The All-H Hatchery Analyzer (AHA)

Hatchery Reform Technical Discussion Paper, August 2005[1]

Background

Management decisions about salmon and steelhead hatchery programs are best made in the context of the particular circumstances in a given watershed. This requires understanding the current and expected future status of 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 represents a new, watershed-based approach to management of anadromous salmonids, one that takes into account all the factors that affect a species (sometimes referred to in the case of salmonids as the "H's"—habitat, harvest and hatcheries). Recognizing this, the state and tribal co-managers of Washington's salmon and steelhead asked the Hatchery Scientific Review Group (HSRG) to work with them to develop tools for managing hatcheries in this new context.

Technical discussions in 2004 with Washington State Department of Fish and Wildlife (WDFW) and Northwest Indian Fisheries Commission (NWIFC) scientists resulted in one such tool—the "All-H Hatchery Analyzer" (AHA). AHA was applied to 27 case studies in a series of technical workshops in Puget Sound and coastal Washington during the summer of 2004. It is being refined during technical discussions in 2005 among scientists from the HSRG, WDFW, NWIFC and individual treaty tribes.

Purpose

AHA is a hatchery management planning tool, built on recent work by HSRG, WDFW, NWIFC, NOAA Fisheries and other scientists.[2] AHA is used to project the effects of artificial propagation on the target stock, given details about brood sources, survival rates and general information about the productivity and capacity of natural habitat and overall harvest rates on natural- and hatchery-origin fish.

AHA provides a way to explore the genetic implications of alternative broodstock management strategies and enables planners to compare alternative scenarios for incorporating natural-origin broodstock into hatchery programs, as well as different program sizes. AHA projects the effects of various hatchery scenarios, under differing harvest and habitat assumptions, on the productivity and abundance of associated natural spawners of natural and hatchery origin, in terms of whole population performance.

AHA allows salmon and steelhead managers to:

- Use current habitat productivity/capacity, harvest rates and hatchery operations in a watershed to consider what will result from that set of factors, in terms of the number of adult fish returning to the habitat, harvest and hatchery, and the amount of influence the natural environment has on integrated natural/hatchery populations.

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[1] This paper was produced by the Hatchery Reform Technical Discussion Group, which has included John Barr, Lee Blankenship, Don Campton, Trevor Evelyn, Tom Flagg, Connie Mahnken, Lars Mobrand Lisa Seeb, Paul Seidel and Bill Smoker, Hatchery Scientific Review Group; Alan Chapman, Lummi Indian Nation; Ken Currens and Terry Wright, Northwest Indian Fisheries Commission; Chris Weller, Point No Point Treaty Council; Kip Killebrew, Stillaguamish Tribe; Kit Rawson, Tulalip Tribes; and Andy Appleby, Heather Bartlett, Craig Busack and Jim Scott, WDFW.

[2] See for example:

Ford, M.J. 2002. Selection in captivity during supportive breeding may reduce fitness in wild. Conserv. Biol. 16:815-625

Lynch, M., and M. O'Hely. 2001. Supplementation and the genetic finess of natural populations. Conservation Genetics 2: 363-378.

- 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 that 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.

AHA is important, because it:
- Uses the best available scientific information to predict implications, and quantifies/tracks fish produced naturally and in hatcheries, fish removed for harvest or hatchery broodstock, and the likely genetic interactions of hatchery and natural fish spawning 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.[3]
- Can be used in conjunction with detailed habitat models, such as SHIRAZ or EDT, and more detailed harvest models, such as FRAM, if more detail of habitat and harvest management is required.[4]

Current Status and Next Steps

- Participants in the Hatchery Reform Technical Discussion Group are currently discussing AHA and considering possible refinements. The group encourages salmonid managers and others to do case studies using AHA and welcomes informal feedback, to help improve it.
- The HSRG is in the process of preparing a manuscript for publication in a peer reviewed journal, where AHA will be used to analyze the implications of integrated hatchery programs in western Washington. The methods section of this journal article will also serve to describe and document AHA for peer review. The draft manuscript will be made available electronically once it is submitted for publication.
- AHA is being used by co-managers in Puget Sound and coastal Washington to develop short-term harvest, habitat and hatchery strategies that can lead to the recovery of important natural stocks and sustainable fisheries.
- As part of the Northwest Power and Conservation Council's sub-basin planning process, AHA is being used to bring together hatchery strategies with the habitat components of sub-basin plans.
- AHA will be used to document the assumptions made about harvest, habitat and hatchery programs in the Managing for Success (MFS) tool currently being developed to support adaptive management, monitoring and evaluation.

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[3] Because this is an area of uncertainty, the effects of fitness gain or loss can be adjusted or turned off in AHA.
[4] For more information on these models, see:

Lestelle, L. C., L. E. Mobrand, and W. E. McConnaha. 2004. Information Structure of Ecosystem Diagnosis and Treatment (EDT) and Habitat Rating Rules for Chinook Salmon, Coho Salmon, and Steelhead Trout. Mobrand Biometrics, Inc., Vashon Island, WA, 27 pages.

Model Evaluation Workgroup. 2004. Fishery regulation assessment model (FRAM): An overview for Chinook and coho, 39 pages (Available from Northwest Indian Fisheries Commission, 6730 Martin Way E., Lacey, WA 98516).

Mobrand, L. E., J. A. Lichatowich, L. C. Lestelle, and T. S. Vogel. 1997. An approach to describing ecosystem performance "hrough the eyes of salmon."Canadian Journal of Fisheries and Aquatic Sciences 54:2964-2973.Sharma, R., A. B. Cooper, and R. Hilborn. 1997. A quantitative framework for analysis of habitat and hatchery practices on pacific salmon. Columbia River Inter-Tribal Fish Commission, Scientific, Seattle, 58 pages.

Scheuerell, MD, R Hilborn, MH Ruckelshaus, KK Bartz, K Lageux, A Hass, and K Rawson. (in review). SHIRAZ: a model framework for incorporating fish-habitat relationships in conservation planning. Canadian Journal of Fisheries and Aquatic Sciences.