



Applying Science to Hatchery Management

HSRG APPROACH TO HATCHERY REFORM

In 2000, when the US Congress tasked the HSRG with reviewing the Puget Sound and coastal Washington salmon and steelhead hatchery system, the general discussion about hatcheries debated whether hatcheries were “good” or “bad.” The HSRG chose a more scientifically sound approach—applying science to assess the benefits and risks from hatchery programs, and using this science to make recommendations that increase the likelihood of improving benefits and reducing risks, on a program-specific basis.

The HSRG determined that management decisions about hatchery programs must be made in the context of the particular circumstances in a given watershed. This approach requires an understanding of the current and expected future goals for all natural and hatchery stocks in an ecosystem—along with the habitat on which they depend—as well as harvest and conservation goals. Only within this context can it be determined if a hatchery program is an appropriate tool for helping to reach harvest and conservation goals for a given stock and, if so, what size and type of program is appropriate.

This sophisticated, methodical application of science was the foundation upon which the HSRG conducted its review of over 200 hatchery programs in 10 regions of Puget Sound and the coast—resulting in over 1,000 recommendations for change at individual hatcheries, along with 18 recommendations to be applied across the entire system. The HSRG called for management based on clear goals, scientifically defensible programs and informed decision-making. This process has moved the debate from problem identification to problem solving.

As a foundation for reform, the HSRG recommended that hatchery managers change their measure of success from the number of juvenile fish released, to the number of adult fish returning to sustain the stock and provide fishing opportunities. This means focusing on quality over quantity, understanding the carrying capacity of the freshwater and marine environments into which fish are released, and other scientifically sound hatchery practices.

Central to the HSRG’s work is the concept that hatchery fish must be managed either as part of a wild population (genetically integrated) or as a wholly separate population (genetically segregated). Segregated programs are for use primarily where the goal is to provide fishing opportunities, and where interactions between these fish and wild populations can be limited. Integrated programs are most appropriate where conservation is a primary goal, or for harvest programs where the potential for significant genetic interactions between hatchery and wild fish makes this the best strategy for meeting regional stock goals (for more information, see Appendix F, Technical Discussion Papers).

A properly integrated program maintains fish that are adapted to the natural environment, in that the naturally-spawning component drives the adaptation of the composite population. Therefore, these fish



may be appropriate for helping to rebuild declining wild populations. They should also survive in greater numbers than fish from a poorly integrated program, providing more fish for meeting either harvest or conservation goals.

Successful integrated programs require healthy naturally-spawning populations and the functional habitats that sustain them. In this context, a hatchery should not be seen as a substitute for habitat, but rather as an extension of it—a productive tributary of the watershed in which it resides.

The HSRG's approach affects more than just hatcheries. It requires a new approach to managing salmon and steelhead—one that begins with goals for and understanding of the status of naturally-spawning stocks and then designing hatchery programs consistent with conservation and harvest goals for those stocks. Far from seeing hatcheries as a substitute for habitat, hatchery reform recognizes that healthy, abundant habitat is essential to the success of hatchery programs that seek to meet these goals. The size and health of natural populations and the habitat on which they depend controls what hatcheries can do to boost natural spawning and/or provide a harvestable surplus. Hatchery reform means managing a holistic, science-based system that results in more adult fish returning to both maintain healthy, fit natural populations and provide harvest opportunities.

2004 PROJECT ACCOMPLISHMENTS

The Puget Sound and Coastal Washington Hatchery Reform Project brings together a unique combination of independent science, manager coordination, political support and third-party project coordination/facilitation that has proven to be a highly effective formula. The partnership is guided by the assumption that the best way to help the managers succeed in moving their hatchery system forward is to let the scientists focus on science and the managers on management. The scientific recommendations assess benefits and risks, but leave the “how-to's” to the managers. Each member of this partnership achieved significant accomplishments in 2004, which are described below (2004 expenditures are detailed in Appendix A).

HSRG Principles and Recommendations Report

In April 2004, the HSRG completed the regional review phase of the Hatchery Reform Project by publishing a report containing over 1,000 recommendations for change at individual hatcheries, along with 18 recommendations to be applied across the entire system. The HSRG also provided three principles to guide hatchery management in the future:

1. *Goals* for all stocks must be quantified and expressed in terms of values to the community (harvest, conservation, education, research, etc.)
2. The purpose, operation and management of each hatchery program must be *scientifically defensible* and consistent with current scientific knowledge.
3. *Decisions must be informed* and modified by continuous evaluation and new scientific information.

The report was released at a news conference in Seattle. At the news conference, WDFW Director Jeff Koenings and Northwest Indian Fisheries Commission (NWIFC) Chair Billy Frank, Jr.



pledged to implement the recommendations. Washington Governor Gary Locke pledged to include funding for hatchery reform in his proposed 2005–07 biennial budget. Congressman Norm Dicks, D-WA, applauded the progress achieved. The report was widely praised in extensive media coverage (see Publications page of the project’s web site, www.hatcheryreform.org).

The report also included a set of tools developed by the HSRG for the regional review process, which can be used by the managers to apply science to decision making about hatcheries into the future. Those tools (all available from the project’s web site) include:

Scientific Framework

Organizes the current state of knowledge about how actions associated with hatcheries affect the environment and fish resources. Forms the basis for all of the HSRG’s tools, processes and recommendations. First published in 2000, after review by over 200 scientists and stakeholders. Updated in 2004.

Benefit/Risk Assessment Tool

Adapted from a tool developed by the co-managers, allows the user to evaluate the relative benefits and risks associated with specific actions and choices in hatchery management. Central to the regional review effort.

Hatchery Operational Guidelines

Describe operational practices to meet conditions for success, as defined in the Scientific Framework.

Annual Research Grant Program

A competitive grant program funding research projects to address knowledge gaps identified in the Scientific Framework.

Emerging Issues in Hatchery Reform

White papers on emerging issues critical to 21st-century hatchery management, such as the effects of changing ocean conditions on fisheries, preventing hatchery fish from preying on wild fish, and methods for preserving genetic diversity and fitness in hatchery populations.

Technical Discussions and Workshops, Tools Developed

The state and tribal co-managers of Washington’s salmon and steelhead asked the HSRG to work with them in 2004 to develop tools for managing hatcheries consistent with the new context described in the HSRG’s principles and recommendations. Building on the tools developed during the review process (see above), the HSRG held technical discussions with WDFW and NWIFC scientists in the spring of 2004 that resulted in several important products. The first were technical discussion papers refining, and providing guidelines for implementing, the integrated and segregated hatchery program concepts (see Appendix F, Technical Discussion Papers).



This scientific work provided a foundation for development of the “All H Analyzer” (AHA) management tool. AHA was used in a series of HSRG/co-manager technical workshops that were held in all ten Puget Sound and coastal Washington regions in the summer of 2004. The purpose of the workshops was to apply the guidelines for integrated and segregated hatchery programs to regional case studies, preparing the co-managers for decision-making meetings about implementing reform. AHA was applied to 27 case studies during the workshops. The managers found it to be a useful tool for understanding the implications of management alternatives and actions. AHA has generated a great deal of interest, because it is the only tool currently available for assessing the likely results of habitat, harvest and hatchery actions and alternatives together on a specific stock (a generic example of AHA is included as Appendix G).

AHA is a management decision-making tool, built on recent work by HSRG, WDFW, NWIFC, National Oceanic and Atmospheric Administration (NOAA) Fisheries and other scientists, that allows the user to:

- Use current habitat productivity/capacity, harvest rates and hatchery operations in a watershed and consider what will result from that set of factors, in terms of the number of fish returning to the habitat, harvest and hatchery, and the amount of influence the natural environment should have on integrated natural/hatchery populations.
- Examine how these results could be modified in the short- and long-terms if habitat, harvest and/or hatchery programs are changed.
- Confirm current conditions, describe a goal for the long-term future of the population, and develop one or more scenarios for achieving or moving toward the goal.
- Apply a scientific approach in the face of the uncertainty always present in natural resource management.
- Move from general management guidelines to strategies specifically tailored to unique watershed conditions and circumstances identified during the regional reviews.

The management tool itself:

- Allows managers to take a more sophisticated approach by considering the habitat, harvest and hatchery factors together.
- Is basically an accounting tool that uses the best available scientific information to predict implications, quantifies and tracks fish produced naturally and in hatcheries, fish removed for harvest or hatchery broodstock, and the likely results of hatchery/natural fish interactions in the natural environment.
- Fosters accountability, by documenting goals, assumptions, scientific hypotheses, relationships, management decisions and the rationale behind these decisions. The assumptions can then be verified by monitoring and evaluation; the hypotheses can be tested by research. In this way, AHA can be used to help identify areas where better science will make a difference in decision making.



- Tests a key hypothesis about whether fitness loss can be addressed without losing demographic benefits from hatcheries. Because this is an area of uncertainty, the effects of fitness gain or loss can be adjusted or turned off in AHA. The HSRG is also funding research on this topic (see chapter on research in the HSRG's April 2004 report).

The spring 2004 technical discussions also lent momentum to an effort by HSRG, NWIFC and WDFW scientists to provide the managers with a practical and cost-effective set of variables to monitor, in order to ensure hatchery programs are accountable for their results, successfully meeting goals, and adaptively managed to improve performance and adjust to changing circumstances. The HSRG, seeing this as a critical element of successful hatchery reform, has continued to work on this tool. The result will be a management tool entitled "Managing for Success and Accountability at Hatcheries." Moving forward on this tool will be a central task for the project in 2005.

Research and Scientific Publications

The HSRG continues to oversee a competitive grant program to fund research projects that fill knowledge gaps about using hatcheries to meet harvest and/or conservation goals. In February 2004, the HSRG held its annual research review meeting at the NOAA Fisheries Science Center in Seattle, receiving reports from funded researchers. Over 40 state, tribal, federal, academic and private scientists and technical staff attended. Following this review, the HSRG decided to continue funding for five projects (research project reports are available at the project's web site).

In May 2004, the HSRG responded to a request from the Alaska Department of Fish and Game and the University of Alaska-Fairbanks to co-host scientific workshops in Juneau and Anchorage, Alaska. These workshops presented an overview of the Hatchery Reform Project and the work of the HSRG, and allowed an exchange of information and research results on hatchery-related issues with Alaskan researchers, managers and policy makers. The presentations made at the workshops are available on the project's web site.

In the fall of 2004, the HSRG began preparing a series of manuscripts to be submitted to the peer-reviewed, scientific literature, on topics including the integrated/segregated concept, quantification of fitness loss, guidance on when to consider conservation hatchery programs, and others. One will apply the AHA tool to analyze the implications of integrated hatchery programs in western Washington. The first manuscript accepted for publication is *Hatchery Reform in Washington State: Principles and Emerging Issues*. It will be published in the American Fisheries Society's *Fisheries* magazine in June 2005. The HSRG will continue to put an emphasis on scientific publications. Manuscripts will be made available electronically, once submitted for publication.

Agency Science Teams

Information below provided by the Washington State Department of Fish and Wildlife

Major 2004 hatchery reform accomplishments for the WDFW hatchery science team include participating in development of AHA (see above). Also, all anadromous Puget Sound hatcheries were assessed and estimated costs generated by professional engineers for intake/passage and abatement compliance, implementation of HSRG recommendations, and



capital needs to maintain current production for the next ten years. Severe hatchery fish losses to avian and mammalian predators were curtailed through installation of predator control devices at Marblemount, Palmer, Sol Duc and Bogachiel hatcheries.

In addition, 12 multi-year, hatchery research studies supported by hatchery reform funding were continued in 2004, including work on hatchery/wild interactions, survival and diet studies. New hatchery technology necessary to implement reform was acquired and integrated into hatchery operations, including brood stock handling machines, an automated fish snout snipper for coded-wire tag recovery, and carbon dioxide stunner units used with adult fish pumps. Twenty previously-untagged hatchery stocks were coded-wire tagged, so important information on survival, harvest and return distributions can be ascertained.

Information below provided by the Northwest Indian Fisheries Commission

Tribal hatchery reform funding not devoted to implementation projects at tribal facilities (see section below on implementation funding provided/still needed) has been used to support the tribal hatchery science team within the Enhancement Services Division at NWIFC, as well as the tribal representative to the HSRG, based at the Nisqually Tribe. The NWIFC hatchery reform-funded science team consists of a geneticist, a biometrician and a salmon ecologist, who are supervised by a senior geneticist. The geneticists provide technical support for commission and tribal staff on issues involving genetics and salmon recovery including: appropriate uses of hatcheries in salmon recovery programs; planning, implementation and monitoring of hatchery research; risk assessment; and mixed stock fishery analysis using genetic data. The salmon ecologist provides technical support for tribal programs on issues involving ecology and artificial production such as the role of fish behavior, interspecies interactions and freshwater and nearshore habitats in designing hatchery programs; planning, implementation and monitoring of research for hatchery activities; and risk assessment of hatchery programs. The biometrician provides technical support for NWIFC and tribal enhancement staff on experimental design and monitoring, statistical analysis and database maintenance.

FY 2004 tribal science team work activities:

- NWIFC staff geneticists worked with tribes on genetic issues associated with the development of hatchery management and reform plans; helped collect and analyze morphological and DNA data on threatened Nooksack River and Stillaguamish River wild Chinook; developed tribal research to evaluate genetic changes in hatchery and wild populations; reviewed HSRG guidelines and developed models for the HSRG to use with the co-managers in deciding when to start hatchery programs and how to integrate hatchery and wild production consistent with sustainable natural production; coordinated information exchange between the co-managers, the HSRG, other independent scientific review groups such as the Recovery Science Review Panel, federal regulatory agencies, and the Shared Strategy for Salmon Recovery in Puget Sound; secured a grant and began developing a quantitative risk assessment model for hatcheries.
- The NWIFC staff biometrician worked with the tribes to develop statistical techniques for assessing the contribution of hatchery and wild fish to natural spawning aggregations;



analyzed data on returns of hatchery fish, which is useful for evaluating the success of hatchery programs; and provided statistical consulting on tribal research and monitoring projects. The biometrician has assisted the HSRG in developing monitoring and evaluation criteria that can be used to determine the success of a hatchery program in meeting its goals and objectives. These criteria will also consider what data is needed for future research on hatcheries. The biometrician has also begun work with participants in regions already reviewed by the HSRG, to aid them in tailoring monitoring and evaluation criteria to the features and circumstances of their region.

- The NWIFC salmon ecologist helped tribes develop and implement estuary research for investigating co-occurrence between hatchery and wild fish; continued to build upon a literature database on ecological interactions; and is developing a database of tribal hatchery reform recommendations and completed hatchery reform projects. The ecologist also worked with individual tribes to assist in development and implementation of ecological studies funded through the Hatchery Reform effort.
- New hatchery management software and a database have been developed and distributed, to greatly improve the amount of information available to hatchery managers. The software, called HatPro, improves monitoring, management and planning capabilities for hatchery managers, as well as allowing on-site electronic transfer of key hatchery data directly to state, tribal and federal agencies. Four group training workshops, and numerous on-site training sessions, have been provided to tribal hatchery managers.

Information below provided by the US Fish and Wildlife Service

FY 2004 USFWS science team work activities included:

- Participation of a USFWS fish geneticist as a member of the HSRG, including preparation of reports and scientific papers.
- Conduct of a science support project by a USFWS fish nutrition specialist concerning analysis and quality control of fish feed at Olympic Peninsula fish hatcheries.