HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Elochoman Type-N Coho (Integrated/segregated)
Species or Hatchery Stock:	Type-N Coho (*Oncorhynchus kisutch*) Elochoman River Stock
Agency/Operator:	Washington Dept. of Fish and Wildlife
Watershed and Region:	Grays-Elochoman/ Columbia River Estuary Province
Date Submitted:	June 28, 2019
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EXECUTIVE SUMMARY

The Washington Department of Fish and Wildlife is submitting a Hatchery and Genetic Management Plan (HGMP) for Elochoman Type-N (late-returning) coho program to the National Marine Fisheries (NMFS) for consultation under Section 4 (d) of the Endangered Species Act (ESA). NMFS will use the information in this HGMP to evaluate the hatchery impacts on salmon and steelhead listed under the ESA. The primary goal of an HGMP is to devise biologically-based hatchery management strategies that ensure the conservation and recovery of salmon and steelhead populations. This HGMP focuses on the implementation of hatchery reform actions adopted by the Washington Fish and Wildlife Commission Policy on Hatchery and Fishery Reform C-3619, and implementing actions identified in the Mitchell Act Biological Opinion (MA BIOP) (NMFS 2017).

The purpose of the program is to produce Elochoman Type-N coho for sustainable escapement to the watershed, while providing recreational, commercial, and tribal harvest. This program also supports a commercial Select Area Fishery in Deep River. The Elochoman program consists of two components: 1) on station integrated; and 2) off station segregated. In addition, the segregated program may provide up to 40,000 eyed-eggs to the Peterson Coho Project enhancement co-op program, located near the mouth of an unnamed tributary to the lower Columbia River at R.M 16, near Knappton WA, and up to 10,000 eggs for the Wahkiakum High School FFA program.

This Type-N "integrated" Coho program is built around the principles and recommendations of the Hatchery Scientific Review Group (HSRG). These principles and recommendations represent the best science available for operating hatchery facilities consistent with the conservation of salmonid species. A Type-N coho program at Elochoman Hatchery was operated as a segregated type program, as defined by the HSRG, from 1954 until the facility was closed in 2009; an integrated on-station Type-N coho program has also operated at Grays River Hatchery since 2007.

An "integrated" program is one in which natural-origin individuals are used in the hatchery broodstocks. Integration is achieved by using up to 30% of the returning adult natural-origin Type-N coho (distinguished by an intact adipose fin and no CWT) returning to the hatchery. Coho have been 100% mass-marked (adipose fin-clipped and/or coded wire tagged) at Lower Columbia River facilities since brood year 1995. All on-station releases (integrated program) will be 100% mass-marked and 45,000 will be coded-wire tagged, the segregated releases will be 100% mass-marked with an adipose fin-clip (AD); a portion of the Deep River Net Pens group (45,000) will also be coded-wire tagged (AD+CWT).

A "segregated" (isolated) program is one in which only hatchery-origin individuals are used in the hatchery broodstocks. Segregation will be initiated with the 2019 brood, using broodstock developed from first generation (F1) returns from the integrated Elochoman program or from integrated adults returning to Grays River Hatchery. Segregated program fish are 100% AD-marked: Peterson Coho Project releases approximately 39,000 fry into the lower mainstem Columbia River; Wahkiakum FFA releases approximately 5,000 yearlings into Birnie Creek (WRIA 25.0281); and the Deep River Net Pens releases 700,000 yearlings.

The Lower Columbia River coho are listed as "Threatened" under the ESA. The Evolutionarily Significant Unit (ESU) includes the Grays River and Peterson Coho Project artificial propagation programs.

Broodstock Collection:
The broodstock is derived from Elochoman stock returning to the Elochoman River. The on-station integrated program will be initiated with the 2019 brood, with the goal of potentially developing a broodstock using 100% NOR returns to the Elochoman River in the future, depending upon the status of the NOR population. In years with low abundance, integration rate may be reduced to less than 100% to ensure adequate natural escapement to the Elochoman basin. Broodstock collection will occur in the lower Elochoman River at the Foster Road resistance board weir (RBW) (RM 2.73), and at Beaver Creek Hatchery. Broodstock for this program will be managed with a goal of having pNOB at least twice the

value of pHOS to ensure that the proper PNI level is achieved. Incubation and initial rearing will occur at Beaver Creek Hatchery, with smolt releases from Beaver Creek Hatchery. The egg-take goal for the integrated on station program will be 300,000 at Beaver Creek Hatchery. Around 100 adult pairs will be needed to produce 225,000 yearlings.

The broodstock is derived from Elochoman stock returning to the Grays/Elochoman River Sub-basins Beginning in 2019, broodstock for the segregated off station program will use first generation (F1) returns from the integrated on station program, collected at Beaver Creek Hatchery. Additional broodstock collection may occur at the Foster Road RBW or Grays River Hatchery, as needed to achieve program smolt release goals. Incubation and initial rearing will occur at Beaver Creek Hatchery; additional rearing for Deep River program coho may occur at Beaver Creek, North Toutle, Washougal or Kalama Falls hatcheries, prior to transfer to the net pens for final rearing/acclimation and release. The egg-take goal for the Deep River Net Pen segregated program is 930,000, from around 350 hatchery-origin adult pairs, to produce 700,000 smolts. The egg-take goal for the cooperative programs is 60,000 for the Peterson Project (around 22 adult pairs), and 10,000 for the Wahkiakum FFA Project (around 5 adult pairs) collected. During the transition period, smolts from the Grays River integrated program may be used for the off-station segregated program.

Surplus hatchery fish in excess of broodstock needs are donated to food banks or used for system nutrient enhancement, or released upstream for harvest.

Harvest:

Total annual harvest is dependent on management response to annual abundance in *Pacific Salmon Commission* (PSC - U.S./Canada), *Pacific Fishery Management Council* (PFMC - U.S. ocean), and *Columbia River Compact* forums. NMFS issued a Biological Opinion for mainstem Columbia River fisheries through a Section 7 consultation under the 2018–2027 *U.S. v Oregon* Management Agreement" (2018–2027 MA). All fisheries are reviewed annually through the North of Falcon and PFMC processes. The *U.S. v Oregon* Technical Advisory Committee (TAC) has prepared Biological Assessments (BAs) for combined fisheries based on relevant *U.S. v Oregon* management plans and agreements. The current BA concerns Columbia River treaty Indian and non-Indian fisheries, as described in the "2018–2027 *U.S. v Oregon* Management Agreement" (2018–2027 MA). WDFW has submitted a *Fisheries Management and Evaluation Plan* (FMEP) for tributary fisheries and has received a permit from NMFS for those fisheries. WDFW will be updating the FMEP for lower Columbia River tributary fisheries within the next few years to include changes to fall Chinook, coho, and steelhead fisheries. The current harvest matrices for fall Chinook and coho that are included in the Biological Opinion for the Columbia River and ocean fisheries do not include impacts to ESA-listed stocks in the tributaries. Tributary impacts would be small (primarily mark-selective fisheries), but would be additive to the Columbia River/ocean harvest matrices. Because Columbia River and ocean fisheries are managed conservatively (i.e. not to exceed ESA-limits), tributary fisheries would fall within the harvest matrices in many years.

The Elochoman Type-N coho program is being re-established at Beaver Creek Hatchery as an integrated program, and only past segregated program (brood years 2001-2007) harvest data is available (**Table 6**). Due to tagging limitations, not all fish can be accounted for as being harvested, recovered on the spawning grounds, or as back-to-rack counts; smolt-to-adult survival rates (SAR) are likely underestimated. Based on an average SAR of 0.67% for the previous Elochoman segregated program (brood years 2001-2007), and a program release goal of up to 225,000 yearlings, the estimated production goal would be 1,508 adults. Based on a SAR (2.00%) using recent year average SARs (2007-2011 brood years) from the Grays integrated program and a release goal of up to 225,000 yearlings, the estimated production goal would be 4,500 adults.

Operation and Maintenance of Hatchery Facilities:

Beaver Creek Hatchery uses Beaver Creek gravity flow surface water, provided by a creek intake station and division dam, located on Beaver Creek approximately 0.5 miles upstream from the main hatchery complex. The Elochoman River is used in the summer and fall. Beaver Creek or filtered well water is used mid-November through mid-May to incubate eggs, and for early-rearing. Of the two well water

sources, one is used for fish rearing at 1 cfs; the other is for domestic use only. The return water systems operate under a National Pollutant Discharge Elimination System (NPDES) permit.

Water for the Peterson Coho Project is supplied from a gravity-fed holding tank used for non-potable water from an unnamed non fish-bearing nearby stream through an upstream intake on the landowner's property. This project uses a short-term rearing and off-channel acclimation pond. Feeding and production stays under NPDES guidelines for permitting.

Monitoring and Evaluation:
Performance indicators for harvest will be accomplished by continuing mass-marking (adipose fin-clip); CWT recoveries help determine stray rate contributions on spawning grounds by watersheds close in proximity to this program's release vicinity.

All hatchery-origin fall Chinook captured at the Foster Road RBW and the adult trap at Beaver Creek Hatchery, will be lethally removed to manage pHOS within standards prescribed by NMFS. Hatchery-origin coho will be released upstream for fisheries or lethally removed.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Elochoman Type-N Coho

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

Elochoman River Type-N Coho (*Oncorhynchus kisutch*)

ESA Status: "Threatened" June 28, 2005 (70FR37160); reaffirmed on August 15, 2011 (76 FR 50448); updated April 14, 2014 (79 FR 20802).

1.3 Responsible organization and individuals

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

NOAA-National Marine Fisheries Service (NMFS) – Manager of Mitchell Act Funds

Wahkiakum High School Future Farmers of American (FFA) – educational co-op volunteers for Wahkiakum FFA program, oversees operations for this portion of the production at Beaver Creek Hatchery and Birnie Creek rearing channel.

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

Funding Sources	Operation Information
Mitchell Act	Full time equivalent staff – 1.75
	Annual operating cost (dollars) - $414,537

The above information for full-time equivalent staff and annual operating cost applies cumulatively to anadromous program facilities and cannot be broken out specifically by program. Staff currently deployed at Grays River Hatchery will also be involved in the operations at Beaver Creek and will eventually be stationed there.

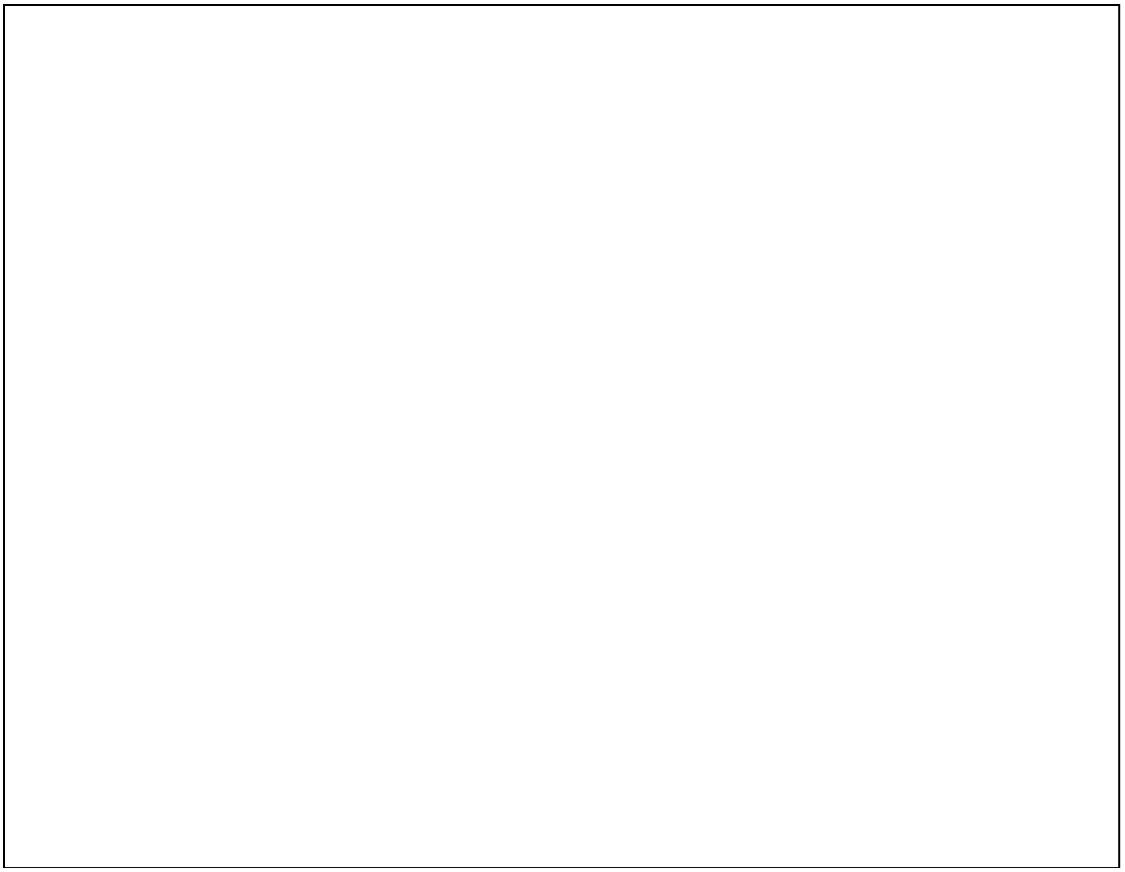
1.5 Location(s) of hatchery and associated facilities.

Broodstock Source: Elochoman River Type-N (late-returning) coho

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Grays River Hatchery	Broodstock collection	WF Grays River (WRIA 25.0130) at RKm 3.2; tributary to the Grays River (WRIA 25.0093) at RKm 20.3; tributary to the Columbia River at RKm 37.0, Lower Columbia River, Washington.
Beaver Creek Hatchery	Broodstock collection, Adult holding/ spawning, Incubation, Rearing, Acclimation	Beaver Creek (WRIA 25.0247) at RKm 0.8; tributary to the Elochoman River (WRIA 25.0236) at RKm 8.8; tributary to the Columbia River at RKm 58.6), Lower Columbia River, Washington.
Elochoman Weir	Broodstock collection	Elochoman River (WRIA 25.0236), near the Foster Road bridge, at RKm 4.8 (R.M. 2.73).
Wakhiakum FFA program. Birnie Creek Rearing Channel	Final-rearing/Acclimation	Birnie Creek (WRIA 25.0281) at 0.1 RKm; tributary to the Columbia River at RKm 62.9 (RM 39.1) at the confluence with Cathlamet Channel.
Peterson Project RSI	Incubation, early rearing	Located at N 46.271072 W 123.830281, on an unnamed tributary to the Columbia River at approximately RKm 25.7 (R.M 16), off Hagerup Rd, near the Knappton Cove Heritage Center.

See also Deep River Net Pens Coho HGMPs.



- **Figure 1.5.1: Map of Elochoman and Grays River basins and facilities, including the Foster Road adult trap, and Deep River Net Pens, Peterson Project RSI, and Birnie Creek co-ops sites. Source: WDFW GIS staff, 2016.**

1.6 Type of program.

Integrated Conservation/Harvest (on-station releases)

Segregated Harvest (Peterson Coho Project, Wahkiakum High School FFA). See also Deep River Net Pen Coho HGMPs.

1.7 Purpose (Goal) of program.

Mitigation/Augmentation. The goal of this program is to provide escapement to the watershed and meet harvest goals, while minimizing impacts to natural-origin listed salmon and steelhead.

The harvest goal for lower Columbia coho (all programs combined) is to provide for ocean fisheries in a way that allows for a June to September sport fisheries and equivalent commercial and tribal ocean fisheries; Buoy 10 season from August through December annually, and commercial fisheries. The primary goal for the on-station integrated program is conservation, however the segregated program will provide fish to meet harvest goals (see also Deep River Type-N coho HGMP).

Development of a hatchery coho broodstock similar to the late returning historical natural populations in the coastal region to improve abundance and distribution of naturally-produced coho. The proposed integrated strategy for this program is based on WDFW's assessment of the genetic characteristics of the hatchery and local natural population, the current and anticipated productivity of the habitat used by the populations, the potential for successfully implementing an isolated program, and NMFS' listing determination (August 15, 2011 76 FR 50448). Integration of natural origin broodstock (NOBs) into existing hatchery stocks is consistent with principals of the

Hatchery Scientific Review Group (HSRG), hatchery reform goals, the Lower Columbia Fish Recovery Board (LCFRB) Hatchery Sub-Basin Plans, and the MA BIOP. The percentage of natural influences changes (PNI), have been modeled by the "All-H Analyzer" (AHA), with short-term goals for hatchery programs. WDFW will evaluate and modify program as needed achieve Percentage of Natural Influence (PNI) goal of >0.67.

WDFW is moving this program to the Beaver Creek Hatchery on the Elochoman River; re-stablishing the program will require a transition period. Results from AHA modeling (Table A4) show that this level of program can be operated successfully within the Elochoman River by operating the weir on the Elochoman through the coho return timeframe. In addition, beginning in 2019, this facility will provide eggs from first generation (F1) returns from the integrated on station program for the segregated programs: the Peterson Coho Project, Wahkiakum FFA and the Deep River Net Pen coho program (see Deep River Net Pen HGMPs).

Wahkiakum FFA. The purpose of this hatchery program is to provide harvest and educational benefits as per the Future Farmers of America (Wahkiakum High School). This is an educational program that augments the harvest in the Columbia River and, in conjunction with habitat restoration work, will also seek to re-establish natural production in Birnie Creek in the future. Education, the environment, and the economic development of Wahkiakum County were the focus of the Cathlamet Future Farmers of America (FFA) chapter in their community development program.

1.8 Justification for the program.

The program is funded through the Mitchell Act via NOAA-NMFS for the purpose of mitigation for lost fish production due to development within the Columbia River basin.

The Mitchell Act programs are intended to support Northwest fishing economies – particularly coastal and Native American -- that have relied on Columbia River production both before and after dam construction. Catches of hatchery fish sustain the economies of local communities while keeping incidental mortalities of ESA-Listed fish at approved levels. Value of hatchery production and benefit to local economies will be further increased by implementing fisheries that increase harvest of hatchery produced fish, as expected through implementation of the LCSRP.

WDFW protects listed fish and provides harvest opportunity on hatchery fish through the Lower Columbia River *Fish Management and Evaluation Plan* (FMEP) (WDFW 2003). Most tributary fisheries and some mainstem salmon/steelhead fisheries are managed as mark-selective (no wild retention) fisheries to minimize the impact on ESA-listed wild fish.

To minimize impact on listed fish by the Elochoman Type-N Coho program and operations, the following risk aversions are included in this HGMP (**Table 1.8.1**).

Table 1.8.1: Summary of risk aversion measures for the Elochoman River Type-N Coho program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.1	*Beaver Creek Hatchery.* Water rights are formalized through trust water right from the Department of Ecology (**Table 7**). Monitoring and measurement of water usage is reported in monthly NPDES reports (**Tables 8** and **9**).
Intake Screening	4.1	*Beaver Creek Hatchery.* The intake screens are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not meet the current *Anadromous Salmonid Passage Facility Design Criteria* (NMFS 2011). Structures have been assessed, and changes have been proposed and are scheduled to occur in summer of 2019.

Effluent Discharge	4.1	*Beaver Creek Hatchery* operates under the "U*pland Fin-Fish Hatching and Rearing*" *National Pollution Discharge Elimination System* (NPDES) administered by the Washington Department of Ecology (DOE) - WAG 13-1010. *Birnie Creek rearing channel.* Production and feed amounts do not exceed requirements needed for NPDES permit.
Broodstock Collection & Adult Passage	7.9	*Beaver Creek Hatchery.* All fish are marked (adipose fin-clipped and/or coded-wire tagged) prior to release. Broodstock collection and sorting procedures can quickly identify listed non-target listed fish, and if encountered, released per protocol to minimize impact as determined by WDFW Region 5 staff. *Birnie Creek rearing channel.* No broodstock are collected at this site. Returning adults are able to pass upstream. The upper end of the channel may be screened, however, the stream gradient is swift and steep, which tends to keep juveniles in the pond even when the upper screens aren't used. Moreover, upstream passage ¼ mile upstream from the upper end of the channel is blocked by a large, natural cliff-like falls.
Disease Transmission	7.9, 10.11	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) and the *Fish Health Policy in the Columbia Basin* details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Fish are released at a time, size and the system and life history stage to foster rapid migration to marine waters, and to allow juvenile listed fish to grow to a size that reduces potential for predation. Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish.

Wahkiakum FFA. This program has provided an invaluable learning experience for many students growing up in Wahkiakum County. Students have participated in numerous hands-on science projects, and collect data on a weekly basis. They also assist WDFW hatchery personnel in spawning salmon.

See also Deep River Net Pen Coho HGMPs.

1.9 List of program "Performance Standards".

See HGMP section 1.10. Standards and indicators are referenced from Northwest Power Planning Council (NPPC) Artificial Production Review (APR) (NPPC 2001).

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

1.10.1 "Performance Indicators" addressing benefits.

Table 1.10.1.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.2 Program contributes to mitigation requirements. Program provides mitigation for lost fish production due to development within the Columbia River Basin.	Number of fish released by program returning, or caught, as applicable to given mitigation requirements.	Annually estimate survival and contribution for each brood year released. This program provides mitigation for lost fish production due to development within the Columbia River Basin and contributes to a meaningful harvest in sport and commercial fisheries.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions. The FMEP has been submitted to NOAA and was revised after the coho listing. Ocean and Columbia River fisheries are covered under section 7 permits.	Hatchery program operation addresses ESA requirements through the development and review of this HGMP. HGMP updated and re-submitted to NOAA with significant changes or under permit agreement. Compliance with ESA is managed with fishery regulations that minimize impacts to ESA-listed fish and are monitored by WDFW law enforcement officers. The FMEP outlines anticipated encounter rates and expected mortality rates for these fisheries. Natural populations are monitored annually to assess trends and compare with goals.
3.2.1 Fish produced for harvest are propagated and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	Annual number of fish produced by this program caught in all fisheries, including estimates of fish released.	A quality control check is done prior to release to estimate the error rate of mass marking. The external mark enables mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Harvest is regulated to meet appropriate biological assessment criteria. Agencies monitor harvests to provide up-to-date information. Estimate survival and contribution to fisheries for each brood year released.
3.3.1 Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	An annual number of naturally-produced adults or redds on the spawning grounds or selected natural production index areas is estimated.	The returns to the hatchery and spawning grounds are monitored and reported annually.

3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (fin-clip, CWT, otolith-mark, other, etc., depending on species) production fish to identify them from naturally produced fish. See also Standard *3.2.1*.	Annually monitor and report size, number, mass-mark quality (mark rate/tag rate) and date of all hatchery releases by mark type. Annually sample returning fish for the mass-mark and CWT in fisheries and at the hatchery; monitor and report numbers of estimated hatchery (marked) and natural (unmarked) fish. Report CWT analysis to RMIS database.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal distribution of broodstock collection at point of collection.	Collect broodstock representatively and systematically throughout the late return (late-October through mid-December). Collect annual run timing, age and sex composition and spawning escapement timing data. Adhere to WDFW spawning guidelines (Seidel 1983; HSRG 2009).
3.5.5 Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with natural-origin fish.	Level of smoltification (size, appearance, behavior, etc.) at release compared to WDFW rearing and release guidelines. Release type (forced, volitional, or direct).	Monitor fish condition in the facilities throughout all rearing stages. Annually monitor and record size, number, and date of release.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply basic monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, age and sex composition data upon adult return. Annually record growth rates, mark rate and size at release and release dates. See also HGMP section 11 for program monitoring and evaluation.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is designed to help achieve the end goal of conserving and stabilizing natural salmon populations.	Long-term monitoring of system population will indicate success of program.

1.10.2 "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries.

	authorizations for harvest and hatchery actions.	Program risks have been addressed in this HGMP through best available science hatchery management actions. WDFW staff annually reviews Future Brood Document (FBD) for stock, size, number, date and location of releases from all production programs. Monitor and record juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	The number of marks released and proportion of marks in out-migrant juveniles and returning adults on the spawning ground. Production fish are mass-marked (adipose fin-clip) to allow for their differentiation from naturally-produced fish are estimated annually.	Monitor and record juvenile hatchery fish size, number, date of release and mass-mark (fin clips, tags, etc.) quality; monitor contribution of hatchery adult fish to fisheries and escapement. Harvest is regulated to meet appropriate biological assessment criteria. Coho fisheries in the Elochoman River are mark selective, and require the release of all wild coho. Agencies monitor harvests and hatchery escapements to provide up-to-date information.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish for selective fisheries.	Annually monitor and report size, number, date of release and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Annually assess harvest of mass-marked hatchery fish based on CRC estimates and creel surveys.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	All hatchery production is identifiable in some manner (fin-marks, tags, otolith, etc.) consistent with information needs.	Annually monitor and record size, number, date of release and mass-mark quality (tag rate) of hatchery releases. Examine returning fish encountered for the mass-mark (CWT) at the hatchery. Annually record numbers of estimated hatchery (marked) and natural (unmarked). PNI goal this program is ≥0.67.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and	Temporal and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Collect annual run timing, age and sex composition and return timing data.

age distribution of population from which broodstock is taken.		
3.4.3 Life history characteristics of the natural population do not change as a result of the hatchery program.	Life history characteristics are measured in adult and juvenile hatchery fish: return timing, age and sex composition, spawning timing, and size in returning hatchery adults; size, growth rates, and survival to release in juvenile production. Life history patterns of juvenile and adult NOR are stable.	Collect annual run timing, origin, and age and sex composition data. Annually monitor and record juvenile hatchery fish size, growth rates, number released, mass-mark/tag data, survival-to-release rates, and date of release. Examine returning fish for the mass-mark (fin-clips, CWTs) at broodstock collection points and on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked).
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure is not affected by artificial production.	See HGMP section 11 for M&E information.
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Total number of natural-origin spawners (if any) reaching the collection facility. Timing of collection compared to overall run timing.	All on-station hatchery releases are identifiable in some manner (fin-marks, tags, etc.). Collect annual run timing, origin, and age and sex composition data. CWT data reported to RMIS. Examine returning fish for the mass-mark (fin-clips, CWTs) at broodstock collection points and on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked).
3.5.3 Hatchery-origin adults in natural production areas do not negatively affect the total natural spawning population.	The ratio of observed and/or estimated total numbers of artificially-produced fish on natural spawning grounds, to total number of naturally-produced fish (pHOS).	Examine returning fish for the mass-mark (fin-clips, CWTs) at broodstock collection points and on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked). Hatchery-origin fish in excess of broodstock needs are removed from the system (see HGMP section 7.5).

3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release). Proportion of adult returns to program's intended return location, compared to fisheries and artificial or natural production areas.	Examine returning fish for the mass-mark (fin-clips, CWTs) at broodstock collection points and on the spawning grounds. Annually record and report numbers of estimated hatchery (marked) and natural (unmarked). Annually record and report release information, including location, method and age class in hatchery data systems (WDFW Hatcheries Headquarters Database).
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional or direct).	Annually monitor and record size, number, date of release and release type.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State*).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. See also Attachment 1 for pre-release Fish Health History. The program is operated consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006), *Fish Health Policy in the Columbia Basin*, and *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995).
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. WDFW water rights permit compliance.	Flow and discharge reported in monthly NPDES report (see HGMP section 4.2).
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized (see HGMP section 4.2).
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the	Necropsies of fish to assess health, nutritional status, and culture conditions.	DFW Fish Health Section inspect adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess

levels of existing pathogens. Follow the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, revised 2006).		health and detect potential disease problems. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	Examine fish 1 to 6 weeks prior to transfer or release, in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below broodstock collection site is currently compared to historic distribution.	Trap is checked regularly. Non-target and/or listed fish, when encountered, are returned to the river.
3.7.7 Weir/trapping operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap. Pre-spawning mortality rates of captured fish in the hatchery and/or after release.	Traps checked regularly. Annually record and report abundances and observations of natural- origin fish at hatchery facilities.
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally-origin salmon and steelhead (Sharpe et al. 2008).
3.8.2. Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	Total cost of program operation.	Annually monitor and report feed costs and fish health actions.

1.11 Expected size of program.

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

The green egg-take goal for the on-station program is up to 300,000; off-station programs require approximately 1.0 million (**Table 1.11.1**).

Table 1.11.1.1: Egg-take goals for Elochoman River integrated and segregated programs.

Program	Egg-Take	Program Type
Elochoman River on-station	Up to 300,000	Integrated
Wahkiakum FFA[a]	Up to 10,000	Segregated
Peterson Coho Project[b]	Up to 60,000	Segregated
Deep River Net Pens[c]	Up to 930,000	Segregated

Source: Proposed program changes and Future Brood Document 2019, WDFW proposed (2019).

[a] FFA program initiated in 2015.

[b] The Peterson Program was initiated to plant additional chum in the Grays River, and converted to Type-N coho in 2010.Program may be converted to chum in the future.

[c] See Deep River Net Pen Coho HGMPs (Mitchell Act and BPA-funded).

Integrated program. Around 100 adult pairs, not including jacks, are needed to achieve the established egg-take goal of up to 300,000 for the on-station program. This is based on an average fecundity of approximately 3,000 eggs/female, and a pre-spawning mortality of 10% and expected loss in the hatchery. Program take of natural origin fish will not exceed 30% of the natural-origin return. If adequate numbers of natural origin fish are not available to support the on-station program, pNOB will be reduced to less than 100%.

Segregated program.

Peterson Coho Project. A total of around 22 hatchery-origin adult pairs are needed to achieve the egg-take goal of 60,000 collected for the enhancement co-op program.

Wahkiakum FFA. The Wahkiakum FFA program was initiated in brood year 2015, with an egg-take goal of up to 10,000 for an eventual 8,000 yearling release (current goal is 5,000 yearlings). Around five spawning pairs are required for this portion of the production.

Deep River Net Pens (DRNP). A stock change to type-N coho for the DRNP programs occurred with the 2016 brood. Beginning in 2019, the DRNP program will come from Beaver Creek Hatchery, Elochoman weir and Grays River Hatchery. A total of around 350 hatchery-origin adult pairs to achieve the egg-take goal for a segregated program egg-take of 930,000.

1. **Mitchell Act-funded**: Program produces up to 300,000 yearlings released.
2. **BPA-funded**: Program produces up to 400,000 yearlings released.

The on-station program will take precedence; in the event of broodstock shortfalls for the DRNP egg-take (see Deep River Net Pens Coho HGMPs). Eggs will initially also come from Grays River Hatchery.

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

Table 1.11.2.1: Proposed annual fish release levels (maximum number) by life stage and location, Elochoman River Type-N coho.

Location	Age Class	Max. No.	Size (fpp)	Release Date	Major Watershed
Elochoman River	Yearlings	Up to 225,000	15.0	April	Elochoman River
Deep River Net Pens	Yearlings	Up to 700,000[a]	15.0	April	Deep River
Birnie Creek[b]	Yearlings	Up to 5,000	16.0	April	Columbia mainstem
Columbia River[c]	Fry	Up to 39,000	200.0	April/May	Columbia mainstem

Source: Future Brood Document 2019.

[a] **Deep River Net Pens (DRNP).** Initial total releases from the Deep River Net Pen program will be 700,000 yearling smolts. A proposed stock change to Elochoman River type-N coho for the DRNP programs in 2019 requires a total of 350 hatchery-origin adult pairs to achieve the egg-take goal for a segregated

program egg-take of 930,000 to achieve a smolt release goal of 700,000 yearlings. During the transition period stock source will includes Grays River Hatchery, Beaver Creek Hatchery, and Elochoman weir[b]
Wahkiakum FFA

[c] Peterson Coho Project.

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

Elochoman Hatchery previously produced coho for the Elochoman sub-basin programs from 1954, until the facility was closed in 2009. Grays River Type-N coho production was initiated in 2007, in response to the Elochoman Hatchery closure. **Table 1.12.1** shows production and returns to the hatchery from Elochoman Hatchery from 2000-2009. There have been no previous coho production releases from Beaver Creek Hatchery. See also Grays River Type-N Coho HGMP.

Table 1.12.1: Total coho program releases and adult hatchery returns to Elochoman Hatchery, 2000-2009.

Release Year	Total Release		Return Year	Hatchery Returns					
	Type-S	Type-N		Type-S			Type-N		
				Hatchery	Unk	Wild	Hatchery	Unk	Wild
2000	263,500	250,800	**2002**	8,209	101		4,347	90	0
2001	360,525	548,600	**2003**	7,803	306	30	3,004	28	0
2002	370,792	396,671	**2004**	5,740	58	26	1,101	52	32
2003	433,681	493,146	**2005**	2,926	0	16	856	0	27
2004	423,000	500,000	**2006**	2,712	32	36	329	0	17
2005	411,000	440,000	**2007**	2,117	0	99	988	0	21
2006	294,922	492,601	**2008**	3,673	0	164	2,033	0	76
2007	402,500	540,900	**2009**	822	0	66	690	0	5
2008	135,038	266,438	**2010**[a]	0	0	0	31	0	5
2009	20,567	146,088	**2011**	----	----	----	----	----	----
Average	**311,553**	**407,524**		**3,778**	**55**	**55**	**1,487**	**19**	**20**

Source: WDFW Hatcheries Headquarters Database 2016.

[a] 2010 returns are to Beaver Creek Hatchery.

See also **Table 3.3.1.1** for SAR estimate.

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

Beaver Creek Hatchery. The integrated Type-N coho program at Beaver Creek is a new program starting in brood year 2019. The segregated programs will use F1 generation returns from this program starting in 2019.

Grays River Hatchery. This facility began operations in 1961. The Type-N coho program was initiated in brood year 2007 (2009 release year). This program will provide broodstock for the Elochoman programs during the transition period (2019-2021).

Wahkiakum FFA. This program was initiated in brood year 2015; the first release at Birnie Creek (WRIA 25.0281) will be in 2017. A previous program using Elochoman Type-N coho released fish at this site from 1999-2009.

The Peterson Coho Project. This project was initiated with the goal of planting more Grays River chum in lower Columbia tributaries. As a trial run, Type-N Coho from Grays River were shipped to this project as eyed eggs in 2010. This program will transition to Elochoman Type-N coho or Grays River Type-N in 2019.

Deep River Net Pens. Revised broodstock source will start with the 2019 brood. After incubation and initial-rearing at Beaver Creek Hatchery, fish may also be shipped to Washougal, North Toutle or Kalama Falls hatcheries for additional rearing.

1.14 Expected duration of program.

Elochoman River (at Beaver Creek Hatchery). Program initiated in 2019, with no plans for termination.

Wahkiakum FFA. Program is on-going, with no plans for termination.

The Peterson Coho Project. This project is on-going, although in the future, this stock will be replaced with Grays River wild chum.

Deep River. Program is on-going, with no plans for termination.

1.15 Watersheds targeted by program.

Elochoman River (WRIA 25.0236)/ Grays-Elochoman Sub-Basin/ Southwest Washington DPS/ Columbia River Estuary Province.

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

1.16.1 Brief Overview of Key Issues.

Elochoman River Type-N coho are considered a Primary population for recovery. The Type-N stock (characterized by a later spawn timing) generally enters the river from late-September through November, with peak spawning in November/December. The Type-N stock was rated as "depressed" in 1992. The Elochoman program at Beaver Creek Hatchery is a part of a strategy to meet conservation and/or harvest goals for the target stock.

The Elochoman sub-basin previously had Type-N and Type-S coho programs at the Elochoman Hatchery. HSRG (2009) recommended that an integrated harvest program be developed for the Type-N coho. WDFW initiated this alternative at Grays River Hatchery in brood year 2007 (2009 release year). The Type-N program was moved from Elochoman Hatchery to Grays River Hatchery prior to closing the Elochoman facility in 2009. Type-S coho hatchery programs in both Grays and Elochoman sub-basins were discontinued in 2007, although Deep River Net Pen releases continued to use Type-S coho from other Lower Columbia facilities (see Deep River Net Pen Coho HGMPs).

1.16.2 Potential Alternatives to the Current Program

Alternative 1: *Shift the program to Beaver Creek Hatchery on the Elochoman River*. This action is being taken to develop an integrated broodstock in the Elochoman Sub-basin to meet pHOS goals, and conservation and harvest objectives in the Deep River/Elochoman Sub-basins. Development of a segregated program using first generation returns (F1) from the Elochoman integrated program will continue to provide production for the SAFE program while reducing impacts to Elochoman natural origin coho. This alternative continues to support important ocean and lower Columbia sport and commercial fisheries, including a Select Area fishery in Deep River, consistent with mitigation requirements.

Alternative 2: *Eliminate the program*: This action would reduce potential interaction with natural populations and eliminate potential impacts on other ESA-listed species. Currently this program supports popular sport, commercial and tribal fisheries in the ocean, sport fisheries at Buoy 10, sport and commercial fisheries in the lower Columbia and important commercial fisheries in Deep River Select Area, which is consistent with the mitigation requirements.

1.16.3 Potential Reforms and Investments

Reform/Investment 1: A resistance board weir (RBW) installed in the lower Elochoman River (Foster Road trap) will attempt to be operated through December. All hatchery-origin fall Chinook captured at the Foster Road RBW and the adult trap at Beaver Creek Hatchery, excluding those used for broodstock, will be lethally removed to manage pHOS within standards prescribed by NMFS. Hatchery-origin coho will be released upstream for fisheries or lethally removed.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-LISTED SALMONID SPECIES AND NON-SALMONID SPECIES ARE ADDRESSED IN ADDENDUM A)

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

None currently. This HGMP is submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 10 or 4(d). Impacts to other species and stock are already covered under the MA BIOP.

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.

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

Lower Columbia River coho (*Oncorhynchus kisutch*). Identified as a candidate species on June 25, 1995 (60FR38011). Listed as threatened on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448), updated April 14, 2014 (79 FR 20802).

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program. None**.** The effects on these populations shown below were analyzed in the MA BIOP.

Lower Columbia River steelhead (*Oncorhynchus mykiss*). Listed as a threatened species on March 19, 1998 (63FR13347); threatened status reaffirmed on January 5, 2006 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448), updated April 14, 2014 (79 FR 20802).

Lower Columbia River Chinook (*Oncorhynchus tshawytscha*). 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 (76 FR 50448), updated April 14, 2014 (79 FR 20802).

Columbia River chum salmon (*Oncorhynchus keta*). Listed as threatened on March 25, 1999 (64FR14507); threatened status reaffirmed on June 28, 2005 (70FR37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

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. The populations affected by this program were already analyzed under the MA BIOP.

Lower Columbia River Chinook: In Washington, the LCR Chinook ESU includes all naturally spawned Chinook populations from the mouth of the Columbia to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, as well as fifteen artificial propagation programs. Excluded are upper Columbia River bright hatchery stocks that spawn in the mainstem Columbia River below Bonneville Dam and in other tributaries upstream from the Sandy River to the Hood and White Salmon rivers (NMFS 2014 79FR20802).

Status: Currently only two of 32 historical populations – the North Fork Lewis and Sandy late-fall populations – are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years, and some populations are extirpated, or nearly so. Five of the six strata fall significantly short of the Willamette- Lower Columbia Technical Recovery Team

(WLC TRT) criteria for viability. One stratum – Cascade late fall – meets the WLC TRT criteria (Dornbusch and Sihler 2013). Dam construction eliminated habitat for a number of populations leading to the extirpation of spring Chinook salmon populations in the Upper Cowlitz, Cispus, Tilton, North Fork Lewis , Big White Salmon rivers, and fall Chinook populations in the Upper Cowlitz and Big White Salmon rivers (SHIEER, NMFS 2004). Projects to allow access have been initiated in the Cowlitz and Lewis systems but these are not close to producing self-sustaining populations; Condit Dam on the Big White Salmon River was breached October 26, 2011. Based on the 2010 recovery plan analyses, all of the 14 Tule populations (**Table 2.2.2.1**) are considered very high risk except one that is considered at high risk. The modeling conducted in association with Tule harvest management suggests that three of the populations (Coweeman, Lewis and Washougal) are at a somewhat lower risk (LCFRB 2010).

Table 2.2.2.1: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River Chinook populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Fall										
Grays/Chinook	Contributing[2]	VL	H	VL	VL[2]	M+	+500%	800	<50	1,000
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	+150%	3,000	<50	1,500
Mill/Aber/Germ	Primary[1]	VL	H	L	VL[2]	H	+155%	2,500	50	900
Youngs Bay (OR)	Stabilizing	--[3]	--[3]	--[3]	L	L	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Contributing[1]	--[3]	--[3]	--[3]	VL	L	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	L	H	--[3]	--[3]	--[3]	--[3]
Cascade Fall										
Lower Cowlitz [C]	Contributing	VL	H	M	VL[2]	M+	+50%	24,000	500	3,000
Upper Cowlitz	Stabilizing	VL	VL	M	VL	VL	--	28,000	0	--
Toutle[C]	Primary[1]	VL	H	M	VL[2]	H+	+265%	11,000	<50	4,000
Coweeman [G]	Primary	VL	H	H	VL[2]	H+	+80%	3,500	100	900
Kalama	Contributing[2]	VL	H	M	VL[2]	M	+110%	2,700	<50	500
Lewis [G]	Primary	VL	H	H	VL[2]	H+	+280%	2,600	<50	1,500
Salmon	Stabilizing	VL	H	M	VL	VL	--	n/a	<50	--
Washougal	Primary	VL	H	M	VL[2]	H+	+190%	2,600	<50	1,200
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Contributing[1]	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Cascade L Fall										
Lewis NF [C,G]	Primary	VH	H	H	VH[1]	VH	0%	23,000	7,300	7,300
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Cascade Spring										
Upper Cowlitz [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	22,000	300	1,800
Cispus [C,G]	Primary	VL	L	M	VL[2]	H+	>500%	7,800	150	1,800
Tilton	Stabilizing	VL	VL	VL	VL	VL	0%	5,400	<100	--
Toutle	Contributing	VL	H	L	VL	M	>500%	3,100	100	1,100
Kalama	Contributing[2]	VL	H	L	VL	L	>500%	4,900	100	300
Lewis NF [C]	Primary	VL	L	M	VL	H	>500%	15,700	300	1,500
Sandy (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Fall										
L. Gorge (WA/OR)	Contributing	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
U. Gorge (WA/OR) [C]	Contributing[1]	VL	M	L	VL[2]	M	>500%	n/a	<50	1,200
White Salmon [C]	Contributing	VL	L	L	VL	M	>500%	n/a	<50	500
Hood (OR)	Primary[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge Spring										
White Salmon [C]	Contributing	VL	VL	VL	VL	L+	>500%	n/a	<50	500
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	VH	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.

VL = Very Low; L = Low; M = Moderate; H = High; VH = Very High.

[1] Increase relative to interim Plan.

[2] Reduction relative to interim Plan.

[3] Addressed in Oregon Management Unit plan.

[C] Designated as a historical core population by the TRT.

[G] Designated as a historical legacy population by the TRT.

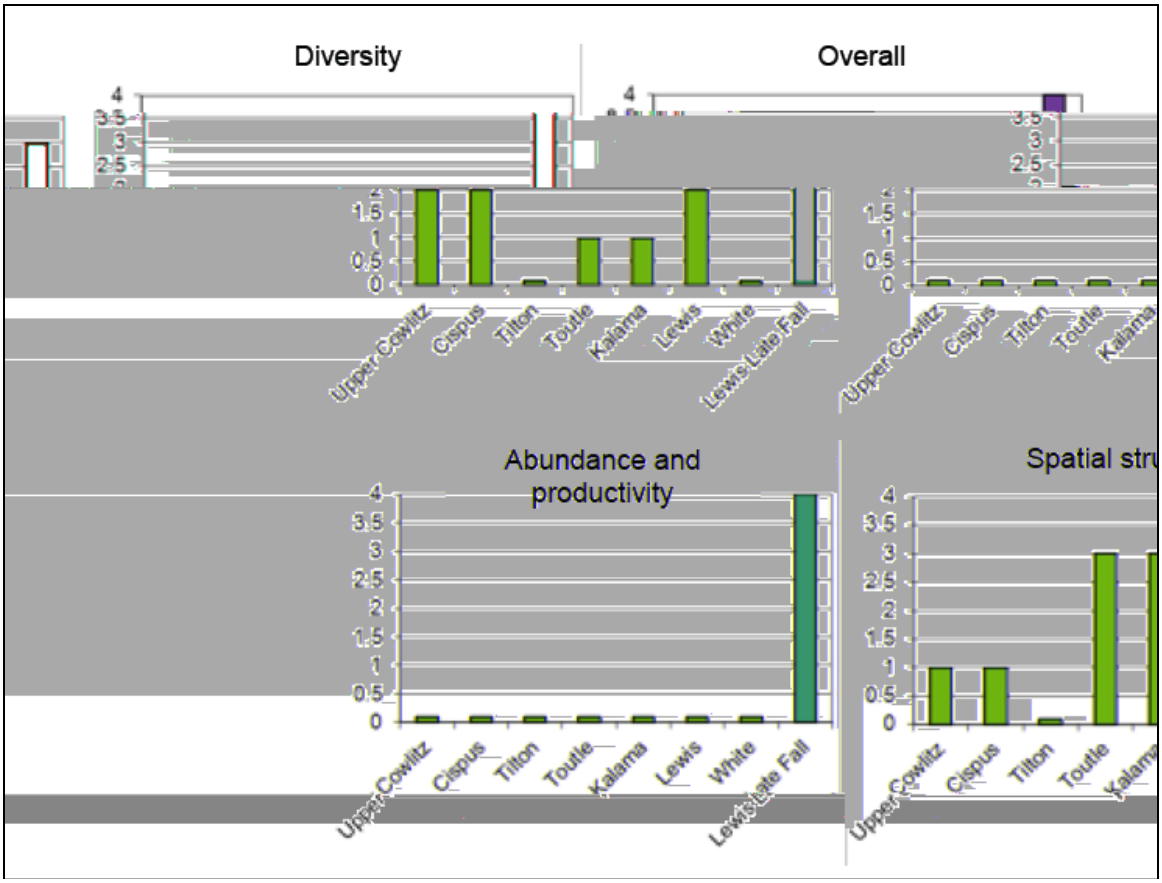


Figure 2.2.2.1 Current status of Washington lower Columbia River spring Chinook and late fall-run (bright) Chinook salmon populations for the VSP parameters and overall population risk. (LCFRB Recovery Plan 2010, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

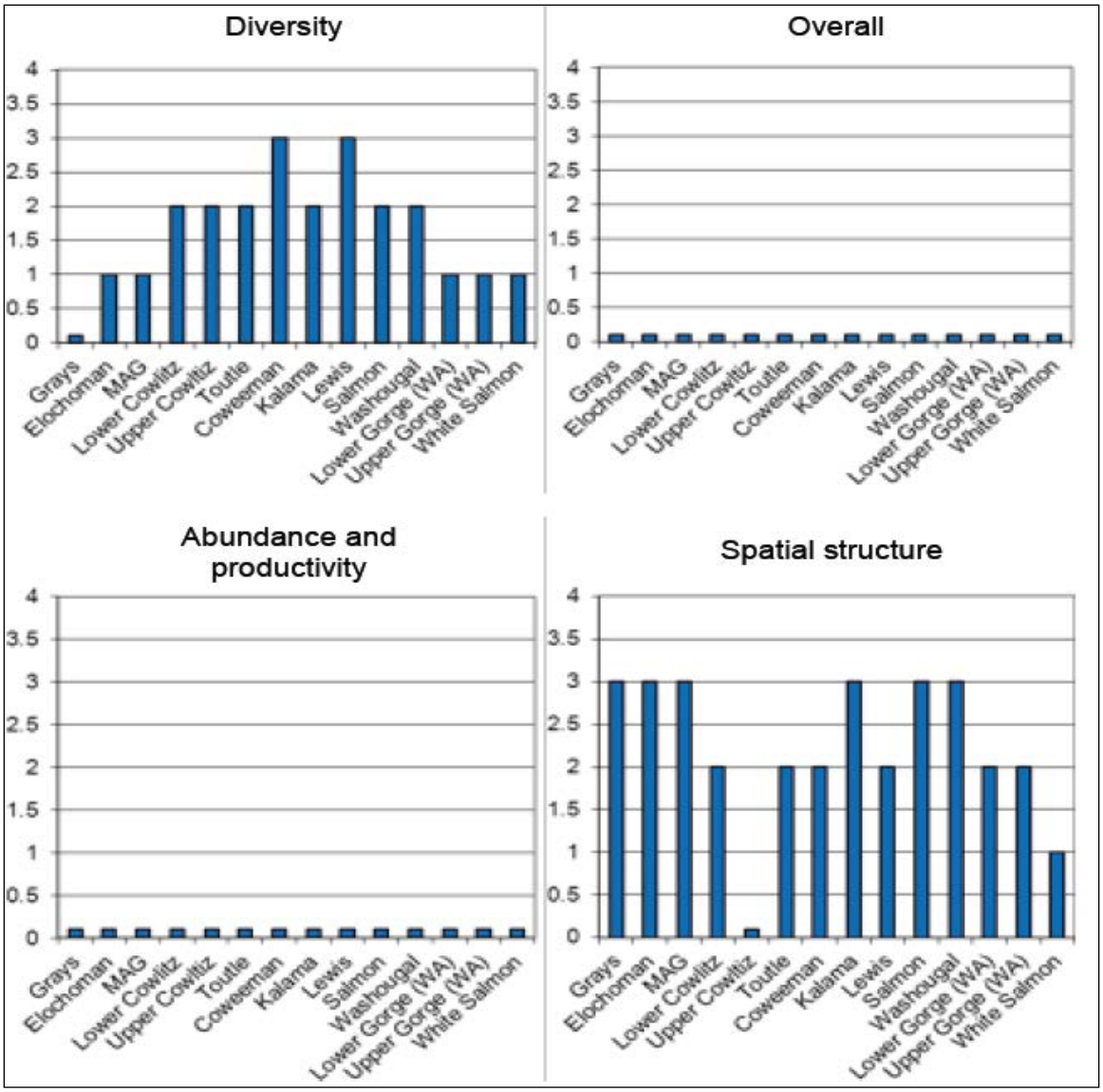


Figure 2.2.2.2: Current status of Washington lower Columbia River fall-run (Tule) Chinook salmon populations for the VSP parameters and overall population risk. (LCFRB Recovery Plan 2010, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk. MAG = Mill, Abernathy and Germany creeks (Ford 2011).

Lower Columbia River Steelhead *(Oncorhynchus mykiss)*: The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), and excludes fish originating from the upper Willamette River Basin above Willamette Falls. The DPS includes seven artificial propagation programs, including the Cowlitz Trout Hatchery Winter-late (Lower Cowlitz), Kalama River Wild (winter- and summer-run) and Lewis River Wild Winter (NMFS 2014 79FR20802). The Grays River winter steelhead population is part of the Southwest Washington DPS, which is not listed.

Status: Currently, 16 of the 23 Lower Columbia River steelhead populations have a low or very low probability of persisting over the next 100 years, and six populations have a moderate probability of persistence. Only the summer-run Wind population is considered viable. All four

strata in the DPS fall short of the WLC TRT criteria for viability (Dornbusch and Sihler 2013). Populations in the upper Lewis and Cowlitz watersheds remain cut-off from access to essential spawning habitat by hydroelectric dams. Projects to allow access have been initiated in the Cowlitz and Lewis systems but these have not yet produced self-sustaining populations (Ford 2011). Condit Dam on the White Salmon River was breached October 26, 2011. WDFW is currently developing watershed-specific management plans in accordance with the SSMP. As part of this planning process, WDFW is proposing to complete a thorough review of current steelhead stock status using the most up to date estimates of adult abundance, juvenile production and genetic information.

Table 2.2.2.2: Baseline viability status, viability and abundance objectives, and productivity improvement targets for SW Washington and lower Columbia River steelhead populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast Winter										
Grays/Chinook	Primary	VH	VH	M	M[1]	H	0%[4]	1,600	800	800
Eloch/Skam	Contributing	VH	VH	M	M[1]	M+	0%[4]	1,100	600	600
Mill/Ab/Germ	Primary	H	VH	M	M[1]	H	0%[4]	900	500	500
Youngs Bay (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Big Creek (OR)	Primary	--[3]	--[3]	--[3]	H	VH	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary	--[3]	--[3]	--[3]	VH	VH	--[3]	--[3]	--[3]	--[3]
Cascade Winter										
Lower Cowlitz	Contributing	L	M	M	L	M	+5%	1,400	350	400
Upper Cowlitz [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,400	<50	500
Cispus [C,G]	Primary	VL	M	M	VL[2]	H[1]	>500%	1,500	<50	500
Tilton	Contributing	VL	M	M	VL	L	>500%	1,700	<50	200
S.F. Toutle	Primary	M	VH	H	M	H+	+35%	3,600	350	600
N.F. Toutle [C]	Primary	VL	H	H	VL[2]	H	+125%		120	600
Coweeman	Primary	L	VH	VH	L[2]	H	+25%	900	350	500
Kalama	Primary	L	VH	H	L[2]	H+	+45%	800	300	600
N.F. Lewis [C]	Contributing	VL	M	M	VL[2]	M	>500%	8,300	150	400
E.F. Lewis	Primary	M	VH	M	M[1]	H	+25%	900	350	500
Salmon	Stabilizing	VL	H	M	VL[2]	VL	0%	na	<50	--
Washougal	Contributing	L	VH	M	L[2]	M	+15%	800	300	350
Clackamas (OR) [C]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [C]	Primary	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Cascade Summer										
Kalama [C]	Primary	H	VH	M	M[1]	H	0%[4]	1,000	500	500
N.F. Lewis	Stabilizing	VL	VL	VL	VL	VL	0%	na	150	--
E.F. Lewis [G]	Primary	VL	VH	M	VL[2]	H	>500%	600	<50	500
Washougal [C,G]	Primary	M	VH	M	M[1]	H	+40%	2,200	400	500
Gorge Winter										
L. Gorge (WA/OR)	Primary	L	VH	M	L[2]	H	+45%	na	200	300
U. Gorge (WA/OR)	Stabilizing	L	M	M	L[2]	L	0%	na	200	--
Hood (OR) [C,G]	Primary	--[3]	--[3]	--[3]	M	H	--[3]	--[3]	--[3]	--[3]
Gorge Summer										
Wind [C]	Primary	VH	VH	H	H[1]	VH	0%[4]	na	1,000	1,000
Hood (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
VL = Very Low; L = Low; M = Moderate; H = High; VH = Very High.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

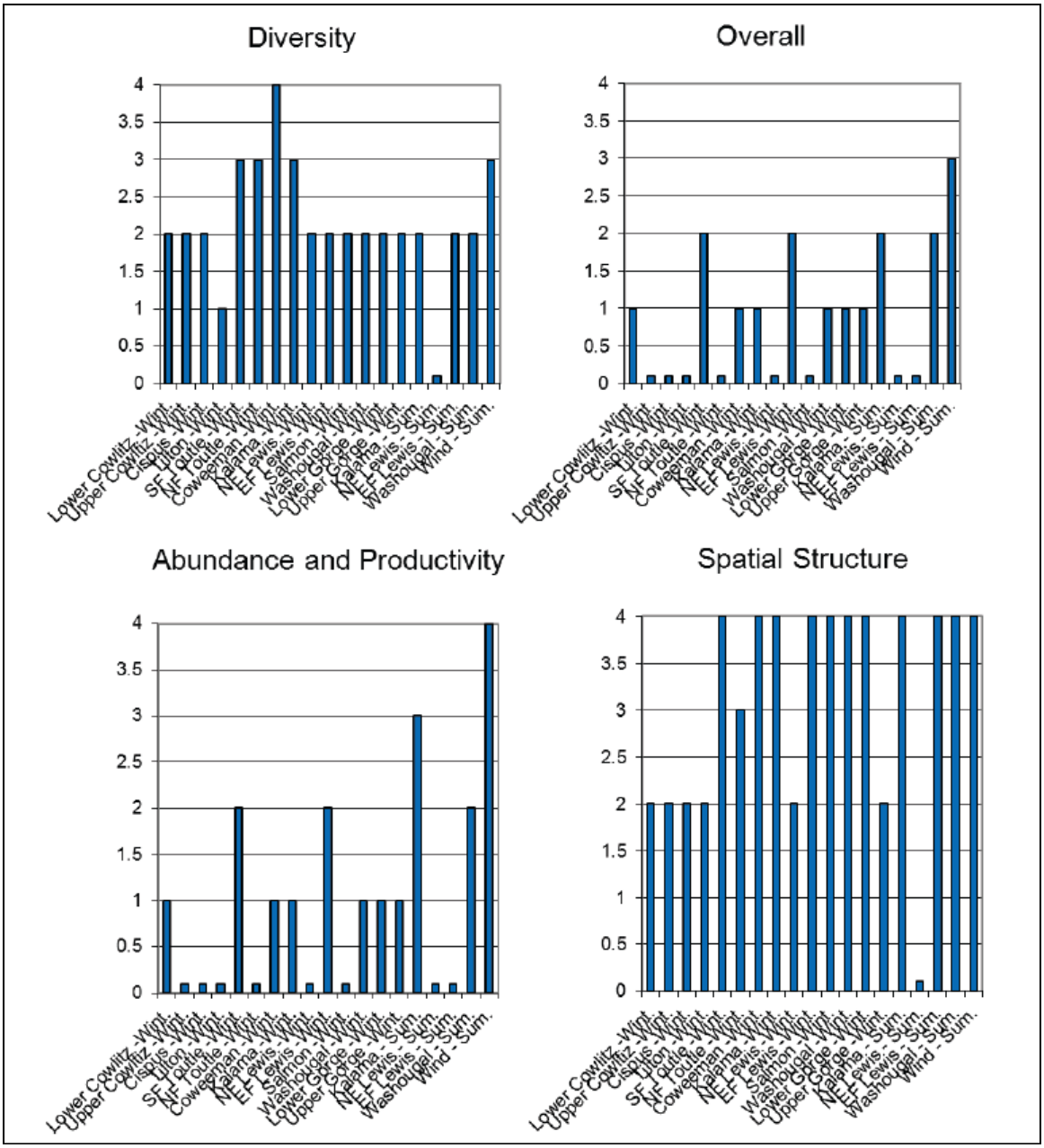


Figure 2.2.2.3: Current status of Washington LCR steelhead populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lower Columbia River coho *(Oncorhynchus kisutch)*: Originally part of a larger Lower Columbia River/Southwest Washington ESU, Lower Columbia coho were identified as a separate ESU and listed as threatened on June 28, 2005. The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers, The twenty-one artificial propagation programs include: the Grays River, Peterson Coho Project, Cowlitz Type-N Coho Program in the upper and lower Cowlitz Rivers, Cowlitz Game and Anglers Coho Program, Friends of the Cowlitz Coho Program, North Fork Toutle River Hatchery, Kalama River Type-N and Type-S Coho Programs, Lewis River Type-N and Type-S Coho programs, Fish First Wild

Coho and Type-N Coho programs, Syverson Project Type-N Coho Program, and Washougal Hatchery Type-N Coho Program (NMFS 2014 79FR20802).

Status: Status evaluations of LCR coho status, all based on WLC-TRT criteria, have been conducted since the last BRT status update in 2005 (McElhany et al. 2007, Beamesderfer et al. 2010, LCFRB 2010, Dornbusch and Sihler 2013). All of these evaluations concluded that the ESU is currently at very high risk of extinction. All of the Washington side populations are considered at very high risk, although uncertainty is high because of a lack of adult spawner surveys. The 2005 BRT evaluation noted that smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining (Ford 2011). Since this time WDFW has implemented an ESU wide monitoring program for LCR coho which began in 2010. Preliminary results indicate that natural origin population abundance may be higher than previously thought for certain populations (WDFW, unpublished). Results from the first 3 years of monitoring should be available in the near future. Currently, 21 of the 24 Lower Columbia River coho salmon populations are considered to have a very low probability of persisting over the next 100 years, and none is considered viable (Dornbusch and Sihler 2013). All three strata in the ESU fall significantly short of the WLC TRT criteria for viability.

Table 2.2.2.3: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River coho populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [L]	Primary	VL	H	VL	VL[2]	H	+370%	3,800	<50	2,400
Eloch/Skam [L]	Primary	VL	H	VL	VL[2]	H	+170%	6,500	<50	2,400
Mill/Ab/Germ [L]	Contributing	VL	H	L	VL[2]	M	>500%	2,800	<50	1,800
Youngs (OR) [L]	Stabilizing	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [L]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR) [L]	Primary[1]	--[3]	--[3]	--[3]	L	VH	--[3]	--[3]	--[3]	--[3]
Scappoose (OR) [L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Cascade										
Lower Cowlitz [L]	Primary	VL	M	M	VL[2]	H	+100%	18,000	500	3,700
Upper Cowlitz [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	18,000	<50	2,000
Cispus [E, L]	Primary[1]	VL	M	L	VL	H[1]	>500%	8,000	<50	2,000
Tilton [E, L]	Stabilizing[2]	VL	M	L	VL	VL[2]	0%	5,600	<50	--
Toutle SF [E, L]	Primary	VL	H	M	VL[2]	H	+180%	27,000	<50	1,900
Toutle NF [E, L]	Primary	VL	M	L	VL[2]	H	+180%		<50	1,900
Coweeman [L]	Primary	VL	H	M	VL[2]	H	+170%	5,000	<50	1,200
Kalama [L]	Contributing	VL	H	L	VL[2]	L	>500%	800	<50	500
NF Lewis [E, L]	Contributing	VL	L	L	VL[2]	L	+50%	40,000	200	500
EF Lewis [E, L]	Primary	VL	H	M	VL[2]	H	>500%	3,000	<50	2,000
Salmon [L]	Stabilizing	VL	M	VL	VL	VL	0%	na	<50	--
Washougal [L]	Contributing	VL	H	L	VL[2]	M+	>500%	3,000	<50	1,500
Clackamas (OR) [E, L]	Primary	--[3]	--[3]	--[3]	M	VH	--[3]	--[3]	--[3]	--[3]
Sandy (OR) [E, L]	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L Gorge (WA/OR) [L]	Primary	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge (WA) [L]	Primary[1]	VL	M	VL	VL[2]	H	+400%	na	<50	1,900
U Gorge/Hood (OR)[E]	Contributing[4]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]

Source: LCFRB 2010.
VL = Very Low; L = Low; M = Moderate; H = High; VH = Very High.
[1] Increase relative to interim Plan.
[2] Reduction relative to interim Plan.
[3] Addressed in Oregon Management Unit plan.
[4] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[E] Early run (Type S) coho stock.
[L] Late run (Type N) coho stock.
(Core and Legacy populations not designated by the TRT for coho).

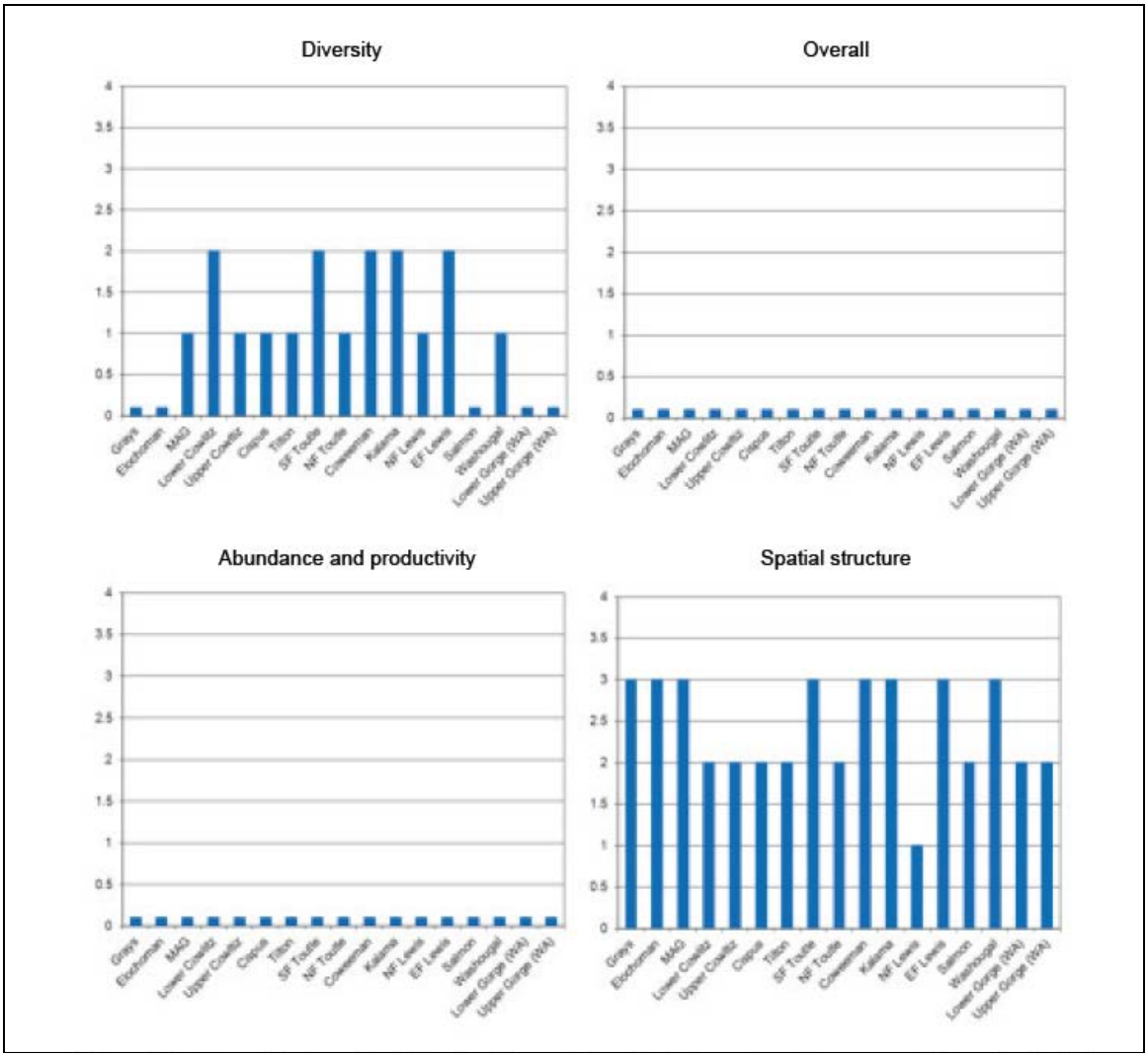


Figure 2.2.2.4: Current status of Washington LCR coho populations for the VSP parameters and overall population risk. (LCFRB 2010 recovery plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Columbia River chum salmon (*Oncorhynchus keta*). ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, as well as artificial propagation programs at Grays River and Washougal River/Duncan Creek chum hatchery programs (NMFS 2014 79FR20802).

Status: A report on the population structure of lower Columbia River salmon and steelhead populations was published by the WLC-TRT in 2006 (Myers et al. 2006). The chum population designations in that report are used in this status update and were used for status evaluations in recent recovery plans by ODFW and LCFRB.

The LCFRB completed a revision recovery plan in 2010 that includes Washington populations of Columbia River chum salmon. This plan includes an assessment of the current status of Columbia River chum populations, which relied and built on the viability criteria developed by the WLC-TRT (McElhany et al. 2006) and an earlier evaluation of Oregon WLC populations (McElhany et al. 2007). This evaluation assessed the status of populations with regard to the VSP parameters of A/P, spatial structure, and diversity (McElhany et al. 2000). The result of this analysis is shown in **Figure 2.2.2.5**. The analysis indicates that all of the Washington populations with two exceptions

are in the overall very high risk category (also described as extirpated or nearly so). The Grays River population was considered to be at moderate risk and the Lower Gorge population to be at low risk. The very high risk status assigned to the majority of Washington populations (and all the Oregon populations) reflects the very low abundance observed in these populations (e.g., <10 fish/year) (Ford 2011). Currently, 15 of the 17 populations that historically made up this ESU are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so; this is the case for all six of the Oregon populations. Currently almost all natural production occurs in just two populations: Grays/Chinook and the Lower Gorge. All three strata in the ESU fall significantly short of the WLC TRT criteria for viability (Dornbusch and Sihler 2013).

Table 2.2.2.4: Baseline viability status, viability and abundance objectives, and productivity improvement targets for lower Columbia River chum populations.

		Baseline viability					Prod.	Abundance		
Population	Contribution	A&P	S	D	Net	Obj.	target	Historical	Baseline	Target
Coast										
Grays/Chinook [C,G]	Primary	VH	M	H	M[1]	VH	0%[4]	10,000	1,600	1,600
Eloch/Skam [C]	Primary	VL	H	L	VL[2]	H	>500%	16,000	<200	1,300
Mill/Ab/Germ	Primary	VL	H	L	VL	H	>500%	7,000	<100	1,300
Youngs (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Big Creek (OR) [C]	Stabilizing[2]	--[3]	--[3]	--[3]	VL	VL	--[3]	--[3]	--[3]	--[3]
Clatskanie (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Scappoose (OR)	Primary[1]	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Cascade										
Cowlitz (Fall) [C]	Contributing	VL	H	L	VL	M	>500%	195,000	<300	900
Cowlitz (Summer) [C]	Contributing	VL	L	L	VL	M	>500%	n/a	n/a	900
Kalama	Contributing	VL	H	L	VL	M	>500%	20,000	<100	900
Lewis [C]	Primary	VL	H	L	VL	H	>500%	125,000	<100	1,300
Salmon	Stabilizing	VL	L	L	VL	VL	0%	n/a	<100	--
Washougal	Primary	VL	H	L	VL[2]	H+	>500%	18,000	<100	1,300
Clackamas (OR) [C]	Contributing	--[3]	--[3]	--[3]	VL	M	--[3]	--[3]	--[3]	--[3]
Sandy (OR)	Primary	--[3]	--[3]	--[3]	VL	H	--[3]	--[3]	--[3]	--[3]
Gorge										
L. Gorge (WA/OR) [C,G]	Primary	VH	H	VH	H[1]	VH	0%[4]	6,000	2,000	2,000
U. Gorge (WA/OR)	Contributing	VL	L	L	VL	M	>500%	11,000	<50	900

Source: LCFRB 2010.
VL = Very Low; L = Low; M = Moderate; H = High; VH = Very High.
[5] Increase relative to interim Plan.
[6] Reduction relative to interim Plan.
[7] Addressed in Oregon Management Unit plan.
[8] Improvement increments are based on abundance and productivity; however, this population will require improvement in spatial structure or diversity to meet recovery objectives.
[C] Designated as a historical core population by the TRT.
[G] Designated as a historical legacy population by the TRT.

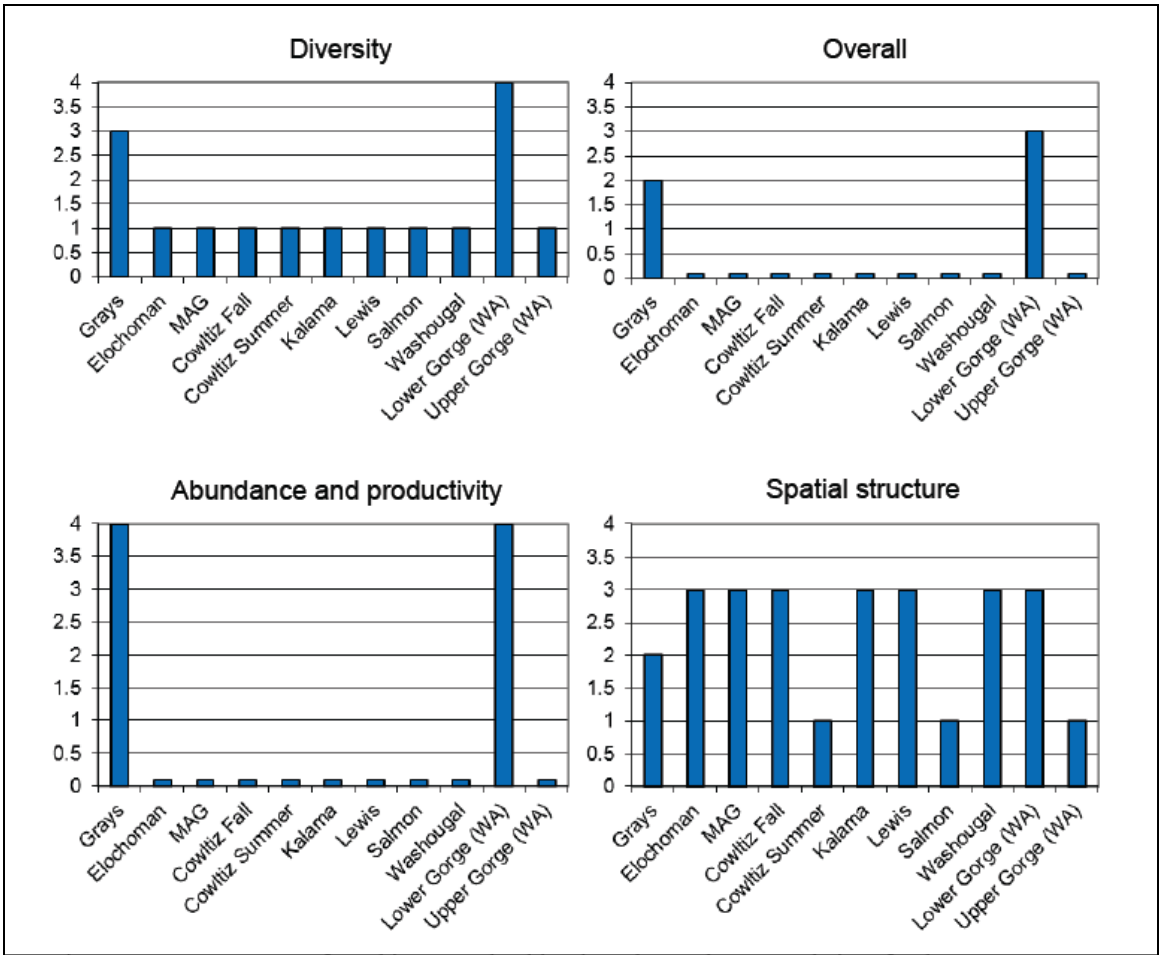


Figure 2.2.2.5: Current status of Washington CR chum populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, Chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population.

Juvenile coho production estimates is the one measure of production in the Lower Columbia system. See HGMP section 11.1 for planned M&E.

Table 2.2.2.5: Lower Columbia River Washington tributary coho smolt production estimates (WDFW, Region 5).

Year	Grays River[a]	Mill Creek[b]	Abernathy Creek[b]	Germany Creek[b]	Tilton/ Mayfield Dam[a]	Upper Cowlitz[a]	Coweeman[b]	Cedar Creek[a]
2004	--	5,677	6,448	5,062	36,100	173,530	--	37,000
2005	--	15,170	11,764	5,033	40,900	128,161	--	58,300
2006	--	7,778	5,174	2,466	33,600	264,921	--	46,000
2007	--	12,261	5,202	2,715	33,650	74,228	--	38,450
2008	--	10,930	5,699	3,826	34,190	104,277	10,121	29,340
2009	4,453	7,023	4,020	2,634	36,240	14,315	13,393	36,340
2010	2,377	13,332	4,341	1,133	40,640	40,477	---	61,140
2011	2,182	11,425	14,268	6,744	58,916	110,362	22,924	60,778
2012	5,014	8,918	8,106	5,350	45,436	34,632	14,879	44,047
2013	6,501	12,581	3,313	2,262	59,278	10,504	14,014	52,656
2014	3,745	9,345	7,505	8,705	47,151	213,703	13,354	41,000
2015	4,254	12,168	5,795	3,779	32,808	74,367	23,141	33,137

Source: Cindy LeFleur, WDFW 2016.
Note: Data in yellow was unconfirmed.
[a] Data are from *WDFW Wild Coho Forecast reports for Puget Sound, Washington Coast, and Lower Columbia River* available at: http://wdfw.wa.gov/conservation/research/projects/wild_coho
[b] Data is the WDFW Juvenile Migrant Exchange (JMX) database.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 2.2.2.6: Spring Chinook salmon total spawner abundance estimates in LCR tributaries.

Year	Cowlitz		Kalama			Lewis	
2003	1,953		790			745	
2004	1,877		358			529	
2005	405		380			122	
2006	783		292			857	
2007	74		2,150			264	
2008	425		364			40	
2009	763		34			80	
2010*	711	(78)	0	(0)	[61]	160	(52)
2011	1,359	(124)	26	(0)	[176]	120	(45)
2012	1,359	(86)	28	(0)	[81]	200	(4)
2013		(190)	158	(4)	[81]	60	(2)
2014		(270)	157	(0)	[38]	428	(0)
2015		(161)	479	(25)	[25]	159	(0)

Source: Joe Hymer, WDFW data 2016.
* Beginning in 2010, estimates in parenthesis "( )" are NOR only; estimates in brackets "[ ]" are NORS put upstream.

Table 2.2.2.7: Fall Chinook salmon total spawner abundance estimates in LCR tributaries, 2003-2015.

Year	Elochoman River	Coweeman River	Grays River	Skamokawa Creek	Cowlitz River	Green River (Toutle)	SF Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River
2003	6,765	1,106	373	583	10,048	13,806	137	24,710	714	4,936	3,440
2004	4,781	1,503	726	2,099	4,466	4,108	603	6,612	886	535	10,404
2005	2,173	853	122	526	2,870	2,979	324	9,168	598	1,378	2,671
2006	317	566	383	7	2,944	5,551	201	10,386	427	447	2,600
2007	165	251	96	3	1,847	1,053	96	3,296	237	285	1,528
2008	841	424	95 (33)	479	1,828	1,527	198	3,734	379	381	2,491
2009	1,464	783	555 (210)	3	2,602	410	129	7,546	596	1,376	2,741
2010	788 (119)	639 (446)	156 (70)	530 (35)	4,488 (3,169)	1,712 (184)	427 (91)	7,057 (832)	426 (378)	1,506 (866)	6,087 (833)
2011	635 (30)	566 (500)	405 (70)	492 (29)	3,685 (2,782)	1,204 (177)	404 (161)	8,869 (599)	870 (827)	1,084 (627)	4,725 (842)
2012	141 (55)	463 (412)	205 (43)	96 (9)	2,725 (1,946)	686 (193)	276 (66)	8,948 (517)	634 (601)	1,134 (646)	1,101 (305)
2013	353 (126)	2,035 (1,398)	2,033 (189)	284 (61)	4,436 (3,593)	1,686 (610)	597 (340)	12,061 (1,037)	1,540 (1,441)	4,867 (4,002)	7,185 (3,018)
2014	189 (169)	890 (857)	729 (322)	680 (23)	4,500 (2,970)	372 (250)	373 (121)	11,537 (1,029)	942 (856)	3,590 (1,724)	2,038 (1,362)
2015	264 (253)	1,449 (1,430)	1,026 (156)	714 (60)	6,061 (4,182)	437 (355)	282 (85)	7,241 (3,598)	1,041 (947)	NA	3,990 (1,703)

Source: WDFW SCoRE 2016.

Note: Estimates of total adult and jack fall Chinook. May include fish put upstream of hatchery weirs.
NORs indicated in parenthesis "( )".
NA = final estimate not complete.

Table 2.2.2.8: Wild winter steelhead escapement estimates for select SW Washington and LCR DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Grays River	Elochoman/ Skamokawa	Mill/ Abernathy/ Germany	Coweeman	SF Toutle	NF Toutle/ Green	Kalama	EF Lewis	Washougal
WDFW Escapement Goal	**1,486**	**853**	**508**	**1,064**	**1,058**	**NA**	**1,000**	**1,243**	**520**
LCSRP Abundance Target	**800**	**600**	**500**	**500**	**600**	**600**	**600**	**500**	**350**
2003	1,200	668	342	460	1,510	----	1,815	532	764
2004	1,132	768	446	722	1,212	----	2,400	1,298	1,114
2005	396	376	274	370	520	388	1,856	246	320
2006	718	632	398	372	656	892	1,724	458	524
2007	724	490	376	384	548	565	1,050	448	632
2008	764	666	528	722	412	650	776	548	732
2009	568	222	396	602	498	699	1,044	688	418
2010	422	534	398	528	274	508	961	336	232
2011	318	442	270	408	210	416	622	308	204
2012	488	378	184	256	378	473	1,061	272	306
2013	834	784	402	622	972	553	811	488	678
2014	386	502	310	496	708	587	948	414	388
2015	950	1,244	666	940	1,340	1,540	1,206	678s	648

Source: WDFW Data2016.

Table 2.2.2.9: Wild summer steelhead population estimates for LCR populations from 2001 to 2011, current WDFW escapement goals, and LCSRP abundance targets.

Location	Kalama	EF Lewis	Washougal	Wind
WDFW Escapement Goal	**1,000**	**NA**	**NA**	**1557**
LCSRP Abundance Target	**500**	**500**	**500**	**1,000**
2003	817	910	607	1,113
2004	549	425	NA	893
2005	435	673	608	600
2006	387	560	636	658
2007	361	412	681	766
2008	237	365	755	638
2009	308	800	433	605
2010	370	600	787	766
2011	534	1,036	NA	1,497
2012	646	1,084	842	815
2013	738	1,059	NA	760
2014	406	617	544	281
2015	814	843	783	577

Source: WDFW data 2016.

Table 2.2.2.10: Coho salmon total NOR spawner abundance estimates in LCR tributaries, 2010-2014.

Year	Elochoman/Skamokawa River	Coweeman River[a]	Grays /Chinook River	L. Cowlitz River	NF Toutle/Green	SF Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River	MAG	Salmon	Lower Gorge
2010	501	2,318	303	5,015	1,421	1,115	4	1,031	1,537	645	849	2133	396
2011	498	2,372	125	4,148	1048	1019	8	1,160	1,026	707	391	1,473	392
2012	284	2,049	518	2990	1,037	1,369	17	1,875	545	376	386	868	352
2013	435	2881	668	4522	2469	2130	31	1811	662	424	475	1096	636
2014	2115	3545	2158	17201	4296	7343	59	2472	1016	477	1575	2790	1157
2015	148	606	125	1576	604	906	12	212	160	70	422	474	324
2016	325	2154	454	4340	1592	2692	62	246	427	178	731	1169	950

Source: WDFW data 2018.

Table 2.2.2.11: Spawner estimates in monitored locations of hatchery- and natural-origin fall chum salmon in the Lower Columbia River.

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Crazy Johnson Creek	2,954	5,130	1,051	1,418	3,819	870	1,093	996	865	2,304	3,475	1,925	1,541
WF Grays River	5,678	6,162	6,970	1,407	1,377	1,902	793	1,130	1,814	5,996	2,817	1,857	67
Mainstem Grays River	3,081	5.377	5,696	1,379	1,510	1,227	721	750	3,701	2,509	1,717	1,352	1,375
I-205 area	3,145	2,932	2,324	923	869	576	644	1,154	2,148	4,801	2,498	1,364	1,387
Multnomah area	1,627	1,131	704	192	293	148	29	93	452	621	107	201	299
St Cloud area	2	179	115	95	160	3	1	28	126	329	1	77	79
Horsetail area	---	---	114	12	65	25	32	6	52	112	78	55	71
Ives area	4,100	767	331	255	427	105	262	138	159	79	160	110	299
Duncan Creek[a]	13	16	2	7	42	9	2	26	48	85	4	27	24
Duncan Creek Channel[b]	65	54	68	39	31	30	40	25	26	70	46	61	72
Hardy Creek	343	413	52	74	109	12	3	46	175	157	75		108
Hamilton Creek	1,000	435	497	178	251	133	118	142	404	542	352	255	261
Hamilton Spring Channel	794	386	220	88	227	47	114	94	190	325	137	392	665
Total	**22,802**	**17,610**	**18,144**	**6,067**	**9,180**	**5087**	**3,852**	**4628**	**10160**	**17,930**	**11,467**	**7,676**	**6,248**

Source: SaSI data 2016. Spawner estimates are based on Jolly-Seber mark recapture, unless otherwise noted.

[a] Adults that volitionally returned to Duncan Creek. Either captured in the adult trap just upstream from the creeks mouth, found/observed during spawning ground surveys in years when no adult trap was operated, or captured using beach seines in the creek Does not include broodstock translocated to the spawning channel from staging/spawning locations outside of Duncan Creek.

[b] Adults that were captured at nearby staging/spawning locations outside of Duncan Creek and transferred to the Duncan Creek spawning channel.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known. See MA BIOP for recent pHOS estimates

The proportion of hatchery-origin spawners (pHOS) should be less than 30% of the naturally spawning population per HSRG guidelines (2009). See also HGMP section 11.1.1 for planned M&E.

Potential hatchery-origin strays from this program into adjacent basins (Grays/Elochoman) are reduced by the use of monitoring weirs (NOAA Section 10(a) Scientific Research Permit #16578) that are in place and operating during the fall Chinook and coho return to trap and remove identified (marked) hatchery fish from the systems.

2.2.3 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.

- 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.

Broodstock Program:

Broodstock Collection: The goal for the on-station release is to use 100% WxW fish. Type N coho begin entering the Elochoman River system in late-September. Spawning peaks in November and December. Coho are intercepted at the Elochoman weir and transported to Beaver Creek Hatchery or volitionally enter the ladder and holding pond at the hatchery. No more than 30% of the natural-origin run will be used as broodstock. Unmarked fish not used for integration needs will be released upstream of the hatchery.

The program plans to fully transition to Beaver Creek Hatchery by 2022. During years of low abundance, it may be necessary to collect broodstock at the Elochoman weir or at Grays River Hatchery to achieve smolt release goals.

Any listed Chinook that would enter the pond during this time are monitored and released upstream of this point. “Take: tables will be submitted to NMFS in a separate format and cover all Mitchell Act programs.

Genetic introgression: Broodstock for this program will be initiated from local coho salmon. Egg-takes will be representative of adult arriving throughout the run and the current collection protocol preserves the range timing of the historical coho stock in the system. Most natural spawners in the system are composites and representative of the lower Columbia coho (SaSI 2002). There are no known genotypic, phenotypic, or behavioral differences between either the hatchery stock or natural stock in the sub-basin. Indirect take from genetic introgression is unknown.

Rearing Program:

Operation of Hatchery Facilities: Facility operation impacts include water withdrawal, effluent, and intake compliance. Effluent at outfall areas is rapidly diluted with mainstem flows and operation is within permitted NPDES guidelines (see HGMP sections 4.1 and 4.2). Indirect take from this operation is unknown.

Disease: Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the hatchery programs. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*-Chapter 5 (IHOT 1995) have been instrumental in reducing disease outbreaks. Although pathogens occur in the wild and fish might be affected, they are believed to go undetected with predation quickly removing those fish.

In addition, although pathogens may cause post release mortality in fish from hatcheries, there is little evidence that hatchery origin fish routinely infect natural populations of salmon and steelhead

in the Pacific Northwest (Enhancement Planning Team 1986 and Steward and Bjornn 1990). Prior to release, the hatchery population health and condition is established by the Area Fish Health Specialist. This is commonly done one to three weeks pre-release, and up to six weeks on systems with pathogen-free water and little or no history of disease. Indirect take from disease is unknown.

Release:

Hatchery Production/Density-Dependent Effects: Hatcheries can release numbers of fish that can exceed the density of the natural productivity in a limited area for a short period of time and can compete with listed fish. Fish are released as active smolts that will emigrate in order to minimize the effect of the release. Indirect take from density dependent effects is unknown.

Potential Elochoman hatchery coho predation and competition effects on listed salmonids and eulachon: The proposed annual production goal for this program is about 225,000 yearlings for the on-station integrated program and up to 700,000 yearlings for off-station segregated programs. Coho are released at 15 fpp (146 mm fl). Due to size differences between coho smolts and fingerling listed stocks, competition is unlikely with different prey items and habitat preferences.

Table 2.2.3.1: Peak migration timing and average fork length (mm) of out-migrant juvenile Chinook, coho and steelhead captured in rotary screw traps on Mill, Germany and Abernathy creek, Lower Columbia River, 2008.

Stream	Chinook		Coho		Steelhead	
	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration	Avg Size (mm)	Peak Migration
Mill Cr	37.0	Mar 10-Apr 13	104.2	Mar 17-23	154.5	Apr 28-May 4
Germany Cr	39.8	Mar 17-23	115.3	May 19-25	177.8	May 12-18
Abernathy Cr	37.9	Mar 31 – Apr 6	112.1	May 19-25	163.8	May 12-18

Source: Kinsel et al 2009.

Both juvenile and adult salmonids have been documented to feed on eulachon (Gustafson et al. 2010). Predation of eulachon by coho reared in this program may occur, however it is unknown to what degree such predation may occur.

Salmon and steelhead smolts have been known to prey on smaller fingerling or fry-sized fish. Hatchery practices are designed to rear and release a highly migratory smolt that leaves the system quickly. Smolts that do not migrate and residualize are of bigger concern.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, volitional release strategies, size, and time guidelines.

- Condition factors, standard deviation and co-efficient of variation (CV) are measured throughout the rearing cycle and at release.
- Feeding rates and regimes throughout the rearing cycle are programmed to satiation feeding to minimize out-of-size fish and programmed to produce smolt size fish at date of release.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimation ponds.
- Releases from these ponds are volitional with large proportions of the populations moving out initially with the remainder of the population vacating within days or a few weeks.

Monitoring:

Associated monitoring Activities: WDFW has implemented an expanded monitoring program for Chinook, coho, chum and steelhead populations in the Lower Columbia River (LCR) region of Southwest Washington (WDFW's Region 5) and fishery monitoring in the lower mainstem of the Columbia River. The focus of this expanded monitoring is to 1) gather data on Viable Salmonid Population (VSP) parameters – spawner abundance, including proportion of hatchery-origin

spawners (pHOS), spatial distribution, diversity, and productivity, 2) to increase the coded wire tag (CWT) recovery rate from spawning grounds to meet regional standards, and 3) to evaluate the use of PIT tags to develop harvest rates for salmon and steelhead populations. Additionally, key watersheds are monitored for juvenile salmonid out-migrant abundance. Coupled with adult abundance information, these data sets allow for evaluation of freshwater productivity and development of biological reference points, such as seeding capacity. Monitoring protocols and analysis methods utilized are intended to produce unbiased estimates with measurements of precision in an effort to meet NOAA monitoring guidelines (Crawford and Rumsey 2009).

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

New program, take data not available.

- 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).

"Take" tables will be submitted to NMFS in a separate format and cover all Mitchell Act programs. Take tables for all species except NOR coho for broodstock are included in the MA BIOP. Take for NOR coho for broodstock is described in this document, and not to exceed 30% of the NOR population.

- 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 situations are expected to occur where take would exceed ESA limits. If significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist, Fish Health Specialist or Area Habitat Biologist who, along with the Hatchery Complex Manager, would determine an appropriate plan and consult with NOAA-NMFS for adaptive management review and protocols.

Handling and release of wild coho in broodstock trapping operations is monitored and take observations have been rare. Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance.

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.

WDFW has several policies/plans that help inform management decisions regarding the HGMPs currently under review. These policies include:

1. *Hatchery and Fishery Reform Policy* (Commission Policy C3619)
2. *Lower Columbia Conservation and Sustainable Fisheries Plan*
3. *NMFS Lower Columbia River Plan*
4. Mitchell Act
5. Mitchell Act Biological Opinion (MA BIOP)

Descriptions of these policies and excerpts are shown below:

Policies/Plans – Key Excerpts

Hatchery and Fishery Reform Policy: Washington Department of Fish and Wildlife Commission Policy C-3619. WDFW adopted the Hatchery and Fishery Reform Policy C-3619 in 2009. Its purpose is to advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. WDFW Policy C-3619 works to promote the conservation and recovery of wild salmon and steelhead and provide fishery-related benefits by establishing clear goals for each state hatchery, conducting scientifically defensible-operations, and using informed decision making to improve management. It is recognized that many state operated hatcheries are subject to provisions under *U.S. v Washington* (1974) and *U.S. v Oregon* and that hatchery reform actions must be done in close coordination with tribal co-managers. Washington Fish and Wildlife Commission Policy: POL-C3619.

Guidelines from the policy include:

1. Use the principles, standards, and recommendations of the Hatchery Scientific Review Group (HSRG) to guide the management of hatcheries operated by the Department.
2. Develop watershed-specific action plans that systematically implement hatchery reform as part of a comprehensive, integrated (All-H) strategy for meeting conservation and harvest goals at the watershed and Evolutionarily Significant Unit (ESU)/Distinct Population Segment (DPS) levels. Action Plans will include development of stock (watershed) specific population designations and application of HSRG broodstock management standards.

Lower Columbia Conservation and Sustainable Fisheries Plan (*CSFP*)*:* The CSFP was developed to meet WDFW's responsibilities outlined in the *NMFS Lower Columbia Salmon Recovery Plan* and address the HSRG suggested solutions and achieve HRSG standards for primary, contributing and stabilizing populations. The plan was adopted in partnership with the Lower Columbia Fish Recovery Board. The plan describes the implementation of changes to hatchery and harvest programs and how they assist in recovery and achieve HSRG guidelines. The draft plan also identifies Viable Salmonid Population (VSP) parameters that will be addressed and includes a strong adaptive management approach that will be used to evaluate and modify programs as needed to achieve conservation goals.

NMFS Lower Columbia River Recovery Plan (2013): NMFS developed a recovery plan which sets goals and actions that, if implemented, would reverse the decline of salmon and steelhead in the Lower Columbia River ESUs. Based on the guidance of the Willamette-Lower Columbia Technical Recovery Team (TRT), the plan sets minimum viability thresholds required to allow for delisting, and recovery actions partly based on information from the *Washington Lower Columbia River and Fish & Wildlife Subbasin Plan* (2010), developed by the Lower Columbia Fish Recovery Board (LCFRB). Recovery actions would be voluntarily implemented by federal and state agencies, local jurisdictions and tribal governments, as well as local citizens and organizations.

Mitchell Act: This program receives Mitchell Act Funding. Initially passed in 1938, the Mitchell Act is intended to help rebuild and conserve the fish runs, and mitigate the impacts to fish from water diversions, dams on the mainstem of the Columbia River, pollution and logging. The Mitchell Act specifically directs establishment of salmon hatcheries, conduct of engineering and biological surveys and experiments, and installing fish protective devices. It also authorizes agreements with State fishery agencies and construction of facilities on State-owned lands. NMFS has administered the program as of 1970. There are 15 Mitchell Act hatcheries in Washington State; the majority of which are below Bonneville Dam.

The Mitchell Act programs are intended to support Northwest fishing economies – particularly coastal and Native American -- that have relied on Columbia River production both before and

after dam construction. Catches of hatchery fish sustain the economies of local communities while keeping incidental mortalities of ESA-Listed fish at approved levels. Value of hatchery production and benefit to local economies will be further increased by implementing fisheries that increase harvest of hatchery produced fish, as expected through implementation of the LCSRP.

Mitchell Act BIOP: The MA BIOP includes protocols for managing Mitchell Act hatchery programs in the Columbia River basin.

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

Future Brood Document. Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document, a pre-season planning document for fish hatchery production in Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30).

See also HGMP section 3.1.

3.3 Relationship to harvest objectives.

Total annual harvest is dependent on management response to annual abundance in *Pacific Salmon Commission* (PSC - U.S./Canada), *Pacific Fishery Management Council* (PFMC - U.S. ocean), and *Columbia River Compact* forums. NMFS issued a Biological Opinion for mainstem Columbia River fisheries through a Section 7 consultation under the 2018–2027 *U.S. v Oregon* Management Agreement (2018–2027 MA). All fisheries are reviewed annually through the North of Falcon and PFMC processes. The *U.S. v Oregon* Technical Advisory Committee (TAC) has prepared Biological Assessments (BAs) for combined fisheries based on relevant *U.S. v Oregon* management plans and agreements. The current BA concerns Columbia River treaty Indian and non-Indian fisheries, as described in the "2018–2027 *U.S. v Oregon* Management Agreement (2018–2027 MA).

3.3.1 WDFW has submitted a *Fisheries Management and Evaluation Plan* (FMEP) for tributary fisheries and has received a permit from NMFS for those fisheries. WDFW will be updating the FMEP for lower Columbia River tributary fisheries within the next few years to include changes to fall Chinook, coho, and steelhead fisheries. The current harvest matrices for fall Chinook and coho that are included in the Biological Opinion for the Columbia River and ocean fisheries do not include impacts to ESA-listed stocks in the tributaries. Tributary impacts would be small (primarily mark-selective fisheries), but would be additive to the Columbia River/ocean harvest matrices. Because Columbia River and ocean fisheries are managed conservatively (i.e. not to exceed ESA-limits), tributary fisheries would fall within the harvest matrices in many years.

Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Hatchery coho can contribute significantly to the lower Columbia River commercial fishery; commercial harvest of early coho is constrained by fall Chinook management; commercial harvest of late coho is focused in October during the peak abundance of hatchery late coho. A substantial estuary sport fishery exists between Buoy 10 and the Astoria-Megler Bridge; majority of the catch is early hatchery coho, but late hatchery coho harvest can also be substantial.

The previous Elochoman River Type-N program was terminated in 2008, with the last release 2009 (2007 brood). Past harvest data for the Type-N program is available (**Table 3.3.1.1**). Based on an average past SAR of 0.67% (**Table 3.3.1.1**), and a programmed release goal of up to 225,000 yearlings, the estimated production for the new Type-N program should average of 1,508 adults. Based on a SAR (2.00%) using recent year average SARs (2007-2011 brood years) from the Grays integrated program, the estimated production goal would be 4,500 adults. See also Deep River Net Pens coho HGMPs.

Table 3.3.1.1: Elochoman River Type-N (late fall) coho fishery contributions.

Brood Years: 2001-2007 Fishery Years: 2004-2010		
	Average SAR%[a]	**0.67**
Agency	**Non-WA Fishery**	***% of total Survival***
CDFO	All	*1.75*
Agency	**OR Fishery**	***% of total Survival***
ODFW	10- Ocean Troll	*2.65*
ODFW	21- Columbia R. Gillnet	*25.37*
ODFW	40- Ocean Sport	*14.56*
ODFW	45- Estuarine Sport-(buoy 10)	*1.17*
ODFW	50- Hatchery Escapement	*0.10*
ODFW	72- Juvenile Sampling - Seine (Marine)	*0.09*
Agency	**WA Fishery**	***% of total Survival***
WDFW	10- Ocean Troll	*0.50*
WDFW	15- Treaty Troll	*1.54*
WDFW	22- Coastal Gillnet	*0.36*
WDFW	23- PS Net	*0.32*
WDFW	40- Ocean Sport	*0.67*
WDFW	41- Ocean Sport- Charter	*6.44*
WDFW	42- Ocean Sport- Private	*11.18*
WDFW	45- Estuarine Sport	*0.50*
WDFW	46- Freshwater Sport[b]	*3.34*
WDFW	50- Hatchery Escapement	*29.47*
	Total	*100.00*

Source: RMIS 2016.

[a] Average SAR% = (tags recovered/tags released).

[b] Freshwater Sport based on WDFW Catch Record Card (CRC) data.

WDFW has been researching alternative gear (purse and beach seines) for several years, the new *Columbia River Basin Salmon Management Policy* (C-3620) calls for implementation of alternative gear in the Lower Columbia River. Seines may be used in the future for commercial harvest and can be used as an effective tool to harvest surplus hatchery fish.

A new coho harvest matrix was adopted by NMFS for marine and freshwater fisheries. This matrix establishes new harvest rate limits for ESA-listed Lower Columbia natural coho that provides modest increases in fisheries opportunity. This action was based on new information on coho status, and maintains a minimal level of risk to the conservation recovery of this species (PFMC 2014).

Relationship to habitat protection and recovery strategies.

The following processes have included habitat identification problems, priority fixes and evolved as key components to *the Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans* (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, LCFRB 2010) and the *Lower Columbia River Salmon and Steelhead ESA Recovery Plan* (Dornbusch and Sihler 2013).

Sub-Basin Planning - The current HGMP processes are designed to deal with existing hatchery programs and potential reforms to those programs. A regional sub-basin planning process (Draft Grays River and Elochoman River Sub-basin summaries May 17, 2002 and May 2004) are broad-scale initiatives that will provide building blocks of recovery plans by the Lower Columbia Fish Recovery Board (LCFRB) for listed fish and may well use HGMP alternative ideas on how to

utilize hatchery programs to achieve objectives and harvest goals. In order to assess, identify and implement restoration, protection and recovery strategies, Region 5 staff is involved in fish and wildlife planning and technical assistance in concert through the LCFRB including the role of fish release programs originating from Grays River Hatchery. The Lower Columbia fish Recovery Board (LCFRB) has adopted The *Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans* (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004, June 17, 2014) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection – The LCSRP will be utilized to assess current and historic habitat status for lower Columbia sub-basins. *Ecosystem Diagnosis and Treatment* (EDT) results have been used in the recovery plan to assist in identifying priority habitat location, limiting factors and restoration/preservation needs. EDT compares current habitat to that of the basin in a historically unmodified state. WDFW is also conducting a *Salmon Steelhead Habitat Inventory Assessment Program* (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA) - A WRIA 25 LFA was conducted by the Washington State Conservation Commission (January 2002). The Grays River suffers from severe habitat degradation (siltation, poor water quality). This is the result of widespread ongoing logging in the watershed. Freshwater and estuarine ecosystems have been degraded by past and present human activities that have reduced the habitat quality, quantity, and complexity. The primary land use activities responsible for these include: road building, timber harvesting, agriculture, and rural development. These upslope and riparian activities have increased sediment, altered woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

3.4 Ecological interactions.

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* Out-migrant hatchery fish can be preyed upon through the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays, as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons in the Columbia mainstem sloughs, can prey on coho smolts. Mammals that can take a heavy toll on migrating smolts and returning adults include: harbor seals, sea lions, river otters and orcas

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. In addition the program may have unknown impacts on eulachon populations in the basin.

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Multiple programs including fall Chinook, coho and steelhead programs are released from the

Grays River Hatchery and limited natural production of Chinook, coho, chum and steelhead occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.).

(4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* Coho smolts can be preyed upon release thru the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs can prey on coho smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that benefit from migrating smolts and returning adults include: harbor seals, sea lions, river otters and orcas. Except for yearling coho and steelhead, these species may serve as prey items during the emigration through the basin. Hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish and may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Hatchery releases can also behaviorally encourage mass emigration of multiple species through the watershed, reducing residency. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including:

a) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998);
b) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and
c) Juvenile salmonids have been observed to feed directly on carcasses (Bilby et al. 1996).

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.

Table 4.1.1: Water sources for the Beaver Creek Hatchery.

Water Source	Water Right		Available Water Flow	Avg Water Temp. (F°)[a]	Usage	Limitations[b]
	Record/Cert. No.	Permit No.				
Wells (2)	G2-*04790C WRIS/ 03349	04774	1650 gpm	51-54F	Fish rearing (1 cfs)	Fish rearing water table will drop to under ½ cfs during late spring-summer.
Beaver Creek (surface) gravity intake	S2-13719CWRIS/ 07419	10643	20 cfs (8900 gpm)	34 - 68F	Acclimation	High water temps from mid-July to September, low flows from mid-June to Sept., summertime pathogens, *Trichodina*, *Costia*, furunculosis, *Ich*, columnaris and botulism.
Elochoman River (surface)	S2-CV2P855/ 07418	10642	10 cfs (4500 gpm)	34 - 68F	Broodstocking, rearing, acclimation	
	S2-*18801C WRIS/ 09453	13766	2 cfs		Not used since January 1999	None

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW hatchery data.

Beaver Creek Hatchery. Beaver Creek Hatchery uses Beaver Creek gravity flow surface water, provided by a creek intake station and diversion dam, located on Beaver Creek approximately 0.5 miles upstream from the main hatchery complex. The Elochoman River is used in the summer and fall, while Beaver Creek water is used from mid-November through mid-May. Beaver Creek or filtered well water is used to incubate eggs, and for early-rearing (IHOT 1998). Well water is from two sources: one is used for fish rearing at 1 cfs; the other is for domestic use only.

The water rights permit for the Beaver Creek Hatchery were formalized through the Washington Department of Ecology in 1955 and 1957 (**Table 4.1.1**). Beaver Creek Hatchery has an additional claim (S2-*18801CWRIS) from the Elochoman River for 2 cfs, however, this has not been used since January 1999 (Mark Johnson, pers. comm. 2012).

Wahkiakum FFA – Birnie Creek rearing channel. The natural feature constructed rearing channel used to rear fish is constructed in a wide spot in Birnie Creek. A dam at the end of the channel controls pond level and release structures. All available water flow of approximately 2 cfs gravity flows through the pond. Habitat improvement upstream include log weir grades and riparian zone restoration.

Peterson Coho Project. Water for this project is supplied from a gravity fed holding tank used for non-potable water from the nearby creek. Creek water is collected for this tank through an upstream intake on the landowner's property.

Deep River Net Pens. See Deep River Net Pens Coho HGMPs.

NPDES Permits:
Beaver Creek Hatchery 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 Department of Ecology (DOE).

Discharges from the cleaning treatment system are monitored as follows:

- *Total Suspended Solids* (*TSS*) 1 to 2 times per month on composite effluent, maximum effluent and influent samples.
- *Settleable Solids* (*SS*) 1 to 2 times per week on effluent and influent samples.
- *In-hatchery Water Temperature* - daily maximum and minimum readings.

Table 4.1.2: Record of NPDES permit compliance.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
Beaver Creek WAG13-1027	Y	Y	Y	10/11/2011	5	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2016.

Table 4.1.1.3: List of NPDES violations at Beaver Creek Hatchery over the last five years (2012-2016).

Month/ Year	Parameter	Sample Type	Result/ Violation	Permit Limit	Comment	Action
Apr 2012	TSS	Drawdown	137.4 mg/L	100.0 mg/L	Sample taken late at end of drawdown. And sediments in pond from years of flooding.	Explanation to personnel to correct procedures
Nov 2014	TSS	Avg Net Composite	Failure to Sample	NA	1,722 lbs of fish and 484 lbs of feed	Explanation to personnel to correct procedures
	TSS	Max Net Grab		NA		
Dec 2014	TSS	Avg Net Composite		NA	1,722 lbs of fish and 484 lbs of feed	
	TSS	Max Net Grab		NA		

Source: Ann West, Hatcheries Headquarters Database 2016.
Note: These violations did not result in non-compliance with NPDES permit.

Wahkiakum FFA and Peterson Coho Project. This is a short-term rearing acclimation pond. Feeding and production stays under NPDES guidelines for permitting. The pond and hatchery facilities meet guidelines which do not require the (NPDES) general permit (>20,000 lbs total on site production and > 5,000 lbs of fish feed per month).

Deep River Net Pens. See Deep River Net Pens Coho HGMPs.

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.

Beaver Creek Hatchery. The intake screens are in compliance with state and federal guidelines current Anadromous Salmonid Passage Facility Design criteria (NOAA-NMFS 2011). WDFW secured funding in 2012 for scoping, design, and construction work of a new creek intake system to meet NOAA-NMFS compliance (Mitchell Act Intake and Fish Passage Study Report 2003). The new intake was completed in fall 2012. WDFW has also received funding in the Capital Budget for the 2013-2015 biennium to upgrade Beaver Creek Hatchery's Elochoman River intake to meet current NMFS and WDFW standards. Work in expected to be completed by 2019.

Fish rearing activities meet State water quality guidelines and satisfy all required permits-Washington Department of Ecology #1995-SW-00373.

- Pond screens are used in the raceways Beaver Creek Hatchery to hold fish captive until release.

- Program fish are confined in structures until an active smolting phase and time is achieved.
- Discharge effluents are under NPDES permit guidelines for monthly feed limits and total program production.

Wahkiakum FFA – Birnie Creek rearing channel. No actual withdrawal of water needed (in-stream rearing site). Birnie Creek is a steep-gradient, fast-moving stream where it enters the upper end of the pond, and terminates ¼ mile upstream at an impassable waterfall; juveniles do not migrate out the upper end.

SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

Broodstock will initially be collected from volitional hatchery returns to Grays River Hatchery during the transition period (brood years 2019-2021) and from returns to Beaver Creek Hatchery beginning in 2019 (see Grays River Type-N Coho HGMP).

Lower Elochoman Weir. Starting in 2019, broodstock will be collected from the mainstem Elochoman River via the trap located near Foster Road (RM 2.73). The lower river weir has been operated since fall 2009. Originally a fixed-panel weir, the structure was transitioned to a resistance board weir (RBW) in 2013. The resistance board weir was installed on the permanent concrete sill with adjoining live box (**Figures 5.1.1 and 5.1.2**); weir panels are built with 1.5-inch spacing. The site is located just above Foster Road, near the head of tidal fluctuation at RM 2.73. For several decades, this site was used to trap broodstock for the WDFW Elochoman Salmon Hatchery fall Chinook program. After closure of the Elochoman Hatchery in 2008, responsibility for operation of the weir transferred to WDFW Region 5 Fish Management.

The weir is installed in early-August, and operates through late-October, depending on flow levels and fish recruitment. Plans to potentially operate the weir later through the coho and chum migration seasons depends on available funding to make the structural changes and extend the staffing levels that would be required to successfully fish the higher flows prevalent in November and December. Fish selected for brood purposes will be transported to Beaver Creek Hatchery. The trap will be checked daily, or more often (as needed), during peak returns. Hatchery-origin fish beyond broodstocking needs will be lethally removed to help meet basin pHOS goals.

Figure 5.1.1: Overview of the Lower Elochoman River resistance board weir (RBW), located near the Foster Road Bridge, RM 2.73 (Source: WDFW).

Figure 5.1.2: Lower Elochoman River adult weir configuration in 2016, located near the Foster Road Bridge. (Source: Patrick Hulett, WDFW.)

Beaver Creek Hatchery. The trap at Beaver Creek Hatchery is operated from September to February. Adult returns to the hatchery negotiate a five-step ladder to a "V"-trap, into a small holding area. During peak trapping, fish pass through the holding area to the main collection channel. Fish are sorted by a crowder weekly, or more often (as needed) during peak return.

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

Grays River Hatchery. During the transition period (brood year 2019-2021) gametes will be collected from volitional adult returns to Grays River Hatchery, if needed, and transported to Beaver Creek Hatchery for spawning. Fish will be collected in the Elochoman River at Beaver Creek Hatchery and at the weir beginning in 2019.

Table 5.2.1: Transportation equipment available at Beaver Creek Hatchery.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Truck with Tank	1100	Y	N	45	None	NA
Truck With Tank	1100	Y	N	45	None	NA
Flatbed truck w/ tank	500	Y	N	n/a	None	NA

Beaver Creek Hatchery. Adults collected at Beaver Creek Hatchery are not transported.

Foster River Trap. Adults collected at the RBW are transported from collection site to Beaver Creek Hatchery via truck (**Table 5.2.1**).

Wahkiakum FFA. Yearlings (20 fpp) are transported from Beaver Creek Hatchery to the Birnie Creek rearing channel via 1000 gallon tanker truck. Transit time is around 30 minutes.

5.3 Broodstock holding and spawning facilities.

Table 5.3.1: Adult holding/spawning facilities available at Beaver Creek Hatchery.

Ponds (No.)	Pond Type	Volume (cu-ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
H-1	Cement Pond (Adult Holding or Fish Acclimation Unit)	7,200	120	80	5	3,000
H-2	Cement Pond (Adult Holding or Fish Acclimation Unit)	7,200	120	80	5	3,000

Beaver Creek Hatchery. The broodstock will be held in one of two 12'x 120'x 5' (7,200 cu-ft.) cement ponds. When creek water is utilized, the pond has the capability of up to 3,000 gallons per minute of reuse flow depending on current weather trends. If the pond is supplied by river pumps, a consistent 3,000 gallons per minute can be achieved. When broodstock is established, spawning will take place under a covered portable structure on the adjacent asphalt deck surrounding the pond. During times of excessive adult returns, holding pond #2 can be utilized.

5.4 Incubation facilities.

Table 5.4.1: Incubation containers at Beaver Creek Hatchery 1/.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Loading-Hatching (eggs/unit)
Heath Vertical Stacked Tray Units	1	3-5	NA				8000-1000
Shallow Troughs	10	6-8	8.7	15.0	0.6	1.0	20,000-120,000

1/ Incubation capacity will be expaned once Grays River Hatchery closes and programs are transitioned to Beaver Creek.

Beaver Creek Hatchery. Eggs are hatched in a Heath-style stacked tray incubators.

Wahkiakum FFA. Students assist with spawning the broodstock at Beaver Creek Hatchery. Eggs are incubated in Heath trays, and then transferred into shallow troughs, where they remain until ponding.

Table 5.4.2: Incubation vessels available at Peterson Coho Project site.

Type	Number	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Loading (eggs/unit)
Vertical Stack Tray Units (8 trays each)	1 half stacks (8 trays)	10.7	2.0	2.1	2.7	3-5	49,000-70,000

Peterson Coho Project. Eyed-eggs are transferred from Beaver Creek Hatchery to the rearing site near Knappton, and are incubated in vertical half stack trays.

5.5 Rearing facilities.

Table 5.5.1: Rearing ponds available at Beaver Creek Hatchery.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
20	Concrete Raceways	2,400	10	80	3	250	4 lbs/ gpm	0.42 lbs/ cuft
10	Concrete intermediate Raceways	135	3	15	3	160	NA	NA
2	Concrete holding/rearing ponds	7,200	12	120	5	2,000	NA	NA
1	Earthen Pond (1.1 acres)	225,000	450	100	5	4,000	NA	NA

Beaver Creek Hatchery. On-station releases will be ponded in shallow troughs, then moved to an intermediate raceway. They are transferred into standard concreted raceways for rearing in March, where they remain until release.

Wahkiakum FFA. Fry are ponded at Beaver Creek Hatchery into an intermediate raceway, where they remain until they are mass-marked (adipose fin-clip) in May/June. Sub-yearlings are then moved to a standard raceway, until transfer to Birnie Creek rearing channel.

Peterson Coho Project. Rearing takes place in a 96 cu. ft. intermediate rearing trough donated by WDFW.

Deep River Net Pens. After incubation and initial rearing, Deep River Net Pen program coho may be transferred to North Toutle, Washougal or Kalama Falls hatcheries, prior to transfer to the Deep River net pens for final rearing/acclimation (see Deep River Net Pens coho HGMPs).

5.6 Acclimation/release facilities.

Beaver Creek Hatchery. See **Table 5.5.1.** Fish will be reared a raceway on Elochoman River/Beaver Creek water while at the hatchery.

Table 5.6.1: Birnie Creek rearing channel.

Ponds (No.)	Pond Type	Volume (cu. ft.)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
1	Earthen pond/pool	24,000	200	20	6.0	800-1000	-----	0.3

Wahkiakum FFA. The natural-feature earthen pond constructed by WDFW in a wide spot in Birnie Creek (in-stream rearing). A channelized section in the upper portion of the pond can be screened, but the stream gradient is swift and steep enough that juveniles do not leave the pond. A dam at the

lower end of the pond controls pond level and release structures. During the acclimation period, the top of the fish ladder can be screened off to prevent any early releases.

Peterson Coho Project. Fish are force-released after dark from the rearing trough directly into the creek used for the project's water supply. Release site in the creek is approx. 250-yds upstream from its confluence with the Columbia River.

Deep River Net Pens. See Deep River Net Pens coho HGMPs.

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

Beaver Creek Hatchery. Flooding and associated debris and sediments have chronically affected fish production programs at this facility. Current hatchery practices and production changes have helped to alleviate these issues to a more manageable level. Flood events can lead to inundation of the river intake with flood waters. Fish stocks are generally managed away from this water source during likely times that flooding would occur.

Wahkiakum FFA. The Birnie Creek rearing channel is a natural pond, which has not suffered significant mortality, but natural predation occurs.

Peterson Coho Project. The site has some potential intake issues during extremely low water due to freezing events

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.

Beaver Creek Hatchery. A prolonged loss of hatchery water supply would result in catastrophic loss of all rearing units, with incubation and the raceways being most vulnerable. Under a temporary cessation of the surface water supply, water can be re-directed from other supply sources as first pass or re-use to the units. Hatchery is staffed 24/7 and ready to react to system failure and WDFW has emergency procedures and plans in place. All systems are alarmed to alert us of failure.

IHOT fish health guidelines are followed. WDFW fish health specialists conduct inspections monthly and problems are managed promptly to limit mortality and reduce possible disease transmission. In the event of possible virus outbreak, WDFW facilities follow very strict disinfection procedures and comprehensive lab analysis of all egg-takes for culling, if needed.

Wahkiakum FFA-Birnie Creek rearing channel. High school/FFA staff communicates with WDFW Hatcheries staff on operational, fish health, or fish culture needs.

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.

Type-N (late-returning) NOR and HOR coho adults returning to the Elochoman River.

Integrated program. The on-station integrated program will be initiated with the 2019 brood, with the goal developing a broodstock using 100% NOR returns to the Elochoman River. In years of low abundance integration rate may be reduced to less than 100% to ensure adequate natural escapement to the Elochoman basin. Grays River broodstock may be used to supplement the programs. The broodstock will be managed with a goal of pNOB at least twice the value of pHOS to ensure that the proper PNI level is achieved.

Segregated program. Beginning in 2019, broodstock for the segregated off station program will use first generation (F1) returns from the integrated on station program at Beaver Creek Hatchery. In years for low abundance returns to Grays River Hatchery may be used to achieve smolt release goal.

6.2 Supporting information.

6.2.1 History.

Beaver Creek Hatchery. Elochoman Type-N coho are from a group of mixed-origin Lower Columbia River coho salmon (**Table 6.2.1**), characterized by a later-run time (late-October to December), but most recently were from the Grays River Hatchery late coho program. Records indicate coho from the Cowlitz River Hatchery were transferred to other facilities including Lewis and Elochoman hatcheries. The Elochoman Hatchery Type-N coho program was discontinued when WDFW closed the facility in 2009.

Table 6.2.1: Elochoman Type-N coho hatchery stock origin.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
N.F. Lewis River Type N Coho (Lewis River Hatchery)	H	1992	1998
Elochoman River Type N Coho	H	1991	2009

Wahkiakum FFA. The original Wahkiakum High School FFA program released coho from Birnie Creek rearing channel from 1999-2009, using Elochoman Hatchery Type-N coho. This is a group of mixed-origin coho salmon from the Lower Columbia River. It is characterized by a later run time (late October to December). In 2015, the program was reinstated using integrated-program Type-N coho from Grays River Hatchery.

Peterson Coho Project. This project was initiated with the goal of planting more Grays River chum in Lower Columbia tributaries. As a trial run, Type-N Coho from Grays River were shipped to this project as eyed eggs in 2010. This project, utilizing Type-N coho is on-going, although in the future, this stock will be replaced with wild chum.

Deep River Net Pens. Deep River Net Pen SAFE program (BPA-funded) coho was initiated with stock from North Toutle Hatchery (1993-1995). From 1995 through 2010, coho was primarily supplied from Grays River Type-S coho stock. The Grays River Type-S coho on-station program was discontinued in 2008, although the facility continued to provide Type-S coho for the SAFE program through brood year 2010. The program continued primarily from Toutle River Type-S coho stocks. The Mitchell Act-funded program was initiated with the 2008 brood Lewis River Type-S coho. Both programs were changed in 2016 to use Grays River Type-N hatchery coho. See also Deep River Net Pens coho HGMPs.

6.2.2 Annual size.

Integrated program. Around 100 adult pairs, not including jacks, are needed to achieve the established egg-take goal of 300,000 for the on-station program. This is based on an average fecundity of around 3,000 eggs/female and a pre-spawning mortality of 10% and projected losses in the hatchery.

Segregated program. The egg-take goal for the Deep River Net Pen segregated program is up to 930,000, from around 350 hatchery-origin adult pairs, to produce up to 700,000 smolts. (see Deep River Net Pens coho HGMPs).

The egg-take goal for the cooperative programs is 60,000 for the Peterson Project (around 22 adult pairs), and 10,000 for the Wahkiakum FFA Project (around 5 adult pairs).

6.2.3 Past and proposed level of natural fish in broodstock.

New program, past data not available from Beaver Creek Hatchery, Elochoman River natural-origin Type-N coho will be used to establish the program, along with HOR coho from Grays River Hatchery or Beaver Creek Hatchery.

The on-station integrated program will be initiated with the 2019 brood, with the goal of developing a broodstock using 100% NOR returns to the Elochoman River. In years for low abundance integration rate may be reduced to less than 100% to ensure adequate natural escapement to the Elochoman basin. The broodstock will be managed with a goal of pNOB at least twice the value of pHOS to ensure that the proper PNI level is achieved. No more than 30% of the natural-origin run will be used as broodstock.

Beginning in 2019, broodstock for the segregated off station program will use first generation (F1) returns from the integrated Grays River program, collected at Beaver Creek Hatchery, from Grays River Hatchery, and the Elochoman weir. In the event of extremely poor returns, hatchery-origin broodstock will be used to ensure that collection of natural-origin fish does not exceed 30% of total natural-origin return.

6.2.4 Genetic or ecological differences.

Integrated program. The broodstock is derived from stock returning to the sub-basin. There are no known genotypic, phenotypic, or behavioral differences between either the hatchery or natural stocks in the sub-basin. This broodstock was founded from Elochoman late-returning (Type-N) coho.

Wahkiakum FFA. Prior to the original FFA coho program (1999-2009), fish (including coho), have not been observed in Birnie Creek, within the recent memory of locals. Thus, a native population does not exist in this stream. But program coho do represent native populations that inhabit other streams within the Elochoman and Columbia Estuary sub-basins. There are no known genotypic, phenotypic or behavioral differences between the hatchery and natural stocks in the target area.

6.2.5 Reasons for choosing.

Locally-available stock. This production is designed to supplement Type-N coho escapement to the Elochoman River, while providing harvest opportunities in the sub-basin, lower Columbia mainstem and tributaries, and Washington and Oregon coastal fisheries.

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.

- Natural spawners will be integrated into the broodstock to represent the natural Type-N coho run throughout the season.
- Hatchery program fish are mass-marked.
- There are no known genotypic, phenotypic, or behavioral differences between either the hatchery stock or natural stock in the sub-basin.
- Holding pond procedures follow IHOT guidelines.
- Other listed fish encountered during the broodstock collection process will be returned directly to the river or passed into the upper watershed, with minimal handling and holding time.
- Any observed mortalities will be reported in the WDFW Hatcheries Headquarters Database.

SECTION 7. BROODSTOCK COLLECTION

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

The broodstock is derived from adult and jack Elochoman stock returning to the Grays/Elochoman River Sub-basins, and will transition to using fish returning to the Elochoman Sub-basin. Broodstock collection from the Elochoman Sub-basin will begin in 2019 for the integrated and segregated programs. Fish will also be collected at Grays River Hatchery and the Elochoman weir in beginning in 2019,

7.2 Collection or sampling design.

Broodstock collection will occur at the Foster Road RBW (lower Elochoman mainstem) and Beaver Creek Hatchery. Type-N coho are collected annually (October through December) from the run at large. Broodstock are collected throughout the entire run to maintain run-timing for the population. Capture efficiency is 100% for fish volunteering to the trap, which is operated from September to February.

On-station program. The goal for the on-station release is to use 100% WxW fish.

The program will collect NORs that volunteer to the Foster Road RBW and Beaver Creek Hatchery, retain all unmarked adult coho until spawning begins, and continue to collect potential NORs and HORs throughout the run (October-December). Other means of NOR collection (e.g., hook and line, seining, mining eggs from redds) may be used in the future if hatchery volunteers continue to be fewer than HSRG recommendations. All fish collected will be wanded for coded-wire tag recovery. No more than 30% of the natural-origin run will be used as broodstock. Unmarked fish not used for integration needs are released upstream of the hatchery.

Segregated programs. Beginning in 2019, broodstock for the segregated off station program will use first generation (F1) returns from the Grays River Hatchery integrated on station program, collected at Beaver Creek Hatchery. Additional broodstock collection may occur at the Foster Road RBW or Grays River Hatchery, as needed to achieve program smolt release goals.

7.3 Identity.

All coho produced from this program will be released mass-marked with an adipose fin-clip (AD) or coded wire tag (AD+CWT).

Integrated program. 100% of the on-station releases (225,000 yearlings) will be mass-marked.

Segregated programs. The fish produced for Deep River net pens, Peterson Coho Project, and Wahkiakum FFA programs will be 100% AD-marked, with 45,000 yearlings from Deep River net pens released AD+CWT.

7.4 Proposed number to be collected:

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

See HGMP section 6.2.2.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 2008-13), or for most recent years available:

New program, no data available for the Elochoman Type-N Coho program.

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

Hatchery-origin coho in surplus of broodstock needs will be surplused to food banks or used as nutrient enhancement. All hatchery-identified coho intercepted at the Foster Road RBW and Beaver Creek Hatchery, in excess of broodstock needs, will be removed from the system to maintain desired pHOS levels, or be released upstream for fisheries.

7.6 Fish transportation and holding methods.

Adults collected at Beaver Creek Hatchery are not transported for this program. Fish collected at Resistance Board Weir will be transferred from field location Beaver Creek Hatchery, and placed in the adult holding ponds (see HGMP section 5.3).

7.7 Describe fish health maintenance and sanitation procedures applied.

The adult holding area is separated from all other hatchery operations. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution, and spawning area and implements are disinfected with iodophor solution at the end of the spawning day.

7.8 Disposition of carcasses.

Spawned carcasses are used for system nutrient enhancement or disposed in landfills.

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.

On-station program. Proper trap operation and fish handling techniques are followed. Out-of-basin transfers are limited. Broodstock are collected throughout the return period. Broodstock collection procedures quickly identify non-target fish encountered; natural-origin fish not used in the program are immediately released.

Birnie Creek rearing channel. The channel provides in-stream rearing, with a screen section on the upper portion of the creek that can be used to keep fish in the manmade pond section, or screens can be left out which would allow fish to move upstream. However, upstream migration is blocked by a large natural cliff-like falls about a ¼ mile or less upstream from the rearing channel. Moreover, the stream gradient is swift and steep which tends to keep fish in the pond even when the upper screens weren't used. The lower end of the pond has a dam board section which backs up the creek to make the pond. On the Marina side of the creek, on the downstream end of the pond, a permanent fish ladder is in place for returning adults.

SECTION 8. MATING

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

8.1 Selection method.

Representative portions of the run are randomly selected from fish returning late-October through mid-December. Spawning can occur over a period of weeks, depending on adult returns and broodstock goals. Most spawning is conducted during the month of December. The goal for the on-station release is to use 100% WxW fish. No more than 30% of the natural-origin run will be used as broodstock.

Beginning in 2019, broodstock for the segregated off station program will use F1 returns from the Grays River 2016 brood that was released from the Beaver Creek Hatchery in 2018, returns to Grays River Hatchery from the integrated on-station program, , and fish collected at the Elochoman weir. In the event of extremely poor returns, hatchery-origin broodstock will be used to ensure that collection of natural-origin fish does not exceed 30% of total natural-origin return.

Unmarked fish not used for integration needs are released upstream of the hatchery.

8.2 Males.

A ratio of 1:1 males to females is used. Jack coho salmon (2-year old) are incorporated into the broodstock as males at a minimum of 5% of the total spawning population.

8.3 Fertilization.

Agency spawning guidelines are closely followed (Seidel 1983). Fertilization occurs at a 1:1 ratio (females/males). Gametes for 1:1 fertilization will not be pooled prior to mixing. All available ripe unmarked fish are crossed at a 1:1 ratio with ripe adipose fin clipped fish; if only WxW fish are available, spawners are crossed at 1:1 ratio. Milt is mixed with green eggs with the ovarian fluid. Water hardening procedures with iodophor are followed after twenty minutes. Iodophor solution is used as rinse that is applied to hands and spawning implements per spawning. Iodophor foot baths are located at entrance to incubation room. Generally, sixty ovarian fluid and kidney/spleen samples are collected from female spawners to test for the presence of viral pathogens.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

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.

- Mating cohorts are randomly selected.
- Protocols for population size, fish health disinfection and genetic guidelines followed.
- Spawn all collected mature broodstock if possible without regard to age, size, color or other physical characteristics. If not spawning all collected mature adults over the season, apply the same rationale to individual spawn days.
- Randomize mating and avoid selectivity beyond ripeness on a given spawn day.
- Use one male to one female as much as possible in order to ensure an equal genetic contribution.
- Do not mix milt from multiple males and add to eggs (pooling prior to mixing) in order to eliminate disproportionate genetic male contributions.
- Do not re-use males except as part of specific spawning protocols.

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.

Beaver Creek Hatchery. This is a new program; data not currently available for Beaver Creek Hatchery.

Table 9.1.1.1: Type-N coho eyed-egg transfers to the Peterson Coho Project.

Brood Year	Number Transferred
2010	10,000
2011	20,000
2012	40,000
2013	40,000
2014	40,000
2015	40,000
2016	40,000

Source: WDFW Hatcheries Headquarters Database 2016.

Wahkiakum FFA: This project was initiated in 2015. Around 10,000 green-eggs are taken, with a goal of 8,000 eggs incubated Beaver Creek Hatchery, where they will be under the care of Wahkiakum FFA students. Approximately 5,500 yearlings (20 fpp) are transferred from Beaver Creek Hatchery to the Birnie Creek rearing channel in February/March the following year. Around 5,000 yearlings are released directly into Birnie Creek (WRIA 25.0281) in April. The first release will occur in 2017.

Peterson Coho Project. Around 40,000 eyed-eggs (segregated program) may be transferred to the Peterson Coho Project for incubation and rearing. Eggs are transported in coolers wrapped in wet burlap bags. Transport time is around 35 minutes.

Deep River Net Pen Coho. A program using Grays River/Elochoman River Type-N coho (segregated program) was initiated in 2016; current Type-N program data not yet available. The green egg-take goal is up to 930,000. Initial rearing takes place at Beaver Creek Hatchery. See also Deep River Net Pen Coho HGMPs.

9.1.2 Cause for, and disposition of surplus egg takes.

In the event that egg survival is higher than expected, WDFW Regional Managers will be contacted for instructions for disposition of the surplus in accordance with Regional policy and guidelines set forth in management plans/agreements and ESA permits.

9.1.3 Loading densities applied during incubation.

WDFW follows *Integrated Hatchery Operations Team* (IHOT) species-specific incubation recommendations for water quality, flows, temperature, substrate, and incubator capacities.

Eggs are placed in stack incubators for hatching. Removal of dead eggs, accurate enumeration and loadings are adjusted during this time. Type-N coho eggs range in size from 1,550 eggs/lb to 1,650 eggs/lb. Eggs are loaded at 7,000-7,500 eggs (approximately 4.5 lbs) per tray.

9.1.4 Incubation conditions.

IHOT species-specific incubation recommendations are followed for water quality, flows, temperature, substrate and incubator capacities. Incubation water temperature is monitored by digital thermometer and recorded. Temperature units (TU) are tracked for embryonic development.

Beaver Creek Hatchery. After weighing, eyed-eggs are placed in trays with a Vexar® substrate. Flow rate through the trays is 4 gpm; well water temperatures are a constant 51°F, while the creek temperatures will range from 45-50°F. Dissolved oxygen ranges around 9-11 ppm. Siltation is controlled with rodding, as needed.

Eggs for the segregated programs will be kept separately from the on-station integrated program.

Peterson Coho Project. After transport to the RSI site, eyed-eggs are incubated in vertical trays on gravity water supplied from the nearby creek. Creek water used for incubation typically runs clean, with temperatures ranging from 45 to 52°F. Trays are cleaned by rodding, as needed, during high water conditions.

9.1.5 Ponding.

On-station. Fry are typically ponded to the raceways in early-March, when the yolk slit is closed to approximately 1-mm wide (approximately 1,650 TUs) or KD factor (95% yolk absorption).

Wahkiakum FFA. Fry are ponded at Beaver Creek Hatchery. Unfed fry are transferred from Heath trays to the shallow troughs and then into intermediate raceways, until marking in May/June.

Peterson Coho Project. Once hatched, fry are ponded and reared in an intermediate raceway donated by Elochoman Hatchery. Fed fingerlings (~200 fpp) are adipose fin-clipped prior to release in early-May.

Deep River Net Pens projects. After initial rearing, fry may be transferred to North Toutle, Washougal, or Kalama Falls hatcheries. See Deep River Net Pens coho HGMPs.

9.1.6 Fish health maintenance and monitoring.

Fish health is continuously monitored in compliance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Staff conducts daily inspection, visual monitoring and sampling from eye, fry, fingerling and sub-yearling stages. As soon as potential problems are seen, these concerns are immediately communicated to the WDFW fish health specialist. In addition, fish health specialists conduct inspections monthly. Potential problems are managed promptly to limit mortality and reduce possible disease transmission. Disease treatment varies with the pathogen encountered, but is generally antibiotic in nature for bacterial infections and bath or drip treatments with chemotheraputants for external infections.

See also **Attachment 1** for health monitoring information.

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.

- IHOT and WDFW fish health guidelines followed.
- Multiple units are used in incubators.
- Splash curtains can isolate incubators.
- Temperature, dissolved oxygen, and flow are monitored.
- Dead eggs are discarded in a manner that prevents disease transmission.

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 years (2008-13), or for years dependable data are available.

On-station. Fish for this program will be reared at Beaver Creek Hatchery. No data is yet available for this program.

Deep River Net Pens. Program using Type-N coho was initiated in 2016; current Type-N program data not yet available.

A portion of the production may be transferred to Washougal, North Toutle, or Kalama Falls hatcheries for early-rearing; the remainder will be incubated and reared at Grays River or Beaver Creek hatcheries. See also Grays River and Deep River Net Pen coho HGMPs.

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

On-station. Loading and density levels at WDFW hatcheries conform to standards and guidelines set forth in *Fish Hatchery Management* (Piper et. al. 1982), the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). IHOT standards are followed for water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading and density.

Densities are kept at or below 3.3 lbs /gpm and 0.3 lbs /cu ft. before the last loading reduction in the fall of the year. Trough maximum loading is 40 lbs at 12 gpm (3.33 lbs/gpm). Tank and raceway maximum loading for early rearing is 132 lbs for the tanks at 40 gpm (3.3 lbs/gpm) and 800 lbs per raceway at 300 gpm.(2.66 lbs/gpm). The final loading per raceway is approximately 3,200 lbs. at 300 gpm (10.6 lbs/gpm).

Wahkiakum FFA. The Bernie Creek rearing channel has approximately 24,000 cubic feet of rearing space; maximum densities do not exceed 0.050 lbs/cf^3 or exceed much more than one to one pound per gpm.

9.2.3 Fish rearing conditions

Table 9.2.3.1: Monthly average surface water temperature (°F) at Beaver Creek Hatchery.

Month	Average Water Temperature (ºF)
January	44
February	42
March	47
April	50
May	57
June	63
July	64
August	66
September	57
October	58
November	56
December	48

Source: WDFW Hatchery Records.

On-station program. Fish are reared on river water. Temperature, dissolved oxygen (DO) and pond turn-over rate are monitored and recorded daily during fish rearing; water temperatures at Beaver Creek Hatchery generally ranges from 60°F to 32°F.

The raceways are vacuum-cleaned weekly to remove settleable solids, unused feed and feces, and broom-cleaned as needed to ensure proper cleanliness. Predator netting over the rearing ponds minimize predation. All ponds are pressure washed between broods.

Fish are mass-marked in April when they are about 250 fpp.

Wahkiakum FFA. After mass-marking in May/June at Beaver Creek Hatchery, the fish are transferred into a standard raceway until they are ready for transfer to the Birnie Creek rearing channel. The lower end of the channel, at the top of the concrete fish ladder, is screened during

rearing. Dissolved oxygen readings and water temperatures for Birnie Creek rearing channel are monitored (data not yet available in 2016).

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.

No data available for Beaver Creek Hatchery Type-N coho growth rates, but should be similar to that at Grays River Hatchery (**Table 9.2.4.1**).

Table 9.2.4.1: Monthly fish growth information by length (mm), weight (fpp), condition factor and growth rate, collected during rearing, Grays River Type-N coho.

Rearing Period	Length (mm)	Weight (fpp)	Growth Rate
March	45	500	0.64:1
April	57	250	0.70:1
May	64	175	0.80:1
June	75	110	0.86:1
July	85	75	0.94:1
August	94	55	0.98:1
September	105	40	1:1
October	108	35	1:1
November	112	32	1:1
December	115	30	1.05:1
January	120	27	1.15:1
February	125	24	1.1:1
March	134	19	1:1
April	146	15	1:1

Source: WDFW Hatchery Records.

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

See HGMP section 9.2.4. No energy reserve data available.

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*).

On-station. Fish are given variety of diet formulations including starter, crumbles and pellets; the food brand used may vary, depending on cost and vendor contracts. Feeding frequencies varies depending on the fish size and water temperature, and usually begin at 8 feedings/7 days a week, and end at 1 feeding/3 days a week. Feed rates vary from 1.0% to 2.5% B.W./day. The overall season feed conversion ratio has averaged approximately 1:1.

Wahkiakum FFA-Birnie Creek rearing channel. Fish are fed 2-3 times weekly with 2.0 mm pellets. Feed rate is 0.9-0.8 percent daily, with feed conversions at approximately 1.10:1.0.

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

Monitoring. Policy guidance includes: *Fish Health Policy in the Columbia Basin*. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995). A fish health specialist inspects fish monthly and checks both healthy and presence of symptomatic fish. Based on pathological or visual signs by the crew, age of fish and the history of the facility, the pathologist determines the appropriate tests. External signs such as lesions, discolorations, and fungal growths will lead to

internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted (see **Attachment 1** for Fish Health monitoring history).

Disease Treatment. As needed, appropriate therapeutic treatment will be prescribed to control and prevent further outbreaks. Mortality is collected and disposed of at a landfill. Fish health and/or treatment reports are kept on file.

Sanitation. All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy). All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Mortalities are collected and disposed of at a landfill. Fish Health and/or treatment reports are kept on file (see **Attachment 1** for Fish Health monitoring history).

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

Gill ATPase activity is not measured. Fish size at release time is critical to the readiness for migration. The migratory state of the release population is determined by fish behavior. Aggressive screen and intake crowding, swarming against sloped pond sides, a leaner (0.80 – 0.90) condition factor (K), a silvery physical appearance and loose scales during feeding events are signs of smolt development. Surface water from the West Fork Grays is used for fish rearing, and provides a natural water temperature profile.

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

Not applicable.

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.

See HGMP sections 5.8, 6.3, 7.9 and 9.1.7.

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 release levels (maximum number), Elochoman River Type-N coho.

Age Class	Max, Number	Size (fpp)	Release Date	Location	Major Watershed
Yearlings	Up to 225,000	15.0	April/May	Beaver Creek	Columbia Estuary
	Up to 5,000	16.0	April	Birnie Creek	
Fry	Up to 39,000	200.0	April/May	Columbia mainstem	

Source: WDFW Future Brood Document 2016.
Note: 15 fpp = 146 mm fork length (fl)
200 fpp = 61.6 mm fl

Up to 700,000 Elochoman/Grays River Type-N coho yearlings will be released at Deep River Net Pens beginnng in 2021. Specific location(s) of proposed release(s).

Table 10.2.1: Specific location of proposed releases, on-station program.

Stream, river, or watercourse:	Beaver Creek (WRIA 25.0247); tributary to Elochoman River
Release point:	Beaver Creek Hatchery at RKm 0.7; enters Elochoman at R.M. 5.5
Major watershed:	Grays-Elochoman (WRIA 25)
Basin or Region:	Columbia River Estuary

Table 10.2.2: Specific location of proposed releases, Wahkiakum FFA program.

Stream, river, or watercourse:	Birnie Creek (WRIA 25.0281)
Release point:	RKm 0.1; tributary to the Columbia River at the confluence with Cathlamet Channel at RKm 62.9/
Major watershed:	Grays-Elochoman
Basin or Region:	Columbia River Estuary

Table 10.2.3: Specific location of proposed releases, Peterson Coho Project.

Stream, river, or watercourse:	Mainstem Columbia
Release point:	N 46.271072 W 123.830281, on an unnamed tributary to the Columbia River
Major watershed:	Grays
Basin or Region:	Columbia River Estuary

See also Deep River Net Pen Coho HGMPs.

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

Beaver Creek hatchery. This is a new program, initiated with the 2019 brood; first release is expected to be in 2018 with fish from Grays River Hatchery, released from Beaver Creek Hatchery.

Wahkiakum FFA. Program was initiated in 2015; first release of 5,000 yearlings (16 fpp) occurred in April 2017 from the Birnie Creek rearing channel.

10.3 Actual dates of release and description of release protocols.

On-station. This is a new program, with the first release in 2018 (see above); data not yet available. Yearlings will be force-released from Beaver Creek Hatchery raceways around April 15-May 15.

Wahkiakum FFA. Yearlings will be released from Birnie Creek rearing channel in April. The screens and boards at the top of the fish ladder, on the downstream end of the rearing channel, will be removed, and the fish volitionally-released. First release was in 2017.

10.4 Fish transportation procedures, if applicable.

On-station program. Juvenile fish are not transported; fish are released on-station.

Wahkiakum FFA. Approximately 5,500 sub-yearlings will be transported from Beaver Creek Hatchery to the Birnie Creek rearing channel in February/March (first transfer in 2017) via 1000-gallon tanker truck. Transit time is around 30 minutes.

Peterson Coho Project. Juvenile fish are not transported; fish are released on-station.

Deep River Net Pens. Sub-yearlings are transferred to the Deep River net pen programs in November. See also Deep River Net Pens coho HGMPs.

10.5 Acclimation procedures (methods applied and length of time).

On-station program. Fish will be reared and acclimated on surface water from Beaver Creek or the Elochoman River their entire time at Beaver Creek Hatchery. Yearlings are released directly from the raceways or rearing pond into Beaver Creek.

Wahkiakum FFA. Sub-yearlings (20 fpp) will be transported in February/March (first transfer in 2017) from Beaver Creek Hatchery to Birnie Creek rearing channel. Fish are reared, acclimated and volitionally-released at approximately 16 fpp from the rearing channel. Fish released at this site for the previous program (1999-2009) were observed to leave the channel in April.

Peterson Coho Project. Fish are reared and acclimated on-site, on the same creek water as used for incubation. Fry are released into the creek in May, at approximately 200 fpp.

Deep River Net Pens. See Deep River Net Pens Coho HGMPs.

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

Table 10.7.1: Marked releases, by brood year, age class and mark-type, Grays River Type-N coho releases.

Age Class	Program	Mark Type	
		AD-only	AD+CWT
Yearlings	Beaver Creek On-station	180,000	45,000
	Deep River Net Pens	655,000	45,000
	Wahkiakum FFA	Up to 5,000	0
Fry	Peterson Coho Project	Up to 39,000	0

Source: WDFW proposed 2019.

Grays River Type-N coho have been 100% adipose fin-clipped (AD) since 1998.

Integrated program. The on-station production will be 100% mass-marked, to identify them upon their return as adults.

Segregated program. The Wahkiakum FFA and Peterson Project productions will be released 100% AD-only. Grays River/Elochoman River Type-N coho transferred to the Deep River Net Pens program are also 100% adipose fin-clipped (AD), with a portion AD+CWT (see Deep River Net Pen coho HGMPs).

Snouts collected from program adults are dissected, recovered and read at the WDFW CWT Lab in Olympia. Scale samples are read at WDFW Headquarters Olympia to verify hatchery- or natural-origin. CWT data is reported annual to RMIS.

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

The program guidelines for annual broodstock/egg-take collection are managed to prevent any surpluses, and maintained within the ±5% guideline. In the event of surplus >10%, WDFW Regional Managers will in accordance with regional policy and guidelines set forth in management plans/agreements and ESA permits, and after consultation with NMFS, instruct hatchery staff for disposition of the surplus.

10.8 Fish health certification procedures applied pre-release.

All fish are examined for the presence of "reportable pathogens" as defined in the P*acific Northwest Fish Health Protection Committee* (PNFHPC) disease control guidelines, within three weeks prior to release.

Fish transfers into the sub-basin are inspected and accompanied by notifications as described in IHOT and PNFHPC guidelines.

Prior to release, the population health and condition is established by the Area Fish Health Specialist. This is commonly done 1-3 weeks pre-release and up to 6 weeks on systems with pathogen-free water and little or no history of disease. Prior to this examination, whenever abnormal behavior or mortality is observed, staff also contacts the Area Fish Health Specialist. The fish specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) and IHOT guidelines.

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

Hatchery staff will make every attempt to keep the fish alive and healthy throughout the entire rearing-release cycle; all appropriate resource managers from the Complex level to the Federal level will be informed of the actions taken.

Adult Holding: Broodstock are held in the concrete holding ponds at the Beaver Creek Hatchery prior to spawning. The holding ponds are supplied by gravity-fed Elochoman River water; any disruption to the water supply to the ponds would be detected by an alarm system. The hatchery staff would have at least three rescue options.

1) Depending upon stream conditions, the ponds may be switched to gravity flow Beaver Creek water until the main water supply is restored.
2) The pumps could be placed in nearby raceways or to the earthen pond.
3) If none of the above locations are suitable, the fish could be released into the river.

Spawning and incubation-to-fry stage: In the event of a failure in the gravity pipeline disrupts the water flow to the units:

1) If the eggs have not hatched, each vertical tray would be de-watered and the eggs can be kept moist for up to 24 hours or longer, until replacement pumps can be installed or the line repaired.
2) If that is not possible, well water, creek water or river water can be used.
3) If all water lines are ruptured, egg trays could be carried out to the rearing raceways or earthen pond and supplied with gently moving water at those locations.

Rearing: In the event that water flow is disrupted, some of the fish could be converted to well water, if it is available. If all water supplies are disrupted, fry can be maintained by supplying each raceway with air stones that are fed by cylinders of compressed air, or (depending upon conditions in the river and time of year) the fish could be released into the Elochoman River.

10.10 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.

- The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with naturally produced juveniles.
- Coho smolts are released in May to allow listed Chinook to grow to a size that will reduce predation opportunities, and still be in advance of winter and summer steelhead fry emergence in Columbia River tributaries.
- Returning hatchery fish are under heavy selective harvest, and may be differentiated from natural-origin fish by the adipose fin-clip or CWT.
- WDFW proposes to continue monitoring, research and reporting of hatchery smolt migration performance behavior, and intra and interspecific interactions with wild fish to access, and adjust if necessary, hatchery production and release strategies to minimize effects on wild fish.
- WDFW fish health and operational concerns for Grays River Hatchery programs are communicated to WDFW Region 5 staff for any risk management or needed treatment. See also HGMP section 9.7.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE

INDICATORS

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

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

Performance indicators for harvest will be accomplished by continuing mass marking (adipose fin-clip). CWT recoveries will help determine stray rate contributions on spawning grounds by watersheds close in proximity to this program's release vicinity.

Coho captured in the adult weir in the lower Elochoman River and returning to Beaver Creek Hatchery will be enumerated, with annual run timing, mark-type (origin), size, age and sex composition data collected upon adult return (see **Tables 1.10.1.1** and **1.10.2.1**). All hatchery-origin fall Chinook captured at the Foster Road RBW and the adult trap at Beaver Creek Hatchery, will be lethally removed to manage pHOS within standards prescribed by NMFS. Hatchery-origin coho will be released upstream for fisheries or lethally removed.

Additional research, monitoring and evaluation in the Lower Columbia. WDFW is currently conducting the following Mitchell Act-funded research, monitoring and evaluation projects:

Table 11.1.1.1: Current WDFW Mitchell Act-funded research, monitoring and evaluation projects.

Project	Description
LCR Monitoring	WDFW has implemented an expanded monitoring program for Chinook, coho, chum and steelhead populations in the Lower Columbia River (LCR) region of Southwest Washington (WDFW's Region 5) and fishery monitoring in the lower mainstem of the Columbia River. The focus of this expanded monitoring is to 1) gather data on Viable Salmonid Population (VSP) parameters – spawner abundance, including proportion of hatchery-origin spawners (pHOS), spatial distribution, diversity, and productivity, 2) to increase the coded wire tag (CWT) recovery rate from spawning grounds to meet regional standards, and 3) to evaluate the use of PIT tags to develop harvest rates for salmon and steelhead populations. Additionally, key watersheds are monitored for juvenile salmonid out-migrant abundance. Coupled with adult abundance information, these data sets allow for evaluation of freshwater productivity and development of biological reference points, such as seeding capacity. Monitoring protocols and analysis methods utilized are intended to produce unbiased estimates with measurements of precision in an effort to meet NOAA monitoring guidelines (Crawford and Rumsey 2011).

Adult weirs. In an effort to reduce the proportion of hatchery-origin spawners (pHOS) to meet HSRG standards and improve abundance estimates to meet NOAA's accuracy and precision guidelines, WDFW began installing and operating river-spanning weirs for fall Chinook management in Lower Columbia River (LCR) basins in 2008. The Grays River Weir was the first LCR weir focused on fall Chinook management, which was installed in fall 2008. The Elochoman River Weir was added in fall 2009, followed by the Coweeman in fall 2011 (WDFW 2011, Glaser et al. 2016). Operations are primarily be focused on fall Chinook abundance monitoring and management, as well as broodstock collection; however, they are also used to improve monitoring and management, where possible, of other returning salmonids (chum, coho, steelhead).

At all three locations, lethal removal of known hatchery fish, identified by fin-mark (adipose fin-clip), will be utilized as a tool to promote recovery of wild stocks and meet management guidelines and objectives. All three projects are on-going, with an annual weir installation of August 1, and

proposed removal of late-November; if conditions allow, operation may continue through December. Traps are checked daily (multiple times, if necessary), and captured fish will be sampled and released.

The goal for the Elochoman weir will be to extend operations through the end of December to collect broodstock over the full spectrum of coho run timing. Extended operation period will assist in monitoring status of natural origin coho in the Elochoman basin.

See **Appendix A** for number and disposition of salmonids handled at the weirs in 2011-2015.

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

Except for a risk involving genetic introgression, all other aspects of the M&E outlined in the tables in HGMP section 1.10 are currently funded (see also HGMP section 11.1.1).

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.

Monitoring, evaluation and research follow scientific protocols with adaptive management process if needed. WDFW will take risk aversion measures to eliminate or reduce ecological effects, injury, or mortality as a result of monitoring activities (see tables in HGMP section 1.10). In addition, we will adaptively manage all aspects of the program to continue to minimize associated risks using the more recent available scientific research.

SECTION 12. RESEARCH

12.1 Objective or purpose.

No current research is directly associated with the program.

12.2 Cooperating and funding agencies.

Any research is conducted by WDFW.

12.3 Principle investigator or project supervisor and staff.

WDFW staff.

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Not applicable.

12.5 Techniques: include capture methods, drugs, samples collected, tags applied.

Not applicable.

12.6 Dates or time period in which research activity occurs.

Not applicable.

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

Not applicable.

12.8 Expected type and effects of take and potential for injury or mortality.

Not applicable.

12.9 Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Not applicable.

12.10 Alternative methods to achieve project objectives.

Not applicable.

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Not applicable.

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Not applicable.

SECTION 13. ATTACHMENTS AND CITATIONS

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ATTACHMENT 1: WDFW VIROLOGY SAMPLING 2005-2006 THROUGH 2015-2016: GRAYS RIVER HATCHERY.

Hatchery/ Collection Site	Stock	Species	Date Sampled	Results	Comments	Life Stage	Sample number	Number of fish sampled						ID	Cell Line	Inoc Date
								OF	pools	K/S	pools	fry/visc	pools			
GRAYS R	GRAYS R	COHO	11/01/05	NEV		AD	1102-3/4	60	12	60	12					
GRAYS R	GRAYS R	SCOHO	10/24/06	NEV		AD	1025-3/4	60	12	60	12					
GRAYS R	GRAYS R	SCOHO	10/23/07	NEV		AD	1024-3/4	60	12	60	12					
GRAYS	GRAYS R	SCOHO	10/23/08	NEV		AD	1024-7/8	60	12	60	12					
GRAYS	GRAYS R	SCOHO	10/28/10	NEV		AD	1028-1/2	18	4	60	12					
GRAYS	GRAYS R	NCOHO	12/07/10	NEV		AD	1208-12/13	60	12	60	12					
GRAYS	GRAYS R	NCOHO	12/07/11	NEV		AD	1208-1/2	60	12	60	12					
GRAYS	GRAYS R	NCOHO	12/05/12	NEV		AD	1206-5/6	60	12	60	12					1/31/2013
GRAYS	GRAYS R	NCOHO	12/09/13	NEV		AD	1209-1/2	60	12	60	12					12/10/13
GRAYS R	GRAYS R	N-COHO	12/9/14	NEV		AD	1210-4/5	60	12	60	12					12/10/2014
GRAYS R	GRAYS R	N-COHO	12/3/15	NEV		AD	1204-2/3	60	12	60	12					12/4/2015

Source: WDFW Fish Health Lab data 2016.

ATTACHMENT 2 – FISH HEALTH SUMMARIES: GRAYS RIVER HATCHERY, OCTOBER 1, 2009 THROUGH MARCH 31, 2009 TO OCTOBER 1, 2011 THROUGH MARCH 31, 2012.

Grays River Hatchery Coho

Juveniles:

2010 brood year N-coho

This stock suffered some lingering loss in October and botulism was suspected along with low levels of *Trichodina*. The fish were treated with oxytetracycline medicated feed and the crew kept the loss picked from the pond bottom as well as on the screen and loss declined. The fish remained healthy through the rest of this reporting cycle.

Adults:

N-coho (Elochoman River stock) – Eggs were collected at Elochoman Hatchery and transferred green to Grays River Hatchery. No viruses were detected in a sample of 60 fish submitted in five fish pools.

2011 N-coho

Sixty of the spawning adults were tested for regulated viral pathogens and no virus was detected.

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:_____

SECTION 15. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (ANADROMOUS SALMONID EFFECTS ARE ADDRESSED IN SECTION 2).

15.1 List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions, including hatchery operations.

> *"The department is authorized by the USFWS for certain activities that may result in the take of bull trout, including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys..."*

15.2 Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Several listed and candidate species are found in Cowlitz, Clark and Skamania Counties; however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

"No effect" for the following listed species:

Bull trout (*Salvelinus confluentus*) – Threatened (Critical Habitat Designated)
Marbled murrelet (*Brachyramphus marmoratus*) –Threatened (Critical Habitat Designated)
Columbian White-Tailed deer (*Odocoileus virginianus leucurus*) – Endangered
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened (Critical Habitat Designated)

Candidate Species:
(Cathlamet) Mazama pocket gopher (*Thomomys mazama* ssp. *louiei*) [historic]
Streaked horned lark (*Eremophila alpestris strigata*)

15.3 Analyze effects.

Not applicable.

15.4 Actions taken to minimize potential effects.

Program fish are released fully smolted to foster rapid outmigration from the basin and to minimize predation and residualism risks.

15.5 References

Not applicable.

APPENDIX A

Table A1: Disposition of salmonids handled at the Grays River adult weir, by mark and year, 2011-2015.

Species	Mark	Number Trapped (Male/Female/Jack)					Disposition
		2011	2012	2013	2014	2015	
Chinook	LV or ADLV	69 (14/55/0)	28 (11/10/7)	467 (139/326/2)	243 (37/84/122)	283 (85/140/58)	Removed
	AD only	31 (18/12/3)	22 (8/9/5)	35 (23/5/7)	98 (54/22/22)	313 (160/145/8)	Removed
	None	14 (5/8/1)	12 (3/7/2)	40 (18/21/1)	37 (14/17/6)	97 (38/39/20)	Released upstream
	None	0	2 (0/2/0)	0	0	0	Released downstream
Coho	AD	296 (148/137/11/)	105 (39/62/4/)	37 (20/17/0)	297 (180/106/11)	78 (39/28/11)	Released upstream
	AD	0	0	0	107 (74/31/2)	5 (2/2/1)	Removed
	None	25 (17/8/0)	45 (29/15/1)	41 (16/18/7)	309 (140/159/10)	69 (36/30/3)	Released upstream
	None	0	15*	0	0	0	Trucked for brood
Chum	None	0	45 (29/16/0)	0	0	7 (5/2/0)	Released upstream
	None	0	0	0	1 (0/1/0)	1 (0/1/0)	Released downstream
Pink	None	0	0	1 (1/0/0)	0	0	Released upstream
Sockeye	None	0	2 (2/0/0)	0	0	0	Released upstream
	None	0	1 (1/0/0)	0	0	0	Released downstream
Steelhead	AD	4 (0/4/0)	3 (1/2/0)	0	5 (2/3/0)	1 (0/1/0)	Released upstream
	AD	0	1 (0/1/0)	0	0	0	Removed
	None	0	1 (0/1/0)	0	1 (1/0/0)	0	Released upstream

Source: Glaser et al., 2016

Notes: LV= Left Ventral Fin Clip; AD = Adipose Fin Clip; Left ventral fin clips typically identify Select Area Bright (SAB) fall Chinook from Oregon SAFE program releases.

Trap morts not included.

* Sex not determined.

Table A2: Disposition of salmonids handled at the Elochoman River adult weir, by mark and year, 2011-2015.

Species	Mark	Number Trapped (Male/Female/Jack)					Disposition
		2011	2012	2013	2014	2015	
Chinook	LV or ADLV	50 (23/27/0)	15 (6/5/4)	17 (7/9/1)	67 (25/28/14)	31 (9/16/6)	Removed
	AD only	1347 (521/821/5)	95 (42/49/4)	185 (120/68/7)	959 (557/375/27)	1472 (802/660/10)	Removed
	AD only	645 (240/381/24)	0	0	0	0	Released upstream
	AD only	0	175 (93/78/4)	0	0	0	Trucked for brood
	None	78 (35/40/3)	31 (13/17/1)	37 (17/20/0)	197 (88/85/24)	243 (122/110/11)	Released upstream
	None	0	2 (0/2/0)	0	0	0	Released downstream
Coho	AD	1 (1/0/0)	0	2 (0/2/0)	1 (1/0/0)	4 (0/4/0)	Released upstream
	AD	10 (4/6/0)	6 (2/4/0)	16 (9/7/0)	198 (95/103/0)	33 (13/20/0)	Removed
	None	83 (51/30/2)	72 (33/39/0)	58 (37/21/0)	368 (195/172/1)	121 (75/45/1)	Released upstream
Chum	None	2 (1/1/0)	5 (2/3/0)	30 (16/14/0)	0	2 (1/1/0)	Released upstream
	None	0	0	0	1 (0/1/0)	0	Released downstream
Steelhead	AD	23 (5/18/0)	25 (6/19/0)	8 (2/6/0)	26 (17/9/0)	3 (1/2/0)	Released upstream
	None	2 (1/1/0)	0	0	7 (3/4/0)	1 (1/0/0)	Released upstream

Source: Glaser et al., 2016

Notes: LV= Left Ventral Fin Clip; AD = Adipose Fin Clip; Left ventral fin clips typically identify Select Area Bright (SAB) fall Chinook from Oregon SAFE program releases.

Trap morts not included.

Table A3: Disposition of salmonids handled at the Coweeman River adult weir, by mark and year, 2011-2015.

Species	Mark	Number Trapped (Male/Female/Jack)					Disposition
		2011	2012	2013	2014	2015	
Chinook	AD only	57 (39/18/0)	58 (36/22/0)	83 (48/35/0)	159 (88/68/3)	202 (113/87/2)	Removed
	LV only	0	0	1 (0/1/0)	6 (2/2/2)	6 (1/4/1)	Removed
	None	387 (164/207/16)	186 (122/60/4)	87 (38/48/1)	514 (227/270/17)	1321 (628/628/65)	Released upstream
Coho	AD	8 (2/6/0)	1 (0/0/1)	1 (1/0/0)	6 (0/3/3)	8 (2/6/0)	Removed
	None	46 (29/17/0)	66 (41/23/2)	6 (3/3/0)	158 (72/75/11)	286 (155/115/16)	Released upstream
Steelhead	AD	4 (2/2/0)	1 (0/1/0)	0 (0/0/0)	11 (4/7/0)*	5 (1/4/0)	Released upstream
	None	4 (1/3/0)	6 (0/6/0)	1 (0/1/0)	5 (1/4/0)	9 (3/6/0)	Released upstream

Source: Glaser et al., 2016

Notes: LV= Left Ventral Fin Clip; AD = Adipose Fin Clip; Left ventral fin clips typically identify Select Area Bright (SAB) fall Chinook from Oregon SAFE program releases.

Trap morts not included.

* Includes one AD+RV-mark.

Table A4. AHA Results based on 300,000 smolt release program

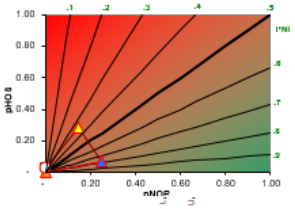
All H Analyzer (AHA) — Apply & Recalculate — Elochoman Coho (Late- Type N)

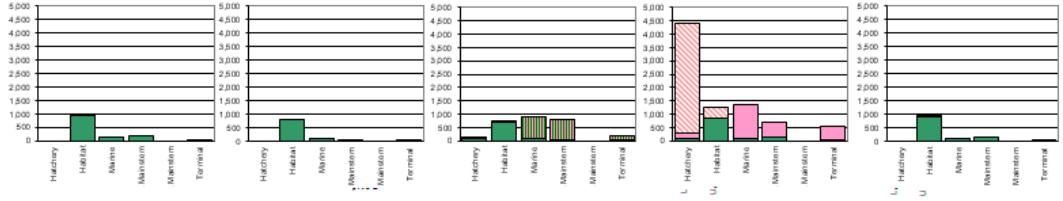
Population (Ctrl + Page Up/Down to Scroll)

Subregion/Subbasin	Species/Race	Population Management Intent:	tribute to recovery of ESU and provide hat	tribute to recovery of ESU and provide hat	tribute to recovery of ESU and provide hat	tribute to recovery of ESU and provide hat	tribute to recovery of ESU and provide hat
Elochoman	Coho	Harv&Hatchery Strategy:	Integrated hatchery, selective harvest	Integrated hatchery, selective harvest	Integrated hatchery, selective harvest	Integrated hatchery, selective harvest	Integrated hatchery, selective harvest
Elochoman Coho (Late- Type N)		Population Recovery Designation:	Primary	Primary	Primary	Primary	Primary

			Historic		Current		No Hat		HSRG Sol		LCR C&SF Plan		LCR C&SF Plan 2	
Habitat	Productivity (Adult)	Ad. Capacity	3.90	2,083	3.90	2,083	3.70	1,315	3.70	1,315	3.70	2,083	3.90	2,083
	Min NOR Escape	% Kelt	1		1		1		1		1		1	
	Smolt Productivity	Sm. Capacity	75	40,058	75	40,058	71	25,288	71	25,288	71	40,058	75	40,058
Hydro	Ocean Surv	Baseline SAR	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052	0.052
	Juv Passage Surv.	Adult Passage	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	Adjusted Productivity	Adj. Capacity	3.90	2,083	3.90	2,083	3.70	1,315	3.70	1,315	3.70	2,083	3.90	2,083
Harvest	Harv - Marine	NORs	0.090	0.180	0.090	0.180	0.100	0.180	0.120	0.240	0.090	0.180	0.090	0.180
	Harv - L. Mainstem	NORs	0.150	0.170	0.150	0.170	0.050	0.200	0.030	0.300	0.120	0.100	0.150	0.170
	Harv - U. Mainstem	NORs												
	Harv -Terminal	NORs	0.020	0.100	0.020	0.100	0.020	0.100	0.020	0.100	0.020	0.100	0.020	0.100
	Total Exploitation Rate	NORs	0.242	0.387	0.242	0.387	0.162	0.410	0.163	0.521	0.215	0.336	0.242	0.387
Hatchery	Broodstock Composition	pNOB-Goal	pNOB	pHOS	pNOB	pHOS	pNOB	pHOS	pNOB	pHOS	pNOB	pHOS	pNOB	pHOS
		PNI		3%	3%		50%	0.87	7%	30%		28%		3%
	Purpose	Type	Cons/Harv/Both	Int/Segr/Step/None	None	None	None	None	Both	Int	None	None	None	None
	Broodstock by Source	Local / Imported	Smolt Release						150	146,475	307	299,786		
	rood Exported (from HOR Surplus)	Export Goal/Realized	Strays	35			20			60		175		35
	Destination for HOR Returns	% to Hatchery	% to Nat. Spawn.	100%	90%	10%			95%	5%	90%	10%		100%
	Productivity of Hatchery Fish	Recruits/Spawner	Fitness? [Y / N]		20.0		20.0		20.0		20.0		20.0	
Patterns	Patterns shown here are assigned to the population from the AHA or ROL file. Red cells indicate patterns are not assigned to this population/scenario in the rollup application. The shown pattern needs to be added to the application, or a different pattern should be assigned to this population in the ROL/AHA file.	Habitat ----->	LCR_C&SF Habitat		Current Habitat		Current Habitat		Current Habitat		LCR_C&SF Habitat		LCR_C&SF Habitat	
		Hydro ----->	Current Hydro		Current Hydro		Current Hydro		Current Hydro		Current Hydro		LCR_C&SF_Plan UpCov	
		Harvest --->	_CR_C&SF Harvest Plar		Current Harvest				HSRG Harvest		_CR_C&SF Harvest Plar		_C&SF Harvest Plan_Up	
Update		Hatchery												

Realized Spawning Composition





	80		80			Relative Hatchery Optimum ->	80		80			80		
	50%		90%			Weir Factor ->	90%					90%		
						Relative Reproductive Success (HOS) ->								
						Initial Fitness Factor (A) ->								
						Fitness Factor after 100 generations (B) ->								
						Average Fitness Factor (100 Generations) ->								
						Generations until average fitness is reached ->								