HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Kalama River Type S Coho
Species or Hatchery Stock	*Oncorhynchus kisutch* Kalama Coho Salmon
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Kalama Subbasin/Lower Columbia Province
Date Submitted	nya
Date Last Updated	August 17, 2004

Section 1: General Program Description

1.1 Name of hatchery or program.

Kalama River Type S Coho (At Fallert Creek Hatchery)

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

Coho Salmon (Oncorhynchus kisutch)

ESA Status: Currently not one of 21 artificial propagation programs proposed for listing (NOAA 69 FR 33101; 6/14/2004). WDFW does not concur with this decision and proposes to operate as an integrated program.

1.3 Responsible organization and individuals.

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

Co-operators	Role
National Marine Fisheries Service	Administrator of Mitchell Act Funds

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

Funding Sources
Mitchell Act

Operational Information	Number
Full time equivalent staff	6.0
Annual operating cost (dollars)	$605,527

The above information for full-time equivalent staff and annual operating cost applies cumulatively to Kalama River Anadromous Fish Programs conducted at Kalama Falls and Fallert Hatcheries and cannot be broken out specifically by program.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Kalama River Hatchery Type S Coho
Broodstock collection location (stream, RKm, subbasin)	Fallert Creek Hatchery /Kalama River/RKm 8.2/Kalama Subbasin
Adult holding location (stream, RKm, subbasin)	Fallert Creek Hatchery/Kalama River/RKm 8.2/Kalama Subbasin
Spawning location (stream, RKm, subbasin)	Fallert Creek Hatchery/Kalama River/RKm 8.2/Kalama Subbasin
Incubation location (facility name, stream, RKm, subbasin)	Fallert Creek Hatchery/Kalama River/RKm 8.2/Kalama Subbasin
Rearing location (facility name, stream, RKm, subbasin)	Fallert Creek Hatchery/Kalama River/RKm 8.2/Kalama Subbasin

1.6 Type of program.

Integrated Harvest - (Lower Columbia River)
The proposed integrated strategy for this program is based on WDFW's assessment of the genetic characteristics of the hatchery and local natural population, the current and anticipated productivity of the habitat used by the populations, the potential for successfully implementing an isolated program, and NMFS' proposed listing determination (69 FR 33102; 6/14/2004). Modification of the proposed strategy may occur based upon NMFS' final listing determination and as additional information are collected and analyzed.

1.7 Purpose (Goal) of program.

- Rear and release 350,000 coho smolts into the Kalama River,
- Produce coho salmon to help mitigate for fish losses, including commercial and sport harvest in the Columbia River for activities within the Columbia River Basin that have decreased salmonid populations including federal dams.

1.8 Justification for the program.

- Legal justification includes: Mitchell Act, Pacific Northwest Electric Power Planning and Conservation Act, and U.S. v Oregon court agreements.

- WDFW protects listed fish and provides harvest opportunity on Kalama River coho programs 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 the 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.

In order to minimize impact on listed fish by WDFW facilities operation and the Kalama Type S coho program, the following Risk Aversion are included in this HGMP:

Table 1. Summary of risk aversion measures for the Kalama Type S coho program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Water rights are formalized thru trust water right #S2-*21721 from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	WDFW has requested funding for future scoping, design, and construction work of a new river intake system on Fallert Creek to meet NOAA compliance (Mitchell Act Intake and Screening Assessment 2002).
Effluent Discharge	4.2	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) administered by the Washington Department of Ecology (DOE) - WAG 13-1053.
Broodstock Collection & Adult Passage	7.9	Will limit out of basin broodstock. Broodstock collection and sorting procedures can quickly identify listed fish if encountered and are released per protocol to minimize impact as determined by Region 5 staff.
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* (Genetic Policy Chapter 5, IHOT 1995).
Competition & Predation	2.2.3, 10.11	Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish. See also those sections.

1.9 List of program "Performance Standards".

See HGMP 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 a meaningful harvest for sport, tribal and commercial fisheries. Achieve a 10-year average of 1.90% smolt-to-adult survival (range .07% - 8.83%) that includes harvest plus escapement.	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 Limit out of basin transfers Maximize available natural origin (adipose present) broodstock (NOB)	A minimum of 500 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return Interim guidelines for basin transfers	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 (100% adipose-fin clip) for selective fisheries with additional groups Ad+CWT (30,000/8.5%)for evaluation purposes	Returning fish are sampled throughout their return for length, sex and mark.
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 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
	Release and/or transfer exams for pathogens/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/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/parasites	Controls 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 (17.0 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, in stream 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 in stream 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).

WDFW has established an egg take goal of 420,000 eggs in the Future Brood Document (FBD). To meet this goal a total of 140 females and 140 males need to be collected annually excluding jacks, based on an average fecundity of 3000 eggs/female and pre-spawning mortality of 10%. A pre-season meeting between Hatchery and Fish programs will occur in June/July to review past hatchery operations, natural escapement, and develop a plan for weir and hatchery operations during the upcoming fall season. Since run size predictions are not always accurate and run timing varies annually, programs must maintain flexibility to meet our goals of ensuring natural and hatchery numerical escapement objectives as well as selection for run timing, spawning time, and size.

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	350000 FBD	17.0	Mid-April	Kalama River	8.2	Kalama River	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.

BY	SAR	Total Catch	Hatchery Escapement
1989	8.83	13675	Na
1990	0.67	577	Na
1991	0.16	2171	Na
1992	0.11	109	Na
1993	0.08	322	Na
1994	0.18	184	Na
1995	0.07	451	1,564
1996	Na	1060	1,120
1997	1.11	893	1,350
1998	1.90	2160	5,926
1999	0.22	Na	6,965
mean	1.90%	2160	3,385
2000	Na	Na	6,372
2001	Na	Na	15,992
2002	Na	Na	4,844

Data from PSMFC RMIS web-site.

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

The first year of operation for this hatchery was 1895. Hatchery coho have been planted in the sub-basin since 1942 from the Fallert Creek Hatchery.

1.14 Expected duration of program.

The program is on going with no planned termination.

1.15 Watersheds targeted by program.

Kalama Subbasin/Lower Columbia Province

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

1.16.1 Brief Overview of Key Issues:

Type S coho are collected at Fallert Creek Hatchery and at Kalama Falls Hatchery. They are reared and released from both stations. Returning adults are not allowed to pass by Kalama Falls.

1.16.2 Potential Alternatives to the Current Program:

Alternative 1: Truck the smolts down to the lower Kalama and release below the rearing area of wild fall chinook and other ESA listed species. Experience with transportation of coho smolts in the Lewis River has shown that smolts survive at a lower rate than direct hatchery released smolts and the stray rate of returning adults may increase as well. WDFW does not support this alternative.

Alternative 2: Change the program and release only Type N or Type S coho. WDFW does not support this alternative. The hatchery complex is suited to raising both types of coho. Coho in the future may be a single stock that encompasses the entire run timing of both stocks.

1.16.3 Potential Reforms and Investments:

Reform/Investment 1: Modernize Modrow Trap. This trap facility has several issues related to unsafe handling of adult listed fish. A complete investigation and comprehensive re-design is needed to accommodate a facility that can be installed and removed without putting machinery in the stream, as well as a trap facility that will sort, and load fish with a water to water transfer method to cause no harm to hatchery or wild stocks $$.

Reform/Investment 2: Address intake screens at Fallert Creek The Kalama River water intake at Fallert Creek is not in compliance. The profile bar screen openings exceed the maximum allowable of 1.75mm. Additionally the intake is threatened by the influence of a growing gravel bar which will in time move low stream flows away form the intake and cause in stream work that may not be necessary if we take the recommended action. The solutions are a) installing new screens. B) The solution to the gravel bar invasion is to obtain an easement on property on the other side of the river to build a small groin, or a series of groins, which would concentrate the river flow to the hatchery bank $$.

Reform/Investment 3**:** Adult sorting and handling in general is very hard on adult fish and routinely causes mortality that can be prevented with a modern sorting and handling system designed to cause the least harm possible to all fish handled. A semi-automated sorting system would be comprised of the following: An initial holding pond would collect and hold the fish until sorting is initiated by opening a gaiter, which allows adults to be attracted through a false weir and onto a fabricated, sloped, sorting chute. The chute contains paddles and side chutes. The side chutes lead to different adult ponds, and also provide returns to the river above and below the in stream barrier. An observer located in a control tower above the main chute identifies the fish as it enters the chute and then activities in of the paddles to direct the fish to the desired location. Staff does not physically handle the fish during this sorting process. Adults desired for spawning are directed into the adult ponds equipped with mechanical crowders and a spawning shed at the soppy end. There the adults can be held, crowded, sorted and spawned. Most adult ponds have a river return option as part of the sorting and piping associated with the ponds $$$.

Reform/Investment 4: Monitoring and evaluation $.

The hatchery program is a part of a strategy to meet conservation and/or harvest goals for the target stock. The tables below indicate what the short- and long-term goals are for the stock in terms of stock status (biological significance and viability), habitat and harvest. The letters in the table indicate High, Medium, or Low levels for the respective attributes. Changes in these levels from current status indicate expected outcomes for the hatchery program and other strategies (including habitat protection and restoration).

	Biological Significance	Viability	Habitat
Current Status	L	H	H
Short-term Goal	L	H	H
Long-term Goal	M	H	H

Section 2: Program Effects on ESA-Listed Salmonid Populations

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

Production is consistent with the "Biological Assessment For The Operation Of Hatcheries Funded by The National Marine Fisheries Service (March 99)". Statewide Section 6 consultation with USFWS for interactions with Bull Trout. By 2004, WDFW is writing HGMP's to cover all stock/programs produced at Kalama; fall and spring chinook, N & S coho, summer and winter run steelhead.

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
Fall Chinook	H	M
Spring Chinook	L	M
Summer Steelhead (Local)	M	M
Winter Steelhead (Local)	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.		

Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.
Lower Columbia River Coho *(Oncorhynchus kisutch*) is proposed as threatened on June 14, 2004 although NOAA initial determination is not to include Kalama natural coho or hatchery populations within the ESU.

Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a) are federally listed as "threatened" under the ESA on March 24, 1999.
Lower Columbia River Steelhead *(Oncorhychus mykis*s), 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.

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

Describe the status of the listed natural population (s) relative to "critical" and "viable" population thresholds. Critical and Viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team (TRT) to review population status within the ESU and develop critical and viable population thresholds.

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). Late stock coho (or Type N) were historically produced in the Kalama basin with spawning occurring from late November into March. Early stock coho (or Type S) were historically produced in the Kalama basin with spawning occurring from October to mid November. Columbia River early and late stock coho produced from Washington hatcheries are genetically similar. Kalama River wild coho run is a fraction of its historical size. An escapement survey in the late 1930s observed 1,422 coho in the Kalama River. In 1951, WDF estimated coho escapement to the basin was 3,000; both early and late coho were present. Hatchery production accounts for most coho returning to the Kalama River. Natural coho production is presumed to be very low. Electrofishing for juveniles in the Little Kalama River (a major tributary downstream of Kalama Falls) in 1994 and 1995 showed no coho but good numbers of steelhead. Coho have been planted in the Kalama basin since 1942; releases were increased substantially in 1967. The coho program at the two Kalama hatchery complexes was greatly reduced in recent years because of federal funding cuts; the remaining coho program is about 700,000 smolts released annually, split evenly between early stock (reared at Fallert Creek) and late stock (reared at Kalama Falls). (LCFRB Kalama Subbasin Report Volume II, Chapter 10).

Lower Columbia River fall chinook salmon *(Oncorhychus tshawytsch*a) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999.

Status: WDFW has submitted natural and hatchery draft management guidelines for Kalama fall chinook that will be used in the interim until the TRT recommendations are developed (Fall 2003). In Washington, the LCR chinook ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the Cascade Crest. Native fall chinook have been reported in the Kalama, but a distinct stock no longer exists. The Kalama River fall chinook natural spawners are a mixed stock of composite production with a significant portion of the natural spawners hatchery produced fish. Kalama fall chinook are rated healthy because escapements have usually exceeded the escapement goal of 2,000 adults (**SaSI** 2002). Natural spawning abundance has exceeded 20,000 spawners, with spawning escapements from 1986-2001 ranging from 1,420 to 24,297 (average 6.287) but escapement levels have normally ranged from 2,000 to 4,000 since 1990. Although final escapement objectives have not been established by the NMFS through a recovery plan, WDFW has established **draft** interim minimum escapement objectives. The minimum fall chinook MSY escapement goal is 400 to 450 adult spawners passed above the weir (based on habitat between the weir and Kalama Falls Hatchery). Since some fish swim through the weir, this would lead to an escapement of 444 to 500 spawners in most years. In addition, there is a significant amount of spawning that occurs below the Modrow weir.

Table 2. Fall chinook salmon abundance estimates in the LCMA (FMEP 2003)

Year	Cowee-man River	Cowlitz River	Green River	Toutle River	Kalama River	EF Lewis River	NF Lewis River	Washougal River	Wind River Bright	Wind River Tule
1990	241	2,698	123		20,54	342	17,506	2,062	177	11
1991	174	2,567	123	33	5,085	230	9,066	3,494	269	52
1992	424	2,489	150		3,593	202	6,307	2,164	51	54
1993	327	2,218	281	3	1,941	156	7,025	3,836	686	0
1994	525	2,512	516	0	2,020	395	9,939	3,625	1,101	11
1995	774	2,231	375	30	3,044	200	9,718	2,969	278	4
1996	2,148	1,602	667	351	10,630	167	14,166	2,821	58	166
1997	1,328	2,710	560		3,539	307	8,670	4,529	220	148
1998	144	2,108	1,287	66	4,318	104	5,929	2,971	953	202
1999	93	997	678	42	2,617	217	3,184	3,105	46	126
2000	126	2,700	852	27	1,420	323	9,820	2,088	25	14
2001	646	5,013	4,951	132	3,714	530	15,000	3,901	217	444
2002	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na
2003	Na	Na	Na	Na	Na	Na	Na	Na	Na	Na

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. Critical and Viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team (TRT) to review population status within the ESU and develop critical and viable population thresholds. Reports of considerable historic numbers of spring chinook in the Kalama have not been verified and by the 1950s, only remnant (<100) spring chinook runs existed on the Kalama. Kalama spring chinook are a mixed stock with composite production and one of four spring chinook populations in the Columbia River Evolutionarily Significant Unit. Currently, natural spawning is concentrated on the mainstem Kalama between the Kalama Falls (RM 10.5) and Fallert Creek (Lower Kalama) Hatcheries (RM 4.8). Spring chinook enter the Kalama River from March through July with wild spring chinook passed above Lower Kalama Falls with spawners having been observed up to upper Kalama Falls (RM 36.8). Kalama River spawning escapements from 1980-2001 ranged from 0 to 2,892 (average 444). Hatchery strays account for most spring chinook spawning in the Kalama River although integration of wild and hatchery adults above Kalama Falls can be monitored.

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. Critical and Viable population thresholds have not been established by the Lower Columbia River/Willamette River Technical Review Team (TRT). Winter steelhead stock status is rated healthy in 2002 because this stock has maintained relatively stable escapement estimates within the normal range of variation (**SaSI** 2002). An escapement goal of 1,000 fish has been established for this native stock. Kalama summer steelhead are rated depressed based on a short-term severe decline in escapement from 1998 through 2001. The escapement goal for this stock is 1,000 adult spawners. Escapements in 1998 through 2001 have been only 14% to 33% of the goal. This is a native stock with wild production. Summer and winter steelhead have been observed spawning in the same area therefore runs are not always reproductively separate. Genetic sampling was conducted in 1994, however the collection (juveniles) may contain both summer and winter steelhead, so comparisons of this collection with other collections are not very informative (Myers et al. 2002). An estimated 40% of returning naturally produced adults had at least one hatchery parent; however, wild stock has retained genetic traits of considerable adaptive value relative to the transplanted hatchery stock (Hulett and Leider 1989). Spawning occurs above Kalama Falls in the mainstem and Kalama River and throughout many tributaries, including Gobar, Elk, Fossil, and Wild Horse Creeks with falls at RM 36.8 blocking upstream migration. WDW estimated potential summer and winter steelhead smolt production was 34,850; naturally-produced steelhead smolts migrating annually from 1978-1984 ranged from 11,175 to 46,659. Wild summer steelhead sport harvest in the Kalama River from 1977-1999 ranged from 5 to 2,978; since 1986 regulations limit harvest to hatchery fish. Summer hatchery steelhead are not produced in the Kalama but are transferred from Skamania and acclimated at Fallert Creek released directly into the Kalama River.

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			Index Trap/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

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.

Hatchery activities are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999). The following are identified as general hatchery actions that have direct mortality (via predation, broodstock collection and disease transmission) and indirectly through genetic and ecological interactions in the natural environment:

Broodstock Program:

Broodstock Collection: Program broodstock volitionally enter the holding ponds at Fallert Creek in late September or early October on the first freshet. Escapement is quickly met but egg take is spread out weekly over the month of October. In 2002, spawn dates were: 10/12, 10/19, 10/26 and 11/02. Unmarked steelhead, coho and spring chinook are sorted out and returned to stream. Region 5 fish program staff plans upcoming adult handling in a preseason meeting with hatchery staff and there is staff communication to best handle unforeseen or weather related events that can impact runs and procedures. See take tables at the end of the document.

Genetic introgression: Both early and late coho stocks are probably represented on the spawning grounds in the Kalama River today although they may not represent what was historically present. The only data collected on natural escapement has been incidental to directed fall chinook surveys and no estimates of annual escapements are available. All adults recruited for use as broodstock have been of hatchery origin since 1998. In 2004, WDFW will propose to maximize the number of natural origin fish into the broodstock. Indirect take from genetic introgression is unknown.

Rearing Program:

Operation of Hatchery Facilities: During low flows during late summer and early fall, the area from the intake location and where the non-consumptive water rejoins the river is a distance of approximately 600 ft. (Mitchell Act Hatcheries Intake and Fish Passage Study report April (2003). Water in Fallert Creek is very low during the dry months and water is not used for hatchery operations at that time. Water intakes have engineered design criteria to minimize impingement of naturally produced fish on intake screens and the Mitchell Act Hatcheries Intake and Passage Study (April 2003) has assessed which structures are ESA compliant and forwarded needed improvements for funding. Water withdrawal is permitted, intake and screening compliance has been assessed and solutions identified. Effluent at outfall areas is rapidly diluted with mainstem flows and operation is within permitted guidelines. Indirect take 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 Kalama River Hatcheries. Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1994) chapter 5 have been instrumental in reducing disease outbreaks. Although pathogens occur in the wild and fish might be affected, they are believed to go undetected with predation quickly removing those fish. In addition, although pathogens may cause post release mortality in fish from hatcheries, there is little evidence that hatchery origin fish routinely infect natural populations of salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986; foot et al. 2000; Stewart and Bjornn 1990). Prior to release, the coho population health and condition are 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.

Rearing Program:

Hatchery Production/Density-Dependent Effects: Hatcheries can release numbers of fish that exceed the density of the natural productivity in a limited area for a short period of time and can compete with listed fish. Kalama S coho releases since 1999 have been reduced 25% from the period (1994-199) to the current level of 350,000 and are mass marked to provide intensive select fisheries and provide protection for wild coho. Coho releases are scheduled to start mid-April but environmental conditions or unforeseen problems could occur and require region staff to adjust the program as needed. Indirect take from density dependent affects is unknown.

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." Coho smolts though can migrate quickly (Puget Sound data from Seiler et al. 1997; 2000) indicating coho smolts released from the Marblemount Hatchery on the Skagit River migrated approximately 11.2 river miles day. 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).
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."
5) Studies from Fuss (2000) on the Elochoman River and Riley (2004) on two Willapa Bay tributaries (Nemah and Forks Creek), indicate that hatchery reared coho and Chinook can effectively leave the system within days.

Predation: Coho yearlings from this program may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, 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. WDFW is unaware of any studies that have been empirically estimated the predation risks to listed fish by this program.

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 Kalama system is a large river with annual flows ranging from a high of 4,500 cfs during the winter to a low of 300 cfs in late summer. During June, flows can still be 1,000 cfs although average flow can be approximately 500 cfs by the end of the month (Wade 2002). There is enough flows to disperse the volitional releases and Kalama No. 2 (Fallert Creek) is within a mile of the tidal influence area.

Dates of Releases: The release date can influence the likelihood that listed species are encountered. 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 thru August (LCFRB Subbasin Planning Kalama Report 2004). Listed steelhead are present in the system as migrating smolts and as emergent fry starting in April. Chum are present in tributaries and the mainstem Columbia from March to May.

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). 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.

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 that 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. Kalama No.2 Hatchery (Fallert Creek) is located at RKm 8.2. Releases from this facility are low in the system.

We have provided a summary of empirical information and theoretical analysis of competition and predation interactions that may be relevant to the Kalama Hatchery coho programs.

Potential Kalama Type S coho predation and competition effects on listed salmonids: The proposed annual production goal for this program is 350,000 fish. Coho releases are at 17.0 fpp (131 mm fl) and can be released starting mid-April of the year. This window of release of Kalama coho could encounter listed fish in the Kalama subbasin and Columbia mainstem. Due to size differences between coho smolts and fingerling listed stocks (Chinook, steelhead and chum), competition is probably low. At 17 fpp (131 mm fl), potential predation on listed fish would be on fish of 43-44 mm fl and smaller.

Relative Body Size: Below are some data available for chinook fry and fingerling lengths from area Lower Columbia streams. The current release poses a risk to listed Chinook of less than 44-45 mm fl although as mentioned previously, the magnitude of predation will depend upon the

characteristic of the listed population of salmonids and the habitat in which the population occurs. Indirect take due to predation is unknown.

- Lengths 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 though 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 (Pat Hanratty pers comm. 2004). Growth for wild chinook from Abernathy Creek from the first of April to May 1 is unknown.
- Average fork length by week from 26 sampling sites on the Kalama River 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 (Pettit, 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, and are growing rapidly with fish 55-60 mm fl by April 26 and May 3, 2004.
- Current lengths and data for proposed listed coho in the basin is unknown. Depending on water temperatures, hatchery coho fry during the month of April can range from 42 – 40 mm fl and reach 50 mm fl by early May (Kalama fry data 2001). Data for wild coho fry is unknown.

Listed steelhead are in the system, but a release date of May 1st, would result in hatchery plants vacating the system before peak emergences. Depending on available temperature units, eggs will hatch in 4-7 weeks with fry emergence approximately 2-3 weeks after hatching (LCSI Draft 1998). Wild summer run spawn timing is approximately one month earlier with the week of March 23 representing the halfway point of the summer spawn time from Feb 1st to May 1st (Table 2).

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 River Research Report 2003

Current lengths and data if coho are proposed for listing in the Kalama basin is unknown. Depending on water temperatures, hatchery coho fry during the month of April can range from 42 – 40 mm fl, and 50mm fl by May 1 (Kalama Hatchery data 2001). Data for wild coho fry is unknown.

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

- Condition factors, standard deviation and co-efficient of variation (CV) are measured through out the rearing cycle and at release.

- Feeding rates and regimes through out the rearing cycle are programmed to satiation feeding to minimize out of size fish and programmed for smolt phase as release or plant times approach.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.
- Releases from these ponds are volitional with large proportions of the populations moving out initially with the remainder of the population vacating with in a couple of days.
- Minimal residualism from WDFW coho programs following these guidelines has been indicated from snorkeling studies on the Elochoman River (Fuss 2000).

Indirect take from residualism is unknown.

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once in the main stem, Witty et al. (1995) has concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor. Evidence in estuarine and nearshore environments indicate that diets are often dominated by invertebrates with Durkin (1982) reporting that diet of coho smolts (128-138 mm fl) in the Columbia River estuary was composed almost entirely of invertebrates without evidence of salmonids as prey (HSRG - Hatchery Reform 2004). 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 Activities - The following monitoring 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. Adult 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.
In late summer and early fall, environment conditions require staff to increase scrutiny of this operation during trapping. Options/plans for reducing pre-spawn mortality will be discussed an evaluated at the pre-season meeting and broodstock needs will be adjusted according to the success of these plans. 2003 options: (1) Tighten collection curve, by beginning collection later, (2) improve holding conditions, (3) segregate broodstock into three groups: early, middle late, (4) increase formalin treatment in hatchery if needed (consult with pathologist). Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance.

Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.
Handling and release of wild steelhead, coho and chinook is monitored and take observations have been rare. Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance.

Section 3: Relationship of Program to Other Management Objectives

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

For ESU-wide hatchery plans, the production of coho salmon from Kalama River Hatcheries is consistent with:

- 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 coho salmon from Kalama River Hatcheries 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).

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:

- 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

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.

Coho returning to the Columbia River are managed according to two major stocks. The early-returning fish are referred to as the south-turning or S-type fish because they contribute well to the more southern ocean fisheries. The late-returning coho are referred to as north-turning or N-type fish because they contribute more heavily to the northern ocean fisheries. They also provide a significant sport fishery in tributary streams.

The purpose of the majority of hatchery programs is to provide harvest opportunity. Hatchery coho, steelhead, and sea-run cutthroat are adipose-fin marked to allow quick identification of these hatchery fish intended for harvest. The presence of the adipose fin also allows for quick identification of wild stocks. With mass marking, the agency staff has taken steps to identify natural coho stocks and handle them in a manner that would provide for their survival and reproduction yet maximizing harvest thus limiting hatchery coho on the spawning grounds. Harvest rates for Columbia River coho have averaged 74.2% in the mid 1980s (1985-89). The harvest rates for the recent two years have averaged 48.8% (1997-98). With strong hatchery returns in the future in conjunction with mass marking, aggressive harvest rates on hatchery coho might be achieved with minimal take on subbasin natural coho in the future.

Hatchery coho can contribute significantly to the lower Columbia River gill net fishery; commercial harvest of early coho in September is constrained by fall chinook and Sandy River coho management; commercial harvest of late coho is focused in October during the peak abundance of hatchery late coho. Natural produced lower Columbia River coho are beneficiaries of harvest limits aimed at Federal ESA listed Oregon Coastal coho and Oregon State listed Clackamas and Sandy River coho. During 1999-2002, fisheries harvest of ESA listed coho was less than 15% each year. A substantial estuary sport fishery exists between Buoy 10 and the Astoria-Megler Bridge; majority of the catch is early coho, but late coho harvest can also be substantial. An average of 1,272 coho (1979-1986) were harvested annually in the Kalama River sport fishery. CWT data analysis of the 1995-97 Fallert Creek Hatchery early coho indicates 30% were captured in a fishery and 70% were accounted for in escapement. CWT data analysis of 1995-97 brood Kalama Falls Hatchery late coho indicates 76% were captured in a fishery and 24% were accounted for in escapement. Fishery CWT recoveries of 1995-97 brood Kalama early coho are distributed between Columbia River (49%), Washington Ocean (42%), and Oregon ocean (9%) sampling areas. Fishery CWT recoveries of Kalama coho are distributed between

Columbia River (58%), Washington ocean (32%), and Oregon ocean (10%) sampling areas (see also section 1.12).

BY	SAR	Total Catch	Hatchery Escapement
1989	8.83	13675	Na
1990	0.67	577	Na
1991	0.16	2171	Na
1992	0.11	109	Na
1993	0.08	322	Na
1994	0.18	184	Na
1995	0.07	451	1,564
1996	Na	1060	1,120
1997	1.11	893	1,350
1998	1.90	2160	5,926
1999	0.22	Na	6,965
mean	1.90%	2160	3,385
2000	Na	Na	6,372
2001	Na	Na	15,992
2002	Na	Na	4,844

Data from PSMFC RMIS web-site.

3.4 Relationship to habitat protection and recovery strategies.

Subbasin Planning and the Lower Columbia Fish Recovery Board (LCFRB)

Kalama River HGMP processes are designed to deal with existing hatchery programs and potential reforms to those programs. A regional sub-basin planning process (Draft Kalama River Subbasin Summary May 17, 2002 and May 2004) is a broad-scale initiative that will provide building blocks of recovery plans use 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, WDFW 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 Kalama Complex. Staff is assessing the risks posed by the hatchery program using the Benefit-Risk Assessment Procedure (BRAP) in tandem with the LCFRB recovery plan.

Habitat Treatment and Protection

WDFW is presently conducting or has conducted habitat inventories within the Kalama River subbasin. 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 documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis

A WRIA 27 (Kalama, North Fork Lewis River, and East Fork Lewis River Salmon) habitat limiting factors report (LFA) has been completed by the Washington State Conservation Commission. Loss of channel diversity, increased sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawn, water temperature, and inundation and loss of spawning/rearing habitat through dam construction, and fragmentation of habitat all affect

productivity of natural salmonid populations within the watershed. Reduced summer flows in recent years are likely the result of diminished glacial melt following the eruption of Mt. St. Helens.

3.5 Ecological interactions.

Below are discussions on both negative and positive impacts relative to the Kalama winter 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: Kalama coho smolts can be preyed upon through the entire migration corridor, from the Kalama river sub basin to the main stem Columbia River and estuary. Northern pike minnows and introduced spiny rays in the Columbia main stem 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 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 main stem 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 thru 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 from the Kalama system and limited natural production of chinook, coho, chum and steelhead occurs in this system along with non-salmonid fishes (sculpins, lampreys and sucker etc.). Accept for yearling coho and steelhead, these species may serve as prey items during the emigration thru the basin. 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. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 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). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). Assuming limited spawning, up to 1,000 adult carcasses could contribute approximately 10,000 pounds of marine derived nutrients to organisms in the Kalama River. *Saprolegniasis* occurrences in young hatchery fish have been observed in greater frequency on Mitchell Act stations that have nutrient enhancement programs.

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.

4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program. Kalama coho smolts can be preyed upon release thru the entire migration corridor from the river sub basin to the main stem Columbia River and estuary. Northern pike minnows and introduced spiny rays in the Columbia main stem 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 and returning adults include: harbor seals, sea lions, river otters and Orcas.

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.

At Fallert Creek, water can be gravity fed from the creek intake providing up to 5,000 gpm. Pumps need to used when dewatering becomes a concern late summer and early fall and the river intake is located adjacent to the hatchery with a four chambered pump system which can provide up to 5,000 gpm. Between the facilities, a total of 15,112 gpm is used (Montgomery Watson 1997). Low flows during late summer and early fall can create problems for adult coho to Fallert Creek.

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 Measure
Hatchery water withdrawal	Water rights total 26,031gpm from October to June (Montgomery Watson 1997) and are formalized thru trust water right #S2-24832 from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports (see below).
Intake/Screening Compliance	At Fallert Creek hatchery, both intake and screen criteria are not in compliance as WDFW has determined that fish passage upstream is necessary. From the assessment, significant changes are needed, WDFW has been requesting funding for future scoping, design, and construction work of a new intake system (The Mitchell Act Intake and Screening Assessment 2002). The Kalama Falls intake was rebuilt in 2001 and is in 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 13-1010. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE. Adherence with the NPDES permit will likely lead to no adverse effects on water quality from the program on listed fish. 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).

Type S coho start arriving in the main river in early September and usually have to wait for the first rain in late September to access Fallert Creek rack which is located immediately downstream of the adult holding pond. With the first significant rains, a majority of the fish push into the trap, which leads to an asphalt pond of 72000 cu.ft with 1200 gpm available.

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

Adult coho do not need to be transported.

5.3 Broodstock holding and spawning facilities.

Integrated Hatchery Operations Team (IHOT) adult holding guidelines are followed for adult holding, density, water quality and alarm systems. Adults are seined, sorted, killed and spawned directly from the adult holding pond. Fish not ready to spawn are returned to the pond for further maturation. Spawning for this program takes place in a covered area.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Asphalt Pond (Adult Holding or Juvenile Rearing Unit)	72000	190	55	6.0	1200

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Stack Tray Unit (14 trays/stack)	5	5	nya	9000	9200

Present incubation facilities has the capacity for approximately 3.5 million eggs. The hatchery building contains 5 stack incubators for the eyeing and hatching. Water source is from Fallert Creek. Standard 1:6000 (1667ppm) formalin drip treatments controls fungus on eggs and are administered 15 minutes 6 times weekly.

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
3	Concrete Standard Raceways	nya	80	20	3.0	500	1.61	0.30
1	Asphalt Pond (Adult Holding or Juvenile Rearing Unit)	72000	190	55	6.0	1200	1.61	0.30

5.6 Acclimation/release facilities.

Same see HGMP Section 5.5 above. Fish are released from the adult holding unit to the river below the falls. Kalama River and Fallert Creek water has been used from initial rearing to smolt stage.

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

In some years low water and high temperatures in spring 2003 led to significant low dissolved oxygen levels which led staff to cut back feeding regimes and release the programs at Fallert Creek earlier before program size was met.

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.
- Aeration pumps are used to maximize the water conditions in the adult collection pond during periods of low water quality, which benefits fish held until sorting can be accomplished.
- 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.
- Staff monitors the trap operation daily to keep the numbers of fish stacking in the trap area to manageable volumes. Heavy volumes can create density problems for listed fish if they are not removed expeditiously.

Section 6. Broodstock Origin and Identity

6.1 Source.

Kalama No. 2 (Fallert creek) rears and releases Type S coho while Kalama Falls rears and releases Type N coho. Coho returning to the Columbia River are managed according to two major stocks. The early-returning fish are referred to as the south-turning or S-type fish because they contribute well to the more southern ocean fisheries. They are generally recognized as Toutle River origin fish. The late-returning coho are referred to as north-turning or N-type fish because they contribute more heavily to the northern ocean fisheries. They are generally recognized as Cowlitz origin hatchery fish. Eggs from adults returning to the hatchery are always given priority for on-station use. Source will be from Kalama River returns and staff will limit out of basin transfers except in rare circumstances.

6.2.1 History.

Coho were historically present in the Kalama basin but not in great abundance; the Washington Department of Fisheries estimated about 3,000 fish. Both early-returning and late-returning fish were present, but distribution was confined to the area below Kalama Falls (RM 10.0) until a fish ladder was constructed in 1936. Coho from the Lower Kalama Hatchery have been released in the basin since at least 1942 (WDFW 1998, Vol. 1). The Kalama River coho stock status is depressed based on chronically low production. Natural spawning is presumed to be quite low and subsequent juvenile production is considered below stream potential. The current management policy on the Kalama River is to not pass coho past the lower Kalama Falls (RM10), and the only tributaries that provide good coho production potential are Hatchery (Fallert), Spencer Creek, and Cedar Creek (Wolf Dammers 2000, personal comm.) This is a mixed stock with composite production. Coho are native to the Kalama River. Coho have been produced at Fallert Creek Hatchery at RKm 8.2 and upper Kalama Falls Hatchery at RKm 16.2. WDFW will limit future non-local transfers into the system except in rare circumstances.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Kalama River Type S Coho	H	1996	Present
Lewis River Type S Coho	H	U	2002 only
North Toutle Type S Coho	H	U	1992 & 1997

6.2.2 Annual size.

280 adults at 1:1 male to female ratio.

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

The level of natural fish in the returning brood stock is unknown prior to 1998. Since that time only hatchery origin returning brood stock have been used for propagation purposes identified by their missing adipose fin. Natural fish have been identified within the captured population of broodstock since 1998 and have been returned to the mainstem. In 2004, WDFW will propose to maximize the number of natural origin fish into the broodstock.

6.2.4 Genetic or ecological differences.

The broodstock is derived from stock returning to the Kalama subbasin. All adults recruited for use as broodstock have been of hatchery origin since 1998. There are no known genotypic, phenotypic, or behavioral differences between the hatchery stock or natural stock in the Kalama River. Much of the remaining available (tributary) habitat below the lower falls was probably more conducive to later spawning coho (late November- February) pre-hatchery and skewed earlier due to early spawning hatchery coho.

6.2.5 Reasons for choosing.

The stock has a run entry pattern and timing that provides harvest opportunities for fisheries in the subbasin, the lower Columbia mainstem/tributaries and Washington/Oregon Coast. The stock contributes significantly to the Washington coastal fisheries especially in zones 1 & 2. Combination of Type N and Type S stocks provide an extended period of quality catch in both the fresh water recreational and commercial fisheries. This stock provides the fresh water commercial fishers and opportunity (timing) outside the peak fall chinook returns in the lower Columbia River.

Type-S coho provide more fishing opportunity. The early stocks are the strength of the Buoy 10 coho fishery at the mouth of the Columbia River. They also return to the tributaries when the weather is warmer and stream flows are moderate providing excellent sport fishing opportunities. Combined with later returning stock(s), they provide an extended period of quality catch in both the freshwater recreational and commercial fisheries.

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

- Limit future non-local transfers into the system except in rare circumstances.
- Integrating natural spawners will represent the existing Type S coho run through out the season.
- Hatchery program fish are mass marked.
- Mating cohorts are randomly selected.
- There are no known genotypic, phenotypic, or behavioral differences between either the hatchery stock or natural stock in the subbasin.
- Holding pond procedures follow IHOT guidelines.
- Other listed fish will be released immediately if encountered during the broodstock selection process.

Section 7. Broodstock Collection

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

Adults, including jacks.

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
Planned	200	200	4	nya	nya
1993	664	806	8	nya	nya
1994	535	722	26	nya	nya
1995	610	583	210	nya	nya
1996	261	247	5	nya	nya
1997	274	259	4	nya	nya
1998	505	505	5	nya	nya
1999	744	755	36	nya	nya
2000	477	506	293	nya	nya
2001	nya	nya	nya	nya	nya

7.2 Collection or sampling design

Program broodstock volitionally enter the holding ponds at Kalama No. 2 in late September or early October on the first freshet. Escapement is quickly met but egg take is spread out weekly over the month of October. In 2002, spawn dates were: 10/12, 10/19, 10/26, and 11/02. Coho are also can be collected at Kalama Falls if needed but this has not been the case in recent years. Marked fish (AD Clipped) can be taken out at this point or recycled downstream for recreational opportunities. All unmarked coho were recycled downstream after being sampled for CWT and have their operculum punched.

Proposed Integration – Starting with 2004 brood, WDFW will be maximizing natural coho into the broodstock program from cohorts represents the timing and distribution of natural Type S coho to the rack.

7.3 Identity.

Type-S coho enter the Columbia River by mid-August and begin entering tributary streams in early September. Spawning activity peaks between October 20 and November 1. The only data collected on natural escapement has been incidental to directed fall chinook surveys and no estimates of annual escapements are available. Currently, all spawned broodstock are AD clip.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):
260 spawners at 1:1 ratio.

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

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
Planned	200	200	4	nya	nya
1993	664	806	8	nya	nya
1994	535	722	26	nya	nya
1995	610	583	210	nya	nya
1996	261	247	5	nya	nya
1997	274	259	4	nya	nya
1998	505	505	5	nya	nya
1999	744	755	36	nya	nya
2000	477	506	293	nya	nya
2001	nya	nya	nya	nya	nya

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

When needs beyond broodstock and carcass nutrient enhancement are met, additional Type S coho fish may be surplussed to a contract buyer including large numbers of jacks. Neither hatchery nor wild fish are released above Kalama Falls. Type S coho trapped at Kalama Falls can be used if broodstock is needed at Kalama No. 2 but fish are more typically recycled downstream if needed or sent to local food banks (including jacks).

7.6 Fish transportation and holding methods.

Fish are not transported at Kalama No.2, if any need to be transported from Kalama Falls a flatbed truck equipped with a 1000 gallon tanker can be used for the short haul to Kalama No. 2. A large asphalt pond with 1200 gpm is used to hold adults. Fish maturation is monitored weekly by inspection for ripeness. Staff seines and inspects for broodstock ripeness weekly with decisions on spawn volume, surplussing excess, and holding ripe fish made before weekly spawning which begins mid October and continues thru early November.

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 rare and only for fungus control using formalin bath treatments.

7.8 Disposition of carcasses.

A nutrient enhancement program is underway for the Kalama River, with the planting of 1,904 carcasses in 1997 and 3,444 fish in 1998 (Hale 1999, personal comm.). In 2002 almost 10,000 coho were used for nutrient enhancement. Additional studies are needed to truly define the number of fish that could be supported by the amount of available habitat in the Kalama, and then to determine the level of nutrient enhancement required to maintain that level of productivity. After this, fish can be sold on contract or donated to food banks.

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.

- Limit out of basin transfers except in rare circumstances
- Coho will be collected through out the run time from adults arriving at the hatchery rack.
- Additional natural coho are presumed to spawn downstream of the hatchery.
- Broodstock collection and sorting procedures can quickly identify non-target listed fish if encountered. Fish not used in the program are released immediately.

Section 8. Mating

8.1 Selection method.

Spawning is conducted weekly, and occurs over a period of up to six weeks with the peak in late October. Spawning activity peaks between October 20 and November 1. Currently, all spawned broodstock are AD clip. Unmarked fish are electronically sampled and returned back to the river. Since run size predictions are not always accurate and run timing varies annually, programs must maintain flexibility to meet our goals of ensuring natural and hatchery numerical escapement objectives as well as selection for run timing, spawning time, and size.

8.2 Males.

The spawning protocol is described in the IHOT 1995 Volume III as follows; The intent is to use a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male-to-female ratio will be 1:1 for all stocks. When spawning more than one million eggs in a day, the ratio will not be less than 1 male to 3 females. Jacks are incorporated into spawning protocol up to 2%.

8.3 Fertilization.

Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution, and spawning area and implements are disinfected with iodophor solution at the days end of spawning. Fertilization occurs at a 1:1 ratio (females/males). Milt is mixed with green eggs with the ovarian fluid. Water hardening procedures with iodophor are followed after twenty minutes. Iodophor solution is used as rinse that is applied to hands and spawning implements per spawning. Iodophor footbaths are located at entrance to incubation room.

Fish health procedures used for disease prevention include water hardening of eggs in an iodophor at spawning and biological sampling of spawners. Generally, sixty ovarian fluid and kidney/spleen samples are collected from female spawners to test for the presence of viral pathogens.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

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

- Limit out of basin transfers except in rare circumstances.
- Listed coho will be collected through out the run time from adults arriving at the hatchery rack.
- Mating cohorts are randomly selected.
- Protocols for population size, fish health disinfection and genetic guidelines followed.
- Eggs water hardened in iodophor (1:600).

Section 9. Incubation and Rearing.

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

The egg take goal for 2004 is 420,000 eggs (FBD 2004).

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 (%)
1993	1548000	95.0	nya	90.0	nya	nya	nya
1994	1487900	90.0	nya	90.0	nya	nya	nya
1995	1790300	86.0	nya	90.0	nya	nya	nya
1996	796500	93.0	nya	90.0	nya	nya	nya
1997	938300	88.0	nya	90.0	nya	nya	nya
1998	1527870	91.0	nya	90.0	nya	nya	nya
1999	2499580	96.0	nya	90.0	nya	nya	nya
2000	485024	92.7	99.04	90.0	nya	nya	nya
2001	nya	nya	nya	nya	nya	nya	nya

9.1.2 Cause for, and disposition of surplus egg takes.

The program broodstock collection goal set forth in the annual brood document usually prevents surpluses. Eggtakes are planned according to data/information of historical eggtakes at the Kalama River Hatcheries. Thus, eggtakes are maintained within the plus/minus 5% guideline of the Section 7 permit. BKD and viral sampling lots (60 fish lots) are conducted over the course of the season.

9.1.3 Loading densities applied during incubation.

Eggs are placed in deep troughs to the eye stage then moved to stack incubators for hatching. Removal of dead eggs, accurate enumeration and loadings are adjusted during this time. See section 5.4 for load and hatching criteria. Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations are followed for water quality, flows, temperature, substrate and incubator capacities.

9.1.4 Incubation conditions.

Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations are followed for water quality, flows, temperature, substrate, and incubator capacities. Harmful silt and sediment is cleaned from incubation systems regularly while eggs are monitored to determine fertilization and mortality. Incubation water is from Fallert Creek and temperature is monitored by thermograph and recorded and temperature units (TU) are tracked for embryonic development. Dissolved oxygen content is monitored and have been at acceptable levels of saturation with a minimum criteria of 8 parts per million (ppm). When using artificial substrate, vexar or bio-rings, egg densities within incubation units are reduced by 10%.

9.1.5 Ponding.

Fry are ponded when: a visual inspection of the amount of volk sac remaining with the volk slit

closed to approximately 1 millimeter wide (approximately 1600 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) starting mid January.

9.1.6 Fish health maintenance and monitoring.

Staff conducts daily inspection, visual monitoring and sampling from eyed egg, 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 regular monitoring, fish health specialists conduct inspections monthly. Potential problems are managed promptly to limit mortality and reduce possible disease transmission.

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.

- Limit out of basin transfers except in rare circumstances.
- IHOT and WDFW fish health guidelines followed.
- Multiple units are used in incubators.
- Splash curtains can isolate incubators.
- Temperature, dissolved oxygen, and flow are monitored.

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 (%)	Egg Survival Perfor-mance Std.	Fry-fingerling Survival (%)	Rearing Survival Perfor-mance Std.	Fingerling-Smolt Survival (%)
1993	1548000	95.0	nya	90.0	nya	nya	nya
1994	1487900	90.0	nya	90.0	nya	nya	nya
1995	1790300	86.0	nya	90.0	nya	nya	nya
1996	796500	93.0	nya	90.0	nya	nya	nya
1997	938300	88.0	nya	90.0	nya	nya	nya
1998	1527870	91.0	nya	90.0	nya	nya	nya
1999	2499580	96.0	nya	90.0	nya	nya	nya
2000	485024	92.7	99.04	90.0	nya	nya	nya
2001	nya	nya	nya	nya	nya	nya	nya

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

In all facilities within Kalama Complex, 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.

Coho are reared on a combination of Kalama River and Fallert Creek water. Temperature, dissolved oxygen and pond turn over rate are monitored. IHOT standards are followed for: water

quality, alarm systems, predator control measures (netting) to provide the necessary security for the cultured stock, loading and density. Settleable solids, unused feed and feces are removed regularly to ensure proper cleanliness of rearing containers. All ponds are broom cleaned as needed and pressure washed between broods. Temperature and dissolved oxygen are monitored and recorded daily during fish rearing. Temperatures during the rearing cycle range from a high of 70 to a low of 32 degrees F. Ponds are vacuum cleaned on an as needed basis although generally weekly. Netting covers the rearing ponds to minimize predation.

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	Hepatosomatic Index	Body Moisture Content
January 2001	37	980	0.9138	nya	nya	nya
February 2001	40	700	1.0125	0.286	nya	nya
March 2001	42	613	0.9980	0.124	nya	nya
April 2001	58	280	0.8300	0.543	nya	nya
May 2001	64	181	0.9560	0.354	nya	nya
June 2001	77	102	0.9740	0.436	nya	nya
July 2001	85	75	0.9840	0.265	nya	nya
August 2001	94	56	0.9750	0.253	nya	nya
September 2001	105	40	0.9800	0.286	nya	nya
October 2001	107	38	0.9740	0.050	nya	nya
November 2001	111	34	0.9750	0.105	nya	nya
December 2001	115	33	0.9040	0.029	nya	nya
January 2002	129	27	1.0720	0.182		
February	142	20	0.7920	0.259		
March	152	16	0.8070	0.200		
April	159	15	0.7523	0.063		

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

Same, see above.

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
1700-525 fpp	Moore Clark Nutra 0	nya	1.5-1.8	nya	nya
525-275 fpp	Moore Clark Nutra 1	nya	1.5-1.8	nya	nya
275-125 fpp	Moore Clark Nutra 2	nya	1.5-1.8	nya	nya
125-80	Moore Clark Nutra Fry 1.2	nya	1.5-1.8	nya	nya
80-40 fpp	Moore Clark Nutra Fry 1.5	nya	1.5-1.8	nya	nya
40-12	Moore Clark Nutra Fry 2.0	nya	1.5-1.8	nya	nya

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

A fish health specialist inspects fish monthly 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. 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. IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification to or within the watershed.

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

The migratory state of the release population can be observed by staff. Aggressive screen and intake crowding, swarming against sloped pond sides, leaner condition factors, a more silvery physical appearance and loose scales during feeding events are signs of smolt development. Multiple smolt events can also be triggered by environmental cues including daylight increase, a spike in the water temperature and spring freshets. ATPase activity is not measured.

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

None used.

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.

- Limit out of basin transfers except in rare circumstances.
- At least 500 adults are available in the population.
- Listed coho will be collected through out the run time from adults arriving at the hatchery rack.
- Protocols for population size, fish health disinfection and genetic guidelines followed.
- Eggs water hardened in iodophor (1:600).
- Multiple incubation and rearing units are used.
- Staff is available 24/7 to respond to emergencies.
- IHOT guidelines are followed for rearing, release and fish health parameters.

Section 10. Release

10.1 Proposed fish release levels.

350,000 yearling smolts are released from the outlet of the adult holding/yearling pond. Fish are 17 fpp (131 mm fl) and are released starting in early April.

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

The hatchery outlet enters Fallert Creek shortly above the confluence with the Kalama River at RKm 8.2.

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

	Yearling Release		
Release Year	No.	Date (MM/DD)	Avg Size (fpp)
1994	508100	May 1	16.1
1995	467900	April 17-18	14.3
1996	545200	April 26	14.4
1997	489626	April 15	11.0
1998	415695	April 15	12.0
1999	411380	April 15	11.0
2000	nya	nya	nya
2001	354740	April	16.0
2002	251904	April	15.0
2003	384155	mid-Apirl	17.0

10.4 Actual dates of release and description of release protocols.

Releases start in mid April. In 2003 fish were released on April 21 from Pond 9. Sumps and stoplogs are removed from the holding pond to slowly lower the water level. Much of the initial release is volitional.

10.5 Fish transportation procedures, if applicable.

Fish are released from the station, transportation not needed.

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

Coho for this program are reared, acclimated, and released as smolts directly from the rearing/acclimation units at the Kalama Falls facility. All production occurs with a mixture of river water, un-named creeks on the property and a mixture of these as re-use giving the on-station coho release a distinct location indicator. All fish are programmed to be in a smolt size before release with release falling within the normal migration time of natural fish.

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

8.5% (30k) are CWT marked as an index group for management purposes. The remainder of the production (320k) is Ad Clipped. All carcasses and trapped salmon are examined for fin clips

(mark sampling) and snouts taken from fish with missing adipose and ventral fins collected in carcass surveys. Lengths, sex, and scales will be randomly (biological sampling) taken from trapped adults and carcasses with the adipose fin intact and from all adipose-clipped fish recovered. Snouts from the adipose-clipped carcasses will be dissected at the WDFW Olympia office. Scale samples and CWTs will also be read in Olympia. This is standard procedure for all Columbia River samples collected by WDFW.

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

If surplus exceeds 10% of the program goal, the hatchery complex manager would contact the regional manager to apprise him/her of the situation. The Regional manager would consult with appropriate regional co-managers/NMFS to get recommendation for fish disposition. The hatchery complex manager would instruct staff to implement recommendation. In 2000, 42k were destroyed as fecundity was higher than expected that year.

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 examine, whenever abnormal behavior or mortality is observed, staff also conducts 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.

Every effort will be made to avoid pre-programmed releases. Emergency releases, if necessary and authorized, would be managed by removal of outlet screens and pull sumps of the rearing units. If possible, staff would set up portable pumps to use river water to release the fish. If fish survival is imperiled from floods, fish can be forced from the ponds as a last resort after consultation with Region Fish Program Manager.

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.

- 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.
- WDFW uses acclimation and release of smolts in lower river reaches where possible,this in an area below known 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.
- Mass marking allows identification of hatchery and natural coho adults.
- WDFW will be reviewing programs that drive the current release dates so that releases will occur after May 1st to minimize predation and competition on listed fish.
- WDFW fish health and operational concerns for Washougal Hatchery programs are communicated to Region 5 staff for any risk management or needed treatment. See also section 9.7.

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.

For all hatchery related data needs (broodstock handling and collection, adult spawning, incubation, rearing and release data), staff will continue to monitor egg takes, transfers, plants, escapement reports for all activities needed at this station as part of the funding of this facility thru the Mitchell Act. Refer to Section 1.10 for a discussion of how each "Performance Indicator" will be monitored and evaluated. Additional coho interaction work is being conducted on the Lewis River, which may have implications to the Kalama River. The proportion of hatchery coho on the spawning grounds is now being monitored with the start of the Mass Making Program. The Cedar Creek (Lewis River) natural fish populations are now being monitored with both an upstream migrant trap installed (1998) in the Cedar Creek Fish Way and a downstream smolt migrant (screw) trap beginning in 1998. An attempt will be made to determine the interaction of naturally spawning hatchery coho with natural spawning coho. With the ultimate goal of determining if limit access of hatchery coho to the upper Cedar Creek watershed increase natural coho production. Secondly, to evaluate whether a stream (coho stock) strongly impacted by the genetics of hatchery fish changes (spawn timing, etc.) over a short period of time with the exclusion of hatchery fish. Implement programs on other streams based on the data gather from the Cedar Creek evaluation. Ecological interactions between program fish and natural fish will be addressed through Cedar Creek monitoring and evaluation measures proposed and further investigations of coho smolt residuals (emigration rates and release sites) and fall chinook predation by hatchery coho smolts in the Lewis River.

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

To evaluate hatchery programs comprehensive monitoring and evaluation programs are needed. These programs at a minimum must measure adult hatchery and wild escapement, and fishery contributions from hatchery and wild salmonids for every stock. Reproductive success should be measured for representative wild and hatchery stocks. Ecological interactions (predation, competition, and disease) need to be measured for representative stocks as well. 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 baseline monitoring and evaluation needs while research is on-going for coho interaction in the Lewis 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.

No research with this program is conducted.

12.2 Cooperating and funding agencies. NA

12.3 Principle investigator or project supervisor and staff. NA

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

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

12.6 Dates or time periods in which research activity occurs.

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

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

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).

12.10 Alternative methods to achieve project objects. NA

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

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. NA

Section 13. 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	Kalama River Type S Coho
Location of hatchery activity	Kalama River Hatchery, Fallert Creek Hatchery
Dates of activity	September – November
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	0*	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

* Spring Chinook bypass the Fallert Creek facility and move up to Kalama Falls.

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	Kalama River Type S Coho
Location of hatchery activity	Kalama River Hatchery, Fallert Creek Hatchery
Dates of activity	September – November
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	Unk*	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	Unk*	nya
Unintentional lethal take (f)	nya	nya	Unk*	nya
Other take (specify) (h)	nya	nya	nya	nya

Unk* Chinook are not mass marked so cannot be identified. Most fall Chinook have been transferred from Modrow trap to Kalama Falls.

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	Kalama River Type S Coho
Location of hatchery activity	Kalama River Hatchery, Fallert Creek Hatchery
Dates of activity	September – November
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	0-1*	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	0	nya
Unintentional lethal take (f)	nya	nya	0	nya
Other take (specify) (h)	nya	nya	nya	nya

* Unmarked steelhead enter the pond rarely and are returned to stream immediately. See also Kalama River Wild Summer and Winter Steelhead HGMPs.

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

ESU/Population	Lower Columbia River Coho
Activity	Kalama River Type S Coho
Location of hatchery activity	Kalama River Hatchery, Fallert Creek Hatchery
Dates of activity	September – November
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		nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., broodstock (e)	nya	nya	Up to 280	nya
Intentional lethal take (f)	nya	nya	Up to 280	nya
Unintentional lethal take (f)	Up to 37800*	Up to 34,398*	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

* Based on 90% egg to fry survival and 90% fry to smolt survival.

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