HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Puyallup "Winter" Steelhead Program
Species or Hatchery Stock:	Steelhead *(Onchorynchus mykiss)* Puyallup River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Puyallup River Puget Sound
Date Submitted:	March 17, 2003
Date Last Updated:	February 9, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Puyallup "Winter" Steelhead Program

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

Puyallup River Steelhead (*Onchorynchus mykiss*) - not listed

1.3) Responsible organization and individuals

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

The Puyallup Tribe of Indians shares co-management authority of the fish resources in the Puyallup watershed.

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

Funding is from the State Wildlife Fund. Permanent staff at the Puyallup Hatchery consists of 4 full time employees.

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

Puyallup Hatchery:	Located at RM 3.5 on Clarks Creek (10.0027), tributary of the Puyallup River with its confluence at RM 5.8.
Voights Creek:	Located at RM 0.5 on Voights Creek (10.0414), a tributary of the Carbon River (10.0413). Voights Creek enters the Carbon River at RM 4. The Carbon River is a tributary to the Puyallup River (10.0021) and joins it at RM 17.8.

1.6) Type of program.

Isolated harvest

1.7) Purpose (Goal) of program.

Augmentation.

The goal of this program is to provide adult fish for sport and treaty harvest opportunity.

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. Attempt 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 below.

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 - *** (see section 1.11.2)**	Future Brood Document (FBD) 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 - **goal: 250**	Rack counts
	Stray Rates	Spawning guidelines
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning - **late November to mid-February**	Spawning guidelines Hatchery records
	Adherence to spawning guidelines - **see section 8.3**	
	Total number of wild adults passed upstream - **0 (section 4.2)**	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Out-migration timing of listed fish / hatchery fish - **mid-May/see section 1.11.2**	FBD and historic natural outmigration times
	Size and time of release - **7 fpp/April release (see Voights Cr. HGMP)**	FBD and hatchery records
	Hatchery stray rates	Hatchery records (marked vs unmarked)
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	

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	
	Vaccines will be administered when appropriate to protect fish health	Fish Health Monitoring Records
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

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

A total of 250 adults are needed for the Puyallup River winter steelhead program. These adults are collected at the Puyallup Trout Hatchery, Voights Creek Hatchery and the Puyallup Tribal Hatchery at Diru Creek.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling		

*-24,500 trucked and planted into the Deschutes River at RM 15.5.

**- Will discontinue the planting of 20,000 into the White River from the Puyallup facility and shift that release out of Voights Creek (see Voights Cr. HGMP).

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

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

The hatchery began production in 1948. It is unclear when the first year of steelhead production began.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Puyallup River (10.0021)

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

None.

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

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

None

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

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

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

None.

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

Puyallup River Fall Chinook.

Adults spawn in the mainstem Puyallup River from approximately RM 10.4 upstream to the anadromous barrier at Puget Sound Energy's Electron diversion facility (RM 41.7). Sexually mature fish begin arriving back at the river mouth in late July and continue to enter the river until mid-October. The upstream migration peaks in late August to mid-September. Spawning begins in early September, peaks in early October and is generally complete by November. Fall chinook spawning habitat is available in the Carbon River from its mouth up into Mt. Rainier National Park. Tributary spawning takes place in Clarks Creek, Fennel Creek, Canyon Falls Creek, South Prairie Creek, Wilkeson Creek and Kapowsin Creek.

Most naturally produced Puyallup River chinook migrate to salt water as zero age smolts after spending only a few months in freshwater (Out-migration timing was not currently well defined but a study initiated in 2000 by the Puyallup Tribe, to determine juvenile production levels and migration timing, has indicated that the peak out-migration occurs in mid-May. Size of the chinook out-migrants at the peak was 80-90 mm). After a few weeks of estuarine acclimation, most juveniles begin moving to nearshore feeding grounds in Puget Sound and the Pacific Ocean.

White River Summer/Fall Chinook.

This stock was listed in SASSI, however, there was no stock characterization beyond a presumed October spawning time and no stock assessment data were listed.

White River Spring Chinook.

Adults spawn in the mainstem White River from the Puget Sound Energy project tailrace at Dieringer (river mile 3.5) up to the Puget Sound Energy diversion dam at river mile 24.3. Sexually mature fish begin arriving back at the river mouth in May and enter the river through mid-September. Collection and passage (upstream 12 miles) at the Buckley trap commences in late May or early June and ends in early October. Spawning takes place from early September through mid-October. Tributary spawning takes place in Boise Creek, below the diversion dam, and in the Greenwater River, Clearwater River, Huckleberry Creek and the West Fork White River, all above Mud Mountain Dam.

Like the Puyallup fall chinook, the White River spring chinook juveniles are predominantly zero age outmigrants.

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

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

Critical and viable population thresholds under ESA have not been determined, however, the SASSI report (WDFW) determined both the Puyallup River Fall Chinook and the White River Summer/Fall Chinook populations status to be "unknown". The report determined that the White River Spring Chinook population status was "critical".

- 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.

There is no stock-specific data available to estimate survival or productivity of the natural Puyallup River fall chinook.

Washington run size is not estimated for White River spring chinook and coded-wire-tagging results have not yet provided the stock-specific harvest rate data necessary to calculate adult production rates.

- 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.

Estimates of Puyallup River fall chinook spawning naturally in the South Prairie Creek sub-basin[1]

1994	798
1995	1335
1996	1225
1997	622
1998	1028
1999	1422

1. Note that the historic Puyallup River fall chinook escapement estimates listed in Run Reconstruction are not considered accurate by the co-managers and are not relative to estimates made by a new method, beginning in 1999. The South Prairie Creek sub-basin has been chosen as an indicator of Puyallup River escapement, with a local spawning objective of 500 adults.

Numbers of adult White River spring chinook passed above Mud Mountain Dam[1] (From Army Corps of Engineers trucking records):

1988	127
1989	83
1990	275
1991	194
1992	406
1993	409
1994	392
1995	605
1996	628
1997	402
1998	320
1999	553

1. Note that there are currently no estimates made of spring chinook spawning below the Puget Sound Energy diversion dam at Buckley.

- 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.

Puyallup River fall chinook - Unknown. There has been no identification of hatchery-origin fish in this basin until the 1997 brood. Ratios will be developed when these fish mature and return to spawn.

White River spring chinook - Unknown, although only unmarked, untagged fish are trucked above Mud Mountain Dam. This precludes identified hatchery-origin adults from being passed upstream, but unidentified hatchery-origin fish may be in the upper river natural spawning population. 1999 coded-wire-tag recoveries at the Buckley trap/White River Hatchery showed contributions of Skagit River spring chinook (released into Tulalip Bay), Fox Island Net Pen fall chinook, Voights Creek fall chinook, South Sound Net Pen fall chinook, Elliott Bay Net Pen fall chinook, Diru Creek fall chinook and Hoodsport Hatchery fall chinook. All of these strays were removed from the spawning population, however, unmarked elements of these production units (and others) may have been incorporated into the local broodstock, both above and below the barrier.

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

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

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

Unknown

- 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).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

Unknown (see "take" table).

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

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.

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

Puyallup basin hatchery winter steelhead production levels are specified to be a minimum of 200,000 smolts per year by agreement between the Puyallup Tribe and WDFW.

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.

The following catches and harvest rates for Puyallup Basin hatchery winter steelhead include fish from both the Voights Creek program and the Puyallup Hatchery program which cannot be distinguished from one another.

Year	Sport Catch	Treaty Catch	Harvest Rate
1988	528	676	92.9%
1989	804	862	92.3%
1990	587	332	92.3%
1991	720	261	92.3%
1992	693	824	92.3%
1993	310	190	92.3%
1994	560	431	92.3%
1995	456	335	92.3%
1996	316	45	64.5%
1997	154	10	61.7%
1998	404	85	70.7%
1999	339	24	62.2%

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:

<u>Environmental Characteristics.</u> 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.

<u>Relative Body Size.</u> 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 (Simestad 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 the Puyallup Hatchery is Clarks Creek, which is a combination of spring and surface water runoff, capable of producing up to 15 cubic feet per second (cfs) of water for the hatchery. Average use of water has declined in recent years of operation due to increasing municipal water withdrawals and development in the watershed.

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.

Salmon (adults and juveniles) do not have access to areas above the water intake and will not be impacted by hatchery water withdrawals or screening issues. All NPDES monitoring requirements are followed for maintaining water quality; the effect of effluent discharge on listed fish has not been examined in this watershed.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

A removable box trap is installed annually. It is a 10' X 12' aluminum picket box with a v-trap entrance. It is typically installed after the Thanksgiving holiday post-chinook migration and spawning.

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

Adults are held and spawned on site. Juveniles are hauled with either a 2000 gallon tanker truck equipped with oxygen airstones and recirculating pumps or a tanker truck containing 3-500 gallon tanks equipped with airstones and recirculating pumps.

5.3) Broodstock holding and spawning facilities.

Fish are held in available raceways not used for fish culture.

5.4) Incubation facilities.

Eggs can be incubated in either 7 vertical full stacks or 112 shallow troughs.

5.5) Rearing facilities.

The Puyallup Hatchery has sixteen 40' diameter round ponds, 10 standard raceways and a large 40' X 120' X 4' rearing pond for fish rearing.

5.6) Acclimation/release facilities.

Fish are reared on Clarks Creek water before being trucked to the Deschutes River where they are planted.

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

During extreme flood events the intake screens can clog which reduces water flow both to the hatchery and to the ponds.

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.

Standby personnel are on duty 24 hours a day to respond to emergencies. A backup generator is available to provide water to ponds supplied with pumps.

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.

Chambers Creek stock is the founding stock used in the Puyallup system. In recent years, an effort has been made to use all steelhead adults returning to hatcheries on the Puyallup River system for broodstock. In years when there are not enough returning fish to meet the egg take goal, eggs are imported from the Bogachiel Hatchery or the Tokul Creek Hatchery.

6.2) Supporting information.

6.2.1) History.

The original source for broodstock for the Puyallup system came from Chambers Creek, which was chosen because it produced an adult that returned in December-January and spawned earlier than wild Puyallup system steelhead stocks. This stock could be harvested at high rates without impacting the later returning native stock of steelhead. In recent years, when not enough adults have returned to supply eggtake needs, stocks from the Bogachiel Hatchery and Tokul Creek Hatchery have been utilized. Both of these stocks are considered Chambers Creek derivatives.

6.2.2) Annual size.

250 adipose-fin clipped adults used for broodstock (see 1.11.1).

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

Unknown

6.2.4) Genetic or ecological differences.

There is a difference in return and spawn timing between the hatchery and wild steelhead stocks in the Puyallup system. Hatchery adults return between November/January and spawn between December/February. Wild steelhead typically return between January and April with peak spawning in April and May. In addition, smolts are produced in the hatchery in one year, in the wild the average smolt age is 2 years.

6.2.5) Reasons for choosing.

The stock chosen returns at an earlier time than the native stock which reduces the chance of hatchery fish spawning with native fish. This allows a greater harvest rate on the hatchery stock. This early run timing also makes it possible to produce a one-year smolt.

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.

Adult fish are captured between Thanksgiving and mid-February in a box trap installed in Clarks Creek. All clipped fish captured are utilized for broodstock purposes.

7.3) Identity.

All steelhead returning to facility are mass marked (adipose-fin clipped).

7.4) Proposed number to be collected:

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

250 adults (125:125). See section 1.11.1.

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

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997	8	10		24,000	
1998	17	20		42,500	
1999	25	25		86,678	
2000	2	1		*	
2001				**	

Data source: Puyallup Trout hatchery records

*- 2 females/1 male trapped at Puyallup; 5 females/2 males trapped at Voights Cr.

**- All adults trapped at Voights Cr.

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

Has not occurred to date for females. Excess males have been donated to food banks. If fish are in pre-spawn condition, they can be recycled for additional sport fishing opportunity.

7.6) Fish transportation and holding methods.

Smolts that are planted into the Deschutes River system are hauled in various sized tanker trucks equipped with oxygen tanks, airstones, and re-circulating pumps.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adults are held in raceways and to date no drug treatments have been utilized during adult holding.

7.8) Disposition of carcasses.

Spawned carcasses are used as nutrient enhancement or sold to a fish buyer. Unspawned carcasses may be donated to a food bank.

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

NA

SECTION 8. MATING

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

8.1) Selection method.

Randomly over the entire run from ripe fish on a certain day.

8.2) Males.

Backup males are used whenever available. Jacks are used when available, however, they are a rare occurrence at this facility.

8.3) Fertilization.

When adequate broodstock is available, fish are spawned in accordance to a 1:1 ratio with the use of a backup male to insure fertilization. At times, adequate numbers of males have not been available to meet this and are used to fertilize more than 1 female.

8.4) Cryopreserved gametes.

NA

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

NA

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Egg take has varied widely from 50,000 to over 225,000 for the Puyallup system. Generally, eye-up rates of 80 to 90% are achieved.

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

Any surplus eggs are generally grown into fish and the excess fish are planted into lowland lakes with no outlet.

9.1.3) Loading densities applied during incubation.

Steelhead eggs range from 2800 to 3000 to the pound. Eggs are loaded into vertical stacks at 10,000 eggs per tray. Vertical stacks receive 4-5 gallons per minute (gpm) per incubator. Eggs are also incubated and hatched in shallow troughs with up to 20,000 eggs or fry per section.

9.1.4) Incubation conditions.

Temperature is monitored daily. Dissolved oxygen is not monitored frequently, but is generally saturated. Incubation water is run through a packed column to minimize nitrogen levels. Silt is generally not a problem at Puyallup Hatchery, but can be during high water events. During these times incubators are flushed to remove silt. Puyallup Hatchery has a cold water temperature profile with water temperatures ranging from 46 to 52 degrees year round.

9.1.5) Ponding.

Fry are ponded when visibly buttoned up at 95% (only 5% of yolk is showing) or greater level. Ponding is forced into the holding and rearing ponds. Fish that are incubated in shallow troughs can swim up volitionally, but ponding is forced into raceways or round ponds.

9.1.6) Fish health maintenance and monitoring.

Incubating eggs receive daily formalin treatments to minimize fungus growth. Eggs are manually shocked and picked at 600 Temperature Units (TU's) with dead eggs being removed with an electronic egg picker. Fish Health Specialists perform routine inspections to insure fish health.

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) <u>Rearing</u>:

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..

Not available

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

Numerous criteria are applied depending on the fish's size, the pond style they reside in, water quality, water temperature, relative health and water conditions. However, as a rule, the criteria limits loadings to a maximum of 3 pounds fish/gpm of flow until they have reached a size of 100 fpp.

9.2.3) Fish rearing conditions

Temperature is monitored daily and is fairly constant because of its spring source. Dissolved oxygen levels are not checked frequently, but are generally saturated. Ponds are split when loadings approach 3 lbs/gpm inflow unless fish are close to release. Then they can be loaded at 5 lbs/gpm inflow.

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.

Not available.

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

Not available.

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

Fish are fed a variety of dry pellet and crumbles depending on size of the fish. Newly ponded fish are fed at a high body weight percentage which is between 2 and 5% B.W./day, up to 8 times per day. Smolts and pre-smolts are fed between .5 and 1.5% B.W./day, once a day. Food conversions are generally 1:1, although they can range between .8 and 1.3:1 depending on time of year and diet formulation used.

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

Ponds are cleaned as frequently as needed, from once a week to once a month depending on size of fish and time of year. Fish health is monitored by a Fish Health Specialist that makes scheduled visits to check on fish health and prescribe treatments if necessary.

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.

Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling				0

*** -** 24,500 trucked and planted into the Deschutes River at RM 15.5. See HGMP for Tumwater Falls Winter Steelhead program.

**** -** Will discontinue the planting of 20,000 into the White River and shift that release out of Voights Creek (see Voights Cr. HGMP).

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

Stream, river, or watercourse:
Release point:
Major watershed: Puyallup River (10.0021)
Basin or Region: Puget Sound

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

*For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in **Attachment 2**. Cite the data source for this information.*

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995							24,938*	6
1996							24,000*	6
1997							18,600*	6
1998							19,600*	5
1999							18,210*	9
2000							20,000*	6
2001							21,000*	7
Average							20,907	6

Data source:

*** -** Releases into the White R.

**- Releases into Puyallup R.

Release year	#'s Released	Fpp	RM
1995	39,648	6	11
	41,155	5	17
	14,310	5	22
1996	2,500	7	09
	52,900	7	11
	31,500	6	14
	21,000	7	22
1997	3,300	6	09
	111,858	5	11
	31,300	6	14
	2,750	6	15
	11,200	6	22
1998	10,000	5	09 (Clark's Cr)

1999			
2000	5,000	6	09 (Clark's Cr)
2001	10,000	7	09 (Clark's Cr)

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

NA

10.5) Fish transportation procedures, if applicable.

Steelhead are loaded into various sized tanker trucks equipped with oxygen tanks, airstones and re-circulating pumps. Fish are loaded into the truck at 1 lb/gallon of water.

10.6) Acclimation procedures

Fish are reared on Clarks Creek water before being trucked to the Deschutes River where they are planted.

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

All steelhead are 100% identified with an adipose-fin clip (mass marked).

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

Fish in excess of program level can be planted into area lowland lakes with no outlet to provide sport fishing opportunity.

10.9) Fish health certification procedures applied pre-release.

Fish are examined by a WDFW Fish Health Specialist prior to release or transfer in accordance with the Co-Managers Salmonid Disease Policy.

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

Screens can be pulled to release fish, if necessary.

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.

Trucking of steelhead to be released into the White River will no longer take place. Steelhead will be trucked to the Deschutes River for planting. The Puget Sound Technical Recovery Team has not identified the Deschutes River as historically having a chinook salmon population. See appropriate HGMPs.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

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

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.

There is currently no research being conducted using Puyallup Winter Steelhead.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

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

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

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

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

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

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

12.10) Alternative methods to achieve project objectives.

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

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.")*.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

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

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

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

Instructions:

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