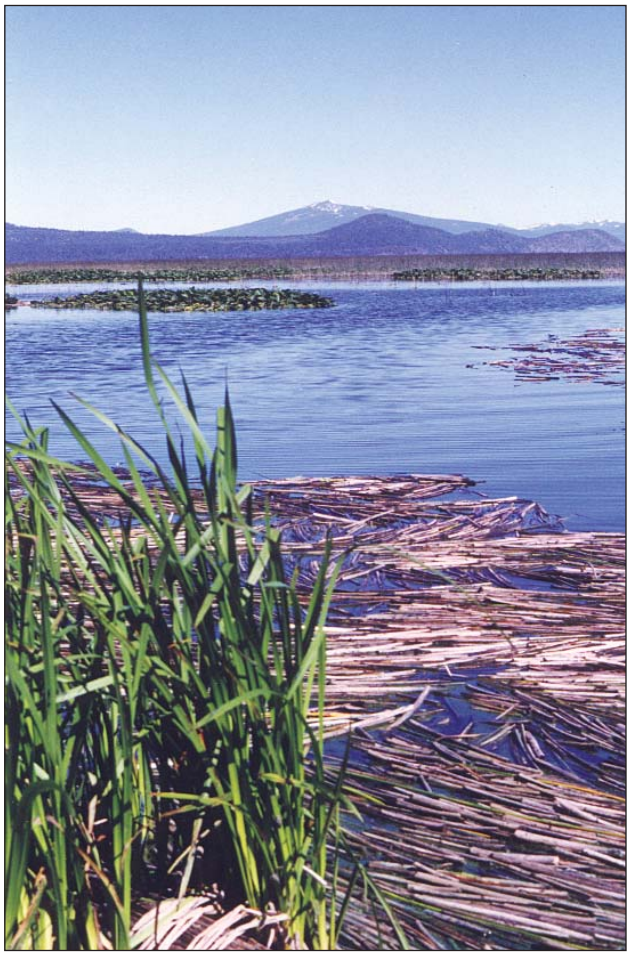
Biologists charged with protecting endangered species are caught in a battle over water rights; a critical National Academy of Sciences report has exposed them to heavy fire

'Combat Biology' on the Klamath

KLAMATH FALLS, OREGON—As a cold February night settles in, Rip Shively wades into the icy waters of Upper Klamath Lake near the Oregon-California border and hauls ashore a squirming, meter-long fish. The fish, netted as it prepared to spawn, is an endangered male Lost River sucker. Shively, a fisheries biologist at the U.S. Geological Survey (USGS), scans the fish with a wand. Similar tests on about a dozen earlier catches produced no response, but this time the wand beeps, indicating that the fish had been caught previously and tagged. Based on its size, Shively judges the sucker to be more than 15 years old, and from the tag's location on the fish's back, he surmises that it was tagged in 1995. That means it lived through three massive fish die-offs that hit the lake in 1995, 1996, and 1997. "She's beautiful," he says. "A real survivor."

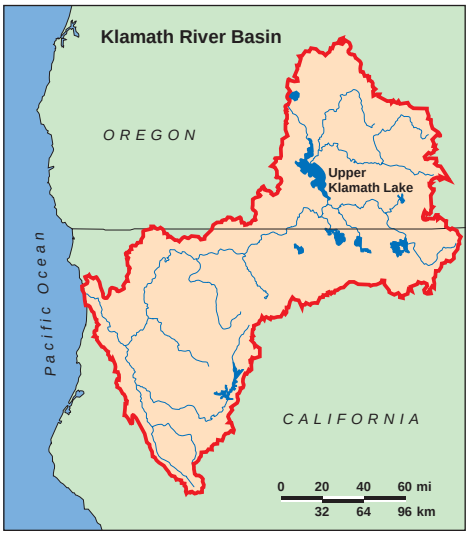
Shively and colleagues at USGS and other government agencies, universities, and Indian tribes are racing to study the suckers and endangered coho salmon that swim the Klamath River below the lake. Their work guides federal plans to prevent the fishes' extinction. Federal wildlife managers used the scientists' preliminary research to recommend limiting the withdrawal of irrigation water from the lake in 2001 to minimize the impact of a regional drought on the endangered fish. But a report issued last year by the National Academy of Sciences (NAS) has cast a cloud over much of the fisheries research in the Klamath Basin. The report concluded that there was "no sound scientific basis" to justify turning off the irrigation spigot from the lake to farmers dependent on its water for crops.



Troubled waters. Long the source of conflict between fishers and farmers, the Klamath Basin is now spawning scientific controversy.

The report's conclusion sparked an outcry in this small farming community that federal agencies are supporting "junk science," and it bolstered calls for reforming or scrapping the Endangered Species Act (ESA). But over the past year, it has also sparked another, more muted outcry, this one among fisheries biologists. They contend that the report's analyses were simplistic, its conclusions overdrawn, and—perhaps worst of all—that the report has undermined the credibility of much of the science being done in the region if not fueled an outright anti-science sentiment.

"The opinions of [NAS's National Research Council] committee pretty much run counter to [those of] all the people who work in the region," claims Mike Rode, a fisheries biologist at the California Department of Fish and Game (DFG) in Mount Shasta, California. "It was very offensive to many folks here," adds Larry Dunsmoor, a research biologist working for the Klamath Tribes in Chiloquin, Oregon, who has studied the endangered suckers for the last 15 years. "It has been a very painful thing to see everything we have worked for over the past decade [described] as useless."



Biologists here are caught in a classic western water fight, one that pits two of the region's major occupations—farming and fishing—against each other. At stake is the future not just of the suckers but of the salmon downstream—and the needs of the two fish populations are sometimes also in conflict. Instead of defusing these tensions, the biologists say the report has only made matters worse, ratcheting up an already hostile environment for many of the researchers working in the area. "Some people refer to it as combat biology," says Ron Larson, a fisheries biologist at the U.S. Fish and Wildlife Service (USFWS) in Klamath Falls. "It's perhaps an exaggeration. But not by much," he says.

Now all sides are girding for another major battle, and not just over the academy's final report, which is due out this summer. As of late March, the region's snowpack was a little over half the normal level. Because

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snow feeds the region's streams through typically dry summers, this year is shaping up to be nearly as parched as 2001. This month, the U.S. Department of Reclamation is expected to make its call on how dry a summer it foresees and therefore how much lake water it expects to release for irrigation. Court rulings expected this spring could tighten water supplies further if judges rule that additional water must be kept in area lakes and rivers to protect endangered fish.

How these events play out could set a new precedent for how much scientific proof is needed to take action to protect endangered wildlife. The ongoing NAS review of Klamath Basin water distribution evaluates whether wildlife managers have solid evidence that the actions they take will benefit species. This standard, some researchers say, is almost impossible to apply universally and could derail other protection efforts.

Historic battles

A quiet, high desert landscape of sagebrush and juniper, the Klamath Basin seems dominated more by solitude than acrimony. The upper basin sits on the eastern flank of Oregon's southern Cascade Mountains and is one of North America's busiest way stations for migrating waterfowl. Before the arrival of the first white settlers in the 1820s, the basin was home to members of the Klamath, Modoc, and Snake Indians. A treaty with the U.S. government in 1864 guaranteed those tribes—by then collectively referred to as the Klamath Indians—abundant fish stocks in perpetuity. But those stocks were soon to face pressures they'd never seen before.

In 1902, Congress passed the Reclamation Act in an effort to promote settlement in the arid west. One of the effort's first undertakings was the Klamath Irrigation Project to support the establishment of farms in the basin. Its target was water flowing in and around Upper Klamath Lake, 32 kilometers long but, with an average winter depth of just 3 meters, practically a pond. Homesteaders diked and drained 16,000 hectares of marshland along the lake's northern reach. To the south, an 830-km network of canals carried lake water to hundreds of farms. Seven dams were added to lakes and streams in the region to provide additional irrigation water. In 2001, the Klamath Irrigation Project encompassed 97,000 hectares of irrigable land. In addition to the farms, water from the lake also feeds a series of wildlife refuges.

In a typical year, about 62,000 hectare-meters (500,000 acre-feet) of water is diverted from Upper Klamath Lake and surrounding waterways to irrigate nearby farms. Additional water is diverted from upstream tributaries before it reaches the lake. By the mid-1980s, the lake's fish had begun to show the stress of the annual drawdowns in water and the altered habitat. Phosphorus-rich runoff from farms and ranches prompted massive algal blooms every summer, turning the lake into a vast cauldron of pea soup. The blooms triggered wild swings in the lake's acidity level and dangerous drops in the amount of oxygen dissolved in the water.

These factors, together with chronic overfishing, caused a steady decline in the lake's two populations of suckers, the shortnose and Lost River suckers. By 1988, both species were on the endangered species list. The Klamath River coho salmon was listed as threatened in 1997. The listings required USFWS and the National Marine Fisheries Service (NMFS) to come up with recovery plans—known as biological opinions, or "BiOps"—for the fish and specify how much irrigation water the Bureau of Reclamation was allowed to divert to Klamath Irrigation Project farmers.

In its April 2001 BiOp for the suckers, USFWS biologists stated that, for the safety of the fish, the lake should not be drained below 4140 feet (1262 meters) above sea level, just below its historic level. Meanwhile, NMFS's opinion for the oceangoing coho salmon stated that the flow of water in the lower Klamath River had to stay above a minimum of 1000 cubic feet (28 cubic meters) per second.

In decline. Poor water conditions continue to threaten the coho salmon (*above*) and shortnose sucker (*left*).

CREDIT: (LEFT TO RIGHT) ROLLIE WHITE/U.S. FISH AND WILDLIFE SERVICE; WILLIAM LEONARD

But 2001 was a bad year for water. That winter, the Cascades tallied less than half the usual snowpack. Managers at the Bureau of Reclamation were in a bind. With so little water in the system and the need to fulfill the NMFS and USFWS recommendations, they announced in April that there would be no water diversions for irrigation. The head gates of the Klamath Irrigation Project were locked.

Farmers and many others in the surrounding community revolted. That summer, they staged continual demonstrations at the head gates calling for water to be released, and they even forced open the head gates briefly in an act of defiance. Angry signs sprouted throughout the community: "Some sucker stole my water," read one common refrain. A notice at a local restaurant stated that U.S. government employees were not welcome. Hoping to stay out of the line of fire, USFWS and USGS biologists went so far as to remove the government license plates from their vehicles, a practice some still follow today.

In October 2001, after much of the fervor had died down, Interior Department Secretary Gale Norton asked NAS to determine whether the water cutoff was scientifically justified. The academy's scientific arm, the National Research Council (NRC), hastily organized a 12-member panel made up primarily of academic fisheries biologists and led by William M. Lewis Jr. of the University of Colorado, Boulder. The panel was given a deadline of 3 months to turn in a preliminary report, which was published in draft form in February 2002. The final version of the interim report appeared that September.

The NRC panel concluded that most of the recommendations in the USFWS and NMFS biological opinions were scientifically justified. But it balked at the two most important ones: the minimum water level for Upper Klamath Lake and the downstream flow for the coho. "A substantial data-collection and analytical effort by multiple agencies, tribes, and other parties has not shown a clear connection between water levels in Upper Klamath Lake and conditions that are adverse to the welfare of the suckers," the report said. As a result, "there is presently no sound scientific basis" for the mandated lake levels. As for the coho, it

added that there was equally little justification for increased minimum water flows down the main stem of the Klamath River.

Opponents of the BiOps seized on the panel's conclusions. "A handful of U.S. Fish and Wildlife Service bureaucrats withheld desperately needed water from farmers in the Klamath Basin last summer. Now we find out that that decision was based on sloppy science and apparent guesswork. … This latest travesty in the enforcement of the Endangered Species Act should be one more nail in the coffin of that broken law," said Representative James Hansen (R–UT), chair of the House Committee on Resources.

Congressional representatives and farmers weren't the only ones to draw on NRC's conclusions. In February 2002, the Bureau of Reclamation came out with a revised management plan for the Klamath Irrigation Project designed to govern operations for 10 years. The bureau recommended dropping summer water flows in the Klamath River below NMFS's recommended 1000 cubic feet per second to provide extra water for irrigation.

After studying the proposal, NMFS biologists concluded that the bureau's plan was inadequate to protect the coho and recommended bringing the flows back up. In the end, the agencies settled on dropping summertime flows to as little as half the minimum recommended in the 2001 BiOp. The bureau's plan would eventually restore the flows by establishing a "water bank" and taking land out of production: The bureau would "lease" water from Klamath Irrigation Project farmers, paying to keep it in the lake and streams rather than diverting it for irrigation. (Last month, the Bureau of Reclamation announced that it would spend $4 million this year on water leases, which it estimates will idle 5000 hectares of farmland during the summer.)

But fish-friendly critics cried foul, pointing out that flows would drop immediately and that the plan would restore full minimum flows only after 9 years. As if on cue, 33,000 fish went belly-up in the lower Klamath River in September 2002—reportedly the largest fish kill in North American history. Most of the fish were Chinook, although some were endangered coho and oceangoing steelhead trout. According to a preliminary report from DFG, the fish died when low water levels forced spawners into cramped quarters, spreading naturally occurring infections. If true, it would seem to validate recommendations in NMFS's 2001 BiOp. But some have questioned DFG's objectivity, saying that its scientists blamed federal policy for the fish die-off before their study was even begun. The NRC panel is now reviewing the causes and will include its findings in its final report.

After the fish kill, it was the environmentalists and fishers who went on the offensive against biologists for caving in to the Bureau of Reclamation. "The current federal water plan ignores science and instead relies on guesswork, wishful thinking, and voluntary measures," said Glen Spain of the Pacific Coast Federation of Fishermen's Associations in Eugene, Oregon. "This is a water plan for killing fish. Why should farmers have all the water they need while coastal fishing-dependent communities and fishing families wind up with dead fish and dry rivers?"

Cause and effect? California state biologists blame last year's record fish kill on natural infections magnified by low water levels in the Klamath River.

In late September 2002, a coalition of fisheries groups, environmental organizations, and Representative Mike Thompson (D–CA) filed suit, seeking an injunction against the NMFS BiOp that accepted reduced flows for 9 years and asking a judge to require higher summer water flows in the lower Klamath. A hearing is scheduled for 29 April.

Bureau of Reclamation spokesperson Jeff McCracken defends his agency's handling of the water distribution plan. He says the bureau took its lead from the NRC report, which he calls "the best available science."

The best science?

But many fisheries biologists in the Klamath Basin disagree. "To see [the NRC report] held up as some great science proving the ESA has run amok hit us the wrong way," says Douglas Markle, a fisheries biologist at Oregon State University (OSU) in Corvallis, who co-wrote an extended critique of the NRC interim report in the March 2003 issue of *Fisheries*.

For Upper Klamath Lake, the NRC panel found that poor water quality conditions that are harmful to fish do not coincide with years with low water levels. And the best years for young fish aren't clearly associated with high water levels. As a result, panel scientists concluded that there was no clear link between lake levels and the health of fish. For the Klamath River, they found that water added in dry years to bolster flows was small "and probably insignificant." It could even make matters worse, because sun-warmed lake water might harm cold-water coho.

Few biologists claim that there is an iron-clad case that higher water levels in the lake and river will always help the fish. The 2001 USFWS BiOp, they point out, didn't argue that low lake levels are always associated with poor water quality, rather that higher lake levels carry numerous benefits to water quality and fish habitat. But the NRC panel, critics charge, didn't look beyond the lack of a clear link between water levels and fish health for indications that—all other factors being equal—the fish would do better with higher water levels. The panel "pursued an unnecessarily simple view of a complex ecosystem which, combined with several clear errors in their assessment of existing data, led them to a flawed conclusion," wrote the Klamath Tribes' Dunsmoor and Jacob Kann, an aquatic ecologist at Aquatic Ecosystem Sciences in Ashland, Oregon, in another detailed critique sent to the NRC committee last year.

Markle and others contend that numerous examples show the importance of taking a more complex view of the Klamath ecosystem. In the summers of 1995, 1996, and 1997, for instance, lake levels were intermediate or high compared with the rest of the 1990s; nevertheless, the 3 years saw successive fish kills. Algae in the lake experienced massive blooms and crashes, causing swings in pH and depleting oxygen, which can kill fish or make them more susceptible to infection.

The NRC panel noted that "… lake level fails to show any quantifiable association with extremes of dissolved oxygen or pH." But Dunsmoor and Kann argue that the panel overlooked another important factor: wind. It aerates and mixes the water, driving much of the algae below the level of light penetration

CREDIT: ELIZABETH J. FINNEY

and reducing their growth rate. Without the wind, as in the relatively calm summers of 1995 to 1997, the water stagnates, the algae explode, and water quality plummets. Wind of course can't be predicted. But higher water levels, they argue, can soften the blow by diluting nutrients to slow the algae bloom.

In 1991 something of the reverse happened. The population of young suckers boomed, despite a lake level at its lowest since 1950. But Markle and Cooperman note that in June, one of the most important months for the emergent fish fry, the lake level was fairly high and dropped considerably only in October. As well, the OSU authors point out that 1991 was a cool, windy year, which forestalled the algae bloom and led to relatively good water quality. That information was ignored by the NRC panel, say Dunsmoor and Kann.

In a rebuttal to the Markle and Cooperman article in the same issue of *Fisheries*, NRC panel chair Lewis fires back that "variations of weather conditions from year to year do seem to underlie variations in mass mortality of adult suckers from year to year, but there is no hint of any connection with water level." And even though the notion that a higher water level could benefit the lake fish is a plausible theory and potential justification for keeping more water in the lake, he points out that it's a decision based not on scientific evidence but on professional judgment. The panel, he noted, "unanimously reached several strong conclusions because it was confident that the evidence presented to it supported those conclusions."

The scientific brawling isn't limited to the suckers. Critics charge the committee with oversimplifying matters with regard to river-based coho as well. The NMFS 2001 BiOp recommended releasing additional water from Upper Klamath Lake in the summer months, in part to increase the amount of habitat available to the juvenile coho before they migrate to the ocean. But the NRC panel concluded that additional water sent down the main stem of the Klamath River would likely have little impact on the tributaries where the coho linger.

The panel concluded that coho use the main stem of the river chiefly to migrate to and from the ocean. But DFG's Rode points out that some of the fish feed in the main stem for part of the day and return to the cooler tributaries while building strength for their migration. Excess water—and the habitat improvement it would bring—is of critical importance to the young fish, he says. Proponents of low river flows have used the NRC report to "try to use science to justify the low flows," Rode says.

Lewis responds that the NRC panel's job was simply to see whether flow rates were justified by documented science. "That doesn't preclude the agencies from recommending [higher flow rates] anyway," he says.

Asking too much?

Perhaps the most fundamental objection to the NRC's interim report is that the panel was asked the wrong question. The committee's charge, settled upon after negotiations with its sponsors, the Departments of Interior and Commerce, was to determine whether there was scientific proof that the policies embraced by USFWS and NMFS would accomplish what they set out to do. But critics note that this isn't the standard set for the wildlife agencies. In carrying out the ESA, USFWS and NMFS are charged with using the best available science to protect the species. Where the science is questionable, they are supposed to err on the side of conservation to protect species already on the brink. In some cases, that means taking steps to preserve habitat or living conditions even if the steps haven't been proven to work.

Farmers, Markle points out, can tell you precisely how they will use a given volume of water and its value for their crops. "But with fish data, there is no certainty of the benefit you get from an added acre-foot of water or the cost of removing it," he says. By asking for scientific proof that those actions would benefit fish, the NRC panel was setting the bar too high, he says.

The trouble, adds Dunsmoor, is that the NRC report has put pressure on agencies to mandate only those recovery actions that are scientifically well established. In essence, Dunsmoor says, that puts the burden of proof on the conservation agency to show that particular management actions will help the fish: "It's a paradigm shift. It would reset how these decisions are made." To prove that a particular action will have consequences, agencies would be forced to wait until they see that harm is done by not carrying out the action, which some would say is exactly what happened with the fish kill in the lower Klamath. "All conservation goes out the window if you have to wait for fish to die to say there is an effect," Dunsmoor says.

In his *Fisheries* rebuttal, Lewis readily agrees that the NRC panel's purpose was different from that of the agencies. But he writes, "Where the economic stakes are high … it is useful for all parties to recognize which components of Biological Opinions are indeed scientifically solid and which are to varying degrees based on informed speculation."

Raising the bar on how much proof wildlife agencies must have before they take action would doom long-term restoration efforts, says Mark Buettner, a fisheries biologist at the Bureau of Reclamation. One example, he says, is the ongoing effort to prevent phosphorus-rich farm and ranch runoff from reaching Upper Klamath Lake. Even if vast strides are made in reducing the amount of phosphorus that reaches the lake, such an effort may not have an impact on water quality for years or decades to come. That's because the lake's muddy bottom is chock-full of phosphorus and other nutrients that leach back into the water, Buettner points out. If wildlife agencies were required to show a rapid effect of their actions, reducing nutrient inflows—which virtually all fisheries experts agree is important—would never get off the ground.

In protest. Many farmers say federal wildlife officials based their decision to cut off irrigation water in 2001 on "junk science."

CREDIT: RON WINN/HERALD AND NEWS/AP

It may take decades of research to demonstrate any link between lake level and the health of the endangered fish. But many researchers worry that public reaction to the NRC interim report could undermine the research efforts needed to unravel the basin's complex ecology. "It has led many non-scientists to the conclusion that the question [of proper management] has been answered," Larson says. "It's frustrating," says one biologist who asked not to be identified. "What we do has instantly become junk science." The NRC panel may soften its tone in the final report due out this summer. But many on biology's front lines here fear that the damage has already been done.

–ROBERT F. SERVICE