HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Lewis (Merwin) River Summer Steelhead
Species or Hatchery Stock	Summer Steelhead (Oncorhynchus mykiss)
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Lewis Subbasin/Lower Columbia Province
Date Submitted	nya
Date Last Updated	August 16, 2004

Section 1: General Program Description

1.1 Name of hatchery or program.

Lewis River Summer Steelhead

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

Summer Steelhead (*Oncorhynchus mykiss*)

ESA Status: Not listed and not a candidate for listing

1.3 Responsible organization and individuals.

Name (and title):	Eric Kinne
	Lower Columbia River Complex Manager
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.

Co-operators	**Role**
PacifiCorp	Funding Source

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

Funding Sources
PacifiCorp

Operational Information	Number
Full time equivalent staff	2.75
Annual operating cost (dollars)	$318,347

The above information for Full-Time Equivalent Staff and Annual Operating Cost applies cumulatively to Merwin Hatchery Anadromous Fish Programs.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Lewis River Hatchery Summer Steelhead
Broodstock collection location (stream, RKm, subbasin)	Lewis River Hatchery Trap/North Fork Lewis River/RKm 20.9/Lewis; and Merwin Trap/North Fork Lewis River/RKm 25.8/Lewis
Adult holding location (stream, RKm, subbasin)	Merwin Hatchery/North Fork Lewis River/RKm 30.6/Lewis
Spawning location (stream, RKm, subbasin)	Merwin Hatchery/North Fork Lewis River/RKm 30.6/Lewis
Incubation location (facility name, stream, RKm, subbasin)	Merwin Hatchery/North Fork Lewis River/RKm 30.6/Lewis
Rearing location (facility name, stream, RKm, subbasin)	Merwin Hatchery/North Fork Lewis River/RKm 30.6/Lewis;

1.6 Type of program.

Isolated Harvest

1.7 Purpose (Goal) of program.

- Rear and release 175,000 summer steelhead smolts at 5.0 FPP into the Lewis River.
- The purpose of this isolated program is to provide adult harvest under the selective fishery regulations (retention of adipose clipped fish only) and provide protection to listed fish.
- Provide some escapement for broodstock for continued Merwin hatchery production.
- Portions of this HGMP (broodstock collection and egg goals) also cover transfers of 35,000 subyearling to Elochoman Hatchery in October and 60,000 yearlings to the Fish First Echo Bay Co-op Net Pens.
- Operate hatcheries consistent with the recovery of steelhead in the Lewis River. The major hatchery issues are: 1) to maintain the genetic diversity of steelhead in the Lewis River, and ensure the reproductive success of steelhead meets or exceeds recovery goals, 2) minimize the ecological interactions of hatchery steelhead on naturally produced salmon and steelhead, and minimize the mortality of naturally produced juvenile and adult salmon and steelhead due to facility operations.
- To achieve management and reduce risk to listed fish, for programs designed for steelhead harvest, WDFW tries to minimize natural escapement of hatchery fish to protect the genetic diversity of wild stocks. The first most commonly used approach for steelhead management is to maximize the difference between hatchery and wild stocks, so that if hatchery fish spawn, they are not likely to interbreed with wild spawners. Strategies used by WDFW to limit genetic and ecological risks include these actions: 1) limit the number of hatchery spawners by providing intense selective fisheries, and maintaining high trapping efficiency at the hatcheries or adult traps that remove hatchery fish prior to spawning; 2) advance the spawning timing of Chambers Creek and Skamania type steelhead stocks, so these fish spawn three months earlier than wild stocks, minimizing interbreeding between these two groups; 3) keep hatchery steelhead

spawners in the lower river away from prime wild steelhead spawning areas through lower river releases and acclimation; 4) since the reproductive success of Chambers Creek stock is 11% of wild winter steelhead and Skamania Stock is 18% of wild summer steelhead, the few fish that do survive to spawn will produce few offspring (Kalama River Research Project); 5) use hatchery management practices, acclimation, timing, and lower river releases to limit steelhead residualism and the competition and predation that can occur when steelhead smolts residualize; and 6) Follow the Integrated Hatchery Operations Team (IHOT 1995) guidelines to limit disease risks from hatchery steelhead.

1.8 Justification for the program.

- PacifiCorp (formerly Pacific Power and Light (PPL)) is the mitigation funding source on the North Fork Lewis River. They provide funding for operations of the three existing fish cultural facilities located on the North Fork system.
- WDFW protects listed fish and provides harvest opportunity on Lewis River summer steelhead through the Fish Management and Evaluation Plan (FMEP). The objectives of the WDFW's FMEP are based on the WDFW Wild Salmonid Policy. In that policy, it states that harvest rates will be managed so that 1) spawner abundance levels abundantly utilize available habitat, 2) ensure that the number and distribution of locally adapted spawning populations will not decrease, 3) genetic diversity within populations is maintained or increased, 4) natural ecosystem processes are maintained or restored, and 5) sustainable surplus production above levels needed for abundant utilization of habitat, local adaptation, genetic diversity, and ecosystem processes will be managed to support fishing opportunities (WDFW 1997). In addition, fisheries will be managed to insure adult size, timing, distribution of migration and spawning populations, and age-at-maturity are the same between fished and unfished populations. By following this policy, fisheries' impacts to listed steelhead, chinook salmon, and chum salmon in the Lower Columbia River (LCR) Evolutionary Significant Unit (ESU) will be managed to promote the recovery of these species and not at rates that jeopardize their survival or recovery.

To minimize impacts on listed fish by WDFW facilities operation and the Merwin Hatchery summer steelhead program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Merwin Hatchery summer steelhead program steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Water rights are formalized through trust water right #S2-24939 Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	Maintain intakes and screens for NOAA compliance
Effluent Discharge	4.2	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE). WAG -1052. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE.
Broodstock Collection & Adult Passage	7.9	No listed natural fish are used for broodstock collection. The trap area is monitored daily for enumeration and wild fish release.
Disease Transmission	7.9, 10.11	*Fish Health Policy in the Columbia Basin*. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Health Policy Chapter 5, IHOT 1995).
Competition & Predation	See also 2.2.3, 10.11	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 section 1.10 below.

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

1.10.1 Benefits:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Assure that hatchery operations support Columbia River fish Mgt. Plan *(US v Oregon)*, production and harvest objectives	Contribute to the harvest of hatchery summer steelhead on the Lewis River. Achieve a 10-year average catch of 496 fish. Contribution of this program cannot be identified independently.	Survival and contribution to fisheries will be estimated for each brood year released. Work with co-managers to manage adult fish returning in excess of broodstock need.
Maintain outreach to enhance public understanding, participation and support of Washington Department of Fish & Wildlife (WDFW) hatchery programs	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments	Participate in annual coordination meetings between the co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity. Maintain effective population size.	A minimum of 450 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return	Annual run timing, age and sex composition and return timing data are collected. Adhere to WDFW spawning guidelines. (WDFW 1983)
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts to natural and hatchery origin fish	Use mass-mark (adipose-fin clip) for selective fisheries with additional groups Ad+CWT and CWT only for evaluation purposes	Returning fish are sampled throughout their return for length, sex, mark and
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-managers Fish Health Disease Policy (1998).	Necropsies of fish to assess health, nutritional status, and culture conditions	WDFW Fish Health Section inspect adult broodstock yearly for pathogens and parasites and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary 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	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy
	Inspection of adult broodstock for pathogens and parasites	At spawning, lots of 60 adult broodstock are examined for pathogens
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites	Control of specific fish pathogens through eggs/fish movements are conducted in accordance to Co-managers Fish Health Disease Policy.

1.10.1 Risks:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt-size (5.0 fish /lb) and released from the hatchery at a time that fosters rapid migration downstream. Mass mark production fish to identify them from naturally produced fish (except CWT only groups)	As identified in the HGMP: Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including IHOT, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	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
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and instream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries.	Harvests are monitored by agencies and tribes to provide up to date information.

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

450 adults at a 1:1 male to female ratio excluding jacks. Extra adults can be taken in case of virus (IHN positive eggs) concerns and can provide back-up to the Skamania summer steelhead program.

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

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	175,000	5.0	Mid April-Mid May	North Fork Lewis River	RKm 8.1	Lewis	Lower Columbia

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

Data below are total catch of hatchery summer run steelhead on the N.F Lewis River. It is not possible to differentiate the contribution of this program from other programs . (WDFW Historical database). Smolt–to-adult survival rates are not available.

Return Year	Sport Harvest Hatchery	Escapement
1989/90	1,451	Na
1990/91	1,991	Na
1991/92	3,408	Na
1992/93	2,542	Na
1993/94	2,008	Na
1994/95	1,237	Na
1995/96	1,198	905
1996/97	442	1619
1997/98	311	1215
1998/99	453	1439
1999/00	1,806	1087
2000/01	3,916	2077
2001/02	5,229	Na
Average	1,999	Na

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

The first year of operation for this hatchery was 1994 .

1.14 Expected duration of program.

On-going program.

1.15 Watersheds targeted by program.

Lewis Subbasin/Lower Columbia Province

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

1.1.6.1 Brief Overview of Key Issues:

The sole purpose of the release of Lewis stock (a derivative of Skamania stock) summer steelhead into the NF Lewis is to continue a summer steelhead sport fishery while eliminating a directed harvest on wild summer steelhead. Adults are trapped at Merwin Dam and are spawned and incubated at Merwin Hatchery. Rearing takes place at Merwin Hatchery and in net pens in Speelyai Bay. Returning hatchery steelhead that are trapped at Merwin Dam are marked and returned to the river just below the confluence with the EF Lewis (rm 3.4) for additional harvest opportunity. If they are trapped at Merwin Dam a second time, they are trucked to Horseshoe Lake for additional sport harvest in a closed system. Any adults that escape the fishery may spawn in the system, but the historic spawning area for wild summer steelhead in the NF Lewis is not accessible at this time because of a series of dams that blocks migration.

1.16.2 Potential Alternatives to the Current Program

Alternative 1: Eliminate the non-local program and use the native stock for this program. WDFW is currently involved in a research project on the Kalama River that will provide information on the feasibility of using the native population. This alternative would require mining of the local stock.

Alternative 2: Eliminate the program. This action would significantly reduce potential interaction with the natural population and eliminate impacts on other ESA listed species. This alternative is not considered acceptable. Currently this program supports a popular sport fishery in the NF Lewis River and elsewhere.

Potential Reforms and Investments

Reform/Investment 1: If the local stock were to be used for this program, new rearing facilities and heated water systems would be needed to produce 1-year smolts from the entire run time.

Reform/Investment 2: If the local stock were to be used for this program, new trapping facilities would be needed to acquire broodstock and maintain an integrated population.

Reform/Investment 3: If the local stock were to be used for this program, monitoring and evaluation will be needed to ensure that the survival of the native population is not impacted and to decrease the risk of impacting other ESA listed species.

Section 2: Program Effects on ESA-Listed Salmonid Populations

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

Program is described in "Biological Assessment For The Operation Of Hatcheries Funded by The National Marine Fisheries Service (March 99)". By 2004 WDFW is writing HGMP's to cover all programs produced from and released at Lewis River, Merwin and Speelyai Hatcheries.

2.2.1 Descriptions, status and projected take actions and levels for ESA-listed natural populations in the target area.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Spring Chinook-Hatchery	M	H
Fall Chinook Tule-Natural	L	M
Fall Chinook LRB-Natural	H	M
Late Winter Steelhead-Natural	M	M
Coho- Hatchery and Natural	Na	Na
H, M and L refer to high, medium and low ratings, low implying critical and high healthy.		

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

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

None.

Identify the ESA-listed population(s) that may be incidentally affected by the program.
Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999.
Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a) are federally listed as "threatened" under the Endangered Species Act. Coweeman, Cowlitz and Toutle Populations.
Lower Columbia River steelhead *(Oncorhynchus mykis*s) were listed as "threatened" under the ESA on March 19, 1998.
Lower Columbia River coho (*Oncorhynchus kisutch*) has been proposed for listing as "threatened" on June 14, 2004.

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

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act. In Washington, the LCR chinook ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the Cascade Crest. As defined by harvest management units, there are four defined stocks of fall chinook that return to the Columbia River. These include the lower river hatchery (LRH), lower river wild (LRW), Bonneville Pool Hatchery (BPH)) and the upriver brights (URBs) (the North Lewis wild fall chinook represent about 80 percent to 85 percent of the wild fall chinook returning to the lower Columbia River (Norman 1987). LRW fish also return to the East Fork Lewis. In addition, LRW fish are also found in the

Cowlitz and Sandy rivers. Hatchery production of fall chinook has been inconsistent in terms of numbers and types of releases. Some release groups were for experimental rather than production purposes. After brood year 1985, no hatchery production has taken place. Current production is entirely natural. Natural spawning over the last 10 years has ranged from about 5,300 to 19,000 adults. Escapement estimates are based on peak fish counts, which are used as an index to estimate total spawners. The majority of the spawning takes place within the 4 mile stretch between the Lewis River Hatchery and Merwin Dam, in addition to Cedar Creek. Surveys are also conducted in the East Fork Lewis River within the 4.2-mile stretch from the area of Lewisville Park to Daybreak Park.

Table 2. Fall chinook salmon abundance estimates in the LCMA.

Year	Cowee-man River	Cowlitz River	Green River	Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River
1990	241	2,698	123		20,54	342	17,506	2,062
1991	174	2,567	123	33	5,085	230	9,066	3,494
1992	424	2,489	150		3,593	202	6,307	2,164
1993	327	2,218	281	3	1,941	156	7,025	3,836
1994	525	2,512	516	0	2,020	395	9,939	3,625
1995	774	2,231	375	30	3,044	200	9,718	2,969
1996	2,148	1,602	667	351	10,630	167	14,166	2,821
1997	1,328	2,710	560		3,539	307	8,670	4,529
1998	144	2,108	1,287	66	4,318	104	5,929	2,971
1999	93	997	678	42	2,617	217	3,184	3,105
2000	126	2,700	852	27	1,420	323	9,820	2,088
2001	646	5,013	4,951	132	3,714	530	15,000	3,901
2002	Na	Na	Na	Na	Na	Na	Na	Na
2003	Na	Na	Na	Na	Na	Na	Na	Na

Lower Columbia River spring chinook salmon *(Oncorhynchus tshawytsch*a)

At one time, an indigenous stock of spring chinook existed in the Lewis River, but with the construction of Merwin Dam (RM 19.5) in 1931, the majority of the spawning reaches became inaccessible and the stock subsequently declined. Early attempts to save the stock through hatchery production failed. By 1950, only a remnant population existed in the river, spawning primarily in the waters immediately below Merwin Dam and Cedar Creek. In 1971 managers used the Carson Hatchery stock, which originated from Bonneville Dam fishway. These fish were reared and released from Speelyai Hatchery. Since then, releases have been made from both the Speelyai and the Lewis River hatcheries. The stocks used now include Cowlitz and Kalama, along with on-station returns to the Lewis River. The 1977 through 1987 average run size to the Lewis River is estimated at about 6,000 fish, with about 10 percent of the returns constituting jacks. Annual returns during this time period have ranged from about 2,300 adults in 1980 to nearly 17,000 adults in 1987. Although the spring chinook has a low contribution rate in terms of ocean harvest, returns do provide mainstem recreational fisheries and a popular sport fishery within the Lewis River. Natural escapement of adult fish, based on annual spawning ground counts have averaged about 1,400 adults, ranging from just over 300 to nearly 7,000 adults. The remainder of the fish return to the hatcheries, which averages only a few hundred adults annually because of poor trapping efficiency. Early attempts to save the native population through hatchery production failed, and by the 1950's spring chinook runs in both the Lewis and Kalama rivers had been reduced to only remnant populations. In 1951, Washington Department of Fisheries estimated the escapement of spring chinook in the Lewis River at only 100 fish. Nearly all of the spawning on the Lewis River occurs in a 4-mile reach from Merwin Dam downstream to the Lewis River hatchery (WDF/WDW

1993). Hatchery programs for spring chinook were established at Kalama Falls Hatchery after its completion in 1959 and at Speelyai and Lewis River hatcheries beginning in 1971. The Lewis River naturally spawning spring chinook population was considered healthy based on escapement trend (WDF/WDW 1993). However, Myers et al. (1998) indicated the possibility that the native Lewis River spring chinook run is extinct, and the observed stock has undergone extensive hybridization. This information conflicts with the 1993 SASSI report (WDF/WDW 1993) that lists the Lewis River spring Chinook stock as native Additional information is needed to determine the stock origin and recent stock status for Lewis River spring chinook (Rawding 1999, personal communication). Natural spawn escapement from 1980-1991 has averaged 2,194 with a low of 345 in 1981 and a peak of 6,939 in 1987. Only occasional stray spring chinook return to the East Fork Lewis (WDF/WDW 1993).

Table 3. Spring chinook salmon abundance estimates in the LCR (included hatchery and wild fish, FMEP 2003).

Year	Cowlitz	Kalama	Lewis	Wind
1990	320	34	1,419	173
1991	284	34	1,632	141
1992	279	168	1,328	248
1993	236	100	1,429	657
1994	167	408	478	50
1995	347	392	279	32
1996	36	272	504	425
1997	455	45	417	227
1998	356	46	213	60
1999	285	224	270	99
2000	266	34	439	216
2001	347	578	475	412
2002	Na	Na	Na	Na
2003	Na	Na	Na	Na

Lower Columbia River steelhead *(Oncorhynchus mykiss*) were listed as threatened under the ESA on March 19, 1998. In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. No total estimates of wild run size or escapement exist for either the North or East Fork Lewis River. Lucas (1985) determined that the wild component of winter steelhead at Lucia Falls ranged from 35 percent to 74 percent of the creel surveyed fish :between 1973 and 1984, averaging 56 percent. Specific age information for wild fish is limited. Of the 12 wild winter steelhead sampled from the 1977-1978 season through the 1979-1980 season in the North Fork fishery, 17 percent were l-ocean jacks and 83 percent were 2-ocean adults (Lavoy and Fenton 1983). In another study by the same authors, hatchery and wild fish were not separated; of 364 fish from the North Fork winter fishery, the largest group (63 percent) was 2- ocean fish with fork lengths that averaged between 67.1 cm and 71 cm. Three-ocean fish and return spawners made up the next largest group (30 percent) and had average fork lengths of 80.1 cm to 84.2 cm. Only 2 percent of l-ocean fish were found, with fork lengths of 24 cm and 46 cm (Table 27). Adult winter steelhead enter the basin from November through May with peak migration occurring in January and March for hatchery and wild fish, respectively (Table 28). Spawning occurs from March through June in both the North and East forks (Howell et al. 1985). Lucas and Pointer (1987) found that peak spawning during the 1987 brood year in the East Fork occurred from mid-March through late April. McMillan (1985) suggests that spawning above Sunset Falls on the East Fork occurs over a short period of time in mid-March. Emergence occurs from April through July and the fish rear until spring a year later. Most wild North Fork smolts probably outmigrate in April and May at a size of 160 mm. The majority (83 percent) were found to have emigrated after two years, while about 17 percent

emigrated after three years (LaVoy and Fenton 1983). East Fork stocks tend to follow the same time- frame, however no distribution of freshwater residency is available.

Table 4. Wild summer steelhead abundance estimates in the LCMA (FMEP 2003).

Brood Year	Pop Est. Trap	Snorkel Surveys			Index/Redds
	Kalama	EF Lewis	Washougal	Wind	Wind
1990	745		156	116	228
1991	704		31	123	294
1992	1,075		77	129	287
1993	2,283		71	101	
1994	1,041		49	104	
1995	1,302		70	136	84
1996	614	85	44	96	
1997	598	93	57	106	106
1998	205	61	112	44	
1999	220	60	115	43	96
2000	140	99	118	26	
2001	329	117	145		
2002	Na	Na	Na	Na	Na
2003	Na	Na	Na	Na	Na

Table 5. Wild winter steelhead abundance estimates in the LCMA.

Brood Year	Index Redd Surveys					Pop. Est. Trap Counts		Redd/redd
	Coweeman	SF Toutle	Green	EF Lewis	Washougal	NF Toutle	Kalama	Cedar Creek
1990	522	752	86	102		36	419	
1991		904	108	72	114	108	1,128	
1992		1,290	44	88	142	322	2,322	
1993	438	1,242	84	90	118	165	992	
1994	362	632	128	78	158	90	853	
1995	252	396	174	53	206	175	1,212	
1996	44	150				251	853	70
1997	108	388		192	92	183	537	78
1998	314	374	118	250	195	149	438	38
1999	126	562	72	276	294	129	562	52
2000	290	490	124	207	939	238	941	
2001	284	334	192	79	216	185	1085	
2002	Na	Na	Na	Na	Na	Na	Na	Na
2003	Na	Na	Na	Na	Na	Na	Na	Na

Lower Columbia River Coho (*Oncorhynchus kisutch*) is proposed as threatened on June 14, 2004.

Status: NMFS concludes that the LCR coho ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers. Twenty-one artificial propagation programs are considered to be part of the ESU as NMFS has determined that these artificially propagated stocks are genetically no more than moderately divergent from the natural populations (NMFS, 2004b). Coho historically spawned throughout the basin. Natural spawning is thought to occur in most areas accessible to coho; coho currently spawn in the North Lewis tributaries below Merwin Dam including Ross, Cedar, NF and SF Chelatchie, Johnson, and Colvin Creeks; Cedar Creek is the

most utilized stream on the mainstem. Construction of Merwin Dam was completed in 1932; coho adults were trapped and passed above Merwin Dam from 1932-1957; the transportation of coho ended after the completion of Yale Dam (1953) and just prior to completion of Swift Dam (1959). As part of the current hydro re-licensing process, reintroduction of coho into habitat upstream of the three dams (Merwin, Yale, and Swift) is being evaluated. Late stock coho (or Type N) were historically present in the Lewis basin with spawning occurring from late November into March. Early stock coho (or Type S) were historically present in the Lewis basin with spawning occurring from late October to November. Columbia River early and late stock coho produced at Washington hatcheries are genetically similar. Lewis River wild coho run is a fraction of its historical size. An escapement survey in the late 1930s observed 7,919 coho in the North Fork. In 1951, WDF estimated coho escapement to the basin was 10,000 fish in the North Fork (primarily early run). Escapement surveys from 1944-1999 on the North and South Fork Chelatchie, Johnson, and Cedar Creeks documented a range of 1-584 fish/mile. Currently, hatchery production accounts for most coho returning to the Lewis River. Natural coho production is presumed to be generally low in most tributaries. A smolt trap at lower Cedar Creek has shown recent year coho production to be fair to good in North and South forks of Chelatchie Creek (tributary of Cedar Creek) and in the mainstem Cedar Creek.

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

Describe hatchery activities: The following activities listed below are identified as general hatchery actions that are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999).

Broodstock Program:

Broodstock Collection: Broodstock are collected at this location. summer steelhead begin entering the Lewis River system from June and continue through October with hatchery broodstock entering the Merwin holding ponds in October and November and spawned close to that time frame. Spawning time differences are significant between adult hatchery steelhead and wild steelhead. The incidence of capture on listed summer steelhead has been low. A total of 6 and 8 wild summer steelhead volunteered into the traps in 1999 and 2000, respectively (R. Nicolay, WDFW, pers. comm. 2000). See take tables at end of document.

Genetic introgression: To reduce the number of hatchery fish that could interbreed with listed steelhead, WDFW uses a wild steelhead management strategy removing steelhead through selective harvest. Strategies used by WDFW to limit genetic and ecological risks include: 1) limit the number of hatchery spawners by providing intense selective fisheries, and maintaining high trapping efficiency at the hatcheries or adult traps that remove hatchery fish prior to spawning; 2) advance the spawning time of Chambers Creek and Skamania type steelhead stocks, so these fish spawn 3 months earlier than wild stocks, minimizing interbreeding between these two groups; 3) keep hatchery steelhead spawners in the lower river away from prime wild steelhead spawning areas through lower river releases and acclimation; 4) since the reproductive success of Chambers Creek stock is 11% of wild winter steelhead and Skamania Stock is 18% of wild summer steelhead, the few fish that do survive to spawn will produce few offspring (WDFW Kalama River Research); 5) use hatchery management practices, acclimation, timing, and lower river releases to limit steelhead residualism and the competition and predation that can occur when steelhead smolts residualize. Indirect take from genetic introgression is unknown.

Rearing Program:

Operation of Hatchery Facilities: Potential facility operation impacts on listed fish include; water withdrawal, hatchery effluent, and intake compliance. Monitoring and maintenance are conducted along with staff observations. Effluent at outfall areas is rapidly diluted with main stem flows and operation is within permitted guidelines. (See HGMP Sections 4.1 and 4.2). Indirect take from this operation is unknown.

Disease: Outbreaks in the hatchery may cause significant adult, egg, or juvenile mortality. Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the programs at Merwin/Lewis River Hatcheries. Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1994) Chapter 5 have been instrumental in reducing disease outbreaks. When steelhead reach larger sizes (sub-yearling phase to yearling phase), they have generally been problem free. Prior to release, the steelhead 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. 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. WDFW proposes to continue monitoring, research and reporting of hatchery smolt migratory performance behaviors (Kalama River research efforts) that will be used to assess and adjust, if necessary, hatchery production and release strategies. Any additional smolts or sub-smolts above program goals could be lake planted for resident fish harvest rather than be released. The Merwin (Lewis River) steelhead hatchery program maximizes smolting condition through behavior, acclimation, timing, feed management and condition factor so releases will migrate quickly, thus reducing affects of density limiting factors such as residualism, competition and predation.

Competition: Salmon and steelhead feed actively during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988) and if they do not migrate they can compete with wild fish. WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that "migrant fish will likely be present for too short a period to compete with resident salmonids." Studies have shown that coho moved downstream quickly, suggesting that coho spend little time in the river after release (Fuss and Byrne 1995). Coho smolts released from the Marblemount Hatchery on the Skagit River migrated approximately 11.2 river miles per day (Puget Sound data from Seiler et al. 1997; 2000). On station release in large systems may travel even more rapidly – migration rates of approximately 20 river miles per day were observed by steelhead smolts in the Cowlitz River (Harza 1998). Snorkeling studies on the Elochoman River indicated few hatchery released chinook remaining after 2 weeks (Fuss 2000).
2) NMFS (2002) noted that "..where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates."

3) Flagg et al. (2000) concluded, "By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids." Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment."
4) Fresh (1997) noted that "Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results." Indirect take from competition is unknown.

Predation (Freshwater): Steelhead released from this program may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population, the habitat in which the population occurs and the characteristics of the hatchery program (e.g.. release time, location, number released and size upon release). The site-specific nature of predation and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of this specific hatchery release. Currently, steelhead from this program are hauled downstream to the town of Woodland for release. (See Section 10.11)

WDFW is aware of studies that have estimated the predation risks to listed fish posed by the Merwin/Lewis River Hatchery steelhead program. 'Predation by Juvenile Hatchery Salmonids on Wild Fall Chinook Fry in the Lewis River, Washington' (Hawking and Tipping 1999) a number of documents in the PacifiCorp / Cowlitz PUD/Lewis River Hydroelectric Projects Technical Reports - FERC Project Nos. 935, 2071, 2111, 2213. In this study, coho, steelhead and sea-run cutthroat trout were found to prey on naturally produced chinook fry. Mean chinook fry per stomach sampled ranged from 0.05-0.11 for coho; 0.01-1.13 for steelhead; 0.00-2.13 for sea-run cutthroat. The authors also noted that:

- "Because data were not available on evacuation rates of fry consumed, hatchery smolt residency time by species, the number of wild chinook salmon fry each year, or their vulnerability over time, total fry consumed by hatchery smolts was not estimated".
- "The estimated mean number of chinook salmon fry consumed per hatchery smolt was much greater in the Lewis River than in upper Columbia River areas."
- "The substantial increase in predation rates in 1998 probably reflects an increase chinook fry abundance that year. Nearly 3 times more chinook fry appeared to be present in 1998 compared to 1997, based on similar seining effort, timing and sampling sites."
- Releases of hatchery sea-run cutthroat trout on the Lewis River will stop after the 1999 release, due to their consumption of wild chinook fry as smolts and their low return rates as adults."
- "This stock has remained relatively healthy while other lower Columbia River stocks have

declined in the last decade."

Along with site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented.

Predation Risk Factors:

Environmental Characteristics: These characteristics can influence the level of predation (see SIWG 1984 for a review) with risk greatest in small systems during periods of low flow and high clarity. The Lewis River watershed is a large system approximately 93 miles long, has a total fall of approximately 12,000 feet, and drains an area of about 1,050 square miles (EA Engineering 1999) The mainstem of the Lewis, also known as the North Fork, flows southwesterly from its source in Skamania County through three impoundments, Swift Reservoir (River Mile 47.9), Yale Reservoir (34.2), and Merwin Lake (RM 19.5). A major tributary, the East Fork Lewis River, enters the mainstem at RM 3.5. From this point the mainstem Lewis flows westerly, entering the Columbia River at RM 88. The average annual streamflow for the entire Lewis River system is approximately 6,125 cubic feet per second (cfs). Releasing steelhead (mid-April to early May) during spring river freshets, combined with observed smolt behavior, is an important release consideration.

Dates of Releases: Steelhead smolts are released from late April to early May. Staff has been implementing releases after May 1st. . There are limited studies on migration timing of naturally produced chinook but listed chinook from the Lower Columbia ESU are believed to emigrate over a wide window from March through August (LCFRB Technical Reports 2004). (see also below).

Release Location and Release Type: The likelihood of predation may also be affected by the location and the type of release. Other factors being equal, the risk of predation may increase with the length of time fish co-mingle. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release and the speed at which fish released from the program migrate. At Merwin Hatchery smolted steelhead move from rearing ponds to a "smolt pond" where they are loaded onto trucks and planted at I-5 (RKm 8.2).

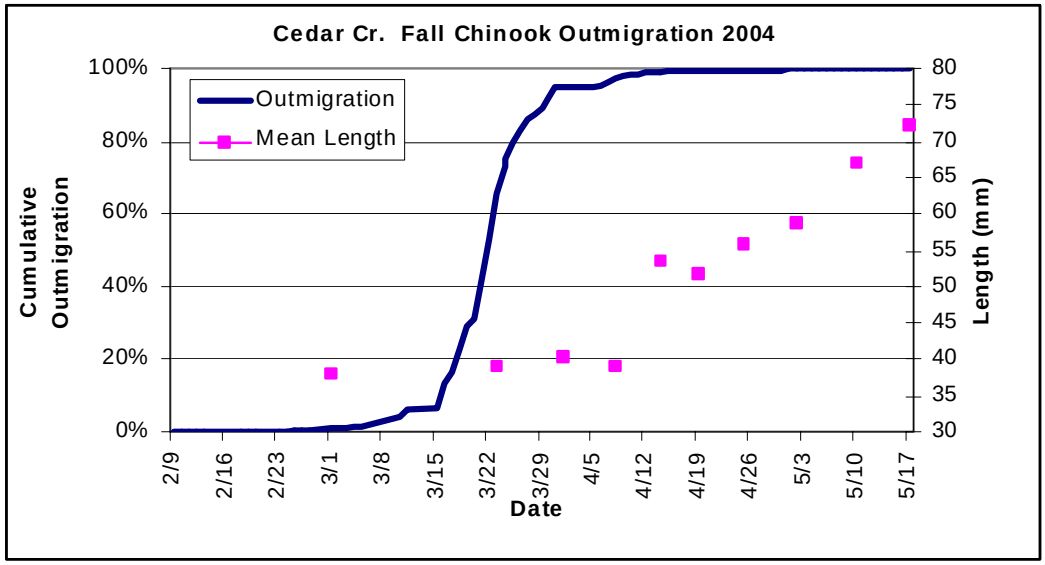
Relative Body Size: Studies and opinions on size of predator/prey relationships vary greatly and although there is evidence that salmonids can prey upon fish up to 50% of their body length, most prey consumed is probably much smaller. Keeley and Grant (2001) suggest that the mean prey size for 100-200 mm fl salmonids is between 13-15% of predator body size. Salmonid predators were thought to be able to prey on fish up to approximately 1/3 of their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length in aquarium environments (Pearsons et al. 1998). Artic char are well known as piscivorous predators, but recent studies suggest the maximum prey size is approximately 47% of their length (Finstad et al. 2002). The "33% of body length" criterion for evaluating the potential risk of predation in the natural environment has been used by NOAA Fisheries and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994; NMFS 2002). Although predation on larger Chinook juveniles may occur under some conditions, WDFW believes that a careful review of the Pearson and Fritts (1999) study supports the continued use of the "33% of body length criterion" is valid for listed species until further data for this system can be collected. A summary of lower Columbia River fall chinook length data are presented below:

- Fork lengths of naturally produced chinook from the Lewis River system during the month of June indicate fish 48-55 mm fl (Columbia River Progress Report 2003-16). The Lewis River system fall chinook stock timing is the latest for the Columbia tributary stocks, and considered to be the worst case scenario (smaller size) when compared to other Columbia River systems.
- Abernathy Creek (WRIA 25) indicated lengths of 36mm – 40mm from March to April 1 (P. Hanratty, WDFW, pers comm. 2004). Growth for wild chinook from Abernathy Creek from the first of April to May 1 is unknown.
- Average fork length from 26 sampling sites on the Kalama River by week indicate fish 44 mm fl (April 25), 46 mm fl (May 3), 56 mm fl (May 11) and 62 mm fl (May 16). Other lengths thru August are available (Pettet WDFW 1990).
- Fork lengths from Cedar Creek (tributary to the N.F. Lewis River) indicate that average Chinook lengths reach approximately 50 mm fl between the weeks of April 12 and April 19, 2004, with fish 55-60 mm fl by April 26 and May 3, 2004 and fish approaching 70 mm fl by mid-May (Rawding 2004).

We have provided a summary of empirical information and a theoretical analysis of competition and predation interactions that may be relevant to the Merwin (Lewis River) summer steelhead program.

Potential Merwin summer steelhead predation and competition effects on listed salmonids: The proposed annual production goal for this program is 175,000 fish. Steelhead releases are at 5.0 FPP (208 mm fl) and can be released starting April 15 of the year. Steelhead released as actively migrating smolts would not likely compete for food or habitat with fingerling stocks of chinook or steelhead (Section 7). At 5.0 fpp steelhead pose an unknown risk on listed fish of 69 mm fl and smaller. Hatchery migrants would encounter wild spring chinook fry and fingerlings. Due to size differences between yearling smolts and fingerlings, competition is probably low with first year chinook and steelhead due to food and spatial preference between species and age of fish. Spring chinook fry emerge between November and March, depending on time of egg deposition and water temperature, and spend one full year in fresh water, and emigrate in their second spring as age-2 smolts. Fall chinook emergence is believed to start in late March or April, peeking in late April and early May, in the Lewis River. Outmigration continues to late summer. Emigration from Cedar Creek to the Lewis River occurs early, starting in mid-March (Rawding 2004). Below (Figure 1) are length data vs. outmigtation rate for Cedar Ck. fall chinook: (provided by D. Rawding WDFW)

Figure 1. Cedar Creek Outmigration.



Actively migrating summer steelhead smolts released by late April or early May are unlikely to interact with listed steelhead as spawning time for wild winter steelhead stocks in the ESU occurs from March to May with April 20th the peak week of spawning and depending on available temperature units, eggs will hatch in 4-7 weeks with fry emergence approximately 2-3 weeks after hatching which indicates listed fish not available until late May to mid June (LCSI Draft 1998). Wild summer steelhead fry emerge from late April through July; juveniles generally rear in fresh water for two years; juvenile emigration occurs from March to May, with peak migration in early May (LCFRB Subbasin Technical Document 2004). Indirect take from predation or competition is unknown.

Table 6. Steelhead Spawn and Emergence Windows.

Race	Spawn Time	Peak Spawn Window	Incubation to Hatch	Swim-up Window	Swim-up @ 50% Date	Source
Winter	March – May	April 15 - 25th	May 13 – June 15	May 27-July 7	June 17	LCSI Draft 1998
Summer	February – April	March 20-30th.	April 14 – May 18	April 28 – June 2	May 15	Kalama Research Report

*Listed Coho (Proposed):*Length data for wild coho in the Lower Coulmbia River is unknown. Depending on water temperatures, during the month of April, lower Columbia River hatchery coho fry can range from 42 – 40 mm fl, and 50mm fl by May 1 (LCR Hatchery data 2001). Indirect take from predation or competition is unknown.

- *Residualism*: To maximize smolting characteristics and minimize residual steelhead, WDFW adheres to a combination of acclimation, volitional release strategies, active pond management, size, and release guidelines (WDFW Steelhead rearing guidelines July 31, 2001). Condition factors of 0.90-0.99 (K factor) and co-efficient of variation on fork lengths (CVs) of less than 10% are steelhead the release guidelines. Recent research (Rhine et al. 1997, Bigelow 1997)

indicates steelhead smaller than 180 mm are more prone to residualize, while smolting and survival are optimized for fish greater than 190 mm fl (WDFW Steelhead rearing guidelines July 31, 2001). As a case in point, data from steelhead release programs on the Toutle River system are representative of the Lower Columbia steelhead programs at release that illustrates that few fish are <180 mm fl and greater than > 250 mm fl on release. Below are presented length frequency samples of 100 smolts from 20,000 summer steelhead released directly from the N.F.Toutle Hatchery and 20,000 summer steelhead released from the Cowlitz Game and Anglers Acclimation Pond located on the S.F. Toutle River. In both cases, few fish are outside these general guidelines for optimum steelhead size at release. Indirect take from residualism is unknown.

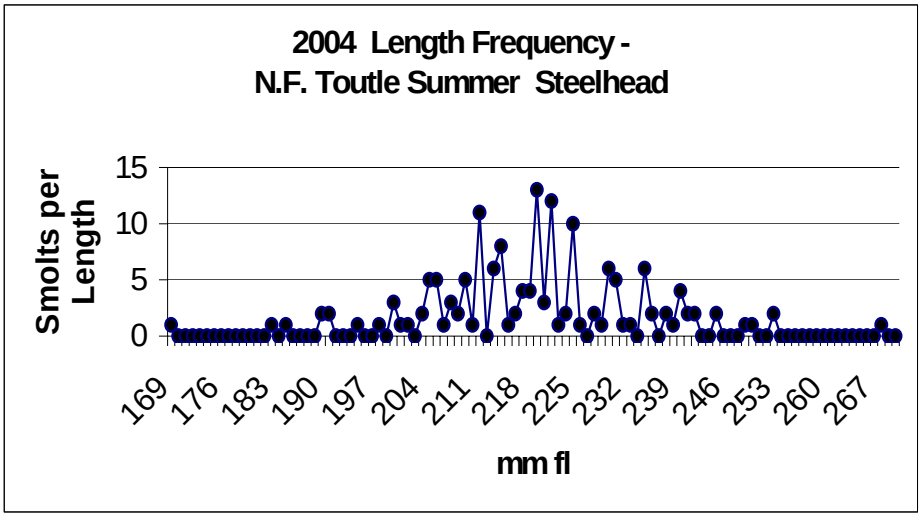


Figure 2. N.F. Toutle Summer Steelhead Plants (Hatchery Site Plants)

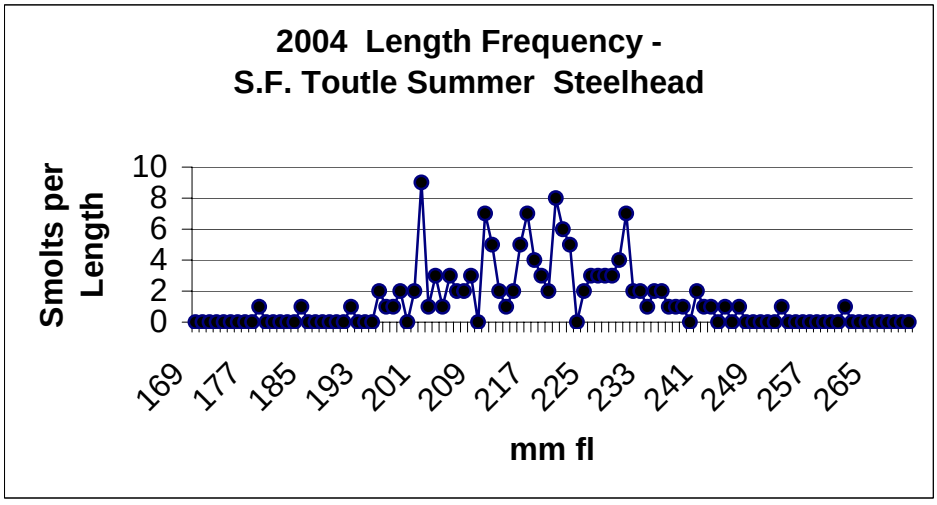


Figure 3. S.F. Toutle Summer Steelhead Plants (Hatchery Site Plants)

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once in the mainstem, Witty et al. (1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor. There appear to be no studies demonstrating that large numbers of Columbia system smolts emigrating to the ocean affect the

survival rates of juveniles in the ocean in part because of the dynamics of fish rearing conditions in the ocean. Indirect take in the migration corridor or ocean is unknown.

Monitoring:

Associated monitoring and evaluation and research programs: The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek, a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

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).
In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant 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 Take Tables at the end of this document for identified levels).

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.
Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform WDFW District Biologist along with the Complex Manager would determine an appropriate plan and consult with NOAA for adaptive management review and protocol.

Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.
No data available.

Section 3: Relationship of Program to Other Management Objectives

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

For ESU-wide hatchery plans, the production of Merwin summer steelhead is consistent with:

- PacifiCorp Agreement
- 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin
- 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin
- Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1994)
- The *U.S. v. Oregon* Columbia River Fish Management Plan
- NWPPC Fish and Wildlife Program

For statewide hatchery plan and policies, hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW Columbia hatchery operations with which the production of spring chinook salmon from Lewis River Hatchery is consistent with the following WDFW Policies*:*

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon.. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be use to maintain genetic variability within the hatchery populations.. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release for each hatchery. It is designed to foster development of locally-adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDF 1991).

Fish Health Policy in the Columbia Basin. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Policy Chapter 5, IHOT 1995).

WDFW Steelhead Rearing Guidelines. Details rearing guidelines and rearing parameters statewide (July 31, 2001).

National Pollutant Discharge Elimination System Permit Requirements This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

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

The program described in this HGMP is consistent with the following agreements and plans:

- PacifiCorp Mitigation Agreement
- The Columbia River Fish Management Plan
- U.S. vs. Oregon court decision
- Production Advisory Committee (PAC)
- Technical Advisory Committee (TAC)
- Integrated Hatchery Operations Team (IHOT) Operation Plan 1995 /Volume III.
- Pacific Northwest Fish Health Protection Committee (PNFHPC)
- In-River Agreements: State, Federal, and Tribal representatives
- Northwest Power Planning Council Sub Basin Plans
- Washington Department of Fish and Wildlife Wild Salmonid Policy
- Lower Columbia Steelhead Conservation Initiative

3.3 Relationship to harvest objectives.

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

The releases of adipose-fin clipped summer steelhead provide sport harvest opportunity for anglers in the Lewis and lower Columbia rivers. They enter fisheries from March through October and most of the catch occurs from late May through August. Selective harvest regulations allow only the harvest of adipose-fin clipped summer steelhead in the lower Columbia River to protect wild summer steelhead. Specific harvest rates for the hatchery steelhead are unknown, however, punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest.

Only wild steelhead release fisheries are permitted in the Lower Columbia Management Area (LCMA). Estimated tributary fisheries exploitation (includes incidental mortality due to other-species targeted fisheries) rate in the LCMA on wild summer steelhead is < or = to 10%. Until wild steelhead populations have recovered, wild steelhead release regulations will be in effect with incidental mortality limited to less than 7% on wild stocks. The harvest rate of hatchery fish is expected to remain greater than 40% for most stocks.

Return Year	Sport Harvest Hatchery
1989/90	1,451
1990/91	1,991
1991/92	3,408
1992/93	2,542
1993/94	2,008
1994/95	1,237
1995/96	1,198
1996/97	442
1997/98	311
1998/99	453
1999/00	1,806
2000/01	3,916
2001/02	5,229
Average	1,999

3.4 Relationship to habitat protection and recovery strategies.

Merwin Hydroelectric Project – FERC:
Options for restoring and re-introduction of salmonid are being discussed with PacifiCorp. Along with current production levels for programs below Merwin Dam during the current re-licensing process.

Subbasin Planning and the Lower Columbia Fish Recovery Board (LCFRB):
The current Lewis System HGMP processes are designed to deal with existing hatchery programs and potential reforms to those programs. A regional sub-basin planning process (Draft Lewis River Subbasin Summary May 17, 2002) is a broad-scale initiative that will provide building blocks of recovery plans by the Lower Columbia Fish Recovery Board (LCFRB) for listed fish and may well use HGMP alternative ideas on how to utilize hatchery programs to achieve objectives and harvest goals. In order to assess, identify and implement restoration, protection and recovery strategies, Region 5 staff is involved in fish and wildlife planning and technical assistance in concert through the LCFRB including the role of fish release programs originating from Lewis River and Washougal Hatchery Complexes.

Habitat Treatment and Protection:
WDFW is presently conducting or has conducted habitat inventories within the Lewis River. Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. It creates a model to predict fish population outcomes based on habitat modifications. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP) which document 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:
A WRIA 27 (Kalama, North Fork Lewis River, and East Fork Lewis River Salmon) habitat limiting factors analysis (LFA) has been completed by the Washington State Conservation Commission (Wade G., March 2001) with the input from WDFW Region 5 staff.

3.5 Ecological interactions.

Below are discussions on both negative and positive impacts relative to the Washougal summer steelhead program and are taken from the Puget Sound listed and non-listed HGMP template (WDFW and NOAA 2003).

(1) Salmonid and non-salmonid fishes or species that could negatively impact the program: Lewis River winter steelhead smolts 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. See also Section 2.2.3 Predation and Competition.

3) Salmonid and non-salmonid fishes or other species that could positively impact the program. Multiple programs including fall chinook and coho programs are released into the Lewis River watershed and limited natural production of chinook, coho, and steelhead occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.).

4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program. Merwin steelhead smolts can be preyed upon release thru the entire migration corridor from the river subbasin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs can predate on steelhead smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that benefit from migrating smolts (river otters), and returning adults include: harbor seals, sea lions and Orcas. While not always desired from a production standpoint, these 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. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Wild co-occurring salmonid populations might be benefited as hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Successful or non-successfully spawner adults originating from this program may provide a source of nutrients in oligotrohic coastal river systems and stimulate stream productivity. Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). The Lewis River drainage is thought to be inadequately seeded with anadromous fish carcasses can be used throughout the basin. Three species are not meeting escapement goals in the North Fork Lewis River; winter and summer steelhead, and coho salmon. Very few chum salmon return to the watershed; however, at one time the estimated escapement from the Lewis River was 3,000 fish (WDF 1951). These low escapement numbers mean a loss of ocean-derived nutrients from salmon carcasses that could be a limiting factor within the basin. A nutrient enhancement program is underway on the North and East Fork Lewis River systems. In 1997, WDFW and volunteer groups planted 1407 fish carcasses in tributaries to the North and East Forks of the Lewis River. In 1998, they planted 4,659 carcasses (Hale 1999, personal comm.). *Saprolegniasis* occurrences in young hatchery fish have been observed in greater frequency on Mitchell Act stations that have nutrient enhancement projects and 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.

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.

The holding ponds at the Merwin site are supplied with 100% Lake Merwin water (600 gallons per minute (gpm)). Water temperatures range below and above generally acceptable levels (42-61 degrees) during adult holding. Water clarity is good. Water for incubation and rearing is from the same source and feeds 15 vertical incubators, six intermediate ponds, four shallow troughs, ten raceways (9.5' x 80' x 2.5') and four 1/4 acre rearing ponds. Total flow to these is approximately 5,000 gpm. Program complies with all NPDES permits.

Total available flow is 5,000 gpm which is pumped from Lake Merwin. This facility has ozonation capabilities to treat 3,800 gpm. Two intakes are used at depths of 15 and 110 feet. At RM 10, there are seven in-river net pens with approximately 50,000 cubic feet of rearing space.

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.

Potential Hazard	Risk Aversion Measures
Hatchery water withdrawal	Water for raceways are diverted from formalized through trust water right #S2-24939 from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports (see below).
Intake/Screening Compliance	WDFW has requested funding for future scoping, design, and construction work of a new river intake system on Lewis River to meet NOAA compliance.
Hatchery effluent discharges. (Clean Water Act)	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE). WAG 13-1052. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE. Discharges from the cleaning treatment system are monitored as follows: *Total Suspended Solids (TSS)* C1 to 2 times per month on composite effluent, maximum effluent and influent samples. *Settleable Solids (SS)* C1 to 2 times per week on effluent and influent samples. *In-hatchery Water Temperature* - daily maximum and minimum readings.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

All summer steelhead broodstock for the program are volunteers to the Lewis River (RM 15.7) and Merwin (RM 19) traps. Traps are open for adult collection for approximately 7 months to allow for collection over the entire run time. Both traps have "V" weirs to prevent the escape of captured fish. The Lewis River trap is 200' x 7' x 5' with a flow of 3,500 gpm. The Merwin trap is approximately 60' x 12' x 7' with a flow of 25,000 gpm. The following ponds are used to hold adult steelhead until spawning:

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
3	Adult Holding Ponds	1732.5	33	7.5	7.0	180
2	Concrete Raceways (Adult Holding and Smolt Collection)	1410	40	11.75	3.0	450

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

Adult or smolts can be transported by the following tankers depending on availability and program:

Equip. Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
2 Tanker Truck (Adult and Juvenile/Smolt Transport)	1800	Y	N	5-12	nya	nya
1 Tanker Truck (Adult and Juvenile/Smolt Transport)	1100	Y	N	5-12	nya	nya

5.3 Broodstock holding and spawning facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
3	Adult Holding Ponds	1732.5	33	7.5	7.0	180
2	Concrete Raceways (Adult Holding and Smolt Collection)	1410	40	11.75	3.0	450

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Vertical Stack Units	6	7.6	nya	10000	8000

5.5 Rearing facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
4	Shallow Troughs	nya	17	1.5	0.833	20	1.8	0.20
4	Intermediate Ponds	nya	34	4.5	2.0	100	1.8	0.20
6	Raceways	nya	80	9.5	2.5	520	1.8	0.20
2	1/4-Acre Pond	nya	184	84	4.0	950	1.8	0.20

5.6 Acclimation/release facilities.

Same as above, see section 5.5.

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

Despite the fact that all water supplied during incubation and early rearing for this stock is ozone treated, we still experience periods of high mortality. These losses would be in the category of difficulties rather than disasters. The condition or diseases associated with these losses are *saprolegniasis* and Low Temperature Disease *(Cytophaga psychrophila.)*. We have also experienced high losses in the adults being held for spawning during each of the past five seasons. These losses are associated with *saprolegniasis* and IHN.

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.

- All pumps, broodstock holding, incubation and rearing receptacles have water loss alarms.
- Staff is available 24/7 to respond to pump failure, water loss, and flooding events.
- Fish health protocols through broodstock collection, incubation and rearing phases are followed and monitored monthly.
- Broodstock collection is checked daily for program and listed fish.

Section 6. Broodstock Origin and Identity

6.1 Source.

Hatchery identified broodstock for this program can come from Skamania and/or Merwin Hatcheries.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Skamania Hatchery Summer Steelhead	H	1994	Present
N.F. Lewis River Summer Steelhead	H	U	Present

6.2.1 History.

Summer steelhead are indigenous to the Lewis River watershed. Lewis River summer steelhead are composed of both wild and hatchery stocks. On the North Fork, only about 1.6 percent of the returning summer steelhead are wild fish, while on the East Fork, the wild fish component is higher, (27 percent based on one study). The primary management intent is to maximize wild fish escapement while using hatchery fish to provide the harvest opportunities. The stock was originally Skamania (Washougal River)/Klickitat River crosses (1950's). Historically, plants of this stock were made into the Lewis River system from the Skamania Hatchery. Since the hatchery was built on the Lewis River, the broodstock has derived from taking eggs from returning summers in the Lewis system or importing eggs from the Skamania Hatchery.

6.2.2 Annual size.

See Section 7.1.

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

Natural origin fish are not integrated within the broodstock program.

6.2.4 Genetic or ecological differences.

The difference in spawn timing (3 months earlier for Merwin (Skamania)), poor reproductive success for these fish in the wild (Hulett et al. 1998) and spatial separation at spawning have helped to maintain genetic differences between hatchery and wild fish. Fish are released as age-1+ smolts whereas wild steelhead are predominantly age-2+ smolts. Outmigration timing for both life history types is similar but is slightly earlier for hatchery component (Fuss et. al. 1999).

6.2.5 Reasons for choosing.

There has been a long history of adaptation of the stock to Skamania facility contributing to the success of the summer steelhead program. Skamania stock has been the source of nearly all the hatchery summer steelhead smolts that WDFW releases in the Lower Columbia River region with the exception of Cowlitz and Lewis rivers (BO for CRFD funded facilities, March 1999). Summer steelhead broodstock are available for this program to be localized for the Lewis system which will give flexibility for fish health and operational management considerations.

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.

Listed fish are not used in broodstock selection and can be identified by adipose fin presence. Non-target listed fish are released back to the Lewis River as prescribed by WDFW Region 5 staff.

Section 7. Broodstock Collection

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

Adults

7.2 Collection or sampling design

Spawners are selected randomly over the entire run from fish arriving at both Merwin Dam Fish Collection Facility and Lewis River Trap. Numbers set aside represent that percentage of the total run that is collected during that particular sorting period.

Adult collection and spawning guidelines for Summer Steelhead at Merwin Hatchery:
1) Broodstock will be collected from July through September (50% July, 30% August, and 20% September). However, shortfalls may require additional collections through the fall.
2) There will be no size selection.
3) Spawning will occur from December (50%) through January (50%) and will be completed by January 31.
4) Spawning will be one-to-one female unless shortfalls in broodstock occur; then half of the eggs from one female will be spawned with a different male.

7.3 Identity.

All hatchery-origin Skamania/Merwin summer steelhead are adipose-fin clipped. Only adipose fin-clipped adults are used for broodstock.

7.4 Proposed number to be collected:

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

450 adults at a 1:1 male to female ratio excluding jacks. Extra adults could be used in case of culling due to IHN or as needed for the Skamania summer steelhead program.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available.

Year	Females	Males
Planned	225	225
1995	53	U
1996	U	U
1997	NA	NA
1998	132	196
1999	46	92
2000	104	206
2001	158	109

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

Returning hatchery steelhead that are trapped at Merwin Dam are recycled (opercle punch) and returned to the river just below the confluence with the EF Lewis (rm 3.4) for additional harvest opportunity. If they are trapped at Merwin Dam a second time, they can be trucked to Horseshoe Lake for additional sport harvest in a closed system.

7.6 Fish transportation and holding methods.

Steelhead adults from Lewis River Hatchery are transported to Merwin Hatchery by 1800 or 1100 gallon capacity tanker trucks. Transit time is 5-12 minutes. Fish can be held in raceways or holding ponds for maturation. The first adult summer steelhead begin arriving at Merwin Hatchery in May and are held until December before spawning begins. Pre-spawning mortality is typically 1 to 2%. Water source is from Lake Merwin.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
3	Adult Holding Ponds	1732.5	33	7.5	7.0	180
2	Concrete Raceways (Adult Holding and Smolt Collection)	1410	40	11.75	3.0	450

7.7 Describe fish health maintenance and sanitation procedures applied.

The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection (chlorine) 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 Co-Managers Fish Health Policy.

7.8 Disposition of carcasses.

All carcasses are taken to the local landfill for disposal.

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.

No listed natural spawning fish are taken for broodstock.

Section 8. Mating

8.1 Selection method.

Spawners are selected randomly over the entire run from fish arriving at both traps. Numbers set aside represent that percentage of the total run that is collected during that particular sorting period.

8.2 Males.

A spawning matrix of one primary male for fertilization backed up by a second male to insure fertilization is always used no matter how large the egg take. A proportion of the males were live spawned in the years 1999, 2000, and 2001. The occurrence of jacks is scarce in the returning population. Genetic protocols would allow use up to 2% if jacks were present.

8.3 Fertilization.

For all egg takes we use one fish pool of eggs fertilized by one male. Disease prevention includes water hardening of all eggs in a iodophor solution for one hour. A 100% sampling of ovarian fluid and kidney/spleen samples taken for virus check.

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.

No listed natural fish are used in the mating scheme. Early spawning hatchery fish have been selected to decrease the chances of mating with listed natural spawning fish. Also, all hatchery-origin fish are marked.

Section 9. Incubation and Rearing.

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

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Egg Survival Perfor-mance Std.	Fry-fingerling Survival (%)	Rearing Survival Perfor-mance Std.	Fingerling-Smolt Survival (%)
1995	230060	nya	nya	nya	87.04	nya	95.28
1996	276500	nya	62.90	nya	93.53	nya	98.73
1997	66500	nya	99.60	nya	92.20	nya	98.48
1998	247500	nya	81.30	nya	93.93	nya	97.15
1999	325200	nya	78.6	nya	86.47	nya	99.80
2000	440609	nya	71.30	nya	90.67	nya	99.73
2001	634331	nya	98.44	nya	88.71	nya	99.51
2002	399,000		Na		Na		Na
2003	444,500		Na		Na		Na

Shortfalls can be made up from Skamania Hatchery. Eyed eggs were transferred from Skamania Hatchery to Merwin Hatchery in 1997 (252,000). 60,000 eyed eggs are transferred to Skamania Hatchery in February of the year. Skamania hatches and rears up to 50,000 yearlings for transfer to the Fish First Echo Bay Net Pens in April. Additionally, 35,000 subyearlings are transferred from Merwin to Elochoman Hatchery in October, fish are 25 FPP.

9.1.2 Cause for, and disposition of surplus egg takes.

With mortality rates of approximately 22.56%, due to poor fertilization (green males) and past disease problems (IHN), extra eggs have been taken. Smolt releases have never exceeded the program release goal of 235,000. Dead or destroyed eggs are disposed of at the landfill.

9.1.3 Loading densities applied during incubation.

Summer steelhead eggs range in size from 2,800 eggs/lb to 3,000 eggs/lb. Standard loading of eyed eggs per shallow trough basket is 20,000. Trough flow is varied from 8 to 12 gallons per minute depending on the stage of the egg or fry.

9.1.4 Incubation conditions.

Water is pumped from the Merwin Reservoir and provides silt free water to the incubators. Since all the water to the hatchery is ozonated, runs through an enclosed stripper and has additional packed columns, the water is disbursed of any entrained gases and well oxygenated. They are closely monitored and have been well within appropriate levels.
Family spawnings are incubated separately during the Green to Eyed-Egg stage to monitor for IHN. The water temperature is monitored continuously with a thermograph and recorded while temperature units (TU) are tracked for embryonic development.

9.1.5 Ponding.

Initial feeding and early rearing occurs in the incubation troughs. Ponding / feeding begins on a volitional basis when the fry are 100% at the swim-up stage. At this point very little, if any, yolk sack will be present. Fry are ponded when: a visual inspection of the amount of yolk sac remaining with the yolk slit closed to approximately 1 millimeter wide (approximately 1200 TU's) or based on (95% yolk absorption) KD factor. At this time fry are transferred to the appropriate starter raceway (See HGMP Section 5.5 for raceway specifications). Ponding dates each year run between February 25th and April 5th.

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 inspections monthly. Potential problems are managed promptly to limit mortality and reduce possible disease transmission. Formalin (37% formaldehyde) is dispensed into water for control of ecto-parasites on juvenile fish and for fungus control on eggs. Egg mortality ranges from 6 to 16 % and all eggs are processed through an automated egg picking machine and to some degree by hand. All eggs are treated with iodophor during water hardening for disease prevention. They are also treated with formalin during incubation for prevention of fungus. Yolk-sac malformation is of such low levels as to provide no concern. Most egg losses are due to lack of fertilization. Egg mortality removal is done on a daily basis by use of hand pickers. All data is recorded each day.

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

All eggs incubated are from hatchery-origin marked adults only.

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 (1990-2001), or for years dependable data are available.

Year	Egg Take	Green-Eyed Survival (%)	Eyed-Ponding Survival (%)	Fry-fingerling Survival (%)	Fingerling-Smolt Survival (%)
1995	230060	nya	nya	87.04	95.28
1996	276500	nya	62.90	93.53	98.73
1997	66500	nya	99.60	92.20	98.48
1998	247500	nya	81.30	93.93	97.15
1999	325200	nya	78.6	86.47	99.80
2000	440609	nya	71.30	90.67	99.73
2001	634331	nya	98.44	88.71	99.51

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

The fish are reared using the loading densities recommended by Piper et al. (1982). In all 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.

Environmental parameters: flow rates, water temperatures, dissolved oxygen and Total Settable Solids (TSS) are monitored on a routine basis through the rearing period. All ponds are broom cleaned every other day and pressure washed between broods. The raceways are not covered to protect the fish from birds and we see the effects in fish loss. We use demand feeders on all raceways throughout the fall and winter months. Water is pumped from the Merwin Reservoir and provides silt free water to the incubators and rearing facilities. Since all the water to the hatchery is ozonated, runs through an enclosed stripper and has additional packed columns, the water is disbursed of any entrained gases and well oxygenated. They are closely monitored and have been well within appropriate levels. Standard pond management as per Piper et. al. (1982).

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.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
04/07/02	31.1	2245	1.88	nya
05/24/02	44.0	601.1	0.88	nya
08/15/02	91.0	50.0	1.20	nya
10/07/02	124.2	21.1	1.12	nya
11/08/02	144.2	12.5	1.20	nya
12/13/02	166.0	8.3	1.18	nya
3/11/02	188.0	6.2	1.10	nya
04/03/02	201.6	5.0	1.10	nya
04/28/02	213.8	4.8	0.95	nya

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

Same as above, see 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*).

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
Ponding-500 fpp	Moore Clark Nutra #0	nya	nya	nya	nya
500-250 fpp	Moore Clark Nutra #1	nya	nya	nya	nya
250-80 fpp	Moore Clark Nutra #2	nya	nya	nya	nya
80-12	Moore Clark Nutra #3	nya	nya	nya	nya
12-Release	Trout AB 2.5	nya	nya	nya	nya

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

Monitoring	A fish health specialist inspects fish monthly at Skamania and Vancouver hatcheries and checks both healthy and if present 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. Kidney and spleen are checked for bacterial kidney disease (BKD). Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted.
Disease Treatment	Bacterial cold water disease (Flavobacteriosis) can occur mid-summer with Florfenicol used. IHN can occur from mid-summer to fall. Loss of fish to IHN in 2002 was 6% of the summer steelhead population although losses can be more substantial insome years. As needed, appropriate therapeutic treatment will be prescribed to control and prevent further outbreaks. Mortality is collected and disposed of at a landfill. Fish health and or treatment reports are kept on file.
Sanitation	All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy). All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. 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.

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

Besides time, size and past history, aggressive screen and intake crowding, swarming against sloped 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 .90 (K). Staff can observe smolt ratios during final length frequency measurements upon release. Any observations of non-smolted fish are communicated to Merwin staff. ATPase activity is not measured.

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

Not applicable.

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

- Listed fish are not under propagation.
- Steelhead are marked for broodstock identification.
- Holding pond procedures follow IHOT guidelines.
- Non-target listed fish will be released immediately, if encountered, during the brood stock collection process.

Section 10. Release

10.1 Proposed fish release levels.

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	175,000	5.0	Start 1st of May	North Fork Lewis River	RKm 8.1	Lewis	Lower Columbia

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

Releases occur beginning the first of May. Fish that volitionally migrate from 2 rearing ponds to a "smolt collection pond". They are pumped into tank trucks on a daily basis and hauled to the release sites. Some days have only a haul or two and on other days several hauls are required to move all of the fish collected. This assures that all trucked fish have exhibited smolt behavior. Fish are trucked and planted at the I-5 bridge site (RM 5.0).

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

	Fry Release			Fingerling Release			Yearling Release		
Release Year	No.	Date (MM/DD)	Avg size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)
1996	nya	nya	nya	34572	November	17.0	122279	April 13-May 1	5.85
1997	nya	nya	nya	nya	nya	nya	123776	April 20-May 11	6.3
1998	80476	Late April	800	nya	nya	nya	155218	April-May	6.4
1999	nya	nya	nya	48541	October	30.8	149242	April 17-May 7	5.7
2000	nya	nya	nya	6256	July	23.0	172038	April 16-May 1	4.8
2001	nya	nya	nya	nya	nya	nya	238188	April 16-May 7	4.5-5.0
2002	125677	June	67.3	nya	nya	nya	178160	April 16-May 8	4.9
Avg	nya	nya	nya	nya	nya	nya	nya	nya	nya

(1) Fry and/or fingerling releases in 1996,1998,1999,and 2000 were outplanted into Merwin Reservoir.
(2) The fry release in 2002 was outplanted into Yale Reservoir.

10.4 Actual dates of release and description of release protocols.

Releases occur from mid-April to May 10th. Actual days of release are usually on all weekdays between the above mentioned days.

10.5 Fish transportation procedures, if applicable.

For fish transported as adults or smolts, the tankers listed below are used depending on availability.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
2 Tanker Truck (Adult and Juvenile/Smolt Transport)	1800	Y	N	5-12	nya	nya
1 Tanker Truck (Adult and Juvenile/Smolt Transport)	1100	Y	N	5-12	nya	nya

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

Fish have been reared on Lake Merwin water. As spring smolt occurs, summer fish reared in 2 intermediate ponds can move to one of two lower “smolt” ponds. As these fish are exhibiting smolt signs they are loaded into trucks and transported daily as needed from the Merwin Hatchery to RKm 8.1 (N.F. Lewis River) for a direct river release during the period of April 15-May 10. This area at the I-5 bridge is below much of listed Chinook habitat but above the confluence of the N.F. with the E.F. minimizing straying into the E.F. Lewis.

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

Program is 100% adipose-fin clipped.

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

Fish surplus to the anadromous program have been planted in Merwin Reservoir and contribute as landlocked trout for the lake fishery. We have no excess fish at time of smolt releases. With mortality rates of approximately 22.56%, due to poor fertilization (green males) and past disease problems (IHN), extra eggs have been taken. Smolt releases have never exceeded the program release goal of 175,000.

10.9 Fish health certification procedures applied pre-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 Co-managers Fish Disease Control Policy and IHOT guidelines.

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

Emergency procedures and disposition of fish would adhere to the protocols and procedures set forth in the Program Section 7 Permit protocols. If an emergency release was authorized, fish would be released according to procedures and methods that assure the highest probability of fish surviving to adulthood. In a case of no authorization for release, the procedures would be implemented to minimize catastrophic loss if held at hatchery.

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.

- Program is mass marked for heavy harvest identification
- The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal rearing of delay in the rivers, limiting interactions with naturally produced steelhead juveniles.
- Fish exhibit smolt behavior by volitionally migrating from 2 rearing ponds to a "smolt collection pond".
- WDFW collects volitionally migrating steelhead produced at Merwin Hatchery for truck planting downstream to the city of Woodland, to promote homing of returning hatchery steelhead to the lower area where wild fish are not likely to spawn. This reduces competition and predation on wild steelhead that generally rear in up-river areas.
- WDFW uses acclimation and release of hatchery steelhead smolts in lower river reaches where possible, this in an area below wild fish spawning and rearing habitat.
- WDFW proposes to continue monitoring, research and reporting of hatchery smolt migration performance behavior, and intra and interspecific interactions with wild fish to access, and adjust if necessary, hatchery production and release strategies to minimize effects on wild fish. (Biological Opinion On Artificial Propagation in the Columbia River Basin, Section 7 Consultation, March 29, 1999).

Section 11. Monitoring and Evaluation of Performance Indicators

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

Continue to calculate annual fisheries contribution rates based on coded-wire-tag recoveries in regional commercial and sport fisheries. Continue use of mass marked (ad clip) and coded-wire-tagged groups as effective management and research tools. Ongoing research by the Kalama Research Station may provide applicable methods for management of this steelhead program.

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

With the loss of Mitchell Act funding, staffing and logistical support may be lost to continue the monitoring and evaluation of this and other programs on the Columbia River. Current Fish Program staff is available to complete monitoring and evaluation baseline Lower Columbia system needs while research is on-going for coho interaction in the Lewis River and steelhead in the Kalama River.

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

Monitoring, evaluation and research follow scientific protocols with adaptive management process if needed. WDFW will take risk aversion measures to eliminate or reduce ecological effects, injury, or mortality as a result of monitoring activities. Most trap mortalities are the result of extreme environmental conditions that flood traps or equipment failure. WDFW will take precautions to make sure the equipment is properly functioning during the season. If environmental conditions are forecast that will cause high mortality then traps will be removed or opened up to allow unobstructed passage without mortality. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

Section 12. Research

12.1 Objective or purpose.

A Steelhead Rearing Density Study will help to define the rearing capacity of Merwin Hatchery. It may determine that fewer steelhead can be released to produce the same number of adults. This decrease could benefit listed natural stocks by reducing potential competition. A Steelhead Precocity Study will help to define the effects of feeding regimes and juvenile size on precocity. Reducing precocity rates would decrease residualism which would reduce competition with listed natural juveniles. This could also reduce release numbers, as well.

12.2 Cooperating and funding agencies.

WDFW and PacifiCorp

12.3 Principle investigator or project supervisor and staff.

Jack Tipping and Todd Hillson

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

Juveniles from hatchery stock are used in the research.

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

Steelhead Rearing Density Study.

Capture was done either with dip net or by seining ponds. MS-222 was used to anesthetize fish when needed. 300 juveniles were sampled just prior to release to determine mean length and K-factor. Study groups (approximately 60,000 in each group) were identified with blank coded-wire tags located in the cheek. Standard hatchery fish culture protocols were used throughout the rearing period.

Steelhead Precocity Study.

Approximately 6,000 juvenile fish reared in raceways are involved. Capture was done with dip nets. MS-222 was used to anesthetize fish when needed. 300 juveniles were sampled to determine a length distribution in mid-August. the largest 10 percent were then graded off and marked with a coded-wire tag. Three equal groups were made from the remaining fish and then equal numbers of marked fish were added into the three groups. These three groups were then fed different levels (power fed, normal ration, reduced ration) during the remainder of August and through September. All fish will be sampled/examined in late December and, again, prior to release for precocity.

12.6 Dates or time periods in which research activity occurs.

Steelhead Rearing Density Study: Summer steelhead released in 1999-2001.

Steelhead Precocity Study: August to release, 2000-02.

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

Steelhead Rearing Density Study.
Capture was done either with dip net or by seining ponds. MS-222 was used to anesthetize fish when needed. 300 juveniles were sampled just prior to release to determine mean length and K-factor. Study groups (approximately 60,000 in each group) were identified with blank coded-wire

tags located in the cheek. Standard hatchery fish culture protocols were used throughout the rearing period.

Steelhead Precocity Study.
Approximately 6,000 juvenile fish reared in raceways are involved. Capture was done with dip nets. MS-222 was used to anesthetize fish when needed. 300 juveniles were sampled to determine a length distribution in mid-August. the largest 10 percent were then graded off and marked with a coded-wire tag. Three equal groups were made from the remaining fish and then equal numbers of marked fish were added into the three groups. These three groups were then fed different levels (power fed, normal ration, reduced ration) during the remainder of August and through September. All fish will be sampled/examined in late December and, again, prior to release for precocity.

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

None.

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

None

12.10 Alternative methods to achieve project objects.

None

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

None

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.

No listed natural fish will be used in the research.

Section 13. Attachments and Citations

13.1 Attachments and Citations

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Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 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:_____

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

Spring Chinook

ESU/Population	Lower Columbia River Spring Chinook
Activity	Merwin Summer Steelhead
Location of hatchery activity	Lewis River and Merwin Hatchery
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)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	0*	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., broodstock (e)	nya	nya	0	nya
Intentional lethal take (f)	nya	nya	Unk	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

0* Steelhead are separated from the spring Chinook trapping. No take has been observed.
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.

Take Table 2. Estimated listed salmonid take levels by hatchery activity.

Fall Chinook

ESU/Population	Lower Columbia River Fall Chinook
Activity	Merwin Summer Steelhead
Location of hatchery activity	Lewis River and Merwin Hatchery
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)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	0*	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya		nya
Removal (e.g., broodstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya		nya
Other take (specify) (h)	nya	nya	nya	nya

* Steelhead are separated from the fall Chinook trapping. No take has been observed.

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.

Take Table 3. Estimated listed salmonid take levels by hatchery activity.

Steelhead

ESU/Population	Lower Columbia River Steelhead
Activity	Lewis River and Merwin Hatchery
Location of hatchery activity	Merwin Hatchery
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)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	0*	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya		0*	nya
Removal (e.g., broodstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

* Hatchery Steelhead are separated. Up to 15 wild steelhead are released back to stream. No take has been observed.

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

Take Table 4. Estimated listed salmonid take levels by hatchery activity.

Coho (Proposed)

ESU/Population	Lower Columbia River Coho
Activity	Merwin Summer Steelhead
Location of hatchery activity	Lewis River and Merwin Hatchery
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)	nya	nya	nya	nya
Collect for transport (b)	nya	nya	nya	nya
Capture, handle, and release (c)	nya	nya	0*	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., broodstock (e)	nya	nya	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

0* Listed coho are returned to stream during trapping season.. No observed take has been reported.

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.