Wild fish are *Electives* when it comes to fish management

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The first salmon hatchery in Oregon was started by Livingston Stone in 1877 on the Clackamas River at the mouth of Clear Creek. Hatchery development has been in response to declining runs of salmon and heralded with the promised increase production and catch.

Spencer Baird, the first U.S. Fish Commissioner (1871) said that stocking hatchery fish would make regulation unnecessary. This conviction was expanded when Milo Moore stated in the 1960 Washington Department of Fisheries report to the Governor of Washington State that the "artificial taking of spawn, may provide the reality – salmon without rivers."

Over the last 33 years since Reisenbichler and McInyre published their study of hatchery and wild steelhead performance on the Deschutes River, scientists have been attempting to determine the effect of hatchery salmon on wild salmon in streams. This work is leading the way toward a better understanding of hatchery impacts and providing a factual assessment of hatchery programs. This work may lead to improved hatchery management and accountability if state, federal and tribal fish management agencies use this information to reduce impacts on wild salmonids.

The recent studies by Kostow et al. (2003), Chilcote et al. (2003, 2011), Araki et al. (2008), and Berntson et al. (2011) have made a valuable contribution to our understanding of hatchery impacts on wild salmonids. In addition to these studies a review of hatchery impacts on Snake River spring chinook by the Independent Scientific Review Panel (2011) have set the stage for major reform of government hatchery operations.

Araki et al. 2008: "Captive breeding is used to supplement populations of many species that are declining in the wild. The suitability of and long-term species survival from such programs remain largely untested, however. We measured lifetime reproductive success of the first two generations of steelhead trout that were reared in captivity and bred in the wild after they were released. By reconstructing a three-generation pedigree with microsatellite markers, we show that genetic effects of domestication reduce subsequent reproductive capabilities by ~ 40% per captive-reared generation when fish are moved to natural environments. These results suggest that even a few generations of domestication may have negative effects on natural reproduction in the wild and that the repeated use of captive-reared parents to supplement wild populations should be carefully reconsidered."

Berntson et al. 2011. "Hatchery supplementation programs are designed to enhance natural production and maintain the fitness of the target population, however, the relative reproductive success (RRS) of hatchery-origin fish was 30–60% that of their natural-origin counterparts. There is acute interest in evaluating the reproductive performance of hatchery fish that are allowed to spawn in the wild."

"Despite the higher reproductive success for natural individuals, hatchery fish outnumbered natural ones by more than five to one, yielding an overall hatchery contribution to our offspring sample that was nearly twice that of natural fish… yet it is equally clear that hatchery-reared fish left fewer offspring per individual than their natural counterparts."

Chilcote 2003: "Naturally spawning population comprised of equal numbers of hatchery and wild fish would produce 63% fewer recruits per spawner than one comprised entirely of wild fish. For natural populations, removal rather than addition of hatchery fish may be the most effective strategy to improve productivity and resilience."

Chilcote et al. 2011: "We found a negative relationship between the reproductive performance in natural populations of steelhead, coho, and Chinook salmon and the proportion of hatchery fish in the spawning population. We used intrinsic productivity as estimated from fitting a variety of recruitment models to abundance data for each population as our indicator of reproductive performance. The magnitude of this negative relationship is such that we predict the recruitment performance for a population comprised entirely of hatchery fish would be 0.128 of that for a population comprised entirely of wild fish. The effect of hatchery fish was the same among all three species. Further, the impact of hatchery fish from 'wild type' hatchery broodstocks was no less adverse than hatchery fish from traditional, domesticated broodstocks. We also found no support for the hypothesis that a population's productivity was affected by the length of exposure to hatchery fish. In most cases, measures that minimize the interactions between wild and hatchery fish will be the best long-term conservation strategy for wild populations."

Kostow 2003 : "Our data support a conclusion that hatchery summer steelhead adults and their offspring contribute to wild steelhead population declines through competition for spawning and rearing habitats."

ISRP 2011: The findings of the ISRP in their evaluation of hatchery programs to supplement wild spring chinook populations in the Snake River basin point to numerous problems.

To mitigate for reduced harvest caused by the construction and operation of four lower Snake River hydro dams operated by the Army Corps of Engineers, the Lower Snake River Compensation Hatchery Program (LSRCP) was authorized by Congress in 1976. It wasn't until after the Snake River chinook were listed under the ESA that the LSRCP hatcheries added a conservation purpose in the mid-1990s.

Some Findings of the ISRP review:

1. Hatchery supplementation may prevent extinction but does not increase productivity of natural populations.
2. Hatchery supplementation does not contribute to demographic increase, or in other words an increase in naturally produced salmon.
3. LSRCP hatcheries are not meeting their optimistic goals for production and harvest contribution.
4. Hatchery origin spring chinook age at spawning, size and fecundity is less than wild spring chinook.
5. The LSRCP hatcheries came on line 23 years ago on the Imnaha River with the objective to produce hatchery fish that mimic the age composition of the original wild population. But the hatchery salmon are mostly three year olds and fewer five year olds at return compared to the wild population.
6. There is no evidence that wild production benefits from hatchery stocking.
7. The analysis reveals that the hatchery program has not resulted

in an increase in abundance of wild spawners.

Based on this information hatcheries may prevent extinction of a wild population but they do not increase the natural productivity of the population. At the same time using hatcheries to recover wild salmon is not supported by the data, but remains a major purpose of agencies promoting hatchery solutions to complex ecological problems. The reproductive success of hatchery fish is lower than that of wild fish and hatchery fish compete with wild fish for food, rearing space and spawning sites and mates. The larger hatchery juveniles can be predacious and attract predators both of which have an impact on wild fish.

While these factors are operating in our rivers stocked with hatchery fish and placing ESA-listed fish at greater risk, the agencies are dedicated to securing more public funds for hatchery programs.

In a recent article in *Fisheries* (July 2011) by Abigail Lynch, a Ph.D student at Michigan State University said that Dr. William Taylor concluded: "One major fallacy rampant in agency and university bureaucracies is their reluctance to change. All our institutions are set up for stability and for maintaining the success of the past."

The Chief of Michigan Department of Natural Resources, Fisheries Division, Dr. Kelly Smith, said that "science is a service to management. It provides information to management; but management still drives the bus."

These comments also apply to Oregon where too often fisheries management refuses to use science to inform programs to conserve and protect native, wild salmonid populations. The Oregon Department of Fish and Wildlife stubbornly avoids its overriding obligation to prevent the serious depletion of native species under state law. Confirmation can be found in every watershed where the agency responsible for native fish conservation is confronted with populations that are 3% to 10% of historical abundance. The institutional purpose is to maintain harvests and to advocate for more public funds to expand hatchery production.

When the public presents information that would improve conservation management of native fish populations, the response of the agency and the commission is often one of suspicion and rejection of citizen and even some staff proposals. Certainly, there are exceptions, but these are always a surprise for conservation is viewed as incompatible with producing fish for the market economy. The economic interests of the commercial and recreational industries and the agency's interest in license sales are more important. The agency's interest extends to federal hatchery funding that it relies on to support commercial and sport fisheries and the bulk of agency staff.

Hatcheries have become hardwired and conservation is an elective. For example the Lower Snake River Compensation hatchery program for chinook was authorized in 1976 by Congress to provide harvest mitigation for spring chinook. It was not until the mid-1990s; after chinook were listed under the Endangered Species Act as a threatened species that conservation became another purpose of this program.