HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Dungeness River Steelhead
Species or Hatchery Stock:	Steelhead (*Oncorhynchus mykiss)* Bogachiel River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Dungeness River (Strait of Juan de Fuca) Puget Sound
Date Submitted:	March 17, 2003
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SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Dungeness River "Winter" Steelhead Program

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

Bogachiel River "Winter" Steelhead (*Oncorhynchus mykiss*) - not listed

1.3) Responsible organization and individuals

Name (and title):	Ron Warren, Region 6 Fish Program Manager Don Rapelje, Dungeness Complex Manager	
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

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

This program is funded through the Wildlife State Fund.

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

Dungeness Hatchery:	Dungeness River (18.0018) at RM 10.5
Hurd Creek:	Hurd Creek (18.0028) at RM 0.2, tributray to Dungeness River (18.0028) at RM 3.
Bogachiel Hatchery:	Bogachiel River (20.0162)

1.6) Type of program.

Isolated harvest

1.7) Purpose (Goal) of program.

Augmentation

The goal of this program is provide fish for in-river sport fishery.

1.8) Justification for the program.

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

1. Release steelhead as smolts with expected brief freshwater residence.

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

3. Only appropriate stock will be propagated.

4. Mark all reared fish.

5. Hatchery fish will be propagated using appropriate fish culture methods and consistent with Co-Managers Fish Health Policy and state and federal water quality standards; e.g. NPDES criteria.

1.9) List of program "Performance Standards".

See section 1.10.

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

Performance Standards and Indicators for Puget Sound **Isolated Harvest** Steelhead programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch.
Meet hatchery production goals	Number of juvenile fish released - **10,000**	Future Brood Document and Hatchery records
Manage for adequate escapement where applicable	Hatchery return rates	Hatchery return records

Minimize interactions with listed fish through proper broodstock management and mass marking. Maximize hatchery adult capture effectiveness. Use only hatchery fish	Number of broodstock collected - **up to 30 (need 6 adults: 3 females; 3 males)**	Stream surveys, rack counts Spawning guidelines
	Stray Rates	
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning - **December-February**	Spawning guidelines Hatchery records
	Adherence to spawning guidelines - **see section 8.3**	
	Total number of wild adults passed upstream - **No rack on Dungeness, wild fish don't generally volunteer into trap**	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	Future Brood Document and hatchery records
	Out-migration timing of listed fish / hatchery fish - **refer to section 2.2.1 (chinook) / after June 1**	FBD and historic natural outmigration times
	Size and time of release - **5 fpp / after June 1**	FBD and hatchery records Mark/unmark ratios
	Hatchery stray rates	
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	HOR spawners	Spawning ground surveys

Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy
	Fish pathologists will diagnose fish health problems and minimize their impact	Fish Health Monitoring Records
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES reports

1.11) Expected size of program.

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

Would take up to 30 adults (At a minimum 6 adults: 3 females; 3 males) and take a proportional amount to get 10,000 eggs. Have used Bogachiel stock.

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

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Dungeness River (18.0018)	10,000

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

For winters 1995-96 through 1999-2000, WDFW punchcard data shows an average of 84 adipose fin-clipped winter steelhead were harvested, 0.84% of those released. With the assumption that sport harvest represents 50% of total return, overall survival is estimated at 1.68%.

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

1994 (actual program was initiated by the "old" Game Department and were incorporating Bogachiel stock)

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Dungeness River (WRIA 18.0018).

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

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

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

No ESA permits.

This hatchery, as well as other WDFW hatcheries within the Puget Sound Chinook ESU, operates under U.S. v Washington and the Puget Sound Salmon Management Plan. This co-management process requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop program goals and objectives and agree on the function, purpose and release strategies of all hatchery programs.

Two brood documents are reviewed and agreed to annually. The Future Brood Document (FBD) is a detailed listing of annual production goals. This is reviewed and updated each spring and finalized in July. The Current Brood Document (CBD) reflects actual production relative to the annual production goals and it is developed each spring after eggs are collected.

Two additional processes that involve co-managers include 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", both are authored by the PNPTC, WDFW and Makah Tribe.

Although not directly related to hatchery programs, the North of Falcon Process should be mentioned as an avenue for developing harvest regulations. Conducted in concert with the Pacific Fisheries Management Council, this is an annual process that involves co-managers and stakeholders. The primary focus is to develop salmon fishing regulations for commercial and recreational fisheries in marine and freshwater areas.

In addition, WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon (Hershberger and Iwamoto 1981).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be used to maintain genetic variability within the hatchery populations (Seidel 1983).

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

Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. This policy designates and delineates Fish Health Management Zones and defines inter and intra-zone transfer policies and guidelines for eggs and fish. These are designed to limiting the spread of fish pathogens between and within watersheds. (WDFW, NWIFC, USFWS 1998).

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

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

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

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

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

Puget Sound chinook, specifically the Dungeness River population.

Adult Age Class Structure - Ages range from 2 to 6 year-olds, predominately 4 year-olds.
Sex Ratio - Unknown. Assumed to be 1.5 males to females when estimating the number of wild spawners from redd counts.
Size Range - Primarily from spawning ground surveys with a few hatchery recoveries (WDFW database, 1987-98). Samples ranged from 60 centimeters (cm) to 127 cm in length. The hatchery would have data relative to the size of captive brood.
Migrational Timing - Precise migrational timing is unknown, however, Ray Johnson, retired WDFW Fish Biologist, reported that during tagging studies for pink salmon in the early 1960's, chinook were captured "infrequently" during seining operations near the river mouth beginning around July 20 (Ray Johnson, pers. comm.).
Spawn Timing and Range - Spawning chinook have been observed in the mainstem Dungeness River up to RM 18.7 and up to RM 5.0 in the mainstem Gray Wolf River since 1986. Historical spawning range in the Gray Wolf is thought to be to approximately RM 9.5. Spawn timing in the lower river (RM 0-6.4) begins in September, ending in early to late October. From RM 6.4 to 10.8, spawning generally occurs from late August through September. In the Upper Dungeness River (RM 10.8-18.7), spawning usually begins in mid-August and ends in early September (Bill Freymond, WDFW Dungeness Progress Report, 1993-98).

Juvenile Life History - Most juveniles are thought to out-migrate as subyearlings after 5 to 8 months of rearing. However, 6 to 10 m chinook were captured in a Jamestown S'Klallam's life history study conducted from October 1997 through March 1998 (Jamestown S'Klallam Tribe, March, 1998). Most were progeny of project released fish and may indicate a life history preference towards yearling migration in some juveniles. Smolt emigration timing has been measured by WDFW smolt traps from early June through early September (Dave Seiler, WDFW, unpublished data, 1997). Mainstem smolt traps have not been operated prior to June 11.

Bull trout are listed as threatened in the Dungeness system (Genetics Unit within WDFW have information to suggest that they are Dolly Varden). There may be some competition between juvenile bull trout, planted subyearling chinook, yearling coho, and steelhead. However, this has not been documented. Bull trout may actually benefit from large plants of chinook fry through increased prey availability.

Summer chum may be incidentally affected, but only 1 or 2 are observed (on average) in August while conducting chinook surveys (Bill Freymond, WDFW Regional Biologist, personal communication).

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

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds

Critical and viable population thresholds under ESA have not been determined, however, the SASSI report (1992) determined that status of the Dungeness River chinook population is "critical". Critical is defined in the SASSI document as: " A stock of fish experiencing production levels that are so low that permanent damage to the stock is likely or has already occurred".

Critical and viable population thresholds under ESA have not been determined, however, as described in the Summer Chum Salmon Conservation Initiative (2000) the status of the summer chum population is "unknown".

The SASSI report determined that the status of the two stocks of bull trout in the Dungeness River are "unknown".

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

Progeny to parent ratios - There is no progeny to parent ratios or survival by life-stage data for Dungeness River wild chinook. The returns of 1999 were the first 4 year-old adult returns to the river but due to the small release numbers (13,000 fingerlings), the returns were not expected to be significant. 2000 were the first return of 4 year-olds from a plant of 1.8 million fish. They were not trapped, but were allowed to spawn naturally.

Carcass counts and otolith samples / mark samples, will be utilized to estimate the total survival to return of progeny of captive brood adults.

- 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.

Most recent 12 year estimates of annual spawning abundance estimates - The following table provides spawning escapement estimates for wild chinook salmon in the Dungeness River system for 1986-1999.

Dungeness River System Wild Chinook Escapements, 1986-99.

Year	Escapement
1986	238
1987	100
1988	335
1989	88
1990	310
1991	163
1992	153
1993	43
1994	65
1995	163
1996	183
1997	50
1998	110
1999	75

The wild chinook annual escapement goal is 925.

- 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.

Data from otoliths and heads recovered on the spawning grounds in 2001 have not yet been analyzed. Preliminary data, from 2000 chinook returns, seem to indicate that a majority of spawners (+ or - 90%) are of hatchery origin.

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

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

The release of fish as described in this HGMP could potentially result in ecological interactions with listed species. These potential ecological interactions are discussed in Section 3.5, and risk control measures are discussed in Section 10.11. Implementation of the program modifications provided in this HGMP, and the actions previously taken by the comanagers, are anticipated to contribute to the continued improvement in the abundance of listed salmonids.

Collection of steelhead broodstock takes place between December and early March oustide the return time of the spring, summer and fall chinook runs. No likely effects to "take" of listed chinook.

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

See "take" table 1.

- 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.

NA

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.

Fish production is consistent with the current Future Brood Document. The Current Brood Document reflects actual production relative to the annual production goals which are developed in the spring after eggs are taken from captive brood.

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

None.

3.3) Relationship to harvest objectives.

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

Provides for an in-river sport fishery. Average sport harvest of steelhead for 95/96-99/00 is 92.

3.4) Relationship to habitat protection and recovery strategies.

The comanagers' resource management plans for artificial production in Puget Sound are expected to be one component of a recovery plan for Puget Sound chinook under development through the Shared Strategy process. Several important analyses have been completed, including the identification of populations of Puget Sound chinook, but further development of the plan may result in an improved understanding of the habitat, harvest, and hatchery actions required for recovery of Puget Sound chinook.

3.5) Ecological interactions.

The program described in this HGMP interacts with the biotic and abiotic components of the freshwater, estuarine, and marine salmonid ecosystem through a complex web of short and longterm processes. The complexity of this web means that secondary or tertiary interactions (both positive and negative) with listed species could occur in multiple time periods, and that evaluation of the net effect can be difficult. WDFW is not aware of any studies that have directly evaluated the ecological effects of this program. Alternatively, we provide in this section a brief summary of empirical information and theoretical analyses of three types of ecological interactions, nutrient enhancement, predation, and competition, that may be relevant to this program.

Recent reviews by Fresh (1997), Flagg et al. (2000), and Stockner (2003) can be consulted for additional information; NMFS (2002) provides an extensive review and application to ESA permitting of artificial production programs.

Nutrient Enhancement
Adults originating from this program that return to natural spawning areas may provide a source of nutrients in oligotrohic coastal river systems 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).

Predation – Freshwater Environment
Coho and steelhead released from hatchery programs may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs, and the characteristics of the hatchery program (e.g., release time, release location, number released, and size of fish released). The site specific nature of predation, and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of any specific hatchery program. WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP.

In the absence of site-specific empirical information, the identification of risk factors can be a useful tool for reviewing hatchery programs while monitoring and research programs are developed and implemented. Risk factors for evaluating the potential for significant predation include the following:

> Environmental Characteristics. Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.
>
> Relative Body Size. The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon originating from natural production have been

monitored in numerous watersheds throughout Puget Sound, including the Skagit River , Stillaguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 3.5.1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 3.5.1 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

Table 3.5.1. Average length by statistical week of natural origin juvenile chinook salmon migrants captured in traps in Puget Sound watersheds. The minimum predator length corresponding to the average length of chinook salmon migrants, assuming that the prey can be no greater than 1/3 the length of the predator, are provided in the final row of the table. (NS: not sampled.)

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	43.2	48.3	50.6	51.7	56.1	59.0	58.0	60.3	61.7	66.5	68.0
Stillaguamish [2] 2001-2002	51.4	53.5	55.7	57.8	60.0	62.1	64.2	66.4	68.5	70.6	72.8
Cedar [3] 1998-2000	54.9	64.2	66.5	70.2	75.3	77.5	80.7	85.5	89.7	99.0	113
Green [4] 2000	52.1	57.2	59.6	63.1	68.1	69.5	NS	79.0	82.4	79.4	76.3
Puyallup [5] 2002	NS	NS	NS	66.2	62.0	70.3	73.7	72.7	78.7	80.0	82.3
Dungeness [6] 1996-1997	NS	NS	NS	NS	NS	NS	NS	NS	77.9	78.8	81.8
All Systems Average Length	50.4	55.8	58.1	61.8	64.3	67.7	69.2	72.8	76.5	79.0	82.4
Minimum Predator Length	153	169	176	187	195	205	210	221	232	239	250

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from regression models presented in Griffith et al. (2001) and Griffith et al. (2003).

[3] Data are from Seiler et al. (2003).

[4] Data are from Seiler et. (2002).

[5] Data are from Samarin and Sebastian (2002).

[6] Data are from Marlowe et al. (2001).

Date of Release. The release date of juvenile fish for the program can influence the likelihood that listed species are encountered or are of a size that is small enough to be consumed. The most extensive studies of the migration timing of naturally produced juvenile chinook salmon in the Puget Sound ESU have been conducted in the Skagit River, Bear Creek, Cedar River, and the Green River. Although distinct differences are evident in the timing of migration between watersheds, several general patterns are beginning to emerge:

1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;
2) Two broad peaks in migration are often present during the January through July time period; an early season peak (typically in March) comprised of relatively small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

Table 3.5.2. Average cumulative proportion of the total number of natural origin juvenile chinook salmon migrants estimated to have migrated past traps in Puget Sound watersheds.

Watershed	Statistical Week										
	16	17	18	19	20	21	22	23	24	25	26
Skagit [1] 1997-2001	0.61	0.64	0.68	0.73	0.76	0.78	0.83	0.86	0.90	0.92	0.94
Bear [2] 1999-2000	0.26	0.27	0.28	0.32	0.41	0.52	0.73	0.84	0.92	0.96	0.97
Cedar [2] 1999-2000	0.76	0.76	.0.76	0.77	0.79	0.80	0.82	0.84	0.87	0.88	0.90
Green [3] 2000	0.63	0.63	0.64	0.69	0.77	0.79	0.84	0.86	0.88	0.98	1.00
All Systems Average	0.56	0.58	0.59	0.63	0.68	0.72	0.80	0.85	0.89	0.94	0.95

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..

[2] Data are from Seiler et al. (2003).

[3] Data are from Seiler et. (2002).

Release Location and Release Type. The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time the fish released from the artificial production program are commingled with the listed species. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release, and the speed at which fish released from the program migrate from the watershed.

Coho salmon and steelhead released from western Washington artificial production programs as smolts have typically been found to migrate rapidly downstream. Data from Seiler et al. (1997; 2000) indicate that coho smolts released from the Marblemount Hatchery on the Skagit River migrate approximately 11.2 river miles day. Steelhead smolts released onstation may travel even more rapidly – migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). However, trucking fish to offstation release sites, particularly release sites located outside of the watershed in which the fish have been reared, may slow migrations speeds (Table 3.5.3).

Table 3.5.3. Summary of travel speeds for steelhead smolts for several types of release strategies.

Location	Release Type	Migration Speed (river miles per day)	Source
Cowlitz River	Smolts, onstation	21.3	Harza (1998)
Kalama River	Trucked from facility located within watershed in which fish were released.	4.4	Hulett (pers. comm.)
Bingham Creek	Trucked from facility located outside of watershed in which fish were released.	0.6	Seiler et al (1997)
Stevens Creek	Trucked from facility located outside of watershed in which fish were released.	0.5	Seiler et al (1997)
Snow Creek	Trucked from facility located outside of watershed in which fish were released.	0.4	Seiler et al (1997)

Number Released. Increasing the number of fish released from an artificial production program may increase the risk of predation, although competition between predators for prey may eventually limit the total consumption (Peterman and Gatto 1978).

Predation – Marine Environment
WDFW is unaware of any studies that have empirically estimated the predation risks to listed species posed by the program described in this HGMP. NMFS (2002) reviewed existing information on the risks of predation in the marine environment posed by artificial production programs and concluded:

"1) Predation by hatchery fish on natural-origin smolts or sub-adults is less likely to occur than predation on fry. Coho and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). During early marine life, predation on natural origin chinook, coho, and steelhead will likely be highest in situations where large, yearling-sized hatchery fish encounter sub-yearling fish or fry (SIWG 1984)."

“2) However, extensive stomach content analysis of coho salmon smolts collected through several studies in marine waters of Puget Sound, Washington do not substantiate any indication of significant predation upon juvenile salmonids (Simenstad and Kinney 1978).”

“3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance.”

Competition

WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that “migrant fish will likely be present for too short a period to compete with resident salmonids.”
2) NMFS (2002) noted that “..where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates.”
3) Flagg et al. (2000) concluded, “By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids.” Flagg et al (2000) also stated “It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment.”
4) Fresh (1997) noted that “Few studies have clearly established the role of competition and predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions.

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

SECTION 4. WATER SOURCE

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

The water source for this program is surface water from the Dungeness River. It is the same as the natal water used by the natural spawning population. It is of good quality except during times of flooding when it become quite silty due to upriver slides. An intake on Canyon Creek, a Dungeness River tributary, is used as a backup in the event the Dungeness becomes excessively silty or clogged with ice. The Dungeness is a very cold water system, prone to icing in the winter, thus slowing growth of the fish. The hatchery operates under the following permits:

Water right permit # 3518 - 1944 - 25CFS
" # S2-21709C - 1973 - 15CFS
" # S2-00568C - 1970 - 8.5CFS (Canyon Creek)
Discharge permit # WAG131037

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.

The Dungeness River auxiliary intake (siphon) is not currently compliant with State or Federal withdrawal guidelines. It will be operated only on an emergency basis, and was not used from 1999 through 2002. The Dungeness River Hatchery intake was identified as a high-priority capitol project for the 2001-03 fiscal biennium. Effective February 2001, Hatchery Scientific Review Group, "Gorton" funds have been committed to begin immediate scoping, design and construction work on a new compliant intake system. WDFW has requested and received funding to conduct a scoping study of the intake requirements and options for replacing the current system.

The Dungeness Hatchery has an off-line settling pond and artificial wetland for effluent removal before the water is discharged back into the river.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Dungeness Hatchery has an off-channel adult pond. There is no in-river rack on the Dungeness River and fish all volunteer to the pond.

There is no broodstock collection at Hurd Creek.

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

The Dungeness Complex has a 1200 gallon and a 400 gallon tank used for fish transport.

5.3) Broodstock holding and spawning facilities.

Steelhead adults are held in an earthen adult pond. (42' X 135' X 2.5'). Spawning is done at the pond site.

5.4) Incubation facilities.

Incubation at Hurd Creek consists of vertical stack (FAL) incubators.

5.5) Rearing facilities.

Rearing started at Hurd Creek in 4' diameter circular ponds and in a 20' diameter circular pond prior to transport back to Dungeness for final rearing in 10' X 100' raceways.

5.6) Acclimation/release facilities.

Dungeness Hatchery acclimates in 10' X 100' raceways and releases the steelhead. Hurd Creek does not acclimate or release on site.

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

NA

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.

The hatchery is staffed full-time, with 24 hour stand-by, and equipped with many low-water alarms which help prevent catastrophic fish loss resulting from any type of water system failure. Pumping power would be provided with an emergency backup generator (at Hurd Creek only), equipped with an auto start, in the event of loss of normal power. The generator is capable of providing power to all hatchery components indefinitely, with fuel supplied as needed. Onsite fuel storage capacity is 1490 gallons, a seven day supply at full generator load. Further, a surface water backup supply from Hurd Creek can be supplied to the 20 foot rearing ponds in the unlikely event of total loss of all power sources.

Dungeness Hatchery uses gravity-fed water from 3 different sources. Any of these can be used in the event of another failure.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

Adult returns to Dungeness Hatchery or Bogachiel transfers.

6.2) Supporting information.

6.2.1) History.

Have been historically Bogachiel stock, but intent is on using local broodstock as in BY 2000.

6.2.2) Annual size.

Up to 30

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

None.

6.2.4) Genetic or ecological differences.

Unknown

6.2.5) Reasons for choosing.

To develop a locally adapted broodstock.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

NA

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

Adults volunteering to earthen adult pond at Dungeness Hatchery.

7.3) Identity.

Returning adipose-fin clipped adults to earthen adult pond.

7.4) Proposed number to be collected:

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

Program goal is 6 adults, but would like to take as many adults as possible (up to 30) and take a proportional amount to get 10,000 eggs.

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

Year	Adults Females	Males	Jacks	Eggs	Juveniles released
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000	2	2		7,000	
2001	1	2		3,000	

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

No surplus

7.6) Fish transportation and holding methods.

Earthen pond used to hold adults. No transportation of adults.

7.7) Describe fish health maintenance and sanitation procedures applied.

NA

7.8) Disposition of carcasses.

Carcasses used for nutrient enhancement.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Steelhead adults are collected for broodstock (December-February) when chinook (August-October) are not in the watershed. Any bull trout/dolly varden encountered are released back into the river immediately.

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 available spawners are utilized and are chosen, at random, as they become mature.

8.2) Males.

One male per one female.

8.3) Fertilization.

Pooled eggs from 3 females are split into 3 aliquots (lots). Each lot is fertilized with sperm from one male.

8.4) Cryopreserved gametes.

NA

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

Steelhead adults are collected for broodstock (December-February) when chinook (August-October) are not in the watershed. Any bull trout/dolly varden encountered are released back into the river immediately.

<u>SECTION 9. INCUBATION AND REARING</u> -

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.

When eggs are from either Dungeness or Bogachiel hatchery, 92% survive to ponding.

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

No surplus has taken place.

9.1.3) Loading densities applied during incubation.

8,000 eggs per vertical tray (@ ~3 gallons per minute (gpm)).

9.1.4) Incubation conditions.

Incubation is done in vertical stack incubators. The water supply is well water via a denitrophication tower. Temperature range is 47 +/- 0.5 degrees Fahrenheit. Dissolved oxygen is saturated at approximately 11.3 ppm.

9.1.5) Ponding.

Button-up fry are force ponded when yolk is approximately 95-100% absorbed. This is done with a visual check of a dozen fry. Temperature units (TU's) at ponding is approximately 1350 TUs.

9.1.6) Fish health maintenance and monitoring.

Fish health is monitored monthly by a WDFW Fish Health Specialist.

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

NA

9.2) Rearing:

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

In 2000, fry survival from ponding until transfer to Dungeness Hatchery was 96%.

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

Density index goals are < 0.3. Actual levels = 0.1

9.2.3) Fish rearing conditions

Fry are started in 4' diameter circular ponds and moved to 20' diameter at approximately 100 fish per pound (fpp) until transfer to Dungeness Hatchery at 10 fpp. Temperature range is 47 +/- 0.5 degrees Fahrenheit (at Hurd Creek). Temperatures range from 34-39 degrees Fahrenheit at the Dungeness Hatchery in early/late March.

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.

Fish size vs weeks from ponding date.

Size(fpp)	wks
2075	0
1525	1
1365	2
1145	3
670	5
410	7
250	10
195	11
170	12
125	15
85	17
67	19
45	24
18	32
12	38
10	40
9	44

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

Not available.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Feed types used are Bioproduct's Biodiet Starter #2, 3#, Moore Clarks's Fry and Rangen Steelhead Dry (Floating) in 20' diameter tanks. Fish are fed according to feed manufacturer's recommendations and the hatchery specialists expertise.

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

The fish are monitored on a routine monthly basis by WDFW Fish Health Specialist or on an as-needed basis. Disease treatments to date have not been required.

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

NA

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

NA

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

NA

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	10,000	5	after June 1	Dungeness R. (18.0018)

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

Stream, river, or watercourse: Dungeness River (18.0018)
Release point: Dungeness River (RM 10.5)
Major watershed: Dungeness River
Basin or Region: Puget Sound (Straits of Juan de Fuca)

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

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size fpp	Fingerling	Avg size fpp	Yearling	Avg size fpp
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995							9,900	5
1996							10,008	5
1997							7,800	5
1998							10,690	9
1999							11,000	6
2000							10,465	6
2001							12,199	6
Average							10,295	6

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

Will be released after June 1 to avoid possible impacts to migrating pink salmon, chinook juveniles and summer chum fry.

10.5) Fish transportation procedures, if applicable.

NA

10.6) Acclimation procedures

Acclimated at Dungeness Hatchery on river water after transfer from Hurd Creek.

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

All fish released are marked with adipose-fin clip only.

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

None

10.9) Fish health certification procedures applied pre-release.

The fish are checked by the area Fish Health Specialist before release.

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

Drain the raceway and release the fish directly into the river at the hatchery site.

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.

To minimize the possible adverse interactions and ecological effects to pink salmon juveniles, all yearling steelhead smolts are released on or after June 1. This release date also minimizes the effect to listed natural chinook salmon, summer chum and bull trout juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in July to August.

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 comanagers conduct numerous ongoing monitor programs, including catch, escapement, marking, tagging, and fish health testing. The focus of enhanced monitoring and evaluation programs will be on the risks posed by ecological interactions with listed species. WDFW is proceeding on four tracks:

1) An ongoing research program conducted by Duffy et al. (2002) is assessing the nearshore distribution, size structure, and trophic interactions of juvenile salmon, and potential predators and competitors, in northern and southern Puget Sound. Funding is provided through the federal Hatchery Scientific Review Group.

2) A three year study of the estuarine and early marine use of Sinclair Inlet by juvenile salmonids is nearing completion. The project has four objectives:

a) Assess the spatial and temporal use of littoral habitats by juvenile chinook throughout the time these fish are available in the inlet;

b) Assess the use of offshore (i.e., non-littoral) habitats by juvenile chinook;

c) Determine how long cohorts of juvenile chinook salmon are present in Sinclair inlet;

d) Examine the trophic ecology of juvenile chinook in Sinclair Inlet. This will consist of evaluating the diets of wild chinook salmon and some of their potential predators and competitors. Funding is provided by the USDD-Navy.

3) WDFW is developing the design for a research project to assess the risks of predation on listed species by coho salmon and steelhead released from artificial production programs. Questions which this project will address include:

a) How does trucking and the source of fish (within watershed or out of watershed) affect the migration rate of juvenile steelhead?

b) How many juvenile chinook salmon of natural origin do coho salmon and steelhead consume?

c) What is the rate of residualism of steelhead in Puget Sound rivers?

Funding needs have not yet been quanitifed, but would likely be met through a combination of federal and state sources.

4) WDFW is assisting the Hatchery Scientific Review Group in the development of a template for a regional monitoring plan. The template will provide an integrated assessment of hatchery and wild populations.

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

See 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.

Not applicable.

12.2) Cooperating and funding agencies.

12.3) Principal investigator:

12.4) Status of stock (In addition to the information provided below, refer to section 2.2.1 2.2.2 and 2.2.3)

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

12.6) Dates or time period in which research activity occurs

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

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

12.9) Level and take of listed fish

12.10) Alternative methods to achieve project objectives.

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

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

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

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

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

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

Listed species affected: Bull Trout ESU/Population: Puget Sound Activity: Hatchery Operations				
Location of hatchery activity: Dungeness Hatchery Dates of activity: December/January-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)			Unknown	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	Unknown	
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.

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

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

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

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

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

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

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

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

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

h. Other takes not identified above as a category.