HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Cowlitz River "Type N" Coho Program
Species or Hatchery Stock:	"Type N" Coho (*Onchorynchus kisutch*) Cowlitz River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Cowlitz River, tributary to Columbia River Washington state
Date Submitted:	July 18, 2001
Date Last Updated:	July 10, 2001

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Cowlitz River "Type N" Coho Program

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

Cowlitz River "Type N" Coho Salmon (*Onchorynchus kisutch*)

1.3) Responsible organization and individuals

Name (and title):	Chuck Johnson, Region 5 Operations Manager Don Peterson, Complex Manager	
Agency or Tribe:	Washington Department of Fish and Wildlife	
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The Cowlitz Salmon Hatchery was constructed by, and is owned, funded and maintained by Tacoma Public Utilities (TPU). It is operated by the State of Washington Department of Fish and Wildlife (WDFW) to mitigate for the impact of Mayfield and Mossyrock Dams on Cowlitz River salmon stocks.

Friends of the Cowlitz (40,000 eyed eggs into lower Cowlitz tributary)
Cowlitz Game and Anglers (40,000 eyed eggs into lower Cowlitz tributary)
Kraus Ryderwood program (1000 adipose clipped fingerlings),
Region 5 educational programs(1,700 eyed eggs).

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

Funding for this program is provided through Tacoma Public Utilities.

1.5) Location(s) of hatchery and associated facilities.

Cowlitz Salmon Hatchery is located on the Cowlitz River (WRIA 26.0002), eleven miles east of I-5 near State Highway 12, south of Salkum, Washington at RM 49. Elevation of the facility is 250 feet (76m) above sea level.

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 "Type N" coho salmon that would have been produced naturally in the Cowlitz River system in the absence of hydroelectric dams built in the Cowlitz River basin; to provide restocking of the upper Cowlitz watershed with coho and to provide a limited number of eggs to other hatchery programs.

1.8) Justification for the program.

This program will be operated to provide fish for harvest while minimizing adverse effects on listed fish. This will be accomplished in the following manner:

1. Release "Type N" coho as smolts with expected brief freshwater residence.

2. Time of release not to coincide with out-migration of listed fish.

3. Mark all reared fish.

4. Consistent with Fish Health Policy, genetics guidelines and NPDES criteria.

1.9) List of program "Performance Standards".

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

Performance Standards and Indicators for lower Columbia River **Integrated Harvest** Coho programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch and measure survivals by periodical CWT data. (if available)

Meet hatchery production goals	Number of juvenile fish released	Estimating number of fish planted (weighing / counting fish), monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW data base. Future Brood Documents.
Manage for adequate escapement	Hatchery and wild return rates Catch rates	Monitoring hatchery/wild return rates through trapping (at the hatchery or at weir), live fish counts in index areas on the spawning grounds plus catch records.

Minimize interactions with listed fish through proper broodstock management	Total number of broodstock collected	Measuring number of fish actually spawned and killed to meet egg take goal at the hatchery. Hatchery Records.
	Sex ratios	Hatchery Records, Spawning guidelines
	Timing of adult collection	Start trapping prior to historical start of the run, continue trapping throughout the run, dates and times are recorded on hatchery divisions "adult reports", data available on WDFW data base.
	Number of listed fish passed upstream	
	Hatchery stray rate	CWT data and spawning ground surveys
	Number wild fish used in broodstock	Hatchery records
	Return timing of hatchery / wild adults	Hatchery records
	Adherence to spawning guidelines	Hatchery records Spawning guidelines

Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	Future Brood Document (FBD) and hatchery records
	Outmigration timing of listed fish / hatchery fish	Hatchery records and historical natural out-migrant data FBD and hatchery records
	Size and time of release	CWT data and mark / unmarked ratios of adults
	Hatchery stray rates	
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	Spawning ground surveys
Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy Fish Health monitoring records
	Fish pathologists will diagnose fish health problems and minimize their impact	
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	

	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

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

5,400 adults (2,700 males and 2,700 females).

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

Life Stage	Release Location	Annual Release Level
Eyed Eggs	Lower tribs to Cowlitz River *	81,700
Unfed Fry		
Fry	Upper Cowlitz River (26.0002)	**1,000,000
Fingerling	Cambell Cr. (26.0443)	1,000
Smolts	Cowlitz River (26.0002), RM 49	***3,200,000

* - Tributaries are Salmon and Lacamas Creeks. 1,700 eggs go to school aquarium projects.
**-To be accomplished only if insufficient adults are available for natural spawning in upper basin.
***-Program reduction from 4,000,000 down to 3,200,000 smolts, beginning with broodyear 2000.

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

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

This program has been in operation since construction of the hatchery in 1967 and the 35 year mitigation agreement between Washington Department of Fish and Wildlife and

Tacoma Public Utilities which is force until December 31, 2001. A new agreement is under negotiation with Tacoma Public Utilities at this time. Tacoma Public Utilities is requesting a 40 year license from FERC.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Cowlitz River (26.0002).

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

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

None

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

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

ESA listed salmonids in Cowlitz basin affected by hatchery coho releases include, late winter steelhead, chinook (spring and fall) and chum. Hatchery coho are released as yearling smolts so as to encourage rapid outmigration and minimize residualization. Spring and fall chinook and chum spawn in the main Cowlitz River downstream of the Cowlitz Salmon Hatchery station release site, while steelhead spawn primarily in downstream tributaries. Therefore the life stage of chinook and chum affected is primarily subyearling (fry/fingerlings) while steelhead affected ar primarily smolts.

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

None

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

Lower Columbia Steelhead, Chinook and Chum, Mid Columbia Steelhead, Upper

Columbia Steelhead and Spring Chinook, Snake River Sockeye, Chinook and Steelhead, Upper Willamette Steelhead and Chinook and Columbia River Bull Trout.

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

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1").*

Critical and viable population thresholds have not been established for the above ESU's and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team to review population status within these ESU's and develop critical and viable population thresholds.

The SASSI report (WDFW) describes the status of coho in the Cowlitz as "depressed".

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Unknown

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Refer to WDFW lower Columbia River FMEP tables 3-6.

Cowlitz River fall chinook natural spawning escapements:

Year	Abundance estimate
1988	7,700
1989	7,220
1990	2,698
1991	2,567
1992	2,489
1993	2,218
1994	2,512
1995	2,231
1996	1,602
1997	2,710
1998	2,108
1999	997

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if

known.

Cowlitz River fall chinook

Year	Hatchery	Natural [1]
1988	2487	5503
1989	3350	4022
1990	1926	824
1991	935	1745
1992	1022	1827
1993	1247	1127
1994	994	1640
1995	1191	1160
1996	561	1146
1997	571	2153
1998	1054	1106
1999	818	227

[1] Includes Lewis River wild strays

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 *(see "Attachment 1" for definition of "take")***.**

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

The Cowlitz Salmon Hatchery is designed to stop or reduce adult fish migration at the barrier dam downstream of the hatchery separator. Adult salmon migrate up a fishway to a trap. The trap is located at the fish separator described in section 6.2.5. We attempt to have broodstock represent the widest possible adult return timing and, within adult return groups, represent a wide range of egg take dates. 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. The hatchery trap is generally operated on a daily basis to reduce impact on listed fish and to return them to the appropriate waters.

Coho smolt releases.

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

Not known.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult)

quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "take" table.

- 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.

Take was modeled as a "worst case" scenario and we do not expect to exceed these levels. However, should this happen, NMFS would be consulted immediately.

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.

US. vs. OR Cowlitz River Fisheries Management Plan
Lower Columbia Steelhead Conservation Initiative.
IHOT, Columbia River Fisheries Development Program

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

Mitigation agreement for Cowlitz Hatchery (Agreement Number FERC PROJECT # 2016 dated Aug. 9, 1967), which requires Tacoma Public Utilities to produce sufficient production to achieve 17,300 adults to the Cowlitz Salmon Hatchery Fish Barrier (as counted at the fish ladder separation facility).

Cowlitz Falls Fishery Management Plan; Cowlitz Relicensing Settlement Agreement; Cowlitz Mitigation Agreement.

3.3) Relationship to harvest objectives.

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

Harvest Rates are not available at this time.
Ocean and Columbia River sport and commercial fisheries and Cowlitz River sport fisheries benefit from program.

3.4) Relationship to habitat protection and recovery strategies.

Natural production has been affected by habitat degradation in Cowlitz River tributaries and passage barriers at Mayfield, Mossryrock and Cowlitz Falls dams.

FERC minimum stream flow requirements below Mayfield Dam provide some protection for mainstem Cowlitz River spawning and rearing of fall chinook, chum and steelhead. Cowlitz Settlement Agreement calls for habitat program protection and improvement. Limiting factors in Cowlitz Basin have been established by Washington Conservation Commission. Cowlitz Hatchery coho are being trucked and released in the Tilton River and upper Cowlitz River to recover wild coho.

3.5) Ecological interactions.

Hatchery coho smolts compete for food and space with wild fall chinook, steelhead and chum in Cowlitz River and lower Columbia River.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

The hatchery is supplied from three sources. The majority of water is supplied from the Cowlitz River with an average 75,000 gallons per minute (gpm) available to the rearing ponds. An additional 15,000 gpm is available for the fish separator and ladder. The other two sources are "C-wells" (1,000 gpm) and "PW–wells"(700 gpm). The wells are used between August and April, normally for egg incubation and early fry rearing. TPU has a 211 cubic feet per second (cfs) water right at the Cowlitz Salmon Hatchery. An additional water right of 8 cfs was obtained for the BPA funded Stress Relief Ponds (SRP) for utilization with the upper Cowlitz River Restoration Project.

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.

Cowlitz Salmon Hatchery main intake screens **do not** conform with NMFS screening guidelines to minimize the risk of entrainment of listed juvenile fish. The hatcheries' waste discharge conforms to NPDES criteria and guidelines.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam across the river with an associated fish ladder. Adult salmon migrate up the fish ladder to the sorting, transfer and holding facilities. Adults can be sorted to holding ponds that are 20' x 100' x 5.5'. They can also be transferred to a number of other ponds via direct pond

to pond transfer or, after being in the spawning room, via a return tube.

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

There are two 1,500 gallon tank trucks able to transport adults that both have oxygen and re-circulating systems. These trucks are equipped with flumes for planting fish wherever there is adequate access. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities.

5.3) Broodstock holding and spawning facilities.

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).

5.4) Incubation facilities.

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.

5.5) Rearing facilities.

The Cowlitz Salmon Hatchery has 36 modified Burrows ponds measuring 20' X 100' X 8' with 1800 - 2400 gallons per minute (gpm) and 17 ponds (kettles) measuring 5' X 90' X 100' X 8' with ~ 400 gpm for starting fish and one kettle modified to operate at 4' water depth with ~ 300 gpm flow.

5.6) Acclimation/release facilities.

Releases are from rearing ponds discharging into wasteways that flow into the Cowlitz River upstream of the fish barrier dam.

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

No operational difficulties or disasters have led to significant fish mortality at the facility. There have been higher losses in the incubators due to poor water quality and the inability to treat with appropriate therapeutics, but no significant mortality due to disasters or operational problems.

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.

Tacoma Public Utilities upgraded its electrical service at the Cowlitz Salmon Hatchery in the summer of 1999 including a new electrical service line from the Lewis County Power Supply Line. 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 (SR) ponds, water is stored in empty ponds for flushing in case fish need to be released due to lack of flow. A diversion valve was also added to reroute water to the SR ponds.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Adult coho returning to the Cowlitz Salmon Hatchery.

6.2) Supporting information.

6.2.1) History.

Cowlitz River "Type N" coho have been collected for broodstock at Cowlitz Salmon Hatchery since 1967.

6.2.2) Annual size.

5,400 adults collected each year. No estimates can be made on the proportion of natural fish used for broodstock in the past.

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

Past levels of natural fish in broodstock is unknown. Present levels are hatchery-origin fish.

6.2.4) Genetic or ecological differences.

None known.

6.2.5) Reasons for choosing.

The native stock of the Cowlitz River.

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.

NA

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Presently, adults are collected throughout the entire run to meet specific fish management objectives and maintain the genetic integrity of this stock of fish. Collection criteria is as follows: August 1 - October 15 = 30%, October 16 - November 30 = 60%, December 1 - February 28 = 10%. At the base of the barrier dam (designed to stop/reduce all adult fish migration upstream) is a fish ladder leading to a trap and a fish separator. Adults can be sorted/separated into appropriate ponds for holding until spawned.

7.3) Identity.

All coho released from the Cowlitz Salmon Hatchery are currently mass marked. All fish are hand sorted at the Cowlitz Salmon Hatchery and only hatchery fish of the appropriate time and number are retained for spawning use. All wild coho are transported to the upper basin. Excess hatchery-origin fish are transported to the upper basin at WDFW Fish Managements direction.

7.4) Proposed number to be collected:

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

5,400 adults (2,700 males and 2,700 females)

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults				
	Females	Males	Jacks	Eggs	Juveniles
1988	7,944	22,944	11,104	14,583,000	
1989	11,194	24,692	7,634	10,634,000	
1990	5,068	7,941	16,278	9,901,000	
1991	16,568	29,735	4,991	9,829,000	
1992	5,733	9,047	3,511	8,623,000	
1993	2,742	2,899	1,336	6,465,000	
1994	3,302	3,620	1,507	7,442,000	
1995	3,524	4,113	5,853	8,636,350	
1996	5,919	5,433	2,975	10,189,471	
1997	6,282	9,288	1,034	8,458,800	
1998	8,889	9,759	5,820	11,053,736	
1999	19,025	21,296	483	8,964,300	

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

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

Fish in excess of hatchery needs are released up into upper basin as per Fish Managements direction. Fish Management is currently developing escapement goals for the upper basin.

7.6) Fish transportation and holding methods.

Fish used 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).

7.7) Describe fish health maintenance and sanitation procedures applied.

All equipment used for broodstock collection is sanitized using an iodine solution.

7.8) Disposition of carcasses.

Prior to 1999 brood year, all spawned carcasses and mortalities were buried at a Tacoma Public Utilities upland site. Beginning with 1999 brood coho, unspawned carcasses (due to high fecundity and program change) were distributed downstream of the salmon hatchery for nutrient enhancement.

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.

NA

SECTION 8. MATING

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

8.1) Selection method.

We collect and spawn adults from the whole adult run spectrum that returns to the Cowlitz Salmon Hatchery. Presently, we collect brood adults as per the following criteria : August 1 - October 15 = 30%, October 16 - November 30 = 60%, December 1 - February 28 = 10%.

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).

8.3) Fertilization.

The coho sex ratio at spawning is 1:1, currently with pooled gametes from 4 females and 4 males. Every season 60 ovarian fluid samples are taken to check for IHNV.

8.4) Cryopreserved gametes.

NA

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.

NA

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on

the success of meeting the desired hatchery goals.

9.1) Incubation:

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

Broodyear	# of eggs taken	% survival to eye-up
1988	14,583,000	83.6%
1989	10,634,000	93.3%
1990	9,901,000	93.2%
1991	9,829,000	87.6%
1992	8,623,000	88.7%
1993	6,465,000	87.0%
1994	7,442,000	90.9%
1995	8,636,350	88.2%
1996	10,189,471	87.6%
1997	8,458,800	85.0%
1998	11,053,736	91.5%
1999	8,964,300	82.4%

9.1.2) Cause for, and disposition of surplus egg takes.

Higher than expected egg fecundity in females and a slight buffer for incubation loss may be a few circumstances where extra eggs may be taken and reductions mid-season in program.

9.1.3) Loading densities applied during incubation.

Heath vertical incubators are used from egg take through button - up. After eye-up, eggs are picked and loaded at 8,000 eggs per tray. Eggs are incubated with 3 gpm to conserve well water while fry are incubated at 5 gpm and confined in ConWed substrate to discourage excessive swimming. In recent years, coho eggs are typically 1800 to 2000 per pound.

9.1.4) Incubation conditions.

Typically, in an eight tray ½ stack incubation unit with eggs, influent water to top tray is 11 parts per million (ppm) and effluent water (bottom tray) is ~9 ppm at < 10 degrees C (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%, but influent water is typically above 100% saturation as measured by HARZA N.W. and the Cowlitz crew.

9.1.5) Ponding.

Coho fry are ponded when less than 1 millimeter (mm) of yolk is showing to total button-up. They typically have ~1440 Temperature Unit's (TU's), are ~1310 fish per pound (fpp) and are ~34 mm long. At Cowlitz Salmon Hatchery, these fish are usually ponded between mid-January and mid-May due to conservation of a wide range of egg take dates. 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 Saprolegniasis is the primary concern during incubation requiring daily treatments with formalin at 1:600 for 15 minutes. While eggs are incubated at 3 gpm, fry are incubated at 5 gpm 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 their early life stages, but BCWD seems to be increasingly a problem at the Cowlitz Salmon Hatchery, particularly with coho.

Excessive gas in the incubation influent water is variable and appears to be associated with periodic increases in yolk coagulation in eggs and fry. In some years, coho are especially prone to fragmented yolk showing up with fry after hatching.

Sometimes there has been a whitish growth that would matt over eggs or fry causing massive mortality in a stack of trays before it was caught. This was found to be a result of iron bacteria in the water supply. We later found dark water in PW-Well #3 and these growths stopped when this well was not in use. This well was chlorinated to kill the bacteria and continues to be off at this time.

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.

NA

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

Broodyear	% survival to release (fry + smolt)
1988	94.3%
1989	94.6%
1990	93.6%
1991	89.6%
1992	82.7%
1993	91.1%

1994	83.7%
1995	90.6%
1996	89.1%
1997	94.7%
1998	96.7%
1999	95.4%

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. Fish smaller than 100 fpp are routinely kept under 3 lbs/gpm flow and under 0.5 lbs/ft³. At planting, Cowlitz coho, assuming a flow of 2,000 gpm, recently are at a flow index of ~1.54 and a density index of ~0.186. At this time, the yearling coho program is based upon releasing 4,000,000 yearlings from 14 ponds at 15 fpp (program for year 2000 has been reduced to 3,200,000 yearlings).

9.2.3) Fish rearing conditions

CO2 has not been measured in recent years. Total gas and corresponding dissolved oxygen (DO's) have been extensively monitored by HARZA N.W., contractors with Tacoma Power. Due to the recirculating nature of the Cowlitz ponds, DOs of influent and effluent water are often nearly the same. In March, 1996 with water temperature at 8° C, a heavily loaded pond with 21,100 pounds of fish had 8.4 ppm O2 influent and 9.0 ppm O2 in effluent water. A lightly loaded pond with 5,357 pounds of fish had influent and effluent DOs of >11 ppm.

In both ponds and kettles at Cowlitz Salmon Hatchery, DOs in effluent water can sometimes exceed DOs of influent water. For example, at 8° C, a kettle with 733 pounds of fish had an influent DO of 10.2 ppm and an effluent DO of 11.4 ppm. This situation is possibly due to the relative amounts of saturated gasses in the influent water vs. that of effluent. In ponds, studies of flow patterns indicate that some influent water crosses to mix directly with effluent water. This differs from how normal raceways operate. When total gas at the influent end of a kettle is at 100% saturation and O2 saturation is 100%, these ponds operate as one would normally expect. For example: at 8° C, a kettle with 1,100 pounds of fish had an influent DO of 11.1 ppm and an effluent DO of 9.6 ppm.

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.

Monthly fish growth from first ponding to planting (during the months of March and April fish go out of incubators at about 1400 fpp at various stages):

Month:	Fish per pound (fpp):	Length (inches)
March	1400-600	1.33 - 1.77

April	1400-300	1.33 - 2.21
May	240	2.40
June	100	3.21
July	70	3.63
August	60	3.82
September	50	4.05
October	40	4.35
November	32	4.69
December	26	5.03
January	20	5.48
February	18	5.68
March	16.5	5.86
April	15	6.04

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

Not available.

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*).

Historically, coho were reared on moist feed. In recent years, Cowlitz coho are started on BioDiet Starter #3, then fed BioMoist Grower 1.0 mm. These fish are then converted to BioDry 1000 - 1.0 mm through 1.5 mm, then finished on Clark's Fry 2.0 mm and New Age Pacific 0,5 mm feeds. Overall feed conversions, including overwintering of yearling groups is typically around 1.5:1. Feeding rates range from 0.5 to 4.0 % B.W./day

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

Health and disease monitoring is done by pathologists currently budgeted for the Cowlitz Complex. Adult salmon are routinely sampled for IHNV and BKD. ELISA sampling is done on coho and, though their progeny were segregated during rearing by ELISA values for a couple of years, this sampling is currently conducted to monitor levels of BKD in adults returning to the hatchery. BCWD is becoming increasingly more troublesome and work is ongoing to reduce problems from this disease both through lower rearing densities and trials using new drugs.

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

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 N. W.

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 used.

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

NA

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	81,700	1,500		*Lower Cowlitz tribs
Unfed Fry				**
Fry	***1,000,000	1400-500	March-June	Upper Cowlitz River
Fingerling	****1,000	250	April	Cambell Cr.
Smolts	3,200,000	15	May	Cowlitz River

***-** Eggs are incubated in Remote Site Incubators (RSI's-80,000) and fry released into Salmon & Lacamas Creeks. 1,700 transferred to school aquarium projects.
**- Excess fry released into Swoford Pond.
***- To be accomplished only if insufficient adults are available for natural spawning in upper basin.
****- Kraus Ryderwood project (all adipose clipped prior to transfer) is the Campbell Creek release.

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

Stream, river, or watercourse: Cowlitz River (26.0002), Cambell Cr. (26.0443), Salmon Cr (26.0479), Lacamas Cr. (26..0467) and Hill Cr. (26.0423)

Release point: Cowlitz Hatchery (RM 49), Cambell Cr., Salmon Cr. , Lacamas Cr. and Hill Cr. (26.0423)

Major watershed: Cowlitz River

Basin or Region: Columbia River

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

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988					2,320,650	68.1	4,686,200	17.2
1989	3,160,000	1,500			1,186,000	51.1	4,405,700	17.2
1990	214,000	1,507			589,345	26.4	3,893,200	14.7
1991	10,000	909			1,092,000	40.3	4,587,600	17
1992	230,000	1,484	525,400	195			4,555,800	14.5
1993							3,642,400	11.1
1994							4,468,827	16.5
1995					540,355	63.1	4,105,406	16.3
1996	2,753,550	1,395	407,147	171	1,120,582	34.1	3,699,868	10.8
1997	1,167,000	1,522	100,200	168	440,500	48	3,966,721	13.1
1998	4,035,000	1,275	219,609	183	482,297	34.4	4,116,792	13
1999	635,900	1,453			15,430	40.5	4,195,758	13.5
Average	1,525,681	1,381	313,089	179	865,240	45.1	4,193,689	14.6

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

10.4) Actual dates of release and description of release protocols.

Broodyear	# Released	Size (fpp)	Release Method	Reason for Release
1999				
Apr 19, 2001	593,013	12.8 - 13.7	Forced	Showing Smolting Behavior
Apr 20, 2001	299,780	13.6	Forced	Showing Smolting Behavior
Apr 30, 2001	3,302,965	12.6- 14.8	Forced	Programmed Release Time
1998 Brood				
Apr 19, 2000	300,821	14.4	Forced	Showing Smolting Behavior
May 1, 2000	3,815,971	13.0	Forced	Programmed Release Time
1997 Brood				
Apr 5, 1999	727,900	13.0	Forced	Ponds needed for Fall Chinook
May 18 & 19, 1999	3,512,760	13.1	Forced	Showing Smolting Behavior
1996 Brood				
May 1, 1998	765,757	10.9	Forced	Programmed Release Time
May 4 & 5	1,333,699	11.1	Forced	Programmed Release Time
May 15 & 16	529,719	10.3	Forced	Programmed Release Time

May 19, 1998	515,491	11.2	Forced	Programmed Release Time
May 22, 1998	498,124	8.8	Forced	Programmed Release Time
1995 Brood				
April 18,1997	445,725	20.3	Forced	Ponds needed for Fall Chinook
April 29, 1997	718,686	19.2	Forced	Programmed Release Time
May 1 & 2	2,279,785	16.1	Forced	Programmed Release Time
June 3, 1997	329,687	15.9	Forced	Previous programmed release
June 6, 1997	328,523	14.9	Forced	Previous programmed release

All yearling fish released from ponds. No culling occurred for these broods after final ponding. Excess fish are removed during final ponding (for yearling release). These excess fish are currently released into Swofford Pond for the resident program. Egg take goals and spawning/incubation protocols are currently being reviewed and modified to significantly reduce fish in excess of those needed to accomplish program goals.

10.5) Fish transportation procedures, if applicable.

Several small tankers with air stones (one 750 gallon, one 1,000 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities and also transporting fry and fingerlings to upper watershed.

10.6) Acclimation procedures.

On-Station Release
Acclimated on river water during their entire rearing time.

Off-Station Release
For acclimation of fish that are being transported to upper watersheds, river water temperatures are taken to make sure they are within 7 degrees Fahrenheit of the water they are transported in. If the temperature is greater than 7 degrees, river water is circulated through the tank by pumps. This is done by draining some of the water out of the tank and pumping river water back into the tank so the fish can become acclimated to the temperature difference. This is done for approximately 15 minutes to 1/2 hour or until the tank water is within the 7 degree temperature of the water the fish are to be planted in.

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

Prior to the 1995 brood, coho were marked for the Columbia River Index. After that time, mass marking (adipose fin clip only) was attempted to comply with ESA requirements.

The 1995 brood coho were adipose fin clipped (AD only) for the first mass marking program. Clipping was stopped due to problems with BCWD (59.3% mass marked).

All the 1996 brood coho to be adipose fin clipped were clipped. But fish set aside for double index, that is adipose-fin clip + coded-wire tag and coded-wire tag only, contracted BCWD and were not marked. This brood was planted with 6.1% of the population unmarked.

The 1997 brood coho were 100% adipose-fin clipped only with no double index. This brood was the first successful mass marked population of coho released. A portion of this brood was tagged according to Section 10 (ESA) needs.

The 1998 brood coho were successfully mass marked without a double index (portion tagged for Section 10 needs). A large number of these fish were adipose-fin clipped + coded-wire tagged for Jack Tipping's Time of Return study.

The 1999 brood coho were 100% mass marked. All programmed tagging was accomplished.

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

Excess fish are removed during final ponding (for yearling release). These excess fish are currently released into Swofford Pond for the resident program. Egg take goals and spawning/incubation protocols are currently being reviewed and modified to significantly reduce fish in excess of those needed to accomplish program goals.

10.9) Fish health certification procedures applied pre-release.

Health and disease monitoring is done by pathologists currently budgeted for the Cowlitz Complex. Adult salmon are routinely sampled for IHNV and BKD. ELISA sampling is done on coho and, though their progeny were segregated during rearing by ELISA values for a couple of years, this sampling is currently conducted to monitor levels of BKD in adults returning to the hatchery. BCWD is becoming increasingly more troublesome and work is ongoing to reduce problems from this disease, both through lower rearing densities and trials using new drugs.

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

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 diversion valve has been added to the ponds to divert water from the aeration stacks directly into the ponds.

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.

Fish released as yearling smolts to decrease residence time in freshwater to reduce

direct/indirect competition on any listed natural fish in system.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

See section 1.10

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

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.

SECTION 12. RESEARCH

12.1) Objective or purpose.

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

12.10) Alternative methods to achieve project objectives.

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

IHOT (Integrated Hatchery Operations Team). 1996. 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.

Washington Department of Fish and Wildlife. 1997. Annual mitigation report. Cowlitz Hatchery Complex for January 1, 1997 to December 31, 1997. Section Two: Cowlitz Salmon Hatchery mitigation report 1997. Pp. 2-1 - 2-62.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information 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:_____

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

Listed species affected: Chinook ESU/Population: Lower Columbia Activity: Hatchery Operation				
Location of hatchery activity: Cowlitz River Dates of activity: September-May Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			Unknown	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)	Unknown	Unknown	Unknown	
Other Take (specify) h)				

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

Instructions:

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

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

Listed species affected: Steelhead ESU/Population: Lower Columbia Activity: Hatchery Operation				
Location of hatchery activity: Cowlitz River Dates of activity: September-May Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown		
Other Take (specify) h)				

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

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

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

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

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

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

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

h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.

2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).

3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table

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

Listed species affected: Chum ESU/Population: Lower Columbia Activity: Hatchery Operation				
Location of hatchery activity: Cowlitz River Dates of activity: September-May Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown		
Other Take (specify) h)				

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

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

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

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

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

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

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

h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.

2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).

3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table