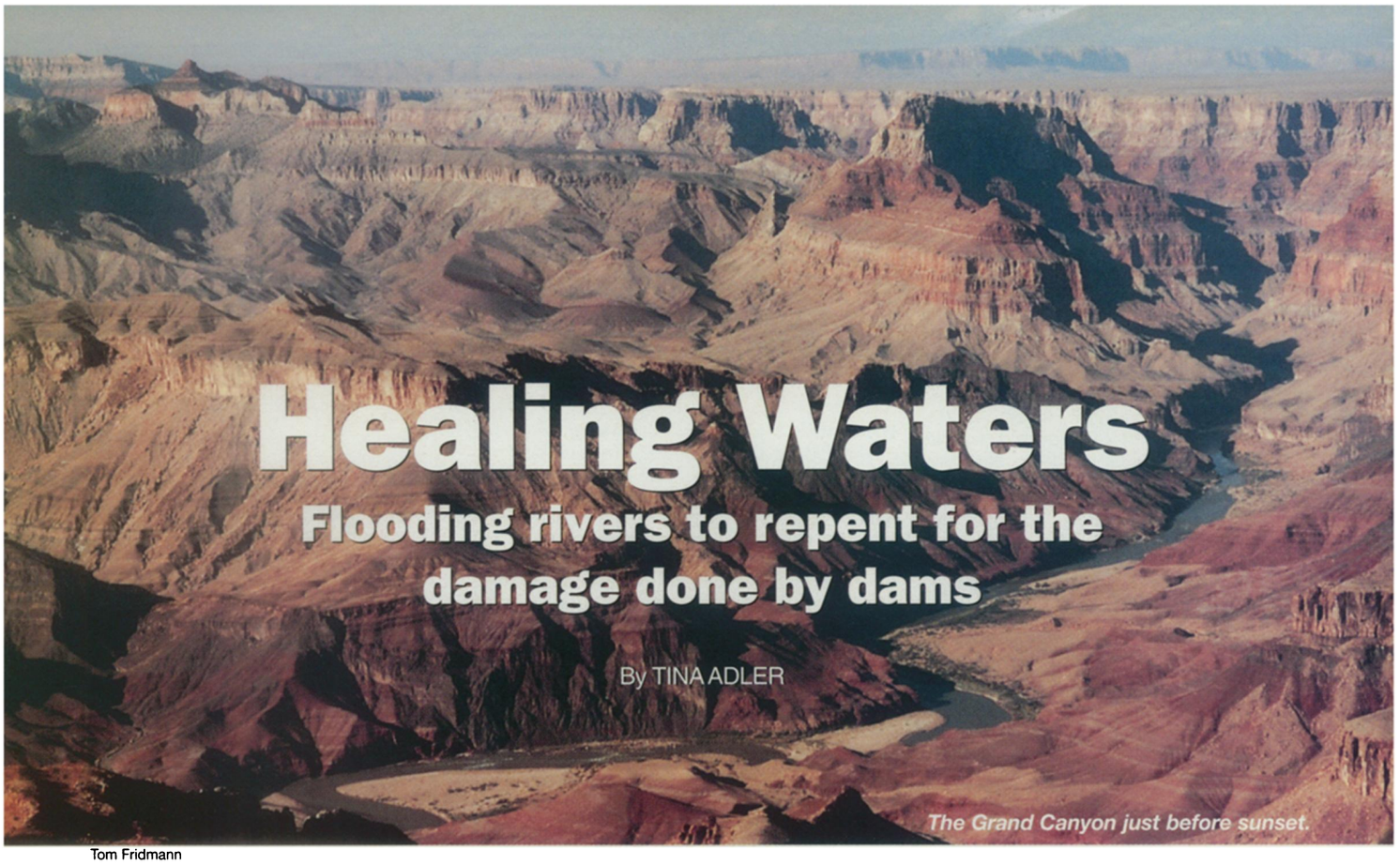


Healing Waters

Flooding rivers to repent for the damage done by dams

By TINA ADLER

The Grand Canyon just before sunset.

Tom Fridmann

If Noah had been hanging around the Grand Canyon at the end of March, he'd probably have thought he was having one distorted flashback.

He would have seen Department of the Interior Secretary Bruce Babbitt push a button controlling the Glen Canyon Dam and let loose a huge flood of the Colorado River below. As in the Bible story, much preparation preceded the deluge. More than a hundred investigators who had received word of the coming torrent moved some endangered animals to higher ground and set up about 30 projects to study the effects of the flooding.

Babbitt and his crew didn't plan this flood to punish anyone. Instead, they wanted to restore the river to at least a shadow of its former self, before the dam was constructed in 1963. They hoped to improve certain features of the river, such as sandbars, that benefit both native fish species and human campers.

This marked the first time that dam managers have used a large flood to renew the health of a river ecosystem, they say.

The flood began gradually, then flowed at 45,000 cubic feet per second (cfs) for a week. A flood that big hadn't hit the Grand Canyon since a natural deluge in the mid-1980s. Before the dam was built, floods averaging 125,000 cfs occurred annually. In recent years, 12,000 cfs of water would normally travel over the dam during late March.

Huge water flows alter a river's ecology by scouring out backwater lagoons, washing away the banks' vegetation, and moving sand from the bottom toward the shore to create sandbars. New lagoons form behind these sandbars. Ecologists liken the services that floods provide rivers to the benefits that fires offer forests.

Today, most big rivers in the United States are controlled by dams, which floods rarely overpower. As part of its recent efforts to make up for ecosystem changes that have resulted from the lack of flooding, the Interior Department's Bureau of Reclamation decided to go along with scientists' requests to run a trial flood in the Grand Canyon.

Final reports from the researchers who monitored the effects of this $1.5 million flood are due out at the end of the year. A couple of weeks after the event, Interior Department staff were describing it as a resounding success, but scientists who collected data on the river this summer are providing mixed reviews.

High on the project organizers' list of goals for this torrent was creating better conditions for the beleaguered native fish. Only five native species remain of the eight that graced this stretch of the Colorado River before the dam began operation, explains ecologist Richard A. Valdez of Bio/West, an environmental consulting firm in Logan, Utah. Of those five, the humpback chub and razorback sucker are endangered.

Before construction of the dam, the Colorado River ran hot and cold through the Grand Canyon, reaching highs of almost 90°F in the summer and dropping to almost freezing in the winter. Now, 45°F water from the bottom of Lake Powell gets pumped into the river at the dam, so the temperature rarely exceeds 60°F.

The native fish, however, need a warmer environment for spawning and for their young to develop. They still reproduce in tributaries, which are warmer than the river, but there they must endure cramped quarters and an occasional flash flood, Valdez explains. Moreover, the young often die of cold when they leave the tributaries to enter the Colorado.

Since the dam began operation, the fish have had fewer nurseries—the warm lagoons where the young mature before competing with the adults in the river. Without flooding, few new lagoons had developed, and established ones had become overgrown with vegetation.

This year's artificial flood created at least 55 new sandbars, the Interior Department announced at the end of May. More than half of the existing sandbars grew bigger, and only 10 percent lost sediment. It's difficult, however, to predict how long any of them will last.

"Sandbars are relatively ephemeral," explains Edmund D. Andrews of the U.S. Geological Survey in Boulder, Colo. They can erode in a few days to a few years.

Some nurseries will form behind the new and the improved sandbars as the

river gradually scours out the channel between the shore and the sandbar, predicts Lawrence E. Stevens, a river ecologist with Applied Technology Associates who works as a consultant to the Bureau of Reclamation's Glen Canyon Environmental Studies program in Flagstaff, Ariz.

Because of its modest size, the flood proved less successful at carving out lagoons than at creating sandbars, at least in the near term. "With this flow, it doesn't look like backwater habitats did all that great," asserts geologist Matt Kaplinski of Northern Arizona University in Flagstaff.

"Rejuvenation of backwaters? Some happened, but not as much as we would have liked to have seen," agrees Stevens. Only four of the several hundred along the flooded stretch improved dramatically. Others filled in with sediment or remained unchanged. Overall, he says, "we may have gained a little bit in backwater."

Besides water temperature and lack of nurseries, the native fish have another big problem: their nonnative neighbors, which eat them, their food, and their eggs; carry parasites and diseases; and compete with them for the river's prime habitat. The greatest threats include the channel catfish, fathead minnow, common carp, mosquito fish, brown trout, and rainbow trout, says Valdez. Most of the trout come from tributaries, where they were stocked in the 1940s, says David L. Wegner, a fisheries biologist and program manager of the Glen Canyon program.

Researchers had hoped that the flood might flush some of the nonnative fish into Lake Mead, about 300 miles below the dam, Valdez says. Most of the nonnatives had evolved in slow-moving waterways, so researchers expected them to be unprepared for huge rushes of water.

During the flooding, the natives either took to the tributaries or to eddies in the river. The centers of these swirling waters remain fairly quiet and trap an abundance of insects and plant matter on which the fish dine.

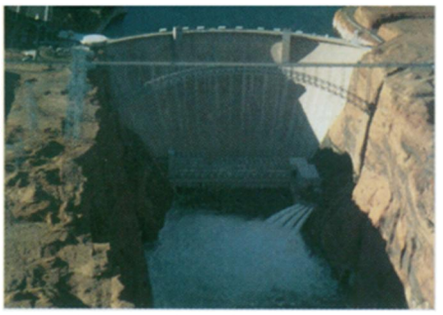
Unexpectedly, most of the nonnatives also survived the March torrent—by hiding in the shoreline vegetation, which a bigger flood would have destroyed, he notes.

Larger, naturally occurring floods, including one in 1984 in the Colorado River above Lake Powell, have knocked down the nonnative populations, Valdez says. The 1984 Colorado flow carried twice the water of this year's event.

Staging a flood that big "would be politically difficult to do and maybe structurally too," Valdez warns. The flood might damage the dam walls. Also, it would probably prove unpopular with people who benefit from the water and the electricity the dam generates; the upper basin states would have to agree to give the lower basin states the water.

"Out here [people say], 'You can have my beer and my wife, but not my water,'" Valdez jokes.

Glen Gantz



An aerial view of the Glen Canyon Dam on the Colorado River during the flood.

The artificial flood ripped out or buried much of the shoreline vegetation that had grown up since the last big flow. Such destruction provided campgrounds for tourists and returned the shore closer to its pre-dam state. The loss of vegetation, however, worried some scientists, including Stevens.

Two of the waterway's endangered terrestrial natives, a snail and a bird, live near the river's edge. They have both come to rely on vegetation that spread down to the river after the end of the regular floods, explains Stevens.

The kenab ambersnail traditionally lived higher up on the banks and consumed both bacteria living on the crimson monkeyflower and decayed parts of its leaves, flowers, and stems. The dam's control of flooding allowed that native plant, and thus the snails, to move closer to the river's edge. The snails have also developed a taste for watercress, a nonnative plant flourishing along the banks, thanks to the dam, Stevens says.

To protect the snail population, he and his coworkers moved 1,300 of the approximately 3,100 creatures to a higher elevation. The flood, as expected, washed away those left behind, as well as the plants. However, the fecund survivors are doing a good job of boosting the depleted population. Much of the monkeyflower and watercress has also returned, and the snails are beginning to move back towards shore, Stevens finds.

In the course of their flood-related research, he and his colleagues unraveled a mystery. By observing the snails, they discovered the perpetrator of mass ambersnail murders that have occurred twice in the past few years. Mice, they learned, enjoy an occasional feast of escargot. "They hammer the [population of] snails pretty hard," Stevens says.

The endangered bird, a type of flycatcher, has also come to rely on a nonnative species—salt cedar trees—that thrives along the river. The few flycatchers that remain in the Grand Canyon nest in these trees, feeding on the insects that live among their branches and in the marshes. These birds survived the flood without human intervention. Their nesting sites remain intact, and enough vegetation persists that they have plenty to eat, Stevens reports.

Because of the successes of this large Colorado River flood, scientists hope to repeat it in 5 to 10 years.

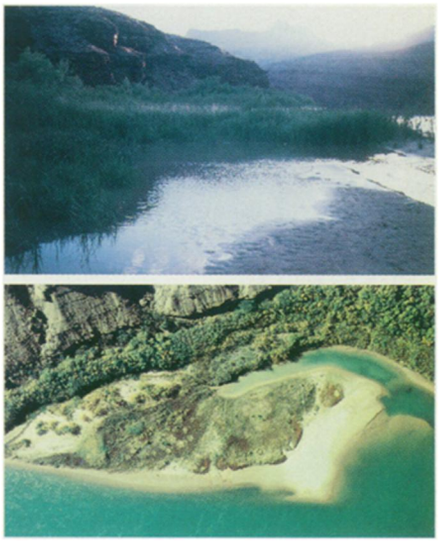
Owners and managers of power systems are discussing plans for restoration floods in the Columbia River basin in the Pacific Northwest and in the Missouri River basin, says Wegner. Government officials and others in Japan and Turkey have talked to him about organizing such floods in their countries, he reports.

Initiating any large torrent inevitably involves many people and a lot of land, water, electricity, and money, say participants in the Grand Canyon project. Moreover, each river has different needs and obstacles. Designing the studies for this recent flood and getting the approval of all the groups took about 10 years, says Wegner.

Restoration floods may not become a trend, Valdez suspects. However, river managers are experimenting with other techniques to make the dams more environmentally friendly. For example, at Glen Canyon they are considering pumping warmer water from Lake Mead into the river to help the native fish. They must first determine whether such a move benefits the natives more than the nonnatives, he adds.

Mark Schaefer, deputy assistant secretary for water and science with the Department of Interior, says, "In general, most people [at the Bureau of Reclamation] feel that we can do more to try to run some of our river systems more naturally." □

Stevens



Quiet backwaters in the Grand Canyon, such as the marshes near Cardenas Creek (top) and behind the sandbar at Kwagunt Creek (bottom), formed before the restoration flood—but there were not enough to keep the native fish safe.