

Southwest Biological
Science Center

The State of the Colorado River Ecosystem in Grand Canyon

A Report of the
Grand Canyon
Monitoring and
Research Center
1991-2004

USGS Circular 1282

U.S. Department of the Interior
U.S. Geological Survey



INFORMATION SHEET

Major Findings

- Under current dam operations, the Colorado River transports more sand out of the system than is supplied by tributaries on a seasonal to annual basis (that is, export exceeds input), preventing multi-year accumulation in the channel. As a result, erosion of channel and sandbar deposits from Marble and Grand Canyons continues.
- Since the report was finalized, scientists have continued to evaluate the results of the November 2004 High Flow Experiment. One of the most surprising findings was the robust increase in sandbar area and volume in upper Marble Canyon, which has historically been one of the most sediment limited reaches of the river. These more recent findings suggest the use of short, strategically timed high-flow releases following sporadic sand inputs from tributaries is a possible strategy for rebuilding beaches and sandbars.
- The number of federally endangered adult humpback chub (*Gila cypha*) in the Grand Canyon ecosystem has declined since at least the late 1980s, which is in part the result of a reduction in the rate of young chub surviving long enough to reach spawning age.
- Nonnative rainbow trout (*Oncorhynchus mykiss*) in the Lees Ferry reach and downstream as far as river mile 75 have proliferated under the modified low fluctuating flow (MLFF) alternative that governs day-to-day dam operations. Likewise, nonnative brown trout (*Salmo trutta*) have increased dramatically around Bright Angel Creek and upstream to above the Little Colorado River confluence (river mile 61). Both species prey on native fishes.
- Although there is no basis for claiming that the current operation at Glen Canyon Dam resulted in recent and repeated low recruitment and the continued decline of humpback chub, it is clear that the restrictions on dam operations since 1991 have not produced the hoped-for restoration and maintenance of this endangered species.
- Archaeological sites in the river corridor and locations of traditional importance to Native Americans continue to receive negative impacts from side channel surface erosion and recreational visitors. These processes are aggravated by the diminishing supply of sediment, which appears to be contributing to and exacerbating the rate and amount of erosion.
- Between 1998 and 2003, the area available for camping at high-elevation campsites used by summer recreationists decreased by 55 percent and the average rate of decrease was 15 percent per year. The decrease in campsite area occurred both in Marble and Grand Canyons as the result of erosion and vegetation encroachment. As noted above, these areas appear to have benefited from the November 2004 High-Flow Experiment.

Other Important Findings

Chapter 2. Fishes of Grand Canyon

Humpback chub are infected with Asian tapeworms (*Bothriocephalus acheilognathi*), a nonnative parasite. This parasite was first found in the Little Colorado River in 1990 and by 2001, 90 percent of all humpback chub sampled were infected. This tapeworm can cause mortality, but most often is responsible for reduced growth and poor condition in infected fish.

Chapter 3. Climatic Fluctuations, Drought, and Flow in the Colorado River

Comparisons with reconstructed climatic data suggest that the low-flow of the Colorado River from 2000–04 may be the lowest since A.D. 1579 to 1600.

Chapter 4. Water Quality in Lake Powell and the Colorado River

“Natural” warming of releases resulting from drought-induced falling reservoir levels (a drop of more than 140 ft between 1999–2005) is currently providing an important opportunity to test ecosystem responses to a proposed temperature control device, which would route warmer surface waters through the Glen Canyon Dam powerplant.

Chapter 6. Riparian Vegetation and Associated Wildlife

Since the 1990s, stable but fluctuating flows and experimentation have resulted in the expansion of vegetation into formerly open areas, including campsites and channel margins.

The number of federally endangered Kanab ambersnails (*Oxyloma haydeni* ssp. *kanabensis*) has not changed significantly since 1998. Fall numbers generally exceed spring numbers, as would be expected with seasonal recruitment.

Chapter 7. Birds of the Colorado River in Grand Canyon: a Synthesis of the Status, Trends, and Dam Operation Effects

The small population of federally endangered southwestern willow flycatchers (*Empidonax traillii extimus*) in the upper river corridor continues to persist at only one or two sites. There are no direct flow-related impacts to southwestern willow flycatchers because they nest high in tamarisk vegetation and well above the water level of MLFF flows.

Chapter 10. Status and Trends of Hydropower Production at Glen Canyon Dam

The environmental constraints that are part of the MLFF regime affect hydropower production at Glen Canyon Dam to varying degrees under different circumstances. Typically, these constraints are most limiting for moderate monthly release volumes and less constraining at either very high or very low release volumes.

Power generation at Glen Canyon Dam has diminished since the onset of the drought in 2000. The average annual hydropower production during the period 1978 to 1999 was approximately 5.2 million megawatt-hours (MWh). In 2001, approximately 3.9 MWh were generated. By water year 2004, only 3.3 MWh were generated.

Chapter 12. Recreational Values and Campsites in the Colorado River Ecosystem

The 1996 experimental high flow increased the number, size, capacity, and aesthetic qualities of campsites. These benefits were substantial but degradation occurred quickly. Within six months, nearly half the new campsites were unusable, the remaining new sites were half their initial size, and most of the increased area on measured established sites had eroded away.