In Central California, Coho Salmon Are on the Brink

Lagunitas Creek starts high on the north flank of Mount Tamalpais, just north of San Francisco, California, and makes a short run to the Pacific Ocean, passing through a rural valley and a coastal redwood forest. It was once a thriving breeding ground for coho salmon. Local legends tell of streams so thick with fish returning from the sea to spawn that a person could walk from one side to the other on the fishes' backs. The state record coho, a 10-kilogram whopper, was caught on a tributary in 1959.

But those days are long gone. The subspecies of coho that lives along the central California coast is the most endangered of the many troubled salmon populations on the West Coast of North America, says Charlotte Ambrose, a recovery coordinator with the National Marine Fisheries Service (NMFS) in Santa Rosa, California. Listed as an endangered species in 2006, the central coast coho's numbers have recently taken an even sharper turn for the worse. As this year's winter spawning season draws to an end, biologists who've been surveying streams and rivers throughout the fish's range are reporting dismal numbers. A federal species recovery plan to be released next month has morphed into a species survival plan, Ambrose says: "We truly are at the brink of extinction."

The recovery plan will focus on 28 watersheds where NMFS thinks habitat restoration efforts—such as restoring floodplains, preserving forested areas along creek sides, and placing woody debris in streams to provide shelter for fish—can have an immediate impact on the coho's survival. Lagunitas Creek, which has one of the strongest remaining runs of wild central coast coho, is one. A tour of the watershed last week illustrated why it may be one of the coho's last best hopes—and why success is far from guaranteed.

In a soaking rain, Greg Andrew, a fishery program manager with the Marin Municipal Water District, unlocked a gate and piloted his hybrid SUV up a steep, unpaved road that parallels the creek. After a kilometer, what look like two giant concrete slides come into view: spillways for Peters Dam, the largest of seven dams built in the area between 1872 and 1979 to create drinking water reservoirs. The dams blocked off about half of the former coho habitat, Andrew says: "We're trying to make what's left as good as possible."

These efforts include periodic dips in the road and other drainage features added to reduce the amount of sediment that washes into the creek, where it can suffocate salmon eggs and clog nooks and crannies in the streambed that young fish use for shelter. Further downstream, Andrew points out a woody debris structure in the creek, one of about 60 built by the water district. These strategically placed piles of logs create slow eddies where fish can escape the raging flows created by winter storms.

The final stretch of Lagunitas Creek passes through Point Reyes National Seashore before emptying into Tomales Bay. In a $6.2 million project completed in 2008, the National Park Service knocked down levees at the mouth of the creek and restored more than 100 hectares from cattle pasture into a tidal wetland. The project provides crucial floodplain habitat for coho and other

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wildlife, says park service hydrologist Brannon Ketcham. For coho, the wetlands provide another refuge from the rushing water in winter and a place for smolts to bulk up before heading out to sea in spring.

If only there were more fish to take advantage of it. As of last week, biologists surveying the creek for the Marin water district had counted only 64 coho in Lagunitas Creek and its tributaries. In the already lean years prior to the coho's addition to the endangered species list, nearly 600 fish returned on average. Because the run usually peaks in early January, Andrew doesn't expect the count to rise substantially, if at all. Across the entire range, Ambrose estimates that only 500 fish have returned this year.

In Lagunitas Creek and elsewhere, this marks the third straight year of abysmal returns for the coho, an especially ominous milestone, biologists say, because of the fish's 3-year life cycle. Salmon born in a given year migrate out to sea and return to their natal stream 3 years later to spawn and die. This creates three distinct "year classes," each of which returns every 3 years. This year's feeble return suggests that all three classes are faring poorly across the coho's range.

The precipitous decline is probably due to a combination of factors, beginning with a 150-year history of land and water use—including dams, mining, agriculture, and urbanization—that have degraded freshwater habitat throughout the central coast coho's range. More recently, the seasonal upwelling of nutrient-rich deep water off the California coast has been delayed, which may have reduced the availability of food for hungry smolts beginning their migration out to sea, says Brian Spence, a research fishery biologist with NMFS in Santa Cruz. Moreover, California's 3-year drought has dried up streams and delayed access to spawning grounds, he says: "When you stack all that on top of the already diminished freshwater capacity, I think that's why some of these populations are getting precariously close to blinking out altogether."

Conserving and improving what's left of the coho's freshwater habitat is the best hope for the fish's survival, says Ambrose. Lagunitas Creek illustrates the best case scenario, she adds. Everyone from the National Park Service to the county water district to local conservation groups has done work on the coho's behalf. "There is nothing like this kind of collaboration anywhere else in the range of the central coast coho," Ambrose says.

But even here there is some resistance. At an animated public meeting last week, some residents voiced opposition to a salmon conservation plan commissioned by the county government on the grounds that it could violate their property rights. More than 100 people braved the rain and packed into a room at a local school. As a woman from the environmental consulting firm that prepared the plan explained one of its main recommendations—preserving an undeveloped buffer zone of up to 30 meters along the sides of the creek—many in the audience groaned. In a narrow valley where many lots hew closely to the creek, the idea did not seem to sit well. One man yelled out: "Are you being realistic? Are you on planet Earth?" In the public comment session, residents' concerns seemed roughly split between preserving property rights and aiding the salmon.

Aside from habitat restoration, the only remaining way for humans to help coho is to raise them in captivity and release them into the wild. Unfortunately, conservation hatcheries have at best a mixed success rate, says John Carlos Garza, an NMFS geneticist in Santa Cruz. "Historically, our best guess is that hatcheries have overall had a detrimental effect on salmon populations," he says. One reason is inbreeding: When populations dwindle, the chances of breeding related individuals goes up, and the inbred offspring have poor survival rates in the wild, Garza explains. To mitigate this problem, Garza has helped the two coho hatcheries in central California implement a genetic matchmaking service. They now use DNA tests to select which pairs of fish to breed in order to maximize genetic diversity.

Garza also oversees an experimental project in which captive-bred fish are raised in fresh water and released into streams as adults. This offers advantages over the standard approach of releasing young fish born in the hatchery: For one, the offspring of the adult-released fish imprint on the stream where they hatched rather than on the hatchery. Garza thinks this approach may be valuable for repopulating streams where salmon have been completely wiped out.

These innovative methods may help make conservation hatcheries more successful, but they won't be enough to save the coho on their own, Garza and others say. "They're very expensive and intensive strategies that should be adopted only when there aren't a lot of other good strategies available," Garza says. Unfortunately, the central coast coho are running out of options. "Let's be clear," Garza says, "these are last-ditch efforts."

–GREG MILLER

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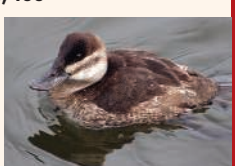
Colliding Particles *Can* Make Black Holes
You've heard the controversy. Particle physicists predict that the world's new highest-energy atom smasher, the Large Hadron Collider near Geneva, Switzerland, might create tiny black holes. Curiously, though, nobody had ever shown that Einstein's theory of general relativity predicts that a black hole can be made this way. Now a computer model shows conclusively for the first time that a particle collision really can make a black hole. http://bit.ly/blackholes

Bats and Whales Share Sonar Protein
Bats and dolphins are about as different as mammals get. Yet, both home in on their prey by emitting sound waves and sensing the reflections, a process called echolocation. A new study shows that in both groups the same protein evolved in the same way to make that possible. Researchers say it's surprising to discover a molecular convergence in these very distantly related groups of animals. http://bit.ly/batwhale

Cold War Split Birds, Too



The Cold War divided the people of Europe for nearly half a century, and it turns out humans weren't the only ones stuck behind the Iron Curtain. Trade blockades led to vastly different numbers and types of invasive birds in Western and Eastern Europe, new research reveals. The findings, say experts, highlight the dramatic impact human activity can have on the success of alien species. http://bit.ly/coldwarbirds

Birdlike Dinosaur Was Adept Glider
The fight over bird flight evolution is one of the longest-running and most heated debates in paleontology. Were the first flyers arboreal creatures that initially glided from treetops to the ground? Or were they bipedal ground runners with evolving wings that allowed them to take progressively longer jumps? The first flight tests of a foam model of a four-winged, feathered dinosaur lend credence to the former hypothesis. http://bit.ly/dinoflight

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