monitoring and mitigation program, what impacts are occurring, how these impacts alter resource condition, and how adverse impacts can be effectively mitigated. The NPS has developed a draft plan that includes individual and integrated resource-monitoring components.
- Backcountry Management Plan: This plan describes provisions for back country use, resource and wilderness management within Grand Canyon National Park. The plan

is being updated in 2011.

The Arizona Game and Fish Department (AGFD) is also a cooperating agency in this EA. The following are related actions identified by that State agency.

- Changes to bag limits: the AGFD and the Arizona Game Commission changed size limits and bag limits for trout in the Lees Ferry reach in 2010. These changes are designed to better manage abundance and size of trout in the Glen Canyon trout fishery, and to reduce the numbers of trout emigrating downstream to habitat occupied by humpback chub, where they prey upon and compete with this endangered fish species. Two river reaches and corresponding regulations were redefined: Paria Rifle (RM 1) to Navajo Bridge (RM 4) – 6 rainbow trout/day, 8 in possession; unlimited take of all other sport fish other than rainbow trout; and unlimited take of all sport fish from Navajo Bridge (RM 4) to Separation Canyon (RM 239.5) including all tributaries within Grand Canyon National Park.
- USFWS intra-Service consultation on Arizona Game and Fish Department stocking of sport fish in the State of Arizona outside of GCNP and the GCNRA.

1.8 Agency Roles and Responsibilities

Five agencies within Interior and one within the U.S. Department of Energy have responsibilities under the GCPA, and undertake operations pursuant to the GCPA. The role of each responsible agency under the GCPA is briefly addressed below.

1.8.1 Department of the Interior

1.8.1.1 Bureau of Indian Affairs

The Bureau of Indian Affairs' (BIA) mission, among other objectives, includes enhancing quality of life, promoting economic opportunity, and protecting and improving trust assets of American Indian Tribes and individual American Indians. This is accomplished within the framework of a government-to-government relationship in which the spirit of Indian self-determination is paramount. As part of the GCDAMP, BIA's Western Regional Office is committed to working hand-in-hand with interested tribes and other participating agencies to ensure that this fragile, unique, and traditionally important landscape is preserved and protected.

1.8.1.2 Bureau of Reclamation

Reclamation operates Glen Canyon Dam pursuant to applicable federal law and in accordance with the additional criteria and operating plans specified in section 1804 of the Grand Canyon Protection Act as well as in accordance with approved experimental plans. Glen Canyon Dam is also operated consistent with and subject to numerous compacts, federal laws, court decisions and decrees, contracts and regulatory guidelines commonly and collectively known as the "Law of the River."

1.8.1.3 National Park Service

The NPS manages and protects units of the national park system and administers resource-related programs under the authority of various federal statutes, regulations, and executive orders and in accordance with written policies set forth by the Secretary and the Director of the NPS, including the NPS Management Policies 2006 and the NPS Director's Orders. The NPS manages GCNP and GCNRA under the Organic Act (16 U.S.C. §§ 1 and 2-4, as amended); other acts of Congress applicable generally to units of the national park system; and the legislation specifically establishing those park units (16 U.S.C. §§ 221-228j and 16 U.S.C. §§ 460dd through 460dd-9 (2006)). The Organic Act directs the NPS to “*promote and regulate the use of . . . national parks . . . in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*” The agency emphasis is not only on preserving species and habitat, but also on maintaining natural processes and dynamics that are essential to long-term ecosystem perpetuation.

1.8.1.4 U.S. Fish and Wildlife Service

The USFWS provides Endangered Species Act (ESA) conservation and associated consultation and recovery with various stakeholders primarily to benefit four ESA-listed species in Grand Canyon: humpback chub, razorback sucker, southwestern willow flycatcher (*Empidonax trailii extimus*), and Kanab ambersnail (*Oxyloma haydeni kanabensis*).

The USFWS also provides Fish and Wildlife Coordination Act (FWCA) planning assistance and recommendations to support conservation of important fish and wildlife resources. Of special concern to the USFWS is the opportunity provided under the FWCA for collaborative development of recommendations to conserve non-listed native species such that the need for listing in the future under the ESA is unnecessary.

A FWCA report (June 28, 1994) provided recommendations that included timing for flows, protection of juvenile humpback chub and other native fish, and trout management, in support of preparation of the 1995 EIS. This information was provided to support conservation of fish and wildlife, including endangered species, in GCNP and GCNRA.

1.8.1.5 U.S. Geological Survey

The Grand Canyon Monitoring and Research Center (GCMRC) of the U.S. Geological Survey (USGS) was created to fulfill the mandate in the GCPA for the establishment and implementation of a long-term monitoring and research program for natural, cultural, and recreation resources of GCNP and GCNRA. The GCMRC provides independent, policy-neutral scientific information to the GCDAMP on: (a) The effects of the operation of Glen Canyon Dam and other related factors on resources of the Colorado River Ecosystem using an ecosystem approach, and (b) the flow and non-flow measures to mitigate adverse effects. GCMRC activities are focused on: (a) monitoring the status and trends in natural, cultural and recreation resources that are affected by dam operations, and (b) working with land and resource management agencies in an adaptive management framework to carry out and evaluate the effectiveness of alternative dam operations and other resource conservation actions.

1.8.2 Department of Energy

1.8.2.1 Western Area Power Administration

Western's mission is to market and deliver clean, renewable, reliable, cost-based federal hydroelectric power and related services. The Colorado River Storage Project (CRSP) Management Center markets power from the CRSP and its participating projects (Dolores and Seedska-dee and the Collbran and Rio Grand projects). These resources are provided by 11 powerplants in Arizona, Colorado, New Mexico, Utah and Wyoming and are marketed together as the Salt Lake City Integrated Projects. CRSP staff also markets power from the Provo River Project in Utah and the Amistad-Falcon Project in Texas. Transmission service is provided on transmission facilities in Arizona, Colorado, Nevada, New Mexico, Texas, Utah and Wyoming.

1.9 Previous Non-native Fish Control Efforts

Non-native fish control was previously tested from 2003 to 2006, and in 2009. During this time, a removal and related mitigation program was implemented in the vicinity of the Colorado and Little Colorado rivers confluence (the LCR reach). Flows from Glen Canyon Dam, "non-native fish suppression flows," designed to reduce recruitment of trout in Lees Ferry were also tested from 2003-2005. Tribes had expressed concern over non-native fish control when it was first proposed in 2002. Consultation between these tribes, Reclamation, and the USGS resulted, at that time, in the identification of a beneficial human use that served to mitigate the tribes' concerns for the experimental action; fish removed were emulsified and used as fertilizer in the Hualapai tribal gardens. The program was effective at reducing numbers of trout and in meeting tribal concerns, although subsequent studies indicate that the program was conducted at a time when the trout population was undergoing a natural system-wide decline, and other ecosystem changes, including warmer water temperatures, confounded efforts to evaluate the response of native fishes to the control efforts (Coggins et al. 2011).

Several key results were derived from this period of experimentation. Although the "non-native fish suppression flows" did result in a total redd⁶ loss estimate of 23% in 2003 and 33% in 2004, this increased mortality did not lead to reductions in overall recruitment due to increases in survival of rainbow trout at later life stages (Korman et al. 2005; Korman et al. 2011). Removal of non-native fish using boat-mounted electrofishing in the LCR reach was effective for both rainbow trout and brown trout removal. Of 36,500 fish captured from 2003-2006, 23,266 were non-native, including 19,020 rainbow trout and 470 brown trout. Levels of both trout species were effectively suppressed in the LCR reach using this method, especially rainbow trout, which dropped from an initial estimated abundance of 6,466 in January of 2003 to a low of 617 in February 2006 (Coggins et al. 2011). During the period of removal, the humpback chub population stabilized and increased, indicating that removal had enabled higher survival and hence, recruitment by humpback chub (Coggins 2008a; Coggins and Walters 2009; Coggins and Yard 2010). However, a system-wide decrease in rainbow trout abundance concurrent with removal and drought-induced increases in river

⁶ A redd is a fish "nest" where spawning occurs and fertilized eggs are buried.

water temperature confounded efforts to determine with certainty the causes of apparent increases in juvenile native fish survival and recruitment (Coggins et al. 2011).

Although diet content analysis indicated that rainbow trout predation rate on humpback chub was relatively low, the overall loss of young humpback chub to predation by rainbow trout was substantial due to the high density of rainbow trout in the reach. Yard et al. (2011) found that during the 12 removal trips conducted from 2003-2004, 9,326 humpback chub were eaten by trout. Therefore reducing numbers of rainbow trout in the LCR reach (19,020 rainbow trout were removed) effectively reduced predation losses of young humpback chub, a clear beneficial effect to the species, although other factors, such as warmer mainstem water temperatures in Grand Canyon during this period, confounded the overall effect of removal on humpback chub recruitment in the system (Andersen 2009; Coggins et al. 2011; Yard et al. 2011). Also during this period, rainbow trout declined system-wide, indicated both by abundance estimates from the control reach of the non-native control project and from monitoring throughout the system (Coggins et al. 2011; Makinster 2007).

The decline of rainbow trout abundance observed in the control reach may have been due to several factors. First, rainbow trout abundance in the Lees Ferry reach of the Colorado River increased during approximately 1992-2001 and then steadily fell during 2002-2006 (Makinster 2007). The 2002-2006 decrease took place during the period of removal, but upstream 60 miles in Glen Canyon. This illustrates that there was a system-wide decline in rainbow trout at the same time removal was occurring in the LCR reach. So while removal directly reduced trout numbers in the LCR reach, system-wide, rainbow trout were also declining, and it is unlikely that removal alone resulted in the decline. The decline in trout was more likely due to other factors. Possible causes include a system-wide reduction in flow and increases in water temperature due to drought, changes that could have affected the Lees Ferry rainbow trout population by reducing food base and thus creating less suitable conditions for survival and growth.

One non-native removal trip was also conducted in 2009, which provided important information for consideration of non-native fish control efforts (Makinster et al. 2009). Results from the 2009 trip indicated that rainbow trout populations rebounded since declines in 2006-2007, a trend first documented in 2008 (Coggins 2008a). AGFD removed 1,873 rainbow trout during the 2009 removal trip. The numbers of rainbow trout in 2009 in the LCR reach prior to removal are estimated to be similar to the high densities observed in 2002. Wright and Kennedy estimate that about 6-7,000 rainbow trout occupied the reach in 2002 and 2009, although these estimates are based on catch per unit effort, a less accurate measure than other methods such as catchability coefficients used by Coggins et al. (2011). By comparison, removal efforts from 2003-2006 reduced the rainbow trout population to a low of 617 in February 2006 (Coggins et al. 2011).

1.10 Role of Adaptive Management in Non-native Fish Control

The proposed action in this EA for non-native fish control would be conducted as a component of the ongoing Glen Canyon Dam Adaptive Management Program. The GCDAMP is administered through a designated senior Department of the Interior (DOI)

official who chairs the Adaptive Management Work Group (AMWG). The AMWG provides advice and recommendations to the Secretary of the Interior relative to the operation of Glen Canyon Dam, in accordance with the additional criteria and operating plans specified in Section 1804 of the GCPA, and to the exercise of other authorities under existing laws in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including but not limited to natural and cultural resources and visitor use, as provided in Section 1802 of the Act.

The decision to conduct non-native fish control would be informed by scientists and federal managers in determining the need for non-native fish control and would be based on the numbers and location of non-native fish in the system, as described in section 2 of this document. The decision would also include consideration of the concerns expressed by American Indian Tribes and Pueblos during the NEPA process. This intersection of scientists and managers is a fundamental principle of adaptive management and uses the best available scientific information to make decisions about management of the ecosystem relative to dam operations. The AMWG would continue its role as advisor to the Secretary on this 10-year proposed action and the adaptive management process. The 10-year non-native fish control action is intended to build on prior efforts of the GCDAMP to control non-native fishes through “learning by doing,” which is a fundamental principal of adaptive management.

A Science Plan is attached to this EA for the proposed action (see Appendix B). This plan addresses research and monitoring activities necessary to evaluate non-native fish control and the effects of both control and related actions such as experimental releases from the dam. The plan was developed by GCMRC and its cooperating scientists with consultation/coordination with the cooperating agencies. Members of the GCDAMP and the general public were afforded an opportunity to comment on the plan through the public review process for the EA. Key research questions that would be addressed in the Science Plan include, but are not be limited to:

- Research Question #1: Can a decrease in the abundance of rainbow trout and other cold- and warm- water non-natives in Marble and eastern Grand canyons be linked to a higher recruitment rate of juvenile humpback chub in the adult population relative to other potential sources of mortality? Or conversely, can an increase in numbers of non-native fish predators be linked to a decrease in adult humpback chub?

Rationale: The goal of the proposed action is, in part, to determine if humpback chub recruitment can be improved by controlling non-native fish species, and in particular, rainbow and brown trout.

- Research Question #2. Can removal efforts focused in the PBR reach (e.g., interception fishery) be effective in reducing downstream movement of trout such that trout levels in the LCR reach remain low? Will recolonization from tributaries, from downstream and upstream of the removal reach, or local production require that removal be an ongoing management action in the LCR reach?

Rationale: Although previous efforts to reduce trout numbers in the LCR reach were effective, they were conducted during a period of decreasing trout abundance throughout the system. This control effort would assess whether reductions in numbers of trout, and other non-native fish species, can be sustained while also reducing effort and cost of control actions.

- Research Question #3: Can non-native fish control offset any increases in rainbow trout from multiple HFEs?

Rationale: Ongoing research and monitoring of fish populations downstream from Glen Canyon Dam have shown that the status and trends of these populations are influenced by complex interactions of river flows, water temperature, water clarity, and tributary influences. The humpback chub population declined from about 11,000 adults in 1989 to about 5,050 adults 2001, and has subsequently stabilized and increased to 7,650 adults in 2008. Korman et al. (2011) found that the March 2008 HFE resulted in increased productivity of trout in Lees Ferry, and Makinster et al. (2010) found that this appeared to be linked to increased emigration rates, and ultimately contributed to higher numbers of trout in the LCR reach. Wright and Kennedy (2011) also reported that the 2008 HFE appears to have contributed to an increase in rainbow trout numbers in the LCR reach. Focused investigations are needed to better understand how aspects of an HFE (timing, magnitude, duration, and frequency) affect fish populations, including nearshore habitat, movement of young native fish from the Little Colorado River, recruitment of young, and food base. Due to the proposed HFE Protocol and the potential for future HFEs, non-native fish control efforts would need to be evaluated with regard to their efficacy at offsetting increases in rainbow trout that result from HFEs.

- Research Question #4: What is the importance of mainstem habitats to humpback chub recruitment relative to the LCR?

Rationale: A long standing question of humpback chub recovery has been what is the relative importance of mainstem habitats to humpback chub recruitment? Much of the recruitment of humpback chub is thought to occur in the LCR. Non-native fish control actions would improve survivorship of humpback chub predominantly in the mainstem. However, if a vast majority of recruitment is occurring in the LCR, potential improvements in survivorship in the mainstem through non-native fish control may have relatively little effect on overall recruitment of humpback chub. Better estimates of juvenile humpback chub abundance and survivorship in both the LCR and the mainstem would be required to answer this question.

The proposed action includes both PBR reach and LCR reach removal. Removal efforts would be implemented through adaptive management. The goal of the proposed action is to reduce predation and competition from non-native fishes on humpback chub while continuing to address the concerns of American Indian tribes surrounding non-native fish removal. Through adaptive management, effort would be shifted between the two removal

reaches depending on the results of removal actions and the status of native and non-native fishes reported through monitoring and modeling results.

In order to both address the concerns of American Indian tribes over non-native fish removal, and to better understand the relationship between predation by rainbow trout on humpback chub survivorship, removal at the LCR would only be implemented if monitoring and modeling data indicate that a trigger has been reached as defined in the 2011 Opinion (see appendix E, U.S. Fish and Wildlife Service 2011). Reclamation proposes to use this trigger for LCR reach removal because this is consistent with the USFWS biological opinion on this action.

The proposed action would also include research to better understand trout movement dynamics in the action area, as well as the relative importance of habitats in the Little Colorado River and mainstem Colorado River to juvenile humpback chub. Rainbow trout would be marked with PIT tags in the Lees Ferry area, and monitoring in Marble Canyon would be increased. This additional monitoring, along with pilot testing of PBR reach removal, should assist in evaluating how and when trout move from the Lees Ferry area to downstream reaches. The proposed action would also include new research on habitat use and abundance of juvenile humpback chub in both the Little Colorado River and the mainstem Colorado River to assess the relative importance of mainstem habitats to humpback chub recruitment.

As part of the adaptive management process, Reclamation would undertake development of suppression options, with stakeholder involvement, that reduce recruitment of non-native fish at, and emigration of those fish from, Lees Ferry. Both flow and non-flow experiments focused on the Lees Ferry reach may be conducted in order to experiment with actions that would reduce the recruitment of trout in Lees Ferry, lowering emigration of trout. These actions may also serve to improve conditions of the recreational trout fishery in Lees Ferry. Additional environmental compliance may be necessary for these experiments. Utilizing actions such as Glen Canyon Dam releases to reduce recruitment and emigration rates of trout in Lees Ferry may be more economical and effective over the long-term at mitigating the effects of trout on humpback chub (Runge et al. 2011). However, flow options alone also may prove to be ineffective at reducing emigration of trout from the Lees Ferry population. Thus the goal is to use adaptive management to experiment with a variety of options to determine the extent to which non-native fish control is necessary and develop a long-term management strategy that is culturally sensitive and cost effective.

In evaluating flow options for use in non-native fish control, Reclamation would evaluate a number of research elements, including, but not limited to, the following:

- Determining if stranding flows could reduce rainbow trout recruitment by dewatering redds or stranding juvenile trout;
- Evaluating the potential for utilizing changes in down-ramp rates to strand or displace juvenile trout and reduce recruitment;

- Evaluating different types and magnitudes of stranding flows;
- Evaluating the potential to use water quality of dam releases (low oxygen levels) below Glen Canyon Dam to reduce trout survivorship.
- Determining if flow and non-flow actions are effective in improving the Lees Ferry trout fishery.

Developing and testing dam releases and other non-flow methods would require involvement of both scientists and stakeholders to adequately analyze effects of these actions.

Reclamation would work with these groups to develop a proposal and science plan for evaluating these flow and non-flow actions with these groups over the next one to two years.

1.11 Public Involvement

Based on the previous experiments and before beginning preparation of this EA, a wide variety of people were contacted to get their ideas and concerns about the status of endangered fish in the Colorado River and possible treatments to reduce numbers of non-native fish, as well as the anticipated effects of these treatments. The Grand Canyon Monitoring and Research Center convened and conducted a Non-native Fish Workshop on March 30-31, 2010, to: (1) Describe non-native fish management in Grand Canyon, (2) identify critical issues and develop approaches to these issues, describe perspectives on management of native and non-native species, and (3) describe agency roles for non-native fish control in conservation and recovery of native fish in Grand Canyon. Two modeling workshops were also held by GCMRC on April 14-15 and on October 12-15, 2010 that helped to clarify the role of trout predation on the humpback chub and preliminarily identified possible strategies and treatments for managing trout populations in Grand Canyon.

The following cooperating agency (CA) meetings were also held:

- A cooperating agency workshop was conducted in Salt Lake City June 17-18, 2010;
- A CA and tribal meeting was held in Flagstaff on August 20, 2010; and,
- CA conference calls were conducted on July 12, September 2, 9, 16, 23, 30, and November 4 and 21, 2010, and January 5, 2011, and March 24, 2011.
- SDM Workshops were conducted on October 18-20, November 8-10, 2010.
- AZGFD met with Marble Canyon business owners on January 28th 2011 to discuss the EAs; USGS, NPS, and Western were also in attendance.
- The AZGFD, USFWS, Reclamation, NPS, USGS, and Western also met with flyfishing guides and Marble Canyon business owners to discuss their concerns

regarding removal on April 16, 2010, and Reclamation met separately with the Marble Canyon business owners on August 20 and December 20, 2010.

The draft EA was published on January 28, 2011 for a 30-day public review and comment period. In response to requests from the interested public, the comment period was extended to March 18, 2011. Thirty-five comment letters or emails were received and were fully considered in making revisions to the draft EA. This revised draft EA was circulated again for a two-week public review and comment period on July 5, 2011 in order to provide the interested public the opportunity to review revisions to the previously published draft EA; this public comment period closed on July 26, 2011. There were 15 public comments received during the second comment period which were fully considered in making revisions to the final EA.

1.12 Consultation with American Indian Tribes

Reclamation has a responsibility to recognize Indian Trust rights and maintain compliance with section 106 of the National Historic Preservation Act (NHPA), which forms part of the need for this EA. The Federal government holds Trust responsibilities that recognize the sovereign status and management authority of tribes, and assures the tribes that federal agencies will not knowingly compromise traditional practice and livelihoods in execution of their duties. Executive Order 13007 adds specificity to this principal in stating that federal agencies “shall avoid adversely affecting the physical integrity of sacred sites,” while Secretarial Order 3206 stipulates that within the context of the ESA the “Departments will carry out their responsibilities under the Act in a manner that harmonizes the Federal trust responsibility to tribes.” Further, the NHPA requires federal agencies to take into account the effects of their actions on historic properties, which, through the National Register of Historic Places, includes special provisions for places of cultural and religious importance.

Reclamation also has a responsibility to consult with tribes on actions it undertakes under Presidential Executive Order 13175, which was enacted on November 6, 2000, “in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes.” President Barrack Obama also recently issued a memorandum on November 5, 2009 that further refined this responsibility, stating:

My Administration is committed to regular and meaningful consultation and collaboration with tribal officials in policy decisions that have tribal implications including, as an initial step, through complete and consistent implementation of Executive Order 13175. Accordingly, I hereby direct each agency head to submit to the Director of the Office of Management and Budget (OMB), within 90 days after the date of this memorandum, a detailed plan of actions the agency will take to implement the policies and directives of Executive Order 13175.

Non-native fish control was first implemented through the GCDAMP beginning in 2002 with a proposal to utilize removal in the LCR reach and altered flow regimes at Glen Canyon Dam

to control trout numbers in the system. At the time, several tribes expressed concern over the taking of life associated with the project in a culturally important place, both the Grand Canyon as a whole, and the confluence of the LCR and Colorado River in particular. The Hopi Tribe, the Kaibab Band of Paiute Indians, Paiute Indian Tribe of Utah, the Hualapai Tribe, and the Zuni Tribe objected to the experimental action of removal unless there was a beneficial human use for fish removed. Consultation between these tribes, Reclamation, and the USGS resulted in the identification of a beneficial human use that served to mitigate the tribes' concerns for the experimental action. Fish that were removed were emulsified and used for fertilizer at the Hualapai tribal gardens. From 2003 through 2006 and in 2009, a removal and related mitigation program was implemented in the vicinity of the Colorado and Little Colorado rivers confluence (LCR reach). The program was effective at reducing numbers of trout, although the program was conducted at a time when the trout population was undergoing system-wide decline.

As part of the Annual Work Plan of the Glen Canyon Dam Adaptive Management Program for Fiscal Year 2010-2011, one or two river trips to remove non-native fish were included and tentatively scheduled for May-June 2010 and 2011. Some tribal representatives to the program expressed concern and asked for government-to-government consultation regarding the killing of non-native fish in the vicinity of the confluence of the Little Colorado and Colorado rivers, a location of cultural, religious, and historical importance. The Pueblo of Zuni, in a letter to Larry Walkoviak, dated June 30, 2009, from Zuni Governor Norman J. Coeoyate, expressed the Zuni Tribe's concerns with the "taking of life" associated with removal, and their concern that Reclamation and the USFWS had not sufficiently consulted with the Zuni Tribe concerning this management action. The letter also requested initiation of formal tribal consultation with the Bureau of Reclamation on this issue. In response, Reclamation and other DOI representatives met with Zuni tribal leaders to hear their concerns on September 15, 2009.

A meeting of DOI and tribal representatives was held on January 12-13, 2010, where the tribes requested government-to-government consultation on the proposed removal. Tribal concerns were also expressed in February 2010, as part of a 2-day series of GCDAMP-related public meetings in Phoenix, Arizona. The Pueblo of Zuni sent a letter to the Assistant Secretary of the Interior for Water and Science on February 19, 2010, in which the Governor of Zuni expressed his dissatisfaction with the nature and content of consultation that had occurred to date regarding non-native fish control. In response, in March 2010, Reclamation cancelled the two planned non-native fish removal trips in 2010 and reinitiated consultation with the U.S. Fish and Wildlife Service on cancelling removal.

The Assistant Secretary met with Pueblo of Zuni Governor Coeoyate and the Tribal Council on August 5, 2010, in Zuni, New Mexico. The Pueblo later sent Reclamation a Zuni Tribal Council Resolution (No. M70-2010-C086), a document and formal position statement generated by the Executive and Legislative Branches of the Zuni Government, that clearly stated the position of the Zuni Tribe and religious leaders concerning the adverse effects to the Pueblo from the removal of non-native fish in Grand Canyon and also explaining that the Zuni Tribe believes the Grand Canyon and Colorado River are Zuni Traditional Cultural Properties eligible for inclusion to the National Register of Historic Places. The resolution

included a position statement by the Zuni Religious leaders that explained that all life and the entire environment in Grand Canyon is sacred to the Zuni people and that mechanical removal results in counterproductive energy and negative effects to the Zuni people and all life.

Government-to-government consultation was initiated with the Havasupai Tribe, Hopi Tribe, Hualapai Tribe, Kaibab Band of Paiute Indians, Paiute Indian Tribe of Utah, San Juan Southern Paiute Tribe, Las Vegas Paiute Tribe, Moapa Band of Paiutes, Navajo Nation, the Havasupai Tribe, the Yavapai Apache Nation, the Pueblo of Jemez, and Pueblo of Zuni regarding the proposed action, and consultation is continuing. The Hualapai Tribe and Pueblo of Zuni are cooperating agencies for the EA. The following government-to-government tribal consultation, informal tribal consultation, and cooperating agency (CA) meetings were held since 2009:

- Government-to-government tribal consultation meetings were held with the Zuni Tribe at the Pueblo of Zuni at Zuni, New Mexico, on September 15, 2009, March 24, and June 4, 2010;
- Government-to-government tribal consultation meetings were held with the Hopi Tribe (March 4 and April 22 2010, January 27, 2011), Navajo Nation (June 9, 2010, and January 26, 2011), Hualapai (March 6, 2010, and January 8, 2011), Havasupai (March 15, 2010), Kaibab Paiute Tribe (March 18, 2010, and January 20, 2011), and the Paiute Indian Tribe of Utah (December 13, 2010);
- On July 29, 2010, Reclamation participated on a discussion panel about this issue at the 2010 Native American Fish and Wildlife Society Southwest Conference entitled “Non-Native Fish Removal in the Grand Canyon: Cultural Considerations and Fish Management”;
- The Assistant Secretary and other representatives from DOI and Reclamation met with the Governor of the Pueblo of Zuni, the Zuni Tribal Council, Zuni Cultural Resource Advisory Team, and the Zuni public at Zuni, New Mexico, to discuss non-native fish removal and the objection of the Zuni people to the killing of rainbow trout on August 5, 2010.
- The Pueblo of Zuni sent Reclamation the Zuni Tribal Council Resolution No. M70-2010-C086 on September 27, 2010, regarding their concerns with mechanical removal and the request that Grand Canyon be included as a TCP eligible for listing on the National Register. This resolution included a signed position statement of the Zuni religious leaders that was given to the Assistant Secretary at the August 5, 2010 meeting.
- A CA and tribal meeting was held in Flagstaff on August 20, 2010.
- CA conference calls were conducted on September 2, 9, 16, 23, 30, and November 4 and 21, 2010, and on January 5, 2011, and March 24, 2011. These often included the

tribes that participated as cooperating agencies, the Pueblo of Zuni and Hualapai Tribe.

- SDM Workshops were conducted on October 18-20, November 8-10, 2010, and representatives from three of the five tribes (the Navajo, Hopi, and Zuni tribes) participated in these.
- Additional tribal consultation meetings with the Pueblo of Zuni were held on January 25, August 30, and December 13, 2011.

Reclamation, along with the USFWS, NPS, BIA, and USGS, is committed to ongoing consultation with these and any other concerned American Indian tribes. Additional meetings will be held with tribes as necessary to define and resolve effects of the proposed action under NHPA section 106.

1.13 *Relevant Resources and Issues*

Reclamation has utilized the scoping results from prior NEPA analyses (e.g. U.S. Department of the Interior 2002), as well as knowledge gained from prior experiments (e.g. Coggins 2008a; Coggins and Yard 2010; Coggins et al. 2011; Gloss et al. 2005; Korman et al. 2010; Makinster et al. 2009b, 2010; Rosi-Marshall et al. 2010; Wright and Kennedy 2011; Yard et al. 2011) to determine the relevant resources and issues for analysis in this environmental assessment. Table 1 presents the list of relevant resources considered for analysis in this EA. Resources in bold were analyzed for effects from the no action and proposed action alternatives. Resources not in bold were considered but not affected by the alternatives.

Table 1. List of resources and issues evaluated.

NATURAL RESOURCES	CULTURAL RESOURCES	SOCIOECONOMIC RESOURCES
Water Resources Water Quality Air Quality Sediment Vegetation Terrestrial Invertebrates and Herptofauna Aquatic Food Base Fish <ul style="list-style-type: none"> • Humpback chub • Razorback sucker • Other native fishes • Trout • Other non-native fishes • Fish habitat Birds Mammals	Historic Properties Traditional Cultural Properties Sacred Sites	Hydropower Recreation (including Public Safety and Sport Fishing)

1.14 Authorizing Actions, Permits or Licenses

Implementation of the proposed action would require a number of authorizations or permits from various federal and state agencies and American Indian tribal governments. Any field work within the boundaries of GCNP or GCNRA would require permits from the NPS. Tribal permits from the Hualapai Tribe or Navajo Nation would be needed for any field work within reservation boundaries. Researchers working with threatened or endangered species would need to obtain a permit from the USFWS. The proposed action could cause effects to the endangered humpback chub through electrofishing and handling that could require a USFWS ESA section 10(a)(1)(A) permit. Researchers working with resident fish may also need an Arizona Game and Fish Department (AGFD) permit. No other permits are known to be required at this time.

In addition, implementing this action also required additional ESA section 7 consultation with the USFWS. A biological assessment was prepared, along with a supplement to that biological assessment. The USFWS also completed a biological opinion, the 2011 Opinion, on this action. These documents are attached to the EA as Appendix C, D, and E, respectively.

1.15 *Decision Framework*

Reclamation's responsible official must decide whether to implement either the proposed action, an alternative action, or take no action. As the manager of the affected portion of the Colorado River, the NPS would determine whether the proposed action comports with their management plans and policies. The mission of the NPS is to "to conserve the scenery and the natural and historic objects and the wild life therein and...leave them unimpaired for future generations" (1916 NPS Organic Act). The proposed action complies with the overall NPS mission and with NPS Management Policies (National Park Service 2006a, §4.4.4.2) which direct that all exotic (i.e., non-native) species that are not maintained to meet an identified park purpose will be managed—up to and including eradication—if: (1) Control is prudent and feasible; and (2) the non-native species interferes with natural processes and the perpetuation of natural features, native species, or natural habitats. This action is also consistent with the humpback chub recovery goals (U.S. Fish and Wildlife Service 2002a) in which "Brown trout and rainbow trout control programs [shall be] developed and implemented to identify levels of control that will minimize negative interactions on humpback chub in the Colorado River through Grand Canyon."

1.16 *Relationship between EAs for Non-native Fish Control and High-Flow Protocol*

Reclamation has prepared two EAs related to the ongoing implementation of the Glen Canyon Dam Adaptive Management Program. In addition to this EA that addresses non-native fish control, the other EA addresses the development and implementation of a protocol for HFEs from Glen Canyon Dam. Both efforts are designed to include important research components, with the expectation that the undertakings would improve resource conditions, and thereby provide important additional information for future decision-making within the GCDAMP. Although both EAs relate to and are part of the overall GCDAMP, Reclamation has considered the content of both efforts and believes that it is appropriate to maintain separate NEPA processes because each activity under consideration serves a different and independent purpose, has independent utility, and includes very different on the ground activities and actions (rate, duration and timing of water releases as compared with non-native fish research, management and control actions).

The HFE Protocol would evaluate the use of short-duration, high-volume dam releases during sediment-enriched conditions for a 10-year period, 2011–2020, to determine how multiple events can be used to better conserve sand over a long time period in the Colorado River corridor within GCNP. Under the concept of HFEs, sand stored in the river channel is suspended by these dam releases and a portion of the sand is redeposited downstream as sandbars and beaches, while another portion is transported downstream by river flows. These sand features and associated backwater habitats may provide key wildlife habitat, may protect archaeological sites, enhance riparian vegetation, and provide camping opportunities along the Colorado River in GCNP. Additional attention would be given to ensure that other resources would not be unduly or unacceptably impacted or that any such impacts could be sufficiently mitigated.

The Non-native Fish Control EA is designed to further evaluate the control of non-native fish in the Colorado River downstream from Glen Canyon Dam in conserving native fish in GCNP, and is also needed to meet requirements and obligations of several USFWS biological opinions on the operation of Glen Canyon Dam. The proposed action would minimize the negative impacts of competition and predation on an endangered fish, the humpback chub in Grand Canyon. Competition and predation by non-native fishes, and in particular rainbow trout and brown trout, are reducing survival and recruitment of young humpback chub and threatening the potential recovery of the species. The action also addresses the concerns of American Indian tribes over the taking of life associated with non-native fish control.

During the first round of public review and comment on the HFE Protocol and Non-Native Fish Control EAs, several comments from the public suggested that these high-flow dam release and fish control activities are “connected actions” or “similar actions” for NEPA purposes and therefore must be combined into a single NEPA document. The primary basis for this concern appears to be that, notwithstanding the differing nature of the experimental actions, based on a previous high-flow release, there is a concern that high-flow events during certain times of the year have the potential to increase the number of non-native trout that have been documented to feed upon native, endangered humpback chub.

Reclamation reviewed and considered these comments and has added this discussion to this EA in order to provide the public with additional information with respect to the basis for the NEPA processes that are being utilized for the development of these two actions.

As an initial matter, the HFE Protocol and the Non-Native Fish Control efforts are not portions of a single action. The protocol would address multiple projected experimental operations (i.e., variable, high-flow water releases) from Glen Canyon Dam that would link high-volume releases to sediment availability in reaches downstream of Glen Canyon Dam. The high-flow releases would be conducted over a period of years and on multiple occasions to assess the ability to reduce the erosion of beach habitat in the Grand Canyon and potentially to enhance and retain beach habitat over multiple years.

Separately, the non-native fish research and control efforts are designed to enhance understanding of the life-cycle, movement and impacts of non-native fish on the native species in areas of the Colorado River downstream of Glen Canyon Dam. The non-native fish control actions are likely to address methods to reduce the population of predatory non-native trout in areas where young-of-year native fish are located. Predation by non-native fish (both warm water and cold water species) has been identified as a primary threat to native fish in the Colorado River Basin.

Reclamation has considered the most appropriate approach to NEPA compliance for these actions and has reached a conclusion at this stage of analysis that it is not necessary to combine the EAs into a single NEPA document under the applicable NEPA regulations. Under NEPA’s implementing regulations, the question of whether the two actions must be analyzed in a single compliance document turns on whether the two actions are considered “connected actions,” “cumulative actions,” or “similar actions.” Pursuant to 40 C.F.R. §

1508.25(a)(1), connected actions are “closely related and therefore should be discussed in the same impact statement.” The regulations go on to provide that: “Actions are connected if they: (i) Automatically trigger other actions which may require environmental impact statements. (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously. (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.” 40 C.F.R. § 1508.25(a)(1).

The EAs do not meet the regulatory standard for connected actions. Neither activity under consideration will automatically trigger other actions which may require environmental impact statements as part of the Glen Canyon Adaptive Management Program. Also, non-native fish control would be necessary regardless of whether or not the HFE Protocol were implemented. Implementation of both the high flow and non-native fish control actions are designed and expected to advance scientific knowledge and inform future GCDAMP decision-making, and may lead to adjustments in release patterns and/or strategies to control the size and location of predatory non-native fish. However, Reclamation cannot conclude at this time that such information will automatically trigger other actions which may require EISs. Secondly, the non-native fish control process is not dependent on other actions being taken previously or simultaneously. Rather, the timing and manner of nonnative fish control will depend, in part, upon the results of monitoring efforts determining the number of trout, their location and movement, etc. While the implementation of spring high-flows has been raised as an issue, given the post-2008 trout monitoring results, it is clear that both warm and cold-water non-native fish control actions may be necessary regardless of high flow implementation. There are no other actions that are conditions precedent to the efforts proceeding, and neither action depends on a larger action for their justification.

There are some obvious relationships and linkages between the two proposed actions, but those similarities do not rise to the standard of requiring preparation of a single NEPA document as “connected actions” for NEPA purposes. Both actions are part of the overall GCDAMP, and they share a common overall geographic area (primarily focused on the mainstem of the Colorado River below Glen Canyon Dam). In addition, there are some overlapping impact analysis issues that are discussed herein, as it is possible that certain high-flow releases may impact the abundance and distribution of nonnative fish that have been identified as species that prey on native fish. However, each action has independent methods (dam releases vs. fish monitoring, tracking, and potential removal actions), an independent focus (geomorphic protection and enhancement of riparian (sandbar) habitat vs. non-native fish research, monitoring and control), and each action has independent utility whether or not the other action proceeds. Moreover, where the two proposed actions are projected to involve overlapping environmental effects (i.e., potential effects on predatory non-native fish species), the relevant analysis of these common environmental effects is included in both EAs.

Another regulatory basis for NEPA documents to be combined is if the activities in question are “similar actions.” Pursuant to 40 C.F.R. § 1508.25(a)(3), similar actions “have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography.” While the two efforts address areas downstream of Glen Canyon Dam (and thus share a common geography, as well as timing), there are unique

areas that will be the focus of each NEPA effort. The primary action of the high flow protocol is the timing, rate and duration of releases of water from Glen Canyon Dam. In terms of downstream research and monitoring, the HFE Protocol has a particular focus on sediment transport and geomorphological processes, and will include research and monitoring focused on the number, size and distribution of sandbars throughout Marble and Grand Canyons. In contrast, the non-native fish control efforts are focused on biological processes and expected to focus analysis on particular areas that are important to both native and non-native fish species, the PBR and LCR reaches.

Even where two actions are deemed to be “similar actions” under the regulations, the applicable NEPA regulations go on to provide that, “[a]n agency may wish to analyze these actions in the same impact statement . . . when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement.” 40 CFR § 1508.25(a)(3). This regulatory provision leaves the agency decision makers with sufficient discretion to determine the “best way” to assess impacts of similar actions. Given the differences between the two efforts, and based on the analysis of the differing scientific focus of each experimental effort, Reclamation, based on the best available information that is available at this stage of analysis, has considered this issue and determined that the best way to analyze each action is to continue to analyze the high flow protocol and the non-native fish control strategy through separate and independent NEPA processes, recognizing that resource analyses that are relevant to both EAs have been documented and included in both EAs, where appropriate (e.g., potential high flow impacts on population and distribution of predatory non-native species). Reclamation is also ensuring that both EAs contain up-to-date information on resource status and impacts and has been carefully coordinating the preparation schedules of the two EAs to ensure consistency of content.

Finally, both actions do not constitute “cumulative actions” necessitating review in a single NEPA document as defined by 40 CFR 1508.25 (a)(2). Nonetheless, Reclamation does address the cumulative effects from both actions in the affected environment section of each EA, under the topical discussion for each resource (see Section 3). Thus Reclamation has properly considered the cumulative effects from these two actions and other actions in both NEPA documents. Consistent with these analyses, at this point in the NEPA process Reclamation has not concluded that the actions have “cumulatively significant impacts” which pursuant to 40 C.F.R. § 1508.25(a)(2) would indicate that the actions “should therefore be discussed in the same impact statement.”

1.17 Relationship between this EA and the Long-Term Experimental and Management Plan

As discussed herein, there are a number of ongoing activities of the GCDAMP that complement the actions and research anticipated under this EA. In addition, the Department is embarking on the first major, comprehensive analysis of the GCDAMP since 1996 with the initiation of the Glen Canyon Dam Adaptive Management Program Long Term Experimental and Management Plan (LTEMP; 76 FR 39435-46, July 6, 2011). The Department has determined that it is appropriate and timely to undertake a new

environmental impact statement (EIS) that reviews and analyzes a broad scope of Glen Canyon Dam operations and other related activities. Given that it has been 15 years since completion of the 1996 ROD on the operation of Glen Canyon Dam, the Department will study new information developed through the GCDAMP, including developed through the non-native fish control addressed in this EA, as well as information on climate change, so as to more fully inform future decisions regarding the operation of Glen Canyon Dam and other management and experimental actions. The LTEMP is a component of the Department's efforts to continue to comply with the ongoing requirements and obligations established by the Grand Canyon Protection Act of 1992 (Pub. L. No. 102-575). The Department has determined that the LTEMP EIS will be co-led by the Bureau of Reclamation and the National Park Service. Reclamation and the NPS will co-lead this effort because Reclamation has primary responsibility for operation of Glen Canyon Dam and the NPS has primary responsibility for GCNP and GCNRA. A formal notice of intent to prepare an EIS was published in the Federal Register on July 5, 2011 (76 FR 39435), and a notice to solicit comments and hold public scoping meetings on the LTEMP was published in the Federal Register on October 17, 2011 (76 FR 64104).

The purpose of the proposed LTEMP is to utilize current, and develop additional, scientific information to better inform Departmental decisions and to operate the dam in such a manner as to improve and protect important downstream resources while maintaining compliance with relevant laws including the GCPA, the Law of the River, and the Endangered Species Act (ESA). Information developed through this EA and through the monitoring and implementation of the proposed action will be further reviewed and analyzed as part of the LTEMP process. That is, while this EA is designed to analyze and adopt an approach to non-native fish control, the effectiveness of such actions will also be further analyzed, integrated and potentially refined and/or modified as part of the LTEMP NEPA process. Scientific and resource information developed through this EA, and the implementation of the non-native fish control efforts of the proposed action are essential to ensuring that fully informed decisions are made as part of the LTEMP process. Accordingly, Reclamation has determined that it is essential and appropriate to move forward with this EA because it will provide important information related to non-native fish control. This information is important for independent reasons described throughout this EA, and it will also aid in future decisions associated with the LTEMP process. Such information on the predation and migration patterns of non-native fish would not be available absent implementation of the non-native fish control actions described herein. Continuing with the EA to learn more information about Glen Canyon Dam operations is consistent with the principles of adaptive management, which have guided decision making since the 1996 ROD.

1.18 *Issues for Analysis*

NEPA requires that any issues directly or indirectly caused by implementing the proposed action be analyzed. The Council on Environmental Quality (CEQ) NEPA regulations in 40 CFR 1501.7 allow that issues may be excluded from analysis if they are identified as those: (1) Outside the scope of the proposed action; (2) already decided by law, regulation, plan; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. Relevant issues must be analyzed to determine the effects of potential

actions to resources of concern, and thereby select an alternative that best meets the purpose and need.

The relevant issues to the proposed action were identified through the NEPA process, including through the SDM Project with the cooperating agencies and tribes, and these issues were used in this EA as criteria for selection of the proposed action. In the SDM Project, the “issues” described in this section led to a definition of “objectives” of the undertaking, against which various actions were compared for their ability to achieve the objectives (see Appendix A, Section 4.3). This process revealed that the primary issues surrounding non-native fish control in Grand Canyon deal with effects to natural resources, impacts to recreation, and cultural and socioeconomic concerns. These issues were carefully analyzed in the SDM Project and in this EA to help formulate and evaluate alternatives and identify the proposed action.

The proposed action is designed to benefit native and endangered fish with the acknowledgement that there may be unintended side effects to this beneficial action. These issues capture what those unintended side effects may be, and were further analyzed in the SDM Project and in other sections of this EA.

Issue 1: American Indian Concerns with the Taking of Life

Beginning with tribal consultation on the first experimental non-native fish removal efforts in 2002, several southwestern tribes (The Hopi Tribe, the Kaibab Band of Paiute Indians, Paiute Indian Tribe of Utah, the Hualapai Tribe, and the Zuni Tribe) objected to the taking of life at the confluence of the Colorado and Little Colorado rivers. To mitigate these concerns, the action agencies (USGS, NPS, and Reclamation) and the concerned tribes agreed that fish removed from the LCR reach during 2003-2006 and 2009 would be put to a beneficial use. The beneficial use consisted of euthanizing removed fish, which were then ground to an emulsion, packaged in 50-gallon barrels on site in the Grand Canyon, and transported to the Hualapai Tribe where they were used as fertilizer for organic vegetable farms on Hualapai tribal lands.

Since 2006, the rainbow trout population has undergone an increase in the LCR reach (Wright and Kennedy 2011). In response to increasing trout numbers, and as part of the conservation measure to control non-native fish in the 2008 USFWS Biological Opinion, Reclamation, through the GCDAMP, conducted a single non-native fish removal trip in the LCR Reach to better determine levels of trout abundance in the LCR reach and refine the level of removal necessary to meet as yet undefined goals for trout suppression. The Pueblo of Zuni subsequently expressed concern over the taking of life in the Colorado River from this action, and later the other GCDAMP tribes all indicated some level of concern about this aspect of non-native fish control. The Navajo and Hopi tribes also expressed concerns about the geographic location of non-native removal in the LCR reach, which is an important traditional cultural place for these tribes.

The Pueblo of Zuni has expressed concern over both the action of removing and euthanizing fish and the location of where that action takes place. The Zuni place traditional and

historical importance on the Grand Canyon and the confluence of the Little Colorado River and Colorado River. The Zuni have stated that it is not only the taking of life that concerns the Zuni people, but also the adverse affect this action has on the Zuni values that are ascribed to the Grand Canyon, the Colorado River, and the confluence of the LCR and Colorado Rivers as a National Register-eligible traditional cultural property.

The GCDAMP tribes and other stakeholders have expressed skepticism in the premise that removing rainbow trout and non-native predatory fish actually benefits humpback chub. This is because, as discussed above, although humpback chub status improved during the period of non-native fish removal from 2003-2006, other factors may have been responsible for this improvement (Yard et al. 2011, Coggins et al 2011). The 2003-2006 removal efforts successfully reduced numbers of rainbow trout in the LCR reach from approximately 6,446 to 617, and during this period humpback chub recruitment continued to increase and the adult humpback population in the LCR increased from approximately 5,000 to 7,650 (Coggins and Walters 2009; Coggins et al. 2011). However, as discussed previously, rainbow trout were also undergoing a decline system-wide during this period, possibly due to lower flows and warmer water temperatures, conditions which also may have benefitted humpback chub. And although there is compelling evidence that rainbow trout can consume large numbers of young humpback chub, a causal link between non-native trout predation on humpback chub and adult abundance of humpback chub has not been established (Yard et al. 2011).

This issue was considered in the SDM Project. The SDM Project identified cultural concerns as a fundamental objective (see Appendix A, Section 4.3), and different non-native fish control actions were evaluated, in part, on their performance in minimizing adverse effects to the tribal concerns. The proposed action is further analyzed here in comparison with no action with regard to effects to cultural resources and in light of cultural concerns in Section 3, Affected Environment and Environmental Consequences. A criticism of some tribes has been that the SDM Project did not place sufficient emphasis on learning to address the uncertainties in the need to conduct removal to conserve humpback chub. Measures to address these concerns are incorporated into the proposed action as described in sections 1.10 and 2.3 of this EA.

Issue 2: Efficacy of Alternative Means of Controlling Non-native fish and Effects on Other Aquatic Life

Several methods have been used to control non-native fish in the Colorado River below Glen Canyon Dam, including:

- Removal of trout with boat electrofishing in the LCR reach;
- Low flows to strand rainbow trout eggs and young (“non-native fish suppression flows”);
- Removal of brown and rainbow trout from Bright Angel Creek with a fish weir (this action is both a past and ongoing action by the NPS).

The most effective single method of reducing non-native fish numbers has been removal of fish using boat-mounted electrofishing in the LCR reach. This method directly removes non-native fish, predominantly rainbow trout, from the area of greatest impact to humpback chub and was effective at reducing numbers of trout during 2003-2006 (Coggins et al. 2011), and this action also appeared to substantially reduce predation losses of humpback chub (Yard et al. 2011). However the method was applied at a time of system-wide trout decline (Coggins et al. 2011) and the numbers of rainbow trout in the LCR reach recovered to former levels by 2009. Although about 20,000 trout were removed from the LCR reach from 2003-2006 (Coggins, 2008a; Coggins and Yard 2010; Yard et al. 2011), the large 2008 rainbow trout cohort spawned in Lees Ferry, apparently as a result of the 2008 HFE (Korman et al. 2010), is thought to have led to downriver migration of this cohort, and, combined with local recruitment along downriver sections, contributed to an increase in rainbow trout densities in the vicinity of the Little Colorado River since 2006 (Makinster et al. 2010, Wright and Kennedy 2011). This recovery made it clear that in order to reduce trout abundance in the LCR reach numbers of trout moving into the area would have to be controlled on a routine basis or reduced at their sources, at or near the Lees Ferry reach for rainbow trout, and in Bright Angel Creek for brown trout.

There are a number of other alternative means, including many that have not been tested in this system but have worked in other regulated rivers when applied appropriately. One mechanism that has been tested in the action area and may be effective at controlling non-native fish involves manipulating flows at Glen Canyon Dam to suppress the rainbow trout population at its primary source in Lees Ferry. There is clear evidence that this method can work because unrestrained fluctuating flows of approximately 3,000 to 30,000 cfs from Glen Canyon Dam before the implementation of interim/modified low fluctuating flows in 1991 eliminated almost all natural reproduction of rainbow trout in Lees Ferry, to the point that the fishery was not self-sustaining, but also had adverse effects to native fishes and other resources, leading to the 1995 EIS and 1996 ROD selection of MLFF as an alternative flow operation. To attempt to mimic this effect, fluctuations of from 5,000 to 20,000 cfs were tested from 2003-2005 (“non-native fish suppression flows”). These flows were effective in reducing survival of young trout, but density-dependent factors compensated with higher survival and growth of the remaining fish (Korman et al. 2005), thus the flows were not effective at limiting trout recruitment.

Evaluating the effect of non-native fish control on humpback chub is difficult because losses to fish predation are just one source of humpback chub mortality. Other sources of mortality include starvation, stranding, cold-water shock, parasites and diseases, and downstream transport from the LCR reach to less suitable habitat (Berry and Pimentel 1985; Hoffnagle et al. 2006; Korman et al. 2006; Marsh and Douglas 1997; Robinson et al. 1998; U.S. Fish and Wildlife Service 2002a; Ward and Bonar 2003). It is difficult to isolate the effect of any single mortality source and evaluate its effect on the overall population. Different sources of mortality may have a stronger effect at some times than others, and often the degree of effect from a single source may interact with other sources or environmental factors in complex ways.

Although the population of adult humpback chub (age 4 and >200 mm total length) declined from 1989 to 2001, the adult population of humpback chub has been increasing since 2001 (Figure 3). Because these estimates include fish that are 4 years of age and older, survival of fish that contributed to the population increase after 2001 was affected by factors starting in about 1998 (Coggins and Walters 2009). Although this increase began at the peak of trout density in the Lees Ferry reach, the subsequent increase in the humpback chub population is a pattern opposite that of the declining trout population, and suggests an effect from reduced trout density (Wright and Kennedy 2011). The sudden increase in the trout population in 2008 is attributed, at least in part, to the spring 2008 high flow experiment and the effect of this increase on humpback chub survival and recruitment has not been evaluated.

Tribes and members of the public expressed concerns about the effect of elements of potential actions (particularly the use of electrofishing) on invertebrates or other aquatic species. Electrofishing is used widely for sampling fish populations (Snyder 2003), and in some cases there is increased drift of invertebrates resulting from electrofishing, but in most cases there have been no long-lasting or fatal effects reported on macroinvertebrates (Elliott and Bagenal 1972; Fowles 1975; Mesick and Tash 1980); the only case where electrofishing produced mortality of macroinvertebrates (30% mortality of the midge species *Chironomus plumosa*) was in cases where voltages were 15-126 times the maximum levels normally used for sampling fish (Shentyakova et al. 1970). Although there has been no effort to specifically study the effect of electrofishing on macroinvertebrates or other non-target aquatic species, biologists involved in electrofishing in Grand Canyon have not reported any noticeable effect on these species, and it has not been considered by researchers to be an issue of concern.

These issues were analyzed in detail in the SDM Project, which evaluated the performance of different methods of non-native fish control. The proposed action is further analyzed in comparison with no action with regard to effects to the aquatic ecosystem in Section 3, Affected Environment and Environmental Consequences.

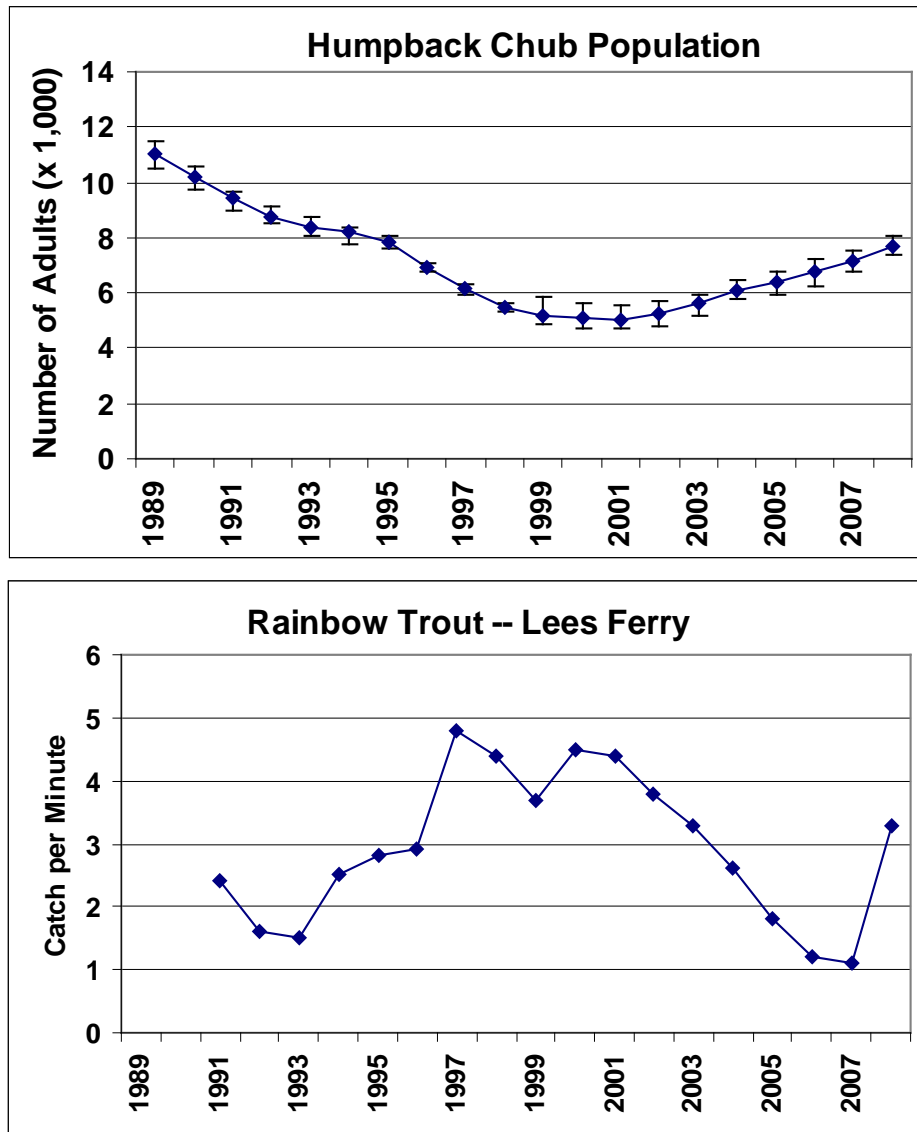


Figure 3. (Top) Annual population estimates of adult humpback chub (age 4+) with an age-structured mark-recapture (ASMR) model, 1989-2008 (Coggins and Walters 2009) (Bottom) Average annual catch rates of rainbow trout in the Lees Ferry reach, 1991-2008 (Makinster et al. 2010)

Issue 3: Diminished Sport Fish Angling Opportunities

Controlling numbers of trout in Grand Canyon has the potential to affect visitors who come to the parks for recreation. Because the actions analyzed here directly affect fish populations, there would be effects to sport fishing, potentially as reduced opportunity for sport fishing in the action area. If non-native fish control were to affect the Lees Ferry trout population, there would also be a potential impact to fishing guides whose livelihoods derive from providing guide services for anglers in the Lees Ferry reach. Reducing the numbers of rainbow trout in the Lees Ferry reach could affect angler catch rates, depending on the number of anglers and the density of trout in areas fished. Adverse impacts to recreational angling and subsistence fishing by local American Indian residents is also an aspect of this issue.

Reducing the numbers of trout in the system could also provide a beneficial effect to the sport fishery in the action area by improving the quality of the fishery. Reducing numbers of rainbow trout in the system, particularly when densities are high, could improve the fishery by providing more space for fish, reducing competition for available food resources, reducing emigration, and possibly increasing growth rate, and size and condition of individual fish. It is possible that reduction of the overall abundance of trout in the Lees Ferry reach would not affect catch rate if current trout density is high and competition is high for a limited food supply. The existing data appear to indicate that rainbow trout are leaving the Lees Ferry reach and moving downstream, presumably as a density-dependent response to high numbers, which may indicate an over-abundance of trout in Lees Ferry (Korman et al. 2010; Wright and Kennedy 2011).

This issue was identified as an objective in the SDM Project (see Appendix A, Section 4.3), and different actions were evaluated, in part, on their performance in minimizing adverse effects to recreational trout fishing, and thereby utilized to select the proposed action. The proposed action is further analyzed here in comparison with no action with regard to effects to recreation, in Section 3, Affected Environment and Environmental Consequences.

Issue 4: Effects to Wilderness

Pursuant to the 1964 Wilderness Act, Grand Canyon National Park was evaluated for wilderness suitability. After the park was enlarged in 1975, Grand Canyon's Wilderness Recommendation was updated following a study of the new park lands. The most recent update of Grand Canyon's Wilderness Recommendation occurred in 2010. Grand Canyon National Park proposed Wilderness or proposed potential Wilderness covers 94 percent of the park. In accordance with NPS Management Policies, these areas are managed in the same manner as designated wilderness, and the NPS will take no action to diminish wilderness suitability while awaiting the legislative process.

The proposed action would implement up to 10 PBR reach trips in any one year, and up to 6 LCR reach trips in any one year; LCR reach removal would only occur if monitoring and modeling data indicate that a trigger has been reached as defined in the 2011 Opinion (U.S. Fish and Wildlife Service 2011). Motorized electrofishing boats would operate at night, utilizing lights and gas-generators to power electrofishing equipment. Removal trips would have up to 6 passes of electrofishing boats through a reach per trip, and this would take place over multiple nights as described in more detail in the "Effects of the Proposed Action" section. Recreationists seek the GCNRA and GCNP out, in part, due to the wilderness character of these remote areas. The proposed action would result in disturbance to members of the public utilizing these areas for recreation. These impacts would be further assessed and mitigated through the NPS Minimum Requirement Analysis.

The NPS is mandated under the Organic Act of 1916 "to conserve the scenery and the natural and historic objects and the wild life therein and...leave them unimpaired for future generations" (1916 NPS Organic Act). In accordance with this mandate and the NPS Management Policies (National Park Service 2006a, §4.4.4.2), all exotic (i.e., non-native) species must meet an identified park purpose or be controlled or eradicated. Rainbow trout

and brown trout in the vicinity of the Colorado and Little Colorado rivers compete with and prey on humpback chub and threaten the recovery of the species. Hence, control of non-native fish within GCNRA and GCNP is consistent with the mission and mandates of the NPS, as well as compliance by the DOI and its agencies under the provision of the ESA, and adds to the wilderness quality of the park in a manner that is consistent with NPS management policies.

These issues were identified as an objective in the SDM Project (see Appendix A, Section 4.3), and different actions were evaluated, in part, on their performance in minimizing adverse effects to wilderness recreation, and thereby utilized to select the proposed action. The proposed action is further analyzed here in comparison with no action with regard to effects to recreation, in Section 3, Affected Environment and Environmental Consequences.

Issue 5: Diminished Public Services and Losses to Local Economies

Recreation in GCNRA and GCNP provides economic benefits to local economies, particularly in the areas of Vermilion Cliffs and Marble Canyon, Page, and Flagstaff, Arizona, and Kanab and surrounding areas of southern Utah. These economic and social benefits are to both small rural communities and to the region. A number of businesses (lodges, restaurants, guides, outfitters, and others) and individuals derive their income from recreationists who have come to the area to fish, hike, or engage in white water rafting. Economic benefits are associated with factors such as the number of days anglers visit the area, and the number of white water rafting trips that occur in a given year.

A key aspect of economic benefits from visitation to the area is associated with wilderness and park experiences. GCNP provides benefits to both local and regional economies. Non-native fish control could affect the experience of the public who come to the area for wilderness recreation through the additional activities associated with the removals, particularly motorized and night-time operations within proposed wilderness that cause disturbance.

The cost of non-native fish control is also an issue because the GCDAMP and Reclamation have limited annual budgets with which to carry out non-native fish control actions. In the past, non-native fish control efforts have utilized flows from Glen Canyon Dam as well as electrofishing at the confluence of the Colorado and Little Colorado Rivers to limit numbers of non-native fishes, particularly rainbow and brown trout. Past control efforts have been costly and GCDAMP stakeholders are interested in finding effective means of non-native fish control that are economically viable.

Any alternative considered for non-native fish control must be consistent with maintaining required water storage and delivery per the Colorado River Storage Project (CRSP). The CRSP and the Colorado River are managed and operated under numerous compacts, federal laws, court decisions and decrees, contracts, and regulatory guidelines collectively known as the “Law of the River.” This collection of documents apportions the water and regulates the use and management of the Colorado River among the seven basin states and Mexico. Glen

Canyon Dam is also operated to be in compliance with the 2007 Colorado River Interim Guidelines.

A key public service provided by Glen Canyon Dam is electricity generation. The electricity produced at Glen Canyon Dam through hydropower is a renewable and environmentally preferred resource. It is integrated into the electrical production of several large Colorado River Storage Project Dams and it serves part of the needs of over five million people, in the rural Rocky Mountain and desert Southwest. It also provides a large portion of the electrical needs of American Indian communities in the southwest. It is sold as a long-term firm product, at the cost of production, under terms that allow flexibility so as to schedule electrical power deliveries to maximize the value of the Glen Canyon Dam power resource.

These issues were thoroughly evaluated in the SDM Project (see Appendix A, Section 4.3) by assessing alternatives, in part, on their performance in minimizing adverse effects to these resources, and thereby used to select the proposed action. The proposed action is further analyzed here in comparison with no action with regard to effects to recreation, in Section 3, Affected Environment and Environmental Consequences.

Issue 6: Constraints Imposed by Reclamation’s Authority and Operational and Legal Requirements

This EA is in large part driven by commitments and responsibilities to maintain compliance with the ESA. The need for non-native fish control arose out of an ESA Section 7 consultation on dam operations, and implementation of non-native fish control through the GCDAMP by physical removal is part of the proposed action for the operating biological opinion on Glen Canyon Dam operations, the 2011 Opinion (U.S. Fish and Wildlife Service 2011).

Alternatives must also meet Reclamation’s responsibilities with regard to operation and maintenance of the dam, as well as meeting scheduled downstream deliveries of water. Potential actions were evaluated in this regard in the SDM Project and this contributed to the selection of the proposed action.

Reclamation also has a responsibility to recognize Indian Trust Assets and maintain compliance with section 106 of the National Historic Preservation Act (NHPA), which is part of the need for this EA. The Federal government holds Trust responsibilities that recognize the sovereign status and management authority of Tribes, and assures the Tribes that Federal agencies will not knowingly compromise traditional practice and livelihoods in execution of their duties. Executive Order 13007 adds specificity to this principal in stating that Federal agencies “shall avoid adversely affecting the physical integrity of sacred sites,” while Secretarial Order 3206 stipulates that within the context of the ESA the “Departments will carry out their responsibilities under the Act in a manner that harmonizes the Federal trust responsibility to tribes.” Further, the NHPA requires Federal agencies to take into account the effects of their actions on historic properties, which, through the National Register of Historic Places, includes special provisions for places of cultural and religious importance.

These issues were identified in the SDM Project (see Appendix A, section 4.3), and different alternatives were evaluated, in part, on their performance in minimizing adverse effects to Reclamation's operational and legal responsibilities, and thereby used to select the proposed action. The proposed action is further analyzed here in comparison with no action with regard to effects to cultural resources, in Section 3, Affected Environment and Environmental Consequences.