HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Friends of the Cowlitz (FOC) Cowlitz River Spring Chinook (Wallace Pond Net Pens)
Species or Hatchery Stock	Spring Chinook (*Oncorhynchus tshawytscha*)- Cowlitz Hatchery Stock
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Cowlitz/Lower Columbia
Date Submitted	
Date Last Updated	April 19, 2005

Section 1: General Program Description

1.1 Name of hatchery or program.

Friends of the Cowlitz (FOC) - Cowlitz River Spring Chinook

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

Spring Chinook *(Oncorhynchus tshawytscha)*

ESA Status: Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999.

1.3 Responsible organization and individuals.

Name (and title):	Mark Johnson
	Cowlitz Complex Manager
Agency or Tribe:	Washington Department of Fish & Wildlife
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.

Co-operators	Role
Tacoma Public Utilities	Funding Source and Facility Maintenance
Friends of the Cowlitz	Coop Group that operates the Wallace Pond Spring Chinook Net Pen Project

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

Funding Sources
Tacoma Public Utilities – Total costs at the Cowlitz Salmon Hatchery cannot be broken down specifically for this portion of spring Chinook production.
Friends of the Cowlitz (FOC) – Non profit organization provides in-kind services.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Cowlitz Hatchery Spring Chinook Stock
Broodstock collection location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Adult holding location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Spawning location (stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Incubation location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz
Rearing location (facility name, stream, RKm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/RKm 78.8/Cowlitz Wallace Pond Net Pens/Cowlitz River/RKm 41.1/Cowlitz

1.6 Type of program.

Integrated Harvest*

1.7 Purpose (Goal) of program.

Mitigation - The goal of this program is to mitigate for the loss of spring chinook salmon that would have been produced naturally in the Cowlitz River system in the absence of the Cowlitz River Hydroelectric Project in the basin. The purpose is to provide harvest and to contribute to conservation, recovery, research and education. Release from the lower river is intended to spread harvest opportunity in the areas downriver of the Cowlitz Salmon Hatchery.

*Re-Introduction - Spring Chinook adults not harvested upon return could potentially end up at the salmon hatchery and can be utilized as part of the upper Cowlitz basin adult restoration efforts.

1.8 Justification for the program.

As a 501(c)3 non-profit organization that began on 1988, Friends of the Cowlitz (FOC) is a citizen organization dedicated to work to restore the runs of anadromous fish (salmon, steelhead and cutthroat trout) in the Cowlitz River and it's tributaries. Landowners, sports fisherman and other interested parties have worked on the fish and wildlife projects for benefit in the Cowlitz River and several major tributaries. FOC is also involved in net pen rearing projects in the lower Cowlitz River with summer steelhead and spring Chinook and as part of the resident trout mitigation in Lake Mayfield. This has been possible because of FOC being able to work successfully with the Washington Department of Fish and Wildlife, Lewis County PUD and BPA. FOC has taken a proactive role in Tacoma Power's relicensing of Mayfield and Mossyrock Dams and participated in the initial Conservation Caucus during these proceedings. The Conservation Caucus was a strong advocate for volitional passage, habitat improvements and improved hatchery practices.

Fish transfers to the Friends of the Cowlitz (FOC) Wallace Pond site, are a portion of the total 967,000 production of the main CSH operations based on the FHMP. The FOC spring Chinook releases from the lower Cowlitz River are designed to spread out the harvest opportunities in

lower Cowlitz River. The river adjacent to Wallace Pond is popular drift with fishing guides as fish may imprint to the release site for a time. A WDFW Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement is used for monitoring the FOC spring Chinook cooperative program (see also section 3.2). Spring Chinook releases to the lower river are yearling type smolts at 10 ffp. The size, time of release based on past history indicates that as smolts, fish released can migrate quickly soon after releases.

In order to maximize harvest and identify wild spring Chinook for upper river reintroduction strategies, spring Chinook have been massed marked beginning with 1997 brood year fish (1999 releases). All hatchery-origin released spring chinook except for fingerlings taken to the upper watershed (RV or LV clipped) are marked either with an adipose-fin clip only or adipose-fin clip/coded-wire tag. FOC net pen spring Chinook are 100% adipose clipped. WDFW provides harvest opportunity on the Cowlitz programs through the Lower Columbia Region Fish Management and Evaluation Plan (FMEP) approved by NOAA on December 31, 2003. The primary focus of anadromous salmonid fisheries in the LCR is to target harvest of known hatchery origin steelhead, spring chinook, coho salmon, sea-run cutthroat, and fall chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

In order to minimize impact on listed fish by the Cowlitz River spring Chinook program, the following Risk Aversion (Table 1) are included in this HGMP :

Table 1. Summary of risk aversion measures for the Cowlitz Spring Chinook program.

Potential Hazard	**HGMP Reference**	**Risk Aversion Measures**
Water Withdrawal	4.2	Not applicable to net pens situated in a gravel pit impoundment not accessible to the Cowlitz River.
Intake Screening	4.2	Not applicable to net pens situated in a gravel pit impoundment not accessible to the Cowlitz River.
Effluent Discharge	4.2	The Wallace Pond Net Pen program meets the guidelines not requiring a NPDES permit as on-site production or feed totals are within limits: • "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit (>20,000 lbs total on site production and > 5,000 lbs of fish feed per month).
Broodstock Collection & Adult Passage	7.9	Not applicable to this HGMP. See Cowlitz Salmon Hatchery Spring Chinook HGMP.
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	Fish are released as smolted yearlings that emigrate from the basin and Columbia river within the year of release. The release location is low in the river and below several miles of potential lower river habitat.

1.9 List of program "Performance Standards".

This is a final acclimation, imprinting and release site and is a transfer of subyearling fish from the main spring Chinook program at Cowlitz Salmon Hatchery. See Cowlitz Salmon Hatchery Spring Chinook HGMP for additional performance standards, indicators and risks associated with the program.

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

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Benefits include partnerships and education with local government and local citizens	Friends of the Cowlitz coordinates ongoing and future cooperative projects	Volunteer involvement is tracked yearly and total hours committed are recorded.
Support Upper Cowlitz basin restoration and recovery	Achieve Phase 1 spring Chinook adult goals in the upper Cowlitz.	Adult hauled to the upper Cowlitz are monitored and tracked yearly
Release up to 55,000 fish in smolt condition at the Lower Cowlitz River site.	Contribute to harvest for sport, tribal and commercial fisheries. Achieve a 10-year average contribution similar to smolt-to-adult survival at the Cowlitz Salmon Hatchery.	Survival and contribution to fisheries will be estimated for each brood year released at Cowlitz Salmon Hatchery.
Rearing programs operate per Cooperative Fish and Wildlife Project Memorandum of Understanding Fish Production Agreement	Cooperator reviews and submits MOU to WDFW for each year involved in the project.	WDFW compiles MOU and manages volunteer and partnership program reporting procedures
Individual rearing program sites are highly successful at acclimating and releasing fish from the Lower River site.	Program achieves a 95% survival from transfer to release.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on success of program. WDFW reviews and recommends changes if needed.
Program releases fish at a time, size and condition that minimizes impacts and/or interactions to ESA listed fish. See also Risks below.	Program production and numbers of fish reared and released are consistent with the WDFW FBD.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on fish released, date of releases and location of projects.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Program releases fish at a time, size and condition that minimizes impacts and/or interactions to ESA listed fish. See also Risks below.	Program production and numbers of fish reared and released are consistent with the WDFW FBD.	Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details on fish released, date of releases and location of projects.
Net Pen rearing units operate in compliance with all applicable fish health protocols.	Fish health documented. Goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stock.	FOC Project lead coordinates and communicate regularly with Region 5 staff. Fish are disposed of properly at a landfill.
Ensure net pen rearing operations comply with state and federal water quality and quantity standards through proper environmental monitoring	MOU Section 4. The Cooperator shall also be responsible for obtaining and complying with any and all necessary permits to conduct the project(s) described in the attached Exhibit(s), which may include but are not limited to: Hydraulic Project Approvals (HPA), State Environmental Protection Act checklist (SEPA), National Pollution Discharge Elimination System (NPDES), Water Rights, local construction, grading, or filling permits, etc, with the exception of federal ESA compliance, which can only be deferred upon WDFW or the Treaty Tribes of Washington. MOU Section 4. The Cooperator is responsible for obtaining and complying with any and all necessary permits to conduct the project(s) described in the attached Exhibit(s), which may include but are not limited to: Hydraulic Project Approvals (HPA), State Environmental Protection Act checklist (SEPA), National Pollution Discharge Elimination System (NPDES), Water Rights, local construction, grading, or filling permits, etc, with the exception of federal ESA compliance, which can only be deferred upon WDFW or the Treaty Tribes of Washington.	The Cooperator complies with all permits required and submits MOU to WDFW for each year involved in the project before project is approved.

Net pen complex placement will not affect spawning behavior of natural populations or pose a substantial risk to listed juveniles.	WDFW staff provides technical site evaluation and operational support to minimize impacts and maximize the success of the program.	The Cooperator submits yearly WDFW Volunteer Fish production Project Release and Planting Record Form that includes details success or operational concerns.

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

Production transferred to the FOC program are part of approximately 712 adults are required to produce the 967,000 spring Chinook smolts needed to ensure enough adults return to implement the adult supplementation program in the upper Cowlitz River.

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	55,000	8.0	March-April	Cowlitz River	41.1 Wallace Pond located on Mandy Rd. off of Jackson Hwy.	Cowlitz	Lower Columbia

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

The release of spring Chinook from the Wallace Pond net pens constitute approximately 5.5% of the total production released to the lower river. Adults probably contribute to harvest and hatchery escapement but cannot be separated from the main production from the Cowlitz Salmon Hatchery production. The table referred to below is for the Cowlitz Salmon hatchery. The program spreads the harvest opportunity to a popular area in the lower river. Along with harvest contribution in ocean and river fisheries, the original WDFW/TPU mitigation agreement goal was 17,300 fish to the Cowlitz Salmon Hatchery. Since 1996, available spring Chinook adults above hatchery needs were reintroduced into the upper Cowlitz basin. In 2002, the upriver goal including wild and hatchery adults was a minimum of 2,000 adults, which has been achieved through 2004 (See also HGMP section 7.5).

Smolt-to-adult survival rates – Overall survival averaged 0.469% from brood years 1988-1999. 1993 and 1996 brood years were low (0.5 and 0.6% respectively), whereas recent brood years 1998 and 1999 have indicated an increase of .82 and 1.12% respectively.

Adult production levels - Spring Chinook adult production and survival rates during the 1990's dropped significantly from levels seen from 1967– 1992. Total catch averaged 1,081 from return years 1992-2004. Catches in 1997 and 1998 were low (66 and 165 total respectively), reflecting the low survival of some of the mid-1990's brood. Since 2000, levels has increased and averaged 2,005 fish, with 2004 showing a significant catch increase of 4,756 fish.

From 1967 through 2003, returns have averaged 7,763 adults (44.8%) of the past mitigation goal excluding harvest (Cowlitz Annual Reports). For the period from 1974 through 1988, levels were significantly higher than low survival during much of the 1990's and early 2000 years with

a high year of 20,865 fish in 1981. In the past two years (2003-04), escapement levels have been significantly higher than the previous nine year trend (1994 – 2002) and was 62.9% of the original mitigation goal (Table 2).

Table 2. Cowlitz Salmon Hatchery Spring Chinook Adult Return/SAR from 1990 BRD Year to Present and Lower Cowlitz River Escapement.

Year	Hatchery Return	Lower Cowlitz R. Escape-ment	BRD YR SAR	Year	Hatchery Return	Lower Cowlitz R. Escape-ment	BRD YR SAR
1980	15,860	166	-	**1993**	6,194	214	0.20
1981	20,865	959	-	**1994**	1,881	159	0.20
1982	12,230	209	-	**1995**	1,772	282	0.05
1983	13,319	70	-	**1996**	1,869	34*	0.16
1984	13,645	147	-	**1997**	1,298	437*	0.19
1985	6,806	156	-	**1998**	812	262*	0.59
1986	5,591	467	-	**1999**	1,321	235*	0.06
1987	13,679	71	-	**2000**	1,408	264*	0.82
1988	9,080	172	-	**2001**	1,306	315*	1.12
1989	5,659	563	-	**2002**	3,134	419*	-
1990	4,525	278	1.14	**2003**	11,006	1,937*	-
1991	5,384	149	-	**2004**	12,972	1,793*	-
1992	7,922	266	0.63	**2005**	-	-	-

* Additionally, wild and hatchery adults above hatchery needs are transported to the Upper Cowlitz River, see also HGMP Section 7.5 for numbers transported above Lake Scanewa.
Sources - Stock assessment reports (BPA), annual reports, StreamNet Annual Coded-Wire Tag Washington Missing Production Groups, Cowlitz Annual Report for 2000.

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

Spring Chinook cooperative rearing began in Fall 1991 with the first release from Wallace Ponds in spring of 1992. From 1991-1995, additional cooperative programs releasing Spring Chinook in the lower Cowlitz River included net pens in "Janisch Pond" located near Castle Rock and "Stones Pond" located in Toledo (See plants section 10.3). Both WDFW and FOC cooperative programs at these sites released fish but were discontinued after 1995. Since 1996, only the Wallace Pond site has produced spring Chinook.

1.14 Expected duration of program.

The program is on-going although long-range future production in the Cowlitz system will be based on long range plans for the Cowlitz River (FERC No. 2016, August 2004).

1.15 Watersheds targeted by program.

Cowlitz/Lower Columbia

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

1.16.1) Brief Overview of Key Issues

The Friends of the Cowlitz (FOC) organization has been involved in habitat and rearing program with WDFW and Tacoma Power for almost two decades. Productivity and future plans for the Cowlitz River are part of the new SA (FERC 2016). Levels of future productivity from the lower river are outlined in the Final FHMP. Issues in the FHMP are mostly agreed upon and form the basis of future hatchery production in the basin.

Note: Issues stated below have been addressed in the new FERC Settlement Agreement (The Cowlitz River Project, FERC No. 2016, August 2004).

Issue 1: Since 1967, spring Chinook have been released to the Cowlitz River in order to satisfy the mitigation adult goal and also contributed significant harvest benefits to freshwater and limited ocean fisheries. Ocean survival through the 1990's dramatically affected contribution and survival but also facility design limitations and disease problems at Cowlitz Salmon Hatchery (CSH) reduced overall mitigation goals as described in the prior Settlement Agreement (SA) that expired in 2001 (FERC 2016). The new SA as agreed upon by the parties has prioritized the operation of the hatcheries for the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels. In the FHMP, reductions of hatchery production have been proposed but should be based on whether fish passage (Issue 2) is successful and whether upper basin productivity has been proven. Overall plans for future restoration and recovery of the spring chinook program exists in the FHMP (Section 5.1).

Issue 2: In the new SA, significant upper river reintroduction and natural production is occurring. Since the mid-1990's, significant restoration activities in the upper basin have taken place including adult re-introduction, fry and fingerling releases and subsequent natural smolt productivity. The greatest obstacle to restoration of upper basin anadromous fish runs is downstream passage of juvenile salmonids (smolts). They must be captured or collected to ensure that they do not residualize in a reservoir or run through a turbine. The Cowlitz Falls Dam (operated by the Lewis County Public Utility District) is the center of efforts to collect downstream migrant salmonids and transport them safely around hazards of reservoirs and dams to the lower river. Juvenile salmonids produced in the Tilton River pass downstream through a fishway at Mayfield Dam. In both cases Fish Collection Efficiency (FCE) improvements are needed.

1.16.2 Potential Alternatives to the Current Program

Note: Although instructions in the Potential Alternatives HGMP section indicate draft plans not necessarily endorsed by management, the following alternatives have been agreed upon and supported by parties to the SA.

Alternative 1: Significant remodel plans within the Cowlitz Complex facilities are described in Article 7 that will be of significant benefit to producing spring Chinook for continued support of upper river efforts. Both the Cowlitz Salmon Hatchery and Cowlitz Trout Hatchery will be rebuilt within five years of license issuance with emphasis on innovative rearing practices. Planning, developing and reviewing alternatives for Cowlitz River Fisheries Management is currently underway through the Cowlitz Fisheries Technical Committee. The committee is comprised of representatives from Washington Department of Fish and Wildlife, NOAA fisheries, Tacoma Power, Trout Unlimited, Washington Department of Ecology, US Fish and Wildlife Service, and The Yakima Indian Nation. These include: a) hatchery design drawings that include decreased rearing densities and innovative practices to replicate historic out-migration size and timing; b) plans for construction scheduling; c) provision for hatchery water supply that maximizes water from existing groundwater wells and, if necessary, provides for treatment of up to 10 cfs additional river water; and d) a plan for gradual transition to innovative rearing practices. Both, current and future lower and upper river production are proposed by the FHMP. The FHMP indicates that as natural production increases, hatchery production would decrease based on credit mechanisms (see section 3.7 FHMP) after the hatchery re-build (>2008). The Project though has inundated miles of river and tributaries that natural production may not totally be able return to pre-project levels. WDFW is committed to improving hatchery production and making it consistent with wild fish restoration in the Cowlitz basin, but modification of hatchery practices or reductions in lower river production must be evaluated.

Alternative 2: Significant habitat improvements for upstream and downstream have been agreed to in the SA including: Article 1. Downstream Fish Passage: Riffe Lake and Cowlitz Falls Collection and Passage, Article 2. Downstream Fish Passage: Mayfield and Article 3. Upstream Fish Passage: Barrier, Mayfield and Mossyrock. In the meantime, existing hauling of adults and trucking of smolts will continue. A number of issues hinge on the success of fish passage improvements including the full potential of the upper basin production.

Potential Reforms and Investments:

Although costly, the development of restoration programs for the Cowlitz River watershed upstream of the barrier Dam represents a balancing act between competing needs for harvest and stock restoration, the evolving improvement of fish collection and passage for downstream migrants, the restoration of ecological function in the watershed, and host of other inputs currently unknown. The plan used to guide the process will need to be flexible enough to adapt to new information, aggressive enough to achieve success, and well-enough evaluated to guide this and future projects of this type.

Section 2: Program Effects on ESA-Listed Salmonid Populations

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

None, although NOAA Fisheries has consulted on the operations of all the fish production activities at these facilities as part of a Columbia River basin wide hatchery biological opinion in 1999 for listings prior to 1998. On March 23, 2004, NOAA Fisheries (Consultation No. 2001/02045) issued a Biological Opinion for the Cowlitz River Hydroelectric Project (FERC No. 2016).

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	M	L
Cowlitz Fall Chinook	L	L
Coweeman Fall Chinook-Natural	H	M
Toutle Fall Chinook	M	L
Late Winter Steelhead	H	L
Coho- (Proposed)	Na	Na
Chum-	Na	Na
H, M and L refer to high, medium and low ratings, low implying critical and high healthy.		

2.2.1

<u>Description of ESA-listed salmonid population(s) affected by the program.</u>

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

Lower Columbia River spring chinook salmon listed as "threatened" under the ESA on May 24, 1999. Of the 14 hatchery stocks included in the LCR ESU, only the Cowlitz River spring chinook salmon was considered essential for recovery, but was not listed (64 FR 14308, March 24, 1999).

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

Lower Columbia River fall chinook salmon are listed as "threatened" under the ESA on May 24, 1999.
Lower Columbia River Steelhead listed as threatened under the ESA on March 19, 1998.

Lower Columbia River Coho within the Lower Columbia River/Southwest Washington Evolutionary Significant Unit (ESU) were proposed as threatened under the federal Endangered Species Act in 2004 (NOAA 69 FR 33101; 6/14/2004).

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

Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*): Cowlitz Hatchery Spring Chinook are integrated with the Upper Historic population under NOAA's proposed listing determination (69 FR 33102; 6/14/2004). The current spring Chinook hatchery

stock is listed as a core genetic legacy population in the Cowlitz system **(**Myers et al. 2002), and core/legacy status (McElhany et al. 2003). Natural escapement levels in the lower river below the barrier dam (which include hatchery-origin fish) are typically only 200 to 400 fish (SaSI 2002), although escapement in 2003 and 2004 have increased significantly **(Table 3).** Estimates of adults above Mayfield Dam in the 1960's indicated approximately 9,900 spring Chinook (Serl and Morrill 2004). Currently, significant numbers of adults have been transported the past few years approaching these numbers. Current carrying capacity for spring Chinook smolts in the upper Cowlitz basin is 311,000 smolts (Serl and Morrill 2004). Current productivity in the upper system is approximately 225,000 smolts **(Table 4)** although less than 40,000 - 45,000 smolts (19%) can be collected at the CFFF (Serl and Morrill 2004). Spring Chinook short and long term objectives for the programs are covered in Section 5.1 (FHMP). Tacoma Power continues to truck adults above the Cowlitz Falls Dam as part of the anadromous reintroduction program **(Table 5).**

Table 3. Spring Chinook Abundance Estimates in the Lower Cowlitz River

Year	Lower Cowlitz River
1990	320
1991	284
1992	279
1993	236
1994	167
1995	347
1996	36
1997	455
1998	356
1999	285
2000	266
2001	347
2002	419
2003	1,937
2004	1,793

Source – Lower Columbia Region FMEP 2003 and WDFW Spawning Surveys (2004).

Table 4. Total smolt production* of the Upper Cowlitz since 1997.

Year	Steelhead Unmarked	Steelhead RV(& hatchery)	Coho	Chinook	Cuthroat	Total Emigration
2004	*23,249*	*44,355*	*308,079*	*225,164*	*1,487*	*602,334*
2003	21,565	25,480	400,762	254,368	1,880	704,055
2002	9,300	41,361	168,281	119,673	1,676	340,291
2001	30,861	66,629	796,948	156,545	1,867	1,052,850
2000	26,184	25,426	236,960	136,920	2,051	427,541
1999	25,368	28,235	88,788	36,717	1,349	180,457
1998	24,505	39,321	196,520	51,913	1,363	313,622
1997	7,714	29,253	17,490	134,206	722	189,385

* FCE for 2004 include: winter steelhead (48.5%), coho (41.6%), spring Chinook (19%), and cutthroat (48.5%). Source – Cowlitz Falls Annual Reports 1997-2004.

Table 5. Spring Chinook Adults transported to the Upper Cowlitz River Basin, 1996 – present.

Year	Not sexed	Female Ad Clip	Female Un Mark	Male Ad Clip	Male Un Mark	Jack	Total
2004		4,786	116	5,928	139	502	11,471
2003		4,482	264	4,089	284	18	8,589
2002	1,465	119	Unk	179	Unk	50	1,787
2001		68	Unk	60	Unk	0	128
2000		98	Unk	106	Unk	0	204
1999		53	Unk	38	Unk	177	268
1998		0	0	0	0	0	0
1997		0	0	25	0	26	51
1996		2	Unk	4	Unk	0	6

Source – Cowlitz Falls Annual Reports 1997-2004.

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a): In 1951, the fall chinook escapement to the Cowlitz River and tributaries was estimated at 31,000, with the following distributions: 10,900 to the mainstem Cowlitz and its minor tributaries, 8,100 to the Cispus, 500 to the Tilton, 6,500 to the Toutle, and 5,000 to the Coweeman (WDF 1951). Forty-six percent of the fall chinook run in the Cowlitz River was estimated to have come from above Mayfield Dam in 1950 to 1961, and 28 percent of the spawning grounds were inundated by Mayfield and Mossyrock reservoirs (Easterbrooks 1980). Age ranges from 2-year-old jacks to 6-year-old adults, with dominant adult age of 3, 4, and 5 (averages are 16.49%, 58.05%, and 19.31%, respectively). Natural spawning abundance is more a reflection of the size of returns to the Cowlitz Salmon Hatchery and stray rates than of natural production. The natural spawning escapement goal is 3,000 adults. Until 2001 the goal had not been met since 1989 (SaSI 2002). In 2002, escapement was 1,427 while 2003 had 10,329 and 4,466 were reported for 2004 (**Table 6**). Most of the spawning takes place between the Kelso Bridge and the Cowlitz Salmon Hatchery (WDF et. al. 1993). Fall Chinook will not be used in the upper Cowlitz while the spring Chinook evaluation is ongoing but adults are taken to the Tilton River. Fall Chinook production occurs in

the Tilton River and Mayfield Lake tributaries as adults are hauled by Tacoma Power **(Table 7).** Smolts are collected at Mayfield Dam **(Table 8).**

Coweeman River: Historically, Coweeman River fall chinook spawned from Mulholland Creek (RM 18.4) downstream approximately 6 miles to the Jeep Club Bridge (WDF et. al. 1993). The estimated annual escapement of fall chinook in 1951 was 5,000, although splash dams probably impacted production (WDW 1990). The Coweeman River has received fall chinook plants from at least 1951 until 1979 (WDW 1990). SaSI (WDF et. al. 1993) listed fall chinook stocks as healthy in 1993; status today is depressed (SaSI 2002).

Toutle River Fall Chinook. Natural spawners of both hatchery and natural origin in the Toutle subbasin averaged 6,573 fish from 1964 through 1979 with the following distribution: 4.8 percent from the mainstem, 3.8 percent South Fork Toutle, 49.4 percent North Fork Toutle, and 42 percent Green River (Kreitman 1981 as cited in WDW 1990). Natural spawners (hatchery and natural origin) from 1964 through 1979 averaged 42 percent (equal to 4,517 fish) of the Toutle subbasin spawners, which were estimated at 10,756 fish (Kreitman 1981 as cited in WDW 1990). From 1990–2001, escapement in the South Fork Toutle system averaged 57 fish although significant increases in fall Chinook escapement for 2002 and 2003 reflect the Lower Columbia River trend for those past 2 years.

Table 6. Fall chinook salmon abundance estimates in the Cowlitz System.

Year	Coweeman River	Cowlitz River	Green River	SF Toutle River
1990	241	2,698	123	0
1991	174	2,567	123	33
1992	424	2,489	150	0
1993	327	2,218	281	3
1994	525	2,512	516	0
1995	774	2,231	375	30
1996	2,148	1,602	667	351
1997	1,328	2,710	560	0
1998	144	2,108	1,287	66
1999	93	997	678	42
2000	126	2,700	852	27
2001	646	5,013	4,951	132
2002	891	14,427	7,452	444
2003	1,082	10,329	13,806	137
2004	1,550	4,466	4,108	603

Source – LCR FMEP (2003) up to 2001. 2002 – 2004 data from WDFW database.

Lower Columbia River Steelhead *(Oncorhynchus mykiss*): In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. The Cowlitz system had six historical populations including three core (Cispus, Upper Cowlitz and N.F. Toutle) populations. All are winter steelhead stocks with the Cispus winter run population hatchery stock is listed as a core genetic legacy population (Myers et al. 2002). Late winter steelhead including wild adults of wild and fry plants (RV) and of lower river hatchery releases have been transferred upstream since 1996 **(Table 7).** In 2004, 35,032 steelhead smolts were collected at the CFFF of which 11,276 (32%) were of wild origin Fry plants identified by RV clip contribute to the escapement, while yearling plants of RV and adipose fin clips (37,500) provide some level of harvest on identified steelhead for the upper basin. As current FCE was 48.5% for steelhead, current production in the upper basin is

approximately 65% of the 1994 GAIA estimates (100,000) carrying capacity of the upper Cowlitz River. Steelhead abundance estimates are made in a number of Lower Columbia tributaries including the S.F Toutle, Green, Coweeman, E.F Lewis and Washougal Rivers but not the Lower Cowlitz system (FMEP 2003).

Table 7. Late Winter Steelhead Adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked STHD			RV – Right Ventral Clip			AD – Adipose Clip			Totals
	UM-Female	UM-Male	UM-Jack	RV - Female	RV - Male	RV – Jack	AD-Male	AD – Female	AD - Jack	
1996-7	22	12	0	5	14	0	0	1	0	54
1997-8	6	5	0	5	1	0	26	23	0	66
1998-9	15	24	13	10	29	3	6	49	8	157
1999-2000	108	107	0	28	73	0	19	77	0	412
2000-01	133	125	37	71	122	20	70	124	27	729
2001-02	346	419	1	174	492	1	453	898	3	2,787
2002-03	316	205	2	335	241	0	933	497	3	2,532
2003-4	146	146	4	100	167	0	214	619	1	1,397
2004-5										
Totals										

Source - *DRAFT* 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT `

Lower Columbia River Coho *(Oncorhynchus kisutch)*: In the lower Cowlitz, Mayfield Dam has blocked tributaries above river mile (RM) 52 since 1968 but natural production still occurs in several small tributaries of the lower Cowlitz including Olequa, Lacamas, Ostrander, Blue, Otter, Brights, Mill, Arkansas, Foster, and Hill creeks. Adults are also released each year to spawn in the Tilton River and upper Cowlitz system. Presently, most Cowlitz River coho are of hatchery origin although significant numbers of NOS have been identified and taken to the upper Cowlitz since 1999 **(Table 8).** FCE of coho smolts in 2004 was 42% with 128,161 coho smolts collected at CFFF with a majority of them transported to the Cowlitz Salmon Hatchery Stress Relief ponds in 2004. Total smolt production was 308,079. Based on a maximum potential egg deposition of 92 million eggs, egg-to-smolt survival was 0.33% (Serl and Morrill 2004).

The Northwest Power Planning Council's model estimated smolt production capacity of 123,123 for the lower Cowlitz River, 131,318 for Tilton River and Winston Creek, and 155,018 for above Cowlitz Falls.

Table 8. Hatchery Coho adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked Coho			AD – Adipose Clipped Coho			Totals
	UM-Female	UM-Male	UM-Jack	AD - Female	AD - Male	AD – Jack	
1996-7	0	0	0	932	594	629	2,155
1997-8	0	0	0	2,774	1,262	464	4,500
1998-9	0	0	0	4,128	4,140	3,154	11,422
1999-2000	2,398	2,383	120	10,594	11,635	7,197	34,327
2000-01	514	778	284	14,653	16,674	9,566	42,469
2001-02	1,150	1,644	96	15,504	21,564	1,497	41,455
2002-03	3,661	4,688	416	23,698	30,490	6,300	69,253
2003-04	3,477	4,511	484	9,526	11,169	6,143	35,310
2004-05							
Totals	11,200	14,004	1,400	81,809	97,528	34,891	240,891

Source - *DRAFT* 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT

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

Describe hatchery activities: The following hatchery activities are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999). 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. FOC program does not take broodstock. Therefore, no take tables will be submitted with this HGMP.

Broodstock Program:

Broodstock Collection: Refer to the Cowlitz Spring Chinook HGMP.

Genetic introgression: The spring chinook stock is a mixture of all historical populations of Cowlitz River spring Chinook populations and genetically representative of the legacy population. Until mass marking of spring Chinook began with 1997 brood year fish (1999 releases), an unknown level of integration occurred in the program since inception in 1967. Since mass marking, only hatchery adults have been used as broodstock and in the short term, naturally produced adults will not be incorporated into the hatchery population so long as the upper basin productivity experiment is being conducted. Eventually, integration of the hatchery and natural components of the run will be possible once a self-sustaining run is established in the basin.

Rearing Program:

Operation of Hatchery Facilities: See HGMP section 4.2 for water withdrawal, intake screening compliance and hatchery effluent discharges.

Disease: Rearing program adheres to WDFW Fish Health Management guidelines including monitoring.

Release:

Hatchery Production/Density-Dependent Effects: Current levels of hatchery production are described in the Final FHMP including after the remodeling and phase-in plan, and the Disease Management Plan (>2008). Lower river production is also dependent on agreement of future upriver credit mechanisms between WDFW and Tacoma Power (Section 3.7). The current 55,000 fish are approximately 5.5% of the total lower river production.

Competition: Fish are released at a time, size and condition factor that indicates fish will migrate quickly. The lower river release site is significantly below upper river productivity. Once in the lower Columbia River mainstem of tidal influence, in a study designed to define the migrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 RKm daily respectively.

Predation: Hawkins and Tipping (1999) reported that in 1998, yearling stock coho, steelhead and cutthroat sampled on the Lewis River, Washington contained Chinook salmon fry. The variable predation rates cited above were associated with extremes in Chinook salmon fry abundance; low predation rates had low spawner densities and high predation rates had high spawner densities. Predation studies have not been conducted on the Cowlitz River system but several risk factors have been associated with predation:

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 Cowlitz River is a very large river system averaging 6,664 and 7,490 cfs during April and May (Real Time average 1934- present). Below I-5, the Toutle River, a large tributary of the Cowlitz River adds another 2,000 – 2,600 cfs to the system.

Dates of Releases: Listed Chinook from the Lower Columbia ESU are believed to be present in many systems over a wide rearing and migration window from March thru August. Listed winter steelhead can be emerging during the release period with 50% swim up occurring by mid-June (LCSI Draft 1998). Some overlap could be occurring, but actual habitat, spatial or behavioral characteristics during the overlap are unknown. The release of the spring Chinook program by March is well in advance of smolt productivity from the upper basin which occurs in April and peaks in late May and early June (Serl and Morrill).

Relative Body Size: Yearling spring Chinook releases at 5 - 16 fpp (approximately 200 - 136 mm fl) pose a risk to listed fish in the lower river. Most upper river produced smolts are of yearling size 110 – 200 ml fl (Serl and Morrill). This would require some overlap of predator and prey, but actual habitat preferences, spatial separation or behavioral characteristics during the overlap are unknown.

Release Location and Release Type: The release from the Wallace Pond net pens is below I-5. Net pens are towed to a release pipe extending through a road dike and physically released. Based on past history, time and size release parameters, fish are in a smolted condition and could be migrating quickly upon release.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, size, and time guidelines. Condition factors, standard deviation and co-efficient of variation (CV) are measured through out the rearing cycle and used for determining release time.

- Feeding rates and regimes through out the rearing cycle are programmed to satiation feeding to minimize out of size fish and programmed for smolt phase as release or plant times approach.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once reaching the Columbia River, fish appear to travel quickly. Median Travel Time of subyearling chinook, on the mainstem Columbia River, from McNary to Bonneville Dam was estimated to average 8.0 days (29.2 RKm/d) during the years 1997 to 2003 (Memo- Michele DeHart to Bill Tweit (WDFW), 2003). In a study designed to define the migrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 RKm/d respectively. 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: Interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Carcass surveys on Cowlitz spring and fall Chinook are conducted annually. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact. See also HGMP section 11.0 (Monitoring).

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).

Refer to the Cowlitz Spring Chinook HGMP for any take numbers.

Indicate contingency plans for addressing situations where take levels within a given year

have exceeded, or are projected to exceed, take levels described in this plan for the program.

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

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.

The production developed for this program will be integrated with *U.S. v Oregon* and the Columbia River Fish Management Plan (CRFMP) and with hatchery plans documented in WDFW's yearly Future Brood Document (FBD), and Lower Columbia Fisheries Management and Evaluation Plan (2002 FMEP) which has been agreed to by NOAA for listed steelhead, chum, and Chinook in the ESU.

For ESU-wide hatchery plans, the spring Chinook production from Cowlitz Salmon Hatchery was described in the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin and the 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. Current production numbers can vary from past productivity levels and reflect reductions in programs due to ESA concerns.

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. The following is a list of guidelines, policies and permit requirements that guide WDFW Columbia hatchery operations:

- *Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington*.
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).
- *Spawning Guidelines for Washington Department of Fisheries Hatcheries*.
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).
- *Stock Transfer Guidelines*.
- *Fish Health Policy in the Columbia Basin*.
- *National Pollutant Discharge Elimination System Permit Requirements*

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

- Cowlitz Basin Fish Management Plan - The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.
- Mitigation agreement for Cowlitz Hatchery (Agreement Number FERC PROJECT # 2016 dated Aug. 9, 1967). That license expired on December 31, 2001. The Project has operated under annual licenses until the new license was issued (effective July 18, 2003). The new thirty-five year license was issued March 13, 2003, and became effective on July 18, 2003. Tacoma Power has contracted with the Washington Department of Fish

and Wildlife (WDFW) to operate their Cowlitz hatcheries through 2008.

- Cowlitz Fisheries and Hatchery Management Plan (Final August 2004).
- Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833).

3.3 Relationship to harvest objectives.

The FOC spring Chinook program is approximately 5.5 % of the total releases from the lower river. Specific harvest cannot be separated from the Cowlitz Hatchery portion but is combined with harvest opportunity as described below. WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of wild indigenous salmonid runs, the Pacific Salmon Treaty, the Pacific Fisheries Management Council, *US v. Oregon*, and other state, federal, and international legal obligations. Besides ocean fisheries, specific harvest objectives will vary depending on the phase of the reintroduction and recovery program. The current Fishery Management Evaluation Plan (FMEP) has been approved by NOAA Fisheries as of December 2003 for harvest in the Lower Columbia Region. Overall, WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of wild indigenous salmonid runs, the Pacific Salmon Treaty, the Pacific Fisheries Management Council, US v. Oregon, and other state, federal, and international legal obligations.

Harvest of Cowlitz River spring Chinook in marine fisheries in Southeast Alaska and British Columbia is expected to occur through 2008 under the provisions of the 1999 annexes of the Pacific Salmon Treaty (PST). These provisions include a schedule of allowable harvest rates that vary with aggregate stock abundance for fisheries in Southeast Alaska (troll, net, and sport gear), Northern British Columbia (troll and Queen Charlotte sport), and West Coast Vancouver Is land (troll and outside sport). Provisions in the PST also require Canada and the United States to r educe by 36.5 percent and 40 percent respectively , the total adult equivalent mortality rates (relative to the 1979-82 base period) in other fisheries that affect the prescribed list of stocks. Although Cowlitz River spring Chinook are not included in that list, reductions in exploitation rates for the stocks remain likely due to their co- mingled status (FHMP 2004).

Harvest of spring Chinook with an adipose fin in commercial fisheries in the mainstem Columbia River may occur in February and March. Current US v. Oregon agreements and ES A requirements limit this fishery to a maximum of a 0.6 percent harvest rate. Sport fisheries selective for adipose fin-clipped spring Chinook are expected to occur in the mainstem Columbia River and the lower Cowlitz River from March through July. Assuming a 10 percent mortality rate for the release of un clipped fish, a 6 percent encounter rate in the mainstem Columbia, and a 30 percent encounter rate in the lower Cowlitz River, the WDFW objective for the total freshwater harvest rate in these sport fisheries is 3.6 percent.

Spring chinook are an important target species in Columbia River commercial and recreational fisheries, as well as tributary recreational fisheries. CWT data analysis of the 1989–1994 brood years from the Cowlitz Salmon Hatchery indicate a 40% exploitation rate on spring chinook; 60% of the adult return was accounted for in escapement. Most of the harvest occurred in the Cowlitz River sport fishery. Exploitation of wild fish during the same period likely was similar. Selective fisheries targeting hatchery spring chinook have been implemented in recent years in the mainstem Columbia sport and commercial fisheries and in the Cowlitz River sport fishery. Regulations allowing retention of hatchery fish and requiring release of wild fish increase opportunity to catch hatchery fish and significantly decrease impacts to wild fish. The selective fishery program enables the spring Chinook reintroduced into the upper Cowlitz to pass through the fisheries.

Sport fisheries in the Cowlitz River below the Barrier Dam will be managed according to a schedule that links escapement goals to harvest policy in the Cowlitz River. Harvest in the lower

portion of the basin (below Barrier Dam) would be reduced if; 1) the 2,000 fish escapement goal (NOR + HOR) cannot be met for the upper basin, or 2) the results of monitoring studies indicate fishing mortality on naturally produced fish exceeds 3.6 percent.

Through the 1980s, spring chinook salmon harvest rates have averaged 67%, 42%, and 30% for the Lewis, Kalama, and Cowlitz spring chinook salmon fisheries, respectively, during periods when hatchery fish were abundant. As these stocks declined in the 1990s, fisheries restrictions reduced harvest. The new selective fisheries for spring chinook salmon that were implemented in 2002 will reduce natural spring chinook salmon harvest rates to less than 10%, and impacts will generally average closer to 5%.

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

Fisheries benefiting from this program will include:

1. Ocean recreational and commercial fisheries from the mouth of the Columbia River north to S.E.Alaska.
2. Columbia River Zone 1-3 commercial fishery
3. Columbia River Zone 1-3 recreational fishery
4. Lower and Upper Cowlitz River recreational fisheries

Cowlitz River spring Chinook are harvested in a variety of sport and commercial fisheries in Southeast Alaska, British Columbia, Oregon and Washington (**Table 9**). Total adult equivalent exploitation rates in all fisheries since the 1977 brood have ranged from 11 (1992 brood) to 75 percent (1985 brood), with an average exploitation rate of 52 percent in all years. Based on coded wire tag analysis of hatchery origin fish (HOR), the majority of the exploitation has historically occurred in ocean fisheries, primarily in Washington and off the west coast of Vancouver Island, with an average total adult equivalent exploitation rate in all ocean fisheries of 34 percent for the 1977 through 1996 broods. Reductions of exploitation rates in these fisheries in recent years, particularly in response to the poor survival rates of many stocks in the early 1990s, resulted in ocean exploitation rates as low as 11 percent (1992 brood).

Table 9. Percent of Cowlitz Spring Chinook Contribution to Largest Fisheries.

Brood Year	Alaska Troll	Cana-dian Troll	WA Troll	OR Troll	Treaty Troll	Col. River Gillnet	Cana-dian Ocean Sport	WA Ocean Sport	WA Fresh-Water Sport
Avg. (1994-2000)	5.7%	12.3%	6.3%	16.1%	5.7%	11.8%	6.6%	16.3%	11.0%

3.4 Relationship to habitat protection and recovery strategies.

Additional Processes:

The following processes have included habitat identification problems, priority fixes and evolved as key components to The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004).

Sub-Basin Planning

Regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Cowlitz River Subbasin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan. *The Lower Columbia fish Recovery Board (LCFRB)* has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum

Counties, December 15, 2004) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

Habitat Treatment and Protection
Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans and has been used by Tacoma Power for the FERC re-liscensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis (LFA)
A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven subbasins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

3.5 Ecological interactions.

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program*: Chinook smolts can be preyed upon through the entire migration corridor from release to the mainstem Columbia River estuary. Northern pikeminnows and introduced spiny rays along the Columbia mainstem sloughs can predate on chinook smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Based on PIT tags recovered at a large Caspian Tern nesting colony on Rice Island, a dredge material disposal island in the Columbia river estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids from the Columbia reaching the estuary were consumed by the terns in 1997 (Roby, et al. 1998). River otters (*Lutra canadensis*) are present in the lower Columbia region and may represent a substantial predation source on juvenile salmonids. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food. These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed. Additionally, other hatchery fish may be a source of competition for Cowlitz chinook.

(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). The potential exists for large-scale hatchery releases of fry and fingerling ocean-type chinook salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be "overgrazed" when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Listed fish can be impacted through a complex web of short and long term processes and over multiple

time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

3) Salmonid and non-salmonid fishes or other species that could positively impact the program. Returning chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system. There are no species that are known to directly positively impact the program. Multiple hatchery programs salmonids releases into the Columbia river system along with listed species (section 2), benefit the program by providing additional predation opportunity in the Columbia mainstem and estuary. Numerous non-salmonid fishes sculpins, lampreys and sucker etc. also would provide the same indirect benefits.

4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program. A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Wild co-occurring salmonid populations might be benefited as hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Successful or non-successfully spawner adults originating from this program may provide a source of nutrients in oligotrohic coastal river systems and stimulate stream productivity. Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996).

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.

Wallace Pond is a privately owned gravel pit pond of approximately 20 surface acres. Springs water seeps into Wallace Pond although the amount is unknown. Water seeps through the existing dike road, which separates the pond from the river. Water temperatures reflect ambient temperatures occurring in the river although thermal heating on warm days can elevate the temperatures in the net pens. Water temperatures during the rearing period is generally from the low 40's to the low 50's upon release in March.

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.

As the Wallace Pond is a privately owned gravel pit pond of approximately 20 surface acres, it is segregated from the Cowlitz River. There is no access to the pond by other fish. The facility operates within the limitations established in its National Pollution Discharge Elimination System (NPDES) permit and the production from this facility falls below the minimum production requirement for an NPDES permit.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam (constructed in 1969) across the river (length of 318') and an associated fish ladder. The Barrier Dam directs migrating adult fish to the fish ladder, which leads to the salmon hatchery sorting facilities. There are right and left bank entrances to the fish ladder and an under spillway transport channel connecting the two ladder entrances. Fish move up the ladder to the sorting, transfer and holding facilities. Since construction, neither the transport channel nor the left bank entrances are in use because of design problems with the attraction flow. There is also an electrical field at Barrier Dam to aid in blocking fish. Adults can be sorted to holding ponds or also held in one of six circular tanks if they are to be transported. The adults can also be transferred to a number of other ponds via transfer tube.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	-	-	-	-
5	Concrete Ponds	10000	100	20	5.0	2000

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

Adult fish and occasionally juveniles, to be transported from the Cowlitz Salmon Hatchery fish separation unit, are held in one of six 643 cubic feet circular tanks at the adult trap and separator. Tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon, one 1500 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities. Adult upriver hauls can take up to one hour

5.3 Broodstock holding and spawning facilities.

Adults are separated to the following ponds for holding or transfer. The circular tanks are designed to hold up to 1,250 pounds of fish.

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643				
5	Concrete Ponds	10000	100	20	5.0	2000

5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Techna Vertical Stack Units (16 trays/Stack Unit)	216 (3456 Trays)	3-5	-	7000	7000

There are 272 stacks of vertical incubators (Heath Techna). TPU proposal calls for replacing these with 140 stacks of new vertical stack incubators. Each stack consists of 16 trays which are divided into two 1/2 stacks of 8 trays with separate water supplies. Each half-stack has a separate water supply at 3 gpm (to hatch).. Fry are incubated at 5 gpm (to ponding) and confined in ConWed substrate to discourage excessive swimming.

5.5 Rearing facilities.

The Cowlitz Salmon Hatchery has 36 modified Burrows ponds and 17 ponds (kettles). In addition, 12 BPA Stress Relief Ponds and two starter vessels were added to this facility in 1996 to assist the Upper Cowlitz River Reintroduction Program. See also below:

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
36	Modified Burrow Ponds	16000	100	20	8.0	2000	1.61	0.3
17	Concrete Kettle Ponds	4000	100	5	8.0	330	1.61	0.3
1	Concrete Raceway	2000	100	5	4	330	1.61	0.3

5.6 Acclimation/release facilities.

From CSH: Releases are from rearing ponds (see section 5.5) discharging into the Cowlitz River upstream of the fish barrier dam.
For upper river fingerling releases: Cowlitz Falls Dam presents a barrier which impedes or prevents downstream migration of smolts from the Upper Cowlitz. However, the dam includes a juvenile bypass system.

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

Sand and debris still accumulate in these small inlet jets and reduce water flow from the optimum of 2,300 gpm. This flow constraint contributes to causing the flow indexes to exceed the allowable contract value of 1.0 in the coho and fall chinook ponds. End walls on the south side of the hatchery still leak profusely, even after gaskets were replaced by Tacoma Power (TP) employees. These leaking end walls allow juvenile salmon to escape from the ponds into the center channel and then out to the river via the waste way making inventory control impossible. These end walls also leak water from the center channel into the juvenile rearing ponds. This allows infectious organisms from the returning adults to infect the juvenile fish being reared on that side of the hatchery. Kettle gates have also allowed fry to escape during planting of our yearling smolts. This problem was addressed by T.P. employees by cementing some of the kettle gates closed.

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.

During trapping season, tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to any listed adult fish.

The hatchery has two back-up generators located in separate sheds. One of these generators has sufficient capacity to operate the two-200 hp pumps and two of the 600 hp pumps along with the residences in the event of a power outage. A new 1.5 KBW generator with upgraded switching equipment was also installed in 1999. The new generator is capable of suppling the power

previously supplied by the three previous generators combined. Tacoma Public Utilities has retained the 600 KW generator and switching equipment in case the new generator should ever fail. Tacoma Public Utilities staff maintains the facility. Tacoma Public Utility staff and Washington Department of Fish and Wildlife Staff test the emergency systems weekly. In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery. At the stress relief ponds, water is stored in empty ponds for flushing in case fish need to be released due to lack of flow. Also, a water supply shunt valve was installed in 1999 to bypass the de-nitrification columns to provide water during the time the auxillary power is being used.

Fish are reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss. The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.

Spring chinook adults are inoculated with Erythromycin for Bacterial Kidney Disease. They undergo ELISA segregation during rearing, as well as oral prophylactic treatments with Erythromycin. All fish for hatchery production are below low ELISA fish. Efforts are currently underway to improve fish health and reduce the amount of drugs used by lowering fish rearing densities as much as possible during all stages of the rearing cycle. Water inflow jets on all the north side ponds for spring chinook rearing have been upgraded in order to provide the water needed to reduce rearing densities.

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.

- Fish are not reared in multiple facilities or with redundant systems to reduce the risk of catastrophic loss.
- The facility is sited so as to minimize the risk of catastrophic fish loss from flooding.
- Staff is notified of emergency situations at the facility.
- The facility is continuously staffed to assure the security of fish stocks on-site.

Section 6. Broodstock Origin and Identity

6.1 Source.

(From Cowlitz Salmon Spring Chinook HGMP). Only Cowlitz River spring chinook returning to CSH have been used for brood stock since 1967.

6.2.1 History.

(From Cowlitz Salmon Spring Chinook HGMP). Historically, there were 3 demographically independent populations in the Tilton, Cispus, and Upper Cowlitz River Basins. These populations were homogenized into a single hatchery stock, which is currently released into the Lower Cowlitz River. Although the hatchery program has not achieved its mitigation goal, that hatchery has been able to maintain production using locally returning adults. The average natural escapement has been 232 (1990-1999), with the majority of these thought to be hatchery produced. The hatchery stock represents one of the few remaining spring Chinook salmon populations in the LCR chinook salmon ESU, and is vital to the reestablishment efforts in the basin (Biological Opinion, Section 7 for FERC 2016. NOAA Consultation No. 2001/02045).

6.2.2 Annual size.

(From Cowlitz Salmon Spring Chinook HGMP). A total of 800 adults identified by adipose fin clipped will be used for broodstock. From 1990-2000, an average of 745 females and 618 males were used in the broodstock collection. No estimates can be made on the proportion of natural fish used for broodstock during that period.

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

(From Cowlitz Salmon Spring Chinook HGMP). Since 1967, no estimates can be made on the proportion of natural fish used for broodstock. Mass marking of spring Chinook began with 1997 brood year fish (1999 releases). Since 1997 and the introduction of mass marking, no natural populations of spring chinook will be collected for broodstock. The program will attempt to implement an integrated program based on wild spring Chinook re-established in the upper basin. This decision could take 12-15 years at which time a preferred management approach (Segregated versus Integrated) will be made for the hatchery production in the basin. Until this decision is met, only adipose fish will be used in the broodstock program.

6.2.4 Genetic or ecological differences.

(From Cowlitz Salmon Spring Chinook HGMP). Cowlitz Salmon Hatchery spring Chinook stock is believed to be a mixture of all historical populations of Cowlitz River spring Chinook populations. Between 1948 and 1993, 96 percent of all spring Chinook released in the Cowlitz River were Cowlitz Hatchery stock. Spring chinook in the Cowlitz River are a hatchery stock of mixed origin, and very few individuals are produced from natural spawning (WDF et. al. 1993). Natural escapement from 1990-1999 was 232 fish of which a majority were believed to be hatchery fish.

Stock mixing likely began when hatchery supplementation was initiated in 1967 at the salmon hatchery below Mayfield Dam (WDF et. al. 1993). Genetic analysis in the 1980s indicated that Cowlitz Salmon Hatchery spring chinook were genetically similar to, but distinct from, Kalama Hatchery and Lewis River wild spring chinook and significantly different from other lower Columbia River spring chinook stocks. (LCFRB Basin Plans 2004).

6.2.5 Reasons for choosing.

(From Cowlitz Salmon Spring Chinook HGMP). Cowlitz Salmon Hatchery spring Chinook stock is a mixture of all historical populations of Cowlitz River spring Chinook populations and genetically representative of the legacy population.

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.

(From Cowlitz Salmon Spring Chinook HGMP).

- Broodstock protocols and procedures of the program will assure that sufficient numbers are collected to minimize founder effects of locally adapted populations re-introduced into the mainstem Cowlitz and tributaries.
- Program broodstock is collected from marked adult volunteers of Cowlitz Hatchery returning to the barrier dam.
- Hatchery adults have been deemed appropriate for use along with unmarked fish to be transported and released in the upper Cowlitz basin/tributaries for natural spawning (FHMP 2004).
- Wild fish are not used in the broodstock collection while upriver re-introduction programs are on-going.

Section 7. Broodstock Collection

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

Up to 1,100 adults and up to 20 jacks are collected.

7.2 Collection or sampling design

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam across the river (length of 318') with an associated fish ladder. Fish move up the ladder to the sorting, transfer and holding facilities. Broodstock collected represent the widest possible adult return timing and, within a dult return groups, represent a wide range of egg-take dates. Currently, broodstock is separated into three groups: April - May 15; May 16 - June 6 and June 7 - August. Biologists periodically review collection procedures, as fish are kept for broodstock while other fish are shipped upstream. In season collection adjustments are made in collaboration with biologists in the WDFW Fish Management section. Representative samples of the population are collected with respect to size, age, sex ratio, run and spawn timing, and other traits important to long-term fitness. Spring chinook collection occurs from March through late August.

7.3 Identity.

Mass marking of spring Chinook began with 1997 brood year fish (1999 releases). All hatchery-origin spring chinook except for fingerlings taken to the upper watershed are marked either with an adipose-fin clip only or adipose-fin clip/coded-wire tag. For spring release 2005, 2003 brood year fish will be 10.9% adipose clipped and coded wire tagged (CWT) with the remainder 88.9% fin clipped. 55,000 spring Chinook transferred to the Friends of the Cowlitz (FOC) rearing site in the lower river (Wallace Ponds) are 100% adipose clipped.

All adult fish are hand sorted at the Cowlitz Salmon Hatchery and only hatchery fish of the appropriate time and number are retained for spawning use. Since 1997 and the introduction of mass marking, natural spring chinook have not been integrated within the current broodstock. For years prior to mass marking no estimates can be made on the proportion of natural fish used for broodstock.

Wild production including fry releases (RV or LV) plants are identified at the CSH separator facilities and hauled to the upper Cowlitz system. Releases in 1999 (1997 BRD) spring chinook released from the Cowlitz Salmon Hatchery were 100% adipose-fin clip/coded-wire tagged. For the 1996 brood year, 75% of the population was adipose-fin clipped/coded-wire tagged for "time of release" and "prophylactic Aquamycin" survival studies. Finally, the 1998 brood Cowlitz spring chinook were "mass marked" with adipose-fin clip only except for a group marked (adipose-fin clip/coded-wire tagged) for required Section 10 evaluation and an additional feed regime study.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):
1,100 adults and up to 22 jacks.

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

Year	Adults		
	Females	Males	Jacks
1990	829	884	25
1991	906	756	25
1992	843	723	27
1993	974	707	17
1994	776	613	53
1995	772	533	75
1996	813	647	58
1997	663	494	36
1998	358	350	14
1999	572	478	66
2000	690	614	67
2001	656	491	*158
2002	532*	625*	143*
2003	491*	460*	37*
2004	705*	533*	59*

*Total number collected for brood including mortality and culled.

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

In the past, first time arrivals could be opercle punched and recycled downstream to Olequa Creek area in the lower river. Recaptures back to Cowlitz Salmon Hatchery were transported to the upper river. In 2002, 46.1% were recaptured after release. In the future all available adults above hatchery need (AHN) will be transferred to the upper Cowlitz.

Returning hatchery adults provide significant escapement and nutrient needs to the upper system. In 2004, 97.7% of the 10,969 adults used for the upper river reintroduction were hatchery origin fish (Serl and Morrill, Draft 2004). Spring chinook that returned to the Cowlitz Salmon Hatchery separator are sorted and those fish designated for the upper watershed were placed in holding tanks. These are transported and released by Tacoma Power at the boat launch to Lake Scanewa at the LCPUD Day Use Park. Since the mid 1990's, more than 20,000 adult spring Chinook hatchery-origin fish along with natural origin spring Chinook have been transported above Cowlitz Falls Dam as part of the reintroduction program **(Table 10**). Adaptive management plans have spring chinook adults distributed in the Upper Cowlitz at Packwood and the Cispus

River to spread reintroductions due to temperature and fall back problems in Lake Scanewa. Under the draft FHMP, no restrictions on placing hatchery fish upstream will occur until a trigger of 40% fish passage survival is achieved with current survival under 20%.

Table 10. Spring Chinook Adults transported to the Upper Cowlitz River Basin, 1996 – present (Draft Cowlitz Annual Reports 2004).

Year	Unsexed	Female Ad Clip	Female Unmark	Male Ad Clip	Male Unmark	Jack	Total
2004		4,786	116	5,928	139	502	11,471*
2003		4,218	264	3,805	284	18	8,589**
2002	1,465	119	unk	179	unk	50	1,787
2001		68	unk	60	unk	0	128
2000		98	unk	106	unk	0	204
1999		53	unk	38	unk	177	268
1998		0	unk	0	unk	0	0
1997		0	unk	25	unk	26	51
1996		2	unk	4	unk	0	6

*4 reported mortality due to transfer.
** 2 reported mortality due to transfer.
Source - *DRAFT* 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT

7.6 Fish transportation and holding methods.

Fish collected at the Cowlitz Salmon Hatchery for broodstock are held in ponds that are 20' X 100' X 5.5'. From here they can be transferred from the ponds to the spawning room where they can be checked for ripeness, anesthetized and spawned or returned to a holding pond via a return tube (if not ripe).

Adult fish, and occasional juveniles, to be transported are held in one of six 643 cubic foot circular tanks at the adult trap and separator. These tanks are designed to hold up to 1,250 pounds (lbs.) of fish. There are two 1,500 gallon tanker trucks capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck (2)	1500	Y	N	30-60	NA	NA
Tanker Truck (1)	750	Y	N	30-60	NA	NA
Tanker Truck (1)	1000	Y	N	30-60	NA	NA
Tanker Truck (Several)	250	Y	N	30-60	NA	NA

7.7 Describe fish health maintenance and sanitation procedures applied.

All fish held for spawning are treated with formalin at 1:6000 for fungus and parasite control. Spring chinook adults are inoculated with Erythromycin (liquamycin) for *bacterial kidney disease (BKD)* at a rate of 0.5cc/10lbs of fish. A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic fish.

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. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning. Spawning implements are rinsed with an iodophor solution, and spawning area and implements are disinfected with iodophor solution at the days end of spawning.

7.8 Disposition of carcasses.

Presently, all spawned carcasses and mortalities are buried at a Tacoma Public Utilities upland site and not utilized for nutrient enhancement. Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed for broodstock fish health inspection , transfer of eggs or adults and broodstock holding and disposal of carcasses.

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.

- All broodstock collected will be of hatchery-origin (marked).
- Fish are collected throughout the entire run which occurs from March through late August.
- Spawners are selected randomly over the entire run from fish arriving at both traps.
- Males and females available on a given day are mated randomly.
- Broodstock are inoculated with antibiotics for BKD in the pond and treated with formalin for fungus. With directed goals to improve fish rearing conditions, enzyme linked immunosorbant assay tests (ELISA) were used on all spawned spring chinook females. This allows for the rearing of offspring from parents with low levels of bacterial kidney disease (BKD) separately from those with high levels of BKD. This year's spring chinook IHN test results came back positive.
- Wild spring chinook adults hauled to the upper basin are transported directly from the holding tanks to trucks via fish with water displacement method that results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river.

Section 8. Mating

8.1 Selection method.

Fish are collected throughout the entire run which occurs from March through late July/early August. Currently, broodstock are selected randomly and separated into three groups: April - May 15; May 16 - June 6; June 7 - August. Males and females available on a given day are mated randomly. Spawners are selected randomly over the entire run from fish arriving at both traps. Numbers set aside represent that percentage of the total run that is collected during that particular sorting period. Males are normally used once except when the following occurs; when too few males per ripe females exist then they are live spawned and returned to pond (occasionally occurs at the first and last spawnings). Final spawning in 2004 occurred on September 23rd, with an adjusted egg take of 1,747,100 eggs.

8.2 Males.

Males are normally used once except when the following occurs; when too few males per ripe females exist then they are live spawned and returned to pond (occasionally occurs at the first and last spawnings). Precocious males (0.02%) of the male population used for broodstock. are used as a set percentage or in proportion to their contribution to the adult run.

8.3 Fertilization.

Equal sex ratio and 1:1 matings with no pooled gametes (refer to previous section for additional information when 1:1 ratio does not exist). Pathogen free water is added to enhance fertilization.

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.

- Listed natural fish will not be used.
- Males and females available on a given day are mated randomly.
- After water (pathogen free) is added to enhance fertilization, the fertilized eggs from each female are disinfected and water hardened in an iodine solution for one hour.
- Every season, 60 ovarian fluid samples are taken to check for IHNV.
- ELISAs are done on all females.
- Eggs are isolated according to ELISA values.
- "Below-low" ELISA designations are ponded and reared separately.
- Various combinations of spring chinook with low, moderate and high ELISA values are reared from year to year in one or two rearing units, segregated from all fish with "below-low" ELISAs. Gametes are not pooled prior to fertilization.
- Hands and spawning implements are rinsed in an iodophore solution between individual spawnings.

Section 9. Incubation and Rearing.

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

The egg take goal is 1,806,000. The overall average green egg fecundity was 4,435 per hen. See also 9.2.1.

9.1.2 Cause for, and disposition of surplus egg takes.

In cases where egg survival exceeds criteria and/or surplus eggs are taken, fish would be outplanted as unfed fry into the Upper Cowlitz subbasin/tributaries or provided to cooperative programs. There have been a number of reasons for taking excess eggs. A few examples are uncertainty of fecundity, compensation for anticipated shortfalls at other facilities and inventory variation due to hatchery design and changing pond cleaning methods. Prior to the 1993 brood spring chinook, unfed fry from excess eggs were planted through the hatchery wasteway to the river. Later broods were no longer planted as unfed fry. Zero age plants through the hatchery wasteway to the Cowlitz River ended with the 1996 brood spring chinook. Currently, all spring chinook are utilized based upon program priorities: Cowlitz Salmon Hatchery yearling production, Upper Cowitz River Restoration Project (Cowlitz Falls Dam smolt collection), in basin cooperative rearing programs (Wallace Pond) and SAFE support (Deep River Net Pens).

9.1.3 Loading densities applied during incubation.

Spring chinook eggs are typically ~ 1,590 eggs/pound (lb.) Standard loading per Heath tray at eyeing is 7,000 eggs/tray. Prior to this, the trays are loaded one female per tray for ELISA separation. When results of tests are known, eyed eggs with like-ELISA values are combined into 7,000 egg/tray. Heath vertical incubators consist of 16 trays divided into two 1/2 stacks of 8 trays. Each half-stack has a separate water supply at 3 gpm (to hatch). Fry are incubated at 5 gpm (to ponding) and confined in ConWed substrate to discourage excessive swimming. Water flow to fry below 6 gpm is known to reduce or eliminate Bacterial Cold Water Disease (BCWD) in the early life history of salmon in vertical incubators.

9.1.4 Incubation conditions.

All eggs are water hardened in a 100-ppm iodophor solution for 1 hour and hatched in vertical incubators with flows set at 5 gallons per minute. Chinook eggs are hatched at 7,000 eggs per tray. After eyeing and picking of the eggs, vexar, a plastic substrate, is placed into the tray to promote resting. This promotes healthier, larger and more uniform fry development. The overall average green egg fecundity in 2004 was 4,435. Typically, in an ½ stack (8 trays) incubation unit with eggs, influent water to top tray has a dissolved oxygen (DO) content of 11 parts per million (ppm) while the effluent water at bottom tray has ~9 ppm at < 50 degrees Fahrenheit. Influent total gas continues to be variable and sometimes unacceptably high depending upon well and other water sources. Total gas in influent water in the header trough has exceeded 113% and influent water is typically above 100% saturation as measured by HARZA N.W. and the Cowlitz crew. Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD). A fish pathologist routinely checks for Infectious Hematopoeitic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD). All equipment in the rearing ponds is sanitized with an iodine solution after each use.

9.1.5 Ponding.

Spring chinook fry are ponded when less than 1 millimeter (mm) of yolk is showing. They typically have accumulated ~1780 Temperature Units (TU's), are ~1200 fish per pound (fpp) and are ~36 mm long. At the Cowlitz Salmon Hatchery these fish are usually ponded between mid-November and late December. Ponding is forced, as Heath incubators do not lend themselves to volitional ponding of swim-up fry.

9.1.6 Fish health maintenance and monitoring.

Salmon fungus (*Saprolegniasis)* is the primary concern during incubation requiring daily treatments with formalin at 1:600 for 15 minutes. Water flow to fry below 6 gpm is known to reduce or eliminate Bacterial Cold Water Disease (BCWD) in the early life history of salmon in vertical incubators. Excessive gas in the incubation influent water is variable and appears to be associated with periodic increases in yolk coagulation in eggs and fry. A fish pathologist routinely checks for Infectious Hematopoeitic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD).

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.

Egg are incubated at density levels that have proven to be effective and safe. Disinfection procedures are implemented during incubation that prevent pathogen transmission between stocks of fish on site. Headboxes are equipped with low water level monitoring alarms.

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. For 1988-1991, the average fry to smolt survival was 88% (IHOT, 1996).

Year	Egg Take	Green-Eyed Survival (%)	Fingerling-Smolt Survival (%)
1990	3388000	94.1	
1991	3767000	82.2	96.8
1992	3337000	93.5	96.0
1993	3769000	90.9	92.0
1994	2805000	92.5	92.0
1995	2684000	86.5	95.6
1996	2663500	94.5	93.1
1997	2469600	91.6	86.5
1998	1368012	95.1	96.3
1999	2301200	91.3	94.7
2000	2209657	91.9	83.4
2001	2272881	92.0	85.3
2002	1871400	NA	NA
2003	1791600	95.8	NA
2004	1700200	NA	NA

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

In recent years, there has been an increased emphasis on controlling numbers of fish reared to enhance quality. Densities are < 0.5 lbs/ft³ and at release the density index is ~0.1. At this time, the yearling spring chinook program is based upon stocking 16 ponds at 60,000 fish each and planting 912,000 yearlings (5% loss) at 4 fpp. Historically, spring chinook pond loadings have been higher than desirable. Past high densities with 90,000 fish/pond were around 0.75 lbs/cubic foot, Density Index = 0.14 lb/cubic foot/inch and loadings above 6 lbs/gpm flow or Flow Index = 1.2 lb/gpm/inch. At 60,000 fish/pond, typically had a Density Index of 0.11 and a Flow Index of >0.9. The goal is to not exceed a Density Index of 0.1 and maintain a Flow Index of around 0.3 to 0.6.

9.2.3 Rearing conditions.

Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers. IHOT standards are followed for: water quality , alarm systems , predator control measures to provide the necessary security for the cultured stock , loading and density.Total gas and corresponding DO's have been extensively monitored by HARZA N.W., contractors with TPU. Due to the re-circulating nature of the Cowlitz Salmon Hatchery ponds, DO's of influent and effluent water are often nearly the same. For example, with water temperatures at 46° Fahrenheit, a pond of fish had 8.4 ppm DO influent and 9.0 ppm DO in effluent water. When total gas at the influent end of a kettle (a rearing vessel) is at 100% saturation and DO saturation is 100%, these ponds operate as one would normally expect. For example, at 8° C, a kettle with 1,100 lbs of fish had an influent DO of 11.1 ppm and an effluent DO of 9.6 ppm. Carbon dioxide has not been measured in recent years.

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.

See section 9.2.5 below.

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

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
December (At Swimup)	35	1100	0.00035	
January	39	700	0.00035	0.364
February	50	300	0.00035	0.571
March	60	175	0.00035	0.417
April	66	140	0.00035	0.300
May	73	98	0.00035	0.235
June	80	75	0.00035	0.280
July	90	54	0.00035	0.222
August	97	42	0.00035	0.167
September	103	35	0.00035	0.2857
October	116	25	0.00035	0.200
November	123	20	0.00035	0.450
December	130	17	0.00035	0.150
January	140	14	0.00035	0.177
February	151	11	0.00035	0.214
March	165	8	0.00035	0.273

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*).

Spring chinook are kept on a moist diet due to the consistent ability to add Erythromycin to this feed for prophylactic treatments against BKD. Spring chinook are started on BioDiet Starter #3, then fed BioMoist Grower and BioMoist Feed. The 1995 brood spring chinook were fed 353,918 lbs of feed, the 1994 brood were fed 365,963 lbs and the 1993 brood were fed 554,394 lbs of feed. Overall feed conversions, including overwintering of yearling groups averages around 1.6:1. Zero age spring chinook, particularly late ponded fish and fish destined for plants at 0+ age, are fed as much as 2.5 - 3% B.W./day. Yearling groups, as water cools in December prior to release, are sometimes fed as little as 0.5% B.W./day.

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
1200-440	Bio Diet Starter #3	5-8	3.5	0.225	1.3
440-340	BioMoist Grower 1.0mm	3-4	2.5	0.200	1.3
340-110	BioMoist Grower 1.3mm	1-3	1.0-2.0	0.200	1.3
110-70	BioMoist Grower 1.5mm	1	0.5-1.0	0.230	1.3
70-40	BioMoist Feed 2.0mm	1	0.5	0.005	1.4
40-20	BioMoist Feed 2.5mm	1	0.5	0.010	1.4

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

FOC feeds regularly through the week and reports any problems to the staff a Cowlitz Salmon Hatchery. A fish health specialist can monitor the health of fish on a regular basis or as needed. Fish being reared at these net pens have been doing very well over the past few years. BKD is treated in at the hatchery with prophylactic treatments before transfer. After transfer, a final Aquamycin treatment is given in February before release. Mortality is removed form the net pens and disposed of at a landfill.

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

None used at this time. Although, organosomatic indexes were conducted by personnel from the WDF fish health section during late 1980s and early 1990s under BPA funding. ATPase work was conducted by Wally Zaugg, NMFS, in the early 1980s and reported in the Proceedings of the Northwest Fish Culture Conference for the fish released in the Cowlitz River.

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

None. Mimicking the natural environment in rearing ponds will be a goal for the future CSH remodel (Article 7, FERC 2016).

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

See HGMP sections 5.8, 6.3, 7.9 and 9.1.7 for risk aversion measures taken under this propagation program.

Section 10. Release

10.1 Proposed fish release levels.

Current FBD is for 55,000 smolts annually.

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

Wallace Pond (Toledo Sand & Redi-Mix), is located adjacent to the Cowlitz River at approximately RKM 41.1. Fish are released from net pens located in Wallace Ponds directly to the river.

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

Release Year	Yearling Release		
	No.	Date (MM/DD)	Avg Size (fpp)
1991	10,000*	April	Na
1992	14,800* 41,500^	3/29/92 4/2/92	6.5 6.5
1993	15,000*	5/1/93	7.1
1994	19,000* 7,000**	May May	5.0 5.0
1995	11,500* 24,800** 23,700**	12/5/94-4/7/95 12/6/04-3/13/95 2/5/94- 3/13/95	5.0
1996	34,000^	4/15/96	5.0
1997	NA	NA	NA
1998	NA	NA	NA
1999	19,800^	3/2-3/4/04	5.65
2000	NA	NA	NA
2001	NA	NA	NA
2002	NA	NA	NA
2003	50,000^	3/25/04	10.8
2004	56,965^	3/15/04	9.5

***Releases made from Stones Pond (since discontinued).**
****Fish reared in Janisch Pond Net Pens (since discontinued).**
^ Wallace Pond Rearing

10.4 Actual dates of releases and description of release protocols.

See dates of release above in section 10.3. Fish have been reared in net pens anchored in Wallace Pond from November to March. For release, the net pens are towed approximately 100 meters to the northwest section of Wallace Pond. This is where a dike road separates Wallace Pond from the Cowlitz River and is at it's narrowest. A six inch diameter PVC pipe is embedded through the dike and extends out approximately 7' over an off channel section adjacent to the river. Fish need to be pumped from the pens through the pipe extending approximately 150' to where the end of the pipe spills to the river. This is a forced release when fish reach program size in early March.

10.5 Fish transportation procedures, if applicable.

Equipment Type	Capacity (gallons)	Supp. Oxygen (y/n)	Temp. Control (y/n)	Norm. Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Tanker Truck (2)	1500	Y	N	30-60	NA	NA
Tanker Truck (1)	750	Y	N	30-60	NA	NA
Tanker Truck (1)	1000	Y	N	30-60	NA	NA

Fish are transferred from CSH to Wallace Ponds in the tankers above.

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

Fish are reared in the Wallace Pond Net Pens for approximately four months prior to release. Water for Wallace Pond seeps through the dike road directly from the Cowlitz River and regulates the level of the pond with some spring seepage feeding the pond also reported. Both spring Chinook and summer steelhead releases imprint to this lower release site as fishing guides congregate to this area heavily (pers. comm. Don Glaser).

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

Only a set program number as identified in the FBD are transferred to the Wallace Pond site.

10.9 Fish health certification procedures applied pre-release.

Prior to release, population health and condition is established by the Cowlitz Complex Fish Health Specialist. This is commonly done 1-3 weeks pre-release. 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.

The net pens would elevate within Wallace Pond due to flooding. Net pen material allows water exchange even in flooding conditions.

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.

- Releases are consistent with past history indicating the time, size and conditional release of smolts for migration fitness and smoltification occurs within nearly the entire population, which reduces residence time in the river after release.
- Current size of release experiments in the lower river will be used to improve survival and result in additional information needed for life history traits
- Physiological measures, including allowable population fork length standard deviation (STD) and coefficient of variation (CV) maximums, will be used to monitor growth and population variations
- Fish are acclimated for several weeks at the site before release.

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.

In addition to the regional monitoring activities associated with this program, see section 2.2.3-Monitoring, the Cowlitz Hatchery evaluation Biologist monitors and evaluates the following factors associated with this hatchery program: Condition Factor of hatchery spring chinook smolts prior to release, Smolt-to-Adult survival rates of hatchery spring chinook releases, Freshwater harvest levels for hatchery program releases. In association with upper Cowlitz watershed recovery efforts, the Cowlitz Hatchery evaluation Biologist also operates the smolt trap at Mayfield Dam. This trap receives emigrating juveniles generated from plants and natural production in the Tilton River watershed.

As part of Tacoma Powers mitigation for the Cowlitz River dams, WDFW is funded to conduct monitoring and evaluation of the fisheries resources in the lower Cowlitz River. These include spawning and population monitoring of wild steelhead and fall chinook, angler surveys, biological sampling of the hatchery escapement and hatchery practice studies. This work is reported in the Cowlitz Fish Biologist Annual Reports (WDFW, Olympia). Populations of wild fall chinook are monitored by aerial redd counts and biological sampling of carcasses for age, mark and other population data. The aerial surveys have been conducted annually since the 1970s. Seining and CWT tagging of fall Chinook juveniles to estimate survival has also begun on the lower river.

The completion of the Surface Collection System and Fish Facilities at the Cowlitz Falls Dam in 1996 marked the beginning of a unique opportunity to restore anadromous salmonids to an estimated 240 linear miles of historically productive habitat in the upper Cowlitz and Cispus watersheds. Since then, WDFW funded by Tacoma Power, has monitored productivity of spring Chinook, late winter steelhead, coho and cutthroat trout. Fish Collection Efficiency (FCE) is monitored by mark-recapture of steelhead, coho and age-zero spring chinook smolts that are marked with visible implant elastomer tags.

The Cowlitz River Fisheries and Hatchery Management Plan is a component of the Cowlitz Hydroelectric Project Settlement Agreement with a large component of monitoring and evaluation of the upper basin recovery. Currently monitoring is being conducted as a component of the Cowlitz Evaluation Program funded by Tacoma Power. Current funded activities include: hatchery broodstock sampling for biological and mark information; Lower Columbia River fall chinook spawning ground surveys for naturally spawning fall chinook, including aerial redd counts and biological and mark examination of carcasses; tributary steelhead spawning ground surveys for abundance; operation of Mayfield Dam juvenile collector to enumerate juvenile out-migration; creel survey of lower Cowlitz and reservoir fisheries; warm water fish population composition and abundance surveys on Mayfield Lake and Swofford Pond, reintroduction of coho, steelhead, and cutthroat into the Tilton River and hatchery production evaluations. These activities focus on the Lower River and Tilton. This plan and future decisions will be guided by a Fisheries Technical Team. Fisheries obligations will be met through a combination of effective upstream and downstream passage, habitat restoration and improvement, and an adaptive management program.

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

Tacoma Public Utilities funds the staffing and support logistics for the program monitoring and evaluation. Staffing is comprised of and derived from a pool of personnel used in fish cultural and pathology related tasks.

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 activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS – 222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

Section 12. Research

12.1 Objective or purpose.

See Cowlitz River Spring Chinook HGMP

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

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

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.

Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

Dammers, W., P.A. Foster, M.Kohn, C. Morrill, J. Serl, G. Wade. 2002. Draft Cowlitz River Subbasin summary, prepared for the Northwest Power Planning Council. Columbia Basin Fish and Wildlife Authority, Portland, Oregon.

Dawley, E. M., R.D. Ledgerwood, T.H Blahm, R.A. Kirn, and A.E. Rankis. 1984. Migrational Characteristics And Survival Of Juvenile Salmonids entering the Columbia River estuary During 1983. Annual Report to the Bonneville Power Administration, Portland, OR.

Easterbrooks, J. 1980. Salmon production potential evaluation for the Cowlitz River system upstream of the Cowlitz Falls Dam site. Washington Department of Fisheries.

Fuss, H.J., J. Byrne, and C. Ashbrook. 2000. Migratory Behavior and Incidence of Post-Release Residualism of Hatchery Reared Coho and Chinook Salmon Released into the Elochoman River, WDFW Annual Report FPA99-08.

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

Harza 2000. Lower Clark Fork River Fish Transport Plan. Final Report to Avista Corp. Portland, Oregon, 32 pgs.

Hawkins, S.W., Tipping, J. M. 1999. Predation By Juvenile Hatchery Salmonids on Wild Fall Chinook Salmon Fry in the Lewis River, Washington. California Fish and Game 85(3):124-129

Healey, M. C. 1991. Life history of chinook salmon. Pages 311–394 in C. Groot and L. Margolis (eds.), Pacific salmon life histories. Vancouver, BC: University of British Columbia Press. Groot and Margolis 1991

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.

Lichatowich, J. A., and J. D. McIntyre. 1987. Use of hatcheries in the management of Pacific anadromous salmonids. American Fisheries Society Symposium 1: 131-136.

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.

McElhany, P., T.Bachman, C. Busack, S. Heppell, S. Kolmes, A. Maule, J. Myers, D. Rawding, D. Shively, A. Steel, C. Steward, and T. Whitesel. 2003. Interim report on viability criteria for Willamette and Lower Columbia Basin Pacific salmonids. Unpublished report. NOAA Fisheries.

McNeil, W.J. and D.C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.

Mobrand Biometrics, Inc. August, 1999 Draft. The EDT Method. 9920 SW Bank Rd, Vashon, WA 98070. (206) 463 5003.

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.

Myers, J.M., C. Busack, D. Rawding, and A. Marshall. 2002. Identifying historical populations of chinook and chum salmon and steelhead within the Lower Columbia River and Upper Willamette River Evolutionarily Significant Units. May 10, 2002 Co-manager Review Draft. Willamette/Lower Columbia River Technical Recovery Team.

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

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.

Reimers, P .E. 1973. The length of residence of juvenile fall chinook salmon in the Sixes River, Oregon. Fish. Comrn. Ore. Res. Briefs. 4:1-43.

Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian Predation on Juvenile Salmonids in the Lower Columbia River 1997 Annual Report. Bonneville Power Administration Contract 97BI33475 and U.S. Army Corps of Engineers Contract E96970049. 70 p.

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

Serl, J., and Morrill, C. 2004. Draft: 2004 Annual Report for the Cowlitz Falls Project. Washington Department of Fish and Wildlife. Olympia.

SIWG (Species Interaction Work Group). 1984. Evaluation of potential 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 Dept. of Fish and Wildlife. Olympia, WA. 80 pp.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fish

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.
Washington Department of Fisheries (WDF). 1951. Planning Reports. Lower Columbia River Fisheries Development Program. Preliminary draft, August 1951. 211 p. + appendices

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.

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.

WDW (Washington Department of Wildlife), Confederated Tribes and Bands of the Yakima Indian Nation, Confederated Tribes of the Colville Indian Reservation, and Washington Department of Fisheries. 1990. Methow and Okanogan rivers Subbasin, salmon and steelhead production plan. Available from the Northwest Power Planning Council, Portland, OR. WDW 1990

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.

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:_____