4(d) Rule Limit 6

Proposed Evaluation and Pending Determination

Title of RMP:	Twelve Hatchery and Genetic Management Plans for Nooksack River basin and Georgia Strait Salmon
RMP Submitted by:	Lummi Nation Nooksack Indian Tribe Washington Department of Fish and Wildlife
ESU/DPS:	Puget Sound Chinook Salmon ESU Puget Sound Steelhead DPS
4(d) Rule Limit:	Limit 6
NMFS Tracking Number:	WCRO-2024-00669
Date:	May 12, 2025

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

1 EVALUATION

NOAA's National Marine Fisheries Service (NMFS) issued a final Endangered Species Act (ESA) 4(d) rule adopting regulations necessary and advisable to conserve Puget Sound Chinook salmon (50 CFR 223.203(b); 70 FR 37160, June 28, 2005). These regulations were subsequently applied to the Puget Sound Steelhead Distinct Population Segment (DPS) in a separate final rule (73 FR 55451, June 25, 2008). Under limit 6 of the Rule, ESA section 9 take prohibitions for these listed salmonid species do not apply to hatchery activities that are undertaken in compliance with a resource management plan (RMP) developed jointly by the Tribes and the State of Washington that is consistent with the 4(d) rule criteria.

Section 9 of the ESA prohibits the take of endangered species, and pursuant to §4 NMFS has extended that prohibition to threatened salmon and steelhead. Under the joint state-tribal 4(d) rule (50 CFR 223.203(b)(6)), those prohibitions are rescinded for hatchery activities described in an RMP, provided that:

- The Secretary of Commerce has determined pursuant to 50 CFR 223.204(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 plans applying for 4(d) limit 6 review will be implemented and enforced within the parameters set forth in U.S. v. Oregon or U.S. v. Washington; and
- The Secretary of Commerce has taken comment on how any HGMP addresses the 4(d) rule limit 5 criteria (§223.203(b)(5)).

The Lummi Nation, Nooksack Tribe of Indians, and Washington Department of Fish and Wildlife (WDFW), as co-managers of the fisheries resource under U.S. v.Washington (1974), have provided NMFS with hatchery and genetic management plans (HGMP) proposed for implementation of twelve salmon hatchery programs in the Nooksack River watershed, Georgia Strait, and adjacent marine areas (Table 1; Figure 1). The applicants have provided the HGMPs and supplementary information for review and determination by NMFS pursuant to limit 6 of the ESA 4(d) rule. Each HGMP serves as an RMP for the purpose of limit 6 consideration; for this evaluation, descriptions of the proposed activities will focus on the descriptions given in the individual HGMPs.

The proposed plans share some common 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 (Lummi Nation 2024a; 2024b; 2024c; 2024d; 2024e; WDFW 2024a; 2024b; 2024c; 2024d; 2024e; 2024f; WDFW and Lummi Nation 2024). HGMPs for all twelve hatchery programs were assembled consistent with the Puget Sound Salmon Management Plan (1985), and the Federal court orders under U.S. v. Washington (1974) that govern fisheries harvest management and hatchery salmon production.

The Skookum Creek and Kendall Creek Chinook salmon programs have been designed to support increased abundance and productivity of the natural-origin South Fork (SF) Nooksack and North Fork (NF) Nooksack River populations, respectively. The other ten salmon hatchery programs are harvest augmentation programs and will support Tribal treaty fishing rights.

Table 1. Proposed salmon hatchery programs for the Nooksack River basin and Georgia Strait; ESA = Endangered Species Act; WDFW = Washington Department of Fish and Wildlife; BTC = Bellingham Technical College; LLTK = Long Live the Kings.

Hatchery and Genetics Management Plan (HGMP)	Program Operator	ESA Listed
Skookum Creek Hatchery Chinook Salmon Program	Lummi Nation	Yes
Kendall Creek North/Middle Fork Nooksack Native Spring Chinook Salmon Restoration Hatchery Program	WDFW	Yes
Lummi Bay Hatchery Chinook Salmon	Lummi Nation	Yes
Samish Fall Chinook Salmon Hatchery Program	WDFW	No
Whatcom Creek Hatchery Fall Chinook Salmon Program	BTC	No
Glenwood Springs Hatchery Fall Chinook Salmon Program	LLTK	No
Skookum Creek Hatchery Coho Salmon Program	Lummi Nation	No
Kendall Creek Hatchery Coho Salmon Program	WDFW	No
Lummi Bay Hatchery Coho Salmon Program	Lummi Nation	No
Kendall Creek Hatchery Nooksack Fall Chum Salmon Program	WDFW	No
Lummi Bay Hatchery Chum Salmon Program	Lummi Nation	No
Whatcom Creek Hatchery Chum Salmon Program	BTC	No

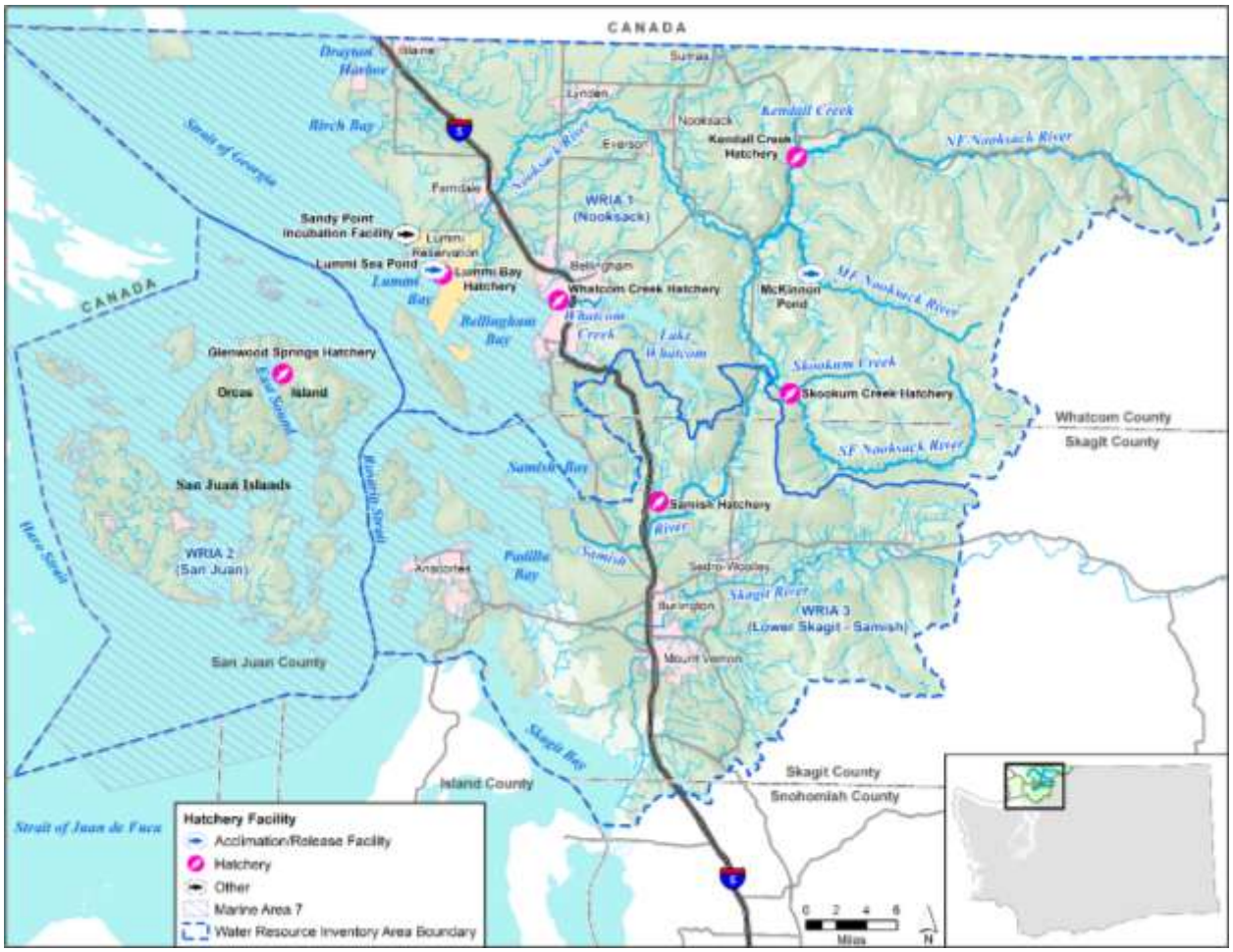

Figure 1. The Nooksack River watershed, Strait of Georgia, adjacent marine areas, and the facilities associated with the Nooksack salmon hatcheries.

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 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 are to contribute to:

- Mitigating for lost natural-origin fish production
- Recovering ESA-listed Puget Sound Chinook salmon or not inhibiting recovery
- Fulfilling federal tribal treaty rights affirmed in U.S. v. Washington (1974)

- Providing for ceremonial and subsistence fishery values
- Meeting Pacific Salmon Treaty obligations

Performance objectives and performance indicators that would be 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 are further described in Section 1.8 of this document and are summarized in Table 2.

Monitoring of 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; and
3. Effects of the program on listed natural-origin fish populations in Puget Sound freshwater and marine waters where these fish may migrate or return.

Table 2. Summary of HGMP program performance standards and indicators.

Standard	Indicator
Produce fish for harvest while optimizing hatchery returns	• Estimate and assess release, adult harvest and escapement goals vs performance • Marking to allow identification of program fish
Supplement natural population (integrated programs only)	• Increasing proportion of natural-origin fish • Increasing natural smolt levels
Proper broodstock collection and management	• Collected randomly throughout the run • Weir/trap checked regularly • Proportion of natural-origin fish • Designated mating scheme, sex ratio • Adheres to spawning guidelines • Escapement rates
Meet hatchery juvenile production goal	• Egg to fry or smolt survival is as expected • Release target
Minimize interactions of releases with natural-origin fish	• Juveniles released at sea-water ready life stages • Size and time of release is appropriate for a well-integrated program • Monitoring of fish after release
Life history characteristics of the natural population do not change due to artificial propagation	• 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	• Proportion of naturally spawning hatchery fish • Genetic assessment
Limit pathogen amplification and transmission	• Follows co-manager fish health policy (NWIFC and WDFW 2006)

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 and steelhead populations relative to "critical" and "viable" population thresholds within the Nooksack watershed and references NMFS reviews' of species status.

The current abundance of both NF and SF Nooksack Chinook salmon is substantially reduced from historical levels. Between 1999 and 2018, the estimated average total annual naturally spawning NF Nooksack Chinook salmon escapement was 1,532, compared to the recovery goal of 3,800 natural spawners. During this same period, the estimated average total annual naturally spawning SF Nooksack Chinook salmon escapement was 266, compared to the recovery goal of 2,000 natural spawners (Ford 2022). Hatchery-origin Chinook salmon associated with the conservation hatchery programs make up a sizeable fraction of the annual naturally spawning adult abundance, averaging 86% in the NF Nooksack and 51% in the SF Nooksack. Total naturally spawning fish escapements have fluctuated with recent increases from the conservation hatchery programs. The 5-year geometric mean of total annual naturally spawning Chinook salmon escapement is 1,553 with 137 of those being NORs in the NF Nooksack and 106 with 42 of those being NORs in the SF Nooksack. This is a 29% increase of mean total spawners from the previous 5-year period in the NF Nooksack and a 203% increase in the SF Nooksack (NMFS 2022). The most recent NMFS status review for the ESU found that productivity trends for the Nooksack Chinook salmon populations, as measured by recruit per spawner and spawner to spawner rates, have been below replacement levels in all years since the mid-1980s (Ford 2022).

Two extant steelhead populations are native to the Nooksack River watershed and part of the listed Puget Sound steelhead DPS: Nooksack River winter-run and SF Nooksack summer-run(Myers et al. 2015). The Nooksack winter-run Demographically Independent Population (DIP) spawns in all three forks and several mainstem tributaries of the Nooksack River from mid-February to mid-June. Historical estimates from in-river harvest suggest that there was a substantial run of steelhead into the Nooksack Basin in the early 1900s. Spawner surveys of the North Fork and Middle Fork Nooksack rivers in 1930 identified a number of tributaries that supported steelhead (Myers et al. 2015). The current abundance of the Nooksack River winter-run population is estimated to be 1,850 spawners with a recovery goal of 6,500 to 21,700 spawners depending on productivity(NMFS 2019). The estimated five-year geometric mean natural spawner count increased 9% for the most recent five-year period 2015-2019 as compared to the previous five-year period 2010-2014, from 1,745 to 1,906 spawners (Ford 2022).

The SF Nooksack summer-run steelhead population spawn in the upper mainstem SF Nooksack River and in upper river tributaries above a series of falls and cascades from February to April (Myers et al. 2015). Adult steelhead enter the SF Nooksack River and migrate upstream from April to October and juvenile steelhead outmigrate beginning in March through July (Natural Systems Design 2021). Preliminary genetics evidence suggests the summer- and winter-run Nooksack River steelhead populations are genetically distinct from one another (Myers et al. 2015). There are no estimates for spawner abundance for this population. This population exists but at very low spawner abundance (NMFS 2019; Ford 2022). Although this summer-run steelhead population is likely very small currently, the recovery goal is 400 to 1,300 spawners depending on productivity (NMFS 2019).

Outside of the Nooksack watershed, a DIP is recognized in the Samish River and in a series of independent tributaries and creeks that drain into Samish and Bellingham Bay. The Samish River and Bellingham Bay Tributaries winter-run DIP spawns in a lowland basin with rain dominated flow. The main spawning areas are in Friday Creek and the Samish River with the majority of spawning occurring from mid-February to mid-June. The current spawner abundance is 1,090 with a recovery goal of 1,800 to 6,100 depending on productivity (NMFS 2019). The estimated five-year geometric mean natural spawner count increased 74% for the most recent five-year period 2015-2019 as compared to the previous five-year period 2010–2014, from 748 to 1,305 spawners (Ford 2022). There is no evidence of steelhead populations on the San Juan islands where Glenwood Springs Hatchery is operated (Myers et al. 2015). None of the programs considered here rear steelhead. The salmon released from these programs will not interact with steelhead populations at levels that will lead to ecological effects reducing VSP parameters for Puget Sound steelhead.

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

Under the 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.

ESA listed Chinook salmon are collected for broodstock as part of the Skookum Creek and Kendall Creek Hatchery Chinook salmon programs. Natural-origin adult Chinook salmon returns to the NF and SF Nooksack populations have been below their Critical Escapement Threshold

(CET) and the hatchery programs operate to increase naturally spawning adults to increase abundance and productivity. Natural-origin broodstock are collected to ensure the hatchery component of the population is in genetic equilibrium with the natural component to promote recovery. The Skookum Creek Hatchery Chinook program spawns 1,000 adults and the Kendall Creek Hatchery Chinook program spawns 2,166 adults to support the releases at Kendall Creek Hatchery, the off-station releases in the NF Nooksack River, and the release at Lummi Bay Hatchery. Both programs are integrated but currently the majority of the spawners are hatchery-origin as the numbers of natural-origin Chinook salmon are low. Skookum Creek Hatchery uses a sliding scale to adjust the number of natural-origin adults used for broodstock according to the number of returning natural origin adults. As the number of natural-origin SF and NF Nooksack adults increases due to the supplementation programs, the programs will incorporate more natural-origin adults into the broodstock.

Broodstock used for non-listed programs are discussed in the following section (1.4).

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 for fish health, broodstock collection, broodstock spawning, rearing and release of juveniles, disposition of hatchery adults, and catastrophic risk management.

Fish Health (HGMP Sections 7, 9, and 10)

All of the hatchery programs would be operated in compliance with the co-manager fish health policies (NWIFC and WDFW 2006). 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 or NWIFC would provide fish health management support and diagnostic fish health services.

Broodstock Collection and Spawning (HGMP Sections 6, 7, and 8)

Both natural and hatchery-origin fish are used for two of the six Chinook salmon hatchery programs, consistent with the purpose of the integrated programs. The Skookum Creek and Kendall Creek coho salmon programs and Kendall Creek fall chum salmon program collects both natural and hatchery-origin salmon that are not ESA-listed.

The protocols for broodstock implement spawning actions consistent with published guidelines (HSRG 2004). Matrix spawning (e.g., 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 use of a sterile adult during spawning (Busack and Knudsen 2007). Broodstock collection and spawning details are summarized in

Table 3.

Table 3. Annual number of broodstock collected, collection method, and spawning approach.

Program	Collection Location	Collection Duration	Collection Method	Adults Collected	Broodstock Needed	Mating Protocol	Natural Origin Broodstock	Egg Take Goal
Skookum Creek Hatchery Chinook Salmon Program	Skookum Creek Hatchery	July-October	Volunteers to Hatchery Pond	10,000	1,000	1 X 1 Crosses	Sliding scale/Up to 700	2,200,000
North/Middle Fork Nooksack Native Spring Chinook Salmon Restoration Program	Kendall Creek Hatchery	May-Sept 7	Volunteers to Hatchery Trap	10,000	2,166 (1,140 for Lummi Bay)	5 X 5 Matrix	Escapement dependent	5,400,000
Samish River Hatchery Fall Chinook Salmon	Samish River Hatchery	September-October	Volunteers to Hatchery Weir and Trap	30,000	4,320 adults (300 for Whatcom)	5 X 5 Matrix	None, Segregated program	7,000,000 + 600,000 for Whatcom
Glenwood Springs Hatchery Fall Chinook Salmon	Glenwood Springs Hatchery, Orcas Island	September-October	Volunteers to Hatchery Ladder	2,200	600	4 X 4 Matrix	None, Segregated program	1,000,000
Skookum Creek Hatchery Coho Salmon Program	Skookum Creek Hatchery	September-December	Volunteers to Hatchery Pond	30,000	4,800	10 X 10 Matrix w/ pooled eggs	As many as volunteer	1,300,000 + 2,300,000 for Lummi Bay
Kendall Creek Hatchery Coho Salmon Program	Kendall Creek Hatchery	October-January	Volunteers to Hatchery Trap	15,000	550	5 X 5 Matrix w/ pooled eggs	10% minimum escapement dependent	575,000

Kendall Creek Hatchery Nooksack Fall Chum Salmon Program	Kendall Creek Hatchery	November - January	Volunteers to Hatchery Trap, In-River with weir and seine	30,000	4,500	5 X 5 Matrix w/ pooled eggs	Escapement dependent	6,000,000
Lummi Bay Hatchery Chum Salmon Program	Lummi Bay Hatchery	October-November	Volunteers to Hatcheries	30,000	8,800	10 X 10 Matrix w/ pooled eggs	None, Segregated program	12,000,000
Whatcom Creek Hatchery Chum Salmon Program	Whatcom Creek Hatchery	October 1-December 15	Volunteers to Hatchery	30,000	4,400	Matrix spawning	None, Segregated program	2,600,000

Rearing and Release of Juveniles (HGMP Sections 9 and 10)

Fish from the programs would be released as seawater-ready smolts or fry to ensure rapid emigration downstream through watershed areas where interactions with rearing listed fish may occur. Release numbers, life stage, location, percentage marked, and dates for all hatchery programs are detailed in Table 4.

Disposition of Hatchery Adults (HGMP Sections 7.5 and 7.8)

Adult Chinook salmon collected in excess of annual broodstock needs are released into freshwater outside the hatchery to spawn naturally. Spawned carcasses may also be sold to a contracted fish buyer or placed in the watershed for marine-derived nutrient enhancement purposes.

Catastrophic Risk Management (HGMP Section 5.8)

All facilities adhere to the applicants' fish health policies (NWIFC and WDFW 2006). Facilities have a hatchery employee on standby at the hatchery at all times to monitor hatchery operations and respond to any unexpected events. The facilities are equipped with low water alarms and a back-up generator in case of power loss.

Table 4. Proposed release goals and protocols for the Nooksack River basin-Georgia Strait salmon hatchery programs.

Program	Release Duration	Release Location	Current Release Goal	Size in Fish per Pound (fpp) and Life Stage at Release	Acclimation; Release Strategy	Mark
Skookum Creek Hatchery Chinook Salmon Program	May–June	Skookum Creek Hatchery	2,000,000[a]	Sub-yearling smolt 50-85 fpp	Volitional Release from Hatchery	Minimum 650,000 CWT-Only 200,000 AD+CWT 100% Otolith Mark
	April–May	Upper South Fork Nooksack	500,000	Sub-yearling smolt 50-85 fpp	Direct plant	100% AD Clip 50,000 AD+CWT 100% Otolith Mark
North/Middle Fork Nooksack Native Spring Chinook Salmon Restoration Program	April–May	Kendall Creek Hatchery	900,000 increasing to 1,400,000 in ten years	Sub-yearling smolt 80-100 fpp	Volitional Followed by Forced Release from Hatchery, NF Acclimation Sites, and McKinnon Pond; Direct plant in MF	100% AD Clip and Otolith Marked; 200,000 also CWT
		NF Nooksack	800,000			100% AD Clip and Otolith Marked 50,000 CWT per site
		MF Nooksack	500,000			100% AD Clip and Otolith Marked 50,000 CWT per site
Samish River Hatchery Fall Chinook Salmon	May-June	Samish holding pond into Samish River	6,000,000	Sub-yearling smolt 80fpp	Acclimated to water source; Volitional Release from hatchery	5,600,000 AD clip 200,000 AD+ CWT 200,000 CWT

Program	Release Duration	Release Location	Current Release Goal	Size in Fish per Pound (fpp) and Life Stage at Release	Acclimation; Release Strategy	Mark
		Samish Hatchery into Friday Creek				
Whatcom Creek Hatchery Fall Chinook Salmon	April–May	Whatcom Creek	500,000	Sub-yearling smolt 80 fpp	Acclimated to water source, Forced release during high tide	450,000 AD clip Up to 50,000 AD+CWT
Lummi Bay Chinook Salmon	April–May	Lummi Bay Hatchery	500,000 increasing to 2,000,000	Sub-yearling smolt 40-90 fpp	Acclimated to sea pond water, forced release into seawater	100% AD clip and Otolith including ≥50,000 AD+CWT
Glenwood Springs Fall Chinook Salmon	May	Eastsound, Orcas Island	800,000	Sub-yearling smolt 80 fpp	Volitional Release from Hatchery into seawater	700,000 AD 100,000 AD+CWT
Skookum Creek Hatchery Coho Salmon Program	April–June	Skookum Creek Hatchery	1,000,000 + 200,000 for research[b]	Yearling smolt 15-30 fpp; Experimental group 15-40 fpp	Acclimated to water source; Volitional release from Skookum hatchery	100% AD Clip 50,000 AD + CWT
Kendall Creek Hatchery Coho Salmon Program	April–May	Kendall Creek Hatchery	500,000	Yearling smolt 17 fpp	On-station release; forced release	455,000 AD Clip 45,000 AD + CWT
Lummi Bay Hatchery Coho Salmon Program	April–May	Lummi Bay Hatchery, Lummi Sea Pond	2,000,000	Yearling smolt 15-30 fpp	Acclimated to Sea Pond water. Forced release from net-pen, volitional movement through tide-gates	100% AD Clip ≥50,000 AD+CWT

Program	Release Duration	Release Location	Current Release Goal	Size in Fish per Pound (fpp) and Life Stage at Release	Acclimation; Release Strategy	Mark
Kendall Creek Hatchery Nooksack Fall Chum Salmon Program	April–May	Kendall Creek Hatchery	5,000,000	Fed Fry 400-1200 fpp	On-station release; volitional or forced release	100% Otolith marked
Lummi Bay Hatchery Chum Salmon Program	March–May	Lummi Bay Hatchery	10,000,000	Fed Fry 350-550 fpp	Six-week acclimation to salt water	May be otolith marked after marking system installed
	March–April	Jordan Creek; Jordan Creek RSI	250,000	Fed Fry 350-900 fpp or Eyed Egg	Forced or volition release	
Whatcom Creek Hatchery Chum Salmon Program	April-May	Whatcom Creek	2,000,000	Fed Fry 800 fpp	On-station release, forced during high tide	100% Otolith marked

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 Nooksack River basin 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). There are no genetic effects to steelhead as none of the programs considered here propagate steelhead. The coho and chum salmon produced by these hatchery programs are not ESA-listed and do not reproduce with any ESA-listed populations so there are no genetic effects associated with these programs. Therefore, our discussion of genetic effects focuses on the propagation of Chinook salmon.

Because the two hatchery programs propagating ESA-listed Chinook salmon, Skookum Creek and Kendall Creek, operated as integrated programs, some interbreeding between hatchery- and natural-origin fish is an objective. These two Chinook salmon hatchery program HGMPs account for and minimizes genetic risks through implementation of the following measures:

- Broodstock are randomly collected throughout the adult return to ensure full representation of run timing, age class, and sex ratio
- Factorial mating ensures that all spawners contribute to the production of progeny to retain genetic diversity in the NF Nooksack stock
- 1 X 1 mating in the SF Nooksack stock ensure close relatives are not mated to maximize effective population size
- Natural-origin fish are incorporated into the broodstock to limit divergence from the native Nooksack Chinook salmon populations
- Chinook salmon broodstock collection at Skookum Creek Hatchery is conducted on a sliding scale based on the estimated in-season abundance of natural-origin spawners to allow adults to escape to natural spawning areas. Kendall Creek Hatchery only collects natural-origin adults that volunteer to the hatchery to use as broodstock.
- All fish are marked to differentiate them from other Chinook salmon stocks, assess out-of-basin escapement, and estimate proportions of hatchery- and natural-origin spawners
- Juveniles are acclimated at their site of release to decrease straying potential. Acclimation of hatchery juveniles 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).

Adults produced by the segregated programs propagating fall Chinook salmon are not intended to spawn naturally. The Chinook salmon produced by segregated programs are marked with adipose clips so they may be readily distinguished from natural origin fish in fisheries, at hatcheries, and on spawning grounds. The comanagers will ensure that the proportion of hatchery origin spawners (pHOS) from segregated programs is less than 5% in the Nooksack Basin.

Ecological effects

The primary ecological risks to natural-origin salmon and steelhead populations posed by salmon and steelhead hatchery programs are identified in the HGMPs as competition for food resources and space, and predation (NMFS 2012). Pathogen transfer and amplification are also risk factors. As noted in the HGMPs and earlier in this document, all hatchery actions would be implemented in accordance with the co-manager's Disease Control Policy (NWIFC and WDFW 2006) to account for and minimize the risks of pathogen transmission and amplification.

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

- Fish are released as seawater-ready smolts or fry to foster rapid emigration seaward, maximizing clearance from freshwater and estuarine areas where natural fish would be most concentrated and most vulnerable to ecological interactions.
- Trapping data indicates juveniles Chinook, coho, and chum salmon migrate seaward rapidly minimizing the potential for ecological effects in freshwater
- Releases of juvenile fish occur during freshets if possible when there is elevated turbidity to speed outmigration
- Chum salmon fry are too small at the time of their release to prey on or compete for preferred prey of any co-occurring natural-origin juvenile Chinook salmon or steelhead
- The majority of hatchery releases occur from March to early June and hatchery fish leave the watershed prior to the emergence of steelhead fry

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

The HGMPs describe the relationship of the proposed actions with fisheries management in Section 3.

The HGMPs indicate that all co-managed hatchery programs in the Puget Sound region would operate consistent with the U.S. v. Washington (1974) fisheries management framework. This legal framework sets forth required measures for coordinating implementation of State and Tribal hatchery programs, defining artificial production objectives, and maintaining treaty-fishing rights through the court-ordered Puget Sound Salmon Management Plan (1985). This fisheries resource co-management process requires that both the State of Washington and the Puget Sound Tribes develop salmon and steelhead hatchery program goals and objectives, and reach agreement on the function, purpose, and fish production strategies for all Puget Sound hatchery programs.

The goals of the HGMPs include providing hatchery-origin Chinook, coho, and chum salmon for harvest to support fisheries and Tribal treaty rights. The goal of the Skookum Creek and Kendall Creek Chinook salmon programs are to increase the abundance and productivity of the SF Nooksack and NF Nooksack River populations, respectively, for conservation purposes and to a harvestable surplus in the future as the population recovers. State recreational and tribal fisheries for hatchery-origin species may incidentally affect natural-origin Chinook salmon. However, these fisheries are not considered interrelated with or interdependent on these programs because these programs are not the sole producers of fish for the fisheries. The effects of fisheries on Puget Sound Chinook salmon are considered in a separate Biological Opinion.

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

The programs that propagate ESA-listed Chinook salmon take measures to reduce the potential for catastrophic loss of rearing populations in the event of water or power failure at the facility. Skookum Creek Hatchery is staffed full-time with five full-time permanent employees residing on-station allowing for quick response in an emergency. All critical electrical water pumps, including well pumps and reuse pumps, are connected to failure alarms and can be powered by a 125kW propane gas generator that can provide power for the entire hatchery for up to seven days in the event of electrical grid power loss. Rearing facilities are equipped with low water alarm probes, oxygen concentration, and temperature alarms as well as twenty-four-hour temperature and dissolved oxygen monitoring. All incubators, raceways, tanks, and rearing ponds at the hatchery have been designed to operate with either ground water or gravity-fed Skookum Creek water allowing full operation of the hatchery in the event of a power outage and backup generator failure. Rearing facilities at Kendall Creek hatchery are equipped with low water alarms and backup generators are available for power outages. Staff is available 24 hours a day to respond to alarms. Kendall Creek can be used as a water source in case of an emergency.

Facilities that rear over 20,000 pounds of fish operate under applicable National Pollutant Discharge Elimination System (NPDES) general permits, which provide for monitoring of temperature, chlorine, settleable, and suspended solids in facility effluent. 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). 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.

The HGMPs include implementation of adequate monitoring and evaluation actions to evaluate the performance of each program in meeting program objectives. These actions are summarized in Section 1.10, and are further described in Section 11 of each HGMP. Some of these activities may be covered using other ESA pathways (e.g., Section 10 research permits), but the information obtained may be relevant to our evaluation of the hatchery program. Monitoring and evaluation actions implemented include:

- Spawning ground/redd surveys to determine the proportion of naturally spawning hatchery-origin fish
- Trapping of outmigrating juveniles to determine post-release emigration timing, emigration rate, and hatchery fish predation levels on natural fish

- Estimating of smolt-to-adult survival rates, harvest of hatchery fish, and escapement of Nooksack-Georgia Strait hatchery salmon to other Puget Sound watersheds using mark recovery programs
- Collection of abundance, timing, age class, sex ratio, and fish health condition data for broodstock to assess run traits of the target populations
- Monitoring of water withdrawal and effluent to ensure compliance with permitted levels
- Monitoring of broodstock collection, egg take, releases, hatchery and natural fish escapements, and fish survival rates to assess program performance
- Fish health monitoring and reporting in compliance with fish health policies.

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 in Section 1.10, data collected relating to hatchery program performance and effects would be evaluated by the applicants to determine whether performance standards are being 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 Future Brood Documents, Annual Operating Plan documents, and/or the HGMPs as necessary. These programs are co-managed by WDFW and Puget Sound tribes consistent with *U.S. v. Washington* (1974) and comanagers will submit annual reports and operating plans to NMFS. The tribes and WDFW employ enforcement officers throughout the area, who are responsible for on the ground enforcement to prevent ESA violations.

1.10 5(i)(J) NMFS provides written concurrence [with] the HGMP, which specifies the implementation and reporting requirements.

NMFS will make a determination regarding the adequacy of the twelve Nooksack River basin and Georgia Strait salmon 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 the criteria specified in limit 6 of the 4(d) rule, NMFS will so notify the applicants 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 Nooksack River basin and Georgia Strait salmon 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 salmon and steelhead populations in the Nooksack River

watershed and Georgia Strait. The ESU recovery plan for Chinook salmon (NMFS 2006; SSDC 2007) has hatchery, harvest, and habitat components, and includes monitoring, research, and restoration recommendations to complement artificial production. The hatchery actions described in the HGMPs are included within, and consistent with, this recovery plan. 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 hatchery programs.

2 PENDING DETERMINATION

As required by limit 6 of the 4(d) rule, the Secretary is seeking comment from the public on the pending determination as to whether or not the plans evaluated here would appreciably reduce the likelihood of survival and recovery of the listed salmon and steelhead. In addition, comment is sought on whether the plans meet the requirements of limit 6 of the 4(d) rule.

NMFS has reviewed the plans and evaluated them together against the requirements of the 4(d) rule. Based on this review and evaluation, NMFS' pending determination, subject to information provided during public comment, is that activities implemented as described would not appreciably reduce the likelihood of survival and recovery of ESA-listed species. This pending determination does not prejudge the outcome of any additional environmental reviews that may be scheduled to be completed prior to a final determination. As required in (6)(iv) of section 223.203 of the 4(d) rule for salmon and steelhead, the Secretary will publish notice of his determination together with a discussion of the biological analysis underlying that determination.

3 REEVALUATION CRITERIA

NMFS will reevaluate its final determination regarding these HGMPs if: (1) the actions described by the plans 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 plans.

4 REFERENCES

Busack, C., and K. P. Currens. 1995. Genetic risks and hazards in hatchery operations: Fundamental concepts and issues. AFS Symposium 15:71-80.

Busack, C., and C. M. Knudsen. 2007. Using factorial mating designs to increase the effective number of breeders in fish hatcheries. Aquaculture 273:24-32.

Dittman, A. H., and T. P. Quinn. 2008. Assessment of the Effects of the Yakima Basin Storage Study on Columbia River Fish Proximate to the Proposed Intake Locations. A component of Yakima River Basin Water Storage Feasibility Study, Washington. Technical Series No. TS-YSS-13. U.S. Department of the Interior, Denver, Colorado. 179p.

Ford, M. J. (editor). 2022. Biological viability assessment update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. NOAA Technical Memorandum NMFS-NWFSC-171. U.S. Department of Commerce. January 2022. 337 pages. Available at https://doi.org/10.25923/kq2n-ke70.

HSRG. 2004. Hatchery Reform: Principles and Recommendations of the Hatchery Scientific Review Group. Prepared for Long Live the Kings. April 2004. 329 pages.

Lummi Nation. 2024a. Hatchery and Genetic Management Plan: Lummi Bay Hatchery Chinook. December 18, 2024. 45 pages.

Lummi Nation. 2024b. Hatchery and Genetic Management Plan: Lummi Bay Hatchery Coho. December 18, 2024. 53 pages.

Lummi Nation. 2024c. Hatchery and Genetic Management Plan: Lummi Bay Hatchery Chum Program. December 18, 2024. 44 pages.

Lummi Nation. 2024d. Hatchery and Genetic Management Plan: Skookum Creek Hatchery Chinook Program. December 18, 2024. 56 pages.

Lummi Nation. 2024e. Hatchery and Genetic Management Plan: Skookum Creek Hatchery Coho Program. December 18, 2024. 58 pages.

McElhany, P., M. H. Rucklelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units. NOAA Technical Memorandum NMFS-NWFSC-42. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA. June 2000. 156 pages.

Myers, J. M., J. J. Hard, E. J. Connor, R. A. Hayman, R. G. Kope, G. Lucchetti, A. R. Marshall, G. R. Pess, and B. E. Thompson. 2015. Identifying Historical Populations of Steelhead within the Puget Sound Distinct Population Segment. March 2015. U.S. Dept. Commer., NOAA Technical Memorandum NMFS NWFSC-128. 175 pages.

Natural Systems Design. 2021. Upper South Fork Nooksack River Effectiveness Monitoring Assessment and Recommendations. April 13, 2021. 148 pages.

NMFS. 2006. Final Supplement to the Shared Strategy's Puget Sound Salmon Recovery Plan. National Marine Fisheries Service, Northwest Region, Portland, Oregon. November 17, 2006. 47 pages.

NMFS. 2012. Effects of Hatchery Programs on Salmon and Steelhead Populations: Reference Document for NMFS ESA Hatchery Consultations. December 3, 2012. Northwest Region, Salmon Management Division, Portland, Oregon. 50p.

NMFS. 2019. ESA Recovery Plan for the Puget Sound Steelhead Distinct Population Segment (*Oncorhynchus mykiss*). National Marine Fisheries Service, Office of Protected Resources and West Coast Region, Seattle, WA. December 20, 2019. 174 pages.

NMFS. 2022. Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Impacts of the Role of the BIA Under its Authority to Assist with the Development of the 2022-2023 Puget Sound Chinook Harvest Plan, the Role of the U.S. Fish and Wildlife Service in Activities Carried out under the Hood Canal Salmon Management Plan and in Funding the Washington Department of Fish and Wildlife under the Sport Fish

Restoration Act in 2022-23, and the Role of the National Marine Fisheries Service in authorizing fisheries consistent with management by the Fraser Panel and Funding Provided to the Washington Department of Fish and Wildlife for Activities Related to Puget Sound Salmon Fishing in 2022-2023. NMFS Consultation Number: WCRO-2022-01000. NMFS West Coast Region. May 13, 2022. 451 pages.

NWIFC and WDFW. 2006. The Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Northwest Indian Fish Commission and Washington Department of Fish and Wildlife, Olympia, WA. Revised July 2006. 38 pages.

Puget Sound Salmon Management Plan. 1985. *United States of America vs. State of Washington* No. 9213 Phase I (sub no. 85-2). October 17, 1985. Order Adopting Puget Sound Salmon Management Plan. 50p.

SSDC. 2007. Puget Sound Salmon Recovery Plan. Prepared by the Shared Strategy Development Team, Shared Strategy for Puget Sound, Seattle, WA. January 19, 2007. 480 pages. Available at https://repository.library.noaa.gov/view/noaa/16005. Retrieved from website September 30, 2022.

Washington, U. S. v. 1974. 384 F. Supp 312 (W.D. Wash.), aff'd, 500F.2nd 676 (9thCr. 1975, cert. denied), 423 U.S. 1086 (1976), Seattle, Washington.

WDFW. 2024a. Hatchery and Genetic Management Plan: North/Middle Fork Nooksack Native Chinook Hatchery Restoration Program. December 18, 2024. 40 pages.

WDFW. 2024b. Hatchery and Genetic Management Plan: Nooksack River Coho - Kendall Creek Hatchery Program. December 18, 2024. 37 pages.

WDFW. 2024c. Hatchery and Genetic Management Plan: Glenwood Springs Fall Chinook salmon. December 18, 2024. 30 pages.

WDFW. 2024d. Hatchery and Genetic Management Plan: Samish Fall Chinook Hatchery Program. December 18, 2024. 38 pages.

WDFW. 2024e. Hatchery and Genetic Management Plan: Whatcom Creek Hatchery Fall Chinook Program. December 18, 2024. 29 pages.

WDFW. 2024f. Hatchery and Genetic Management Plan: Whatcom Creek Chum. December 18, 2024. 28 pages.

WDFW and Lummi Nation. 2024. Hatchery and Genetic Management Plan: North Fork Nooksack River Fall Chum Hatchery Program. December 18, 2024. 36 pages.