Columbia River hatcheries: an evolving role

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Hatcheries are a major element of Columbia Basin salmon management efforts and have been for more than 100 years. In the last three decades, the role of hatcheries has changed and continues to change today.

Part of the Northwest salmon story

The first hatchery in the Northwest was built in 1877 on the Clackamas River south of Portland, Ore. More soon followed to restore salmon populations affected by booming harvests.

Today, there are 208 salmon and steelhead hatchery programs in the Columbia River Basin, and about 80 percent of the salmon and steelhead that return as adults were hatched and reared in hatcheries.

The Bonneville Power Administration financially supports about 40 percent of the basin's hatchery programs under three different mandates. In all cases, BPA funding fulfills the agency's responsibility to offset damage done by construction and operation of the region's federal dams for hydro power. BPA funds:

1. Hatcheries built and operated at the direction of Congress to offset the impacts of federal hydro power dams. BPA funds these mitigation hatchery programs through direct funding agreements with the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service.
2. Hatcheries built and operated as part of the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program.
3. Hatchery programs conducted as part of the federal effort to recover salmon, steelhead and other fish listed under the Endangered Species Act. Most of these hatcheries also are funded through the Council's Columbia Basin Fish and Wildlife Program.

Snake River sockeye released as fingerlings from a life-line hatchery into Redfish Lake, Idaho, spawn naturally on their return as adults. (Photo: Jeff A. Heindel, Idaho Department of Fish and Game)

BPA's annual funding for Columbia Basin hatcheries was $86 million in 2009.

Evolving management techniques

Initially, hatcheries were designed to increase salmon runs for ocean and in-river harvest. They also bolstered numbers reduced by habitat degradation from logging, mining, agriculture and urbanization. Still, in the first half of the 20th century, Columbia River salmon runs declined significantly, leading government agencies to ban certain fishing techniques, such as horse seines and fish wheels.

Early hatcheries planted salmon fry directly in rivers as soon as they hatched. Over the decades, hatchery managers learned to produce better returns by growing fish until they were ready to migrate to sea. This approach significantly increased salmon returns in the 1960s–70s, and led to a boom in hatchery construction and a dramatic increase in the Oregon commercial fishing fleet from 2,500 in 1960 to 8,500 in 1978.

Rearing salmon to smolt size and then releasing them to migrate downstream is still the dominant hatchery management technique today. Survival from egg to smolt in Northwest hatcheries today runs 60 to 90 percent, compared to 2 to 9 percent for wild fish. In 2009, Northwest hatcheries released 141 million salmon and steelhead in Columbia Basin streams.

In recent years, fish biologists and hatchery managers have launched a new hatchery strategy, "supplementation," in which hatcheries are specifically designed to jump-start the natural restoration of decimated runs. For example, the Yakama Hatchery in Cle Elum, Wash., is the centerpiece of a joint Yakama Nation/Washington Dept. of Fish and Wildlife program to rebuild salmon runs in the Yakima River. These runs had dropped from historic estimates of 900,000 fish per year to fewer than 5,000 in the early 1980s due to numerous water diversions from the river for irrigation. The Yakama Hatchery program has benefited the Yakima River spring chinook run, which has ranged in the last decade from 21,472 in 2001 to 9,394 in 2009.

Supplementation hatcheries raise fish under conditions that mimic natural streams. These fish typically are planted in ponds next to natural streams where they acclimate to the river before they are ready to migrate downstream. Later, as adults, they return to the stream to spawn naturally.

Shifting priorities and purposes

The Northwest Power Act of 1980 called for a comprehensive Columbia River Basin Fish and Wildlife Program, to be prepared by the interstate Northwest Power and Conservation Council (also created by that act) in consultation with federal, state and tribal fish and wildlife managers.

The Council first set a goal of "doubling the runs" of Columbia River salmon to 5 million returning adults per year. That goal remains today. Hatcheries were and are a significant tool in this program. From 1981-1991, hatcheries accounted for 40 percent of the budget for salmon restoration under the Council's program. Most of these hatcheries were designed to restore runs that originate above Bonneville Dam for tribal as well as non-tribal harvest. Today, about 28 percent of the Council's Fish and Wildlife Program budget goes for hatchery construction, operation/maintenance, and research, monitoring and evaluation, including hatcheries that help fish listed under the Endangered Species Act.

In 1991, the first of now 13 Columbia Basin salmon and steelhead runs was listed under the Endangered Species Act. Among other techniques, the federal government uses safety-net hatchery programs to prevent extinction of a run where too few wild fish remain to sustain a population. Such programs are now in place for Snake River sockeye, Snake River spring/summer chinook, Columbia River chum and mid-and lower Columbia steelhead.

Because ESA focuses on the wild runs, it raised questions about the broader role of hatcheries in the Columbia River system. Questions remain today about both the reproductive viability of hatchery fish and their effect on the salmon ecosystem. There are four key issues.

1. Historically, hatchery fish have not reproduced as well as wild fish, raising concerns that interbreeding between hatchery and wild fish could weaken the stocks.
2. Hatchery fish introduced in numbers may compete with wild fish for food and habitat. If there's a big size difference, the larger may out-compete the smaller.
3. Hatchery fish whose ancestors originated in a different stream could overwhelm native runs, reducing the genetic diversity of salmon.
4. Uncertainties remain about supplementation hatcheries' long-term ability to spur naturally sustained salmon production.

Defining best management practices

In the last decade, fish scientists and hatchery managers have identified a number of "best management practices" designed to integrate hatchery programs with the natural populations, offset supplementation hatcheries' potential negative consequences and enhance their benefits.

Supplementation hatcheries raise fish in a more natural environment.

These include:

- Use local brood stock. Don't transfer stock between river basins.
- Use some fish of natural origin as brood stock, not just returning hatchery fish.
- Control the number of hatchery fish on the spawning grounds. For example, trap returning adult fish at a weir, send the appropriate number of natural-origin and hatchery-origin fish on their way and harvest the surplus hatchery fish.
- As closely as possible, mimic natural rearing conditions in the hatchery. For example, raise fish at the temperature of the natural stream in which they'll be released.

BPA also funds research to evaluate the effectiveness of hatchery supplementation. This research will help fish managers understand the effects of hatchery-bred fish on naturally spawning populations.

Implementing hatchery reforms

In recent years, federal, state and tribal fish managers have intensively reviewed hatcheries' long-term role in the Columbia River Basin, culminating in a Report to Congress on Columbia River Basin Hatchery Reform by the congressionally mandated Hatchery Scientific Review Group in March 2009. The report calls for using hatcheries only as part of comprehensive strategies where habitat, hatchery and harvest management are coordinated to best meet clearly defined resource management goals for each population. This work is now under way.

For example, the Council's 2009 Fish and Wildlife Program calls for new artificial production strategies and for changes in some hatchery practices to create a more balanced, ecological approach to fish production, consistent with the hatchery reform project recommendations. The Council's program calls for consideration of formal adoption of the hatchery reform project's recommendations.

Outlet channel from acclamation facility to Yakima River.

Similarly, under a 2008 Biological Opinion on federal hydropower operations for fish and wildlife protection, NOAA Fisheries is requiring hatchery operators in the Upper Columbia, Middle Columbia and Snake River basins to update hatchery and genetic management plans for their programs. NOAA Fisheries' goal is to reduce potentially harmful effects of artificial production on wild salmon recovery. BPA, the U.S. Army Corps of Engineers and the Bureau of Reclamation are using the hatchery reform project's recommendations to help guide funding decisions to ensure that hatchery programs funded by BPA rate payers do not impede recovery of salmon or steelhead runs listed as threatened or endangered.

BPA also continues to fund safety-net hatchery programs to reduce the extinction risk of endangered runs. For example, the Snake River sockeye program has produced hundreds of thousands of progeny from the remnants of the wild stock. These sockeye, the first Columbia Basin fish to be listed as an endangered species, received much media attention in 1992 when only one fish, dubbed Lonely Larry, completed the 900-mile journey to Redfish Lake high in Idaho's Sawtooth Mountains.

Today, returns are steadily increasing with 650 adult sockeye salmon returning in 2008, 883 in 2009 and more than 1,800 in 2010. In 2008, BPA signed a fish accord with Idaho that commits funding for a new sockeye fish hatchery that will ensure propagation of up to 1 million sockeye smolts a year.

Conclusion

For more than a century, the Northwest has used hatcheries to produce salmon. Today, hatcheries are called on to balance a number of objectives to supplement wild fish populations, to meet Endangered Species Act and other legal requirements and to provide fish for harvest. Hatcheries, along with hydro passage, habitat improvement and harvest management, are a major part of the Northwest's effort to protect and restore its salmon runs. Until salmon runs are fully sustainable, hatchery production is expected to continue to play a major role in both the recovery and harvest aspects of this effort.

For more information

To find out more, visit the following websites:

- "Report to Congress on Columbia River Basin Hatchery Reform," Hatchery Scientific Review Group, February 2009. *www.hatcheryreform.us*
- "Protecting Salmon and Steelhead." 2008 Progress Report Summary. U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, BPA, December 2009. *www.salmonrecovery.gov/BiologicalOpinions/FCRPS/BiopImplementation/BiOpImplementation2008.aspx*
- "Columbia River Basin Fish and Wildlife Program, 2009 Amendments." Northwest Power Planning and Conservation Council, June 2009. *www.nwcouncil.org/library/2009/2009-09/Default.asp*
- Bonneville Power Administration — *www.bpa.gov*
- Columbia Basin Fish and Wildlife Program — *www.cbfish.org*