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Hatched And Wild Fish: Clash Of Cultures

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TO millions of true believers, there is nothing more beautiful in all of nature, nothing to make the heart beat faster, than the aristocratic trout and its royal cousin, the salmon. Brilliantly spotted, pink-flanked or simply and elegantly silver, they linger in the mind's eye as paragons of sleek grace and primitive power.

In pursuit of that vision, and to replenish commercial salmon stocks, fisheries biologists over the last half century or so have released billions of hatchery-reared fish in American streams, rivers and lakes. For years, no one thought much about the ecological and genetic consequences of turning them loose.

But now it is clear that fish-stocking programs have transformed the nation's trout and salmon population and may even be threatening the long-term survival of wild fish.

When adult hatchery trout are suddenly thrust into a stream where wild trout have already established a stable social order, "they run around like a motorcycle gang, making trouble wherever they go," says Dr. Robert A. Bachman, a behavioral ecologist who directs Maryland's freshwater fisheries division. The new arrivals charge about the stream in a tight school, something the wild fish would never do, provoking fights everywhere. The conflict and chaos, Dr. Bachman has found, eventually result in fewer fish of either kind.

Other studies have also found that stocking tends to reduce the number of wild trout. The hatchery trout dwindle, too, since they are generally more easily caught and less adept at feeding on wild fare. The outcome is often an impoverished fishery dependent on periodic fixes of stocked fish.

Of more serious concern are the genetic risks posed by stocking programs. The genetic integrity of some wild strains, and at least one species, is being threatened by interbreeding and hybridization. Meanwhile, hatcheries in some cases have produced populations of trout and salmon with less genetic variety than is found in the wild. As these fish breed with wild trout, scientists say, they erode the natural gene pool and may impair the ability of wild fish to adapt genetically to environmental changes.

Awareness of these dangers is encouraging fisheries biologists to preserve and bolster populations of wild fish and is prompting a shift in fishery practices. Some states have imposed strict limits on killing trout, thus limiting the need for restocking. Hatcheries and "put-and-take" stocking programs, in which adult fish are planted in streams only to be caught almost immediately, are being re-examined and assigned a reduced role in many places.

In one sense, stocking from state, Federal and private hatcheries has enriched the nation's fisheries, giving millions of anglers the chance to go after trout and other game fish. Nearly 40 million Americans, about 12 million of them trout and salmon anglers, spend more than $20 billion a year on freshwater sport fishing. The widespread introductions have also helped put a delectable and healthful food on many tables.

The ranges of the major species of stream-dwelling trout have been greatly expanded. Brown trout originally were found only in Europe; rainbow trout, in western North America; brook trout, in eastern North America. Now all are established in cold waters across North America -- in many cases crowding out the original denizens. Other fish, especially bass, have been widely propagated as well. But trout and salmon account for most hatchery and stocking activity.

In the typical trout or salmon hatchery, scientists say, fish are reared under conditions that cause them to act differently from wild fish. They grow up in concrete tanks where they are usually segregated by size class, in dense concentrations, under unnatural light and temperature. They eat "fish chow," specially prepared pellets of fish meal and other ingredients that resemble dry pet food, and grow used to the humans who cast the pellets into the water. Disrupting a Stream's Ecology

Under these conditions, fish that rush to the food fastest, disregarding the presence of humans, survive and prosper. In the wild, survival depends on just the opposite response. Besides avoiding fishermen and other predators, wild fish in streams must capture the insects and crustaceans they feed on while expending as little energy as possible in fighting the current. Positioning becomes critical.

A fish that uses more energy than it takes in will waste away and die.

When brown trout raised in a hatchery were placed in a stream with wild brown trout, Dr. Bachman found in a study in Pennsylvania, they would "throw caution to the winds," rushing around in search of food. But they spotted wild food less skillfully and swam farther than wild fish to get it. Their energy equations did not balance and they tended to get thin and die.

While they lived, they thoroughly disrupted the ecology of the stream. Wild trout jealously guard their prized feeding and resting stations. But because hatchery trout do not easily recognize body-language signals used by wild trout to warn away interlopers, they readily antagonized the established residents. Exhausting fights ensued, and the wild trout were often ousted from their preferred spots, disrupting their feeding patterns. The upshot, said Dr. Bachman, was that after two years the stream contained fewer trout, both hatchery and wild, than there were wild trout when the experiment started. Four Kinds of Risk

Trout from genetically different local strains, subspecies and even species often interbreed after fish are introduced from one range to another. A dramatic example concerns the rainbow trout and the cutthroat trout, both native to the northwestern United States. In Montana, one of the nation's trout-fishing meccas, the commonest fish is now a rainbow-cutthroat hybrid, said Dr. Robb Leary, a fisheries geneticist at the University of Montana. This hybridization, he said, is probably the main cause of widespread loss of the native cutthroat population. "That's genetic extinction right there," he said.

Regional authorities in the Pacific Northwest are undertaking a new program in which hatchery salmon will supplement wild populations that are declining because of overfishing and habitat loss. As part of an attempt to avoid inadvertent genetic damage, four kinds of genetic risk posed by hatchery operations have recently been identified by a scientific panel of the Northwest Power Planning Council. This is an organization established by Congress to protect wildlife in the region. These are the risks:

*Local extinction of wild fish populations. This can happen when a declining population is reduced even further by the need to obtain wild fish whose eggs can be used in hatcheries. "The hatchery can increase the risk of extinction if you're continually mining the wild parents and if the hatchery fish don't do well and don't contribute to the wild population," said Dr. Anne Kapuscinski, a fisheries geneticist at the University of Minnesota who heads the team of scientists examining the problem.

*Loss of genetic variability. Some important genes can be lost as a result of hatchery operations if, for example, the operators rely on too few parent fish for eggs or if sperm comes from too few males.

*Loss of population identity. This can happen if hatchery fish whose parents came from one stream are introduced into another stream with a different environment. Because of the environmental difference, the local fish populations will have developed different genetic adaptations. The introduced fish may not perform well in the new river. But they will interbreed with the natives, and the resulting hybrids may not perform well, either.

*Domestication of hatchery fish. Hatcheries inadvertently select for characteristics that are inappropriate in the wild. They may also promote an unrepresentative section of the wild gene pool, for example by taking brood stock from fish that spawn just in the first part of a weeks-long spawning run. If the early spawners then predominate in the wild, the population may be less able to survive a poorly timed spell of bad weather or flooding.

Genetic changes become "more of a problem over a long period of time as you increase the number of hatchery fish that are surviving and returning to reproduce," said Dr. Harold Kincaid, a research geneticist at the National Fisheries Research and Development Laboratory, an agency of the Fish and Wildlife Service, at Wellsboro, Pa. "We gradually lose genetic material," he said, as genomes are "basically broken up" by the modified hatchery population. This, he said, is already happening: "I'm sure it's widespread, no question about that." How serious this will be, he said, remains to be seen.

Alerted to all these dangers, many fisheries biologists have begun thinking wild and changing their practices. A Return to the Wild

Increasingly, the role of hatcheries and put-and-take stocking is being reduced. A number of states have allowed prime trout water to return to the wild state, with no stocking, while permitting anglers to keep one or two fish a day, or none. In Maryland, for instance, this type of fishing has been expanded. In Maryland streams where natural reproduction is insufficient but the habitat is otherwise favorable, hatchery trout are introduced as small "fingerling" fish and allowed to grow up essentially wild. Put-and-take angling for adult hatchery-raised trout is being restricted to waters that for much of the year are too warm for trout to survive.

"By and large," said Dr. Bachman, "what you're seeing across the country" is a recognition that "where one can manage streams for wild trout, you're better off doing so."

In the Pacific Northwest salmon fishery, commercial fishing will continue to make some stocking necessary. But in a new approach, stocking is considered strictly supplementary and the hatcheries are managed to minimize genetic differences with the wild fish. "It's a

pretty hot topic out here; all the states are going into it in a big way," said Dr. Craig Busack, a geneticist with the Department of Fisheries in the Washington State. Dr. Busack was one of the first to delineate the genetic threats posed by hatcheries.

One way to reduce the mismatch between wild and hatchery fish is to make hatcheries more natural. There are some precedents for this. At the Connetquot River State Park Preserve on Long Island, which contains a surprisingly pristine spring-fed trout stream, trout are bred in a hatchery section of the stream itself. The trout are screened from human contact as much as possible. As a result, "our fish swim away from you," said Gilbert Bergen, the park manager for the environment. "At every other hatchery they come and crowd at your feet. We're trying to raise these fish as close to natural fish as possible."

That may or may not become widespread, given the large investment in traditional hatcheries. But more and more fisheries experts are convinced that going wild, with hatcheries secondary, is the wave of the future. "It has to be," said Dr. Kincaid.