HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Dungeness River Early Winter Steelhead Hatchery Program (Segregated)
Species or Hatchery Stock:	Early Winter Steelhead (*Oncorhynchus mykiss*)
Agency/Operator:	Washington Department of Fish & Wildlife
Watershed and Region:	Dungeness River (Strait of Juan de Fuca)/ Puget Sound
Date Submitted:	July 28, 2014
Date Last Updated:	July 26, 2014

Executive Summary

ESA Permit Status:
On March 31, 2004 the Washington Department of Fish and Wildlife (WDFW) and the Puget Sound Treaty Tribes submitted a Hatchery Genetic Management Plan (HGMP) for the Dungeness River Hatchery early winter steelhead program under Limit 6 of the 4(d) rule. In a letter from NOAA Fisheries dated August 4, 2004, the co-managers were informed that NOAA Fisheries anticipated completing a draft Environmental Impact Statement (EIS) by the summer of 2005. NOAA noted that "A final EIS may then be completed by winter 2005-2006, after which time NOAA Fisheries will release ESA 4(d) Rule determinations for the hatchery plans." The letter concluded by stating that "Your work on these hatchery plans is important, and will substantially contribute to on-going salmon recovery efforts within the region." The WDFW provided updated HGMPs to NOAA Fisheries in August 2005.

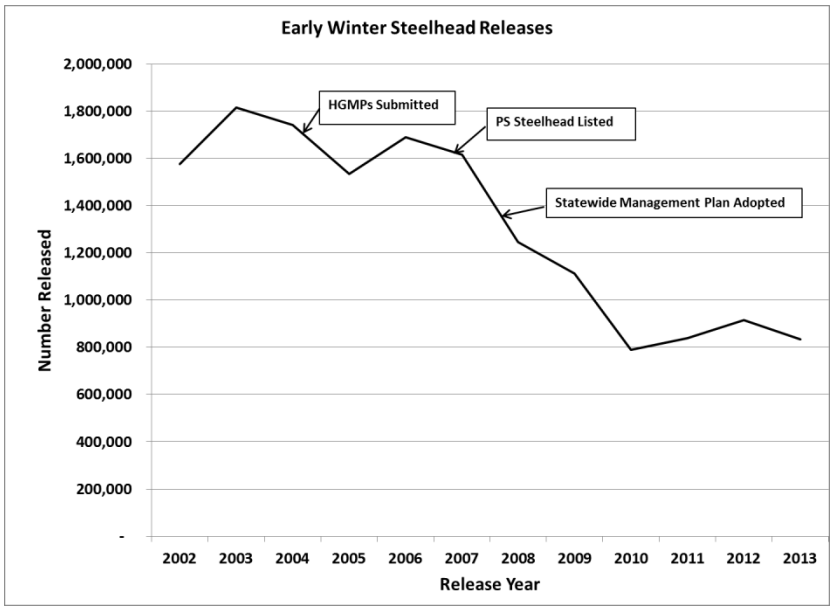
The co-managers are now re-submitting an HGMP for the Dungeness River Hatchery early winter steelhead program to further update the description of the program and incorporate new information and analyses.

The Puget Sound steelhead Distinct Population Segment (DPS) is listed as "Threatened" under the ESA, however, Dungeness Hatchery early winter steelhead are not included in the ESA-listing. The Puget Sound Technical Recovery Team has preliminarily delineated one Demographically Independent Population of native winter steelhead in the Dungeness Basin.

Early Winter Steelhead - Additional Risk Reduction Measures:
The co-managers have implemented substantial additional risk reduction measures for early winter hatchery steelhead programs since the HGMPs were first submitted in 2004. The risk reduction measures were developed around the principles and recommendations of the co-managers' Resource Management Plans, the Puget Sound Hatchery Scientific Review Group, and the Statewide Steelhead Management Plan adopted by the Washington Fish and Wildlife Commission in 2008.

Across the Puget Sound Distinct Population Segment (DPS), these risk reduction measures include:

- >50% reduction in hatchery releases of early winter steelhead;
- >65% reduction in release locations;
- Elimination of cross-basin transfers;
- Establishment of a network of natural origin stock gene banks; and
- Genetic monitoring of hatchery strays to natural spawning areas.



The developments of new genetic analysis techniques since July 2013 has provided significant new information to evaluate and, as necessary, further modify hatchery programs.

Dungeness Hatchery Early Winter Steelhead Program:
The purpose of the program is to produce Dungeness River early winter steelhead for sustainable recreational and tribal fisheries. Juvenile fish will be produced at the Dungeness Hatchery (located on the Dungeness River) and Hurd Creek Hatchery (located on Hurd Creek, a tributary to the Dungeness River). The program will release 10,000 yearling smolts to the lower Dungeness River annually.

The program will be operated as a "segregated" program with the intent for the hatchery population to represent a distinct population that is reproductively isolated from naturally-spawning populations. Segregation will be achieved operationally by using only adult hatchery early winter steelhead (distinguished by an adipose fin-clip) returning to the Dungeness River Hatchery trap, and by operating the program in a manner to limit gene flow to the natural origin population.

Analyses of effective pHOS and gene flow do not indicate that program size needs to be reduced from the 2005 level. The effective pHOS for the program is estimated to be less than 0.01 with gene flow < 2%. The Hatchery Scientific Review Group has recommended an effective pHOS of less than 10% for contributing populations, and an effective pHOS of less than 5% for primary populations (HSRG 2009). The Statewide Steelhead Management Plan requires an average gene flow of less than 2% for primary populations.

Additional risk- reduction measures that have been implemented since 2005 include:

- Hatchery trap now remains open through March 31 to provide opportunity for all adult hatchery fish to return to the hatchery.
- All eggs are taken from hatchery fish returning prior to January 31 to maintain a temporal separation in the spawn-timing of hatchery and natural origin fish.
- All eggs are collected from broodstock returning to the Dungeness Hatchery (rather than the Elwha Hatchery) to promote fidelity of homing to the hatchery.

Risk control measures are also in place to address other potential hazards including ecological interactions, disease transmission, and facility effects.

Harvest:
WDFW and Tribal co-managers (Point No Point Treaty Council representing the Port Gamble Tribe, the Jamestown S'Klallam Tribe and the Lower Elwha Klallam Tribe) prepare an annual Fisheries Management Plan for the harvest of Dungeness River winter steelhead produced from this program (WDFW et al. 2008 to present). Returning early winter steelhead adults provide for limited tribal commercial and subsistence use and provide a localized recreational sport fishery, mostly from November through January each year. Tribal fisheries include net and hook and line fisheries, generally from early-December through late-February. The sport fishery directed at hatchery-origin adults for the 2013-14 season was open October 16 to January 31, within selected stream reaches with two hatchery-origin steelhead over 20 inches allowed (WDFW Sport Fishing Rules 2013/2014).

Monitoring, Evaluation, and Adaptive Management:
WDFW and the Jamestown S'Klallam Tribe conduct annual spawning ground surveys in the Dungeness River mainstem and the Gray Wolf River. Survey data are used to track annual trends in natural population abundance and spatial distribution. WDFW and the Jamestown S'Klallam Tribe continues to annually monitor natural production and smolt emigration timing via juvenile trapping on Matriotti Creek and the mainstem Dungeness River, at RKm 0.5. WDFW is also implementing a genetic monitoring program to measure the proportion effective hatchery contribution (PEHC) and gene flow between

segregated hatchery steelhead and natural origin populations in the Puget Sound DPS. These monitoring programs will provide information to adaptively manage the early winter hatchery programs.

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Dungeness River Early Winter Steelhead Program.

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

Dungeness River Early Winter Hatchery Steelhead (*Oncorhynchus mykiss*).

Not listed – The early winter hatchery stock is not considered part of the Puget Sound Distinct Population Segment (DPS) for Puget Sound Steelhead listed as *Threatened* under the ESA (National Marine Fisheries Service, May 11, 2007); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448).

1.3) Responsible organization and individuals

Name (and title): Randy Aho, Region 6 Hatchery Operations Manager
Agency: Washington Department of Fish and Wildlife
Address: 48 Devonshire Road, Montesano, WA 98563
Telephone: 360 249-1203
Fax: (360) 249-1229
Email: Randy.Aho@dfw.wa.gov

Fish Management Staff Lead Contact
Name (and title): Mike Gross, District 16 Fish Biologist
Agency: Washington Department of Fish and Wildlife
Address: 48 Devonshire Road, Montesano WA 98563
Telephone: 360-249-4628 ex 1210
Fax: 360-664-0689
Email: Michael.Gross@dfw.wa.gov

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

Co-manager policies are in effect for all Puget Sound hatchery programs.

The Lower Elwha Klallam Tribe and the Point No Point Treaty Council (**Jamestown S'Klallam and Port Gamble S'Klallam Tribes)** along with WDFW prepare an annual fishery management plan for the harvest of Dungeness River early winter steelhead produced from this program.

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

Program	Funding Sources	Operational Information (FY 2011)
Dungeness Hatchery	General Fund –State PST Grant	Annual operating cost (dollars $163,667) FTEs = 3.0
Hurd Creek Hatchery	GF-State	Annual operating cost (dollars $134,413) FTEs = 2.0 FTE = 0.5 (CWT/Mass Marking Funds)

The annual operating costs apply to all species produced from these facilities.

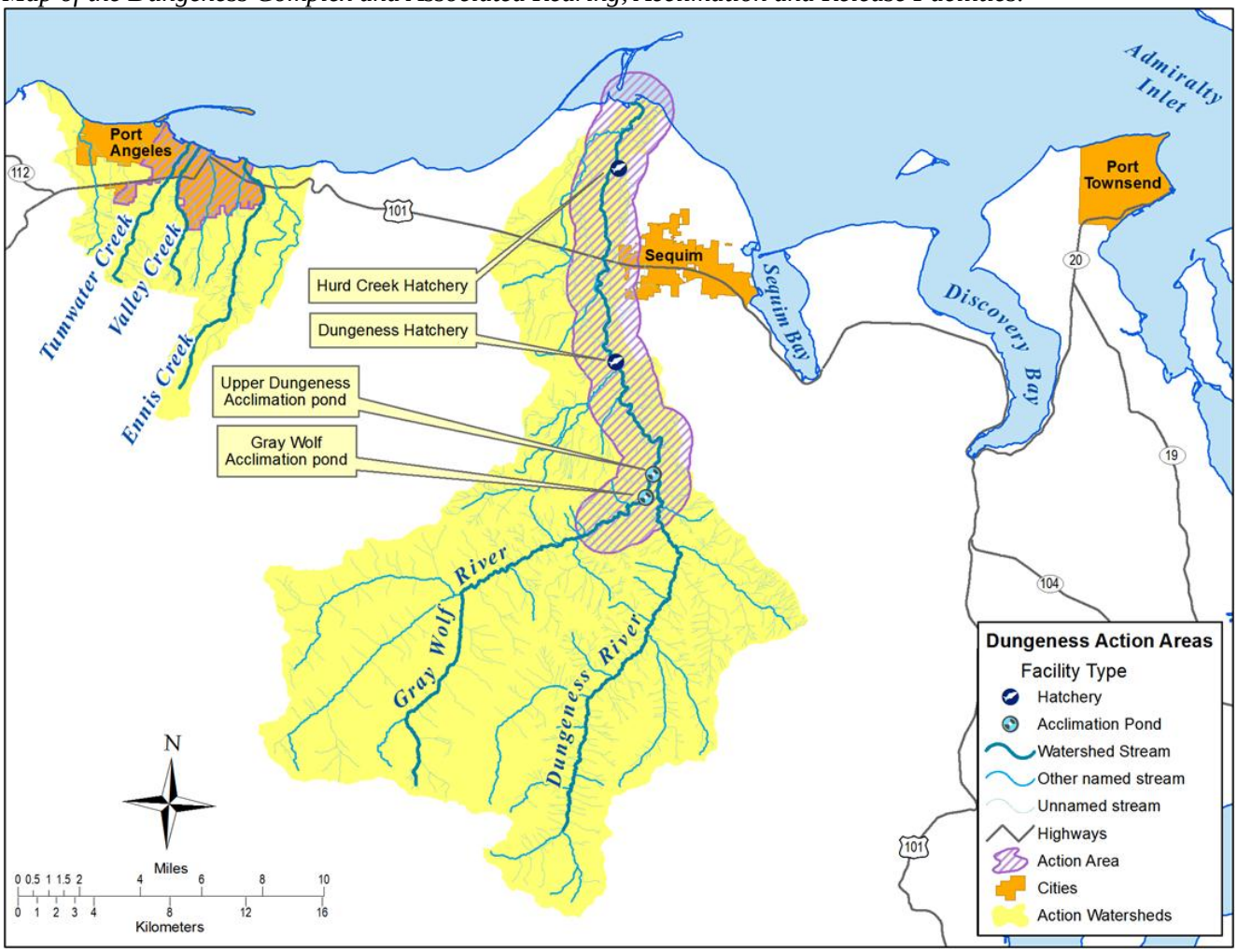
1.5) Location(s) of hatchery and associated facilities.

Broodstock Collection; Acclimation; and Release Location:
Dungeness Hatchery: Located on the Dungeness River (WRIA 18.0018) at RM 10.5.

Incubation and Rearing Location

Hurd Creek Hatchery: Located on Hurd Creek (WRIA 18.0028) at RM 0.2; tributary to Dungeness River (WRIA 18.0018) at RM 3.0.

Map of the Dungeness Complex and Associated Rearing, Acclimation and Release Facilities.



Source: WDFW GIS Staff.

1.6) Type of program.

Segregated Harvest.

1.7) Purpose (Goal) of program.

Harvest Augmentation.

1.8) Justification for the program.

Natural-origin steelhead populations cannot sustain sport or treaty tribe harvest opportunities in the Dungeness River Basin and without hatchery augmentation these opportunities would not exist.

The purpose of the program is to produce Dungeness River early winter steelhead for sustainable fisheries, for harvest in terminal recreational fisheries and to fulfill Treaty Indian fishing right entitlements in *U.S. v Washington* (1974).

To minimize impacts on listed fish from facilities operations: the following Risk Aversions are included in this HGMP:

Table 1.8.1: Summary of risk aversion measures for the Dungeness early winter steelhead program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Surface water rights for Dungeness Hatchery are formalized through trust water right permits #'s S2-06221 (25CFS) and S2-21709 (15CFS) for the Dungeness River and # S2-00568 (8.5CFS) for Canyon Creek. Canyon Creek is used when the Dungeness River is excessively silty or icy. Hurd Creek water rights are formalized through permit # G2-24026.
Intake Screening	4.2	The auxiliary intake (siphon) at Dungeness River Hatchery is unscreened and has not operated since 1999. The regular intake was compliant with the guidelines existing at the time of construction (NMFS 1995, 1996). The water intakes at Dungeness River Hatchery are to be screened to be in compliance with current NMFS guidelines (NMFS 2011c) to protect juvenile fishes. The Dungeness River Hatchery Canyon Creek intake was identified as a high-priority capitol project and funds were designated in 2012 to replace/renovate the intake to meet current fish passage and screening requirements. Construction on the auxiliary intake (siphon) is dependent upon funding and obtaining permission from the landowner. The intake screen at Canyon Creek was identified as a Jobs Now project and is currently designed and in the permitting phase, the WDFW target for completion is 2017. The WDFW Capitol and Assets Management Program informs that the bid for repair of this intake and restoration of fish passage to Canyon Creek is anticipated in autumn 2014, and that the work is scheduled to be completed in the summer/autumn of 2017. Modifications to the siphon and main Agnew Ditch intakes are infeasible at present; the timeline for design, funding, permitting and construction is 2021.
Effluent Discharge	4.2	The Dungeness Hatchery has an off-line settling pond and artificial wetland for effluent removal before the water is discharged back into the river (regulated through NPDES permit # WAG 13-1037). 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. Funds were designated in 2012 construct a new two-bay pollution abatement pond, scheduled to begin by Spring 2014.

Broodstock Management & Adult Passage	2.2.3, 7.9	At the Dungeness facility, hatchery steelhead voluntarily enter an off-channel pond in a time period (November through March) outside the return time of the spring Chinook run. Hatchery protocols and program size assessed and adjusted to meet pHOS and gene flow standards.
Disease Transmission	9.2.7	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) details hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	Hatchery fish are reared to meet Statewide Steelhead Rearing and Release Guidelines (Tipping 2001). Steelhead smolts are released in May foster rapid migration to marine waters and to allow juvenile listed fish to grow to a size that reduces the potential for predation.

1.9) List of program "Performance Standards".

See HGMP Section 1.10. Standards and indicators are referenced from Northwest Power Planning Council (NPPC) Artificial Production Review (APR) (NPPC 2001).

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

1.10.1) "Performance Indicators" addressing benefits.

Table 1.10.1.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.1 Program contributes to fulfilling tribal trust responsibility mandate and treaty rights as described in *U.S. v Washington*.	Contributes to co-manager harvest.	Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process, HAIPs, annual fisheries management plans).
3.1.2 Program contributes to mitigation requirements.	Number of fish released by program, returning, or caught, applicable to given mitigation requirements.	Annually estimate survival and contribution to fisheries for each brood year released. This program provides mitigation for lost fish production due to development within the Dungeness system and contributes to sport and tribal fisheries.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
3.2.1 Fish produced for harvest are propagated and released in a manner enabling effective	Annual number of fish produced by program caught in all fisheries, including estimates of	Annually mass-mark hatchery steelhead releases to differentiate hatchery from natural-origin fish

harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	fish released.	and record estimates of mark rate. The external mark enables mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Agencies monitor harvests and hatchery returns to provide up-to-date information. See 3.3.3. Estimate survival and contribution to fisheries for each brood year released.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Number of marks released and estimated proportion of marks in out-migrant juveniles and returning adults. Percentage of total hatchery releases are mass-marked (fin clips, otoliths, tags, etc., depending on species) to allow for their differentiation from naturally-produced fish.	Annually monitor and report size, number, date of release and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Annually sample returning fish during coho surveys through February 1st, and at the hatchery; record numbers of estimated hatchery (marked) and natural (unmarked) fish.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal distribution of broodstock collection at point of collection.	Collect broodstock representatively and systematically throughout the early portion of the return (November through January 31). Collect annual run timing, and sex composition and spawning escapement timing data has been collected for 2011 and 2013 by the Jamestown S'Klallam Tribe. Adhere to WDFW spawning guidelines (Seidel 1983; HSRG 2004).
3.5.5 Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with natural-origin fish.	Level of smoltification (size, appearance, behavior, etc.) at release compared to WDFW rearing and release guidelines (Tipping 2001). Release type (forced, volitional, or direct).	Monitor fish condition in the hatchery throughout all rearing stages. Annually monitor and report size, condition factor, number, and date of release.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is properly sized to meet harvest objectives; program fish are fully utilized in target fisheries.	Monitor harvests and hatchery returns throughout the run.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply basic monitoring standards in the hatchery: feed conversion rates, growth trajectories, mark/tag rates, weight distributions (CVs).	Collect annual run timing and sex composition data upon adult return. Annually monitor and report growth rates, mark rate and size at release and release dates. Adhere to HSRG (2004) and

		WDFW spawning guidelines (Seidel 1983).
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Contributes to cultural and recreational benefits to the general population. Also contributes cultural, ceremonial and subsistence (C&S), and recreational benefits for PNW Native Americans. Surplus (food-grade quality) fish provides contributions to local charitable organizations. Recreational fishery angler days, length of season, number of licenses purchased.	Assess annual harvest of hatchery fish based on Catch Record Card (CRC) estimates. See 3.3.2. Annually record and report number of surplus fish donated to local food banks.

1.10.2) "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance Indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science and hatchery management actions. Monitor juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and hatchery escapement.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	Annual number of fish produced by this program caught in all fisheries, including estimates of fish released.	Annually mass-mark hatchery steelhead releases (adipose fin-clip) to differentiate hatchery from natural-origin fish, and record estimates of mark rate. The external mark enables state agencies to initiate mark-selective fisheries, which can reduce directed harvest mortality on natural-origin fish. Harvest is regulated to meet appropriate biological assessment criteria. Agencies monitor harvests and hatchery escapements to provide up-to-date information.
3.2.2 Release groups are sufficiently marked in a manner	Number of marks released and estimated proportion of marks in	Annually monitor and report size, number, date of release,

consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	out-migrant juveniles and returning adults at the hatchery. Percentage of total hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) produced fish to allow for their differentiation from naturally produced fish for selective fisheries.	and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Assess annual harvest of mass-marked hatchery fish based on CRC estimates.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	All hatchery production is identifiable in some manner (fin-marks, tags, otolith, etc.) consistent with information needs.	Annually monitor and report size, number, date of release and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Examine returning fish for the fin-mark at the hatchery. Annually monitor and report numbers of estimated hatchery (marked) and natural (unmarked) fish. As adopted in the *Statewide Steelhead Management Plan* (*SSMP 2008),* segregated harvest programs are to result in an average gene flow of less than 2% from the hatchery to the natural origin stock for primary populations as well as a pHOS of less than 5%. Performance standards for contributing are <10% and maintaining current conditions for stabilizing (HSRG 2004).
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Segregated program - only marked hatchery fish are used for broodstock purposes; fish are spawned before January 31, to minimize potential overlap with natural origin spawn timing. Collect annual run timing and sex composition data.
3.4.3 Life history characteristics of the natural population do not change as a result of this hatchery program.	Life history patterns of juvenile and adult NOR are stable.	Currently not monitored.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure will not affect survival of the population	Conduct genetic monitoring of the hatchery and natural populations (see HGMP section 11.1).

3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Total number of natural-origin spawners (if any) reaching the collection facility. Timing of collection compared to overall run timing - broodstock-separated timing of earlier hatchery fish from later natural origin spawners to minimize potential spawning.	All hatchery production is identifiable in some manner (fin-marks, tags, etc.). Segregated program - only marked hatchery fish are used for broodstock purposes; fish are spawned before January 31. Collect annual run timing, origin, and sex composition data. Examine returning fish for the fin-mark at the hatchery. Annually monitor and report numbers of estimated hatchery (marked) and natural (unmarked). As adopted in the *Statewide Steelhead Management Plan* (*SSMP 2008)*, segregated harvest programs are to result in an average gene flow of less than 2% from the hatchery to the natural origin stock for primary populations as well as a pHOS of less than 5%. Performance standards for contributing are <10% and maintaining current conditions for stabilizing (HSRG 2004).
3.5.3 Hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.	The ratio of observed and/or estimated effective hatchery-origin spawners on natural spawning grounds, to total number of naturally-produced fish (pHOS).	Examine returning fish for the fin-mark at the hatchery. Annually record numbers of estimated hatchery (marked) and natural (unmarked) fish. Spawner surveys were not conducted in the Dungeness River from 2002 through 2009. The Jamestown S'Klallam Tribe has conducted spawner surveys in each year beginning in 2010: Surveys in 2010, and particularly in 2012, were cut short due to high water levels associated with spring rain and snow runoff; however escapement estimates can be obtained through the use of timing curves from other comparable river systems. The Jamestown S'Klallam Tribe has completed estimates of spawners for the entire season for 2011 and 2013. As adopted

		in the *Statewide Steelhead Management Plan* (*SSMP 2008)*, segregated harvest programs are to result in an average gene flow of less than 2% from the hatchery to the natural origin stock for primary populations as well as a pHOS of less than 5%. Performance standards for contributing are <10% and maintaining current conditions for stabilizing (HSRG 2004). WDFW is implementing a genetic monitoring program to measure proportion effective hatchery spawners and gene flow between segregated hatchery (Early winter stock and early summer) steelhead and natural origin populations in the Puget Sound DPS (see Anderson et al. 2014 for additional information).
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually record release information (including location, method, and age class) in WDFW Hatcheries Headquarters Database.
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Release type (forced, volitional or direct).	Annually monitor and report size, number, date of release and release type.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is sized appropriately for harvest goals. Numbers of surplus hatchery returns are calculated annually.	Annually monitor and report numbers of adults returning to the hatchery, broodstock collected, and surplus returns.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, the *Co-Managers' Salmonid Disease Control Policy*, INAD, MDFWP).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. The program is operated consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit.	Flow and discharge reported in monthly NPDES reports.

	WDOE water right permit compliance.	
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. Follow the *Co-Managers' Salmonid Disease Control Policy* (WDFW and WWTIT 1998, updated 2006).	Necropsies of fish to assess health, nutritional status, and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	Examine fish 1 to 6 weeks prior to transfer or release, in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites.	At spawning, examine adult broodstock for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Conduct controls of specific fish pathogens through eggs/fish movements in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
3.7.5 Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines.	All applicable fish disease policies are followed. See HGMP sections 7.5 and 7.8	Conduct controls of specific fish pathogens through eggs/fish movements in accordance to the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

		Record and report disposition of carcasses in the WDFW Hatcheries Headquarters Database
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below weir/trap currently compared to historic distribution.	Trap is checked regularly. When natural-origin steelhead are encountered during trapping, they are safely returned to the river.
3.7.7 Weir/trap operations do not result in significant stress, injury or mortality in natural populations.	Mortality rates in trap. Pre-spawning mortality rates of captured fish in the hatchery and/or after release.	Trap checked regularly. Annually monitor and report abundances and observation natural- and hatchery-origin fish at hatchery facilities.
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Hatchery smolt release size and time are monitored to quantify/minimize predation effects on naturally-produced listed fish (Sharpe et al. 2008, Pflug et al. 2013) (see also HGMP section 2.2.3). No predation data available for the watershed.
3.8.1 Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	Total cost of operation.	Compare annual operational cost of program to calculated fishery contribution value (Wegge 2009).

1.11) Expected size of program.

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

Up to 30 adults collected annually with an egg take goal of up to 50,000.

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

Table 1.11.2.1: Proposed annual fish releases.

Life Stage	Release Location	Annual Release Level
Yearling	Dungeness River (WRIA 18.0018)	10,000

Source: Future Brood Document 2013.

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

Due to a lack of coded-wire tag (CWT) studies and limitations that not all fish can be accounted for as being harvested or as back-to-rack counts, accurate smolt-to-adult survival rates (SAR) cannot be calculated. Based on the average smolt-to-adult survival of 0.52% for brood years 1996-2007 and a programmed release goal of 10,000 yearlings, the estimated adult production (goal) level would be 52 (See HGMP section 3.3.1).

Table 1.12.1: Hatchery Escapement, Dungeness Hatchery 2001-2013.

Year	Hatchery Escapement
2001/2002	12
2002/2003	10
2003/2004	22
2004/2005	34
2005/2006	16
2006/2007	39
2007/2008	4
2008/2009	3
2009/2010	29
2010/2011	20
2011/2012	52
2012/2013	67
Average	**26**

Source: WDFW Hatcheries Headquarters Database 2013.

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

Early winter steelhead have been planted in this system since 1955 from the Bogachiel and Elwha Basin Hatcheries. Dungeness Hatchery began releasing early winter steelhead in 1995.

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Dungeness River (WRIA 18.0018)/Strait of Juan de Fuca.

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

Alternative 1: *Reduce the program*. Reduce hatchery-origin early winter steelhead release numbers as a measure to decrease genetic and ecological risks to natural-origin steelhead. The Co-Managers did not pursue this alternative because the program is projected to meet standards and a reduction would gain negligible ecological benefits while imposing harsh consequences on harvest; this alternative would not meet enhancement or harvest objectives for the program and would not meet the goals of either Co-Manager, including providing recreational, cultural and subsistence, ceremonial, religious, commercial and non-commercial benefits, nor be compatible with Treaty fishing rights assured through *U.S. v Washington* (1974) for sustainable fisheries.

Alternative 2: Discontinue the program. The Co-Managers did not pursue this alternative because: 1) program is projected to meet standards; and 2) it would not meet enhancement or harvest objectives for the program and would not meet the goals of either Co-Manager, which include providing recreational, cultural and subsistence, ceremonial, religious, commercial and non-commercial benefits, nor be compatible with Treaty fishing rights assured through *U.S. v Washington* (1974) for sustainable fisheries.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

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

WDFW previously submitted the Dungeness HGMP to NOAA in August of 2005. However the HGMP was not acted on by NOAA. This HGMP will be submitted to NOAA Fisheries for ESA consultation, and determination regarding compliance of the plan with ESA section 4(d) rule criteria for joint state/tribal hatchery resource management plans affecting listed species.

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

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

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

None directly.

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

Puget Sound Chinook (*Oncorhynchus tshawytscha*): Listed as *Threatened* on March 24, 1999 (64FR14308); *Threatened* status reaffirmed on June 28, 2005 (70FR37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The Puget Sound Chinook salmon ESU is composed of 31 historically quasi-independent populations, of which 22 are believed to be extant currently. The ESU includes all naturally-spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington (Ford 2011), as well as twenty-seven artificial propagation programs (NMFS 2013 78FR38270). In the Strait of Juan de Fuca region, the Technical Recovery Team (TRT) has identified demographically independent populations (DIPs) in the Dungeness and Elwha River basins (Ruckelshaus et al. 2006).

Hood Canal summer chum (*Oncorhynchus keta*): Listed as *Threatened* on Mar. 25, 1999 (64FR14507); *Threatened* status reaffirmed on June 28, 2005 (70FR37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). Final designation for Critical Habitat was published Sept. 2, 2005 (70FR52630), with effective date of Jan. 2, 2006. The ESU includes all naturally spawned populations of summer-run chum in Hood Canal and its tributaries, populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington (Ford 2011). Also includes summer chum from four artificial propagation programs: Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, Tahuya River and the Jimmycomelately Creek Fish Hatchery summer-run chum programs (NMFS 2013 78FR38270).

Puget Sound steelhead *(Oncorhynchus mykis*s): Listed as *Threatened* under the ESA on May 11, 2007 (72FR26722); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The DPS includes all naturally-spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, below natural migration barriers in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington. This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive) (Ford 2011). Also includes steelhead from six artificial propagation programs: Green River Natural; White River Winter Steelhead Supplementation; Hood Canal

Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and the Lower Elwha Fish Hatchery Wild Steelhead Recovery (NMFS 2013 78FR38270). In the Dungeness Basin, the TRT has preliminarily delineated one demographically independent population (DIP) of winter steelhead. A population of summer steelhead may also be present in the watershed and if so would become part of a combined winter/ summer DIP (PSSTRT 2013).

2.2.2) Status of NMFS 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

Dungeness spring Chinook in the Puget Sound Chinook ESU: NMFS (1999) considered this stock to be part of the ESU and essential for recovery. The population was designated Category 1a. This broodstock was recently founded by naturally spawning fish native to the basin, although persistent small run sizes may have result in moderate levels of divergence from the historical population. Recent escapement levels (2000-2011) have averaged 559 for natural spawners in the Dungeness River DIP and the population has shown a slight declining trend during this same period (SaSI, WDFW 2012).

Puget Sound Chinook salmon: Updated Risk Summary. All Puget Sound Chinook populations are well below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Several of the risk factors identified by Good et al. (2005) are also still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat. Many of the habitat and hatchery actions identified in the Puget Sound Chinook recovery plan are expected to take years or decades to be implemented and to produce significant improvements in natural population attributes, and these trends are consistent with these expectations. Overall, the new information on abundance, productivity, spatial structure and diversity since the 2005 review does not indicate a change in the biological risk category since the time of the last BRT status review (Ford 2011).

Table 2.2.2.1: Dungeness Chinook (Strait of Juan de Fuca), minimum viability spawning abundance and abundance at equilibrium or replacement, and spawning A/P at MSY for a recovered state as determined by EDT analyses of properly functioning conditions and expressed as a Beverton-Holt function. The TRT minimum viability abundance was the equilibrium abundance or 17,000, whichever was less.

Region and population	TRT minimum viability abundance	Under properly functioning conditions (PFC)			NMFS Escapement Thresholds	
		Equilibrium abundance	Spawners at MSY	Productivity at MSY	Critical[a]	Rebuilding[b]
Dungeness	4,700	4,700	1,000	3	200[c]	925[d]
ESU	**261,300**	**307,500**	**70,948**	**3.2**	**3,875**	**2,785**

Source: Ford 2011; NMFS 2011b.

[a] Critical natural-origin escapement thresholds under current habitat and environmental conditions (McElhaney et al. 2000; NMFS 2000a).

[b] Rebuilding natural-origin escapement thresholds under current habitat and environmental conditions (McElhaney et al. 2000; NMFS 2000a).

[c] Based on generic VSP guidance (McElhaney et al. 2000; NMFS 2000a).

[d] Based on alternative habitat assessment.

Dungeness summer chum in the Hood Canal summer chum ESU. The numbers of summer Chum seen in the Dungeness are so low that they may not represent a self-sustaining stock, but may be strays from other stocks. There are no data prior to 1980 that indicate the presence of a summer chum stock in the Dungeness River (SaSI, WDFW 2012).

Strait of Juan de Fuca summer chum in Hood Canal summer chum ESU. A viable population of summer chum salmon in the Strait of Juan de Fuca population has 12,500 spawners, assuming a 1:1 replacement rate and density-independent dynamics at low population sizes. Spawner escapement numbers for a viable Strait of Juan de Fuca population could be as low as 4,500 adults if it can be assumed that the population is driven by density-dependent dynamics and the intrinsic α and β parameters of the population's viable spawner-recruit curve can be estimated and achieved (i.e., for escapement = 4,500, then α = 5 and β = 3,300) (Sands et al. 2009).

Hood Canal summer chum salmon - Updated Risk Summary: The spawning abundance of this ESU has clearly increased since the time of listing, although the recent abundance is down from the previous five years. While spawning abundances have remained relatively high compared to the low levels in the early 1990s, productivity has decreased significantly for the last five brood years, being lower for brood years 2002-2006 than any previous 5-year average since 1971. This is a concern for future production. Since abundance is increasing and productivity is decreasing, this suggests that improvements in habitat and ecosystem function are needed. Diversity is increasing from the low values seen in the 1990s due both to the reintroduction of spawning aggregates and the more uniform relative abundance between populations; this is a good sign for viability in terms of spatial structure and diversity. Spawning survey data show that the spawning distribution within most streams has been extended further upstream as abundance has increased (WDFW and PNPTC 2007). Overall, the new information considered does not indicate a change in the biological risk category since the time of the last BRT status review (Ford 2011).

Dungeness steelhead in the Puget Sound steelhead DPS. Spawner surveys were not conducted in the Dungeness River from 2002 through 2009. The Jamestown S'Klallam Tribe has conducted spawner surveys in each year beginning in 2010:

2010: 80 redds and 3 live fish observed.
2011: 170 redds and 7 live fish observed
2012:40 redds and 29 live fish observed
2013: 203 redds and 178 liver fish observed

Surveys in 2010, and particularly in 2012, were cut short due to high water levels associated with spring rain and snow runoff; however escapement estimates can be obtained through the use of timing curves from other comparable river systems. The Jamestown S'Klallam Tribe has completed estimates of spawners for the entire season for 2011 and 2013. An estimated 410 fish spawned in 2011, and an estimated 564 fish spawned in 2013 after March 10. Ford (2011) used spawner data collected through 2001 and concluded the following: "The counts have been very low and have steadily declined since the early 1990s. The estimated probability that this steelhead population would decline to 10% of its current estimated 228 abundance (i.e., to 8 fish) within 100 years is high but could not be calculated. With an estimated mean population growth rate of -0.096 ($\lambda = 0.908$) and process variance of < 0.001, NOAA was highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 20 years (but will occur within 30 years), and that a 99% decline will not occur within the next 40 years (but will occur within 55-60 years). However, for other years and values of decline NOAA was less certain about the precise level of risk." Based on a preliminary intrinsic potential (IP) estimate by the PSSTRT (2013), the capacity for steelhead in this system is 246 to 4,930 fish (Table 2.2.2.2).

*Puget Sound steelhead: Updated Risk Summary***.** The number of winter steelhead spawners has increased for many populations in Puget Sound since 2009. The number of spawners for 16 Puget Sound winter steelhead populations, relative to the average number of spawners for each population in the four year period up to the listing in 2007, increased to an average of 53% in 2009 to 141% in 2013.

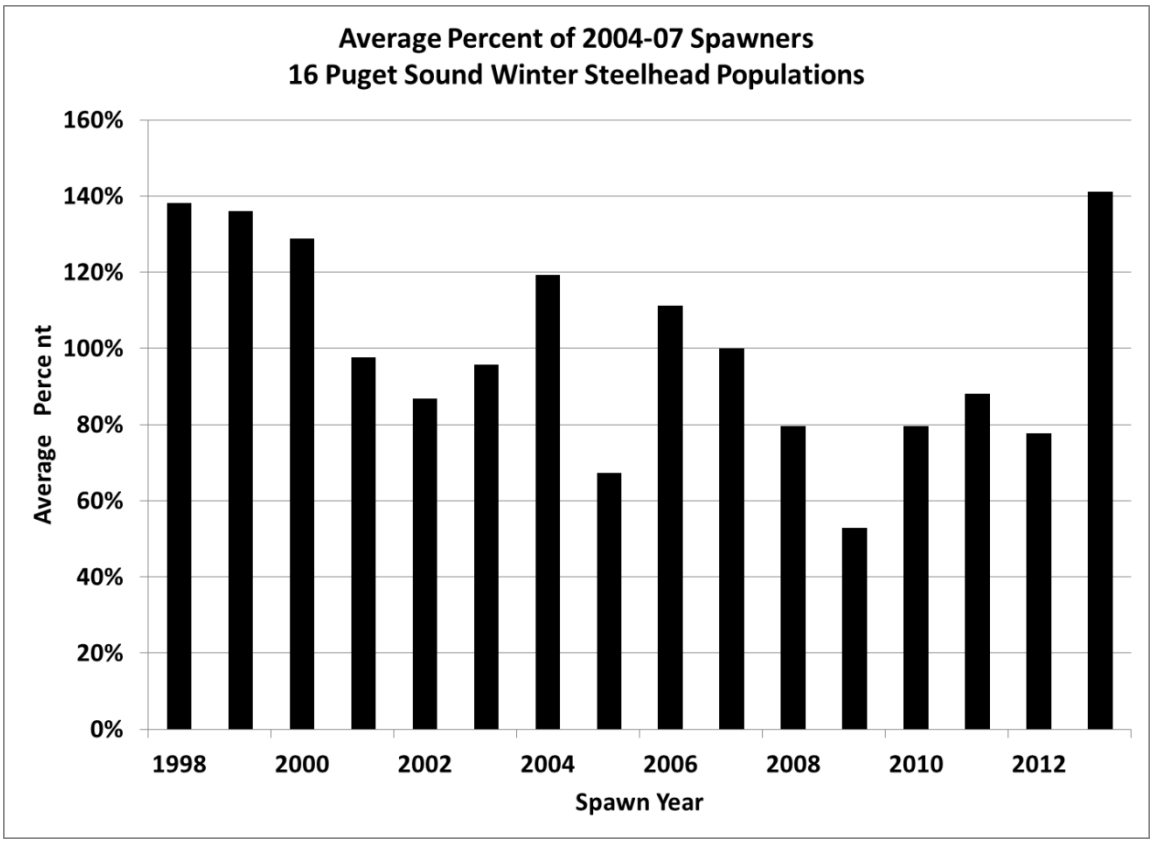


Figure. 2.2.2.1. Average percent of 2004-2007 spawners for 16 Puget Sound winter steelhead populations.

These recent, short-term increases in spawners are a positive development, but do not negate the long-term risks facing Puget Sound steelhead DPS. Using spawner data collected through 2008 or 2009, Ford (2011) concluded that the status of the listed Puget Sound steelhead DPS has not changed substantially since the 2007 listing, and that steelhead in the Puget Sound DPS remain at risk of extinction throughout all or a significant portion of their range in the foreseeable future but are not currently in danger of imminent extinction.

Table 2.2.2.2: Interim DIP abundance goals for steelhead in Puget Sound, based on a four-year average. Abundance goals for summer-run fish (italics) are still under review. QET, quasi extinction threshold; SAS, smolt to adult survival. Minimum abundance = 100 (Low Abundance), 250 (Viable).

Population Basin				Quasi Extinction Threshold	Low Abundance	Viable	Capacity
Population Name	Area km^2	Mean Elevation (m)	Total Stream Length (m)		1% SAS	5% SAS	20% SAS
Dungeness R	564	978	306,740	30	246	1,232	4,930
Puget DPS Total				**1,462**	**30,449**	**153,194**	**613,662**

Source: Hard et al. 2014.

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.

Dungeness Spring Chinook (*Oncorhynchus tshawytscha*): WDFW smolt monitoring activity occurs on this system. Most downstream migrants caught are sub-yearlings, although some yearlings are caught each year. Since trapping began in 2005 freshwater production has declined, with an average of 106,070 migrants per year from 2005-2007 and 24,459 from 2008 to 2012.

Table 2.2.2.3: Natural/Natural origin Freshwater Production Estimates for Chinook in the Dungeness River 2005-2012.

Outmigration Year	Chinook Sub-yearling			
	Freshwater Production	CV	Fry[a]	Parr[a]
2005	72,040	5.26%	19,084	52,911
2006	136,724	12.79%	74,319	62,405
2007	109,445	7.23%	27,740	81,705
2008	11,506	7.79%	3,400	8,108
2009	20,196	5.77%	3,904	16,292
2010	9,674	8.01%	1,801	7,873
2011	10,222	NA	1,451	8,771
2012	70,697	5.60%	24,636	46,062
Average	**55,063**		**19,542**	**35,516**

Source: WDFW Topping 2012.

[a] Fry and parr are both sub-yearling Chinook migrants, but represent different freshwater rearing strategies; fry ≤ 45 mm fork length.

Table 2.2.2.4: Puget Sound Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S). Trend over the intervals is also given.

Brood Years	1982-1986		1987-1991		1992-1996		1997-2001		2002-2006		Trend	
Populations	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**
Dungeness	*0.58*	*0.21*	*0.31*	*0.11*	*0.25*	*0.2*	*1.67*	*0.93*	*0.44*	*0.18*	*0.11*	*0.08*
ESU	***9.57***	***2.19***	***5.05***	***0.96***	***3.01***	***1.24***	***2.70***	***1.19***	***1.67***	***0.67***	***-1.81***	***-0.28***

Source: This table was provided by Ford (2011). These analyses incorporate assumptions for years where escapements were not sampled for hatchery: natural-origin ratios that are not necessarily agreed to by WDFW and the Tribes.

Table 2.2.2.5: Short and long term population trend and growth rate estimates for the Puget Sound Chinook ESU populations

Regions and Populations	Years	Trend Natural Spawners w/Cl	Hatchery Fish Success = 0 Lambda w/Cl	p>1	Hatchery Fish Success = 1 Lambda w/Cl	p>1
Dungeness River Summer Run	1995-2009	1.209 (1.093 - 1.336)	1.191 (0.279 - 5.074)	0.82	0.805 (0.269 - 2.408)	0.12
	1986-2009	1.096 (1.039 - 1.156)	1.079 (0.764 - 1.523)	0.73	0.728 (0.53 - 1.001)	0.03

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Tribes. "Lambda" is a measure of population growth rate. See Ford (2011) for explanation of the columns.

Dungeness Summer Chum (*Oncorhynchus keta*):

Table 2.2.2.6: Short and long term population trend and growth rate estimates for the Hood Canal Summer Chum ESU populations.

Population	Years	Trend Nat Sp w/CI	Hatchery Fish Success =0		Hatchery Fish Success =1	
			Lambda w/CI	p>1	Lambda w/CI	p>1
Strait of Juan de Fuca	1995-2009	1.184 (1.06 - 1.324)	1.139 (0.242 - 5.365)	0.76	1.009 (0.255 - 3.989)	0.53
	1971-2009	1.013 0.984 - 1.043)	1.028 (0.872 - 1.211)	0.65	0.99 (0.867 - 1.129)	0.43

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Tribes. "Lambda" is a measure of population growth rate. See Ford (2011) for explanation of the columns.

Dungeness Steelhead (*Oncorhynchus mykiss*): WDFW smolt monitoring activity occurs on this system and between 2005 and 2012, the average freshwater production was 10,953 migrants. See Table 2.2.2.7.

Table 2.2.2.7: Natural/Natural origin Freshwater Production Estimates for steelhead in the Dungeness River 2005-2012.

Outmigration Year	Steelhead Smolts	
	Freshwater Production	CV
2005	9,192	n/a
2006	6,125	16.96%
2007	11,445	7.80%
2008	8,155	16.59%
2009	10,101	20.72%
2010	17,486	14.70%
2011	19,600	14.54%
2012	5,521	11.04%
Average	**10,953**	**14.62%**

Source: Topping 2013.

Table 2.2.2.8: Estimates of exponential trend in the natural logarithm (ln) of natural spawners (lambda) for winter-run populations of steelhead in the Puget Sound DPS over the entire data series (1985 – 2009; last data point is 2001) (95% CI)

Population	1985-2009	1995-2009
Dungeness River winter-run	0.926 (0.909 - 0.943)	0.919 (0.786 - 1.075)

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Tribes.

- 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.

Table 2.2.2.9: Dungeness River system salmon escapement estimates 2001-2012.

Return Year	Spring Chinook[a]	Summer Chum[b]
2001	453	10[c]
2002	633	1[c]
2003	640	0
2004	953	123
2005	955	2
2006	1,405	3
2007	305	2
2008	140	0
2009	128	1
2010	345	2
2011	535	3
2012	508	6
Average	583	13

Source: WDFW SaSI 2013. Spring Chinook escapement goal is NOR 925 adults.

[a] Total Natural Spawners - This is a redd based estimate, 2.5 fish per redd, of the number of adult Chinook that spawned naturally in the Dungeness and Gray Wolf rivers. Escapement estimate includes both NORs and HORs.

[b] Estimate of escapement based on live and/or dead chum observed during September and early October while conducting spawner surveys for pink and Chinook salmon throughout the Dungeness watershed. Chum observations are incidental and not systematic.

[c] Trap count; minimum estimate.

Dungeness Steelhead (*Oncorhynchus mykiss*): Due to difficult environmental conditions, the ability to conduct spawner surveys is limited. The Jamestown S'Klallam Tribe has conducted spawner surveys in each year beginning in 2010. Surveys in 2010, and particularly in 2012, were cut short due to high water levels associated with spring rain and snow runoff; however escapement estimates can be obtained through the use of timing curves from other comparable river systems. The Jamestown S'Klallam Tribe has completed estimates of spawners for the entire season for 2011 and 2013. An estimated 410 fish spawned in 2011, and an estimated 564 fish spawned in 2013 after March 10. Prior to 2010, the last escapement estimate for Dungeness winter steelhead was in the 2000/2001 season with an estimated escapement of 183 based on index areas.

- 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.

Dungeness Spring Chinook (*Oncorhynchus tshawytscha):*

Table 2.2.2.10: Hatchery and natural-origin Chinook spawners in the Dungeness system 2001-2012.

Year	HOR	NOR
2001	96%	4%
2002	82%	18%
2003	81%	19%
2004	81%	19%
2005	90%	10%
2006	71%	29%
2007	52%	48%
2008	39%	61%
2009	45%	55%
2010	78%	22%
2011	84%	16%
2012	58%	42%
Average	**71%**	**29%**

Source: WDFW (Bill Freymond & Bruce Sanford, 2001 - 2006; R. Cooper, 2007-2009, SaSI 2013). Data from 2001 returns indicated that a majority of spawners (+ or - 90%) were of hatchery origin.

Dungeness Chum (*Oncorhynchus keta*): The level of summer run chum hatchery spawners in the Dungeness River is unknown.

Dungeness Steelhead (*Oncorhynchus mykiss*): Existing data on the level of hatchery winter-run steelhead spawners in the Dungeness River is limited. We developed two alternative approaches to estimate hatchery-origin spawners in the Dungeness River, the effective pHOS, and gene flow:

> Method 1 **–** we estimated the number of hatchery-origin spawners based on the number of redds constructed prior to March 15th;
>
> Method 2 – we estimated the number of hatchery-origin fish spawners based on an assumed stray rate.

Both methods resulted in an estimated effective pHOS of less than 0.05 and an estimated gene flow of < 2% (Table 2.2.2.11).

Table 2.2.2.11: Estimated pHOS and gene flow for the Dungeness early winter steelhead program.

Estimation of HOS	pHOS	Gene Flow
Method 1. Spawner Surveys	< 0.01	0.9% - 1.4%
Method 2. Assumed Stray Rate	< 0.01	< 1%

Method 1. Preliminary 2013 spawning ground estimates provided by the Jamestown S'Klallam Tribal staff indicate that an estimated 46 adults spawned prior to the March 15th cut-off date for natural-origin steelhead, and 564 adults spawned after that date.

Using the methods of the HSRG (2009), the effective pHOS is estimated using the following equation:

$$pHOS_{Eff} = \frac{N_{HOS} \cdot Rel\_Surv_{HOS}}{(NOS_{HOS} \cdot Rel\_Surv_{HOS}) + N_{NOS}}$$

where N_{HOS} and N_{NOS} are the number of natural spawning hatchery and natural-origin adults, respectively. The Rel_Surv_{HOS} is the survival of domesticated early winter steelhead relative to naturally produced steelhead. We followed the HSRG (2009) and set Rel_Surv_{HOS} to 0.11, and estimated pHOS as < 1%:

$$pHOS_{Eff} = \frac{46 \cdot 0.11}{(46 \cdot 0.11) + 564}$$

We estimated gene flow using the methods of Scott and Gill (2008) and the following sources for parameter estimates:

Spawn Timing of Hatchery-Origin Spawners (o_H). The spawn timing of early winter hatchery steelhead was estimated from the spawn timing at the Tokul Creek Hatchery.

Spawn Timing of Natural-Origin Spawners (o_N). The spawn timing of natural-origin fish to the Dungeness River is not well known. We used a range of values from Scott and Gill (2008) to bracket the likely spawn timing.

Fitness of HxH Crosses (k_1). As discussed above, we used the same value (0.11) as used by the HSRG (2009).

Fitness of HxW Crosses (k_2). We used a ranged of values to bracket the likely value for this parameter. For the worst case, we used the same value as for a HxH cross. For the best case, we assumed that the relative productivity would be half of that of a natural origin by natural origin cross.

Proportion of Total Natural Spawners of Hatchery-Origin (q). We estimated the proportion of hatchery-origin spawners from the spawner surveys conducted in 2013.

The estimated gene flow ranged from about 0.90% to about 1.4% (Table 2.2.2.12) with hatchery-origin spawners estimated from spawning ground surveys.

Table 2.2.2.12. Estimated gene flow for the Dungeness early winter steelhead program under four alternative cases and q estimated from spawner survey data.

	Case 1	Case 2	Case 3	Case 4
	Natural: Snow Creek HxW: 0.11	Natural: Snow Creek HxW: 0.50	Natural: Clearwater R. HxW: 0.11	Natural: Clearwater R. HxW: 0.50
Hatchery Mean Spawn Date	January 14	January 14	January 14	January 14
Hatchery SD	15.6	15.6	15.6	15.6
Natural Mean Spawn Date	March 28	March 28	April 21	April 21
Natural SD	18.1	18.1	20.4	20.4
o_N	0.0739	0.1100	0.0118	0.0118
o_H	0.1153	0.1730	0.0208	0.0208
k_1	0.1100	0.1100	0.1100	0.1100
k_2	0.1100	0.5000	0.1100	0.5000
q	0.0754	0.0754	0.0754	0.0754
Gene Flow	0.90%	1.38%	0.89%	0.95%

Method 2. The HSRG has generally used stray rates of 0.10 or 0.20 for hatchery programs where juveniles are released on-station and the hatchery has adult collection facilities. Using an assumed stray rate of 0.20, we estimated the number of hatchery-origin spawners in the Dungeness River for the years 2009-2010 through 2012-2013 (years when the hatchery relied strictly on on-station returns to meet production objectives). Estimates of natural-origin spawners are available for only the years 2010-2011 and 2012-13, and are likely biased low because glacial melt reduces the visibility of redds in May and June. Using the methods discussed above, we estimated that the effective pHOS ranged from 0.0013 to 0.0020 with an average of 0.0017 (Table 2.2.2.13).

Table 2.2.2.13. Effective pHOS as estimated from an assumed stray rate of 0.20.

Spawn Year	Hatchery Return	Predicted HOS	Effective HOS	Natural- Origin Spawners	q	Effective pHOS
2009-2010	29	7	0.8			
2010-2011	20	5	0.6	410	0.0120	0.0013
2011-2012	52	13	1.4			
2012-2013	42	11	1.2	564	0.0183	0.0020
Average	36	9	1.0	487	0.0152	0.0017

The estimated gene flow rates based on an assumed stray rate of 0.20 ranged from 0.17% to 0.27% (Table 2.2.2.14)

Table 2.2.2.14. Estimated gene flow for the Dungeness early winter steelhead program under four alternative cases and q estimated from an assumed stray rate of 0.20

	Case 1	Case 2	Case 3	Case 4
	Natural: Snow Creek HxW: 0.11	Natural: Snow Creek HxW: 0.50	Natural: Clearwater R. HxW: 0.11	Natural: Clearwater R. HxW: 0.50
Hatchery Mean Spawn Date	January 14	January 14	January 14	January 14
Hatchery SD	15.6	15.6	15.6	15.6
Natural Mean Spawn Date	March 28	March 28	April 21	April 21
Natural SD	18.1	18.1	20.4	20.4
o_N	0.0739	0.1100	0.0118	0.0118
o_H	0.1153	0.1730	0.0208	0.0208
k_1	0.1100	0.1100	0.1100	0.1100
k_2	0.1100	0.5000	0.1100	0.5000
q	0.0152	0.0152	0.0152	0.0152
Gene Flow	0.17%	0.27%	0.17%	0.18%

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS 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 and Spawning: The trapping facility at Dungeness Hatchery is a side irrigation channel fed with water from the main river. The entrance to the trap offers little or no incentive for listed fish to voluntarily enter. Collection of hatchery steelhead broodstock has taken place between late November and the end of March, outside the return time of listed spring Chinook, and summer chum in the Dungeness River. This is also earlier than timing of the bulk of listed natural origin winter steelhead. If natural origin fish are encountered during the early timeframe, and inadvertently trapped, they would be identified by presence of an adipose fin and returned to stream immediately. Only adults identified as hatchery-origin (missing adipose fin) are used for broodstock. No take of listed fish has been reported during broodstock collection activities.

Broodstock Spawning/Pathology Sampling: Only hatchery-origin steelhead (adipose fin-clip only) are spawned for the Dungeness River early winter steelhead program. After spawning, moribund females or fresh pond mortalities may be kidney/spleen sampled for thorough pathogen screening (*Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington*, WDFW and WWTIT 1998 and updated 2006). No listed fish are included in this program.

Rearing Program: Only hatchery-origin steelhead are reared on-station. Listed fish are not reared in this program.

Residualism:

Rearing and release strategies are key components to minimizing risks from hatchery programs on outmigrating salmonids. Ideally, hatchery steelhead are released when fish are smolting to

encourage rapid outmigration to minimize the opportunity for predation or residualism risks (Fuss et al. 1999 and Snow et al. 2013) of hatchery fish on natural outmigrants. Studies conducted on predation risks to natural-origin Chinook (Sharpe et al. 2008) and steelhead (Naman and Sharpe 2012; Pflug et al. 2013) have shown predation risks to be minimal. Short outmigrating travel times have also been shown to minimize opportunity for negative interactions (9 days Moore et al. 2013 Puget Sound wide; 16.4 days Goetz et al. 2014, Green River).

Our protocol is based on 30 years of staff observations and the studies conducted to evaluate predation and residualization risks. The current protocol as described incorporates the following risk aversion factors into best practices to reduce risks to ESA-listed populations while meeting management goals.

- FISH UNIFORMITY: Monitor population uniformity of hatchery steelhead through CVs (CV = coefficient of variation for length and weight) and condition factors prior to release to ensure release criteria are met (uniform size, condition, etc.).
- FISH SIZE: Release groups will meet the minimum size criteria of 10 fpp established by Tipping 2001.
- RELEASE TIMING: Releases of hatchery smolts will occur on or after May 1 to minimize predation risks on out-migrating natural-origin listed fry in the freshwater system so long as the first two criteria of fish uniformity and fish size are met (Tynan 2012 analysis-unpublished; Iverson and Missildine 2013 unpublished).
- VOLITIONAL RELEASE: Releases of hatchery smolts will be volitional to minimize residualization risks.
    - Volitional release will begin after May 1 when steelhead display cues of outward physical signs and behaviors of active smoltification, such as loss of parr marks, banding of tail, actively cruising pond edges, inflow, and outflow areas.
    - Hatchery Staff will pull screens to provide the opportunity for steelhead smolts ready to emigrate to leave the pond(s) or raceway(s).
    - Steelhead that have not volitionally left the holding area by the end of the release period (approximately one month (Fuss 1999; Tipping 2001)) will be transferred to non-anadromous lakes for angling opportunities.

    For more information on predation and competition risks see HGMP 2.2.3 *Competition/Niche-Displacement* and *Predation* sections below.

Genetic Introgression: Genetic introgression may occur if hatchery adults spawn in the wild. However both temporal and spatial separation of hatchery and natural-origin steelhead play a role in the amount of potential impact. Run timing for natural-origin winter steelhead stocks in Puget Sound systems range from November to June with the current existing peak spawn time in most populations from mid-April through May (SaSI, WDFW 2013). No historic native summer steelhead populations are currently known to occur in the Dungeness (see HGMP section 2.2.1).

Plants to various locations in the system occurred in the past, but have been eliminated and program fish are currently released on-station (100% mass marked) and with no out of basin transfers. This reduces overlap potential and straying incidences. For the early winter steelhead stocks in Puget Sound, eggs will not be taken later than January 31 in order to reduce potential overlap of hatchery fish from the existing natural-origin winter steelhead peak spawning time frame in the Dungeness system. The natural-origin winter run steelhead spawning generally occurs from early March to early June.

The expected gene flow rate can be much lower than the "stray" rate. In a well-run segregated program, the level of gene flow should be quite low for three reasons: 1) the numbers of hatchery-origin fish that have escaped harvest should be low compared to the number of natural-origin fish present; 2) the reproductive success of the hatchery-origin fish can be expected to be low (Leider et al. 1990; Kostow et al. 2003; McLean et al. 2003; McLean et al. 2004); and 3) spawning overlap may be low (Scott and Gill 2008).

Operational changes are being implemented to remove hatchery fish, including adults trapped above broodstock needs since 2008. These will not be re-cycled for additional sport opportunities and trapping facilities will continue removing hatchery fish until March 31st in the Dungeness system.

Gene Flow. We estimated the gene flow from stray rates for on-station and off-station releases using a spreadsheet program (Hoffmann 2014). We assumed a stray rate of 100% for off-station releases and stray rates of 20% and 30% for on-station releases.

We estimated gene flow using the methods of Scott and Gill (WDFW 2008) and the following sources for parameter estimates:

Spawn Timing of Hatchery-Origin Spawners (o_H). The spawn timing of early winter hatchery steelhead (Hoffmann 2014) was estimated from: a) the spawn timing at the Tokul Creek Hatchery; and b) entry timing of winter steelhead into the Dungeness Hatchery.

Spawn Timing of Natural-Origin Spawners (o_N). The spawn-timing of natural-origin fish in the Dungeness River populations (Hoffmann 2014) was estimated from: a) the range of values from Scott and Gill (2008) to bracket the likely spawn timing; and b) the spawn-timing observed for natural populations in the Dungeness River Winter population.

Relative Fitness of HxH Crosses (k_1). The early winter hatchery programs are operated with a segregated, nonlocal broodstock that has been domesticated over a period of more than 60 years. Unlike well run integrated hatchery programs, we can anticipate that the relative fitness will be low for fish produced from this type of program. We used a range of values (0.02 to 0.13) for relative fitness drawn from the empirical studies for steelhead programs that use nonlocal broodstock (Araki et al. 2008). These studies were not conducted with Puget Sound steelhead populations. The co-managers are committed to continuing research and monitoring to refine estimates of fitness and overlap in spawning to better understand gen flow between early winter steelhead and natural-origin steelhead.

Relative Fitness of HxW Crosses (k_2). We used a value of 0.54 which is halfway between the average value for HxH crosses (0.084) and a relative fitness of 1.0.

Proportion of Total Natural Spawners of Hatchery-Origin (q). We estimated the proportion of hatchery-origin spawners using the assumed stray rate of 100% for off-station releases and 20% or 30% for on-station releases.

Combinations of parameter values used for the six cases analyzed are summarized in Table 2.2.3.1. The estimated gene flows for six cases of alternative parameter values for the Proportion Hatchery Effective Contribution (pHEC) are provided in table 2.2.3.2. The pHEC is the proportion of natural spawners that are genetically derived from the early winter hatchery program and includes both hatchery-natural origin hybrids and pure natural-origin hatchery-lineage fish.

Table 2.2.3.1. Parameter values for six alternative cases for estimating PEHC and gene flow.

Assumed Homing Rate	0.8
Hatchery Spawner Effectiveness	0.11

Spawn Year	Hatchery Return	Predicted HOS	Effective HOS	Natural- Origin Spawners	q	Effective pHOS
2009-2010	29	7	0.8			
2010-2011	20	5	0.6	410	0.0120	0.0013
2011-2012	52	13	1.4			
2012-2013	67	17	1.8	564	0.0288	0.0033
Average	42	11	1.2	487	0.0204	0.0023

Table 2.2.3.2. Estimated pHEC of spawners contributing to the natural origin steelhead populations for the Dungeness River Winter steelhead population under six alternative cases**.** Estimates of Dungeness River Winter spawners are available for 2010-2011 and 2012-2013 only.

	Case 1 Natural: Snow Creek Hatchery: Tokul Creek Stray Rate = 0.20		**Case 2** Natural: Clearwater R. Hatchery: Tokul Creek Stray Rate = 0.20		**Case 3** Natural: Dungeness Hatchery: Dungeness Stray Rate = 0.20		**Case 4** Natural: Snow Creek Hatchery: Tokul Creek Stray Rate = 0.30		**Case 5** Natural: Clearwater R. Hatchery: Tokul Creek Stray Rate = 0.30		**Case 6** Natural: Dungeness Hatchery: Dungeness Stray Rate = 0.30	
Spawn Year	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13	K_1= 0.02	K_1= 0.13
2002-2003	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2003-2004	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2004-2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005-2006	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2006-2007	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2007-2008	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2008-2009	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2009-2010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2010-2011	0.05%	0.12%	0.03%	0.15%	0.06%	0.19%	0.16%	0.37%	0.05%	0.28%	0.08%	0.30%
2011-2012	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2012-2013	0.13%	0.30%	0.07%	0.36%	0.10%	0.42%	0.39%	0.88%	0.13%	0.68%	0.15%	0.69%
Through 2012	0.05%	0.12%	0.03%	0.15%	0.06%	0.19%	0.16%	0.37%	0.05%	0.28%	0.08%	0.30%
All Years	0.09%	0.21%	0.05%	0.25%	0.08%	0.30%	0.27%	0.62%	0.09%	0.48%	0.11%	0.50%
No Offstation	0.09%	0.21%	0.05%	0.25%	0.08%	0.30%	0.14%	0.33%	0.08%	0.40%	0.19%	0.50%
Release 10,000	0.10%	0.21%	0.05%	0.26%	0.08%	0.31%	0.15%	0.33%	0.08%	0.40%	0.19%	0.51%

Estimated gene flow rates from Dungeness Hatchery early-winter steelhead to natural winter steelhead range from 0.03% to 0.62%. This limited gene flow is less than the 2% gene flow rate mandated in the Statewide Steelhead Management Plan (WDFW 2008) and reflects separation of hatchery-origin and natural-origin steelhead by run timing, river entry, and time of spawning.

Operation of Hatchery Facilities: Potential facility operation impacts on listed fish include; water withdrawal, hatchery effluent, and intake compliance or barrier blockages. Monitoring and maintenance of hatchery facilities is conducted regularly. Effluent at outfall areas is rapidly diluted with main stem flows and operation is within permitted guidelines (see HGMP sections 4.1 and 4.2). All permit requirements are followed in order to minimize the potential indirect 'Take" associated with the operations of these facilities. No take of listed fish have been reported by staff during normal operations at the hatchery facility.

To further separate potential spawn timing overlap with natural origin steelhead stocks, programs propagating early winter hatchery stocks will no longer take eggs later than January 31. The natural origin winter run steelhead spawning generally occurs from early-March to early-June.

Operational changes were implemented including the removal of adults trapped above broodstock needs at facilities. Re-cycling downstream to provide additional harvest opportunity of these fish was discontinued in 2009, and trapping facilities continue to operate and remove hatchery-origin steelhead until March 31st annually.

Competition/Niche-Displacement: Freshwater carrying capacity may be compromised if hatchery steelhead smolts planted or those produced naturally from hatchery spawners competitively displace or compete with natural origin fish in their natural rearing habitats. Studies specific to competition or niche displacement in the Dungeness River system are not conducted. Smolts from on station releases in large river systems travel rapidly – migration rates of approximately 20 river miles per day have been observed with steelhead smolts released in the Cowlitz River (Harza 1999). Interactions with listed salmonids in the estuarine and nearshore environment are likely to be limited. Telemetry studies indicate that steelhead migrate out of the Puget Sound quickly, with an average travel time of approximately nine days to the Strait of Juan de Fuca (Moore et al. 2013, Moore et al. 2010, Goetz et al. 2008).

Disease Transmission: Interactions between hatchery reared and naturally produced populations may be a source of pathogen and disease transmission although there is little evidence showing that diseases are transmitted from hatchery fish to natural origin fish (Steward and Bjornn 1990).

WDFW conducts fish disease examinations to ensure minimal disease transmission and to prevent the introduction and/or spread of any fish diseases. Fish health-monitoring efforts include fish health examinations and virus sampling, abnormal fish loss investigations, and pre-transfer and pre-liberation inspections. All activities are done in accordance with guidelines developed under the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

Predation: Steelhead released from hatchery programs are unlikely to prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). Based on stomach fullness, most steelhead smolts do not begin to feed extensively until about a week after release (Cannamela 1993). Recent WDFW research (Sharpe et al. 2008) has shown that the predation risks from hatchery steelhead smolt releases are minimal on smaller prey fish. A recent study in the Skagit basin, Pflug et al. 2013 showed that hatchery steelhead smolts did not prey on natural origin juvenile steelhead.

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

Listed spring Chinook and summer chum have not been collected during early winter steelhead trapping. Bull trout (not observed at hatchery weirs) or natural origin steelhead may also be inadvertently handled and released from trapping facilities but operational protocols are in place to return these adults back to stream as quickly as possible when and where they occur. Inadvertent mortality on all listed fish encountered at these trapping sites and returned back to stream is estimated to be 0-1 fish yearly. In almost all years, staff have reported no encounters of listed fish.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See "Take" tables.

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

Any projected take that will exceed the estimates given in this HGMP from this operation on a yearly basis would be communicated to WDFW Fish Program, TAC and NOAA Fisheries staff for additional guidance.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

This hatchery program is consistent with the following:

The Washington Department of Fish and Wildlife *Statewide Steelhead Management Plan* (*SSMP*): *Statewide Policies, Strategies, and Actions,* (WDFW 2008), was adopted by Washington

Fish and Wildlife Commission on March 8, 2008. http://wdfw.wa.gov/conservation/fisheries/steelhead/management_plan.html. Under this plan segregated harvest programs are to result in an average gene flow of less than 2% from the hatchery to the natural origin stock for Primary populations, a pHOS of less than 10% for Contributing populations, and to maintain current conditions for Stabilizing populations. In addition segregated programs will use broodstock that originated from releases of juveniles in that watershed unless no hatchery or trapping facility exists.

According to the *SSMP*:

> Where risks are inconsistent with watershed goals, one or more of the following actions should be implemented:
>
> - Leave trapping facilities open during the entire return time for adults of the segregated stock.
> - Eliminate recycling of hatchery-origin adults to anadromous waters.
> - Release steelhead juveniles from steelhead programs only at locations where returning adults can be captured.
> - Increase the harvest rates on hatchery-origin fish.
> - Reduce the number of fish released or change the release location, rearing practices affecting the rate of residualism, or other program characteristics to reduce the rate of gene flow.
> - Eliminate the segregated hatchery program.
> - Replace the segregated program with an integrated program with risks that are consistent with watershed goals.

Summer Chum Salmon Conservation Initiative (SCSCI). Summer chum supplementation, habitat restoration and harvest management measures are integrated as presented in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000 and subsequent updates). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed. The goal of the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages.

Washington Department of Fish and Wildlife Commission Policy C-3619. WDFW adopted the Hatchery and Fishery Reform Policy C-3619 in 2009. Its purpose is to advance the conservation and recovery of natural origin salmon and steelhead by promoting and guiding the implementation of hatchery reform. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. WDFW Policy C-3619 works to promote the conservation and recovery of natural origin salmon and steelhead and provide fishery-related benefits by establishing clear goals for each state hatchery, conducting scientifically defensible-operations, and using informed decision making to improve management. It is recognized that many state operated hatcheries are subject to provisions under U.S. v. Washington (1974) and U.S. v. Oregon and that hatchery reform actions must be done in close coordination with tribal co-managers (available at http://wdfw.wa.gov/commission/policies/c3619.html).

Hatchery Reform- Principles and Recommendations of the Hatchery Scientific Review Group: WDFW programs have incorporated the suggestions this report provided, in 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) (also see HGMP section 6.2.3).

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

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

The Lower Elwha Klallam Tribe and the Point No Point Treaty Council (Port Gamble S'Klallam and Jamestown S'Klallam Tribes) along with WDFW prepare an annual fishery management plan for the harvest of Dungeness River system early winter steelhead produced from this program. Emergency in-season regulations may restrict fishing when hatchery escapement shortfalls are anticipated.

Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document. The Future Brood Document (FBD) is a pre-season planning document for fish hatchery production in Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30). While it does not include all of the requirements of the EBD, the FBD is coordinated between WDFW, the Northwest Indian Fisheries Commission (NWIFC) representing Puget Sound and coastal treaty tribes, eastern Washington treaty tribes, and Federal fish hatcheries. Hatchery production by volunteers, schools, and Regional Fisheries Enhancement Groups are represented by WDFW.

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Steelhead DPS, operates under *U.S. v Washington* (1974) and the *Puget Sound Salmon Management Plan* (PSSMP 1985) which provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights through the Puget Sound Salmon Management Plan.

See also HGMP section 3.1.

3.3) Relationship to harvest objectives.

WDFW general harvest goals are to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of natural origin indigenous salmonid runs, the Pacific Salmon Treaty, the Puget Sound Salmon Management Plan, the Pacific Fishery Management Council (PFMC) a North of Falcon (NoF) annual fisheries management planning process, *U.S. v Washington* (1974), and other state, federal, and international legal obligations. Watershed Resource Management Plans (RMPs) when developed will manage maximum harvest impacts to listed steelhead in the system.

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

Table 3.3.1.1: Dungeness Hatchery winter steelhead harvest 2001-2013.

Return Year [a]	Smolt Release[a]	Freshwater Sport[b]	Tribal Harvest[c]	Hatchery Return	Smolt-to-Adult Contribution (%)
2000/01	11,000	44	2	3	0.45
2001/02	10,465	188	26	12	2.16
2002/03	12,199	41	3	10	0.42
2003/04	10,250	46	0	22	0.66
2004/05	13,715	24	33	34	0.42
2005/06	10,500	32	1	16	0.46
2006/07	9,825	38	67	39	0.78

2007/08	10,900	21	14	4	0.23
2008/09	10,700	7	0	3	0.09
2009/10	10,200	19	0	29	0.47
2010/11	3,700	26	7	20	1.24
2011/12	4,575	57	9	52	2.38
2012/13*	11,600	92		67	1.37
Average	**9,971**	**49**	**14**	**24**	**0.86**

Source: WDFW catch record cards (CRC) 2013, WDFW Hatcheries Headquarters Database 2013.
* Note 2012/13 data are preliminary, some values not yet reported.
[a] Smolt release two years earlier in the spring.
[b] 2- or 3-salt returns cannot be broken out.
[c] With the exception of 2001/02, tribal harvest numbers were not broken out to hatchery or natural origin fish and were not used in the SAR% estimate. Therefore these values represent a minimum estimate of survival.

The Lower Elwha Klallam Tribe and the Point No Point Treaty Council (Port Gamble S'Klallam and Jamestown S'Klallam Tribes) along with WDFW prepare an annual fishery management plan for the harvest of Dungeness River winter steelhead produced from this program (WDFW et al. 2008 to present). Returning winter steelhead adults provide for limited tribal commercial and subsistence use and provide a localized recreational sport fishery, mostly from November through February each year. Tribal fisheries include net and hook and line fisheries generally from early December through late February. The directed sport fishery is open October 16 to January 31 within selected stream reaches with two hatchery origin steelhead over 20 inches allowed (WDFW Sport Fishing Rules 2013/2014).

Incidental impact on non-targeted natural origin steelhead: Implementation of selective-fishing rules which requires the release of all natural origin, unmarked steelhead in Puget Sound began in the 1990s. This has reduced natural origin steelhead harvest statewide to approximately 1% of the catch. Cool water temperatures at this time minimize mortality on listed steelhead. Non-targeted natural origin steelhead may be hooked and released with an unknown impact for most streams and direct studies have not been done in this system. Nelson et al. (2005) showed catch and release mortalities of 1.4% to 5.8% in 1999 and 2000 respectively on steelhead caught in recreational fisheries on the Chilliwack River in British Columbia. This study also showed no indication of increased mortality on fish that had been caught released multiple times. A hook and line mortality study conducted in the Samish River on winter-run steelhead also showed similar results, although it indicated that there may be a negative relationship between a fish being caught in a sport fishery and their survival to out-migration as kelts (Ashbrook et al. in press). Taylor and Barnhart (1999) determined that summer steelhead caught and released in the Mad and Trinity Rivers of California had a 9.5% mortality rate, with 83% of the mortalities occurring at water temperatures of 21°C or greater. As such hooking mortality associated with recreational sport harvest is generally believed to be less than 10% of fish hooked and released. As the Dungeness River sport harvest season ends February 1st, most of the incidental catch and release is designed to be prior to the natural origin winter run being present.

3.4) Relationship to habitat protection and recovery strategies.

The Co-managers have participated together with Clallam County, local landowners (including irrigators) and other local entities in the habitat restoration planning efforts (see below). This team (Dungeness River Management Team (DRMT)) has overseen extensive research on the limiting factors affecting Chinook and other salmonid species in the Dungeness River. Habitat problems, including water removal for irrigation; dikes in the lower river, scouring and poor gravel recruitment or gravel aggradations, result in poor spawning and rearing habitat for salmon.

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) for the Dungeness 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, Quileute and Hoh), 3.5 WRIAs (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. The local Watershed Recovery Plan developed will "rollup" into the regional salmon recovery plan (Shared Strategy for Salmon Recovery) See also http://www.rco.wa.gov/salmon_recovery/lead_entities.shtml.

Regional Fisheries Enhancement Groups (*RFEGs*): Several citizen based groups in conjunction with local governments work on habitat actions to benefit both listed and non-listed stock in the system including the North Olympic Salmon Coalition.

Puget Sound Partnership Action Plan: An ESU-wide recovery planning effort is being undertaken by the Puget Sound Partnership, a collaborative group dedicated to restoring salmon and steelhead throughout Puget Sound (online at http://www.pugetsoundpartnership.org).

State of Our Watersheds: Individual member Tribes have worked with the NWIFC and SSHIAP to create the State of Our Watersheds report. This document examines key indicators of habitat quality and quantity across more than 20 watersheds in western Washington that lie within tribal Usual and Accustomed fishing areas as defined by *U.S. v Washington* (1974). The Dungeness River habitat section can be found under the Jamestown S'Klallam chapter at http://maps.nwifc.org:8080/sow2012/.

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 Dungeness Hatchery winter steelhead 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 steelhead 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 steelhead 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 steelhead 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
- Bull Trout/ Dolly Varden

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

- Southern Resident Killer Whales
- 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).*

- Puget Sound Chinook
- Puget Sound steelhead
- Hood Canal Summer chum
- Puget Sound 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 trout and other salmonid species present in the Dungeness River watershed through natural production. Juvenile fish of these species may serve as prey items for the steelhead during their downstream migration in freshwater and into the marine area. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating steelhead. Salmonid adults that return to the river and any seeding efforts using adult salmon carcasses may provide a source of nutrients and stimulate stream productivity. 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).

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.* The steelhead program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying steelhead carcasses might also benefit fish in freshwater. These species include:

- Northern pikeminnow
- Cutthroat trout
- Bull trout/ Dolly Varden
- Steelhead
- Coho salmon
- Pacific staghorn sculpin

- 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.

Table 4.1.1: Water source available at Dungeness and Hurd Creek Hatcheries.

Facility	Water Source	Available Water Flow (gpm)	Temp. (F)	Usage	Limitations
Dungeness Hatchery	Dungeness River (surface)	18,000	32-60	Adult attraction, holding pond, rearing, acclimation	Can't be used in cold weather due to ice presence, and during high flows due to debris clogging intake.
	Canyon Creek (surface)	3,800	34-50	Rearing,	Used when Dungeness water can't be used: in cold weather due to icing and during high flows.
Hurd Creek	Well (5)	400-2,000	47-48	Adults holding incubation, rearing, acclimation	No limitations.
	Hurd Creek (surface)	610	42-52	Rearing, emergency back-up for incubation	Low flows.

Table 4.1.2. Record of NPDES permit compliance at Dungeness Hatchery.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
Dungeness WAG13-1037	Y	Y	Y	1/10/2012	0	N	Y

Source: WDFW Hatcheries Headquarters Database 2013.

Dungeness Hatchery Water Sources: Water for production is supplied from Dungeness River and Canyon Creek. Water from Dungeness River is of good quality with exception of during high water events, when silt from upriver slides and debris may clog the intakes. The Dungeness River is a very cold water system and is prone to icing during the winter. During the colder winter months the intake screens are frequently clogged with ice and need to be de-iced to function properly. The low water temperatures also slow the fish growth.

Dungeness Hatchery Intakes: There are currently three water intakes on Dungeness River and one on Canyon Creek, which do not meet the current "Anadromous Salmonid Passage Facility Design" criteria (NMFS 2011). Improvements to the intakes were identified as a high-priority project that was approved and funded through a jobs creation bill passed by the State Legislature in 2012. The project, which continues to be a high priority for WDFW has currently been delayed due to unforeseen circumstances involving an easement dispute with the landowner of the proposed intake construction site. Upon project completion there will be one water intake on Dungeness River and the dam on Canyon Creek will have a ladder for fish passage.

Canyon Creek is a tributary to the Dungeness River and can supply water to the hatchery most of the year, with exception of during low flow months. Canyon Creek may act as the hatchery's main water source when the Dungeness River becomes excessively silty or if the intakes become clogged with anchor ice. The Canyon Creek intake is adjacent to a small dam that blocks access to any upstream spawning habitat.

The Hatchery Scientific Review Group (HSRG) recommended finding a warmer water source for the hatchery to help culture fish to a proper size at the time of release. If an alternate water supply can be found, the HSRG also recommended removing or remodeling the Canyon Creek dam to allow fish passage throughout the creek. A consulting firm was hired to scope possible water supply options for the hatchery but the two test wells drilled in 2002 proved unsuccessful in achieving this goal and no alternate water source has been found to date. Plans to build a fish ladder to allow passage over the Canyon Creek dam have been approved (see HGMP section 4.2).

Hurd Creek Hatchery: Is supplied with well and surface water from Hurd Creek, which is a tributary to the Dungeness River. Five wells supply excellent quality water, but require passage through a de-nitro tower to improve dissolved oxygen content. These wells are the main source for hatchery production including broodstock holding, incubation, rearing and acclimation. Surface water from Hurd Creek is used for rearing may act as an emergency back-up source.

The hatchery water rights are regulated through permit # G2-24026(6.4 cfs).

All hatcheries in the Puget Sound region are regulated by water withdrawal permits issued by the Washington Department of Ecology (WDOE). These permits specify the allowable level of surface or ground water that may be withdrawn to rear fish while safeguarding natural migration and production areas for anadromous fish. The usage of surface water from the Dungeness River is regulated under the water rights permits: # S2-06221 (25 cfs), # S2-21709 (15 cfs), and from Canyon Creek by permit # S2-00568 (8.5 cfs).

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.

A non-compliant auxiliary intake (siphon) has not been operated since 1999. To avoid possible "take" concerns, it was operated only on an intermittent basis. It can, however, be operated during emergency situations, when winter icing conditions or late summer low flows make operation of the other gravity intakes impossible or ineffective.

To reduce any potential adverse effects on receiving waters, hatchery effluent discharge is also regulated by WDOE permits (see **Table 4.1.2**). The Dungeness Hatchery has an off-line settling pond and artificial wetland for effluent removal before the water is discharged back into the river.

This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE), WAG 13-3002. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE.

Discharges from the cleaning treatment system are monitored as follows:

- *Total Suspended Solids (TSS)* 1 to 2 times per month on composite effluent, maximum effluent and influent samples.
- *Settleable Solids (SS)* 1 to 2 times per week on effluent and influent samples.
- *In-hatchery Water Temperature* - daily maximum and minimum readings.

Hurd Creek Hatchery: The intake screens for Hurd Creek are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not meet the current "Anadromous Salmonid Passage Facility Design" criteria (NMFS 2011a). The Hurd Creek Hatchery produces a relatively small amount of fish each year, well under the 20,000 pound limit, set by WDOE as the level for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Early winter steelhead broodstock is recruited from volunteers returning to the hatchery off-channel trap. The trap is operated from mid-May through the end of March to accommodate hatchery broodstocking needs and to remove hatchery-origin fish from the system. Hatchery-origin steelhead typically return to the hatchery from mid-November to February.

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

Table 5.2.1: Tanks available for fish transportation at Dungeness and Hurd Creek Hatcheries.

Type	Capacity	Fish transported
Truck-mounted tanks	750-gallon	Juveniles
	450-gallon	Juveniles
	150-gallons	Adults only

Trucks are equipped with aerators and oxygen tanks.

5.3) Broodstock holding and spawning facilities.

Broodstock is held in an (42' x 135' x 2.5') earthen pond located at the end of the hatchery off-channel. The pond is supplied with river water and encircled with a chain link, electrical fence and bird netting to prevent predation. Green females and excess males can be held in the circular ponds and spawning takes place at the pond site.

5.4) Incubation facilities.

Table 5.4.1: Incubation vessels available at Dungeness and Hurd Creek Hatcheries.

Hatchery	Type	Number	Size
Dungeness	Vertical stack incubators	192	24" x 25" x 3"
Hurd Creek		1,104	

5.5) Rearing facilities.

Table 5.5.1: Rearing ponds available at Dungeness and Hurd Creek Hatcheries.

Facility	Type	Number	Size
Dungeness	Fiberglass raceways	8	3' x 15' x 3'
	Fiberglass circular ponds	2	16'diameter
	Concrete Raceways	10	10' x 100' x 3.5'
	Earthen pond	1	135' x 42' x 2.5'
Hurd Creek	Fiberglass circular ponds	13	20' diameter
	Fiberglass circular ponds	24	4' x 2.5'
	Fiberglass raceways (intermediate)	7	3' x 15' x 3'
	Fiberglass raceways	5	5.5' x 45' x 4'
	Earthen ponds	4	24' x 80' x 3.5'
	Earthen pond	1	150' x 20' x 2.5'

5.6) Acclimation/release facilities.

Steelhead at the Dungeness Hatchery are acclimated in 10' x 100' raceways prior to release and the Hurd Creek Hatchery does not acclimate or release on site.

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.

Listed fish are not reared in this program but risk aversion measures are in place to protect the hatchery stock. The hatchery is staffed full-time, with 24-hour stand-by and equipped with many low-water alarms that help prevent catastrophic fish loss resulting from any type of water system failure. In the event of power loss, pumping power is provided by an emergency backup generator (at Hurd Creek only), which is equipped with an auto start. The generator is capable of providing power to all hatchery components indefinitely, with fuel supplied as needed. The onsite fuel storage capacity is 1490 gallons, which can supply full generator operation for seven days. Further, in the unlikely event of total loss of all power sources at Hurd Creek, a surface water backup can maintain minimal flows throughout the facility.

Dungeness Hatchery uses gravity-fed water from three different sources. Any of these can be used in the event of failure.

Fish rearing practices at both facilities are conducted in compliance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Adherence to artificial propagation, sanitation and disease control practices defined in the policy should reduce the risk of any fish disease or pathogen transfers.

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 natural origin fish of the same species/population.

6.1) Source.

Broodstock is supplied by adult hatchery-origin early winter steelhead (distinguished by an adipose-fin clip), returning to the Dungeness River Hatchery trap until January 31. The hatchery-origin early winter steelhead stock used for this program is not included in the DPS of ESA-listed native Dungeness winter steelhead.

6.2) Supporting information.

6.2.1) History.

Non-local early winter steelhead stocks have been planted in the Dungeness River system since the 1950's and fish derived from this stock are presently utilized at the Dungeness Hatchery. The early winter hatchery steelhead stock was established from a winter run steelhead population collected at South Tacoma Hatchery, (now Lakewood Hatchery -WRIA 12). Warmer water available at the location was used to accelerate spawning time and encourage growing of smolts as a one year age product rather than two, thereby significantly reducing cost of rearing in freshwater and survival (Crawford 1979). This early winter hatchery stock, as a part of Regional Egg Source, was utilized in Puget Sound by several hatcheries and transferred to and between several river systems including the Skykomish, Snoqualmie, Skagit, Stillaguamish and Bogachiel Rivers. Other early winter stock derivatives came from the Lower Elwha S'Klallam Tribal Hatchery (via Bogachiel stock).

Until 1994 fish released into the Dungeness River were direct plants from other hatcheries (e.g. Bogachiel and Eells Springs). From 1994 to 2000 juveniles were transferred in February to Dungeness Hatchery for final rearing and release. In 2000 broodstock collection was initiated at Dungeness Hatchery and 2001 was the last year of releases from Bogachiel stock (mixed with Dungeness stock). From that time if egg collection at Dungeness Hatchery was not sufficient, eggs from Elwha stock were also used to meet program goals. In 2008 the co-managers decided to eliminate the use Elwha River early stock steelhead in the Dungeness River system, which required Dungeness Hatchery to be self-sufficient in securing broodstock.

6.2.2) Annual size.

Up to 30 adults are collected for broodstock. No natural-origin fish are included.

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

Prior to the implementation of mass-marking of steelhead by the Washington State Department of Game in 1981, any level of mixing natural fish in the broodstock could not be identified (B. Crawford pers. comm. 2006). As most steelhead programs had volunteer collection sites on small tributary streams in the past, natural origin stock spawners may not have had a strong incentive to enter those trapping sites.

Currently this early winter steelhead program is managed as segregated, where hatchery broodstock is reproductively segregated from naturally spawning populations and is composed entirely of returning hatchery-origin adults identified by a missing adipose fin (HSRG 2004).

6.2.4) Genetic or ecological differences.

Steelhead collected at the Dungeness Hatchery are a locally-adapted early winter hatchery-origin steelhead stock, which are segregated from the natural-origin population both spatially and

temporally. Phelps et al. (1997) compared genetic samples, collected in two time periods (1975 and 1993-1996), from natural-origin winter steelhead and from the locally adapted hatchery-origin early winter steelhead stock. Analysis of genetic distances indicated that gene flow from the locally adapted early winter hatchery-origin stock to larger naturally-spawning populations in the Nooksack, Skagit, Stillaguamish and Skykomish rivers "has been minor and has not been widespread over the past twenty years". Future DNA collections and analysis will be conducted to update the genetic makeup of endemic and non-local steelhead stocks in Puget Sound.

The early winter hatchery steelhead stock typically returns from late-November through early-February, while their natural-origin counterparts return from November through June. Peak hatchery spawning occurs in January, while peak natural-origin winter spawning occurs in late-May. Hatchery steelhead are released as age 1+ smolts, whereas natural-origin steelhead are predominately age 2+ smolts. Out-migration timing for both life history types is similar but is slightly earlier for hatchery component (Fuss et al. 1998).

See also "*Genetic Introgression*" in HGMP section 2.2.3.

6.2.5) Reasons for choosing.

The early winter hatchery steelhead stock was selected for its early arrival and spawn timing (as compared to natural origin steelhead), availability and the ability to release one-year smolts (Crawford 1979). This stock has been used statewide to provide fish for recreational and/or tribal harvest with minimal overlap in time and space with natural origin steelhead.

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.

Fish collected for this hatchery program are from the early winter hatchery stock and priority is given to keeping hatchery returns to Snoqualmie facilities (Tokul Creek) and the Skykomish facilities (Wallace and Reiter) within each respective river basin in an effort to promote local adaptation and reduce straying. No natural-origin fish are included in the broodstock. No eggs are collected after January 31 (change implemented with the 2008 broodstock collection). Target of 100% mass marking allows exclusion of natural-origin fish from the hatchery broodstock and selection for earlier-maturing fish deepens temporal separation, keeping the hatchery and naturally-spawning fish genetically different and increasing divergence of the populations.

This production is managed as a segregated program with the intent to separate hatchery and natural origin stocks and excludes utilization of natural-origin (adipose present) steelhead. The separation was achieved by producing fish that spawn earlier than natural origin fish. Early winter stock hatchery fish typically return from late-November through early-February, while their wild counterparts return from November through June. Peak hatchery spawning takes place in January, while the peak spawn timing for natural origin winter steelhead is from late-April through early May (Hoffmann 2014). To further accentuate and minimize spawning overlap with known natural origin winter steelhead present in the system, adipose clipped hatchery broodstock collection period was further limited to fish maturing before January 31st, from the previously accepted date of February 28.

The proposed rules for listing Puget Sound steelhead (71 FR15666; March 29, 2006) stated "Several BRT members noted that anecdotal historical accounts discuss significant early runs of wild steelhead, but expressed concern that these early wild spawners have apparently disappeared from several river systems." While we acknowledge that significant uncertainty exists in our understanding of the historical run and spawn timing of steelhead, we believed that it was important to evaluate the risk that the proposed early winter hatchery programs could suppress re-

expression of this potential component of the population. This could occur, for example, if the early spawning natural origin steelhead spawned with hatchery-origin steelhead, and if the resulting hybrids had a lower chance of survival than natural origin by natural origin crosses.

One important piece of information to evaluate this risk is the historical spawn timing of steelhead in Puget Sound rivers. The PSSTRT (2013) compiled historical records from a wide variety of sources to help define the historical populations of steelhead in the Puget Sound DPS. We have summarized this information in Table 6.3.1. The limited information available from these sources is consistent with our current observations for the spawn timing of Puget Sound natural origin winter steelhead (Hoffmann 2014).

Table 6.3.1. Summary of historical information regarding the spawn timing of steelhead in the Puget Sound DPS.

River Basin	Timing	Comments
Baker	March 8 – May 9	Collection of adults in 1900 for Baker Lake Hatchery. May include summer-run. Ravenal (1900) cited in PSSTRT (2013).
Sauk	Early February through June 15	Collection of steelhead spawn in 1906. Riseland (1907) as cited in PSSTRT (2013).
Sultan	April 8 – June 4	Spawning at the Sultan River Hatchery in 1920s. Leach (1923) as cited in PSSTRT (2013).
Quilcene	February 27 – June 7	Spawning at the Quilcene National Fishery Hatchery in 1922. USBF (1923) as cited in PSSTRT (2013)
Hood Canal West Side Tributaries	March 24 – May 1	Spawning of ripe fish in 1926. Leach (1927) as cited in PSSTRT (2013).

The PSSTRT (2013) also reviewed records of steelhead spawning at Washington Department of Game hatcheries in the 1930s. The PSSTRT cautioned that the timing of egg collection "may not be fully representative of natural spawn timing"; however, little if any spawning occurred at the Nooksack, Samish, Skykomish, or Dungeness hatcheries prior to March 1. In some years, spawning did occur earlier at the Puyallup Hatchery (as early as early February in two of six years analyzed) and the Green Hatchery (as early as early-February), but there is no evidence that these early spawning fish comprised a significant component of the return,

A third source of information is Snow Creek, a small lowland tributary to the Strait of Juan de Fuca. The Department has conducted extensive research on Snow Creek for more than 30 years. Fishing has been prohibited since 1977, and no releases of hatchery-origin steelhead have occurred that would affect the timing of spawners. The initial redds in this stream can be constructed as early as February or March. For example, the date of first redd construction was the week of March 1 in 1979 and February 4 in 1980. The average date of spawning in these years was March 28th , and 95% of the spawning occurs after the end of February (Hoffmann 2014).

The PSSTRT (2013) concluded that "steelhead spawn earlier in small lowland streams where water temperatures are generally warmer than in larger rivers with higher elevation headwaters."

Our analysis of historical information and current data support this conclusion and suggest that natural origin steelhead spawn from early March through mid-June in rivers originating in the Cascades or Olympics. As evident from Snow Creek, initial spawning in small lowland streams can be earlier, early February to early March.

This information, and the substantial modification of early winter steelhead programs that have occurred since 2008, suggest that interbreeding of early winter hatchery-origin and natural origin steelhead is unlikely to suppress re-expression of a potential early spawning component of a natural origin steelhead population. In the larger rivers with higher elevation headwaters, the hatchery-origin early winter steelhead spawn well before the natural origin steelhead. In small lowland streams, like Snow Creek, the potential for genetic interaction between hatchery-origin early winter steelhead and natural origin steelhead is greater, but remains small. Even in this case, Hoffmann (2014) estimated that only 7.4% of Snow Creek natural origin steelhead would spawn during the same time period as early winter steelhead from the Tokul Creek Hatchery. Even more importantly, the elimination of all off-station releases and the cessation of releasing steelhead in small streams (e.g., Samish River, Pilchuck Creek, Pilchuck River, Raging River, Tolt River, Sultan River, east side Hood Canal rivers) provided additional risk control measures.

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

Early winter steelhead broodstock is recruited from volunteers returning to the hatchery off-channel trap. Steelhead typically return from mid-November to February and fish for broodstock are collected through January 31. Any volunteers returning after that date are removed from the system.

The program release goal (10,000 yearlings) does not require collection of more than few pairs for broodstock; however, utilization of only a few spawners poses a risk of inbreeding depression. To increase genetic representation, beginning in 2005, the Co-managers agreed to collect up to 15 pairs or 50,000 eggs. All eggs are incubated and reared to the unfed fry stage (2,200 fpp), at which time any fry in excess of program needs are released into non-anadromous lakes (Horseshoe and Ludlow). Remaining fish are reared to the smolt stage (5 fpp) to meet the 10,000 release goal.

The majority of returning fish are ripe and spawned shortly after arrival. If any green females are present, they are held separately in the circular ponds until ripe and ready to spawn.

7.3) Identity.

All fish released through this hatchery program have been consistently 100% mass-marked (adipose fin clipped), since the inception of the program (brood year 1994, release year 1995).

7.4) Proposed number to be collected:

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

Up to 30 adults collected annually.

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

Table 7.4.2.1: Sex composition of early winter steelhead broodstock spawned at Dungeness Hatchery.

Brood Year	Females	Males
2002	4	4 + 2
2003	4	4
2004	6	6
2005	14	9 + 5
2006	2	2
2007	17	35
2008	2	2
2009	1	1
2010	12	15 + 2
2011	13	+12
2012	16	23
2013	16	25
Average	**9**	**12**

Source: WDFW Hatcheries Headquarters Database 2013, (2011-12 data preliminary).
Note: "+ number" indicates live spawned males.

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

No surplus females are available through this program. Trapping success has been fairly limited and often not enough females are available to meet program needs. If any surplus males are available they are either donated to local food banks or used for nutrient enhancement.

7.6) Fish transportation and holding methods.

Adults are not transported. Upon returning to the hatchery, broodstock is held in an earthen pond until spawning. Green females and excess males (if available) may be held separately in the circular ponds supplied with river water.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult broodstock are sampled for viruses in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated in 2006) and spawning procedures follow the guidelines set forth in WDFW Spawning Guidelines (Seidel 1983, HSRG 2004). Standard fish culture techniques and sanitation procedures are applied during spawning procedures. Eggs are water hardened in iodophor solution to minimize the chance of disease transmission and all tools are disinfected between each use. Use of chemical treatment (formalin, antibiotics) is not necessary and not administered due to cool water temperatures and the short period of time adults spend in the raceways.

7.8) Disposition of carcasses.

Food-grade quality spawned carcasses may be donated to local food banks. Spawned females and non-food-grade quality carcasses, including mortalities, are used for nutrient enhancement within the watershed.

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.

ESA-listed steelhead are not targeted in this program. The hatchery off-channel trap is the homing location for hatchery-origin releases and would require listed fish to volunteer to the trap site. Any natural origin or listed steelhead encountered during broodstock collection would be identified from the hatchery broodstock by the presence of an adipose fin and would be immediately returned back to stream.

Hatchery steelhead broodstock collection takes place from mid-November through January 31. This time period is generally earlier than the peak natural origin winter steelhead run (see HGMP section 2.2.3). Policies in place preclude egg takes past January 31, to accentuate and minimize overlap with current known natural origin winter steelhead timing in the system.

This timeframe also mostly if not totally avoids listed spring Chinook during the trapping season. Bull trout are not encountered at any trapping sites.

SECTION 8. MATING

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

8.1) Selection method.

All fish are selected and spawned randomly based on ripeness on any spawn day until January 31. In years when limited numbers of fish are collected, all available fish are utilized for broodstock.

8.2) Males.

All males collected are considered for spawning and are selected randomly on spawn days.

Steelhead males may be live spawned to ensure enough males are available for mating. Live spawned males are marked and reused only when necessary.

8.3) Fertilization.

Since only 15 pairs are targeted for broodstock collection, factorial spawning may be used to maximize genotypic diversity. The typical protocol calls to split the eggs from each of 2–5 females into 2–5 aliquots of approximately equal size, and then use similar aliquots from 2–5 males to fertilize the eggs of each female in a checkerboard (matrix) fashion. This way the milt and egg aliquots are combined in all possible pairwise combinations, (e.g., 2x2, 3x3, 2x3, etc.) in separate containers, (Campton 2004). This fertilization protocol will be followed at Dungeness Hatchery and possible cross combinations are determined by the number of ripe fish available on any spawning day.

When an equal number of fish representing each sex are available, on any given spawning day, a pairwise spawning technique is applied and eggs from one female are fertilized with milt from one male. When the number of fish representing each sex is skewed, in order to maximize use of all available individuals, a nested spawning technique is applied. This involves individuals from the less abundant sex being mated with two or more individuals from more abundant sex to increases genetic representation.

8.4) Cryopreserved gametes.

Cryopreserved gametes are not used.

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

No listed steelhead broodstock are a part of the mating scheme.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Table 9.1.1.1: Survival rates from egg-take to ponding, Dungeness early winter steelhead program[a].

Brood Year	Eggs Collected	Survival Rates (%)	
		Green-to-Eyed Up	Eyed-Up-to-Ponding
2000	7,000	NA	NA
2001	3,000[b]	NA	NA
2002	10,000	NA	NA
2003	11,200	97.3	98.5
2004	14,700	93.5	86.9
2005	35,200	87.4	97.0
2006	4,000[c]	97.0	88.0
2007	42,500	NA	NA
2008	5,000	95.2	87.4
2009	3,000	93.3	NA
2010	22,000	83.4	92.4
2011	32,500	98.8	99.6
2012	38,500	92.6	99.1
Average	**17,585**	**93.2**	**93.6**

Source: WDFW Hatcheries Headquarters Database 2013.

[a]Egg-take goal is 10,000; excess are planted in non-anadromous lake.

[b]In 2001, an additional 10,000 eyed-eggs were transferred from Bogachiel Hatchery.

[c]In 2006, 10,700 released smolts were from Elwha stock.

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

The program goal to release 10,000 fish does not require the collection of more than few pairs to reach release goal. However utilization of few spawners poses a risk of inbreeding depression. As a prevention measure, in 2005, the Co-managers agreed to collect up to 15 pairs and up to 50,000 eggs. All eggs are incubated and reared to the fry stage, at which time any surplus fry are released into non-anadromous lakes (Horseshoe and Ludlow).

9.1.3) Loading densities applied during incubation.

Eggs are fertilized and incubated at Hurd Creek Hatchery. Approximately 3 pounds of eggs (~9,000-11,000 eggs) are placed in each tray.

9.1.4) Incubation conditions.

All eggs are incubated in vertical trays supplied with well water at the rate of 3 gpm, and a constant temperature of 47-48ºF. Dissolved oxygen is checked as needed and Vexar® layers are placed in the trays to provide substrate.

9.1.5) Ponding.

When completely buttoned up and ready for initial feeding (mid-April, at 1,350TU), fry are ponded into intermediate raceways and supplied with well water.

After ponding, excess fish are transported in a 750-gallon tanker truck and released into Horseshoe and Ludlow lakes. Transport time is approximately 45 minutes.

9.1.6) Fish health maintenance and monitoring.

All fertilized eggs are water hardened in an iodophor solution. Fungus in troughs is controlled by formalin drip, (15-minute every day drip at a target dose of 1,667-ppm formalin), throughout incubation to just prior to hatching. Once eyed (~600TU), eggs are shocked and mortalities are removed. Fry loss is picked daily.

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.

Listed fish are not incubated for this program.

9.2) Rearing:

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

Table 9.2.1.1: Survival rates from fry-to-sub-yearlings and sub-yearlings-to-smolts, Dungeness early winter steelhead, 2000-2012.

Brood Year	Survival Rates (%)	
	Fry-to-Sub-yearling	Sub-yearling-to-Smolt
2000	NA	98.9
2001	NA	NA
2002	NA	99.4
2003	98.7	99.0
2004	99.5	97.9
2005	94.8	99.0
2006	97.0	97.6
2007	98.5	92.7
2008	97.4	97.4
2009	NA	97.3
2010	98.4	98.0
2011	96.6	94.3
2012	99.0	97.5
Average	**97.8**	**97.4**

Source: WDFW Hatchery Records 2013.

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

Loading and density levels at WDFW hatcheries conform to standards and guidelines set forth in *Fish Hatchery Management* (Piper et. al. 1982) and the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Fish rearing densities are maintained at maximum of less than 3lbs of fish /gpm at release and under 0.35lbs/ft^3.

9.2.3) Fish rearing conditions

Fry are initially reared at Hurd Creek Hatchery in the intermediate raceways. After marking in June/July (~200 fpp) the fish are moved to raceways, and then to the smaller earthen pond in September (~20 fpp). All rearing vessels are supplied with well water. In March (6 fpp) fish are moved to Dungeness Hatchery and placed in raceways supplied with river water for final rearing and release.

Table 9.2.3.1: Monthly average surface water temperature (°F) at Dungeness River.

Month	Average Dungeness River Water Temperature (ºF)
January	37
February	38
March	39
April	42
May	44
June	48
July	53
August	54
September	51
October	45
November	41
December	37

Source: WDFW Hatchery Records 2012.

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.

Table 9.2.4.1: Average size (fpp), by month, of juvenile winter steelhead reared at Dungeness Hatchery.

Month	Average Size (fpp)
April	1,300
May	550
June	225
July	150
August	75
September	50
October	25
November	15
December	12
January	10
February	9

March	8
April	7
May	6

Source: WDFW Hatchery Records 2012.

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

See **Table 9.2.4.1** for growth information. No energy reserve data 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).

Steelhead are fed a variety of diet formulations including starter, crumbles and pellets; the food brand used may vary, depending on cost and vendor contacts. Feeding frequencies varies depending on the fish size and water temperature and usually begin at 8 feedings/7 days a week and ends at 1 feeding/5 days a week. Feed rates varies from 0.7% to 3% B.W./day. An overall season food conversion rate is approximately 0.6-0.9:1.

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

Fish health is monitored on a daily basis by the hatchery staff and at least monthly by a state Fish Health Specialist (FHS). Hatchery personnel carry out treatments prescribed by the FHS. Procedures are consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). See also HGMP section 10.9 for WDFW Standard Fish Health Procedures.

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.

This production is managed as a segregated program. Listed steelhead are not included in the hatchery broodstock and are not reared through this hatchery program.

Hatchery fish are reared to meet *Statewide Steelhead Rearing and Release Guidelines* (Tipping 2001) to achieve a size and condition factor at a time of releases that represents the best chance for survival in order to meet adult goals. Rearing fish to a yearling smolt stage is mandatory in order to foster out migration and subsequent survival when the fish vacate the system. Fry or sub-yearlings stage would not be reared and released from this program in order to eliminate and minimize interaction with listed fish rearing in the system.

All reasonable and prudent measures are employed to minimize rearing and incubation losses. These include the use of high quality or well water for incubation, high quality feeds for rearing, rearing densities and loadings that conform to best management practices, frequent fish health inspections and presence of professionally trained personnel to operate facilities. Hatcheries are designed to provide a safe and secure rearing environment through the use of alarm systems, backup generators, and water re-use pumping systems to prevent catastrophic fish losses.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Table 10.1.1: Propose release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Yearling	10,000	5.0	May, June	Dungeness River

Source: WDFW Future Brood Document 2013.
Note: 5 fpp ~210 mm fork length.

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

Stream, river, or watercourse: Dungeness River (18.0018)

Release point: RM 10.5 (Dungeness Hatchery)

Major watershed: Dungeness River

Basin or Region: Puget Sound/ Strait of Juan de Fuca

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

Table 10.3.1: Actual number, size at release and release dates, Dungeness winter steelhead, 2002-2013.

Release Year	Yearling	Avg. size (fpp)	CV	Release Dates
2002	10,250	5.0	9.3	6/10
2003	13,715	6.3	8.8	5/1
2004	10,500	6.3	6.3	6/1
2005	9,825	5.7	9.0	4/27
2006	10,900	5.7	8.1	6/1
2007	10,700	4.6	8.5	6/1; 6/2
2008	10,200	5.2	4.3	6/2
2009	3,700	5.0	9.1	6/1
2010	4,575	5.1	5.9	5/19-26
2011	11,750	6.0	6.8	5/23-30
2012	11,000	4.6	7.4	5/16
2013	11,600	5.6	10.7	5/15-22
Average	**9,893**	**5.4**	**7.9**	

Source: WDFW Hatcheries Headquarters Database 2013.
Note: 5 fpp ~210 mm fork length (fl); 6 fpp ~198 mm fl.

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

Steelhead are forced-released. Steelhead and coho are reared in ponds that are connected and are released at the same time. In order to release the coho, the water level in their pond has to be lowered, also lowering the level in the steelhead pond and forcing them to exit. See **Table 10.3.1** for actual release dates.

10.5) Fish transportation procedures, if applicable.

Juveniles are transported from Hurd Creek to Dungeness Hatchery for final rearing and release in a 750-gallon tanker truck equipped with aerators and oxygen tanks. Transport time is approximately 15 minutes.

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

After transfer from Hurd Creek Hatchery in March fish are reared for at least two months at Dungeness Hatchery on river water before release from the hatchery.

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

Table 10.7.1: Marks Applied.

Brood Year	Release	Marking
2013	10,000	AD only

Source: Future Brood Document 2013.

Hatchery reared steelhead are intended to be 100% adipose-fin clipped prior to release. Due to regeneration of a partially clipped adipose fin or fin missed completely, some hatchery adults may return with an adipose fin. WDFW monitors the successful clip rate during the marking process and partial or missed clips are recorded as a bad clip.

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

There are no surplus fish available at the time of release. Excess fry, when available, are released right after ponding into Horseshoe and Ludlow Lakes. This has only occurred twice in 2008 we released 32,780 fry were released into the lakes and 19,425 in 2012.

10.9) Fish health certification procedures applied pre-release.

Standard Fish Health Procedures performed at the facility:

- *All fish health monitoring is conducted by a qualified WDFW Fish Health Specialist.*
- *Juvenile fish examinations are conducted at least monthly and more often if necessary*. A representative sample (at the discretion of the fish health specialist) of healthy and moribund fish from each lot is examined.
- *Abnormal levels of fish loss are investigated if they occur.*
- *Fish health status is determined prior to release or transfer to another facility*. The exam may occur during the regular monthly monitoring visit, i.e. within one month of release or transfer.
- *Appropriate actions, including drug or chemical treatments are recommended as necessary*. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile is be generated when possible.
- *Findings and results of fish health monitoring are recorded on a standard fish health reporting form and maintained in a fish health database.*
- *Fish culture practices are reviewed as necessary with facility personnel*. Where pertinent; nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures and treatments are discussed.

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

In the case of a catastrophic event (drought or flooding) critical to fish survival, fish could be released early to prevent the loss.

Hatcheries Standby Procedures (revised in March 2012), a guideline developed by WDFW, includes information regarding proper actions for hatchery employees to follow in case of an emergency.

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.

WDFW has taken following actions to minimize adverse genetic and ecological effects to listed species resulting from hatchery releases:

- Eliminated transfers of eggs and juveniles between watersheds.
- Eliminated egg-takes after January 31, to keep hatchery and natural populations temporally segregated.
- Eliminated off-station releases where no trapping facilities are available.
- Eliminated recycling of hatchery origin adults back to anadromous waters for sport fishing opportunities.
- Leave trapping facilities open during the entire return time for adults of the segregated stock.
- Eliminated fry and sub-yearling releases, and mandatory rearing; release only yearling smolts, which are in migratory condition. This promotes rapid out-migration and thus minimizes the time spent in the river, in order to minimize or eliminate interactions with natural-origin salmonids rearing in the system (*Statewide Steelhead Interim Steelhead Rearing and Release Guidelines*; Tipping 2001).
- Promoted volitional releases to foster rapid seaward migration and limit residualism and freshwater interactions with listed Chinook and steelhead juveniles, bull trout and other naturally-produced salmonids.
- Mass-mark all releases for harvest selection and removal from the system.
- Release fish no earlier than May 1 in the Dungeness system, to allow listed stocks (Chinook, chum and steelhead) and pink salmon, to emigrate out of the system, and/or provide time for additional growth to minimize potential predation.
- Continue monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with natural origin fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on natural origin fish.

Hatchery steelhead releases have been 100% mass-marked since 1980s to enable identification during selective harvest, broodstock selection and, most recently, removal from the system.

WDFW continues monitoring, research and reporting of hatchery smolt migration performance behavior, and interactions with natural-origin fish to assess and adjust, if necessary, hatchery production and release strategies to minimize effects on natural-origin fish. WDFW is conducting research on the effects of volitional releases in Upper Columbia basin. This study is not yet fully completed, but preliminary results suggest faster fish migration, and lower rates of residualism when released volitionally (Snow et al. 2013).

With changes already being implemented, WDFW continues monitoring its hatchery programs and the affected watersheds to observe the effects on the populations at the hatcheries and natural spawning grounds.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

The purpose of monitoring is to identify and evaluate the benefits and risks from this hatchery program, elements of which are identified in HGMP section 1.10. The co-managers conduct numerous ongoing monitoring programs, including, catch, escapement, marking, tagging, smolt trapping and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species.

Currently the Jamestown S'Klallam Tribe is conducting steelhead escapement surveys to the natural spawning areas. Surveys were conducted in 2011 and 2013. See Section 2.2.2.

The Jamestown S'Skallam Tribe operates a full spanning weir smolt trap on Matriotti Creek (a major tributary to the Dungeness). This trap collects Chinook, coho, steelhead and trout that utilize the system. The coho and steelhead smolts are given an upper caudal fin clip which is used in a mark recapture study in association with the WDFW and the screw trap near the mouth of the Dungeness. The catch and release data provides trap efficiency information for the WDFW out-migrant trap at RKm 0.5 near the mouth of the Dungeness River. This trap enumerates Chinook, coho, chum, pink, and steelhead, as well as facilitates the collection of biological data on age, size and timing.

Additional research, monitoring and evaluation in the Dungeness watershed: Table 11.1.1.1 should be considered preliminary as this framework is still under development and subject to funding and to future changes.

Table 11.1.1.1: WDFW Dungeness River steelhead monitoring.

Project	Description
Hatchery Reform Implementation	This project focuses on the implementation of hatchery reform actions called for by the Washington Fish and Wildlife Commission Policy C-3619 on Hatchery and Fishery Reform. Activities include oversight and implementation of WDFW Hatcheries, spawning ground surveys and weir operations. Additional activities include in-season management of broodstock collection activities at WDFW facilities to implement hatchery reform actions. Deliverables include: development of hatchery management plans that will contribute to HGMP updates; estimation of performance metrics for WDFW hatchery programs includes adult run timing, spawn timing, broodstock mortality (including handling and pathology), fecundity, egg mortality rate, sex ratios, and juvenile marking protocols; and pNOB and PNI in areas where pHOS is known).
Monitoring of Populations of Winter Steelhead	This project will implement spawning ground (redd) surveys February through April in the Dungeness River and its tributaries in cooperation with Co-managers as funding and staff levels permit. Surveys will provide data regarding abundance and spatial distribution, which are two key VSP parameters. Deliverables include abundance estimates. Data can be used to track annual trends in abundance and spatial distribution.
Monitoring of Gene Flow/Introgression from Hatchery Steelhead Populations to Natural origin	WDFW is implementing a genetic monitoring program to measure pHOS and gene flow between segregated hatchery (early winter stock) steelhead and natural origin populations in the Puget Sound

Steelhead Populations	DPS (see Anderson et al. 2014 for additional information).

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

See HGMP section 11.1.1.

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.

Risk aversion measures will be developed in conjunction with the monitoring and evaluation plans.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Research specific to the Dungeness and hatchery steelhead program is not currently conducted.

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 information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

ADDENDUM A. 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.

Dungeness Bull Trout *(Salvelinus confluentus):* Bull trout were listed as a threatened species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910). Two local populations have been identified in the Dungeness Core Area, based the distribution of suitable spawning and rearing habitat: the middle Dungeness River up to river mile 24 and tributaries, including Silver, Gold, and Canyon Creeks; and the Gray Wolf River to its confluence with Cameron, Grand, and Cedar creeks. These populations are thought to exhibit anadromous, fluvial and resident life history forms, but conclusive data are lacking (WDFW Bull Trout SaSI, 2004). The current status of the Dungeness/Gray Wolf bull trout is unknown (WDFW Bull Trout SaSI, 2004) and only anecdotal angler reports and results of electrofishing sampling are available. Anglers report that historically bull trout were very common and widespread from the lower to the upper watershed. They report that they are still widespread, but greatly reduced in numbers (Mongillo 1993). The recovered abundance level for bull trout in the Dungeness Core Area has been set at 1,000 adult spawners, based on current habitat capacity (USFWS 2004).

Table 15.2.1: Summary table of core area rankings for population abundance, distribution, trend, threat, and final rank

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Dungeness River	50-250	25-125	Unknown	Substantial, imminent	High Risk

Source: USFWS 2008.

Habitat -- Roads, forestry, agriculture, fisheries management, and residential and urban development all pose significant threats to bull trout populations. In the upper Dungeness River watershed, forest roads are thought to be one of the most important causes of habitat degradation due to the inherently unstable geology and steep slopes found within the core area. The road network has increased mass wasting and sediment delivery to streams. Forestry has permanently modified much of the lower watershed, which is now primarily used for farms and homes. Water rights are over-appropriated in the Dungeness River and water diversions have altered stream flows, resulting in elevated water temperatures, seasonal migration barriers, and false attractions of bull trout to other streams. Increased storm water from urban and residential development and agricultural practices, including direct animal access to waterways and irrigation diversions, also impact water quality in the Dungeness core area. The hatchery water intake on Canyon Creek is identified as a complete barrier to upstream fish passage (USFWS 2004).

Several other listed and candidate species are found in Clallam County; however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

Listed or candidate species:
"No effect" for the following species:

Marbled murrelet (*Brachyramphus marmoratus*) –Threatened [critical habitat designated]
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened [critical habitat designated]

Candidate Species
Fisher *(Martes pennanti)* – West Coast DPS
(Olympic) Mazama pocket gopher *(Thomomys mazama ssp. melanops)*
Taylor's checkerspot *(Euphydryas editha taylori)*
Whitebark pine *(Pinus albicaulis*)

15.3) Analyze effects.

The water intake on Canyon Creek at the Dungeness Hatchery acts as barrier to bull trout migration. Bull trout may be encountered the hatchery programs during broodstock collection activities. There may be some mortality from hook and release of bull trout in fisheries targeting other species. Any unintended take, observed or unobserved encounters of bull trout are reported by WDFW to USFWS.

15.4) Actions taken to minimize potential effects.

Plans for a fish ladder and new intake on Canyon Creek have been drafted, and funding has been approved. Permits are in process, and bids are expected to be let in late 2014 with a targeted completion date of 2017. Bull trout may be encountered in other hatchery programs during broodstock collection activities (steelhead or coho) that would directly impact or create potential effects on bull trout in this system based on the current understanding of the status of these fish.

15.5) References

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

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Puget Sound/ Dungeness Winter and Summer Steelhead	**Activity:** Dungeness Winter Steelhead Program
Location of hatchery activity: Dungeness Hatchery: RM 10.5 Dungeness R. (18.0018) Hurd Creek Hatchery: RM 0.2 Hurd Creek (18.0028)	**Dates of activity:** December-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)	-	-	4*	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-

* Value reflects 5 year (2006-12) average natural origin steelhead trapped and released during hatchery steelhead broodstock trapping season.

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 natural origin and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

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

Table 2. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound/ Dungeness Chinook	**Activity:** Dungeness Winter Steelhead Program
Location of hatchery activity: Dungeness Hatchery: RM 10.5 Dungeness R. (18.0018) Hurd Creek Hatchery: RM 0.2 Hurd Creek (18.0028)	**Dates of activity:** December-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)	-	-	0	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-

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

Instructions:

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

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

Listed species affected: Summer Chum *(Oncorhynchus keta)*	**ESU/Population:** Hood Canal Summer Chum	**Activity:** Dungeness Winter Steelhead Program
Location of hatchery activity: Dungeness Hatchery: RM 10.5 Dungeness R. (18.0018) Hurd Creek Hatchery: RM 0.2 Hurd Creek (18.0028)	**Dates of activity:** December-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)	-	-	0	-
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
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.*