Salmonid hatcheries cause 'stunning' loss of reproduction

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The rearing of steelhead trout in hatcheries causes a dramatic and unexpectedly fast drop in their ability to reproduce in the wild, a new Oregon State University study shows, and raises serious questions about the wisdom of historic hatchery practices.

The research, to be published Friday in the journal *Science*, demonstrates for the first time that the reproductive success of steelhead trout, an important salmonid species, can drop by close to 40 percent per captive-reared generation. The study reflects data from experiments in Oregon's Hood River.

"For fish to so quickly lose their ability to reproduce is stunning, it's just remarkable," said Michael Blouin, an OSU associate professor of zoology. "We were not surprised at the type of effect but at the speed. We thought it would be more gradual. If it weren't our own data I would have difficulty believing the results."

Fish reared in a hatchery for two generations had around half the reproductive fitness of fish reared for a single generation. The effects appear to be genetic, scientists said, and probably result from evolutionary pressures that quickly select for characteristics that are favored in the safe, placid world of the hatchery, but not in the comparatively hostile natural environment.

"Among other things, this study proves with no doubt that wild fish and hatchery fish are not the same, despite their appearances," said Michael

Blouin, an OSU associate professor of zoology. “Some have suggested that hatchery and wild fish are equivalent, but these data really put the final nail in the coffin of that argument.”

Even a few generations of domestication may have significant negative effects, and repeated use of captive-reared parents to supplement wild populations “should be carefully reconsidered,” the scientists said in their report.

Traditionally, salmon and steelhead hatcheries obtained their brood stock and eggs from fish that were repeatedly bred in hatcheries – they tended to be more docile, adapted well to surface feeding, and they thrived and survived at an 85-95 percent level in the safe hatchery environment.

More recently, some “supplementation” hatchery operations have moved to the use of wild fish for their brood stock, on the theory that their offspring would retain more ability to survive and reproduce in the wild, and perhaps help rebuild threatened populations.

“What happens to wild populations when they interbreed with hatchery fish still remains an open question,” Blouin said. “But there is good reason to be worried.”

Earlier work by researchers from OSU and the Oregon Department of Fish and Wildlife had suggested that first-generation hatchery fish from wild brood stock probably were not a concern, and indeed could provide a short-term boost to a wild population. But the newest findings call even that conclusion into question, he said.

“The problem is in the second and subsequent generations,” Blouin said. “There is now no question that using fish of hatchery ancestry to produce more hatchery fish quickly results in stocks that perform poorly in nature.”

Evolution can rapidly select for fish of certain types, experts say, because of the huge numbers of eggs and smolts produced and the relatively few fish that survive to adulthood. About 10,000 eggs can eventually turn into fewer than 100 adults, Blouin said, and these are genetically selected for whatever characteristics favored their survival. Offspring that inherit traits favored in hatchery fish can be at a serious disadvantage in the wild where they face risks such as an uncertain food supply and many predators eager to eat them.

Because of the intense pressures of natural selection, Blouin said, salmon and steelhead populations would probably quickly revert to their natural state once hatchery fish were removed.

However, just removing hatchery fish may not ensure the survival of wild populations. Studies such as this consider only the genetic background of fish and the effects of hatchery selection on those genetics, and not other issues that may also affect salmon or steelhead fisheries, such as pollution, stream degradation or climate change.

Blouin cautioned that these data should not be used as an indictment of all hatchery programs.

“Hatcheries can have a place in fisheries management,” he said. “The key issue is how to minimize their impacts on wild populations.”

Source: Oregon State University