HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	George Adams Fall Chinook Fingerling Program
Species or Hatchery Stock	Hood Canal Fall Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Hood Canal Puget Sound
Date Submitted	August 04, 2005
Date Last Updated	July 25, 2005

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

George Adams Hatchery Fall Chinook - Fingerling Program

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

Hood Canal Fall Chinook (*Oncorhynchus tshawytscha*) – listed as "threatened" June 2005

1.3) Responsible organization and individuals

Name (and title):	Ron Warren, Region 6 Fish Program Manager Denis Popochock, Complex Manager	
Agency or Tribe:	Washington Department of Fish and Wildlife	
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

In addition to WDFW production, the Hood Canal Salmon Enhancement Group (HCSEG) and Long Live the Kings (LLTK) operate cooperative projects (Hamma Hamma & Rick's Pond) that produce fall chinook fingerlings and yearlings.

George Adams Hatchery operates under *U.S. v. Washington*, the Puget Sound Salmon Management Plan and the Hood Canal Salmon Management Plan between WDFW and the Point No Point Treaty Council (PNPTC) which includes the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam and Lower Elwha S'Klallam tribes.

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

Operational Information	Number
Annual operating cost (dollars)	$292,246
The above information for annual operating cost applies cumulatively to the George Adams Hatchery Fish Programs and cannot be broken out specifically by program. Funding sources are General Fund - State and General Fund – Local (Tacoma City Light)	

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

Broodstock Collection, Incubation, Rearing and Release:

George Adams Hatchery: Located at RM 1.0 on Purdy Creek (16.0005), a tributary of the lower Skokomish River (16.0001) that flows into Hood Canal in southwestern Puget Sound near Union, Washington. Basin name: Hood Canal.

1.6) Type of program.

Integrated harvest. The proposed integrated strategy for this program is based on WDFW's assessment of the genetic characteristics of the hatchery stock and local natural populations, the current and anticipated productivity of the habitat used by the populations, the potential for successfully implementing programs as integrated, and NOAA's final listing determinations (64 FR 14308, June 28, 2005). Modification of the proposed strategy may occur as additional information is collected and analyzed.

1.7) Purpose (Goal) of program.

The goal of the George Adams program is to release 3,800,000 fall chinook fingerlings to provide adult fish for sustainable fisheries (Magnuson/Stevens Act) and, in part, to provide partial mitigation for reduced natural production in the Skokomish system, primarily caused by hydroelectric dams on the North Fork Skokomish. The Skokomish Tribe, whose reservation is located near the mouth of the river, has a reserved treaty right to harvest chinook salmon *(US v Washington)*.

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 fingerling chinook at the appropriate size that mimics the naturally produced listed chinook (reduce predation risk) and as smolts to minimize freshwater residence (reduce competition).

2) A portion of the fingerling chinook will be Double Index Tagged (DIT). The DIT group can serve as an index group for wild fingerling fall chinook as well as providing data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds (see section 10.7).

3) Beginning with the 1999 brood, released excess chinook fry, if any, into landlocked lakes rather than into Purdy or Finch Creeks, as in the past.

4) Beginning with 1999 brood, eliminated transfers of George Adams chinook for release into east Hood Canal streams (Union, Tahuya and Dewatto Rivers) to avoid freshwater

and estuarine interactions with Hood Canal summer chum. Previously, these streams received a total of 130,000 fingerlings annually.

5) Beginning with 2000 brood, eliminated transfers of George Adams fall chinook eggs to Hood Canal-area school and cooperative volunteer programs for fry releases into Hood Canal. This program change reduces any potential interactions between George Adams fall chinook and listed chinook and summer chum.

6) Adult chinook produced from this program will be harvested at a rate that allows adequate escapement of listed chinook.

To minimize impacts on listed fish by WDFW facilities operation and the George Adams fall chinook fingerling program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the George Adams fall chinook program

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Surface water rights are formalized through trust water right permit # S2-20811. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	Intake screens do not conform to state and current federal guidelines to minimize the risk that wild juvenile salmonids could enter the fresh water intake. There are no wild chinook or chum above the Purdy Creek intake.
Effluent Discharge	4.2	There is no formal pollution abatement pond at George Adams. Hatchery effluent is discharged into an adjacent wetland at George Adams and does not violate the conditions of the NPDES permit (permit # WAG13-1019).
Broodstock Collection & Adult Passage	5.1, 7.9, 2.2.3	There is no in-river rack on the Skokomish River, which might prevent adults from passing upstream naturally. Fish enter Purdy Creek where an instream rack collects and holds adults. No chinook are passed upstream.
Disease Transmission	9.2.7	Co-Managers Fish Disease Policy. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	See sections 2.2.3 & 10.11

1.9) List of program "Performance Standards".

1.10) List of program "Performance Indicators".

Benefits:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Assure that hatchery operations support Puget Sound Salmon Management Plan (*US v Washington*), the Shared Strategy for Salmon Recovery, Hood Canal Salmon Management Plan, production and harvest objectives.	Contribute to a meaningful harvest for sport, tribal and commercial fisheries. Achieve a 10-year average of 0.24% smolt-to-adult survival that includes harvest plus escapement.	Survival and contribution to fisheries will be estimated for each brood year released. Work with co-managers to manage adult fish returning in excess of broodstock need.
Maintain outreach to enhance public understanding, participation and support of WDFW hatchery programs.	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off-station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights.	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments.	Participate in annual coordination between co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity. Maintain effective population size.	A minimum of 500 adults (2,900) is collected throughout the spawning run in proportion to timing, age and sex composition of return.	Annual run timing, age and sex composition and return timing data are collected. Adhere to HSRG (2004) and WDFW spawning guidelines (WDFW 1983).
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts on natural and hatchery-origin fish.	Use CWT only index for evaluation purposes. The co-managers are discussing a plan to apply an identifiable mark to 100% of the fall chinook production released through the George Adams program beginning in 2005 (2004 BY) to allow monitoring and evaluation of the hatchery program production and provide NOR/HOR ratios on the spawning grounds.	Returning fish are sampled throughout their return for length, sex, and CWTs.

Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-managers Fish Health Disease Policy (1998).	Necropsies of fish to assess health, nutritional status and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy.
	Inspection of adult brood-stock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Control of specific fish pathogens through eggs/fish movements is conducted in accordance to Co-managers Fish Health Disease Policy.

Risks:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt size (60-80 fish/lb) and released at a time that fosters rapid migration downstream.	Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, in-stream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including HOPPS, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration.	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed.
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring.	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and in-stream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations.	Harvest is regulated to meet appropriate biological assessment criteria.	Agencies and tribes to provide up-to-date information needed to monitor harvests.

1.11) Expected size of program.

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

For George Adams there is no specific program goal for adult broodstock collection, only for egg take of 4.57 million fall chinook eggs. Assuming a fecundity of 4,500 eggs per female and a 60% male / 40 % female sex ratio, and a pre-spawning mortality of < or = 5%, the number of adults required to meet the egg take goal would be about 2,670 (maximum of 2,900). Note: the 2000 broodyear egg take of 4.57 million was reduced from the previous goal of 5.72 million.

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	Purdy Creek (16.0005)	3,800,000
Yearling		

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

Table 2. Program performance for George Adams fingerling fall chinook. Survivals are based on CWT recoveries obtained form the Pacific States Marine Fisheries Commission Regional Mark Information System database (www.rmis.org). Hatchery escapements are from the WDFW Hatchery Escapement database.

Year	Smolt-to-Adult Survival (%) (Brood Year)	Adult Production Survival x Release) (Brood Year)	Hatchery Escapement (Return Year)	Wild Escapement (Return Year)
1988	0.11	4,147	4439	Unknown
1989	0.08	3,342	2513	Unknown
1990	0.01	452	2185	Unknown
1991	0.04	1,562	3068	Unknown
1992	0.15	3,262	294	Unknown
1993	0.25	3,293	612	Unknown
1994	0.05	754	495	Unknown
1995	0.11	3,854	5687	Unknown
1996	0.84	15,215	3394	Unknown
1997	0.10	1,933	7181	Unknown
1998	0.71	24,625	7049	Unknown
1999	0.48	18,143	8297	Unknown

Escapement of naturally spawning chinook in the Skokomish, Hamma Hamma, Dosewallips and Duckabush rivers has averaged 1,811 adults during 1999 through 2003.

The average survival rate for 1988-1999 broodyears was approximately 0.24%.

Broodstock levels back to the hatchery rack for brood years 1995 through 2003 were 5,687, 3,184, 2,243, 6,354, 8,469, 5,520, 9,831, 8,963 and 10,459, respectively.

Based on the average smolt-to-adult survival rate of 0.24% and a programmed release goal of 3,800,000 fingerlings, the estimated adult production (goal) level would be 9,120.

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

Production of Hood Canal fingerling fall chinook began at George Adams Hatchery in 1961.

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Skokomish River (16.0001),
Purdy Creek (16.0005)

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

To fully integrate the population to the level as recommended by the Hatchery Scientific Review Group (HSRG), it would require that the hatchery chinook population be 100% mass marked. With mass marking, wild fish integration into the hatchery program and the proportion of hatchery spawners in the Skokomish River could be accurately measured. WDFW supports external mass marking. The tribes, although supportive of monitoring the status and productivity of the naturally spawning chinook, are concerned about the implications of mass marking on the coast-wide coded-wire tagging program and impacts of new selective fisheries on allocation between treaty and non-treaty fishers. The co-managers believe that a properly integrated Skokomish River chinook program is tied to habitat recovery. Currently degraded habitat within the Skokomish River Basin precludes adequate natural spawners for incorporation into the hatchery broodstock. However, there are actions that can occur to more closely meet the integration guidelines. External identification of hatchery fish is paramount to achieving improvement and clearly identifying successful actions.

The Puget Sound Salmon Management Plan (PSSMP) (1985) and the Hood Canal Salmon Management Plan (HCSMP) are federal court orders that currently control both the harvest management rules and production schedules for salmon in Hood Canal under the *U.S. v. Washington* management framework between WDFW and the Point No Point Treaty Council (PNPTC) which includes the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam and Lower Elwha S'Klallam tribes. The co-management process requires that both the State of Washington and the relevant Puget Sound tribes agree on the function and purpose of each hatchery program and on production levels. Guidelines for production at Hood Canal facilities are set out in the Hood Canal Salmon and Steelhead Production 1996 MOU and the Future/Current Brood Document. The PSSMP explicitly states that "no change may be made to the Equilibrium Brood Document (production goals) without prior agreement of the affected parties."

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

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

During 2004-05, WDFW is writing HGMP's to cover all stock/programs produced at the George Adams facility for authorization under the 4(d) rule of the ESA.

Harvest management of chinook populations within Puget Sound is implemented through the draft Puget Sound Comprehensive Chinook Management Plan (PSCCMP) - Harvest Management Component (Puget Sound Indian Tribes and WDFW, March 2004).

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.

Puget Sound ESU chinook (Skokomish chinook; mid Hood Canal chinook (draft SaSI, WDFW, 2002)):

Watersheds flowing into Hood Canal from the west, draining out of the Olympic Mountains, are high gradient rivers with limited access to anadromous fish due to natural barriers; major watersheds include the Hamma Hamma, Duckabush and Dosewallips rivers. Watersheds flowing into Hood Canal from the east, off the Kitsap Peninsula, are lower gradient, smaller systems; these include the Union, Dewatto, and Tahuya rivers. The Skokomish River, including the South and North forks, is the largest watershed and enters Hood Canal from the southwest. Natural salmon production occurs throughout the Hood Canal basin, but chinook salmon occur in only these few streams. In Hood Canal, most natural chinook spawning occurs in the Skokomish River (including the South and North forks) (Skokomish chinook), with smaller populations in the Dosewallips, Duckabush, and Hamma Hamma rivers (mid-Hood Canal chinook). Small numbers of chinook spawners have been periodically observed in the Union, Dewatto and Tahuya rivers, but it is unknown whether these streams historically supported naturally sustainable chinook populations.

We have little information on the adult age structure, sex ratio, size range or smolt distribution and emigration timing of wild chinook in Hood Canal streams. We do not know if Hood Canal (George Adams) hatchery-origin fingerling fall chinook interact with wild Hood Canal chinook. Hood Canal wild chinook are thought to emigrate mainly as sub-yearlings, probably from April through early June. The summer flows in the South Fork Skokomish River may be too low to support chinook through the summer, though some areas in the Lower North Fork do have sufficient water (C. Baranski, WDFW, personal communication, March 2000). Hood Canal fall chinook spawn from mid-September through October with a peak in mid-October (WDF, WDG and WWTIT 1992).

Chinook spawning occurs in the mainstem Skokomish River, the lower South Fork Skokomish and tributaries such as Vance Creek, lower North Fork Skokomish and tributaries, and the lower reaches (below anadromous barriers) of Lilliwaup Creek, John Creek, the Duckabush, Dosewallips, Big and Little Quilcene Rivers, and the lower Union, Tahuya and Dewatto rivers. Chinook spawning in many of these streams may be largely the result of hatchery releases.

SaSI (draft, WDFW unpublished 2002) classified Hood Canal summer/fall chinook as two stocks (see above) of mixed origin (both native and non-native) with composite production (sustained by wild and artificial production) (Washington Dept of Fisheries et al., 1992). The combination of recent low abundances (in all tributaries except the Skokomish River) and widespread use of hatchery stocks (primarily originating from sources outside Hood Canal) led to the conclusion in SASSI (1992), that there were no remaining genetically unique, indigenous populations of chinook in Hood Canal. However, a sampling effort is currently under way (led by WDFW in cooperation with NOAA Fisheries and Treaty Tribes) to collect genetic information from chinook juveniles and adults in the tributaries of Hood Canal. This investigation is intended to provide further information on the genetic source and status of existing chinook populations. The current distinction between these two populations is based on spawning distribution (SaSI draft, WDFW unpublished 2002).

Genetic characterization of the Skokomish chinook stocks has, to date, been limited to comparison of adults and juveniles collected from the Skokomish River with adults from other Hood Canal and Puget Sound populations. Genetic collections were made during 1998 and 1999 in the Skokomish River and there appeared to be no significant genetic differentiation between natural spawners and the local hatchery populations. It appears that Hood Canal area populations may have formed a group differentiated from south Puget Sound populations, possibly indicating that some level of adaptation may be occurring following the cessation of transfers from south Puget Sound hatcheries (Anne Marshall, WDFW memo dated May 31, 2000). Current adult returns are a composite of natural- and hatchery-origin fish. During 1998 and 1999, known hatchery-origin fish comprised from 13% to 41% of the samples collected on the natural spawning grounds. Genetic analysis of samples collected from Lake Cushman was inconclusive as to stock origin, and exhibits low genetic variability (Ann Marshall, WDFW memo dated April 14, 1995).

Genetic characterization of the mid-Hood Canal stocks has, to date, been limited to comparison of adults returning to the Hamma Hamma River in 1999 with other Hood Canal and Puget Sound populations. These studies, although not conclusive, suggest that Hamma Hamma returns are not genetically distinct from the Skokomish River returns, or recent George Adams and Hoodsport hatchery broodstock (A. Marshall, WDFW unpublished data). The reasons for this similarity are unclear, but straying of chinook that originate from streams further south in Hood Canal, and hatchery stocking, could be contributing causes. Analysis of GSI collections made during 2002 is pending.

Because there is no specific information on wild smolt temporal and spatial distribution in Hood Canal streams, the extent to which they might interact with hatchery chinook released locally is unknown.

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

<u>Hood Canal Summer Chum:</u>

The following is paraphrased from life history information for Hood Canal and Strait of Juan de Fuca summer chum presented in the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW et al., 2000):

Hood Canal and Strait of Juan de Fuca summer chum populations are one of three genetically distinct lineages of chum salmon in the Pacific Northwest region; and were designated as an evolutionary significant unit (ESU) based upon distinctive life history and genetic traits. The uniqueness of the summer chum life history is best characterized by their late summer entry into freshwater spawning areas, and their late winter/early spring arrival in the estuaries as seaward-migrating juveniles. A significantly different migration and escapement timing and geographic separation from other chum stocks have afforded reproductive isolation.

Summer chum spawning occurs from late August through late October. Eggs eye in redds after about 4 to 6 weeks incubation and hatch about 8 weeks after spawning. Fry emerge from redds, usually with darkness, between February and late May and immediately commence migration downstream to estuarine areas. Summer chum fry initially inhabit nearshore areas and occupy sublittoral sea grass beds for about one week and are thought to be concentrated in the top few meters of the water column both day and night. Upon reaching a size of 45-50 millimeters (mm), fry move to deeper offshore areas. Migrating at a rate of 7-14 kilometers (km) per day, the southernmost out-migrating summer chum fry population in Hood Canal would exit the Canal 14 days after entering seawater (90% of population exits by April 28 each year, on average); and Strait of Juan de Fuca summer chum would exit the Discovery Bay area 13 days after entering seawater (90% completion by June 8 each year, on average).

In the Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW and PNPTT 2000), the most recent information on historical and current summer chum salmon distribution and on the genetic profiles of the populations has been reviewed. This analysis has resulted in an updated list of 16 summer chum stocks, which form the basic population units used throughout the recovery plan. Six current summer chum stocks have been identified in Hood Canal: Quilcene, Dosewallips, Duckabush, Hamma Hamma, Lilliwaup, and Union. Six additional stocks are identified as recent extinctions: Skokomish, Finch, Tahuya, Dewatto, Anderson, and Big Beef. In the Strait of Juan de Fuca, three currently existing stocks have been identified: Snow/Salmon, Jimmycomelately, and Dungeness. Chimacum is noted as a recent stock extinction.

In Hood Canal streams, the continuous and cumulative reduction in habitat productivity and capacity has influenced summer chum salmon by lowering survival rates and population resiliency, and reducing potential population size. Net fisheries in Hood Canal, when combined with harvests in Puget Sound and the Strait of Juan de Fuca, began to catch a high percentage of returning summer chum salmon in 1980, contributing to low escapements through the 1980s. At the same time, oceanic climate changes influenced regional weather patterns, resulting in unfavorable stream flows during the winter egg incubation season. Fall spawning flows dropped substantially in 1986 (also likely climate related), contributing to the poor status of these stocks. The current low production of Hood Canal summer chum salmon appears to be the result of the combined effects of lower survivals caused by habitat degradation, climate change and increases in harvest. The Summer Chum Conservation Initiative (SCSCI) requires that no hatchery fish releases are to occur prior to April 1 as a protection measure during out-migration of listed Hood Canal summer chum.

The pattern of decline of summer chum salmon in Strait of Juan de Fuca streams is similar to the Hood Canal experience, however, the drop in escapements occurred ten years later, in 1989. The combined effects of reductions in habitat quality, stream flows, and fishery harvests have resulted in low summer chum salmon production in the Strait of Juan de Fuca region.

There have been a number of factors that are positive for summer chum salmon recovery. One is the successful reduction in harvests within Hood Canal fishing areas, averaging less than 2% of the runs during the 1993-1997 seasons. Successful supplementation projects are increasing the numbers of returning summer chum adults to two streams, and are providing eggs for reintroducing summer chum to two other streams. There have also been meaningful changes in the production of hatchery fish in the region, designed to reduce negative interactions with summer chum juveniles. The combined effects of these changes have contributed to some higher summer chum escapements in recent years. However, additional measures, particularly with respect to habitat protection and restoration, are required for successful recovery of summer chum salmon.

There are no known interactions between the George Adams fall chinook program and the Hood Canal summer chum populations. There will be no take table for summer chum included with this HGMP.

<u>Puget Sound Bull Trout</u> (South Fork Skokomish stock (WDFW 1998)):

There is little or no information on adult age class structure, sex ratio, juvenile life history strategy or smolt emigration timing. Hood Canal Ranger District (Olympic National Forest) staff recently conducted a radio-tagging study of (presumed) bull trout in the South Fork Skokomish River (Ogg and Taiber 1999). The objectives of the study were to examine seasonal migration patterns and to identify spawning grounds and spawning times. In addition, Forest Service staffs have been conducting trapping, snorkeling and electrofishing surveys for bull trout in the South Fork. They believe that fluvial and resident life history forms are present. There is no evidence from their work of an anadromous life history form, though anadromous fish may be present. Sexually mature fluvial fish range from 38 to 59 cm. During the course of the telemetry study, spawning migration activity in fluvial fish began in late October when the water temperature dropped below 7EC and river flow increased. Spawning time appears to be from late October through late November. Spawning grounds have tentatively been identified in the mainstem South Fork from RM 18 through RM 23.5 and in Church, LeBar and Brown Creeks. Juvenile rearing areas include, but should not be considered restricted to, RM 19 through RM 23.5. In general, chinook are not seen above the Gorge of the South Fork beginning at RM 7 (C. Baranski, WDFW, personnel communication, March, 2000) so interactions between hatchery chinook and bull trout are not expected unless fluvial or anadromous fish, if any, move downstream into the lower South Fork or the mainstem Skokomish River.

There are no known interactions between the George Adams fall chinook program and the Skokomish bull trout populations. There will be no take table for bull trout included with this HGMP.

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

Preliminary critical and viable population thresholds under ESA for the Skokomish River chinook have been determined by the Co-managers (Puget Sound) Technical Recovery Team (PSTRT) to be at 1,300 and 3,650, respectively (PSTRT 2003). Also, critical and viable population thresholds under ESA for the mid-Hood Canal have been determined by the PS TRT to be at 400 and 750, respectively.

WDFW SaSI (2002) lists the following:

Summer/Fall chinook stock in the Skokomish is *depressed.* The mid-Hood Canal stock status is *critical.*

Hood Canal summer chum stocks (WDFW and PNPTC, 2000):

1. Union River are *healthy*
2. Lilliwaup and Jimmycomelately Creeks are *critical*
3. Hamma Hamma, Duckabush, Dosewallips, Big/Little Quilcene, and Salmon/Snow Creek, *depressed*.

Puget Sound bull trout in Hood Canal are *viable.*

- 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.

George Adams Hatchery program fish have survived at an average rate of 0.24 % for the years 1988 to 1999. (RMIS TS-1 reports)

No estimates of productivity are available for chinook or for bull trout in the Hood Canal region.

No good estimates of Hood Canal summer chum productivity are available because age data are not available. Recruit-per-spawner estimates done by WDFW, the NWIFC and PNPTC range from 1.5 to 1.8, but none of these are reliable at present (J. Ames, WDFW, personnel communication, February 2000). The co-managers are committed to collecting this information and have done so during 1999 and 2000, but may need additional funding to assemble an adequate database.

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

Table 3. 1988-2003 spawner abundance data for Hood Canal fall chinook, Hood Canal summer chum and Lake Cushman bull trout/Dolly Varden. Chinook data are from the 1998 WDFW chinook run reconstruction. Summer chum data are from J. Ames (WDFW, personnel communication). Bull trout data are from WDFW through 1996 and from D.Collins (WDFW, personnel communication) thereafter.

Year	Fall Chinook	Summer Chum	Bull Trout/Dolly Varden
1988	2,772	2,967	152
1989	1,425	598	174
1990	724	429	299
1991	1,858	746	299
1992	940	1,954	285
1993	1,172	712	412
1994	1,072	2,050	281
1995	1,999	8,971	250
1996	1,028	19,683	292
1997	492	8,420	No data collected
1998	1,803	4,001	119
1999	3,020	4,114	90
2000	1,690	8,649	93
2001	2,883	12,041	87
2002	1,725	11,454	93
2003	1,512	35,696	

- 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.

Analysis of the 1988, 89, 90, 91, 92, 93, 94 and 95 broods show a low stray rate (.08 to .56%) within the same GDU and none outside the GDU. 88 % of the stray rates above were from yearling releases. No more yearling releases take place at George Adams.

In recent years hatchery-origin chinook, identified by adipose-fin clips and scale patterns, have been recovered from spawning grounds in the mainstem Skokomish River during sampling for genetic analysis. In 1998, 61 chinook spawners were sampled, ten of which were coded-wire tagged. They originated from George Adams Hatchery (n=3), Hoodsport Hatchery (n=2), Long Live the Kings releases from Rick's Pond (n=4) and the now-defunct Sund Rock net pens (n=1). Seven of these fish had been released as yearlings and three as fingerlings. Since George Adams releases only fingerlings, the yearlings would probably have come from the Long Live the Kings project, Hoodsport Hatchery or the now-defunct net pens. Scale analysis of the untagged adults in the genetics sample showed that an additional 16 fish had hatchery yearling scale patterns. Thus, hatchery-origin fish comprised at least 43% of the sample. More fish in the sample may have been of hatchery origin, but chinook released, as fingerlings would have scale patterns indistinguishable from those of wild chinook, which out-migrate mainly as fingerlings.

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

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

Fall Chinook: Adult broodstock collection and spawning, incubation and juvenile rearing, release and genetic sample collection may lead to the take of listed chinook. Listed wild chinook cannot be distinguished from unmarked hatchery fish, so they cannot be returned to Purdy Creek or the Skokomish River (see section 7.9). If wild listed chinook enter the hatchery, they will be retained and killed for spawning, surplussing, nutrient enhancement, etc. The principal effect of this indirect take is the removal of listed chinook from the wild spawning population. We do not have good information on the proportions of chinook in these categories. See take table at the end of the document.

The risks and benefits posed by hatchery-origin juveniles will depend on the number, size, release time and stream residence time of the hatchery fish. George Adams releases approximately 3.8 million fingerling smolts annually and production will be managed to minimize potential adverse effects to listed fall chinook.

Competition and Predation: As mentioned earlier, George Adams smolts are expected to migrate quickly to Puget Sound, however, their actual stream residence time and freshwater competition between George Adams chinook and wild Skokomish-basin chinook have not been examined. These smolts are released at a size of about 80 to 100 mm in May when wild Skokomish smolts are expected to be about 60 to 80 mm long (D. Seiler, WDFW, personal communications, February, 2000). The USFWS (1994) has suggested that juvenile salmonids can consume fish that are one-third or less their own body length. Given this rule of thumb and approximate sizes of hatchery and wild fish at the time George Adams chinook are released, predation by hatchery smolts is not expected to be a significant problem.

The numbers of wild chinook smolts have been estimated for the Skokomish basin and all of Hood Canal and are compared with numbers of hatchery chinook released in the table below.

Table 4. Comparison of wild and hatchery chinook smolts in the Skokomish River and in all of Hood Canal. Hatchery chinook include those released from George Adams, Hoodsport and Long Live The Kings (U of W at Big Beef Creek program release of 200,000 eliminated in 2004; Hoodsport release decrease by 200,000 fingerlings). Numbers for the Skokomish permit a direct comparison of wild production with George Adams and other releases.

Area	**Wild Smolts**[1]	**Hatchery Smolts**	**Hatchery Yearlings**
Skokomish River	104,400	3,830,000	120,000
Hood Canal Streams	132,000	2,910,000[2]	250,000

[1]Wild smolt numbers were estimated by averaging the 1995-1998 wild escapements in Hood Canal, halving that number to estimate the number of female spawners, applying a fecundity of 4,000 eggs per female (Bill Tweit, WDFW, personal communication) to estimate the total number of eggs produced, then applying a freshwater survival rate of 5% (Bill Tweit, WDFW, personal communication) to the egg estimate to estimate the number of surviving smolts.

[2]Includes 110,000 chinook released into the Hamma Hamma River by Long Live the Kings and 2,800,000 fingerlings released from Hoodsport Hatchery into Finch Creek by WDF&W (eliminated Big Beef Cr. release of 200,000 (2004) and reduced Hoodsport release by 200,000 (2004)).

The Species Interaction Working Group (SIWG) (1984) categorized various risks to wild salmon species and steelhead from hatchery-origin salmon species and steelhead. Their assessments of risks to wild chinook from hatchery chinook were summarized below.

Table 5. Risks posed by hatchery-origin chinook to wild chinook. Data from SIWG (1984).

Type of Risk	Level of Risk
Freshwater predation	Unknown
Freshwater competition	High potential
Early marine predation	Unknown
Early marine competition	High potential

The high risk of competition assumes significant temporal and spatial overlap between hatchery and wild juvenile chinook and increases when numbers of hatchery fish released are far larger than numbers of wild fish (SIWG 1984). We have no information on hatchery-wild overlaps in the Skokomish basin or in the waters of Hood Canal. Clearly the number of juvenile hatchery chinook greatly exceeds (reduced by 400,000 in 2004) the estimated number of wild juveniles in the Skokomish basin and throughout Hood Canal that may increase the risk of competition or attraction of fish and avian predators.

Releases of hatchery chinook may confer some benefits to wild chinook. The George Adams Hatchery fry released by the Skokomish tribe may serve as food for out-migrating wild fish. If hatchery and wild chinook juveniles occupy the lower Skokomish and the same areas of Hood Canal at the same time, the large excess of hatchery fish may provide wild chinook with some protection from fish and avian predators.

<u>*Behavior modification*</u>: If large numbers of hatchery chinook are released into watersheds containing younger and/or smaller wild juveniles, they can stimulate premature out-migration in wild fish via a Pied Piper effect (Hillman and Mullan 1989). Premature out-migration can reduce survival of wild fish because they would be smaller than normal size, making them more vulnerable to predation and they may not have completed the physiological changes required to adapt to life in salt water. We do not know if this is a concern in the Skokomish basin.

<u>*Disease Transmission*</u>: The George Adams Hatchery operates under a standing NPDES permit that limits discharge effects on the environment, and requires monitoring of effluent for settleable and suspended solids. Adherence with the NPDES permit will likely lead to no adverse effects on water quality from the program on listed fish. It is possible that hatchery fish that have been infected by transmissible pathogens or effluent from hatcheries with sick fish could infect wild fish. Hatchery effluent is not tested for pathogens, so we do not know if George Adams is releasing pathogens into the environment. However, disease transmission from hatchery to wild fish does not appear to occur routinely, possibly because pathogen spread does not occur as readily in less crowded wild fish as in hatchery fish (Tynan 1999). As indicated by Steward and Bjornn (1990), hatchery populations can be considered to be reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, but there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish.

Summer Chum: The George Adams on-station fall chinook program is conducted in a manner consistent with the Hood Canal Summer Chum Conservation Initiative (SCSCI) (WDFW and PNPTC 2000). Specifically, chinook are not released until after April 1 in order to reduce potential interactions with listed Hood Canal summer chum. There are no summer chum in the Skokomish River. Those from Lilliwaup Creek are expected to migrate to salt water in February and March and then to swim seaward quickly (Tynan, 1992). They are expected to clear the area well before the release of George Adams fingerling chinook in May. WDFW considers that both juveniles and returning adults from the on-station program pose low risk for competition or predation to summer chum (Tynan, 1999).

Bull Trout: We have no information on interactions between George Adams chinook and wild bull trout in the Skokomish (the only watershed in the Hood Canal currently known to have native char). The risk of competition between hatchery chinook juveniles and bull trout is unknown. Presumably, competition can occur where wild and hatchery fish overlap, and space or foods are limiting, but juvenile distribution of bull trout in the South Fork Skokomish is not known in detail. South Fork Skokomish bull trout are found over-wintering as far down as the confluence with the North Fork (L. Ogg, USFWS, Hood Canal Ranger District, personal communication, February 2000). Whether they overlap with George Adams chinook when these fish are released in May is unknown. Bull trout from the North Fork Skokomish (Lake Cushman and Upper North Fork stocks) are unlikely to pass through the hydropower projects to interact with George Adams chinook.

Predation risks to bull trout from hatchery chinook are likely to be low, since the smallest native char juveniles are likely to be found in the uppermost portions of the Skokomish watershed. By the time South Fork fluvial or possibly anadromous char reach lower river reaches where they are more likely to overlap with hatchery juveniles, they may be too large to be preyed upon. Spawning grounds of South Fork bull trout have not been identified in detail, but are unlikely to overlap with those of fall chinook, so competitive interactions on spawning grounds are unlikely to occur.

No documented interaction between hatchery program activities and Skokomish bull trout populations. No take table for bull trout is included in this HGMP.

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

Because hatchery-origin and listed wild chinook can't generally be distinguished in the trap or the adult holding pond, we do not know the numbers of listed wild chinook captured, injured or dead at George Adams as well as being able to differentiate between hatchery and natural-origin chinook on the spawning grounds. The co-managers are discussing a plan to apply to the remaining production (3,350,000) an adipose-fin clip only, beginning in 2005 (2004 BY), to allow monitoring and evaluation of the hatchery program production and provide NOR/HOR ratios on the spawning grounds. The DIT group can serve as an index group for wild fingerling fall chinook as well as providing data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds.

-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).

Annual take of natural-origin Puget Sound listed chinook cannot be quantified since they cannot be distinguished from unmarked George Adams Hatchery chinook. The likely sources of take resulting from George Adams Hatchery operations are broodstock collection, injury or mortality during incubation and rearing, injury or mortality during egg or fry transport to school or other co-operative programs, injury or mortality during rearing in co-operative programs, injury or mortality during on-station or off-station release.

Worst-case scenarios would include hatchery broodstock collection that consists only of listed fish, then subsequent loss of the all progeny of wild fish through catastrophic flooding, equipment failure or disease.

- 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.

Contingency plans to limit "take" to pre-determine numbers are too mass mark (adipose-fin clip only) all chinook at the facility. This will provide the means to differentiate hatchery and natural-origin fish returning to the hatchery and on the spawning grounds (see section 10.7).

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.

The George Adams Hatchery fingerling fall chinook salmon HGMP is included as one of 29 WDFW-managed plans under the co-managers' Resource Management Plan (RMP) for Puget Sound region chinook salmon hatcheries. This HGMP is in alignment with the RMP, which serves as the overarching comprehensive plan for state and tribal chinook salmon hatchery operations in the region.

As affirmed in the co-managers' RMP, WDFW hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements in order to operate. 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).

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

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release for 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 (WDF 1991).

Fish Health Policy of the Co-managers of Washington State. This policy designates zones limiting the spread of fish pathogens between watersheds, thereby further limiting the transfer of eggs and fish in Puget Sound that are not indigenous to the regions (WDFW, NWIFC, WSFWS 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.

In 1999, several PS and coastal stocks were listed as threatened under the federal Endangered Species Act (ESA). State, tribal and federal managers need to ensure that their hatcheries do not present a risk to listed species. Through this HGMP and hatchery efforts, the Co-managers have sought to go beyond merely complying with ESA directives. The new approach is to reform hatchery programs to provide benefits to wild salmon recovery and sustainable fisheries. Hatchery management decisions will be based on system-wide, scientific recommendations, providing an important model that can be replicated in other areas.

In addition, the Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and the Shared Strategy for Salmon Recovery. Both are collaborative efforts to protect and restore salmon runs across Puget Sound. They bring together the experience and viewpoints of citizens, major state and federal natural resource agencies, local governments, non-government organizations and Puget Sound Tribes. The SRFB provides grant funds to protect or restore salmon habitat and assist related activities that produce sustainable and measurable benefits for fish and their habitat. The Shared Strategy process helps identify what is needed in each watershed to recover salmon habitat through a watershed recovery plan (see section 3.4 for more details).

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

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* and the Puget Sound Salmon Management Plan (PSSMP)(1985). It also operates under the Hood Canal Salmon Management Plan (HCSMP). The salmon resource co-management process affirmed through these court orders, and under the court approved plan, requires that both the State of Washington and the Puget Sound Tribe(s) develop *Equilibrium Broodstock Programs*. Two documents are completed each year, describing agreed hatchery fish production levels for each brood year. The "Future Brood Document" is a detailed listing of agreed annual juvenile fish production goals. This document is reviewed and updated each spring, and finalized in July. The "Current Brood Document" presents actual juvenile fish production levels relative to the annual production goals. This second document is developed in the spring after eggs spawned that year have been enumerated and actual resultant juvenile fish production levels can be estimated. Through this process, the co-managers document their agreement on the function, purpose and release strategies for all Puget Sound region hatchery programs. The parties to the SCSCI recognize that it may be necessary to modify these plans in order to implement the recommendations that will result from the SCSCI. However, the provisions of the PSSMP and HCSMP will remain in effect until modified through court order by mutual agreement

3.3) Relationship to harvest objectives.

Tribal and non-Indian commercial and recreational fisheries directed at fall chinook and other species produced through WDFW hatchery releases will be managed to minimize incidental effects to listed chinook salmon and summer chum salmon. Time and area, gear-type restrictions, and chinook and summer chum release requirements will be applied to reduce takes of listed salmon in the Hood Canal mainstem, extreme terminal marine area, and river areas where these fisheries directed at other hatchery species occur. Compliance with the fisheries management strategy defined in the SCSCI will lead to fisheries on WDFW hatchery-origin stocks that are not likely to adversely affect listed chinook or listed summer chum.

Each year, state, federal and tribal fishery managers plan the Northwest's recreational and commercial salmon fisheries. This pre-season planning process is generally known as the North of Falcon process, which involves a series of public meetings between federal, state, tribal and industry representatives and other concerned citizens. The North of Falcon planning process coincides with meetings of the Pacific Fishery Management Council, which sets the ocean salmon seasons at these meetings.

For example, during 2000 as an outcome of the North of Cape Falcon Fishery Planning process, the state/tribal Puget Sound Chinook Harvest Management Plan (enclosed in letter from Billy Frank, Jr., NWIFC and Jeff Koenings, WDFW to Will Stelle, NMFS, dated February 15, 2000) contained proposals for the 2000/2001 fishing season. In Hood Canal, the proposed fisheries are designed to target George Adams Hatchery chinook while minimizing catch of wild chinook.

For the 2001-02 and 2002-03 seasons, the co-manager's prepared a Harvest Management Plan for Puget Sound Chinook Salmon. The Plan states specific objectives for harvest of the 15 Puget Sound management units, the technical bases for these objectives, and procedures for their implementation. The Plan assures that the survival and recovery of the Puget Sound ESU will not be impeded by fisheries-related moratlity. The Plan was submitted and NMFS (NOAA Fisheries) reached a finding, based on the conditions stated in the 4(d) rule, that fisheries-related take in Washington waters is exempt from prohibition under Section 9 of the ESA. NOAA Fisheries is currently reviewing a five-year Plan submitted by the co-managers for the 2004-05 through 2008-09 seasons.

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

Because George Adams fall chinook CWT survivals have been low (<1%) for many years, recoveries in specific fisheries vary considerably from year to year. The most consistent catches of George Adams fall chinook in recent years have occurred in the following fisheries:

Washington Strait of Juan de Fuca and Hood Canal sport fisheries
Canadian Vancouver Island, Georgia Strait and Strait of Juan de Fuca sport fisheries.

Strait of Juan de Fuca and Hood Canal treaty net fisheries
Strait of Juan de Fuca treaty troll fishery
George Adams chinook have also been caught in Alaska troll fisheries, the Canadian West Coast Vancouver Island troll fishery, the Washington ocean treaty troll, ocean non-treaty troll and ocean sport fisheries, and the Oregon troll fisheries.

For BY's 1988-1997, CWT catch contribution data indicate approximately 30% of the catch was in Washington waters while 17% was in Canadian waters. Up to 52% was escapement back to the hatchery and to the spawning grounds (Washington). Small numbers of fish contributed to the Oregon and Alaska fisheries.

For the Skokomish and Mid-Hood Canal management units (MU), during the recovery period, pre-terminal fisheries in southern U.S. areas (SUS) will be managed to ensure a pre-terminal exploitation of 15% or less, as estimated by the FRAM model. If the recruit abundance is insufficient for each MUs goal to be met, additional terminal fishery management measures will be considered.

The NOAA Fisheries Section 7 consultation on the 2000-01 through 2003-04 PFMC, Fraser Panel and Puget Sound marine and freshwater fisheries resulted in approval of the fisheries proposed in the Puget Sound Chinook Harvest Management Plan. NOAA Fisheries is currently reviewing a five-year Plan submitted by the co-managers for the 2004-05 through 2008-09 seasons.

3.4) Relationship to habitat protection and recovery strategies.

The co-managers’ 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.

Hood Canal chinook: Limiting factors analyses have not been completed specifically for Hood Canal natural chinook stocks and factors for decline and recovery are not currently available. Limiting factors analyses have recently been completed for streams and nearshore areas in WRIA 16 (Skokomish, Dosewallips, Duckabush and Hamma Hamma rivers) and WRIA 17 by the Washington State Conservation Commission (2002-03); these reports will provide information useful for identifying factors limiting chinook populations in Hood Canal. In addition, since listed chinook and listed summer chum utilize similar habitats, habitat protection and recovery strategies designed to recover summer chum (see below) will also aid in the recovery of listed Hood Canal chinook.

The principle chinook streams in Hood Canal, the Skokomish, Hamma Hamma, Duckabush, Dosewallips and Big Quilcene rivers are on the westside of Hood Canal. They provide spawning and rearing habitat only in the lower river sections with relatively low gradients. Gradients rapidly become steep with impassable waterfalls, so most of these rivers are not accessible to chinook. All of these rivers, especially the Skokomish and Big Quilcene have suffered damage from human activities (dams, roads, logging, diking, agriculture and development) which have exacerbated natural summer low flows, winter flooding, streambed scouring and sediment deposition due to unstable soils and slopes. Large woody debris is lacking in most areas used by chinook as a result of forest practices. In the Skokomish, the Cushman hydropower project on the North Fork has reduced stream flow in the Skokomish by about 40% and has altered the normal pattern of sediment delivery to the estuary with the result that eelgrass has been lost (WDFW and WWTIT 1994). Gravel aggradations and removal have been problems in the lower Big Quilcene.

<u>Summer chum:</u> Summer chum supplementation, habitat restoration and harvest management measures are integrated as presented in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed. Habitat factors for decline and recovery for each watershed are described. In addition, at the summer chum ESU scale, protection and restoration strategies for each limiting factor for decline are provided. The goal of the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages. Hood Canal summer chum in westside Hood Canal streams (Lilliwaup Cr., Hamma Hamma, Duckabush, Dosewallips, Big Quilcene and Little Quilcene) are affected by much the same habitat conditions as Hood Canal chinook, especially by habitat perturbations such as diking, streambed instability/gravel aggradations in the lower stream reaches. On the eastside, Hood Canal summer chum streams such as the Union River and Big Beef Creek are low elevation, low gradient streams which are being heavily impacted by rapid development on the Kitsap Peninsula. Logging and associated road construction has historically created conditions that increased sediment delivery to streams and reduced the supply of large woody debris to streams.

<u>Bull trout:</u> Bull trout in the Hood Canal region are found in the South Fork Skokomish, Lake Cushman and the upper North Fork Skokomish above Staircase Falls. The condition of the South Fork is poor, as mentioned above. Lake Cushman is now a reservoir and the water level in the one-half mile of the North Fork Skokomish just above the reservoir fluctuates too much to provide stable spawning habitat. Further, the upper and lower Cushman dams have eliminated the anadromous life history form from the North Fork. However, most of the North Fork above Lake Cushman is in the Olympic National Park, and the habitat is essentially pristine.

Habitat Protection Efforts and Probable Benefits:

Habitat protection efforts include the Northwest Forest Plan, adopted by the Forest Service and the Bureau of Land Management in the Northwest in 1994. The plan requires increased stream buffers to protect stream habitat for salmonids and limits road construction and some forms of logging on steep/unstable slopes. Most of the Olympic National Forest is in Late Successional Reserves that limits logging to thinning in stands under 80 years old and severely limits or prohibits logging in older stands. The Forest Service is updating road inventories and embarking on a long-term program to improve or close some of the roads that pose the greatest threats to slope stability and streams. Within Washington State, Washington Legislature accepted the Forests and Fish Report, prepared by the USFWS, NOAA Fisheries, EPA, Office of the Governor of the State of Washington, WA DNR, WDFW, WA DOE, the Colville Tribes, Washington counties, and timber industry groups, in 1999. The emergency forest practices rules that were developed from the Report will result in some improvements in state and private forestland management including increased stream buffers and some reduction in logging in riparian areas and unstable upslope areas. Both the federal and state and private forest plans will result in habitat improvements, but are far from ideal for fish. The resulting improvements in fish habitat, such as increased large woody debris in streams, may not be realized for decades given the very poor current conditions of many fish-bearing streams and their riparian areas.

The George Adams Hatchery is making a modest contribution to habitat improvement by donating fish carcasses to an Olympic National Forest Service (Hood Canal District) crew that places the carcasses in streams and riparian areas for nutrient enhancement. In 1997 and 1998, a total of nearly 1,500 George Adams fall chinook were donated to the nutrient enhancement program.

The Legislature, in 1999, created the Salmon Recovery Funding Board (SRFB) and, as indicated earlier, the Shared Strategy for Salmon Recovery. Both are collaborative efforts to protect and restore salmon runs across Puget Sound. They bring together the experience and viewpoints of citizens, major state and federal natural resource agencies, local governments, non-government organizations and Puget Sound Tribes. The SRFB provides grant funds to protect or restore salmon habitat and assist related activities that produce sustainable and measurable benefits for fish and their habitat. The Shared Strategy process helps identify what is needed in each watershed to recover salmon habitat through a watershed recovery plan.

Shared Strategy

The Shared Strategy is based on the conviction that:
1) People in Puget Sound have the creativity, knowledge, and motivation to find lasting solutions to complex ecological, economic, and cultural challenges;
2) Watershed groups that represent diverse communities are essential to the success of salmon recovery;

3) Effective stewardship occurs only when all levels of government coordinate their efforts;
4) The health and vitality of Puget Sound depends on timely planning for ecosystem health and strong local and regional economies; and
5) The health of salmon are an indicator of the health of our region salmon recovery will benefit both human and natural communities.

The 5-Step Shared Strategy

1) Identify what should be in a recovery plan and assess how current efforts can support the plan.
2) Set recovery targets and ranges for each watershed.
3) Identify actions needed at the watershed level to meet targets.
4) Determine if identified actions add up to recovery. If not, identify needed adjustments.
5) Finalize the plan and actions and commitment necessary for successful implementation.

Salmon Recovery Funding Board

Composed of five citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities (see below). SRFB has helped finance over 500 projects. The Board supports salmon recovery by funding habitat protection and restoration projects. It also supports related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities

Lead entities are voluntary organizations under contract with the Washington State Department of Fish and Wildlife (WDFW). Lead entities define their geographic scope and are encouraged to largely match watershed boundaries. Lead entities are essential in ensuring the best projects are proposed to the Board for funding in its annual grant process.

All lead entities have a set of technical experts that assist in development of strategies, and identification and prioritization of projects. The lead entity citizen committee is responsible under state law for developing the final prioritized project list and submitting it to the SRFB for funding consideration. Lead entity technical experts and citizen committees perform important unique and complementary roles. Local technical experts are often the most knowledgeable about watershed, habitat and fish conditions. Their expertise is invaluable to ensure priorities and projects are based on ecological conditions and processes. They also can be the best judges of the technical merits and certainty of project technical success. Citizen committees are critical to ensure that priorities and projects have the necessary community support for success. They are often the best judges of current levels of community interests in salmon recovery and how to increase community support over time with the implementation of habitat projects. The complementary roles of both lead entity technical experts and citizen committees is essential to ensure the best projects are proposed for salmon recovery and that the projects will increase the technical and community support for an expanded and ever increasing effectiveness of lead entities at the local and regional level. (http://www.iac.wa.gov/srfb/leadentities.htm).

The Lead Entity for the Hood Canal basin is the Hood Canal Coordinating Council. It oversees an area that is 62 miles long (Hood Canal) and covering about 358 miles of shoreline. Land ownership in the watershed is 48% federal and includes portions of Olympic National Park and Olympic National Forest, 39% private, 12% state and local, and 1% Tribal trust lands. Major projects are underway to restore critical estuarine habitat. These include removal of levees; ditches and tide gates to allow disconnected and degraded salt marshes to recover in the Skokomish, Union and Dosewallips estuaries. Natural functions and processes are being restored in the Chimacum Creek estuary through removal of fill and riprap.

3.5) Ecological interactions.

(1) Salmonid and non-salmonid fishes or other species that could negatively impact the program.

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

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

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

- Orcas
- Sea lions
- Harbor seals
- River otters

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

- Summer chum
- Chinook
- Bull trout

(*3) Salmonid and non-salmonid fishes or other species that could positively impact the program*.

Fish species that could positively impact the program may include other salmonid species and trout present in the Skokomish River watershed through natural and hatchery production. Juvenile fish of these species may serve as prey items for the chinook during their downstream migration in freshwater and into the marine area. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating chinook. Chinook adults that return to the river may provide a source of nutrients and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). With integrated spawning and any carcass seeding efforts, 1,500-3,000 adult chinook carcasses could contribute, assuming average size of adult chinook is 15 pounds, approximately 22,500 - 45,000 pounds of marine derived nutrients to organisms in the river.

(4) Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.

The chinook program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying chinook carcasses might also benefit fish in freshwater. These species include:

- Northern pikeminnow
- Coho salmon
- Cutthroat trout
- Steelhead
- Pacific staghorn sculpin
- Numerous marine pelagic fish species

SECTION 4. WATER SOURCE

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

George Adams Hatchery: Water for the George Adams Hatchery is supplied from Purdy Creek, three wells and Ellis Spring. Well water is currently used for incubation and also for rearing any fish that require pathogen-free water. This generally means fish that are transferred to George Adams for short-term rearing can be then transferred out of the Fish Health Management Zone.

The water right for Purdy Creek is 21.3 cubic feet/second (cfs). Flow in Purdy Creek has diminished in recent years because of drought conditions and development in the watershed. Because of its proximity to Highway 101, Purdy Creek is at risk from contamination from spills on the highway. One such spill of zinc occurred several years ago.

The water right for Ellis Spring is 2.5 cfs. Flow is variable from a low of 1.0 cfs to 2.5 cfs.

The water right for George Adams wells is 6.4 cfs. The wells are used only for incubation or in instances when pathogen-free water is required. Otherwise, they are not used in order to allow the aquifer to recharge.

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 surface water intakes at George Adams Hatchery do not meet current NOAA criteria for screening or passage. There are no wild chinook or summer chum above the Purdy Creek intake (small spring fed stream). There is no formal pollution abatement pond at George Adams. Hatchery effluent is discharged into an adjacent wetland at George Adams and does not violate the conditions of the NPDES permit (permit # WAG13-1019). The Production Division has proposed installation of a clarifier to treat effluent before routing it to the wetland, if funding becomes available.

The water right permit # for Purdy Creek (21.3 cfs), Ellis Spring (2.5 cfs) and the wells (6.4 cfs) (at George Adams) is S2-20811 (for further water right information contact the Department of Ecology).

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

George Adams Hatchery: Adult broodstock collection occurs in a 71' X 157' X 27" trap/holding pond located in Purdy Creek. The trap begins operation August 1 for chinook and remains open through the end of the chum run in early December.

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

George Adams Hatchery: It is not typically necessary to transport adult broodstock on site, however, they are transported in a 400-gallon planting tank with supplemental oxygen and recirculation motors when necessary.

5.3) Broodstock holding and spawning facilities.

George Adams Hatchery: Adult broodstock are held in the trap/holding pond until they are spawned. Spawning facilities are located adjacent to the trap/holding pond.

5.4) Incubation facilities.

George Adams Hatchery: Chinook eggs are incubated to eyed-egg stage in Simms deep troughs which are each loaded with 450 pounds of eggs (approximately 900,000 chinook eggs). Egg density in the deep troughs is 19 pounds per cubic foot (lbs/cu.ft). After eyeing, eggs are transferred to vertical stack incubators for hatching. Egg density at hatching is 5.5 pounds per tray (approximately 9,900 chinook eggs).

5.5) Rearing Facilities

George Adams Hatchery: After hatching, chinook eggs are moved from the incubators into 3- 20' X 77' X 31" raceways for initial rearing. 2.4 million fish are then transferred from the raceways to a 61' X 167' X 55" gravel-bottomed rearing/release pond (Pond 9) with a maximum density of 1.26 lbs/cu.ft. at release and 1.4 million fish are transferred from the raceways to a 48' X 240' X 33" gravel-bottomed rearing/release pond (Pond 7) with a maximum density of 1.29 lbs/cu.ft at release.

5.6) Acclimation/release facilities.

George Adams Hatchery: As they grow chinook juveniles are split into two gravel-bottomed rearing/release ponds with a maximum density of 1.29 lbs/cu.ft. at release. George Adams fall chinook are reared on Purdy Creek water that should minimize straying into other watersheds.

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

Severe flooding at George Adams Hatchery in 1997 led to the early release of 1,949,600 chinook fry. Some of these died, but the number is not known.

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.

George Adams Hatchery is staffed full time with resident professional staff. The hatchery is equipped with alarm systems and backup generator to provide auxiliary power in the event of a power failure. There are provisions at George Adams Hatchery for switching to alternate water sources in the event of the loss of one water source.

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.

George Adams fall chinook originated in 1961 from the Hoodsport Hatchery stock. The Hoodsport stock was started in 1952 with a release of Dungeness spring/summer chinook. This was followed by several years of Soos Creek (Green River) releases until the stock became (largely) self-sustaining at Hoodsport. Additional inputs at Hoodsport include chinook from Tumwater Falls (largely derived from Soos Creek), Voights Creek (Puyallup basin), Big Beef Creek, Minter Creek and Trask River, Oregon hatchery populations. The actual contribution of these various hatchery stocks to the George Adams stock is unclear. WDF&W shall continue the use of gametes procured from fall chinook salmon adult volunteering to the George Adams to affect the program.

6.2) Supporting information.

6.2.1) History.

The Green River fall chinook stock originated from adults collected in the Green River. The stock was propagated at the Soos Creek Hatchery and disseminated widely throughout Puget Sound hatcheries. The hatchery began operation in 1901 and we assume that fall chinook broodstock collection began at that time.

Dungeness chinook are a spring/summer stock native to the Dungeness. They were not successfully introduced at Hoodsport and may not have contributed significantly to the George Adams stock.

The Voights Creek stock originated from Voights Creek chinook but had significant infusions of Soos Creek fish. The Minter Creek fall chinook stock is a Soos Creek derivative via Soos Creek and the Deschutes. Trask River chinook stock is derived from Tillamook Bay tributary stock.

There have not yet been three consecutive generations of chinook releases based solely on adult returns to the hatchery because there are frequent egg transfers from Hoodsport Hatchery. George Adams has achieved its egg-take goals less than 50% of the time in the past 12 years, largely due to low flows in Purdy Creek and difficulty encountered by the adults in negotiating a swamp below the hatchery outfall. Consequently, the George Adams stock is considered introduced and not locally adapted at George Adams. A genetic analysis of George Adams chinook was done during 1999 and no significant differences were found overall between George Adams and Hoodsport hatcheries. It did appear that Hood Canal area populations formed a group differentiated from south Puget Sound populations, although at a relatively low level. This is noteworthy given the history of stock transfers between the two years (memo from Anne Marshall, WDFW, 31 May 2000) and may indicate local adaptation is occurring in the Hood Canal hatchery stocks. Also, the difference between South Sound and Hood Canal area populations may be due to that Hood Canal fish have retained some of their historical genetic characteristics.

No intentional selection for any characters such as size or run timing has been conducted. In most years, insufficient chinook return to the hatchery to achieve the egg take goal (4.57 million eggs), so nearly all chinook returning to the hatchery are spawned, and it is unlikely that any consistent inadvertent selection has occurred.

6.2.2) Annual size.

Approximately 2,670 (maximum of 2,900).

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

The proportion of natural-origin fall chinook incorporated as broodstock at the hatchery each year is unknown, but it is likely low given the off-channel and lower river location of the hatchery broodstock collection.

6.2.4) Genetic or ecological differences.

There are no known genetic or ecological differences between either the hatchery stock and natural listed stock in the sub basin.

6.2.5) Reasons for choosing.

The program uses the locally adapted hatchery stock established in and returning to the Purdy Creek trap. With stock transfer limitations imposed beginning in the early 1990s, George Adams and Hoodsport hatcheries have become more self-sufficient, securing chinook adults that return to the hatcheries needed to fill their production programs, and thereby minimizing the risk of out-breeding depression that may result from out-of-basin transfers.

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.

No special risk aversion measures are in place to protect listed wild fish since unmarked hatchery and wild fish cannot be distinguished at this time. The program has incorporated natural-origin fish for use as broodstock at an unknown level over the years. This level of natural-origin fish spawning has likely reduced genetic divergence of the propagated population from the naturally spawned Hood Canal population.
Since hatchery and natural-origin fish cannot be distinguished at this time, it would be appropriate to mass mark all hatchery fish (risk aversion measure) to differentiate the two at the time of broodstock selection.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

WDFW shall procure gametes from adults volunteering to George Adams to affect the programs at those particular sites.

At George Adams Hatchery the adult trap (a wooden picket trap) is opened by August 1 each year. Fall chinook return to George Adams from early August through mid-September with a peak in early September. Fish enter the adult holding/juvenile release pond and are held until they are ready to spawn, typically about a week. The trap is only closed when the maximum carrying capacity for broodstock has been reached. The trap is effective in trapping returning adults, however, some natural spawning does occur below the trap on low-water years.

There are no known features of the trap that would lead to collection of a non-representative sample of chinook. As mentioned earlier, numbers of chinook entering the trap are usually insufficient to meet egg take goals. Consequently, nearly all chinook are spawned, making it unlikely that a timing bias has been introduced into broodstock collection.

7.3) Identity.

Unmarked hatchery-origin chinook cannot presently be distinguished from natural-origin chinook.

7.4) Proposed number to be collected:

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

For George Adams, there is no specific program goal for adult broodstock collection, only for an egg take of 4.57 million fall chinook eggs. Assuming a fecundity of 4,500 eggs per female and a 60% male / 40 % female sex ratio, and a pre-spawning mortality of < or = 5%, the number of adults required to meet the egg take goal would be about 2,670 (maximum of 2,900). Note that the 2000 egg take of 4.57 million has been reduced from the previous goals of 5.72 million.

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

George Adams:

Year	Adults Females	Males	Jacks	Eggs
1992	103	191	3	443,000
1993	290	322	4	1,174,000
1994	109	386	2	464,000
1995	1,599	1,563	34	6,821,000
1996	1,347	1,300	12	5,281,600
1997	762	733	3	2,814,000
1998	863	911	30	3,002,000
1999	1,144	1,152		4,500,000
2000	979	857	14	4,349,900
2001	1,309	1,300	7	5,668,100
2002	951	864	6	4,629,000
2003	969	973	6	4,583,800

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

Chinook collected in excess of egg take needs at George Adams are killed rather than passed upstream. There are currently no upstream escapement goals for Purdy Creek as it is a small spring fed stream. In 1995, 173 males, 78 females and 15 jacks were hauled from George Adams to the Skokomish River to spawn naturally, but this was an exception. See below for information on carcass disposal.

7.6) Fish transportation and holding methods.

George Adams adult chinook are not generally transported. When they are, hauling is carried out using WDFW loading rate guidelines which specify densities for salmon of different species and sizes, oxygen levels, salinity and disinfection procedures (WDFW undated).

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish health and sanitation measures are consistent with the Co-managers Fish Health Policy (NWIFC and WDFW 1998). Brood stocked females used for the yearling program at Rick's Pond are injected with liquid erythromycin for control of Bacterial Kidney Disease (BKD). They are also subjected to an Enzyme Linked Immunosorbant Assay (ELISA) screening for BKD. Only eggs from below-low titer females are used for the yearling production.

7.8) Disposition of carcasses.

The disposition of chinook carcasses at George Adams depends upon the condition of the carcasses and whether the fish had been treated with drugs. Drug-treated fish are buried on station or in a local landfill. Carcasses of untreated fish, both spawned and un-spawned may be sold to a contracted buyer, donated to a food bank, tribe or used as part of an approved nutrient enhancement program.

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

Since the hatchery chinook have not been 100% mass marked in the past, the hatchery fish cannot be distinguished from the natural-origin listed chinook. No special risk aversion measures are in place at this time (2004) to protect listed wild fish from being incorporated into the broodstock.

The program has incorporated natural-origin fish for use as broodstock at an unknown level over the years (integrated program). This level of natural-origin fish spawning has likely reduced genetic divergence of the propagated population from the naturally spawned Hood Canal population. And with stock transfer limitations imposed beginning in the early 1990s, George Adams and Hoodsport hatcheries have become more self-sufficient, securing chinook adults that return to the hatcheries needed to fill their production programs, and thereby minimizing the risk of out-breeding depression that may result from out-of-basin transfers.

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 ripe fish are selected randomly for spawning from available broodstock.

8.2) Males.

Males are selected randomly and mated 5 X 5 with the females.

8.3) Fertilization.

Eggs and milt are mixed, 5 X 5, and allowed to sit for a minute. Fertilized eggs are pooled and taken to the hatchery for distribution into the incubators.

8.4) Cryopreserved gametes.

Not used.

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

Until 100% mass marking takes place, no special risk aversion measures are in place to protect listed wild fish from being incorporated into the mating scheme. Mating cohorts are randomly selected throughout the entire run time and at least 500 adults (up to 2,900) are used for broodstock to maintain stock integrity and genetic diversity.

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.

George Adams: (see section 7.4.2 for egg take numbers)
Average green egg to fry survival from 1996 through 2000 was 92.4%.

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

Egg takes shall be managed to limit the likelihood of surplus eggs.

9.1.3) Loading densities applied during incubation.

At George Adams green eggs are bulk eyed in deep troughs. At the eyed-egg stage, they are hatched in vertical incubators at a rate of 5.5 pounds (lbs.) of eggs per tray.

9.1.4) Incubation conditions.

At George Adams Hatchery eggs are incubated on well water.

9.1.5) Ponding.

Fry are forced ponded when yolk absorption is 95%+ complete.

9.1.6) Fish health maintenance and monitoring.

The Area Fish Health Specialist monitors fish health on a routine basis. If needed, treatment plans are prescribed in accordance with the Co-manager's Fish Health Policy (1998).

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.

Until co-manager agreement on 100% mass marking (see section 10.7), no special risk aversion measures are in place to protect incubating eggs except using well water.

Dead eggs are picked and discarded in a manner to prevent any disease transmission as per Co-manager Fish Health Policy (1998).

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.

George Adams:
Average fry to fingerling smolt survival from 1996 through 2000 was 94.4%.

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

In general, loading and density levels conform to standards and guidelines set forth in Fish Hatchery Management (Piper et. al., 1982). Chinook are generally split into ponds at 3 lbs/gpm and released at 5 lbs/gpm.

9.2.3) Fish rearing conditions

At George Adams the fish are reared in ambient surface water from Purdy Creek.

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 are weight sampled weekly and feed rates are adjusted to achieve a proper size and time of release.

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 reared in a diet of Bio Oregon's Bio-Diet Starter and BioDiet Grower feed at rates between 1.7 and 2.5% B.W./day.

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

The Area Fish Health Specialist monitors fish health on a routine basis. If needed, treatment plans are prescribed in accordance with the Co-managers Fish Health Manual and Policies (1996, 1998).

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

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

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

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

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

Until co-manager agreement on 100% mass marking (see section 10.7), no special risk aversion measures are in place to protect rearing fish.

The Area Fish Health Specialist monitors fish health on a routine basis during rearing. If needed, treatment plans are prescribed in accordance with the Co-managers Fish Health Policy (1998).

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	3,800,000	60-80	May	Purdy Creek
Yearling				

Note: 60-80 fpp ~ 88-80 mm fork length

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse:
Release point:
Major watershed:
Basin or Region:

George Adams fall chinook are released into the following rivers or streams:

Purdy Creek (16.0005)((R 1.8) in the Skokomish watershed, Hood Canal Region (WDFW George Adams Hatchery)

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

George Adams:

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size (fpp)	Fingerling	Avg size (fpp)	Yearling	Avg size
1992	1,700,000 (unfed fry)		1,546,900 5,604,958	376 225				
1993					3,926,912	72		
1994					1,317,200	79		
1995					1,508,750	49		
1996					3,504,032	71		
1997			1,949,600 (flood loss)	240	1,811,338	70		
1998	491,700 (excess)	1,448			3,865,355	72		
1999					3,468,321	74		
2000					3,779,853	76		
2001					3,835,620	69		
2002					3,748,748	62		
2003					3,806,706	87		
Average	552,766	1,448	1,623,963	345	3,458,130	75		

Data source: WDFW Hatcheries database. 1988-1994 data are from Plants table. 1995-1999 data are from Form 4 table.

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

George Adams chinook are generally released in mid-May when they exhibit strong migratory behavior (schooling and swimming around ponds) and migratory appearance (silver body coloration). Release is volitional for the first 24 hours and the fish are free to leave. After about 24 hours, the water level in the ponds is lowered to flush out the remaining fish.

10.5) Fish transportation procedures, if applicable.

Not applicable

10.6) Acclimation procedures

The major water source for rearing at George Adams is Purdy Creek, which should increase the likelihood that chinook reared and released on-station will return to the hatchery.

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

George Adams releases a Double-Index Tag (DIT) group of adipose-fin clip/coded-wire tagged chinook fingerlings. 225,000 of the on-station fingerling smolt release is coded-wire tagged and adipose-fin clipped each year. An additional 225,000 of the on-station fingerling smolt release are coded-wire tagged without an adipose-fin clip (all returning fish will be “wanded” to prevent taking of natural fish).

For the 2004 broodyear (2005 release), only 166,000 chinook were mass marked (adipose-fin clip only). The co-managers are continuing to discus a plan to apply to the remaining production (3,350,000) an adipose-fin clip only to allow monitoring and evaluation of the hatchery program production and provide NOR/HOR ratios on the spawning grounds. The DIT group can serve as an index group for wild fingerling fall chinook as well as providing data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds.

The average weighted proportion of tagged and marked fish released yearly since 1995 is shown below in Table.

Table 6. Proportion of yearly releases of George Adams chinook that are coded-wire tagged and /or adipose-fin clipped.

Year	Proportion CWT + AD
1995	15%
1996	6%
1997	6%[1]
1998	5%[2]
1999	13%

[1]Includes 1,949,600 unmarked fry released early due to flooding.
[2]Includes the 491, 700 unmarked excess fry released early.

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

Beginning with the 1999 brood year, any excess George Adams chinook fry (resulting from higher than expected survival) will be released into landlocked lakes in the Hood Canal area following consultation with the tribes.

10.9) Fish health certification procedures applied pre-release.

A WDFW Fish Health Specialist prior to release or transfer examines each lot of fish, which is in accordance with the Co-managers Fish Health Policy (1998).

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

In the event of a water system failure, screens would be pulled to allow fish to exit the pond. In some cases they can be transferred into other rearing vessels to prevent an emergency release. In cases of severe flooding the screens are not pulled. Past experience has shown that the fish tend to home down to the bottom of the pond and only those that are inadvertently swept out are allowed to leave. During severe drought conditions, fish may be released early and directly into Purdy Creek.

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

The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with listed chinook. To minimize the risk of residualization and impact upon natural fish, hatchery fingerlings are released chinook are released from George Adams are released only as sub-yearling smolts, generally in mid-May. Releasing sub-yearling smolts should reduce the likelihood of hatchery fish preying on wild chinook since wild chinook are expected to be nearly as large as the hatchery fish at the time of release. Hatchery chinook would probably be smaller than any fluvial or anadromous bull trout that they might encounter in the lower Skokomish. Wild summer chum are considered extirpated in the Skokomish River so adverse effects in fresh water are not expected.

In addition, a rearing parameter of the fingerling program is to attain a coefficient of variation for length of 10.0% or less in order to increase the likelihood that most of the fish are ready to migrate (Fuss and Ashbrook 1995). Such fish would be less likely to residualize in fresh water and interact with listed wild fish. The average CV for release years' 1995-2002 was 7.46%.

We know little about saltwater interactions between hatchery chinook and listed wild chinook and summer chum, but we expect that wild summer chum would have cleared lower Hood Canal before the chinook are released. Specifically, chinook are not released until after April 1 in order to reduce potential interactions with listed Hood Canal summer chum. Those from Lilliwaup Creek are expected to migrate to salt water in February and March and then to swim seaward quickly (Tynan, 1992). They are expected to clear the area well before the release of George Adams fingerling chinook in May. WDFW considers that both juveniles and returning adults from the on-station program pose low risk for competition or predation to summer chum (Tynan, 1999).

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

Elements of the annual Monitoring and Evaluation plan for this program are identified in Section 1.10. The purpose of a monitoring program is to identify and evaluate the benefits and risks that may derive from the hatchery program. The monitoring program is designed to answer questions of whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Each production group shall be identified with distinct otolith marks, adipose clips, coded wire tags, blank wire tags or other identification methods as they become available, to allow for evaluation of each particular rearing and/or release strategy. This will allow for selective harvest on hatchery stocks when appropriate, monitoring of interactions of hatchery and wild fish wherever they co-mingle in riverine, estuarine and marine habitats and assessment of the status of the target population. WDFW shall monitor the chinook salmon escapement into the target and non-target chinook populations to estimate the number of tagged, un-tagged and marked fish escaping into the river each year and the stray rates of hatchery chinook into the rivers.

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

<u>Benefit Indicator 1</u>: Achieve broodstock/egg take goals to provide fish for stable, predictable fishery

The <u>maximum number</u> of spawners needed to meet the egg take has been determined to be 2,900 (1,450 females and 1,450 males). Because fish are not sorted by sex at the time they enter the adult pond from the trap, more than 2,900 chinook will be collected. The number of spawning days is planned in advance, based on typical return timing. The number of males and females to be spawned on each day can be determined. The risk is that the number of females will fall short of the number needed, and egg take will be less than required.

Egg takes are estimated at the time of spawning and refined after shocking and picking.

<u>Benefit Indicator 2:</u> Communicate within WDFW and with tribes, citizen groups, private citizens and federal agencies regarding program goals and production objectives. Meet ESA recovery requirements.

WDFW staff and PNPTC/tribal staff communicate if production changes are proposed. Production changes involving the Regional Fish Enhancement Group (RFEG), Hood Canal schools or volunteer co-op groups are communicated through the WDFW's Region

6 office. The changes in goals and production levels that result from these discussions are reflected in the Future Brood Document (FBD) compiled by WDFW. Recently NOAA Fisheries has also become involved in discussions of changes to production at George Adams affecting the regions' fish hatchery programs.

WDFW and NOAA Fisheries are engaged in discussions of hatchery chinook production and release in Hood Canal to ensure that agency hatchery programs to be consistent with recovery requirements.

<u>Benefit Indicator 3</u>: Provide carcasses for Skokomish nutrient enhancement program.

This is an ad hoc program conducted by the Forest Service. The hatchery provides carcasses as available and needed for nutrient enhancement.

<u>Risk Indicator 1</u>: Reduce hatchery broodstock collection impacts on wild fish

In order to avoid collecting wild chinook for spawning, they must be separable from all hatchery chinook and be returned to the Skokomish River. This is currently not possible for two reasons. First, unmarked hatchery fish cannot currently be distinguished from wild fish. Second, wild fish entering the hatchery need to be identified and returned quickly to the river. There is no system to return wild adults directly to the river.

The problem of distinguishing wild from hatchery fish could be addressed by marking all hatchery fish. The state and the PNPT tribes are discussing the need to mass mark chinook in Hood Canal. The problem of separating hatchery and wild fish once they can be identified could be solved if the adult pond could be divided and a sorter was installed at the trap or the entrance to the pond. Once wild fish can be sorted from hatchery fish, they can be returned to the Hood Canal for release. We must be aware, however, that even with mass marking, a small number of unmarked hatchery fish may return depending on the proportion of "bad clips or marks" at the time of marking.

<u>Risk Indicator 2</u>: Reduce interactions between hatchery and wild juvenile fish.

This would require monitoring of hatchery smolts following release into Purdy Creek and determination of the temporal and spatial distribution of juvenile bull trout and wild chinook.

<u>Risk Indicator 3</u>: Maintain hatchery stock integrity and genetic diversity.

This requires that no chinook from outside the Hood Canal region be introduced into George Adams. It also requires also that the spawning population be sufficiently large to avoid significant effects of genetic drift and that spawners represent the entire run timing.

<u>Risk Indicator 4</u>: Meet disease prevention and control standards in Co-managers Fish Health Policy (1998). This requires that measures prescribed for examining fish to be

transferred or released be followed, that routine health inspections be conducted and that disease outbreaks be contained quickly.

Risk Indicator 5: Reduce interactions between hatchery adults and wild adult spawners on the spawning grounds.

This would require monitoring the adult return numbers, ratios, and interactions between hatchery-origin and wild-origin adult spawners to assess the status of the target population.

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

Funding, staffing and other support logistics committed to allow implementation of the monitoring and evaluation of program:

1. Staff funding and manpower to count hatchery adult returns and determine egg take needs are available at the current level.

2. Staff and funding are available to carry out discussions of production programs at George Adams and to make changes to the Future Brood Document to reflect those changes.

3. Staff and funding are available to provide chinook carcasses for a Forest Service crew to pick up and distribute in the watershed.

Staff, funding and logistical support that are not available:

1. Funding is not currently available to construct a means of separating wild and hatchery fish at the hatchery.

2. The staff, funding and logistical support are not available to undertake monitoring of hatchery smolts, determination of the extent to which they overlap with wild fish and the effect of the overlap.

3. Only hatchery returns, volunteering to the George Adams Hatchery shall be used to affect this program.

4. Funding not available to monitor chinook salmon escapement to the Skokomish River sites to estimate the number of tagged, untagged, and marked fish escaping to the river each year. This monitoring would allow for assessment of the status of the target population.

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.

It is anticipated that adherence to monitoring and evaluation protocols will not elevate risk to any listed salmonid species.

SECTION 12. RESEARCH

The only research being conducted in direct association with the George Adams fall chinook program was genetic analysis of a sample of adults at the hatchery during the 1999 spawning season and subsequent next generation of chinook (2003 or 2004).

12.1) Objective or purpose.

To determine the genetic relationship between the George Adams hatchery fall chinook stock and naturally spawning fish in the Skokomish, Hamma Hamma, Duckabush, Dosewallips and Quilcene rivers.

Sampling at George Adams Hatchery was conducted in 1999. Further, hatchery sampling will probably not occur until 2003 or 2004 (the next generation of chinook).

12.2) Cooperating and funding agencies.

WDFW with some funding from the Pacific Salmon Treaty.

12.3) Principle investigator or project supervisor and staff.

Anne Marshall, Genetics Unit, WDFW conducts the analyses. Rick Ereth, WDFW Genetics Unit, coordinates sample collection by WDFW Genetics Sampling crewmembers, WDFW regional Fish Program staff or hatchery staff.

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

See section 2.

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

The Genetics Sampling crew or hatchery staff removes tissue samples (heart, eye fluid, liver, muscle and fin or operculum) for allozyme and DNA analysis from fresh chinook carcasses at the hatchery. Typically tissue samples are obtained from100 chinook (50 females and 50 males) taken throughout the run and spawn timing.

The Genetics Sampling Crew and/or regional Fish Program staff snag spawned out chinook and kill them by a blow to the head or sample recently dead chinook (gills still red) on spawning grounds in the streams listed above.

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

Tissue collection at the hatchery occurs on spawning days from mid-September through late October. Tissue collection in the field occurs during the same time period.

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

Not applicable.

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

Hatchery fish are dead at the time of sampling. Currently all field-sampled fish are killed prior to tissue collection.

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).

The level of lethal spawning and subsequent sampling of listed (wild) chinook at the hatchery is unknown, but is likely less than 100 fish since the entire sample is 100 fish. The level of take of fish on the spawning grounds would not exceed 100 fish in each major drainage.

12.10) Alternative methods to achieve project objectives.

If NMFS determines that killing spawned out and moribund fish on spawning grounds cannot be continued, genetic analysis could continue using fin clips from live fish. Some allozyme analysis has been conducted on fin tissue from chinook, but such a change in sampling would likely result in a change from allozyme to DNA analysis. If the take incurred during this sampling were judged acceptable to NMFS, and if WDFW were able to install a weir or trap to collect live fish, sampling could continue. However, it should be noted that the baselines for DNA would not be comparable to those available for allozymes for some time to come.

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

None.

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.

None.

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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:_____________

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

Chinook

ESU/Population	Puget Sound Chinook *(Oncorhynchus tshawytscha)*- Hood Canal
Activity	George Adams Fall Chinook Program
Location of hatchery activity	George Adams Hatchery, RM- 1.0 on Purdy Creek (16.0005)
Dates of activity	August-July, 31
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)	-	-	Unknown *	-
Unintentional lethal take (g)	<8%	<6%	5%	-
Other take (indirect, unintentional) (h)	-	Unknown	-	-

*- Currently there is an unknown level of natural-origin fish in the hatchery broodstock. With implementation of mass marking, hatchery and natural-origin chinook could be identified. An integration plan could then be developed. This plan would identify a prescribed level (goal) of natural origin fish (by percentage of the total) to be incorporated into the hatchery broodstock. Actual number would be determined by availability.

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.