Fisheries Management Plan
Colorado River-Lees Ferry
2015-2025

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Location

The 15.5-mile stretch of Colorado River through Glen Canyon (within Glen Canyon National Recreation Area) between the Glen Canyon Dam and the beginning of Marble Canyon (within Grand Canyon National Park) is commonly referred to as Lees Ferry (Figure 1).

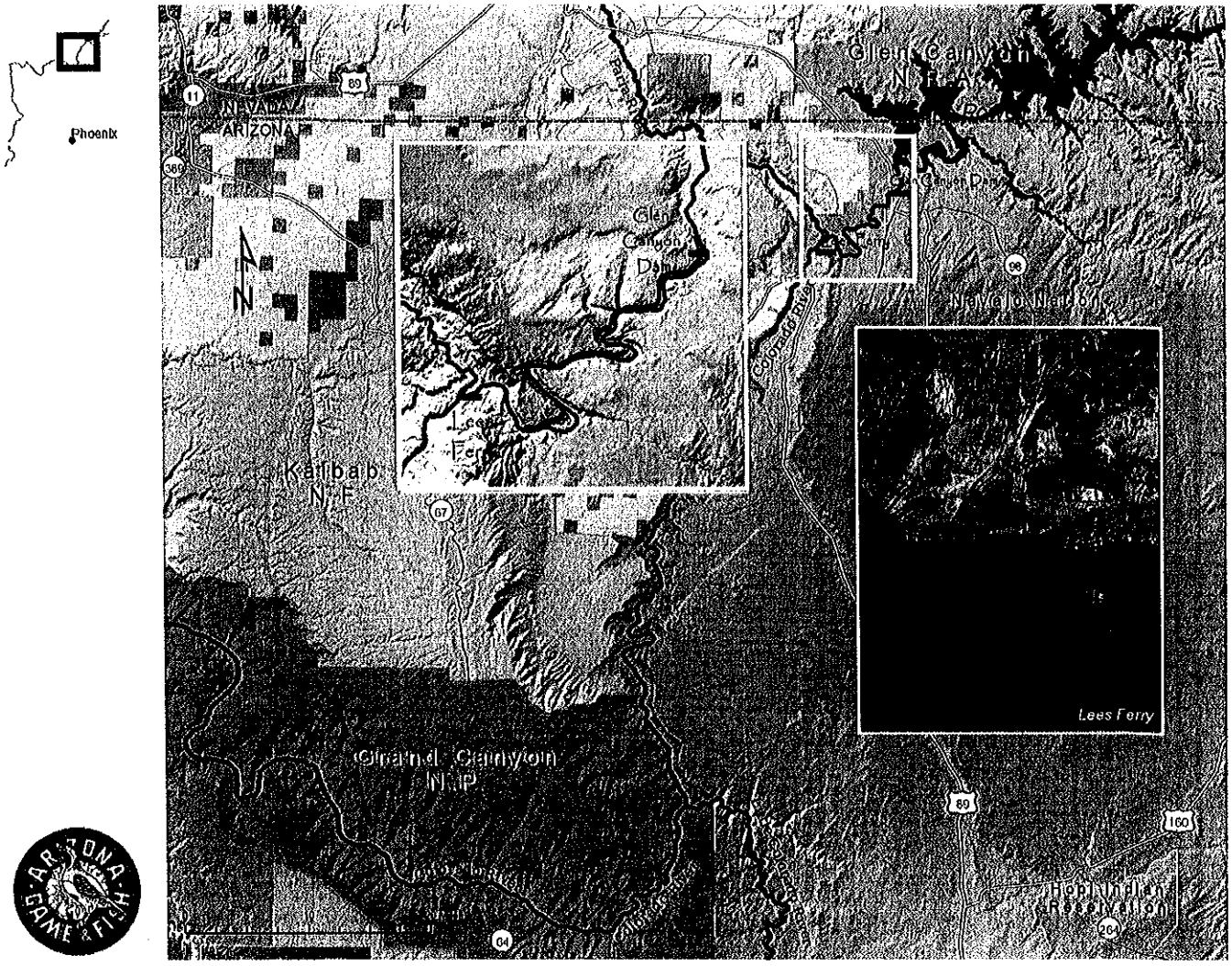

Figure 1. Location Map for Colorado River-Lees Ferry

Management Prescription

Rainbow Trout:
The Arizona Game and Fish Department will maintain and enhance a Blue Ribbon Rainbow Trout fishery at Lees Ferry that does not adversely affect the native aquatic community in Grand Canyon National Park with four main objectives.

Objective 1: Maintain a healthy population of Rainbow Trout at Lees Ferry to support recreational fishing.

Objective 2: Provide a quality trout fishing experience with catch frequency commensurate with the Blue Ribbon status of the fishery.

Objective 3: Grow quality sized trout that are available to the angler, consistent with the Blue Ribbon status of the fishery.

Objective 4: Avoid catastrophic failure of the trout population, and establish protocols for emergency recovery from population loss.

Management strategies to meet objectives are identified in Table 1.

Table 1. Lees Ferry Objectives and Adaptive Management Strategies:

Parameters	Objective Guideline	Strategies if Objectives are not met
OBJECTIVE - Maintain a healthy population of Rainbow Trout at Lees Ferry to support recreational fishing.		
Recruitment	Rainbow Trout ≤ 6 inches compose 20% - 50% of the Lees Ferry population as determined by fall electrofishing	• Stocking • Trout Management Flows • HFEs
Abundance	Rainbow Trout electrofishing CPUE exceeds 1 fish per minute (all sizes of trout)	• Stocking • HFEs • Change in regulations
OBJECTIVE – Provide a quality trout fishing experience with catch frequency commensurate with the Blue Ribbon status of the fishery.		
Angler Catch Rate	Angler catch rate ≥ 1 Rainbow Trout per hour	• Stocking • HFEs • Change in regulations
OBJECTIVE – Grow quality sized trout that are available to the angler, consistent with the Blue Ribbon status of the fishery.		

Parameters	Objective Guideline	Strategies if Objectives are not met
Angler Catch Quality	10 Rainbow Trout ≥ 14 inches caught by the angler in a 10-hour day, at least one ≥ 20 inches Maintain trout condition factor ≥ 1 during the summer months.	• Food base enhancement • Trout Management Flows • Change in regulations
OBJECTIVE – Avoid catastrophic failure of the trout population, and establish protocols for emergency recovery from population loss.		
Water Quality	Dissolved Oxygen ≥ 5 mg/l as measured at outflow from GCD.	• Flow manipulation • Temperature Control Device • Use of river outlet tubes
Catastrophic Failure of Population	If failure of multiple age classes is documented by electrofishing and <0.25 trout per hour is documented in creel surveys, mitigation will be necessary.	• Stocking • Translocation of wild trout from the Colorado River downstream of Lees Ferry

Other Trout Species:
Other trout species are not desirable in this reach and will not be purposefully managed there. Brown Trout are known predators of native fish and will be removed during regular fisheries monitoring. Anglers will be encouraged to remove Brown Trout when they are caught.

Non-Native Warm water Species:
Species such as Striped Bass, Largemouth Bass, Smallmouth Bass, Channel Catfish, Black Crappie, Sunfishes, Common Carp, Black and Yellow Bullhead and Walleye are not desirable in this reach and will be removed when encountered during monitoring. If necessary, specific targeted removal of these species may be warranted.

Native Fish Species:
Actions regarding these species will be consistent in the fulfillment of the Department commitments to recovery and conservation plans and programs and with the Department's best management practices.

Background

Since 1964, with the completion of the Glen Canyon Dam, this tailwater has hosted a recreational Rainbow Trout fishery that has grown in importance and reputation locally, regionally, nationally, and internationally. Anglers from around the world travel to Lees Ferry to fish for high quality Rainbow Trout in this large, clear, swift-flowing river. This Blue Ribbon recreational sport fishery has also become a financial and economic mainstay for the small community of Marble Canyon, the City of Page to the north, and Coconino County. A 2013 statewide angler survey estimated the contribution of the Lees Ferry fishery to the State's economy in excess of $16.8 million, helping to support 251 jobs in Arizona (Fedler 2014). Anglers support local businesses such as hotels, restaurants and other service providers, in

addition to utilizing fishing and outdoor recreation equipment suppliers and guides.

Because of the reliable flows of cold water ranging from 44 to 60 degrees F, the Lees Ferry reach of the Colorado River has a proven capacity to support a remarkable trout fishery in the desert. The fishery itself has changed since it was first created following the completion of the Glen Canyon Dam in 1964. During its infancy, the fishery produced large Rainbow Trout ranging from 10 to 20 pounds. Since then, the fishery has gone through upswings and declines, but throughout its history has provided some of the most sought-after destination Rainbow Trout fishing opportunities in the Southwest.

Land, water, and wildlife resources in the Colorado River Corridor in Glen Canyon, including the Lees Ferry sport fishery, are managed by multiple authorities. The Arizona Game and Fish Department (Department) is the primary management agency for fish and wildlife in the state of Arizona. The U. S. Bureau of Reclamation manages water and dam operations, in concert with Western Area Power Administration, for hydroelectric generation. The National Park Service manages the lands and compatible uses in Glen Canyon National Recreation Area and Grand Canyon National Park. The U.S. Fish and Wildlife Service along with the Department, manages threatened and endangered species, including the endangered Humpback Chub. The U.S. Fish and Wildlife Service (USFWS) along with the Department have a joint responsibility to advise U. S. Bureau of Reclamation (USBR) on the effects of water projects on endangered species. The Adaptive Management Working Group is a Federal Advisory Committee formed as a result of the 1996 Environmental Impact Statement. It advises the Secretary of the Department of Interior on matters related to the operations of Glen Canyon. The Department maintains a position on this advisory group along with USBR, Western Area Power Administration (WAPA) and USFWS, Department of Interior and others.

The Departments intends that this Lees Ferry Fishery Management Plan becomes a living document that is used to guide future Colorado River planning processes and decisions related to management of the Lees Ferry trout fishery. It is important that this plan will also be used to provide input on the biological issues needed to maintain a Blue Ribbon Rainbow Trout fishery relating to operations of Glen Canyon Dam. Though the Department has management authorities over aquatic wildlife in the Lees Ferry area, other key components to successful management of aquatic wildlife are not under the Departments authorities. Therefore it is critical the Department work closely with its Federal Partners as well as local businesses, anglers and stakeholders. This document will be amended with new science and information as they become available. The Department's fisheries management plan is intended to complement and augment the National Park Service's (NPS) 2014 Cooperative Fisheries Management Plan for the Colorado River below Glen Canyon Dam. The Department cooperated with NPS during the crafting of that plan, but it focuses primarily on fishes in Grand Canyon. The Cooperative Fisheries Management Plan (CFMP) is lacking in detail with regards to how to achieve the management goals that it describes for the Lees Ferry trout fishery.

Productivity/Water Quality

The availability of oxygen in the water released from Glenn Canyon Dam is directly influenced by the oxygen profile of Lake Powell. That profile is affected by complex processes, including

cold runoff input events rich in organic materials that occur far upstream of the dam, which can create mid-depth drops in oxygen levels. Poorly oxygenated water, if discharged through the dam, can severely stress fish in the tailwater, resulting in reduced growth and even mass mortality.

Fish kills in the Lees Ferry reach due to low dissolved oxygen (DO) levels were documented in 2005. In 2014, DO levels dangerously approached the lethal limit for a large scale trout die off. The combined effect of low dissolved oxygen, high water temperatures, and low food production did result in a substantial die off in 2014 and continues to pose a direct and immediate hazard to Rainbow Trout and other fish species in Lees Ferry. The Department will again, work closely with USBR and Grand Canyon Monitoring and Research Center to ensure DO levels in Lake Powell and in the Colorado River are closely monitored. The Department will also work with partners to ensure alerts are provided when DO levels are expected to approach dangerous levels below Glen Canyon Dam.

Water temperatures are a primary driver for the well-being and health of native and non-native fish communities in Glen, Marble and Grand Canyons, yet currently there is no capability to affect release temperatures from Glen Canyon Dam. The recently completed USBR Water Supply and Demand Study for the Colorado River Basin suggests that Lake Powell elevations will likely decrease in the future as a result of increased water demands, drought, and climate change. Lower Lake Powell elevations will lead to releases of warmer water from Glen Canyon Dam, which could lead to invasions of highly picivorous cool and warm water fishes and other invasive species (e.g., crayfish) into the Glen, Marble and Grand Canyons. There is clear evidence from the Upper Colorado River basin that such an invasion would have a devastating impact on Humpback Chub and other native fishes in the Colorado River below Glen Canyon Dam (Tyus and Saunders 2000). Warm water temperatures will also impact Rainbow Trout energetics and survival. Warm water temperatures along with a suppressed food base have been implicated in two fish kills at Lees Ferry over the past decade.

The Department will continue to engage with USBR in an effort to move forward with implementing a Temperature Control Device that has the capacity to release both cold and warm water from the dam as recommended by the Glen Canyon Dam Adaptive Management Program Science Advisors (Gunderson et al. 2003) and reaffirmed in a 2008 expert panel review (GCMRC 2008). In the interim, the Department supports the use of the river outlet tubes, which are located 96 feet below the penstocks in scenarios where low DO levels pose health risks to downriver fish resources. Opening river outlet tubes could provide cooler water and help prevent invasion of warm water nonnatives, and provide further protection to the Rainbow Trout at Lees Ferry and to Humpback Chub populations in the Grand Canyon.

It is well established that Rainbow Trout significantly reduce feeding activity when water clarity is low. Runge et al (2011) identified the strategy of a "turbidity curtain" (providing inputs of fine sediment below the Paria River) as the highest priority mitigation option for controlling Rainbow Trout in Marble Canyon. Introducing turbidity into the Colorado River below the Paria River would minimize the need for mechanical removal near the Little Colorado River. In order to focus Rainbow Trout in the Lees Ferry area, the Department will work with partners on the Adaptive Management Working Group (AMWG) and others on investigating ways to possibility

reduce water clarity below the Paria River by artificially suspending sediment in that drainage and increasing turbidity in the main stem.

Forage/Prey

The current aquatic food base in the tailwater is insufficient to sustain a quality trout fishery (Kennedy et al, 2014). Recent studies by Kennedy and collaborators have shown that the productivity of this food base is low. Further, the food base in Grand Canyon is dominated by only two groups of invertebrates: midges and blackflies, both of which are small-bodied, relatively low-quality prey. Larger, more nutritious aquatic insects such as mayflies, stoneflies, and caddisflies, are virtually absent throughout Glen, Marble, and Grand Canyons. These conditions of low invertebrate productivity and the absence of high quality invertebrate prey have resulted in a fishery throughout Glen, Marble, and Grand Canyons that is food-limited; negatively affecting the abundance of native fishes such as Humpback Chub (*Gila cypha*), as well as the growth of Rainbow Trout (*Oncorhynchus mykiss*). The abundance and size composition of the available food items for trout, when viewed in the context of anatomical realities of how trout collect their food, limits their ability to grow to preferred sizes (Mike Dodrill, USGS 2015, annual reporting meeting). The availability of energy-rich food items in the right size assortments influences the ability of trout to grow both in length and in girth (condition). The Lees Ferry aquatic food base is relatively immobile and subject to effects of dewatering due to flow changes and scouring due to velocity changes.

Changes in the wetted perimeter of the river channel due to daily, monthly or seasonal changes in water delivery may influence the availability and abundance of mayflies, stoneflies and caddisflies (also known as Ephemeroptera, Plecoptera, Tricoptera or EPT). The EPT Index is a simple measure of stream quality based upon the abundance of three orders of benthic aquatic insects, premised on the understanding that the highest quality streams support the highest diversity of species in these three orders (Lenat and Penrose, 1996). This relationship holds particularly well when evaluating the aquatic food base for primarily insectivorous fishes like trout and Humpback Chub. High abundance and diversity of these aquatic insects are reflective of a productive and resilient aquatic ecosystem. The EPT index for the Lees Ferry reach is currently zero, which we believe limits growth and survival of trout to quality sizes. The absence of quality food items impacts the growth and survival of other fishes downstream of Lees Ferry, such as Humpback Chub, that are largely dependent upon aquatic insects as forage.

Patterns of release from Glen Canyon Dam may have detrimental consequences on trout growth and the abundance of quality trout in the population (USGS and BOR 2014). The processes that affect trout are complex and include the influence of water temperature and quality on the physiological capacity of trout to grow; the abundance and diversity of food items needed to provide the sustenance necessary for their growth; and the numbers of trout present in the tailwater potentially leading to increased levels of competition for a limited food supply. The Department will support experimental testing of "bug flows" as a means to enhance recruitment and survival of a healthy and robust EPT population.

Experimental "bug flows" involve stable flows every weekend (during periods of lower power demand) from May through August. The discharge on weekends would be the minimum

discharge for that month to ensure that the insect eggs laid during weekends would not be subjected to drying due to lower water levels at any point prior to larval development. No change in monthly volumes, ramping rates, or the daily range in discharge during weekdays would be required as part of this experiment. To offset the smaller water releases that would occur during weekends within a given month, larger releases would need to occur during the weekdays within a given month.

A rich assemblage of EPT and other aquatic food base species are present in the waters above the dam and river tributaries below the dam and were present before the dam was constructed (USGS and BOR 2014). Consistent with NPS policy that the recovery and restoration of extirpated species is a desired goal, the Department will also work with the NPS towards the translocation of historic EPT species from other parts of the Colorado River drainage into the Lees Ferry reach coincidentally with the experimental flows discussed above to restore a rich diverse food base. A series of experimental translocations to repatriate these species should be initiated, followed by monitoring and evaluation of success and sustainability.

To maintain a Blue Ribbon fishery into the future, Lees Ferry must be managed such that the food base includes a diversity of aquatic insects with greater than 10% of the abundance comprised of mayflies, stoneflies and caddis flies.

Invasive Species

Whirling disease, New Zealand Mudsnails, Quagga Muscles, and Dydimo have all been detected at Lees Ferry over the past decade. The Department will work with partners to maintain and enhance surveillance for other aquatic invasive species, including non-native fish that may harm the fishery. The existing monitoring programs have the ability to detect invasive species, but need to be expanded and coordinated to improve early detection and report findings rapidly and consistently. The Department also plans to coordinate efforts with Glen Canyon National Recreation Area to better inform the angling and boating public of aquatic invasive species and to allow the decontamination of boats and equipment on site at Lees Ferry.

Habitat

In-stream habitat availability and suitability is largely regulated by dam operations. Riparian vegetation also influences habitat suitability and food base for many species. Rainbow Trout recruitment, survival, growth, density, and spawning are driven by flows regulated by Glen Canyon Dam. Below are strategies for best management of fish habitat within the Lees Ferry sport fishery reach of Glen Canyon. The Department will work with partners towards implementation of one or all of these strategies given limited resources and labor.

Riparian Vegetation Restoration

The Department will continue to emphasize that restoration of riparian vegetation in the Lees Ferry reach should be a high priority of the NPS. In addition, the feasibility of using dead tamarisk as fish habitat to improve aquatic productivity in the Lees Ferry reach should be investigated. Riparian vegetation plays an important role in supporting terrestrial insect

abundance (important food source), and providing overhanging shade and cover for fish.

Overall Dam Operations

In general, the Department supports a continuation of the current Modified Low Fluctuating Flow regime. The Modified Low Fluctuating Flow (MLFF) regime provides relatively low daily fluctuations that are adjusted monthly based on water availability, electrical energy demands and water delivery requirements to Lake Mead. This flow regime reduces stranding of young Rainbow Trout, allows anglers more consistent, predicable access to upriver sections and may provide a more stable environment for invertebrates. However, some modification of the MLFF regime is needed to determine whether a more steady flow regime will promote the establishment of a more diverse and stable aquatic food base.

Minimum Flows

Water release levels lower than 8,000 cfs in combination with daily fluctuations result in reduced nearshore habitats which are important for survival of young of year fish and aquatic invertebrates. Low flows also create navigation problems and safety concerns for boaters and fishermen. The Department will continue coordination for ongoing studies to establish a more science based minimum flow.

Fall and Spring High Flow Experiments

High Flow Experiments (HFEs) are controlled water releases from Glen Canyon Dam that are designed to mimic natural pre-dam seasonal flooding. The primary objective of these releases is to rebuild sand bars that provide habitat for native plants and animals, supply camping beaches, and provide a source of fine sediments that protect archaeological sites from weathering and erosion. The 2008 spring high flow enhanced recruitment and survival of young Rainbow Trout, and enhanced the aquatic food base (Korman et al. 2011; Kennedy and Ralston 2011). As a result, because of concerns about Rainbow Trout impacts on the endangered Humpback Chub, recent HFEs have been restricted to the fall to help limit Rainbow Trout recruitment and survival.

Spring HFEs are needed however, to further evaluate the food base and trout response that was observed in 2008. Spring HFEs may be a management option for use when there has been a significant decline in the trout population and/or drop in food production. HFEs held in spring should also provide other resource benefits such as helping to control nonnative mudsnails and build camping beaches in Marble Canyon and the Grand Canyon immediately before the peak rafting season. Spring HFEs will also provide a source of fine sediment just prior to the windy season in the Grand Canyon and will help protect archeological sites from weathering and erosion. Finally, spring floods, which historically occurred on a regular basis in the Grand Canyon, will help re-establish natural ecological processes in the Colorado River below Glen Canyon Dam

The Department will work to identify and set triggers for spring high flows that are based on trout recruitment, adult trout population and aquatic food production, in addition to down river sediment conservation needs. A spring HFE could be used in lieu of or in conjunction with trout

stocking when the trout fishery has experienced a significant decline.

Experimental Trout Management Flows

Rainbow Trout at Lees Ferry have shown the capability to reproduce prolifically under favorable conditions. Historically, when there is an over-abundance of young-of-year Rainbow Trout, the quality and condition of Rainbow Trout decline. This is likely due to the low quality and low abundance of food sources in Lees Ferry. Trout Management Flows are flow treatments that are hypothesized to reduce the abundance of young-of-year trout by stranding trout shortly after they emerge from their redds (J. Korman, Ecometric Research, Inc., personal communications, 2015). The best long-term and ecologically appropriate solution to managing trout densities is to increase invertebrate diversity and manage Glenn Canyon Dam flows to avoid excessive trout spawning and recruitment. The Department will continue to caution water managers on collateral damage that Trout Management Flows (TMFs) could have on other resources especially the aquatic food base and young native fish that could become stranded. TMFs may be especially useful when spring HFEs are implemented or in years when high equalization flows are required.

TMFs should only be implemented in a carefully designed experimental framework that includes quantified criteria for success (for managing trout recruitment and improving the Humpback Chub population). The impacts of TMFs to other resources, especially the aquatic food base, should be fully assessed. Mitigation measures such as emergency stocking of trout need to be in place prior to the implementation of TMFs in case of catastrophic loss to the fishery. TMFs should only be used when the Rainbow Trout population is stable and includes a healthy abundance of all size classes of Rainbow Trout.

Experimental TMFs that are implemented without regard to the status of the trout and the Humpback Chub fisheries are unsupportable and unnecessarily jeopardize the trout fishery. The experimental evaluation of TMFs needs to recognize the trout fishery as a highly valued asset. Finally, the Department will work to ensure it has a seat at the table along with Federal agencies on any discussion and decisions related to implementation of TMFs.

Equalization Flows

The impact of sustained periods of high flows that are designed to equalize water storage in Lake Powell and Lake Mead can result in undesirably high trout recruitment in the Lees Ferry reach. For example, the high equalization flows in 2011 are correlated with the recruitment of a large age class of Rainbow Trout. Large age classes such as these may not be sustainable under normal release volumes given the current forage base and available habitat. The Department will work with partners to revisit the current equalization guidelines to provide greater flexibility in meeting annual delivery requirements from Lake Powell to Lake Mead. For example, greater flexibility in making water deliveries outside of the water year would increase the flexibility to manage Glen Canyon Dam releases consistent with the desired future conditions for sand conservation and the Lees Ferry Rainbow Trout fishery.

Access

Access to Lees Ferry is limited by canyon walls throughout much of the fishery. Pedestrian fishing is primarily feasible at the "Walk in Area" that extends from approximately one mile upstream from the Lees Ferry boat launch to the confluence of the Colorado and Paria Rivers. The uppermost 15.5 miles of the fishery is accessed primarily by boats that are launched from Lees Ferry.

Species

Lees Ferry continues to provide the best opportunity for the Department to provide a high quality, Blue Ribbon Rainbow Trout fishery for anglers. Very few places exist in Arizona or the Southwest that provide the type of quality trout fishing anglers enjoy at Lees Ferry. However, as discussed above, this fishery is highly dependent upon water from upstream and how/when it is released from Glen Canyon Dam.

The Lees Ferry sport fishery will be managed as a Blue Ribbon Rainbow Trout fishery. Department goals and objectives are based on the best available scientific information gathered through the Glen Canyon Dam Adaptive Management Program (GCDAMP), the Desired Future Conditions that were adopted by the AMWG and the Secretary of the Interior, the CFMP, and the mandate of the Grand Canyon Protection Act to operate Glen Canyon Dam to improve the values for which Glen Canyon National Recreation Area was established. A prescription of how the Department will manage fish species in the Lees Ferry reach is outlined on pages 3-4. Additional guidelines and strategies are included below.

Regulations

Historically, harvest regulations were the only tools available for managing the Lees Ferry trout population. The Department, with the Arizona Game and Fish Commission's approval, can adjust harvest regulations to respond to abundance or quality parameters of the population of trout at Lees Ferry. Consideration will be given to encouraging the public to harvest trout especially when the Rainbow Trout population isn't meeting the objectives of the fishery. The Department will implement public education and outreach campaigns as necessary to encourage anglers to embrace new harvest regulations and trout population management goals.

Marble Canyon Trout Fishery

Rainbow Trout numbers in Marble Canyon (just downstream of Lees Ferry) can at times approach or even exceed those in the Lees Ferry reach. The CFMP provides for using angling to remove nonnative cold water fish in Marble Canyon as a means of reducing competition between Rainbow Trout and native warm water fish. The Marble Canyon trout population also provides an opportunity to use a presently underutilized recreational fishing resource to grow local businesses and employment. The Department in conjunction with the National Park Service will facilitate ways to use tribal members, local guides, and recreational anglers to harvest Rainbow Trout in Marble Canyon as a means of helping reduce downstream emigration of Rainbow Trout, and enhancing recreational use and employment and business opportunities in the local

community.

Stocking

Sequential annual losses of young-of-year recruits to the population would have severe consequences on future catch rates, angler satisfaction, and local economies. To respond to this possibility, the CFMP includes the provision to stock sterile Rainbow Trout in the event of a significant decline in trout abundance and angler catch rates over a period of several years. However, with declining water levels in Lake Powell, there is also an enhanced possibility of a catastrophic failure of the fishery resulting from any combination of low dissolved oxygen levels, high water temperatures or low food availability. In these events, stocking should be utilized to restore the trout fishery as soon as the factors that caused the catastrophic failure have been identified and ameliorated. Restocking may also occur using the progeny of wild trout currently found in the Colorado River below Glen Canyon Dam or other sources. Wild trout currently found in Lees Ferry are well adapted to survive and provide a quality fishery consistent with the Blue Ribbon standard. A sufficient number of wild fish may be collected for use as brood stock if it appears that a collapse of the fishery is imminent. If this is not feasible, a high quality strain of Rainbow Trout may be stocked with proper fish health certifications. Additionally when stocking is deemed appropriate, the Department may translocate wild Rainbow Trout from downstream of the Paria River when needed to supplement the trout population within the Lees Ferry reach. Translocation could help achieve multiple goals by enhancing Lees Ferry sportfish opportunities and reducing down river migration of trout.

Monitoring

Long-term resource monitoring is the key to effective adaptive management (Walters and Holling 1990). The Department has been conducting long term monitoring of the Lees Ferry fishery using creel (angler) surveys since 1964 and standardized electrofishing surveys of the fish population since 1991. Electrofishing surveys currently occur in spring, summer and fall and provide valuable information on relative abundance, population structure, recruitment, and condition of the entire fish community in Lees Ferry (Rogowski 2014). The long-term creel and electrofishing surveys have provided valuable information on many of the goals and metrics discussed above. Information gained during these surveys is currently used to address many of the concerns of the angling community, particularly as it relates to angler catch, angler satisfaction, harvest rates, and the economic impacts of the fishery.

Long-term monitoring through electrofishing and creel will be conducted as described in Rogowski (2014) unless changes are necessary in response to outside review or management needs.

A healthy trout population requires good habitat, a robust food base, and water quality that is conducive to supporting the desired biota. GCMRC has an established water quality monitoring and food base monitoring program that is pertinent to assessing the limitations that exist for achieving the described goals and objectives (Carlisle et al 2012). It is important for those programs to continue to conduct field monitoring and report conditions as they pertain to the Lees Ferry fishery.

In addition, the Department will work to ensure flows, temperature, dissolved oxygen, and nutrient levels continue to be monitored below Glen Canyon Dam. Conditions in Lake Powell that potentially lead to low DO releases of water should be monitored and reported in a timely fashion. Channel geomorphology (mapping) and riparian habitat in the Lees Ferry reach should be monitored on a periodic basis.

The Department will work to ensure that Lees Ferry monitoring programs and proposed management actions will be a major focus of the Protocol Evaluation Panel (PEP) review of the GCDAMP fishery program in late 2015 or early 2016. The Panel will be requested to provide recommendations on:

1. Approaches to identify the root cause(s) of the unstable trout populations in Lees Ferry;
2. The highest priority actions to stabilize and enhance the quality of the aquatic food base and the Lees Ferry trout fishery;
3. The appropriate metrics to trigger TMFs, stocking, and other management actions;
4. The most appropriate methods and level of effort to effectively monitor progress towards achieving the goals outlined in this report;
5. Important data gaps that need to be filled and uncertainties that need to be resolved; and
6. The need to develop a Stock Assessment Model to:
    a. measure progress towards reaching the goals contained in this report,
    b. determine the suitability of the metrics identified in the report, and
    c. evaluate the effectiveness of increasing harvest as a tool for managing the trout fishery.

The Department will work toward ensuring a synthesis of available fish, food base, flow and water quality data for the period of 2003–2014 precedes the PEP review. This period includes warming water temperature, spring and fall HFEs, winter TMFs, low DO, equalization flows and several steady flow tests. To facilitate a productive PEP review, we recommend that a technical workshop be held prior to the PEP review to review and summarize the available data for the panel.

Catch

Catch rates of ≥ 1 Rainbow Trout per hour with a condition factor ≥ 1 during the summer months is the base objective for this reach. To address the Blue Ribbon quality aspect of this fishery, however, catch rates of 10 Rainbow Trout ≥ 14 inches in a 10-hour day, at least one ≥ 20 inches will be the management objective for all anglers. The Department will also set a target use rate of ≥ 20,000 angler days per year as measured by creel counts and contacts.

Satisfaction

The level of angler satisfaction is critically important to the Department. Most frequently, anglers are satisfied by catching the sizes, numbers, and species of fish they expect to catch during a fishing trip. Angler expectations of the Blue Ribbon fishery at Lees Ferry include

reasonable catch rates, strong healthy trout and the chance to catch a trophy sized fish (trout > 20 inches).

During Creel surveys and interactions with anglers, Department staff will ask a standardized question regarding an angler's satisfaction with the fishery. Satisfaction of 70% is the goal of the fishery. Results will be documented and reported on annually.

Thank You

The Department would like to thank the sportsmen and women who were integral to the development of this document. It is through their passion and diligence that we are able to best manage these important resources. We would like to offer a special thanks to John Hamill (Theodore Roosevelt Conservation Partnership) and John Jordan (Trout Unlimited) for their recommendations.

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