HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	George Adams Coho Yearling Program
Species or Hatchery Stock:	Coho (*Onchorynchus kisutch*) Hood Canal
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Hood Canal Puget Sound
Date Submitted:	March 17, 2003
Date Last Updated:	March 25, 2003

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

George Adams Hatchery Coho Program

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

Hood Canal Coho (*Oncorhynchus kisutch*) - not listed

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 at George Adams, the hatchery receives 450,000 eyed eggs from the Quilcene Hational Fish Hatchery and rears the fish for eventual transfer to the Port Gamble Bay Net Pens.

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. 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.

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

Funding for yearling production at George Adams is provided through the State General Fund. George Adams receives $242,000 annually from the State General Fund and additional mitigation funding of $84,000 annually from Tacoma Public Utilities. George Adams Hatchery is staffed with 5 full-time employees.

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

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

1.6) Type of program.

Isolated harvest (The intent of these programs is to be "Isolated" but an unknown number of adults stray onto the spawning grounds of the Skokomish River).

1.7) Purpose (Goal) of program.

Augmentation and mitigation**.**

Hatchery coho production has been developed to augment harvest opportunities 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 coho salmon.

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 yearling smolts with expected brief freshwater residence.

2. RELEASE AFTER APRIL 15 to avoid freshwater and estuarine interactions with Hood Canal summer chum.

1.9) List of program "Performance Standards".

See section 1.10

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

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

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch and CWT data
Meet hatchery production goals	Number of juvenile fish released - **500,000**	Future Brood Document (FBD) and hatchery records
Manage for adequate escapement where applicable	Hatchery return rates	Hatchery return records
Minimize interactions with listed fish through proper broodstock management. Maximize hatchery adult capture effectiveness. Use only hatchery fish	Number of broodstock collected - **1,058**	Stream surveys, rack counts
	Stray Rates	Spawning guidelines
	Sex ratios	Hatchery records
	Age structure	
	Timing of adult collection/spawning - **early October to early December**	Spawning guidelines Hatchery records
	Adherence to spawning guidelines - **see section 8.3**	
Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Out-migration timing of listed fish / hatchery fish - **Feb-March(summer chum) - mid May-early June (chinook) /after April 15**	FBD and historic natural outmigration times FBD and hatchery records CWT data
	Size and time of release - **17 fpp /after April 15**	

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

1.11) Expected size of program.

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

The George Adams program egg take goal is 590,000. Assuming a fecundity of 1469 (HOPPS AVG) eggs per female, a 60% male / 40 % female sex ratio and a prespawning mortality of < or = 5%, the number of adults required to meet the egg take goal would be about 1058. Adults in excess of escapement goals will be killed and sold, donated to food banks, or used in an approved nutrient enhancement program.

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

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Purdy Creek (16,0005)	500,000

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

The average smolt-to-adult survival rate for 91-97 BY's was 3.48%. The escapement levels back to the hatchery from 1995 through 2001 have been 7,979, 15,143, 12,282, 2,899, 7,524, 10,327 and 23,427, respectively.

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

1961.

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Purdy Creek (16.0005)

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

None

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

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

None

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

2.2.1) 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.

None

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

Puget Sound ESU fall chinook (Hood Canal fall chinook stock (WDF 1993):

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), with smaller populations in the Dosewallips, Duckabush, and Hamma Hamma rivers. 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 to what extent that George Adams hatchery-origin yearling coho 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, personnel communication, March 2000). Hood Canal fall chinook spawn from mid-September through October with a peak in mid-October (WDFW and WWTIT 1994). 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, Hamma Hamma, 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.

SASSI classified Hood Canal summer/fall chinook as a single stock 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 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 NMFS 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.

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 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 (Marshall, 1995a).

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 2000 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 coho released locally is unknown.

Hood Canal Summer Chum:

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.

Puget Sound Bull Trout (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 staff 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 7°C 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.

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

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

In the draft Viable Salmon Population and the Recovery of Evolutionary Significant Units (NMFS 1999) National Marine Fisheries Service provides a review of the various parameters that relate to populations and ESU viability guidelines. Seven major items were identified.

1) ESUs should contain multiple populations,
2) Some populations in an ESU should be geographically widespread,
3) Some populations should be geographically close to each other,
4) Populations should not all share common catastrophic risks,
5) Populations that display diverse life-histories and phenotypes should be maintained (create circumstances that will protect the integrity of individual populations),
6) Some populations should exceed VSP guidelines, and
7) Evaluations of ESU status should take into account uncertainty about ESU-level processes.

The basic elements of the above statement include three items: diversity, abundance and distribution. Diversity refers not only to genetic variations that characterize populations but also those traits that are influenced by environmental and demographic factors. This means: 1) maintaining the genetic integrity of each of the core populations within the Puget Sound ESU, 2) protecting habitat to the extent that ecological variations and processes attributed to fish production are maintained, and 3) controlling human-caused factors that could potentially alter traits such as run timing, age structure, size, fecundity, morphology and behavior of individuals and populations.

This section refers specifically to annual abundance levels for each of the natural management units, without regard to genetic diversity and distribution. The viable threshold, as defined by NMFS, is the level of abundance and function at which the population has a negligible risk of extinction over both the short (e.g., 3 generations) and long (100 years) term. The critical threshold is the level of abundance and function at which the population is at high risk of extinction over a short time period.

The present threshold estimates are subject to change.

Chinook: The co-managers have identified minimum abundance levels and recovery exploitation rates in the Harvest Management Component of the Puget Sound Comprehensive Chinook Management Plan. These recovery exploitation rates were established based on current estimated survival and productivity rates with adjustments to account for data uncertainty and management imprecision. The basic strategy is to hold harvest impacts neutral and to turn short-term increases in productivity into additional fish on the spawning grounds. However, it should be stated that data quality in many cases is limited that these exploitation rates should be periodically reviewed to assure that they are representative of critical thresholds.

Within Hood Canal, there are two chinook management units (MUs): Skokomish River and Mid-Hood Canal. The immediate and short-term objective for Skokomish River MU is to manage chinook as a composite population (including naturally and artificially produced chinook). The composite population will be managed, in part, to achieve a suitable level of natural escapement; and to continue hatchery mitigation for the effects of habitat loss; and to provide to the Skokomish Tribe partial mitigation for its lost treaty fishing opportunity. Habitat recovery and protection measures will be sought to improve natural production. The Mid-Hood Canal MU is comprised of chinook populations of the Dosewallips, Duckabush, and Hamma Hamma watersheds. The management objective is to maintain and restore sustainable, locally adapted, natural-origin chinook. Management efforts will focus on increasing natural population numbers and meeting specified minimum escapement rates or numbers.

For the Skokomish chinook MU, during the recovery period, pre-terminal southern U.S. are managed to achieve a total rate of exploitation of 15% or less as estimated by the FRAM model. This can be considered the critical exploitation rate threshold for the MU. A low abundance threshold escapement of 1300 chinook (comprised of 800 natural spawners and 500 adults returning to the hatchery rack) and can be considered the critical abundance threshold. The natural escapement component threshold is set at approximately 50% of the current MSY estimate and represents a level necessary to ensure in-system diversity and spatial distribution. During the 1996-2000 period, the composite low threshold was exceeded in all years for the Skokomish MU and in four of the five years for natural escapement. An escapement goal of 3,150 chinook (comprised of 1650 in-stream spawners and 1500 spawners required for the maintenance of hatchery production) is set and is intended to maintain full hatchery mitigation and meet current estimates of MSY escapement to natural production areas under current habitat conditions; this can be considered the viable threshold. During the 1996-2000 period, composite escapement exceeded the 3150 goal in 4 of 5 years, natural escapement has exceeded 1650 chinook in 2 of 5 years, and hatchery escapement has exceeded 1500 chinook in all 5 years.

For the Mid-Hood Canal chinook MU, during the recovery period, pre-terminal southern U.S. are managed to achieve a total rate of exploitation of 15% or less as estimated by the FRAM model. This is considered the critical exploitation rate threshold for the MU. A low abundance threshold escapement of 400 chinook is considered the critical abundance threshold which is approximately 50% of the current MSY estimate and represents a level necessary to ensure in-system diversity and spatial distribution. During the 1996-2000 period, the low threshold was exceeded in 2 of 5 years for the Mid-Hood Canal MU. An escapement goal of 750 chinook is set and represents current estimates of MSY escapement to natural production areas; this can be considered the viable threshold. During the 1996-2000 period, escapement exceeded the 750 goal in 1 of 5 years.

Summer chum: In the SCSCI, a separate procedure has been used to estimate extinction risk based on the numbers of spawners representing each summer chum stock. Summer chum critical thresholds focus on minimum number of spawners required to have a viable population, and estimates the risk of extinction for populations below the viable threshold. The assessments identified two stocks that are currently rated as having a high risk of extinction: Lilliwaup and Jimmycomelately. A moderate rate of extinction rating is assigned to the Hamma Hamma and Union stocks. Dungeness is rated of special concern because of the lack of stock assessment information. The remaining summer chum have a low risk of extinction.

Bull trout: The status of Puget Sound bull trout in Hood Canal is unknown, but believed to be 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.

No estimates of productivity are available for Puget Sound chinook or for Puget Sound 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 data base.

- 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 X. 1988-2000 spawner abundance data for Hood Canal fall chinook, Hood Canal summer chum and Lake Cushman bull trout/Dolly Varden. Chinook data are from the 1999 WDFW chinook run reconstruction and WDFW files. Summer chum data are from SCSCI run reconstruction, dated May 2001. Bull trout data are from WDFW (1998) through 1996 and from D.Collins (WDFW, personnel communication) thereafter.

Year	Fall Chinook	Summer Chum	Bull Trout/Dolly Varden
1988	2,853	2,967	152
1989	1,425	598	174
1990	724	429	299
1991	1,858	747	299
1992	940	1,945	285
1993	1,172	7,072	412
1994	1,072	2,044	281
1995	1,999	8,971	250
1996	1,028	19,707	292
1997	492	8,419	No data collected
1998	1,834	3,404	119[1]
1999	3,020	3,882	90[1]
2000	1,690	7,987	- - -
2001	No data at this time	11,501 (prelim)	

- 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 chinook broods show a low stray rate (0.08 to 0.56%) within the same GDU and none outside the GDU. The stray rate risk rating is "Low" per the WDFW Hatchery Risk Assessment Worksheet, Version 2, 11/2/00.

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

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[1] Counts were incomplete due to high water (D.Collins, personal communication, February, 2000)

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 net pens in Hood Canal. 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 outmigrate 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.

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

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

No known past takes.

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

See "take" table.

- 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.

Because take levels cannot be quantified, contingency plans to limit take to pre-determined numbers have not been developed at George Adams Hatchery.

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 coho program is conducted in a manner consistent with the Summer Chum Salmon Conservation Initiative or SCSCI (WDFW and PNPTT 2000). Specifically, Coho are not released until after April 1 in order to reduce potential interactions with listed Hood Canal summer chum. It is unknown whether there is a summer chum population in the Skokomish River. However, Hood Canal summer chum are expected to migrate to salt water in February and March and swim seaward quickly (Tynan 1992). They are expected to clear the marine area well before the release of George Adams coho in late April.

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 HGMP is consistent with relevant standing orders and agreements. The Puget Sound Salmon Management Plan (PSSMP, 1985) and the Hood Canal Salmon Management Plan (HCSMP, 1986) 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. 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 coho 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.

The PFMC/North of Falcon process is conducted for management of salmon-directed marine and freshwater fisheries. Each year, preseason forecasts are made of the abundance of individual fish stocks. These forecasts can be based on a number of factors, such as juvenile outmigration abundance, spawning escapement, hatchery returns, terminal area fishery samples, and historic returns. Taken together, these numbers provide an indication of the strength of the upcoming season's populations. The forecast is added to a base of information on the historic run-size strength and fishery impacts for the fish populations. The primary tool used to develop this base of information for chinook salmon is CWTs.

This information is then input into computer models, which estimates potential catches for each stock under various fishing regulation options. Results from these computer simulations are then compared to conservation goals, obligations under U.S.-Canada treaties, treaty tribe and non-treaty allocations, and protection requirements for some wild fish populations under the ESA. Conservation goals are set jointly by state and tribal co-managers, and are based on the best available scientific information on the number of fish a given stream is capable of supporting and the number of recruits that can be produced by each pair of spawning adults. Conservation goals are designed to ensure that enough fish survive harvest in order to spawn and perpetuate the long-term health and existence of the run.

Fishing season options are developed each year in the late winter and early spring, and are set by the end of April. Because state fishing activities affect species that migrate over thousands of miles, WDFW participates in three separate harvest management panels:

! The Pacific Salmon Commission, which consists of representatives Alaska, Washington, Oregon, Canada, the treaty tribes of Washington and the Columbia River, and the federal government. Panels and technical committees within the commission address specific ocean fisheries.

! The Pacific Fisheries Management Council (PFMC), which includes the principal fisheries officials from Alaska, Washington, Oregon, California, the regional director of NMFS, and eight private citizens appointed by the U.S. Secretary of Commerce. The Council jointly manages coastal fisheries, including salmon and groundfish, from three to 200 miles off shore. The season-setting process occurs in a series of public meetings.

! The North of Falcon public planning forum, in which state, tribal, and federal fish managers meet with commercial and recreational fishing industry representatives and other concerned citizens, in tandem with PFMC deliberations on ocean seasons, to set salmon fisheries for Puget Sound and waters within three miles of the Washington and northern Oregon coasts. The season setting process occurs following a series of public meetings each spring.

Except where specifically authorized, according to the management framework developed within the annual PFMC/North of Falcon agreements, salmon fisheries are closed. The PFMC/North of Falcon process includes the analysis of impacts to salmon stocks of concern, including those to ESA-listed salmon ESUs.

For example, during 2000 as an outcome of the North of Falcon 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.

For the 2001/2002 season, the co-manager's have 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 with the expectation that NMFS will reach 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. NMFS reviewed and approved the Plan.

Forecasts and management recommendations for Hood Canal hatchery and wild coho are prepared and reported annually by State and Tribal co-managers (for example, see PNPTC and WDFW 2000).

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

Canadian commercial and sport fisheries.

Washington Coastal commercial (tribal and non-tribal) and sport fisheries.

Strait of Juan de Fuca and Hood Canal treaty net fisheries.

Strait of Juan de Fuca and Hood Canal all citizens net fisheries.

Hood Canal sport fisheries

3.4) Relationship to habitat protection and recovery strategies.

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

Hood Canal chinook Limiting factors analyses have not been completed for Hood Canal natural chinook stocks and factors for decline and recovery are not available. However, 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 and 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 aggradation and removal have been problems in the lower Big Quilcene.

Summer chum Summer chum supplementation, habitat restoration and 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 aggradation 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 have historically created conditions which increased sediment delivery to streams and reduced the supply of large woody debris to streams.

Bull trout 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.

Other 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 which 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 which pose the greatest threats to slope stability and streams. Within Washington State, the Forests and Fish Report, prepared by the USFWS, NFMS, EPA, Office of the Governor of the State of Washington, WA DNR, WDFW, WA DOE, the Colville Tribes, Washington counties, and timber industry groups, was accepted by Washington Legislature in 1999. The emergency forest practices rules which were developed from the Report will result in some improvements in state and private forest land 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.

3.5) Ecological interactions.

The program described in this HGMP interacts with the biotic and abiotic components of the freshwater, estuarine, and marine salmonid ecosystem through a complex web of short and longterm processes. The complexity of this web means that secondary or tertiary interactions (both positive and negative) with listed species could occur in multiple time periods, and that evaluation of the net effect can be difficult. WDFW is not aware of any studies that have directly evaluated the ecological effects of this program. Alternatively, we provide in this section a brief summary of empirical information and theoretical analyses of three types of ecological interactions, nutrient enhancement, predation, and competition, that may be relevant to this program. Recent reviews by Fresh (1997), Flagg et al. (2000), and Stockner (2003) can be consulted for additional information; NMFS (2002) provides an extensive review and application to ESA permitting of artificial production programs.

Nutrient Enhancement

Adults originating from this program that return to natural spawning areas may provide a source of nutrients in oligotrohic coastal river systems and stimulate stream productivity. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003).

Predation – Freshwater Environment

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

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

> Environmental Characteristics. Water clarity and temperature, channel size and configuration, and river flow are among the environmental characteristics that can influence the likelihood that predation will occur (see SWIG (1984) for a review). The SIWG (1984) concluded that the potential for predation is greatest in small streams with flow and turbidity conditions conducive to high visibility.
>
> Relative Body Size. The potential for predation is limited by the relative body size of fish released from the program and the size of prey. Generally, salmonid predators are thought to prey on fish approximately 1/3 or less their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length (Pearsons et al. 1998). The lengths of juvenile migrant chinook salmon originating from natural production have been monitored in numerous watersheds throughout Puget Sound, including the Skagit River , Stillaguamish River, Bear Creek, Cedar River, Green River, Puyallup River, and Dungeness River. The average size of migrant chinook salmon is typically 40mm or less in February and March, but increases in the period from April through June as emergence is completed and growth commences (Table 3.5.1). Assuming that the prey item can be no greater than 1/3 the length of the predator, Table 3.5.1 can be used to determine the length of predator required to consume a chinook salmon of average length in each time period. The increasing length of natural origin juvenile chinook salmon from March through June indicates that delaying the release hatchery smolts of a fixed size will reduce the risks associated with predation.

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

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

Sources:

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

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

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

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

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

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

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

1) Emigration occurs over a prolonged period, beginning soon after enough emergence (typically January) and continuing at least until July;
2) Two broad peaks in migration are often present during the January

through July time period; an early season peak (typically in March) comprised of relatively small chinook salmon (40-45mm), and a second peak in mid-May to June comprised of larger chinook salmon;
3) On average, over 80% of the juvenile chinook have migrated past the trapping locations after statistical week 23 (usually occurring in the first week of June).

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

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

Sources:

[1] Data are from Seiler et al. (1998); Seiler et al. (1999); Seiler et al. (2000); Seiler et al. (2001), and Seiler et al. (2002)..
[2] Data are from Seiler et al. (2003).
[3] Data are from Seiler et. (2002).

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

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

(Table 3.5.3).

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

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

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

Predation – Marine Environment

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

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

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

"3) Likely reasons for apparent low predation rates on salmon juveniles, including chinook, by larger chinook and other marine predators are described by

Cardwell and Fresh (1979). These reasons included: 1) due to rapid growth, fry are better able to elude predators and are accessible to a smaller proportion of predators due to size alone; 2) because fry have dispersed, they are present in low densities relative to other fish and invertebrate prey; and 3) there has either been learning or selection for some predator avoidance."

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

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

SECTION 4. WATER SOURCE

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

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 which require pathogen-free water. This generally means fish which are transferred to George Adams for short-term rearing, then transferred out of the Fish Health Management Zone. George Adams coho are reared on Purdy Creek water which should minimize straying into other watersheds.

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.

George Adams has an NPDES permit. There is no pollution abatement pond. Vacuumed pond wastes are applied to the wetland next to the hatchery. Hatchery effluent has not violated the conditions of the NPDES permit.

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.

Intake screens conform to minimize the risk that wild juvenile salmonids could enter the fresh water intake. There are no wild chum or chinook above the Purdy Creek intake. 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. The Production Division has proposed installation of a clarifier to treat effluent before routing it to the wetland, if funding becomes available.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

George Adams Hatchery: Fish volitionally recruit up a fish ladder, through a V-trap and into an instream (Purdy Creek) 71' X 157' X 27" trap/holding pond. The trap begins operation August 1 for chinook and remains open through the end of the coho 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 instream 71' X 157' X 27" trap/holding pond until they are spawned. Spawning facilities are located adjacent to the trap/holding pond.

5.4) Incubation facilities.

George Adams Hatchery: Coho eggs are incubated to eyed-egg stage in deep troughs. 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 12,500 coho eggs).

5.5) Rearing Facilities

George Adams Hatchery: After hatching, coho eggs are moved from the incubators into 2- 20' X 77' X 31" raceways for initial rearing. The fish are then transferred to a 71' X 157' X 27"gravel-bottomed adult holding/release pond with a maximum release density of 1.17 lbs./cubic foot.

5.6) Acclimation/release facilities.

George Adams Hatchery: As they grow, coho juveniles are split into a gravel-bottomed rearing/release pond with a maximum density of 1.29 lbs/cu.ft. at release.

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 total 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 auxilliary 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.

Adults returning to the Purdy Creek trap.

6.2) Supporting information

6.2.1) History.

George Adams coho originated in 1961 from Finch Creek, Eagle Creek, and Green River stock. In the mid-late 60's, eggs were also imported from Cranberry Creek, May Creek (Wallace R.) and Minter Creek for on-station release. The last release into Purdy Crek of an imported stock (from Minter Creek) occurred in 1980.

6.2.2) Annual size.

The George Adams program egg take goal is 590,000 coho. Assuming a fecundity of 1,469 (HOPPS AVG) eggs per female, a 60% male / 40 % female sex ratio and a prespawning mortality of < or = 5%, the number of adults required to meet the egg take goal would be about 1058.

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

From CWT data, it was calculated that <.7% was from wild-origin adults for 2000 and 2001 broodyears.

6.2.4) Genetic or ecological differences.

None

6.2.5) Reasons for choosing.

Locally adapted stock.

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

NA

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

WDF&W shall procure gametes from adults volunteering to George Adams to effect the programs at those particular sites.

At George Adams Hatchery the adult trap (a wooden picket trap) is opened by August 1 each year. Coho return to George Adams from early October through early-December with a peak in early November. Fish enter the adult holding/juvenile release pond and are held until they are ready to spawn. 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.

7.3) Identity.

Hatchery returns.

7.4) Proposed number to be collected:

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

The George Adams program egg take goal is 590,000 coho. Assuming a fecundity of 1,469 (HOPPS AVG) eggs per female, a 60% male / 40 % female sex ratio and a prespawning mortality of < or = 5%, the number of adults required to meet the egg take goal would be about 1058.

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

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995	494	518	15	920,000	
1996	589	625	2	755,000	
1997	579	568		663,500	
1998	493	491	5	820,000	
1999	306	335	2	590,000	
2000	291	274	2	712,400	
2001	261	261		588,700	

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

Coho collected in excess of egg take needs at George Adams are killed rather than passed upstream. See below for information on carcass disposal.

7.6) Fish transportation and holding methods.

NA

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish health measures are consistent with the Co-Managers fish health policy (NWIFC and WDFW 1998).

7.8) Disposition of carcasses.

Carcasses, both spawned and unspawned, 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.

Broodstock collection for George Adams coho may result in take of listed Puget Sound fall chinook through capture at the hatchery trap. There are no known summer chum returning to the Skokomish River.

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. Jacks are included in the spawning population at a level of no more than 2% of the males and females spawned on a given day.

8.3) Fertilization.

Eggs and milt are pooled from 5 females and 5 males and allowed to sit for 5 minutes. Fertilized eggs are then pooled and taken to the hatchery for distribution into the deep trough incubators for disinfection during water hardening.

8.4) Cryopreserved gametes.

NA

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

NA

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

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

9.1) Incubation:

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

From Hood Canal Operational Plan:

<u>George Adams:</u>
Green egg to fry survival: Range of 87.0 % to 93.0 % (FROM HOPPS)
Fry to yearling smolt survival: Range of 45.6% to 75.0% (FROM HOPPS)

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

There is a provision that all eggs in excess of program (Future Brood Document) goals be hatched and released as unfed fry into landlocked lakes. To date, no excess fry from George Adams Hatchery have occurred.

9.1.3) Loading densities applied during incubation.

At George Adams, green eggs are bulk eyed at 44 pounds (lbs.) per deep trough. Flows are set at 12 gpm per trough (10 cells/trough). When eyed, they are hatched in vertical incubators at a rate of 5.5 pounds of eggs per tray (approximately 12,500/tray) with flows set at 4 gpm (11 lbs eggs/gpm).

9.1.4) Incubation conditions.

At George Adams Hatchery eggs are incubated and hatched on well water. High nitrogen content and low dissolved oxygen in the well (ground) water necessitate first passing the water through an aeration and de-gassing tower before distribution to the hatchery. Water temperature is a constant 48^0 F.

9.1.5) Ponding.

Fry are forced ponded when yolk absorption is 95%+ complete (85 days from egg take date).

9.1.6) Fish health maintenance and monitoring.

Fish health is monitored on a routine basis by the Area Fish Health Specialist. If needed, treatment plans are prescribed in accordance with the WDFW Fish Health Manual and Policies.

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

NA

9.2) Rearing:

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

From Hood Canal Operational Plan:

George Adams:
Green egg to fry survival: Range of 87.0% to 93.0%
Fry to yearling smolt survival: Range of 45.6% to 75.0%.

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 Piper, et. al., 1982.

9.2.3) Fish rearing conditions

At George Adams the fish are reared in ambient surface water from Purdy Creek. Water temperatures are variable and range from 40 to 52^0 F.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Not available.

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

Not available.

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

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

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

Fish monitored throughout rearing for disease (cold-water disease) and checked prior to release. Cold-water disease, which generally occurs during early stages of rearing, occassionally requires antibiotic treatment.

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

NA

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

None

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

NA

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Table. Core coho program at George Adams Hatchery showing on-station yearling releases.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	500,000	17	after April 15	Purdy Cr.

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

Stream, river, or watercourse: Purdy Creek
Release point: George Adams Hatchery
Major watershed: Skokomish River
Basin or Region: Hood Canal

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

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995							413,469	15
1996							396,084	18
1997							434,157	18
1998							527,317	16
1999							534,554	18
2000							502,266	17
2001							493,992	17
Average							471,691	17

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

George Adams coho are generally released in late April 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.

NA

10.6) Acclimation procedures.

The major water source for rearing at George Adams is Purdy Creek which should increase the likelihood that coho 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 coho are mass-marked and they receive a double-index comprised of 45,000 fish with adipose-fin clip + coded-wire tag and 45,000 fish with coded-wire tag and no adipose-fin clip.

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

NA

10.9) Fish health certification procedures applied pre-release.

Each lot of fish is examined by a WDFW Fish Health Specialist prior to release or transfer, in accordance with the Co-Managers Salmonid Disease Policy.

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

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 to the bottom of the pond and only those that are inadvertently swept out are allowed to leave.

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.

Hatchery coho will be larger than chinook and any fluvial or anadromous bull trout which they might encounter in the lower Skokomish. Although wild summer chum are considered extirpated in the Skokomish River, 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. Fish will be released at a stage (smolted), time (after April 15), and location (river mile 1.0) that promotes rapid migration from freshwater areas.

We know little about saltwater interactions between hatchery coho and listed wild chinook and summer chum, but we expect that wild summer chum would have cleared lower Hood Canal before the coho are released (after April 15).

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

See Section 11.1.1.

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

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

SECTION 12. RESEARCH

12.1) Objective or purpose.

Not applicable.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

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

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

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

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

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

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

12.10) Alternative methods to achieve project objectives.

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

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

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by______________________________ Date:_____________

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

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

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

Instructions:

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

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

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

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

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

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

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

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

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

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

h. Other takes not identified above as a category.

Instructions:

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

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

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

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

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

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

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

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

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

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

h. Other takes not identified above as a category.

Instructions:

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