HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Lewis River Winter-late (Endemic) Steelhead (Integrated)
Species or Hatchery Stock:	Winter-late Steelhead (*Oncorhynchus mykiss*) Lewis River Endemic Stock
Agency/Operator:	Washington Department of Fish and Wildlife PacifiCorp Energy
Watershed and Region:	Lewis River/ Lower Columbia River
Date Submitted:	
Date Last Updated:	July 15, 2014

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Executive Summary

The Washington Department of Fish and Wildlife and PacifiCorp Energy is submitting a Hatchery and Genetic Management Plan (HGMP) for the Lewis River winter-late Steelhead program to the National Marine Fisheries (NMFS) for consultation under Section 10(a)(1)(A) 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 implementation of PacifiCorp Energy's Federal Energy Regulatory Commission (FERC) Licenses.

The purpose of the program is to produce Lewis River winter-late steelhead for reintroduction into the upper basin as mitigation for lost fish production due to development within the Lewis River Basin. Program fish will be produced at the Merwin Hatchery, located on the Lewis River (WRIA 27.0168). The program will annually release 50,000 yearlings into the Lewis River.

This winter-late steelhead HGMP 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. The program has been operated as a "integrated type" program, as defined by the HSRG. An "integrated" program is one in which natural-origin individuals are used in the hatchery broodstocks. Integration is achieved by using returning adult natural-origin winter-late steelhead (distinguished by an intact adipose fin and a lack of blank wire tags) returning to the Lewis River at the Lewis River Hatchery trap (RKm 25.0), and the Merwin Dam Fish Collection Facility (FCF) at RKm 30.4 or collected via tangle nets, seining or hook and line angling from January through June. All fish released through this hatchery program have been 100% mass-marked (blank-wire tags) since 2009.

The Lower Columbia River steelhead are listed as "Threatened" under the ESA and Lewis River winter-late steelhead are included in the DPS.

Broodstock Collection:
The broodstock is derived from natural-origin stock returning to the Lewis River sub-basin. The current egg-take goal is 90,000 (+/-20 %) at Merwin Hatchery; up to 50 adults may be collected. Returning fish with blank-wire tags will be trapped and transported, via tanker, to the upper Lewis watershed above Swift Reservoir for reintroduction.

Harvest:
While there may be a low level of mixed stock or incidental harvest on these program fish, there will be no directed fishery benefiting from this conservation program, these fish are not ad-clipped.

Monitoring and Evaluation:
The Lewis River Settlement Agreement (SA 2004) outlines monitoring requirements for the Lewis River Hatchery programs developed as part of the new license that PacifiCorp and Cowlitz PUD received from FERC. A Monitoring and Evaluation (M&E) Plan, a Hatchery and Supplementation (H&S) Plan and associated Annual Operating Plans (AOP) have been developed to address the monitoring requirements of the Settlement Agreement (SA 2004, H&S 2009, M&E 2010).

Operation and Maintenance of Hatchery Facilities:
WDFW's Lewis River winter-late steelhead program fish are spawned and reared at Merwin Hatchery. The facility draws water from an intake on Lake Merwin at a rate of up to 11 cubic feet per second (cfs). The intake and screen criteria are in compliance with state and federal guidelines

(NOAA-NMFS 1995, 1996), and meet the current *Anadromous Salmonid Passage Facility Design* criteria. The return water systems operates under the *National Pollutant Discharge Elimination System* (NPDES) permit.

1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

Lewis River (Merwin Hatchery) winter (late) steelhead.

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

Lewis River (Merwin Hatchery) winter (late) steelhead (*Oncorhynchus mykiss*) used in this broodstock are listed as "threatened", because the broodstock collected for this program are all natural-origin fish.

1.3 Responsible organization and individuals

Hatchery Operations Staff Lead Contact

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Fish Management Staff Lead Contact

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

Cowlitz Co. PUD: Local Government

PacifiCorp Energy and Cowlitz PUD: FERC license operators for Lewis River Hydroelectric Projects.

PacifiCorp Energy Staff Lead Contact

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

Funding Sources	Operation Information – FY 2013
PacifiCorp	Full time equivalent staff – 3.7
	Annual operating cost (dollars) - $481,288

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.

PacifiCorp Energy and the Cowlitz County Public Utility District (PUD) No. 1 funds production of mitigation fish released in the Lewis River system, including spring Chinook, kokanee, rainbow trout, coho and steelhead.

1.5 Location(s) of hatchery and associated facilities.

Broodstock Source: Lewis River winter (late) steelhead

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
Lewis River Hatchery	Broodstock collection	Located at RKm 24.95 on the Lewis River (WRIA 27.0168), Lewis sub-basin; tributary to the Columbia River at RKm 140, Lower Columbia River Washington.
Merwin Dam Fish Collection Facility (FCF)	Broodstock collection	Located at RKm 30.42 on the Lewis River (WRIA 27.0168), Lewis sub-basin; tributary to the Columbia River at RKm 140, Lower Columbia River Washington.
Merwin Hatchery	Adult holding/ spawning, incubation, rearing, acclimation	Located at RKm 30.6 on the Lewis River (WRIA 27.0168); tributary to the Columbia River at RKm 140, Lower Columbia River Washington.

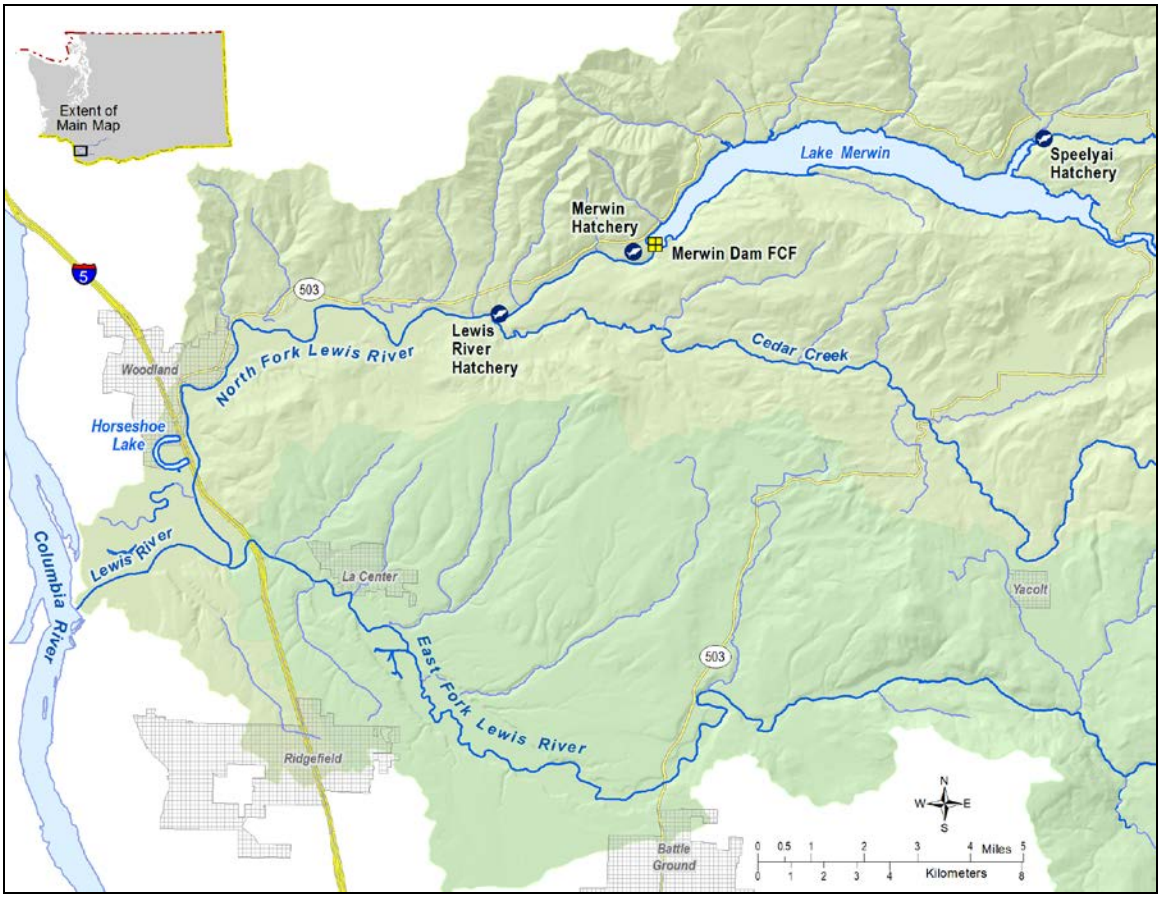

Figure 1.1: Map of Lewis Hatchery Complex. Source: WDFW GIS 2014.

1.6 Type of program.

Integrated Recovery

1.7 Purpose (Goal) of program.

Restoration. The goal of this program is to release hatchery-spawned and reared winter-late steelhead smolts from native locally-adapted stocks to establish a self-sustaining naturally producing population of adult recruits of local-stock origin upstream of Swift Reservoir.

1.8 Justification for the program.

The program is funded through PacifiCorp and the Cowlitz County PUD for the purpose of mitigation for lost fish production due to development within the Lewis River Basin. WDFW protects listed fish through the *Fisheries Management and Evaluation Plan* (FMEP) (WDFW 2001) and the *Lewis River Hatchery and Supplementation Plan* (H&S 2006).

The North Fork Lewis River historical winter steelhead population was one of the larger in the Lower Columbia Basin, and was predominately produced in the upper Lewis watershed above Swift Dam (LCRFB 20010. In recent years, the late-winter steelhead population has been relegated to the lower N.F. Lewis mainstem and tributaries. The integrated recovery program, initiated in 2009, was designed to be a short-term (15 years) surrogate population to the endemic fish in the lower NF Lewis, to supplement adult reintroduction in the upper watershed. This supplementation program would buffer the natural population against the potential loss associated with initial direct movement of adults into the upper watershed. The highly reproductive environment of the hatchery (~21 Recruits per Spawner) would enable a smaller broodstock (N=50) to produce substantially more ocean-recruits for the upper watershed re-introduction.

To minimize impact on listed fish by the Lewis River 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 Lewis River winter-late steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.1	Water rights are formalized through trust water right from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.1	Intake and screen criteria are in compliance with state and federal guidelines (NOAA-NMFS 1995, 1996), and meet the current *Anadromous Salmonid Passage Facility Design* criteria (NOAA-NMFS 2011).
Effluent Discharge	4.1	Merwin 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 13-1052.
Broodstock Collection & Adult Passage	7.9	All fish produced by this program are mass-marked (blank-wire tagged) prior to release. Broodstock collection and sorting procedures can quickly identify listed fish -- assumed if adipose fin is intact and no blank-wire tag (BWT) is present -- and if not needed for broodstock, are released per protocol to minimize impact as determined by WDFW Region 5 staff.
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* (Genetic Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Fish are released at a time, size and life history stage to foster rapid migration to marine waters. Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish.

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: "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 Lewis River Basin and will over time contribute to a meaningful harvest in sport fisheries.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	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 sport 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.
3.3.1. Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	Annual number of naturally-produced adults or redds on the spawning grounds or selected natural production index areas.	Annually monitor and report returns to the hatchery and the number of program fish hauled into the upper basin for reintroduction.
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 is 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 3.2.1.	Annually monitor and report size, number, mass-mark quality (mark rate/BWT rate) and date of all hatchery releases. Annually sample returning fish for the mass-mark and BWT at broodstock collection points and on the spawning grounds;

		monitor and report numbers of estimated hatchery (marked) and natural (unmarked) fish.
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 return (February through May). 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: **"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 authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. 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.
3.2.2 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 that are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, or other external mark, depending on species) produced fish to allow for their differentiation from naturally produced fish for selective fisheries.	Fish from this program are intentionally not externally marked to prevent them from being harvested in selective fisheries; they are given a BWT to identify them from natural-origin fish. Annually monitor and report mass-mark type, quality and rates. Annually assess returns of mass-marked (BWT) artificially-produced fish at broodstock collection points and on the spawning grounds. Live-captured fish not used for broodstock will be tagged to determine collection efficiencies which can assist in determining pHOS.
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 report mass-mark type, quality and rates. Live-captured fish not used for broodstock will be tagged to determine collection efficiencies which can assist in determining pHOS. Examine returning fish encountered for the mass-mark (BWT) at broodstock collection points and on the spawning grounds. Utilize mark/recapture or other methodology to assess spawning ground composition of natural and hatchery-origin fish.
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 and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Collect annual run and/or spawn timing data , and age and sex composition data from natural and hatchery populations.
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-	Total number of natural-origin spawners (if any) reaching the	All hatchery releases are identifiable in some manner (fin-

spawning population.	collection facility. Timing of collection compared to overall run timing. Total number of natural-origin fish used in broodstock.	marks, tags, etc.). Collect annual run timing, origin, and age and sex composition data from returning adults. Monitor proportion of natural-origin abundance annually removed for broodstock.
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).	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 average size at release, condition factor (cv) 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. 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* (Genetic 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 reports.
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.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels	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

of existing pathogens. Follow the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, revised 2006).		to assess 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 up to 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.	Traps checked regularly. Non-target and/or ESA 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 <u>Proposed annual broodstock collection level (maximum number of adult fish).</u>

Up to 50 adults (25 males and 25 females) natural-origin (non-adipose fin-clipped, non-BWT) winter-late steelhead may be collected for broodstock in order to identify fish that assign

genetically to North Fork Lewis stock (H&S 2006). This includes mortality due to trapping, combined with holding loss. Proposed annual fish release levels (maximum number) by life stage and location.

Table 1.11.1: Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Max. No.	Location	Major Watershed
Yearlings	50,000	NF Lewis River (WRIA 27.0168)	Lewis

Source: Future Brood Document 2014.

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

Program was initiated in 2009.

Table 1.12.1: Total program smolt releases and resultant adult return, Lewis River endemic winter (late) steelhead program.

Brood Year	Smolt Release	Return Year	Adult Return	
			To Traps	Est'd Escapement
2009	24,300	**2012**	189	556
2010	57,025	**2013**	742	898
2011	34,570	**2014**	1,046	n/a
2012	49,650	**2015**	n/a	n/a

Source: WDFW Hatcheries Headquarters Database, 2014.
N/a = data not yet available.

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

Merwin Hatchery began operations in 1993. The endemic winter steelhead program was initiated in 2009; the first yearlings were released in 2010.

1.14 Expected duration of program.

The lower-river adult winter endemic steelhead broodstock collection began in 2009; the program is expected to continue through the spring of 2021 (12 years), it will be reviewed by NOAA and the ACC to determine if the program will continue beyond this date. The entire program, including the adult-supplementation portion, is planned to run for a total of 15 years.

1.15 Watersheds targeted by program.

NF Lewis River (WRIA 27.0168), Lewis Sub-Basin, Lower Columbia River.

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.

Construction of Merwin Dam in 1929 blocked anadromous fish passage to most of the usable spawning and rearing habitat in the watershed. The N.F. Lewis late-winter steelhead population is part of the Lower Columbia River Steelhead ESU, which is listed as "Threatened" under the ESA. The majority of this population's historic spawning and rearing habitat was located above the three dams and reservoirs operated by PacifiCorp Energy and Cowlitz PUD. The current population is relegated to approximately 20% of its historic habitat. DNA analysis (NOAA 2007) has identified a distinct late population of winter steelhead in the lower North Fork; limited escapement data and modeled productivity estimates suggest the population is small. Preliminary

analysis of Cedar Creek Weir data suggests the population is on the order of 50 to 100 fish annually (pers. comm. D. Rawding and J. Holowatz, WDFW 2010).

The Lewis River sub-basin plan (LCFRB 2004) and the Settlement Agreement (SA 2004), submitted by PacifiCorp and Cowlitz PUD (November 2004), call for reintroduction projects involving late-winter steelhead into the upper NF Lewis River. The current late-winter population in the lower river seems to be the best candidate for these projects. However, concerns regarding the abundance numbers and potential genetic and fitness concerns associated with a hatchery program need to be acknowledged.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: *Transport wild adults from the lower N.F. Lewis River directly into the upper watershed*. An important part in assuring the success of the overall reintroduction project is efficient capture of the juvenile production out of the upper North Fork into Swift Reservoir. If the efficiency is lower than planned, this alternative could essentially "trap" a portion of the natural production in the upper system. This issue is reduced by using only supplementation adults until the efficiencies of the juvenile capture facility is tested and capture efficiency targets are achieved.

In addition, abundance of naturally-spawning winter-late steelhead in the lower basin is inadequate to support and meet the reintroduction goals.

Alternative 2: Utilize an anadromous O. mykiss broodstock source from an adjacent basin (within same DPS). Steelhead from an adjacent sub-basin (East Fork Lewis or Kalama rivers) could be used. Recent preliminary analysis (NOAA, 2007) identifies a genetically distinct winter-late stock in the North Fork Lewis River. LCFRB (2004) identifies the NF Lewis stock (including Cedar Creek) as the preferred source for reintroduction. Recent escapement estimates and trapping numbers at the Merwin FCF suggest abundance is adequate to support the use of this stock.

Alternative 3: Develop the broodstock source from O. mykiss juveniles in the upper system, that have been observed to display anadromous characteristics. WDFW regional staff have reported that there may be a significant number of resident *O. mykiss* in Swift Reservoir that exhibit smolt characteristics in the spring (pers. communication Jim Byrne). These fish could provide an alternative source or supplementation to anadromous broodstock. This should continue to be an alternative if an appropriate anadromous broodstock source is not available. This alternative would require genetic sampling of fish used for supplementation.

Alternative 4: Utilize non-local broodstock source. The Merwin Hatchery winter-early steelhead in the Lewis River is a non-local stock and unacceptable for use as a wild supplementation stock. Up-river reintroductions should be indigenous anadromous stocks only, as they will be more adaptable for the habitat and compatible with the natural Lewis River population in the lower river.

Alternative 5: Incorporate generational hatchery fish from W x W crosses into the broodstock. The rational for using only wild (natural-origin) adults, rather than F1 returns from program fish, in the annual broodstock is to maximize the genetic diversity of the natural-origin population passed into the supplementation fish, which will help to minimize the potential negative gene-flow issues when hatchery-origin fish interact with natural-origin fish.

1.16.3 Potential Reforms and Investments

Reform/Investment 1: Expand gene flow monitoring. Genetic characterization of the natural stock should be elevated to include samples from fish remaining in the lower N.F. Lewis in order to complete ongoing DNA baseline genetic collection (currently only fish from the Merwin Dam FCF and Cedar Creek are sampled). Confirmation of historical wild steelhead collected

downstream would be the result, along with providing the tools to better manage steelhead within the basin.

Reform/Investment 2: *Kelt reconditioning.* Consider kelt reconditioning for the endemic broodstock program after year three of this program. This investment would allow these fish to preserve genetic diversity.

2 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 4(d), 7, or 10.

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 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).

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

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).

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).

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.

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 seventeen artificial propagation programs (NMFS 2005 -70FR37160).

Status: Of the 32 historical populations in the ESU, 28 are considered extirpated or at very high risk (Ford 2011). 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 recovery plan analyses, all of the 14 Tule populations (**Table 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. The Lewis River late-fall population is considered low or very low risk (Ford 2011).

Table 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: LCRFB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[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.

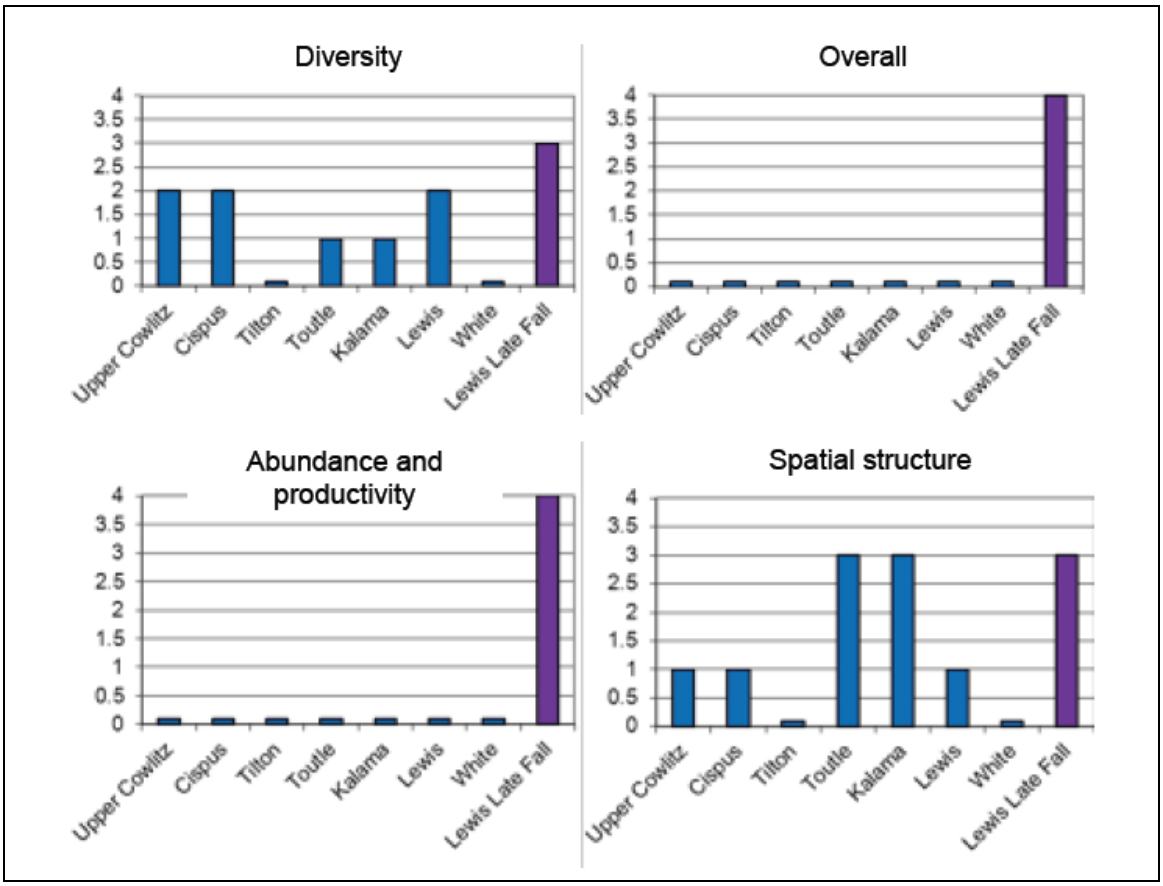

Figure 2.1: Current status of Washington lower Columbia River spring Chinook and late fall-run (bright) Chinook salmon populations for the VSP parameters and overall population risk. (LCFRB Recovery Plan 2010, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

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), as well as ten artificial propagation programs: the Cowlitz Trout Hatchery Late-Winter (Cispus, Upper Cowlitz, Lower Cowlitz, and Tilton rivers), Kalama River Wild (winter- and summer-run), and four Oregon programs (NMFS 2006). Merwin Hatchery steelhead programs are not considered part of the DPS listing. Broodstock collection for the Lewis River Late-Run Winter Steelhead Program (initiated in 2009) uses natural-origin late-run winter steelhead that are genetically representative of the North Fork Lewis River natural-origin winter steelhead population for broodstock.

Status: Of the 26 historical populations in the ESU, 17 are considered at high or very high risk. 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: Baseline viability status, viability and abundance objectives, and productivity improvement targets for 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: LCRFB 2010.

L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.

[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.

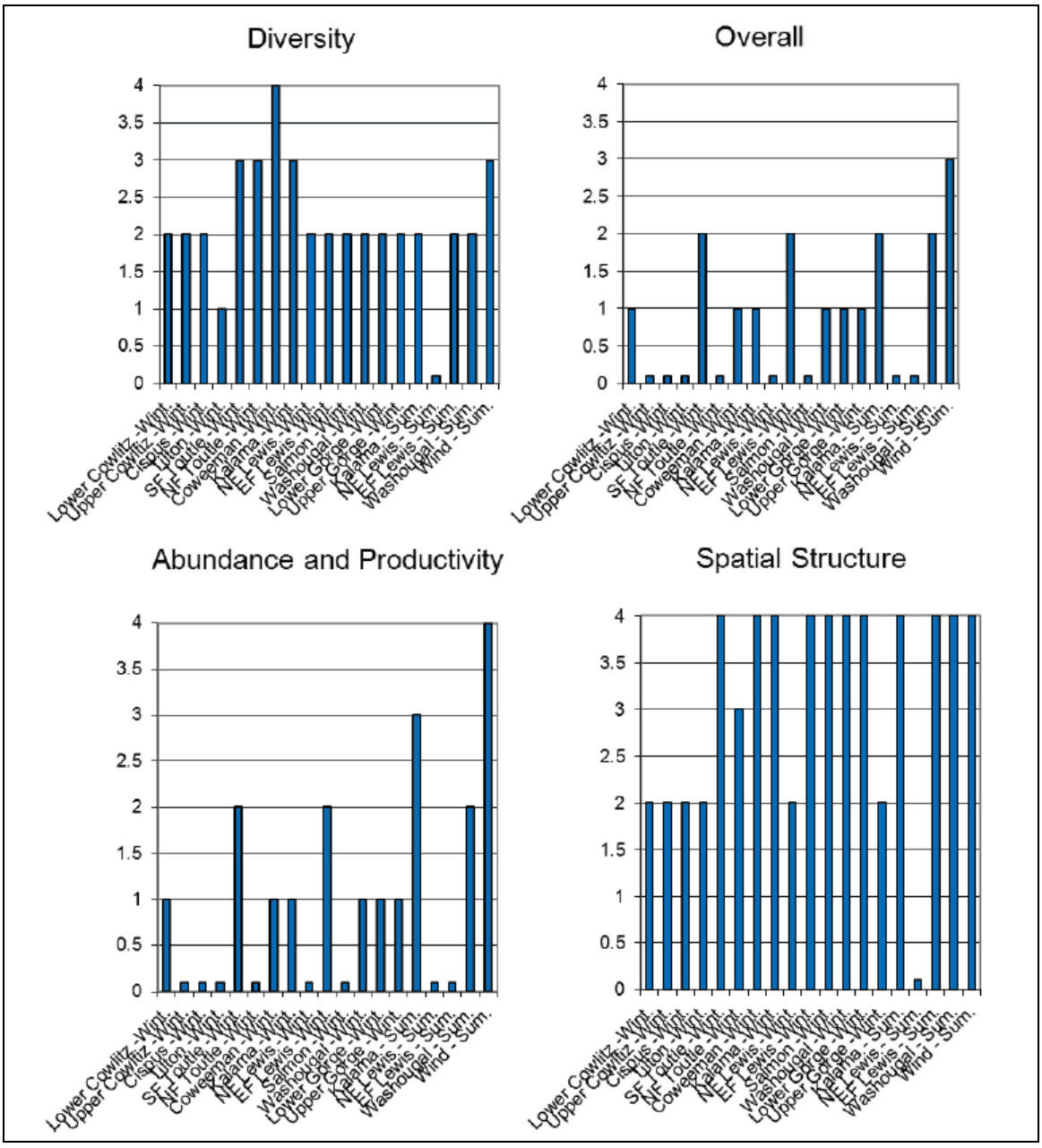

Figure 2.2: Current status of Washington LCR steelhead populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") 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-five artificial propagation programs include: the Grays River, Sea Resources Hatchery, Peterson Coho Project, Big Creek Hatchery, Cathlamet High School FFA Type-N Coho Program, 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 Coho Program, Kalama River Type-S Coho Program,

Washougal Hatchery Type-N Coho Program, Lewis River Type-N Coho Program, Lewis River Type-S Coho Program, Fish First Wild Coho Program, Fish First Type-N Coho Program.

Status: Three 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). All three 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.

Table 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: LCRFB 2010.

L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.

[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).

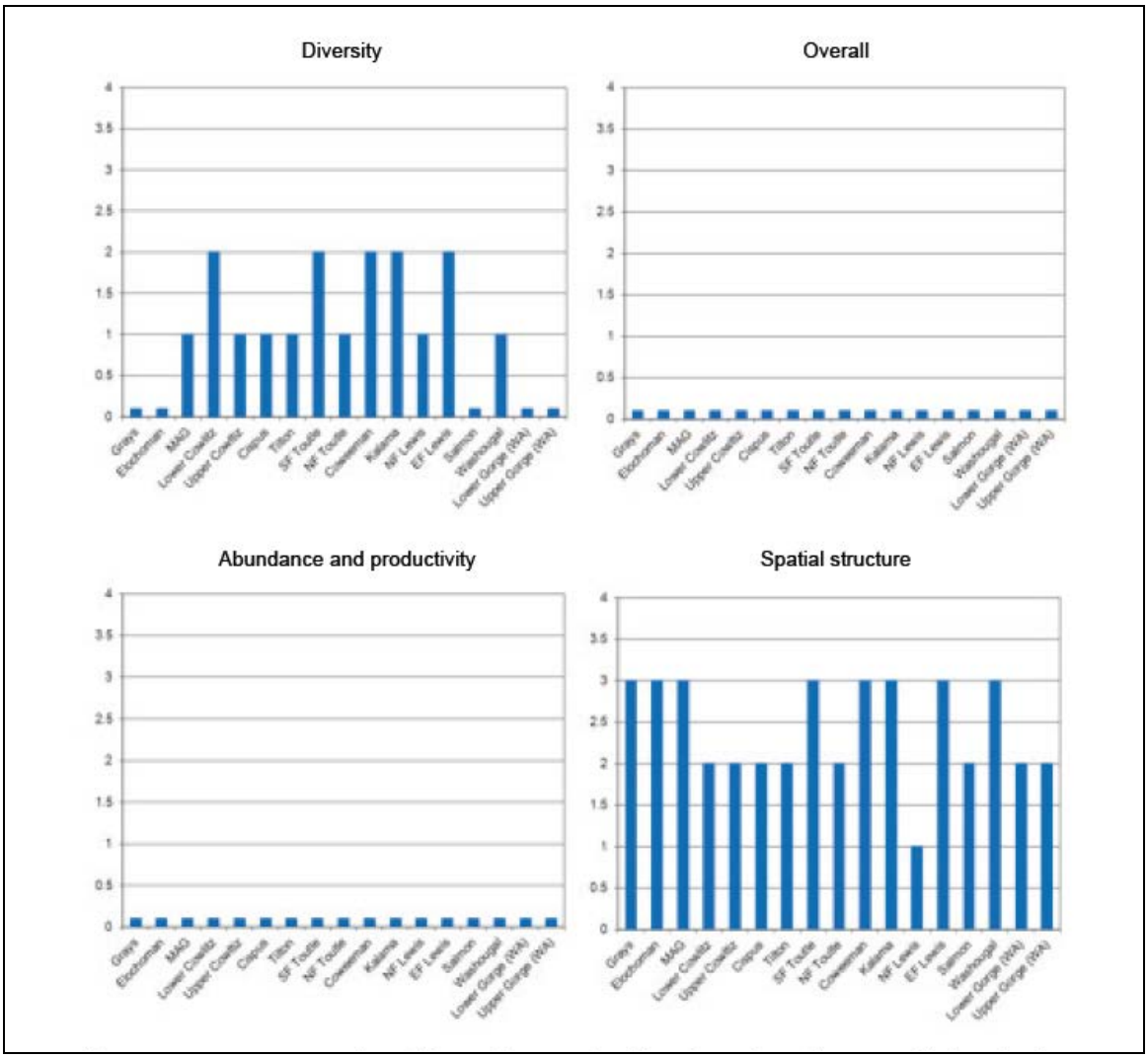

Figure 2.3: Current status of Washington LCR coho populations for the VSP parameters and overall population risk. (LCFRB 2010 recovery plan, chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 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 Big Creek, Grays River, Lewis River, and Washougal River/Duncan Creek chum hatchery programs.

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 2.3**. 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).

Table 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: LCRFB 2010.
L = Low; M = Moderate; H = High; VH/E = Very High/Extinct.
[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.

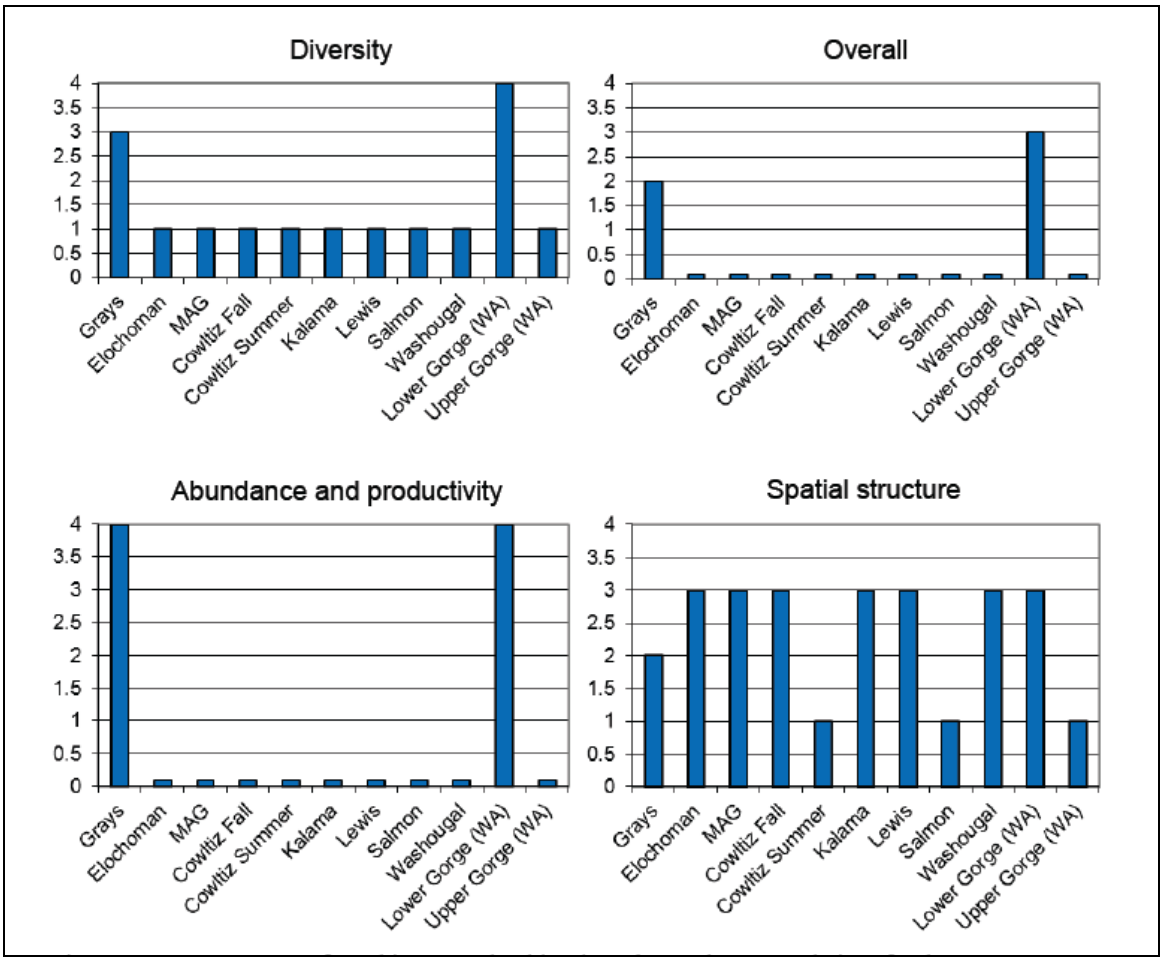

Figure 2.4: Current status of Washington CR chum populations for the VSP parameters and overall population risk. (LCFRB 2010 Recovery Plan, Chapter 6). A population score of zero indicates a population extirpated or nearly so, a score of 1 is high risk, 2 is moderate risk, 3 is low risk ("viable") and 4 is very low risk (Ford 2011).

Lewis River eulachon (*Thaleichthys pacificus):* The Southern Distinct Population Segment (DPS) of Pacific eulachon was listed as *Threatened* under the ESA on May 17, 2010 (75 FR 13012).

Status: The lower Columbia River and its tributaries support the largest known spawning run of eulachon. The main stem of the lower Columbia River provides spawning and incubation sites, and major tributaries in Washington State that have supported runs in the past include the Grays, Elochoman, Cowlitz, Kalama and Lewis Rivers. Although generally not considered as large a eulachon run as the Cowlitz River, the Lewis River has produced very large runs periodically and nearly half of the total commercial eulachon catch for the Columbia River Basin in 2002 and 2003 came from the Lewis River. Larval eulachon have been caught in the Lewis River during sampling efforts by WDFW and the Cowlitz Indian Tribe (JCRMS 2009, NMFS 2011). During spawning, eulachon typically move upstream in the Lewis River about 10 miles to Eagle Island, but they have been observed as far upstream as Merwin Dam RM 19.5 mi. Larval eulachon have also been caught in the East Fork of the Lewis River, up to the confluence with Mason Creek, RM 5.7 mi. Merwin Dam was completed in 1931, and it presents a passage barrier to all anadromous fish, including eulachon (LCFRB 2004). The current abundance of eulachon is low and is declining in all surveyed populations throughout the DPS. The major threats and continued causes for declines in eulachon populations include climate change and its impacts on both ocean

conditions and freshwater habitat, by-catch in commercial fisheries, dams and water diversions, degraded water quality, dredging and predation (NMFS 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.

Not available for most species. See HGMP section 11.1 for planned M&E. Juvenile coho production estimates is the one measure of production in the Lower Columbia system.

Table 2.2.5: Lower Columbia River Washington tributary coho smolt production estimates, 1997-2009 (WDFW, Region 5).

Year	Cedar Creek	Mill Creek	Abernathy Creek	Germany Creek	Cowlitz Falls Dam	Mayfield Dam
1997	-----	-----	-----	-----	3,700	700
1998	38,400	-----	-----	-----	110,000	16,700
1999	28,000	-----	-----	-----	15,100	9,700
2000	20,300	-----	-----	-----	106,900	23,500
2001	24,200	6,300	6,500	8,200	334,700	82,200
2002	35,000	8,200	5,400	4,300	166,800	11,900
2003	36,700	10,500	9,600	6,200	403,600	38,900
2004	37,000	5,700	6,400	5,100	396,200	36,100
2005	58,300	11,400	9,000	4,900	766,100	40,900
2006	46,000	6,700	4,400	2,300	370,000	33,600
2007	29,300	7,000	3,300	2,300	277,400	34,200
2008	36,340	90,97	5,077	3,976	-----	38,917
2009	61,140	62,83	3,761	2,576	-----	29,718
2010	-----	-----	-----	-----	-----	49,171
2011	-----	-----	-----	-----	-----	43,831

Source: LCR FMEP Annual Report 2010 and WDFW Data 2012.

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

Table 2.2.6: Spring Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2012.

Year	Cowlitz	Kalama	Lewis
2000	266	34	523
2001	347	578	754
2002	419	898	498
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	0	160
2011	1,359	26	120
2012	1,359	28	200

Source: Joe Hymer, WDFW Annual Database 2012

Table 2.2.7: Fall Chinook salmon total spawner abundance estimates in LCR tributaries, 2000-2011[a].

Year	Elochoman River	Coweeman River[a]	Grays River	Skamokawa Creek	Cowlitz River	Green River (Toutle)	SF Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River
2000	884	424	80	482	2,100	1,580	204	3,877	391	6,504	2,757
2001	230	251	104	3	1,979	1,081	102	3,451	245	4,281	1,704
2002	332	566	390	7	3,038	5,654	216	10,560	441	5,518	2,728
2003	2,204	753	149	529	2,968	2,985	327	9,272	607	11,519	2,678
2004	4,796	1,590	745	2,109	4,621	4,188	618	6,680	918	13,987	10,597
2005	6,820	1,090	387	588	10,329	13,846	140	24,782	727	18,913	3,444
2006	7,581	900	82	372	14,427	7,477	450	18,952	1,375	17,106	6,050
2007	194	140	99	36	2,724	961	30	1,521	308	10,934	2,143
2008	782	95	311	253	1,334	824	45	2,617	236	4,268	3,182
2009	231	147	93	139	2,156	1,302	66	4,356	110	6,112	2,995
2010	1,883	1,330	12	268	2,762	605	NE	3,576	314	8,908	4,529
2011	508	2,148	353	41	1,616	668	NE	10,639	334	14,033	2,961

Source: Ron Roler, WDFW Natural Spawn Progress Reports 2012.

* Estimates of total adult and jack fall Chinook. May include fish put upstream of hatchery weirs.

Table 2.2.8: Wild fall Chinook escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCFRP abundance targets.

Location	Grays River	Elochoman/ Skamokawa	Mill/Abernathy/ Germany
WDFW Escapement Goal	**1486**	**853**	**508**
LCFRP Abundance Target	**800**	**600**	**500**
2000	1064	650	380
2001	1130	656	458
2002	724	370	354
2003	1200	668	342
2004	1132	768	446
2005	396	376	274
2006	718	632	398
2007	724	490	376
2008	764	666	528
2009	568	222	396
2010	422	534	398
2011	318	442	270
3-year average	**436**	**399**	**355**
5-year average	**559**	**471**	**394**
10-year average	**697**	**517**	**378**

Source: WDFW Data 2012

Table 2.2.9: Wild fall Chinook escapement estimates for select SW Washington DPS populations, current WDFW escapement goals and LCSRP abundance targets.

Location	Coweeman	SF Toutle	NF Toutle/ Green	Kalama	EF Lewis	Washougal
WDFW Escapement Goal	**1064**	**1058**	**NA**	**1000**	**1243**	**520**
LCSRP Abundance Target	**500**	**600**	**600**	**600**	**500**	**350**
2000	530	490	----	921	NA	NA
2001	384	348	----	1042	377	216
2002	298	640	----	1495	292	286
2003	460	1510	----	1815	532	764
2004	722	1212	----	2400	1298	1114
2005	370	520	388	1856	246	320
2006	372	656	892	1724	458	524
2007	384	548	565	1050	448	632
2008	722	412	650	776	548	732
2009	602	498	699	1044	688	418
2010	528	274	508	961	336	232
2011	408	210	416	622	308	204
3-year average	**513**	**327**	**541**	**876**	**444**	**285**
5-year average	**529**	**388**	**568**	**891**	**466**	**444**
10-year average	**487**	**648**	***588**	**1374**	**515**	**523**

Source: WDFW Data 2012.
* 7-year average for NF Toutle/Green.

Table 2.2.10: 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	**1000**	**NA**	**NA**	**1557**
LCSRP Abundance Target	**500**	**500**	**500**	**1000**
2001	286	271	184	457
2002	454	440	404	680
2003	817	910	607	1096
2004	632	425	NA	861
2005	400	673	608	587
2006	387	560	636	632
2007	361	412	681	737
2008	237	365	755	614
2009	308	800	433	580
2010	370	602	787	788
2011	534	1084*	956*	1468
3-year average	**404**	**829**	**725**	**945**
5-year average	**362**	**653**	**722**	**837**
10-year average	**450**	**627**	**652**	**804**

Source: WDFW Data 2012.
* Preliminary estimates.

Table 2.2.11: Population estimates of chum salmon in the Columbia River.

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010[a]	2011[a]
Crazy Johnson Creek	---	---	966	1,471	3,639	759	1,034	981	677	2,374
WF Grays River	---	---	9,015	1,324	1,232	1,909	800	994	1,967	7,002
Mainstem Grays River	---	---	4,872	1,400	1,244	1,164	886	750	3,467	1,848
I-205 area	3,468	2,844	2,102	1,009	862	544	626	1,132	2,105	4,947
Multnomah area	1,267	1,130	665	211	313	115	28	102	427	641
St Cloud area	---	137	104	92	173	9	1	14	99	509
Horsetail area	---	---	106	40	63	17	33	6	45	183
Ives area[b]	4,466	1,942	363	263	387	145	168	141	214	162
Duncan Creek[c]	13	16	2	7	42	9	2	26	48	85
Hardy Creek	343	392	49	73	104	14	3	39	137	173
Hamilton Creek	1,000	500	222	174	246	79	114	115	247	517
Hamilton Spring Channel	794	363	346	84	236	44	109	91	187	324
Grays return[d]	12,041	16,974	15,157	4,327	6,232	3,966	2,807	2,833	6,399	11,518
I-205 to Bonneville return	11,351	7,324	3,959	1,953	2,426	976	1,084	1,666	3,509	7,541
Lower Columbia River Total	23,392	24,298	19,116	6,280	8,658	4,942	3,891	4,499	9,908	19,059

Source: Todd Hillson - WDFW Chum Program 2012

[a] Data for 2010 and 2011 is preliminary.

[b] Ives area counts are the carcass tagging estimate plus fish removed for broodstock, except for 2007 and 2008, which is area under the curve.

[c] Totals for Duncan Creek do not include broodstock brought in from mainstem spawning areas, adult trap catch or surveys below monitoring weirs only..

[d] Grays return totals include natural spawners and removed for broodstock.

- 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.

Not available for most species. In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependent on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. See HGMP section 11.1 for planned M&E. The proportion of effective hatchery-origin spawners (pHOS) should be less than 10% of the naturally spawning population.

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 Trapping/Holding: Broodstock used for this program are collected at the Lewis River Hatchery and the Merwin Dam FCF. The traps are opened for steelhead collection during the entire run to allow for collection over the entire run timing. Fish are sorted on a weekly schedule as dictated by numbers of fish entering the trap. All fish are identified as natural-or hatchery-origin through examination for fin-clips or CWTs, and are examined for gill net or predator marks. Fish sorted at the collection facility and released may sustain some physical damage but little or no mortality is documented (see "take" tables to be submitted to NMFS).

Non-local winter-early steelhead enter the Merwin FCF traps primarily from December through February, while endemic winter-late steelhead primarily enter from late February thru June. in. Steelhead collected at the Merwin Trap are sorted and transferred via overhead brail into a 1, 800-gallon tanker truck. Fish are transported ¼ mile from the Merwin FCF to one of four adult holding ponds at Merwin Hatchery. The transfer from Merwin FCF to tanker truck to holding pond is water to water, with little or no adult loss expected. Pre-spawn steelhead captured for use as broodstock will be held until ripe and spawned. Because of a short holding period and the cool environment during the late-winter and spring, broodstock survival to spawning period is expected to be high, with minimal loss of adults.

Broodstock collection in the Lower NF Lewis River and tributaries. The *Hatchery and Supplementation Sub-group* (HSS) identified four direct-capture methods to complement collection activities at the trapping facilities. These methods include targeted tangle net drifts, targeted seining and angling. Tangle-netting will likely be the primary method of fish capture. Other methods will be supplemental and opportunistic. Success in collecting fish in the lower NF Lewis River will depend greatly on river flow conditions and visibility.

- *Targeted tangle net drifts* - Monofilament tangle nets of 2.5 or 3-inch stretch mesh will be drifted in known steelhead holding areas. Nets will vary between 60 and 150 feet long and will have a depth of between 6 and 8 feet.
- *Targeted seining* - This method will use small mesh, nylon seine nets to corral or "purse" steelhead holding in suitable seining pools.
- *Angling* - Hook and line sampling may be employed by field crews opportunistically to target fish holding in areas not suitable for tangle-netting or seining. The best available scientific information suggests hook and release mortality of adult steelhead is low. Hooton (1987) found catch and release mortality of adult steelhead to be 3.4% (n= 3,715 fish) on average when using a variety of fishing tackle, including barbed and barbless hooks, bait and artificial lures. Specific fishing techniques, adult netting materials and holding protocols would be reviewed in consultation with NOAA Fisheries to minimize impact on listed fish. Fish would be transferred to Merwin Hatchery in individual soft-sided plastic or rubber containers with lid and air stones. In addition, coordination with select professional river fishing guides and sport anglers will be explored.

Spawning. All broodstock used for the supplementation program were lethally-spawned for the first three years (2009-2011) to determine the prevalence of *Infectious Pancreatic Necrosis* (IPN) and other pathogenic activity. Results were negative. This procedure will be reviewed by the HSS or ACC prior to the start of the 2012 broodstock collection. As of brood year 2012, females will be live-spawned and as many as possible will be released back to the river, as up to 10.2% may survive to repeat-spawn (Kalama River studies, Howell et al. 1985). Also, kelt re-capture studies have indicated greater female survivals (88-91.3%) over males (Branstetter, et al., 2006); Males will be prioritized over females for lethal pathology screening. After spawning, moribund females or even fresh pond mortality may be kidney/spleen sampled for thorough pathogen screening (*Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State,* WDFW and WWTIT 1998, updated 2006). Total lethal take for spawning and pathology screening is any mortality and/or fish in very poor condition.

Kelt Re-conditioning (alternative). This may involve short-term reconditioning to initiate feed and stimulate a feed response. Short-term kelt re-conditioning studies (Branstetter, et al. 2006) have reported mortalities from 0 to 10%. A one-year winter kelt re-conditioning project on the Cedar River was conducted on wild Lake Washington winter steelhead in 2003; a high success rate was reported on holding males in circular tanks and feeding live sand shrimp up to two months (pers. comm. B. Antipa WDFW, 2006).

Rearing Program:
Operation of Hatchery Facilities: Hatchery 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 Lewis winter steelhead predation and competition effects on listed salmonids and eulachon: The proposed annual production goal for this program is 50,000 yearlings. Steelhead releases are at 6.0 fpp (208 mm fl) and can be released starting May 1. Steelhead smolts could encounter listed Chinook, coho, steelhead, chum and eulachon in the Lewis sub-basin and Columbia mainstem. Due to size differences between hatchery smolts and sub-yearling listed stocks, competition is unlikely with different prey items and habitat preferences. Indirect take from predation is unknown.

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

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 acclimated 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.
- Fish that do not volitionally migrate will be trucked to Martins access site and released.

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).

Monitoring activities are developed annually through the Annual Operating Plan (AOP).

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

See **Table 7.5.1**, and "Take" tables to be submitted to NMFS.

- 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).

See "Take" tables to be submitted to NMFS.

- 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.

All adults handled will be noted for condition or injuries observed during broodstock collection, holding or spawning. Alternative methods for broodstock collection (netting, angling) will have stringent capture, handling or holding protocols developed by WDFW in conjunction with NOAA Fisheries staff. All fish handled would be accounted for and condition noted if spawned and released.

3 SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

This is an integrated program used for supplementation onto the upper watershed. The LCFRB Recovery Plan (2010) identifies the presence of hatchery-origin fish on the natural spawning grounds as a factor in the reduced productivity of the natural populations in Lower Columbia River ESUs.

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 uses 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. The Conservation and Sustainable Fisheries Plan (draft)
3. The Hatchery Action Implementation Plans (HAIP)
4. Lower Columbia Salmon Recovery Plan (LCSRP)

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.

Conservation and Sustainable Fisheries Plan (*CSFP*)*:* The CSFP is a draft plan that has been developed to meet WDFW's responsibilities outlined in the Lower Columbia Salmon Recovery Plan (LCSRP) and address the HSRG suggested solutions and achieve HRSG standards for primary, contributing and stabilizing populations. 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.

Hatchery Action Implementation Plans (*HAIP*)*:* The HAIPs illustrate how WDFW is implementing hatchery programs to incorporate the HSRG guidelines. The plans provide the current programs and explain the future goals.

Lower Columbia Salmon Recovery Plan (*LCSRP*)*:* Some sub-basins will be free of hatchery influence and hatchery programs. In other sub-basins, hatchery programs will serve specific conservation and harvest purposes consistent with goals for naturally-spawning populations. The mosaic of programs is designed to ensure that overall each DPS will be naturally self-sustaining.

Strategies

1. Reconfigure production-based hatchery programs to minimize impacts on natural populations and complement recovery objectives.
2. Adaptively manage hatcheries to respond to future knowledge, enhance natural production, and improve operational efficiencies.

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

Lewis Hatchery Mitigation Agreement (*FERC Project #s 935, 2071, 2111 and 2213*). The program will operate under the Settlement Agreement (SA 2014) for the Lewis River Hydroelectric Projects (FERC Nos. 935, 2071, 2111 and 2213). The *Lewis River Hatchery and Supplementation Plan* (H&S Plan) was proposed by Jones and Stokes (April 2006) for the Lewis River Hydroelectric Projects (FERC Nos. 935, 2071, 2111 and 2213). Key elements for planning

and goals for the system were based on the Lewis River Fish Planning Document, S.P. Cramer and Associates, April 2004. The H&S Plan is required under Section 8 of the Lewis River Hydroelectric Projects Settlement Agreement dated November 30, 2004. The goals identified by the parties to the Settlement Agreement formed the basis for actions proposed in this plan. PacifiCorp Energy and Cowlitz PUD provided the following requirements to fulfill Section 14.2.6 of the Settlement Agreement.

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. WDFW has submitted to NOAA Fisheries a *Fisheries Management and Evaluation Plan* (FMEP) for all lower Columbia River tributaries and has updated this document after coho were listed under ESA.

Selective fisheries were initiated for steelhead in the Lower Columbia River tributaries in 1986. Regulations require the release of all natural-origin steelhead, identified by the presence of an intact adipose fin. The estimated mortality for natural-origin winter steelhead for fisheries in lower Columbia River tributaries ranges from 4% to less than 7% per basin. Harvest rates have been reported as high as 70% for hatchery steelhead in the Cowlitz River (pers. comm. J. Tipping 2000). Until steelhead populations have recovered, natural-origin steelhead release regulations will be in effect with incidental mortality limited to less than 7% on natural stocks. The harvest rate of hatchery fish is expected to remain greater than 40% for most stocks.

Fish released from this program will not be adipose fin-clipped, and therefore will not be susceptible to harvest in mark-selective fisheries.

3.3.1 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.

While there may be a low level of mixed stock or incidental harvest on these program fish, there will be no directed fishery benefiting from this conservation program.

3.4 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 Lower Columbia River Salmon and Steelhead ESA Recovery Plan (Dornbusch and Sihler 2013).

Lewis River Hatchery and Supplementation Plan (*H&S Plan*). The development of the Hydroelectric Dams in the Lewis River system has blocked all upstream passage to 80% of the historical anadromous habitat while significant riverine habitat is permanently lost to reservoir storage. Goals as identified in the Settlement Agreement (SA 2004) proposed by PacifiCorp Energy and Cowlitz County PUD for the Lewis River Hydroelectric Projects is to provide self-sustaining, naturally producing, harvestable native anadromous salmonids species throughout their historical range in the North Fork Lewis River FERC Nos. 935, 2071, 2111 and 2213). Options for restoring habitat and the re-introduction of fish have been detailed in the Settlement Agreement (SA 2004). Habitat improvements and productivity models are detailed in the Draft

Lewis River Hatchery & Supplementation Plan and the *Lewis River Fish Planning Document, p*repared *for* PacifiCorp and Cowlitz PUD (April 2006).

Sub-Basin Planning - Regional sub-basin planning processes include the Lewis River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Lewis River Sub-basin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan. 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, revised June 6, 2010) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection - Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The *Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans* and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducted a *Salmon Steelhead Habitat Inventory Assessment Program* (SSHIAP), which documented 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 27 (Kalama, North Fork Lewis River, and East Fork Lewis River/Salmon Creek) LFA was conducted by the Washington State Conservation Commission (May 2002).

3.5 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 steelhead 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 spring Chinook, coho and steelhead programs are released from the Lewis Hatcheries and significant natural production of fall Chinook occurs, with lesser

numbers of natural production of coho, chum and steelhead occurring in this system along with non-salmonid fishes (eulachon, sculpins, lampreys and sucker etc.). None of these species would be expected to have a positive impact on the program except by providing nutrient enhancement which will provide benefit to all of the natural populations.

(4) *Salmonid and non-salmonid fishes or species that could be positively impacted by the program.* Steelhead smolts can be preyed upon release thru the entire migration corridor from the river sub-basin to the mainstem Columbia River and estuary, and thus providing a food source for other populations. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons can prey on steelhead smolts. 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).

4 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 at Merwin Hatchery.

Facility	Water Source	Water Right		Available Water Flow	Avg Water Temp. (F°)[a]	Usage	Limitations
		Record/Cert. No.	Permit No.				
Merwin Hatchery	Lake Merwin (surface)	S2-28311	---	11.0 cfs	42-61	All	None

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

Merwin Hatchery Merwin Hatchery is supplied with 100% Lake Merwin water; total available flow is 5,000 gpm from two intakes used at 15 and 110 ft. deep. Water temperatures range from 42-61°F. Water clarity is good. Merwin Hatchery has ozonation capabilities to treat 3,800 gpm.

Holding ponds are supplied at 600 gallons per minute (gpm). Total flow to incubators and rearing ponds is approximately 5,000 gpm.

The water right permit for the Merwin Hatchery intake is formalized through the Washington Department of Ecology (see **Table 4.1.1**), and was obtained by Pacific Power & Light Co. in 1991.

NPDES Permits:
Merwin 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				
Merwin WAG13-1052	Y	Y	Y	5/18/2013	0	N	Y

Source: Ann West, WDFW Hatcheries Headquarters Database 2014.

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.

Merwin Hatchery. Fish rearing activities meet State water quality guidelines and satisfy all required permits. In addition, 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.

5 SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

Four locations in the lower NF Lewis River basin have been identified for broodstock collection: 1) the Merwin Dam adult trap; 2) the Lewis River Hatchery trap; 3) the Cedar Creek weir/adult trap; and 4) the lower NF Lewis River and tributaries between Merwin Dam and the County Bridge (I-5 bridge) (Figure 1). While the trapping facilities at Merwin Dam FCF and Cedar Creek weir offer the most straight-forward means of capturing natural-origin winter steelhead, recent annual returns suggest that relying on collections from any one location may not provide sufficient numbers or sex ratios of fish to meet program goals. In addition, it is desirable to collect broodstock from multiple locations to increase the probability that the genetic diversity of the stock is represented.

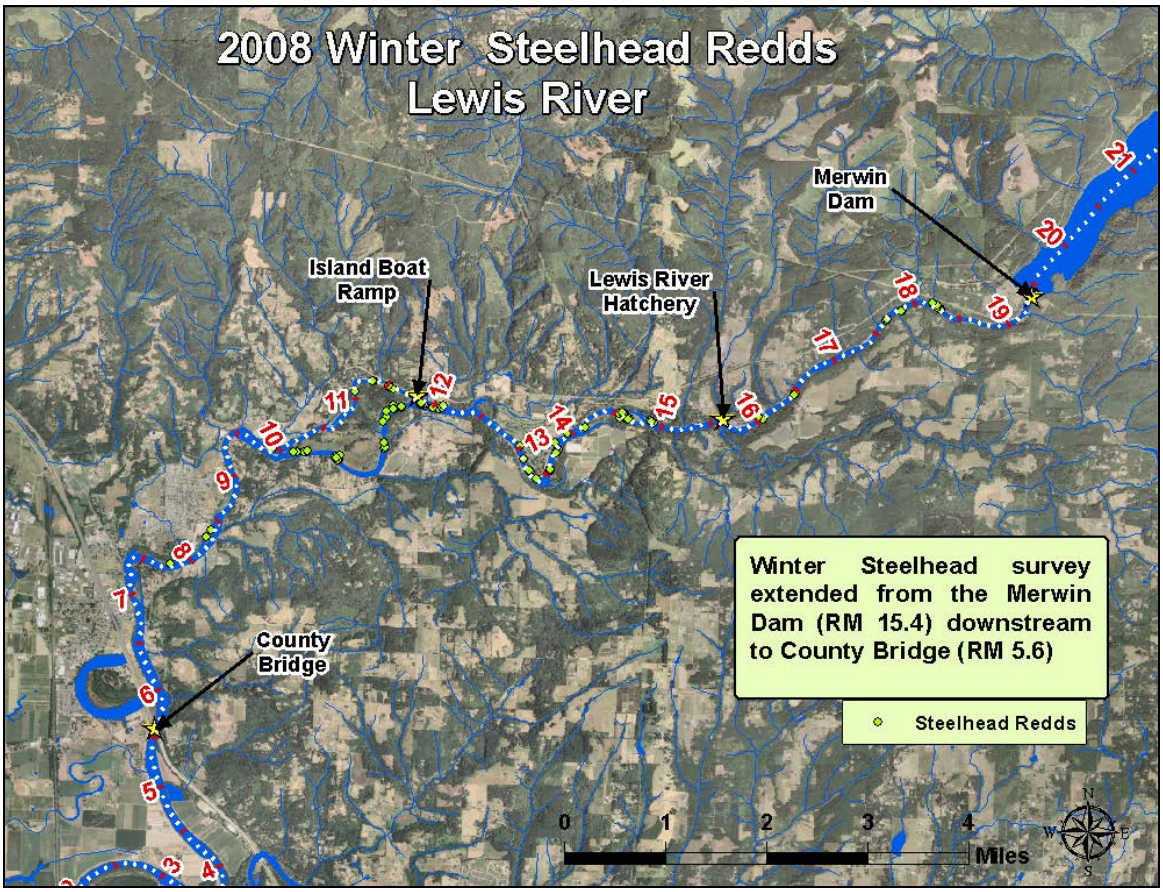

Figure 5.1: 2009 broodstock collection area NF Lewis River between Merwin Dam and the County Bridge, based on the 2008 Winter Steelhead Redds and Survey Area on the N.F. Lewis River.

Table 5.1.1: Broodstock collection facilities at Lewis River Hatchery and Merwin Dam.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Concrete adult/sorting pond (Center Channel) –Lewis*	18,500	170	20	6	3,800 -10,000
1	Adult /pre-sort pond - Merwin FCF	8,000	100	8	10	4,490

* See also **Table 5.3.1** for adult holding facilities.

Lewis River Hatchery. Adults voluntarily enter the pond via the existing ladder and into the center channel (sorting pond) to be crowded. Additionally, each of the four side ponds can be crowded into the center channel via removable bulkheads and side crowders. All crowding is automated by either remote or local controls. Adults can be moved via truck into two of the side ponds when sorting elsewhere is impractical. Once crowded, the adults are side-crowded by an additional crowder into the entry of a large Archimedes Screw "pescalator." From the pescalator entrance, the fish are elevated to a diverter table where they then fill one of two electro-anesthesia baskets. Each electro-anesthesia (EA) basket can be operated independently and drops the fish onto a sorting table. Fish that are selected for surplus or lethal spawning are run through a "wallaby whacker," which kills the fish instantly. A series of tubes and spiral flumes direct the fish to various destinations. Return tubes are capable of returning fish to any four of the side holding ponds. Spiral flumes send carcasses to totes for distribution. A large hoist and fry tank lower adults to be returned to stream via an underground tube exiting at the hatchery outlet.

Cedar Creek Trap. Adults voluntarily enter the ladder on Cedar Creek where they collect in a holding area where they are sorted on a regular basis.

Merwin FCF. The new upstream collection and transport facility at Merwin Dam provides safe, timely, and effective passage of adult salmonids transported upstream as part of PacifiCorp's reintroduction program. Broodstock fish are also collected at the facility and transported to one of three WDFW facilities on the Lewis River (Lewis River, Merwin, and Speelyai hatcheries). The new facility is designed to be constructed in phases, offering the ability to incrementally improve fish passage performance (if needed) in the future to meet biological performance goals. Depending on the biological monitoring of the facility's performance, there are up to four additional phases that will increase flow into the fishway attraction pools, and add a second fishway with additional attraction flow, if necessary. Phase I represents the initial construction that was completed in 2014. The operational components of the Phase I include:

- Construction of Fish Entrance 1, located in the south corner of the powerhouse;
- Nominal 400 cfs attraction flow supplied by two Auxiliary Water Supply (AWS) pumps and the fishway ladder flow;
- Construction of Fishway 1, which consist of a 4-ft entrance slot and four pools with "vertical slot" styles weirs that fish volitionally ascend to reach automatic fish crowder and loading hopper;
- Ladder water supply water which combines hatchery return water from Merwin Hatchery and reservoir water for a total of 30 cfs;
- The automatic crowder located in the upper most fish ladder pool – when the crowder is in the parked position, it works as a V-trap, and when operated crowds fish into the loading hopper;
- Construction of the fish lift and conveyance system which is designed to automatically transport fish from the fishway to the conveyance pipe and into the presort fish holding pond.
- The presort pond is approximately 100-ft x 8-ft x 10-ft, and designed to hold up to 3,700 adult coho at one time.
- Fish are removed from the presort pond into the sorting facility by false weirs and a crowder system;
- An electro-anesthesia (EA) system is provided to temporarily anesthetize the fish to allow easier handling by biologists, and to reduce stress during sorting;
- Fish are sorted and then place in one of four 3,000 gallon holding tanks or one of six 250 gallon small transport tanks;
- Fish are transferred from holding tank to the transport truck using a water-to-water transfer process.

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

Table 5.2.1: Transportation equipment available at Lewis Hatchery Complex.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker truck (WDFW)	1800	Y	N	30	Sodium chloride (salt)	5000
Tanker truck (WDFW)	1100	Y	N	30	Sodium chloride (salt)	5000
Tanker truck (PacifiCorp)	1800	Y	N	60	Sodium chloride (salt)	5000
Tanker truck (PacifiCorp)	1800	Y	N	60	Sodium chloride (salt)	5000

Tanker truck (PacifiCorp)	250	Y	N	60	Sodium chloride (salt)	5000

Adults are transported from the Lewis River Hatchery and the Merwin Dam FCF to Merwin Hatchery via tanker truck; transport time is around 20 minutes. Fish collected at Cedar Creek weir will be transported in a truck mounted with a 300-gallon fiberglass tank plumbed with oxygen to Merwin Hatchery. Fish collected in river by angling and netting will be temporarily held in coolers and transported to an awaiting truck mounted with a 600-gallon fiberglass tank plumbed with oxygen, then transported on to Merwin Hatchery.

5.3 Broodstock holding and spawning facilities.

Table 5.3.1: Adult holding/spawning facilities available, Merwin Hatchery.

(No.)	Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
4	Adult Holding Ponds	953	33	7.7	4.0	180

5.4 Incubation facilities.

Table 5.4.1: Incubation vessels available at Merwin Hatchery.

Type	Units (number)	Size	Flow (gpm)	Volume (cu.ft.)	Loading (eggs/unit)
Vertical Double-Stack Tray Units	30 units (8 tray stacks)	24" x 25' 'x 4"	3.5	n/a	1 female per unit
Portable fiberglass shallow troughs	2	14'x1'x0.5'		7.0	n/a

The incubation/starter building consists of six intermediate raceways, four fry troughs and 15 double stack MariSource vertical incubators. It is fitted with back-up pumps to maintain flow through the intermediate raceways in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted.

Eggs are incubated on water from Lake Merwin; flow through the trays through eye-up is 3.5 gpm. The water used to supply the vertical incubators at Merwin Hatchery is pumped directly from Lake Merwin, treated with ozone, and passed through an enclosed stripper. Water quality is generally very good; water temperatures during incubation range from 48-55°F, with a DO of 10.5 ppm. High water temperatures in the summer (58°F to 59°F) can be a problem, but not during incubation or early rearing (Tetra Tech/KCM 2002). Fiberglass troughs are used only for egg disinfection and as a staging area for picking egg mortalities.

5.5 Rearing facilities.

Table 5.5.1: Rearing vessels available at Merwin Hatchery.

(No.)	Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)
10	Fingerling concrete raceway	2,034	78	9.7	2.7	520
-raceways can be screened into smaller sections		1,426	55.5	9.7	2.7	
		643	22.5	9.7	2.7	
6	Intermediate raceways	382	33.5	4.6	2.5	100
-raceways can be screened into smaller sections		260	22.6	4.6	2.5	
		135	11.6	4.6	2.5	
		254	21.9	4.6	2.5	
		126	10.8	4.6	2.5	
4	Concrete ¼-acre rearing ponds	46,000	175	75.4	3.9	950
2	Smolt ponds	1,357	39	11.6	4.0	450

1	Circular Pond (fiberglass, 1,412 gal)	201	NA	8	4	175

Fish are started in the intermediate raceways. When fish reach approximately 100 fish per pound or they have cleared viral sampling, they may be moved to the outside into four ¼-acre rearing ponds, or transferred to the fingerling raceways. During smolting behavior, fish can make their way to two smolt collection ponds where they will transported to the river for release.

Bird netting spans over the juvenile-rearing raceway series, and are supported by opposing counterweights.

Initial feeding and early rearing occurs in the intermediate raceways in the incubation building. When fish reach approximately 100 fish per pound or they have cleared viral sampling, they may be moved to the outside four concrete rearing ponds, or transferred to the fingerling raceways. During smolting behavior, fish can make their way to two smolt collection ponds where they are transported to the river for release.

5.6 Acclimation/release facilities.

See HGMP section 5.5. Juvenile steelhead for this program may be final-reared in one of the four ¼-acre ponds. During smolting behavior, fish can make their way to two smolt collection ponds where they will transported to the river for release.

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

Merwin Hatchery. Despite the fact that all water supplied during incubation and early rearing for this stock is ozone-treated, the facility still experiences periods of high mortality. These losses are associated with diseases associated from *Saprolegniasis* (fungus) and Low Temperature Disease (*Cytophaga psychrophila*). Adults also experience high losses during holding associated with fungus and IHNV.

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.

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.

6 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.

Broodstock for the program will be collected from natural-origin winter-late steelhead that genetically assign to NF Lewis River stock as represented by Merwin FCF and Cedar Creek genetic baseline collections. Initial analysis of natural-origin fish trapped at these locations shows them to be a distinct stock (NOAA 2007).

6.2 Supporting information.

6.2.1 History.

This program was initiated in 2009, utilizing natural-origin winter-late steelhead collected from the NF Lewis mainstem and tributaries (Cedar Creek). EDT analysis in LCFRB (2004) and Lewis Fish Planning document (2004) estimate adult productivity in the lower N.F. Lewis to be 367 and 534, respectively. Preliminary analysis of Cedar Creek Weir data suggests the population is on the order of 50 to 100 fish annually (pers. comm. D. Rawding and J. Holowatz, WDFW) (see **Table 1.12.1** for recent escapement numbers).

6.2.2 Annual size.

Up to 50 adults (25 males and 25 females) natural-origin (non-adipose fin-clipped, non-BWT) winter-late steelhead may be collected for broodstock that genetically assign to North Fork Lewis stock and meet the program release goal of 50,000 yearlings. Resent history has shown that up to 65 adult will need to be collect in order to obtain the goal of 50 adult that assign correctly. This includes mortality due to trapping combined with holding loss

6.2.3 Past and proposed level of natural fish in broodstock.

This program was initiated in 2009. The entire broodstock for the winter-late steelhead juvenile supplementation program will be composed of up to 50 natural-origin winter-late steelhead from the lower NF Lewis River. Broodstock collection will run for at least 12 consecutive years.

6.2.4 Genetic or ecological differences.

Genotypic, phenotypic and behavior differences in the entire population will be monitored (TBD) for co-occurrence, and deviation.

6.2.5 Reasons for choosing.

The natural-origin winter-late steelhead that return to the Merwin FCF have been shown to be a distinct population, relative to the segregated hatchery stocks that have been produced in the basin (initial DNA analysis, NOAA 2007). These endemic steelhead are optimally-adapted for survival in the Lewis River and will be the most capable of surviving, returning to, and effectively spawning in the Upper Lewis River System. This stock would be the obvious first choice to develop an integrated endemic hatchery steelhead broodstock in the Lewis system, and the LCFRB recovery plan (2004) identifies this stock as the most appropriate for reintroduction. Initial concerns over total abundance of this stock prompted examination of alternatives described in HGMP section 1.16.2. EDT estimates of productivity and recent estimates of abundance via redd surveys from 2008 through 2014 show on average that abundance of the NF Lewis stock is adequate for use in this supplementation program. (see table 1.12.1)

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.

Broodstock collection numbers will remain consistent with guideline limit of 50 adults. Broodstock collection numbers will also remain below the 30% of natural population threshold, as outlined by the HSRG (Technical Discussion Paper #3, March 7, 2005). These measures should provide an effective population (N_e) > 500 (>125/*generation*).

7 SECTION 7. BROODSTOCK COLLECTION

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

Adults collected from the lower NF Lewis River winter-late steelhead run.

7.2 Collection or sampling design.

Broodstock collection relies on three different methodologies: trapping at Merwin Dam, in-river netting, and the use of volunteer anglers.

Merwin FCF and Lewis River Hatchery. Broodstock used for this program are collected at the Lewis River Hatchery, Merwin Dam FCF and Cedar Creek Trap. The traps are opened for steelhead collection during the entire run (January through June) to allow for collection over the entire run timing.

Fish are sorted on a regular schedule as dictated by numbers of fish entering the trap; wild fish are transferred to Merwin Hatchery for spawning, incubation and rearing. All fish are identified as natural-or hatchery-origin through examination for fin clips or BWTs.

Lower NF Lewis and tributaries collection. The *Hatchery and Supplementation Sub-group* (HSS) identified three direct capture methods to complement collection activities at the trapping facilities. These methods include: a) targeted tangle net drifts; b) targeted seining: and c) angling. Tangle netting will likely be the primary method of fish capture. Other methods will be supplemental and opportunistic. Success in collecting fish in the lower NF Lewis River will depend greatly on river flow conditions and visibility.

a) *Targeted tangle net drifts.* Monofilament tangle nets of 2.5 or 3-inch stretch mesh will be drifted in known steelhead holding areas. Nets will vary between 60 and 150 feet long and will have a depth of between 6 and 8 feet.

b) *Targeted seining.* This method will use small mesh, nylon seine nets to corral or "purse" steelhead holding in suitable seining pools.

c) *Angling.* Hook and line sampling may be employed by field crews opportunistically to target fish holding in areas not suitable for tangle-netting or seining. The best available scientific information suggests hook and release mortality of adult steelhead is low. Hooton (1987) found catch and release mortality of adult steelhead to be 3.4% (n= 3,715 fish) on average when using a variety of fishing tackle, including barbed and barbless hooks, bait and artificial lures. Specific fishing techniques, adult netting materials and holding protocols would be reviewed in consultation with NOAA Fisheries to minimize impact on listed fish. Fish would be transferred to Merwin Hatchery in individual soft-sided plastic or rubber containers with lid and air stones. In addition, coordination with select professional river fishing guides and sport anglers will be explored.

7.3 Identity.

Only lower river natural-origin winter-late steelhead adults will be used as broodstock. Genetic assignment analysis is used to identify fish that assign to the NF Lewis River winter-late steelhead baseline, in order to differentiate the lower river natural-origin winter-late run from co-occurring hatchery steelhead adults or naturally occurring strays. During the first two years of collection, initial differentiation at the trap prior to transporting potential broodstock adults was determined by the lack of an adipose fin-clip. From year three through the last year of collection (year 15), origin can be determined by fin-clips (segregated hatchery) and blank-wire tag (BWT) (this program) prior to transporting potential broodstock adults to Merwin Hatchery. However, the unmarked or wild fish from the sixth year forward will be made up of two potential sources: lower river wild production and upper river natural production. DNA analysis will be needed, if applicable, in order to maintain the lower river broodstock collection and the upper river recovery intent of this program. After year 15 of this program, all non-clipped winter steelhead that volunteer into the Merwin FCF will be transported upstream. The run timing of fish that will be planted into the upper basin will be determined by the ACC.

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. 1988-99), or for most recent years available:

Table 7.4.1: Broodstock collection levels, Merwin Hatchery winter (late) steelhead.

Brood Year	Hatchery			
	Egg-Take	Females	Males	Jacks
2009	54,240	12	19	0
2010	93,218	22	24	0
2011	99,656	16	19	0
2012	87,568	+19	23	0
2013	42,840	+8	+11	0

Source: H&S Annual Report, WDFW Hatcheries Headquarters Database 2014.
"+" = live spawned

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

Returning hatchery adults from this program will not be used in the broodstock. All adults from this program, which return to the Merwin FCF, will be trapped and transported, via tanker, to the upper Lewis watershed above Swift Reservoir.

Table 7.5.1: Disposition of unmarked (no adipose fin-clip) winter-late steelhead returning to the Lewis Hatchery Complex.

Brood Year	Mortality	Return to stream	Surplus	Spawn
2009	8	45	1	30
2010	5	58	1	46
2011	5	40	1	35
2012	12	33	0	42
2013	1	20	0	19

Source: WDFW Hatcheries Headquarters Database 2014.

7.6 Fish transportation and holding methods.

Steelhead adults from Lewis River Hatchery and the Merwin Dam FCF are transported to Merwin Hatchery by 1800 or 1100 gallon capacity tanker trucks. Transit time is 5-12 minutes. Salt (NaCl) is added to the water to ameliorate hauling stress, in quantities as described in WDFW *Fish Health Manual*. Fish will be held in raceways or holding ponds for maturation.

Protocols to hold and transport fish from other broodstock collection methods (angling, netting or alternative trapping sites) will be determined by WDFW in consultation with NOAA Fisheries. For all lower river collection methods, aerated transport tanks will be used to protect captured fish and reduce stress during transit to Merwin Hatchery. Fish holding tubes and or aerated transport vessels (i.e. large coolers) will be used by field crews, river guides and sport anglers to transport fish to boat ramps or other river access points.

See also HGMP section 5.2.

7.7 Describe fish health maintenance and sanitation procedures applied.

Broodstock receive routine prophylactic formalin treatments at 1:6000 to minimize fungal infections. Additional treatments as per *Integrated Hatchery Operations Team* (IHOT), *Pacific Northwest Fish Health Protection Committee* (PNFHPC), WDFW's *Fish Health Manual* (1966, updated March 2010) or *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) guidelines are followed. Fish Health Specialists make monthly visits and consult with staff on the procedures needed to maintain fish health. Liquamycin (LA-200) injections may be warranted, but currently not planned as fish may only be held for a month or less.

From 2009-2011, all broodstock used for the supplementation program were lethally-spawned to determine the prevalence of *Infectious Pancreatic Necrosis* (IPN) and other pathogenic activity. Results were negative.

The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection (iodophor) procedures upon entering or exiting the area. Fish treatments are for fungus control using formalin bath treatments. Adults are treated with formalin or hydrogen peroxide or a combination of both to control fungus growth twice weekly. Fish health measures are consistent with the *Salmonid Disease Control Policy* (WDFW and WWTIT 1998, updated 2006).

See also **Attachment 1** for IHNV detections at this facility.

7.8 Disposition of carcasses.

All mortality carcasses will be disposed of in an area landfill.

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.

WDFW will attempt to collect broodstock proportionately throughout the winter-late steelhead run (December to June) to prevent run timing divergence from the natural population. Adults will be selected randomly without regard for size or appearance in order to maximize the genetic representation in the broodstock. Severely damaged (seal bites) and wounded fish may be avoided and returned to stream if holding may result in mortality.

Special protocols will be used when handling listed fish to minimize stress and harm. All adults will be handled with soft fabric or rubber coated dip nets during handling. Pond holding containers may be epoxy painted if problems are encountered with current cement pond walls, and covered if needed be to prevent jumping.

Females will be live-spawned, and those that retain significant portions of unripe or un-extruded eggs could be released back to the river rather than trying to retain the fish for a second spawn. Air spawning may be used to prevent loss of protective mucus that may be encountered by strip spawning. Females that successfully release all eggs from the body cavity would be returned to the river or be candidates for a potential short-term kelt re-conditioning project. This was attempted in 2012 and had very poor success. May try using kelts from the upper watershed in the future.

First generational hatchery returns (F1) from this program will not be used as broodstock even though their lineage is of WxW crosses (**Table 7.9.1**). All would be transported to the upper river.

Table 7.9.1: Priorities for use of hatchery and natural-origin late-winter steelhead broodstock (from Table 6 in the H&S Plan).

Generation after Introduction	Broodstock Source, Number and Composition
1st Generation	All broodstock for juvenile releases obtained from wild adults (50); all returns from the juvenile program transferred to the upper watershed; 500 minimum total adults is the target but may not be met early in the program.
2nd Generation	All broodstock for juvenile supplementation releases obtained from wild adults (not adult returns from supplemented juveniles); all adult returns from the juvenile supplementation; 500 minimum total adults is the escapement target
3rd Generation	All broodstock for juvenile supplementation releases obtained from wild adults (not adult returns from supplemented juveniles); all adult returns from the juvenile supplementation; 500 minimum total adults is the escapement target
4th Generation	Juvenile supplementation program suspended; all adults with intact adipose fins arriving at Merwin released above Swift No.1 Dam. *

* WDFW and NOAA will need to establish the adult handling policy to be followed once late-winter steelhead production meets abundance targets. If NOR late-winter steelhead from the upper basin are marked, agencies have the ability to sort out lower basin wild fish from upper basin steelhead.

8 SECTION 8. MATING

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

8.1 Selection method.

Broodstock will be collected from natural-origin stock selected proportionately from across the run (January through May). Fish with significant damage such as seal bites or scrapes may be excluded from broodstock. Those with a low likelihood of surviving transport and holding stress will be returned back to stream. Males and females that have been collected for broodstock will be examined weekly during holding to determine ripeness and spawned when there are appropriate numbers to complete factorial crosses (preferred mating scheme). All collected fully-mature broodstock will be spawned, without regard to age, size or other physical characteristics.

8.2 Males.

Adult males will be given priority in factorial crosses. When males are not available to meet factorial scenarios on a given spawn day, males may be used more than once. In those circumstances, males will be limited to no more than four times as primary spawners except in extreme cases (egg equivalent = two females). If males are used more than once, they would be tagged for identification purposes after they have been spawned to track the number times a particular male may contribute.

Jacks or smaller males (<20" total length) can be used as a proportion for mating as they occur in the population as either a factorial spawner or back-up male, especially if milt quantity or quality has been poor. Jacks could be valuable on a given spawn date as smaller males may tend to invest more energy in gonad growth than larger fish and produce more sperm per body size than larger males (Vladic and Jarvi, 2001). If needed, a jack could be a surrogate male in event that a viable male is not available on a given spawn date. If more than one jack is available for a given female, they could be used in tandem equally as part of the matrix cross for one female (pers. comm. C Busack 2006).

8.3 Fertilization.

As there are only up to 25 pairs to spawn, with maturation spread over several weeks, the small number of fish ripe on individual days could potentially limit spawning options. On a given spawning day, fertilization will occur at a ratio of 1:1 male to female, factorial crosses (1 x 1) could occur if there are not enough males to maximize the genetic effective population size in the smolt release program (H&S 2006). In order to ensure a high likelihood of genetic expression and fertilization potential, if equal factorial crosses are not present on a given spawn date, other matings could be used to increase the number of overall crosses. For factorial matings, water will be introduced after mixing milt. After 30 seconds, staff will combine eggs to one container in order to provide a minimal male back-up role.

Where insufficient males are available, males may be used as primary more than once. In those circumstances, males will try to be limited to no more than four times as primary spawners (egg equivalent = two females).

Sperm motility may be checked prior to mixing with eggs. After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution.

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.

A ratio of 1:1 male to female spawning ratio will be used as much as possible to reduce the risk of within population genetic diversity loss. A factorial-mating scheme will be used while maintaining a 1:1 male to female spawning ratio as much as possible will be applied as needed.

After the first three years females will be air spawned to prevent mucus loss associated with stripping of the body cavity. Females that retain a percentage of eggs that are still green, may be returned back to stream to possibly spawn the rest of their eggs naturally. Males will be live spawned and returned to river.

Kelt re-conditioning will be considered at this station starting in year four of the program. Short-term success on some females will be investigated and dependent on securing circular ponds and other improvements to the facility. This was attempted in 2012 with very poor success, may try using kelts from the upper basin in the future.

After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution.

9 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.

The program was initiated in 2009. The egg-take goal is 90,000 (+/-20 %) with an approximate survival projection for 50,000 (+/-20 %) smolts; this take was adjusted upwards from the original programmed goal of 80,000 with brood year 2013. Fecundity per female varies from spawner to spawner, with a potential range from 3,000 – 5,500 eggs.

Table 9.1.1: Survival rates (%) from egg-take to ponding, Lewis River winter-late steelhead.

Brood Year	% Egg Survival	
	Green-to-Eyed	Eyed Egg-to-Ponding
2009	74.82	85.25
2010	92.21	99.47
2011	90.58	69.85
2012	83.43	96.45
2013	76.79	90.84

Source: WDFW hatchery data.
NA – Not available

Differences in the survival at any rearing stage may make it necessary to either maximize total broodstock take (25 females), reduce the number of female needed, or take fewer eggs from all 25 females (possible when live/air spawning). The 20% buffer established for the egg-take goal is intended to provide for the expected variance in fecundity and green egg-to-smolt survival.

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. Dead eggs are disposed of at the landfill.

9.1.3 Loading densities applied during incubation.

Eggs from individual females (10.5 to 27 oz. at 2,499 to 5,544) will be isolation-incubated as individual families in MariSource vertical incubator trays through eye-up.

9.1.4 Incubation conditions.

Table 9.1.2: Minimum and maximum temperature ranges (°F) during incubation, Merwin Hatchery.

Month	Temperature Range (°F)
March	41-44
April	42-48
May	45-52
June	51-54

Source: WDFW hatchery data

Water pumped from the Lake Merwin Reservoir provides silt-free water to the incubators. The incubation building is fitted with back-up pumps to maintain flow through the intermediate raceways in emergency situations and with secondary packed columns to maintain water oxygenation above 10 ppm. Because all the water to the hatchery is ozonated, and runs through an enclosed stripper with additional packed columns, the water is disbursed of any entrained gases and is well-oxygenated. Dissolved oxygen is monitored weekly, and generally falls within 9-10 ppm. Water temperatures are monitored continuously during incubation, and formalin would be used to control fungus and ecto-parasites.

Flow through each tray is 3.5 gpm. Heating or chilling water during incubation to fingerling stage may be planned to safely synchronize different lots of eggs and fry into intermediate raceways.

Family spawnings are incubated separately during the green-to-eyed-egg stage to monitor for IHNV.

9.1.5 Ponding.

Fish hatch at around 650-675 TU, and develop to fry stage at 925-950 TU (~2,500 – 2,600 fpp). With water temperature at a constant 45ºF, total time to ponding takes approximately 73 days. Heating water (increasing to 55ºF) could reduce the total time to ponding to 41 days or 38 days (increasing to 58ºF). Fish hatch within the stack incubators and are moved to intermediate raceways upon swim–up. Feed is introduced after all are buttoned up, usually 1-3 days post swim-up.

9.1.6 Fish health maintenance and monitoring.

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 monthly inspections. Potential problems are managed promptly to limit mortality and reduce possible disease transmission.

Disease treatment varies with the pathogen encountered but generally is antibiotic in nature for bacterial infections and bath or drip treatments with chemotheraputants for external infections and parasites. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist and may include treatment with formalin or other accepted fungicides. Treatments are administered every day at 1,666 ppm, for 15 minutes.

Non-viable eggs and sac-fry are removed by bulb-syringe. After eye development (~400 T.U.), eggs will be "shocked", picked, and enumerated. Fry mortalities will be handpicked at ponding in rearing receptacles within the hatchery building.

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.

Eggs are incubated in pathogen-free (ozonated), silt-free water to ensure maximum egg survival and minimize potential loss from disease. The hatchery incubation room is protected by a separate low water alarm system. Both water supplies and the power supply are alarmed to notify hatchery personnel if a failure occurs. Both water supplies are hooked to a back-up generator in case of a power failure. Hatchery staff is available 24 hrs/day.

Isolation incubation until virology testing can be performed will help ensure minimum transmission of pathogens from potentially infectious families.

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 (1988-99), or for years dependable data are available.

Table 9.2.1: Survival rates (%) from ponding to release, Lewis River winter-late steelhead.

BroodYear	Fry-to-Smolt Survival (%)
2009	67.07
2010	61.50
2011	61.62
2012	85.05
2013	87.43

Source: WDFW hatchery data.
NA – Not available

This program was initiated in 2009. The egg take goal is 115,000 (+/-20%), with an approximate survival projection for 50,000 smolts (+/-20%).

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

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.

In all hatchery facilities within Lewis River, densities are kept at or below 3.3 lbs /gpm and 0.5 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 3200 lbs. at 300 gpm (10.6 lbs/gpm).

9.2.3 Fish rearing conditions

Table 9.2.2: Minimum and maximum temperature ranges (°F) during rearing, Merwin Hatchery.

Month	Max-Min Water Temps (°F)
December	44-50
January	41-45
February	41-42
March	41-44
April	42-48
May	45-52
June	51-54
July	53-57
August	54-60
September	57-61
October	56-61
November	50-57

Source: WDFW hatchery data.

The late-winter steelhead program will be raised in intermediate raceways on ozone treated water for 6-8 months or until they outgrow the rearing vessels. Once these fish outgrow the intermediate raceways they will be placed outside into standard raceways and rearing ponds where they will be subject to untreated reservoir water. An upgrade to replace the existing ozone system with current technology is being implemented (SA Schedule 8.7).

Fish are reared on water pumped from Lake Merwin. Ozone water sterilization will be used and about two-thirds of the flow is ozone-disinfected prior to use. A maximum flow of 3,800 gpm can be sterilized and supplied to the hatchery building, raceways, and rearing ponds. The disinfected water is used in incubation and adult holding. The remaining water is routed to outdoor rearing ponds after passing through packed column degassing units. In addition to treating a portion of the incoming water, all water exiting the adult holding ponds and incubation building is routed into two effluent settling ponds (Tetra Tech/KCM, Inc. 2002). Temperature, dissolved oxygen and pond turnover rate are monitored. IHOT standards are followed for water quality, alarm systems, predator control measures (netting), loading and density. Settleable solids, unused feed and feces are removed regularly to ensure proper cleanliness of rearing containers. Bird netting spans over the juvenile-rearing raceway series.

Fish are 100% mass-marked with a blank-wire tag (BWT) in December when they reach around 25 fpp, so that they can be distinguished from the natural population. This occurs generally from July through end of September, during fry stage, a year before release, depending on growth rates and water temperature.

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.

Table 9.2.3: Monthly fish growth information by length (mm), weight (fpp), condition factor and growth rate, collected during rearing at Merwin Hatchery.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
August	54	300	NA	NA
September	78	100	NA	0.562
October	100	45	NA	0.348
November	120	25	1.2	0.167
December	135	20	1.2	0.424
January	140	18	1.1	0.194 – 0.250
February	150	15	NA	NA
March	165	10	1.1	0.138 – 0.187
April	180	8	1.0	NA

Source: WDFW hatchery data.

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

See HGMP section 9.2.4.

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*).

Fry/fingerling will be fed an appropriate commercial dry or semi-moist trout/salmon diet; the food brand used may vary, depending on cost and vendor contacts. Feeding occurs several times daily as necessary to provide the diet at a range of 0.7 – 1.1% B.W./day. As start-up fry, steelhead are hand-fed every 30 minutes. Once steelhead begin feeding regularly, they are hand-fed four times per day; additionally, they could be supplemented with automatic feeders throughout the day. Steelhead are fed between 3% and 5% body weight (BW) depending on their size and ambient water temperature. Feed conversion is expected to fall in a range of 0.8 – 1.3 pounds fed to pounds produced. Due to the duration of spawning time from the natural steelhead, a variety of starter diets and feed schedules may be used to achieve a similar size among the fish before they are moved outside to the rearing raceways. This strategy will reduce the variation (CV's) in size of juveniles within the population, and may reduce the number of residuals observed when fish are eventually released as smolts.

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* (Genetic 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 Virology Sampling reports).

Disease Treatment. As needed, appropriate therapeutic treatment will be prescribed to control and prevent further outbreaks. Bacterial Cold Water Disease (BCWD) has been problematic at Lewis River Hatchery in early phases of rearing and is treated with Florincol and amoxicillin. Mortality is collected and disposed of at a landfill. Fish health and or treatment reports are kept on file. *Saprolegniasis* occurrences in young hatchery fish have been observed at an increasing frequency on Mitchell Act stations. In some cases, circumstantial evidence suggests more outbreaks of gill and tail fungus are the result of nutrient enhancement efforts. Staff is continuing to monitor observations or occurrences of this possibility. Mortality is collected and disposed of at a landfill. Fish health and or treatment reports are kept on file.

Sanitation. All eggs brought to Lewis River Hatchery are surface-disinfected with iodophor (as per disease policy). All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens (see **Attachment 1** for Virology Sampling reports).

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

Besides time, size and past history, aggressive screen and inflow crowding, swarming against pond sides, a silvery physical appearance and loose scales during feeding events are signs of smolt development. From past history, hatchery specialists will reduce feed regimes in early spring as fish show signs of smolting. Also at this time feed conversions fall and fish appear leaner with condition factors falling well below 1.0 (K) to 0.90 (K). No gill ATPase activity or blood chemistry samples to determine degree of smolting or to guide fish release timing is used.

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

Several methods to make the rearing receptacles represent some semi-natural features may be used by staff including; camouflage covers over the outside rearing units, paint so that the walls and bottoms are of nearly natural coloration and texture which will promote natural looking fish. Demand or pneumatic feeders may also be used where possible to limit human interaction. The use of circular raceways to enhance rearing environment and condition of a portion of the release may also be evaluated and used annually.

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

The program will isolation-rear individual families of fish (each female) as long as possible and at least until viral testing for IHNV testing is complete.

Fish will be reared to achieve a size and condition factor at a time that represents the best chance for survival in order to meet adult supplementation goals. Professional personnel trained in fish cultural procedures will operate the Lewis River Complex facilities. Facilities are state-of-the-art to provide a safe and secure rearing environment through the use of alarm systems, backup generators, and water re-use pumping systems to prevent catastrophic fish losses.

The hatchery environment is secured behind fencing, with the adult holding pond strategically located within the complex of buildings. Incubation and starter units are within the hatchery building with several safeguard features to notify staff of water loss. Fish may be reared under camouflage covers to maintain fright response to humans and other potential predators. Fish

released from this program will be reared on river water to provide 100% acclimation and imprinting.

10 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), Lewis River winter steelhead.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Yearlings	50,000	6.0	May/June	Lewis River

Source: WDFW Future Brood Document 2014
Note: 6.0 fpp = 208 mm fork length (fl)

The goal of the program is to produce a yearling smolt that will rapidly emigrate from the system. The target release size will be between 5 and 8 fish per pound (fpp), with a condition factor of <1.0 and fork lengths between 180 – 210 mm to approximate the size of naturally-produced out-migrant smolts. These targets were chosen to prevent residualism in undersized juveniles and maximize survival for adult supplementation (H&S 2006).

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

Stream, river, or watercourse:	NF Lewis River (WRIA 27.0168)
Release point:	Merwin Boat Ramp (RKm 30.8) WDFW's Martin Access(Woodland) RKm 5.5
Major watershed:	Lewis
Basin or Region:	Lower Columbia

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

Table 10.3.1: Number of fish released, size, CVs and release date, by age and year, Merwin Hatchery winter-late steelhead.

Release Year	Unfed Fry[a]				Yearlings			
	Number	Avg Size (fpp)	CV	Date	Number	Avg Size (fpp)	CV	Date
2009	9,293	2000.0	n/a	July 17	-----	-----	-----	-----
2010	-----	-----	-----	-----	24,300	6.7	8.07	May 25
2011	-----	-----	-----	-----	57,025	5.7	10.12	May 16
2012	6,339	2000.0	n/a	July 5	34,570	8.0	6.94	June 08
2013	-----	-----	-----	-----	49,650	9.2	12.40	May 10

Source: WDFW Hatcheries Headquarters Database 2014.
Note: 6.0 fpp = 208 mm fork length (fl); 8.2 fpp = 188 mm fl; 9.4 fpp = 180 mm fl.
[a] Unfed fry were released at Battleground Lake in 2009, and into the NF Lewis River in 2012. Unfed fry were released in 2012 because they genetically assigned as a wild fish but did not qualify for this program. NOAA was consulted on this release and approved through the Hatchery & Supplementation Group.

10.4 Actual dates of release and description of release protocols.

Releases will be dependent on time, size, and condition factor and smolt behavior (see **Table 10.3.1** for actual release dates). This period will overlap the wild smolt emigration in the N.F. Lewis River system. Peak migration of wild steelhead smolts occurred from April 17-May 14 (82% of the population) in Cedar Creek smolt monitoring studies (Rawding et, al., 2006).

Fish are seined out from the smolting ponds and transferred for release to the N.F Lewis River. If fish meet time, size, and condition factor goals, pond levels can be lowered to encourage fish to move to the smolt collection ponds, and are then transported to the river via tanker trucks. In studies, forced releases meeting size, time and condition factor parameters have performed similar to volitional releases (Wagner 1968; Evenson and Ewing 1992). Fish that actively migrate during the volitional release window will be trucked to the Merwin Boat Ramp for release (RKm 30.8). Once the volitional window has ended, the remaining fish will be hauled to the City of Woodland and planted at the county bridge crossing (RKm 9).

10.5 Fish transportation procedures, if applicable.

Fish are loaded from Merwin Hatchery ponds via pump into the truck at 0.75 lb./gallon, and transported N.F. Lewis River and Cedar Creek release sites; transport time is around 30 minutes. Loading densities will not exceed 5.9 lb per cu-ft.

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

Fish are reared on Lake Merwin water at Merwin Hatchery until release. Fish are either released at the boat ramp at RKm 30.8, or transported downstream to the WDFW's Martin Access at Km 5.5. The lower release area is below most of the listed Chinook habitat.

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

Table 10.7.1: Marks applied to on-station releases, Lewis River winter steelhead.

Brood Year	Stage	Number	Mark Type
2014	**Yearlings**	50,000	Blank-wire tag

All Merwin Hatchery summer steelhead are released with adipose fin intact, but 100% mass-marked with a blank-wire tag (BWT). Tagging occurs in December when fish are around 25 fpp.

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

Monitoring of fish numbers, growth and mortality at the hatchery will provide reasonably accurate estimates of live fish throughout their rearing life. In the event of unexpectedly high survival from the green-egg stage, any release of the surplus above the planned smolt release would occur in consultation with NOAA and the ACC. Egg-takes will be adjusted depending on success of higher or lower survival, in order to reach program goals (see HGMP section 9.1.1).

10.9 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.

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.

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

If the program is threatened by ecological or mechanical events, the Complex Manager would contact and inform regional management of the situation and determination and directive per

Section 7 guidelines and policy. Based on a determination of a partial or complete emergency release of program fish, all fish could be hauled by truck to the river and released. No release of fish will occur without a review by WDFW Fish Management and a risk assessment; this type of emergency procedure has not been necessary at this station on existing steelhead programs in the past.

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

For the duration of the program, all fish will be released into the N.F. Lewis. The release of smolts fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with naturally produced steelhead juveniles. Since the standard release strategy consists of releasing yearling smolts only, most will orient to the river for a short time (1-10 days) and then emigrate. The program does not plan to release undersized fish or stages younger than yearlings at this time, except in the event of unexpectedly high survival rates from the green-egg stage (see HGMP section 10.8). Fish that actively migrate during the volitional release window will be trucked to the Merwin Boat Ramp at RKm 30.8 for planting. Once the volitional window has ended, the remaining fish will be hauled to the City of Woodland and planted at the County Bridge crossing at RKm 9.

Since the late-winter steelhead program will need to maximize adult homing instinct back to the Merwin FCF, smolts will be released as far upstream as possible in the lower N.F. Lewis. Section 8.3.2.4 in the Settlement Agreement (SA 2004) has identified procedure for adaptive management actions for unacceptable impacts from hatchery production.

WDFW fish health and operational concerns for Lewis Hatchery Complex programs are communicated to Region 5 staff for risk management or needed treatment. See also HGMP section 9.2.7.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

The HSRG Columbia Basin System Wide Report (2009) provides guidelines and hatchery performance standards that require monitoring both in the hatchery setting and the natural environment. Appendix A4 of the System Wide Report outlines a framework for monitoring hatchery programs that includes:

- Statement of Population Goals
- Implementation Monitoring
- Effectiveness Monitoring
- Validation Monitoring
- Regional Coordination of Monitoring and Evaluation

NOAA Fisheries has developed a guidance document on recovery monitoring that provides recommendations for monitoring, data collection, and reporting ESA information (Crawford and Rumsely 2011). This document is intended to encourage consistency in monitoring across recovery domains.

As described in Section 2.2.3, WDFW has implemented a comprehensive monitoring program in the LCR to evaluate natural-origin salmonid populations and the effects of associated hatchery programs. WDFW has incorporated HSRG and NOAA guidance into this program and has

worked with PacifiCorp to integrate Lewis River monitoring programs into this regional framework.

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

The Lewis River Settlement Agreement (SA 2004) outlines monitoring requirements for the Lewis River Hatchery programs developed as part of the new license that PacifiCorp and Cowlitz PUD received from FERC. A Monitoring and Evaluation (M&E) Plan, a Hatchery and Supplementation (H&S) Plan and associated Annual Operating Plans (AOP) have been developed to address the monitoring requirements of the Settlement Agreement (SA 2004, H&S 2009, M&E 2010).

The M&E plan objectives are as follows:

Objective 1: Quantify overall juvenile fish downstream survival (ODS) which includes reservoir survival, collection survival, transport survival, and survival at the release ponds

Objective 2: Quantify SDF collection efficiency

Objective 3: Quantify the percentage of juvenile fish available for collection that are not captured by the SDF and that enter the powerhouse intakes

Objective 4: Quantify juvenile and adult collection survival

Objective 5: Quantify juvenile injury and mortality rates during collection at the SDF (includes injury and mortality of adult bull trout, adult sea-run cutthroat, and steelhead kelts)

Objective 6: Quantify the number, by species, of juvenile and adult fish collected at the SDF

Objective 7: Quantify the number of juveniles entering Swift Reservoir

Objective 8: Develop index of juvenile migration timing

Objective 9: Quantify adult upstream passage survival

Objective 10: Quantify adult trap efficiency at each upstream fish transport facility (emphasizes analysis of the Merwin Adult Trapping Facility)

Objective 11: Quantify the number, by species, of adult fish being collected at the projects (emphasizes Merwin Dam)

Objective 12: Quantify ocean recruits

Objective 13: Develop performance measures for index stocks

Objective 14: Document upstream and downstream passage facility compliance with hydraulic design criteria

Objective 15: Determine spawn timing, distribution and abundance of transported anadromous adults

Objective 16: Evaluate lower Lewis River wild fall Chinook and chum populations

Objective 17: Objectives for wild winter steelhead, spring Chinook, and coho

Objective 18: Objectives for bull trout

Objective 19: Determine interactions between reintroduced anadromous salmonids and resident fish

Objective 20: Document Project compliance with flow, ramping rate and flow plateau requirements

Objective 21: Determine when reintroduction outcome goals are achieved

Objective 22: Develop a Hatchery and Supplementation Plan (H&S) to support and protect Lewis River native anadromous fish populations and provide harvest opportunity

See HGMP section 1.10 Monitoring and Evaluation for additional plans and methods to collect data necessary.

Additional research, monitoring and evaluation in the Lower Columbia.

Monitoring activities occur in the lower Columbia River for harvest accounting and tag recovery in sport and commercial fisheries, commercial gear evaluations, natural spawn abundance estimate for fall Chinook and Chum, juvenile salmonid evaluations in trawl gear (NOAA Fisheries) and sturgeon/eulachon research and monitoring.

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

Monitoring activities required in the Settlement Agreement (SA 2004) related to their license to operate the hydroelectric projects and outlined in the M&E (2010) and H&S (2009) plan (see HGMP section 11.1.1) are primarily the funding responsibility of PacifiCorp. Many of the other monitoring activities are dependent on state and/or federal funding which is not guaranteed at current levels.

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.

No adverse ecological effects are expected to occur from monitoring and evaluation activities. Monitoring, evaluation and research follow scientific protocols with adaptive management processes, if needed. In addition, we will adaptively manage all other aspects of the program to continue to minimize associated risks using the more recent available scientific research.

Juvenile sampling at hatchery facilities will be conducted with accepted procedures to minimize stress and mortality from sampling. Sample sizes will be the minimum necessary to achieve statistically valid results for growth, tag retention and fish health.

Adult trapping facilities will be monitored daily, or more often as necessary to prevent injury and unnecessary delay.

VSP monitoring (including juvenile out-migrant monitoring) follows established WDFW protocols designed to minimize impacts to listed fish.

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

No research is currently directly associated with the program.

12.2 Cooperating and funding agencies.

12.3 Any future research to be conducted by WDFW and funded by PacifiCorp and Cowlitz PUD would be coordinated through the following contacts. Principle investigator or project supervisor and staff.

WDFW (Bryce Glaser) and PacifiCorp (Erik Lesko).

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.

13 SECTION 13. ATTACHMENTS AND CITATIONS

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Attachment 1: WDFW Virology Sampling 2006-2007 through 2012-2013: Merwin Hatchery.

Source: WDFW Fish Health Lab data 2014 (John Kerwin)

Hatchery/ Collection site	Stock	Species	DateSampled	Results	Comments	LifeStage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
MERWIN	GOLDENDALE	RBT	06/20/07	IHNV	3+/3p; diag; RP14; 10^0, 10^{-1}	imAD/05	0621-1			3	3			DB,SN	E/C	07/05/07
MERWIN	GOLDENDALE	RBT	06/27/07	IHNV	1+/4p K/S; RP12, 10^0, 10^{-1}, 10^{-3}, 10^{-5}	imAD/04	0628-5			4	4					
MERWIN	GOLDENDALE	RBT	06/27/07	IHNV	4+/4p K/S; RP11; 10^0, 10^{-1}, 10^{-3}, 10^{-5}	imAD/05	0628-6			4	4				E/C	03/09 and 22/2011
MERWIN	LEWIS R	SSTHD	12/07/06	IHNV	4+/12p OF & K/S	AD	1208-3/4	35	12	35	12			SN	E/C	02/02/07
MERWIN	LEWIS R	SSTHD	12/13/06	IHNV	2+/7p K/S, #13-19	AD	1214-5/6	18	7	18	7			ND	E/C	ND
MERWIN	LEWIS R	SSTHD	12/20/06	IHNV	2+/9p OF, #20-28	AD	1221-1/2	16	9	13	5			ND	E	ND
MERWIN	LEWIS R	SSTHD	12/27/06	IHNV	4+/9p OF, #31-39	AD	1228-12	26	9					ND	E/C	ND
MERWIN	LEWIS R	SSTHD	01/03/07	NEV	#40-47	AD	0104-7	21	8							
MERWIN	LEWIS R	SSTHD	01/10/07	IHNV	3+/8p OF, #48-55	AD	0111-4	24	8					ND	E/C	ND
MERWIN	LEWIS R	SSTHD	01/17/07	IHNV	1+/3p OF, #56-58	AD	0118-5	8	3					ND	E	ND
MERWIN	LEWIS R	WSTHD	12/27/06	NEV	#1	AD	1228-13/14	3	1	3	1					
MERWIN	LEWIS R	WSTHD	01/03/07	IHNV	1+/1p OF & 1+/2p K/S	AD	0104-8/9	2	1	6	2			DB	E/C	01/26/07
MERWIN	LEWIS R	WSTHD	01/10/07	IHNV	2+/4p OF & 6+/6p K/S, #3-6	AD	0111-5/6	10	4	20	6			ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/17/07	IHNV	6+/6p OF & 3+/4p K/S, #7-12	AD	0118-6/7	17	6	17	6			ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/24/07	IHNV	3+/4p K/S	AD	0123-3			14	4			ND	C	ND
MERWIN	LEWIS R	WSTHD	01/24/07	IHNV	4+/4p K/S, #13-16	AD	0125-2							ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/31/07	IHNV	4+/4p OF, #17-20	AD	0201-1	12	4					ND	E/C	ND
MERWIN	GOLDENDALE	RBT	06/17/08	NEV			0618-2			2	1					
MERWIN	LEWIS R	SSTHD	07/17/07	NEV		JUV/07	0718-2					9	3			
MERWIN	LEWIS R	SSTHD	07/19/07	NEV		JUV/07	0720-1					9	3			
MERWIN	LEWIS R	SSTHD	08/13/07	NEV	diag; ponds 4, 5, 7; 10^0-10^{-3}	JUV/07	0814-1					12	3			
MERWIN	LEWIS R	SSTHD	12/05/07	NEV	#1-19	AD	1206-5/6	54	19	54	19					
MERWIN	LEWIS R	SSTHD	12/11/07	IHNV	1+/12p OF, #20-31	AD	1212-8/9	32	12	7	3			DB	E/C	01/04/08
MERWIN	LEWIS R	SSTHD	12/18/07	NEV	#32-43	AD	1219-11	33	12							
MERWIN	LEWIS R	SSTHD	12/26/07	NEV	#44-54	AD	1228-1	31	11							
MERWIN	LEWIS R	WSTHD	12/26/07	NEV		AD	1228-2/3	7	3	7	3					
MERWIN	LEWIS R	WSTHD	01/02/08	IHNV	1+/2p OF & 1+/1p K/S	AD	0103-27/28	4	2	4	1			SN	E/C	01/24/08
MERWIN	LEWIS R	SSTHD	01/02/08	NEV	#55-61	AD	0103-30	19	7							
MERWIN	LEWIS R	WSTHD	01/09/08	IHNV	4+/6p OF & 4+/5p K/S; OF: #7-12, K/S: #7-11	AD	0110-3/4	16	6	16	5			ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/15/08	IHNV	6+/6p OF & 6+/7p K/S, #13-18	AD	0116-14/15	17	6	33	7			ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/23/08	IHNV	7+/7p OF, #19-25	AD	0124-1	21	7					ND	E/C	ND
MERWIN	LEWIS R	WSTHD	01/30/08	IHNV	3+/3p OF, #26-28	AD	0131-4	8	3					ND	E/C	ND
MERWIN	LEWIS R	SSTHD	06/17/08	NEV	diag; 10^0-10^{-3}	JUV/08	0618-3					10	2			
MERWIN	LEWIS R	SSTHD	12/04/08	IHNV	1+/11p OF & 1+/7p K/S , #1-11	AD	1205-1/2	32	11	32	7			DB	E/C	12/19/08
MERWIN	LEWIS R	SSTHD	12/11/08	IHNV	2+/16p OF & 1+/6p K/S, #12-27	AD	1212-1/2	45	16	28	6				E/C	
MERWIN	LEWIS R	SSTHD	12/16/08	IHNV	1+/13p OF, #28-40	AD	1217-9	37	13						E	
MERWIN	LEWIS R	WSTHD	12/29/08	NEV	#1-3	AD	1230-9/10	8	3	8	3					
MERWIN	LEWIS R	WSTHD	01/12/09	NEV	#4-9	AD	0113-3/4	16	6	17	4					
MERWIN	LEWIS R	WSTHD	01/21/09	IHNV	OF #10-17, K/S #10-14	AD	0122-1/2	24	8	24	5			DB	E	02/05/09
MERWIN	LEWIS R/WILD	WSTHD	04/16/09	NEV	OF & K/S: 10^0-10^{-3}	AD	0417-1/2	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/16/09	NEV	male #12, spawned, sample frozen	AD	0501-4			1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/23/09	NEV	male mortality, sample frozen	AD	0430-4			1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/26/09	NEV	male mortality, sample frozen	AD	0430-5			1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/28/09	NEV	male mortality, fresh	AD	0430-6			1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/29/09	NEV	OF lost in transit, dil w 1ml AB, spawned	AD	0430-1/2	1	1	3	2					
MERWIN	LEWIS R/WILD	WSTHD	04/29/09	NEV	male mortality, fresh	AD	0430-3			1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/30/09	NEV	mortality, #58	AD	0501-5			1	1					
MERWIN	LEWIS R/WILD	WSTHD	05/01/09	NEV	F #23 & M #19 & 39, spawned	AD	0501-2/3	1	1	3	2					
MERWIN	LEWIS R/WILD	WSTHD	05/11/09	NEV	F #63 & M #57 & 40	AD	0513-2/3	1	1	3	2					
MERWIN	LEWIS R/WILD	WSTHD	05/13/09	NEV	F #66-67 & M #17/51, 49/45, 34 (mort)	AD	0514-1/2	2	2	7	5					
MERWIN	LEWIS R/WILD	WSTHD	05/14/09	NEV	F #68 & M #41/55	AD	0515-1/2	1	1	3	2					
MERWIN	LEWIS R/WILD	WSTHD	05/19/09	NEV	F #65 & 69, M #46 & 56	AD	0521-1/2	2	2	4	4					
MERWIN	LEWIS R/WILD	WSTHD	05/21/09	NEV	F #74, M #25	AD	0522-1/2	1	1	2	2					

Hatchery/ Collection site	Stock	Species	DateSampled	Results	Comments	LifeStage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
MERWIN	LEWIS R/WILD	WSTHD	05/26/09	NEV	F #64 & 70, M #73 & 71	AD	0527-2/3	2	2	4	4					
MERWIN	LEWIS R	SSTHD	11/30/09	IHNV	2+/16p OF & 1+/16p K/S	AD	1201-19/20	45	16	45	16			PCR	E/C	12/23/09
MERWIN	LEWIS R	SSTHD	11/30/09	IHNV	2+/16p OF & 1+/16p K/S	AD	1201-19/20	45	16	45	16			PCR	E/C	12/23/09
MERWIN	LEWIS R	SSTHD	12/07/09	IHNV	2+/13p OF & 2+/5p K/S, #17-29	AD	1208-2/3	39	13	15	5				E/C	
MERWIN	LEWIS R	SSTHD	12/07/09	IHNV	2+/13p OF & 2+/5p K/S, #17-29	AD	1208-2/3	39	13	15	5				E/C	
MERWIN	LEWIS R	SSTHD	12/14/09	IHNV	3+/4p OF, #30-33	AD	1215-17	12	4					DB	E/C	01/08/10
MERWIN	LEWIS R	SSTHD	12/14/09	IHNV	3+/4p OF, #30-33	AD	1215-17	12	4					DB	E/C	01/08/10
MERWIN	LEWIS R	WSTHD	12/28/09	NEV	#1-5	AD	1229-9/10	13	5	13	5					
MERWIN	LEWIS R	WSTHD	12/28/09	NEV	#1-5	AD	1229-9/10	13	5	13	5					
MERWIN	LEWIS R	WSTHD	01/04/10	IHNV	1+/1p K/S, #6-9	AD	0105-3/4	12	4	12	4			PCR	E	01/26/10
MERWIN	LEWIS R	WSTHD	01/11/10	NEV	#10, 11	AD	0112-3/4	7	2	7	2					
MERWIN	LEWIS R	WSTHD	01/19/10	IHNV	1+/4p OF & K/S, #12-15	AD	0120-3/4	10	4	10	4				E/C	
MERWIN	LEWIS R/WILD	WSTHD	03/17/10	IHNV	1+/1p OF & K/S, #12-15	AD	0318-1/2	1	1	1	1			PCR	E/C	04/01/10
MERWIN	LEWIS R/WILD	WSTHD	03/26/10	IHNV	1+/1, #12	AD	0326-4			1	1				C	04/20/10
MERWIN	LEWIS R/WILD	WSTHD	04/01/10	NEV	#37	AD	0402-1/2	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/01/10	IHNV	1+/1 OF & K/S, #11	AD	0402-3/4	1	1	1	1				E/C	04/14/10
MERWIN	LEWIS R/WILD	WSTHD	04/06/10	NEV	F#52	AD	0407-2/3	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/09/10	NEV	F#56	AD	0409-2/3	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/12/10	NEV	#21, 57, 59	AD	0413-3/4	3	3	3	3					
MERWIN	LEWIS R/WILD	WSTHD	04/13/10	NEV	#44, 51, 66	AD	0414-4/5	3	3	3	3					
MERWIN	LEWIS R/WILD	WSTHD	04/19/10	IHNV	5+/5 OF & K/S; #47, 64, 67, 69, 72	AD	0421-2/3	5	5	5	5				E/C	05/21/10
MERWIN	LEWIS R/WILD	WSTHD	04/26/10	NEV	F#70, 77	AD	0427-4/5	2	2	2	2					
MERWIN	LEWIS R/WILD	WSTHD	05/14/10	IHNV	2+/3 OF; #88, 95, 99; spawned on Friday, samples frozen over weekend	AD	0518-2/3	3	3	3	3				E/C	06/17/10
MERWIN	LEWIS R	SSTHD	07/15/10	IHNV	1+/2p K/S	IMM AD	0716-1			2	2			PCR	E	08/05/10
MERWIN	LEWIS R	SSTHD	11/30/10	NEV	#1-4	AD	1201-1/2	12	4	12	4					
MERWIN	LEWIS R	SSTHD	12/06/10	NEV	#5-8	AD	1206-1/2	10	4	10	4					
MERWIN	LEWIS R	SSTHD	12/13/10	NEV	#9-14	AD	1214-5/6	16	6	16	6					
MERWIN	LEWIS R	WSTHD	12/29/10	NEV		AD	1229-25/26	15	5	15	5					
MERWIN	LEWIS R	WSTHD	01/05/11	NEV	#6-8, EPC 10^{0}-10^{-2}	AD	0106-7/8	9	3	9	3					
MERWIN	LEWIS R	WSTHD	04/01/11	NEV	#22	AD	0402-1/2	1	1	1	1					
MERWIN	LEWIS R/WILD	WSTHD	04/15/11	NEV	#34	AD	0415-1/2	1	1	1	1					
MERWIN	LEWIS R	SSTHD	12/20/10	IHNV	3+/8p OF & 1+/8p K/S, #15-22	AD	1220-5/6	24	8	24	8			DB	E/C	01/04/11
MERWIN	LEWIS R	WSTHD	01/12/11	IHNV	1+/2p OF & K/S, #9-10	AD	0113-4/5	6	2	6	2			S/N		02/25/11
MERWIN	LEWIS R	WSTHD	05/26/11	IHNV	Int 6, 10^{0}-10^{-3}, diag	JUV/11	0526-3					15	3	PCR	E/C	
MERWIN	LEWIS R	WSTHD	05/31/11	IHNV	10^{0}-10^{-3}, fresh morts	JUV/11	0531-1					20	4			
MERWIN	LEWIS R/WILD	WSTHD	04/11/11	IHNV	2+/2p K/S, males, #25-26	AD	0412-1			2	2			DB	E/C	04/26/11
MERWIN	LEWIS R/WILD	WSTHD	04/18/11	IHNV	2+/2p OF & K/S; F #13, 27	AD	0419-3/4	2	2	2	2				E/C	
MERWIN	LEWIS R/WILD	WSTHD	04/25/11	IHNV	1/3p OF & 3+/9p K/S; F #39, 43, 44 & M #15, 24, 31, 35, 37, 38	AD	0426-1/2	3	3	9	9				E/C	
MERWIN	LEWIS R/WILD	WSTHD	04/28/11	IHNV	2+/2p OF & 4+/4p K/S; F #36, 65 & M #23, 28	AD	0429-2/3	2	2	4	4				E/C	
MERWIN	LEWIS R/WILD	WSTHD	05/02/11	IHNV	1+/1p OF & 1+/3p K/S; F #68 & M #30, 61	AD	0504-8/9	1	1	3	3				E/C	
MERWIN	LEWIS R/WILD	WSTHD	05/12/11	IHNV	F #31, 50, 66, 74 & M #29, 62, 67, 75	AD	0513-1/2	4	4	8	8				E/C	
MERWIN	LEWIS R/WILD	WSTHD	06/06/11	IHNV	2+/2p	JUV/11	WADDL					10	2			
MERWIN	LEWIS R	SSTHD	12/29/10	IHNV	3+/12p & 2+/12p K/S, #23-34, EPC 10^{0}-10^{-3}	AD	1229-23/24	36	12	36	12				E/C	
MERWIN	LEWIS R/WILD	WSTHD	05/16/11	NEV	EPC 10^{0}-10^{-3}; F #84-85 & M #86-87	AD	0517-2/3	2	2	4	4					
MERWIN	LEWIS R/WILD	WSTHD	05/26/11	NEV	healthy, 10^{0}-10^{-1}, from hen 22	JUV/11	0526-1					10	2			
MERWIN	LEWIS R/WILD	WSTHD	05/26/11	NEV	healthy,10^{0}-10^{-1}, from hen 34	JUV/11	0526-2					10	2			
MERWIN	LEWIS R/W	WSTHD	07/21/11	NEV	morts from 1R1, diag 10^{0}-10^{-2}	JUV/11	0722-1					10	2			
MERWIN	LEWIS R/W	WSTHD	07/21/11	NEV	morts from 1R6, diag 10^{0}-10^{-3}	JUV/11	0722-2					5	1			
MERWIN	LEWIS R	SSTHD	11/28/11	NEV	Pools 1-19 have 3 fish, pools 20+21 have 2 fish	AD	1129-5/6	61	21	61	21					
MERWIN	LEWIS R	SSTHD	12/07/11	IHNV	#22-39; 2+/18P	AD	1208-3	53	18					DB		12/27/11
MERWIN	LEWIS R	SSTHD	12/12/11	NEV	#40-45, #43 AND 45 ARE 2 FISH/POOL	AD	1213-4	16	6							
MERWIN	LEWIS R	WSTHD	12/28/11	IHNV	OF: F#1-5, 4+/5p; K/S: F#1-5, M#1-5, 10+/10p	AD	1230-3/4	14	5	28	10			SN	E/C	1/13/12
MERWIN	LEWIS R	WSTHD	01/04/12	IHNV	#6, 7, 8; OF: 3+/3P; K/S: 5+/6P	AD	0105-22/23	9	3	18	6				E/C	
MERWIN	LEWIS R	WSTHD	01/11/12	IHNV	OF:#9-12, 1+/4P; K/S: F#9-12, M#9-10, 3+/6P	AD	0112-5/6	10	4	14	6					
MERWIN	LEWIS R/W	LWSTHD	04/10/12	IHNV	OF: TN-9, 1+/1P; K/S: TN-2, 1+/1P	AD	0411-9/10	1	1	1	1			SN	E/C	4/23/12
MERWIN	LEWIS R/W	LWSTHD	04/17/12	IHNV	OF: #2-5; K/S: TN#8,11, 12,13, 3+/4P	AD	0419-1/2	4	4	4	4				E/C	
MERWIN	LEWIS R/W	LWSTHD	04/25/12	IHNV	OF: #6, 7, 1+/2P; K/S: TN#22, 30, 39, 43, 3+/4P	AD	0427-3/4	2	2	4	4				E/C	

Hatchery/ Collection site	Stock	Species	DateSampled	Results	Comments	LifeStage	Sample number	NUMBER OF SAMPLEs						Cell Line	ID	FROZ Date
								OF	POOL	K/S	POOL	fry/visc/other	pools			
MERWIN	LEWIS R/W	LWSTHD	05/02/12	IHNV	OF: #8, 9, 2+/2P; K/S: TN#66, 69, 2+/2P	AD	0504-3/4	2	2	2	2					
MERWIN	LEWIS R/W	LWSTHD	05/03/12	IHNV	OF: #10 (F#02163), NEV; K/S: TN#44, 40, 2+/2P	AD	0504-5/6	1	1	2	2					
MERWIN	LEWIS R/W	LWSTHD	05/08/12	IHNV	OF: #11-15, 5+/5P; K/S: TN#32, 33, 41, 64, MT#3, 2+/5P	AD	0510-1/2	5	5	5	5				E/C	
MERWIN	LEWIS R/W	LWSTHD	05/09/12	IHNV	OF: #16; K/S: TN#19, 28, 2+/2P	AD	0510-3/4	1	1	2	2				E/C	
MERWIN	LEWIS R/W	LWSTHD	05/14/12	IHNV	OF: #17, 1+/1P; K/S: TN#29, 1+/1P	AD	0515-1/2	1	1	1	1				E/C	
MERWIN	LEWIS R/W	LWSTHD	05/29/12	IHNV	OF: TN-72 1+/1P; K/S: MT-7,10 1+/2P	AD	0530-3/4	1	1	2	2					
MERWIN	LEWIS R	SSTHD	11/28/12	NEV	OF: #1-15, No #3 or #4	AD	1129-8/9	38	13	45	9					
MERWIN	LEWIS R	SSTHD	12/03/12	NEV	OF: #16-22 K/S: #10-12	AD	1204-12/13	19	7	15	3					
MERWIN	LEWIS R	WSTHD	01/02/13	NEV	OF: #8-12	AD	0103-21/22	12	5	23	5					
MERWIN	LEWIS R	WSTHD	01/09/13	NEV	#13,14	AD	0110-9	6	2							
MERWIN	LEWIS R	LWSTHD	04/10/13	NEV	MT-5	AD	0411-1	1	1							
MERWIN	LEWIS R	LWSTHD	04/18/13	NEV	TN-19	AD	0419-1	1	1							
MERWIN	LEWIS R	WSTHD	04/29/13	NEV	#1 orange 100, #2 pit tag#5 699E75, #3 orange 99, #4 white 257, #5 orange 19	AD	0430-1	5	5							
MERWIN	LEWIS R/ W	WSTHD	05/06/13	IHNV	TN-29	AD	0508-1	1	1					E/C		
MERWIN	LEWIS R	WSTHD	12/26/13	NEV		AD	1227-13/14	19	7	37	8					

14 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:_____

15 ADDENDUM A. 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.

Lower Columbia Basin DPS Bull Trout *(Salvelinus confluentus*). Bull trout were listed as threatened in June 1998 (63 FR:31647-31674). Critical habitat was designated in 2005 (70 FR 56211 56311). A recovery plan was drafted in 2005 and has not been finalized. A 5-year review was finalized in 2008. In January 2010, the USFWS proposed a revision of critical habitat.

Status: The Columbia River DPS occurs throughout the entire Columbia River basin within the United States and its tributaries. The Columbia River population segment is composed of 141 subpopulations. The lower Columbia River area includes all tributaries in Oregon and Washington downstream of the Snake River confluence near the town of Pasco, Washington. The Service identified 20 subpopulations in watersheds of nine major tributaries of the lower Columbia River (number of subpopulations in each watershed)—the Lewis River (2), Willamette River (3), White Salmon River (1), Klickitat River (1), Hood River (2), Deschutes River (3), John Day River (3), Umatilla River (2), and Walla Walla River (3).

The Lower Columbia Recovery Unit Team identified two core areas (Lewis and Klickitat rivers) within the recovery unit. The Klickitat Core Area includes all tributaries downstream to the confluence with the Columbia River (USFWS 2002). Local populations within the Lower Columbia Recovery Unit are currently contained in Cougar, Pine, and Rush creeks (Lewis River), and in the WF Klickitat River. Additional spawning and rearing areas within the Klickitat River have not been identified. Studies in the White Salmon and Klickitat rivers should assess the potential habitat suitability and productive capacity of tributaries that could support local populations. Subsequently, factors that may limit the reintroduction potential should be identified, and corrective restoration activities or management actions should be implemented. Reestablishment of local populations within the White Salmon and Klickitat rivers may require the use of artificial propagation and would follow Federal policy and guidelines.

*Changes in the Status of the Columbia River Interim Recovery***:** The overall status of the Columbia River interim recovery unit has not changed appreciably since its listing on June 10, 1998. Populations of bull trout and their habitat in this area have been affected by a number to actions addressed under section 7 of the ESA. Most of these actions resulted in degradation of the environmental baseline of bull trout habitat, and all permitted or analyzed the potential for incidental take of bull trout. The Plum Creek Cascades HCP, Plum Creek Native Fish HCP, and Forest Practices HCP addressed portions of the Columbia River population of bull trout.

Several other listed and candidate species are found in Clark, Cowlitz 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.

Other listed or candidate species:
"No effect" for the following species:

Northern Spotted owl (*Strix occidentalis caurina*) –Threatened (Critical Habitat Designated)
Columbia white-tailed deer (*Odocoileus virginianus leucurus*)
Grizzly bear (*Ursus arctos*)
Canada lynx (*Lynx canadensis*)
Golden paintbrush (*Castilleja levisecta*) [historic]
Water howellia (*Howellia aquatilis*)
Bradshaw's lomatium (*Lomatium bradshawii*)
Nelson's checker mallow (*Sidalcea nelsoniana*)
Marbled murrelet (*Brachyramphus marmoratus*) (Critical Habitat Designated)
Gray wolf (*Canis lupus*); although Table 6.0-1 in the Final BE stated the proposed actions "was not likely to adversely affect" the gray wolf, it was clarified by the Utilities on May 17, 2006, that the effect determination should have been a "no effect" for the gray wolf to be consisted with the statement on page 58 that "we do not anticipate any project effects on the gray wolf."

Candidate Species
(Brush Prairie) Mazama pocket gopher (*Thomomys mazama* ssp. *oregonus*)
North American wolverine (*Gulo gulo luteus*) – contiguous U.S. DPS
Oregon spotted frog (*Rana pretiosa*) [historic]
Fisher (*Martes pennanti*) – West Coast DPS
Mardon skipper (*Polites mardon*)
Whitebark pine (*Pinus albicaulis*)

15.3 Analyze effects.

Actions associated with this hatchery program that may affect the bull trout population in the North Fork Lewis River:
Anadromous Reintroduction- Overall, the anadromous fish reintroduction program will likely be beneficial by providing MDNs and increasing the forage base for bull trout. This strategy will be aided by the reintroduction schedule as laid out in the SA where salmon and steelhead are reintroduced above Swift Creek Dam 4½ years after the licenses are issued. Yale Lake reintroduction begins with the HPP calling for adults to be transported to Yale Lake 8 years after the licenses are issued. Finally Merwin Lake reintroduction begins with the HPP in year 12 of the new licenses. This strategy allows time for assessments to occur prior to massive reintroductions at each project.

Comments received from the ACC on the Draft H&S Plan indicated that they were concerned about the effect reintroducing anadromous fish into the upper basin may have on ESA listed bull trout and other resident species. For example, a concern was expressed that if coho entered and spawned in Rush Creek or Cougar Creek, they may negatively impact bull trout spawning success.

The H&S Plan (2006) proposes to conduct spawning/carcass surveys throughout the upper basin to collect marks, determine distribution etc. which should provide data to identify those areas where species may compete. However, unless actions such as constructing weirs at the mouths of streams like Cougar Creek to prevent coho access are implemented, then collecting data on such interactions may have little value.

The H&S Plan assumes that since bull trout and other species were present historically in the upper basin, the reintroduction program would simply restore ecological function in the system. Impacts such as bull trout feeding on anadromous juveniles or vice-versa are simply accepted.

15.4 Actions taken to minimize potential effects.

The *Hatchery and Supplementation Plan* (2006) will include measures to minimize the potential negative impact of hatchery fish on bull trout and other ESA-listed species (SA 8.2.2.10). Program steelhead are released fully smolted to foster rapid outmigration from the basin and to minimize predation and residualism risks.

15.5 References

Biological Opinion for the Federal Energy Regulatory Commission Relicensing of the Lewis River Hydroelectric Projects: Merwin (No. 935), Yale (No. 2071), Swift No. 1 (No. 2111), Swift No. 2 (No. 2213), FWS Reference number 1-3-06-F-0177.

LCFRB (Lower Columbia Fish Recovery Board). 2004. Lower Columbia salmon recovery and fish and wildlife subbasin plan, volume 1. Longview, Washington.

USFWS (U.S. Fish and Wildlife Service). 2002. Chapter 20, Lower Columbia Recovery Unit, Washington. 89 p. In: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

16 "Take" Tables

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

Listed species affected: Chinook (*Oncorhynchus tshawytscha*) Steelhead *(Oncorhynchus mykiss*) Coho (*Oncorhynchus kisutch*)	**ESU/Population:** Lower Columbia River Chinook Lower Columbia River Steelhead Lower Columbia River Coho	**Activity:** Lewis Summer Steelhead Program
Location of hatchery activity: Lewis River Hatchery, Lewis River (WRIA 27.0168) at RKm 25.0 Merwin Dam Fish Collection Facility, Lewis River (WRIA 27.0168) at RKm 30.4 Merwin Hatchery , Lewis River (WRIA 27.0168) at RKm 46.7	**Dates of activity:** May-December	**Hatchery program operator:** WDFW

Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass [a]	TBD	TBD	TBD	TBD
Collect for transport [b]	TBD	TBD	TBD	TBD
Capture, handle, and release [c]	TBD	TBD	TBD	TBD
Capture, handle, tag/mark/tissue sample, and released[d]	TBD	TBD	TBD	TBD
Removal (e.g. broodstock) [e]	TBD	TBD	TBD	TBD
Intentional lethal take [f]	TBD	TBD	TBD	TBD
Unintentional lethal take [g]	TBD	TBD	TBD	TBD
Other Take (specify) [h]	TBD	TBD	TBD	TBD

* Steelhead are separated from the spring Chinook trapping. See Lewis River Spring Chinook HGMP.

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

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