

TWG Official Member, 02:00 PM 2/13/199, Management Objectives Ad Hoc G

To: TWG Official Members  
From: Dave Garrett <dgarrett@flagmail.wr.usgs.gov>  
Subject: Management Objectives Ad Hoc Group  
Cc: TWG cc's List  
Bcc:

Please find attached (in various formats):

- 1) The Management Objectives (MO's) review developed in the Management Objectives/Budget Ad Hoc Group's first meeting held on January 28, 1998. (MOs1-28)
- 2) Notes taken at the meeting. (Meet1-28)
- 3) The State of Natural and Cultural Resources...Draft Annual Report Outline (dated 2/11/98). Basically the same report (dated 10/29/97) was distributed at the meeting, but is not available electronically (computer problems). However, this one will provide you with information for review. Larry Stevens will incorporate some feedback received into the report on Monday 2/16, and the updated report which will be distributed at the TWG meeting. (SOR2-11)

We will continue our discussions of the MO's at the TWG meeting on February 17 at 1 p.m. The first set of objectives to be discussed will be Lake Powell. There are currently no objectives or information needs for Lake Powell.

Please be sure to bring your TWG Briefing Document binder (October 1997) which contains the original objectives (Tab 4) and information needs (Tab 5).

**Notes from  
Management Objectives Ad Hoc Group Meeting  
January 28, 1998**

Dave Garrett (GCMRC) facilitated the meeting. The Management Objectives Ad Hoc Group is an ad hoc group of the Technical Work Group. TWG formed the ad hoc group at its January 20-21, 1998, meeting. The attendance sheet (Attachment 1) is attached.

**Membership:** Dave Garrett (Facilitator), Cliff Barrett, Bill Davis, Wayne Cook, Norm Henderson, Kurt Dongoske, Bill Persons, Clayton Palmer, Bruce Moore, Amy Heuslein, Tom Moody, Pam Hyde, Dave Cohen, Andre Potochnik, Robert Winfree, Gene Jencsok, Mark Phillips, Steven Lloyd, Larry Stevens

**Purpose:** The ad hoc group's task is to review and revise management objectives and information needs. Also to establish relative priorities by study type, resource class and by research/monitoring question. The Facilitator will report information gathered back to TWG at upcoming meetings until the task is completed.

**Schedule:** The meeting schedule was reviewed at the TWG meeting on January 21, 1998.

2/24 9:30 a.m. - 5 p.m., ADWR Conf. Rm. A, Phoenix, AZ

2/25 8 a.m. - 4 p.m., ADWR Conf. Rm. B, Phoenix, AZ.

Lodging: block of rooms reserved for "Bureau of Reclamation" on 2/24 at Ramada Inn Downtown, 401 N. 1<sup>st</sup> St., Phoenix, AZ. (602) 258-3411 or (800-2RAMADA).

3/17 - Cancelled

3/18 - potential meeting during TWG - time tba on TWG agenda. La Quinta Hotel, Phoenix, AZ.

3/24 - 9:30 a.m. - 5 p.m., ADWR Conf. Rm. A, Phoenix, AZ

3/25 - 8 a.m. - 4 p.m., location tba

This schedule has been posted on the GCMRC AMWG/TWG web site.

**REVIEW OF DAY'S GOALS AND MODIFICATIONS TO AGENDA**

**Goals:** Dave Garrett stated that our charge is to revise the management objectives (MO's) and information needs (IN's), and to add the Lake Powell Program into the MO's and IN's.

**Agenda:** no revisions.

**REVIEW OF STAKEHOLDER OBJECTIVES**

**Objectives Review:** The group used the current MO's as a foundation, and reviewed and revised the objective statements. The group was reminded that the MO's and IN's are changeable and will be reviewed annually by the TWG. Suggested changes are reflected in Attachment 2. NPS'

input is needed to define “wilderness character” in the Recreation MO’s. Hualapai Tribe input is needed about fishing, sport hunting and other aspects of Recreation MO #5. Replace “target(s)” with “objective(s)” throughout document.

State of Resources Outline: Tom Moody distributed a draft Annual Report Outline of The State of Natural and Cultural Resources in the Colorado River Ecosystem (SOR) (Attachment 3). He discussed how the process will contribute to the whole interaction on continued evaluation on the state of Colorado riverine corridor resources. We are trying to create a management strategy process that links scientific information with management decisions and the objectives of the managers. The SOR should parallel the AOP. The year’s data will not be available until the fall, but some quarterly reports will give an indication of the status direction. TWG and AMWG will provide comments September-November and it will be finalized at the same time as the AOP. If elements to this outline are accepted and approved, the data will be compiled to add data points to the graphs which will assist us in understanding how the resources are progressing. The group will review it and consider their specific interests, information needs and long-term needs resource-by-resource. The report produced will be simple and graphical rather than wordy. Graphs will be used to represent resource tracking from baseline to present conditions and trends (like an image of a resource at a certain time). Baselines will need to be established and we need to understand how baseline conditions relate to present conditions. Thresholds and natural variability will also be represented. Data available from other sources will be identified and obtained to avoid duplication of work.

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS<sup>1</sup> IN INFORMATION NEEDS

## CULTURAL RESOURCES

- Characteristics:** Non-renewable  
High historic social values to general public  
High historic/cultural/social values to Native Americans
- Examples:** Prehistoric/historic, archaeological, traditional, cultural properties sites, sacred sites, collection areas
- Objectives:**
- ① *Primary Target:* Conserve in situ all the downstream cultural resources to take into account Native American cultural resource concerns in Glen and Grand Canyons.
- Information Needs:**
1. Develop data and monitoring systems to assess:
    - Types of degradation; threats
    - Rates of degradation
    - Define immediacy of threats to resources
    - Protection methodologies
    - Protection, monitoring and research costs
- Secondary Target:* If in situ conservation is not possible, design mitigative strategies that integrate the full consideration of the values of all concerned tribes with a scientific approach.
- Information Needs:**
1. Characterize through scientific study and data development all assumed historical and current values of resources to tribal nations and to general public
  2. Develop data systems to assess variable risk of damage/loss of differing resources/sites from preferred and alternative strategies and operating criteria
  3. Develop mitigative costs
- ② *Primary Target:* Protect, and maintain physical access to and use of traditional cultural properties and other cultural resources, impacted by dam operations.

<sup>1</sup> Information Needs reviewed by the Transition Work Group July/August, 1996.

**SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS**

**CULTURAL RESOURCES (CONTINUED)**

- Information Needs:** 1. Characterize historic and current religious associations of all sites associated with impacts of dam operating criteria
3. *Primary Target:* Maintain and integrate all cultural data recovered from monitoring, remedial, and mitigative action and incorporate these data into the evolving research designs for understanding the human occupation and use of the Grand Canyon.
- Information Needs:** 1. Characterize all cultural resource sites as to the specific associated management/research needs, i.e.; preservation, stabilization, documentation, etc.; under alternative operating criteria  
2. Preservation, stabilization and/or documentation of cultural resources as impacted by sediment resources associated with alternative operating criteria  
3. Preservation, stabilization of flood terraces holding cultural resources  
4. Evaluate flood terrace stability necessary to maintain cultural resources and terraces at pre-dam conditions

**SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS**

**DATA MANAGEMENT AND DISTRIBUTION**

**SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS**

**HYDROPOWER RESOURCES**

- Characteristics:** Renewable with constraints  
High time and space values  
High monetary and social values  
Replaceable with constraints
- Examples:** Peaking power capabilities  
Base power capabilities
- Objective:** 1. *Primary Target:* Maximize the value of long-term power and energy generation within the criteria and operating plans established by the Secretary under Section 1804 of the Grand Canyon Protection Act.
- Information Needs:** There are no information needs specified

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

## NATIVE TERRESTRIAL WILDLIFE RESOURCES

**Characteristics:** Some renewable under significant constraints  
Not replaceable  
High biological and social value

**Examples:** Native wildlife resources; bats, sheep, riparian birds

**Objectives:**

1. *Primary Target:* Protect, restore, and enhance survival of native and special status species (federal, tribal, and state designations). Ensure that the required habitat for these species is preserved. Maintain native faunal components of the ecosystems for the benefit of threatened and endangered species.

**Information Needs:**

1. Define and specify ecology of native faunal components, especially threatened and endangered species; including evolutionary and environmental changes, natural range of variation, linkages, interdependencies, and requirements
2. Monitor species population to detect departures from natural range of variation
3. Monitoring changes, declines in special status species and characterize ecosystem changes to benefit species

2. *Primary Target:* Maintain a natural age-class distribution throughout the majority of natural range in Glen and Grand Canyons, emphasizing the need to recruit into breeding age classes.

**Information Needs:**

1. Determine species' natural ranges (pre and post dam)
2. Determine historic age class distribution (pre and post dam)
3. Assess natural range and age class disruption, changes, constraints, probable long-term viability implications to species; assess alternate habitat, ecology associations (specifically age class); and ecosystem associations



SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

NATIVE TERRESTRIAL WILDLIFE RESOURCES (CONTINUED)

- 4. Monitor impacts of alternative operating criteria on ecosystem and ecology requirements of species**
3. *Primary Target:* Evaluate the viability of food chain(s) for native fauna, including the Peregrine Falcon, Southwestern Willow Flycatcher, and other special status species.
- Information Needs:**
1. Define food chain associations, interdependencies, requirements, etc., for native species population targets
  2. Monitor impacts of alternative operating criteria on food chain associations
4. *Primary Target:* Inasmuch as such management is not deleterious to naturally occurring ecosystem components, consider and mitigate impacts to special status species that may use the river corridor opportunistically (Bald Eagle). Maintain self-sustaining fish populations as forage to provide opportunities for bald eagles. Monitor for nesting.
- Information Needs:**
1. Characterize historic and current use or expected use of area by species
  2. Determine habitat, forage, nesting, etc.; requirements based on current or future use
5. *Primary Target:* The population of Kanab Ambersnail should be inventoried and maintained near current levels. Efforts to establish additional population center should be guided by the recovery plan for the species.
- Information Needs:**
1. Characterize historical and current populations of Kanab Ambersnail and their locations
  2. Determine ecology and ecosystem related requirements for Kanab Ambersnail to enhance 1996 levels
  3. Monitor changes in populations, health, and character of Ambersnail

**SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS  
NATIVE TERRESTRIAL WILDLIFE RESOURCES (CONTINUED)**

6. *Primary Target:* Maintain and enhance the aquatic food base in Glen Canyon. Maintain continuously inundated areas for Cladophora and aquatic invertebrates at or above 5,000 cfs discharge.

**Information Needs:**

- 1. Determine primary and secondary predatory areas, standing crop of attached vegetation communities and associated invertebrate communities and monitor on a seasonal basis**
- 2. Determine the historical and current wildlife (special status and migratory species, including waterfowl) occupying or using habitats in the Colorado riverine corridor**
- 3. Determine range of natural variability, ecology and ecosystem requirements of species**
- 4. Monitor impacts of operating criteria on wildlife with emphasis on special status species**

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

**WATER RESOURCES**

**Characteristics:** Renewable  
Non replaceable  
Significant physical, biotic and social resource value

**Examples:** High quality water  
Water quantities

**Objectives:**

1. *Primary Target:* The Secretary shall operate Glen Canyon Dam in a manner fully consistent with the preferred alternative and subject to the Grand Canyon Protection Act of 1992, the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in Arizona vs. California, and the provisions of the Colorado River Storage Project Act of 1956, and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development, and exportation of the waters of the Colorado River Basin.

**Information Need:** No information needs specified

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*Proposed new Target:* Maintain water quality at levels appropriate to support physical, biotic, and human resource needs of various ecosystems

- Information Need:**
1. Monitor water quality changes with time
  2. Monitor water quality as compared to state and federal standards
  3. Measure water composition and temperature and their changes over time

**SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS  
SEDIMENT RESOURCES**

**Characteristics:** Partially renewable with significant constraints  
Not replaceable  
High biotic and social values

**Examples:** Flora and fauna habitat  
Beaches for recreation and visual values  
Nutrient transport

**Objectives:** The overall resource management target is to maintain a range of sediment deposits over the long term, including an annually flooded bare-sediment (unvegetated) active zone, a less frequently flooded vegetative zone, terraces (within the 45,000 cfs river stage), and backwater channels. The dam would be operated with the goal of managing sediment resources on a reach-scale basis. Should significant and localized adverse impacts occur, site-specific mitigation would be considered along with possible modifications to dam operations.

1. *Primary Target:* As a minimum for each, maintain the number and average size (area and thickness) of sandbars between the stages associated with flows of 8,000 and 45,000 cfs and the number and average size of backwaters at 8,000 cfs that existed during the 1990/91 research flows.

**Information Needs:**

1. Characterize sandbar/backwater baselines and character and structure in 1990/91
2. Working with various resource agencies and specialists, select most appropriate flow levels/regimes to determine baseline for comparisons for all resources
3. Monitor future changes in sediment and define balances (channel, banks, bars) and hydraulic processes necessary to maintain 1990-91 sandbar levels
4. Evaluation of flow regime impacts on terrace and cultural resources
5. Evaluate historical sandbar/backwater change, and develop methods for predefining beach and sandbar change under alternative operating criteria
6. Determine implications of alternative dam operating criteria on beach and sandbar and backwater character and structure

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

**SEDIMENT RESOURCES (CONTINUED)**

2. *Primary Target:* Periodically increase the average size of sandbars above the 20,000 cfs river stage and number and average size of backwaters at 8,000 cfs to the amounts measured after the 1996 test of the beach/habitat-building flow in as many years as reservoir and downstream conditions allow.

**Information Needs:**

1. Define 1996 and 1990/91 backwater ecosystems and associated flow regimes
2. Define historical variation in backwater number and character
3. Define changes between 1990/91 and 1996 in sediment and backwater resources character and structure associated with dam operating criteria
4. Define all linkages, associations, interdependencies, etc.; of physical sediment resource and backwater resources to biotic entities
5. Define processes necessary to maintain backwaters at 1990 - 1991 and 1996

3. *Primary Target:* Maintain system dynamics and disturbance by redistributing sand stored in the river channel and eddies to areas inundated by river flows up to 45,000 cfs in as many years as possible when downstream resources warrant and when Lake Powell water storage is high. The degree to which these targets are met can be monitored by measuring rates of sediment deposition and erosion, the area of bar sediment deposits, and the number and size (thickness and area) of sandbars of interest (such as camping beaches).

**Information Needs:**

1. Define character and structure of all beaches and backwaters in system after 1996 test flows
2. Develop methodologies to define future flow regimes to maximize benefit to sediment and backwater character and structure
3. Develop an assessment of dam operation impacts on range of variation in sediment and other resources within riverine corridor and the associated processes that created these ranges

**SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS  
SEDIMENT RESOURCES (CONTINUED)**

4. *Primary Target:* Maintain a long-term balance of river-stored sand to support maintenance flow (in years of low reservoir storage), beach/habitat-building flow (in years of high reservoir storage), and unscheduled flood flows. Maintain system dynamics and disturbance by annually (in years which Lake Powell water storage is low) redistributing sand stored in the river channel and eddies to areas inundated by river flows between 20,000 and 30,000 cfs.

**Information Needs:**

1. Define historical and current (character and structure) levels of river stored sediment in system and associated flow regimes
2. Define minimal levels of river stored sediments necessary to maintain long term sandbar, backwater, instream sediment deposits
3. Develop procedures to monitor and predict impacts of alternative operating criteria (flow regimes) on river stored sediment, and impacts in select reaches

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

**FISH AND AQUATIC RESOURCES**

- Characteristics:** Renewable resource with significant constraint  
Non replaceable resource  
High biotic and social values
- Examples:** Native fishes  
Non-native fishes  
Aquatic flora
- Objectives:** The general targets are to protect and enhance native fish populations in Glen and Grand Canyons, recreationally important cold-water sportfish populations in Glen Canyon, and the aquatic food base upon which they depend.
1. *Primary Target:* Maintain or enhance the existing population of humpback chub at or above 1987 levels determined by April/May hoop-net monitoring in the lower 1,200 meters of the Little Colorado River. (Focused at fish >200mm, and should include a fish health assessment.) Maintain levels of recruitment of humpback chub in the mainstem and Little Colorado River, as indexed by size frequency distributions and presence and strength of year-classes. (Focused at young-of-year and juvenile fish, and should include a fish health assessment.)
- Information Needs:**
1. Monitor adult humpback chub populations and evaluate population level trends
  2. Monitor levels of recruitment of humpback chub in the mainstem and the LCR
  3. Monitor quantity and quality of chub backwater and near shore habitat in mainstem
  4. Determine and identify surrogate native or non-native fishes for evaluation of health factors for humpback chub
  5. Develop a backwater quality index, using existing data for humpback chub
  6. Evaluate impacts of sampling methods and recreation use on native fish populations

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
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**FISH AND AQUATIC RESOURCES (CONTINUED)**

2. *Primary Target:* Verify the status of and management for healthy, self sustaining populations of flannelmouth sucker, bluehead sucker, and speckled dace in the mainstem Colorado River in Grand Canyon and its tributaries. Verify the status of and management for healthy, self sustaining populations of native fish in Glen Canyon based upon the capability of the habitat to support those fishes. (Focused at young-of-year, juvenile, and adults to determine size frequency distributions, densities [via catch rates], and assessment of fish health.)

**Information Needs:**

1. Determine historic and current character and structure of species populations
2. Determine historic and current ecosystem requirements (habitat, spacing, food source, interdependencies, etc.) of species
3. Monitor and define impacts of alternative flow regimes on species population character and structure
4. Determine requirements to maintain/enhance self-sustaining populations of species

3. *Primary Target:* Establish a second, self-sustaining population of humpback chub by 2005, contingent on feasibility. Monitor for spawning and determine the contribution of other existing aggregations as one component of assessing feasibility.

**Information Needs:**

1. Develop criteria for self-sustaining populations of humpback chub
2. Assess feasibility of second population including other current aggregations

4. *Primary Target:* In the Colorado River corridor below Glen Canyon Dam to the confluence with the Paria River, natural reproduced fish should compose at least 50% of the Age III rainbow trout. Sufficient suitable spawning habitat should be maintained to reach this objective. The total populations of rainbow trout (age II plus) in this reach should be maintained at approximately 100,000 fish as



SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
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**FISH AND AQUATIC RESOURCES (CONTINUED)**

determined from population estimation.  
Rainbow trout should achieve 18 inches in length by Age III with a mean relative weight ( $W_r$ ) of at least 0.80.

- Information Needs:**
1. Determine ecosystem requirements , population character and structure to maintain reproduced populations of Age II plus fish at 50,000 - 100,000 population levels
  2. Monitor changes in population character and structure
  3. Monitor harvested and field sampled rainbow trout to determine the contribution of naturally reproduced fish to the population
  4. Monitor the availability and quality of spawning substrates in the Glen Canyon reach
  5. Monitor the size of the population of age II plus rainbow trout in the Glen Canyon reach
  6. Monitor the growth and condition of rainbow trout in Glen Canyon
  7. Define criteria for healthy trout population

5. *Primary Target:* Minimize, to the extent possible, interactions between native and non-native fishes.

- Information Needs:**
1. Define areas and conditions of current and future existing and potential interactions
  2. Monitor key attributes associated with interaction
  3. Determine methods for minimizing interactions through isolation
  4. Determine methods for minimizing interactions without isolation
  5. Monitor the species composition, relative abundance, and size class structure of non-native fishes in the Colorado River and important tributaries
  6. Identify existing and potential sources of interaction (predatory, competitive) between extant non-native fishes and native fishes of the Colorado River and important tributaries
  7. Evaluate the effects of beach/habitat building flows and habitat maintenance flows on the

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

**FISH AND AQUATIC RESOURCES (CONTINUED)**

**distribution and abundance of non-native fishes in the Colorado River and important tributaries**  
**8. Identify potential alternative strategies to suppress problematic non-native species in the Colorado River and important tributaries**

*6. Primary Target:*

Maintain and enhance the aquatic food base in Glen Canyon. Maintain continuously inundated areas for Cladophora and aquatic invertebrates at or above 5,000 cfs discharge.

**Information Needs:**

- 1. Define current and historic food base character and structure**
- 2. Define food base character, structure and requirements for maintaining target populations**
- 3. Determine system changes to maintain/enhance food base**
- 4. Define impacts of alternative operating criteria on ecosystem (food base)**
- 5. Monitor the species composition and the distribution of aquatic algae and macrophytes in the Colorado River**
- 6. Monitor the species composition and density of macroinvertebrates in the Colorado River**

*7. Primary Target:*

Evaluate through monitoring and research the reasonable and prudent alternatives specified by the US Fish and Wildlife Service.

**Information Needs:**

- 1. Using monitoring and research programs evaluate all test flows in RPA and potential impacts to threatened and endangered fisheries**
- 2. Determine the benefits and impacts of installing selective withdrawal for thermal modification in the mainstem of the Colorado River downstream of Glen Canyon Dam**

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

**RECREATION**

- Characteristics:** High social values  
Replaceable with constraints  
Renewable
- Examples:** Trout fishing  
White water rafting  
Boating, hiking, sightseeing  
Photography
- Objective:** Provide quality recreation experiences that do not adversely affect natural or cultural resources within the river corridor.
1. *Primary Target:* Maintain or improve the wilderness character of the recreational experience.
- Information Needs:**
1. Determine criteria and aspects that are important to or detract from wilderness experience
  2. Determine the impacts of scientific study on wilderness experience
  3. Characterize procedures to mitigate those aspects of flows that detract from wilderness character of river
2. *Primary Target:* Maintain flows and sediment processes that create an adequate quantity, distribution and variety of beaches for camping, as long as such flows are consistent with management of natural recreation and cultural resource values (other natural resource values).
- Information Needs:**
1. Determine adequate beach quality, character and structure for camping throughout system
  2. Evaluate impacts of operating criteria on establishing and maintaining adequate beaches and distribution of other resources, quality, character and structure
  3. Monitor beach character and structure changes
  4. Develop systems models to predict flow regimes for building and maintaining beaches

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS  
RECREATION (CONTINUED)

3. *Primary Target:* Maintain flows that do not preclude navigability by whitewater craft in Grand Canyon and power craft in Glen Canyon and upper Lake Mead and safe access for boaters, waders, and campers.
- Information Needs:**
1. Determine if operating criteria maintains safe and adequate powercraft navigability in Glen Canyon and upper Lake Mead
  2. Evaluation efforts of operating criteria on recreation safety
  3. Determine if operating criteria maintains whitewater raft navigation in Grand Canyon
  4. Define ecosystem and other resource impacts of flow regimes to maintain navigation
4. *Primary Target:* Maintain quality cold water fishery opportunities in Glen Canyon.
- Information Needs:**
1. Determine flow regimes necessary to maintain fish populations of 100,000 adult Trout (age class II plus)
  2. Determine impacts of operating criteria on other resources and ecosystems
5. *Primary Target:* Maintain sport hunting and wildlife viewing opportunities for water fowl in Glen Canyon.
- Information Needs:**
1. Define pattern of waterfowl and other wildlife use and conflicts to other uses

SPECIFICATION OF INFORMATION NEEDS BY THE GCMRC PLANNING GROUP:  
1996 WORKSHOPS IN INFORMATION NEEDS

## RIPARIAN AND TERRESTRIAL VEGETATION

- Characteristics:** Renewable  
Non replaceable for natural environments  
High biological value
- Examples:** Natural species  
Balanced successional stages  
Unique plants  
T&E plants
- Objectives:** Maintain dynamic vegetative communities made up of diverse groups of native riparian and upland species (where affected by dam operations) at different stages of succession and at different elevations above the water line.
1. *Primary Target:* Preserve or restore (where possible) natural species composition and abundance within riparian and upland communities affected by dam operations.
- Information Needs:**
1. Determine historical natural composition of riparian and upland communities
  2. Characterize normal range of variation and ecology of species
  3. Monitor impacts of operating criteria on the succession processes of natural vegetation communities
  4. Evaluate impacts of dam operations on establishment of and impacts from exotic plant species
  5. Evaluate impacts to vegetation communities of alternate aspects of operating criteria
2. *Primary Target:* Emphasize the preservation of unique plant communities and any special status species (federal, tribal, and state designations) to ensure their perpetuation within the system.
- Information Needs:**
1. Determine historic and current distributions, range of variation and ecology of T&E and special status species
  2. Establish ecosystem requirements of special status species and determine probable impacts of proposed flow regimes
  3. Monitor population changes in special status species