HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Lummi Bay Hatchery Coho
Species or Hatchery Stock:	Coho Salmon (*Oncorhynchus kisutch*) Nooksack Hatchery Stock
Agency/Operator:	Lummi Natural Resources Department
Watershed and Region:	WRIA 1 Lummi Bay
Date Submitted:	August 27, 2015
Date Last Updated:	November 25, 2015

Lummi Bay Hatchery Coho Program Executive Summary

Development of land and resources in the Nooksack River Basin has reduced its capacity to provide a sustainable salmon harvest required to meet the treaty reserved right to take fish. Natural production of salmon has been greatly reduced by the deleterious effects of land use practices on the quantity and quality of properly functioning habitat and salmon hatchery production was established to mitigate for these losses. The coho hatchery programs are and will continue to be an integral component of salmon management until the Nooksack watershed has been restored to provide naturally sustaining salmon at harvestable levels to meet the Treaty Right and the needs of the Lummi community. The program also provides harvest opportunity to local non-tribal, recreational and commercial fisheries.

The Lummi Nation's Lummi Bay Hatchery Coho Program, the subject of this HGMP, and the Skookum Creek Coho hatchery program are expected to contribute to annual average terminal area harvests comparable to levels experienced in the mid 1980s, without impeding the recovery of listed Chinook and steelhead populations. Specifically, Lummi's initial objective is to attain an average annual total terminal area harvest of 171,000 coho salmon, comparable to the average annual harvest from all directed fisheries in the mid-1980s. It is anticipated that 80% of the terminal harvest will be from hatchery production. Recent 12-year (2002-2013) average terminal catch has been approximately 49,000 coho salmon, well below harvest objectives.

The Nooksack-Samish Terminal Area, by co-manager agreement, has been managed for hatchery production since the 1980s. The Kendall Creek hatchery operated by WDFW until recently also produced coho. Natural spawning escapement objectives have not been established. Two naturally spawning coho populations have been identified in the Nooksack-Samish region.

1. A Samish population, currently with a *Primary* designation, is descended from the WDFW hatchery population originating from a composite stock. Spawning escapement has averaged around 10,000 in recent years.
2. A Nooksack population is designated as *Stabilizing*, and is dominated by descendents of the WDFW hatchery population originating from a composite stock.

Lummi Bay and Skookum Creek hatcheries comprise two rearing and release locations and utilize a single hatchery stock of mixed origin that is localized to the tribal hatchery release sites. Two HGMPs have been developed to continue the Skookum Creek program and explore the potential for the Lummi Bay Hatchery to become an independent segregated hatchery. Hatchery releases, smolt to adult returns (SARs), and terminal harvest are summarized in the table below.

Table 1. Hatchery production, SARs, and terminal harvest from 1980-2013.

Brood Years	Annual Release (by release year)			Average Hatchery SAR		Average Terminal Catch (BY +3)
	Skookum Creek	Lummi Bay	Kendall Creek	Skookum Creek	Lummi Bay	
1980-1989	1,511,583	769,106	1,167,561	8.2%	8.6%	139,074
1990-2001	1,482,313	1,218,215	638,134	2.9%	2.0%	53,582
2002-2013	1,106,823	972,147	95,962	2.3%	1.0%	52,496

In recent years, reduced hatchery production and poor post-release survival of hatchery fish have substantially reduced abundance and harvest of Nooksack-Samish coho. Current coho smolt production targets are 1,000,000 from Skookum Creek and 750,000 from Lummi Bay. Production is planned to increase in three phases.

The key management issues affecting the expected benefits and risks of the program are related to the performance of hatchery coho in terms of:

1. Utilization, i.e. survival and contribution to terminal fisheries.
   Solutions:
   i. Hatchery strategies (release size, location and numbers) are designed to maximize the number of adults available for terminal harvest.
   ii. Management strategies will achieve a 75% or greater harvest rate on hatchery returns in the Nooksack River.
   iii. Monitor survival of hatchery returns (SAR) and catch contributions to all fisheries.
2. Genetic and ecological interactions, i.e. destination and volume of hatchery origin fish not harvested or trapped at hatchery facilities.
   Solutions:
   i. Operate adult trapping facilities at Skookum Creek and Lummi Bay efficiently.
   ii. Release smolts at times and locations that maximize homing fidelity and minimize straying.
   iii. In coordination with Co-managers, review and evaluate the contribution of hatchery adults to natural spawning within the Samish population.
   iv. Periodic genetic monitoring of natural origin coho in the harvest and escapement to confirm population identity.
3. Design and implement predation studies to monitor rate of predation of coho hatchery smolts on listed Chinook.

Table 2. Proposed stages for the Skookum Creek and Lummi Bay hatchery programs.

Stage	Smolt Release Targets		Expected % Return to Terminal Area	Criteria for moving to next Phase*	Expected Terminal Harvest Contribution
	Skookum Creek	Lummi Bay			
1	1,000,000	750,000	4%	River Harvest Rate > 75%; SAR > 4%	60,000
2	1,500,000	1,500,000	4%	Terminal Harvest Rate > 75%; SAR > 4%	90,000
3	2,000,000	2,000,000	4%		150,000

*The criteria represent guidelines as averaged over multiple years

Results of research, monitoring, and evaluation activities will be reviewed at annual program review workshops where hatchery program adjustments will be considered in coordination with habitat and harvest management. The purpose of adaptively managing the program is to improve harvest benefits and reduce identified risks to ESA listed populations. The criteria for changing between stages of the program will base on averages evaluated over 3-5 years and will be addressed in annual staff workshops.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lummi Bay Hatchery Coho

1.2) Species and population (or stock) under propagation, and ESA status.

Coho Salmon (*Oncorhynchus kisutch*)

A Puget Sound/Strait of Georgia ESU was identified in a status review of all coho from Washington, Oregon and California. The Biological Review Team was concerned that the ESU was likely to become endangered in the foreseeable future and widespread habitat degradation and hatchery production concerns were noted. The status was determined to be "Not presently in danger of extinction, but likely to become so." (Weitcamp, et al. 1995). Though not listed, the ESU is identified by NOAA as a Species of Concern.

In the Nooksack Watershed, naturally spawning coho in the upper North Fork Nooksack River are genetically distinct from hatchery coho in the Nooksack River and from naturally spawning coho in the lower Nooksack River (Small et. al., 2004). The Upper North Fork Nooksack coho appear to be a native stock that has survived because of earlier migration and local adaptation to cooler glacial fed waters and avoidance of the fishing pressure on hatchery stocks. A distinct non-hatchery coho stock has not been identified outside of the Upper North Fork Nooksack River.

Nooksack Hatchery Coho

The Nooksack hatchery coho production is intended to have no stray impacts on the reported genetically distinct North Fork coho group that has existed though extensive hatchery production and high fisheries exploitation rates. The co-managers have given a stabilizing designation to the Upper North Fork Nooksack coho.

1.3) Responsible organization and individuals

Name (and title):	Merle Jefferson -Natural Resources Director
Agency or Tribe:	Lummi Natural Resources Department
Address:	2665 Kwina Road, Bellingham WA 98226
Telephone:	360-312-2328
Fax:	360-380-6989
Email:	merlej@lummi-nsn.gov

Name (and title):	Linda Delgado, Salmon Enhancement Manager
Agency or Tribe:	Lummi Natural Resources Department
Address:	2665 Kwina Road, Bellingham WA 98226
Telephone:	360- 384-2221
Fax:	360-312-8302
Email:	lindad@lummi-nsn.gov

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and

extent of involvement in the program:

Agency	Involvement
WA Dept. Fish & Wildlife (WDFW)	Co-manager
Nooksack Tribe	Co-manager
US Department of Interior	Primary funding agency

This hatchery is a component of the Equilibrium Brood Document for the Nooksack-Samish Terminal Area mentioned in the Puget Sound Salmon Management Plan (PSSMP) (1985) (US v. Washington No. 9213 (85-2).

1.4) Funding source, staffing level, and annual hatchery program operational costs.

This program is funded by the Lummi Indian Nation Natural Resources Department which receives its funding from the US Department of Interior.

Four permanent employees operate these programs on a combined operational budget of approximately $145,000.

1.5) Location(s) of hatchery and associated facilities.

Lummi Bay Hatchery (Primary program broodstock collection, rearing and release site)

Lummi Bay Hatchery, Southeast Georgia Strait, WRIA 1,
Sections 8,9,10; TWN 38N; Range 1E.

Kendall Creek Hatchery (Egg incubation and initial fish rearing, when Skookum Creek facilities are limited due to the South Fork Chinook Program)

To be phased out when the Lummi Bay program becomes self sufficient, or when Skookum Creek hatchery has regains the capacity support the Lummi Bay program until it becomes self sufficient.

RM 46, North Fork Nooksack River, WRIA 01.0120

Skookum Creek Hatchery (Egg incubation and initial fish rearing)

To support the Lummi Bay program until it reaches a self sufficient state if the demands of the South Fork Chinook Program free up the capacity at the Skookum Creek Hatchery

South Fork Nooksack River, RM 14.3, Nooksack River Basin, WRIA 1, just downstream of the confluence with Skookum Creek

1.6) Type of program.

Harvest Augmentation

1.7) Purpose (Goal) of program.

The goal of this hatchery program is to meet the 1855 Point Elliott treaty obligation for a treaty reserved right to take fish at usual fishing grounds and stations. Specifically, this program is to contribute to a minimum terminal area annual average harvest of 171,000 coho salmon with 80% of the catch being of hatchery origin. The program is required to mitigate for habitat loss associated with forestry, industrial, agriculture, and rural and urban development affecting coho abundance in the terminal area. The program will support terminal area non-treaty fisheries and sport fisheries under co-manager and PFMC management. The program will buffer the impact of harvests of natural production of the Puget Sound Coho ESU in Southern US and Canadian fisheries and support obligations under the Pacific Salmon Treaty to ensure equity in harvest and preserve essential Fraser Panel Fisheries.

1.8) Justification for the program.

The harvest of hatchery fish under this program is part of the Lummi Nation's Federally recognized Treaty Rights. The role of hatcheries associated with our Treaty-reserved fishing Rights is to support four basic values recognized by the Federal courts: (1) conservation of the resource, (2) ceremonial, religious, and spiritual values, (3) subsistence values, and (4) commercial values. Until listed wild stocks are fully recovered, Lummi Nation fisheries will continue to depend on harvestable surplus of hatchery coho. This program mitigates for lost natural-origin fish production by producing coho salmon for meaningful commercial, ceremonial and subsistence harvest and provides important population monitoring in marine and fresh waters while minimizing adverse genetic, demographic, or ecological effects on listed fish and other natural populations. This hatchery program is indispensable in the implementation of the Treaty Right to fish in the face of continuing loss of salmon habitat by degradation and climate change. As long as the Nooksack River and adjacent watersheds within the tribe's U&A fishing area are unable to maintain naturally self-sustaining levels of salmon that ensure that the Lummi Nation is able to harvest salmon in traditional areas in sufficient numbers to carry out the promises of the Treaties fully, and the requirements of United States vs. Washington, this hatchery program will be an integral and indispensable component of our salmon management.

Besides providing fish for harvest, this hatchery program also supports natural resource management responsibilities consistent with Treaty Rights (e.g. US v Washington, PSSMP). The legal basis for Co-management of salmon in Puget Sound is based on the Puget Sound Salmon Management Plan (PSSMP), which was developed by the Co-managers and adopted as an order of the Federal court in 1985 (United States v. Washington, No. 9213 Phase 1 (sub no. 85-2) 1985). This program provides important monitoring, and supplementation of local salmon abundances, and integrates efforts and strategies of the WRIA 1 watershed recovery plan.

Hatchery production of coho salmon in the terminal area was reduced by 65% in the early 2000s as a precautionary matter to reduce potential ecological interactions with ESA-listed Chinook in the watershed. While reduced production coincided with a significant decline in terminal area harvestable Coho, it has not resulted in a quantifiable positive response from the listed Chinook populations.

The program is managed to produce a locally adapted returns of coho to ensure that returning adults that might stray would be able to occupy any underutilized coho habitat as the ecosystem process that create and maintain properly functioning coho habitat are protected and restored.

The program is structured to minimize any potential risk to ESA-listed species. Juveniles will be released directly into seawater as fully smolted yearlings that will quickly disperse into pelagic marine areas; therefore, minimal interaction is expected with any co-occurring ESA-listed juvenile Chinook salmon and steelhead in the estuary of nearshore areas (HSRG, 2014). Program fish return as adults to the terminal area at a time when ESA-listed Chinook have already spawned and prior to the migration of the ESA-listed Steelhead. No adverse fisheries-related effects resulting from implementation of the coho program are expected. Effects of fisheries for Lummi Bay Hatchery coho salmon on ESA listed salmon and steelhead have been previously reviewed and authorized by NMFS through a separate ESA consultation (NMFS 2015).

1.9) List of program "Performance Standards".

See HGMP section 1.10.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

The performance standards for this program will be related to the provision of coho to satisfy legally mandated harvest in a manner which minimizes the risk of adverse effects to ESA-listed species.

Table 1.10.1: "Performance Indicators" addressing benefits.

Standard	Indicator	Monitor
Identification of hatchery production in the hatchery, harvests and spawning grounds.	Absence of adipose fin, otolith mark, CWT, or genetic stock identification.	Sample harvest, hatchery and spawning grounds to provide statistically valid estimates of hatchery fish.
Significant contributions to terminal area harvest.	Proportion in of identified hatchery fish in harvest samples.	Sample at rates to provide statistically valid estimates of contributions to all fisheries.
Effectiveness of program operations	Hatchery operations use the best available science to maximize survival and prevent disease Survival rates recorded at each stage of culture.	Annual report of hatchery activities.
Release survival meets standards.	Proportion of released production that contributes to escapement and fisheries.	Analysis of program contributions to spawning grounds, hatchery return, and all fisheries.

Table 1.10.2: "Performance Indicators" addressing risks.

Standard	Performance Indicator	Monitor
Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (WWIT/WDFW 2006).	Hatchery records document compliance with applicable standards and criteria.	Annual report of hatchery fish health; guidelines and standards met.
Effluent from hatchery facility will not Adversely affect the ecosystem.	Discharge water quality meets NPDES permit standards.	Reports as required by NPDES permit in annual hatchery report.
Water withdrawals and in-stream water diversion structures for hatchery operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals are compliant with water rights. Facility operates in compliance with applicable passage and screening criteria for juveniles and adults.	Annual record of water withdrawal and status of passage and screening include in annual hatchery report.
Releases do not introduce new pathogens and do not increase the levels of existing pathogens in local populations	All State and co-manager fish health policies and standards are followed. Certification of fish health during rearing and release.	Report of compliance with fish health policies and fish health certifications contained in the annual hatchery report.
Any distribution of carcasses or other spawner products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines.	All applicable fish disease policies are followed.	Disposition of carcasses reported in annual hatchery report.
The stray rate will not cause a significant change in the genome of the listed Chinook.	DNA stock identification compared to the baseline.	Statistics comparing stock genomes will not show a significant change.
Competition by hatchery origin releases on natural origin salmonids does not significantly reduce numbers of listed natural origin salmonids.	Dates, size and location of release supporting rapid out migration.	Records from hatchery operations contained in an annual hatchery report. Supplemental information from lower river smolt trap, as available.
Predation by hatchery origin releases on natural origin salmonids does not significantly reduce numbers of listed natural origin salmonids.	Dates, size and location of release supporting rapid out migration.	Records from hatchery operations contained in Annual Hatchery Report. Supplemental information from lower river smolt trap, as available.

1.11) Expected size of program.

Table 1.11.1: Implementation stages of the Lummi Bay coho program.

Phase	Terminal Harvest	Release Goal	SAR	Criteria[1]
1	40,000	750,000	0.04	Current, Kendall incubate and rear, meet standards
2	40,000	1,000,000	0.04	Resources, facilities available; Kendall or Skookum incubate and rear, standards met
3	60,000	1,500,000	0.04	Resources, facilities available; Lummi Bay self sufficient, standards met
4	80,000	2,000,000	0.04	Resources, facilities available; standards met

[1] The standards are adequate facilities and resources to ensure achievement of documented return per smolt released and targeted return to fisheries

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Up to 2,400 adult coho salmon each year (Table 1.11.1.1).

Table 1.11.1.1: Proposed annual broodstock collection levels.

Phase	Brood Stock	Egg Take Goal	Criteria[1]
1	600 F – 600 M	875,000	Supplementation from Skookum possible, improve survival, meet all Best Management objectives
2	750 F – 750 M	1,150,000	No reliance on Skookum to meet objectives, facility improvements at Lummi Bay
3	1,000 F – 1,000 M	1,750,000	Phase 2 objectives met, additional facility expansions and improvements
4	1,200 F – 1,200 M	2,225,000	Phase 3 objectives met

[1] The standards are adequate facilities and resources to ensure achievement of documented return per smolt released and targeted return to fisheries

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Up to 2,000,000 smolts per year released from Lummi Bay Hatchery into the Salish Sea (Table 1.11.1.2).

Table 1.11.1.2: Proposed annual fish release levels (maximum number) by life stage and location.

Phase	Life Stage	Release Location	Annual Release Goal	Criteria
1	Yearling Smolt	Lummi Bay Hatchery	750,000	Current, Kendall incubate and rear, meet standards
2	Yearling Smolt	Lummi Bay Hatchery	1,000,000	Resources, facilities available; Kendall or Skookum incubate and rear,, standards met
3	Yearling Smolt	Lummi Bay Hatchery	1,500,000	Resources, facilities available; Lummi Bay self sufficient, standards met
4	Yearling Smolt	Lummi Bay Hatchery	2,000,000	Resources, facilities available; standards met

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Table 1.12.1: Lummi Bay Program Estimated Smolt to Adult Survival Rates.

		Hatchery Escapement		
Return Year	**Brood Year**	**Adults**	**Jacks**	**Estimated SAR**
2001	1998	8,869	1,119	2.65%
2002	1999	5,306	203	2.76%
2003	2000	3,214	425	3.14%
2004	2001	3,347	123	1.77%
2005	2002	3,152	396	1.27%
2006	2003	2,151	902	1.29%
2007	2004	2,896	494	1.56%
2008	2005	538	102	0.70%
2009	2006	2,283	576	1.63%
2010	2007	4,314	267	0.48%
2011	2008	353	68	2.10%
2012	2009	846	10	1.28%
2013	2010	834	2,218	0.53%
Average		**2,931**	**531**	**1.63%**

Data Source: Lummi Natural Resources, 2014

*Brood year applies only to adults for any particular year row.

† Smolt-to-adult survival rates (SAR total adult returns to fisheries and escapement) applies only to age-3 adults.

1.13) Date program started (years in operation), or is expected to start.

The Lummi Bay Coho Program began in 1977 and has operated continuously since.

1.14) Expected duration of program.

This program is expected to last as long as necessary to meet the treaty right to take fish not met by natural production. The program will be managed to meet mitigation objectives for the loss of natural coho production and may be modified as justified by regular evaluation of monitoring information.

1.15) Watersheds targeted by program.
WRIA 1.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The alternative to hatchery production to meet the needs of the treaty reserved fishing right is to restore the basin and marine habitat to the condition that would support natural production to meet that harvest need.

Catch objectives were being met when the total annual hatchery coho smolt release in the terminal area exceeded 5,600,000. This production was reduced to two million in the terminal area as a precautionary measure to reduce interactions with the ESA-listed Chinook. The reduction resulted in a significant decline in terminal area harvestable coho, however no quantifiable positive response from the listed Chinook populations has been observed.

The WDFW Kendall Creek Hatchery discontinued their 1,300,000 smolt release program because financial resources to sustain the program were lacking. If the Kendall Creek Hatchery coho program were re-initiated, the smolt release goals for the two Lummi hatchery coho programs would be reviewed.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

There are currently no ESA permits or authorizations for this hatchery program. This HGMP is submitted for ESA authorization of this program under ESA 4(d) Rule, limit 6 and NEPA.

Harvest management of coho populations within Puget Sound is implemented through the North of Falcon process of the Pacific Fisheries Management Council to regulate the ocean and inside fisheries to ensure compliance with the sharing and conservation principles of the Boldt decision.

Effects of fisheries for Lummi Bay Hatchery coho on ESA listed salmon and steelhead have been previously reviewed and authorized by NMFS through a separate ESA consultation (NMFS 2015).

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) Description of NMFS ESA-listed salmonid population(s) affected by the program.

Puget Sound Chinook (*Oncorhynchus tshawytscha*): The Puget Sound Chinook ESU was listed as Threatened on March 24, 1999 (64FR14308); Threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed Threatened by five-year status review, completed August 15, 2011 (76FR50448). The Puget Sound Chinook salmon ESU is composed of 38 historically quasi-independent populations, of which 22 have been identified although they may not represent the population that used to be there historically (Ruckelshaus et al. 2006). The ESU includes all naturally-spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan De Fuca from the Elwha River eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington, as well as twenty-six artificial propagation programs (Ford 2011). In the Nooksack basin, the TRT has identified populations in the North/Middle Fork Nooksack and South Fork Nooksack River (Ruckelshaus et al. 2006).

Natural-origin North Fork Spring Chinook, South Fork Nooksack Spring Chinook, Nooksack basin bull trout and Nooksack basin steelhead may be incidentally affected by the program. Incidental effects may include: competition and predation after release of Chinook from the lower Nooksack acclimation facility; and, enhanced potential for fish disease transfer from hatchery to natural-origin fish. The extent to which listed Chinook salmon, steelhead and bull trout will be incidentally affected by the hatchery program is unknown. The release of sub-yearling migrant smolts in lower river tributaries and marine areas reduces fresh water rearing conflicts and conditions the return of adults to the release locations to minimize straying to basin areas used by the listed Chinook. Because the returning adults enter the terminal fishing areas later than the listed early migrating stocks, harvest is managed to avoid interception of early migrating listed Chinook and to maximize the river fishery harvest of returning fall Chinook to minimize straying to areas of listed early Chinook spawning. Southern US Fisheries are managed to a 7% exploitation rate on ESA listed Nooksack Early Chinook to protect the spawning population.

To the extent that the increased recruitment of adults on the returning ocean migration provides an addition to the potential food supply of the listed Killer Whales (*Orcinus orca*) it should the program should be beneficial and buffer predation on the remaining natural-origin recruits. Similarly, increases in program smolts may provide forage to the benefit of sub-adult and adult bull trout as they out-migrate or rear in estuarine or nearshore areas and buffer natural origin listed Chinook from that predation. Since most or all bull trout spawning occurs higher in the watershed (USFWS 2004), predation of bull trout juveniles by sub-yearling Chinook smolts in the lower river tributary and nearshore is unlikely due to the geographic separation.

The Puget Sound Chinook TRT identified 20 Chinook populations outside of the Strait Of Georgia Biological Region, they include the following:

Lower Skagit River
Upper Skagit River
Cascade River
Lower Sauk River

Upper Sauk River
Suiattle River
North Fork Stillaguamish River
South Fork Stillaguamish River
Skykomish River
Snoqualmie River
Sammamish River
Cedar River
Duwamish/Green River
White River
Puyallup River
Nisqually River
Skokomish River
Mid-Hood Canal Rivers
Dungeness River
Elwha River.

Nooksack System Steelhead (*Oncorhynchus mykiss*): Were listed as Threatened under the ESA on May 11, 2007 (72FR26722); reaffirmed Threatened by five-year status review, completed August 15, 2011 (76FR50448). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, below natural migration barriers in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington (Ford 2011). This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), and also includes the Green River natural and Hood Canal winter-run steelhead hatchery stocks. In the Nooksack Basin, the TRT has preliminarily delineated one DIP of winter steelhead in the Nooksack River and one DIP of summer steelhead in the South Fork Nooksack River (PSSTRT 2013). Incidental effects of the program are thought to be minimal or non-existent because differences in migration timing of adults, spawning times and areas, and contemporary size differences.

2.2.2) Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds

Puget Sound (Nooksack System) Chinook (*Oncorhynchus tshawytscha*): All Puget Sound Chinook salmon populations are well below escapement abundance levels identified, as required for recovery to low extinction risk in the recovery plan (WRIA 1 SRB 2005). In addition, most populations are consistently below the productivity goals identified in the recovery plan as necessary for recovery. Although trends vary for individual populations across the ESU, most populations have declined in total natural origin recruit abundance since the last status review; and natural origin recruit escapement trends since 1995 are mostly stable. Several of the risk factors identified in the previous status review (Good et al. 2005) are still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat.

NMFS (1999) considered the Kendall Creek hatchery stock to be part of the ESU, and listed with natural-origin Chinook salmon that are part of the North/Middle Fork Nooksack population (NMFS 2004; 70 FR 37160). The hatchery program was started with natural-origin fish from the North Fork Nooksack River. The Kendall Creek Hatchery North/Middle Fork early Chinook supplementation program has increased abundances and largely maintains the North Fork

population. Because the hatchery program has dramatically increased hatchery-origin Chinook, but natural-origin fish are only slowly increasing, a reasonable conclusion is that the main limiting factor for this population is poor habitat.

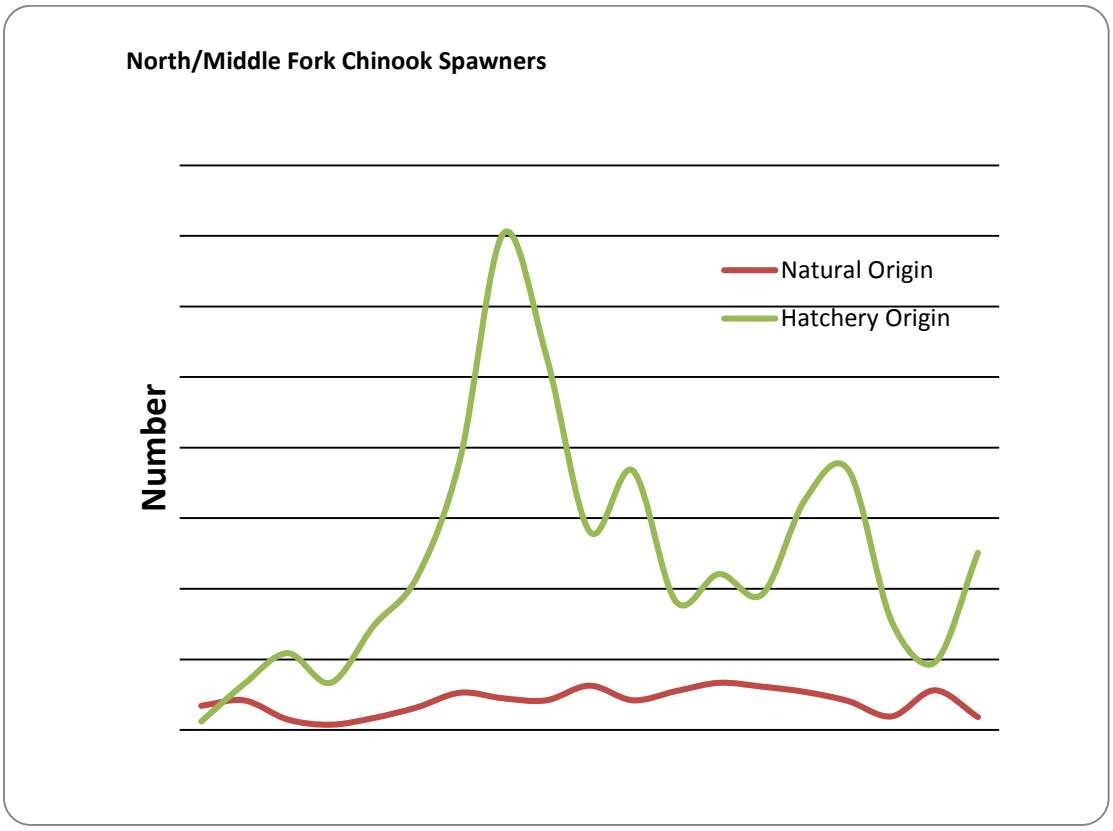

Figure 2.2.2.1: Natural origin spawners and hatchery origin spawners 1995-2013.

Driven by chronically low natural escapements, a restoration program for this locally indigenous stock was developed using a strategy of increasing the numbers of juveniles released and subsequently increasing the number of returning spawners. Recent numbers of natural-origin spawners have been extremely low which emphasizes the importance of the hatchery component of this program as a reservoir for the genome while limiting factors are being addressed. The Kendall program has relied totally on volunteer returns to the hatchery. In the past, hatchery and wild fish were not entirely differentiated with distinguishing marks, so it was possible that wild fish contributed to the broodstock at some level. Most North/Middle Fork Chinook salmon spawned in recent years have been of hatchery-origin. The proportion of natural-origin fish typically used in the broodstock is low and averaged 3.2 Chinook per brood year (WDFW unpublished otolith data). Recent escapement levels (1999-2013) have averaged 1,659 natural spawners in the North/Middle Fork Nooksack River Population.

The South Fork Nooksack early Chinook population has averaged 52 (2003 – 2013 range 10-114) in recent years.

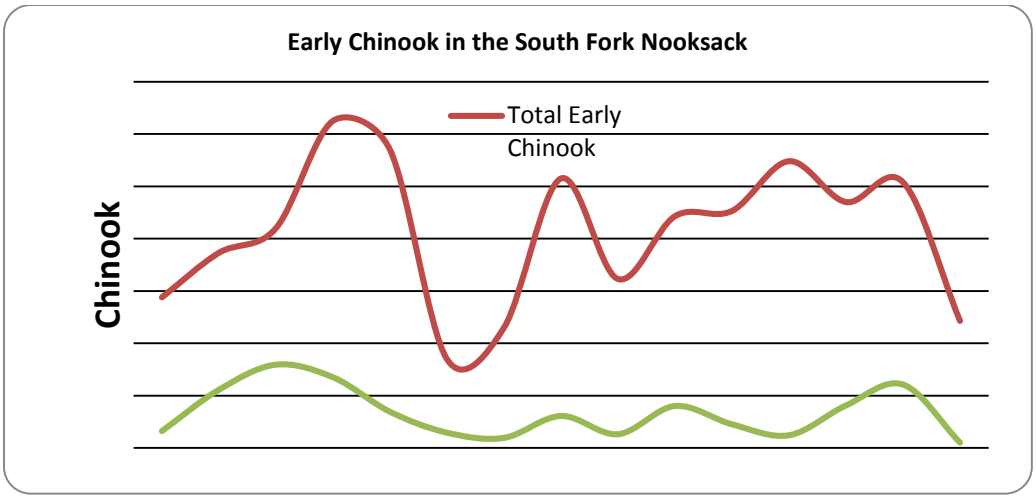

Figure 2.2.2.2: Natural origin South Fork Chinook relative to total early Chinook 1999-2013.

Preliminary critical and viable population thresholds have been identified. The co-managers identified preliminary individual critical and viable thresholds of 200 and 1,250, respectively, for the NF and SF Nooksack populations. The Co-manager's (Puget Sound) Technical Review Team (Ruckelshaus 2006) assigned preliminary critical thresholds of 1,000 for both the NF and SF populations. WDFW recently determined that the NF and SF Chinook populations are "critical" in status (WDFW 2002).

The recent average (2006-2009) abundance of NOR spring Chinook was 294 fish in the North /Middle Fork Nooksack River and 235 fish in the South Fork Nooksack River for 2000-2004. These low average abundance levels are in the range of "critical" levels for an independent Pacific salmonid population below which: 1) depensatory processes are likely to reduce it below replacement; 2) short term effects of inbreeding depression or loss of rare alleles cannot be avoided; and 3) productivity variation due to demographic stochasticity becomes a substantial source of risk.

NMFS (2003) reported a short-term (1990-2002) median population growth rate for the composite (hatchery and natural Chinook) North Fork Nooksack population of 0.75. In developing this estimate, NMFS assumed that the reproductive success of naturally spawning hatchery fish was equivalent to that of natural fish. The composite North Fork Nooksack naturally spawning population is not replacing itself in the short term, despite decades of high contributions of hatchery-origin spawners on the spawning grounds. Long-and short-term population trends estimated for all spawners were 1.16 and 1.42, respectively (NMFS 2003).

Estimates of adult bull trout are not available for the Nooksack River basin and the status of the population relative to the population threshold is "unknown" (WDFW 2002).

Nooksack System Steelhead (*Oncorhynchus mykiss*): In 1996, the National Marine Fisheries Service (NMFS) listed a declining trend in the Nooksack River system of total escapement of –11.6 to –7.0, where trend is defined as percent annual change in total escapement or an index of total escapement (Busby et al. 1996). More recent expanded surveys conducted in this basin in 2003-2004, 2009/2010 & 2010/2011 indicated that a comparatively strong winter steelhead population exists. Summer steelhead spawn in the upper SF Nooksack River including upstream

from RM 30.4, and are native with wild production and an unknown status (PSSTRT 2013, WDFW 2002; 2012).

- Provide the most recent 12 year progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Table 2.2.2.1: Nooksack early Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S). Trend over the intervals is also given.[a]

Brood Years	1982-1986		1987-1991		1992-1996		1997-2001		2002-2006		Trend	
Populations	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**
North + Middle Fork Nooksack	*5.56*	*2.52*	*2.83*	*1.28*	*0.61*	*0.39*	*0.55*	*0.31*	*0.32*	*0.11*	*-1.28*	*-0.58*
South Fork Nooksack	*2.01*	*0.93*	*1.3*	*0.62*	*1.6*	*0.99*	*1.66*	*0.94*	*2.99*	*0.92*	*0.23*	*0.03*
ESU	***9.57***	***2.19***	***5.05***	***0.96***	***3.01***	***1.24***	***2.70***	***1.19***	***1.67***	***0.67***	***-1.81***	***-0.28***

[a]This is from analyses reported by Ford (2011). These analyses incorporate assumptions for years where escapements were not sampled for hatchery: natural-origin ratios, and are not necessarily agreed to by WDFW and Co-managers.

Brood year 1992 to 2000 recruit/spawner levels for natural-origin North Fork/MF Nooksack spring Chinook salmon (Co-managers, unpublished data):

Table 2.2.2.2: Estimated Productivity of North/Middle Fork Natural Spawners

Brood Year	Spawners	Adult Returns	Recruits/Spawner
1992	493	174	0.37
1993	445	77	0.16
1994	45	25	0.56
1995	230	18	0.08
1996	535	248	0.46
1997	617	344	0.56
1998	370	119	0.32
1999	823	196	0.24
2000*	823	325	0.26

*- Age 3 & 4 returns only, Co-Manager data

Table 2.2.2.3: South Fork Chinook Productivity Estimates

Year	Escapement*	Brood Escapement (RY-4)	Recruits/ Spawner
2003	69	32	2.16
2004	29	111	0.26
2005	19	159	0.12
2006	61	135	0.45
2007	26	69	0.38
2008	80	29	2.76
2009	45	19	2.37
2010	24	61	0.39
2011	81	26	3.12
2012	121	80	1.51
2013	10	45	0.22
Average	51.4	69.6	1.36

Nooksack System Steelhead (*Oncorhynchus mykiss*): The glacial hydrology in this system makes it difficult to monitor data for steelhead stocks in this system. In 1996, NMFS listed a declining trend in the Nooksack River system of total escapement of –11.6 to –7.0, where trend is defined as percent annual change in total escapement or an index of total escapement (Busby et al. 1996). Expanded surveys conducted in this basin in 2003-2004 indicated that a substantial winter steelhead population may exist (see escapement below). Summer steelhead spawn in the upper South Fork Nooksack River including upstream from RM 30.4, and are native with wild production and an unknown status, but the run has been historically small.

Conditions in the spawning areas the North/Middle Fork and South Fork Chinook Spawning Grounds make precise and accurate spawning ground estimates difficult. The co-managers have developed protocols to provide an estimate that may provide an annual index of the spawning ground abundance of each population. There are continuing efforts to identify new methodologies to relate the current estimates to a more accurate estimate of the spawning populations.

Table 2.2.2.4: Early Chinook Escapement 1999- 2013

Return Year	Escapement	
	S.F. Nooksack [b]	N. F./MF Nooksack (NOR+HOR)
1999	32	823
2000	111	1,242
2001	159	2,185[a]
2002	135	3,741
2003	69	2,857
2004	29	1,719
2005	19	2,047
2006	61	1,184
2007	26	1,438
2008	80	1,266
2009	45	1,903
2010	24	2035
2011	81	865
2012	121	758
2013	10	1347
Average	**67**	**1,659**

Source: Lummi Compilation of Co-manager Data
[a] Additionally, 4,765 hatchery Chinook were returned to the N.F. Nooksack River.
[b] Represents S.F. native NORs only

Since 1999 the escapement of Chinook to the South Fork Nooksack River has included, in addition to the South Fork population, natural origin and hatchery origin North Fork Chinook and later timed fall Chinook

Table 2.2.2.5: Lummi Trap Catch of Natural Origin Chinook 2006-2014

Year	Effort (min)	Zero	Yearling
2006	44,386	1,297	24
2007	58,724	365	23
2008	53,634	1,324	2
2009	43,006	877	64
2010	53,683	517	35
2011	60,522	1,659	15
2012	101,874	3,956	44
2013	106,104	2,415	92
2014	172,670	1,118	51

Source: Internal Lummi Data

Nooksack System Steelhead (*Oncorhynchus mykiss*): Glacial conditions have limited past spawner surveys throughout the Nooksack watershed. A combination of aerial and ground survey have been conducted during clear water conditions to track abundance.

Table 2.2.2.6: Nooksack River winter steelhead escapement 2004-2014.

Return Year	Escapement
2004	1,574
2005	NA
2006	NA
2007	772
2008	NA
2009	NA
2010	1901
2011	1774
2012	1747
2013	1805
2014	1521
Average	**1585**

- Provide the most recent 12 year estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Table 2.2.2.7: Short and long-term population trend and growth rate estimates for the Nooksack Early Chinook populations.

Regions and Populations	Years	Trend Natural Spawners w/Cl	Hatchery Fish Success = 0 Lambda w/Cl	p>1	Hatchery Fish Success = 1 Lambda w/Cl	p>1
Lower-North Fork-Middle Fork Nooksack Spring Run	1995-2009	1.092 (1.023 - 1.165)	1.082 (0.622 - 1.884)	0.84	0.607 (0.232 - 1.589)	0.05
	1984-2009	1.049 (0.995 - 1.106)	1.032 (0.909 - 1.172)	0.74	0.729 (0.571 - 0.93)	0.01
South Fork Nooksack River Spring Run	1995-2009	1.05 (0.995 - 1.107)	1.068 (0.507 - 2.251)	0.77	0.938 (0.388 - 2.269)	0.26
	1984-2009	1.006 (0.976 - 1.038)	1.009 (0.883 - 1.154)	0.57	0.927 (0.825 - 1.041)	0.07

Source Data: Ford 2011.

[a]This is from analyses reported by Ford (2011). These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Co-managers. "Lambda" is a measure of population growth rate. See Ford (2011) for explanation of the meaning of the columns.

Table 2.2.2.8: NF/MF Nooksack early Chinook spawners (*Oncorhynchus tshawytscha*) from 1998-2010.

Year	NF/MF Nooksack River		
	Natural-Origin	**Hatchery-Origin**	**% of Natural Origin**
1998	37	333	10%
1999	85	738	10%
2000	160	1,082	13%
2001	240	2,185*	12%
2002	224	3,517	6%
2003	210	2,647	7%
2004	318	1,746	18%
2005	210	1,837	10%
2006	275	909	23%
2007	334	1,104	23%
2008	307	959	24%
2009	269	1,634	14%
2010	204	1,840	10%
2011	96	769	11%
2012	281	477	37%
2013	91	1254	7%
Average	**210**	**1402**	**11.7**

Source: (WDFW 2002; WDFW 2012 and Natasha Geiger WDFW 2012).
* - Does not include the 4,765 hatchery "put backs" to the NF Nooksack.

There are three Chinook Stocks encountered during spawning ground surveys in the South Fork Nooksack River. The estimates are broken into hatchery and natural origin based on CWT and/or adipose fin clip, and the natural origin Chinook are further estimated by stock by DNA microsatellite tissue assignment.

Table 2.2.2.9: Estimated Escapement of Chinook into the South Fork Nooksack by Origin and Stock

Return Year	South Fork Native	North Fork NOR	Fall NOR	Kendall Cr Hatchery	Other Hatchery	Total Natural
1999	32	0	127	90	39	288
2000	111	42	132	74	15	373
2001	159	51	65	138	8	420
2002	135	55	98	289	47	625
2003	69	0	150	210	162	591
2004	29	29	88	14	12	172
2005	19	56	56	32	70	233
2006	62	104	192	84	90	532
2007	29	44	128	112	35	348
2008	83	106	126	109	23	447
2009	45	58	187	128	38	456
2010	24	49	123	299	58	552
2011	81	82	114	172	32	481
2012	121	165	93	97	38	514
2013	10	30	22	162	19	243

Preliminary Co-manager Data

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take</u>

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

None expected as a result of operation, maintenance, broodstock collection, fish rearing, and fish release (with exceptions noted below) at the Lummi Bay Hatchery facility. The hatchery is located outside of the Nooksack River watershed and removed from freshwater areas where listed fish are present. Coho salmon produced by the program will not pose substantial ecological risks in freshwater, and no genetic risks, to listed species to fish size, life history, and species differences, and the location of the hatchery adult return and smolt release site directly adjacent to seawater. The water intake structure is located in the tidal area of the lower Nooksack river area removed from the predominant smolt migration corridor and contacts with listed fish are unsubstantial. Regular observations by hatchery personnel have not identified juvenile salmon in the area of the intake. A buildup of large woody debris on the bridge piling just upstream of the pump station has created problems at the intake. Modifications are being developed to remedy this situation and ensure a more dependable water supply to the Lummi Bay Hatchery. While the intake is currently screened, the restoration of a more normal flow of water by intake will include upgrading screening to meet the NOAA 2011 criteria by 2018.

Adult coho salmon produced by the program that stray into Nooksack River basin areas where Early Chinook salmon spawn may affect listed Chinook through redd superimposition. The risk of this effect is low, due to differences in spawn timings and areas, and the tendency for most returning hatchery fish that aren't harvested to return to the hatchery release site.

After their release from Lummi Bay Hatchery, yearling coho smolts may compete with any listed fish juveniles in the estuary and nearshore areas for food. The expected effects of competition are unsubstantial, because all yearling coho will be released as smolts that have been shown through nearshore marine area juvenile sampling to disperse rapidly into pelagic marine areas, limiting the duration of any interactions to just a few days.

Coho smolts may also prey on any co-occurring listed juvenile fish of small enough sizes vulnerable to predation in the estuary and nearshore marine environment. Effects are expected to be low, as demonstrated by stomach content analysis data which shows that newly released coho yearlings are not consuming listed juvenile listed fish.

Effects on migration and survival of water intake screening on listed Chinook salmon and steelhead at Kendall Creek Hatchery in connection with use of the facility for egg incubation and fish rearing for fish destined for Lummi Bay Hatchery. This risk/effect is addressed in WDFW's HGMP for the Kendall Creek Hatchery programs.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

None known.

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

Unknown. There is no record of ESA-listed species entering Lummi Bay Hatchery where the coho program is primarily located

Monitoring and adaptive management will be used to ensure that hatchery practices meet the WRIA 1 Salmonid Recovery Plan (WRIA 1 SRB 2005) objectives of 1) "use hatcheries to sustain treaty-reserved fisheries and non-treaty fishing opportunities, in a manner consistent with salmon recovery" and 2) "hatchery production of Chinook and other salmon will neither cause further decline nor inhibit recovery of WRIA 1 naturally spawning Chinook populations".

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

No take anticipated. There is no record of ESA-listed species entering the Lummi Bay Coho program.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

There is currently no Puget Sound regional hatchery program. Co-manager hatchery plans are developed under U. S. v. Washington (US District Court Western District of Washington No. 9213), the Boldt Decision. The Puget Sound Salmon Management Plan (PSSMP) (1985) (US v. Washington No. 9213 (85-2) provides for an agreed Equilibrium Brood Document.

The Equilibrium Brood Document as contained in the current draft HAIP white paper clearly sets out the plan and policies for the terminal area hatchery programs. Any deviations from that plan are agreed in writing between co-managers.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

This program operates under the applicable orders of U. S. v. Washington (US District Court Western District of Washington No. 9213), the Boldt Decision. The Puget Sound Salmon Management Plan (US v. Washington No. 9213 (85-2) (PSSMP) provides for an agreed Equilibrium Brood Document. The elements of the last agreed equilibrium document are contained in draft white paper for Hatchery Action Implementation Program for the Nooksack-Samish Terminal Area and the agreed summary glossy.

This program is also integrated into the Pacific Salmon Treaty process for cooperative management of fisheries and enhancement programs to provide optimum production and to receive benefits equal to production originating in its waters.

This program was contained in the WRIA 1 Salmonid Recovery Plan was incorporated into the Shared Strategy Puget Sound Chinook Recovery Plan adopted by NOAA in 2007. WRIA 1 Salmonid Recovery Plan stated that hatchery practices meet the WRIA 1 Salmonid Recovery Plan (2005) objectives of 1) “use hatcheries to sustain treaty-reserved fisheries and non-treaty fishing opportunities, in a manner consistent with salmon recovery” and 2) “hatchery production of Chinook and other salmon will neither cause further decline nor inhibit recovery of WRIA 1 naturally spawning Chinook populations”.

3.3) Relationship to harvest objectives.

The primary purpose of this program is to provide harvest to the Nooksack Samish Terminal Area fisheries, particularly to those around the boundaries of the Lummi Reservation. The harvest of program fish is a component of the annual co-manager List of Agreed Fisheries (LOAF) for fisheries in Washington Coastal and Puget Sound Areas by the WDFW and treaty tribes. The list is developed during the Pacific Fisheries Management Council process establishing ocean salmon fisheries to ensure that Chinook escaping the ocean fisheries meet the

requirements of U.S. V. Washington with respect to sharing and conservation.

Effects of fisheries for Lummi Bay Hatchery coho salmon on ESA listed salmon and steelhead have been previously reviewed and authorized by NMFS through a separate ESA consultation (NMFS 2015).

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years, if available.

The primary beneficiaries from this program area expected to be the tribal fishers in and around the Lummi Reservation. Terminal area fisheries have been sampled for missing adipose fins to allow estimation of the contributions of hatchery production to the catch.

Table 3.3.1: Nooksack Samish Terminal Area Coho Catch

Year	Coho
2002	57,755
2003	56,997
2004	86,492
2005	40,486
2006	22,435
2007	27,455
2008	24,725
2009	44,628
2010	72,115
2011	55,508
2012	44,116
2013	53,895
Average	**48,884**

The ultimate goal of the program will be to have a terminal area catch annually averaging 171,000 coho, which was the average annual catch from 1983 to 1987. The combined Lummi programs are projected to contribute 136,000 or 80 percent of the terminal area catch.

The harvest rates on program fish in the extreme terminal area fisheries will be adjusted to ensure minimum escapement into the watershed from late August to late September after the river migration period of the ESA-listed early Chinook and summer Steelhead and well before the migration of the Winter Steelhead.

Program fish will contribute to mark selective recreational fisheries in the ocean and Strait of Juan de Fuca to support the economic return of those fisheries.

Contributions to Pacific Salmon Treaty fisheries will be based on the analysis of the CWT recovery analyses prepared by the PSC Coho Technical Committee.

3.4) Relationship to habitat protection and recovery strategies.

The Lummi Bay Hatchery coho program is part of, and consistent with, the WRIA 1 watershed

plan included as the Nooksack River watershed component of the Shared Strategy Recovery Plan for listed salmon in Puget Sound.

The purpose of this program is to mitigate for lost natural production and provide a harvest opportunity to meet the treaty reserved right to take fish consistent with primary management strategy and recovery objectives. Habitat protection and restoration strategies are essential to the recovery of self-sustaining, natural populations. If land use decisions are made consistent with sufficient habitat protection and restoration, and harvest goals are being met, the hatchery program will be the remaining focus to meet management criteria. The impacts of development in the watershed may be moderated and even reversed, but the conditions required to provide natural origin harvestable surplus coho to meet the treaty reserved right to take fish seem unlikely in the foreseeable future.

Recovery activities in WRIA 1 are focused on the recovery of the ESA-listed Chinook populations in the North and South Forks of the Nooksack River, with habitat restoration directed at the recovery of those populations benefitting all salmon in the area. To the extent possible the effort to restore more natural ecosystem processes required to create and maintain properly functioning Chinook habitat will be supported, and program activities will not impede the recovery of ESA-listed Chinook. The WRIA 1 Salmonid Recovery Plan (WRIA 1 SRB 2005) was incorporated into the Shared Strategy Puget Sound Chinook Recovery Plan adopted by NOAA (NFMS 2007). As stated in the Recovery Plan hatchery practices will meet the objectives of 1) "use hatcheries to sustain treaty-reserved fisheries and non-treaty fishing opportunities, in a manner consistent with salmon recovery" and 2) "hatchery production of Chinook and other salmon will neither cause further decline nor inhibit recovery of WRIA 1 naturally spawning Chinook populations".

3.5) Ecological interactions.

Ecological interactions between the program fish and the ESA-listed species are primarily theoretical. Among the potential ecological interactions with listed and candidate species and program fish may include indirect resource competition and predation. Coho smolts from the program are released in May into the marine area when Chinook fingerlings leaving the river are average greater than 60 mm fork length, more than 60% of the size of the coho, and too large to constitute a suitable prey item for coho (Lummi Smolt Trap Data)

We are not aware of studies characterizing the diets and habitat preferences of hatchery coho, natural coho and listed chinook or other salmonids in the fluvial, estuarine or marine environments in a manner that would allow a determination of predation or competition that might exist between hatchery production and listed and candidate species.

Catch objectives were being met when the total annual hatchery coho smolt release in the terminal area exceeded 5,600,000. This production was reduced to two million in the terminal area by 2003 as a precautionary measure to address the speculation of negative ecological interactions between hatchery-produced coho and ESA-listed species. The reduced production resulted in a significant decline in terminal area harvestable coho, however no quantifiable positive response from the listed Chinook populations was observed.

Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition. By definition, hatchery and wild salmonids will not compete unless they require the

same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. The HSRG (2014), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids," (Flagg et al 2000). Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild Chinook salmon utilize similar or different resources in the estuarine environment.

Juvenile and adult fish produced through the program may benefit marine mammal (killer whale), avian, and terrestrial wildlife species as prey.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Lummi Bay Hatchery

Nooksack River surface water is pumped directly from the river below the Marine Drive bridge through a pipeline to a reservoir and settling pond (100' x 100' x 5') on Chief Martin Road and then gravity-fed to the Lummi Bay facility through an underground water line. The current water supply is limited to approximately 1,050gpm.

Salt water is used at Lummi Bay Hatchery to acclimate juvenile coho prior to release. Salt water is supplied from within the Sea Pond with electric water pumps at volumes of up to 2,450gpm.

Eggs are incubated at an auxiliary facility at Sandy Point on the reservation. Water is gravity-fed to the facility at approximately 100gpm from a groundwater well. The incubation facility is on a 450gpm partial reuse system operated with filters, pumps and UV sterilizers.

Lummi Bay Hatchery operates under the NPDES permit WAG13-0018.

Kendall Creek Hatchery

Well and surface (when available) water can be used in coho production. Well water is of excellent quality, pathogen-free, at constant temperature of 47°F, and is available year round. Well water is passed through a de-nitro tower to improve the dissolved oxygen content.

The surface water supply at the hatchery is limited by water flows. Kendall Creek is a seasonal stream that can run dry during summer; while it maintains flows throughout the spring months, it is not always able to provide water for hatchery use. When available, creek water can be mixed with well water and used for acclimation. However, incubation and initial rearing of coho at Kendall Creek is done strictly on well water.

Surface water rights are formalized through trust water right permits # G1-10562c, G1-2361c, and S1-00317.

Skookum Creek Hatchery

Skookum Creek Hatchery derives its water from two sources: Skookum Creek and ground water. Skookum Creek is the primary source of water, and is drawn into the hatchery by a screened diversion intake approximately 1,000 feet above the creek's confluence with the South Fork. A Washington State water right permit (WDOE #22899, 1983) allows the withdrawal of 40cfs from

the Creek. Under the permit, minimum flows for Skookum Creek are 26cfs. Water flows from the diversion structure by gravity to a settling pond through 36-inch underground pipe and then into the hatchery facility.

Water quality of Skookum Creek is variable through the year. The temperature of Skookum Creek water flowing to the hatchery typically ranges from 32°-65°F. High turbidity and low temperatures during the spring and fall months may limit use for incubation and early rearing purposes.

Four operational groundwater wells provide a secondary source of water to Skookum Creek hatchery. Total available ground water flow is limited to 480 gpm, which is far below the optimal level required by the hatchery. Ground water is used primarily for incubation and secondarily for early rearing.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Lummi Bay Hatchery

The water intake structure is located in the tidal area of the lower Nooksack river area removed from the predominant smolt migration corridor and contacts with listed fish are unsubstantial. Regular observations by hatchery personnel have not identified juvenile salmon in the area of the intake. A buildup of large woody debris on the bridge piling just upstream of the pump station has created problems at the intake. Modifications are being developed to remedy this situation and ensure a more dependable water supply to the Lummi Bay Hatchery. While the intake is currently screened, the restoration of a more normal flow of water by intake will include upgrading screening to meet the NOAA 2011 criteria by 2018.

Lummi Bay Hatchery operates under the NPDES permit WAG13-0018 to ensure effluent discharge does not adversely affect the ecosystem.

Kendall Creek Hatchery

The intake screens at Kendall Creek Hatchery are in compliance with State and Federal guidelines (NMFS 1995, 1996), but do not meet the current *Anadromous Salmonid Passage Facility Design* criteria (NMFS 2011a). Screens are identified for replacement, but are at lower priority than at other hatcheries, as listed fish do not occur above the rack on Kendall Creek.

This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit, which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington DOE, WAG 13-3007. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE.

Skookum Creek Hatchery

Skookum Creek where surface water is withdrawn does not harbor any listed fish populations, and no effects on listed fish associated with water withdrawal activities are expected. Regardless, screens at the intake at Skookum Creek are designed to avoid entrainment of juvenile fish. By 2018, new NOAA-approved fish screens will be installed once a funding source has been identified.

Waste water generated during pond cleaning and drawdown is routed to a series of pollution abatement ponds. Hatchery effluent is monitored according to current NPDES regulation and conforms to all permit requirements.

SECTION 5. FACILITIES

Coho for the Lummi Bay program have been hatched and reared at WDFW's Kendall Creek Hatchery since 2011. Prior to 2011, coho had been reared at Skookum Creek Hatchery for the entire existence of this program. Rearing was relocated to Kendall Creek Hatchery due to capacity constraints due to the South Fork Chinook Rescue Program operated at Skookum Creek Hatchery. Due to the likelihood that this program will again rear fish at Skookum Creek Hatchery by 2017, both Kendall Creek Hatchery and Skookum Creek Hatchery will be referred to as the *upriver rearing facility*.

5.1) Broodstock collection facilities (or methods).

Coho broodstock are selected from adults that voluntarily enter a fish ladder located on the south east side of the Sea Pond complex. This ladder is connected to a 10' x 80' concrete pond. Broodstock are sorted to isolated gender-specific holding ponds and held until maturation.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Under the current program, gametes are collected at the Hatchery and transported to the Sandy Point Incubation Facility for fertilization and eyeing. Eyed eggs are transported to an upriver facility (currently Kendall Creek hatchery, but could transition back to the Skookum Creek Hatchery) for hatching and rearing. Eyed eggs are transported in sanitized 5-gallon buckets individually covered with sanitized, water saturated burlap bags.

Yearling fingerlings are transported from the upriver facility to Lummi Bay Hatchery in a tanker truck with 1,000 gallons of water capacity and 1,000 pounds of fish capacity. Pure oxygen is diffused into the tank and circulated with water pumps during loading and transport.

5.3) Broodstock holding and spawning facilities.

After crowding and sorting the trap, broodstock are transferred to either four 4-foot by 40-foot circular ponds or three 10-foot by 80-foot raceways, depending on capacity constraints. Spawning occurs in a 12-foot by 30-foot pole building located in the middle of the circular ponds.

5.4) Incubation facilities.

Lummi Bay Hatchery

Eggs collected from brood at Lummi Bay Hatchery are incubated until the eyed stage at the Sandy Point Incubation Facility. This facility serves as the incubation and hatching facility for all programs operated out of Lummi Bay Hatchery due to a lack of water suitable for incubating and hatching at the Hatchery. Water for the Sandy Point facility is sourced from a well at a rate of 110gpm. A partial reuse system in the facility produces system volumes of up to 450gpm.

Reused water is filtered and treated with UV-sterilizers at a power of approximately 60-micro joules per cm^2. The Sandy Point facility currently has 18 Nopad incubators and 12 Heath Tray stacks. Plans are currently being developed to expand the number of vertical tray incubators.

Kendall Creek Hatchery

Table 5.4.1: Type and inventory of Kendall Creek Hatchery incubators for program.

Type	Number	Size
Vertical stack incubators	336 trays	24" x 25' x 3"
Troughs	24	24" x 31" x 17"

Skookum Creek Hatchery

The incubation facility is located within the main hatchery facility; it has two rooms with independent plumbing and equipment. Coho are incubated in NoPad™ incubators. The coho incubation room has eighteen NoPad™ incubating trays that have a combined capacity of 2.5 million eggs.

5.5) Rearing facilities.

Kendall Creek Hatchery

Table 5.5.1: Type and Inventory of Kendall Creek Hatchery Ponds and Raceways for Program.

Type	Number	Size
Asphalt-lined rearing ponds	3	½ acre
Standard raceways	12	10' x 100' x 4'
Super-raceways	3	21’ x 130’ x 6’
Fiberglass circular ponds	2	20' diameter x 4'deep
Fiberglass circular ponds	8	16' diameter x 4'deep
Fiberglass circular ponds	6	6' diameter x 4'deep
Aluminum Capilano troughs	8	20' x 3' x 2'
Fiberglass intermediate troughs	6	11' x 3' x 36'
Fiberglass shallow troughs	34	14' x 12" x 7.5"
Fiberglass “ugly trough”	1	15' x 5' x 42'

Skookum Creek Hatchery

Upon absorption of yolk sacs during incubation, coho are transferred to fifteen 10-foot by 4-foot by 90-foot linear concrete raceways for initial rearing. Each raceway has rearing capacity of approximately 175,000 fry. Each linear raceway is plumbed to accept ground water or Skookum Creek water at variable flow volumes depending on water quality requirements.

At 150 to 200 fish per pound, juvenile coho are adipose marked and/or coded-wire tagged and immediately transferred to up to four 80-foot by 280-foot asphalt lined rearing and acclimation ponds which hold approximately 550,390 gallons of water each with a maximum capacity of 650,000 juveniles at an average weight of 20fpp. The four large rearing ponds operate with Skookum Creek water at variable flow volumes.

5.6) Acclimation/release facilities.

Coho are transferred from the upriver rearing facility as yearlings and acclimated in a large

earthen pond supplied with salt water pumped from the large Sea Pond at a volume of 2,450gpm. Nooksack River water is available for this pond to decrease the salinity at the time of transfer into the pond or for emergency situations.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

There have not been any unintentional mortalities resulting from operational difficulties.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Lummi Bay Hatchery

Coho salmon are not ESA-listed, so the issue of their take associated with hatchery facility failure is not a take concern.

Kendall Creek Hatchery

Fish rearing is conducted in compliance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 2006) to minimize the likelihood for the take of listed natural fish that may result from disease transmission. Adherence to artificial propagation, sanitation and disease prevention, diagnosis, treatment and control practices defined in the policy prevent or reduce the incidence and intensity of disease during hatchery spawning, incubation and rearing. Guidelines and best management practices are used to control the transmission of infectious pathogens between hatchery fish and the potential to infect natural-origin salmonids from hatchery effluent or directly by preventing or reducing releases of infected hatchery fish.

Skookum Creek Hatchery

No listed natural-origin fish are native to, or are present in Skookum Creek. Coho salmon are not listed, so the issue of their take associated with hatchery facility failure is not a take concern.

The Skookum Creek hatchery is staffed full-time with four full-time permanent and one half-time employees. Two permanent employees reside on-station in employee housing. All significant electrical water pumps, including well pumps and reuse pumps, are connected to failure alarms. Low water alarm probes tied to the central alarm panel are located in all head boxes and reuse sumps. Oxygen concentration and temperature alarms are currently operating in the partial reuse system with plans to expand monitoring capabilities to all rearing ponds and raceways. 24-hour temperature, pH and dissolved oxygen monitoring and data logging is located in incubation and early rearing and the partial reuse sections.

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. An 80kW backup diesel generator supplies power for all necessary electrical demand in the event of power outages.

Facilities on the hatchery complex are not located in areas not subjected to flood events.

In addition to observations by the hatchery crew, a NWIFC fish health specialist regularly

monitors the health of fish in held in the facilities.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

The coho salmon stock under propagation is of mixed origin, but primarily from Soos Creek (Green River) Hatchery lineage that has through years of planting become localized to the Lummi Bay Hatchery release site. Broodstock are selected from hatchery origin coho voluntarily entering the trap on the hatchery complex; this has been the process since 1991. Historically, the stock has been derived from the Soos Creek, Green River Hatchery Stock received from a variety of hatcheries culturing that stock.

6.2) Supporting information.

6.2.1) History.

Historically the stock has been derived from the Soos Creek, Green River Hatchery Stock received from a variety of hatcheries culturing that stock. The extant Lummi Bay Hatchery coho salmon stock is not part of any listed natural population. The 1989 and 1990 brood year Lummi Coho production was intentionally destroyed as a precautionary action after a detection of a VHS virus before it was understood that this virus was not a significant cause of mortality in Pacific salmon. The hatchery broodstock was rebuilt from contributions of the Soos Creek hatchery stock from WDFW Kendall Creek, Marblemount, and Skykomish hatcheries.

6.2.2) Annual size.

The program will be phased and adjusted as criteria are met.

Table 6.2.2.1: Proposed Stages for the Lummi Bay coho program.

Phase	Brood Stock	Egg Take Goal	Criteria
1	600 F – 600 M	875,000	Supplementation from Skookum possible, improve survival, meet all Best Management objectives
2	750 F – 750 M	1,150,000	No reliance on Skookum to meet objectives, facility improvements at Lummi Bay
3	1,000 F – 1,000 M	1,750,000	Phase 2 objectives met, additional facility expansions and improvements
4	1,200 F – 1,200 M	2,225,000	Phase 3 objectives met

6.2.3) Past and proposed level of natural fish in broodstock.

Stray natural-origin broodstock are not encountered at Lummi Bay Hatchery and therefore not intentionally incorporated at this hatchery. Due to Lummi Bay Hatchery's reliance on Skookum Creek Hatchery to supplement egg take shortfalls, natural origin coho have sometimes been

inadvertently incorporated for Lummi Bay. Refer to Skookum Creek Hatchery's coho HGMP for additional information.

6.2.4) Genetic or ecological differences.

Microsatellite DNA analysis suggests that naturally spawning coho in all areas of the Nooksack River basin are genetically indistinguishable from the Hatchery Coho stock regardless of location sampled, with the exception of naturally spawning coho in the areas upriver of Kendall Creek Hatchery. At this time, there are no known differences in genotype, phenotype, or behavior between hatchery stocks and naturally spawning coho. (Small et. al. 2004)

6.2.5) Reasons for choosing.

This stock has been chosen because of its success in watershed hatchery programs.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

There are no ESA-listed species that would be at risk from broodstock selection processes

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults.

7.2) Collection or sampling design.

Broodstock are selected from returning adult coho that have entered the hatchery trap through the fish ladder. All fish encountered in the trap are scanned for coded wire tags and inspected for physical health. Those considered for broodstock are selected over the entire duration of the returning run to maintain diverse temporal distribution to maximize genetic diversity. Male and female coho selected for broodstock are separated and held in separate ponds or raceways.

Males less than 12" in length are typically not included in the broodstock.

7.3) Identity.

Hatchery origin coho are identified by the lack of an adipose fin, and/or the presence of a CWT. To our knowledge, coho belonging to stocks other than what is released at Lummi Bay Hatchery have not been encountered in Lummi Bay.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Table 7.4.1.1: Proposed Stages for the Lummi Bay Coho Program.

Phase	Brood Stock	Egg Take Goal	Criteria
1	600 F – 600 M	875,000	Supplementation from Skookum possible, improve survival, meet all Best Management objectives.
2	750 F – 750 M	1,150,000	No reliance on Skookum to meet objectives, facility improvements at Lummi Bay.
3	1,000 F – 1,000 M	1,750,000	Phase 2 objectives met, additional facility expansions and improvements.
4	1,200 F – 1,200 M	2,225,000	Phase 3 objectives met.

The program will be phased and adjusted as criteria are met

7.4.2) Broodstock collection levels for the last twelve years, or for most recent years available:

Table 7.4.2.1: Broodstock collection levels from 2002-2014.

Year	Males Spawned	Females Spawned	Eggs Taken
2002	110	305	616,300
2003	406 Total Adults		564,500
2004	155	404	909,300
2005	961 Total Adults		1,200,000
2006	892 Total Adults		1,319,000
2007	1602 Total Adults		970,000
2008	175 Total Adults		437,000
2009	467 Total Adults		908,250
2010	326 Total Adults		841,050
2011	0	0	0
2012	270 Total Adults		469,350
2013	342 Total Adults		869,000
2014	116	352	736,440
Average			**756,938**

Data source: Lummi Natural Resources

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Per the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State 2006* guidelines, surpluses of adults may be used for nutrient enhancement within the South Fork sub-basin after culling. Carcasses may also be donated to Lummi community food programs, sold or donated for animal feed, or sold or donated as bait to tribal crab fishers, all of which

depend on the condition of the fish at the time surplus occurs.

7.6) Fish transportation and holding methods.

Adult coho are not transported.

7.7) Describe fish health maintenance and sanitation procedures applied.

Broodstock may be injected with antibiotics such as tetracycline to reduce the prevalence of bacterial kidney disease or other bacterial diseases. Antibiotic treatments will be administered under the direction of a veterinary doctor and fish health specialist.

7.8) Disposition of carcasses.

Pre-spawn mortalities are disposed of in an approved septic system or used for bait in saltwater fisheries. According to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State 2006*, surpluses of adults may be used for nutrient enhancement within the South Fork sub-basin after culling. Carcasses may also be sold or donated for animal feed, or sold or donated as bait to tribal crab fishers. Broodstock treated with antibiotics will not be used for any of the above described dispositions and will be disposed into approved areas

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Broodstock are collected in an off-channel pond lacking any listed fish populations. Takes resulting from listed fish capture, handling, injury and mortality during broodstock collection at Lummi Bay Hatchery are therefore unlikely to occur.

The risk of fish disease amplification will be minimized by following the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State 2006* guidelines. This will minimize the likelihood for adverse genetic or ecological affects to ESA-listed species.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Broodstock are selected randomly during pre-spawn sorts, with an emphasis on a runtime distribution which reflects the entire adult entry to the hatchery. Adults selected for brood are spawned as they become ripe.

8.2) Males.

Males are chosen randomly to match the number of ripe females on any spawning day. Milt from each male is stored individually in plastic containers until fertilization.

8.3) Fertilization.

The eggs from 10 females are placed in a 5-gallon bucket and mixed. The mixture is then equally distributed between 5 one-gallon buckets. Each bucket is then fertilized with the milt from 2 males.

8.4) Cryopreserved gametes.

Cryopreserved gametes are not used in the program

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

ESA-listed species are not included in this program

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Starting in 2015, 875,000 eggs will be taken annually for this program to account for any significant mortality events, but the goal will be adjusted with the corresponding production phase (see Table 7.4.1.). An egg take goal of up to 15% over the release goal may be taken. Accurate data for egg survival during incubation has not been recorded, but steps are being taken to record necessary data in the future.

Table 9.1.1.1: Lummi Bay Hatchery Egg Takes 2002-2014

Year	Males Spawned	Females Spawned	Eggs Taken
2002	110	305	616,300
2003	406 Total Adults		564,500
2004	155	404	909,300
2005	961 Total Adults		1,200,000
2006	892 Total Adults		1,319,000
2007	1602 Total Adults		970,000
2008	175 Total Adults		437,000
2009	467 Total Adults		908,250
2010	326 Total Adults		841,050
2011	0	0	0
2012	270 Total Adults		469,350
2013	342 Total Adults		869,000
2014	116	352	736,440
Average			**756,938**

9.1.2) Cause for, and disposition of surplus egg takes.

Surplus egg takes occur as a preventative measure against catastrophic loss and to maintain the genetic diversity of the stock. In the event egg takes significantly exceed release goals, eggs will be culled at picking.

9.1.3) Loading densities applied during incubation.

Green eggs, weighing an average of 2,100 epp are loaded at the rate of 180,000 eggs per incubator. After the eggs are eyed, shocked, picked and enumerated, they are transferred to the upriver rearing facility for hatching.

9.1.4) Incubation conditions.

All Facilities
Eggs are hatched and reared on pathogen-free ground water with a near constant temperature of 48°F and a dissolved oxygen content ranging from 7.5mg/L to 11.0mg/L. Water quality is monitored as needed.

9.1.5) Ponding.

All Facilities
Fry are force-ponded when they are completely buttoned up, which occurs through the month of February.

9.1.6) Fish health maintenance and monitoring.

All Facilities
Coldwater disease, which may cause fish health issues on most years, is effectively prevented by providing medicated feed containing florofenicol. Fry may be fed medicated treatment of 10mg of florofenicol per kilogram of fish typically after 14-21 days after ponding. Treatment lasts for 20 days, but is divided into two 10-day treatments separated by one week of non-medicated feed.

Any indications of health-related threats are immediately alerted to fish pathologists. Bi-monthly health inspections by WDFW or NWIFC fish health professionals are regularly scheduled.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

All Facilities
Eggs are incubated and hatched exclusively on pathogen and sediment free ground water.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve, or for year's dependable data are available.

Accurate data for egg survival during incubation has not been recorded. Available evidence indicates that survival from fertilization to ponding has likely averaged 97%. Steps are currently

being taken to record necessary data in the future.

9.2.2) Density and loading criteria (goals and actual levels).

All Facilities

Loading and density levels conform to standards and guidelines set forth in *Fish Hatchery Management* (Piper et al. 1982) and the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State 2006*. Fish rearing densities are maintained at a maximum of less than 3lbs of fish /gpm at release and under 0.35lbs/ft^3.

9.2.3) Fish rearing conditions

All Facilities

Water quality monitoring occurs on a daily basis. The minimum acceptable dissolved oxygen concentration during any stage of rearing is 8.5 mg/L. Raceway and pond outlet screens are cleaned on a daily basis and raceways floors are completely vacuumed a minimum of once weekly. All mortalities are removed on a daily basis and disposed.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Not available.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Table 9.2.5.1: Average Monthly Fish Growth Rate for Program.

Month	Average Size (fpp)
February	1900
March	800
April	450
May	300
June	200
July	150
August	125
September	100
October	85
November	75
December	65
January	55
February	45
March	33
April	25
May	22
June	19

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

All Facilities

EWOS semi-dry pellet food is fed at generally 2.0% of body weight per day. This rate is adjusted to meet growth goals and to mimic natural growth curves. From initial feedings to release, fish transition from #0 crumble to 1.5mm pellets. An FCR of 1.2 is considered acceptable.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

All Facilities

Fish health monitoring and disease treatment follows the *Disease Control Policy of the Fisheries Co-Managers of Washington State 2006* guidelines. A WDFW or NWIFC fish health specialist visits bi-monthly for pathology sampling. Fish health and behavior is inspected by hatchery staff at multiple occurrences throughout the day.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Not applicable. Yearling coho are transferred to the Lummi Bay Hatchery acclimation pond from the upriver rearing facility when they have reached an average size of 28fpp. Although the yearlings are not smolted at the time of transfer, their average size determines saltwater tolerance. Fish are released from the acclimation pond when they display visual signs of smoltification, typically a loss of scales at the time of feeding.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

There are currently no intentional natural rearing methods applied in this program.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

The coho program is completely isolated from the any Chinook recovery program at the upriver rearing facility.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Table 10.1.1: Proposed fish release levels by program phase.

Phase	Life Stage	Release Location	Annual Release Goal	Criteria[1]
1	Yearling Smolt	Lummi Bay Hatchery	750,000	Current, Kendall incubate and rear, meet standards
2	Yearling Smolt	Lummi Bay Hatchery	1,000,000	Resources, facilities available; Kendall or Skookum incubate and rear, standards met
3	Yearling Smolt	Lummi Bay Hatchery	1,500,000	Resources, facilities available; Lummi Bay self sufficient, standards met
4	Yearling Smolt	Lummi Bay Hatchery	2,000,000	Resources, facilities available; standards met

[1] The standards are adequate facilities and resources to ensure achievement of documented return per smolt released and targeted return to fisheries

10.2) Specific location(s) of proposed release(s).

Release Site

Stream, river, or watercourse: Lummi Bay
Release point: Lummi Bay Hatchery
Major watershed: WRIA 1
Basin or Region: Strait of Georgia

10.3) Actual numbers and sizes of fish released by age class through the program.

Table 10.3.1: Lummi Bay Hatchery Coho Yearling Smolt Releases

Release Year	Number Released	Size at Release (fpp)	Release Date(s)
2001	947,700	24.0	5/20
2002	980,000	24.0	5/8
2003	825,000	29.1	5/23
2004	1,100,500	26.1	5/23
2005	911,400	ND	5/27
2006	992,900	24.0	5/14
2007	1,049,800	17.1	4/29
2008	924,641	22.6	4/18 & 5/8
2009	993,766	20.0	4/9 & 4/21
2010	911,240	19.1	4/23 & 5/14
2011	932,559	28.0	5/6
2012	985,293	22.0	3/29 & 4/23
2013	1,028,400	25.1	4/14 & 5/9
2014	948,562	28.0	4/14 & 5/14
Average	**966,554**	**23.8**	

10.4) Actual dates of release and description of release

Over the last 12 years, actual release dates have ranged from early April to late May (Table 10.3.1).

Yearling coho are released by force from the Lummi Bay Hatchery acclimation pond. The date of release may be dependent on the anticipation of *Vibrio spp*. outbreaks caused by warming sea water temperatures. Significant mortality may arise from *Vibrio* infections if action to release fish in anticipation of outbreaks is not taken. Due to the shallow depth within the Sea Pond (average depth of approximately 4 feet), rapid temperature increases from warm air temperatures and clear skies and the subsequent *Vibrio* outbreaks may occur in less than 3 days. For this reason, early releases are taken as a precautionary measure to avoid significant mortality. Additional release protocols are being evaluated to reduce risks from *Vibrio*.

Release years with two release dates are due to a rearing capacity within the acclimation pond caused by the low dissolved oxygen concentration of water pumped from the Sea Pond. A previous program release goal of 1,000,000 exceeded the capacity of the current acclimation pond and required an acclimation and release of two separate groups. Prior to 2008, coho were acclimated in net pens located within the Sea Pond that provided capacity for the entire release group.

10.5) Fish transportation procedures, if applicable.

Transport of yearlings from the upriver rearing facility to the Lummi Bay Hatchery acclimation pond is conducted with Lummi Nation's tanker truck that has a water capacity of 1,000 gallons. Up to 1,000 pounds of juveniles will be transported at a time and transport times average 55

minutes. Pure oxygen is diffused into the tanks and dissolved oxygen levels average 9.0 mg/L at maximum loading density.

10.6) Acclimation procedures

Yearling coho are held in Lummi Bay's acclimation pond for a target of two months minimum. Coho are fed a daily ration of approximately 1.0% B/W to reduce the potential for male precocity. The use of net pens located inside the Sea Pond to acclimate coho is again being considered for the future if conditions and logistics permit.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Lummi Bay coho are a Pacific Salmon Commission indicator stock. Each year, in mid June a target of 50,000 of the coho sub-yearlings are coded-wire tagged. All Lummi Bay coho are 100% mass-marked and quality control of mark rates is conducted several times per day mass-marking is occurring. Tagging and mass-marking occurs at the upriver rearing facility.

Thermal otolith marks may be applied in the future for an additional method to determine contributions to terminal harvest.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Every effort will be made to ensure that the coho smolt release is within 10% of the release goal. If monitoring data during rearing indicate a number significantly greater than the release goal error margin the excess will be culled to reflect the release goal and minimize wastage of resources. The cull, if implemented will be noted in the hatchery records. Co-managers will be consulted if release estimates are or may be within 10% over the release goal.

10.9) Fish health certification procedures applied pre-release.

The release group receives a fish health determination within one week of release by an NWIFC fish pathologist.

10.10) Emergency release procedures in response to flooding or water system failure.

The acclimation pond is equipped with a manually operated slide gate located behind the pond's outlet screen. This gate may be opened within minutes should an emergency situation arise.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

Yearling coho are released as actively migrating smolts in a location and at a size that minimizes impacts to listed species. Between 80% and 90% of the catch of adipose clipped coho at the smolt trap takes place within two weeks release from the Skookum Creek Hatchery illustrating the rapid movement of the smolt migrants.

Once released from Lummi Bay, there appears to be little chance for ecological interaction

between program coho and migrating steelhead, which move rapidly through Puget Sound on their way to the open ocean. Studies in Puget Sound indicate some spatial distribution and diet similarities between coho and Chinook, but coho tend to be less abundant in the nearshore and feed more heavily on plankton. (Duffy et. al. 2005, Duffy et.al.2010, Brennen et al 2004). The major prey of juvenile coho and Chinook off of the Washington and Oregon Coast is larval and juvenile fishes though a substantial proportion of the diet of coho salmon consisted of invertebrates (Brodeur and Pearcy 1990 and Schabetsberger et. al. 2002) This lower reliance on larval and juvenile fish would reduce competitive interaction between coho and Chinook.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

The purpose of the monitoring program is to identify and evaluate the benefits and risks that may derive from the hatchery program. The monitoring program is designed to answer questions of whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Hatchery coho are identified with adipose clips, coded wire tags, or other identification methods as they become available. This will allow for selective harvest on hatchery stocks when appropriate; monitoring of interactions of hatchery and wild fish wherever they co-mingle in riverine, estuarine and marine habitats; and assessment of the status of the target population. Through annual spawning ground surveys, the co-managers will sample the coho salmon escapement within the watershed to develop an estimate of the number of tagged, un-tagged and marked fish escaping into the river each year and the rates of hatchery Chinook into the rivers. The sample of the harvest of coho taken in the Nooksack River fisheries to estimate the proportion of natural origin and hatchery coho can provide an alternate minimum estimated stray rate when compared with the total return to Skookum Creek Hatchery.

In addition, another important aspect of hatchery management is the monitoring and evaluation of the genetic profile of hatchery stock(s) and of nearby natural stock(s). There is an ongoing monitoring need to evaluate changes in the genetic structure of both hatchery and natural populations and the amount and geographic extent of gene flow between them.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Continue to coded-wire tag and remove adipose fins on all coho to allow identification at the hatchery rack and on the spawning grounds.

The co-managers will monitor coho escapement in the Nooksack basin to estimate the number of tagged, untagged and marked fish present on the spawning grounds each year and contributions by hatchery release as appropriate.

The returns to the hatchery will be identified by origin (adipose clip) and coded wire tag. This information will provide an estimate of the year and location of release.

The co-managers will sample the terminal areas fisheries for sufficient CWTs to allow estimation of the total catch of coho by hatchery origin and year of release. Fisheries beyond the terminal area will be sampled according to the PSC coast wide protocols for CWTs to allow the estimation to the total CWTs in the each fishery. The CWT recoveries estimated in all non-terminal fisheries plus the terminal area estimates, spawning ground estimates and hatchery returns of stock, origin, release year and location will allow the evaluation of the program success and the fisheries that benefitted. The development of Parental Based Tagging might provide better estimates of fisheries contributions by hatchery and stock and better estimates of natural spawning ground populations by stock.

The basic information on the hatchery release numbers, mark status, release location and date will be reviewed by the Co-managers and posted with RMIS within a year. The CWT information collected in the terminal area will be prepared by and reviewed by the co-managers to meet the requirements of the PST.

Estimates of the composition of the terminal area catch, the hatchery return and the spawning ground abundance by stock, origin and release strategy will be available within 18 months, and the basis for the estimates of the stock composition by origin from coast wide fisheries that will allow a complete evaluation of adult production from each release is dependent on international teams and may take more than 2 years.

Best management practices will be followed in hatchery operations and records will be kept to monitor performance. Results will be reported annually.

The co-managers will regularly meet to evaluate monitoring results and develop action plans where necessary to ensure programs are producing the expected outcomes, or to evaluate whether we are able to move up to the next level.

Table 11.1.1.1: "Performance Indicators" addressing benefits.

Standard	Indicator	Monitor
Identification of hatchery production in the hatchery, harvests and spawning grounds	Ad Clip, Otolith Mark or CWT	Sample harvest, hatchery and spawning grounds to provide statistically valid estimates of hatchery fish
Significant contributions to terminal area harvest	Proportion in of identified hatchery fish in harvest samples	Sample at rates to provide statistically valid estimates of contributions to all fisheries.
Effectiveness of Program Operations	Survival rates recorded at each stage of culture	Annual Report of Hatchery activities
Release Survival Meets Standards	Proportion of released production that contributes to escapement and fisheries	Analysis of program contributions to spawning grounds, hatchery return and all fisheries

Table 11.1.1.2: "Performance Indicators" addressing risks.

Standard	Performance Indicator	Monitor
Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (Co-manager Fish Health Policy, INAD)	Hatchery records document compliance with applicable standards and criteria.	Annual report of Hatchery fish health guidelines and standards met
Effluent from hatchery facility will not Adversely affect the ecosystem.	Discharge water quality meets NPDES permit standards.	Reports as required by NPDES permit in Annual Hatchery Report
Water withdrawals and in-stream water diversion structures for hatchery operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals are compliant with water rights. Facility operates in compliance with applicable passage and screening criteria for juveniles and adults.	Annual record of water withdrawal and status of passage and screening include in Annual Hatchery Report
Releases do not introduce new pathogens and do not increase the levels of existing pathogens in local populations	All State and Co-manager fish health policies and standards are followed. Certification of fish health during rearing and release.	Report of compliance with fish health policies and fish health certifications contained in the Annual Hatchery Report
Any distribution of carcasses or other spawner products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines.	All applicable fish disease policies are followed.	Disposition of carcasses reported in Annual Hatchery Report.

The stray rate will not cause a significant change in the genome of the listed Chinook	DNA stock identification compared to the baseline	Statistics comparing stock genomes will not show a significant change
Competition by hatchery origin releases on natural origin salmonids does not significantly reduce numbers of listed natural origin salmonids.	Dates, size and location of release supporting rapid out migration	Records from hatchery operations contained in Annual Hatchery Report. Supplemental information from lower river smolt trap as available.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The standard of the monitoring is related to the resources available to it. Basic status quo monitoring is available for hatchery operations. Basic tagging, fin clipping, and otolith marking are funded. The spawning ground characterization requires substantial additional funding to identify the total abundance and the proportion from different stocks origins, date and release strategies. The resources for timely analysis of sample date from the spawning grounds and fisheries is not steady and may delay analyses for up to a year.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Spawning ground surveys will employ measures to ensure that effects on the survival of the listed Chinook salmon population are insignificant. Chinook redds will not be disturbed during surveys and sampling.

The operation of the Lummi smolt trap in the lower river is monitored in variable time periods related to the expected abundance of juveniles passing the site to minimize the duration of holding and risk of harm ESA listed Chinook and Steelhead as it samples the migrations to provide estimates of salmon abundance by species, origin, and age to provide a baseline for evaluation to the production per spawner, and marine survival

SECTION 12. RESEARCH

There are currently no research programs directly related to this program. If a research plan is developed that would provide insight into modifications of the program to improve efficiencies and modify or inform the identification of genetic or ecological impacts of program fish on ESA-listed species, the Co-managers will consult with the listing services.

SECTION 13. ATTACHMENTS AND CITATIONS

Brennan, J. S, Kollin F. Higgins, Jeffery R. Cordell, and Visia A Stamatiou. 2004. Juvenile Salmon Composition, Timing, Distribution and Diet in Marine Nearshore Waters of Central Puget Sound in 2001 and 2002. King County Natural Resources and Parks, Seattle Wa 164 p.

Busby, P.J., T.C. Wainwright, G.J., Bryant, L., Leirheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. NOAA Tech. Memo. NMFS-NWFSC-27, 261 pp.

Duffy, Elizabeth. J., David A Beauchamp, and Raymond M. Buckley. 2005. Early marine life history of juvenile Pacific Salmon in two regions of Puget Sound. Estuarine, Coastal and Shelf Science 64, 94-107

Duffy, Elizabeth J., David A. Beauchamp, Ruston M. Sweeting, Richard J. Beamish, and James A. Brennan. 2010. Ontogenetic Diet Shifts of Juvenile Chinook Salmon in Nearshore and Offshore Habitats in Puget Sound. Transaction of the American Fisheriess Society. 139:803-823

Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. 2005. 70 Federal Register 37160.

Endangered and threatened species: final listing determination for Puget Sound steelhead. 2007. 72 Federal Register 26722. National Marine Fisheries Service (NFMS).

Endangered and Threatened Species; 5-Year Reviews for 17 Evolutionarily Significant Units and Distinct Population Segments of Pacific Salmon and Steelhead. 2011. 76FR50448.

Flagg, T.A., Berejikian, B.A., Colt, J.E., Dickhoff, W.W., Harrell, L.W., Maynard, D.J., Nash, C.E., Iwamoto, M.S.S.R.N., and Mahnken, C.V.W. 2000. Ecological and behavioral impacts of artificial production strategies on the abundance of wild salmon populations. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-41, 92 pp.

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

Good, T.P., R.S. Waples, and P. Adams, (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. DoC, NOAA Tech. Memo. NMFS-NWFSC-66.

Hochachka, P. W. 1961. Liver glycogen reserves of interacting resident and introduced trout populations. J. Fish. Res. Board Can. 18:125-135.

HSRG (Hatchery Scientific Review Group). 2014. On the Science of Hatcheries: An updated perspective on the role of hatcheries in salmon and steelhead management in the Pacific Northwest. A. Appleby, H.L. Blankenship, D. Campton, K. Currens, T. Evelyn, D. Fast, T. Flagg, J. Gislason, P. Kline, C. Mahnken, B. Missildine, L. Mobrand, G. Nandor, P. Paquet, S. Patterson, L. Seeb, S. Smith, and K. Warheit. June 2014. http://hatcheryreform.us

Miller, R. B. 1953. Comparative survival of wild and hatchery-reared cutthroat trout in a stream. Trans. Am. Fish. Sot. 83:120-130.

National Marine Fisheries Service (NMFS). 1995. Juvenile Fish Screen Criteria. National Marine Fisheries Service Environmental & Technical Services Division, Portland, Oregon. 15 p.

National Marine Fisheries Service (NMFS). 1996. Juvenile Fish Screen Criteria for Pump Intakes. National Marine Fisheries Service Environmental & Technical Services Division

Portland, Oregon; 4 p.

National Marine Fisheries Service (NMFS). 1999. Endangered and threatened species: Threatened status for three Chinook salmon Evolutionarily Significant Units in Washington and Oregon, and Endangered status for one Chinook salmon ESU in Washington; final rule. Partial 6-month extension on final listing determinations for four Evolutionarily Significant Units of West Coast Chinook salmon; proposed rule. Federal Register 64:14308-14328.

National Marine Fisheries Service (NMFS). 2003. Chinook salmon species status review and biological review team conclusions – Puget Sound Chinook salmon (Pp 41-77; 145-46). Primary contributors: Mary Ruckelshaus and Norma Jean Sands, Northwest Fisheries Science Center, National Marine Fisheries Service. Seattle, WA.

National Marine Fisheries Service (NFMS). 2004. Salmonid Hatchery Inventory and Effects Evaluation Report (SHIEER) - An evaluation of the effects of artificial propagation on the status and likelihood of extinction of West Coast salmon and steelhead under the federal Endangered Species Act. Technical Memorandum NMFS-NWR/SWR. 557p.

National Marine Fisheries Service (NMFS). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

NFMS. 2015. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation Impacts of Programs Administered by the Bureau of Indian Affairs that Support Puget Sound Tribal Salmon Fisheries, Salmon Fishing Activities Authorized by the U.S. Fish and Wildlife Service, and Fisheries Authorized by the U.S. Fraser Panel in 2015. NMFS Consultation Number: F/WCR-2015-2433. NMFS West Coast Region Sustainable Fisheries Division. Seattle, WA.

Piper, R.G. J.B. McLain, L.E. Orme, J.P. McCraren, L.G. Fowler, and J.R. Leonard. 1982. Fish Hatchery Management. U.S. Fish and Wildlife Service, Washington, D.C.

Puget Sound Salmon Management Plan (PSSMP). 1985. Puget Sound Salmon Management Plan. United States v. Washington (1606 F.Supp. 1405), No. 9213 Phase 1 (sub no. 85-2). Order Adopting Puget Sound Salmon Management Plan.

Puget Sound Steelhead Technical Recovery Team (PSSTRT). 2013. Identifying historical populations of steelhead within the Puget Sound distinct population segment. Final Review Draft. 149 p.

Reimers, N. 1963. Body condition, water temperature, and over-winter survival of hatchery reared trout in Convict Creek, California. Trans. Am. Fish. Sot. 92:39-46.

Ruckelshaus, M.H., K.P. Currens, W.H. Graeber, R.R. Fuerstenberg, K. Rawson, N.J. Sands, and J.B. Scott. 2006. Independent populations of Chinook salmon in Puget Sound. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-78, 125 p.

Small, Maureen P. , A.E. Pichahchy, J.F. Von Bargen & S.F. Young. 2004. Have native coho salmon (Oncorhynchus kisutch) persisted in the Nooksack and Samish rivers despite continuous hatchery production throughout the past century? Conservation Genetics 5: 367–379, 2004.
http://wdfw.wa.gov/publications/01080/wdfw01080.pdf

Washington Department of Fish and Wildlife (WDFW). 2002. Salmon and Steelhead Inventory (SaSI). WA Dept. of Fish and Wildlife. Olympia, WA.

Washington Department of Fish and Wildlife (WDFW). 2012. Salmonid stock inventory (SaSI). Fish Program, Science Division. WDFW. Olympia, Washington. Available from: http://wdfw.wa.gov/conservation/fisheries/sasi/

Washington Department of Fish and Wildlife (WDFW) and Western Washington Treaty Indian Tribes (WWTIT). 2006. The salmonid disease control policy of the fisheries co-managers of Washington State. WA Dept. of Fish and Wildlife. Olympia, WA. 38 pp.

Water Resource Inventory Area (WRIA) 1 Salmon Recovery Board (SRB). 2005 WRIA 1 Salmonid Recovery Plan. Submitted to Shared Strategy for Puget Sound October 2005. 323pp.

Weitkamp, L. A., T.C. Wainwright, G.J Bryant, G.B. Milner, D.J. Teel, R.G. Kope, R.S. Waples. 1995. Status review of Coho salmon from Washington, Oregon, and California. U.S. Dept. of Commerce, NOAA Tech. Memo.,NMFS-NWFSC-24, 258p.

U.S. Fish and Wildlife Service (USFWS). 2004. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentas*). Volume I (Puget Sound Management Unit, 389 + xvii pp.) and II (Olympic Peninsula Management Unit, 277 + xvi pp.). Portland, Oregon.

U.S. District Court of Western Washington. 1976. United States v. Washington, 384 F, Supp. 312.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _____ ESU/Population:_____ Activity:_____				
Location of hatchery activity:_____ Dates of activity:_____ Hatchery program operator:_____				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as "fishery enhancement".

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as "supplementation".
Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural origin recruit (NOR) - See *natural fish* .

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see “Population”).

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.

(generally from Washington Department of Fish and Wildlife, November, 1999).

	SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	SIZE CRITERIA Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Fingerling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fed Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 800	0.6 to <23
X	Sockeye Fall Releases	<150	>2.9
X	Sockeye Fry	> 800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fed Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fingerling	>20 to 150	3 to <23
X	Steelhead Fry	>150	<3
X	Cutthroat Trout Yearling	<=20	>=23
X	Cutthroat Trout Fingerling	>20 to 150	3 to <23
X	Cutthroat Trout Fry	>150	<3
X	Trout Legals	<=10	>=45
X	Trout Fry	>10	<45

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria and 1 year old.