on are in short supply. The flood recreated those habitats, in particular near the inflow of the Little Colorado River, where the largest population of the fish is found. "In one place where there was no sand whatsoever, there is now a great wide beach with a backwater that can be used by humpback chub," reports Larry Stevens, an ecologist with the Bureau of Reclamation's Glen Canyon Environmental Studies Office.

Even if the flood turns out to be a boon to the humpback chub—not to mention to boaters who camp on the Colorado's beaches—there's the question of how long these rejuvenated habitats will last, says Dave Wegner, program manager at the environmental studies office. "How stable are [the beaches]? Do we need to do this every five or every 10 years?" To answer that question he and his colleagues will spend the next 8 months closely monitoring physical and biological changes along the flood route.

Ecologists are hoping that the rebuilt beaches will last, because it won't be possible to turn the floodwaters back on anytime they're needed. For one thing, in the complex world of ecosystem management, what benefits one species can harm another. Take the endangered Kanab amber snail, which slimes along cardinal monkey-flowers and watercress at Vesey's Paradise, 75 kilometers from the dam. The population, one of only two known, was threatened by rising flood waters, so the U.S. Fish and Wildlife Service (FWS) devised a plan to lessen the flood's impact. Four biologists spent days roped to the canyon wall, moving 1300 snails up above the inundation zone. "Picking snails is kind of like picking blueberries. You find good patches and pick a lot of them pretty quick," says Stevens. Next time a flood is needed to rebuild the chub's habitat, however, the snail could stand in the way. Before the Colorado is allowed to flood again, FWS has stipulated that a third population of snails either be found or established, says Vicky Meretsky, an FWS biologist.

What's more, water allowed to rush downstream means lost revenue from the dam's electric dynamos—$1.5 million over the 7 days of the flood, says Tony Morton, an environmental specialist with the Western Area Power Administration, which helps manage dam operation. Still, says Morton, the cost would be acceptable if a flood were staged only every 7 to 10 years.

Even if the Colorado isn't unleashed again any time soon, the flood of results could have ripple effects elsewhere, says Wegner: "The results will be applied not only to Glen Canyon, but potentially to every other dam that controls water releases downstream"—which means dams on every major river system in the United States.

–Bernice Wuethrich

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UNDERGRADUATE EDUCATION

Report Urges NSF to Promote Teaching

It's not easy to change a system 50 years in the making, admits Melvin George, former president of St. Olaf (Minnesota) College. But as chair of an advisory panel that will deliver its recommendations next month to the National Science Foundation (NSF), George hopes the group's proposals will start a revolution in undergraduate education. The panel believes NSF has helped contribute to an imbalance between research and teaching on most college campuses by promoting specialized research careers. What's needed, it says, is for NSF to tell scientists that what they do in the classroom is as important as what they do in the lab.

The committee, which has been deliberating for more than a year, undertook its study at the request of NSF's education chief, Luther Williams.* To bring about the change, the draft report recommends that universities revise their approach to teaching to address the needs of all students. For example, it suggests that departments should set goals for what their students should learn, hold faculty members accountable for students' performance, change the academic reward system to incorporate good teaching, and give science faculty members a bigger role in training kindergarten through grade 12 (K-12) teachers. To achieve these goals, says the report, NSF will need to double its $180 million budget for undergraduate education. But even more important, says George, is a greater commitment to educating students.

"NSF was part of the problem, and so it has an obligation to be part of the solution," says George, who summarized his group's finding earlier this month at a meeting of the advisory committee to NSF's Education and Human Resources directorate.

The "problem" to which George refers is the government's decision after World War II to have universities carry out the bulk of the nation's basic research. That decision has fostered a network of more than 100 research-intensive universities—NSF's primary customers—that is the envy of the world. But George and other advocates of reform point out that 65% of all undergraduates, including some who will become the nation's primary- and secondary-school teachers, attend schools that don't even receive NSF research funds. This has created a system that—according to Harvard University historian of science Gerald Holton—leaves students "homeless" in a world of growing technical complexity.

The panel wants NSF to redress this imbalance by shifting more of its resources into undergraduate programs that focus on teaching. The current lineup grew out of the recommendations of a review in 1986, which focused on how NSF could help science majors. Advisory board members who attended the briefing endorsed the panel's approach. In fact, they suggested several changes to broaden its scope: Integrate the report with the new national K-12 science education standards, address the importance of curriculum reform, acknowledge an increasingly diverse student body on campus, and encourage dissemination of good teaching models. But panelist David Sanchez, vice chancellor for academic affairs at Texas A&M University, believes that these technical issues are not as important as changing how individual departments feel about undergraduate instruction.

"When I meet with departments and ask them, 'What do you expect from your students?' they talk about what students need to know to continue in the field," says Sanchez, a former head of NSF's math and physical sciences directorate. "But I say, 'No, I'm talking about the majority of your students, the ones taking only one science course but who may want to be teachers.' "

NSF's Williams says he appreciates the panel's broad analysis but warns that NSF's ability to bring about change is limited. "The problem, fundamentally, is that a system created to serve 10% of the population is now being asked to serve everybody," he says. "We can be a catalyst, but we're only one of many voices in a national debate." Even so, George and his panel hope the agency will sing out loud and clear: "If NSF sends a message that teaching is important," he says, "universities will start to change their behavior."

–Jeffrey Mervis

NSF'S UNDERGRADUATE PROGRAMS
(FY '95 Budget in Millions)

Instruction-oriented activities	
Teacher preparation	$23.2
Support for minority institutions	$22.1
Instrumentation, lab development	$19.7
Advanced technological education	$18.0
Curriculum development	$17.1
Faculty enhancement	$7.1
Research-oriented activities	
Research experiences for undergraduates	$27.8
Research at undergraduate institutions	$25.0
Support for minority institutions	$20.8

SOURCE: NSF

* "Shaping the Future: New Expectations for Undergraduate Education in Science, Mathematics, Engineering, and Technology."