



## Grand Canyon Monitoring and Research Center Programs

### Overview

The Grand Canyon Monitoring and Research Center (GCMRC) is the cornerstone of the Glen Canyon Dam Adaptive Management Program (AMP). The GCMRC was formally established in October of 1996, and became part of the Southwest Biological Science Center in October 2002. Located in Flagstaff, Arizona, the GCMRC studies effects of Glen Canyon Dam operations on the resources along the Colorado River from Glen Canyon Dam to Lake Mead. The GCMRC's scientific activities contribute to meeting the statutory requirements placed on the Secretary of the Interior by Congress via the 1992 Grand Canyon Protection Act, the 1995 Glen Canyon Dam Environmental Impact Statement, and the 1996 Record of Decision.

The goals of the GCMRC are to develop monitoring and research programs as well as related scientific activities that evaluate short- and long-term impacts of the Glen Canyon Dam operations on the biological, cultural, recreational and physical resources of the Colorado River Ecosystem (CRE). The GCMRC also provides information concerning the status of the CRE to the Adaptive Management Work Group (AMWG) and the Secretary of the Interior.

The GCMRC operates within the Adaptive Management Program to define research objectives, and develop monitoring programs to meet information needs of the AMP. The AMWG consists of a diverse group

of stakeholders, including: Department of Interior Agencies (Bureau of Indian Affairs, Bureau of Reclamation, Fish and Wildlife Service, National Park Service), Western Area Power Administration, Colorado River Basin States, Native American Tribes, Colorado River Energy Development Association, recreational users and environmental organizations. Additionally, a set of Independent Review Panels (IRP) provide assessments of program proposals and accomplishments to ensure scientific objectivity and credibility.

### GCMRC Activities

Long-term monitoring of all vital resources aids in detecting and quantifying changes related to dam operations. Research efforts focus on interpreting and explaining trends, determining causal relationships, and defining inter-relationships among physical, biological, recreational and cultural processes.

The scientific activities are performed by both government and contract researchers, who specialize in terrestrial, fisheries and aquatic biology, limnology, geomorphology, hydrology, and archeology, often in a collaborative effort. A formal Solicitation for Cooperative Agreement Proposals is extended annually to solicit research. Research results are used to refine the future work plans, modeling efforts and monitoring of the impacts of dam operations on the CRE. In addition to monitoring and research activities, information management programs are developed to ensure information is properly archived and transferred to managers, stakeholders and science organizations.

GCMRC provides an annual report to CRE stakeholders. This evaluation, combined with information on predictions of future reservoir storage and weather, is used to discuss potential flow regimes to protect and/or enhance restoration of the CRE.

### Socio-cultural Studies

The socio-cultural program includes cultural, recreational and economic resources. The intent of the cultural component is to preserve cultural resources, consider Native American concerns for resources, maximize available information, and increase understanding of how humans affect the Colorado River Ecosystem. The program incorporates information from several resource areas including archaeology, cultural anthropology, biology and geomorphology. Participating Tribal groups include the Hopi Tribe, the Hualapai Tribe, the Southern Paiute Consortium (composed of the Kaibab Paiute Tribe and the Shivwits Band of the Paiute Tribe of Utah), the Navajo Nation and the Pueblo of Zuni. GCMRC collaborates with stake holders to study and assess resources. Current efforts include the NPS monitoring the condition of archaeological sites, Tribal groups monitoring their traditional resources to provide information on the health of the resources, and GCMRC studies. Ongoing socio-cultural research at GCMRC involves studying erosion at sites and the effectiveness of certain mitigative measures, developing an overall research design for cultural resources and the creation of a central database.

Current cultural projects include:

- Evaluation of the effectiveness of check dam mitigation at archaeological sites using remote sensing techniques
- Development of a cultural resource research design for the river corridor and the greater Grand Canyon area and its environs
- Participation of tribal groups in biological monitoring projects to provide Native American perspectives on resource assessments and conditions
- Support for public outreach relative to Native American perspectives on Canyon resources





*“Descending Sheep” rockart panel in the Eastern Grand Canyon.*

- A public outreach program to provide the Adaptive Management program and general public with current information

There are also many socio-economic resources associated with the Colorado River Ecosystem including recreation, camping beaches and water releases relative to hydropower costs. Areas of monitoring and research in the socio-economic area include:

- Change in campsite beach area, number, location and quality
- Recreational safety
- Angler’s satisfaction determined through creel surveys
- Economic impacts to recreationist



*The Humpback Chub is a large warm-water fish native to the Colorado River that was listed as endangered in 1967.*

## Biological Studies

The CRE contains a fascinating array of plants and animals dependent on the Colorado River for their existence. Many biological projects involve endangered species and how they are affected by the water quality, volume and release patterns from the Glen Canyon Dam.

Monitoring activities address management objectives and information needs of both aquatic and terrestrial resources. This program focuses on the native fish, plant life and animals that populate the river ecosystem. An important research focus within this program is on the Kanab Ambersnail and endangered humpback chub. Other current projects include:

- Terrestrial habitat mapping and

inventory

- Monitoring and evaluating the aquatic foodbase
- Monitoring the terrestrial ecosystem
- Researching and monitoring the effects of the Glen Canyon Dam on the fish community
- Observing the interactions between native and non-native fish
- Researching and monitoring the effects of dam operation on water quality



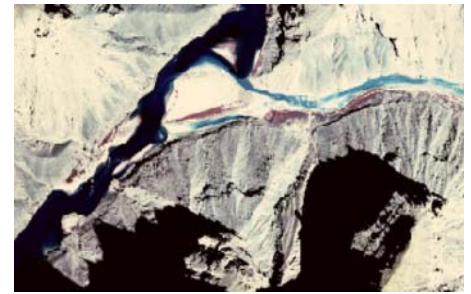
*Researchers downloading an acoustic sensor at Badger Creek.*

## Physical Resources Investigations

The Physical Resources program primarily focuses on monitoring the effects of streamflow and sediment on the CRE, with an emphasis on sediment deposition, storage and erosion. This program provides information on dynamic hydrologic and geomorphic processes that link dam operations to downstream ecosystem resources. Streamflow, sediment, and their interactive processes are the primary topics of concern.

Current projects focus on the following, in both the main channel and the tributaries of the Colorado River:

- Long-term monitoring of fine-grained sediment storage
- Long-term monitoring of streamflow and fine-sediment transport in the main channel Colorado River, Paria River, Little Colorado River and lesser tributaries in Glen and Marble Canyons
- Long-term monitoring of coarse-grained sediment input, storage and impacts to physical habitats
- Streamflow and suspended-sediment transport modeling within the CRE
- Advanced conceptual modeling of coarse-grained sediment related to evolving physical habitats and aquatic processes



## Information Technology Program

The Information Technology Program encompasses six important areas that serve the needs of the research and monitoring programs. The Geographical Information System (GIS), Data Base Management System and library comprise the three core information technologies, developed to organize and distribute the vast amounts of CRE information collected over the last 15 years. In addition, the program has a survey division, a remote sensor division, and also performs systems administration for the center. Current and ongoing projects involve developing a CRE control network and hydrographic mapping program, evaluating airborne remote sensing technologies, and developing a GIS to accommodate multiple stakeholder’s interests, including river base map development.

## Collaboration

In order to construct a comprehensive understanding of the CRE, GCMRC programs work in unison to expand the knowledge base available to stakeholders and decision-makers. For example, physical and biological researchers collaborate to investigate the relationship between streamflows and the survival of young Humpback Chub. It was hypothesized that streamflow fluctuations affect the availability of the low velocity shoreline habitat ideal for juvenile Humpback Chub. Another ongoing cooperative study by biological and cultural researchers is helping to identify and protect indigenous plants that are culturally important to the Native American tribes; the longevity of these plants is vital in preserving Native American traditions. Finally, geomorphologists, archeologists and remote sensing personnel are working together to detect and explain erosion at archeological sites.

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