Model analysis helps protect river's ecosystem

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The Grand Canyon will be experiencing a spring of yesteryear, as water flow rates from the Glen Canyon Dam will be significantly increased, then throttled back in a high-flow experiment that runs March 4 through 9. The result will be a controlled swelling of downstream canyon waters.

The goal of the high-flow experiment, the third since 1996, is to see if such high flows can help reconstruct some of the canyon's beaches and sand bars that are instrumental to ecological systems and native fishes that have suffered since the building of the Glen Canyon Dam in 1963.

For Mark Schmeeckle, an ASU assistant professor in the School of

Geographical Sciences who studies the physics of river flow and turbulence, the exercise will help fine tune three-dimensional computer models that predict how sand bars are rebuilt as a result of water flows through the canyon. Such models can help protect the fragile environments downstream of the dam.

Schmeeckle said data collected before, during and after the flow, including those on topography, flow and sediment transport, will be compared to the 3-D modeling data in an effort to verify the accuracy of the models. He also is working on a model for failure of beach faces after the high-flow event, which will be useful in determining the effect of discharge fluctuations from the dam on beach erosion. Three-dimensional visualization of the modeled data at ASU's Decision Theater has aided in developing a new understanding of complex flow in recirculation regions where sand bars are built.

The high flow experiment run for about 60 hours beginning on the evening of March 4. The flood will peak on March 6 to 8 and begin to fall on March 9.

The Glen Canyon Dam stops all sand. As a result the sand that once flowed through the canyon has been reduced to about 6 percent of what it was prior to construction of the dam. Today, only the Paria and Little Colorado Rivers supply significant amounts of sand downstream of the Glen Canyon Dam.

As a result, native fishes and wildlife have teetered on the brink of extinction. Especially vulnerable is the humpback chub, an endangered, 3.5-million year old fish that has seen its habitat nearly destroyed. Reconstructing, or at least managing the environment that these fishes can survive in has become important to environmentalists and engineers alike, making this experiment significant for the future of the ecology of the Grand Canyon and its wildlife.

By allowing flow of water that, at its peak, will be more than three times its normal rate (to a volume of 41,500 cubic feet per second), researchers hope to flush some of the dam system of its backed-up sediment and reconstruct habitat downstream. It is expected that the high water-flows will rebuild eroded beaches downstream of the dam by moving sand accumulated in the riverbed onto sandbars.

That in turn will allow the re-establishment of eddy sandbars that provide the slow moving, backwater channels vital for native fish species. The sand bars also provide camping areas for river runners and hikers, and the beaches provide sand to the canyon that helps preserve archaeological resources.

Schmeeckle's is one of several experiments that will be run during the high flow period.

"The importance of this experiment is that we will have high-resolution data on the flow and sediment transport in a recirculation eddy during a beach building event," Schmeeckle said. "With the data we will be able to test and improve our model to the point where we can make accurate predictions of beach deposition."

"This predictive capability could lead to dam operations that allow for a sustainable sand beach habitat and recreation sites in the Grand Canyon," Schmeeckle added.

Source: ASU