

HATCHERY REFORM PROJECT

A Scientific and Systematic Redesign of Hatchery Programs to Help Recover Naturally Spawning Salmonid Populations and Support Sustainable Fisheries

EXECUTIVE SUMMARY



HATCHERY SCIENTIFIC REVIEW GROUP'S
HATCHERY REFORM RECOMMENDATIONS

MAY 2003

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INTRODUCTION

The Hatchery Reform Project

The Puget Sound and Coastal Washington Hatchery Reform Project (HRP) is a systematic, science-driven redesign of hatcheries to meet two new goals:

1. Helping to recover and conserve naturally spawning salmonid populations.
2. Supporting sustainable fisheries.

The HRP was created by the U.S. Congress in 2000 with the support of Congressman Norm Dicks (D-Wash), U.S. Senator Patty Murray (D-Wash), Washington Governor Gary Locke and former U.S. Senator Slade Gorton.

This is the first independent scientific evaluation of hatchery programs against measurable goals, on a watershed scale, in the context of what the habitat can support and the potential impact of the programs on every stock in the watershed.

Role of Hatcheries in Washington State

There are approximately 100 hatchery facilities in Puget Sound and coastal Washington operated by the Washington State Department of Fish and Wildlife (WDFW), Puget Sound and coastal Indian Tribes and Nations and the U.S. Fish and Wildlife Service (USFWS). In operation for decades (some for over 100 years), these hatcheries were built for differing purposes ranging from mitigation for lost habitat to creating a fishery where none existed previously, and from meeting tribal trust responsibilities to helping to conserve genetic diversity and rebuild struggling populations. Most hatcheries were built to produce fish for harvest, compensating for declines in naturally spawning salmon populations. Hatcheries are very important to the North Pacific sports and commercial fishing economy. They also play an important role in meeting tribal treaty harvest obligations.

Hatcheries have generally been successful at fulfilling these purposes. However, they have also been identified as one of the factors responsible for the depletion of naturally spawning salmon stocks. Some facilities have created stresses for naturally spawning fish, kept smolts from getting downstream and spawning fish from getting upstream and lowered water quality. Physical and genetic interactions between naturally spawning and hatchery fish may have weakened natural stocks. Hatchery management decisions have often been piecemeal, not systemwide.

Hatchery Reform: A New Direction

Several Puget Sound and coastal salmon and steelhead stocks are listed or proposed for listing under the federal Endangered Species Act (ESA). As part of a larger recovery process, state, tribal and federal managers of Washington's salmon and steelhead must

ensure their hatcheries do not present a risk to listed species. But the managers are going beyond merely complying with ESA directives that hatcheries be operated to minimize risks to endangered fish. There is also an opportunity for hatcheries to provide benefits to the recovery process, in addition to providing harvest, educational and cultural benefits. The managers have established a Hatchery Reform Coordinating Committee (Coordinating Committee) as a vehicle for cooperative management on this reform effort. The Northwest Indian Fisheries Commission (NWIFC), WDFW, USFWS, NOAA Fisheries, Long Live the Kings (LLTK) and the Congressional Hatchery Science Advisory Team are all represented on this committee.

The Hatchery Scientific Review Group

The Hatchery Scientific Review Group (HSRG) is the independent scientific panel established and funded by Congress to evaluate hatchery reform programs in Puget Sound and coastal Washington. The objective of the HSRG is to assemble, organize and apply the best available scientific information to provide guidance to policy makers who are implementing hatchery reform.

The HSRG is composed of five independent scientists (selected from a pool of candidates nominated by the Past Presidents Council of the American Fisheries Society) and four agency scientists designated by WDFW, NWIFC, NOAA Fisheries and USFWS. The nine scientists serving on the HSRG have a broad range of experiences. Their scientific disciplines range from biology, genetics, ecology, fisheries, fish culture, fish pathology, and biometrics to other disciplines. Members include:

- John Barr, NWIFC (Vice Chair)
- Lee Blankenship, Northwest Marine Technology (Vice Chair)
- Donald Campton, PhD, USFWS
- Trevor Evelyn, PhD, retired, Department of Fisheries and Oceans Canada
- Conrad Mahnken, PhD, NMFS Manchester
- Lars Moberg, PhD, Moberg Biometrics (Chair)
- Lisa Seeb, PhD, Alaska Department of Fish & Game
- Paul Seidel, WDFW
- William Smoker, PhD, University of Alaska

The third party facilitator specified by Congress is LLTK, a private, nonprofit organization whose mission is to restore wild salmon to the waters of the Pacific Northwest. LLTK's role includes providing facilitation and project management to the HSRG and the Coordinating Committee, and helping the managers communicate hatchery reform progress to Congress, state legislators, stakeholder groups and the public. LLTK retained Gordon, Thomas, Honeywell to serve on the facilitation team.

Applying a Scientific Approach to Hatchery Management

In the HRP's first year, the HSRG developed a number of tools to assist with the reviews and for the managers' use. These tools have been essential to the project's methodical

and scientific review of hatchery programs. They include 1) a scientific framework that underlies and informs the group's tools, processes and recommendations; 2) a process that assesses benefits and risks associated with specific actions and choices in hatchery management; 3) hatchery operational guidelines consistent with the scientific framework; 4) a research program to fill information gaps (to date, the HSRG has funded four rounds of research on marine environments, hatchery and rearing environments, physiology and disease, and ecological and genetic interactions between hatchery and wild salmonids); and 5) monitoring and evaluation criteria for determining the success of hatchery programs and for gathering data for research and adaptive management.

Early in the process, the HSRG and Coordinating Committee agreed that it is important to evaluate hatchery programs in the context of the watersheds in which they operate and the goals set forth by the managers. For this reason, they divided Puget Sound and the coast into ten regions, providing an opportunity to make region-by-region recommendations based on 1) regional management goals for conservation, harvest and other purposes; 2) stock status (biological significance and population viability); 3) habitat status (current and future); and 4) the particulars of each hatchery program.

This document summarizes area-wide and specific recommendations developed by the HSRG upon reviewing the first six regions during 2001 and 2002. Recommendations on the remaining four regions will be added after they are reviewed in 2003.

AREA-WIDE RECOMMENDATIONS

This section describes reform measures applicable to the entire Puget Sound and coastal Washington area, and wherever hatcheries are used as tools to help meet harvest, conservation or other goals for the fish resource. The HSRG has concluded that three general principals should guide hatchery reform: 1) Goals, 2) Scientific Defensibility, and 3) Informed Decision Making.

1. GOALS

The HSRG has observed that goals for the fish resource are not always explicitly communicated and/or fully understood by the managers and operators of hatchery programs. It is not uncommon for the direct hatchery output (i.e., numbers or pounds of juveniles released) to be cited as the goal by which the program's success is measured.

Goals for the resource should be expressed in terms of values to the community (harvest, conservation, education, research, employment, recreation, etc.), and once they are, hatcheries can serve as a tool to help meet those goals. Harvest goals include production of salmon as a commercial food commodity, and the provision of fish for recreational opportunities and ceremonial and subsistence purposes. Conservation goals include endangered species protection and recovery, environmental aesthetics, maintenance of cultural values and traditions, etc.

Hatcheries are by their very nature a compromise, a balancing of benefits and risks to the target stock, other stocks and the environment affected by the hatchery program. The use of a hatchery program is appropriate when the balance of benefits and risks is more favorable than that associated with other strategies for meeting similar goals. Thus, in addition to the goals for the stock targeted by the hatchery program, the regional context (the status of and goals for the habitat and other stocks) affects the appropriate role of the hatchery program.

The HSRG has developed the following recommendations to help ensure a comprehensive goal setting process:

Take a Regional Approach to Managing Hatchery Programs

The HSRG and the managers have agreed that evaluating hatchery programs in the context of the regions and watersheds in which they operate and the goals set for them by the managers is vital to the success of the process. This same regional approach will be essential to the implementation of hatchery reform.

Measure Success in Terms of Contribution to Harvest, Conservation and Other Goals

In the past, hatchery programs too often have been evaluated on the basis of the number of fish released. More appropriate measures of success include fish quality, harvest opportunity and adults returning to reproduce and sustain the stock. In the future, hatcheries may also be evaluated on the basis of their socio-economic benefits and their contribution to the ecosystem as a whole.

Size Hatchery Programs Consistent with Stock Goals

Fisheries managers should determine the proper size (number of fish released) of a hatchery program based on their goals for the stock. The determining factors will differ depending on whether the program is a conservation, integrated harvest or segregated harvest program.

Have Clear Goals for Educational Programs

The educational programs conducted at, or supported by, hatchery facilities are valuable for educating the public on the biology of salmon, importance of maintaining healthy salmon habitat and sustainable fisheries. It is incumbent upon the fisheries managers to ensure that specific goals, and methods for determining if those goals are being met, are developed for these programs and understood by participants.

2. SCIENTIFIC DEFENSIBILITY

Once the goals for the resource have been established (see above), a scientific rationale for designing, building and/or operating each hatchery and hatchery program must be spelled out as working hypotheses. These hypotheses should explain why and how the hatchery program expects to produce its desired outcomes and should include performance indicators for measuring success. Documentation should include citations from the scientific literature and models that take into account the various factors (e.g., predation assumptions, cumulative effects, etc.).

This approach will establish actions within hatcheries and hatchery programs as experiments, designed so that uncertainties can be resolved through observation and evaluation. The HSRG has developed the following recommendations to help achieve scientific defensibility for hatcheries and hatchery programs.

Operate Hatcheries within the Context of Their Ecosystems

The benefits and risks of hatcheries can only be evaluated in a complete manner in the context of their ecosystems. The current and future status of these ecosystems, including the status of naturally spawning stocks and the environment, will determine the potential for success and the limitations on any hatchery program.

Operate Hatchery Programs as either Integrated or Segregated Relative to Naturally Spawning Populations

Hatchery programs can be classified as either integrated (if the goal is to manage the broodstock as an artificially propagated component of a naturally spawning population) or segregated (if the goal is to maintain a hatchery broodstock that is genetically discrete from naturally spawning populations). Every hatchery program must be identified as either integrated or segregated, with operational procedures designed to achieve the specific goals for one of those two types of programs. In this context, "intermediate" programs cannot exist without potentially posing unacceptable risks to natural populations.

Emphasize Quality, Not Quantity, in Fish Releases

It is important that some measure of the quality, rather than simply the quantity, of fish released from hatcheries be made and evaluated in a regional context.

Develop a System of Wild Steelhead Management Zones

The HSRG recommends an entirely new approach to managing steelhead. The managers should develop a system of “wild steelhead management zones” for each region in Puget Sound and coastal Washington, where streams are not planted with hatchery fish and are instead managed for native stocks. Harvest for steelhead within these zones may be compatible with this approach, but no hatchery-produced steelhead would be introduced.

Use In-Basin Rearing and Locally-Adapted Broodstocks

Some hatchery programs, for lack of adequate facilities and/or proper escapement management, require the importation and movement of eggs and juveniles into and out of the region. The managers should use in-basin rearing and locally-adapted broodstocks.

Take Eggs throughout the Natural Period of Adult Return

Certain life history traits can be lost in hatchery stocks (for example, the failure to spread hatchery egg take over the natural period of adult return can result in a shift in spawn timing). To assure long-term sustainability, the managers should adopt and implement policies that conserve or recover natural life history traits.

Develop Spawning Protocols to Maximize Effective Population Size

The mating of hatchery fish should strive to achieve two principal objectives: 1) maximize the genetic effective number of breeders; and 2) ensure that every selected adult has an equal opportunity to produce progeny. This is particularly critical in conservation programs, where populations are small or have experienced significant declines.

Take into Account both Freshwater and Marine Carrying Capacity in Sizing Hatchery Programs

There seems to be reduced capacity to support hatchery and naturally spawning salmonids over the past decade in certain regions of Puget Sound and the coast. Because of the scientific uncertainty involved, hatchery production should not be increased until managers have a better understanding of the factors controlling survival. Closure of certain unproductive hatcheries and reduced production at other hatcheries may benefit the quality and survival of both naturally spawning and hatchery fish.

Reduce Risks Associated with Outplanting and Net Pen Releases

Releasing smolts in streams geographically removed from a hatchery or adult collection facility is commonly called outplanting. Similarly, saltwater net pens are used to acclimate and release salmon smolts in marine areas where a targeted marine fishery on returning adults is desired. A common feature of these programs is the release of fish where no facilities exist to trap returning adults that escape target fisheries. This may pose significant genetic risks by promoting straying to freshwater areas where interbreeding with naturally spawning populations is undesirable. The HSRG recommends reducing the number and/or size of outplanting and net pen programs and has outlined specific steps the managers can take to reduce risks in those that remain.

3. INFORMED DECISION MAKING

Assuming that goals for the resource have been established (see #1 above), and the scientific rationale has been developed for how a hatchery and/or hatchery program will help achieve this goal (see #2 above), the HSRG further recommends that the managers' decision making processes must be responsive to new information.

Indicators and standards must be identified so that monitoring activities will focus on key uncertainties and effective evaluation of monitoring results can occur. Results of the monitoring and evaluation (M&E) must then be brought forward to the decision making process in a clear and concise way so needed changes can be implemented. This responsive process should be structured to allow for innovation and experimentation so hatchery programs may be responsive to new goals and new concepts in culture practice.

The HSRG has developed the following recommendations to help implement information responsive decision-making:

Incorporate Flexibility into Hatchery Design and Operation

Facilities should be designed and operated in such a way that they are able to respond relatively easily to changes in harvest and conservation goals and priorities, ocean carrying capacity, stock status, freshwater habitat conditions and the myriad other factors that will alter current policies and programs. Programs must also be able to respond to uncertainty and risk.

Evaluate Hatchery Programs Regularly to Ensure Accountability for Success

Hatchery reform will require expanded M&E, with some level of commonality and standardization across Puget Sound and coastal Washington. Each region of Puget Sound and the coast will need to develop its own M&E program consistent with the goals and programs of that region.

REGIONAL REVIEWS

This section provides examples of the recommendations developed by the HSRG upon reviewing the first six regions during 2001 and 2002. These reviews were conducted via in-region meetings and supported by a collaborative information gathering and sharing process among the management agencies and the scientists. The reviews included a consideration of each hatchery program's effects on all hatchery and naturally spawning salmonid stocks in the region.

Regions to be reviewed

2001

- Eastern Straits
- South Puget Sound
- Stillaguamish/Snohomish Rivers

2002

- Skagit River Basin
- Nooksack/Samish Rivers
- Central Puget Sound

2003

- Hood Canal
- Willapa Bay
- Grays Harbor
- North Coast

1. Eastern Strait of Juan de Fuca

This region includes the eastern portion of the Strait of Juan de Fuca, from Point Wilson to the Hoko River. Twelve hatchery programs were reviewed in this region, with 60 specific reforms recommended (see February 2002 HSRG Recommendations Report).

There are major restoration efforts being planned in this region's two large watersheds (dam removal/watershed restoration on the Elwha River, habitat restoration at the mouth of the Dungeness River). Historically, the Elwha River boasted one of the most magnificent and genetically distinct runs of chinook on the Pacific coast. Remnants still return, bumping their noses against the base of the first dam. What happens to an endangered run of chinook when a dam is removed and a hundred years' sediment cascades downstream? The hatcheries on this river system will play a central role in protecting and restoring this run until the habitat is ready to support them again. Federal, state and tribal managers in this region must determine how best to do this. The regional review process has helped them answer questions about how long the fish should be reared in captivity and when and where their progeny should be released to re-establish a naturally spawning population.

2. South Puget Sound

This region includes the portion of Puget Sound south of the Tacoma Narrows. Sixteen hatchery programs were reviewed in this region, with 64 specific reforms recommended (see February 2002 HSRG Recommendations Report).

With the exception of the Nisqually River and Delta—where ambitious habitat restoration efforts are underway—habitat in the South Sound region is less likely to be the focus of large-scale restoration activities in the coming years than habitat in the Eastern Straits. The managers designated this region a harvest management zone as part of their post-Boldt Decision efforts to provide adequate fishing opportunities for the Puyallup, Nisqually and Squaxin Island tribes, all of which have “usual and accustomed” fishing areas here. It includes several old Washington Department of Wildlife trout facilities not suited to salmon production and therefore has been managed based on a series of inter-basin stock transfers. At its height, this region was releasing up to ten million smolts per year (around ten percent of the total releases in Puget Sound and coastal Washington). Despite increased production, returns have declined. The scientists strongly recommend an analysis of the carrying capacity of the Sound and that production be capped or decreased in this region until more certainty is established.

3. Stillaguamish/Snohomish Rivers

This region includes the watersheds contained by the Stillaguamish and Snohomish rivers and Tulalip Bay. Sixteen hatchery programs were reviewed in this region, with 94 specific reforms recommended (see February 2002 HSRG Recommendations Report).

Habitat in the Stillaguamish River system has been heavily altered and compromised by land use activities such as logging, diking, housing development and dairy farming. Population growth could result in a watershed once rural in character becoming urbanized. The Skykomish features relatively undisturbed habitat. While the Snoqualmie is wild-like above North Bend, in rural, eastern King County it has been affected by agriculture and development. When the Skykomish and Snoqualmie join and form the Snohomish, the effects of development are even clearer. The Tulalip Tribes operate a successful terminal harvest program in Tulalip Bay, meaning that all returning fish are targeted by the Tribes and non-Indian sports fishers. The HSRG emphasized the importance of determining whether a significant number of these fish are straying to other regional streams and presenting risks to naturally spawning salmon. Another distinguishing characteristic of this region is its popular steelhead sport fishery. Unfortunately, steelhead in Washington state have been subject to decades of indiscriminate stock transfers without proper consideration of genetic or ecological concerns. Accordingly, this region is one where the HSRG’s “wild steelhead management zones” concept (see Area-Wide Recommendations above) was a particular focus of the recommendations.

4. Skagit River Basin

This region includes the watersheds contained by the Skagit River Basin (including the Skagit, Baker, Sauk and Suiattle rivers) and Whidbey Island. Eleven hatchery programs

were reviewed in this region, with 48 specific reforms recommended (see March 2003 HSRG Recommendations Report).

The Skagit River Basin is the largest watershed in Puget Sound and is home to all six species of anadromous salmonids. A significant amount of natural habitat is still available in this region, though it has been affected by hydropower and other land uses. The Skagit Basin is an important region for the recovery of Puget Sound salmon stocks. Strong spring, summer and fall chinook runs existed in the past and there is still a fair amount of this diversity left. However, there are conservation concerns for several stocks, including chinook, coho and steelhead. The region has a number of hatchery programs serving as indicator stocks for the US/Canada Treaty and other processes. These are important to fisheries management, but not central to recovery. Natural production goals are key for all species in this region. The HSRG recommended the managers size these indicator programs to meet indicator stock needs, but not above that level. The group also noted Baker Lake sockeye as an example of a hatchery program that is meeting its conservation goal by maintaining a stock that would otherwise go extinct.

5. Nooksack/Samish Rivers

This region includes the watersheds contained by the Nooksack and Samish rivers and the San Juan Islands. Nineteen hatchery programs were reviewed in this region, with 89 specific reforms recommended (see March 2003 HSRG Recommendations Report).

The Nooksack/Samish region reminded the HSRG of the Stillaguamish/Snohomish region, in that its habitat has been heavily altered and compromised by natural resource land use activities. Because of this, natural production has been severely impaired. Spring chinook stocks, in particular, are dependent on hatchery programs for recovery. The region also reminded the HSRG of the South Puget Sound region, in that management goals have emphasized hatchery production for harvest, especially on chinook and coho. This region was in the past the center of Puget Sound chinook harvest, but both hatchery production and harvest have been reduced over the last decade or so. The HSRG recommended the managers ensure their hatchery programs are consistent with conservation goals, in particular those for spring chinook. The group pointed out the importance of making sure recovery programs do not produce numbers of fish that exceed the capacity of the limited habitat into which they are released and to which they return. If this occurs, a program might be rebuilding one stock, while at the same time producing strays that compete with natural stocks in other streams.

6. Central Puget Sound

This region includes the central portion of Puget Sound, including the Puyallup River, Green River, Lake Washington and East Kitsap watershed. Thirty-one hatchery programs were reviewed in this region, with 149 specific reforms recommended (see March 2003 HSRG Recommendations Report).

Central Puget Sound is the largest region the HSRG has reviewed, both in terms of the number of programs reviewed and the number of recommendations provided. It is also where the largest concentration of the human population lives in Puget Sound and coastal Washington, putting particular focus on issues surrounding how salmon and people coexist. The HSRG reviewed four sub-regions within Central Puget Sound and found that each had its own distinct character.

The Puyallup River sub-region has been affected by land use and hydropower and is home to White River chinook, the last remaining spring chinook stock in South and Central Puget Sound. White River chinook owes its recent recovery to a successful hatchery intervention. The HSRG said this program has been successful enough that it is time to begin locally-adapting the stock, moving away from out-of-basin rearing.

The East Kitsap sub-region features smaller, shorter streams and is only now beginning to confront the rapid population growth and corresponding pressure on habitat that much of Central Puget Sound has already experienced. Consistent with its short streams, hatchery programs in this sub-region have emphasized chum production. Though the harvest benefits derived from these programs are not always large, the HSRG saw them as good examples of how hatcheries can be used for environmental education, in that they make extensive use of volunteers from the general public, many drawn from the new arrivals who need to learn about protecting salmon stocks and their habitat.

Goals other than conservation and harvest (i.e., education and research) are featured at hatchery facilities in the Lake Washington sub-region, such as Issaquah Hatchery and the University of Washington. Another major effort in this sub-region is the conservation and harvest hatchery program directed on Lake Washington sockeye. The HSRG provided a number of recommendations for allowing fish from this program to more closely emulate the natural life history pattern of sockeye in the Cedar River and Lake Washington.

The Green River sub-region has more than a century's history of hatchery and natural production existing side-by-side on a chinook stock that has remained relatively healthy. The region also features several net pen programs, which acclimate and release smolts in marine areas where a targeted fishery of returning adults is desired. Accordingly, this region is one where the HSRG's recommendations about reducing straying risks from outplanting and net pen programs (see Area-Wide Recommendations above) were a particular focus.

CONCLUSION

It is important to note that the HSRG's recommendations are based upon current goals and the best scientific information available at the time the reviews were conducted. In keeping with the tenets of adaptive management, it will be necessary to review and adapt these recommendations as new scientific information arises and/or goals change. The managers have asked the HSRG to assist them as they design the mechanisms necessary to implement the recommendations and adaptively manage hatchery programs in the future.

The report also focuses primarily on issues that need to be addressed and recommends changes that need to be made. It should not be read as a complete review listing every positive attribute alongside those that need to be changed. The HSRG has been very impressed by the diligence—and frequently the ingenuity—with which the state and tribal staffs carry out their programs, and with their dedication to the resource.

The full recommendations and all other Hatchery Reform Project-related publications (including the HSRG's review tools and a description of the process used to apply them) are available on the project's web site (www.lltk.org/hatcheryreform.html) or by contacting Long Live the Kings at (206) 382-9555.