NPS DESIRED FUTURE CONDITIONS: RATIONALE AND TARGETS

There are two parts to the NPS rationale; Policy and Science. We'll begin with Policy, as it applies to both sets of targets.

NPS Mandate for Resource Protection and Improvement

The NPS derives its management philosophy and direction from the 1916 Organic Act. The key management-related provision of the Organic Act is as follows:

[The National Park Service] shall promote and regulate the use of the Federal areas known as national parks…by such means and measures as conform to the fundamental purpose of the said parks…, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. (16 USC 1)

This direction is further clarified by the NPS Management Policies (as revised in 2006). Several sections of the policies relate to resource conservation and management. We have excerpted portions of those sections here.

1.4.3 'The fundamental purpose of the NPS established by the Organic Act and reaffirmed by the General Authorities Act [1970], as amended [in 1978], begins with a mandate to conserve park resources and values.

1.4.7.2 The Service will also strive to ensure that park resources and values are passed on the future generations in a condition that is as good as, **or better than, the conditions than exist today**. In particular, the service will strive to restore the integrity of park resources that have been damaged or compromised in the past. [Restoration activities will be guided by policies identified in chapters 4 and 5]

- Note that other sections of the Policies do recognize applicability of other legislation that may impact park resources and management.

Recognizing that parks are integral parts of larger regional environments, throughout the policies there is repeated reference to cooperation with other agencies and communities:

'the Service will work cooperatively with others to protect park values, resolve conflicts, and address mutual interests in the community including matters such as compatible economic development and resource and environmental protection'

Chapter 4
4.1 Natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities.
The NPS will determine the **desired future conditions** and identify a strategy to achieve them. The strategy should include working cooperatively with adjacent land and resource managers, as appropriate

Biological or physical processes altered in the past by human activities may need to be actively managed to restore them to a natural condition or to maintain the closest approximation of the natural condition when a truly natural system is no longer attainable.

4.1.5 Restoration of Natural Systems
'The service will reestablish natural functions and processes in parks unless otherwise directed by Congress. ...Impacts on natural systems...include the introduction of exotic species;[and] changes to hydrologic patterns and sediment transport.

"The Service will seek to return such disturbed areas to the natural conditions and processes characteristic of the ecological zone in which the damaged resources are situated. "

4.4 Biological Resource Management
4.4.1 The NPS will maintain as parts of the natural ecosystems of parks all plants and animals native to the park ecosystems...by...

Preserving and **restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems on which they depend**....and...

Minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them.

4.4.2.3 Management of Threatened and Endangered plants and animals

The Service will fully meet its obligations under the NPS Organic Act and the Endangered Species Act to both proactively conserve listed species and prevent detrimental effects on these species. To meet these obligations, the Service will:

- Cooperate with both the U.S. Fish and Wildlife Service and the NOAA Fisheries to ensure that NPS actions comply with both the written requirements and the spirit of the Endangered Species Act.
- undertake active management programs to inventory, monitor, **restore**, and maintain listed species' habitats; control detrimental nonnative species; manage detrimental visitor access; and reestablish extirpated populations as necessary to maintain the species and the habitats upon which they depend;
- manage designated critical habitat, essential habitat, and recovery areas to maintain and **enhance their value** for the recovery of threatened and endangered species;

Clearly the intent was and is to both provide both for enjoyment by the public (recreation) and for preservation and/or restoration of natural processes and ecosystems.

When GCD was authorized and built, Congress recognized that some impacts of GCD were expected and accepted; however, at some point both the American people and Congress decided that some additional protection of GRCA resources was necessary and required; thus, the GRCA PA was passed in 1992 which calls for improving resources:

Sec 1802. Protection of Grand Canyon National Park
(a) In general – The Secretary shall operate Glen Canyon Dam in accordance with the additional criteria and operating plans specified in section 1804 and exercise other authorities under existing law in such a manner as to protect, mitigate adverse impacts to, **and improve the values** for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use.

The purpose of Grand Canyon National Park is based on the legislation establishing the park and the legislation governing the National Park Service.

As a place of national and global importance, Grand Canyon National Park is to be managed to:
* preserve and protect its natural and cultural resources and ecological processes, as well as its scenic, aesthetic, and scientific values
* provide opportunities for visitors to experience and understand the environmental interrelationships, resources, and values of the Grand Canyon without impairing the resources

The 1994 Biological Opinion (USFWS 1994) calls for a second spawning aggregation of humpback chub as an RPA. Further, the 1996 EIS called for resource protection; it speaks of minimizing adverse impacts, and permitting recovery and long-term sustainability of downstream resources. Further, the 2007 Notice of Intent to prepare the LTEP EIS – which provided the initial impetus for the charge to the AHG – called for 'improvement of resources' in the Grand Canyon. The NOI states:

" The LTEP is intended to ensure a continued, structured application of adaptive management **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,** consistent with applicable federal law."

- Note that the language is identical with the GRCA Protection Act with the addition of the last reference to applicable federal law.

Clearly the intent of the Organic Act and Management policies was and is to both provide both for enjoyment by the public (recreation) and for preservation and/or restoration of natural processes and ecosystems. Subsequently, the Grand Canyon Protection Act affirmed the protection of the values for which Grand Canyon National Park was established. Thus, the NPS has set targets which we feel meet our mandate for resource protection and **improvement of resources** in Grand Canyon National Park. We hope to improve resources and return them to conditions observed in recent post-dam history, near the passage of the GCPA or earlier, and for which we have or can develop reasonably good estimates or measures of previous conditions.

Scientific Rationale for NPS DFC targets

The Grand Canyon National Park (GCNP) resources staff held three one day workshops to arrive at the DFC's and targets presented to the TWG/Science Plan AHG in 2006. GCNP followed this process to develop the original DFCs:

- Search NPS Management Policies for direction on resource management, protection, restoration and preventing impairment of park values;

- Identify legal mandates/requirements and park compliance responsibilities with applicable legislation (e.g. Organic Act, ESA, Clean Air, Clean Water, NHPA; Trust responsibilities, etc.,);

- Identify and comply with Park Management Plans and applicable management objectives for park and river corridor resources management, and Science and Resources Management Program direction;

- Staff consulted with or/and utilized previous and current park Resource Management and Cultural Resource Protection plans, funded projects or/and project plans, and applicable park activity plans to arrive at specific target levels. Also, many of the individual resource projects, and all NEPA directed management plans and projects are required to develop mitigation measures and measurable values that define project or plan "success" levels;

- These projects and implementation plans have specific methods to be used, measures and values for accomplishment, and funding and time frames for completion.

HUMPBACK CHUB

The DFC's presented to this AHG in November 2007 were based on the original 2006 DFCs, but were modified during the workshop and subsequent discussions with the park staff. We present additional information to support the scientific credibility of our targets. The language is similar to Recovery Goals, but makes certain targets more specific to Grand Canyon humpback chub. We have excerpted the more specific targets for further explanation here.

Relationship to AMP MOs
Short-term targets 1-4, and Long-term target 1 apply to M.O. 2.1 (Maintain or attain HBC abundance in the LCR and other aggregations…). Short-term targets 4-5, and Long-term targets 4-6 apply to M.O. 2.2 (Sustain or establish HBC spawning aggregations outside of the LCR). Remaining targets include addressing other threats, which would include the disease/parasite threat in MO 2.3.

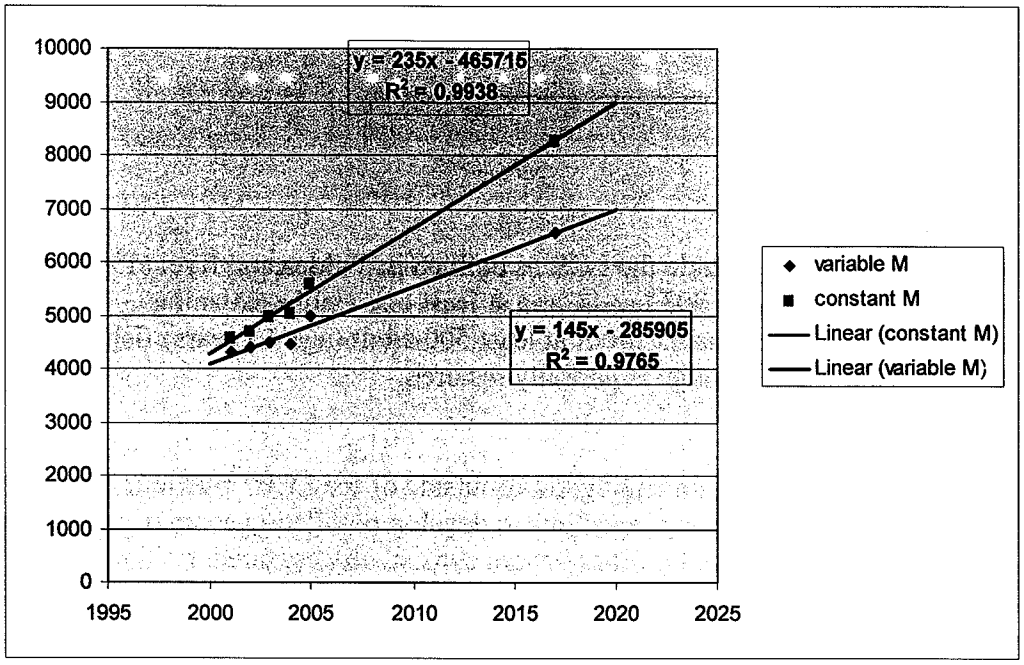
Short-Term Targets (10 years)

2. HBC population estimate is at least 6,500 adult fish, age 4+ years, and a positive trend is maintained from 2008 onwards as determined by ASMR; thus, progress towards the long-term target is being made.

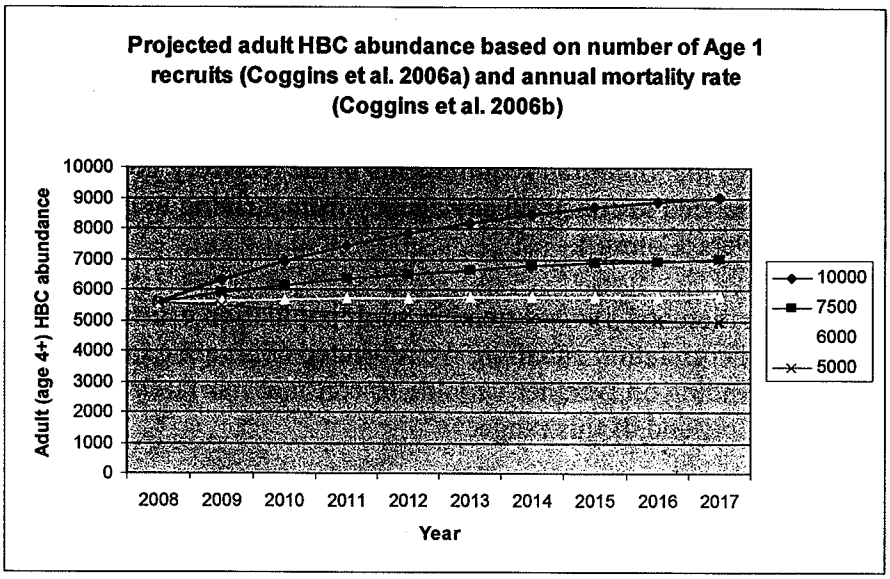
We have set the short-term target at 6,500 adult fish by the end of the 10 year period beginning in 2008 and ending in 2017, to ensure that real progress is being made towards the long-term goal of

10,000 adult fish. We arrived at this number as being reasonable and feasible to achieve in 10 years by examining current abundance, recent trends, estimated mortality, and recruitment rates Coggins et al. 2006a, 2006b, Melis et al. 2006). While a precise number is not possible to predict, the analyses presented here show that it is possible to achieve this target if the present upward trend continues. Although these targets are above the minimum requirements in the recovery goals, there is nothing in the Recovery Goals that is intended to constrain any agency from striving to go beyond the minimum goals (Dr. Richard Valdez, Pers. Comm.).

Method 1. By graphing the recent stabilization and upward trend in adult population estimates from Melis et al. (2006), and generating a linear correlation equation, we projected adult abundance in 10 years to vary between 6260 and 8280 depending on whether variable or constant mortality rates were used. Our target of 6500 is near the low end of this range.



Method 2. We constructed life tables using estimated annual recruitment of 2000 age 2 fish (Coggins et al. 2006a) and simulated age 1 recruits varying from 5000 per year in the late 90s, to 10000 per year in 2000 and 2001 from Melis et al. (2006), and annual mortality rates which vary with age from 68% at age 2 to 18% for older adult fish (Coggins et al. 2006b). Graphing projected annual abundances at four different recruitment values, we see a range in projected abundance from less than 5000 – representing a decline – to over 9000, at the most optimistic values. Given that annual recruitment is likely to vary due to stochastic factors, an average of these projections is 6704 adults in 10 years. Thus the 6500 short term target is conservative.



4. All aggregations in the mainstem outside the LCR as defined in Valdez and Ryel (1995) have been maintained or restored to 1993 levels, and at least one viable spawning aggregation outside the LCR in the mainstem of at least 500 adult (age 4+ years) fish has been established so that the historic range is partially restored.

Valdez and Ryel (1995) recognized 8 mainstem aggregations outside of the LCR. Sufficient captures and recaptures were made in 5 of the aggregations to develop population estimates in 1993. The other 3 had too few captures for an estimate, yet fish were consistently captured at these locations. In intensive riverwide sampling in 2000-2003, no HBC were captured in at least two of the aggregations: Bright Angel inflow, and Pumpkin Springs. It is worthwhile to note that the type locality for the original description of humpback chub as a species (Miller 1946) is the Bright Angel inflow. However, a population estimate made for Middle Granite Gorge in 2000 was for 180 adults, an increase from 1995, and reproduction has been recently observed in the 30-mile aggregation (R. Van Haverbeke, pers. Comm.). In their genetic study, Douglas and Douglas (2006) only recognized 5 aggregations, by collapsing some nearby aggregations, and dismissing very small ones. They did not include the Bright Angel area. However, the NPS believes that maintaining or restoring fish to the locations listed in Valdez and Ryel (1995) will better meet our mandate of restoring historic distribution of this native species (Management Policies 2006).

The target of 500 adults in at least one aggregation is expected to move us toward achieving the long-term goal of a second spawning aggregation in the mainstem (USFWS 1994). An N_e of 500 is commonly used for fishes to establish a minimum 'genetic effective population size' for maintaining a genetically viable population (USFWS 2002). Valdez et al. 2000 rated the Middle Granite Gorge (MGG) area as the only mainstem aggregation with enough existing fish to avoid inbreeding depression without augmentation (Table 1).

Table 1. Nine HBC aggregations as defined in Valdez and Ryel (1995).

RM	Aggregation	No. Adults captured	No. Adults Recaptured	N	SE(N)	Range of 95% CI
29.8-31.3	30-Mile	26	6	52	23	28-136
6557-65.4	LCR Inflow	1524	280	3482	408	2682-4281
65.7-76.3	Lava to Hance	15	3	-	-	-
83.8-92.2	Bright Angel inflow	9	1	-	-	-
108.1-108.6	Shinumo inflow	27	6	57	26	31-149
114.9-120.1	Stephen Aisle	17	2	-	-	-
126.1-129	Middle Granite Gorge	124	48	98	19	74-153
155.8-156.7	Havasu Inflow	7	1	13	12	5-70
212.5-213.2	Pumpkin Spring	6	2	5	2	54-16

5. Develop at least one spawning aggregation in a tributary.

Many of the 9 recognized aggregations are associated with tributary inflows. The NPS has been studying the possibility of translocating HBC into tributaries as one way to increase the Grand Canyon population. Valdez et al. (2000), Van Haverbeke and Simmonds (2004), and SWCA and the Wildlands Council (2006) all addressed various aspects of the feasibility of translocating HBC into one or more tributaries. The SWCA report, funded by NPS, and based largely on Valdez et al. 2000, ranked several perennial tributaries for their potential to support a spawning population of HBC. The NPS, in cooperation with the FWS and AGFD plans to begin translocations into Shinumo Creek in 2008. As part of the LTEP EIS, a plan to translocate HBC into at least two additional tributaries was to be developed in the first year of implementation. We expect that plan will still be developed and implemented.

Long-Term Targets (more than 10 years)

1. HBC population estimate is at least 10,000 adult fish, age 4+ years, as determined by ASMR.

ASMR model: GCMRC has developed and extensively reviewed and published a model that estimates current adult population, annual recruitment, and trends of HBC in the LCR aggregation, and also backcasts population estimates to 1989. The model estimates about 10,000 adult HBC were in the LCR aggregation in 1989 (Coggins et al. 2006). Although the USGS science workshop (USGS 2007) suggests that the carrying capacity of the LCR is about 5000 fish, they limit this estimate to residents of the LCR itself, not including the associated mainstem area. We believe that the 13.5 km of mainstem near the LCR can support the remainder of this aggregation, particularly if the water temperature is warmed, sediment is conserved, and shoreline habitats are stabilized at least part of the year. Valdez et al. (2000) estimate that this reach was supporting about 3,800 adult fish in the early 90's, and could support 28,510 young fish per km. We are not proposing to return the HBC population to pre-dam levels, but to a time when we have a reasonably good estimate, and a time near to the passage of the GCPA.

5. HBC population and distribution will meet or exceed short-term targets based on further evaluation of the CRE habitat and carrying capacity of the river and perennial tributaries.

The reestablishment or maintenance of other mainstem aggregations achieved in the short-term should be maintained in the long-term. If new scientific evidence shows that carrying capacity has been reached before the targets have been met, the targets may be reconsidered.

6. A spawning aggregation of at least 1,667 adult (age 4+ years) fish has been established in the mainstem.

This is expected to be the same spawning aggregation that was targeted for 500 fish in the short-term. The value of 1,667 adult fish was suggested by Valdez et al. (2000) in their report on the feasibility of establishing a second spawning aggregation in the Grand Canyon mainstem. This number is based on genetic viability, but is lower than the Recovery Goal minimum number, because it does not include all the risk factors. Valdez et al. (2000) calculate that the estimated carrying capacity of the MGG area could support 3,611 adults, well above the calculated genetic effective population size of 1,667 adults need to achieve long-term viability.

7. Spawning aggregations in at least three tributaries have been developed.

As part of the LTEP EIS, in addition to Shinumo Creek, a plan to translocate HBC into at least two additional tributaries was to be developed in the first year of implementation. We assume that plan will be developed and implemented. Tributary fish would provide additional protection against catastrophic loss of the primary LCR aggregation.

Remaining Targets and Assumptions

The remaining targets serve to support the primary targets by ensuring that the threats to HBC are mitigated or eliminated. We believe that completion of the Humpback Chub Comprehensive Plan and implementation of actions outlined therein would contribute to addressing the threats.

SEDIMENT

The NPS has provided a reasonable way to address DFC's for sediment. Our rationale to select post-1983 sandbar/beach area was; that 1983 provided high flow levels of greater than 60,000 cfs, that sediment dispersal and habitat reconstruction was at acceptable levels, that key stretches of the river near-shore and sandbar area were restored to acceptable levels, including camping beaches; and most importantly, 1983 showed that post-dam flows could attain our desired conditions relative to sediment use and riparian function. Also, that the HBC population was still at an acceptable level in the mainstem.

We believe the sandbar, beach, and backwater area could be calculated for key reaches by using collected sediment data, remote sensed data collected since 1990 (e.g. first used), and early aerial photography from post-1983. Once a reliable value for sandbar/beach area is determined, it should be possible to calculate a useable value of sediment volume present in these reaches in 1983-84. This will require using sediment data/information gained from past sediment modeling and/or sediment measurements, and to assess erosion rates under the flow regime conducted at that time (as applicable). A reasonably accurate baseline condition or target for future desired conditions could be developed that would define the sediment DFC for sandbar/beach area, near shore habitat development and maintenance requirements.

Our short-term target is to restore the shoreline sediment distribution, volume and areal extent up to the 45000 cfs level, to show progress towards meeting the long-term goal. An important assumption to support both targets is that sufficient sediment and water inputs will occur, and the dam can be operated, to achieve these targets over the long-term. Since GCMRC is still studying the effects of BHBFs, particularly tied to sediment triggers, the ultimate feasibility of achieving the targets is unknown; however, we choose to set targets for desired future conditions that represent improvement over present conditions, until proven otherwise.

Additionally, by meeting the sediment targets, we assume we will also make sand available for aeolian transport to upper benches to enhance native riparian community function and protect cultural sites.

Relationship to AMP MOs
MOs 8.1-8.4 are all addressed by the short- and long-term targets by the parenthetical statement (abundance, grain size, and distribution including volume and areal extent).

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National Park Service Management Policies

I. Key Federal Law – Laws governing management of the NPS system

1. NPS Organic Act
   a. To conserve the scenery, natural and historic objects and the wildlife
   b. Provide for enjoyment
   c. Leave parks unimpaired for future generations

2. Redwoods Amendment 1976
   a. Reemphasized the NPS Organic Act
   b. Recognized the high public value of parks
   c. Management cannot be exercised in derogation of the values and purpose of the units
   d. Senate report made it clear that "The Secretary has the absolute duty to fulfill the mandate of the 1916 Act to take whatever and seek whatever relief as will safeguard the units of the National Park system."

National Park Service Management Policies

B. Specific laws governing GRCA/GLCA

1. Legislation establishing GRCA/GLCA (1919 and 1972)
2. GRCA Protection Act - "Protect, mitigate adverse impacts to and improve the values for which GRCA and GLCA were established including natural and cultural resources and visitor use

C. General Environmental laws

1. ESA (requires all federal agencies to conserve listed species)
2. Clean Water Act (standards for discharged waters into parks)
3. Clean Air Act
4. Fish and Wildlife Coordination Act of 1957

National Park Service Management Policies

II. 2006 NPS Management Policies- Agency interpretation of applicable laws

A General Management Concepts - Natural Resource Management

1. **General -** The National Park Service will strive to understand, maintain, restore, and protect the inherent integrity of the natural resources, processes, systems and values of the parks (Sec. 4.0)

2. **Impairment -** The Service manages the natural resources of parks to maintain them in an unimpaired condition (Sec. 4.0)

3. **System approach -** Natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features and plant and animal communities (Sec. 4.1)

National Park Service Management Policies

4. **Natural focus** - The Service will try and maintain all components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plants and animal species native to the ecosystem (Sec. 4.1)

5. **Desired future conditions** - The Park Service will determine the desired future conditions for each park unit and identify a strategy to achieve them (Sec. 4.1)

6. **Actively manage resources** - Biological or physical processes altered in the past by human activities may need to be actively managed to restore them to a natural condition or the closest approximation possible (Sec. 4.1)

National Park Service Management Policies

B. Restoration of Natural Systems (Sec. 4.1.5)

1. **Functions and processes** - The Service will reestablish natural functions and processes in parks unless otherwise directed by congress

2. **Rehabilitation of disturbed areas** - The Service will seek to return disturbed areas (including changed hydrologic patterns and sediment transport) to the natural conditions and process characteristic of the ecological zone in which the damaged resources are situated

National Park Service Management Policies

Biological Resource Management (Sec. 4.4)

1. Preserve and restore natural abundance, diversity, dynamics, distribution, habitat and behavior of native plant and animal populations and the communities and ecosystems in which they occur (Sec. 4.4.1)

2. Restore native plant and animal populations in parks when they have been extirpated by past human-caused actions (Sec. 4.4.1)

3. Prevent the introduction of exotic species or remove if possible

National Park Service Management Policies

Biological Resource Management (cont)

4. Whenever possible natural processes will be relied upon to maintain native plant and animal species (Sec. 4.4.2)

5. Restore and maintain habitat for listed species; control detrimental nonnative species, reestablish extirpated populations (Sec. 4.4.2.3)

6. Exotic species will not be allowed to displace native species (Sec. 4.4.4)