

**4(d) Rule Limit 6
Evaluation and Recommended Determination**

Title: Hatchery and Genetic Management Plans for Hood Canal Hatchery Fall Chinook Salmon, Fall Chum Salmon, Pink Salmon, Coho Salmon, and Steelhead Trout

Plans Submitted by: Washington Department of Fish and Wildlife
Port Gamble S'Klallam Tribe
Skokomish Tribe
United States Fish and Wildlife Service

ESU/DPS: Puget Sound Chinook Salmon ESU
Hood Canal Summer Chum Salmon ESU
Puget Sound Steelhead DPS

4(d) Rule Limit: ESA 4(d) Rule Limit 6

**NMFS Tracking
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1 EVALUATION

NOAA's National Marine Fisheries Service (NMFS) issued a final Endangered Species Act (ESA) 4(d) rule adopting regulations (50 CFR 223.203) to conserve listed salmon and steelhead (70 FR 37160 and 73 FR 55451; NMFS and NOAA 2005; NMFS & NOAA 2008). However, under limit 6 of the 4(d) rule (the joint state-tribal 4(d) rule), ESA section 9 take prohibitions for listed species do not apply to hatchery activities described in a resource management plan (RMP) developed jointly by the Tribes and the States of Washington, Oregon, and/or Idaho provided that:

- The Secretary of Commerce has determined pursuant to 50 CFR 223.209(b) [the Tribal 4(d) rule] and the government-to-government processes therein that implementing and enforcing the RMP will not appreciably reduce the likelihood of survival and recovery of listed salmon and trout
- The joint plan will be implemented and enforced within the parameters set forth in *U.S. v. Washington* or *U.S. v. Oregon*
- The Secretary of Commerce has taken comment on how any HGMP addresses the 4(d) rule limit 5 criteria (§223.203(b)(5))

The Washington Department of Fish and Wildlife (WDFW) and the Port Gamble S'Klallam and Skokomish Tribes, as co-managers of the fisheries resource under *United States v. Washington* (1974), as well as the United States Fish and Wildlife Service (USFWS), have provided NMFS with 10 hatchery and genetic management plans (HGMP) proposed for implementation in the Hood Canal region (Table 1; Figure 1). The effects of any additional programs (e.g., Skokomish) in the region will be assessed when those programs are ready for evaluation. The applicants have provided the HGMPs for review and determination by NMFS pursuant to 4(d) rule limit 6. Each HGMP serves as an RMP for the purpose of limit 6 consideration; for this evaluation, description of the proposed activities will focus on the descriptions given in the individual plans. The proposed plans are similar through: shared salmon population recovery and harvest augmentation objectives and effects; broodstock collection locations and actions; fish rearing and release sites; monitoring and evaluation actions; and funding sources. All 10 HGMPs were assembled consistent with the Puget Sound and Hood Canal Salmon Management Plans (1986; 1985), the Federal court orders under *U.S. v. Washington* (1974) that control fisheries harvest management and hatchery salmon production in Hood Canal.

As per the tribal 4(d) rule, NMFS consulted with the applicants during the development of the HGMPs through government-to-government and technical work group meetings to provide technical assistance, to exchange information and discuss what would be needed to conserve the listed species, and to be consistent with legally enforceable tribal rights and the Secretary's trust responsibilities to the treaty tribes. The HGMPs were reviewed and NMFS determined that they were sufficient¹ for NMFS to proceed in its evaluation of plan effects on ESA-listed Puget Sound Chinook salmon, Hood Canal summer chum salmon, and Puget Sound steelhead. The following

¹ November 3, 2014, letter from R. Jones, NMFS, to P. Anderson, WDFW, R. Charles, Port Gamble S'Klallam Tribe, J. Pavel, Skokomish Tribe, and T. McDowell, USFWS.

discussion evaluates whether the submitted plans address the criteria in section 223.203(b)(5) of the 4(d) rule for salmon and steelhead.

Table 1. Proposed hatchery programs for Hood Canal salmon and steelhead.

Hatchery Program	Operator ²	Program Purpose	Date Submitted
Hamma Hamma Fall Chinook Supplementation ¹	LLTK/HCSEG/ WDFW	Integrated Recovery	May 1, 2013
Hood Canal Steelhead Supplementation	NMFS	Integrated Recovery	November 28, 2012
Quilcene National Fish Hatchery Yearling Coho Salmon Production	USFWS	Segregated Harvest	July 15, 2013
Hoodsport Hatchery Fall Chinook	WDFW	Segregated Harvest	May 6, 2014
Hoodsport Hatchery Fall Chum	WDFW	Segregated Harvest	January 11, 2013
Hoodsport Hatchery Pink Salmon	WDFW	Segregated Harvest	July 15, 2013
Port Gamble Coho Net Pen	PGST	Segregated Harvest	February 28, 2013
Port Gamble Hatchery Fall Chum	PGST	Segregated Harvest	February 28, 2013
Quilcene Bay Coho Net Pen	ST	Segregated Harvest	September 18, 2013
Enetai Creek Hatchery Fall Chum	ST	Segregated Harvest	September 10, 2013

¹ This program was discontinued after the 2015 release year. However, NMFS will still evaluate the program in preparation for it potentially being resurrected in the future.

² LLTK = Long Live the Kings; HCSEG = Hood Canal Salmon Enhancement Group; PGST = Port Gamble S'Klallam Tribe; ST = Skokomish Tribe.

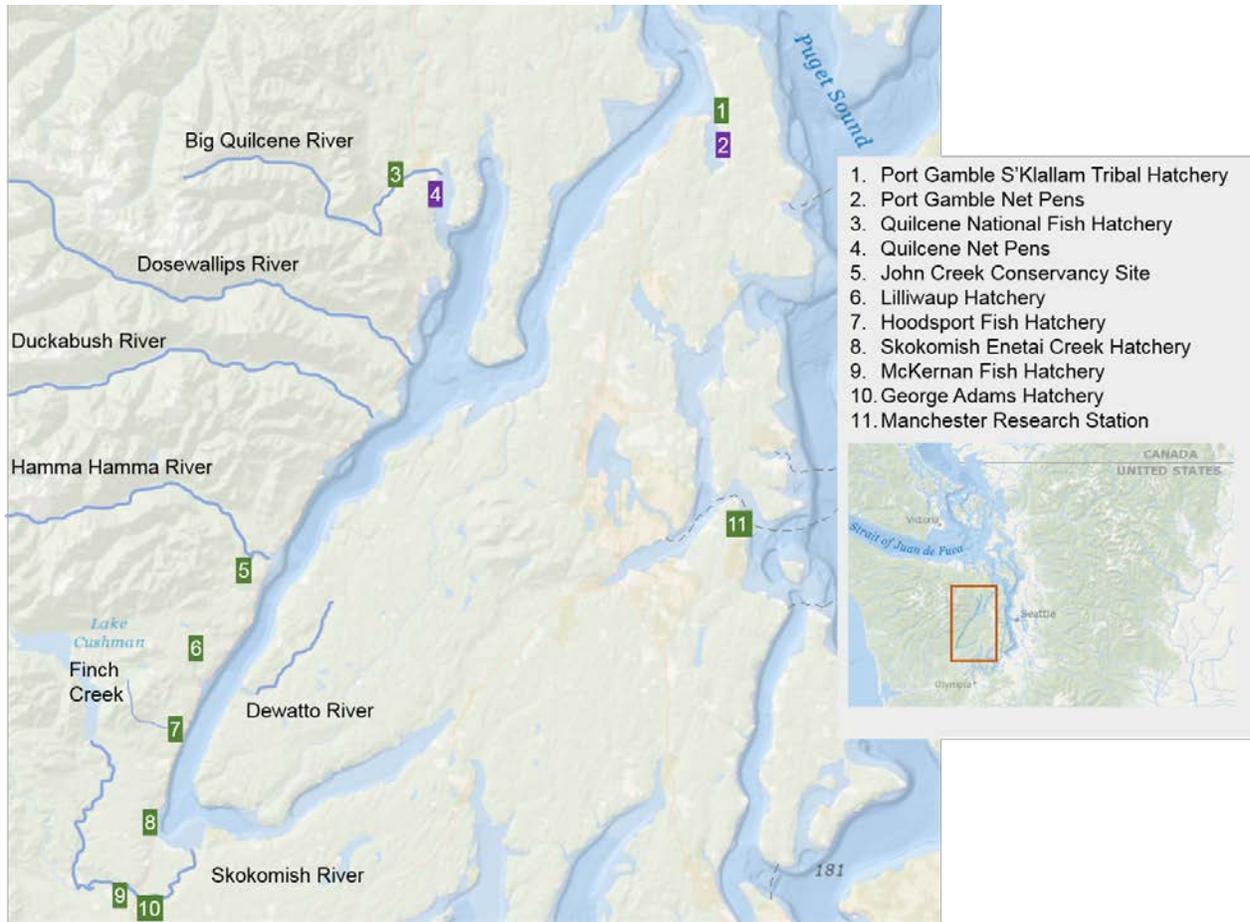


Figure 1. Hood Canal and the facilities associated with the proposed continued operation of Hood Canal salmon and steelhead hatcheries.

1.1 5(i)(A) The HGMP has clearly stated goals, performance objectives, and performance indicators that indicate the purpose of the program, its intended results, and measurements of its performance in meeting those results.

Each of the 10 HGMPs has clearly stated its goal, performance objectives, and methods for measuring the progress toward achieving those objectives. The general program goals described in section 1.7 of each HGMP for propagating hatchery fish in the Hood Canal region are to:

- Mitigate lost natural-origin fish production
- Aid in the recovery of ESA-listed Puget Sound Chinook salmon and steelhead
- Meet tribal fishery harvest allocations guaranteed through treaties and affirmed in *U.S. v. Washington* (1974)
- Meet Pacific Salmon Treaty harvest sharing agreements with Canada.

Performance objectives derived from the Northwest Power Planning Council Artificial Production Review (Northwest Power Planning Council 2001), and performance indicators that would be ERD Hood Canal HGMPs

used to gauge compliance with each objective, are described in section 1.10 of each HGMP. Evaluation and monitoring to ensure standards and indicators are met is further described in section 1.8 of this document and are summarized in Table 2. HGMP implementation would generally be designed to determine:

1. Program consistency with proposed hatchery actions and intended results (e.g., juvenile fish release and adult return levels)
2. Measurement of the program’s success or failure in attaining results
3. Effects of the program on listed natural-origin fish populations in the Hood Canal region.

Table 2. HGMP program performance standards and indicators.

Standard	Indicator
Produce fish for harvest while minimizing excess hatchery returns	<ul style="list-style-type: none"> • Measure adult harvest and escapement • Mass marking to allow selective fisheries
Supplement natural population (integrated only)	<ul style="list-style-type: none"> • Increasing proportion of natural-origin fish • Increasing natural smolt levels
Proper broodstock collection and management	<ul style="list-style-type: none"> • Collected randomly throughout the run • Weir/trap checked regularly • Proportion of natural-origin fish • Designated mating scheme, sex ratio • Adheres to spawning guidelines (Seidel 1983) • Stray rates
Meet hatchery juvenile production goal	<ul style="list-style-type: none"> • Egg to fry or smolt survival is as expected • Release target
Minimize interactions of releases with natural-origin fish	<ul style="list-style-type: none"> • Juveniles released at sea-water ready life stages • Size and time of release accounts for listed stocks
Life history characteristics of the natural population do not change	<ul style="list-style-type: none"> • Stable life history patterns of natural fish • Age and size data for natural population
Natural population genetic variation does not change due to artificial propagation	<ul style="list-style-type: none"> • Proportion of naturally spawning hatchery fish • Genetic assessment
Limit pathogen amplification and transmission	<ul style="list-style-type: none"> • Follows co-manager fish health policy (NWIFC and WDFW 2006) • Follows USFWS fish health policy (2004)

1.2 5(i)(B) The HGMP utilizes the concepts of viable and critical salmonid population thresholds, consistent with the concepts contained in the technical document entitled “Viable Salmonid Populations.”

HGMPs proposed for consideration under the 4(d) rule must use the concepts of viable and critical thresholds as defined in the NMFS Viable Salmonid Population (VSP) document (McElhany et al. 2000). Application of these VSP concepts is needed to adequately assess and limit the take of listed salmonids for the protection of the species. Section 2.2.2 of each HGMP describes the status of the listed Chinook salmon, summer chum salmon, and steelhead populations relative to “critical” and “viable” population thresholds within the Hood Canal region. All 10 programs are here being evaluated for their effects on listed Chinook salmon and

steelhead. Nine out of the ten hatchery programs were previously evaluated for their effects on Hood Canal summer chum salmon. NMFS determined that the programs would not appreciably reduce the likelihood of survival and recovery of the listed species (2002). Because the Hood Canal Steelhead Supplementation Program began after 2002, the effects of only this program on summer chum salmon will be evaluated.

The mid-Hood Canal Chinook salmon population is among the 22 populations of Chinook salmon included in the listed Puget Sound Chinook Salmon ESU (70 FR 37160, NMFS 2005; Ruckelshaus et al. 2006). The 22 populations are located within five biogeographical regions; the Hood Canal biogeographical region encompasses the action area. Consistent with ESU viability criteria, the two extant populations within the Hood Canal biogeographical region (Skokomish and mid-Hood Canal) need to be recovered to a low extinction risk status for the ESU to be considered recovered and delisted (NMFS 2006; SSPS 2005). Hatchery-origin Chinook salmon produced through the Hamma Hamma Chinook salmon supplementation program are included as part of the mid-Hood Canal population, but those propagated at Hoodport Hatchery are not part of either population or the ESU. The critical abundance threshold for the mid-Hood Canal population is 200 and the minimum viability threshold is 11,000 fish (Ruckelshaus et al. 2002). The average return for the population from 2000 to 2012 was 175 fish, with 134 fish attributed to the supplementation program, suggesting the population may decline further without the hatchery program (Long Live the Kings et al. 2013).

The listed Hood Canal Summer-run Chum Salmon ESU (70 FR 37160, NMFS 2005) includes all natural-origin summer-run chum salmon in the eastern Strait of Juan de Fuca and Hood Canal of western Washington. Sands et al. (2009) identified two independent populations of natural-origin summer-run chum salmon, with the Hood Canal population residing in Hood Canal watersheds. The viability abundance threshold for this population is 24,700 spawners with a 1:1 replacement rate and assuming density-independent dynamics at low population sizes (Sands et al. 2009).

The Puget Sound Steelhead Technical Recovery Team (PSSTRT) delineated four steelhead demographically independent populations (DIP) within the Hood Canal region as components of the listed Puget Sound Steelhead DPS (Myers et al. 2015). Critical abundance thresholds have not been established for these populations, but the intrinsic potential (IP) for each population based on current habitat conditions (Table 3) suggests that current populations are about 2-5 percent of their potential (Hard et al. 2015). The one hatchery program intended to supplement the four steelhead populations would not use adult fish as broodstock, but instead would collect natural-origin eggs for rearing to avoid reducing escapements. All steelhead produced through the program are included as part of the listed Puget Sound Steelhead DPS (72 FR 26722, NMFS & NOAA 2007).

Table 3. Hood Canal steelhead DIPs (demographically independent populations).

DIP	Primary Tributaries	2000-11 Mean Escapement/Range (Number of Fish)	IP estimate (Number of Fish)
East Hood Canal	Dewatto River, Big Beef and Anderson Creeks	34 / 13-92 (Dewatto)	1270 - 2540
South Hood Canal	Tahuya and Union Rivers	156 / 58-269	2985 - 5970
Skokomish River	Skokomish River	309 / 132-567	10030 - 20060
West Hood Canal	Hamma Hamma, Duckabush, Dosewallips and Quilcene Rivers	205 / 99-358	3608 - 7216

Sources: (Hard et al. 2015; WDFW and LLTK 2012)

1.3 5(i)(C) Taking into account health, abundances, and trends in the donor population, broodstock collection programs reflect appropriate priorities.

A prioritized purpose of a broodstock collection program using listed fish is to re-establish an indigenous salmonid population for conservation purposes, including restoration of similar at-risk populations within the same ESU, and reintroduction of at-risk populations to under-seeded habitat. Under this 4(d) rule criterion, as described in the 4(d) rule, listed salmonids may be intentionally taken for broodstock only if:

1. The donor population is currently at or above the viable threshold and the collection will not impair its function, or
2. The donor population is not currently viable but the sole objective is to enhance the propagation or survival of the listed ESU, or
3. The donor population is shown with a high degree of confidence to be above the critical threshold although not yet functioning at viable levels, and the collection will not appreciably slow attainment of viable status for that population.

Consistent with this prioritized purpose, the Hamma Hamma Hatchery Chinook Salmon program would be operated with the primary goal of creating a viable, self-sustaining Chinook salmon population in the Hamma Hamma River (one of the three rivers included in the mid-Hood Canal Chinook salmon population). The Hamma Hamma program addresses criterion 2, above, because the Hamma Hamma population is not currently viable and the fish from this program are not intended for harvest (e.g., they are not adipose-clipped to reduce their potential harvest in mark-selective fisheries). The broodstock collection methods will enhance the survival of the population (and, by extension) the ESU with steps specifically intended to maintain the population’s genetic integrity. To restrict collection of fish for this program as much as possible to returns to the Hamma Hamma River itself, 100 percent of the broodstock will be collected from the Hamma Hamma River using hook and line or block seine methods. If numeric broodstock goals cannot be reached in this way, a closely related hatchery population at George Adams Hatchery would be used as an egg source. To limit divergence of the propagated population, broodstock would be collected from the run at large (Long Live the Kings et al. 2013).

The Hood Canal Steelhead Supplementation program collects natural-origin eggs from redds using hydraulic suctioning within the Dewatto, Duckabush, and Skokomish Rivers. The sole objective of the program is to enhance the propagation or survival of the populations within the listed DPS that are not currently viable (criterion 2; WDFW and LLTK 2012).

The remaining eight fall Chinook, coho, fall chum, and pink salmon programs propagate non-listed fish stocks and collect broodstock only from fish returning to the hatcheries. No listed fish are intentionally collected for broodstock and any listed fish encountered in weirs or traps are released with minimum adverse effect to continue migration upstream.

1.4 5(i)(D) The HGMP includes protocols to address fish health, broodstock collection and spawning, rearing and release of juveniles, disposition of hatchery adults, and catastrophic risk management.

The proposed HGMPs include protocols, or “best management practices” (BMPs), for fish health, broodstock collection, broodstock spawning, rearing and release of juveniles, deposition of hatchery adults, and catastrophic risk management. These practices, when implemented, would be appropriate for the purpose of adequately limiting the risk of substantial direct and incidental adverse effects on listed fish in the Hood Canal region.

Fish Health (HGMP sections 7, 9, and 10): All of the hatchery programs would be operated in compliance with the co-manager and USFWS fish health policies (NWIFC and WDFW 2006; USFWS 2004). The policies are designed to limit the spread of fish pathogens between and within watersheds by regulating the transfers of eggs and fish. The policies also outline standard fish health diagnosis, maintenance, and hatchery sanitation protocols to reduce the risk of pathogen amplification and transmission within the hatchery and to fish in the natural environment during broodstock collection and mating as well as fish incubation, rearing, and release. Fish health specialists and pathologists from WDFW, NWIFC, or the USFWS would provide fish health management support and diagnostic fish health services.

Broodstock Collection and Spawning (HGMP sections 6, 7 and 8): To minimize the risk of intentional artificial trait selection, broodstock are collected over the course of the run for each species under propagation (NMFS 2012). Because the two net pen programs only rear juvenile fish, and the steelhead supplementation program collects natural-origin eggs in place of adults, broodstock collection and spawning protocols do not apply (Table 4). A portion of the broodstock sustaining the Hamma Hamma Chinook salmon supplementation program are collected using hook and line or seining in the mainstem Hamma Hamma River. Both natural and hatchery origin fish are used, consistent with the purpose of an integrated program, but otolith analyses are conducted post-spawning to assess the proportion of hatchery and natural-origin fish. Any additional broodstock needed for the Hamma Hamma Chinook salmon program are collected from adult returns to George Adams Hatchery. Eyed eggs are collected for the Hood Canal Steelhead Supplementation Program from natural-origin redds using hydraulic suctioning. For the segregated programs, broodstock are collected from adult fish returning to the hatchery release sites using a trap/weir. Any non-target fish would be released back into the natural environment. Fall chum salmon programs would only begin collecting broodstock after October 15th to limit overlap with a majority of the summer chum salmon run, minimizing the risk of incidental capture of the listed species.

Table 4. Number of broodstock collected and spawning approach.

Program	# Collected	Sex Ratio (Female:Male)	Spawning Approach ²
Hamma Hamma Fall Chinook	60 adults	1:1	At least 2 x 2
Hood Canal Steelhead	62802 eggs	NA	NA
Hoodsport Hatchery Fall Chinook	2500 adults	1:1	1 x 1
Hoodsport Hatchery Fall Chum	9000 adults	3:2	5 x 5
Hoodsport Hatchery Pink Salmon	920 adults	1:1	1 x 1
Port Gamble Hatchery Fall Chum	1300 adults	2:1	2 x 2
Enetai Hatchery Fall Chum	3000 adults	1:1	10 x 10
Port Gamble Coho Net Pens	NA ¹	NA	NA
Quilcene Bay Coho Net Pens	NA	NA	NA
Quilcene National Fish Hatchery Coho	1500 adults	1:1	1 x 1

¹NA = not applicable

²The spawning approach can be either with one female and one male (1 x 1) or with multiple females and multiple males (e.g., 2 x 2).

The BMPs for broodstock spawning are described in section 8 of the HGMPs, and implement spawning actions consistent with published guidelines (HSRG 2004; Seidel 1983). Pairwise spawning (1 x 1) is logistically easier, but factorial spawning (e.g., 2 x 2; eggs from a single female are fertilized by multiple males and a single male fertilizes multiple females) conserves genetic diversity by limiting the risk of a sterile adult (Busack and Knudsen 2007).

Rearing and Release of Juveniles (HGMP sections 9 and 10): Listed fish are only being reared and released from the Hamma Hamma Chinook and Hood Canal Steelhead supplementation programs. Therefore, our discussion of specific rearing protocols only pertains to these two

programs. All fish, including those from segregated programs would be released as seawater-ready, migrating smolts to ensure rapid emigration downstream through watershed areas where interactions with rearing listed fish may occur. All Chinook salmon, coho salmon, and steelhead would receive a mark or tag prior to release to allow for their differentiation from natural-origin salmon or steelhead. All fish would be released at times consistent with requirements set forth in NMFS's biological opinion (NMFS 2002) to limit interactions (e.g., competition, predation) with emigrating ESA-listed Hood Canal summer chum salmon fry. Release numbers, life stage, mark/tag types, and dates for all hatchery programs are detailed in Table 5.

Eggs for the Hamma Hamma Chinook salmon program are shipped to George Adams Hatchery for fertilization, eying, and incubation. Once fish reach a size of 75 to 85 fish per pound (fpp), they are transferred to either earthen ponds or fiberglass raceways in John Creek until release.

After collection from either the Dewatto, Duckabush, or Skokomish Rivers, eggs for the Hood Canal Steelhead Supplementation program are transferred to the isolation buildings supplied with pathogen-free well water at either McKernan (Skokomish origin) or Quilcene National Fish Hatchery (Dewatto and Duckabush). After ponding, fry from Quilcene National Fish Hatchery will be transferred to Lilliwaup Hatchery. Fish destined for release as smolts will remain at either McKernan or Lilliwaup Hatchery for approximately two years until release. Steelhead reared for release as adults will be held at the Manchester Field Station for 3 to 4 years

Table 5. Fish release details in Hood Canal (HC).

Program	Release #	Release Location	Life Stage	Mark	Egg-Release Survival (%)	Release Date
Hamma Hamma Fall Chinook Supplementation	95,000	John Creek	subyearling	100%	85.7	mid May-mid June
Hood Canal Steelhead Supplementation Program	7,400	Dewatto River	yearling	100%	81.0	April 15-May 15
	6,667	Duckabush River	yearling	100%		April 15-May 16
	34,500	Skokomish River	yearling	100%		April 15-May 17
	253, alternate years	Dewatto River	adult	100%	81.0	Feb-March
	230, alternate years	Duckabush River	adult	100%		Feb-May
	400	Skokomish River	adult	100%		March-May
Hoodsport Hatchery Fall Chinook	3 million	Finch Creek/HC confluence	subyearling	100%	94.6	May-June
	120,000		yearling			95.4
Hoodsport Hatchery Fall Chum	12 million	Finch Creek/HC confluence	fry	None	97.1	April
Hoodsport Hatchery Pink	500,000	Finch Creek/HC confluence	fry	None	95.3	April-May
Port Gamble Coho Net Pens	400,000	Port Gamble Bay	yearling	100%	98	May
Port Gamble Hatchery Fall Chum	950,000	Little Boston Creek	fry	None	94.5	April-May
Quilcene National Fish Hatchery Yearling Coho Salmon Production	400,000	Big Quilcene River	yearling	100%	81.3	late April-early May
Enetai Creek Hatchery Fall Chum	3.2 million	Enetai Creek	fry	None	72.0	April
Quilcene Bay Coho Net Pens	200,000	Quilcene Bay	yearling	100%	81.3	May

Disposition of Hatchery Adults (HGMP section 7.5): Spawned hatchery carcasses for the eight segregated programs are either sold to a contracted fish buyer, provided to food banks, or distributed to the treaty tribes for subsistence use. Fish treated for pathogens or otherwise unfit for human consumption are buried in approved land-fills. Surplus adults returning to the hatchery are disposed of in the same manner, except for Quilcene National Fish Hatchery, which passes ~200-800 adult coho upstream for natural spawning and nutrient enhancement. Spawned broodstock carcasses from the Hamma Hamma Chinook salmon supplementation program are returned to the Hamma Hamma River for nutrient enhancement.

Catastrophic Risk Management (HGMP section 5.8): All facilities identified in Table 6 adhere to the applicants' fish health policies (NWIFC and WDFW 2006; USFWS 2004) and apply BMPs to reduce the risk of catastrophic loss of fish under propagation.

Table 6. Measures taken to reduce the likelihood of catastrophic loss of fish at the hatchery facilities.

Facility	Program (s)	Personnel	Water	Power loss	Disease	Other
Hoodsport Hatchery	Pink, fall chum, fall Chinook	On station at all times	Alarm	Alarm; Back-up generator		
Quilcene National Fish Hatchery	Coho; Hood Canal steelhead		Alarm; Emergency water supply	Alarm; Uninterrupted power supply		Eggs on well water to prevent siltation
John Creek Conservancy Site	Hamma Hamma Chinook	Checked daily, on site in inclement weather	Gravity flow water supply with no pump required	Non-electric Gravity-fed water supply		
Lilliwaup Hatchery	Hood Canal Steelhead	On site within 15 minutes	Alarm; Emergency water supply	Alarm		Isobar intake and gravel excavation to prevent water intake blockages
George Adams Hatchery	Hamma Hamma Chinook	On station at all times	Alarm; Emergency water supply	Alarm; Back-up generator		
Mckernan Hatchery	Hood Canal Steelhead	On station at all times	Alarm; Emergency water supply	Alarm; Back-up generator		
Manchester Research Station	Hood Canal Steelhead		Alarm	Alarm; Back-up generator		
Enetai Creek Hatchery	Fall chum		Alarm			
Port Gamble Hatchery	Fall chum		Gravity flow water supply			Sediment filter

		with no pump required		
Port Gamble, Quilcene net pens	Coho	NA; in marine bays	NA	Vibrio vaccine, early release if toxic algae bloom

1.5 5(i)(E) The HGMP evaluates, minimizes, and accounts for the propagation programs’ genetic and ecological effects on natural populations, including disease transfer, competition, predation, and genetic introgression caused by straying of hatchery fish.

The Hood Canal HGMPs provide evaluations of potential genetic and ecological effects on listed salmon and steelhead in section 2 and risk minimization measures in sections 6-10.

Genetic effects: Artificial fish production may result in a loss of within-population genetic diversity (the reduction in quantity, variety and combinations of alleles in a population), outbreeding depression (loss in fitness caused by changes in allele frequency or the introduction of new alleles) and/or hatchery-influenced selection (Busack and Currens 1995). Genetic effects of pink and coho salmon on the three listed species in Hood Canal are unlikely because these species do not interbreed. Although there may be some risk of fall chum salmon interbreeding with the listed Hood Canal summer chum salmon population, these risks were assessed previously by NMFS (2002). NMFS found that interbreeding between these species was unlikely to occur due to temporal differences in spawning; August to early October for summer chum salmon compared to early-November to early January for hatchery fall chum salmon. Therefore, our discussion of genetic effects focuses on the propagation of Chinook salmon and steelhead.

The original broodstock for the Hamma Hamma Chinook Supplementation program were of Green River lineage transferred from George Adams Hatchery, a within-ESU stock that has been liberally used throughout Hood Canal. Any native Chinook salmon of the Mid-Hood Canal population were supplanted by the Green River-lineage fish subsequently delineated as the extant population (Ruckelshaus et al. 2006). Thus, Chinook salmon from the Hamma Hamma Chinook Supplementation program are not genetically distinct from fish spawning naturally in the Hamma Hamma River, and are included as part of the Mid-Hood Canal population within the listed ESU (Jones 2006). Therefore, it is appropriate to use fish from that program to maintain the natural population. Because the program is operated as an integrated conservation program, interbreeding between hatchery- and natural-origin fish is an objective. The HGMP for the program accounts for and minimizes genetic risks to listed Hood Canal Chinook salmon populations through implementation of the following measures:

- Broodstock are randomly collected throughout the adult return to ensure full representation of run timing, return location, age class, and sex ratio
- Factorial mating ensures that all fish contribute to the production of progeny to retain genetic diversity

- All fish are marked with a coded-wire tag to differentiate them from other Chinook salmon stocks and with an otolith mark to distinguish between Hamma Hamma River and any George Adams broodstock
- Straying is monitored to assess spawning proportions of hatchery- and natural-origin Chinook salmon
- Juveniles are acclimated at their site of release to decrease straying potential

There are no listed Chinook salmon in Finch Creek where Hoodspport Hatchery is located. The Chinook salmon stock reared at the hatchery originated from transfer of Green River lineage fish from other watersheds. Chinook salmon produced by the program are not genetically distinct from fish reared at George Adams Hatchery or for the Hamma Hamma River supplementation program (WDFW 2014). Because there is no associated natural-origin population, the Hoodspport Hatchery Chinook salmon stock is not included as part of the listed ESU (Jones 2006). The program is operated as an isolated harvest program, and contribution to natural spawning is not an objective. In addition, the percent of Hoodspport Hatchery Chinook salmon that stray outside of Finch Creek is 1.9 and 5 of the total adult returns from the subyearling and yearling components of the program, respectively (PSMFC 2015). The HGMP for the program minimizes and accounts for genetic risks to listed Hood Canal Chinook salmon through implementation of the following measures:

- All fish are marked with an adipose fin clip to identify them as hatchery fish and make possible their rejection from use in broodstock
- Straying of Hoodspport Hatchery Chinook salmon is monitored and is at or below the HSRG recommendation of 5 percent for a segregated program (HSRG et al. 2004)
- Juveniles are acclimated at their site of release to decrease straying potential. Acclimation of hatchery juvenile before release increases the probability that hatchery adults will home back to the release location, reducing their potential to stray into natural spawning areas (Dittman and Quinn 2008)

Broodstock for the Hood Canal Steelhead Supplementation program are the native ESA-listed winter-run steelhead eyed-eggs collected from redds in the Dewatto, Duckabush, and South Fork Skokomish Rivers. Because the program is operated as an integrated conservation program, interbreeding between the hatchery-reared and naturally-reared fish is an objective. The program HGMP minimizes and accounts for genetic risks to listed Hood Canal steelhead populations through implementation of the following measures:

- Use of natural-origin eyed eggs allows for mate choice by the parents
- Egg collection from multiple redds in each river to maintain genetic diversity to the greatest extent possible within the hatchery-reared fish
- Fish are released as 1- and 2-year smolts to mimic natural life history
- Smolts are released into their river of origin to reduce straying

Ecological effects: The primary ecological risks to natural-origin salmon and steelhead populations posed by salmon and steelhead hatchery programs are increased pathogen transfer,

competition, and predation (NMFS 2012). As noted in the HGMPs and earlier in this document, all hatchery actions would be implemented in accordance with the co-manager and USFWS fish health policies (NWIFC and WDFW 2006; USFWS 2004), as a means to account for and minimize the risks of pathogen amplification and transmission.

All of the HGMPs also evaluate the risks of competition and predation, and have incorporated the following measures to minimize risks associated with program implementation:

- No hatchery fish would be released until after April 1st, when a majority of Hood Canal summer chum salmon juveniles have emigrated out of the system to reduce competition and predation effects of hatchery-produced juveniles on summer chum salmon (NMFS 2002).
- All fish produced would be released as seawater-ready (smolts or fry, Table 5) to foster rapid emigration seaward to limit competition with natural-origin fish.
- Pink and fall chum salmon fed fry are too small to prey on juvenile Chinook and summer chum salmon and steelhead.
- A 9.5 million reduction in the number of fish released relative to 2006 from the Hoodsport Hatchery pink and fall chum programs may reduce interactions with summer chum, but could also reduce prey availability for listed Chinook salmon and steelhead.
- Location of hatchery facilities close to or at the Hood Canal confluence and in tributaries with no listed fish (Hoodsport in Finch Creek, Port Gamble in Little Boston Creek, Enetai Hatchery on Enetai Creek) to reduce the risk of adult straying and limit juvenile interactions in freshwater.

1.6 5(i)(F) The HGMP describes interrelationships and interdependencies with fisheries management.

The HGMPs indicate that all hatchery programs in the Puget Sound region would operate consistent with the *U.S. v. Washington* (1974) fisheries management framework. This legal framework requires measures for coordinating State and tribal implementation of agreed hatchery programs. This fisheries resource co-management process requires that both the State of Washington and the Puget Sound Tribes cooperate and agree on the function, purpose, and fish production strategies for all Puget Sound hatchery programs (Hood Canal Salmon Management Plan 1986; Puget Sound Salmon Management Plan 1985).

Within Hood Canal, recreational and treaty and non-treaty commercial fisheries for non-listed, hatchery-origin species produced through the programs may incidentally affect natural-origin Chinook and summer chum salmon and steelhead (i.e., Hoodsport Hatchery Chinook, pink, coho, and fall chum salmon). Despite the eight segregated programs' purpose for producing fish for harvest, fisheries are not considered interrelated with or interdependent on these programs because the programs are not the sole producers of fish for the fisheries. The Hood Canal Steelhead supplementation program is also not interrelated or interdependent with fisheries because the program propagates listed steelhead. There are no fisheries directed at or managed for harvest of listed steelhead.

However, because management of the Chinook salmon fishery follows a weak stock management scheme, adult Chinook salmon produced by the Hamma Hamma Supplementation Program are interrelated and interdependent with management of the Puget Sound Chinook salmon fishery. That harvest management is based on a weak-stock approach, with the mid-Hood Canal population representing one of the stocks with abundance criteria that help decide annual harvest management, which may limit fisheries when mid-Hood Canal population abundances are low. The Hamma Hamma program propagates fish from the mid-Hood Canal population, thereby helping maintain population levels more conducive to harvest implementation.

NMFS determined (NMFS 2001; NMFS 2014) that implementing and enforcing the harvest components of the resource management plans for summer chum and Chinook salmon (Bureau of Indian Affairs 2014; WDFW and PNPTT 2000) would have little measurable effect on the listed populations.

1.7 5(i)(G) Adequate artificial propagation facilities exist to properly rear progeny of naturally spawned broodstock, to maintain population health and diversity, and to avoid hatchery-influenced selection and domestication.

The two programs that propagate ESA-listed fish utilize multiple facilities to properly rear progeny. As described in sections 4 and 5 of the Hamma Hamma Chinook salmon and Hood Canal Steelhead supplementation HGMPs, the hatchery facilities used to implement the programs have adequate surface and groundwater sources, fish trapping and holding facilities, egg incubation and fish rearing vessels, and fish release facilities to ensure proper rearing. As mentioned previously, fish health is maintained throughout rearing by adhering to fish health policies and using pathogen-free water sources when possible (NWIFC and WDFW 2006; USFWS 2004). As indicated in Table 5, both programs have a demonstrated record of maintaining high egg-to-fish-release survival rates, consistent with goal rates identified for well-run hatchery programs (Fuss and Ashbrook 1995). Minimization of catastrophic loss and genetic risks associated with these programs were addressed in sections 1.4 and 1.5, respectively, of this document.

1.8 5(i)(H) Adequate monitoring and evaluation exist to detect and evaluate the success of the hatchery program and any risks potentially impairing the recovery of the listed ESU.

Monitoring and evaluation actions to identify the performance of each program and hatchery-related effects on ESA-listed fish are also proposed. These actions are summarized in section 1.10 of each HGMP, and are further described in section 11 of each HGMP. Monitoring and evaluation actions that would be implemented include:

- Spawning ground/redd surveys and hatchery escapement to determine total escapement and percent of hatchery-origin spawners spawning naturally (possible for marked fish only)
- The number and distribution of marked, unmarked, and otolith-marked fish to determine the status of the natural- and hatchery-origin salmon returns and harvest relative to goal levels

- Abundance, timing, age class, sex ratio, and fish health condition data collected for broodstock to assess run traits of the target populations
- Water withdrawal and effluent discharge to ensure compliance with permitted levels
- Monitoring of broodstock collection, egg take, fish survival rates, and smolt release levels for each program to determine compliance with program goals
- Fish health monitoring and reporting in compliance with fish health policies

Additional monitoring would take place for the Hood Canal Steelhead Supplementation program to improve our understanding of steelhead life history, genetics, and movement including:

- Collection of out-migrating juveniles to estimate production, including production by program-origin adults released into spawning areas
- Using telemetry tags to estimate ocean survival and migration behavior
- Sampling of natural- and hatchery-reared adults and juveniles for genetic analysis of heterozygosity, loss of rare alleles or change in allele frequencies
- Sampling of natural- and hatchery-reared adults and juveniles for determining contribution of resident populations to smolts with an anadromous life history

1.9 5(i)(I) The HGMP provides for evaluating monitoring data and making any revisions of assumptions, management strategies, or objectives that data show are needed.

Under the HGMPs (section 1.10), data collected relating to hatchery program performance and effects would be evaluated by the co-managers to determine whether performance standards were met. Annual reports for the programs assembled by the applicants would be jointly reviewed by NMFS to document program results, and to determine if adjustments to the programs assumptions and management strategies are warranted. Any changes would be incorporated into annual Future Brood Documents produced by the co-managers and Hatchery Action Implementation Plans produced by local watersheds. The applicants indicate in the HGMPs the funding and staff that would be committed to monitor and evaluate the programs. Additional periodic review and suggested changes to the Hamma Hamma Chinook Salmon Supplementation program would be conducted by the co-managers, and evaluated by NMFS for continued consistency with this evaluation.

1.10 5(i)(J) NMFS provides written concurrence of the HGMP which specifies the implementation and reporting requirements.

After completion of the public review and comment period for this proposed evaluation and pending determination document, and after consulting with itself under section 7 of the ESA, NMFS will make a determination regarding the adequacy of the ten Hood Canal HGMPs. If the determination is made that implementing and enforcing the plans will not appreciably reduce the likelihood of survival and recovery of the ESA-listed species, and that the plans address all of the criteria specified in limit 6 of the 4(d) rule, NMFS will so notify the managers in writing, and will specify any necessary implementation and reporting requirements.

1.11 5(i)(K) The HGMP is consistent with plans and conditions set within any Federal court proceeding with continuing jurisdiction over tribal harvest allocations.

The 10 Hood Canal region salmon and steelhead HGMPs were developed by the applicants pursuant to the *U.S. v. Washington* (1974) fisheries and hatchery management framework. The HGMPs are one component of an effort to preserve and recover to a fishable status listed Chinook salmon, steelhead, and other, non-listed, anadromous salmon populations in the Hood Canal region. The ESU recovery plans for Chinook salmon (NMFS 2006; SSPS 2005) and summer chum salmon (HCCC 2005; NMFS 2007) have hatchery and habitat components, and include monitoring, research, and restoration recommendations to complement artificial production. The hatchery actions proposed in the HGMPs are included within, and consistent with, these recovery plans. There are no other plans or conditions set within Federal court proceedings, including memorandums of understanding, court orders or other management plans, that direct operation of the proposed salmon and steelhead hatchery programs.

2 PUBLIC REVIEW AND COMMENTS

As required in (6)(iv) of section 223.203 of the 4(d) rule for salmon and steelhead, the Secretary published notice of his proposed evaluation and pending determination together with a discussion of the biological analysis underlying that determination on March 3, 2016 (81 FR 11192). We received no public comments.

3 RECOMMENDED DETERMINATION

NMFS has reviewed the HGMPs and evaluated them together against the requirements of the 4(d) rule. Based on this review and evaluation, NMFS' recommended determination is that activities implemented as described would not appreciably reduce the likelihood of survival and recovery of ESA-listed Puget Sound Chinook salmon, Hood Canal summer chum salmon, or Puget Sound steelhead. If the Regional Administrator concurs with this determination, take prohibitions would not apply to activities implemented in accordance with the 10 HGMPs for salmon and steelhead populations in the Hood Canal region included herein. In addition, the hatchery programs would operate in conjunction with on-going habitat restoration and harvest management actions, implemented consistent with recovery plan objectives for listed species, until natural-origin salmon populations that would sustain fisheries are restored.

4 REEVALUATION CRITERIA

NMFS will reevaluate this determination if: (1) the actions described by the HGMPs are modified in a way that causes an effect on the listed species that was not previously considered in NMFS' evaluation; (2) new information or monitoring reveals effects that may affect listed species in a way not previously considered; or (3) a new species is listed or critical habitat is designated that may affect NMFS' evaluation of the HGMPs.

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