HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Lewis River Type N Coho
Species or Hatchery Stock	*Oncorhynchus kisutch* Lewis River Coho Salmon
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Lewis 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.

Lewis River Type N Coho

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

Coho Salmon (Oncorhynchus kisutch)

ESA Status: One of 21 artificial propagation programs proposed for listing (NOAA 69 FR 33101; 6/14/2004).

1.3 Responsible organization and individuals.

Name (and title):	Eric Kinne
	Lewis River Hatchery Complex Manager
Agency or Tribe:	Washington Department of Fish and Wildlife
Address:	600 Capitol Way N. Olympia WA 98501
Telephone:	(360) 225-6201
Fax:	(360) 225-6330
Email:	ekinne@dfw.wa.gov

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

Co-operators	Role
PacifiCorp	Mitigation Funding Source
National Marine Fisheries Service	Manager of Mitchell Act Funding Source Relative to Broodstock Supplementation for Mitchell Act Hatcheries

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

Funding Sources
PacifiCorps (Mitigation for Lost Fish Production Due to N.F. Lewis River Hydroelectric Projects).
Mitchell Act (Supplemental Funds for Broodstock Programs of Local Mitchell Act Hatcheries .

Operational Information	Number
Full time equivalent staff	5.67
Annual operating cost (dollars)	$838,771

The above information for Full-Time Equivalent Staff and Annual Operating Cost applies cumulatively to all Lewis River Anadromous Fish Programs conducted at Lewis River and Speelyai Hatcheries.

1.5 Location(s) of hatchery and associated facilities.

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

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 NOAAs proposed listing determination (69 FR 33102; 6/14/2004). Modification of the proposed strategy may occur based upon NOAAs final listing determination and as additional information are collected and analyzed.

1.7 Purpose (Goal) of program.

- Plant 815,000 Type N smolts at 16.0 ffp into the Lewis River.
- Produce coho salmon to mitigate for hydroelectric system development in the Lewis system and for activities within the Columbia River Basin for the loss of late coho salmon stock that would have been produced naturally in the North Fork Lewis River system in the absence of the hydroelectric dams.
- Incorporate natural stock into the existing hatchery population to support overall ESU recovery goals.
- Provide for enough returning broodstock to fill the egg needs of regional programs. Obligations as of 2004 also include: transferring 460,000 eyed eggs to Fish First for RSI production in N.F.Lewis tributaries, transferring 1,150,000 eyed eggs to Klickitat Hatchery, transfer 6,250 eyed eggs to Region 5 Salmon in the Classroom (SIC), 5,000 eyed eggs to Steve Syversion project, and if needed transfer 2,700,000 eyed eggs to Washougal Hatchery for the Klickitat River direct release.

1.8 Justification for the program.

- Legal justification includes: PacifiCorp Hydro mitigation, Columbia River Fisheries Development Program, Columbia River Fish Management Plan and U.S. v Oregon court agreements.
- WDFW protects listed fish and provides harvest opportunity Lewis River 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 ensure adult size, timing, distribution of migration and spawning populations, and age-at-maturity are the same between fished and unfished populations. By following this policy, fisheries' impacts to listed steelhead, chinook salmon, and chum salmon in the Lower Columbia River (LCR) Evolutionary Significant Unit (ESU) will be managed to promote the recovery of these species and not at rates that jeopardize their survival or recovery.

To minimize impacts on listed fish by WDFW facilities operation and the Lewis River Type N coho program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Lewis River Type N coho program.

Potential Hazard	**HGMP Reference**	**Risk Aversion Measures**
Water Withdrawal	4.2	Water rights are formalized through trust water right #S2-24939 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 Lewis River to meet NOAA compliance.
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 13-1040.
Broodstock Collection & Adult Passage	7.9	Broodstock collection and sorting procedures can quickly identify non-target listed fish, if encountered, and are released per protocol to minimize impact as determined by WDFW 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

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 1.98% smolt-to-adult survival (range .20% - 6.65%) that includes harvest plus escapement (16,137 fish at current production levels)..	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 for use as broodstock. Maximize the use of available Natural Origin Broodstock .	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). Adhere to WDFW stock transfer guidelines. (WDFW 1991).
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts to natural and hatchery origin fish.	Use 100% mass-mark (adipose-fin clip) for selective fisheries with additional groups, Ad+CWT (75,000) and CWT (75,000) only, 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. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy.
	Inspection of adult broodstock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	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 (16.0 fish/lb) and released from the hatchery at a time that fosters rapid migration downstream. Mass mark production fish to identify them from naturally produced fish (except CWT only groups)	As identified in the HGMP: Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including IHOT, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed.
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and instream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities.	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations.	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries.	Harvests are monitored by agencies and tribes to provide up-to-date information.

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

WDFW has established an egg take goal of 5,100,000 eggs in the Future Brood Document (FBD 2004). To meet this goal a total of 1900 females and 1900 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 WDFW Hatchery and Fish Program staff will occur in June/July to review past hatchery operations, natural escapement, and to develop a plan for weir and hatchery operations during each 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	815,000 FBD	16.0	April/May	N.F.Lewis	20.9	Lewis River	Kalama/Lewis

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

BroodYear	SAR (%)	Total Catch	Hatchery Escapement
1991	6.65	37938	Na
1992	1.74	9926	Na
1993	0.77	4392	Na
1994	0.59	1682	Na
1995	0.20	831	Na
1996	0.41	1002	7,972
1997	0.77	2008	13,100
1998	0.58	1890	13,027
1999	1.90	6658	24,756
2000	2.45	11381	34,219
2001	5.77	17869	65,238
2002	Na	Na	10,650
2003	Na	Na	N/A
Avg.	1.98%	8,697	24,137

Ruggerone Report (Natural Resource Consultants- WDFW report), WDFW Annual Hatchery Escapement Report, BPA SAR (hatchery only) Annual Coded-Wire Tag Program, Washington Missing Production Groups, Annual Report 2000

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

The first year of operation for this program was 1980 .

1.14 Expected duration of program.

The program is on-going with no planned termination.

1.15 Watersheds targeted by program.

Lewis Subbasin/Lower Columbia Province

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

Type N coho are collected at Lewis River Hatchery and at Merwin Dam. They are held at Lewis River Hatchery until ripe, then spawned, incubated, reared and released from the hatchery. Merwin trap is outdated. There are on-going discussions on which coho stock to use for reintroduction into the upper watershed. These issues are identified in the current re-licensing process.

Potential Alternatives to the Current Program

Alternative 1: Truck smolts down to the lower river 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. Use volitional releases in conjunction with flow augmentation and then truck the smolts that did not migrate out of the rearing ponds. The need for flushing flows is a part of the

current re-licensing process. An undesirable impact may be that naturally rearing wild fall chinook are forced out of the system prematurely. This alternative would require monitoring and evaluation to determine the impacts of this strategy.

Potential Reforms and Investments

Reform/Investment 1: There is a need to expand the monitoring of coho in the Lewis River to identify a strategy that would reduce predation on wild fall chinook and other ESA listed species. Developing a program to move coho smolts quickly through the system will increase survival and reduce the risk to ESA stocks

Reform/Investment 2: There is potential for reintroduction above the projects in conjunction with relicensing. The current Fish and Hatchery Management Plan is being negotiated for the new licensing agreement with Pacific Power with the hope to include these needs into that agreement. The process has identified numerous changes to all facilities to allow better rearing, trapping, hauling, and holding operations.

Section 2: Program Effects on ESA-Listed Salmonid Populations

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

This rearing program is consistent with the "Biological Assessment For The Operation Of Hatcheries, Funded by The National Marine Fisheries Service (March 99)". WDFW is writing HGMP's to cover all anadromous fish rearing and release programs at the Lewis Complex including; spring chinook, Type S and Type N 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
Spring Chinook-Hatchery	M	H
Fall Chinook Tule-Natural	L	M
Fall Chinook LRB-Natural	H	M
Late Winter Steelhead-Natural	M	M
Coho- Hatchery and Natural (Proposed)	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 directly affected by the program.
Lower Columbia River Coho (*Oncorhynchus kisutch)* is currently a candidate for listing (proposed as threatened on June 14, 2004).
Identify the ESA-listed population(s) that may be incidentally affected by the program.
Listed salmon and steelhead present in LCR include:
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 *(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.
Columbia Basin DPS Bull Trout *(Salvelinus confluentus)* were listed as threatened on June 10, 1998 (63 FR 31647).

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*) proposed as threatened on June 14, 2004.
Status: NMFS concludes that the LCR coho ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries from the mouth of the Columbia up to and including the Big White Salmon and Hood Rivers. Twenty-one artificial propagation programs are considered to be part of the ESU as NMFS has determined that these artificially propagated

stocks are genetically no more than moderately divergent from the natural populations (NMFS, 2004b). Coho historically spawned throughout the basin. Natural spawning is thought to occur in most areas accessible to coho; coho currently spawn in the North Lewis tributaries below Merwin Dam including Ross, Cedar, NF and SF Chelatchie, Johnson, and Colvin Creeks; Cedar Creek is the most utilized stream on the mainstem. Construction of Merwin Dam was completed in 1932; coho adults were trapped and passed above Merwin Dam from 1932-1957; the transportation of coho ended after the completion of Yale Dam (1953) and just prior to completion of Swift Dam (1959). As part of the current hydro re-licensing process, reintroduction of coho into habitat upstream of the three dams (Merwin, Yale, and Swift) is being evaluated. Late stock coho (or Type N) were historically present in the Lewis basin with spawning occurring from late November into March. Early stock coho (or Type S) were historically present in the Lewis basin with spawning occurring from late October to November. Columbia River early and late stock coho produced at Washington hatcheries are genetically similar. Lewis River wild coho run is a fraction of its historical size. An escapement survey in the late 1930s observed 7,919 coho in the North Fork. In 1951, WDF estimated coho escapement to the basin was 10,000 fish in the North Fork (primarily early run). Escapement surveys from 1944-1999 on the North and South Fork Chelatchie, Johnson, and Cedar Creeks documented a range of 1-584 fish/mile. Currently, hatchery production accounts for most coho returning to the Lewis River. Natural coho production is presumed to be generally low in most tributaries. A smolt trap at lower Cedar Creek has shown recent year coho production to be fair to good in North and South forks of Chelatchie Creek (tributary of Cedar Creek) and in the mainstem Cedar Creek.

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

At one time, an indigenous stock of spring chinook existed in the Lewis River, but with the construction of Merwin Dam (RM 19.5) in 1931, the majority of the spawning reaches became inaccessible and the stock subsequently declined. Early attempts to save the stock through hatchery production failed. By 1950, only a remnant population existed in the river, spawning primarily in the waters immediately below Merwin Dam and Cedar Creek. In 1971 managers introduced the Carson Hatchery stock, which originated from Bonneville Dam fish way. These fish were reared and released from Speelyai Hatchery. Since then, releases have been made from both the Speelyai and the Lewis River hatcheries. The stocks used now include Cowlitz and Kalama, along with on-station returns to the Lewis River. The 1977 through 1987 average run size to the Lewis River is estimated at about 6,000 fish, with about 10 percent of the returns constituting jacks. Annual returns during this time period have ranged from about 2,300 adults in 1980 to nearly 17,000 adults in 1987. Although the spring chinook have a low contribution rate in terms of ocean harvest, returns do provide mainstem recreational fisheries and a popular sport fishery within the Lewis River. In-river sport catch estimates from 1977 through 1987 have ranged from about 1,250 to nearly 10,000 adults, with an average annual catch of about 3,660 adults. In addition, an average of about 400 jacks per year are harvested. Natural escapement of adult fish, based on annual spawning ground counts, have averaged about 1,400 adults, ranging from just over 300 to nearly 7,000 adults. The remainder of the fish return to the hatcheries, which averages only a few hundred adults annually because of poor trapping efficiency.

Table 2 . 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 fall chinook salmon *(Oncorhynchus tshawytsch*a) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act. . In Washington, the LCR chinook ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the Cascade Crest. As defined by harvest management units, there are four stocks of fall chinook that return to the Columbia River. These include the lower river hatchery (LRH), lower river wild (LRW) , Bonneville Pool Hatchery (BPH) and the upriver brights (URB**).** The North Lewis wild fall chinook represent about 80 percent of the wild fall chinook returning to the lower Columbia River, (Norman, 1987). LRW fish also return to the East Fork Lewis. In addition, LRW fish are also found in the Cowlitz and Sandy rivers. Hatchery production of fall chinook has been inconsistent in terms of numbers and types of releases. Some release groups were for experimental rather than production purposes. After brood year 1985, no hatchery production has taken place. Current production is entirely natural. Natural spawning over the last 10 years has ranged from about 5,300 to 19,000 adults. Escapement estimates are based on peak fish counts, which are used as an index to estimate total spawners. The majority of the spawning takes place within the 4- mile stretch between the Lewis River Hatchery and Merwin Dam, in addition to Cedar Creek. Surveys are also conducted in the East Fork Lewis River within the 4.2-mile stretch from the area of Lewisville Park to Daybreak Park.

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

Lower Columbia River steelhead *(Oncorhynchus mykiss*), were listed as threatened under the ESA on March 19, 1998. In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. No total estimates of wild run size or escapement exist for either the North or East Fork Lewis River. Smoker et al. (1951) believed that combined winter and summer runs of native steelhead on the North Fork above Merwin Dam formerly exceeded 1,000 adults. Lucas (1985) determined that the wild component of winter steelhead at Lucia Falls averaged 56% (ranged 35-74 percent) of the creeled fish between 1973 and 1984. Specific age information for wild fish is limited. Of the 12 wild winter steelhead sampled from the 1977-1980 seasons in the North Fork fishery, 17 percent were l-ocean jacks and 83 percent were 2-ocean adults (Lavoy and Fenton 1983). In another study by the same authors, hatchery and wild fish were not separated; of 364 fish from the North Fork winter fishery, the largest group (63 percent) was 2- ocean fish with fork lengths that averaged between 67.1 cm and 71 cm. Three-ocean fish made up the next largest group (30 percent) and had average fork lengths of 80.1 cm to 84.2 cm. Only 2 percent of l-ocean fish were found, with fork lengths of 44 cm and 46 cm. Adult winter steelhead enter the basin from November through May with peak migration occurring in January and March for hatchery and wild fish, respectively. Spawning occurs from March through June in both the North and East forks (Howell et al. 1985). Lucas and Pointer (1987) found that peak spawning during the 1987 brood year in the East Fork occurred from mid-March through late April. McMillan (1985) suggests that spawning above Sunset Falls on the East Fork occurs over a short period of time in mid-March. Emergence occurs from April through July and the fish rear until spring a year later. Most wild North Fork smolts probably outmigrate in April and May at a size of 160 mm. The majority (83 percent) were found to have emigrated after two years, while about 17 percent emigrated after three years (Lavoy and Fenton 1983). East Fork stocks tend to follow the same time- frame, however no distribution of freshwater residency is available.

Table 4. Wild winter steelhead abundance estimates in the LCMA.

Brood Year	Index Redd Surveys					Pop. Est. Trap Counts		IndexTrap/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

Columbia Basin DPS Bull Trout *(Salvelinus confluentus)* were listed as threatened on June 10, 1998 (63 FR 31647). The Columbia River Distinct Population Segment is threatened by habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, and past fisheries management practices such as the introduction of non-native species. The Lower Columbia Recovery Unit Team identified two core areas (Lewis and Klickitat rivers) within the recovery unit. Generally, in drainages colonized by anadromous salmon and steelhead, char successfully co-exist by occupying a different ecological niche. Coho smolt releases in the lower mainstem reaches of the Lewis River are believed to migrate quickly with low incidences of residuals and interaction with bull trout. The U.S. Fish and Wildlife Service recognized two sub-populations of bull trout in the Lewis River system: the Yale Reservoir Sub-Population and the Swift Reservoir Sub-Population (USDI 1998a and 1998b). Both sub-populations exhibit an adfluvial life history type. Adult fish reside in the reservoirs for the majority of the year and then migrate into the main river or its tributaries during late spring. Adult fish hold in their spawning tributaries throughout the early summer months, then spawn in August and September. After spawning, the adult fish return to the reservoirs until the following year's spawning season. Cougar Creek is the only tributary to Yale Reservoir where bull trout are known to spawn. The Yale Reservoir Sub-Population contains a low number of fish, coming dangerously close to extinction. PacifiCorp has been conducting bull trout spawner counts on Cougar Creek since 1978. The estimated Cougar Creek spawner population ranges from zero to 40 individuals (PacifiCorp and Cowlitz PUD 1999a, 100% Initial Information Package). Pine and Rush creeks are believed to be the principal spawning tributaries supporting the Swift Reservoir Sub-Population (Faler and Bair 1996). A cooperative monitoring effort began in the early 1990s on the Swift Reservoir Sub-Population. The primary cooperators include the Washington Department of Fish and Wildlife, PacifiCorp, and U.S. Forest Service. In the early 1990s, radio-tagging of adult bull trout was conducted to determine distribution of spawners. Beginning in 1994, population size estimates have been made on an annual basis using a visual mark-recapture method.

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: All Type N coho broodstock used for the program at Lewis River hatchery are volunteers to the traps at either Lewis or Merwin Hatcheries. The traps are opened for coho collection during the entire the run to allow for collection of the entire run-timing. Both traps are supplied with Lewis River water and both traps have "V" weirs to prevent escape of captured fish. Fish are handled without the use of an anesthetic at this time, but future use of anesthetics at the Merwin trap may be an option. All fish are identified as to wild or hatchery origin through examination for fin clips or wire tags, in the case of double index groups, and observed for gill net or predator marks. The incidence of capturing fall chinook has ranged between 100 and 300 adults yearly (volunteered into traps). The take on other listed fish (spring chinook, winter and summer steelhead) has been low. A total of 6 and 8 wild summer steelhead volunteered into the traps in 1999 and 2000, respectively. (See Direct Take Table 1).

Genetic introgression: Both early and late coho stocks are probably represented on the spawning grounds in the Lewis River today. Type-N coho enter the Columbia River by mid-October and begin entering tributary streams in early November thru January. Spawning activity peaks between late November and late December. There are no known genotypic, phenotypic, or behavioral differences between either the hatchery stock or natural stock in the subbasin. Most wild spawners are considered to be progeny of hatchery spawning. All adults recruited for use as broodstock have been of hatchery origin since 1998. In 2004, WDFW is proposing to maximize the numbers of natural coho available into the broodstock program. Indirect take from genetic introgression is unknown.

Rearing:

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

Disease: Outbreaks in the hatchery may cause significant adult, egg, or juvenile mortality. Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the programs at Lewis River Hatchery. 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; Stewart and Biornn 1990; Foot et al. 2000).

Prior to release, the health and condition of the coho population 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. Indirect take from disease effects is unknown.

Release:

Hatchery Production/Density-Dependent Effects: Hatcheries can release numbers of fish that can exceed the density of the natural productivity in a limited area for a short period of time and can compete with listed fish. Coho releases are scheduled to start mid-April but environmental conditions or unforeseen problems could occur and require WDFW Regional staff to adjust the program as needed. Indirect take from density dependent effects 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." Studies have shown that coho moved downstream quickly, suggesting that coho spend little time in the river after release (Fuss and Byrne 1995). Coho smolts released from the Marblemount Hatchery on the Skagit River migrated approximately 11.2 river miles per day (Puget Sound data from Seiler et al. 1997; 2000). Fish released on station in large river systems may travel even more rapidly – migration rates of approximately 20 river miles per day were observed by steelhead smolts in the Cowlitz River (Harza 1998). Snorkeling studies on the Elochoman River indicated dramatic migration of hatchery chinook after 2 weeks (Fuss 2000).
2) NMFS (2002) noted that ".where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates."
3) Flagg et al. (2000) concluded, "By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids." Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment."
4) Fresh (1997) noted that "Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced

fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results."

5) Studies from Fuss (200) on the Elochoman River and Riley (2004) on two Willapa Bay tributaries (Nemah and Forks Creek), indicate that hatchery reared coho and chinook effectively leave the watersheds with days after release.

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

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

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

Predation Risk Factors:

Environmental Characteristics: These characteristics can influence the level of predation (see SIWG (1984) for a review) with risk greatest in small systems during periods of low flow and high clarity. The Lewis River watershed is a large system approximately 93 miles long, has a total fall of approximately 12,000 feet, and drains an area of about 1,050 square miles (EA Engineering 1999). The headwaters arise on the southern flanks of Mt. Saint Helens and Mt. Adams. The mainstem of the Lewis, also known as the North Fork, flows southwesterly from its source in Skamania County through three impoundments,

Swift Reservoir (River Mile 47.9), Yale Reservoir (34.2), and Merwin Lake (RM 19.5). The middle and lower sections of the North Fork Lewis form the boundary between Clark and Cowlitz Counties. A major tributary, the East Fork Lewis River, enters the mainstem at RM 3.5. From this point the mainstem Lewis flows westerly, entering the Columbia River at RM 88. The average annual stream flow for the entire Lewis River system is approximately 6,125 cubic feet per second (cfs).

Dates of Releases: Coho smolts are released in May and June. In 2001, the coho were transported for release to the lower river (RKm.6). Trucking of coho began May 10 and ended June 7. Hatcheries are at their highest density and loading levels close to release times and are at the mercy of environmental conditions, or unforeseen problems such as high temperatures or unusual low water conditions. These can require staff to consider options as needed for the safety and health of the fish from April to June.

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

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

Potential Lewis Type N coho predation and competition effects on listed salmonids: The proposed annual production goal for this program is 815,000 fish. Coho are released at 16.0 FPP (133 mm fl) and can be released starting in mid-April. Coho released in this time frame (April -June) could encounter listed fish in the Lewis subbasin and Columbia mainstem. Due to size differences between coho smolts and fingerlings, competition

with naturally produced fingerling chinook and steelhead is probably low with regards to food and spatial preference between species and sizes. At 16 FPP (133 mm fl), potential predation on listed chinook would be on fish of 43-44 mm fl and smaller.

Risk would be low for listed steelhead fry as spawning time for wild winter steelhead stocks in the ESU occurs from March to May with April 20th the peak week of spawning and depending on available temperature units, eggs will hatch in 4-7 weeks with fry emergence approximately 2-3 weeks after hatching which indicates listed fish would not available until late May to mid June (LCSI Draft 1998). Program is below bull trout areas.

Indirect take or levels of take associated with known studies from predation is unknown.

Residualism: To maximize smolting characteristics and minimize residuals:

- WDFW adheres to a combination of acclimation, volitional release strategies, size, and time guidelines.
- Condition factors, standard deviation and coefficient of variation on fish lengths are monitored and measured throughout the rearing cycle and adjusted towards the release time for optimum smolt conditions.
- Releases have occurred from acclimation facilities on the natal stream.

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 mainstem, 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. Durkin (1982) reporting that the 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).

Listed chinook cannot be distinguished from hatchery tule chinook without mass marking. In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. (See Take Tables at the end of this document for identified levels).

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

Any additionally mortality from this operation on a yearly basis would be communicated to WDFW Fish Program and NOAA 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.

In late summer and early fall environment conditions require staff to increase scrutiny of this operation during adult trapping operations. 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 WDFW Fish Program and NOAA 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 Lewis River Hatchery is consistent with:

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

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

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

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

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

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

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

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

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

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

3.3 Relationship to harvest objectives.

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

The Columbia River Fisheries Development Program, Columbia River Fish Management Plan (CRFMP) and *U.S.*vs.*Oregon* and the parties to these programs, plans and court cases are therefore involved in short and long-term production planning. The CRFMP defines the roles of harvest and production in the Columbia River basin, including the Snake River. 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 to the more southern ocean fisheries. The late-returning coho are referred to as north-turning or N-type fish because they contribute to the northern ocean fisheries.

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 in more recent years have averaged 48.8% (1997-98). With mass marking, WDFW staff has taken steps to identify natural coho stocks and manage them in a manner that would provide for their survival and reproduction. At the same time, attempts are made to maximize the harvest of hatchery origin fish to limit their numbers on the spawning grounds.

Hatchery coho can contribute significantly to the lower Columbia River gill net fishery; commercial harvest of early coho 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. A substantial estuary sport fishery exists between Buoy 10 and the Astoria-Megler Bridge; majority of the catch is early hatchery coho, but late hatchery coho harvest can also be substantial. An average of 3,500 coho (1980-98) were harvested annually in the North Lewis River sport fishery. CWT data analysis of the 1995-97 brood early coho released from Lewis River hatchery indicates 15% were captured in a fishery and 85% were accounted for in escapement. CWT data analysis of the 1995-97 late coho released from Lewis River Hatchery indicates 42% were captured in a fishery and 58% were accounted for in escapement. Fishery CWT recoveries of 1995-97 brood Lewis early coho were distributed between Washington ocean (58%), Columbia River (21%), and Oregon ocean (21%) sampling

areas. Fishery CWT recoveries of 1995-97 brood Lewis late coho were distributed between Columbia River (56%), Washington coast (31%), and Oregon ocean (21%) sampling areas (LCFRB Lewis River Sub Basin Plans 2004).

BroodYear	SAR (%)	Total Catch
1991	6.65	37938
1992	1.74	9926
1993	0.77	4392
1994	0.59	1682
1995	0.20	831
1996	0.41	1002
1997	0.77	2008
1998	0.58	1890
1999	1.90	6658
2000	2.45	11381
2001	5.77	17869
2002	Na	Na
2003	Na	Na
Avg.	1.98%	8,697

3.4 Relationship to habitat protection and recovery strategies.

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

Subbasin Planning and the Lower Columbia Fish Recovery Board (LCFRB):
The current Lewis System HGMP process is designed to deal with existing hatchery programs and potential reforms to those programs. A regional sub-basin planning process (Draft Lewis River Subbasin Summary May 17, 2002) is a broad-scale initiative that will provide building blocks of recovery plans by the Lower Columbia Fish Recovery Board (LCFRB) for listed fish. This group 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 with the LCFRB, including the role of fish release programs originating from Lewis River Hatchery.

Habitat Treatment and Protection:
WDFW is presently conducting, or has conducted, habitat inventories within the Lewis River. Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. It creates a model to predict fish population outcomes based on habitat modifications. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which document barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis:
A WRIA 27 (Kalama, North Fork Lewis River, and East Fork Lewis River/Salmon Ck.) habitat limiting factors report (LFA) has been completed by the Washington State Conservation Commission (Wade G., March 2001) with the input of WDFW Region 5 staff.

3.5 Ecological interactions.

Below are discussions on both negative and positive impacts relative to the Lewis River Type S coho program and are taken from the Puget Sound listed and non-listed HGMP template (WDFW and NOAA 2003).

(1) Salmonid and non-salmonid fishes or species that could negatively impact the program: Lewis River coho smolts can be preyed upon through the entire migration corridor from the river subbasin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays along the Columbia mainstem sloughs can predate on coho 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 mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted 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 spring chinook, coho and summer and winter steelhead programs are released in the Lewis 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.). Except for yearling stocks (coho and steelhead), these species may serve as prey items during the emigration through the basin. While not always desired, 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 release of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). The addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). A nutrient enhancement program is underway on the North and East Fork Lewis River systems. Starting in 1997, WDFW and volunteer groups planted 1,407 fish carcasses in tributaries of the North and East Forks of the Lewis River. In 1998, they planted 4,659 carcasses (Hale 1999, personal comm.). However, S*aprolegniasis* occurrences in young hatchery fish have been observed in greater frequency at facilities that have nutrient enhancement projects. In these cases, circumstantial evidence suggests more outbreaks of gill and tail fungus are the result of nutrient enhancement efforts as well. Fish health 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. Lewis Type S coho smolts can be preyed upon through the entire migration corridor, from the river subbasin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs can predate on steelhead smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that benefit from migrating smolts 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.

Lewis River Hatchery water rights total 38,613 gpm from three sources: the Lewis River, an unnamed stream and Colvin Creek. Total available flow for Speelyai Hatchery is 9,200 gpm from a gravity flow intake on Speelyai Creek.

All adults trapped are supplied with 100% North Fork Lewis River water with adults selected for spawning purposes transported to the Speelyai Hatchery holding pond. Here they are held in Speelyai Creek water. Water quality is quite good at Speelyai with clarity and temperatures (48-55 degrees) providing for excellent adult holding. All eggs taken are eyed at Speelyai and that portion destined for the Lewis River Hatchery program is transported back to the Lewis River Hatchery for hatching and rearing. Water temperatures at the Lewis River Hatchery range from 40-61 degrees Fahrenheit. Since this facility is receiving water from the reservoirs upstream, water clarity is usually good. Maximum inflow at Speelyai is 20 cubic feet per second (cfs) and the maximum inflow at Lewis River Hatchery 65 cfs. There would be no difference between the water used by naturally spawning populations and that being used at the Lewis facility. All water flow to the Lewis facility is provided via pumps while the water flow at Speelyai is provided by gravity.

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 for raceways are diverted from formalized thru trust water right #S2-24939. from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports (see below). Water withdrawals are granted under S2-24939.
Intake/Screening Compliance	WDFW has requested funding for future scoping, design, and construction work for a new river intake system on the Lewis River to meet NOAA compliance.
Hatchery effluent discharge.	The facility conducts effluent monitoring and reporting and operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit administered by the Washington Department of Ecology. WAG 13-1040. 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).

Broodstock for the program are trapped at the Lewis River Hatchery ladder (RK 20.9) and Merwin Dam (RK 25.8). Traps are open for adult collection for approximately 7 months to allow for collection over the entire run time. Both traps have "V" weirs to prevent the escape of captured fish. The Lewis River trap is 200' x 7' x 5' with a flow of 3,500 gpm. The Merwin trap is approximately 60' x 12' x 7' with a flow of 25,000 gpm. The following ponds are used to hold coho until spawning:

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Adult Holding/Sorting Pond	82500	200	75	5.5	2500-6000

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

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

5.3 Broodstock holding and spawning facilities.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Adult Holding/Sorting Pond	82500	200	75	5.5	2500-6000

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Vertical Stack Tray Units	50	3.5-7.0	nya	10000	8000

The Lewis hatchery has an egg eyeing capacity of eleven million eggs and utilizes FAL verticals and bulk eyeing troughs. Incubation water is supplied from the Lewis River via pumps and is equipped with a de-gassing tower to be used when total gas levels exceed the accepted standard. A backup pump is available if needed and the system is alarmed at several points to provide backup if one system fails. In case of power failure, the system is fully served by one of two auxiliary generators.

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
5	Concrete Raceways	4000	100	10.0	4.0	660	1.26	0.12
1	1/2-Acre Pond	92813	225	75	5.5	7500	1.10	0.18

Coho at Lewis River are ponded into the raceways and remain there until mass marked and coded wire tagged in June and July. Fish are then transferred to two of the large rearing ponds. Rearing loadings adhere to the Piper (1982) loading levels at all times. Lewis River water is used during the entire rearing period.

5.6 Acclimation/release facilities.

Same as above, see section 5.5. The Type N coho at Lewis River Hatchery are acclimated during the entire rearing and release program with North Fork Lewis River water.

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

Speelyai Hatchery: Flooding compromised water intake in 1976, 1977, 1996, and 1997. Lewis River Hatchery: Flooding of pump room and water intake problems in 1976, 1977, 1996, 1998, and 2003.

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

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

Section 6. Broodstock Origin and Identity

6.1 Source.

Native Lewis River coho salmon provided the initial brood stock for the hatchery. The first brood was captured in the trap located at Merwin Dam. There were a significant number of adults, sometimes numbering in the tens of thousands. The dam precluded any natural migration upstream so adult coho salmon were trucked around the dam to continue their migration into the upper reaches of the system.

6.2.1 History.

Historically, the Lewis River system had abundant wild coho. At one time coho were present in the Lewis River all the way to the headwater tributaries of Pine Creek at river mile (Rm) 59.0 and the Muddy River (Rm 60.0), including Clearwater and Clear Creeks (WDF/WDW). In 1949, Bryant described the Lewis River as one of the most important coho producers in the Columbia Basin. In 1951, WDF estimated that 15,000 coho entered the Lewis River system to spawn, with 10,000 entering the North Fork and 5,000 the East Fork (WDF/WDW 1993). After construction of Merwin Dam in 1931, but before Yale Dam was built, coho were trapped and transported to the Merwin Reservoir to use upstream habitats. After Yale Dam was constructed, spawning and rearing habitats were flooded. Downstream passage for juveniles became impractical and transportation was discontinued (WDFW 1998, vol. 1 appendices). Lucia Falls (RM 21.3) is the upstream terminus for coho migrations in the East Fork Lewis (WDF/WDW 1993).

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Cowlitz River Type N Coho	H	1980	1982
Lewis River Type N Coho	H	1983	Present

6.2.2 Annual size.

The current annual program broodstock goal is 3800 fish, equally divided by sex. This level is dependent on whether Washougal Hatchery supplies 2.75 million for the Klickitat River coho plants. All other hatchery origin adults and jacks from this stock are removed from the system and sold by contract or donated to foodbanks.

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

Starting with 1998 brood, the coho program has been mass marked (adipose fin clip) but natural fish were not incorporated within the broodstock program. Starting with 2004 brood, WDFW is proposing to be maximizing available Type N natural spawners into the program for the Lewis River broodstock needs.

6.2.4 Genetic or ecological differences.

There are no known genotypic, phenotypic or behavioral differences between the hatchery and natural stocks in the Lewis River drainage. The broodstock chosen displays morphological and life history traits similar to the natural population. Large numbers of coho are released from integrated programs in the Washington tributaries in the Lower Columbia province (Lewis, Cowlitz, Washougal rivers) and are expected to contribute to natural populations.

6.2.5 Reasons for choosing.

In the late 1970's and early 1980's production shifted to late coho. Late coho (Type N) move northward from the mouth of the Columbia and are more readily caught in Washington waters

providing greater benefits to Washington's commercial and recreational fisheries. Type N coho provide for extended fishing opportunity and do not overlap in return timing with Lower Columbia River chinook, which makes them more available to commercial fisheries in the lower river. Type N stock(s) are the strength of the Columbia River contribution to the Washington coastal fisheries especially in zones 1 & 2 (Ilwaco, Westport, WA). Combined with earlier returning stocks they provide an extended period of quality catch in both the fresh water 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.

- Integrating natural spawners will represent the natural Type N coho run through out the season.
- Limit out of basin transfers except in rare circumstances.
- 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, when identified, will be released immediately during the broodstock collection process.

Section 7. Broodstock Collection

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

Adults

7.2 Collection or sampling design

All coho broodstock used for the programs at Lewis River and Speelyai hatcheries are volunteers to the traps at Lewis and Merwin. The traps are opened for coho collection during the entire run. Traps are supplied with Lewis River water and have “V” weirs to prevent the escape of captured fish.

The Lewis trap utilizes a denil ladder using both first run river water (75%) and hatchery effluent water (25%) as attractant. Upon reaching the top of the ladder the fish pass through a “V” weir into a channel 200 feet long and 7 feet wide. This channel has a good flow rate of fresh water, a automatic crowding system and a sorting brail. Stress on fish being held is very low but obviously raises when being handled and sorted. With high water temperatures during this period, the fish are susceptible to disease and are treated daily. All fish are selected at random. Adult mortality rates are very low, normally in the 0.38% range. The larger egg take from the later part of the run occurs over several spawning sessions beginning the last week of November and continuing to the last week of December or even into January. Egg takes at Lewis River Hatchery have ranged between 3,982,000 to 14,562,000 over the past ten years. The average egg take over this period is 9,292,000.

Fish are handled without the use of an anesthetic at this time but future use of anesthetics in the Merwin trap may is being considered. All fish are identified as to wild or hatchery origin through examination for fin clips or coded-wire-tags (in the case of double index groups) and observed for gill net or predator marks.

Proposed Integration – Starting with 2004 brood, WDFW will be maximizing natural coho into the broodstock program for the on-station release portion of the Type N coho program from cohorts representing the timing and distribution of natural Type N coho to the rack. Fish for transfer to the Klickitat River may be from hatchery identified fish.

7.3 Identity.

The target population is Lewis River Hatchery "Type N" stock. Run timing is usually used to identify this stock. This population is mass marked to identify them as being from hatchery origin. Since this stock is of a double index group, all captured fish returning with an adipose fin are wanded for coded-wire tag recovery.

7.4 Proposed number to be collected:

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

3800 adults are required to provide 5,100,000 eggs (FBD 04). This program provides eggs for Lewis, Elochoman, Kalama, Washougal and Klickitat Programs if needed. Transfer goal – 120,000 eyed eggs to Fish First for RSI’s in the NF Lewis River tribs. Transfer 1,150,000 to Klickitat Hatchery. Transfer 6,250 eyed eggs to Region 5 co-ops. 5,000 eggs to Steve Syversion project.

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	1900*	1900*	nya	nya	nya
1992	5115	4267	104	nya	nya
1993	4032	2666	43	nya	nya
1994	3986	2331	36	nya	nya
1995	545	521	10	nya	nya
1996	2453	1920	40	nya	nya
1997	3414	3442	42	nya	nya
1998	2262	2296	39	nya	nya
1999	1714	1753	35	nya	nya
2000	1150	1159	11	nya	nya
2001	462	469	15	nya	nya
2002	584	566	8		

*= current goal if eggs are needed for Klickitat program.

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

All spawned carcasses are either used for nutrient enhancement or taken to the local landfill for disposal. All mortality is taken to the landfill for disposal. In years of large escapement, remaining fish after nutrient enhancement needs may be donated to local food bank organizations, sold to a contract buyer or donated for educational purposes to local schools and colleges. Tests on transferring limited numbers of live fish above Merwin and Swift dams to fill unused habitat have been made. This remains an option for future consideration. In the near term this has accomplished needed nutrient enhancement.

7.6 Fish transportation and holding methods.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck (2)	1800	Y	N	20	nya	nya
Tanker Truck (1)	1100	Y	N	20	nya	nya

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Adult Holding/Sorting Pond	82500	200	75	5.5	2500-6000

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.

Spawned carcasses are either used for nutrient enhancement in the Lewis River and Cedar Creek system or taken to the local landfill for disposal along with pond mortality.

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 of fish or eggs for use as broodstock, 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.

Spawners are selected randomly over the entire run from fish arriving at both traps from November to January.

8.2 Males.

A ratio of 1:1 males to females are used.
Precocious males are used as a set percentage, up to 2%, or in proportion to their contribution to the adult run if less than 2%.

8.3 Fertilization.

Five fish pools of eggs and five fish pool for sperm are combined. Fish health procedures used for disease prevention include water hardening of all eggs in an iodophor solution for one hour. Sixty adult fish are sampled for ovarian fluid and kidney/spleen to test for viral pathogens. Agency spawning guidelines are closely followed.

8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

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

- Mating is done randomly.
- Limit out of basin transfers of fish or eggs for use as broodstock, except in rare circumstances.
- 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).

Section 9. Incubation and Rearing.

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

For 2004, up to 5,100,000 eggs could be taken (2004 FBD). In the past three years, Washougal Hatchery has taken the 2.5 million eggs needed for the Klickitat Program which could be the case again. 1,150,000 million eggs are taken for transfer to Klickitat Hatchery. These eggs could be taken from hatchery broodstock only.

Approximately 1,250,000 eggs are needed for the 815,000 plant from Lewis River Hatcher and for 460,000 eggs for the RSI program. These eggs would be made up of available integrated eggs. .

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 (%)
1992	10407600	90.10	98.68	nya	95.50	nya	97.10
1993	10073000	90.54	99.52	nya	96.92	nya	99.32
1994	8936900	92.06	99.33	nya	93.80	nya	98.77
1995	1680200	94.03	99.31	nya	96.60	nya	98.57
1996	7696400	92.96	97.84	nya	98.28	nya	99.63
1997	9996987	93.14	98.88	nya	97.32	nya	99.32
1998	7750612	90.42	98.91	nya	95.96	nya	99.74
1999	6570833	93.60	99.37	nya	97.00	nya	99.33
2000	4154920	92.87	99.22	nya	97.88	nya	97.96
2001	1734806	92.61	98.90	nya	98.20	nya	96.38
2002	2228766	87.59					

9.1.2 Cause for, and disposition of surplus egg takes.

The program guidelines for annual broodstock/egg take collection is managed to prevent surpluses. At times, shortfalls in egg take occur at other Lower Columbia hatcheries, and surplus eggs would be transferred to these hatchery programs to meet egg take/program objectives. Otherwise, in cases of egg surplus, WDFW Regional managers would be contacted, and instructions would be given for disposition of the surplus in accordance with regional policy and guidelines set forth in management plans/agreements and ESA permits.

9.1.3 Loading densities applied during incubation.

Heath stack incubators are used for this stock. Incubation conditions are consistent with loading densities recommended by Piper et al. (1982). Water is supplied by the Lewis River for all eggs to eye stage, water quality is generally very good but water temperatures are quite cold (40 degrees) during incubation and into the early rearing period. Stack flows during incubation are 3.6 gpm. Eggs are treated with formalin at 600 ppm to keep them free of fungus.

9.1.4 Incubation conditions.

Influent dissolved gas levels are/have never been a problem at Speelyai Hatchery. However, since

Lewis River is located below four hydroelectric generation facilities, the water system is closely watched and monitored at all times. The hatchery is equipped with four de-gassing towers that have proved to be very efficient in treating incoming water with high total gas levels.

9.1.5 Ponding.

At a time when fry have a ventral slit of less than 1 millimeter (mm), fish are ponded. In addition, Temperature units (TUs) are monitored and a Condition Index (KD) is calculated to ensure proper development. Ponding normally takes place at approximately 1320 TU's..

9.1.6 Fish health maintenance and monitoring.

Fish Health Monitoring	A fish health specialist inspects fish programs at Lewis Complex monthly and checks both healthy and if present symptomatic fish and eggs.
Disease Treatment	All eggs are water hardened in iodophor solution. Formalin is used to control fungus outbreaks. Egg mortality at Lewis River Hatchery and Speelyai Hatchery is generally well within our objectives with most mortality due to lack of fertilization or high water temperature. Historic averages for both programs on this stock would be <8% loss each year. All disease control procedures are conducted consistent with our Agencies disease policy. No disease outbreaks have occurred during the incubation to ponding period in the "Type N" program during the past 20 years and mortality remains within acceptable levels. Egg information is recorded on standardized agency forms that are forwarded to Olympia monthly. Fish health and or treatment reports are kept on file.
Egg Disposal	Dead/undeveloped eggs are frozen and disposed at a local landfill. If eggs are disease-free, they could be placed in designated tributaries for nutrient enhancement
Sanitation	All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy). All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Footbaths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

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

IHOT and WDFW fish health guidelines followed for incubation.
Eggs are placed in multiple units.
Splash curtains are used to 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 (%)
1992	10407600	90.10	98.68	nya	95.50	nya	97.10
1993	10073000	90.54	99.52	nya	96.92	nya	99.32
1994	8936900	92.06	99.33	nya	93.80	nya	98.77
1995	1680200	94.03	99.31	nya	96.60	nya	98.57
1996	7696400	92.96	97.84	nya	98.28	nya	99.63
1997	9996987	93.14	98.88	nya	97.32	nya	99.32
1998	7750612	90.42	98.91	nya	95.96	nya	99.74
1999	6570833	93.60	99.37	nya	97.00	nya	99.33
2000	4154920	92.87	99.22	nya	97.88	nya	97.96
2001	1734806	92.61	98.90	nya	98.20	nya	96.38
2002	2228766	87.59					

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

The juvenile rearing density and loading guidelines used at the facility are based on: standardized agency guidelines, life-stage specific survival studies conducted on-site, life-stage specific survival studies conducted at other facilities and staff experience. The pond loading densities maintained for this program are consistent with those recommended by Piper et al. (1982). We closely monitor pounds of fish, water temperatures and water flows and adjust where needed.

9.2.3 Fish rearing conditions.

Total gas levels are carefully monitored and if they were to exceed acceptable levels, the water is routed through the degassing towers to reduce the gas concentrations to levels compatible to good fish rearing conditions. Environmental parameters: flow rates, water temperatures, dissolved oxygen and Total Settable Solids (TSS) are monitored on a routine basis throughout the rearing period.

Settleable solids, unused feed and feces are removed regularly (vacuumed) to ensure proper cleanliness of rearing containers. Ponds are pressure washed between broods.

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
03/21/01	U	1135	U	nya	nya	nya
04/20/01	U	540	U	0.524	nya	nya
05/25/01	U	227	U	0.580	nya	nya
06/22/01	70.5	124	1.170	0.454	nya	nya
07/22/01	U	89.8	U	0.276	nya	nya
08/29/01	75.6	84.0	1.249	0.065	nya	nya
09/22/01	88.8	66.3	U	0.211	nya	nya
10/30/01	92.4	48.0	1.196	0.276	nya	nya
11/24/01	106.5	38.6	U	0.196	nya	nya
12/22/01	113.7	31.9	U	0.174	nya	nya
1/19/02	123.4	24.7	U	0.226	nya	nya
02/23/02	131.0	20.7	U	0.162	nya	nya
03/23/02	136.7	18.2	U	0.121		
04/27/02	143.7	15.7	1.170	0.137		

* Frequency of feeding decreases as fish grow from fry (hourly) to smolt.(once or twice daily)
** Lbs. fed per gpm is < 0.10 lb./gpm in standard raceways. Parameters for larger rearing containers may exceed this due to increased volume and turnover rates.

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

Same, see section 9.2.4 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
Ponding-450 fpp	Moore Clark Nutra #0	nya	nya	nya	nya
450-225 fpp	Moore Clark Nutra #1	nya	nya	nya	nya
225-130 fpp	Moore Clark Nutra #2	nya	nya	nya	nya
130-90	Moore Clark Fry 1.2	nya	nya	nya	nya
90-45 fpp	Moore Clark Fry 1.5	nya	nya	nya	nya
45fpp-Release	Moore Clark Fry 2.0	nya	nya	nya	nya

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

Fish Health Monitoring	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.
Disease Treatment	As needed, appropriate therapeutic treatment will be prescribed to control and prevent further outbreaks. Bacterial Cold Water Disease (BCWD) has been problematic at this facility in early phases of rearing and is treated with Florincol and amoxicillin. Mortality is collected and disposed of at a landfill. Fish health and or treatment reports are kept on file. *Saprolegniasis* occurrences in young hatchery fish have been observed at an increasing frequency on Mitchell Act stations. In some cases, circumstantial evidence suggests more outbreaks of gill and tail fungus are the result of nutrient enhancement efforts. Staff is continuing to monitor observations or occurrences of this possibility.
Sanitation	All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy). All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Footbaths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

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

This program is released on a volitional basis over a six week period with approximately 80% of the stock volitionally migrating during that time period. The remaining 20% are forced out prior to May 20th. No smolt index is assessed other than the pre-stated data. Fish size at release time is critical to the readiness for migration. The migratory state of the release population is determined by fish behavior. Aggressive screen and intake crowding, swarming against sloped pond sides, a leaner (.95 – 1.05) condition factor (K), a silvery physical appearance and loose scales during feeding events are signs of smolt development.

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

None at this time.

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.

- At least 500 adults are available in the population.
- Limit out of basin transfers of eggs or fish for use as broodstock, except in rare circumstances.
- Available integrated eggs would prioritized for Lewis River on-station releases and the Fish 1st RSI program (460,000 eggs - 2004 FBD).
- 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.

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	815000	16	May 10 –June 7	North Fork Lewis River	6.4	Lewis	Lower Columbia

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

Released at Lewis River Hatchery site (RKm 20.9).

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

	Fry Release			Fingerling Release			Yearling Release		
Release Year	No.	Date (MM/DD)	Avg size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)	No.	Date (MM/DD)	Avg Size (fpp)
1991	nya	nya	nya	nya	nya	nya	4476700	April-May	15.6
1992	nya	nya	nya	nya	nya	nya	4233000	April-May	14.4
1993	1989500	June	317	nya	nya	nya	3438700	May	17.3
1994	nya	nya	nya	nya	nya	nya	869400	April-May	14.0
1995	nya	nya	nya	nya	nya	nya	2199200	April-May	14.1
1996	nya	nya	nya	nya	nya	nya	2414000	April-May	13.0
1997	nya	nya	nya	nya	nya	nya	1981379	April-May	14.8
1998	nya	nya	nya	116955	May	150	2289440	April-May	13.3
1999	1359588	April	1160	217032	April	140	2193653	April-May	14.2
2000	158846	April	565	277566	September	71	2126655	April-May	13.2
2001	200665	May	609	nya	nya	nya	868756	April 10	14.7
2002	nya	nya	nya	nya	nya	nya	841000	May 10	16.0
Avg	nya	nya	nya	nya	nya	nya	nya	nya	nya

10.4 Actual dates of release and description of release protocols.

This program is released on a volitional basis over a six-week period beginning on or after April 15th. Approximately 80% of the stock volitionally migrating during that time period. The remaining 20% are forced out prior to May 20th.

10.5 Fish transportation procedures, if applicable.

Fish are released in the same subbasin as the final rearing facility.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck (2)	1800	Y	N	20	nya	nya
Tanker Truck (1)	1100	Y	N	20	nya	nya

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

The stock is reared to release in their natal river water during the entire time.

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

Recently all "Type N" produced for the mitigation portion of this program (815,000 on-station release) are mass marked (adipose fin clip) except for the double index group of 75,000. One group is coded-wire tagged only while the other group of 75,000 is coded-wire tagged and adipose-fin clipped (Ad+CWT).

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

The program guidelines for annual broodstock/egg take collection is managed to prevent surpluses. At times, shortfalls in egg take occur at other Lower Columbia hatcheries, and surplus eggs would be transferred to these hatchery programs to meet egg take/program objectives. Otherwise, in cases of egg surplus, WDFW Regional managers would be contacted, and instructions would be given for disposition of the surplus in accordance with regional policy and guidelines set forth in management plans/agreements and ESA permits.

10.9 Fish health certification procedures applied pre-release.

Prior to release, the population's 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. 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.

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

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

a. The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with naturally produced steelhead juveniles.
b. 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.
c. Out of basin fish and eggs will be limited and used only in rare circumstances.
c. In 2001, smolts were trucked to the lower river (RKm 6.0) for release to avoid listed fish interaction above this point. The circumstances were dependent on river flow and the cost and hauling effect on fish for this program.
d. 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.
e. WDFW fish health and operational concerns for Lewis River Hatchery programs are communicated to WDFW 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.

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 Lewis 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 and “Best Practices” designed to minimize impact.

Section 12. Research

12.1 Objective or purpose.

Both wild coho and hatchery origin coho are being used in RSI programs on the N.F. Lewis River. See Lewis River Fish First Wild Coho HGMPs.

12.2 Cooperating and funding agencies.

12.3 Principle investigator or project supervisor and staff.

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

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

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.

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

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.

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

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.

Section 13. Attachments and Citations

13.1 Attachments and Citations

1.) Becker, C.D. 1973. Food and growth parameters of juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in central Columbia River. Fish. Bull. 71: 387-400.

2.) Berg, R. and D. Nelson. 2003. Mitchell Act hatcheries intake and fish passage study report. Washington Dept. of Fish and Wildlife. Olympia, Wa.

3.) Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquat. Scit. 53: 164-173.

4.) Byrne, J. and H.J. Fuss. 1998. Annual coded-wire tag program Washington: Missing Production Groups. Annual Report 1998. Bonneville Power Administration, Portland, Or. Project Number 89-066. 107 pp.

5.) Durkin, J.T. 1982. Migration characteristics of coho salmon (*Oncorhynchus kisutch*) smolts in the Columbia River and its estuary. In: V.S. Kennedy (editor), Estuarine comparisons, p. 343-364. Academic Press, New York.

6.) Enhancement Planning Team. 1986. Salmon and steelhead enhancement plan for the Washington and Columbia River conservation area. Preliminary Review Draft.

7.) Finstad, A.G., P.A. Jansen, and A. Langeland. 2001. Production and predation rates in a cannibalistic arctic char (*Salvelinus alpinus* L.) population. Ecol. Freshw. Fish. 10: 220-226.

8.) Flagg, T.A., B.A. Berejikian, J.E. Colt, W.W. Dickhoff, L.W. Harrell, D.J. Maynard, C.E. Nash, M.S. Strom, R.N. Iwamoto, and C.V.W. Mahnken. 2000. Ecological and behavioral impacts of artificial production strategies on the abundance of wild salmon populations. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-41: 92p.

9.) Fresh, K.L. 1997. The role of competition and predation in the decline of Pacific salmon and steelhead. *In* D.J. Stouder, P.A. Bisson, and R.J. Naiman (editors), Pacific salmon and their ecosystems: status and future options, p. 245-275. Chapman Hall, New York.

10.) Fuss, H.J., J. Byrne, and C. Ashbrook. 1998. Stock characteristics of hatchery-reared salmonids and Washington Department of Fish and Wildlife Columbia River Hatcheries. Washington Department of Fish and Wildlife, Annual Report H98-03. 65 pp.

11.) Fuss, H.J. and P. Seidel. 1987. Hatchery incubation techniques at WDF hatcheries. Washington Department of Fisheries, Technical Report 100. 86 p

12.) Gregory, S.V., G.A. Lamberti, D.C. Erman, K.V. Koski, M.L. Murphy, and J.R. Sedell. 1987. Influence of forest practices on aquatic production. *In* E.O. Salo and T.W. Cundy (editors), Streamside management: forestry and fishery interactions. Institute of Forest Resources, University of Washington, Seattle, Washington.

13.) Hatchery Scientific Review Group (HSRG). 2004. Hatchery Reform: Principles and recommendations of the HSRG. Long Live the Kings, 1305 4th Ave., Suite 810, Seattle, Wa.

14.) Harza. 1999. The 1997 and 1998 technical study reports, Cowlitz River Hydroelectric Project. Vol. 2, 35-42.

15) Hershberger, W.K., and R.N. Iwamoto. 1981. Genetics Manual and Guidelines for the Pacific Salmon Hatcheries of Washington. Univ. of Wash. College of Fisheries. Seattle, Wa. 83 pp.

16.) Hochachka, P.W. 1961. Liver glycogen reserves of interacting resident and introduced trout populations. Can. J. Fish. Aqua. Sci. 48: 125-135.

17.) IHOT (Integrated Hatchery Operations Team). 1995. Operation plans for anadromous fish production facilities in the Columbia River basin. Volume III-Washington. Annual Report 1995. Bonneville Power Administration, Portland Or. Project Number 92-043. 536 pp.

18.) Johnston, J.M. 1967. Food and feeding habits of juvenile coho salmon and steelhead trout in Worthy Creek, Washington. Master's thesis, University of Washington, Seattle,Wa.

19.) Keeley, E.R. and J.W.A. Grant. 2001. Prey size of salmonid fishes in streams, lakes and oceans. Can. J. Fish. Aquat. Sci. 58: 1122-1132.

20.) Kline, T.C., J.J. Goring, Q.A. Mathisen, and P.H. Poe. 1997. Recycling of elements transported upstream by runs of Pacific salmon: I $d^{15}N$ and $d^{13}C$ evidence in Sashin Creek, southeastern Alaska. Can. J. Fish. Aquat. Sci. 47: 136-144.

21.) Levy, S. 1997. Pacific salmon bring it all back home. BioScience 47: 657-660.

22.) Lister, D.B., and H.S. Genoe. 1970. Stream habitat utilization by cohabiting underyearlings of Chinook (Oncorhynchus tshawytscha) and coho (O. kisutch) in the Big Qualicum River, British Columbia. J. Fish. Res. Board. Can. 27: 1215-1224.

23.) Lower Columbia Fish Recovery Board (LCFRB). 2004. Lower Columbia salmon and steelhead recovery and sub-basin plan. Lower Columbia Fish Recovery Board, Washington state.

24.) Marshall, A. R., C. Smith, R. Brix, W. Dammers, J. Hymer, and L. LaVoy in Busack, C. and J.B. Shaklee, editors. 1995. Genetic diversity units and major ancestral lineages of salmonid fishes in Washington. Washington Department of Fish and Wildlife, Fish Management Program, Technical Report # RAD 95-02. 62 pp.

25.) Mathisen, O.A., P.L. Parker, J.J. Goering, T.C. Kline, P.H. Poe, and R.S. Scalan. 1988. Recycling of marine elements transported into freshwater systems by anadromous salmon. Verh. Int. Ver. Limnol. 23: 2249-2258.

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

27.) Muir, W.O. and R.L. Emmelt. 1988. Food habits of migrating salmonid smolts passing Bonneville Dam in the Columbia River, 1984. Regulated River 2: 1-10.

28.) NMFS (National Marine Fisheries Service). 1999. Biological Opinion On Artificial Propagation in the Columbia River Basin. National Marine Fisheries Service, Northwest Region

29.) NMFS (National Marine Fisheries Service). 2002. Biological opinion on artificial propagation in the Hood Canal and eastern Strait of Juan de Fuca regions of Washington State. National Marine Fisheries Service, Northwest Region.

30.) Nilsson, N.A. 1967. Interactive segregation between fish species. *In* The biological basis for freshwater fish production. *Edited by* S.D. Gerking. Blackwell Scientific Publications, Oxford. pp. 295-313

31.) Pearsons, T.N., G.A. McMichael, K.D. Ham, E.L. Bartrand, A. l. Fritts, and C. W. Hopley. 1998. Yakima River species interactions studies. Progress report 1995-1997 submitted to Bonneville Power Administration, Portland, Oregon. DOE/BP-64878-6.

32.) Pearsons, T.N., and A.L. Fritts. 1999. Maximum size of Chinook salmon consumed by juvenile coho salmon. N. Am. J. Fish. Manage. 19: 165-170.

33.) Peterson, G.R. 1966. The relationship of invertebrate drift abundance to the standing crop of benthic drift abundance to the standing crop of benthic organisms in a small stream. Master's thesis, Univ. of British Columbia, Vancouver, B.C.

34.) Piper, R. et al. 1982. Fish Hatchery Management. United States Dept. of Interior, Fish and Wildlife Service. Washington, D.C.

35.) Reimers, N. 1963. Body conditioning, water temperature and over-winter survival of hatchery-reared trout in Convict Creek, California. Trans. Amer. Fish. Soc. 92: 39-46

36.) Riley, S. 2004. Ecological effects of hatchery-reared juvenile chinook and coho salmon on wild juvenile salmonids in two Washington streams. N. Amer. Jour. of Fish. Management 24: 506-517.

37.) Taylor, E.B. 1991. A review of local adaptation in Salmonidae with particular reference to Pacific and Atlantic salmon. Aquaculture 98: 185-207.

38.) Sager, P.M. and G.J. Glova. 1988. Diet feeding periodicity, daily ration and prey selection of a riverine population of juvenile Chinook salmon, *Oncorhynchus tshawytscha*. J. Fish. Biol. 33: 643-653.

39.) Seidel, Paul. 1983. Spawning Guidelines for Washington Department of Fish and Wildlife Hatcheries. Washington Department of Fish and Wildlife. Olympia, Wa.

40.) SIWG (Species Interaction Work Group). 1984. Evaluation of potential species interaction effects in the planning and selection of salmonid enhancement projects. J. Rensel, chairman and K. Fresh, editor. Report prepared for the Enhancement Planning Team for implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Department of Fisheries. Olympia, WA. 80pp

41.) Slaney, P.A., B.R. Ward. 1993. Experimental fertilization of nutrient deficient streams in British Columbia. *In* G. Schooner and S. Asselin (editors), Le developpmente du saumon Atlantique au Quebec: connaitre les regles du jeu pour reussir. Colloque international e la Federation quebecoise pour le saumon atlantique, p. 128-141. Quebec, decembre 1992. Collection *Salmo salar* n°1.

42.) Slaney, P.A., B.R. Ward, and J.C. Wightman. 2003. Experimental nutrient addition to the Keogh River and application to the Salmon River in coastal British Columbia. *In* J.G. Stockner, (editor), Nutrients in salmonid ecosystems: sustaining production and biodiversity, p. 111-126. American Fisheries Society, Symposium 34, Bethesda, Maryland.

43.) Steward, C. and T.C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. Tech. Rpt. 90-1. Idaho Cooperative Fish and Wildlife Research Unit. University of Idaho, Moscow, ID.

44.) USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fush and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service (NMFS) under cover letter, dated August 2, 1994, from William F. Shake, Acting USFWS Regional Director, to Brian Brown, NMFS.

45.) Ward, B.R., D.J.F. McCubbing, and P.A. Slaney. 2003. Evaluation of the addition of inorganic nutrients and stream habitat structures in the Keogh River watershed for steelhead trout and coho salmon. . *In* J.G. Stockner, (editor), Nutrients in salmonid ecosystems: sustaining production and biodiversity, p. 127-147. American Fisheries Society, Symposium 34, Bethesda, Maryland.

46.) Washington Department of Fisheries. 1991. Stock Transfer Guidelines. Hatcheries Program, Washington Department of Fisheries. Olympia, Wa.

47.) Washington Department of Fish and Wildlife (WDFW). 1987-2003. Semi-Annual Operations Reports for Lower Columbia Fisheries Development Program Mitchell Act Hatcheries (Washington State). Washington Dept. of Fish and Wildlife. Olympia, Wa.

48.) Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and Western Washington Treaty Indian Tribes (WWTIT). 1992. 1992 Washington State salmon and steelhead stock inventory (SASSI). Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 212 pp.

49.) Washington Department of Fisheries (WDF) and Washington Department of Wildlife (WDW). 1993. 1992 Washington State salmon and steelhead stock inventory - Appendix three Columbia River stocks. Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 580 pp.

50.) Washington Department of Fish and Wildlife (WDFW). 1997. Wild Salmonid Policy, draft environmental impact statement. Washington Dept. of Fish and Wildlife. Olympia, Wa.

51.) Washington Department of Fish and Wildlife. 1998. Water resource inventory area river mile indices for the Columbia and Snake river basins. Unpublished document. Habitat Management Division, Washington Department of Fish and Wildlife, Olympia, WA.

52.) Washington Department of Fish and Wildlife (WDFW). 2001 (updated Oct, 2003). Fisheries Management and Evaluation Plan (FMEP), Lower Columbia River. Washington Dept. of Fish and Wildlife. Olympia, Wa.

53.) Washington Department of Ecology. 2002. A guide to instream flow setting in Washington state. Olympia, Wa.

54.) Wipfli, M.S., J. Hudson, and J. Caouette. 1998 Influence of salmon carcasses on stream productivity: response of biofilm and benthic macroinvertebrates in southeastern Alaska, U.S.A. Can J. Fish. Aquat. Sci. 55: 1503-1511.

55.) Witty, K., C. Willis and S. Cramer. 1995. A review of potential impacts of hatchery fish on naturally produced salmonids in the migration corridor of the Snake and Columbia Rivers. S.P. Cramer and Associates, Inc., 600 NW Fariss, Gresham, Oregon.

56.) Wood, J.W. 1979. Diseases of Pacific Salmon, their prevention and treatment, 3rd edition. Washington Department of Fisheries, Hatchery Division, Olympia, Washington. 82 p.

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	Lewis River Type S Coho
Location of hatchery activity	Lewis River 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	0-20*	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		nya
Unintentional lethal take (g)	nya	nya	0	nya
Other take (specify) (h)	nya	nya	nya	nya

* Wild spring Chinook are released and returned to stream.
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	Lewis River Type S Coho
Location of hatchery activity	Lewis River 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	0-20	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 (g)	nya	nya	Unk	nya
Other take (specify) (h)	nya	nya	nya	nya

*Fall Chinook are released back to stream.

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

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

Steelhead

ESU/Population	Lower Columbia River Steelhead
Activity	Lewis River Type S Coho
Location of hatchery activity	Lewis River 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	nya	nya
Intentional lethal take (f)	nya	nya	nya	nya
Unintentional lethal take (f)	nya	nya	nya	nya
Other take (specify) (h)	nya	nya	nya	nya

0* Listed steelhead are not present until after the coho operation has finished.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category

Take Table 4. Estimated listed salmonid take levels by hatchery activity.
Coho (Proposed)

ESU/Population	Lower Columbia River Coho
Activity	Lewis River Type S Coho
Location of hatchery activity	Lewis River 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	unknown	nya
Capture, handle, tag/mark/tissue sample, and release (d)	nya	nya	nya	nya
Removal (e.g., broodstock (e)	nya	nya	Up to 3800	nya
Intentional lethal take (f)	nya	nya	Up to 3800	nya
Unintentional lethal take (g)	500,000*	450,000*		nya
Other take (specify) (h)	nya	nya	nya	nya

* Based on 90% survival from egg to fry and 90% survival from fry to smolt and if the entire 5,100,000 eggs would be taken. If the 3.75 million to Klickitat system are segregated eggs, then the portion of integrated listed eggs would be 1,150,000 and the unintentional lethal take would be approximately 20% of that amount. At this time WDFW is reviewing operational concerns for these options.
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 5. Estimated listed salmonid take levels by hatchery activity.

Bull Trout

ESU/Population	Lower Columbia River Spring Chinook
Activity	Lewis River Type S Coho
Location of hatchery activity	Lewis River 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		nya
Unintentional lethal take (g)	nya	nya	0	nya
Other take (specify) (h)	nya	nya	nya	nya

Bull trout have not been recently observed in the operation.
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.