HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Elwha River Summer/Fall Chinook Fingerling, Yearling Programs
Species or Hatchery Stock:	Elwha River Summer/Fall Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Elwha River / Puget Sound Strait of Juan de Fuca
Date Submitted:	
Date Last Updated:	November 2, 2011

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Elwha River Summer/Fall Chinook Program

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

Elwha Summer / Fall Chinook (*Oncorhynchus tshawytscha*) - listed as "threatened"

1.3) Responsible organization and individuals

WDFW Fish Hatchery Staff Lead Contact

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

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

Funding information	Operational Information
General Fund –local	Annual operating cost (dollars) $303,367 FTEs = 3.23
Annual operating cost applies to the Elwha Chinook Programs.	

Originally the program was funded as a mitigation program through the original Elwha dam owners, the Crown Zellerback Paper Company, The pulp mill at Ediz Hook operated by CZ was sold to Daishowa America, and then to Nippon Paper Industries. The ownership of the Elwha dams has now shifted to the National Parks Service (Federal government).

In January 1992 the U.S. Congress enacted the Elwha River Ecosystem and Fisheries Restoration Act (Public Law 102-495). The Elwha Act (http://www.nps.gov/olym/naturescience/elwha-restoration-docs.htm) provided funding for the federal acquisition of the Elwha and Glines Canyon dams and required a specific plan to achieve full restoration of the Elwha River ecosystem and fisheries (Ward et al 2008). Operation and maintenance funding for the Elwha rearing channel and the Morse Creek facility is provided by a donation from the National Parks Foundation.

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

Broodstock Collection

Elwha Channel: Elwha River (WRIA# 18.0272) at RM 3.5

In-river Resistance-board Weir:
Elwha River (WRIA# 18.0272) at RM 3.7

Incubation and Rearing:

Hurd Creek Hatchery: Hurd Creek (WRIA#18.0028) at R.M. 0.2, tributary to Dungeness River (WRIA#18.0028) at RM 2.8.

Sol Duc Hatchery: Sol Duc River (WRIA#20.0096) at RM 29.

Acclimation and Release:

Elwha Channel: Elwha River (WRIA# 18.0272) at RM 3.5

Morse Creek Hatchery: Morse Creek (WRIA# 18.0185) at approximately RM 1.0

1.6) Type of program.

Integrated recovery.

1.7) Purpose (Goal) of program.

Prior to the development of the *Elwha River Fish Restoration Plan* (ERFRP) (Ward et.al 2008), this program was operated as mitigation for the continued operation of the two mainstem Elwha River dams.

The role of the program, throughout the restoration effort, is to preserve extant populations during dam removal and to help initiate re-colonization of the watershed through the supplementation of Chinook salmon in the basin.

See section 1.11 for discussion on the release goals for the program per removal of dams.

1.8) Justification for the program.

This program enhances the survival of Elwha Chinook due to the loss of natural spawning and rearing habitat as a result of hydropower development and blockage of the river to anadromous salmon migration at RM 4.9. Upon dam removal (began in September 2011), the program will provide a source of Elwha Chinook for reintroduction throughout the Elwha system. This hatchery operation will operate in a manner that is consistent with the ERFRP. Modifications may occur as additional information is collected and analyzed.

The Chinook hatchery program may be terminated sooner than envisioned in the EFRP (a 10 year plan) if RM&E shows that the Chinook population is approaching interim restoration targets.

To minimize impacts on listed fish by WDFW facilities operation and the Elwha Chinook program, the following Risk Aversions are included in this HGMP

Summary of risk aversion measures for the Elwha Chinook program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Surface water and well water rights at Elwha are formalized through trust water right permit # G2-29018. For incubation and initial rearing at Sol Duc, the water rights permit # is S2-21118. For Hurd Creek, the water rights permit # is G2-24026.
Intake Screening	4.2	The current water supply system for the Elwha rearing channel is part of a larger water treatment structure for the City of

		Port Angeles. The intake structure for this system was built in 2009 and meets all current federal screen requirements. This system is meant to operate during the entire dam removal period (2001-2013). Once the dam removal project is complete. the Elwha rearing channel supply will revert to the original intake supply listed below. The four revolving screens on the Elwha Rearing Channel water intake meet state and federal intake screen standards (NMFS, 1995, 1996). According to the WDFW Hatchery Intake Evaluation Project (2004), the surface water intake screens for Hurd Creek, are not compliant with State or draft 2004 Federal guidelines. However, "The intention of these guidelines is to assure future compliance when new construction or major upgrades are to take place" (NOAA Fisheries, draft 2004, p. 3 of 88.).
Effluent Discharge	4.2	The Elwha Rearing Channel operation is consistent with an"Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) permit administered by the Washington Department of Ecology (DOE) - WAG 13-1043. Sol Duc NPDES permit # is WAG13-1045. The Hurd Creek Hatchery produces a relatively small amount of fish each year and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for a NPDES permit.
Broodstock Collection & Adult Passage	5.1, 7.9, 2.2.3	Broodstock are collected throughout the entire run and include both natural and hatchery-origin adults. Trapping and holding conditions are managed to minimize pre-spawn mortality. See section 2.2.3 for complete information.
Disease Transmission	9.2.7	The Co-Managers Fish Disease Policy is followed to reduce fish health related risks at all phases of hatchery operations. The Policy identifies hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	Juvenile fish are release at a time, size and smoltification condition that promotes rapid downstream emigration from the system. See sections 2.2.3 & 10.11

1.9) List of program "Performance Standards".

Program standards represent both goals identified in the ERFRP and general WDFW and co-manager developed guidelines. See table in section 1.10.

1.10) List of program "Performance Indicators."

1.10.1) "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Program meets the production objectives outlined in the *Elwha River Fish Restoration Plan* (Ward et.al 2008)	Throughout the term of the Fish Restoration Plan, the Chinook hatchery program will release an agreed to number and composition of fish from the Elwha rearing channel and the Morse Creek facility. This production will change over time, as the response of the natural Chinook to the dam removal is evaluated.	Annual estimates of program release size and class composition, time and location of releases and appropriate mark and tag reporting. CWT and otolith mark sampling and analyses used upon adult return to determine program performance relative to all goals outlined in the ERFRP.
Program meets conservation objectives set by *ERFRP* Adaptive Management Plan (Ward et.al 2008)	1. Reestablish self-sustaining anadromous salmonid populations and habitats throughout the Elwha River watershed and its nearshore as quickly as possible; 2. Maintain the integrity of the existing salmonid genetic and life history diversity before, during, and after dam removal and the subsequent periods of elevated sediment levels. 3. Maintain the health of fish populations before, during, and after dam removal; 4. Restore the physical and biological processes of the overall ecosystem through dam removal, including the return of viable salmonid populations (VSPs).	Evaluate spatial or temporal rates of species recolonization to understand the effect of various recolonization strategies over the life of the project (20–30 years). Develop genetic baselines for all stocks before dam removal Implement monitoring programs to identify any changes in fish health in Lake Sutherland kokanee, lower Elwha Chinook, coho and steelhead, and any fish disease events. Ecosystem response will be assessed in both freshwater and marine (estuary and nearshore) environments. For physical habitat monitoring, a combination of in situ and remote monitoring techniques in partnership with planned sediment monitoring will be used
Program contributes to the overall recovery goals for Elwha Chinook outlined in the *Puget Sound Salmon Recovery Plan (PSSMP).*	Proper supplementation to establish a self-sustaining natural population with long term adult recruit abundance goals of 17,000 at low productivity (1.0 R/S) and 6,900 at high productivity (4.6 R/S).	Number and distribution of natural-origin Chinook in the Elwha basin over time. Estimates of stock productivity, measured as recruits/spawner.
Program operations support Puget Sound Salmon Management Plan (PSSMP *US v*	Hatchery program planning and operation are cooperatively managed by WDFW and the	Finalization of the HAIP and establishment of the Equilibrium Brood Program with agreed-to

Washington).	Lower Elwha Klallam Tribe (LEKT). The *PSSMP* calls for the development of an Equilibrium Brood Program for all Puget Sound watersheds. The *ERFRP* has established the hatchery programs for the Elwha basin. The programs will be formalized in the Co-manager Hatchery Action Implementation Plan (HAIP) to fulfill the EBD requirement of the *PSSMP*.	M&E and adaptive management framework for alignment with the restoration objectives in the *ERFRP*.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights.	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments.	Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Program outreach helps enhance public understanding, participation and support of WDFW hatchery programs.	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off-station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program implements measures for broodstock management to maintain integrity and genetic diversity, maintain effective population size.	The current annual goal for broodstock collection is 1700 adults. This assumes an equal sex composition and an average fecundity of 4,600 eggs. The collection goal also includes spatial and temporal collection elements to ensure broad genetic representation and inclusion of natural-origin adults. Proper spawning protocols are followed to ensure genetic expression of all contributing adults.	Annual run timing, age and sex, origin composition data are collected. Adhere to HSRG (2004) and WDFW spawning guidelines (WDFW 1983)
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts on natural and hatchery-origin fish.	Use CWT and otolith marking to identify the various production groups by brood year, release size and location.	CWT and otolith mark combinations are applied annually to uniquely identify release groups. No adipose fin-clipped releases. Returning adults are sampled throughout their return for length, sex, coded-wire tags otoliths, and DNA tissue.
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.	Fish pathogen screening of adult fish used as broodstock. Necropsies of fish to assess health, nutritional status and pre-release health conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect

Follow Co-managers Fish Health Disease Policy (1998).		potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy.
	Inspection of adult brood-stock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are sampled and examined for pathogens at the WDFW fish health lab.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Control of specific fish pathogens through eggs/fish movements is conducted in accordance to Co-managers Fish Health Disease Policy.

1.10.2) "Performance Indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt size (10; 80 fish/lb) and released at a time that fosters rapid migration downstream.	Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, in-stream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including HOPPS, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program at least monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed.
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.

Water withdrawals and in-stream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Harvest of hatchery-produced fish minimizes impact to wild populations.	Harvest is regulated to meet appropriate biological assessment criteria.	Agencies and tribes to provide up-to-date information needed to monitor harvests.

1.11) Expected size of program.

Total release = 2,900,000 juveniles.

Post dam removal plans (EFRP) calls for the potential use of several types of rearing and release strategies and locations. These include both of the current on-site release of sub-yearling and yearling juveniles from the Elwha Channel and Morse Creek facilities, as well as, additional outplants and remote acclimation sites in the upper basin.

Future modifications to the size, composition and release location of the current program will occur through coordinated efforts of the parties to the ERFRP.

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

A total of 1,700 adults are required to attain the current egg-take goal of 3.5 million. This assumes a 10% pre-spawning mortality (high end), a 50:50 sex ratio a fecundity of 4,600 eggs per female.

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

Life Stage	Release Location	Annual Release Level
Fingerling	Elwha River (18.0272)	2,500,000
Yearling	Elwha River (18.0272)	200,000
Yearling	Morse Creek*(18.0185)	200,000

* Because of concerns over sediment effects to water quality at the Elwha Channel during and after dam removal, 205,000 yearlings are shipped to Morse Creek for acclimation and release.

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

Historic smolt-to-adult survival estimates for this program are limited due to the low number of brood years identified with coded-wire tags. In the mid 1990s, groups of fingerling and yearling releases were differentially tagged to compare survival rates of the two different age groups. The 1994 yearling release (1992 BY) survived at a rate of 0.24% while the fingerling release (1993 BY) survived at a 0.16% rate. Three tag groups were released from the 1994 brood. Two fingerling groups averaged 0.09% total survival. A third group of yearlings survived at a rate of 0.06%.

Beginning with the 2004 brood year, an origin-specific comparison of the survival and age-at-return was started. All Elwha River Chinook salmon from the 2004 brood year and later were recognizable as one of three out-migrant types wild, juvenile out-migrants, hatchery sub-yearling, or hatchery yearling. Chinook out-migrants during this period were predominantly (84-93%) sub-yearling hatchery fish. In order to compare survival and age-at-return among out-migrant types, Chinook spawner carcasses were collected from the Elwha River during spawner surveys, brood stock collection, and operation of a floating fish weir. For the 2004 brood year, survival-to-return of wild out-migrants was three times greater than sub-yearling hatchery releases and two times

greater than yearling hatchery releases. Age-at-return also differed among out-migrant types. Wild out-migrants returned primarily as age-4 spawners (61%), whereas hatchery yearling releases returned primarily as age-3 spawners (55%). Returns of hatchery sub-yearling out-migrants were evenly distributed among age-3 and age-4 spawners.

Survival-to-return for two hatchery release strategies (subyearling and yearling) and natural fish. (WDFW unpublished).

Return Year	Natural Production Adult Returns		Elwha Hatchery Sub-yearling to Adult Returns		Elwha Hatchery Yearling to Adult Returns	
	BY 2004	BY 2005	BY 2004	BY 2005	BY 2004	BY 2005
2007	27	3	197	41	20	0
2008	47	16	224	788	10	0
2009	0	62	21	2035	7	7
2010	0	21	0	581	0	5
Total Return	74	102	442	3,444	38	12
Total Out	166,639	106,312	2,750,000	3,026,091	173,409	140,900
Survival-to-Return	0.044%	0.096%	0.016%	0.114%	0.022%	0.008%

Survival-to-return for two hatchery release strategies (subyearling and yearling) is calculated as the number of spawners returning divided by the number released for that brood year. Survival-to-return for natural production is calculated as the number of spawners returning divided by the smolt trap estimate of natural juvenile outmigrant production for that brood year. First, returns were partitioned by release strategy (hatchery subyearling, hatchery yearling, natural). Second, with origin type, spawners were assigned to brood year. Run reconstruction (2000) is currently possible from 2004 and 2005 (assuming most fish return by age-5) due to the availability of smolt trap data and otolith sampling of returning adults. Biological sampling of otoliths began in 2007.

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

Chinook releases into the Elwha River started in 1914, but consistent annual releases did not occur until 1953. The Elwha Channel, built in 1974, was originally designed to be a spawning channel, but because of difficulties in attracting adults onto the site, it was modified for use as rearing ponds.

1.14) Expected duration of program.

On-going. Consistent with the ERFRP, the program's objectives are to preserve and then restore the existing native Chinook salmon population. The program will first help ensure that the remnant native Elwha River Chinook population is preserved prior to and during the dam removal period (2007-2014). Post dam removal, the program will produce adult fish with the primary goal of bolstering natural recolonization as the lower river and estuary recover. The program will phase out post dam removal based on monitoring data showing that the natural Chinook salmon population is recovering to a self-sustaining level. A specific program phase-out date cannot be set at this time, because the recovery of the river and natural Chinook productivity in response to dam removal are uncertain in the short term (Ward et al 2008). The 10-year interim restoration goals are the production of around 2,000 natural-origin Chinook salmon with a productivity of > 1.0 R/S.

Construction on Morse Creek Hatchery was completed in 2009. The facility will be operated for up to 12 years, as a genetic reserve and alternative broodstock source in the event of a catastrophic loss of the donor natural- or hatchery-origin components of the population in the

Elwha River during and after dam-removal. After 12 years the infrastructure will be removed and the site will be restored and re-vegetated to its condition before the hatchery was built.

1.15) Watersheds targeted by program.

Elwha River (18.0272)

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

Issue 1: A critical component of the overall restoration strategy is the preservation of existing populations during the time the dams are being removed. Although natural re-colonization is an integral part of the overall restoration strategy, sediment levels in the main stem Elwha River below Glines Canyon Dam are expected to reach levels that may cause direct mortality to fish. Hatcheries will be used to ensure an adequate number of fish survive the dam removal process to effectively preserve and restore currently extant fish populations in the watershed.

The Elwha Act calls for the removal of the dams and full restoration of the Elwha River ecosystem and native anadromous fisheries (Ward et al, 2008). The following are goals central to implementing the act:

- Reestablish self-sustaining anadromous salmonid populations and habitats throughout the Elwha River watershed and its nearshore as quickly as possible, using the most appropriate methods.
- Maintain the integrity of the existing salmonid genetic and life history diversity before, during, and after dam removal and the subsequent periods of elevated sediment levels.
- Maintain the health of fish populations before, during, and after dam removal.
- Restore the physical and biological processes of the overall ecosystem through dam removal, including the return of viable salmonid populations (VSPs).

1.16.2) Potential Alternatives to the Current Program

1) *Discontinuation of the program when the dam removal process begins (2011).* Currently the hatchery program contributes significantly to the overall abundance of Chinook adults returning to the Elwha River. Discontinuation of the program prior to confirmation of the Elwha Chinook population's ability to re-colonize and establish a self-sustaining stock of fish, would potentially risk the extirpation of the Elwha Summer/Fall Chinook. The continuation of the program is essential until the establishment of the stock is verified.

2) *Discontinuation of the program once Dam removal is completed (2013).* Currently the hatchery program contributes significantly to the overall abundance of Chinook adults returning to the Elwha River. Discontinuation of the program prior to confirmation of the Elwha Chinook population's ability to re-colonize and establish a self- sustaining stock of fish, would potentially risk the extirpation of the Elwha Summer/Fall Chinook. The continuation of the program is essential until the establishment of the stock is verified.

3) *Discontinuation of the program once the predicted sediment load is reduced in the Elwha River (2017).* Currently the hatchery program contributes significantly to the overall abundance of Chinook adults returning to the Elwha River. Discontinuation of the program prior to confirmation of the Elwha Chinook population's ability to re-colonize and establish a self-sustaining stock of fish, would potentially risk the extirpation of the Elwha Summer/Fall Chinook. The continuation of the program is essential until the establishment of the stock is verified.

1.16.3) Potential Reforms and Investments

Not applicable

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

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

None currently. This joint WDFW/LEKT HGMP is submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 4(d) or 10 (a)(1A).

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.

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

Elwha River Summer/Fall Chinook Salmon, part of the Puget Sound Chinook ESU (*Oncorhynchus tshawytscha*), listed as "threatened" on March 24, 1999 (64 FR 14308); threatened status reaffirmed on June 28, 2005 (70 FR 37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

- Identify the ESA-listed population(s) that may be incidentally affected by the program.
Elwha River steelhead, part of the Puget Sound Steelhead DPS *(Oncorhynchus mykiss*), were listed as threatened under the ESA on May 11, 2007 (72 FR 26722); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Hood Canal summer chum (*Oncorhynchus keta*): Listed as threatened on March 25, 1999 (64 FR 14507); threatened status reaffirmed on June 28, 20052005 (70 FR 37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Elwha River bull trout, Coastal Puget Sound bull trout DPS (*Salvelinus confluentus*), were listed under the ESA as "threatened" on November 1, 1999 (64 FR 58910). See Section 15 (Addendum A) for status and ESA take authorization for Elwha bull trout through the US Fish and Wildlife Service.

Southern Distinct Population Segment (DPS) of Pacific eulachon (*Thaleichthys pacificus)* were listed as "threatened" on May 17, 2010 (75 FR 13012).

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

Puget Sound Chinook (*Oncorhynchus tshawytscha*). Listed as "threatened" on March 24, 1999 (64 FR 14308); threatened status reaffirmed on June 28, 2005 (70 FR 37160) reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

The most recent 5-year (2005-2009) geometric mean of natural spawners in populations of Puget Sound Chinook salmon ranges from 81 (in the Mid-Hood Canal population) to almost 10,345 fish (in the upper Skagit population). Most populations contain natural spawners numbering in the high hundreds (median recent natural escapement = 909). No trend is notable for the total ESU escapements; while trends vary from decreasing to increasing among populations.

Elwha Summer/Fall Chinook growth-rate estimates

Period	Trend CI
1995-2009	0.973 (0.9 – 1.052)
1986-2009	0.934 (0.896-0.974)

Source: Ford et al, 2010 (Table 40)

The Elwha River natural Chinook salmon population is included in the listed Puget Sound Chinook ESU. Elwha River hatchery-origin Chinook are also included as part of the listed ESU.

Puget Sound Steelhead (*Oncorhynchus mykiss*): listed as threatened under the ESA on May 11, 2007 (72 FR 26722); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Status: The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural, Hamma Hamma winter-run, Hood Canal Steelhead Supplementation Program winter-run, and Lower Elwha native winter-run steelhead hatchery stocks.

Since 1995, Puget Sound winter-run steelhead abundance has also shown a widespread declining trend over much of the DPS. Only three of the 16 populations evaluated exhibit point estimates of growth rate that are positive (East Hood Canal, Skokomish River, and West Hood Canal), and only one of these is significantly greater ($P < 0.05$) than one (positive population growth): West Hood Canal. These four populations are all small. The highest growth rates over the entire series occur in East Hood Canal, the Skokomish River, and the Samish and Skagit rivers; the lowest rates occur in the Elwha and Dungeness rivers, Lake Washington, and the Stillaguamish, Nisqually, and Puyallup rivers. Trends could not be calculated for south Puget Sound tributaries (Ford et al. 2010).

Over the most recent five years (2005-2009), Puget Sound winter-run steelhead abundance has been low over much of the DPS, with a geometric mean less than 250 fish annually for all but eight populations of the 15 evaluated. Four of these are in northern Puget Sound (Samish, Skagit, Snohomish and Stillaguamish rivers), three are in southern Puget Sound (Nisqually, Puyallup, and White rivers), and one is on the Olympic Peninsula (Skokomish River). Only three populations have a geometric mean greater than 500 fish—Green, Skagit and Samish rivers—and two of these are in northern Puget Sound. The Lake Washington, and South Sound tributaries populations all have very low recent mean abundances (< 15 fish)(NOAA 2010). From 1985 through 1997, WDFW estimated that spawning escapements for native Elwha River winter-run steelhead ranged from 47 to 834 fish, with an average return of 323 fish over the 12 year period. No data are available regarding current total run size and spawning escapement abundance for the Elwha River native winter-run steelhead population. Escapement surveys have been conducted in the mainstem Elwha River watershed, but survey results have not yet been evaluated. Further surveys to monitor spawner abundance and distribution in the main stem, Indian Creek, and Little River are planned for implementation subsequent completion of the removal of the Elwha River dams, and restoration of anadromous fish accessibility to river areas upstream of river mile 5.0 in 2014 (Ward et al 2008).

Hood Canal summer chum (*Oncorhynchus keta*)**:** Listed as threatened on March 25, 1999 (64 FR 14507); threatened status reaffirmed on June 28, 2005 (70 FR 37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Status: The ESU includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington, as well as eight artificial propagation programs: the Quilcene NFH, Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, Union River/Tahuya, Big Beef Creek Fish Hatchery, Salmon Creek Fish Hatchery, Chimacum Creek Fish Hatchery, and the Jimmycomelately Creek Fish Hatchery summer-run chum hatchery programs. Critical Habitat Designated September 2, 2005 (70 FR 52630)

Puget Sound bull trout (*Salvelinus confluentus*) were listed under the ESA as "threatened" on November 1, 1999 (64 FR58910).

Status: See Section 15 (Addendum A) for status and ESA take authorization for Elwha bull trout through the US Fish and Wildlife Service.

Southern Distinct Population Segment (DPS) of Pacific eulachon (*Thaleichthys pacificus)* were listed as "threatened" on May 17, 2010 (75 FR 13012).

Status: The capture of 58 adult eulachon was reported in the Elwha River between 18 March and 28 June 2005. Since then, adult eulachon have been captured in the Elwha River annually.

This was the first formal documentation of eulachon in the Elwha River, although anecdotal observations suggest that eulachon were a regular, predictable feature in the Elwha until the mid 1970s.

- 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.

Monitoring of natural-orgin productivity in the Lower Elwha River began with the 2004 brood and has resulted in to full brood year returns of adults back to the river. These estimates represents returns to the river and do not include recruits taken in fisheries.

Return Year	Natural Production Returns	
	BY 2004 Adults produced	BY 2005 Adults Produced
2007	27	3
2008	47	16
2009	0	62
2010	0	21
Total Adult Return	74	102
Total juveniles Out	166,639	106,312
Survival-to-Return	**0.044%**	**0.096%**

Source: M. Zimmerman, WDFW 2011

-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.

The following table provides total escapement estimates for Elwha River Chinook for 1998-2009 (includes hatchery volunteers, gaff/seine removals, in hatchery pre-spawning mortalities & natural spawners). The current escapement goal is 2,900 annually.

Elwha River Chinook Total Escapement Estimates, 1999-10.

Year	Broodstock	Total Natural Spawners	Pre-Spawn Mortality	Total Spawning Escapement
1999	699	903	23	1,625
2000	1136	715	62	1,913
2001	1553	655	38	2,246
2002	1513	863	40	2,416
2003	1182	1045	78	2,305
2004	1329	2075	39	3,443
2005	1396	835	7	2,238
2006	1227	693	11	1,931
2007	757	380	9	1,146
2008	667	470	16	1,153
2009	1514	651	16	2,181

2010	709	564	5	1,278

Source: SaSI (July 2011)

- 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.

With only 1992-1994 brood years being adipose-fin clipped/coded-wire tagged at this time, monitoring NOR/HOR ratios on the spawning grounds has been limited (see section 10.7). It is assumed, though, that the majority of the Chinook on the spawning grounds are of hatchery origin. For many decades, due to the confined and degraded condition of natural spawning and rearing habitat in the watershed and estuary for the ocean-type Elwha River Chinook salmon population. Recent analyses of otolith data collected from adult Chinook salmon that spawned in a lower river side channel area long thought to have sustained natural production of the species showed that first generation hatchery-origin fish comprised 76% (2008) and 96% (2009) of the total number of fish sampled from the area (Ward et al 2008).

Beginning with the 2004 brood year, an origin-specific comparison of the survival and age-at-return was enabled by a hatchery program that fully marks or tags hatchery releases and a smolt trap study that estimates the number of wild Chinook out-migrants. All Elwha River Chinook salmon from the 2004 brood year and later were recognizable as one of three out-migrant types: wild sub-yearling, hatchery sub-yearling, or hatchery yearling. Chinook out-migrants during this period were predominantly (84-93%) sub-yearling hatchery fish.

From 2007 to 2010, WDFW field staff collected mark, coded-wire tag and otolith information from returning adult Chinook from three sources, hatchery trap, collection of broodstock by gaffing adults in-river, and from stream surveys (Table). Origin is interpreted from CWT and otolith marking. Chinook origin was not statistically different among the different collections. For this reason, the composition of all samples was pooled together for an increase in precision resulting from the larger sample size.

Origin of returning Elwha River natural Chinook spawners, 2007-2010.

Number Sampled by Year (Hatchery Trap, Broodstock, Natural Spawner Combined)					**2009-10**	**2009-10**
Strategy	**2007**	**2008**	**2009**	**2010**	**Average**	**Percentage**
Hatchery Elwha Subyearlings	82	196	299	249	274	93%
Hatchery Elwha Yearlings	12	2	2	9	6	2%
Hatchery - Out of Basin Origin	1	0	2	2	2	1%
Natural Origin	9	12	10	15	13	4%
UNK *	235	11	0	0	0	0%
N/A **	41	6	2	0	1	0%
Total	380	227	315	275	272	

Source: Sampling data collected by R. Cooper and S. Williams; compiled by M. Zimmerman, WDFW

* Otolith data were collected but results could not be interpreted because some age classes of unmarked otoliths could be either natural or hatchery sub-yearlings. Not all age classes were marked for returns in 2007 and 2008. This is combination of unmarked hatchery subyearling and natural origin.

** Data collected from these fish were not sufficient to determine an origin (i.e., otolith could not be read, tag lost, etc)

Origin of all Chinook could only be interpreted for the 2009 and 2010 return years because otolith thermal-marking began with the 2004 brood year. Because of the significant number of unknown-origin fish in the 2007 and 2008 data, years 2009-2010 were averaged. About 95% of returning adults from 2008 to 2010 were identified as originating from Elwha hatchery programs.

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 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.

Broodstock Collection: Broodstock collection includes adults volunteering to the hatchery plus river beach seining and gaffing activities to assure egg take goals are met. At this time, <50% of the egg take needs are met by adult Chinook volunteering into the adult trap. The remainder must be netted or gaffed from the river to fulfill the program needs. The resistance board weir, installed 2010 as part of a joint agency research, monitoring and evaluation initiative, may also be used to collect brood stock. Chinook salmon collection at the mainstem weir for use as broodstock was required by NMFS as a term and condition through an ESA section 7 biological opinion authorizing effects on listed Chinook salmon that would result from removal of the Elwha dams (NMFS 2006).

The resistance board weir (RBW) was installed in the lower river at approximately RM 3.7, just upstream of the Elwha Channel. The trap is operated by WDFW's Wild Salmon Production/Evaluation Unit from March through May, and from August through October, depending on fish movement and flow conditions. Chinook and pink salmon broodstock may be collected at the weir prior to and during dam removal (began September 2011). The adult Chinook will be transported to the WDFW rearing channel in a 400-gallon tank for holding and spawning. Steelhead may also be encountered during the period of operation.

Predation/Competition: Hatchery Chinook will be released as fingerling smolts in June to minimize in-river residence and reduce potential competition and predation on native, wild salmonids. Yearlings released in April will be as smolts to quicken there out-migration and reduce the potential predation and competition on wild salmonids (Steward and Bjornn 1990). Any future alterations to the composition and location of releases from this program, as described in the ERFRP, will take into account the potential additional risks associated to completion and predation prior to implementation of changes.

Disease Effects: The risk of disease transmission to the wild portion of the spring Chinook population is low. Transmission of hatchery-origin diseases from the hatchery to wild fish in areas where they co-occur is an unlikely event.

- 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 available.

- 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 the "take" table at end of HGMP.

-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.

The numbers of adult Chinook salmon collected as broodstock and the numbers of juvenile fish released will be consistent with levels described in the ERFRP, the NMFS 2006 biological opinion, and this HGMP. Broodstock collection (take) levels will be limited to levels described in this HGMP through careful monitoring of adult fish encounters, removals, and upstream transport at the mainstem weir, and removals of fish from the river using seines and gaffs. Juvenile fish

release numbers, types, timings, and locations will remain consistent with, and not exceed levels described in this plan. For these reasons, take levels anticipated for the program have a low likelihood for exceedance.

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.

WDFW hatchery programs in Puget Sound operate under and adhere to *U.S. v Washington* which provides the legal framework for coordinating these programs, defining artificial production; objectives *Comprehensive Management Plan for Puget Sound Chinook* (2004); and the Hatchery Action Implementation Plan (HAIP) for the watershed (see Section 3.4).

Hatchery Reform- Principles and Recommendations of the Hatchery Scientific Review Group. This report provides a detailed description of the HSRG's scientific framework, tools and resources developed for evaluating hatchery programs, the processes used to apply these tools, and the resulting principles, system-wide recommendations, and program-specific recommendations to reform (HSRG 2004).

The *Elwha River Fish Restoration Plan* (2008) resulted in changes to the program to develop appropriate production goals and protocols. This is in response to the removal of the Elwha River dams, which began September 2011. Modifications to the program in consultation between WDFW, the Elwha Tribe, and USFWS may occur as additional information is collected and analyzed (see section 1.11).

Hatchery program operation is consistent with the "Agreement Covering Contribution Toward Cost of Construction and Operation of Salmon Rearing Pond and Appurtenant Facilities on Elwha River" (Agreement, April 25, 1975). As of February 2000, with the purchase and operation of the dams by the federal government, WDFW has furnished all the management, planning, supervision, administration, personnel, materials, chemicals, tools, equipment, supplies transportation, facilities and for the operation and maintenance of the Morse Creek facilities, as funded by the NPS.

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

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* and the *Puget Sound Salmon Management Plan* (1985) which provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights through the court-ordered Puget Sound Salmon Management Plan (PSSMP) (1985).

The Annual Management Framework Plans and Salmon Runs' Status Reports for the Strait of Juan de Fuca, and the *Annual Winter and Summer Steelhead Forecasts and Management Recommendations*, are authored by WDFW, the PNPTC, and Makah Tribe.

See also section 3.1 above.

3.3) Relationship to harvest objectives.

Presently, no harvest is directed on this stock. Terminal Chinook fisheries and terminal fisheries for other species as well, have been curtailed in the Elwha River and marine areas in the proximity of the Elwha River to minimize impacts to listed Chinook. Adult fish are harvested in

mixed stock marine waters, particularly the ocean and the Strait of Juan de Fuca as well as Canadian waters. Specific exploitation rates are unknown.

Harvest of the Elwha Chinook, both directly and indirectly, is an objective after the naturally-spawning population has been restored to a healthy, harvestable status. The future operation of and goals for the hatchery, as well as the long term potential for harvest of Elwha River Chinook, will depend in part upon the natural productivity of the Elwha River, post dam removal.

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

There is currently no targeted harvest on this stock. WDFW run reconstruction data shows harvest (all indirect) for 1997-2008:

Year	Total Catch*
1997	44
1998	60
1999	NA
2000	0
2001	0
2002	0
2003	0
2004	0
2005	4
2006	4
2007	4
2008	4

* From 1995-99 catches represent primarily pre-terminal interceptions.
From 2000-08, catches represent non-directed catch in the coho fishery (Data from Randy Cooper WDFW).

Elwha hatchery fingerling fall Chinook fisheries contributions (CWT recoveries) for BY 1993

Total CWT Released		Total CWT Recovered	Smolt-to-Adult Survival
198,079		325	0.16%
Fishery	**Sampling Agency**	**Number of CWT Recovered**	**Percent Adult Contribution**
Adults			
All	ADFG	25	7.83
All	CDFO	55	16.89
Washington State			
15-Treat Troll	WDFW	2	0.64
23-PS Net	WDFW	1	0.40
45-PS Sport	WDFW	33	10.10
50-Hatchery Escapement	WDFW	189	57.99
54-Spawning Ground	WDFW	20	6.15
	Total	**325**	**100.00**
Jacks			
	Total	**0**	**0**

Elwha hatchery yearling fall Chinook fisheries contributions (CWT recoveries) for BY 1992

Total CWT Released	Total CWT Recovered	Smolt-to-Adult Survival
44,448	108	0.24%

Fishery	Sampling Agency	Number of CWT Recovered	Percent Adult Contribution
Adults			
All	ADFG	5	4.70
All	CDFO	26	24.00
Washington State			
10-Ocean Troll	WDFW	1	0.92
23-PS Net	WDFW	2	1.68
45-PS Sport	WDFW	18	16.62
50-Hatchery Escapement	WDFW	52	48.38
54-Spawning Ground	WDFW	4	3.70
	Total	**108**	**100.00**
Jacks			
	Total	**0**	**0**

3.4) Relationship to habitat protection and recovery strategies.

The Elwha Hatchery fall Chinook salmon program is included as part of WDFW-managed plans under the Co-Manager's Puget Sound Hatcheries Resource Management Plan (RMP) (PSTT and WDFW 2011 draft). The RMP is the over-arching document for 114 Puget Sound region HGMPs proposed by the co-managers for ESA approval. The RMP summarizes the hatchery management approach in the region for achieving co-manager objectives for listed and non-listed salmon and steelhead conservation, treaty Indian fishing rights preservation, and sustainable fisheries management. Meeting these objectives requires preservation and restoration of habitat supporting natural and hatchery-origin Chinook salmon populations, and the hatchery actions proposed in the RMP are based on, and integrated with, commensurate actions and plans to preserve and restore habitat.

Dam Removal. The ERFRP is the primary component of the effort to recover the Elwha Chinook salmon population included in the ESA listing of the Puget Sound Chinook salmon ESU. However, the jurisdiction of this plan is directly linked to removal of the two dams on the Elwha River, and therefore cannot address all the factors that led to the decline of Elwha Chinook salmon or, more broadly, Puget Sound Chinook salmon. Removal of both dams, beginning in September 2011 will create access to over 70 miles of potential anadromous fish habitat for Chinook and other salmonid species. The hatchery programs will preserve and bolster Chinook abundance for the recovery program prior to, during, and post-dam removal. The long-term future of the hatchery program will depend, at least in part, upon how successfully Chinook re-colonize the Elwha River naturally.

Hatchery Action Implementation Plans (HAIPs) are watershed-level documents developed by the western Washington Treaty Tribes (Tribes) and WDFW, which consolidate descriptions of hatchery programs from each watershed into a single document. This document addresses co-manager priorities, legal requirements of the Puget Sound Salmon Management Plan (PSSMP) and Endangered Species Act (ESA), and recommendations of the Hatchery Scientific Review Group (HSRG). It describes the adaptation of general principles for hatchery management to the unique genetic and ecological setting of each watershed. The HAIPs also describe how hatchery programs will operate in conjunction with harvest management, habitat restoration, and habitat protection to achieve near- and long-term goals for natural and hatchery production of salmon in each watershed, as well as listing funded and unfunded capital and operating/monitoring needs

for all state and tribal hatchery programs and facilities. Each HAIP will also outline the monitoring and evaluation needs and describe the co-manager's adaptive management approach.

Salmon Recovery Funding Board (SRFB). Created by the Legislature in 1999, the SRFB is composed of five citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities (see below). The Board supports salmon recovery by funding habitat protection and restoration projects, and related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities. The Lead Entity (LE) that includes the Elwha River watershed is the North Olympic Peninsula LE (NOPLE). NOPLE's geographic area encompasses 8,051 salmon river and coastal miles located within 90 independent watersheds and 2 unique coastal systems over 2,330 square miles with management under two counties (Clallam & Jefferson), three cities (Sequim, Port Angeles and Forks), five native tribes (Jamestown S'Klallam, Lower Elwha, Makah, Quillayute and Hoh), 3.5 WRIA's (20, 19, 18 and part of 17), a National Park, a National Forest, a Marine Sanctuary, extensive State trust lands, large private timber companies, and, of course, individual ownership.

Shared Strategy Plan. An ESU-wide recovery planning effort was undertaken by Shared Salmon Strategy for Puget Sound, a collaborative group dedicated to restoring salmon throughout Puget Sound (online at http://www.sharedsalmonstrategy.org). Strait of Juan de Fuca Chinook salmon populations and Elwha Chinook salmon, specifically, are included. Beyond dam removal, the Shared Strategy Plan includes actions adopted through the WRIA 18 Watershed Plan (Elwha-Dungeness Planning Unit 2005), the North Olympic Peninsula Lead Entity Group (NOPLE) Strategy (NOPLE 2005a), and the NOPLE Draft Nearshore Strategy (NOPLE 2005b). Recovery actions included in the Shared Strategy Plan that are not in the ERFRP include water use planning, additional habitat restoration actions, nearshore restoration actions, and land use planning.

3.5) Ecological interactions.

(1) *Salmonid and non-salmonid fishes or other species that could negatively impact the program.* Negative impacts by fishes and other species on the Elwha Hatchery Chinook program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact Elwha Chinook survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile Chinook while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile Chinook through predation include the following:

- Avian predators, including mergansers, cormorants, belted kingfishers, great blue herons, and night herons
- Mammalian predators, including mink, river otters, harbor seals, and sea lions
- Cutthroat trout

Rearing and migrating adult Chinook originating through the program may also serve as prey for large, mammalian predators in marine areas, nearshore marine areas and in the Elwha River to the detriment of population abundance and the program's success in restoration. Species that may negatively impact program fish through predation may include:

- Orcas
- Sea lions
- Harbor seals
- River otters

(2) Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program (focus is on listed and candidate salmonid species).

- Chinook
- Bull trout

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Fish species that could positively impact the program may include Chinook salmon and other salmonid species present in the Elwha River watershed through natural and hatchery production. Juvenile fish of these species may serve as prey items for the Chinook during their downstream migration in freshwater. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating Chinook. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). With integrated spawning and any carcass seeding efforts, 2,900 adult Chinook carcasses (escapement goal) could contribute, assuming average size of adult Chinook is 18 pounds, approximately 52,200 pounds of marine derived nutrients to organisms in the river.

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.* The Chinook program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying Chinook carcasses might also benefit fish in freshwater. These species include:
- Northern pikeminnow
- Chinook salmon
- Steelhead
- Pacific staghorn sculpin
- Eulachon
- Numerous marine pelagic fish species

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.

Elwha Rearing Channel. Surface and well water are both used in the production of Elwha Chinook. The City of Port Angeles completed construction of a water treatment facility in 2010 that provides Elwha River ("surface") water for the hatchery program. The Elwha Water Treatment Plant facility is designed to treat water diverted from the Elwha River through an intake structure by removing suspended sediments. It is designed for a maximum treated water capacity of 37,000 gpm. The facility consists of an influent pump station, influent/chemical mix tanks, sedimentation tanks, chemical feed and storage building, effluent flow distribution structure, slurry pump stations, office/laboratory building and associated pipelines. The plant will be operated during periods of high sediment release resulting from the removal of Elwha Dam and Glines Canyon Dam. The intake includes a concrete control weir, intake structure, supplemental diversion pump structure, fish screen structure; tunnel; piping; electrical; mechanical; utilities and site work (NPS 2010).

Up to 1200 gallons per minute (gpm) of well water is available and used for adult holding, incubation and initial rearing. Surface water is used in later rearing (up to 16,000 gpm) and for

adult attraction. Future discussions for Elwha will include improved incubation water sources and quantity, and an improved adult attraction water supply.

Hurd Creek. Water from five (5) wells provides up to 2,000 gpm water for eyeing, incubation and rearing. Water quality is excellent, requiring only passage through a de-nitro tower to improve dissolved oxygen content. Hurd Creek surface water is available as an emergency back-up supply.

Sol Duc. Gravity-fed spring water is used for both incubation and initial rearing of Elwha Chinook.

Morse Creek Hatchery. Pumps in Morse Creek provide the rearing ponds with 1,600 to 2,400 gpm for fish rearing. Morse Creek has a 1,350- square foot fiberglass pollution abatement pond to treat water used to rear fish prior to its discharge back into Morse Creek, in a condition consistent with EPA water quality standards.

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.

Elwha Rearing Channel. The four revolving screens on the water intake meet state and federal intake screen standards (NMFS, 1995, 1996). Prior to the beginning of dam removal (September 2011), the City of Port Angeles constructed a new intake structure slightly upstream from an existing diversion structure at RM 2.8. Water collected from this intake is treated during spikes of turbidity at an Elwha water treatment plant. The new plant (completed in 2010) supplies treated water to the Lower Elwha Klallam Tribe's Lower Elwha Fish Hatchery, the Elwha Rearing Channel, and acts as a back-up to a new municipal Port Angeles Water Treatment Plant (PAWTP) during and following dam removal.

Hatchery discharge results are monitored and reported per NPDES guidelines and are in compliance with NPDES guidelines under permit # WAG13-1043. The surface and well water are used in the production of Elwha Chinook. The water right permit# is G2-29018

Sol Duc., Spring water is used at for both incubation and initial rearing of Elwha Chinook (water right permit # S2-21118). Monitoring and reporting of effluent discharge results have always been in compliance with NPDES guidelines under permit number WAG13-1045.

Hurd Creek. Well water is used at this facility for eyeing Elwha Chinook eggs. The water right permit is #G2-24026. The Hurd Creek Hatchery produces a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit.

Morse Creek Hatchery. Surface water is used to acclimate and rear Elwha Chinook (water right permit #S2-30527). Intake screening meets current screening and passage criteria and poses no threat to native populations. Monitoring and reporting of effluent discharge results have been in compliance with NPDES permit number WAG13-1013.

Period	Flow (cfs)
October 1 through April 30	5.8
May 1 through June 30	4.4
July 1 through September 30	0.88

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock collection methods include:

1. Beach seining at two specific adult holding areas on the Elwha;

2. Capture of adult fish returning to the Elwha Spawning Channel side-channel weir and trap;
3. Gaffing of spawning adults on the river.
4. Gill netting at specific adult holding areas on the Elwha River (used in the past for adult collection);
5. Capture of adult fish at the resistance board weir (RBW) installed in 2010 on the mainstem Elwha at RM 3.7;
6. Capture of adult fish volunteering to the Lower Elwha Hatchery ladder and trap;
7. Capture of adult fish returning to the Morse Creek Hatchery weir and trap.

Due to poor attraction and trapping capabilities, less than 50% of the broodstock needs are met with volunteers into the Elwha Channel weir and mainstem (RBW) trap.

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

Green adults (those not ready to spawn) are transported from the various broodstock collection locations to the facility in a 400-gallon tank mounted on a flatbed truck.

Trucks available to transport juvenile Elwha Chinook

Type	Capacity
Tanker Trailer	6000 gallon
	5000 gallon
Truck-mounted tanks	2500 gallon
	2200 gallon
	1800 gallon

5.3) Broodstock holding and spawning facilities.

The Elwha Rearing Channel is 1400' x 50' and is divided into two sections by means of screens and stop logs. It was originally built as a spawning channel, but was later modified into a rearing channel. A 125' x 50' adult trapping/holding area is located directly below the Channel outfall and is equipped with a 20' x 15' spawning shed. The adult holding pond is supplied with well water.

5.4) Incubation facilities.

Hurd Creek. Eggs and milt are transported from the Elwha Channel facility (see section 8.3) and are fertilized and incubated to the eyed stage in both vertical incubators and isolation incubation buckets.

Sol Duc. Eyed-eggs transferred from Hurd Creek are incubated from the eyed stage to ponding in Heath vertical incubators. These eggs and fry are isolated from other fish groups at Sol Duc and are checked daily. There are 35 full vertical incubator stacks that can be used to isolate individual egg takes.

Elwha Channel. A 16 half-stack incubation system is set up each year at the head of the rearing channel It is protected from the elements by 28' x 21' canvas Quonset hut. This system is used for incubation of eggs that cannot be transferred off-station.

5.5) Rearing facilities.

Hurd Creek Hatchery. Fish are initially reared in a 20' X 20' X 2' section of the rearing channel. As the fish begin to outgrow this section of the channel, the screens are pulled and the fish are allowed to enter the upper half of the main channel, an area measuring 700' X 50' X 3'.

Sol Duc Hatchery. Elwha Chinook, are started in two Burroughs ponds that are 20' X 120' and hold 45,000 gallons of water each. These ponds are supplied with spring water as needed (up to 900 gallons per minute each). This component of the hatchery population is held at Sol Duc until the fish reach a size of about 400-600 fish per pound (fpp), then are shipped to Elwha Channel for

rearing to sub-yearling or yearling smolt size. Fish destined for release as yearlings at Morse Creek are shipped at 20 fpp.

5.6) Acclimation/release facilities.

Elwha Channel. The Chinook are acclimated to Elwha River water. When fish are started at the head end of this channel, however, they may be supplied exclusively with well water. The juvenile Chinook are released directly from the channel through the adult holding area and into the Elwha River.

Morse Creek Hatchery. Construction on the facility was completed in 2009. Located near the U.S. 101 Bridge (approximately R.M 1.0), just east of Port Angeles. Includes four "portable" fiberglass rearing ponds (100' x 10' x 5'), and a 1,350- square foot fiberglass pollution control board.

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

No operational difficulties have led to significant fish loss.

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.

Elwha channel: gravity feed river water can be used as a backup in the event of loss of power to the well pumps.

Sol Duc Hatchery: all rearing water is gravity fed to the ponds.

Hurd Creek Hatchery: a generator supplies back-up power in the event of power loss.

Morse Creek Hatchery: a generator supplies back-up power in the event of power loss and two gas powered pumps supply water in the event of pump failure.

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 Chinook salmon collected from the Elwha River, representing the extant, native population delineated by the Puget Sound TRT.

6.2) Supporting information.

6.2.1) History.

The Elwha Channel Hatchery program has been sustained for decades only through the collection of broodstock from the adult salmon population returning to the Elwha River. The TRT identified Chinook salmon spawning in the Elwha River as geographically distinct from other populations in east Puget Sound and Hood Canal and genetically distinct from all other Puget Sound Chinook populations (Ruckelshaus et al 2006). The hatchery- and natural-origin components of the Elwha population are genetically indistinguishable and are thought to represent the remnant, genetically-unique and independent Elwha Chinook population. Recent natural-origin Chinook productivity data suggests that Elwha Chinook would be extinct but for supportive breeding provided through annual operation of the Elwha Channel hatchery program over the past 30-40 years.

6.2.2) Annual size.

A total of 1,700 adults are required to attain the current egg-take goal of 3.5 million. This assumes a 10% pre-spawning mortality (high range), a 50:50 sex ratio and a fecundity of 4,600 eggs per female.

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

The past proportion of natural-origin fish incorporated as broodstock is unknown. Recent data from mass-marked hatchery-origin adult returns indicate that hatchery-origin fish compose the majority of the current returning Elwha Chinook salmon population. Considering long-standing blockage of the mainstem river limiting natural production, and operation of the hatchery program consistent with proposed production levels since 1976 broodstock collection operations in the mainstem river and at the hatchery facility for the past 20-30 years have likely incorporated a mix of predominately first generation hatchery fish, with natural-origin fish accounting for a low proportion of totals. The program will continue to collect the required number of adult fish from the run-at-large, representative of the current annual total return..

6.2.4) Genetic or ecological differences.

None.

6.2.5) Reasons for choosing.

This program was developed to conserve and recover the indigenous Elwha River Chinook 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.

Broodstock is selected randomly from all adult returns to the Elwha Channel weir and mainstem RBW trap, and from fish collected in the river. In selecting adults randomly from all returns, natural-origin adults are included annually in the broodstock, keeping the hatchery and naturally-produced fish genetically similar and reducing any risks of domestication the hatchery program.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Only 4.9 miles of river are available to anadromous fish, and the Elwha Channel is located approximately half way from the mouth of the river to the lower dam (at R.M. 2.9); consequently, all adult capture takes place within 2.5 miles of this facility. The Elwha Chinook broodstock are collected throughout the return period from volunteers to the Elwha Channel trap, in-river gaffing and in-river netting/seining operations. Additionally, a resistance-board weir (RBW) installed by WDFW during the Chinook salmon migration period beginning in 2010 will be used to collect additional adults for broodstock.

Seining operations begin in August and may run into early September and take place just below the hatchery in two main adult holding areas. Adult Chinook begin volunteering into the hatchery trap in August and continue into early or mid-October. Gaffing starts in early to mid-September and continues to mid or late-October and is conducted seven days a week, one to two miles above and below the hatchery facility. Gaffed fish are normally fully mature and are spawned as they are collected. Between 75-80% of the adults needed to meet the programmed egg take have been collected by gaffing and/or seining. This will likely diminish due to the use of the RBW for adult collection. All netted, volunteer, and gaffed fish are used in the spawning operation, thereby reducing sources of bias that could lead to a non-representative sample of the broodstock. See section 7.4.2 for a breakdown of the number of fish collected by year.

For all years, most losses of adult fish collected as broodstock are associated with holding adults through maturation and as a result of *Dermocystidium* infestation. Only two to three fish per year are lost in the process of collecting adults on the river.

Per the ERFRP, in 2010, a resistance board weir was installed at approximately RM 3.7 (upstream from the spawning channel) to enable Chinook broodstock collection prior to and during dam removal (began September 2011). The trap is operated by WDFW's Wild Salmon Production/Evaluation Unit (WSPE) from (tentatively) March through May, and August through October, according to fish movement and flow conditions. The adult Chinook are transported to the WDFW rearing channel in a 400-gallon tank for holding and spawning in well water. No broodstock were collected at the RBW in 2010; Chinook and pink salmon broodstock were collected in 2011. Until the weir proves to be a reliable collection site, most of the broodstock will continue to be collected by the previous methods. The spacing for the holding box is 1-inch, small enough to collect jack Chinook (if present) for broodstock.

7.3) Identity.

Since the 2004 brood year, there has been a consistent release of CWT and otolith-marked fish from this program. Beginning with the 2010 brood year releases in 2011, all sub-yearlings and yearlings produced through the program are also tagged with a blank wire tag ("agency wire") While otolith mark only fish cannot be identified while alive, their contribution to both broodstock and naturally spawning groups in the Elwha can be estimated upon return. Fish that receive a wire tag prior to release can be identified as hatchery origin, both as juvenile out-migrants and as returning adults, with the use of a CWT detection device.

7.4) Proposed number to be collected:

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

Program goal is 1,700 fish annually.

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

Elwha channel spawn records

Year	Gaffed	Seined/Trap Volunteers	Total	Loss	Percent	Upstream/ Surplus
1998	702	987	1,689	51	2.17%	
1999	517	182	699	16	1.75%	7
2000	732	404	1,136	21	1.47%	41
2001	958	595	1,553	38	1.91%	
2002	952	561	1,513	40	.72%	
2003	490	692	1,182	78	1.40%	0
2004	849	480	1,329	39	2.94%	0
2005	1,192	204	1,396	7	.36%	0
2006	861	366	1,227	7	.57%	4
2007	574	183	757	9	1.19%	0
2008	578	89	667	16	2.40%	0
2009	1,307	207	1,514	16	1.06%	11
2010*	644	65	709	5		0
				Average Loss =	1.50%	

Source: Data provided by Randy Cooper (WDFW Area Biologist), and Mike Gross (WDFW District Biologist).
* Preliminary.

Sex composition of broodstock collected (hatchery, natural, and unknown-origin combined) for Elwha Chinook program (Source: WDFW Hatchery Database).

Year	Hatchery		
	Male	Female	Jack
1999	293	406	0
2000	509	627	0
2001	732	824	0
2002	678	935	0
2003	562	620	0
2004	573	752	0
2005	604	792	0
2006	487	745	0
2007	286	471	0
2008	306	361	0
2009	537	977	0
2010	334	376	7
Average	492	657	<1

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

Typically, there have been very few if any fish in excess of program needs. The collection table in sec 7.2 shows the annual total of fish returned to the river that were surplus to program needs. In years when large numbers of volunteers have entered the trap on their own, gaffing has been reduced accordingly to prevent excess from occurring. Consistent with during- and post dam removal fish production schedules specified in the ERFRP (Ward et al. 2008), when the total Chinook return abundances exceeds a certain level, fish surplus to hatchery needs will be transported live upstream above the dam sites for release to allow the fish to spawn naturally.

7.6) Fish transportation and holding methods.

Adults netted from the river are placed in 5-ft diameter ring nets and gently maneuvered to a location where they can be transferred to a 400-gallon tank truck. From the ring nets, the fish are placed head first in a half inner tube (tube is sealed at the bottom end and contains a small amount of water), carried via the tube, and placed in a tank, containing a salt solution, on the truck. Transportation to the hatchery takes 5-15 minutes. The fish are removed from the tank, injected with Liquamycin and placed in the holding pond. Pond covers and sprinklers within the holding area keep the fish relatively calm until they ripen.

In 2010, a resistance board weir was installed at approximately RM 3.7 (upstream from the spawning channel) to collect Chinook broodstock prior to and during dam removal. Captured adult Chinook are held in "fish boots" for transport by truck in a 400-gallon tank to the Elwha Channel facility, and held in well water before spawning.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult fish are held on well water, which has an ambient temperature considerably cooler than the river, and assumed relatively pathogen free. At one time, volunteering adults were held on ambient river water. Losses of adults in the trap and the river were occasionally excessive, approaching 30%, due to the parasite *Dermocystidium* sp. The loss of trapped adults mirrored the loss of adults in the wild. Trapping does not appear to exacerbate the loss. The use of well water has significantly reduced mortality from "Dermo" to a level of about 5%.

Adults are treated daily with formalin, at a rate not exceeding 25 parts per million (ppm) at the pond outfall, as a precaution against fungus infection.

Eggs at Sol Duc are incubated on spring water and are received from Hurd Creek so close to hatching that formalin treatments are not administered.

7.8) Disposition of carcasses.

In recent years all carcasses have been returned to the river as part of a nutrient enhancement program.

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.

Broodstock collection from the river is random occurring across the entire breadth of the total annual adult return. In-river activity is minimized to reduce negative impacts on actively spawning fish and redds. Netted or gaffed adults are held in well water if they are not ready to spawn, which enhances their survival to spawning. Typically, water from the Elwha River is not used to hold adults, due to the high water temperatures and the presence of the parasite *Dermocystidium* (sometimes surface water is used when water temperatures are low and extra flow may attract more volunteers).

SECTION 8. MATING

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

8.1) Selection method.

Broodstock are spawned, as they ripen, across the entire maturation time frame. In-river collection, via gaffing, occurs 7-days/week, with a focus on collecting females for egg-take. If there are not enough males collected by gaffing, males from the pond may be used. On pond-spawning day, all females collected from the river, plus the females in the pond are spawned primarily with males in the pond, plus a few males gaffed from the river.

8.2) Males.

All males collected, including jacks (when present), are used in the spawning operation. Males used for spawning are collected randomly from the available spawners (see also section 8.1).

The RBW, installed at approximately RM 3.7, has a picket-spacing of 1-inch, which is small enough to be jack-tight, and could provide jacks for broodstock, per HSRG recommendations (2004).

8.3) Fertilization.

Fertilization takes place at Hurd Creek Hatchery; eggs are not fertilized at the Elwha egg-take sites (although some fertilization may take place at Elwha Channel for eggs that cannot be transferred). Eggs are collected in three- or four-fish pools, depending upon the volume of the eggs. Sperm is collected in one-fish units (no pooling), in plastic bags with oxygen. Eggs and sperm are then iced and transported to Hurd Creek Hatchery, where eggs are fertilized in a "modified factorial" design, where each bucket of pooled eggs is split into three to four aliquots, depending upon the number of females, and each aliquot of eggs is fertilized with sperm from one male. After a few moments, the eggs are recombined and placed into isolation incubation units for water hardening in iodophor and incubated until virus-free certification is completed.

8.4) Cryopreserved gametes.

Not applicable.

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.

Adults to be spawned will be chosen at random from the available gene pool. Out-of-basin strays will not be knowingly spawned or incorporated into the gene pool. Every attempt will be made to ensure that the egg-take is representative of the entire Chinook run in the Elwha River.

In an effort to minimize directed, artificial selection of traits that could negatively affect this listed population, proper spawning protocols are implemented to maximize the representation of each individual adult into the entire brood.

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 onthe success of meeting the desired hatchery goals.

9.1) Incubation:

Elwha Chinook eggs (approximately 3.5+ million) are shipped, unfertilized, to Hurd Creek for eyeing and virus certification. Upon certification, 3.3-million eyed eggs are shipped to the Sol Duc Hatchery for incubation and initial rearing. The fry are returned to Elwha at 400-600 fish per pound (fpp) by April of each year (often as early as late February if the fish are large enough to return to Elwha) for final rearing and imprinting on Elwha river water prior to release. A total of 200,000+ eyed-eggs are kept at Hurd Creek for rearing, before transfer at 20-60 fpp (October) to Elwha Channel for release as yearlings.

There are minimal incubation facilities available at Elwha Channel and no facilities at Morse Creek Hatchery. Eggs/fish destined for grow-out and planting from these facilities are incubated and initially reared at Hurd Creek and Sol Duc hatcheries.

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

Egg-to-incubation survival of Chinook eggs collected at Elwha Channel.

Brood Year	Eggs Collected (Elwha Channel)	Survival Rates*	
		Green-to-Eyed Up (Hurd Cr Hatchery)	Eyed-Up-to-Ponding (Sol Duc Hatchery)
1999	1,602,560	95.52%	98.70%
2000	2,314,320	93.50%	98.40%
2001	4,157,670	94.79%	98.04%
2002	4,304,858	95.13%	97.20%
2003	3,447,125	95.14%	97.24%
2004	3,674,144	91.31%	99.40%
2005	3,930,945	92.16%	95.30%
2006	3,598,300	91.66%	99.10%
2007	2,200,776	94.79%	97.80%
2008	1,429,245	96.13%	99.40%
2009	4,193,714	90.70%	99.40%
2010	1,886,065	92.05%	97.70%
Average	3,061,644	93.57%	98.14%

Source: Hatchery records from Hurd Creek and Sol Duc Hatchery (2011).
*Rates are for both the sub-yearling and yearling components of the program.

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

There are no surplus eggs associated with this recovery program.

9.1.3) Loading densities applied during incubation.

Elwha Spawning Channel: Elwha Chinook eggs average 1300 per pound (/lb) with a range of 1200/lb to 1400/lb.

Hurd Creek Hatchery: Elwha eggs are incubated in vertical style incubators (FAL) at 5 lbs (6000 - 7000 eggs) per tray with a flow of 4 gallons per minute (gpm).

Sol Duc Hatchery: Eyed eggs are incubated at 8,000 eggs per tray or an average of about 6 lbs per tray. Flows are 4 gpm.

9.1.4) Incubation conditions.

Hurd Creek Hatchery: Eggs are incubated on pathogen free ground water at constant 47°F. All effluent water is discharged through a ultra-violet treatment unit. No silt removal is required. Dissolved oxygen remains constant at 11.2 mg/l, provided by a de-gassing tower on the well water supply.

Sol Duc Hatchery: Eggs are incubated on Vexar substrate. The gravity-fed spring water provides very clean water at a constant 46°F. Dissolved oxygen levels stay well within normal incubation levels.

9.1.5) Ponding.

Sol Duc Hatchery: Ponding of Elwha Chinook occurs in December and January when the fish are 95%+ buttoned up. The fry are placed directly into the Burroughs pond for rearing. Fish are transferred to Elwha Channel at 400-600 fpp (February-April) for rearing acclimation and release. Fish destined for release as yearlings at Morse Creek Hatchery are transferred at 20 fpp (October).

Hurd Creek Hatchery. Fish are initially reared in a 20' X 20' X 2' section of the rearing channel. As the fish begin to outgrow this section of the channel, the screens are pulled and the fish are allowed to enter the upper half of the main channel, an area measuring 700' X 50' X 3'. Fish are transferred to Elwha Channel at 20-60 fpp for rearing acclimation and yearling release.

9.1.6) Fish health maintenance and monitoring.

Elwha channel: There are no incubation facilities at the Elwha Channel; fish are incubated at Hurd Creek and Sol Duc hatcheries.

Hurd Creek Hatchery: All eggs are fertilized and water hardened in an iodophore solution. Fungus in incubators is controlled by formalin drip (at a nominal 1,667 ppm) throughout incubation to just prior to hatch. Fungus control is by formalin injection directly into the water supply header for each row of stacks. Application rate is one 15-minute injection per day at a target dose of 1,667-ppm formalin. At approximately 500 TU's the eggs are shocked and dead eggs removed by hand picking prior to laying eggs down to hatch. After mortality removal, around 3.3-million eyed eggs are inventoried and are transferred to the Sol Duc Hatchery for hatching and initial rearing; around 200,000 eyed-eggs are retained at Hurd Creek Hatchery and reared for yearling release at Elwha Channel.

Sol Duc Hatchery: Eggs are incubated on spring water to minimize fungus growth.

Morse Creek Hatchery: There are no incubation facilities at Morse Creek Hatchery Fish reared at Morse Creek are incubated at Hurd Creek and Sol Duc hatcheries.

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.

Hurd Creek Hatchery: Eggs are incubated on well water to avoid loss due to silt and pathogens. All systems are alarmed with 24-hr/day monitoring and an emergency backup generator.

Sol Duc Hatchery: Sol Duc is able to incubate using very clean spring water. Siltation is never a problem during incubation.

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.

Survival rates of Elwha Chinook fingerlings reared at Sol Duc Hatchery, released at Elwha Spawning Channel.

Brood Year	Fingerling Survival Rates	
	Solduc Ponding to Elwha Transfer	Elwha ponding to release
1999	98.10%	N/A
2000	98.40%	N/A
2001	98%	N/A
2002	97.20%	N/A
2003	96.90%	N/A
2004	98.20%	99.52
2005	94.60%	N/A
2006	98.10%	98.94
2007	98.20%	99.77
2008	99.40%	99.62
2009	99.40%	99.71
2010	97.70%	99.44
Average	**97.85%**	**99.50**

Data source: WDFW hatchery records
N/A = Data not available.

Survival rates of Elwha Chinook yearlings, reared at Hurd Creek Hatchery, released at Elwha Spawning Channel

Brood Year	Hurd Creek Hatchery Survival Rates		Elwha Ch Survival Rate
	Ponding to Fingerling	Fingerling to Yearling (transfer to Elwha)	Acclimation to Release*
1999	N/A	N/A	N/A
2000	N/A	N/A	N/A
2001	N/A	N/A	N/A
2002	N/A	N/A	N/A
2003	N/A	N/A	98.09
2004	N/A	N/A	80.70
2005	N/A	N/A	41.70

2006	N/A	N/A	N/A
2007	N/A	N/A	81.06
2008	N/A	N/A	97.84
2009	N/A	N/A	98.33
2010	N/A	N/A	N/A
Average			82.95

Data source: WDFW hatchery records
N/A = Data not available.

- Survival rates are a combination of fish received from Hurd Creek, Bear Springs and Sol Duc, not solely from Hurd Creek

Low survival rates for brood years 2004, 2005, and 2007 are due to fish loss from fish transferred from Sol Duc Hatchery (40,000, 77.000 and 78,000, respectively). Mortalities were associated with bacterial gill disease (BGD), cold water disease (CWD), erythrocytic inclusion body syndrome (EIBS), bacterial kidney disease (BKD) and fungus.

Survival rates of Elwha Chinook yearlings reared at Sol Duc Hatchery, released at Morse Creek Hatchery.

Brood Year	**Sol Duc Hatchery Survival Rates**		**Morse Cr Survival Rate**
	Ponding to Fingerling	**Fingerling to Yearling (transfer to Morse Cr)**	**Acclimation to Release**
1999	98.10%	N/A	N/A
2000	98.40%	N/A	N/A
2001	98%	N/A	N/A
2002	97.20%	N/A	N/A
2003	96.90%	N/A	N/A
2004	98.20%	N/A	N/A
2005	94.60%	N/A	N/A
2006	98.10%	N/A	N/A
2007	98.20%	N/A	N/A
2008	99.40%	N/A	N/A
2009	99.40%	N/A	N/A
2010	97.70%	N/A	N/A
Average	**97.85%**		

Data source: WDFW hatchery records
N/A = Data not available.

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

Fish rearing densities are maintained at maximum under 3 lbs of fish /gpm at release and under 0.35 lbs /cu.ft.

9.2.3) Fish rearing conditions

Elwha channel: Fish are transferred from Sol Duc Hatchery at an individual size of 400-600 fpp, usually in February. Fish are started on 49°F well water, but are soon shifted to surface water from the Elwha River (see table below). Dissolved oxygen levels in the rearing pond are at least 10 ppm, as measured at the outflow.

Morse Creek Hatchery: Fish are transferred into the facility in October, and are reared in surface water from Morse Creek (see table below).

Average water from surface water at Elwha Channel and Morse Creek Hatchery

Month	Average Water Temperature °F	
	Elwha Channel	Morse Creek Hatchery
October	n/a	41-53
November	n/a	34-44
December	n/a	33-44
January	37-41	33-42
February	38-42	33-42
March	40-45	36-45
April	42-47	38-45
May	45-50	n/a
June	49-54	n/a

n/a = "not applicable"

Sol Duc Hatchery: Early rearing at Sol Duc utilizes spring water at a constant 46°F.

Hurd Creek Hatchery: Early rearing uses water from five (5) wells.

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.

Average size (fpp), by month, of juvenile Chinook fingerlings reared at Elwha rearing channel and Sol Duc Hatchery

Month	Average Size (fpp)	
	Elwha Channel	Sol Duc Hatchery
January	625	900
February	485	500
March	310	n/a*
April	175	n/a
May	105	n/a
June	80	n/a

n/a = "not applicable"
* Fish are shipped back to rear at Elwha channel.

Morse Creek Hatchery: Fish are transferred into the facility from Sol Duc Hatchery in mid October at an individual size of approximately 20 fpp and are reared to release at 8 to 10 fpp in early April.

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*).

Fish feeding frequencies begin at 8 feedings/day and end at 2 feedings/day. Depending on fish size and water temperature, feed rates vary from 1.75% to 2.25% B.W./day. An overall season food conversion rate of approximately 1.2:1 is considered normal.

Bio Diet Starter #3 is fed to the Elwha Chinook while at Sol Duc. Pelleted Bio-Diet feeds are fed as a daily grower diet.

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

Fish health is monitored on a daily basis by hatchery staff and at least monthly by a state Fish Health Specialist. Hatchery personnel carry out treatments prescribed by the FHS. Procedures are consistent with the Co-Manager's Fish Health Policy (1998).

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

The migratory state of the release population is determined by fish behavior. Aggressive screen and intake crowding, leaner condition factors, a more silvery physical appearance and loose scales during feeding events are signs of smolt development. ATPase activity is not measured.

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

No "NATURES" type rearing methods are applied through the program.

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.

All reasonable and prudent measures will be employed to minimize rearing and incubation losses. These include the use of high quality spring or well water for incubation, use of high quality feeds for rearing, rearing densities and loadings that conform to best management practices and frequent fish health inspections.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Age Class	Facility	Maximum Number	Size (fpp)	Release Date	Location
Fingerling	Elwha Hatchery	2,500,000	80*	June	Elwha River
Yearling	Elwha Hatchery	200,000	10*	April	Elwha River
	Morse Creek Hatchery	200,000	10	April	Morse Creek

* 80 fpp ~ 80 mm fork length
10 fpp ~ 155 mm fork length

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

Stream, river, or watercourse: Elwha River (18.0272)

Release point: RM 2.9

Major watershed: Elwha River

Basin or Region: Strait of Juan de Fuca

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

Release Year	Elwha Hatchery				Morse Creek Hatchery	
	Fingerling	Avg. size	Yearling	Avg. size	Yearling	Avg. size
1999	4,025,000	78				
2000	1,803,000	64				
2001	2,583,000	60				

2002	3,962,493	71	1,500[1]	10		
2003	3,965,000	73				
2004	2,782,666	79	72,400	8		
2005	2,750,000	78	318,150	8	106,100	11
2006	2,957,000[2]	62	174,500	8	181,400	11
2007	2,609,000	65	140,900	7	206,500	12
2008	1,868,400	71	276,950	7	208,000	10
2009	926,000	61	340,946	9	0[3]	
2010	3,266,130[4]	54	201,517	9	200,500	10
2011	1,230,562[5]	64	200,824	8	202,731	12
Average	**2,671,404**	**68**	**193,465**	**8**	**184,205**	**11**

[1] Fish were initially to be used for Captive Brood program. Project discontinued.

[2] Fingerling releases in 2006-10 do not include 13,000 fish released by the Lower Elwha Tribe to calibrate their screw trap. In May of 2006, estimated 60,000 release of small fish (176 fpp) that arrived from Sol Duc Hatchery not included.

[3] No release into Morse Creek in 2009, fish released as part of 340,946 yearling releases from Elwha.

[4] Includes 228,000 fingerling reared at Morse Creek; does not include 10,000 fish released to calibrate the trap.

[5] Does not include 6,000 fish released to calibrate the trap.

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

Release Type: Volitional/Forced	**Elwha Creek Hatchery**		**Morse Creek Hatchery**
Release Year	**Fingerling**	**Yearling**	**Yearling**
1999	6/8-6/18		
2000	6/15-6/28		
2001	6/10-6/17		
2002	6/11-6/14	11/14	
2003	6/10-6/17		
2004	6/13	5/1-8	
2005	5/10-5/15; 6/10-6/15	4/1-4/5	
2006	5/2:5/12;5/26;6/14-15	4/7-4/18	
2007	6/6-6/14	4/7	
2008	6/4	4/1-4/3	
2009	6/2-6/4	3/25-3/31; 4/1	
2010	6/2; 6/3	4/7	4/7-4/10
2011	6/7	4/13	4/1-4/12

Visible signs dictate fish release dates, i.e. working edges of ponds and screens etc. Screens are pulled to start a volitional release while the remainder are forced to leave after feed has run out or very few remain. Also, release fish in late afternoon into the evening and on a low exchange tide to prevent stranding caused by extreme low tides. From the 2002 brood year population, 70,000 Chinook yearlings were to be planted into Morse Creek. Acclimation sites had not been secured so these fish were eventually planted into the Elwha River in the spring of 2004.

10.5) Fish transportation procedures, if applicable.

The above described numbers of sub-yearling and yearling fish will be released on-station from either Elwha Channel Hatchery or Morse Creek Hatchery. Any transportation of juveniles for off-station release will be consistent with schedules specified in the ERFRP.

10.6) Acclimation procedures

All Elwha Chinook are acclimated on Elwha River water prior to release.

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

Brood Year	Facility	Fingerlings	Yearlings	Marking
2011	Elwha Channel	2,500,000	n/a	Otolith
		n/a	200,000	Blank tag wire only
	Morse Creek Hatchery	n/a	200,000	Otolith+CWT

n/a = "not applicable"
WDFW, Future Brood Document 2011

For 2002 through 2006 brood years, approximately 200,000 fingerlings were coded-wire tagged only (CWT-only) for release in the spring of 2003, 2004, 2005, 2006 and 2007, respectively, into the Elwha River. No fish from the 2007 brood year were tagged and released in the spring of 2008. No adipose-fin clipped/coded-wire tagged (Ad.CWT) fish had been done since the 1994 brood year. At that time, 10.65% of the population was identified with an Ad.CWT. Hoko River fall Chinook are used as the indicator stock for the Straits of Juan de Fuca.

For the 2003 brood year yearling Chinook program, approximately 106,100 were coded-wire tagged (CWT) only and released in the spring of 2005 into Morse Creek while 112,500 CWT-only Chinook (out of the 318,150 total release) were released into the Elwha River. For the 2006 release (2004 BY), 181,400 CWT-only yearling Chinook were reared and transferred from the Sol Duc Hatchery and planted into Morse Creek while 174,500 CWT-only yearling Chinook were released into the Elwha River. For the 2007 release, 206,500 CWT-only yearling Chinook were planted into Morse Creek via Sol Duc Hatchery while 140,900 CWT-only yearling Chinook were planted from the Elwha Hatchery into the Elwha River. For the 2008 release, 208,000 CWT-only yearling Chinook were planted into Morse Creek via Sol Duc Hatchery while 276,950 CWT-only yearling Chinook were planted from the Elwha Hatchery into the Elwha River. In 2009, 340,946 yearling Chinook released from the Elwha Hatchery were CWT-only. The 2004 and 2005 brood year fish have been 100% otolith marked also.

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

No program surplus exists in this recovery program.

10.9) Fish health certification procedures applied pre-release.

Prior to release, fish health is monitored and the fish health status of the population is certified by a WDFW Fish Health Specialist.

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

Emergency release procedures in case of water system failure involve removal of screens and stop logs, switching to a gravity water system, and allowing fish to migrate. If an emergency occurred at the Sol Duc hatchery the fish would be placed on an alternative water source and then transported back to Elwha. During a flood or drought event, fish may be released early directly into the Elwha River to prevent possible fish loss.

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

The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with listed Chinook. To minimize the risk of residualization and impact upon natural fish, hatchery fingerlings are released in June (80 fpp) while yearling smolts are released in April (10.0 fpp).

Hatchery Chinook will be liberated as fingerling smolts in June to minimize in-river residence and reduce potential competition and predation on native, wild salmonids. Yearlings released in April will be as smolts to quicken there out-migration and reduce the potential predation and competition on wild salmonids (Steward and Bjornn 1990). They also concluded that hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearlings) may have different food and habitat preferences than listed natural-origin fish, and that hatchery-origin fish will be unlikely to out-compete natural-origin listed fish. The location of the hatchery in the lower portion of the river (RM 2.9) also acts to reduce interactions with rearing natural-origin listed fish, including newly emerged fry present in the upper portion of the drainage.

In addition, a rearing parameter of the program is to attain a coefficient of variation (CV) for length of 10.0% or less in order to increase the likelihood that most of the fish are ready to migrate (Fuss and Ashbrook 1995). Such fish would be less likely to residualize in fresh water and interact with listed wild fish. The average CV for release years' 1995-2002 (excluding the year 2000) was 7.30%.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

Elements of the annual Monitoring and Evaluation plan for this program are identified in Section 1.10, which identifies and evaluate the benefits and risks that may derive from the hatchery program.

The *Elwha River Fish Restoration Plan* (2008) identifies four Adaptive Management Plan objectives.

Objective 1: Evaluate recolonization by species (or genotype) and method of reintroduction through the examination of rebuilding rates (production), population size (abundance), spatial distribution, and habitat utilization.

Objective 2: Document the genetic structure and life history diversity of existing Elwha River fish populations. Identify how genetic structure and life history diversity are affected by dam removal and hatchery practices over time. Document how any changes affect the viability of the population.

Objective 3: Monitor fish health over time, space, and method of reintroduction.

Objective 4: Document recovery of ecosystem processes over time and space. Ecosystem recovery includes not only freshwater, but also riparian, nearshore, and terrestrial habitats.

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

Until marking (adipose-fin clip/coded-wire tag or adipose-fin clip only) of program fish can take place on a consistent basis, sufficient data cannot be collected to allow for proper monitoring and evaluation of the program. This includes HOR/NOR ratios on the spawning grounds, survival rates and straying to other watersheds.

See also The *Elwha River Fish Restoration Plan* (2008) for monitoring parameters and frequency for adaptive management plan objectives.

The Chinook hatchery program may be terminated sooner than envisioned in the EFRP (a 10 year plan) if RM&E shows that the Chinook population is approaching interim restoration targets.

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

Limited funding and resources are currently committed to monitor and evaluate this program as detailed in the Resource Management Plan for Puget Sound Chinook Salmon Hatcheries (Washington Department of Fish and Wildlife and Puget Sound Treaty Tribes, August 23, 2002).

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.

Limited monitoring and evaluation will be undertaken in a manner that does not result in an unauthorized take of listed Chinook.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Not applicable

12.2) Cooperating and funding agencies.

Not applicable

12.3) Principle investigator or project supervisor and staff.

Not applicable

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

Not applicable

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

Not applicable

12.6) Dates or time period in which research activity occurs.

Not applicable

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

Not applicable

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

Not applicable

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).

Not applicable

12.10) Alternative methods to achieve project objectives.

Not applicable

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

Not applicable

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.

Not applicable

SECTION 13. ATTACHMENTS AND CITATIONS

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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:_____

ADDENDUM A. SECTION 15. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2)

15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions, including hatchery operations.

> *"The department is authorized by the USFWS for certain activities that may result in the take of bull trout, including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys..."*

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

Bull Trout

Bull trout/Dolly Varden in the lower Elwha River (below the hydropower dams) have been identified as a distinct stock based on their geographic distribution. Anglers have reported hooking bull trout/Dolly Varden in the lower river over the years. The population in the lower river is thought to be anadromous.

Elwha River bull trout are included in the Coastal Puget Sound distinct population segment (DPS), which is listed as threatened under the ESA. In the draft recovery plan, the USFWS (2004) identified a number of "core areas," thought to be strongholds for the population, which must be protected and restored. The USFSW identified the Elwha River as a core area with one identified local population and one potential local population in Little River (USFWS 2004).

Other listed or candidate species:

Not Applicable

15.3) Analyze effects.

15.4 Actions taken to minimize potential effects.

15.5 References

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

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound Chinook	**Activity:** Elwha Chinook Program
Location of hatchery activity: Elwha River, Hurd Creek Hatchery, Sol Duc Hatchery	**Dates of activity:** August-June	**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)			10	
Intentional lethal take f)			Up to 1,700	
Unintentional lethal take g)	275,000	80,000	Up to 40	
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.*

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as "fishery enhancement".

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as "supplementation."

Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural origin recruit (NOR) - See *natural fish* .

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery,

natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see "Population").

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.
(generally from Washington Department of Fish and Wildlife, November, 1999).

	SPECIES/AGE CLASS	Number of fish/pound	SIZE/CRITERIA Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Yearling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 8000	0.6 to <23
X	Sockeye Fall Releases	>150	>2.9
X	Sockeye Fry	>800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=0.45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fry	>20 to 150	3 to <23
X	Steelhead Unfed Fry	>150	<3
X	Cutthroat Yearling	<=20	>=23
X	Cutthroat Fingerling	>20 to 150	3 to <23
X	Cutthroat Fry	>150	<3
X	Trout Legals	<=10	>=0.45
X	Trout Fry	>10	<0.45

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria and 1 year old.

DRAFT