COLLABORATIVE MANAGEMENT OF GLEN CANYON DAM: THE ELEVATION OF SOCIAL ENGINEERING OVER LAW

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ABSTRACT

The operation of Glen Canyon Dam on the Colorado River affects several downstream resources and water uses including water supply for consumptive uses in Arizona, California, and Nevada, hydroelectric power production, endangered species of native fish, recreational angling for non-native fish, and recreational boating in the Grand Canyon. Decisions about the magnitude and timing of water releases through the dam involve trade-offs between these resources and uses. The numerous laws affecting dam operations create a hierarchy of legal priorities that should govern these decisions. At the top of the hierarchy are mandatory requirements for water storage and delivery and for conservation of endangered species. Other resources and water uses have lower legal priorities.

The Glen Canyon Dam Adaptive Management Program ("AMP") has substituted collaborative decisionmaking among stakeholders for the hierarchy of priorities created by law. The AMP has thereby facilitated non-compliance with the Endangered Species Act by the Bureau of Reclamation, which operates the dam, and has effectively given hydroelectric power production and non-native fisheries higher priorities than they are legally entitled to.

Adaptive management is consistent with the laws governing operation of Glen Canyon Dam, but collaborative decisionmaking is not. Nor is collaborative decisionmaking an essential, or even logical, component of adaptive management. As implemented in the case of Glen Canyon Dam, collaborative decisionmaking has actually stifled adaptive management by making agreement among stakeholders a prerequisite to changes in the operation of the dam. This Article proposes a program for adaptive, but not collaborative, management of Glen Canyon Dam that would better conform to the law and would be more amenable to adaptation and experimentation than would the current, stakeholder-centered program.

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I. INTRODUCTION

Collaboration is all the rage in public resource management. Virtually every federal agency with responsibility for managing natural resources has convened groups of interested parties, usually labeled "stakeholders," in the hope that the parties could reach some sort of agreement or consensus on the course of action that the agency should pursue. The use of such groups has both spurred, and been spurred by, the growth of an industry of private consultants who, for a fee, "facilitate" such groups by organizing and leading meetings. For the most part, the use of such groups by federal agencies has met with praise by observers in academia and the press. Some critics, however, have questioned the effectiveness of such groups as well as the appropriateness of invoking collaboration among private parties to make decisions about public resources.

This Article examines the role of one such collaborative effort, the Glen Canyon Dam Adaptive Management Program ("AMP"), in the operation of Glen Canyon Dam on the Colorado River. The operation of Glen Canyon Dam presents one of the more difficult and complex problems in public resource management. Decisions about the magnitude and timing of water releases through the dam affect numerous resources and water uses. The effects on some resources and uses, such as water storage and hydroelectric power production, are easily quantified, predicted, and measured. Effects on other resources, however, such as endangered native fish populations, non-native sport fisheries, archaeological sites, and beaches used by recreationists in the Grand Canyon, are complex and much harder to measure and have sometimes proven unpredictable.

Like the resources affected by the dam, the laws affecting the operation of Glen Canyon Dam are numerous and complex. However, they are not unfathomable. These laws, considered together, create a hierarchy of legal priorities among the resources and uses affected by the dam, and this legal hierarchy should constrain decisionmaking about dam operations. At the top of the hierarchy are (1) mandatory requirements for water storage and supply contained in the Colorado River Compact, the Boulder Canyon Project Act, and other laws specific to the Colorado River and (2) mandatory requirements for endangered species conservation contained in the Endangered Species Act. While it is unclear which of these two sets of requirements has a higher legal priority, they are mutually compatible and are both superior to more discretionary laws protecting and promoting other resources and uses, including hydroelectric power production and non-native sport fisheries.

The Endangered Species Act appoints a scientific arbiter, the U.S. Fish & Wildlife Service, to make judgment calls regarding the dam's effects on, and the measures necessary to conserve, endangered species of fish and wildlife. The Fish and Wildlife Service, in a Biological Opinion issued in 1994, identified certain modifications in dam operations that it deemed necessary for the survival of the humpback chub, an endangered species of native fish whose largest surviving population is in the Grand Canyon and a tributary canyon (the Little Colorado) below the dam. Fourteen years later, these changes have not been implemented, and the United States Bureau of Reclamation continues to

operate the dam in a manner that the Fish and Wildlife Service has determined jeopardizes the continued existence of the chub.

Since 1996, the Bureau has operated the dam under a program of "adaptive management." At the heart of the Adaptive Management Program is a committee of "stakeholders" that makes recommendations to the Secretary of the Interior, who oversees the Bureau, concerning operations of the dam. It is the thesis of this Article that the Adaptive Management Program has facilitated non-compliance with the Endangered Species Act by substituting the search for consensus among stakeholders for the requirements of the Act.

Part II of this Article presents background information on the Colorado River, Glen Canyon Dam, and the dam's effects on the aquatic environment of the Colorado River in the Grand Canyon and the fish therein, especially the endangered humpback chub. Part III explores the legal hierarchy of resources and uses created by the laws affecting management of the dam. Part IV traces the recent history of operations of Glen Canyon Dam, with emphasis on the Bureau's non-compliance with the Endangered Species Act. Part V considers the reasons for the Bureau's non-compliance and concludes that the Adaptive Management Program has been a significant factor facilitating, if not causing, that non-compliance. Part VI identifies the attributes of the Adaptive Management Program that have contributed to non-compliance and argues that one such attribute, collaboration among stakeholders, has been unnecessarily included in the program. Finally, Part VII briefly outlines a proposal for adaptive, but not collaborative, management of Glen Canyon Dam that would be consistent with the Endangered Species Act.

II. BACKGROUND

A. The Colorado River Compact and Glen Canyon Dam

The drainage basin of the Colorado River includes portions of seven states: Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada, and California.[1] The Colorado River Compact of 1922 divided the basin into the "Upper Basin" and the "Lower Basin," with the dividing line between the Upper and Lower Basins drawn at Lee Ferry, a point on the river about twenty miles south of the Utah-Arizona border, just upstream of the Grand Canyon.[2] Wyoming's, Colorado's, Utah's, and New Mexico's portions of the Colorado River drainage are entirely or mostly in the Upper Basin and these four states are known as the "States of the Upper Division."[3] Nevada, Arizona, and California are the "States of the Lower Division."[4]

Under the terms of the Compact, each Basin was apportioned an annual consumptive use of 7.5 million acre-feet of the river's water.[5] The Compact also provided that "[t]he States of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet

[1] *See* Colorado River Compact of 1922, art. II, 70 CONG. REC. 324 (1928), *available at* http://www.usbr.gov/lc/region/pao/pdfiles/crcompct.pdf.
[2] *Id.* art. II(f)-(g).
[3] *Id.* art. II(c).
[4] *Id.* art. II(d).
[5] *Id.* art. III(a).

for any period of ten consecutive years."[6] The requirement to ensure decadal flows of seventy-five million acre-feet to the Lower Basin, combined with inevitable fluctuations in the river's flow in response to weather patterns, meant that the Upper Basin could not count on actually utilizing its allocation every year. Specifically, if a dry decade were to result in total runoff of only, say, 125 million acre-feet, then the requirement to allow seventy-five million acre-feet to pass to the Lower Basin would leave only fifty million acre-feet, or an average of five million acre-feet per year, for use in the Upper Basin during that decade.

Glen Canyon Dam was designed to alleviate this potential constraint on the Upper Basin's use of Colorado River water. Authorized by the Colorado River Storage Project of 1956[7] and built by the Bureau of Reclamation between 1956 and 1963, the dam is in the Upper Basin, but just barely. It's in Arizona, about fifteen miles upstream of Lee Ferry and about five miles downstream from the Utah border.[8] When full, the reservoir behind the dam, Lake Powell, holds about twenty-seven million acre-feet of water,[9] or nearly four years' worth of the Upper Basin's obligation to the Lower Basin under the Compact.

Lake Powell fills during wet periods and reduces the likelihood that, in a dry period, water uses in the Upper Basin will have to be curtailed in order to satisfy the Upper Basin's commitment to the Lower Basin under the Compact. While the lake is too low in the basin for its water to be used directly by farms, cities, or industries in the Upper Basin, releases of water from the reservoir can be used to meet the Compact's requirement.

Glen Canyon Dam also produces hydroelectric power. The dam's eight generators can produce a total of 1320 megawatts of power (enough to supply the domestic consumption of about one million homes) at a maximum combined flow rate of 33,200 cubic feet per second ("cfs").[10] Since the average flow through the dam in recent years has been only about 11,000 cfs (eight million acre-feet per year),[11] on average the generators have been running at only about one third of their capacity. But the dam's capacity to produce "peaking power" of up to 1320 megawatts is an important asset on the western power grid. Unlike a coal-burning or nuclear power plant, whose output can be changed only slowly, a hydroelectric plant can be turned up or down in a matter of minutes simply by opening or closing valves to draw more or less water into

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[6] *Id.* art. III(d).

[7] 43 U.S.C. §§ 620-620(o) (2000).

[8] For a map of the vicinity of Glen Canyon Dam, see U.S. DEP'T OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, USGS CIRCULAR 1282, THE STATE OF THE COLORADO RIVER ECOSYSTEM IN GRAND CANYON 3 (Stephen P. Gloss et al. eds., 2005), *available at* http://www.gcmrc.gov/products/score/2005/pdf/score_2005.pdf [hereinafter SCORE REPORT]. The SCORE Report is an extraordinarily valuable source of information on virtually all matters related to Glen Canyon Dam and its operations. This Article relies heavily on information from the SCORE Report.

[9] *Id.* at 2.

[10] *Id.* at 166.

[11] The minimum annual release from Glen Canyon Dam to meet compact requirements and a treaty obligation to Mexico is 8.23 million acre-feet per year. This was also the amount of water actually released from the dam in each of the years 2001 through 2004. *Id.* at 171. One million acre-feet per year equals approximately 1400 cfs.

the turbines. Thus, it can respond quickly to peaks in power demand caused by either predictable events, such as the surge in air conditioning use on a summer afternoon, or unpredictable events, such as the failure of a transmission line bringing in power from another source.[12]

B. The Effects of Glen Canyon Dam on the Aquatic Environment of the Grand Canyon

Because Glen Canyon Dam is immediately upstream of the Grand Canyon,[13] virtually all water flowing in the canyon must first pass through the dam. The existence and operation of the dam has profoundly altered the aquatic environment of the canyon in three respects: flow pattern, sediment content, and temperature.

1. Flow Pattern

The quantity of water flowing in the Colorado River through the Grand Canyon, before it was changed by Glen Canyon Dam, varied enormously from season to season. The flow peaked in the late spring and early summer as the winter snows melted in the river's Rocky Mountain headwaters. The median peak flow at that time of year was around 85,000 cfs, and flows exceeding 120,000 cfs occurred one year in six.[14] The highest flow recorded in historic times was around 200,000 cfs in 1884, and the flow reached 170,000 cfs in 1921.[15] On the other hand, a typical flow in late summer, fall, or winter was only about 3000 cfs.[16]

The construction and operation of the dam has largely eliminated the natural seasonal and annual variability in the river's flow, for two reasons. First, in most years, the dam is not physically capable of releasing flows of the magnitude of the former annual peaks; the holes in the dam are too few and too small. The dam's electric generators can pass a maximum flow of about 33,000 cfs.[17] Another 15,000 cfs can pass through a set of tubes called the river outlet works and commonly know as the "jet tubes."[18] The combined total flow of about 48,000 cfs is little more than half of the typical pre-dam spring peak and only around a quarter of the highest recorded flows. The dam's spillways can convey much greater flows, up to 208,000 cfs,[19] but the intakes to the spillways are near the top of the dam and thus can operate only when Lake Powell is full or

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[12] *See id.* at 166-68.

[13] Strictly speaking, the first fifteen river miles below the dam are in lower Glen Canyon, followed by about sixty miles of Marble Canyon, and then over 200 miles of the Grand Canyon, ending at Lake Mead. The dividing point between Glen Canyon and Marble Canyon is Lee Ferry; the division between Marble Canyon and the Grand Canyon is the mouth of the Little Colorado River. *See id.* at 3 (map), 11. In this Article, as in the SCORE Report, lower Glen Canyon, Marble Canyon, and the Grand Canyon proper, will be referred to collectively as the Grand Canyon.

[14] *See id.* at 2.

[15] *Id.* at 184.

[16] *See id.* at 2.

[17] *Id.* at 70, 166.

[18] *Id.*

[19] *Id.* at 70.

nearly so,[20] a condition that has occurred only once, in 1983.[21] Therefore, in the majority of years, the most water that the dam can convey is 48,000 cfs.

Second, from the dam's completion in 1963 until 1991, the intra-annual pattern of dam releases was determined largely by the demand for electric power. Except for a period in the early 1980s when a full reservoir required greater releases, flows through the dam were limited to the power plant capacity of 33,000 cfs so as to avoid using the jet tubes, which generate no power.[22] Moreover, taking advantage of the dam's flexibility to provide peaking power, from 1963 until 1991 the Bureau of Reclamation operated the dam on a daily fluctuating cycle to match the demand for electric power. In the afternoons, when demand was highest, the generators were typically run near their capacity. At night, when demand was low, flows were reduced to less than 5000 cfs.[23] These daily fluctuations caused the level of the river's surface (known as the "stage" elevation) in the Grand Canyon to rise and fall by seven to thirteen feet each day.

During this period, there was also some seasonal variation in flow, but the pattern was much less pronounced, and much different, than the natural pattern of high flows in the late spring and early summer and low flows in the late summer, fall, and winter. Post-dam, higher flows have been conveyed in mid-summer and mid-winter, when cooling and heating increases electric power use, with lower flows in the fall and spring.[24] Overall, the effect of the dam and its operation has been to replace a regime of high seasonal variability and relatively small daily variability with a regime of high daily variability and minimal seasonal variability.

2. Sediment

Before the construction of Glen Canyon Dam, the Colorado River carried an enormous sediment load through the Grand Canyon. The turbid, muddy river was famously characterized as "too thick to drink; too thin to plow." The total amount of sand transported annually by the river through the canyon has been estimated at twenty-five to thirty million tons.[25]

Because slow-moving water can suspend much less sediment than fast-moving water, a river drops most of its sediment load to the bottom when it enters the standing water of a lake or reservoir. Since the completion of Glen Canyon Dam in 1963, the vast majority of the sediment carried by the Colorado River has been deposited in the upper reaches of Lake Powell. The water passing through the dam is nearly clear.[26] Tributaries entering the river below Glen Canyon Dam, primarily the Paria River and the Little Colorado River, still provide some sediment to the Grand Canyon, but the total sand supply is only approximately 16% of the pre-dam supply.[27]

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[20] *Id.* at 166.
[21] *See id.* at 20 fig.1.
[22] *See id.*
[23] *Id.* at 19.
[24] *Id.*
[25] *Id.* at 18.
[26] *See id.*
[27] *Id.*

The drastic reduction in sand supply, along with the change in flow pattern, has changed the physical environment in the Grand Canyon. Beaches and sand bars in the canyon, if they are to be maintained, need to be periodically replenished with fresh sand to offset the constant loss of sand to erosion by wind and water. Before the construction of the dam, these beaches and sand bars were replenished by the deposit of sand from the river during periods of high flows in the spring and summer.[28] The construction and operation of the dam have eliminated most of the sand supply as well as the floods necessary to raise that sand onto beaches and sandbars. Now, the relatively clear water of the river erodes sandbars and beaches but does not replenish them. As a result, sandbars and beaches in the canyon are shrinking.[29]

3. Temperature

Before the construction of the dam, the temperature of the water in the Grand Canyon varied from near freezing in winter to around eighty degrees Fahrenheit in summer, with a year-round average of around fifty-seven degrees.[30] Now, water enters the canyon via the generator turbines of Glen Canyon Dam, which draw water from deep under the surface of Lake Powell. The temperature of this water is subject to relatively little seasonal fluctuation and is generally colder than the pre-dam average. From 1973 to 2003, the annual average temperature of water released from the dam was about forty-nine degrees.[31]

C. Fish of the Grand Canyon

1. Native Fish

The unusual pre-dam aquatic environment of the Colorado River in the Grand Canyon—extremely turbid water, with enormous seasonal variations in temperature and flow—supported an equally unusual community of native fish. Eight species of native fish were once found in the canyon: five members of the minnow family (humpback chub, bonytail chub, roundtail chub, Colorado pikeminnow (formerly known as squawfish), and speckled dace) and three members of the sucker family (bluehead sucker, flannelmouth sucker, and razorback sucker).[32] Six of these species are found nowhere else in the world besides the Colorado River Basin.[33] Unfortunately, of the canyon's original

[28] *See id.*

[29] *See id.* at 21. There is an offsetting effect. Because the dam has reduced peak floods, it has reduced the erosive power of the river. If this effect reduced erosion more than the loss of sediment reduced deposition, there could conceivably be an increase, rather than a decrease, in the quantity of sediment found in the canyon. But recent empirical studies have revealed that this is not the case. On balance, the changes wrought by the dam have led to a steady loss of sediment from the canyon. *See id.*

[30] *Id.* at 76.

[31] *Id.* at 77. In the period from 2003 to 2005, drought reduced the depth of Lake Powell, and the average temperature of water released from the dam edged up into the upper fifties. *See id.*

[32] *Id.* at 34 tbl.1, 35. The table also lists two other members of the minnow family, Virgin spinedace and woundfin, but notes that these two species were found "almost exclusively" in smaller tributaries of the Colorado rather than in the river itself.

[33] *Id.* at 35.

complement of eight fish species, four species (bonytail chub, roundtail chub, Colorado pikeminnow, and razorback sucker) are no longer found there.[34]

Of the four species of native fish that retain a presence in the Grand Canyon, one, the humpback chub (*Gila cypha)*, is on the federal list of endangered species.[35] Although a member of the minnow family, the humpback chub is a medium-sized fish. Adults reach about twenty inches in length[36] and can live for over twenty years.[37]

The humpback chub, like the other native fish of the Grand Canyon, is considered a "warmwater" fish. Although it can, and did, survive in the canyon's cold water in winter, it requires seasonally warm water in which to spawn and grow. The canyon's warm water in the summer and fall met the chub's needs for reproduction and growth.[38]

The humpback chub has become the principal focus of controversy and litigation over management of Glen Canyon Dam for two reasons. First, it is the only endangered species of fish that currently resides in the Grand Canyon. Second, unlike the three other species of native fish still found in the canyon (speckled dace, bluehead sucker, and flannelmouth sucker), which have greater populations elsewhere, the humpback chub's largest remaining population is in the Grand Canyon.[39] The Grand Canyon population is also the only successfully reproducing population of humpback chub in the lower basin of the Colorado River.[40] Therefore, the fate of the Grand Canyon population is critical to the survival of the species.

2. Introduced Fish

For many years, the native fish of the Grand Canyon have been overwhelmed by far greater numbers of exotic (non-native) fish that have been introduced into the canyon either deliberately, for recreational fishing, or accidentally. As with native fish, quantitative data about non-native fish populations are lacking before the 1980s, but it is known that non-native fish have been present in the Grand Canyon since the nineteenth century.[41] As with native fish, the pre-dam aquatic environment in the Grand Canyon was most hospitable to warmwater species of non-native fish, such as catfish, carp, bass, and sunfish. By the time Glen Canyon Dam was built in the mid-twentieth

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[34] *Id.* at 34 tbl.1, 35.

[35] *Id.* at 35. Of the four fish species that have been extirpated from the Grand Canyon, three (bonytail chub, Colorado pikeminnow, and razorback sucker) are on the federal list of endangered species. Only the roundtail chub is sufficiently common elsewhere to have avoided being listed, at least so far. *See id.* at 34 tbl.1.

[36] *Id.* at 51.

[37] U.S. FISH & WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR, FINAL BIOLOGICAL OPINION: OPERATION OF GLEN CANYON DAM 8 (1994), *available at* http://www.fws.gov/southwest/es/arizona/Documents/Biol_Opin/93167_GlenCanyonOperations.pdf [hereinafter 1994 BIOLOGICAL OPINION].

[38] SCORE REPORT, *supra* note 8, at 36.

[39] 1994 BIOLOGICAL OPINION, *supra* note 37, at 8.

[40] Memorandum from Field Supervisor, U.S. Fish & Wildlife Serv., U.S. Dep't of the Interior, to Reg'l Dir., Bureau of Reclamation, Salt Lake City, Utah 9 (Dec. 6, 2002), *available at* http://www.fws.gov/southwest/es/arizona/Documents/Biol_Opin/03016_Glen_Canyon_Dam.pdf.

[41] SCORE REPORT, *supra* note 8, at 36.

century, one non-native warmwater species, channel catfish, was the most abundant fish in the canyon.[42]

The cooling and clearing of the canyon's waters brought about by the construction of Glen Canyon Dam made the river less hospitable to warmwater fish, but greatly improved conditions for introduced coldwater fish, particularly rainbow and brown trout. While trout had previously been stocked in cooler, clearer, tributaries such as Bright Angel Creek,[43] the dam transformed the mainstem of the river into trout habitat.[44] The fifteen-mile stretch of the river between the dam and Lee Ferry has become a very popular fishery for rainbow trout, and the trout fishery there is a significant asset to the recreational economy in the area.[45]

Altogether, there are about four times as many non-native fish species as native species in the Grand Canyon.[46] In the upper reaches of the canyon, closest to the dam, rainbow and brown trout are the most abundant fish. Warmwater species, including carp, catfish, bass, and sunfish, are still present, but in smaller numbers, and are mostly found lower in the canyon, farther from the dam, where conditions are somewhat more hospitable because the river's water is warmed a few degrees by the sun as it moves through the 200 miles of the canyon.[47]

D. The Humpback Chub in the Grand Canyon

As noted above, because of its endangered status, and because its largest extant population is in the Grand Canyon, the humpback chub has become the focus of controversy and litigation over the management of Glen Canyon Dam and the dam's effects on the aquatic environment of the canyon.

1. Population Trend

Systematic monitoring of humpback chub populations in the Grand Canyon began in the 1980s, so historic populations and trends before that time are largely unknown. What is known is that, from 1989 through the first few years of the twenty-first century, the adult population steadily declined, from 10,000–12,000 adult fish in 1989 to 3000–5000 in 2002.[48] The decline was characterized by an annual mortality of approximately 15%–20% of the adult population and a lack of recruitment (spawning plus survival and growth) of new young fish.[49]

There is some reason to believe that, in the last few years (2001–2005), the population of humpback chub in the Grand Canyon may have stabilized, though at a lower level than the previous population. In this period, the adult population appears to have held steady at about 5000 fish, and in the last two years of the period (2003–2005), there has been some increase in the number of

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[42] *Id.*
[43] *Id.*
[44] *Id.* at 36, 156.
[45] *See id.* at 156, 161 tbl.1.
[46] *Id.* at 36.
[47] *Id.* at 40.
[48] *Id.* at 45 fig.12.
[49] *Id.*

juvenile fish observed, suggesting that conditions for spawning and incubation may have improved.[50]

2. *Factors Affecting the Population*

The factors adversely affecting the humpback chub population in the Grand Canyon are numerous, complex, and not well understood. Some, but not all, of them are attributable to the construction and operation of Glen Canyon Dam.

Among the factors not entirely attributable to the dam is the presence of large numbers of non-native fish. These non-native fish may negatively affect the humpback chub population by preying on chub eggs and young chub, by competing with chub for food, and by driving chub away from spawning and rearing areas.[51] As noted above, the presence of large numbers of non-native warmwater fish in the Grand Canyon predates the dam, and the cool water released from the dam is actually a detriment to non-native warmwater fish. However, as also noted above, the dam has made the canyon hospitable to coldwater non-native fish—rainbow and brown trout—whose large populations are a threat to the chub. Whether, on balance, the dam has increased or decreased the threat to the chub population from non-native fish is a point of debate.

Another factor negatively affecting the humpback chub population that is not attributable to the dam is the presence of a parasite, the Asian tapeworm. Accidentally introduced into the United States in the 1970s, the Asian tapeworm was discovered in the Little Colorado River, a tributary that is the principal spawning area for humpback chub in the Grand Canyon, in 1990.[52] By 2004, over 90% of humpback chub were infested.[53] Asian tapeworm infestation can be fatal to a chub, but more often it causes reduced growth and poor condition.[54] Like warmwater fish, the Asian tapeworm cannot complete its life cycle in the relatively cool water that Glen Canyon Dam releases into the Grand Canyon. It is therefore restricted to warmer tributaries such as the Little Colorado.[55] This limitation on its spread can be seen as a beneficial effect of the dam from the standpoint of the chub.

On the other hand, the changes in the aquatic environment wrought by Glen Canyon Dam are harmful to the chub in several ways. First, as a warmwater fish, the chub cannot spawn in the cool water released from the dam. Since the completion of the dam in 1963, spawning of humpback chub has been largely limited to the Little Colorado River, a tributary whose waters are substantially warmer than those in the mainstem.[56] Moreover, available evidence suggests that juvenile fish entering the mainstem after hatching in the

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[50] GCMRC – Research – Information on Humpback Chub, August 2006, http://www.gcmrc.gov/research/humpback_chub/20060802.aspx.

[51] *See* SCORE REPORT, *supra* note 8, at 42.

[52] *Id.* at 37.

[53] *Id.* at 46.

[54] *Id.* at 37.

[55] *Id.*

[56] *See id.* at 42.

Little Colorado do not do well.[57] They experience a "thermal shock" when they hit the cold mainstem water, which debilitates them and makes them especially vulnerable to predators.[58]

Even those that survive in the mainstem do not grow well in the cold water. They can grow to maturity only by abiding in areas of relatively shallow, slow-moving water where the sun can raise the water temperature substantially higher than in the main channel.[59] Such conditions are found only in shallow, nearshore areas and in backwaters that are separated from the main channel by sandbars. Unfortunately, two of the other changes in the aquatic environment wrought by the dam—the loss of sediment and the alteration of the river's natural flow pattern—have severely reduced the availability of such rearing habitat.

As noted above, the removal of most of the river's sediment by the dam has resulted in ongoing erosion of sandbars and a consequent reduction or loss of backwaters. The relatively clear, sediment-free water also makes young chub more visible and thus more vulnerable to predation. Moreover, the daily fluctuations in the level of the river induced by power plant operations are detrimental to the stability of nearshore and backwater habitats. When the river rises and falls several feet each day, areas that are shallow at low water become relatively deep during high water, and areas that are shallow at high water become dry at low water. Similarly, a relatively warm, sheltered backwater at low water may be inundated by the colder, swifter main channel at high water, and a backwater at high water may be left high and dry at low water.[60] This destabilization of backwaters and nearshore habitats may leave young chub with little or no suitable habitat in which to survive and grow to adulthood once they are swept from their birthplace in the Little Colorado into the mainstem of the river.[61]

The extent to which each of these complex effects influences the population of the humpback chub is difficult to measure and quantify. Hence, one cannot state with any degree of certainty that one or a subset of these factors is principally responsible for the limited reproduction of humpback chub in the Grand Canyon in the late twentieth century, or, conversely, that any single action or set of actions to modify these factors would lead to recovery of the species. However, some of these factors are much more easily changed than others, and it is natural and logical to focus on those factors that are most readily subject to human control.

The most difficult factor to change would be the sediment supply. Short of decommissioning Glen Canyon Dam and draining Lake Powell, the only way to restore the sediment supply to the Grand Canyon would be somehow to transport millions of tons of sand each year from the periphery of the lake, around the dam, and into the canyon. While schemes have been envisioned to do this, it would take many years and cost many billions of dollars to construct

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[57] *Id.*

[58] *Id.* at 42-44.

[59] 1994 BIOLOGICAL OPINION, *supra* note 37, at 11, 27.

[60] *Id.* at 26.

[61] SCORE REPORT, *supra* note 8, at 44.

the transport system, and it would entail numerous, and potentially very serious, collateral environmental impacts.

Raising the temperature of the water in the Grand Canyon to facilitate spawning and growth of humpback chub would be more feasible than restoring the sediment content, but would still be a substantial engineering enterprise involving modification of the dam. A temperature control device would consist of an intake structure on the upstream side of the dam that would draw water from the higher, warmer levels of Lake Powell down into the intakes of the electric generators. Installation of such a device would cost about fifteen million dollars, but would entail substantial risk because it would also make the canyon more hospitable to the several species of non-native warmwater fish that are abundant in the lower part of the Grand Canyon and downstream in Lake Mead.

The easiest factor to modify is the flow pattern. The daily fluctuations in river flow through the Grand Canyon are caused by the opening and closing of the valves that regulate the flow of water through the electric generators. While the economic and legal implications of operating the valves so as to reduce or eliminate these fluctuations may (or may not, as will be discussed below) be complex, there are no physical or technological impediments to doing so. Steady flows through the dam have been implemented, for relatively short times, in the past, and could be implemented again, either temporarily or permanently, at any time.

Because there are no technological barriers to modifying the seasonal and daily pattern of water flows through the dam, there is no excuse for failure to comply with the law in determining what the pattern will be. For this reason, the remainder of this Article, which is concerned with the application (or lack thereof) of the law, will focus primarily on the issue of flow pattern.

III. The Legal Hierarchy of Water Uses and Resources Affected by the Operation of Glen Canyon Dam

The operation of Glen Canyon Dam affects numerous resources and water uses, including, but not limited to, water supply for consumptive uses, hydroelectric power production, endangered species of native fish, recreational angling for non-native fish, and recreational boating in the Grand Canyon. Choices about the operation of the dam involve trade-offs between these resources and uses. The trade-off between hydropower production and endangered species protection is the primary focus of this Article.

Under the law, not all resources and uses affected by the dam are equal in stature. The several federal statutes affecting management of the dam create, in effect, a hierarchy of resources and uses. At the top of the hierarchy are water storage and supply and endangered species, both of which enjoy the protection of specific, mandatory legal requirements that are subject to no, or only very narrow, exceptions. The law also calls on the Bureau of Reclamation to operate the dam in a manner that advances or protects other resources and uses, such as recreation and hydropower production, but only to the extent consistent with the mandatory requirements for water supply and endangered species protection.

A. *Water Storage and Supply*

The Colorado River Compact of 1922, whose requirements provided the primary impetus for the construction of Glen Canyon Dam, also constitutes the primary charter for the dam's operation. Article III(d) of the Compact states that "[t]he States of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years."[62] Thus, a baseline requirement for the dam's operation is that the Lower Basin should receive an annual average flow of at least 7.5 million acre-feet. An additional constraint is placed on the dam's operation by article III(c) of the Compact, which provides that, except in times of surplus, the Upper Basin and Lower Basin shall contribute equally from their shares to satisfy any obligation that the United States may incur to leave water in the river for the benefit of Mexico.[63] This obligation was quantified in 1944 by a treaty between the United States and Mexico, which allocated 1.5 million acre-feet annually of the river's water to Mexico.[64]

In the Colorado River Basin Project Act of 1968,[65] Congress incorporated these constraints in an ordered list of priorities for storage of water in, and releases of water from, Lake Powell. The list gives first priority to satisfaction of the Mexican treaty obligation, second priority to satisfaction of the Upper Basin's obligation to the Lower Basin under Compact article III(d), and third priority to maintaining a sufficient backup supply stored in Lake Powell to ensure that the first two priorities can be met under reasonably anticipated future climatic conditions.[66] The list then specifies that, when there is additional water available for storage or release after these three priorities have been satisfied, additional water may be released either for use in the Lower Basin or to equalize the amount of water stored in Lake Powell and in Lake Mead downstream.[67]

The 1968 Act instructed the Bureau of Reclamation to promulgate "criteria" for dam operations to implement these priorities.[68] In the criteria issued pursuant to this requirement, the Bureau has set the "normal year" release from the dam at 8.23 million acre-feet. This figure was determined by adding the Upper Basin's one-half share (0.75 million acre-feet) of the Mexican treaty obligation to the Compact's requirement of an average flow of 7.5 million acre-feet and then subtracting the average contribution of the Paria River (0.02 million acre-feet), which enters the Colorado below Glen Canyon Dam but just above the division point at Lee Ferry, and thus contributes to the flow from the Upper Basin to the Lower Basin.

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[62] Colorado River Compact of 1922, art. III(d), 70 CONG. REC. 324 (1928).

[63] *Id.* art. III(c).

[64] Treaty on the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande art. 10(a), U.S.-Mex., Feb. 3, 1944, 59 Stat. 1219, *available at* http://www.usbr.gov/lc/region/g1000/pdfiles/mextrety.pdf.

[65] 43 U.S.C. §§ 1501-1556 (2000). This is the statute that, among other things, authorized construction of the Central Arizona Project to bring Colorado River water to Phoenix, Tucson, and surrounding areas.

[66] *Id.* § 1552(a).

[67] *Id.* § 1552(a)(3).

[68] *Id.* § 1552.

Despite these seemingly precise instructions for releases from the dam, significant controversy persists between the Upper Basin and the Lower Basin states regarding required annual releases. The controversy stems from, among other things, ambiguity in the meaning of the word "surplus," which determines when the Upper Basin must contribute to meeting the Mexican treaty obligation, and disagreement over the appropriateness of providing a minimum annual release as opposed to the less demanding decadal average specified in the Compact, which would allow for lesser releases in some years so long as they are compensated by greater releases in preceding or following years.

For purposes of this Article, however, the most salient feature of the statutory provisions governing operation of Glen Canyon Dam is that they govern *only* annual and decadal releases of water from the dam, and they are indifferent to the intra-annual pattern of releases. That is, any pattern of releases from the dam—steady through the year, seasonally fluctuating, daily fluctuating, or a combination—will satisfy the laws governing water storage and supply so long as the correct total amount of water is released from the dam over the course of each year and each decade.

Not only the law, but also water uses in the Lower Basin are indifferent to the intra-annual pattern of releases from Glen Canyon Dam because such releases do not flow directly to Lower Basin water users. Rather, they flow through the Grand Canyon into Lake Mead, behind Hoover Dam. Lake Mead, with a storage capacity roughly equal to that of Lake Powell, acts as a regulating buffer between Glen Canyon Dam and Lower Basin water users. Therefore, hourly, daily, and seasonal fluctuations in releases from Glen Canyon Dam do not affect water uses in the Lower Basin. As far as such uses are concerned, only the total annual water release from the dam matters.[69]

B. Endangered Species

1. The Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 ("ESA") requires every federal agency to ensure "that any action authorized, funded, or carried out by such agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of the designated critical habitat of the species.[70] With respect to dams, "action" within the meaning of this provision includes not only the construction or modification of a dam but also the ongoing operation of a dam.[71] Therefore, the Bureau of Reclamation is required to operate Glen Canyon Dam in a manner that is not likely to jeopardize the continued existence of the humpback chub.

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[69] *See, e.g.*, Upper Colorado Region, Bureau of Reclamation, U.S. Dep't of the Interior, *Interior Secretary Kempthorne Launches Grand Canyon High Flow Experiment*, http://www.usbr.gov/uc/feature/GC-hfe/index.html (last visited May 20, 2008) [hereinafter *High Flow Experiment*] (explaining that sixty-hour high flow experiment conducted in March 2008 would have no effect on the annual quantity of water flowing to Lake Mead and the Lower Basin).

[70] 16 U.S.C. § 1536(a)(2) (2000).

[71] *See* Tenn. Valley Auth. v. Hill, 437 U.S. 153 (1978).

As it happened, the operation of another dam—the Tellico Dam on the Little Tennessee River in Tennessee—gave the Supreme Court the occasion to confirm the mandatory and uncompromising nature of section 7's mandate. In *Tennessee Valley Authority v. Hill*,[72] the Court held that the operation of the dam should be enjoined because it would inundate the last known habitat for a species of small fish called the snail darter. The court rejected arguments that the dam should be allowed to operate because it was constructed before the passage of the ESA, or that Congress had implicitly waived compliance with the ESA by continuing to appropriate money for the dam's operation after passage of the Act. In hewing to a strict application of the Act, the Court wrote:

> This language [section 7(a)(2)] admits of no exception. . . . [E]xamination of the language, history, and structure of the legislation under review here indicates beyond doubt that Congress intended endangered species to be afforded the highest of priorities.[73]

More recently, the Supreme Court placed an important limitation on the mandatory nature of section 7(a)(2). In *National Ass'n of Home Builders v. Defenders of Wildlife*,[74] the Court affirmed a Fish & Wildlife Service regulation that stated that section 7(a)(2) applies only to "actions in which there is *discretionary* Federal involvement or control."[75] Thus, an agency's duty to avoid jeopardy or adverse modification of critical habitat "does not attach to actions . . . that an agency is *required* by statute to undertake once certain specified triggering events have occurred."[76]

The substantive mandate of section 7 is accompanied by a procedural requirement that makes the United States Fish & Wildlife Service the arbiter of whether a proposed agency action is or is not likely to jeopardize the continued existence of a threatened or endangered species. When another federal agency proposes an action that is likely to affect a threatened or endangered species, the Fish and Wildlife Service prepares a "Biological Opinion" evaluating whether the action is likely to jeopardize the species or harm its critical habitat.[77] If the opinion concludes that jeopardy or adverse modification will occur, in violation of section 7(a)(2), then the opinion can suggest "reasonable and prudent alternatives" that would not violate section 7(a)(2).[78]

2. The Grand Canyon Protection Act

The ESA's broad mandate for protection of endangered species is supplemented by another statute that applies explicitly to the operations of Glen Canyon Dam, the Grand Canyon Protection Act of 1992 ("GCPA").[79] Section 1802(a) of that Act requires the Secretary of the Interior to

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[72] *Id.* at 194-95.
[73] *Id.* at 173-74.
[74] Nat'l Ass'n of Home Builders v. Defenders of Wildlife, 127 S. Ct. 2518 (2007).
[75] 50 C.F.R. § 402.03 (2006) (emphasis added).
[76] *Nat'l Ass'n of Home Builders*, 127 S. Ct. at 2536.
[77] 16 U.S.C. § 1536(b)(3)(A) (2000).
[78] *Id.*
[79] Grand Canyon Protection Act of 1992, Pub. L. No. 102-575, 106 Stat. 4600, 4669-73. The Act was Title XVIII of the Reclamation Projects Authorization and Adjustment Act of 1992, Pub. L. 102-575, 106 Stat. 4600.

> 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.[80]

Section 1804, in turn, requires the preparation of an Environmental Impact Statement ("EIS") and an audit of the costs and benefits of dam operations, and the adoption of criteria and plans for dam operations based on the findings of the EIS and the audit.[81] Section 1804 also reiterates that the criteria and plans, as well as the exercise of other existing legal authorities, shall ensure that the dam is operated in a manner consistent with the mandate of section 1802, quoted above, to protect the values for which Grand Canyon National Park ("GCNP") and Glen Canyon National Recreation Area ("GCNRA") were established.[82] Sections 1804(c)(3) and 1805(c) require the Secretary to consult with the governors of the basin states, Native American tribes, academic and scientific representatives, environmental organizations, the recreation industry, electric power purchasers, and the public in the development of operating criteria and plans for the dam and in monitoring and other activities to ensure that the dam is operated in accordance with the Act.[83]

The values for which GCNP was established in 1919 are not explicitly stated in the legislation that established the park, but they may be inferred from the National Park Service Organic Act of 1916 ("Organic Act"), which governs management of the entire national park system, including both GCNP and GCNRA.[84] The Organic Act defines the "fundamental purpose" of national parks to be "to conserve the scenery and the natural and historic objects and the wild life [sic] therein and to provide for the enjoyment of the same in such

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[80] *Id.* § 1802(a). Professor Robert Adler, in a very thoughtful article on the Colorado River, has pointed to an "apparent direct contradiction" between the GCPA's mandate for natural resource protection and its simultaneous insistence that it does not modify the requirements of the Colorado River Compact, the Colorado River Storage Project Act of 1956, or other laws governing water supply and storage and hydroelectric power production on the Colorado River. *See* Robert W. Adler, *Restoring the Environment and Restoring Democracy: Lessons from the Colorado River*, 25 VA. ENVTL. L.J. 55, 86 (2007). However, the apparent contradiction can be at least partially resolved by the recognition, as noted above, *see supra* text accompanying notes 68-69, that compliance with the laws governing water storage and supply depends only on the total annual releases of water through Glen Canyon Dam, and is unaffected by the seasonal and daily patterns or the temperature of those releases. Thus, the Bureau can, and under these laws must, manage the seasonal and daily patterns and the water temperature in a manner to protect resources as required by the GCPA without violating those other laws. As for hydroelectric power production, as noted below, *see infra* text accompanying note 96, the 1956 Act requires maximization of the *quantity* of power produced, but not the *value* of power produced. Therefore, it does not mandate daily fluctuating flows designed to provide peaking power. The Bureau may, and under the GCPA must, reduce or eliminate such fluctuations if and as necessary to protect natural resources.

[81] Grand Canyon Protection Act § 1804.

[82] *Id.* § 1804(c)(1)(B).

[83] *Id.* §§ 1804(c)(3), 1805(c).

[84] *See* 16 U.S.C. § 1c(a) (2000) (defining the "national park system" to include all lands managed by the National Park Service). Both Grand Canyon National Park and Glen Canyon National Recreation Area are managed by the National Park Service.

manner and by such means as will leave them unimpaired for the enjoyment of future generations."[85] The statute that established GCNRA stated that area's purpose to be to "provide for public outdoor recreation use and enjoyment of Lake Powell and lands adjacent thereto in the States of Arizona and Utah and to preserve scenic, scientific, and historic features contributing to public enjoyment of the area."[86] Certainly native fish are "wild life" within the meaning of the Organic Act, and they are arguably "scientific . . . features contributing to public enjoyment of the area" within the meaning of the GCNRA legislation. Thus, they are among the values whose protection is mandated by the Grand Canyon Protection Act of 1992.

Besides requiring that Glen Canyon Dam be operated so as to protect park values, the Grand Canyon Protection Act also recognized that protection of such values might entail the loss of some hydroelectric power production. Section 1809 of the Act instructs the Secretary of Energy, in consultation with others, to "identify economically and technically feasible methods of replacing any power generation that is lost through adoption of long-term operational criteria for Glen Canyon Dam as required by Section 1804 of this title."[87]

C. The Lack of Conflict Between Water Supply and the Humpback Chub

As a theoretical matter, the question of whether the Endangered Species Act takes precedence over the Colorado River Compact, the Mexican treaty, the Colorado River Basin Project Act, and other laws regulating the use of Colorado River water presents an interesting and difficult legal question.[88] However, as far as the operation of Glen Canyon Dam is concerned, that question is hypothetical at this time because the measures identified by the Fish and Wildlife Service as necessary for protection of the chub do not conflict with the demands of water supply and storage. These measures—elimination of the daily fluctuations in releases and increasing the temperature of the water released from the dam—would not affect the total amount of water released over the course of a year. And, as noted above, any measure that does not affect the total amount of water released over the course of a year does not affect Lower Basin water users and does not affect compliance with the laws governing water use and storage.

On the other hand, measures to change daily release patterns and water temperature are likely to affect other resources and uses, including non-native sport fisheries and electric power production. However, as will be discussed in the following sections, these other resources and uses enjoy a lower level of legal protection that is inferior to the mandatory requirements of the Endangered Species Act.

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[85] *Id.* § 1.

[86] *Id.* § 460dd(a).

[87] Grand Canyon Protection Act § 1809.

[88] The question would be whether the requirements of these laws are sufficiently mandatory so as to preclude application of the Endangered Species Act or whether they leave some discretion that could be exercised in favor of protection of endangered species. *See* Nat'l Ass'n of Home Builders v. Defenders of Wildlife, 127 S. Ct. 2518 (2007); *supra* text accompanying notes 74-76.

D. Hydroelectric Power Production

Although hydroelectric power production is one of the statutory purposes of Glen Canyon Dam, it is lower in legal priority than either water storage and supply or endangered species protection. Section 1 of the Colorado River Storage Project Act of 1956 ("CRSPA"), which authorized the construction of the dam, defined hydroelectric power production as an *incidental* purpose of the dam:

> In order to initiate the comprehensive development of the water resources of the Upper Colorado River Basin, 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 Secretary of the Interior is authorized (1) to construct, operate, and maintain [Glen Canyon Dam and other dams].[89]

Section 7 of the CRSPA provides more specific direction regarding power production:

> The hydroelectric powerplants and transmission lines authorized by this chapter to be constructed, operated, and maintained by the Secretary shall be operated in conjunction with other Federal powerplants, present and potential, so as to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates, but in the exercise of the authority hereby granted he shall not affect or interfere with the operation of the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, the Boulder Canyon Project Act, the Boulder Canyon Project Adjustment Act, and any contract lawfully entered into under said Compacts and Acts. Subject to the provisions of the Colorado River Compact, neither the impounding nor the use of water for the generation of power and energy at the plants of the Colorado River storage project shall preclude or impair the appropriation of water for domestic or agricultural purposes pursuant to applicable State law.[90]

The strongest argument for giving a high priority to electric power production is the requirement "to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates," but the succeeding clauses clarify that this requirement is subservient to requirements for water storage and supply. And the term "practicable" implies some degree of discretion, thus opening the door for application of the species protection mandate of section 7(a)(2) of the Endangered Species Act.[91]

Moreover, even if the statutory instruction "to produce the greatest practicable amount of power and energy that can be sold at firm power and energy rates," standing alone, were interpreted as leaving no discretion to sacrifice power production for the sake of endangered species, that instruction has been modified by the Grand Canyon Protection Act's requirement to operate Glen

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[89] 43 U.S.C. § 620 (2000) (emphasis added).

[90] *Id.* § 620f (citations omitted).

[91] *See supra* Part III.B.1.

Canyon Dam so as to protect park values, which include fish.[92] As noted above, that Act explicitly contemplates the reduction of power production in order to fulfill its resource protection mandate.[93] And, under the Supreme Court's interpretation of the Endangered Species Act in *Tennessee Valley Authority v. Hill*,[94] whenever an agency is statutorily *permitted* to tailor its actions so as to protect endangered species, it *must* do so. Therefore, under the law, the maximization of electric power production at Glen Canyon Dam must yield to protection of the humpback chub if necessary to avoid jeopardizing the species.

Finally, it is worth noting that the adverse effects of hydroelectric power production on the humpback chub and other native species are related not to the total amount of power produced but rather to the daily fluctuations in flows through the dam.[95] These fluctuations result from the attempt to maximize the *value* of the dam's power production by concentrating that production at times of peak demand.[96] But maximizing the *value* of power production is not mandated by the CRSPA, which refers only to producing the greatest practicable *amount* of power, or by any other statute. Therefore, any such value maximization is permissible, if at all, only if, and to the extent that, it does not jeopardize the existence of the humpback chub or any other threatened or endangered species.

E. Non-Native Fish

While the non-native sport fishery for rainbow trout at Lee Ferry is a significant tourist attraction and a source of local income,[97] it ranks low in the legal hierarchy of protected resources. Rainbow trout (*Oncorhynchus mykiss*), which are native to the West Coast but not to the Colorado River, are a very common species and are not listed as threatened or endangered. Because the population at Lee Ferry was developed after the completion of Glen Canyon Dam in 1963, it would be difficult to argue that it is among "the values for which Grand Canyon National Park [was] established" within the meaning of the Grand Canyon Protection Act since Grand Canyon National Park was established in 1919. Moreover, the National Park Service ("NPS") has generally interpreted its statutory mandate to protect wildlife in the National Parks[98] as referring to native, not introduced species, and current NPS policy disfavors the maintenance of populations of non-native species within the parks, especially where non-native species may pose a threat to native species, as rainbow trout do to humpback chub.[99]

Recreational fishing for rainbow trout fits more plausibly within one of the purposes for which Glen Canyon National Recreation Area was established in 1972, namely, "public outdoor recreation use and enjoyment of Lake Powell

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[92] *See supra* Part III.B.2.
[93] *See supra* text accompanying note 87.
[94] *See supra* text accompanying notes 72-73.
[95] *See supra* text accompanying note 61.
[96] *See supra* text accompanying note 23.
[97] *See supra* text accompanying note 45.
[98] 16 U.S.C. § 1 (2000).
[99] *See supra* text accompanying note 51.

and lands adjacent thereto." But the GCPA's broad instruction to "protect, mitigate adverse impacts to, and improve" an assortment of values that includes public outdoor recreation is not the kind of specific instruction for protection of rainbow trout that can compete with the Endangered Species Act's specific mandate to avoid jeopardy to the humpback chub, or the Colorado River Compact's allocation of water between the Upper Basin and the Lower Basin. If and when maintenance of the rainbow trout fishery conflicts with endangered species protection or water storage and supply, the trout must yield.

IV. The Recent History of Administration and Operation of Glen Canyon Dam

The history of the administration and operation of Glen Canyon Dam is long and tortured and cannot be fully recounted here. We pick up the story in 1991, when the Bureau of Reclamation first implemented changes in dam operations for the sake of endangered species.[100]

A. 1991–1996: Interim Operating Criteria

Fully thirty years ago, in 1978, the Fish and Wildlife Service issued its first Biological Opinion on the operation of Glen Canyon Dam. That opinion concluded that dam operations jeopardized the continued existence of the humpback chub, but it did not require any immediate changes in those operations, only further study.[101] It was not until 1991 that the Bureau responded with any changes in dam operations. In 1991, the Bureau issued "interim operating criteria" that restricted the degree of daily fluctuation in flow through the dam. In contrast to previous operations, in which flows often fluctuated by more than 25,000 cfs each day (from less than 5000 cfs at night to more than 30,000 cfs during the afternoon), the interim operating criteria limited the degree of daily fluctuation to either 5000, 6000, or 8000 cfs, depending on the total monthly release volume.[102]

B. The 1994–1995 EIS

After passage of the Grand Canyon Protection Act,[103] and pursuant to the Act's mandate, the Bureau of Reclamation prepared an Environmental Impact Statement[104] that analyzed nine different alternative scenarios[105] for future operations of Glen Canyon Dam. A draft EIS was issued for public comment in January 1994[106] and the final EIS was released in March 1995.[107]

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[100] For information on the pre-1991 history of the dam's administration, see 1994 Biological Opinion, *supra* note 37, at 3-4.

[101] *See id.* at 3 (discussing the 1978 opinion).

[102] SCORE Report, *supra* note 8, at 19.

[103] *See supra* Part III.B.2.

[104] U.S. Bureau of Reclamation, U.S. Dep't of the Interior, Operation of Glen Canyon Dam: Final Environmental Impact Statement (1995), *available at* http://www.usbr.gov/uc/library/envdocs/eis/gc/gcdOpsFEIS.html [hereinafter Glen Canyon Dam EIS].

[105] *See id.* at 15-44.

[106] *See* Notice of Availability and Notice of Public Hearings on the Draft Environmental Impact Statement, 59 Fed. Reg. 1023 (Jan. 7, 1994).

1. Alternative Flow Regimes

The principal difference distinguishing the alternatives in the EIS from each other was in the degree of daily fluctuation in water flows to be permitted. Permitting large fluctuations would take maximum advantage of the dam's ability to supply peaking power,[108] but would be harmful to fish and other resources in the Grand Canyon. Thus, the different alternatives analyzed in the EIS represented different potential levels of trade-off between power production and resource protection. The alternatives analyzed varied from the "No Action" alternative,[109] which would have perpetuated the 1963–1991 operations under which flows often varied by more than 25,000 cfs each day, to the "Year-Round Steady Flow" alternative, which, as its name suggests, would have required a steady flow of water through the dam throughout the year.[110] Intermediate alternatives included several that would have allowed some daily fluctuation but restricted the magnitude of the fluctuation,[111] and a "Seasonally Adjusted Steady Flow" ("SASF") alternative that would have eliminated daily fluctuations but allowed flow through the dam to vary seasonally, with the highest flows (18,000 cfs) in May and June and the lowest flows (8000 cfs) in October, November, and December.[112] This alternative, which was designed to protect and enhance native fish populations, would have mimicked, to a limited degree, the natural seasonal flow pattern that prevailed before the dam was built.

The 1995 EIS identified as the Bureau's preferred alternative the "Modified Low Fluctuating Flow" ("MLFF") alternative, which was similar to the interim operating criteria under which the dam had been operating since 1991.[113] Under this alternative, two important constraints would be placed on the degree of daily fluctuation in flows through the dam. First, the flow would not be permitted to drop below 5000 cfs at night or below 8000 cfs during the day, nor to exceed 25,000 cfs (about 25% below the power plant capacity of 33,000 cfs) at any time.[114] Second, and most important, the difference between the maximum and minimum flow in any one day would not be permitted to exceed 5,000–8,000 cfs, the exact limit depending on the total monthly release volume from the dam.[115] This constraint, which was essentially the same as that imposed by the interim operating criteria, was a substantial reduction in fluctuation compared to the 25,000+ cfs variation permitted before 1991 and analyzed under the No Action alternative. Nonetheless, the daily flow fluctua-

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[107] *See* Notice of Availability of the Final Environmental Impact Statement, 60 Fed. Reg. 15,581 (Mar. 24, 1995).

[108] *See supra* text accompanying notes 10-12, 22-23.

[109] GLEN CANYON DAM EIS, *supra* note 104, at 19-23.

[110] *Id.* at 33.

[111] *Id.* at 24-30.

[112] *Id.* at 32-33.

[113] *Id.* at 27-29.

[114] *Id.* at 28. An exception was made to the 25,000 cfs limit for emergencies and for "high inflow and storage conditions," i.e., when Lake Powell is full and high releases are required to avoid overtopping the dam. *Id.*

[115] *Id.*

tion permitted by the MLFF alternative would still cause the level of the river to rise and fall by about three feet each day.[116]

2. Beach/Habitat-Building Flows

In addition to various limitations on daily fluctuations in dam releases, most of the alternatives analyzed in the 1995 EIS, including the MLFF alternative, included provisions for occasional "Beach/Habitat-Building Flows" ("BHBFs") and "habitat maintenance flows." BHBFs, sometimes called "controlled floods," are releases of up to 45,000 cfs for one to two weeks at a time for the purpose of rebuilding sandbars, depositing nutrients, restoring backwater channels, and "provid[ing] some of the dynamics of a natural system."[117] Because 45,000 cfs exceeds the capacity of Glen Canyon Dam's hydroelectric generators, BHBFs require the passing of water through the river outlet works, also called the "jet tubes."[118] Habitat maintenance flows are also high flow events for the same general purpose, but they are within the powerplant capacity of 33,000 cfs.[119]

C. The 1994 Biological Opinion

Pursuant to section 7 of the Endangered Species Act, the U.S. Fish & Wildlife Service prepared a Biological Opinion ("BO") on the effects of Glen Canyon Dam's operation on five endangered species: humpback chub, razorback sucker, bald eagle, peregrine falcon, and Kanab ambersnail.[120] The BO took the Bureau of Reclamation's MLFF alternative as described in the January 1994 draft EIS as the Bureau's proposed action.[121] The BO was issued in December 1994, just before the Bureau issued its final EIS.

1. Jeopardy Determination

The BO concluded that operation of the dam under the MLFF alternative would not jeopardize the continued existence of the bald eagle, peregrine falcon, or Kanab ambersnail, but it would jeopardize the continued existence, and it would adversely modify or destroy critical habitat, of both the razorback sucker and the humpback chub.[122]

In finding that the MLFF alternative would jeopardize the razorback sucker and the humpback chub, the BO noted that much was still unknown about the effects of dam operations on native fish, but it discussed numerous

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[116] *See* 1994 BIOLOGICAL OPINION, *supra* note 37, at 23-24 (noting daily fluctuation in river stage of 0.8 to 1 meter under the MLFF alternative).

[117] GLEN CANYON DAM EIS, *supra* note 104, at 40. Despite the name "controlled flood," the BHBF flow rate of 45,000 cfs is quite modest compared to the natural annual, pre-dam spring flows, which often exceeded 100,000 cfs. *See supra* text accompanying notes 14-16. The current physical structure of the dam does not usually allow releases greater than about 48,000 cfs. *See supra* text accompanying notes 17-20. Thus, the choice of 45,000 cfs as a BHBF flow rate reflects the physical limitations of the dam as much as a deliberate choice.

[118] *See supra* text accompanying note 18.

[119] *See* SCORE REPORT, *supra* note 8, at 7.

[120] 1994 BIOLOGICAL OPINION, *supra* note 37, at 3.

[121] *Id.* at 1.

[122] *Id.* at 3.

ways, some beneficial and some harmful, in which dam operations under that alternative would likely affect these fish. On the positive side, as compared to the No Action alternative, the BO found that the MLFF alternative would benefit the chub and the razorback sucker by increasing minimum flows, decreasing maximum flows, and reducing the magnitude of daily flow fluctuations. However, according to the BO, the MLFF alternative did not go far enough in the direction of steadying flows. The three-foot daily fluctuation in river level permitted by the MLFF alternative would still be enough to eliminate most of the backwater habitat needed by the chub.[123] Moreover, the MLFF alternative would do nothing to alleviate two other effects of the dam, namely, the year-round maintenance of water temperatures too cold for spawning and for healthy growth and development of young fish, and the loss of the sediment needed to maintain beaches and sandbars.

According to the BO, as a result of these three factors—continuing (though reduced) daily flow fluctuations, continued lack of sediment, and continued cold water in the mainstem of the Colorado—spawning and recruitment of young humpback chub would continue to be largely precluded in the mainstem and confined to the warmer, more sediment-laden tributary waters of the Little Colorado River. And with the chub population so dependent on a single, relatively small stream, it is unacceptably vulnerable to decimation by water pollution, a chemical spill, or some other catastrophic event or chronic condition.[124] Therefore, the BO concluded, operation of Glen Canyon Dam under the Bureau's preferred alternative, MLFF, would jeopardize the continued existence of the humpback chub, as well as the razorback sucker, in violation of section 7 of the Endangered Species Act.[125]

2. Reasonable and Prudent Alternative

Pursuant to section 7(b)(3)(A) of the Endangered Species Act,[126] the BO described a "reasonable and prudent alternative" ("RPA") under which, in the judgment of the Fish & Wildlife Service, Glen Canyon Dam could be operated without jeopardy to the humpback chub or the razorback sucker.[127] The RPA's prescription for dam operations differed from the MLFF alternative in two significant respects. First, the RPA called on the Bureau to carry out a program of experimental flows "to include high steady flows in the spring and low steady flows in summer and fall during low water years."[128] "Steady flows" were described as "a flow pattern that resembles the natural hydrograph, as described for those seasons in the SASF [the Seasonally Adjusted Steady Flow alternative described in the EIS[129]]."[130] "Low water years" were defined to mean years in which the total annual release of water through the dam is equal to the mini-

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[123] *Id.* at 23-24.
[124] *Id.* at 20-21, 32.
[125] *Id.* at 3.
[126] 43 U.S.C. § 1536(b)(3)(A) (2000); *see supra* text accompanying note 78.
[127] 1994 BIOLOGICAL OPINION, *supra* note 37, at 33-39.
[128] *Id.* at 35.
[129] *See supra* text accompanying note 112.
[130] 1994 BIOLOGICAL OPINION, *supra* note 37, at 35.

mum 8.23 million acre-feet needed to meet the Upper Basin's obligations to the Lower Basin and Mexico.[131]

The RPA called for the experimental steady flows to begin within three years:

> Design of the experimental flows and associated studies will begin as soon as possible and be targeted for completion by October 1996. Unless the [Fish & Wildlife] Service determines information provided seriously questions the validity of experimental designs developed or contribution of the resulting data to remove jeopardy to the federally-listed aquatic fauna of the Grand Canyon, experimental flows will be initiated in April 1997. If sufficient progress and good faith effort is occurring towards initiating experimental flows, implementation of experimental flows may occur later in 1997.[132]

The RPA also contained a "hammer" clause requiring adoption of the SASF alternative for seven months of each year if the Bureau of Reclamation did not move quickly enough to implement the experimental steady flows: "If the Service believes there is not sufficient progress, Glen Canyon Dam would be operated as SASF flows during spring through fall (April to October) beginning in 1998."[133] In effect, the Fish and Wildlife Service was giving the Bureau a choice for complying with the Endangered Species Act: either promptly implement steady flows on an experimental, part-time basis, or implement them for seven months a year. Under the RPA, continued fluctuating flows without substantial periods of steady flow were not an option.

The second substantive change in dam operations required by the RPA was that the Bureau was instructed to implement a "selective withdrawal program" to increase the temperature of the water flowing from Glen Canyon Dam into the Grand Canyon in order to make the river there more hospitable to spawning and growth of humpback chub.[134] A selective withdrawal program would involve modifying the dam by adding a temperature control device ("TCD") on the upstream side. The TCD would direct water from the higher, warmer levels of Lake Powell into the dam's hydroelectric generators.[135]

D. The Bureau of Reclamation's Response to the 1994 Biological Opinion

On April 6, 1995, the Bureau of Reclamation sent a memorandum to the Fish & Wildlife Service responding to the Service's 1994 Biological Opinion, including the RPA.[136] The memorandum expressed a mix of grudging submission, skepticism, and defiance. The memorandum began by stating that "[i]t is our intent to implement the elements of the Reasonable and Prudent Alternative

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[131] *Id.*; *see supra* text accompanying note 68.

[132] 1994 BIOLOGICAL OPINION, *supra* note 37, at 35.

[133] *Id.*

[134] *Id.* at 36-37.

[135] *See* UPPER COLO. REGION, U.S. BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, GLEN CANYON DAM MODIFICATIONS TO CONTROL DOWNSTREAM TEMPERATURES: PLAN AND DRAFT ENVIRONMENTAL ASSESSMENT (1999), *available at* http://www.usbr.gov/uc/envprog/environment/pdfs/gcdtc.pdf.

[136] Memorandum from Charles A. Calhoun, Reg'l Dir., Upper Colo. Reg'l Office, U.S. Bureau of Reclamation, U.S. Dept of the Interior, to Reg'l Dir., Region 2, U.S. Fish & Wildlife Serv., U.S. Dept of the Interior (Apr. 6, 1995) (on file with author) [hereinafter BuRec Response to RPA].

(RPA)"[137] but then went on to challenge the legal basis for the Service's determination that the Bureau's preferred MLFF alternative would jeopardize the continued existence of the humpback chub.[138] Of course, the *raison d'etre* for the RPA was the Service's determination that the MLFF alternative would jeopardize the chub and adversely modify its critical habitat.[139] Absent the jeopardy and adverse modification determinations, the Bureau would be under no legal compunction to follow the RPA. But the Bureau's memorandum indicated that the Bureau, in recognition of its broader responsibility to utilize its resources in furtherance of the purposes of the ESA,[140] would implement the RPA despite its view that the Service's jeopardy determination was unjustified.[141]

However, in its discussion of the several specific elements of the RPA, the Bureau strongly hinted that it did not intend to implement the RPA's requirement for steady flows in the prompt manner that the RPA required and that it might not implement that requirement at all. The memorandum implied that the RPA did not describe the steady flow requirement with sufficient specificity and expressed doubt as to whether this requirement met the regulatory definition of an RPA.[142] It also treated steady flows as a risky experiment that should not be undertaken without great caution and thorough preparation.[143] (This rhetoric, which turned reality on its head by implying that turning the river up and down on a daily basis to enhance power revenues was the safe, conservative course of action, was a tactic that the Bureau would employ repeatedly as it resisted implementation of steady flows over the next decade.) It concluded that "it will be difficult at best to implement the flows within the period of time recommended by the [Fish & Wildlife] Service."[144]

E. The 1996 Record of Decision

1. Adoption of the MLFF Alternative

In October 1996, seventeen months after informing the Fish & Wildlife Service that it intended to implement the RPA in the Service's 1994 Biological Opinion, the Bureau of Reclamation issued a Record of Decision ("ROD") governing future operations of Glen Canyon Dam.[145] The ROD adopted the MLFF alternative, the preferred alternative described in the EIS and determined by the Fish & Wildlife Service to violate section 7 of the Endangered Species Act.[146]

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[137] *Id.* at 1.
[138] *Id.* at 1-3.
[139] *See supra* text accompanying notes 77-78 (setting forth ESA's connection between jeopardy determinations and RPAs).
[140] BuRec Response to RPA, *supra* note 136, at 3; *see* 16 U.S.C. § 1536(a)(1) (2000).
[141] BuRec Response to RPA, *supra* note 136, at 3, 8.
[142] *Id.* at 4; *see* 50 C.F.R. § 402.02 (2006) (defining "reasonable and prudent alternatives").
[143] BuRec Response to RPA, *supra* note 136, at 4.
[144] *Id.*
[145] U.S. DEP'T OF THE INTERIOR, RECORD OF DECISION, OPERATION OF GLEN CANYON DAM, FINAL ENVIRONMENTAL IMPACT STATEMENT (1996) [hereinafter 1996 RECORD OF DECISION] *available at* http://www.usbr.gov/uc/rm/amp/pdfs/sp_appndxG_ROD.pdf.
[146] *Id.* at 3. The ROD made one minor modification to the MLFF alternative, regarding the timing of Beach/Habitat-Building Flows. *Id.*

2. Adaptive Management

The ROD also initiated an Adaptive Management Program, which had been described in the EIS. The AMP called for monitoring the effects of dam operations on downstream resources, including endangered fish, and modifying those operations if the MLFF alternative were not successful in achieving the desired results:

> It is intended that the [Bureau's decision] will initiate a process of "adaptive management," whereby the effects of dam operations on downstream resources would be assessed and the results of those resource assessments would form the basis for future modifications of dam operations. Many uncertainties still exist regarding the downstream impacts of water releases from Glen Canyon Dam. The concept of adaptive management is based on the recognized need for operational flexibility to respond to future monitoring and research findings and varying resource conditions.
>
> The Adaptive Management Program (AMP) was developed and designed to provide an organization and process for cooperative integration of dam operations, resource protection and management, and monitoring and research information.[147]

While the AMP was defined in terms of monitoring, research, and flexible management, the structure of the AMP described in the EIS introduced another concept, namely, collaboration among stakeholders. The heart of the AMP, as described in the EIS, is the Adaptive Management Work Group ("AMWG"), an advisory committee appointed by the Secretary of the Interior. Membership of the AMWG comprises representatives of federal agencies, each of the Colorado River Basin states, environmental groups, recreational interests, and the electric power industry. The AMWG's responsibilities include "[p]rovid[ing] the framework for AMP policy, goals, and direction," making recommendations to the Secretary regarding possible decisions to modify dam operations, and ensuring that any such decisions are incorporated into operating plans and ongoing activities.[148]

According to the ROD, the Bureau intended to rely heavily on the AMWG to ensure that future dam operations protected downstream resources as required by the Endangered Species Act, the Grand Canyon Protection Act, and other laws. The ROD stated that, should the impacts of the flows and fluctuations permitted by the selected MLFF alternative differ from the predictions of the EIS, the AMWG would make recommendations to the Secretary to modify those parameters.[149] It also assigned to the AMWG the responsibility to recommend the timing, duration, and magnitude of the Beach/Habitat-Building Flows designed to rebuild beaches and sandbars and restore backwater habitats.[150]

3. The ROD's Treatment of the Fish & Wildlife Service's Biological Opinion

Despite the Bureau's having informed the Fish & Wildlife Service that it intended to implement the RPA prescribed in the Service's 1994 Biological

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147 GLEN CANYON DAM EIS, *supra* note 104, at 34.
148 *Id.* at 36.
149 1996 RECORD OF DECISION, *supra* note 145, at 3-4.
150 *Id.* at 10; *see supra* Part IV.B.2.

Opinion, the ROD barely mentioned the BO. The ROD did not reveal that the Fish and Wildlife Service had determined that the alternative the Bureau was adopting (MLFF) would violate the Endangered Species Act. Nor did the ROD describe, let alone adopt, the RPA, with its requirement for a program of steady high flows in the spring and steady low flows in the summer and fall in low-water years.

The ROD's lone mention of the BO was in a section in which the Bureau responded to public comments that it received after publication of the final EIS:

> COMMENT: Endorse the Fish & Wildlife Service's Biological Opinion and implement experimental steady flows to benefit native fishes, subject to the results of a risk/benefit analysis now in progress.
>
> RESPONSE: The preferred alternative provides for experimental steady flows through the Adaptive Management Program for the reasons put forth in the Biological Opinion.[151]

This response, which does not claim that the Bureau will actually follow the prescription of the RPA, is confusing and somewhat misleading. The only arguably "steady" flows that the preferred alternative (MLFF) provided for were the Beach/Habitat-Building Flows, which were high flows of one to two weeks duration to be conducted for the purpose of rebuilding sandbars and restoring backwater channels.[152] Such one to two week flows would not meet the RPA's definition of "steady flows," which was "a flow pattern that resembles the natural hydrograph, as described for those seasons in the SASF [the Seasonally Adjusted Steady Flow alternative described in the EIS]."[153] A flow pattern consisting of daily fluctuating flows interrupted by one to two weeks of steady flows does not resemble the natural hydrograph and is not what was described in the SASF alternative. And even if the high flows of BHBFs were considered "steady flows" within the meaning of the RPA, they do not even arguably satisfy the RPA's requirement for *low* steady flows in the summer and fall, as well as high steady flows in the spring, in low water years.[154]

Moreover, the statement that "[t]he preferred alternative provides for experimental steady flows *through the Adaptive Management Program*" indicated that such flows would not be built into the operating plan put in place by the ROD but rather would be part of the "future modifications of dam operations" that the AMP might (or might not) generate "to respond to future monitoring and research findings and varying resource conditions."[155]

F. 1996–2002: Operations Under the MLFF Alternative

With the issuance of the Bureau's Record of Decision in 1996, the MLFF Alternative, with its restrictions on daily flow fluctuations (which were similar to those that had been imposed by the interim operating criteria since 1991) and its requirements for occasional high flows to build and maintain habitat, but without any provision for the low steady flows in summer and fall in low water

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[151] 1996 RECORD OF DECISION, *supra* note 145, at 8-9.
[152] *See supra* Part IV.B.2.
[153] *See supra* text accompanying note 130.
[154] *See supra* text accompanying notes 128-31.
[155] *See supra* text accompanying notes 147, 151.

years required by the Fish & Wildlife Service's RPA, became the official prescription for future operations of Glen Canyon Dam. In March 1996, to great fanfare, the Bureau conducted the first Beach/Habitat-Building Flow, or "controlled flood."[156] Secretary of the Interior Bruce Babbitt traveled to Glen Canyon Dam so that he could personally open the valves to release 45,000 cfs of water through the Grand Canyon for a period of one week.[157] He declared that the deliberate release of extra water from the dam for ecological purposes marked the beginning of "a new era for ecosystems, a new era for dam management, not only for the Colorado but for every river system and every watershed in the United States."[158] Subsequently, the Bureau implemented a short habitat maintenance flow (a high flow within the power plant capacity of 33,000 cfs[159]) for two days in November 1997.[160]

The Bureau, in memoranda to the Fish & Wildlife Service, cited these high flows as evidence of partial compliance with the RPA's requirement[161] for "high steady flows in the spring and low steady flows in summer and fall during low water years" to enhance and maintain fish habitat.[162] The Fish & Wildlife Service, however, concluded that the Bureau was not making sufficient progress to comply with the RPA:

> This element [steady flows] has not seen sufficient progress. Other than the controlled BHBF in 1996, there have been minimum efforts to develop experimental flows for native fishes. The 1997 Fall Maintenance Flow and canceled 1998 BHBF were designed to protect sediment resources. Although there was some expectation that backwaters and other nearshore habitats could be rejuvenated by these flows, this was not the purpose of the flows.[163]

Moreover, in an earlier memorandum the Fish & Wildlife Service had emphasized that BHBFs and habitat maintenance flows alone could never satisfy the requirements of the RPA because the RPA required not only periods of high steady flows but also periods of *low* steady flows in the summer and fall to provide conditions for rearing and growth of young chub:

> The December 1994 Biological Opinion called for a program of experimental flows to include high steady flows in the spring *and* low steady flows in summer and

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156 *See supra* Part IV.B.2.

157 *See* Larry Warren, *Stirring Things up on the Colorado River*, HIGH COUNTRY NEWS, Apr. 15, 1996, http://www.hcn.org/servlets/hcn.Article?article_id=1772# (describing the flow as a "roaring success" of a media event).

158 *Artificial Flood Created to Rejuvenate the Grand Canyon*, N.Y. TIMES, Mar. 27, 1996, at B8.

159 *See supra* text accompanying note 119.

160 SCORE REPORT, *supra* note 8, at 8, 14.

161 *See supra* text accompanying note 128.

162 Memoranda from Charles A. Calhoun, Reg'l Dir., Upper Colo. Reg'l Office, U.S. Bureau of Reclamation, U.S. Dep't of the Interior, to Field Supervisor, U.S. Fish & Wildlife Serv., Phoenix, Ariz. (Nov. 27, 1996, and Dec. 12, 1997) (on file with author). The term "sufficient progress" was apparently taken from the RPA itself, which required that the Bureau implement Seasonally Adjusted Steady Flows "[i]f the Service believes there is not sufficient progress" in implementing the program of experimental steady flows prescribed in the RPA. *See supra* text accompanying note 133.

163 Memorandum from Field Supervisor, Fish & Wildlife Serv., U.S. Dep't of the Interior, to Reg'l Dir., U.S. Bureau of Reclamation, Salt Lake City, Utah 3 (May 27, 1999) (on file with author).

> fall. . . . Although the Service supported the beach/habitat maintenance flow as a means of reforming backwater channel habitats which could be used by native fishes, the dismissal of the low steady flows in summer and fall indicates only partial progress toward meeting the intent of this element of the RPA. . . . The Service is not aware of progress towards designing a program of experimental flows which will include high steady flows in the spring *and* low steady flows in the summer and fall.[164]

Subsequently, in 2000, the Bureau conducted two additional four-day habitat maintenance flows and a single period of low (8000 cfs) steady flow for three months in the summer.[165] But these very short high flows and a single period of low flow fell far short of the program of steady flows required by the RPA, and the Fish & Wildlife Service concluded again in 2002 that the Bureau was not complying with the RPA:

> This element steady [flows] has not seen sufficient progress. . . . [G]iven the documented decline of the humpback chub in the Grand Canyon, additional delays in developing a program of experimental flows for native fish should not occur. . . . While we support the upcoming [high] flows for sediment conservation and acknowledge the need for flows to disadvantage non-native species, these flows do not meet the objective of this portion of the Reasonable and Prudent Alternative. The program for experimental flows, as required in the biological opinion, should include high steady flows in the spring and low steady flows in summer and fall.[166]

G. 2002–2007: Failure of the MLFF Alternative and New Experiments

By 2002, it had become apparent that operation of Glen Canyon Dam according to the MLFF Alternative since 1996 (and the similar interim flow regime from 1991 to 1996) had failed to achieve two major goals. First, the Beach/Habitat-Building Flows had not succeeded in maintaining or restoring sandbars and beaches in the Grand Canyon. Rather, these areas continued to erode.[167] Second, the population of humpback chub in the Grand Canyon and its tributary, the Little Colorado River, had not stabilized or increased; rather it was continuing to decline, while non-native fish populations, particularly rainbow trout, had increased.[168] The dire situation was bluntly described by the Bureau in 2002:

> Since 1996, the non-native trout population in the Grand Canyon has tripled, the endangered humpback chub (HBC) population has declined precipitously, and tributary sediment inputs are not being conserved as expected in the FEIS [1995 Final Environmental Impact Statement]. These trends are contrary to the expectations of the FEIS and the goals of the adaptive management program. If no actions are taken and current operations continue, these trends are expected to continue.[169]

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[164] Memorandum from Field Supervisor, Ariz. Ecological Servs. Field Office, U.S. Fish & Wildlife Serv., U.S. Dep't of the Interior, to Reg'l Dir., U.S. Bureau of Reclamation, Salt Lake City, Utah 2 (Apr. 3, 1997) (on file with author).

[165] *See* SCORE REPORT, *supra* note 8, at 8, 198.

[166] Memorandum from Field Supervisor, Ariz. Ecological Servs. Field Office, U.S. Fish & Wildlife Serv., U.S. Dep't of the Interior, to Reg'l Dir., U.S. Bureau of Reclamation, Salt Lake City, Utah 3 (June 13, 2002) (on file with author).

[167] *See* SCORE REPORT, *supra* note 8, at 22-25, 209 tbl.1.

[168] *See id.* at 208, 210 tbl.1.

[169] BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, PROPOSED EXPERIMENTAL RELEASES FROM GLEN CANYON DAM AND REMOVAL OF NON-NATIVE FISH, ENVIRONMENTAL

In response to these failures, however, the Bureau did not finally acquiesce in the Fish & Wildlife Service's mandate that it implement Seasonally Adjusted Steady Flows in the spring, summer, and fall in order to maintain better habitat for the humpback chub.[170] Instead, working through the Adaptive Management Program established under the 1996 Record of Decision, the Bureau modified the dam's operations in two ways. First, it made future BHBFs contingent on, and required that they be timed to take advantage of, significant inputs of sediment into the Colorado by floods from its tributary, the Paria, at Lee Ferry.[171] The idea behind this change was that the high flow of a BHBF can be effective at restoring beaches and sandbars if and only if it occurs at a time when there is sufficient sand available in the river bottom for the flood to lift onto the beaches and sandbars. And data collected and analyses performed since 1996 indicated that sufficient sand was present in the river bottom only for a limited time following a large input from a flood on the Paria before it was swept downstream into Lake Mead.[172] The new plan for BHBFs was designed to fit them within this window of opportunity. A BHBF under the new plan was conducted in November 2004.[173]

Second, the Bureau created a new type of experimental flow, "the nonnative fish suppression flow." This type of flow, which is suspiciously (to this author) similar to the highly fluctuating flows permitted before 1991, involves ramping the river up and down from a minimum flow of 5000 cfs to a maximum of 20,000 cfs every day for three months during the winter and early spring, ostensibly for the purpose of disrupting the spawning and recruitment of rainbow trout.[174] Such flows were conducted in 2003, 2004, and 2005.[175] Of course, one effect of such flows was to restore, for three months each winter in those years, most of the peaking power generation that had been taken away by the MLFF's restrictions on daily flow fluctuations, but that was not the Bureau's publicly-stated purpose for instituting such flows.[176]

ASSESSMENT, at vi (2002), *available at* http://www.usbr.gov/uc/envdocs/ea/gc/PropExpReleasesEA-09-2002.pdf [hereinafter 2002 FISH SUPPRESSION EA].

[170] *See supra* text accompanying note 133.

[171] *See* 2002 FISH SUPPRESSION EA, *supra* note 169, at 27.

[172] *See id.* at 24.

[173] *See id.* at 27.

[174] *Id.* at 38-39.

[175] SCORE REPORT, *supra* note 8, at 8.

[176] A proposal for similar flows prepared by the Western Area Power Administration, which markets power from Glen Canyon Dam, labeled such flows "load following" flows, demonstrating, if there was any doubt, that the similarity was not coincidental. *See* Alternative Experimental Flow Regimes in WY 2002-2003 for Consideration by the TWG, Preliminary Draft (Mar. 14, 2002), *available at* http://www.usbr.gov/uc/rm/amp/twg/mtgs/02mar20cc/Attach3.pdf.

Although such flows were designed to disrupt rainbow trout spawning and recruitment, they were nonetheless considered to likely be beneficial to the rainbow trout sport fishery, which had suffered from an excessive number of small fish and a paucity of large fish. It was hoped that reducing the number of fish competing for the river's limited food resources would allow the remaining fish to grow bigger. *See* SCORE REPORT, *supra* note 8, at 38.

H. The 2007 Grand Canyon Trust Lawsuit

In December 2007, the Grand Canyon Trust, one of the two environmental organizations represented on the AMWG, filed a lawsuit against the Bureau of Reclamation.[177] The principal claim raised in the lawsuit is that the Bureau's continuing operation of Glen Canyon Dam under the MLFF regime, and its failure to institute a regime of steady flows as required by the Fish & Wildlife Service's Reasonable and Prudent Alternative, is a violation of the Endangered Species Act.[178] As of this writing, the lawsuit is pending.

I. The 2008 Environmental Assessment and High Flow

In February 2008, the Bureau of Reclamation issued an environmental assessment ("EA") setting forth proposed experimental flows through Glen Canyon Dam for the next five years, through the year 2012.[179] The EA proposed (1) a single sixty-hour high flow of 41,500 cfs in March 2008 and (2) steady flows in September and October for the five years 2008–2012.[180] Outside this period, the dam would continue to be operated under the MLFF regime adopted by the Bureau's Record of Decision in 1996. The high flow proposed in the EA was implemented in early March 2008.[181]

The proposal for two months of steady flows each year, if adopted, would be a significant step towards the Bureau finally coming into compliance with the Endangered Species Act. But it would still fall substantially short of conformance with the Fish & Wildlife Service's RPA, which required a program of low steady flows in the summer as well as in the fall.[182] And it falls even farther short of compliance with the "hammer" clause of the RPA, which required steady flows seven months of each year.[183] Most important, the Bureau has not shown that two months per year of stable nearshore and backwater habitats is enough time to allow the growth and development of young humpback chub that use those habitats.

The 2008 EA also includes significant indications that the Bureau still does not recognize the mandatory nature of the Endangered Species Act's requirements and that it still treats other resources—hydroelectric power production and non-native sport fisheries—with a higher priority than the law provides. The EA explains that, despite the requirements of the RPA, the Bureau

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[177] *See* Complaint for Declaratory and Injunctive Relief, Grand Canyon Trust v. U.S. Bureau of Reclamation, No. 3:07-cv-08164-DGC (D. Ariz. Dec. 7, 2007).

[178] *See id.* at 16-17 (First and Second Claims for Relief, alleging violations of ESA section 7(a)(2), 16 U.S.C. § 1540(g)(1)(A) (2000)).

[179] BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, RECLAMATION: MANAGING WATER IN THE WEST, ENVIRONMENTAL ASSESSMENT, EXPERIMENTAL RELEASES FROM GLEN CANYON DAM, ARIZONA, 2008 THROUGH 2012 (2008), *available at* http://www.usbr.gov/uc/envdocs/ea/gc/2008hfe/GCDexprelEA.pdf [hereinafter 2008 EXPERIMENTAL RELEASES EA].

[180] *Id.* at 9-11. The EA did not use the term "Beach/Habitat-Building Flow" ("BHBF") to describe the proposed high flow, but the nature and purpose of the high flow was essentially the same as the BHBFs prescribed in the 1995 EIS. *See supra* Part IV.B.2. However, the 2008 high flow lasted for only sixty hours, as opposed to the one to two week BHBFs prescribed in the 1995 EIS.

[181] *See High Flow Experiment*, *supra* note 69.

[182] *See supra* text accompanying note 128.

[183] *See supra* text accompanying note 133.

avoided proposing low steady flows during the summer months because steady flows at that time would have a greater impact on hydropower production than in the fall.[184] It also indicates that the timing of the proposed high-flow event was chosen to minimize the public perception of harm to trout fishing opportunities rather than to maximize benefits to the endangered chub.[185]

V. The Causes of the Bureau of Reclamation's Continuing Non-Compliance with the Endangered Species Act

As demonstrated in the narrative above, for the last dozen years, the Bureau of Reclamation has failed to comply with the Reasonable and Prudent Alternative set forth in the Fish & Wildlife Service's 1994 Biological Opinion. Under the RPA, the Bureau should have implemented a program including low steady flows in the summer and fall beginning in 1997, but it did not. Once the Fish & Wildlife Service determined that the Bureau was not making sufficient progress with respect to steady flows, the Bureau should have begun operating Glen Canyon Dam according to the Seasonally Adjusted Steady Flows alternative, but again it did not. Because the Bureau has failed to implement the RPA, it has been operating Glen Canyon in a manner that the Fish & Wildlife Service has determined jeopardizes the continued existence of the humpback chub and adversely modifies the chub's critical habitat. The Bureau has therefore been in violation of section 7 of the Endangered Species Act.

In memoranda to the Fish & Wildlife Service, the Bureau has offered two reasons for its failure to implement the steady flows required by the RPA: (1) a purported need for additional research, analysis, planning, and collection of baseline data before implementing low steady flows, and (2) delays caused by the Glen Canyon Dam Adaptive Management Program. This Part discusses these two purported reasons and concludes that the first does not justify the Bureau's failure to implement the RPA. On the other hand, the AMP, which effectively substitutes collaborative decisionmaking by a diverse group of stakeholders for the legal requirements of the Endangered Species Act, has played a significant role in facilitating, if not causing, the Bureau's non-compliance with the Act.

A. The Purported Need for Additional Research, Analysis, Planning, and Baseline Data Collection

Ever since the Fish & Wildlife Service developed the RPA calling for a program of steady flows, the Bureau of Reclamation has treated such flows as an incompletely formed, novel, and risky proposal that it could not adopt without years of additional study, planning, and analysis. In its April 1995 letter responding to the RPA, the Bureau stated:

> A specific description of experimental flows needed to remove jeopardy must first be developed based on the conceptual description and goals for these flows as outlined in the Opinion. The specific description must also meet the definition of a reasonable and prudent alternative prior to implementation. Specifically, these flows must be

[184] 2008 Experimental Releases EA, *supra* note 179, at 12.
[185] *See id.* at 13.

> evaluated to insure they can be implemented in a manner consistent with the intended purposes of the proposed action, are within the legal authority and jurisdiction of Reclamation, and are economically and technologically feasible.
>
> The plan to implement these flows will include scientifically based peer reviewed criteria to measure and evaluate the impacts of the flows on endangered fish and other resources. It also must contain provisions and defined protocol to alter the flows or return to previous flows if negative impacts to endangered fish or their habitats occur. We must also identify staff and funding levels necessary to conduct the work and program those funds, as well as evaluate the potential benefits and risks which may result. The decision as to when and how to conduct appropriate endangered fish flows will be based on this and other information. Implementation will be coordinated through the AMP.
>
> A general implementation schedule for this element of the RPA has been prepared and Reclamation is continuing the planning and budgeting necessary to allow experimental fish flows of the type described in the Opinion to be implemented at the earliest possible date. We will continue to coordinate with the Service and other stakeholders as the process moves forward. However, it will be difficult at best to implement the flows within the period of time recommended by the Service and we therefore appreciate the provision for annual evaluation of sufficient progress.[186]

Subsequently, the Bureau commissioned a study by a private consulting firm that concluded that "sufficient baseline data to fully evaluate the steady flow experiment do not currently exist."[187] According to the Bureau, the report identified eleven "significant data gaps" and recommended undertaking at least two years of studies to fill those gaps before initiating any low steady flows.[188] The Bureau stated that it was soliciting proposals from interested parties "to develop a research and implementation plan" for experimental steady flows.[189] Later still, in 2002 (seven years after it stated that it would implement the elements of the RPA), the Bureau reported that it had developed a proposal for a "test of concept" of the steady flows required by the RPA, that it was conducting additional research, that it had formed two committees on the subject, and that it would "strive to have a complete program of experimental flows developed" by later that year.[190]

The problem with the Bureau's insistence on the need for additional planning and study before it can implement the steady flows required by the RPA is that, during the many years it has been conducting this planning and study, the Bureau has been operating Glen Canyon Dam under a prescription, the MLFF alternative, that was itself never subjected to the years of additional planning and study that the Bureau now claims are a prerequisite to steady flows. The MLFF alternative and the Seasonally Adjusted Steady Flows alternative were

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[186] BuRec Response to RPA, *supra* note 136, at 4.

[187] Memorandum from Charles A. Calhoun, Reg'l Dir., Upper Colo. Reg'l Office, U.S. Bureau of Reclamation, U.S. Dep't of the Interior, to Field Supervisor, U.S. Fish & Wildlife Serv., Phoenix, Ariz. 2-3 (Feb. 25, 1999) (on file with author).

[188] *Id.* at 3.

[189] *Id.*

[190] Memorandum from Rick L. Gold, Reg'l Dir., Upper Colo. Reg'l Office, U.S. Bureau of Reclamation, U.S. Dep't of the Interior, to Field Supervisor, U.S. Fish & Wildlife Serv., Phoenix, Ariz. 2-3 (May 8, 2002) (on file with author) [hereinafter 2002 Implementation Status Memo].

presented side-by-side in the Bureau's 1995 EIS, were described with the same level of specificity, and were subject to the same level of environmental analysis. The Bureau promptly adopted the MLFF alternative on completion of the EIS, yet it subsequently claimed that steady flows could not be adopted without years of additional study and planning.

Moreover, current operations under the MLFF regime, which cause the level of the Colorado River in the Grand Canyon to rise and fall by three feet every day in order to enhance the value of power production, are a major departure from the natural condition of the river, and have already been determined by the Fish & Wildlife Service to jeopardize endangered native fish and adversely modify their critical habitat. Steady flows, in contrast, would simply be an exercise in letting the river run, for limited times, in a manner that more closely resembles the natural conditions under which the fish survived and propagated for thousands of years. To treat the MLFF as a safe, default position, while treating steady flows as a radical departure, strains credibility.

The Bureau's position that steady flows are an experiment that should not be implemented without years of preparatory study and planning is also glaringly inconsistent with the Bureau's willingness to adopt, with relatively little study and planning, the severely fluctuating "non-native fish suppression flows" that were implemented in 2003, 2004, and 2005, for three months each time.[191] These flows were a much more radical experiment, in the sense that they involved a much greater artificial manipulation of the river environment, than either the MLFF alternative or the steady flows required by the RPA. They also depended on the previously untested hypothesis that they would benefit, rather than harm, native fish by reducing non-native fish populations. Nonetheless, they were planned and executed in a remarkably short time. After a problem was identified based on scientific data and analyses published in 2001 and 2002,[192] an environmental assessment was published in September 2002,[193] the severely fluctuating flows were initiated in January 2003, and they were carried out for a total of nine months over the next three years.[194] In contrast, except for a single three-month period in 2000, low steady flows have yet to be implemented, even though steady flows were analyzed in an EIS and required by a Biological Opinion that was published over a dozen years ago. It is hard to resist the conclusion that the amount of planning and analysis required by the Bureau before initiating a change in the management of Glen Canyon Dam depends, not on how that change may affect endangered species, but rather on whether that change would increase or decrease the production of peaking power by the dam's generators.[195]

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[191] *See supra* text accompanying notes 174-76.

[192] *See* 2002 FISH SUPPRESSION EA, *supra* note 169.

[193] *Id.*

[194] SCORE REPORT, *supra* note 8, at 8.

[195] Professor Adler notes, and I concur, that the AMP has effectively reversed the burden of proof established by NEPA and the ESA, treating management harmful to endangered fish as the status quo while putting a heavy burden on those who advocate management changes designed to restore some semblance of the natural aquatic environment for the benefit of the fish. *See* Adler, *supra* note 80, at 96. Professor Adler later concludes that our environmental laws lack the flexibility needed to implement restoration adaptively. *See id.* at 102. I would state the latter point somewhat differently. The history of the AMP demonstrates that

B. The Effect of the Adaptive Management Program

The second excuse offered by the Bureau for its failure to implement the low steady flows required by the RPA was the Glen Canyon Dam Adaptive Management Program. In a 2002 memorandum to the Fish & Wildlife Service reporting on the status of the Bureau's implementation of the Service's 1994 Biological Opinion, the Bureau wrote: "The longer than anticipated period for developing this program is attributable largely to its being made a part of the adaptive management process."[196] The Bureau repeated this statement in a similar memorandum in 2004.[197] Examination of the function, structure, and recent voting of the Adaptive Management Work Group suggests that it has indeed been a significant factor contributing to the Bureau's failure to implement the steady flows required by the Fish & Wildlife Service's Biological Opinion in 1994.

1. Function of the AMP

As described above, the heart of the AMP is the Adaptive Management Work Group, a federal advisory committee that, among other things, provides recommendations to the Secretary of the Interior regarding modifications to the operations of Glen Canyon Dam.[198] As will be discussed below, the AMWG has never recommended to the Secretary that the Bureau implement the low steady flows required by the Fish & Wildlife Service's RPA, and an overwhelming majority of the AMWG recently voted against a motion to recommend adoption of Seasonally Adjusted Steady Flows as required by the "hammer" clause of the RPA.[199] Thus, in a very direct sense, the AMWG has been a force against implementation of the RPA.

Of course, as an advisory committee, the AMWG has no legal authority to mandate or veto changes in dam operations, nor can its recommendations excuse a violation of the Endangered Species Act by the Bureau of Reclamation. Nonetheless, the Interior Department has assigned the AMWG a role that far exceeds simply providing advice. It has described the AMWG as the "key" to the AMP, and the AMP is the Bureau's program for deciding on possible changes to future dam operations:

> All of the elements are now in place for an effective, credible adaptive management effort. The AMWG is the key; the TWG [Technical Work Group] providing detailed guidance on issues and objectives; the Science Center to conduct the

environmental laws can be manipulated to freeze in existing management and thereby block restoration. But, as the rapid implementation of the "non-native fish suppression flows" demonstrated, those laws have not prevented quick action when such action benefits entrenched interests, in this case electric power production. Perhaps the best conclusion is simply that, with respect to the Colorado River, environmental laws have not yet upset the balance of power that has favored water supply and hydroelectricity over endangered species protection.

196 2002 Implementation Status Memo, *supra* note 190, at 2.

197 Memorandum from Rick L. Gold, Reg'l Dir., Upper Colo. Reg'l Office, U.S. Bureau of Reclamation, U.S. Dep't of the Interior, to Field Supervisor, U.S. Fish & Wildlife Serv., Phoenix, Ariz. 2 (May 5, 2004) (on file with author).

198 *See supra* text accompanying note 148.

199 *See supra* text accompanying note 133.

> research and monitoring needed to evaluate operations; and the independent review panel, the outside review necessary to provide the credible science.
>
> The AMWG continues public involvement in the decision-making process and incorporates those stakeholders with interest in the operation of Glen Canyon Dam and downstream resources. By blending the best science and management practices, the AMWG makes recommendations to the Secretary on how to protect the resources and meet the requirement of the law.[200]

Given the resources and the credibility that the Interior Department has invested in the AMP, to which the AMWG is the "key," and given its claim that the AMWG "blend[s] the best science and management practices," the Interior Department would be hard-pressed to turn around and ignore its recommendations.

The extent to which the AMP has actually caused, rather than acted as a public excuse for, the Bureau's failure to comply with the Fish & Wildlife Service's RPA cannot be known without reading the minds of the Bureau's decisionmakers (or their superiors in the Interior Department and the White House). But given the Bureau's own statements that its failure to timely implement low steady flows is "attributable largely" to the AMP, it is fair to say that the AMP has at least facilitated (by providing an excuse), if not caused, the Bureau's prolonged non-compliance with the Endangered Species Act.

2. The Structure of the AMP

Given the structure of the AMP, there is no reason to expect any correspondence between the recommendations it generates and the requirements of the Endangered Species Act or any other law. While the law governing Glen Canyon Dam creates a hierarchy of resources and uses, with water supply and storage and endangered species protection given the highest priority and hydroelectric power production and non-native species given lower priorities, the structure of the AMP does not reflect that hierarchy. The AMWG, which oversees the AMP and makes recommendations to the Secretary of the Interior, is designed to reflect the interests of a broad variety of stakeholders, not to achieve compliance with the law. The composition of the AMWG is as follows:

- 7 representatives from the state governments in the Colorado River Basin (one each from Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming)
- 6 representatives from Native American governments (Hopi Tribe, Hualapai Tribe, Navajo Nation, Pueblo of Zuni, San Juan Southern Paiute Tribe, and Kaibab Band of Paiute Indians)
- 5 representatives from federal agencies (Bureau of Indian Affairs, Bureau of Reclamation, Department of Energy, Fish and Wildlife Service, and National Park Service)
- 2 representatives from environmental organizations (Grand Canyon Trust and Grand Canyon Wildlands Council)

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[200] Glen Canyon Dam Adaptive Management Program – Background Reclamation UC Region, http://www.usbr.gov/uc/rm/amp/background.html#background (last visited May 17, 2008).

2 representatives from recreational organizations (Federation of Fly Fishers and Grand Canyon River Guides)
2 representatives from organizations of purchasers of electric power from Glen Canyon Dam (Colorado River Energy Distributors Association and Utah Associated Municipal Power Systems)
1 representative from the Arizona Game and Fish Department.[201]

Thus, of the twenty-five entities represented on the AMWG, only five (the two environmental organizations, the Fish & Wildlife Service, the National Park Service, and the Arizona Game and Fish Department) have institutional missions that can be expected to lead them to place a high priority on protection of endangered species of fish.[202]

The AMWG is supported by a Technical Work Group ("TWG") that provides advice and recommendations to the AMWG on scientific and technical issues, but the TWG, despite its title, is not actually a scientific or technical committee. It comprises one representative from each of the same twenty-five entities that are represented on the AMWG itself. Although these representatives are supposed to be "technical," the TWG is, in essence, another stakeholder committee that simply mirrors the AMWG in composition.

3. Bringing the Issue to a Head: A Recent Vote of the AMWG

A recent vote of the AMWG brought into sharp focus the conflict between the multi-stakeholder composition of the AMWG and the legal priority that is supposed to be given to protection of endangered species. At an AMWG meeting on August 30, 2007, the representative of the Grand Canyon Trust, one of the two environmental representatives on the committee, moved that the committee recommend to the Secretary of the Interior that Glen Canyon Dam be operated under a regime of Seasonally Adjusted Steady Flows, i.e., essentially what is required by the "hammer" clause of the RPA issued by the Fish & Wildlife Service over a dozen years ago. The motion was defeated by a vote of thirteen to four, with four representatives abstaining and three absent.[203] Voting for the motion, besides the Grand Canyon Trust, were the representatives of the Grand Canyon River Guides, the National Park Service, and the Fish & Wildlife Service. Votes against the motion included the representatives of all of the basin states, the Bureau of Reclamation and its power marketer the Western Area Power Administration, electric power companies, the Federation of

[201] *See* Glen Canyon Dam Adaptive Management Program – AMWG Members, Reclamation UC Region, http://www.usbr.gov/uc/rm/amp/amwg/amwg_members.html (last visited May 17, 2008).

[202] I have not included the Federation of Fly Fishers or the Grand Canyon River Guides in this count because the humpback chub is not a sport fish and is generally not viewable by boaters in the Grand Canyon. Moreover, at least one of the entities included in this count, the Arizona Game and Fish Department, has an institutional mission that includes promotion of sport fisheries, including the rainbow trout fishery on the Colorado River whose maintenance may conflict with protection of the chub.

[203] E-mail from Linda Whetton, Mgmt. Analyst, Upper Colo. Region, U.S. Bureau of Reclamation, U.S. Dep't of the Interior to the author (Oct. 9, 2007) (on file with author) (with attached spreadsheet); *see also* Letter from Nikolai Ramsey, Grand Canyon Trust, to Dirk Kempthorne, Sec'y of the Interior (Sept. 18, 2007) (on file with author) (containing a minority report on the defeated motion).

Fly Fishers, and the Pueblo of Zuni.[204] Thus, the voice of the Fish & Wildlife Service, the agency authorized by the Endangered Species Act to determine what changes in dam operations are needed to prevent extinction of the humpback chub, was reduced to one of four dissenting votes against an overwhelming committee majority determined to avoid making those changes.

VI. How Adaptive Management of Glen Canyon Dam Went Wrong

The Adaptive Management Program for Glen Canyon Dam has given adaptive management a bad name by causing, or at least facilitating, extended non-compliance with the Endangered Species Act by the Bureau of Reclamation. It did not have to be that way. There is no inherent inconsistency between the concept of adaptive management and compliance with the Endangered Species Act. Indeed, adaptive management can be a valuable tool for ESA compliance. But the Adaptive Management Program for Glen Canyon Dam went wrong in two critical ways. First, the program conflated the concept of adaptive management with the logically separate concept of *collaborative* management by a variety of stakeholders. While there may be much to say for (and against) collaborative stakeholder management in general, it is not a necessary component of adaptive management, and, in the case of Glen Canyon Dam, the effort to make decisions acceptable to a broad spectrum of stakeholders has undermined the priority that the law places on certain interests above others. Second, the program adopted the wrong starting point for adaptive management. It should have started with the legally-mandated Reasonable and Prudent Alternative developed by the Fish & Wildlife Service, and then modified that alternative if and when it proved ineffective in protecting and enhancing endangered fish and their habitat. Instead, it began with an alternative that the Fish & Wildlife Service had already determined would cause jeopardy to endangered fish and adversely modify their critical habitat.

A. Conflating Adaptive Management with Collaborative Management

Adaptive management has been defined by the Department of the Interior as follows:

> Adaptive management is a systematic approach for improving resource management by learning from management outcomes. . . . An adaptive approach involves exploring alternative ways to meet management objectives, predicting the outcomes of alternatives based on the current state of knowledge, implementing one or more of these alternatives, monitoring to learn about the impacts of management actions, and then using the results to update knowledge and adjust management actions.[205]

Thus defined, adaptive management is perfectly consistent with the requirements of the Endangered Species Act and other federal laws, including the National Environmental Policy Act ("NEPA"). An Environmental Impact Statement prepared pursuant to NEPA is an instrument for exploring alternative

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[204] The other Native American tribal representatives abstained or were absent.

[205] Byron K. Williams et al., Adaptive Management: The U.S. Department of the Interior Technical Guide 1 (2007), *available at* http://www.doi.gov/initiatives/AdaptiveManagement/TechGuide.pdf [hereinafter Technical Guide].

ways to meet management objectives.[206] A Biological Opinion prepared pursuant to section 7 of the ESA,[207] as well as the EIS, is an instrument for "predicting the outcomes of alternatives based on the current state of knowledge." Monitoring the effects of management actions, though not required by NEPA or the ESA, can also certainly contribute to achieving their goals by facilitating corrective action when outcomes differ from predictions. And "using the results to update knowledge and adjust management actions" can be achieved through a supplement to the EIS[208] and re-initiation of section 7 consultation.[209]

Unfortunately, however, the Interior Department's definition of adaptive management also adds another element, which is less consistent with the ESA:

> Adaptive management requires the participation of stakeholders. Stakeholders include people and organizations who use, influence, and have an interest, or "stake," in a given resource. Stakeholders should be involved early in the adaptive management cycle, to help assess the problem and design activities to solve it. Stakeholders also can help to implement and monitor those activities, and participate in the evaluation of results. Involvement of stakeholders from the beginning increases management effectiveness and the likelihood of achieving agreed-upon outcomes.[210]

While collaboration among stakeholders may be an attractive concept from many perspectives, it is not a logical or necessary part of the definition of adaptive management.[211] Monitoring the effects of management actions and incorporating the results of that monitoring into future management decisions can be performed by an agency or by a group of experts; it does not require the collaboration of stakeholders.[212] And while the notion of a partnership

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[206] *See* National Environmental Policy Act of 1969 § 102(2)(C)(iii), 42 U.S.C. § 4332(2)(C)(iii) (2000) (requiring consideration of alternatives).

[207] *See* Endangered Species Act § 7(b), 16 U.S.C. § 1536(b) (2000).

[208] *See* 40 C.F.R. § 1502.9(c) (2006).

[209] *See* 50 C.F.R. § 402.16 (2006).

[210] TECHNICAL GUIDE, *supra* note 205, at 4-5 (citations and emphasis omitted).

[211] Professor Adler also argues that adaptive management and stakeholder collaboration are two distinct concepts, and that the Glen Canyon Dam Adaptive Management Program has improvidently merged the two. "[M]erging those goals [stakeholder collaboration and adaptive management] into a single interactive process serves neither goal well, and fundamentally misconstrues the concept of adaptive management." Adler, *supra* note 80, at 103.

Collaborative management by stakeholders should not be confused with providing opportunities for, and consideration of, public input. This author has argued that public input is essential to informed agency decisionmaking. *See, e.g.*, Joseph M. Feller, *Grazing Management on the Public Lands: Opening the Process to Public Participation*, 26 LAND & WATER L. REV. 571 (1991). Moreover, the Grand Canyon Protection Act requires the Secretary of the Interior to consult with the public, including the parties represented on the AMWG. *See* Grand Canyon Protection Act of 1992 §§ 1804(c)(3), 1805(c), Pub. L. No. 102-575, 106 Stat. 4600, 4671-72. But consultation with various parties and consideration of their input is not the same thing as deference to a majority or consensus of their views. The purpose of seeking public input should be to ensure that agency decisionmakers are fully informed, not to ensure that their decisions are acceptable to all, or a majority of, interested parties.

[212] *See, e.g.*, ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT (C.S. Holling ed., 1978); CARL WALTERS, ADAPTIVE MANAGEMENT OF RENEWABLE RESOURCES (1986). These two works, which are described as "seminal" by the Interior Department's Adaptive Management Technical Guide, TECHNICAL GUIDE, *supra* note 205, at 1, extensively describe and discuss adaptive management processes, but do not include stakeholder collaboration as

between managers and stakeholders may appear benign, it can result, and in the case of Glen Canyon Dam it has resulted, in a shift in management direction from the requirements of the law to the needs and desires of the stakeholders.

The placement of a stakeholder committee at the center of the adaptive management process has directed the process towards satisfying the demands of the stakeholders rather than meeting the requirements of the law. As the quotation above suggests, a committee of stakeholders will work toward outcomes that the stakeholders can agree upon, which may not be the outcomes required by the law. Or as the Bureau has stated, somewhat wishfully, on its website: "The AMWG makes it possible for the Secretary to bring all these varied interests to a consensus on how to protect downstream resources and strike a wise balance on river operations."[213] However, the law does not call for the Secretary to "strike a wise balance." Rather, it contains specific directions that give priority to certain interests, namely, water supply and endangered species protection. The search for consensus on a "wise balance" ignores these legal mandates.

In effect, the Adaptive Management Program has elevated social engineering goals—communication, understanding, cooperation, and consensus among stakeholders—over the recovery of endangered species.[214] A Department of the Interior report on the program touts its achievements in improving "[t]he degree of stakeholder buy-in and cooperation," in creating "successful collaboration between diverse stakeholders," and in giving them "input throughout the process, which improves their trust when decisions are made."[215] The report explains:

> Stakeholders who in the past might have resolved their differences in the legal system, at very large cost, now are working together to achieve a set of common objectives. They also have agreed to be patient and risk-tolerant. . . . The 25 stakeholders in the [AMP] are very engaged in the program. Attendance at and engagement in

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a necessary component of such processes. The former work, at pages 140-297, presents five case studies of adaptive environmental assessment and management, none of which involves a stakeholder committee.

A third work described as "seminal" in the Technical Guide does place heavy emphasis on negotiation among diverse parties. *See* KAI N. LEE, COMPASS AND GYROSCOPE: INTEGRATING SCIENCE AND POLITICS FOR THE ENVIRONMENT 87-114 (1993). But even Professor Lee treats adaptive management (the "compass") and negotiation (the "gyroscope") as separate concepts. He cites commercial fishery regulation by a regulatory authority, not a stakeholder committee, as a hypothetical example of the application of adaptive management. *See id.* at 53. Professor Lee advocates negotiation between stakeholders as a process for policy development. *See id.* at 87-114. But where Congress has set policy through legislation such as the Endangered Species Act, it is unlawful for the Bureau of Reclamation to develop an alternative, contrary policy through a stakeholder process. (Professor Lee's work is openly hostile to the Endangered Species Act, describing it as an example of "tragic choice." *See id.* at 94-96.)

[213] Glen Canyon Dam Adaptive Management Program – Adaptive Managemnent Work-Group Main Page, http://www.usbr.gov/uc/rm/amp/amwg/amwg_index.html (last visited May 17, 2008).

[214] Professor Lee also uses the term "social engineering" to describe his concept of adaptive management. *See* LEE, *supra* note 212, at xii.

[215] U.S. Dep't of the Interior, Glen Canyon Dam Adaptive Management Program, at 5-6, *available at* http://www.doi.gov/initiatives/AdaptiveManagement/documents/glencanyondam.pdf.

> meetings has been and continues to be very good. Stakeholders have achieved a degree of respect for the positions of one another and they share a commitment to using science to achieve a better understanding of the relationship between dam operations and Colorado River resources.[216]

The report concedes, however, that the goals of actually improving habitat for, and recovering the population of, the endangered humpback chub have proven "challenging" and that "[d]uring the course of the [AMP], both recruitment of this fish and population levels of adults have declined."[217] The report concludes that "[t]he net effect [of the Adaptive Management Program] may not be to speed the process so much as to assure that there is greater agreement on the outcome."[218]

From the perspective of the hierarchy of laws governing management of Glen Canyon Dam, a committee of multifarious stakeholders is peculiarly unsuited to make recommendations regarding the management of the dam. These laws provide essentially two mandates, one governing total annual releases of water from the dam and the other effectively governing seasonal and daily variations. A stakeholder committee is not well-suited to achieving compliance with either mandate.

Total annual releases from Glen Canyon Dam are governed by the provisions of the Colorado River Compact, the Boulder Canyon Project Act, and other laws regarding the division of water between the Upper and Lower Basin states. In a process completely separate from the Glen Canyon Dam Adaptive Management Program, the Department of the Interior recently adopted detailed guidelines for annual releases that are designed to ensure compliance with those requirements.[219] These guidelines, which were recommended to the Department of the Interior by the seven basin states, will govern annual releases from the dam, leaving no role for a stakeholder committee.

As for seasonal and daily fluctuations, the task facing the Bureau is to choose, within the constraint imposed by the total annual release requirements, that seasonal and daily flow pattern that has the greatest likelihood of conserving and restoring endangered fish populations, particularly the humpback chub, and their habitat. Making that choice is an extraordinarily difficult problem requiring expertise and judgment in fisheries biology, hydrology, sedimentology, and other disciplines. And a process of experimentation and adaptation may be an excellent process for finding the right choice. But it is hard to see how finding the right choice will be, or has been, aided by a stakeholder committee consisting of twenty-five individuals who were chosen, not because of their expertise in these fields, but because they represent various interest groups, most of whose primary concerns have nothing to do with fish.

Such stakeholder committees may be appropriate tools for implementing legal mandates that call for balancing a variety of interests, such as the "multi-

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[216] *Id.* at 6.
[217] *Id.* at 5.
[218] *Id.* at 6.
[219] U.S. DEP'T OF THE INTERIOR, RECORD OF DECISION—COLORADO RIVER INTERIM GUIDELINES FOR LOWER BASIN SHORTAGES AND THE COORDINATED OPERATIONS FOR LAKE POWELL AND LAKE MEAD 1 (Dec. 13, 2007), *available at* http://www.usbr.gov/lc/region/programs/strategies/RecordofDecision.pdf.

ple use" mandate that governs National Forests and lands managed by the Bureau of Land Management ("BLM").[220] But where the law gives priority to certain interests over others, giving a central role to such a committee obscures that priority and creates an opportunity for lower-priority interests to attempt to gain through the committee what they lost in the legislature.

B. Starting Off on the Wrong Foot

Besides conflating the concepts of adaptive and collaborative management, the Adaptive Management Program for Glen Canyon Dam has facilitated non-compliance with the Endangered Species Act by allowing the Bureau of Reclamation to implement a management alternative that does not comport with the ESA while claiming that it will someday come into compliance through adaptation. That is, instead of starting with the Reasonable and Prudent Alternative developed by the Fish & Wildlife Service and modifying it if it proves ineffective in recovering the humpback chub, the Bureau started with the alternative (MLFF) that the Service found unlawful and answered criticisms with promises to later consider modifying its management through the Adaptive Management Program.[221] The Bureau apparently believes that, because under adaptive management all management decisions are provisional, it can get away with starting with any alternative it chooses as long as it promises to consider modifications in the future through the Adaptive Management Program.

The problem with this approach is that the Adaptive Management Program, despite its purported flexibility, is in fact overwhelmingly biased towards continuance of the management alternative that it starts with. Any recommendation for a change in management of the dam requires a two-thirds vote of the AMWG.[222] If two-thirds of the members of the AMWG cannot agree on, say, the low steady flows in the summer and fall required by the RPA, then management defaults to the MLFF, regardless of whether the AMWG agrees to the MLFF. Moreover, before it even gets to a vote of the AMWG, any proposed change in management can be delayed through years of committee meetings, subcommittee meetings, and environmental analysis. But the MLFF gets a free pass because it is treated now as the "no action" alternative, requiring no committee meetings, no study, and no approval by the AMWG.[223]

The combination of the cumbersome nature of the Adaptive Management Program and the requirement of a two-thirds vote of the AMWG to recommend any change in dam operations has not only facilitated non-compliance with the

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[220] *See* 43 U.S.C. § 1702(c) (2000) (defining "multiple use" for the BLM as, among other things, "the management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people" and "a combination of balanced and diverse resource uses"); 16 U.S.C. § 531(a) (2000) (similar definition for National Forests).

[221] *See, e.g.*, 1996 RECORD OF DECISION, *supra* note 145, at 3-4, 8-9.

[222] Operating Procedures of the Glen Canyon Dam Adaptive Management Work Group, Jan. 17, 2002, at 3, *available at* http://www.usbr.gov/uc/rm/amp/amwg/pdfs/OP_02apr24.pdf.

[223] *See, e.g.*, 2008 EXPERIMENTAL RELEASES EA, *supra* note 179, at 8 (treating MLFF as the "no action" alternative).

Endangered Species Act, it has also been antithetical to the concept of adaptive management, which is supposed to be based on experimentation and adaptation. Instead of encouraging adaptation, the Adaptive Management Program has entrenched existing management of the dam and served as an excuse for the Bureau of Reclamation's failure to change that management. Given the effective rigging of the process in favor of continuance of the MLFF, it is no wonder that it remains the dominant management regime fourteen years after it was found unlawful by the Fish & Wildlife Service.

VII. A Proposal for Lawful, Adaptive, Non-Collaborative Management of Glen Canyon Dam

Management of Glen Canyon Dam can be harmonized with the Endangered Species Act and other applicable laws, as well as with principles of adaptive management, by correcting the two fundamental flaws identified in the previous part of this Article. Specifically:

(1) As soon as practicable, the Bureau of Reclamation should begin operating the dam under a regime of Seasonally Adjusted Steady Flows during the months of April through October of each year, as prescribed in the Reasonable and Prudent Alternative presented in the Fish & Wildlife Service's 1994 Biological Opinion. This prescription is also the same as that proposed in the failed motion that was supported by the Grand Canyon Trust, the U.S. Fish & Wildlife Service, the National Park Service, and Grand Canyon River Guides at the August 2007 AMWG meeting. This flow regime would be the starting point for future adaptive management of Glen Canyon Dam. If this flow regime fails to improve spawning and recruitment of humpback chub, departures from this regime could be implemented through the Adaptive Management Program.

(2) The AMWG and the TWG should be abolished. Funds currently devoted to the AMWG and the TWG should be used to create a special unit within the U.S. Fish & Wildlife Service dedicated to adaptive management of Glen Canyon Dam. This unit would comprise fisheries biologists, hydrologists, sedimentologists, and other specialists in disciplines relevant to the conservation of the humpback chub and other endangered species and their habitats in the Grand Canyon. This special unit would be responsible for annually reviewing and revising the Reasonable and Prudent Alternative in the 1994 Biological Opinion to incorporate, and adapt to, the latest information on the effects of dam operations on endangered species and their habitat. The annually revised RPA, which could include experimental departures from the SASF regime, would take the place of the AMWG's recommendations on modifications of dam operations.

In order to comply with the Colorado River Compact, the Boulder Canyon Project Act, and other laws governing use and storage of Colorado River water, the special unit of the Fish & Wildlife Service should be instructed that its recommendations for dam operations must be constrained by the total annual release volumes prescribed by the Interior Department's Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations for Lake Powell and Lake Mead, or such other guidelines for annual releases

that may be developed by the Department in the future. Within that constraint, the special unit would make recommendations for monthly and daily flow patterns.

(3) In order to comply with the Grand Canyon Protection Act's consultation requirements, all of the entities currently represented on the AMWG, as well as the public, should be provided with reasonable notice of, and opportunity to comment on, drafts of the special unit's recommendations on dam operations before those recommendations are finalized and presented to the Secretary.

(4) The roles of the Grand Canyon Monitoring and Research Center[224] and the Independent Review Panel[225] should continue essentially unchanged, except that the Center and the Panel would support, and make recommendations to, the special unit of the Fish & Wildlife Service rather than the AMWG.

CONCLUSION

The concept of collaboration and consensus among stakeholders is an attractive one, and it is perhaps not surprising that it has caught on in a big way among natural resource agencies. But we must not forget that ours is a government of laws, and that citizens have a right to expect that agencies will respect those laws, even when they require outcomes that displease large and powerful elements of the agencies' constituencies.

The Adaptive Management Program for Glen Canyon Dam, as currently constituted, gives too central a role to a committee of stakeholders and places too little emphasis on adherence to the priorities created by the laws governing operation of the dam. The program's emphasis on seeking collaboration and consensus among stakeholders is neither supported by existing law nor necessitated by the concept of adaptive management. Adaptive management is consistent with the laws governing dam operations, but the goal of such adaptive management should be dictated by the requirements of those laws, not by the needs and desires of various stakeholders.

Under existing law, the top priorities in dam operations are meeting the water supply mandates of the Colorado River Compact and associated laws, and conservation of endangered species. These two priorities are compatible, but neither priority requires, or is well-served by, the stakeholder committee at the heart of the existing Adaptive Management Program. The former priority is addressed by the annual water release guidelines that have been developed outside the Adaptive Management Program. Within the constraints of those guidelines, seasonal and daily flow patterns should be determined by an adaptive management program structured for the specific purpose of protecting endangered species rather than seeking collaboration and consensus among stakeholders.

This Article's insistence on legal compliance may be viewed by some as an archaic and inflexible reaction against a new, innovative, and promising paradigm of public resource management. To this view, I offer two brief

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[224] *See* GLEN CANYON DAM EIS, *supra* note 104, at 36-37; Grand Canyon Monitoring and Research Center, http://www.gcmrc.gov/ (last visited May 17, 2008).

[225] *See* GLEN CANYON DAM EIS, *supra* note 104, at 37-38.

responses. First, the democratic values that purportedly motivate proposals for stakeholder management also demand respect for the laws passed by the Congress that was elected by the public. In the broadest sense, all of the American people are stakeholders in the Grand Canyon and in the fish, wildlife, and other natural resources therein. These stakeholders have chosen Congress to represent them, and disobedience to the mandates of Congress disempowers them.

Second, in practice, the stakeholder-driven Adaptive Management Program for Glen Canyon Dam has not been innovative at all. Because it has, in effect, made a two-thirds vote of a large stakeholder committee a prerequisite to changes in dam operations, it has served to entrench existing dam management and prevent the kind of adaptation and experimentation that is supposed to be the hallmark of adaptive management. Ironically, strict adherence to the requirements of the Endangered Species Act would likely result in management that is more adaptive than current management, which is "adaptive" in name only.

EPILOGUE

On February 27, 2008, as this Article was nearing completion, the U.S. Fish & Wildlife Service issued a Biological Opinion on the Bureau of Reclamation's proposed five-year (2008–2012) plan for flows from Glen Canyon Dam.[226] This new Biological Opinion concludes that the proposed plan, which would continue implementation of the MLFF alternative except for a single high-flow event in 2008 and steady flows in September and October each year, would not jeopardize the continued existence of the humpback chub or adversely modify its critical habitat.[227] This new Biological Opinion also states that it replaces the 1994 Biological Opinion that concluded that the MLFF alternative would jeopardize the chub and adversely modify its critical habitat.[228] In effect, therefore, this new Biological Opinion purports to release the Bureau from its obligation to implement the more extensive steady flows required by the previous opinion.

The primary reason stated in the new opinion for the Service's change of position is that the population of humpback chub in the Grand Canyon, which had been declining, has stabilized and increased in the last few years. The current estimated population of about 6000 adult fish, while less than the population in 1994 when the previous Biological Opinion was issued, is an increase over the 3000–5000 adult fish estimated to have been present at the low point in 2002. The Service concluded that this recent upturn in the adult chub popu-

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[226] Memorandum from Field Supervisor, U.S. Fish & Wildlife Serv., U.S. Dep't of the Interior, Phoenix, Ariz., to Deputy Reg'l Dir., U.S. Bureau of Reclamation, Upper Colo. Region, Salt Lake City, Utah, (Feb. 27, 2008), *available at* http://www.usbr.gov/uc/envdocs/bo/FinalGCDBO2-26-08.pdf [hereinafter Final BO Memorandum]. For a discussion of the five-year plan, see *supra* Part IV.I.

[227] Final BO Memorandum, *supra* note 226, at 51.

[228] *Id.* at 2.

lation is a delayed result of increased recruitment of young fish that must have occurred in the late 1990s.[229]

While the reasons for the increased recruitment in the late 1990s are unknown, the Service also concluded that more recent developments—increased water temperature resulting from drought-induced lowering of the level of Lake Powell, efforts to remove non-native rainbow trout, and the low steady flow experiment conducted in 2000—ought to have improved the prospects for spawning and recruitment. Thus, the Service reasoned, if the population has increased in the last few years as a delayed result of increased recruitment in the late 1990s under the MLFF regime, it can be expected to increase even more in the next few years as a delayed result of the more favorable conditions that existed under the MLFF regime in the first few years of the current decade. Therefore, according to the new Biological Opinion, continuance of the MLFF regime for another five years, with the addition of steady flows in September and October, should not threaten the continued existence of the chub.[230]

Because it replaces the 1994 Biological Opinion and its RPA, the new Biological Opinion may render moot much of this Article's legal argument that the Bureau has been violating the Endangered Species Act by failing to follow that RPA. But the new Opinion has not resolved the controversy over the dam's effects on the endangered humpback chub. The Grand Canyon Trust has amended its pending lawsuit to add the Fish & Wildlife Service as a defendant and to allege, among other things, that the Bureau's new five-year plan and the new Opinion approving it are arbitrary, capricious, and contrary to the Endangered Species Act and the Grand Canyon Protection Act.[231] The Superintendent of Grand Canyon National Park has also implicitly denounced the Bureau's plan by calling on the Bureau to reform dam operations to include high flow events every year or two and steady flows during the summer (as opposed to the plan's single high flow event and fall-only steady flows) for the benefit of the humpback chub.[232] Finally, the new Opinion does not change the central thesis of this Article, namely, that the Bureau's Adaptive Management Program for Glen Canyon Dam has substituted the needs and desires of a group of stakeholders for the hierarchy of laws that should govern operation of the dam and that, for many years, the program facilitated non-compliance with the Endangered Species Act.

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[229] *Id.* at 51-52.

[230] *Id.*

[231] Supplemental Complaint for Declaratory and Injunctive Relief, Grand Canyon Trust v. U.S. Bureau of Reclamation, No. 07-cv-08164-DGC, at 23-24 (D. Ariz. Apr. 2, 2008).

[232] April Reese, *Colorado River: High Flows Should Run Regularly to Restore Grand Canyon Resources, Park Chief Says*, LAND LETTER, Apr. 10, 2008, *available at* http://www.eenews.net/Landletter/2008/04/10/4 (subscription required).