The Washington Department of Fish and Wildlife (WDFW) developed the Nooksack Native Spring Chinook Hatchery and Genetic Management Plan (HGMP), placed a draft version on our web page on January 16, 2013, announced its availability, and solicited public comment through February 15, 2013.

A total of two individuals and organizations subsequently provided comments to WDFW during the public comment period. The comments were received from: Mr. Andy Appleby and Dr. Peter Paquet representing the Hatchery Scientific Review Group (HSRG) – Washington; and from one member of the general public via e-mail. Their comments are posted under a separate cover, and our responses are appended below.

WDFW Response to Comments by HSRG – submitted to WDFW February 15, 2013.

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.

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

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 1. *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.*

WDFW Response: The values provided in Table 2.2.2.1 were presented in NOAA Fisheries 2011 status review of Puget Sound Chinook (Ford 2011). These values correspond with the viability goals that NOAA has set for recovery and delisting of the Puget Sound Chinook populations. Ford (2011) describes the process for developing these goals below:

> "The TRT presented viable spawning abundances for 16 of the 22 populations in its viability report, while the Puget Sound Recovery Plan gave abundances for 20 of the populations. For this status review, values for the missing populations are extrapolated based on a linear relationship between basin size and the replacement point on the spawner-recruit function under historical conditions and properly functioning conditions over the populations with estimates. Productivity for populations without estimates was

assumed to be equal to the average productivity of the remaining populations (recruits per spawner [R/S] = 3.2). The high productivity planning target for abundance was then calculated from the spawner-recruit function, defined by the replacement value and the maximum sustained yield (MSY) productivity. These should be considered to be tentative estimates until population specific estimates are available. The spawning abundances at replacement (growth rate = 1) are the minimum target viability abundance. It is important to note that these are viability abundances assuming low (replacement only) productivity; higher productivity would result in lower viable spawning abundances."

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

Comment 2. *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%.*

WDFW Response: Salmon hatchery programs support state sport, state commercial, Treaty commercial, and Treaty ceremonial and subsistence fisheries. Unlike the State's lowland lake trout fisheries where such metrics as are being asked for make sense, the complexities of the salmon life history and salmon harvest management overlaid with Endangered Species Act conservation restrictions do not lend themselves to the creation of specific quantifiable goals for contribution to specific fisheries. The State sport and treaty harvests occur in all of Puget Sound as well as in the freshwater environments. The marine fisheries are supported by a host of hatchery programs throughout Puget Sound, whereas the freshwater fisheries are supported mostly by the local production. In order to create a fishery package for salmon harvest management, there are conservation objectives for specific stocks that must be met. Therefore, the success of fisheries is not only dependent on the size of hatchery programs but also on the fishery package in place that meets all the conservation objectives. For example, it may be that one year the harvest in a particular fishery is less in order to limit the harvest on a population that is not meeting its conservation objective. In another year the harvest might be higher because the limiting stocks did not curtail fisheries where a particular hatchery program's fish are caught. That and the number of different fisheries supported by each hatchery program and the number of different hatchery programs that support each fisheries make the concept impractical for salmon programs.

The Hatchery Science Review Group (HSRG 2003) has noted that well-defined program goals and performance measures provide an important foundation for fostering continued improvements in hatchery management. WDFW concurs, and has initiated an effort that extends beyond the requirements of the ESA to provide specific, numeric performance measures for key program characteristics. These are expected to include, as suggested by several respondents, performance measures related to the proportion of fish on the spawning grounds originating from hatchery production and smolt-to-adult survival rates for hatchery releases.

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

Comment 3. *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.*

WDFW Response: Comment noted.

2. Principle: Design and Operate Hatchery Programs in a Scientifically Defensible Manner.

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

Comment 4. *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.*

WDFW Response: Comment noted.

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

Comment 5. *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).*

WDFW Response: The basic scientific assumption applied in the HGMP for the current hatchery program is that current habitat productivity is too low for the population to be able to replace itself without the assistance of the hatchery program. The current hatchery program described in the HGMP is necessary to maintain critical genetic and demographic traits of this unique population. See also WDFW response to **Comment 6**, p 4.

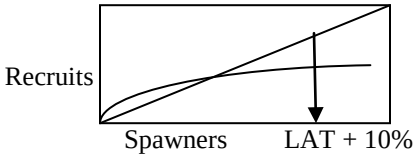
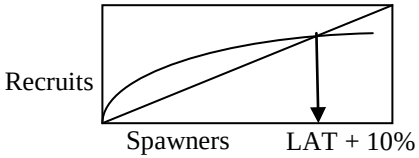
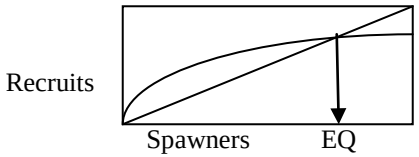
Recommendation 6*: Select an integrated or segregated broodstock management strategy based on population goals and hatchery program purpose.*

Comment 6. *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.*

WDFW Response: The short and long term goals do not refer to a time period, but rather to a response of the population to existing habitat conditions. Short- and long-term are defined by productivity, which is related to habitat condition and its status (degrading, neutral, or improving), and the response of the population to that status. Until there is better understanding of that rate, it is difficult to be specific about short- and long-term descriptors in terms of specific years.

Recovery is a cooperative effort between habitat, harvest, hatcheries, and in some cases hydropower. The philosophy embodied here is based on the HSRG description of phased recovery and the different roles that hatcheries play in the different phases. The response of the population to the habitat will dictate whether the population is in the Preservation, Colonization, Local adaptation phases, or Restored phase. **Table 1** shows the relationship between guidance for hatchery program purpose and structure and the HSRG values for the different phases. The state's hatchery programs demonstrate a variety of strategies depending on the recovery phase the current local objectives are addressing..

Table 1: Phase description for integrated hatchery programs.

PHASE	HSRG DESCRIPTION	WDFW PROGRAM OBJECTIVES	EXAMPLE
Preservation	Secure the genetic identity and diversity of the native population until habitat can support survival at all life stages.	Implement genetic preservation programs to prevent extinction while habitat productivity is either too low or too dynamic for the population to be able to consistently replace itself absent fishing.	Implement programs while spawner-recruit curve EQ point is below replacement line below the LAT + 10%. 
Re-colonization	Re-populate suitable habitat from pre-spawning to smolt outmigration (all life stages).	Implement programs to address demographic risks until the habitat is adequately and consistently productive to more than replace the NOS's for sufficient returns of natural origin fish.	Implement programs when 3 year ave. NOR > value that indicate a population response to Re-colonization programs. 
Local Adaptation – addressing genetic risk	Meet and exceed minimum viable spawner abundance for natural origin spawners. Increase fitness, reproductive success and life history diversity through local adaptation.	Implement programs to address genetic risks until the habitat has sufficient and consistent productivity and capacity to more than replace NOSs for healthy returns of natural origin fish.	Implement programs when 3 year ave. NOR > value that indicate a population response to Re-colonization programs. 
Restoration	Long-term adaptive management to maintain viable population, in terms of all VSP parameters.	Implement programs consistent with recovery parameters.	Delisted and habitat functions fully restored.

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

Comment 7. *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.*

WDFW Response: Comment noted.

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

Comment 8. *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.*

WDFW Response: See response to **Comment 6**, p 4.

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

Comment 9. *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.*

WDFW Response: Comment noted.

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

Comment 10. *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.*

WDFW Response: Comment noted.

***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 11. *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.

WDFW Response: Section 4 in the *Puget Sound Salmon Management Plan* (PSSMP) explains the Equilibrium Brood Program, which describes hatchery programs and the co-manager process of how changes may be made to those programs. Sections 9 and 10 of the PSSMP discuss harvest and harvest allocation. Therefore, the PSSMP addresses both. Chinook were not yet listed under the Endangered Species Act when PSSMP was published, however, so it is true that it does not reflect current conservation issues. Nevertheless, those court decisions guide the current co-management process in both harvest and hatcheries management under the concerns regarding ESA-listed species.

In addition to those documents, the Fish and Wildlife Commission developed Policy C-3619 with the intention of ensuring compatibility between hatchery production and salmon recovery plans. To that end, the co-managers are collecting on-going data via otoliths and coded-wire tags to monitor impacts of key programs likely to affect the population. In addition, the AHA model is the current vehicle for ascertaining impacts from multiple hatchery programs on natural populations.

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

Comment 12. *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.*

WDFW Response: Comment noted.

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

Comment 13. *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.*

WDFW Response: Comment noted.

3. Principle: Monitor, Evaluate and Adaptively Manage Hatchery Programs.

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

Comment 14. *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).

WDFW Response: As stated in NOAA's HGMP template, Tables 1.10.1 and 1.10.2 identify program "benefits" and "risks" utilizing performance standards set by Northwest Power Planning Council (NPPC 2001) in: *Performance Standards and Indicators for the Use of Artificial Production for Anadromous and Resident Fish Populations in the Pacific Northwest*. These performance standards and indicators have been scientifically reviewed by the NPPC's Production Review Committee and incorporate the guidelines of the Science Review Team (SRT), Integrated Hatchery Operations Team (IHOT) and the Pacific Northwest Fish Health Protection Committee (PNWFHPC).

Definitions of the "performance standards" and indicators are found in the NPPC (2001) document as cited below:

> **Standard**: a quantifiable state or condition described in such a way that it is easy to determine whether or not it is being met (Independent Scientific Advisory Board 2000).
>
> **Indicator**: measurable metrics that bear directly on the quantitative determination as to whether or not the standard is being met (Independent Scientific Advisory Board 2000). For the current purpose, indicators are further characterized as Level 1 or Level 2, in terms of scope and importance:
>
>> **Level 1**: Critical to the determination of progress toward achieving the pertinent standard. Many of these indicators are integral to the achievement of a given objective, or to the minimization of a significant risk, and should be part of the operation and monitoring plan of each applicable program – these are designated as All Programs. However, it is recognized that many critical indicators cannot be immediately implemented due to financial or logistical reasons. It is sufficient that these measures be part of a coordinated monitoring program taking place at several key facilities, such that the information gained can be extrapolated to other programs, and potentially help describe where additional research of a similar nature should be designed. Indicators whose immediate implementation is considered critical to evaluating artificial propagation effects, but which need only be implemented at representative locations, are designated as "Level 1–Representative Programs." Plans for addressing these representative program indicators should be developed as a cooperative effort between the co-managers within the region or appropriate subbasin.
>>
>> **Level 2**: Important in evaluating a given program. It is expected that these will need to be implemented as funding is identified. Timeframe for implementation will be recommended in the implementation phase. Most indicators of this type will not be implemented by every program, and therefore should be part of a coordinated implementation effort analogous to that described for "Level 1–Representative Programs" (above).

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 15. *The HGMP describes no research associated with this program.*

WDFW Response: Comment noted.

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

Comment 16. *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).*

WDFW Response: See response to **Comment 6**, p 4.

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

Comment 17. *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.*

WDFW Response: Comment noted.

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.

Independent Scientific Advisory Board. 2000. Review of the Draft Performance Standards and Indicators for Artificial Production in the Northwest Power Planning Council's Artificial Production Review.

Kershner, J, J.F.Samhouri, C.A James, and P.S.Levin. 2011. Selecting indicator portfolios for marine species and food webs: A Puget Sound case study. PLoS ONE 6(10): e25248. doi:10.1371/journal.pone.0025248.

NPPC (Northwest Power Planning Council). 2001. Performance standards and indicators for the use of artificial production for anadromous and resident fish populations in the Pacific Northwest. Portland, Oregon. 19 pp.

Rice, J. C. and M. J. Rochet. 2005. A framework for selecting a suite of indicators for fisheries management. ICES Journal of Marine Science 62:516-527

WDFW Response to Public Comments on the draft WDFW Nooksack Native Spring Chinook HGMP received by e-mail.

Comment from Mr. Kevin Mullen, member of the public, and response:

From: kevin mullen [mailto:kevindmullen@gmail.com]
Sent: Wednesday, January 23, 2013 4:30 PM
To: HGMP-PScomments (DFW)
Subject: hatchery programs, Nooksack and Skagit area

Sirs,

Sorry for all lack of succinctness, but you asked for the input….attached

Kevin

WDFW Response: Thank you for your comment.