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Pacific Salmon Hatchery Reform
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Subject: HSRG Review of North/Middle Fork Nooksack Native Chinook HGMP

A subcommittee of the Hatchery Scientific Review Group (HSRG) has reviewed the North/Middle Fork Nooksack Native Chinook Salmon Hatchery and Genetic Management Plan (HGMP), dated January 16, 2013. The principles and recommendations developed by the HSRG during their review of the Columbia River Basin hatcheries (HSRG 2009) were used as a template to organize information from review of this HGMP. The HSRG reviewers were asked to compare the consistency of the North/Middle Fork Nooksack Native Chinook Salmon HGMP with the principles and recommendations developed by the HSRG for hatchery operations for the Columbia River Basin. The results are as follows:

Principles and System-Wide Recommendations

The HSRG's three principles for hatchery management are presented below, with each of 17 system-wide recommendations (applicable to programs across the Columbia River Basin hatchery system) listed under the principle from which it is derived. These principles and system-wide recommendations represent the key findings of the HSRG during its review of Columbia River Basin hatcheries, but are applicable to all hatchery programs. Hatchery programs that adhere to these principles and recommendations are more likely to contribute to the managers' harvest and conservation goals.

Principle: Develop Clear, Specific, Quantifiable Harvest and Conservation Goals for Natural and Hatchery Populations within an "All H" Context.

"During its reviews, the HSRG observed that goals for fish populations were not always explicitly communicated and/or fully understood by the managers and operators of hatchery programs. These goals should be quantified, where possible, and expressed in terms of values to the community (harvest, conservation, education, research, etc.). At times, goals have been expressed in terms of the numbers of smolts to be released without specifying whether or how this hatchery production contributes to harvest and/or conservation. Hatchery production numbers may be the means of contributing to harvest and/or conservation values, but they are not endpoints. When population goals are clearly defined in terms of conservation and harvest, hatcheries can be managed as tools to help meet those goals."

"To be successful, hatcheries should be used as part of a comprehensive strategy where habitat, hatchery management and harvest are coordinated to best meet resource management goals that are defined for each population in the watershed. Hatcheries are by their very nature a compromise—a balancing of benefits and risks to the target population, other populations, and the natural and human environment affected by the hatchery program. Use of a hatchery program is appropriate when the benefits significantly outweigh the risks and when the benefit/risk mix from the program is more favorable than the benefits/risks associated with non-hatchery strategies for meeting the same goals."

Recommendation 1: *Express conservation goals in terms of a population's biological significance (Primary, Contributing, Stabilizing) and viability (natural-origin spawning abundance and productivity).*

Comment: The HGMP identifies the North/Middle Fork Nooksack Chinook salmon population as a Primary population. The HGMP describes the viability goals for the population in terms of equilibrium abundance (16,000 and 16,400 as identified by the Puget Sound Technical Recovery Team and the Co-managers, respectively, using two independent models) and as an MSY abundance of 3,680 spawners at a productivity of 3.4. According to the TRT, these are conceptually different points on the productivity-abundance curve that defines viable for this population.

Recommendation 2: *Express harvest goals in terms of a population's contribution to specific fisheries.*

Comment: There is no directed harvest on this population in the terminal area and consequently the HGMP does not identify desired contribution to fisheries. The HGMP identifies the hatchery strategy as "integrated recovery" with the focus of maintaining the genetic characteristics and abundance of the population while allowing habitat that supports natural production to recover. Consequently, harvest restrictions in pre-terminal Southern U.S. fisheries are set at a 7% exploitation rate/year to protect the population rather than to protect fishery benefits. Since 2011 the pre-terminal Southern U.S. exploitation rate has averaged 2%.

Recommendation 3: *Ensure goals for individual populations are coordinated and compatible with those for other populations in the Region.*

Comment: At the level of the ESU, the goals for the populations in the Nooksack River and the hatchery strategy of this HGMP are compatible and consistent with the *Puget Sound Salmon Recovery Plan* adopted by NOAA to recover of the ESU. The HGMP also describes the legal and management frameworks used to coordinate and make decisions about hatcheries regionally (e.g., *U.S.* vs. *Washington, Puget Sound Salmon Management Plan, Puget Sound Chinook Salmon Resource Management Plan)* and to set watershed-specific conservation objectives (*WRIA 1 Salmon Recovery Plan*). Although these are the management frameworks under which assessments of compatibility and coordination of hatchery programs occur, the HGMP provides little detail of this assessment. However, the HGMP refers to actions taken to protect earlier-returning Chinook salmon in the South Fork Nooksack River from impacts of the North/Middle Fork Nooksack Chinook salmon program, which indicates that coordination and assessment of hatchery programs is occurring at the watershed scale.

Principle: Design and Operate Hatchery Programs in a Scientifically Defensible Manner.
"Once a set of well-defined population goals has been identified, the scientific rationale for a hatchery program (in terms of benefits and risks) must be formulated, explaining how the program expects to achieve its goals. The purpose, operation and management of each hatchery program must be scientifically defensible. The strategy chosen must be consistent with current scientific knowledge. Where there is uncertainty, hypotheses and assumptions should be articulated."

"Scientific defensibility should be a central consideration throughout all phases of a hatchery program—when determining whether a hatchery should be built or a program initiated; during the hatchery or program planning and design phase; and during the operations phase. This ensures a scientific foundation for hatchery programs, a means for addressing uncertainty, and a method for demonstrating accountability. Documentation for each program should include a description of analytical methods and should be accompanied with citations from the scientific literature."

Recommendation 4: *Identify the purpose of the hatchery program (i.e., conservation, harvest or both).*

Comment: The HGMP identifies the hatchery strategy as "integrated recovery" with the focus of maintaining the genetic characteristics and abundance of the population while allowing habitat to support natural production to recover.

Recommendation 5: *Explicitly state the scientific assumptions under which a program contributes to meeting the stated goals.*

Comment: The scientific assumptions under which this program contributes to meeting the stated goals are not clearly stated. This is a key area where this HGMP could be improved. It is possible to infer some fundamental assumptions from the purpose and strategy of the program (i.e. genetic characteristics can be maintained by the current hatchery strategy; factors other than habitat are not limiting abundance; and habitat structure and function can be recovered to support natural production). It is also possible to infer a number of other critical scientific assumptions from the list of performance standards and indicators (Table 1.10.1 and 1.10.2) but these assumptions are not explicitly stated and in general the descriptions of performance standards and indicators are too poorly defined to understand whether data collected for the indicators would be good enough to test these assumptions (See Recommendation 14 also).

Recommendation 6: *Select an integrated or segregated broodstock management strategy based on population goals and hatchery program purpose.*

Comment: The HGMP identifies the hatchery strategy as integrated. The HGMP identifies a short term proportional genetic influence (PNI) benchmark goal of >.05, and a long term PNI goal of > .70. It does not define the time periods for "short term" and "long term" or identify management triggers based on habitat quality, natural production, or other biological factors that would guide management to get from a PNI of 0.05 to a PNI of 0.70 or greater. We recommend that these be developed.

Recommendation 7: *Size hatchery programs based on population goals and as part of an "all H" strategy.*

Comment: Hatchery program size is consistent with objectives of maintaining a genetic effective size large enough to maintain genetic diversity over a long period, maintaining terminal abundance in the face of Northern fisheries, and providing statistical power for monitoring. Descriptions of changes in program size that were made to protect South Fork Chinook salmon from impacts of the North/Middle Fork hatchery program indicate that program size also considers other populations in the watershed.

Recommendation 8: *Manage harvest, hatchery broodstock and natural spawning escapement to meet HSRG standards appropriate to the affected natural population's designation.*

Comment: The HGMP identifies a short term proportional genetic influence (PNI) benchmark goal of >.05, a long term PNI goal of > .70, and a goal for proportion of hatchery-origin fish spawning naturally (pHOS) of <0.30. The HGMP does not report PNI values but provides most of the demographic information (e.g. pNOB and pHOS) needed to calculate the value. It does not define the time periods for "short term" and "long term" or identify management triggers based

on habitat quality, natural production, or other biological factors that would guide management to get from a PNI of 0.05 to a PNI of 0.70 or greater.

Recommendation 9: *Manage the harvest to achieve full use of hatchery-origin fish.*

Comment: There is no directed terminal harvest on North/Middle Fork Nooksack Chinook salmon and incidental harvest in Southern U.S. fisheries is currently limited to 7% to protect the abundance of this population.

Recommendation 10: *Ensure all hatchery programs have self-sustaining broodstocks.*

Comment: Since 2005, the number of brood stock collected has consistently been less than the maximum of 520 proposed for brood stock collection because survivals in the hatchery have allowed managers to achieve release goals. Returns of Chinook salmon to the North/Middle Fork Nooksack River have averaged approximately 1,800 fish of which approximately 14% are natural origin, which allows for a source of self-sustaining brood stock. However, analyses of growth trend in the population by the National Marine Fisheries Service (Ford 2011) indicate that the population is barely replacing itself even with the assistance of the hatchery.

Recommendation 11: *Coordinate hatchery programs within the Regions ecosystem to account for the effects of all hatchery programs on each natural population and each hatchery program on all natural populations.*

Comment: Section 3.1 and 3.2 of the HGMP describe the management frameworks and tools used to coordinate hatchery programs. The HGMP does not describe whether or how these frameworks have been used to account for the effects of all hatchery programs on natural populations. We recommend that the HGMP include citations that help explain how this assessment and coordination was done.

Recommendation 12: *Assure that facilities are constructed and operated in compliance with environmental laws and regulations.*

Comment: Water quality data for discharges from Kendall Creek Hatchery indicate that the program has operated consistently in compliance with the National Pollution Discharge Elimination System (NPDES) general permit. The HGMP states that the gravity water intake structure meets state and federal guidelines (NMFS 1995, 1996 – *NOTE: THESE CITATIONS ARE MISSING FROM THE HGMP*) but that it does not meet the current Anadromous Salmonid Passage Facility Design criteria (NMFS 2011). The HGMP states that although these screens are identified for replacement, they are a lower priority than others needing screens because listed Chinook salmon do not occur above the rack on Kendall Creek.

Recommendation 13: *Maximize survival of hatchery fish consistent with conservation goals.*

Comment: Fish released from this program appear to be released at times, sizes, and locations that maximize survival of the fish and minimize potentially negative ecological interactions.

Principle: Monitor, Evaluate and Adaptively Manage Hatchery Programs.
"In addition to establishing resource goals and a defensible scientific rationale for a hatchery program, the HSRG recommends that the managers' decisions be informed and modified by continuous evaluation of existing programs, changing circumstances and new scientific information. Decisions about hatcheries must also be made in a broader, integrated context and hatchery solutions must meet the test of being better, in a benefit/risk sense, than alternative available means to meet similar goals. Systems affected by hatchery programs are dynamic and complex; therefore, uncertainty is unavoidable. The only thing certain is that the unexpected will occur."

Recommendation 14: *Regularly review goals and performance of hatchery programs in a transparent, regional, "all-H" context.*

Comment: Many of the management frameworks identified in the HGMP allow for regular review of hatchery programs. However, this HGMP fails to describe the technical components that would support rigorous scientific input into these reviews. Table 1.10.1 and 1.10.2 are a good start as a technical framework for reviewing program goals, objectives, and performance but it needs significant work to be usable. In recent years, scientific thinking and testing of ecological meaningful management indicators has advanced considerably. Unfortunately, these tables do not reflect that work. We recommend that the assumptions (or logic models) that are being addressed by the performance standard and indicators be explicitly stated. We also recommend that the HGMP include definitions of "performance standard" and "indicator" in the glossary (Attachment 1) and that the performance standards and indicators in the tables be consistent with those definitions. We recommend that the selection of indicators be based on assessing potential metrics against scientifically established criteria for choosing good indicators (e.g. NRC 2000, Rice and Rochet 2005, Kershner et al. 2011, and citations therein).

Recommendation 15: *Place a priority on research that develops solutions to potential problems and quantifies factors affecting relative reproductive success and long-term fitness of populations influenced by hatcheries.*

Comment: The HGMP describes no research associated with this program.

Recommendation 16: *Design and operate hatcheries and hatchery programs with the flexibility to respond to changing conditions.*

Comment: The HGMP does not address how the hatchery program will change in response to changing conditions. As noted earlier, the HGMP does not identify the time periods for "short term" and "long term" objectives or identify management triggers based on habitat quality, natural production, or other biological factors that would guide management. A first step in this would be to develop an explicit conceptual model or logical chain for how the hatchery program is expected to support recovery given expected changes in freshwater and near shore habitat and harvest. A second step we have already identified above in Recommendation 14: assess and choose indicators that allow you to evaluate the assumptions of the conceptual model. A third step would be to identify triggers using the indicators based on the conceptual model. A fourth step would be to use Sections 11.1.1 and 11.1.2 to describe a basic monitoring plan (where, when and how the data will be collected).

Recommendation 17: *Discontinue or modify programs if risks outweigh the benefits.*

Comment: The HGMP does not describe how these decisions would be made. Table 1.10.1 and 1.10.2 describe performance standards and indicators for "benefits" and "risks" but as we noted above, these are not currently usable. Narrative in the HGMP – such as the reduction in program size to protect South Fork Chinook salmon from straying North Fork hatchery fish – indicates that the consideration of risk and benefits has already been incorporated into the management of this program.

Literature Cited

Ford, M.J. (ed.). 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-113, 281 p.

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