# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

**DRAFT**

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|---|---|
| Hatchery Program | Hoodsport Fall Chinook<br>Fingerling Program |
| Species or<br>Hatchery Stock | Hoodsport Fall Chinook<br>(*Oncorhynchus tshawytscha*) |
| Agency/Operator | Washington Department of Fish and Wildlife |
| Watershed<br>and Region | Hood Canal<br>Puget Sound |
| Date Submitted | August 04, 2005 |
| Date Last Updated | July 27, 2005 |

# SECTION 1. GENERAL PROGRAM DESCRIPTION

**1.1) Name of hatchery or program**.

Hoodsport Hatchery Fall Chinook - Fingerling Program

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

Hood Canal Fall Chinook (*Oncorhynchus tshawytscha*) Hoodsport - not listed

**1.3) Responsible organization and individuals**


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

Hoodsport 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) | $261,567 |
| The above information for annual operating cost applies cumulatively to the Hoodsport Hatchery Fish Programs and cannot be broken out specifically by program. Funding sources are General Fund – State, General Fund – Federal and Puget Sound Recreational Enhancement Fund. | |

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

**Broodstock Collection; Incubation; Rearing and Release:**

Hoodsport Hatchery: Located at the mouth of Finch Creek (16.0222), which flows into Hood Canal in the town of Hoodsport, Washington. Basin name: Hood Canal.

## 1.6) Type of program.

Isolated harvest. The proposed isolated 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.

A fundamental goal is to propagate the hatchery broodstock as a discrete population or gene pool that is segregated (isolated), genetically and reproductively, from naturally spawning populations. Once established (having all hatchery-origin fish marked), broodstock will be composed entirely of hatchery-origin adult returns. The Hoodsport Hatchery fall chinook fingerling program goal is to release 2,800,000 fish and provide adult chinook salmon for sustainable fisheries (Magnuson/Stevens Act) and *US v Washington* (tribal harvest opportunity).

## 1.8) Justification for the program.

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

1) Release fingerling chinook at the appropriate size (80 fpp) that mimics the naturally produced listed chinook (reduce predation risk) and as smolts to minimize nearshore residence (the hatchery outfall is directly on Hood Canal so there is no freshwater residency for Hoodsport chinook). Release has been reduced, beginning in the spring of 2005, from 3 million to 2.8 million.

2) Beginning with the 2003 brood (2004 release), 200,000-fingerling chinook were adipose-fin clipped/coded-wire tagged to allow for evaluation of fishery contribution, survival rates and stray levels to other Puget Sound watersheds. Also 1.5 million were mass marked (adipose-fin clipped only).

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) All fingerling chinook released will be acclimated at the hatchery facility capable of trapping the returning adults. This practice will minimize straying and make possible the removal of hatchery fish.

5) 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 Hoodsport fingerling chinook program, the following Risk Aversions are included in this HGMP:

Table 1. Summary of risk aversion measures for the Hoodsport fingerling chinook program.

| **Potential Hazard** | **HGMP Reference** | **Risk Aversion Measures** |
|---|---|---|
| Water Withdrawal | 4.1 | Surface water rights are formalized through trust water right permit # S2-20588. Monitoring and measurement of water usage is reported in monthly NPDES reports. |
| Intake Screening | 4.2 | The hatchery water intake (Finch Creek) structure at Hoodsport Hatchery has screens that are in compliance with NOAA Fisheries screening criteria (NMFS 1995; 1996) and WDFW but are not compliant with the current NOAA fish passage guidelines. |
| Effluent Discharge | 4.2 | There is no pollution abatement pond. Vacuumed pond wastes are pumped onto a private upland disposal site and do not re-enter state waters. The hatchery operates in compliance with NPDES discharge permit guidelines (# WAG13-1011). |
| Broodstock Collection & Adult Passage | 5.1, 7.9, 2.2.3 | No adult passage above the rack on Finch Creek and, therefore, no natural production. Capture of adults takes place at the trap on Finch Creek from August through October. The summer chum population is believed to be extinct. |
| 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".

See section 1.10.

## 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), Hood Canal Salmon Management Plan, the Shared Strategy for Salmon Recovery, production and harvest objectives. | Contribute to a meaningful harvest for sport, tribal and commercial fisheries. Achieve a 10-year average of 0.27% 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 needs. |
| 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.<br><br>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 meetings between the 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. | A minimum of 500 adults (2,160) 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.<br>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 to natural and hatchery-origin fish. | Beginning with the 2003 brood (2004 release), 200,000 fingerling chinook were adipose-fin clipped/coded-wire tagged to allow for evaluation of fishery contribution, survival rates and stray levels to other Puget Sound watersheds while 1.5 million were mass marked. With co-manager agreement, WDFW plans to mass mark 2.6 million chinook and coded-wire tag/adipose-fin clip the remaining 200,000 of the 2004 brood egg take to allow monitoring and evaluation of the hatchery program fish releases and adult returns. | Returning fish are sampled throughout their return for length, sex, mass marks and coded-wire tags. |

| | | |
|---|---|---|
| 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.<br><br>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 (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<br><br>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 monitor harvests. |

## 1.11) Expected size of program.

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

For Hoodsport Hatchery, the egg-take goal is 3.1 (includes the eggs needed for the yearling program) million-fall chinook eggs. Assuming a fecundity of 4,000 eggs per female and a 60% male / 40 % female sex ratio, and a pre-spawning mortality of approximately 10%, the number of adults required to meet the egg take goal would be about 2,160. Adults in excess of escapement goals will be killed and sold.

**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** | Finch Creek (16.0222) | 2,800,000* |
| **Yearling** | | |

* The fingerling release program has been reduced from 3,000,000 to 2,800,000 beginning with the release in the spring of 2005 (2004 BY).

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

Hatchery program fingerling smolt-to-adult survival rates have averaged .27% (89-94 broodyears). The only group to be tagged since then has been the 2003 BY (see section 10.7).

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

Broodstock levels back to the hatchery rack for brood years 1995 through 2003 were 3,190, 4,653, 8,342, 10,057, 10,976, 11,646, 4,578, 4,080 and 4,634, respectively.

Based on the average smolt-to-adult survival rate of 0.27% and the new-programmed release goal of 2,800,000, the estimated adult production (goal) level would be 7,560 (total of 8,040 adults for the fingerling and yearling on-station releases).

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

1953.

**1.14) Expected duration of program.**

Ongoing

**1.15) Watersheds targeted by program.**

Finch Creek (16.0222) in Hood Canal.

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

WDFW reduced sub-yearling fall chinook release numbers at Hoodsport Hatchery from a release of 3,000,000 to 2,800,000 with prior agreement from the co-managers. This will help minimize any potential ecological risks and still meet fisheries enhancement objectives for the program, including treaty Indian fishing right entitlements, the Puget Sound Salmon Management Plan (PSSMP), the Hood Canal Salmon Management Plan (HCSMP) and the Magnuson/Stevens Act for sustainable fisheries.

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 Hoodsport 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.**

None

**-Identify the ESA-listed population(s) that may be incidentally 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 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 (WDFW 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.

In 2002, WDFW (SaSI, unpublished data) 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) (WDF 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 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. The current distinction between these two populations is based on spawning distribution as per SaSI in 2002 (WDFW, unpublished data).

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.

**Hood Canal Summer Chum:**

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 sub-littoral 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 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 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, personal 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

### 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**

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 (Puget Sound) Technical Review Team (PSTRT) 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 (in 2003, the co-manager PSTRT revised the Skokomish River viable chinook population threshold to 3,650 (1,650 natural and 2000 hatchery)).

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 that 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.

WDFW SaSI document (draft 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 h*ealthy*
2. Lilliwaup and Jimmycomelately Creeks are *critical*
3. Hamma Hamma, Duckabush, Dosewallips, Big/Little Quilcene, and Snow Creek are d*epressed*

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

Source: Summer Chum Salmon Conservation Initiative (SCSCI).

**- 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.**

See section 1.12 for smolt to adult survival for this group for the hatchery program.
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).

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

**Table 2.** 1988-2003 spawner abundance data for Hood Canal fall chinook, Hood Canal summer chum and Lake Cushman Bull Trout/Dolly Varden.

| 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 | 2,377 | 285 |
| 1993 | 1,172 | 756 | 412 |
| 1994 | 1,072 | 2,429 | 281 |
| 1995 | 1,999 | 9,462 | 250 |
| 1996 | 1,028 | 20,490 | 292 |
| 1997 | 492 | 8,972 | 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 | |

Chinook data are from WDFW chinook run reconstruction through 2002 and WDFW files (T. Johnson, personal comm.). Summer chum data are from WDFW and PNPTT (2003) (J. Ames (WDFW), letter to NOAA Fisheries, December 24, 2003). Bull trout data are from WDFW (1998) through 1996 and from D.Collins (WDFW, personnel communication) thereafter.

**- 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.**

The proportions of direct Hoodsport Hatchery-origin yearling fall chinook and listed Puget Sound wild chinook on natural spawning grounds are unknown. Mass marking has not yet been initiated at Hoodsport and most Hoodsport fall chinook are not coded-wire tagged and adipose-fin clipped (see section 10.7). Consequently, hatchery and wild fish are often indistinguishable on spawning grounds. However, 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**.

Although all hatchery chinook are not mass marked, the risk of take during broodstock collection is low because there is no adult passage above the rack on Finch Creek and, therefore, no natural production. Capture of adults takes place at the trap on Finch Creek from August through October.

**Fall Chinook:** The risks and benefits posed by hatchery-origin juvenile chinook to wild juvenile chinook will depend on the number, size, release time and stream residence time of the hatchery fish. Hoodsport hatchery releases approximately 2.8 million fingerling smolts (reduced from 3.0 million in 2004 for release in 2005) annually and production will be managed to minimize potential adverse effects to listed fall chinook.

*Competition and Predation*: Hoodsport fingerling chinook 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 which 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 Hoodsport Hatchery 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 3.** 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 (the U of W at Big Beef Creek program releases eliminated in 2004; 200,000 sub-yearlings).

| 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] | 120,000 |

[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 by Long Live the Kings, and 2,800,000 fingerlings released from Hoodsport Hatchery into Finch Creek by WDFW (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 assessment of risks to wild chinook from hatchery chinook is summarized below.

**Table 4.** 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 |

* Note: There is no freshwater estuary on Finch Creek. The hatchery outfall is directly on Hood Canal so there is no freshwater residency for Hoodsport chinook.

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 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. If hatchery and wild chinook juveniles occupy 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.

*Behavior modification*: 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.

*Disease Transmission*: 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 Hoodsport Hatchery 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).

**Summer Chum:** The Hoodsport 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. Summer chum 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 Hoodsport fingerling chinook in June. 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 Hoodsport Hatchery 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 Hoodsport Hatchery chinook when these fish are released in May is unknown. 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.

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 Hoodsport Hatchery chinook.

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

Because hatchery-origin and listed wild chinook could not generally be distinguished in the trap or the adult holding pond, we do not know the numbers of listed wild chinook captured, injured or killed at Hoodsport (see section 10.7).

**-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 listed wild Puget Sound chinook cannot be quantified since they cannot be distinguished from unmarked Hoodsport Hatchery chinook. If listed Puget Sound chinook are included in the hatchery broodstock, the likely sources of take resulting from Hoodsport Hatchery operations are broodstock collection, injury or mortality during spawning of adults, sampling of carcasses for scales, genetic stock identification, injury or mortality during incubation and rearing or injury or mortality during on-station release.

Worst-case scenarios would include hatchery broodstock collection that consists only of listed Puget Sound chinook, 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) the chinook fingerlings 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). The programmed release goal was reduced from 3,000,000 to 2,800,000 in 2004 (2005 release).

# 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 Hoodsport 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 use 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.

*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 at each hatchery location and to minimize changes in local-origin stock characteristics associated with continuous, year-to-year transfer and incorporation of non-local salmonid stocks (WDFW 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*. NPDES permits set forth allowable discharge criteria for hatchery effluent and define 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 Hatchery Reform Project, the 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 mortality. 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.

The program at Hoodsport has contributed to the Puget Sound 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 and the Strait of Juan de Fuca treaty troll fishery

The following table (table 5) shows the total fisheries contribution of the Hoodsport fingerling program for broodyears 1989-1994 and the proportion of that total contributed to different fisheries.

**Table 5. Hoodsport Fingerling Chinook Brood Years 1989-1994 Fisheries Contributions**

| Brood Year | Program Release # | # of Fish Program Contri. | Proportion (%) of Total Catch | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | NMFS Groundfish Observ. | Can. Ocean Troll | AK Ocean Troll | OR Ocean Troll | WA Ocean Troll | WA Treaty Troll | Can. Estuarine | PS Comm. (Treaty and Non Treaty) | Can. Ocean Sport | WA Ocean Sport | PS Sport | WDFW Test Fishery | Misc. Fishery Contri. (<1%) |
| 1989 | 828,500 | 875 | 0.0 | 27.1 | 0.0 | 0.0 | 10.3 | 11.9 | 9.3 | 0.0 | 5.0 | 0.0 | 35.6 | 0.0 | 0.8 |
| 1990 | 863,700 | 975 | 0.0 | 13.0 | 0.0 | 0.0 | 3.9 | 2.0 | 0.0 | 2.3 | 21.1 | 0.0 | 56.9 | 0.0 | 0.8 |
| 1991 | 876,500 | 986 | 0.0 | 35.5 | 0.0 | 0.0 | 0.0 | 4.2 | 20.5 | 0.0 | 9.2 | 0.0 | 30.6 | 0.0 | 0.0 |
| 1992 | 809,900 | 294 | 0.0 | 0.0 | 0.0 | 0.0 | 5.8 | 24.7 | 0.0 | 6.5 | 27.6 | 0.0 | 35.4 | 0.0 | 0.0 |
| 1993 | 834,100 | 1,517 | 0.0 | 9.0 | 0.0 | 3.6 | 0.0 | 9.2 | 4.4 | 2.4 | 34.4 | 1.5 | 35.6 | 0.0 | 0.0 |
| 1994 | 1,755,945 | 656 | 6.5 | 3.1 | 2.2 | 0.0 | 2.9 | 0.0 | 6.9 | 0.0 | 3.3 | 0.0 | 72.8 | 2.2 | 0.0 |
| **Avg.** | **994,774** | **884** | **1.1** | **14.6** | **0.4** | **0.6** | **3.8** | **8.6** | **6.8** | **1.9** | **16.7** | **0.3** | **44.5** | **0.4** | **0.3** |

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 MU 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.

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 west side 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. Gravel aggradations and removal have been problems in the lower Big Quilcene.

Summer chum: 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 west side 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.

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.

**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 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 Hoodsport 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 marine and nearshore 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
- Coho salmon

Rearing and migrating adult chinook originating through the program may also serve as prey for large, mammalian predators in marine and nearshore marine areas 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 and Hood Canal basin through natural and hatchery production. Juvenile fish of these species may serve as prey items for the chinook during their migration 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.

*(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.**

Hoodsport Hatchery: Water for rearing fall chinook fingerlings at Hoodsport Hatchery comes from Finch Creek. Finch Creek is mostly spring-fed with additional run-off during rainy periods. Flows vary from 15 to 30 cfs with water temperatures ranging from 41 to51 degrees Fahrenheit. Water quality in Finch Creek has deteriorated because of failing septic systems along Finch Creek. This has resulted in a beach closure to shellfish harvest at the mouth of Finch Creek due to pollution. Saltwater is supplied to Hoodsport Hatchery via two 20 HP vertical turbine pumps capable of pumping 2000 gallons per minute (gpm). Seawater is drawn through a pipeline connected to an intake located 80 feet deep in Hood Canal. Water right for the seawater is 8.8 cfs. Seawater from Hood Canal is added to the release ponds approximately 3 days prior to release. This is done in order help acclimate the fingerlings to Hood Canal salinity thus improving survival.

**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.**

As mentioned above, water for rearing fall chinook fingerlings at Hoodsport Hatchery comes from Finch Creek. The water right (permit #' S2-20588) for Finch Creek is 17.4 cubic feet per second (cfs). The hatchery water intake (Finch Creek) structure at Hoodsport Hatchery is not compliant with current NOAA fish passage criteria but is in compliance with NOAA Fisheries screening criteria (NMFS 1995; 1996) and WDFW. This should minimize any risk that wild juvenile chinook might enter the freshwater intakes. There is no pollution abatement pond. Vacuumed pond wastes are pumped onto a private upland disposal site and do not re-enter state waters. The hatchery operates in compliance with NPDES discharge permit guidelines (# WAG13-1011).

# SECTION 5. FACILITIES

**5.1) Broodstock collection facilities (or methods)**.

Hoodsport Hatchery: Broodstock are collected by installation of removable racks installed in a permanent weir in Finch Creek. Fish enter an adjacent fish ladder that leads them to three adult holding raceways with dimensions of 13' x 205' X 5'. The racks are installed on August 1 and removed in early December at the conclusion of the chum run.

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

Hoodsport 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.**

Hoodsport Hatchery: Adult broodstock are held in adult holding raceways until they are spawned. Spawning facilities are located at the head end of the adult raceways.

**5.4) Incubation facilities**.

Hoodsport Hatchery: Hood Canal fall chinook eggs are incubated to the eyed stage in vertical stack incubators at 5 pounds/tray. Then they are shocked, picked, and enumerated back into the vertical incubators at 5 pounds per tray (approximately 9000 chinook eggs per tray) and artificial substrate is added to the trays for hatching.

**5.5) Rearing Facilities**

Hoodsport Hatchery: After hatching, chinook fry are removed from the vertical incubators and placed in 7- 20' X 80' X 2.5' raceways at a maximum rearing density of .85 pounds per cubic foot (lbs/cu. ft.), at which point they are transferred to the release ponds.

**5.6) Acclimation/release facilities.**

Hoodsport Hatchery: As they grow, chinook juveniles are split into the combination adult holding/juvenile release ponds (15 A,B, &C) and 3 raceways for rearing in ambient Finch Creek water. Seawater is pumped into these ponds for approximately 1 week prior to release to acclimate the fish to seawater. Fingerlings accustomed to seawater prior to release tend to disperse more evenly and quickly from the Finch Creek release site than fish that are not acclimated to seawater. Hatchery exposure to seawater is limited to approximately 1 week to reduce the risks of Vibrio (*Vibrio anguilarum* sp.) outbreaks. Maximum density at release is 1.35-lbs/cu. ft.

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

No operational difficulties or disasters have taken place in recent years that led to significant fish mortality.

**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.**

Hoodsport 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. Fish rearing is conducted in compliance with the Co-managers Fish Health Policy (1998). Adherence to artificial propagation, sanitation and disease control practices defined in the policy reduced the risk of fish disease pathogen transfer to listed natural-origin chinook salmon.

# 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.

The Hoodsport stock was started in 1952 with a release of Dungeness spring /summer chinook. This was followed by several years of Soos Creek Hatchery (Green River) releases until the stock became (largely) self-sustaining. Additional inputs 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 individual hatchery stocks to the Hoodsport stock is unclear. Genetic analysis of the Hoodsport population showed similarities to the Marblemount (Skagit River) Hatchery fall chinook population, which may reflect the mixed origin of both populations.

WDFW shall continue the use of gametes procured from fall chinook salmon adult volunteering to the Hoodsport Hatchery to affect their respective programs.

## 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/Hoodsport 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 (Green River) derivative. We do not know the origins of the Trask River chinook stock. These fish were incorporated into the Hoodsport stock because they tended to be large.

Hoodsport Hatchery has been self sufficient for 11 of the past 13 years (1988 to 2000). No intentional selection for any characters such as size or run timing has been conducted.

**6.2.2) Annual size.**

Wild chinook are not intentionally collected for broodstock. It is not possible to distinguish wild chinook from unmarked hatchery fish at this time (fall of 2004). If wild chinook enter the trap and adult holding pond, they will likely be spawned. The number of wild fish spawned, if any, is not known. Broodstock size is 2,160 adults for programmed egg take (includes adults needed for yearling program).

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

Past levels of natural fish in broodstock are unknown. As mentioned, it is not possible to distinguish wild chinook from unmarked hatchery fish, so if wild chinook enter the trap and adult holding pond, they will likely be spawned. The number of wild fish spawned, if any, is not known.

**6.2.4) Genetic or ecological differences**.

No genetic or ecological differences are known.

**6.2.5) Reasons for choosing.**

The Hoodsport Hatchery broodstock was the closest, locally adapted stock and was selected for that reason.

**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.**

Hoodsport chinook are not considered a viable population segment in the Puget Sound ESU nor is the hatchery population included in NOAA Fisheries Hatchery Listing Policy (June 28, 2005).
No special risk aversion measures are in place to protect listed wild fish since unmarked hatchery and any natural-origin 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 100% of 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 fall chinook salmon adults volunteering to the Hoodsport Hatchery to affect the program.

Adult broodstock are collected at tidewater by installation of racks in Finch Creek, thus blocking upstream passage of adults. This forces adult broodstock to enter the fish ladder where they are trapped, sorted and held in three concrete raceways. The trap at Hoodsport Hatchery is operated from August 1 through the first week of December. The fall chinook are trapped between August 1 and mid-September. The trap consists of an in-stream weir with a removable rack to allow upstream passage between the 2nd week of December and July 31st. On "odd numbered" years, when pink salmon are returning, the barrier is installed the end of June. When the racks are installed fish are diverted to the adjacent fish ladder that leads them into the adult holding raceways. Fish can be diverted into any of 3 raceways and kept separate based on run timing, species, etc. There are no known features of this trap that would lead to the collection of a non-representative sample of broodstock. The trap is only closed temporarily when the maximum carrying capacity is reached.

**7.3) Identity.**

Unmarked hatchery-origin chinook cannot be distinguished from wild fish at this time.

**7.4) Proposed number to be collected:**

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

For Hood Canal the egg-take goal is 3.1 million fall chinook eggs. Assuming a fecundity of 4,000 eggs per female and a 60%males: 40% females sex ratio, and a pre-spawning mortality of < or = 10%, the number of adults required to meet the egg take goal would be about 2,160.

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

| Year | Adults | | | Eggs | Juveniles |
|---|---|---|---|---|---|
| | Males | Females | Jacks | | |
| **1991** | 1,449 | 1,118 | 15 | 5,249,000 | |
| **1992** | 564 | 367 | 7 | 1,608,500 | |
| **1993** | 1,226 | 779 | 15 | 3,468,000 | |
| **1994** | 980 | 886 | 12 | 3,780,000 | |
| **1995** | 702 | 864 | 18 | 3,888,000 | |
| **1996** | 1,346 | 1,271 | 39 | 5,426,600 | |
| **1997** | 2,080 | 1,994 | 9 | 8,293,800 | |
| **1998** | 1,631 | 1,595 | 8 | 6,661,400 | |
| **1999** | 804 | 860 | 10 | 3,322,000 | |
| **2000** | 993 | 861 | 16 | 3,990,000 | |
| **2001** | 508 | 511 | 20 | 2,303,150 | |
| **2002** | 744 | 720 | 6 | 3,637,403 | |
| **2003** | 730 | 769 | 20 | 3,487,913 | |

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

All returning fall chinook are trapped at the Hoodsport Hatchery. There are no allowable upstream escapement levels at Hoodsport. Adult fall chinook males in excess of a 1:1 ratio with females are killed and sold to the contract vendor or donated for tribal ceremonial use, food banks, nutrient enhancement, etc. Females with green, bloody, or water-hardened eggs are culled out of the spawning population. Ripe females, in excess of program need, are sold or donated in the same manner as excess males. The co-managers in 2004 reduced the size of the program from 3 million to 2.8 million to provide acceptable loading and density levels as well as reduce surplus hatchery fish.

**7.6) Fish transportation and holding methods.**

Not transported.

**7.7) Describe fish health maintenance and sanitation procedures applied**.

Fish health and sanitation measures are consistent with the Co-manager's Fish Health Policy (1998). Brood stocked females used for the yearling program at Hoodsport Hatchery 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. A similar approach is being considered for the broodstock that make up the yearling program for Rick's Pond that originates from George Adams Hatchery.

Representative samples of broodstock from Hoodsport Hatchery are routinely sampled for virus as required by this Co-Managers Fish Health Policy (1998).

**7.8) Disposition of carcasses.**

The disposition of chinook carcasses at Hoodsport Hatchery 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, spawned and unspawned, may be sold to a contracted buyer, donated to a food bank or donated to the Forest Service 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.**

Hoodsport chinook are not considered a viable population segment in the Puget Sound ESU nor is the hatchery population included in NOAA Fisheries Hatchery Listing Policy (June 28, 2005).
Since the hatchery chinook have not been 100% mass marked (adipose-fin clip only), the hatchery fish can not been distinguished from the natural-origin chinook. No special risk aversion measures are in place at this time to protect natural-origin fish since unmarked hatchery and wild fish cannot be distinguished.

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.

# 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 1:1 with the females. Jacks are spawned at no more than 2 % of the total males as required by the WDFW Hatchery Spawning Guidelines (Seidel 1983) and HSRG guidelines (2004).

**8.3) Fertilization.**

Eggs and milt are mixed and allowed to sit for 10 minutes. Fertilized eggs are pooled and taken into the hatchery for distribution into the incubators. All eggs are disinfected with iodine at 100 ppm for 1 hour during water hardening as required by the Co-manager's Fish Health Policy (1998).

**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.**

Hoodsport chinook are not considered a viable population segment in the Puget Sound ESU nor is the hatchery population included in NOAA Fisheries Hatchery Listing Policy (June 28, 2005).

Mating cohorts are randomly selected throughout the entire run time and at least 500 adults (up to 2,160) 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.

Hoodsport (see section 7.4.2 for number of eggs taken).
Average green egg to fry survival from 1998 through 2002 was 90.4%.

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

Program intent is not to exceed egg take goals established in the Future Brood Document. If survival is greater than anticipated, excess fry will be planted in landlocked lakes.

#### 9.1.3) Loading densities applied during incubation.

Hoodsport Hatchery green eggs are eyed in vertical incubators at 5.5 lbs. per tray and hatched at 7,500 eggs per tray in artificial substrate with an inflow of 4 gallons per minute (gpm). Average green egg size is 1,700 eggs per pound.

#### 9.1.4) Incubation conditions.

At Hoodsport Hatchery, eggs are incubated and hatched on surface water from Finch Creek. Incubator trays are "rodded" as needed during dirty water conditions. Temperatures during incubation vary from 41 to 45 degrees Fahrenheit. Water flows are visually checked daily.

#### 9.1.5) Ponding.

Fry are forced ponded when yolk absorption is 95 %+ complete. At Hoodsport Hatchery, ponding occurs between January 1 and the first week of February. Accumulated Temperature Units (TU's) at ponding are 1,680.

#### 9.1.6) Fish health maintenance and monitoring.

Eggs at Hoodsport are treated with Paracide-F (Formalin) at a rate of 1: 600 for 15 minutes daily beginning 24 hours after spawning until 3 days prior to hatching. The Area Fish Health Specialist monitors fish health on a routine basis. 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.**

No special risk aversion measures are in place to protect listed wild fish during incubation since unmarked hatchery and wild fish cannot be distinguished at this time.

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.**

Hoodsport:
Average fry to fingerling smolt survival from 1998 through 2002 was 94.9%.

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

In general, loading and density levels conform to standards set forth in Fish Hatchery Management (Piper et al. 1982).

**9.2.3) Fish rearing conditions**

Hoodsport Hatchery fish are reared in ambient surface water from Finch Creek and then acclimated to seawater a week prior to release to minimize stress of seawater entry (there is no buffering estuary at Hoodsport). Waste is vacuumed out of raceways weekly. Release ponds cannot be cleaned during rearing. Pond flows are measured weekly and feed levels adjusted accordingly. Mortality is removed daily and screens are cleaned daily. Maximum and minimum temperatures are also measured daily. Loadings are kept at or below standards set forth in Piper (1982).

**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 started on BioDiet Starter and switched to BioDiet Grower. Manufacturer recommendations are followed regarding when to switch pellet sizes. Feed is fed by hand. Daily feeding frequency is gradually decreased from 5 times per day at ponding to 1 time per day/5 days per week at release at a rate between 1.7 and 2.5% B.W./day.

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

Detailed hatchery practices and operations designed to stop the introduction and/or spread of any diseases are followed as per the Co-Managers Fish Health Policy (1998).

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

Physical appearance and behavior are used to judge smolt development. Gill ATPase activity is not monitored.

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

No "NATURES" rearing is used for the fingerling 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.**

Hoodsport chinook are not considered a viable population segment in the Puget Sound ESU nor is the hatchery population included in NOAA Fisheries Hatchery Listing Policy (June 28, 2005).
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** | 2,8000,000 | 80 | June | Finch Creek |
| **Yearling** | | | | |

Note: 80 fpp ~ 80 mm fork length

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

**Stream, river, or watercourse:** Finch Creek (16.0222)
**Release point:** Finch Creek at its' confluence with Hood Canal
**Major watershed:** Hood Canal
**Basin or Region:** Hood Canal (Puget Sound)

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

**Hood Canal Hatchery:**

| Release year | Eggs/ Unfed Fry | Avg size | Fry | Avg size | Fingerling | Avg size (fpp) | Yearling | Avg size |
|---|---|---|---|---|---|---|---|---|
| **1992** | | | | | 876,500 | 66 | | |
| **1993** | | | | | 809,900 | 64 | | |
| **1994** | | | | | 834,100 | 65 | | |
| **1995** | | | | | 1,755,954 | 69 | | |
| **1996** | | | | | 2,758,150 | 71 | | |
| **1997** | | | | | 4,355,973 | 80 | | |
| **1998** | | | | | 3,168,896 | 75 | | |
| **1999** | | | | | 3,025,396 | 50 | | |
| **2000** | | | | | 3,110,853 | 80 | | |
| **2001** | | | | | 3,059,892 | 76 | | |
| **2002** | | | | | 2,930,377 | 80 | | |
| **2003** | | | | | 3,047,111 | 92 | | |
| **Average** | | | | | 2,477,758 | 72 | | |

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.**

Hoodsport Hatchery fingerling chinook are forced released in early June if no water or pond constraints. Seawater is pumped into the release ponds for approximately 1 week prior to release to acclimate the fish to seawater. Fingerlings accustomed to seawater prior to release tend to disperse more evenly and quickly from Finch Creek release site than fish that are not acclimated to seawater. Hatchery exposure to seawater is limited to approximately 1 week to reduce the risks of Vibrio (*Vibrio anguilarum* sp.) outbreaks. Maximum density at release is 1.35-lbs/cu. ft.

**10.5) Fish transportation procedures, if applicable.**

No fish are transported for off-station release.

**10.6) Acclimation procedures**.

See 10.4. Finch Creek is the freshwater source for the Hoodsport Hatchery. The fish are reared on Finch Creek water until about a week prior to release. Seawater from Hood Canal is introduced into the raceways to acclimate the fingerlings to saltwater prior to release.

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

Beginning with the 2003 broodyear (2004 release), 200,000-fingerling chinook were adipose-fin clipped/coded-wire tagged (AD+CWT) to allow for evaluation of fishery contribution, survival rates and stray levels to other Puget Sound watersheds while 1.5 million were mass marked. For the 2004 broodyear (2005 release), WDFW mass marked (adipose-fin clip only) 2,225,000 and AD+CWT 200,000 chinook fingerlings.

**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 Hoodsport 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, in accordance with the Co-managers Fish Health Policy, examines representative fish.

**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. WDFW also has emergency response procedures for providing back-up pumps, transport trucks, etc. in cases of emergency. In cases of severe flooding the screens are not pulled because floodwaters rise to the point where they breach the ponds. Past experience has shown that the fish tend to lie on the bottom of the pond during flooding events and only those that are inadvertently swept out are able to leave. During severe drought conditions, fish may be released early and directly into the mouth of Finch Creek to prevent fish loss.

**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 in June as fingerling smolts (70 fpp).

Fingerling chinook released from Hoodsport are acclimated to seawater prior to release in early June (if no water or pond constraints). This causes the fingerlings to disperse quickly and not concentrate in the near-shore waters post-release. This may serve to minimize near-shore interactions with wild chinook. In addition, 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 (USFWS 1994). In 2004, the programmed release number was reduced from 3.0 million to 2.8 million.

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 and interact with listed wild fish. The average CV for release years' 1995-2000 (no 2001-02 data) was 5.22%.

We know nothing 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 Hoodsport fingerling chinook in June. 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 is identified (see section 10.7) 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.

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

The maximum number of spawners needed to meet the egg take has been determined to be 2,160 (864 females and 1,196 males). Because fish are not sorted by sex at the time they enter the adult pond from the trap, more than 2,160 chinook will be collected to assure that the program needs are met. 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.

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

There is no formal process for reviewing program goals and production objectives. Typically WDFW Region 6 staff and PNPTC/tribal staff communicate if production changes are proposed. Production changes involving the Regional Fisheries

Enhancement Group (RFEG) or volunteer co-op groups are communicated through the WDFW Region 6 office. The changes in goals and production levels that result from these discussions are reflected in the Future Brood Document compiled by WDFW. Recently NOAA Fisheries has also become involved in discussions of changes to production at Hoodsport Hatchery affecting the RFEG program.

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

Risk Indicator 1: Reduce hatchery broodstock collection impacts on wild fish

In order to minimize collection of wild chinook for spawning, they must be separable from all hatchery chinook. This is currently not possible for two reasons. First, we cannot currently distinguish unmarked hatchery fish from wild fish. Second, we have no way to physically separate the two from entering the hatchery. There is no sorting capability either at the adult trap or in the adult holding pond.

The problem of distinguishing wild from hatchery fish could be addressed by marking all hatchery fish (see section 10.7). 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.

Risk Indicator 2: Reduce interactions between hatchery and wild juvenile fish.

This would require monitoring of hatchery smolts following release from Finch Creek and determination of the temporal and spatial distribution of juvenile hatchery fingerlings and wild salmonids.

Risk Indicator 3: Maintain hatchery stock integrity and genetic diversity.

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

Risk Indicator 4: Meet disease prevention and control standards in Co-managers Fish Health Policy.
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.

### 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 and funding to count hatchery adult returns and determine egg take needs are available.

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

Staff, funding and logistical support that are not available:

1: Funding in 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 that overlap.

Through recommendations from the Hatchery Scientific Review Group (HSRG) funding may become available to monitor and evaluate the above two.

## 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.

Monitoring and evaluation, if funded, will be undertaken in a manner that will not elevate risk to any listed salmonid species.

# SECTION 12. RESEARCH

The only research being conducted in direct association with the Hoodsport Hatchery 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 Hoodsport and George Adams hatchery fall chinook stocks and naturally spawning fish in the Skokomish, Hamma Hamma, Duckabush, Dosewallips and Quilcene rivers.

Sampling at Hoodsport 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 from 100 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".**

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 NOAA Fisheries 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 NOAA Fisheries, 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.

## SECTION 13. ATTACHMENTS AND CITATIONS

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## SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

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

*Chinook*

| | |
|---|---|
| ESU/Population | Puget Sound Chinook *(Oncorhynchus tshawytscha)*- Hood Canal |
| Activity | Hoodsport Fall Chinook Yearling Program |
| Location of hatchery activity | Mouth of Finch Creek (16.0222), Hood Canal |
| Dates of activity | Fingerlings: August- May<br>Yearlings: May- May |
| 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) | - | - | - | - |
| Other take (indirect, unintentional) (h) | - | Unknown | Unknown* | - |

* Because all hatchery chinook are not mass marked, any wild strays that may enter holding pond can not be distinguished.

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.