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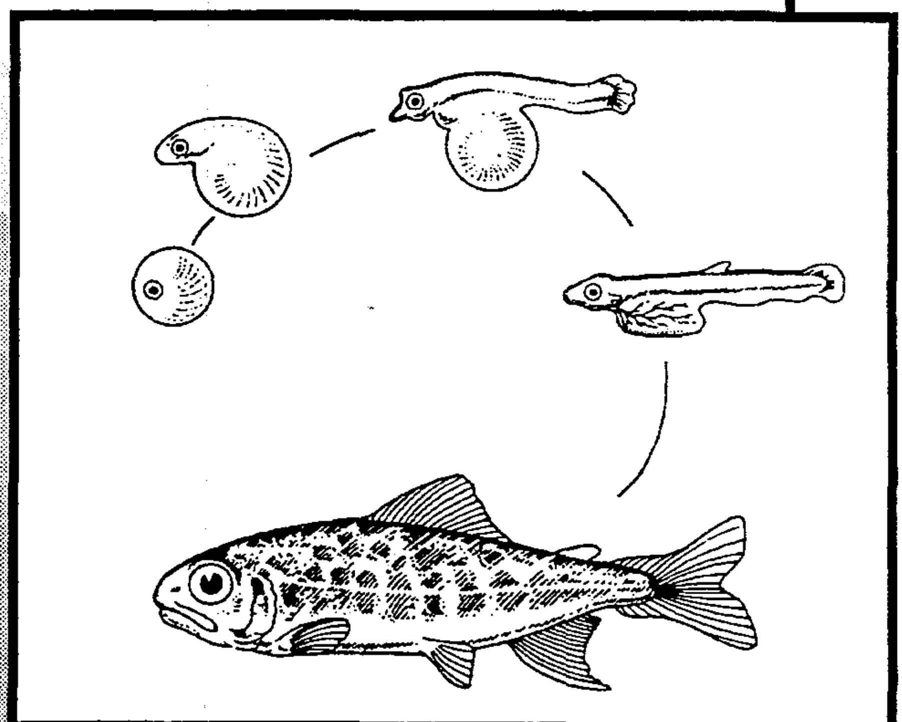
Hatchery Operation Plans and Performance Summaries



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Washington Department of
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Hatchery Operation Plans and Performance Summaries

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(Based on 1993Future Brood Document)

INTRODUCTION

The use of artificial culture to propagate Pacific salmon, steelhead, and trout has a long and diverse history. The first salmon hatchery in Washington was built along the Kalama River in 1895. By 1900, seventeen salmon hatcheries were operating statewide. The primary purpose of these hatcheries was to restore dwindling commercial, and later commercial and recreational, catches of salmon. They were also used to mitigate for lost natural production caused by hydroelectric development.

The first salmon hatcheries were owned and operated by commercial canneries, counties or even townships. Because there was no integrated approach to fish husbandry, fish culture techniques and production decisions were often inconsistent. Today, all production at Washington Department of Fish and Wildlife (WDFW) hatcheries is integrated with management objectives (harvest, restoration, supplementation). In this process, hatchery production is determined by societal needs and considerations, court ordered mandates for allocation, mitigation for lost natural production, and politics.

Operations at each WDFW hatchery are governed by a "hatchery rearing program". This program specifies the number of each species or stock of fish reared, when, where, how, and at what size, these fish will be released or transferred to other hatcheries or citizen-groups interested in rearing fish, and how many eggs from returning adults must be collected each year to meet the production goals. The "hatchery rearing program" is developed annually through the creation of the Future Brood Document (FBD). The FBD translates management objectives into a guide which is agreed upon by the Fish Management and Hatchery Programs within WDFW, and representatives of the treaty tribes of Washington. Within the FBD are production schedules for several broods of fish. For example, within one calendar year, a hatchery may rear two age classes of juvenile coho, one age class of chinook and chum, and collect eggs from returning adults in the fall. For each calendar year, the FBD lists rearing, release, transfer, and egg collection goals for all species and stocks at each hatchery or cooperative rearing project.

To meet fish management objectives, and ensure high quality fish production, operating WDFW hatcheries requires integrating maintenance of hatchery facilities, fish health monitoring and treatment, assessment of hatchery operations and development of new husbandry techniques.

To consistently produce high quality fish at WDFW hatcheries, we have developed and refined protocols for broodstock collection, spawning, incubation, feeding, rearing and release methods, fish health strategies, and many other fish husbandry techniques. These protocols change when new information and technologies become available and in response to concerns about interactions between hatchery reared fish and naturally produced fish.

The Hatchery Operation Plan and Performance Summaries (HOPPS) were developed to describe the physical characteristics of each hatchery, it's purpose for operating, and the production goals for each species. Furthermore, six objectives have been developed that outline how the hatchery will attempt to achieve these goals while operating responsibly within the ecosystem. A performance summary details the performance of each hatchery in achieving the goals listed in the FBD, meeting compliance with National Pollution Discharge and Elimination Permit System (NPDES) requirements, and various rearing and fish health goals established by the WDFW's Hatchery Program. The HOPPS allow audits of program compliance and assure continued program improvement. Furthermore, the HOPPS mesh with the Salmon and Steelhead Stock Inventory (SASSI) by providing additional information on stocks of salmon, trout and steelhead cultured at WDFW hatcheries.

This issue of the HOPPS includes former Washington Department of Wildlife (WDW) hatcheries. The WDW hatchery system was operated differently than former WDF hatcheries. As a result, we modified some measures in the Performance Summaries to fit the format of the database of the former WDW hatcheries. In future editions of the HOPPS, all hatchery programs will be described in a similar manner, and record-keeping will be standardized.

HOW TO USE THE HATCHERY OPERATIONAL PLANS

General Information

The HOPPS are divided into three volumes representing unique geographic areas of Washington. Volume I (2) includes Puget Sound and Strait of Juan de Fuca hatcheries and Volume II (2) the Washington coastal hatcheries. Volume III (1) documents non-anadromous fish production at WDFW Columbia River hatcheries. Production of anadromous fish at Columbia River hatcheries has already been published as: "Operation Plans for Anadromous Fish Production Facilities in the Columbia River Basin, Volume IV", by the Bonneville Power Administration.

In 1995, the Hatchery Program of the WDFW created hatchery complexes. Because of this change in hatchery management, the names of several hatcheries were changed. The organization of Volume I (2) is by hatchery complex, from north to south. Figure 1 shows the location of WDFW hatcheries, and Table 1 lists the hatchery complexes with name changes.

We will update the HOPPS each year to reflect the most recent five year average of hatchery performance, compared to annual changes in production goals outlined in the Future Brood Document.

This issue of the HOPPS compares hatchery performance to FBD goals for 1989-1993.

The following explanations will help the reader understand this document.

Introduction: The introduction describes where the facility and satellite facilities (if any) are located and briefly describes the physical layout of the hatchery.

Purpose: This section describes why the hatchery operates. It will state if the hatchery is operated to produce fish for harvest, and if the hatchery is used in restoration efforts for some stocks of salmon, steelhead, or trout.

Goals: This section defines, in descending order of priority, the production goals for the hatchery.

Objectives: The six objectives we have identified relate to hatchery operations in three ways.

The first is in meeting quantitative goals, for example, are we capturing enough adults or maintaining an adequate captive broodstock to provide enough eggs to produce the number of fish we are programmed to release. The second is the way we culture the fish. If we are doing a good job of rearing fish, then survival at any life stage should be high, the genetic fitness of the fish should be high, and the fish we release should be of good quality. The third is how we operate our hatcheries in relation to the ecosystem. We want to release fish that will not seriously compete with, or prey on, natural fish, and we want to comply with clean water standards. In the section "Current Practices to Achieve Objectives" we detail how the hatchery intends to meet each objective, and in the "Performance Summaries we detail how the hatchery has met each measure within the objective. The six objectives are:

Objective 1, "Hatchery Production", lists the most current production program for each species and stock at each hatchery. For this issue of the HOPPS, the **1993 Future Brood Document** is used.

Objective 2, "Minimize Interactions With Other Fish Populations Through Proper Rearing and Release Strategies", relates to concerns that releasing large numbers of non-smolted fish may affect natural fish populations rearing in the same stream. Most hatchery programs rear and release several thousand to several million fish of a given species. These releases usually occur from May to June each year. Increased fish size and low condition factors must be obtained in a hatchery population before the fish will exhibit strong migratory behavior. However, the variation in size within a population of fish changes with fish culture practices, and this size variability can affect the proportion of the population that will readily migrate. If there is large size variation in a population and the programmed release size is barely attained, more fish may reside in the stream after release. Therefore, the goals for size-at-release are set slightly larger than the known minimum size to ensure a high percentage of migrants.

The method of releasing fish can also affect the proportion of migrating fish. There are several ways to release fish from a hatchery. These include "forced" releases, where all fish of a single species are released within a few days; "split" releases, where groups of several hundred to thousands of fish are released sequentially; and "volitional" releases, where screens of rearing containers are removed, when smolt behavior becomes apparent, and the fish are allowed to migrate for one week to several months. The type of release used depends on the species, the location of the hatchery, the type of rearing container and whether it is needed for rearing other fish, the physiological readiness of the fish, and the goals of the rearing program. Forced releases are usually done when fish exhibit strong migratory behavior, or the containers are needed immediately after release for rearing other fish, or when there is minimal concern about residualization after release. Split releases are used to reduce loadings in rearing containers. Fish released by this method may be either migrant or non-migrant fish. Volitional releases are particularly useful when many fish are reared in large rearing ponds. In a volitional release, only smolting fish exit; the remaining population stays and continues feeding until they are ready to migrate. A volitional release has two main advantages. First, there is more efficient use of rearing space because loadings are not exceeded, and second, a larger percentage of the population is released as migrants, possibly reducing residualism and negative interactions with wild fish.

Objective 3,"Maintain Stock Integrity and Genetic Diversity of Each Unique Stock Through Proper Management of Genetic Resources", responds to the concern of maintaining genetic fitness and diversity. Stocks of fish reared at each hatchery usually originate from one of two sources: 1) Native fish that inhabited the stream or the watershed where the hatchery was built, and have been maintained by successive returns and releases from the hatchery; 2) Importation of a non-native stock to the hatchery. When the hatchery fails to collect enough eggs from returning adults to meet production goals, eggs or fish from a hatchery with "surplus"[1] eggs will be imported. In most cases, the imported stock is from a nearby hatchery in an adjacent watershed. For example, Green River fall chinook eggs or fish have been imported to several other hatcheries in Puget Sound. In some cases the hatcheries that received these initial introductions, now collect enough eggs from returning adults to sustain their production program, and in other cases annual returns of adults are inadequate and eggs must be continually imported. Nonetheless, if an imported stock has been in a watershed for enough generations, it may become locally adapted to that watershed and future introductions from outside sources could be detrimental to the population.

Patterns of genetic diversity and local adaptation are important in maintaining productive fish stocks. Genetic diversity among stocks can be diminished by excessive straying (gene flow), or creating genetically homogenous populations in a broad geographic area. We

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1 The term "surplus" infers that a hatchery collects more eggs than needed to meet the program goals at that hatchery. Some hatcheries collect eggs to meet their own program releases as well as to supply eggs or fish to hatcheries within the region.

attempt to maintain genetic diversity in our salmon hatcheries by development and adherence to "stock transfer guidelines", which were established in the early-1980s. These guidelines list "acceptable" stocks (on a priority basis, contingent on genetic similarity) for importing to each hatchery. First priority is given to fish returning to the hatchery. In contrast, steelhead programs have in the past relied on a central stock of fish at a single location to supply regional planting goals. If the egg collection goal was not met from this central facility, then eggs were obtained from returns (of the same stock) to other hatcheries.

Whatever the origin of a stock, it is important to preserve the genetic fitness and diversity of hatchery reared fish. Fitness can be reduced or lost through several processes, the most common being selective breeding. Both diversity and fitness can be maintained through proper breeding practices (e.g. using breeding populations of more than 500 individuals), responsible stock transfer policies (e.g. no introductions of non-native stocks), and allowing local adaptation of imported stocks.

Objective 4, "Maximize Survival at All Life Stages Using Disease Control and Disease Prevention Techniques. Prevent Introduction, Spread, or Amplification of Fish Pathogens", addresses the importance of producing healthy fry, smolts, and catchable trout. Equally important is preventing the introduction, spread and amplification of fish pathogens which might negatively affect the health of hatchery and naturally reproducing populations. WDFW has programs to control and prevent diseases at all fish rearing facilities. Fish health is affected by the presence of pathogens, environmental conditions, and stress fish experience during rearing. The presence of pathogens can be controlled to some extent by good hatchery practices, such as disinfection at the time fish are transferred, or through the use of antibiotics or germicidal agents. Stress can be reduced by rearing the proper number of fish per rearing container, and by reducing the handling of fish when water temperatures are elevated or fish are at sensitive life stages.

Factors affecting the environment in which the fish are reared are often difficult to control. Hatcheries are vulnerable to land use activities that diminish water quality, and to shedding of pathogens by fish above the hatchery intake. Hatcheries that depend on groundwater can be affected by drought or extensive water withdrawals by both the hatchery or other users.

Objective 5, "Conduct Environmental Monitoring to Ensure that Hatchery

Operations Comply with State and Federal Water Quality Standards", recognizes the importance of complying with standards established through the NPDES. As a natural resource agency, it is important that WDFW set an example for hatchery practices which minimize potential impacts to the ecosystem. Environmental monitoring also allows us to track changes in the quality of water flowing into the hatchery which may be affected by urban development, logging, and other watershed disturbances. Because health and survival of fish are depend on water quality, this knowledge helps us make informed decisions regarding permit applications and long term planning which might impact water quality.

Some of the hatcheries operated by WDFW are not required to comply with NPDES standards because they rear less than 20,000 pounds of fish annually. Also, net pen operations were excluded from compliance as of 1993.

Objective 6, "Communicate Effectively With Other Salmon, Trout, and Steelhead Producers in the Region", recognizes that hatchery production, fish health concerns, and harvest issues are shared or co-managed with various tribal and federal entities, and that communication among all parties is essential. A second component of this objective is the need to produce and maintain hatchery production records which are ultimately used to account for the operations of WDFW hatcheries and to inform interested parties.

Specific Information

Each of the six objectives have information specific to the hatchery and the species and stocks reared at the hatchery. This information can be found in the section, **Current Practices to Achieve Objectives** which details how hatchery practices and policies meet each objective. For **Objective One**, which includes both adult collection and juvenile plants and transfers, a brief statement is included in each hatchery plan describing the intent of the adult collection procedures and whether the hatchery has a weir to facilitate adult capture. It also describes the run and spawn timing for each species and stock.

Objective Two contains an introductory statement, followed by a description of the rearing and release strategies for each species. Fish size-at-release is reported as the "number of fish per pound" or "fish/pound". Fish released at 8 fish/pound are larger than fish released at 100 fish/pound. The size at which fish are released from WDFW hatcheries reflects our knowledge of *the relationship between size and the readiness* to migrate upon release, and marine survival. The relationship of size or condition factor to the incidence of post-release residualism in the stream has not yet been determined. Until this information is known, WDFW hatcheries will continue to release populations of smolts assumed to contain a high proportion of migrants which minimally impact wild populations.

The purpose of **Objective Three** is to maintain the unique qualities of each stock of fish through responsible breeding and transfer practices. This section details the adult collection procedures and spawning protocols used at each hatchery. These protocols are similar at most hatcheries. However, some hatcheries dealing with stocks of special concern use different adult collection and spawning protocols. A list of acceptable stocks that can be reared and released at the hatchery is included for each species. This list was developed from the existing "Stock Transfer Guidelines" developed by the former WDF.

Objective Four describes fish health management programs at WDFW hatcheries. Because the "Fish Health Management Program" covers all WDFW operations, this section is nearly identical for all hatcheries. However there are some differences among hatcheries and these will be noted. The generic form of this objective applies to all WDFW hatcheries as follows:

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs—All Stocks

Health Monitoring

- On at least a monthly basis, and before transfer or release, each stock of fish is examined to determine health status. A minimum representative sample for each lot of fish is examined and the findings reported on WDFW Form FH01.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine affected fish, make a diagnosis and recommend the appropriate treatment.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from lot of adult fish. If the adult return is below 60 fish, then 100% of the fish are assayed.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Disease Prevention (Proactive)

- Routinely necropsy clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.

- Implement disease prevention strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal diets and environmental conditions as well as the use of vaccines where needed.

- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.

- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to incubation room) to prevent spread of pathogens.

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.

- Prescribe appropriate treatments and remedies to disease.

- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.

- Conduct applied research on new and existing techniques to control disease epizootics.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs and fish, as needed.

- Hydrogen peroxide (H_2O_2) is dispensed into water for control of parasites and bacterial gill disease, as needed.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Objective Five details environmental monitoring at each hatchery to comply with standards set forth in the National Pollution Discharge Elimination Permit System (NPDES), as administered by the Washington Department of Ecology. This objective is important both for its relationship to the NPDES, and to the health of fish in the hatchery and stream, because clean, cool, well-oxygenated water is essential to salmonids.

In this section the parameters measured by the hatchery under the NPDES are explained. There are also descriptions of the hatchery water supplies including the domestic water source. Lastly, a graph shows the average water temperature by month over ten years.

Objective Six details the reasons for keeping hatchery records, such as fish production, feed and antibiotic use, disposal of salmon carcasses, fuel use, etc. The three brood documents that are used to communicate fish production among co-managers and hatchery personnel are also described. Appendix II describes the brood document process.

Performance Summaries: This section details the performance of the hatchery in achieving the various goals of each objective. They relate to FBD production goals, other goals such as quality of fish culture, compliance with the fish disease policy, and compliance with NPDES standards. The performance summaries list measures within each objective, in column 1. The species and stock collected or reared at the hatchery are listed in column 2 (Note: Objective 5 does not pertain to species or stock and so these are omitted from column 2). In column 3 of Objective 1 is the individual brood year or a designation of whether the data are averages. In column 4 of Objective 1 (column 3 for all other objectives) is the "Hatchery Goal". The "Realized Goal" can be found in the fifth column (listed as "Five Year Average" and found in column 4 of all other objectives) and is the actual hatchery performance. In column 5 of objective 1 (column 4 all other objectives) we included the range of high and low values of the realized goal. If this column contains a single number, or two numbers separated by a semi-colon, this indicates one or two years of data, respectively.

In the final column, "Comments", will often be found a number that refers the reader to another section, "Constraints/Comments", which explains the comparison of actual and realized goals.

The "Realized" goal may consist of either a single year's performance, or an average of 2-5 years of performance. Averages and ranges in the performance summaries may be numerical or "qualitative". For former WDF salmon hatcheries, a yearly comparison is provided for such measures as adult capture, egg take, fish releases, or transfers. Numerical averages describe such measures as egg to fry survivals, spawning population, or various water quality parameters. Qualitative averages describe such measures as acclimation before release, collecting adults throughout the run, adhering to the disease policy, and developing and reviewing the future brood document. For these types of measures, the goal is stated as either "Yes" or "No". The realized goal is also stated as "Yes" or "No". Thus, a hatchery that achieved the goal of acclimating smolts before release during the last five years, would have a "Yes" in the five year average column of Objective 2.

We used either numerical or qualitative averages for all measures in the former WDW trout and steelhead hatcheries, because the different database used by this agency made it too difficult to capture performance of these hatcheries in the format that was established for the HOPPS.

Future Brood Document Goals:

The Future Brood Document (FBD) sets annual production goals for each species and stock at each hatchery. These goals include number of eggs to be collected, transfers of eggs or fish to either WDFW facilities, tribal facilities, or cooperative rearing projects, and fish releases (including location, date, and size). These production goals may change each year or remain static for several years. They may also change after they are established in the FBD. Thus, production goals stated in the FBD may differ markedly from realized or achieved production.

For any year, the FBD will reflect activities that occur for one or more broods of fish. For example, within a calendar year, a hatchery may have two broods of coho present (subyearlings and yearlings) and collect eggs from a third brood of returning adults. Furthermore, the hatchery may transport eggs from a given brood in one year and fish from the same brood in another year. The 1993 FBD reflects activities associated with egg collection from adults returning in 1993, releases or transfers of 1991 brood yearling fish, and releases or transfers of eyed eggs or subyearling fish from the 1992 brood.

Other Goals

Hatchery workers strive to produce high quality fish, and operate their hatchery in a cost efficient manner. Many of their routine activities can be evaluated similarly to FBD goals.

For example, hatcheries routinely measure the percentage of captured adults surviving until spawning, the percentage of eyed eggs surviving to fry, or the percentage of fry surviving to transfer or release. Many of the factors that affect these variables are not under direct control of hatchery personnel, and will vary among hatcheries due to physical differences such as the type of holding pond, water source, incubation system, rearing containers, the amount of space available, the number of times fish must be handled, and whether the rearing containers have predator controls. There are also biological factors that influence hatchery operations: species and stock reared, run and spawn timing, prevalence of pathogens in the water supply, and numbers and types of predators. The goals for the above measures were determined in a somewhat arbitrary manner, but they are neither too high to expect a reasonable chance for success, nor too low such that achievement is automatic.

The marine survival of fish released from a hatchery is determined primarily by environmental conditions in the ocean. These conditions can be quite variable each year and can cause large differences in survival among broods. Hatchery rearing can also affect survival in several ways. Size-at-release is an important variable that can be controlled in the hatchery and which can affect post-release survival. Other important variables that affect post-release survival include fish health, date of release, and release method. In assigning goals for marine survival rates, we looked at survivals by species and geographic area over 20 years, and assigned a reasonable goal based on average survival. The hatchery should not be considered a failure because these goals are not met, but, *continued poor marine survivals should signal a problem in the hatchery or watershed.* Poor post-release survival should always be compared to other hatcheries and wild stocks in the vicinity. If the poor survivals are unique to a particular hatchery it may indicate problems in the rearing program. Unfortunately, contiguous data sets for several hatcheries are lacking, mainly due to insufficient funding, and comparison among hatcheries is not always possible.

Constraints/Comments: This section explains some of the results in the performance summaries. Some of the comments are generic because the particular action occurs throughout the hatchery system. For example, achieved transfers are often different than programmed transfers at many hatcheries. This may be due to egg or fish availability, changes in demand for these eggs or fish, or changes in management direction.

Stock Profile: The last section of the HOPPS contains information on the origin of each stock reared at the hatchery, the history of importation of non-local stocks, and a determination of stock status (i.e., whether these fish are native stocks, or non-local stocks that have had the opportunity *to adapt to the watershed they were introduced to*). Also included is a section on stock performance, with graphs of annual survival and the 2-5 year average fishery distribution for the stock (as determined through the coded-wire tag program). In some cases, we present only one year of data for stock(s) of particular interest. The 2-5 year average survival rate and catch to escapement ratio is given for each stock when this information is known. Currently we only have CWT information through the 1988 brood of chinook and the 1990 brood of coho.

GLOSSARY

ACCEPTABLE STOCK-- A stock of similar genetic ancestry to a stock reared at a hatchery, and which can therefore be imported to and released from that hatchery.

ACT-- The anadromous form of cutthroat trout.

ALEVIN-- A salmonid fry that has not completely absorbed all yolk reserves.

ANADROMOUS FISH-- Species that are hatched in freshwater, mature in saltwater, and return to freshwater to spawn.

BT-- Brown trout.

BUTTON-UP-- The stage of development when the yolk sac of the salmonid alevin is no longer visible, and the ventral slit of the body cavity has healed. At this stage the alevins are removed from incubators and placed in rearing ponds to begin feeding.

COEFFICIENT OF VARIATION OF LENGTH (CV, CV<10%)-- The coefficient of variation expresses sample variability relative to the mean of the sample. It allows comparison of the relative variability of several different populations. At WDFW hatcheries, fish lengths are measured from 100 fish from a population that has received coded-wire tags. A mean length, standard deviation, and CV are then calculated for the population. CVs under 10% are considered acceptable levels of size variation for releases of smolts.

CO-OPS -- Any person or group of persons that enter into an agreement with WDFW to conduct a project that will benefit the fish and resources of Washington State.

CRESTON NFH ELRB-- Creston National Fish Hatchery, Eagle Lake rainbow trout.

EBT-- Eastern brook trout.

EGG TAKE-- The number of eggs collected in a day from spawning adult salmon.

EGG TAKE GOAL-- The number of eggs to collect to meet a production goal. Egg take goals consider mortality during adult holding, incubation and juvenile rearing stages such that enough eggs are collected to satisfy the programmed numbers of fish to be released or transferred.

ELECTROPHORESIS, STARCH GEL-- A process where charged molecules (such as enzymes and other proteins) are separated in an electric field.

EYED STAGE-- A stage of development during the incubation of salmonid eggs where the pigment of the embryo's eyes are visible. At this stage of development the eggs become insensitive to physical shock and can be moved without excessive mortality.

EYEING-- The act of incubating eggs to the eyed stage.

FBD-- Future Brood Document.

FINGERLING-- A stage of development between the fry and smolt stage. Fingerling fish are so named because they are typically the size of human fingers. Most fingerlings are less than one year old.

FORCED RELEASE-- This is the most common method of releasing fish at WDF hatcheries and consists of slowly draining the rearing container over a 1-3 day period, thus forcing all fish to leave.

FRY-- A developmental stage when the fish has absorbed the yolk sac and has begun feeding. Fry are usually less than two inches long.

GSI, GENETIC STOCK IDENTIFICATION-- A method using starch-gel electrophoresis and histochemical staining used to characterize populations of organisms based on the genetic profiles of individuals.

GT-- Golden trout.

HATCHERY PROGRAM-- The unit within the Washington Department of Fish and Wildlife responsible for operating the hatchery system.

HATCHING-- The point in development when the alevin emerges from the egg capsule.

INCUBATORS-- A structure used to securely hold salmon eggs and alevins while providing adequate flows of water. For a more detailed description of incubator types see Fuss and Seidel (1987).

<u>Deep Trough</u>: A 15 x 1.6 x 1.3 foot trough containing nine compartments with trays for the eggs/alevins.

<u>Shallow Trough:</u> A 15 x 1.6 x 0.7 foot trough with six or seven compartments and baskets for the eggs/alevins.

<u>Vertical Incubators:</u> A cabinet that holds eight 15 x 18 x 2 inch trays with a screened bottom and lid.

<u>Freestyle Incubator:</u> A 2.6 x 2.1 x 1.8 foot box with upwelling flow used to incubate eggs to the eyed stage.

<u>Magnum Deep or Mag Deep Incubator:</u> A 3 x 3 x 2.4 foot box with upwelling flow.

<u>Pond Trays:</u> Various sized rectangular trays with mesh that are placed in incubation style raceways and layered with eggs. After hatch, the alevins can drop through the mesh into the

raceway.

Japanese Style Raceway: A 141 x 5 x 0.9 foot raceway with a single layer of gravel. Pond trays with eyed eggs are placed on the gravel and after hatch the alevins drop through the trays and continue incubation in the gravel.

Keeper Channel: A 108 x 6 x 1 foot raceway with identical incubation style to the Japanese Style Raceway.

Isolation Buckets: Small plastic buckets used to hold eggs from individual female salmon until the eyed stage. Used for separating groups of eggs which may be infected with a viral or bacterial pathogen.

Remote Site Incubator, RSI: A barrel or bucket converted to incubate eggs and alevins. Particularly well suited to off-site or remote incubation sites because of its light weight and effectiveness.

Kd INDEX-- A numerical indicator of the relationship of the weight to the length of an alevin. Used to determine when alevins in incubators should be removed and introduced to feed.

KOK-- Kokanee. A landlocked (non-anadromous) form of sockeye salmon.

NA-- Not applicable.

NATIVE, NATIVE STOCK-- An indigenous stock of fish that has not been substantially impacted by interactions of genetically different fish from other rivers or streams, or by other factors, and is still present in all or part of it's original range. A native stock may exist outside of its original habitat in some cases.

NATURAL, NATURALLY REPRODUCING-- Fish produced outside of the hatchery, regardless of origin. Naturally produced fish may consist of progeny of hatchery produced adults which spawned in the stream.

ND--No data. Data is absent due to lost records or was not recorded at a facility.

NECROPSY-- An examination of a dead fish to determine the cause of death.

NPDES-- The National Pollution Discharge Elimination System, is a permit system established by the US Environmental Protection Agency to regulate discharge of pollutants from point sources. In Washington, this program is administered by the Washington Department of Ecology.

ON-SITE, ON-STATION-- Activities taking place at the hatchery, for example planting fish at the hatchery site.

OUTPLANTING-- Transporting fish from the hatchery to another site for release.

PA-- Pollution abatement pond.

PLANTING-- The act of releasing fish.

PLANTING GOAL-- The number of fish to plant.

PROGRAM-- Specifies for a given year, the number of eggs to collect, the location and number of eggs or fish to transfer, and the number and location of fish to release (plant). Synonymous with the Future Brood Document.

RBT-- A resident (non-anadromous) form of rainbow trout.

RCT-- A resident (non-anadromous) form of cutthroat trout.

REARING CONTAINERS-- Includes several types of containers used for rearing salmon, trout and steelhead juveniles before release or transfer. These containers are typically constructed of concrete or asphalt, but may also be constructed of earth or vinyl.

Pond, Holding or Rearing Pond: Usually oval shaped and larger than 0.33 acres in size. Typically constructed of earth or asphalt, these ponds are used to rear several hundreds or thousands of fish or hold adults before spawning.
Standard Raceway: A concrete trough usually measuring 10 x 100 x 3.5 feet.
Incubation Raceway: Raceways used with pond trays for incubation.
George Adams Raceway: A 20 x 80 x 4 foot raceway.
Burroughs Raceways or Ponds: A raceway design that uses a different style of inflow and drain to create a circular instead of linear flow pattern.
Circular Ponds: A six or ten foot diameter round rearing pond.
Capilano Trough: A 21' x 2.66' x 1.95' trough used to start fry feeding prior to stocking them in larger rearing containers.

SS-- Suspended solids.

SSH-- Summer run steelhead.

STOCK-- The fish spawning in a particular lake or stream(s) at a particular season, and which do not to a substantial degree interbreed with any group of fish spawning in a different place, or in the same place in a different season.

SUBYEARLING-- A salmonid that is less than one year old. This includes fish released in the fall.

TSS-- Total suspended solids.

VOLITIONAL RELEASE-- A release strategy that allows fish to emigrate from the rearing container when they are physiologically ready. This type of release is done using large populations of fish by removing pond outlet screens and allowing fish to migrate. Those fish that remain in the pond are fed until all fish have exited.

WSH-- Winter run steelhead.

YEARLING-- A fish that is one year old. Most releases of steelhead, coho, and spring chinook consist of yearling smolts.

ZUIDER ZEE-- A large raceway-like pond at Hoodsport Hatchery that is located on the shores of Hood Canal. Named after the Dutch term for the series of dikes on the North Sea.

Figure 1. Map of WDFW hatchery locations.

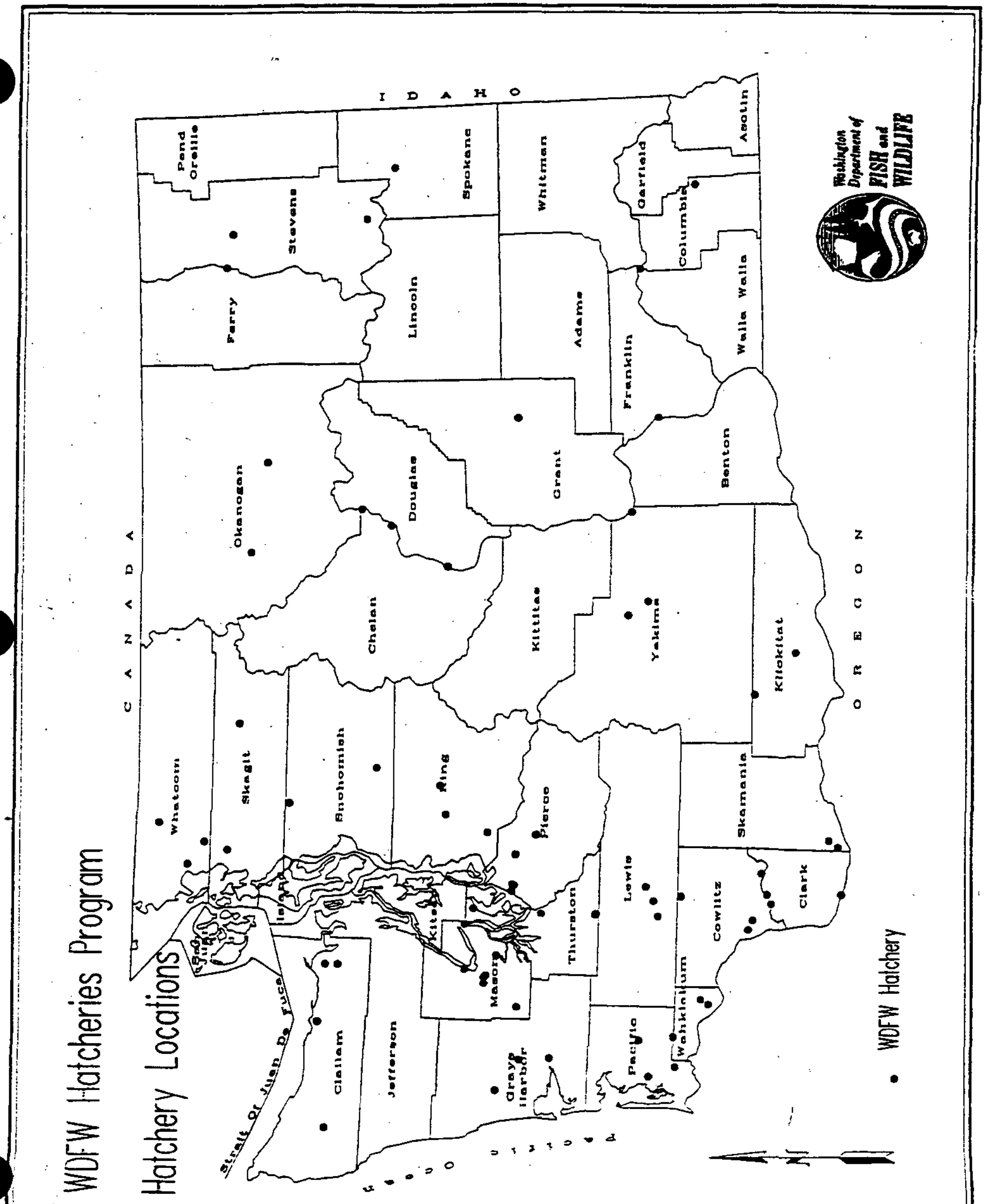

Table 1. List of hatchery complexes showing name changes that occurred in 1995.

Puget Sound Hatchery Complexes

Complex/ Current Hatchery Name	Former Hatchery Name
Nooksack Complex:	
Kendall Creek Hatchery	Nooksack Hatchery
Samish Hatchery	No change
Lake Whatcom Hatchery	No change
Bellingham Hatchery	No change
Skagit Complex:	
Marblemount Hatchery	Skagit Hatchery
Barnaby Slough	No change
Baker Lake Spawning Beaches	No change
Arlington Hatchery	No change
Whitehorse Rearing Ponds	No change
Snohomish Complex	
Wallace River Hatchery	Skykomish Salmon Hatchery
Reiter Ponds	No change
Tokul Creek Hatchery	No change
Green River Complex	
Issaquah Hatchery	No change
Soos Creek Hatchery	Green River Hatchery
Palmer Ponds	Green River Trout Ponds
Cedar River	No change
Puyallup Complex	
Puyallup Hatchery	Puyallup Trout Hatchery
Voights Creek Hatchery	Puyallup Salmon Hatchery

Puget Sound Hatchery Complexes (continued)

Complex/ Current Hatchery Name	Former Hatchery Name
Minter Creek Complex	
Minter Creek Hatchery	No change
Coulter Creek Hatchery	No change
Hupp Springs	No change
Fox Island Net Pens	No change
Lakewood Complex	
South Tacoma Hatchery	No change
Garrison Springs Hatchery	No change
Chambers Creek Hatchery	No change
South Sound Complex	
Tumwater Falls Hatchery	Deschutes Complex
McAllister Hatchery	No change
South Sound Net Pens	No change
Skookumchuck Rearing Ponds	No change
Johns Creek Hatchery	No change
Hood Canal Complex	
George Adams Hatchery	No change
Eells Springs Hatchery	Shelton Trout Hatchery
McKernan Hatchery	No change
Hoodsport Hatchery	No change
Dungeness Complex	
Dungeness Hatchery	No change
Hurd Creek Hatchery	No change
Elwha Rearing Ponds	No change

ACKNOWLEDGEMENTS

This report compiles data collected by many individuals. The data used in the Performance Summaries of the report was collected by numerous hatchery workers throughout Washington. Many hours of hard work went into the collection of these data. It may be easily overlooked that for a hatchery to achieve any of the goals listed in this section requires the dedication of hatchery personnel to work long hours, under at times difficult and trying conditions. Ultimately the success of WDFW hatcheries lay in the capable hands of these dedicated workers, and they deserve much more credit than what is usually afforded them.

The authors also wish to thank the many reviewers of this manuscript. Each hatchery manager deserves a special thanks for adding information that could not be gathered from the central office. The following people also added immeasurably to the completion of the report and the authors extend a special thanks to them: Kevin Amos, Andy Appleby, Pat Chapman, Mark DeCew, Ross Fuller, Kathy Hopper, Chuck Johnson, Mark Kimbel, Catie Mains, Larry Peck, Bryan Quinton, Paul Seidel, Jennifer Sheffler, Joan Thomas, and Geraldine Vander Haegen.

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APPENDIX I

WDFW Hatchery Production Program Development and Coordination Process- Future Brood Document Process

Each year, WDFW develops a hatchery production plan defining fish culture objectives for each of the agency's fish production facilities. This production program translates WDFW's resource management objectives into a comprehensive action plan for hatchery production.

This production plan is the product of WDFW's collective insight into fish culture techniques, optimum production strategies, harvest management regimes, long term planning, disease control, gene conservation, and legal mandates. To assure these broad inputs are reflected in the annual program, the program is developed over a six month consultative process which begins January 1st each year and normally ends by July 1st.

Coordination of the development and maintenance of the FBD rests with the Hatcheries Program Assessment and Development Division. Division managers within the Fish Management and Hatcheries Programs are responsible for development and implementation of the rearing program. The Assessment and Development Division initiates this process with a solicitation for program input form other divisions within WDFW, and tribal and federal managers. That solicitation is followed by a draft production program. This draft is circulated to tribes and other management agencies. After consideration of all appropriate comments, the program is finalized and adopted as the annual production program. It is then distributed throughout the hatchery system for implementation.

The following activities occur to develop the Future Brood Document:

January 1:	Solicit WDFW internal proposals for changes to the rearing program(s). Solicit program applications from tribes and cooperative rearing projects.
March 1:	WDFW proposals received by Hatcheries Program.
April 1:	Requests from tribal and cooperative rearing projects are received by Hatcheries Program.
May 1:	Hatcheries Program circulates draft program within WDFW.
May 14-21:	Both regional and central WDFW staff meet to review draft program.
June 1:	WDFW draft production program is distributed to tribes and other agencies for review and comment.

July 1: Final Current and Future Brood Documents are distributed.

APPENDIX I (CONTINUED)

Changes to existing rearing programs must be considered within the context of how that change will affect the following:

A. Legal Constraints
1. U.S. v Washington
2. U.S. v Oregon
3. U.S./ Canada- Pacific Salmon Treaty
4. Hoh v Baldridge

B. Institutional Constraints
1. Puget Sound Management Plan (U.S. v Washington)
2. Hood Canal Management Plan (U.S. v Washington)
3. Columbia River Fishery Management Plan (U.S. v Oregon)

C. Mitigative Contracts
1. James River Corporation (Elwha River)
2. Pacific Power and Light (Satsop, Skookumchuck, and Lewis Rivers)
3. Tacoma City Light (Cowlitz and Skokomish Rivers)
4. Lower Snake River Compensation Plan (Snake River)
5. Grant County PUD (mid-Columbia River)
6. Chelan County PUD (mid-Columbia River)
7. Douglas County PUD (mid-Columbia River)

D. Agency Goals and Objectives
1. Harvest management strategies
2. Watershed and subbasin plans
3. Stakeholders emphasis
4. Tribal agreements and MOUs (South Puget Sound Agreement)
5. Budget

Nooksack Complex

Kendall Creek Hatchery
Samish Hatchery
Lake Whatcom Hatchery
Bellingham Hatchery

Kendall Creek Hatchery

Introduction

The hatchery is located on Kendall Creek, a tributary of the Nooksack River, 21 miles NE of Bellingham. The original hatchery was constructed in 1899, however many improvements have been added in recent years. Currently, rearing is done in twelve-10' x 100' raceways, eight Capilano starting troughs, four large rearing and release ponds (one is used as an adult holding pond), and three 20' x 140' x 3' rearing ponds. Incubation facilities have been modified such that incubation to the eyed stage is done in isolation incubators in one building, and hatching in vertical incubators (24 stacks) is done in a second building. Use of isolation incubation prevents spread of pathogens from eggs to alevins. Incubation facilities also include 32 magnum deep incubators and 32 shallow trough incubators, 6 deep troughs and 3 fry troughs. Ten shallow troughs have been modified to hold isolation incubation buckets. Eyed egg capacity at the hatchery is approximately 20.7 million. Hatching capacity (includes some pond incubation) is 14.4 million salmon fry. Water is supplied to the station from five wells, a creek pump and gravity flow from Kendall Creek.

Purpose

Kendall Creek Hatchery is being used as one tool in an effort to rebuild the Nooksack native chinook run. The hatchery also collects eggs from fall chinook, coho, chum, and pink to be used in rearing programs at the hatchery, or for transfer of eggs or fish to tribal or cooperative rearing programs. Rearing of these latter four species is done to increase adult production in the Nooksack basin and northern Puget Sound.

Goals

1. Aid in the restoration of a self-sustaining natural population of native chinook that is capable of some level of harvest. This goal will be achieved through a combination of on-station and off-station releases of yearling and sub-yearling fish of native stock origin.

2. Produce fall chinook, coho, and chum that will contribute to the NE Pacific, Puget Sound, and Nooksack River fisheries.

3. Produce fall chinook, coho, and chum eggs or fish for tribal or cooperative rearing programs.

Objectives

Objective 1: 1993 Hatchery Production

Native Chinook

Collect 1,300,000 eggs from 1993 brood returning adults.

Rear 320,000 1992 brood fingerlings for release on-station in 1994.

Rear 400,000 1992 brood fingerlings for transfer to acclimation ponds in 1994.

Plant 200,000 1991 brood yearlings on-station.

Plant 200,000 1992 brood subyearlings on-station.

Summer/Fall Chinook

Receive from Samish Hatchery, or collect from returning adults, 10,600,000 1992 brood eggs.

Plant 5,000,000 1992 brood subyearlings on-station.

Transfer 4,000,000 1992 brood subyearlings to Lummi Tribe hatchery.

Receive 11,500,000 1993 brood eggs from Samish Hatchery and transfer 1,500,000 eyed eggs to Lummi Tribe hatchery, and 800,000 to Whatcom Creek (Bellingham Maritime) hatchery.

Rear 1993 brood fingerlings and release 3,500,000 on-station in 1994, and transfer 4,000,000 subyearlings to Lummi tribe hatchery.

Kendall Creek Coho

Collect 5,300,000 eggs from 1993 brood returning adults.

Transfer 773,100 1993 brood eyed eggs to cooperative rearing programs.

Plant 1,300,000 1991 brood yearlings on-station.

Transfer 1,373,800 1992 brood eggs to cooperative rearing programs.

Supply 2,000,000 1992 brood fry to the Fish Management program for outplanting to local streams.

Chum Salmon

Collect 1,525,000 eggs from returning adults.

Transfer 1,000,000 eggs to tribal and cooperative rearing programs.

Plant 400,000 1992 brood fingerlings on-station.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Kendall Creek Hatchery is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of each stock. A secondary goal is to supply eggs or fish to tribal or cooperative rearing programs. There is no weir on the Nooksack River to prevent returning adults from by-passing the facility.

Nooksack Native Chinook: Adult return timing is not well known due to the glacial coloration of the river in the spring. It is assumed that these fish enter the river between May and August. The fish are spawned at the hatchery primarily in late August to early September. Separation of this stock from fall chinook, is done using a combination of coded-wire tags, otolith marking, and return timing.

Kendall Creek/ Samish Fall chinook: Adults return from August through October. Spawning is from September to October and tends to overlap with the spawn timing of the native chinook. Inadequate returns of Nooksack stock are common due to heavy fishing pressure and recently to poor survivals. Thus, a portion of the hatchery rearing program consists of Samish hatchery summer/fall chinook.

Kendall Creek Coho: Adults return to the hatchery from October to January, with peak spawning in mid-November to early-December.

Chum: Adults return to the hatchery from November to December, with peak spawning in mid-December.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimalized. Newly constructed rearing ponds allow acclimation to Kendall Creek water for several weeks prior to release. This is done to ensure strong homing to the hatchery, thus reducing straying into other areas.

Native Chinook: Yearling fish are reared to 8 fish/pound and released in May. These fish are now acclimated to Kendall Creek water prior to release. Subyearlings are reared to at least 80 fish/pound and released in late-May or June. A portion of the subyearling release occurs on-station and another portion is reared and released from acclimation ponds located on the North Fork Nooksack river.

Kendall Creek/ Samish Fall Chinook: Fish are reared to at least 80 fish/pound and released on-station in late May.

Kendall Creek Coho: Fish are reared to 17 fish/pound and released in May. These fish are acclimated to Kendall Creek water prior to release.

Chum: Fish are reared to 400 fish/pound and released in April.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for each stock is maintained. To separate native and summer/fall chinook, a cut-off date (25 August) is used in conjunction with reading of coded wire tags at the time of spawning. Additionally, otoliths are removed from adults without coded-wire tags to verify their origin. If these otolith marked fish are not native spring chinook, then the eggs from these adults are not used in the rearing program. Adult collection and spawning protocols are established annually based on numbers of coded-wire tagged adults, GSI (see glossary) sampling, and other available data to ensure the genetic integrity of the native chinook broodstock.

Spawning Protocol

The intent is to use a spawning population of at least 500 adults with each species. When spawning native chinook, a one male to one female ratio is used at all times. For summer/fall chinook, coho and chum, a spawning ratio of one male to one female is used when fewer than one million eggs are collected in a single day. On days when more than one million eggs are collected, the male to female spawning ratio is no lower than 0.33. The effective population size (N_e) is not known for the latter species due to pooling of gametes. A portion of each day's eggtake is used for on-site production.

Acceptable Stocks

Native Chinook:
1. Nooksack native chinook.

Coho:
1. Kendall Creek
2. Clark Creek
3. Wallace River

Fall Chinook:
1. Kendall Creek
2. Samish

Chum:
1. Kendall Creek

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Kendall Creek Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under the NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperature daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

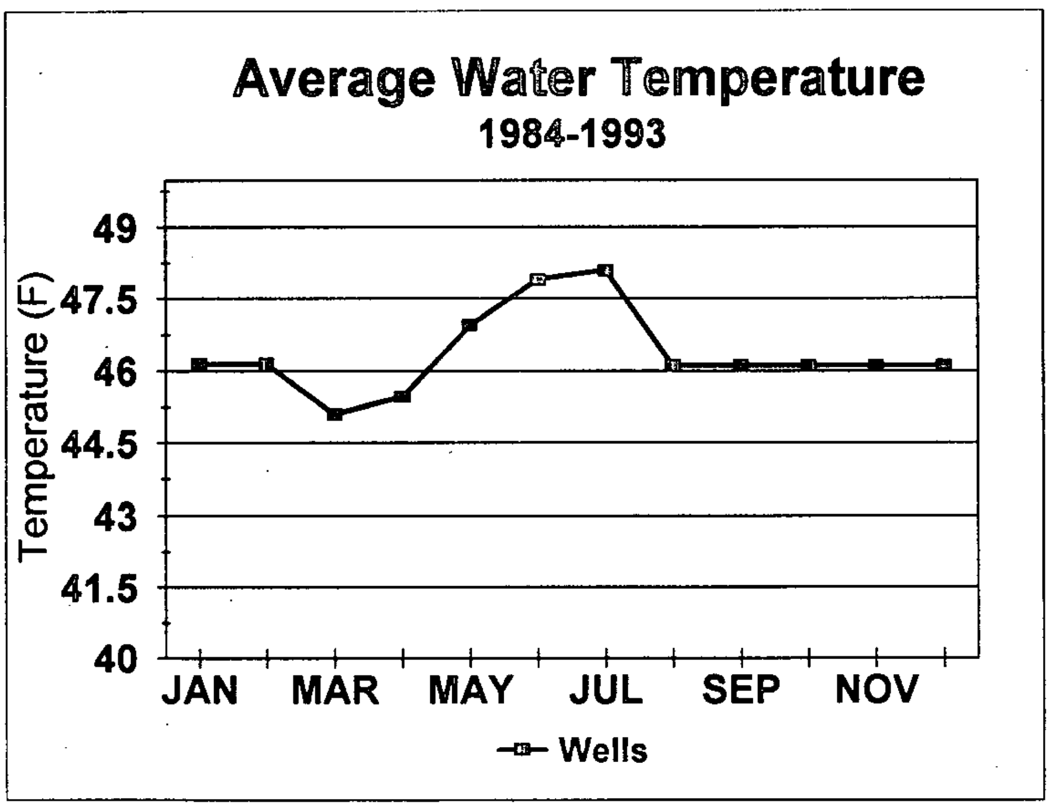
Nooksack Well Water: No problems identified. Water rights are 30 cfs.

Kendall Creek: Water quality has been degraded due to agricultural development upstream of the hatchery. Nutrient levels have likely increased, and summer flows have decreased in the past few years. Water rights are 22.4 cfs.

Domestic Water: Water rights are 20 gpm.

Nooksack River: The hatchery does not use this water source.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption, etc. are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Nooksack and Samish watersheds have been completed. These documents show existing baseline production and current management. Two brood documents are reviewed and agreed to annually by WDF and co-managers. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Lummi and Nooksack Tribes, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries—Kendall Creek Hatchery

Objective 1: Hatchery production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Native (Spring) Chinook	1989	226	470	NA	
		1990	226	109	NA	1
		1991	226	151	NA	1
		1992	226	1,016	NA	
		1993	612	1,364	NA	
	Fall Chinook	1989	3,699	1,180	NA	1,2
		1990	4,838	791	NA	1,2
		1991	5,597	708	NA	1,2
		1992	5,597	742	NA	1,2
		1993	NA	464	NA	3
	Coho	1989	6,990	1,346	NA	2
		1990	6,365	2,482	NA	2
		1991	6,365	6,744	NA	
		1992	6,365	6,406	NA	
		1993	6,365	9,217	NA	
	Chum	1989	1,364	489	NA	1,2
		1990	1,547	995	NA	1,2
		1991	1,516	642	NA	1,2
		1992	1,783	93	NA	1,2
		1993	1,360	728	NA	1,2
Adult Prespawning Survival	Native (Spring) Chinook	Avg.	90%	84.6%	72.0-95.1%	4
	Fall Chinook	Avg.	90%	98.7%	97.2-99.9%	
	Coho	Avg.	90%	99.6%	97.3-100%	
	Chum	Avg.	90%	85.4%	73.2-100%	

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Native (Spring) Chinook[1]	1989	480,000	1,227,600	NA	
		1990	480,000	200,324	NA	1
		1991	480,000	243,500	NA	1
		1992	480,000	1,471,040	NA	
		1993	1,300,000	1,935,316	NA	
	Fall Chinook	1989	7,006,000	1,353,800	NA	2
		1990	9,162,000	2,453,900	NA	2
		1991	10,600,000	1,298,420	NA	2
		1992	10,600,000	895,400	NA	2
		1993	NA	701,900	NA	3
	Coho	1989	5,820,000	1,076,400	NA	2
		1990	5,300,000	997,700	NA	2
		1991	5,300,000	7,107,800	NA	
		1992	5,300,000	6,408,850	NA	
		1993	5,300,000	4,947,800	NA	
	Chum	1989	1,530,000	827,200	NA	1,2
		1990	1,735,000	1,436,800	NA	
		1991	1,700,000	726,500	NA	1,2
		1992	2,000,000	119,740	NA	1,2
		1993	1,525,000	719,200	NA	1,2
	Pink	1991	100,000	0	NA	
Fecundity	Native (Spring) Chinook	Avg.	NA	4,818	4,314-6,408	
	Fall Chinook	Avg.	NA	3,837	2,558-5,028	

[1] Goal for program depends on amount of eggs available, the priority of releases will be in the following order: 200 K yearlings on station; 200 K subyearlings on station; 120 K yearlings on station; 200 K acclimated subyearlings into Deadhorse Creek; 200K unacclimated subyearlings into Deadhorse Creek; 200 K subyearlings into Canyon Creek.

Measures	Species	Brood Year	Goal	Realized	Range	Commen
Fecundity	Coho	Avg.	NA	1,672	1,298-2,102	
	Chum	Avg.	NA	2,571	1,987-2,954	
Green Egg-to-Fry Survival	Native (Spring) Chinook	Avg.	90%	90.7%	85.9-93.0%	
	Fall Chinook	Avg.	90%	87.7%	87.2-94.1%	
	Coho	Avg.	90%	88.2%	76.2-94.9%	
	Chum	Avg.	90%	92.9%	83.9-97.8%	
	Samish Fall Chinook	Avg.	90%	80.6%	63.6-87.9%	5
Fry to Smolt Survival	Native (Spring) Chinook	Avg.	90%	93.7%[2]	89.8-97.5%	
	Fall Chinook	Avg.	90%	98.5%	97.6-99.1%	
	Coho	Avg.	90%	92.1%	76.7-97.5%	
	Chum	Avg.	90%	95.6%	86.1-98.8%	
	Samish Fall Chinook	Avg.	90%	98.9%	97.8-99.6%	
	Clark Creek Coho	Avg.	90%	98.5%	95.7-99.9%	
Fish Releases (* denotes off-station release)	Native (Spring) Chinook Yearlings	1988	400,000	376,792	NA	
		1989	340,000	346,632	NA	
		1990	200,000	173,200	NA	
		1991	200,000	0	NA	6
	Subyearlings	1988	NA	1,142,520	NA	
		1989	NA	545,817	NA	
		1992	NA	390,400	NA	
		1992	NA	480,691*	NA	7
	Nooksack Fall Chinook Subyearlings	1988	6,000,000	1,854,100	NA	1,2
		1989	6,000,000	977,300	NA	1,2
		1990	6,000,000	1,466,400	NA	1,2

[2] This is a four year average. The 1991 brood was taken to Glenwood Springs Hatchery due to mixing of fall chinook with native chinook.

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Nooksack Fall Chinook	1991	5,000,000	508,700	NA	1,2
	Subyearlings	1992	5,000,000	895,400	NA	1,2
	Samish Fall Chinook	1988	NA	2,203,600	NA	8
	Subyearlings	1989	NA	7,577,800	NA	8
		1990	NA	3,013,600	NA	8
		1991	NA	4,521,500	NA	8
		1992	NA	3,790,700	NA	8
	Kendall Creek Coho[3]	1988	854,900	1,184,000	NA	
		1989	854,900	995,400	NA	
		1990	1,300,000	852,400	NA	
		1991	1,300,000	1,263,898	NA	
	Clark Creek Coho	1988	NA	1,176,600	NA	
		1989	249,900	249,500	NA	
		1990	NA	469,000	NA	
	Kendall Creek Chum	1988	400,000	197,600	NA	1,2
		1989	400,000	407,900	NA	
		1990	500,000	479,100	NA	
		1991	250,000	249,300	NA	
		1992	400,000	98,100	NA	1,2
Fish Releases (Off-Station)	Kendall Creek Coho	1988	2,000,000	1,653,300	NA	
		1989	2,000,000	0	NA	2
		1990	2,000,000	0	NA	2
		1991	2,000,000	1,868,500	NA	

[3] An average 772,520 fish were released prior to 45 days.

Measures	Species	Brood Year	Goal	Realized	Range	Commen
Transfers to Tribal Facilities (Eggs/Fish)	Fall Chinook	1988	3,000,000	1,972,600	NA	1,2
		1989	0	3,227,135	NA	
		1990	3,000,000	769,800	NA	1,2
		1991	4,000,000	5,360,200	NA	
		1992	4,000,000	1,894,400	NA	1,2
	Coho	1991	0	1,638,100	NA	
		1992	0	2,153,500	NA	
	Chum	1988	1,000,000	233,000	NA	1,2
		1989	1,000,000	302,700	NA	1,2
		1990	1,000,000	853,900	NA	1,2
		1991	1,000,000	423,000	NA	1,2
		1992	1,000,000	0	NA	1,2
Transfers within WDFW (Eggs/Fish)	Fall Chinook	1988	0	200,500[4]	NA	
		1990	0	2,100,000[5]	NA	
Transfers to Co-ops (Eggs/Fish)	Native Spring Chinook	1988	0	200,960	NA	
		1991	0	179,800	NA	
		1992	0	196,974	NA	
	Fall Chinook	1989	0	250,000	NA	
		1992	0	440,000	NA	
	Coho	1988	1,703,000	843,000	NA	10
		1989	1,865,100	3,581,300	NA	
		1990	1,378,100	466,000	NA	10

[4] Soos Creek stock

[5] Samish stock

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Co-ops (Eggs/Fish)	Coho	1991	1,373,800	1,425,300	NA	
		1992	1,373,800	1,392,600	NA	
	Chum	1991	0	20,000	NA	
Adults Passed Upstream	Native Spring Chinook	Avg.	0	0	NA	11
	Fall Chinook	Avg.	0	0	NA	11
	Coho	Avg.	0	2,100[6]	NA	11
	Chum	Avg.	0	0	NA	11
Percent Survival Smolt to Adult	Native Chinook (Yrling.)	Avg.	2.5%	0.4%[7]	0.03-1.2%	
	Native Chinook (Subyr.)	Avg.	1.0%	0.5%	0.1-0.9%	
	Fall Chinook	1985	1.0%	0.2%	0.2%	
	Kendall Creek Coho	Avg.	10.0%	9.1%	8.4-11.0%	
	Chum	Avg.	1.0%	ND	ND	

[6] 1989 & 1990 broods only.

[7] Data from 1984,1986, and 1987 broods only.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Native Chinook	Yes	No	NA	12
CV< 10%	Fall Chinook	Yes	No	NA	12
	Coho	Yes	No	NA	12
	Chum	Yes	No	NA	12
Acclimation	Native Chinook	Yes	No	NA	13
	Fall Chinook	No	No	NA	13
	Coho	Yes	No	NA	13
	Chum	No	No	NA	13
Volitional Release	Native Chinook	No	No	NA	
	Fall Chinook	No	No	NA	
	Coho	No	No	NA	
	Chum	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults	Native Chinook	Yes	No	NA	14
Throughout Run	Fall Chinook	Yes	No	NA	14
	Coho	Yes	Yes	NA	
	Chum	Yes	Yes	NA	
Spawning Pop.	Native Chinook	Yes	427	71-846	1
>500	Fall Chinook	Yes	604	412-766	
	Coho	Yes	3,893	841-6,815	
	Chum	Yes	505	74-897	
Spawning Ratio	Native Chinook	1.0	0.8	0.4-1.2	15
Male:Female	Fall Chinook	0.33	0.8	0.5-1.0	
	Coho	0.33	0.5	0.3-0.9	
	Chum	0.33	0.7	0.5-0.8	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Four Year Average	Range	Constraint
TSS Effluent Composite	5 mg/L	-0.38	-16.0-5.4	
TSS Max Effluent	15 mg/L	1.58	-10.0-13.5	
SS Effluent	0.1 ml/L	0.01	0.0-0.05	
TSS PA Effluent	100 mg/L	17.68	0-140	
SS PA Effluent	1.0 ml/L	0.5	0-0.5	
Downstream Temp(°F)	Varies	50°	50°	
Maximum Temp	<63°F	66.0°	46-66°	
Minimum Temp	>32°F	38°	38-46°	
Downstream DO(mg/L) >8.0	10.1	10.1	10.0-10.5	
Continuous Monitoring of Other Parameters Yes	No	NA		

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	16
Develop and Review Equil. Brood Doc.	All	Yes	Yes	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	No	NA	

Constraints/Comments—Kendall Creek Hatchery

1. Poor survival in some broods has resulted in too few returning adults and reduces egg collection.

2. High harvest rates in some fisheries reduce the number of returning adults, thus preventing adequate egg takes.

3. No egg collection goal for this year. All eggs to be supplied by Samish Hatchery.

4. Long freshwater holding period of native chinook prior to spawning increases mortality due to handling stress.

5. Transportation from Samish Hatchery reduces survival of green eggs.

6. Fall chinook were accidentally spawned with native chinook, thus the genetics of the stock were compromised if released on-station. These fish were transplanted to Glenwood Springs cooperative rearing project.

7. Released from acclimation ponds on North Fork Nooksack river.

8. Shortages of fall chinook eggs collected from adult returning to the hatchery are backfilled with fall chinook eggs from Samish Hatchery.

9. Lack of current continuous tagging program to evaluate brood survivals.

10. Changes occur in cooperative rearing program requests, after the Future Brood Document is finalized. Thus, some transfers do not occur as purported in the goals section.

11. There is no rack on the Nooksack River to block upstream passage of adults. Because of glacial coloration in the river, the number of fish bypassing the hatchery can not be counted. Fish passed upstream data reflects fish passed upstream on Kendall Creek only.

12. Fish are not measured each year to obtain CVs, or CVs not reported in data base every year.

13. Facility lacks the ability to use Nooksack River water, and can only occasionally use Kendall Creek water for acclimation.

14. Because of cut-off date and presence of ripe fall chinook, not all native chinook are handled and spawned. Also, poor attraction water can reduce number of returning adults.

15. Differential mortality can skew sex ratio.

16. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

Stock Profile:

Nooksack Native Chinook: Nooksack native chinook originated from broodstock captured in 1980-1984 from the Nooksack river (River Mile 46-47). Adults were transported to the hatchery alive, held and then spawned. GSI analysis (1985,1988) has demonstrated that this stock is unique compared to other Puget Sound chinook stocks; and particularly Nooksack/Samish fall chinook. Previous to the broodstocking efforts a mixture of Soleduck (mixed stock origin) and Hood Canal spring chinook were reared at the hatchery. This stock was phased out by 1985. GSI analysis of the 1991 brood showed spring x fall hybrids and fall x fall crosses in the spring chinook population. This brood was removed from the hatchery and was not released in the Nooksack drainage. **Stock Description: Native.**

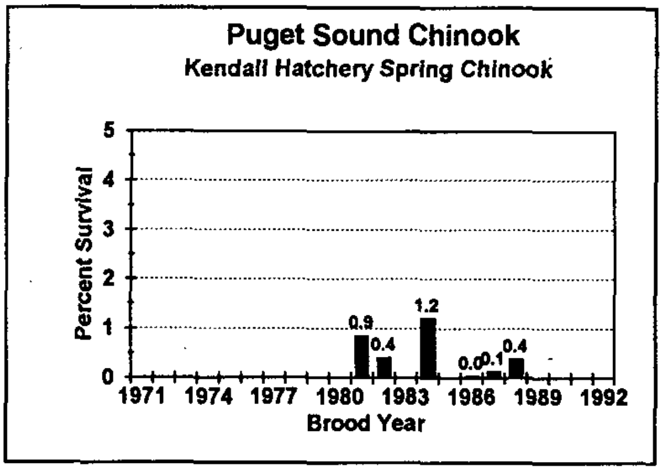
Kendall Creek/Samish Fall Chinook: Fall chinook were apparently cultured at the hatchery in the early 1900s. Records indicate that Kalama and Wind River stocks were planted in the river from 1914-1925. However, there is no record of egg takes from returning adults that would have originated from these stocks. Since 1982, Samish Hatchery has routinely supplied eggs to the Nooksack rearing program, and prior to this a mixture of Soos Creek and Samish stocks. GSI analysis show that fish returning to Nooksack are nearly identical to Samish stock. **Stock Description: Introduced, non-adapted.**

Kendall Creek Coho: This stock originated from native Kendall Creek coho. Since 1977, Clark Creek coho (Skagit) has been used to supplement the Kendall Creek Hatchery in years when there have been insufficient eggs due to low returns. However, there is a strong liklihood of significant introgression from Clark Creek coho. **Stock Description: Mixed**

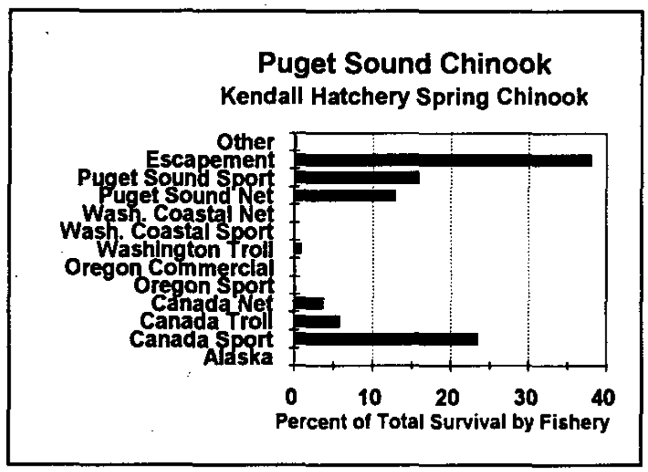
Kendall Creek Chum: This stock originated from local broodstock. However, Hood Canal stock was planted at the hatchery for several years, and some Grays Harbor chum were introduced many years ago. GSI analysis has shown that the North Fork Nooksack chum are distinct from all other chum stocks. **Stock Description: Native.**

STOCK STATUS PROFILE FOR: Nooksack Native Chinook- Yearlings

Survival:



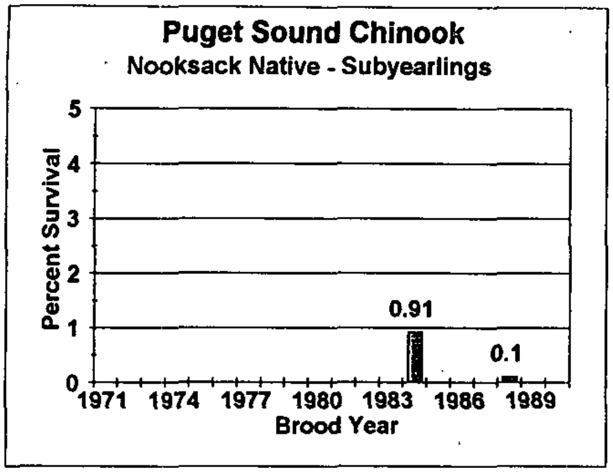
Distribution:



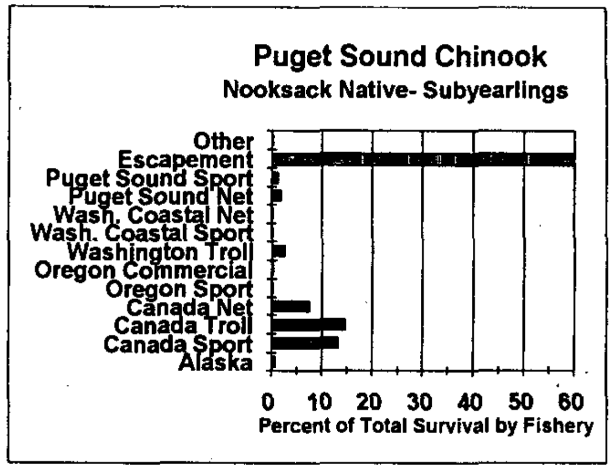
Three Year Average Survival: 0.2%
Catch to Escapement Ratio: 2.6:1

STOCK STATUS PROFILE FOR: Nooksack Native Chinook- Subyearlings

Survival:



Distribution:

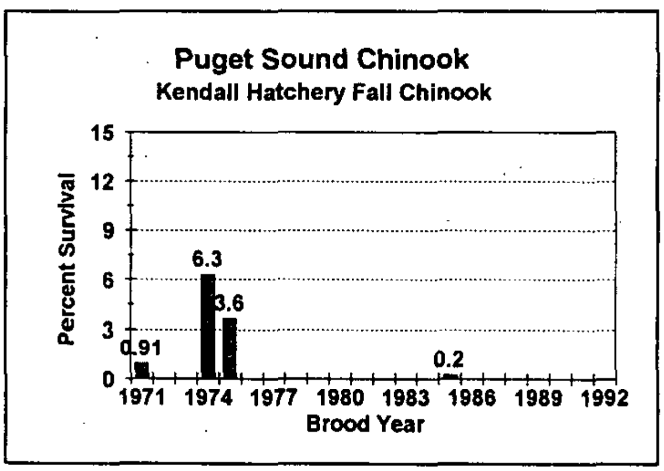


Two Year Average Survival: 0.5%

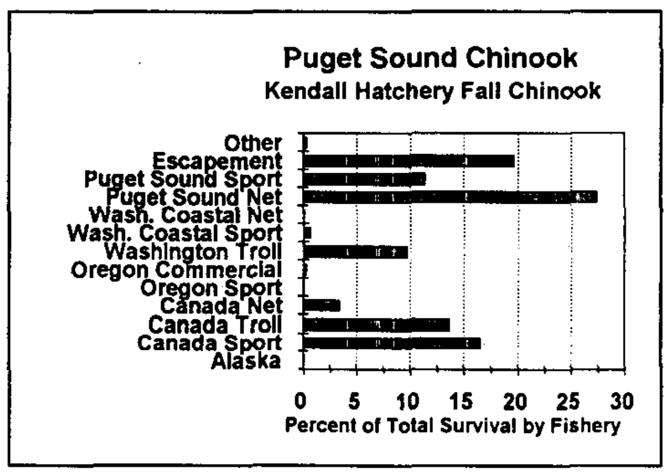
Catch to Escapement Ratio: 0.4:1

STOCK STATUS PROFILE FOR: Kendall Creek/Samish Summer/Fall Chinook

Survival:



Distribution: (One year of data)

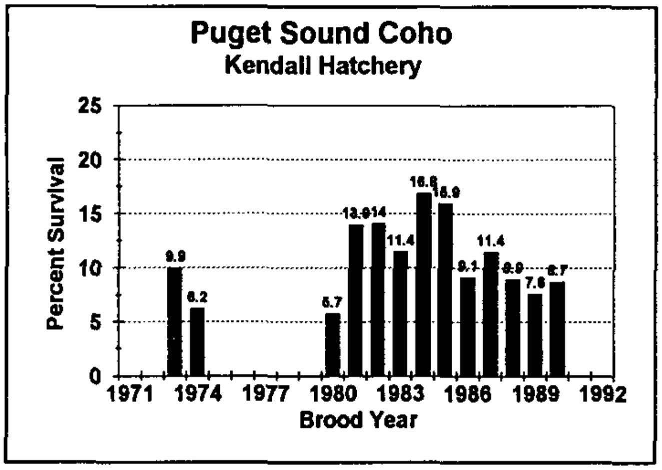


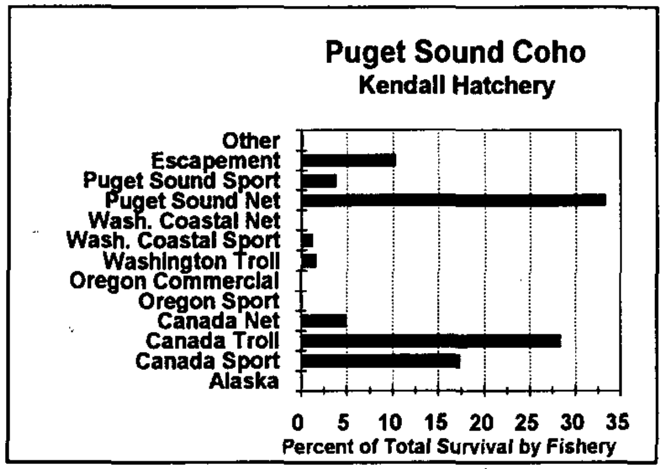
Five year Average Survival: ND

Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Kendall Creek Coho

Survival: **Distribution:**





Five Year Average Survival: 9.1%

Catch to Escapement Ratio: 10.0:1

STOCK STATUS PROFILE FOR: Nooksack Chum salmon

Five Year Average Survival: ND

Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Nooksack Pink salmon

Five Year Average Survival: ND

Catch to Escapement Ratio: ND

Samish Hatchery

Introduction

The Samish Hatchery is located on Friday Creek, a tributary of the Samish River. The hatchery has operated continuously since construction in 1899. Rearing containers include eight standard raceways, four 20' X 80' raceways and two large rearing and release ponds (one serves as an adult holding pond). Release capacity is 5.2 million fingerling salmon. Incubation has been upgraded to include vertical incubators in addition to deep and shallow trough incubators. The hatchery can accommodate 9-12 million eyed eggs and 6.0 million fry. Water for fish rearing is supplied from wells and gravity flow from Friday Creek. Water for the adult pond is supplied by pumps in the Samish River. Samish Hatchery serves as the major source of fall chinook broodstock for the Kendall Creek Hatchery program.

Purpose

Samish Hatchery is used to increase production of fall chinook in north Puget Sound. This is accomplished by on-station rearing and release, as well as collection of eggs for transfer to the Kendall Creek Hatchery, tribal hatcheries, and other cooperative rearing groups. The hatchery also traps and enumerates runs of naturally produced chum and coho, and collects eggs from these species to supply cooperative rearing projects.

Goals

1. Produce fall chinook for the NE Pacific and Puget Sound fisheries.
2. Maintain the Samish fall chinook broodstock.
3. Provide fall chinook eggs for transfer to Kendall Creek and Whatcom Creek Hatcheries to backfill shortages at these hatcheries.
4. Enumerate coho salmon upstream and collect eggs for transfer to cooperative rearing projects.
5. Enumerate chum salmon upstream and collect eggs for transfer to cooperative rearing projects.

Objectives

Objective 1: 1993 Hatchery Production

Fall Chinook

Collect 17,600,000 1993 brood fall chinook eggs.
Rear and release 5,200,000 1992 brood subyearlings on-station.
Transfer up to 11.5 million 1992 brood eggs to Kendall Creek Hatchery.

Coho

Collect 25,000 1993 brood eggs for transfer to cooperative rearing projects.

Chum

Collect 600,000 1993 brood eggs for transfer to cooperative rearing projects.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Samish Hatchery is to collect enough adults to sustain each specie's rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply eggs or fish to cooperative rearing programs. A weir on the Samish river blocks upstream passage allowing the diversion of adults into the hatchery holding pond. This allows nearly complete capture of returning adults in addition to accurate enumeration of fish passed upstream.

Fall Chinook: Fall chinook return to the hatchery from September to November, with peak spawning in October.

Samish Coho: The run of Samish coho consists entirely of naturally produced fish. The hatchery traps only enough coho to supply 25,000 eggs for cooperative rearing programs. Fish are trapped at the hatchery from September to December, and the majority of fish are passed upstream.

Chum: The run of Samish chum consists of introduced and native chum. Adults are trapped and spawned to supply adequate eggs for cooperative rearing programs. Fish are captured at the hatchery from November to December.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery thus reducing straying into other areas.

Fall Chinook: Rear 5.2 million fall chinook to a size of at least 80 fish/pound and release in May.

Samish Coho: Eggs are incubated and shipped to cooperative rearing projects at the eyed stage.

Chum: Eggs are incubated and shipped to cooperative rearing projects at the eyed stage.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Fall chinook adults are collected throughout the entire run to ensure that the run timing of this stock is maintained.

Spawning Protocol

The intent is to utilize a spawning population of at least 500 adults. When collecting fewer than 1 million eggs in a day, the male to female spawning ratio will be 1:1 for all stocks. When collecting more than 1 million eggs in a single day, the male to female spawning ratio will be no less than 0.33. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Eggs from hatchery returning adults are always given priority for station use. The stocks approved for use at the Samish Hatchery are listed below.

<u>Fall Chinook</u>
1. Samish
2. Kendall Creek

<u>Samish Coho</u>
1. Samish

<u>Chum</u>
1. Samish

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDF facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Samish Hatchery in April and May only.

- **Total Suspended Solids (TSS)**—Monitor composite effluent, maximum effluent, and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

Hatchery Water Supply

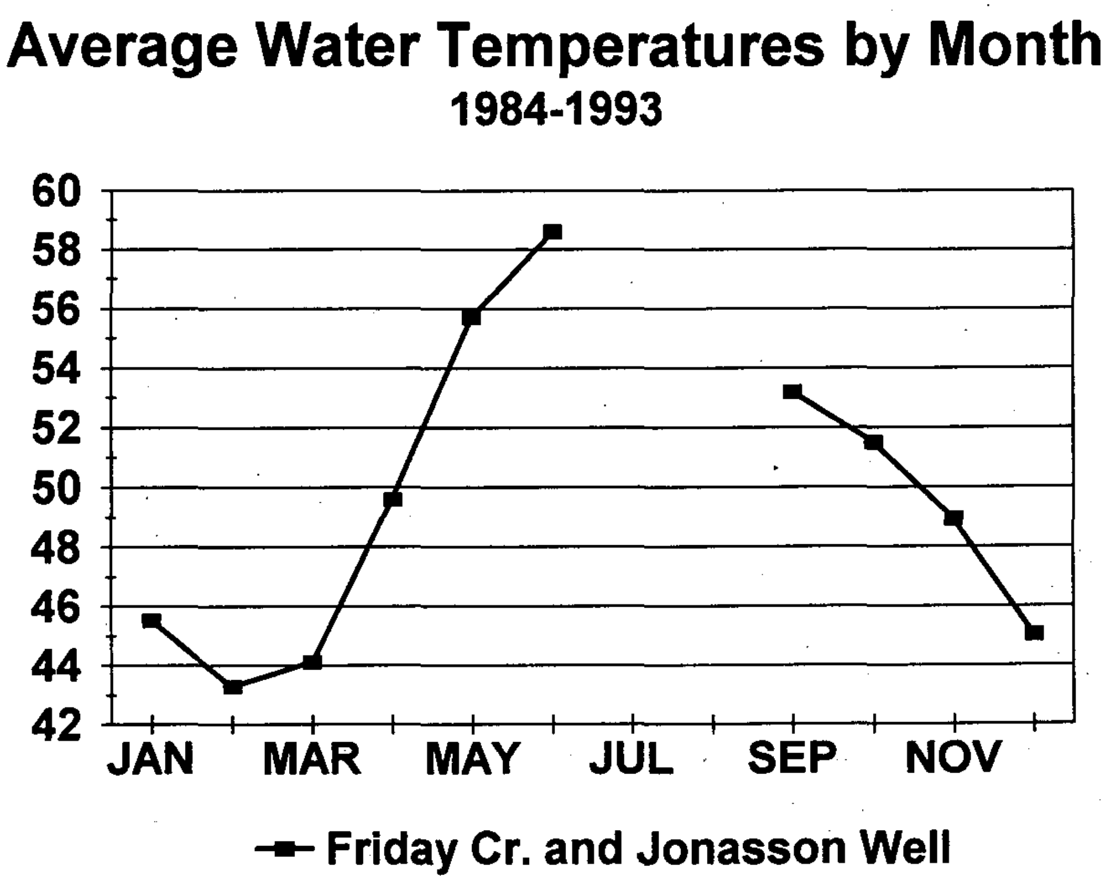
Friday Creek: Development in the upper watershed has led to extreme hydrological fluctuations including low summer/fall flows and occasional flooding during the winter. Future proposals dealing with the level of Lake Samish will potentially exacerbate low flow problems in this creek. Yearling fish cannot be reared at this hatchery due to water temperature constraints. Water rights are 23 cfs.

Samish River: Development in the upper watershed has led to chronic low flows during summer/fall. This has caused stranding of returning chinook and higher disease incidence due to warm water. The river has excellent production potential as evidenced by healthy coho run. Water rights are 32 cfs.

Well: No problems encountered. Water rights are 650 gpm.

Domestic Water: Water rights are 278 gpm.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Nooksack and Samish watershed has been developed. It documents existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Skagit System Cooperative, Lummi Tribe, Nooksack Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries—Samish Hatchery

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adult Capture	Fall Chinook	1989	3,221	16,446	NA	
		1990	3,221	15,469	NA	
		1991	3,266	8,708	NA	
		1992	3,266	7,410	NA	
		1993	7,843	11,319	NA	
	Coho[1]	1989	NA	2,402	NA	1
		1990	NA	6,159	NA	1
		1991	27	10,124	NA	1
		1992	27	7,247	NA	1
		1993	27	9,061	NA	1
	Chum	1989	806	115	NA	
		1990	806	0	NA	2
		1991	888	938	NA	
		1992	95	3,641	NA	
		1993	410	2,656	NA	
Adult Prespawning Survival	Fall Chinook	Avg.	90%	97.1%	95.5-98.6%	
	Coho	Avg.	90%	100%	99.9-100%	
	Chum	Avg.	90%	92.4%[2]	82.6-98.4%	
Eggtake	Fall Chinook[3]	1989	7,230,000	17,663,600	NA	
		1990	7,230,000	16,264,900	NA	
		1991	7,330,000	18,203,900	NA	
		1992	7,330,000	13,556,200	NA	

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1 Trapped at a hatchery rack and enumerated upstream.

2 Four years of data; 1989 and 1991-1993.

3 Adequate eggs are taken to fill other Puget Sound hatchery shortages of eggs.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Eggtake	Fall Chinook	1993	17,600,000	6,084,700	NA	1
	Coho	1991	26,500	42,000	NA	3
		1992	26,500	34,500	NA	
		1993	26,500	52,500	NA	
	Chum	1989	1,180,000	51,100	NA	
		1990	1,180,000	0	NA	2
		1991	1,300,000	491,000	NA	
		1992	135,000	790,500	NA	
		1993	600,000	684,000	NA	
Fecundity	Fall Chinook	Avg.	NA	4,618	4,329-4,880	
	Coho	Avg.	NA	1,942	1,810-2,100	
	Chum	Avg.	NA	2,611[4]	2,284-3,194	
Green Egg-to-Fry Survival	Fall Chinook	Avg.	90%	91.3%	86.5-94.6%	
	Coho	Avg.	90%	89.9%	89.9%	
	Chum	Avg.	90%	76.3%	55.1-91.9%	
	Whatcom Chum	'89,90	90%	85.1%	74.9; 95.3%	
Fry to Smolt Survival	Fall Chinook	Avg.	90%	95.7%	80.5-99.6%	
	Chum	Avg.	90%	99.3%[5]	98.1-99.9%	
	Whatcom Chum	Avg.	90%	99.8%	99.8%	
Fish Releases	Fall Chinook	1988	5,200,000	5,514,200	NA	
		1989	5,200,000	5,486,300	NA	
		1990	5,200,000	4,864,600	NA	

4 Four year average; 1989 & 1991-1993.

5 Three broods of data; 1988-1991.

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Fish Releases	Fall Chinook	1991	5,200,000	5,431,500	NA	
		1992	5,200,000	5,206,400	NA	
	Chum	1988	1,000,000	1,022,500	NA	
		1989	1,000,000	880,200	NA	
		1990	1,000,000	0	NA	4
		1991	250,000	268,000	NA	
		1992	NA	NA	NA	
	Whatcom Chum	1990	NA	1,018,000	NA	
Transfers to Tribal Facilities (Eggs/Fish)	Fall Chinook	1990	NA	591,600	NA	
Transfers within WDFW (Eggs/ Fish)	Fall Chinook	1988	3,350,000	2,403,000	NA	
		1989	2,500,000	10,038,100	NA	
		1990	3,000,000	8,336,400	NA	
		1991	3,500,000	11,102,400	NA	
		1992	3,500,000	7,535,500	NA	
	Coho	NA	NA	NA	NA	2
	Chum	NA	NA	NA	NA	2
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	1988	803,000	400	NA	
		1989	802,000	800,800	NA	
		1990	502,000	139,000	NA	
		1991	802,000	402,200	NA	
		1992	802,000	500	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Transfers to Co-ops	Coho	1991	25,000	42,000	NA	
(Eggs/Fish)		1992	25,000	27,300	NA	
	Chum	1991	125,000	0	NA	
		1992	125,000	591,300[6]	NA	
Adults Passed	Fall Chinook	1989	500	66	NA	
Upstream		1990	500	2,863	NA	
		1991	500	16	NA	
		1992	500	0	NA	
	Coho	1988	All	6,320	NA	
		1989	All	2,630	NA	
		1990	All	6,657	NA	
		1991	All	10,751	NA	
		1992	All	7,871	NA	
	Chum	1992	0	2,776	NA	
Percent Survival	Fall Chinook	Avg.	1.0%	0.83%[7]	0.3-1.8%	
Smolt to Adult	Coho	Avg.	NA	NA	NA	
	Chum	Avg.	NA	NA	NA	

6 Beginning in 1993, the eggs will be transferred to co-ops.

7 Data for three brood years; 1985-1987

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Fall Chinook	Yes	Yes	4.4-7.9	
	Coho	NA	NA	NA	
	Chum	NA	NA	NA	
Acclimation	Fall Chinook	Yes	Yes	NA	
	Coho	NA	NA	NA	
	Chum	NA	NA	NA	
Volitional Release	Fall Chinook	No	No	NA	
	Coho	NA	NA	NA	
	Chum	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	No	NA	5
	Coho	No	No	NA	5
	Chum	No	No	NA	5
Spawning Pop. >500	Fall Chinook	Yes	5,384	4,533-6,174	
	Coho	NA	NA	NA	
	Chum	NA	463	95-679	
Spawning Ratio Male:Female	Fall Chinook	>0.33	0.5	0.4-0.6	
	Coho	NA	0.8	0.3-1.0	
	Chum	>0.33	2.0	0.5-4.9	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	Fall Chinook	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Three Yr. Ave.	Range	Comments
TSS Effluent Composite	5 mg/L	-1.24[8]	-14.0-2.4	6
TSS Max Effluent	15 mg/L	1.11	-15.2-12.4	6
SS Effluent	0.1 ml/L	0.01	0.0-0.05	6
TSS PA Effluent	100 mg/L	NA	NA	7
SS PA Effluent	1.0 ml/L	NA	NA	7
Downstream Temp (°F)	Varies	NA	NA	8
Maximum Temp	<63°F	66.0°	52.0-66.0°	9
Minimum Temp	>32°F	30.0°	30.0-46.0°	9
Downstream DO(mg/l)	>9.5	NA	NA	8
Continuous Monitoring of Other Parameters	Yes	NA	NA	9

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8 Average of two months in 1991 only.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	10
Develop and Review Equil. Brood Doc.	All	Yes	Yes	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Samish Hatchery

1. Realized adult capture data represents the number of adult fish passed upstream.

2. In the past all chum were trapped to provide adequate egg takes for tribal or cooperative rearing projects. In 1990 the funding for this program was cut. The future goal of the hatchery is to pass all chum upstream.

3. No capture or rearing program for these species prior to the 1991 brood.

4. All eggs were transferred from this brood. No rearing took place.

5. Low river flows in some years results in some adults spawning in stream below hatchery.

6. This hatchery has an NPDES permit for the lower rearing pond where fish are reared during April and May only.

7. No pollution abatement pond at this hatchery.

8. Temperature and dissolved oxygen data are required only from June through September. Because fish are not reared during these months at this hatchery there is no need to sample, and no data are available.

9. Not monitored because fish are reared only in spring.

10. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

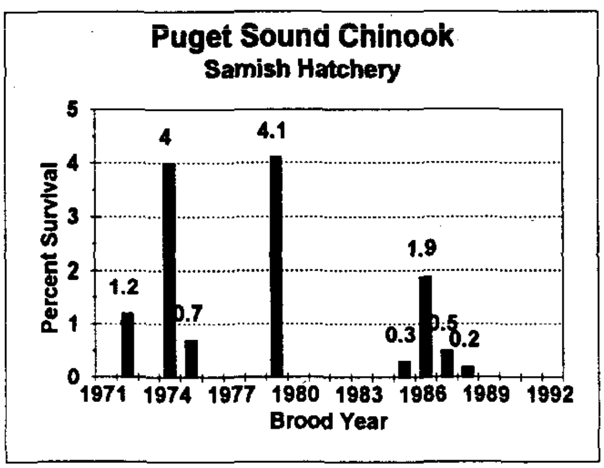
Stock Profile:

Samish Fall Chinook: This stock originated with plants of Soos Creek fall chinook. Plants of Kalama River and Wind River chinook were made between 1914 and 1925 however, there are no records of subsequent eggtakes from returning adults. Significant plants of Soos Creek fall chinook were made in 1965,1972,1973, and 1977. GSI analysis identifies this stock as typical of puget sound fall chinook (especially Soos Creek origin) and different than lower Columbia River Tule stocks. This stock has been reproduced at the hatchery for the last three generations without significant input of genetic material from other sources, including the ancestral stock (Soos Creek) **Stock Description: Introduced, adapted.**

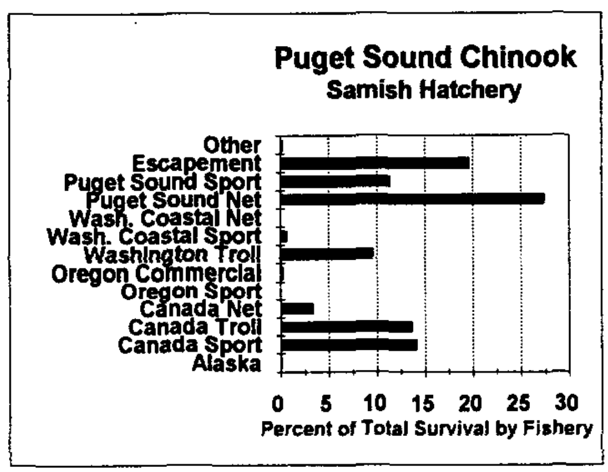
Samish Coho: Since 1913, plants of non-native coho have been made in this drainage. The current stock is a healthy, self-sustaining natural stock consisting of both native and introduced stocks. **Stock Description: Mixed.**

STOCK STATUS PROFILE FOR: Samish Fall Chinook

Survival:



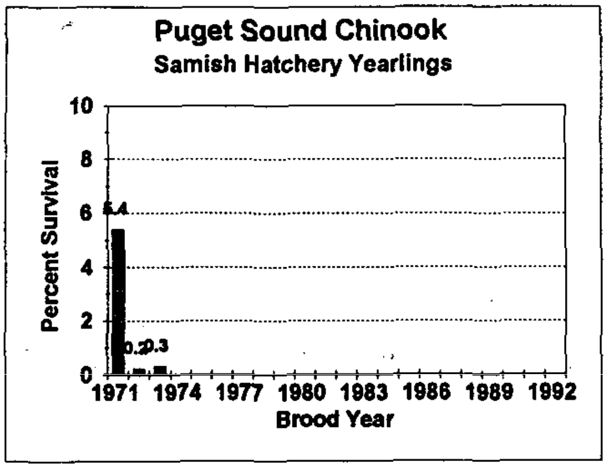
Distribution:



Four Year Average Survival: 0.73%
Catch to Escapement Ratio: 5.6:1

STOCK STATUS PROFILE FOR: Samish Yearling Fall Chinook

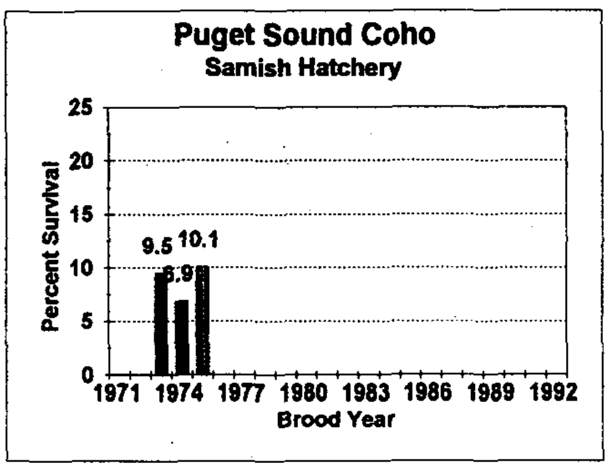
Survival:



Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Samish Coho

Survival:



Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Samish Chum
Five Year Average Survival: ND
Catch to Escapement Ratio: ND

Lake Whatcom Hatchery

Introduction

Lake Whatcom Hatchery is located on the south end of Lake Whatcom, approximately 12 miles southeast of Bellingham, WA. Built in the 1900s, the hatchery was funded by Whatcom County until 1933, when the state assumed the funding. This facility will be going through a renovation in 1995. Rearing occurs in 30 fiberglass and 48 aluminum standard fish troughs, and one 10' x 100' raceway. Two large net pens in Lake Whatcom can be used if neccessary. The main water source is Brannion Creek which supplies about 1 cfs of flow. When the creek turns muddy due to heavy rainstorms, water is pumped out of Lake Whatcom, with maximum flows of about 1.1 cfs. Eyeing capacity is about 12 million kokanee eggs and hatching capacity is about 5 million fry.

Purpose

The Lake Whatcom hatchery was built to enhance the Lake Whatcom kokanee population and supply kokanee eggs to other hatcheries for planting in lowland lakes throughout Washington. The hatchery also rears some trout for planting in lakes in Whatcom and Skagit counties.

Goals

1. Maintain the Lake Whatcom kokanee stock
2. Produce kokanee for planting into Lake Whatcom, and for other hatchery programs within the state.
3. Produce cutthroat trout for planting in several lowland lakes.

Objectives

Objective 1: 1993 Hatchery Production

1. Collect 12 million kokanee eggs.
2. Rear 5,000,000 kokanee for release on-station. Transfer remaining kokanee to other hatcheries to support planting of lowland lakes.
3. Rear 30,000 cutthroat trout catchables for planting in lowland lakes.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, steelhead, and trout producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of adult collection procedures at Lake Whatcom Hatchery is to collect enough adults to sustain the rearing program at the hatchery as well as to supply eggs to other programs within the state. Kokanee are captured at a permanent weir on Brannion Creek.

Kokanee: Kokanee return to the weir from October to December with peak spawning occurring in November.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Kokanee and trout are reared under standard conditions and either planted into Lake Whatcom or local lakes as fry, or at legal retention size (catchables), or transferred to other hatcheries for additional rearing. Trout are not acclimated to receiving waters prior to stocking. Kokanee are acclimated prior to planting into Lake Whatcom.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Kokanee are collected throughout the spawning run to ensure that run timing for this stock is maintained.

Spawning Protocol

Kokanee are not spawned at a 1:1 male to female ratio because of the large numbers of spawners that must be handled by the hatchery crew. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Kokanee
1. Lake Whatcom

Rainbow or cutthroat trout
1. Any suitable strain or stock

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The Lake Whatcom Trout hatchery is exempt from NPDES permit requirements because it rears less than 20,000 pounds of fish.

Hatchery Water Supply

Lake Whatcom: Warm water temperatures in the summer cause disease problems. Withdrawals from the lake result in low flows to the hatchery reducing rearing capacity.

Brannion Creek: Past logging practices have resulted in heavy siltation during excessively heavy rain storms.

Hatchery Water Temperature Profile

No data available.

Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Lake Whatcom Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	NA	NA	NA	NA	1
Adult Prespawning Survival	NA	NA	NA	NA	2
Eggtake	Lk. Whatcom KOK	NA	10,196.5K	7369.4K-12988.3K	
Fecundity	Lk. Whatcom KOK	NA	250	200-300	
Eyed Egg-to-Fry Survival	Lk. Whatcom KOK	85%	87.2%	81.6-93.8%	3
Survival (Fry to Plant or Transfer)	Lk. Whatcom KOK	85%	98.7%	98.0-99.2%	
	S. Tacoma RBT	85%	99.4%[1]	99.1%; 99.8%	
	Mt. Whitney RBT	85%	10.6%	10.6%	4
	Chambers Cr. WSH	85%	99.9%[2]	99.9%	
Plants	Lk. Whatcom KOK	NA	4402.4K	3470.9K-5112.6K	
	S. Tacoma RBT	NA	12,640	8,120; 17,159	5,10
	Mt. Whitney RBT	NA	37,650	37,650	5,10
	Chambers Cr. WSH	NA	98,259	80,808; 115,710	5,10
	Tokul Cr. RCT	NA	32,175	32,175	5,10
Transfers Out (Eggs/fish)	Lk.. Whatcom KOK	NA	4,433,339[3]	2418.7-6092.7K	10
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	NA	NA	NA	NA	6

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1 Two years of data, 1989 and 1990.

2 Two years of data, 1988 and 1989.

3 Eggs only.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	NA	NA	NA	NA	
Acclimation	Trout Spp. Kokanee	No Yes	No Yes	No Yes	
Volitional Release	NA	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Lk. Whatcom KOK	Yes	Yes	Yes	
Spawning Pop. >500	Lk. Whatcom KOK	Yes	40,000	29K-52K	1
Spawning Ratio Male:Female	Lk. Whatcom KOK	None	Unknown	Unknown	7

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	NA	NA	8
TSS Max Effluent	15 mg/L	NA	NA	8
SS Effluent	0.1 ml/L	NA	NA	8
TSS PA Effluent	100 mg/L	NA	NA	8
SS PA Effluent	1.0 ml/L	NA	NA	8
Downstream Temp (°F)	Varies	NA	NA	8
Maximum Temp	<63°F	NA	NA	8
Minimum Temp	>32°F	NA	NA	8
Downstream DO(mg/L)	>8.0	NA	NA	8
Continuous Monitoring of Other Parameters	Yes	NA	NA	8

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	9
Develop and Review Equil. Brood Doc.	All	Yes	No	No	10
Develop and Review Future Brood Doc.	All	Yes	No	No	10
Develop and Review Current Brood Doc.	All	Yes	No	No	10

Constraints/Comments- Lake Whatcom Hatchery

1. The returns of kokanee to this hatchery are estimated to be between 30,000-60,000 depending on the year. On average it is estimated that the hatchery traps 50,000 kokanee per year but these fish are not actually enumerated due to the large numbers of fish handled each day.

2. Fish enter trap ready to spawn so there is virtually no holding of fish until they ripen. Thus prespawning survival is virtually 100%.

3. In some years early spawners are subject to warm lake temperatures and higher egg to fry mortality occurs. Also, muddy water during heavy rainstorms can increase egg or alevin mortality prior to switching water sources.

4. Unexplained shortage causes calculated survival to be low..

5. The hatchery only rears 30,000 rainbow or cutthroat, or 100,000 winter steelhead in any one given year. The species and strain changes yearly depending on availability.

6. Smolt to adult survival cannot be calculated due to multiple age classes of returning adults.

7. Male to female spawn ratios are not recorded because of the large number of returning adults that are spawned in relation to the small hatchery crew size.

8. Because the annual production of this hatchery is less than 20,000 pound per year, it is exempt from NPDES permit requirements.

9. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

10. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus comparison of hatchery goals with programming goals cannot be made in years prior to 1994.

Stock Profile:

Lake Whatcom Kokanee: This stock has remained virtually unchanged since the first egg taking operations in 1915. This stock enter Brannion Creek, a tributary of Lake Whatcom, in October and November which are also the primary months of spawning. An egg taking station at Lake Whatcom takes several million eggs and releases approximately 5 million fry back into the lake to maintain the stock. This stock has been used extensively throughout the state and in some lakes may be mixed with other Kokanee stocks. This stock is best described as a native stock only in the Lake Whatcom watershed.

South Tacoma Rainbow Trout: This stock apparently originated from a commercial fish farm in Meeder, Utah. The origin of the Utah strain is somewhat hazy, but may have been from the McCloud River, Shasta County, California. Although originally a spring spawning strain, through manipulation of both warmer rearing temperatures and selection of early spawners, these fish now spawn predominantly between August and October with peak spawning in September. This shift in spawn timing was done to provide catchable size trout for planting into lowland lakes prior to the opening of the general trout season in April, and fingerling trout plants in May for the next trout season. This strain has experienced heavy artificial selection for both spawn timing and coloration. In recent years egg mortality appears to be on the increase indicating a possible genetic bottleneck.

Mt. Whitney Rainbow Trout: Eggs from this strain were obtained in June, 1962 from the Mt. Whitney Hatchery at Independence, California. The strain is apparently a mixture of Sacramento River rainbow, Klamath River steelhead, and possibly s small contribution of Lahonton cutthroat trout. Spawning occurs from December through March with peak spawning in January. This strain produces a deep bodied fish with a relatively small head that is ideally suited to alpine lakes because it grows well, over-winters well, and reproduces naturally where conditions allow.

Tokul Creek Resident Cutthroat: This strain of resident cutthroat was derived from wild broodstock spawning in tributary creeks of Lake Whatcom. Although this strain may have some influence from Lake Chelan cutthroat, it maintains the morphology of coastal cutthroat strains. The parent stock spawned in December -March but the current captive brood spawns primarily in January and February. The captive brood was "revitalized" in the early 1980's with wild cutthroat from Lake Whatcom. Broodstock is currently maintained at the Tokul Creek Hatchery.

Chambers Creek Winter Steelhead: See Chambers Creek Hatchery HOPPS.

STOCK STATUS PROFILE FOR: Lake Whatcom Kokanee

No current data available.

Bellingham Hatchery

Introduction

Bellingham Hatchery is located within Whatcom Falls Park, on Whatcom Creek. The hatchery was built with Works Progress Administration funds in 1937 and is currently funded by state wildlife funds. Incubation is done in 44 shallow troughs. Rearing is done in ten 40' diam. round ponds, five 10' diam. fiberglass round ponds, and seven 4' x 34' raceways. Water is provided by gravity flow from Lake Whatcom and pumps in Whatcom Creek. Water rights total 15 cfs. Bellingham Hatchery incubates and rears some Lake Whatcom kokanee.

Purpose

The Bellingham Trout Hatchery was built to produce Kokanee and trout for planting into local lakes and beaver ponds.

Goals

1. Produce kokanee fry for planting into Lake Whatcom and other lakes as needed.
2. Produce rainbow trout for planting into local lowland lakes.
3. Produce Tokul Creek cutthroat for planting into local lowland lakes.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear 800,000 kokanee fry for planting in Lake Whatcom and other selected lakes.
2. Rear 135,000 rainbow trout catchables for planting in local lowland lakes.
3. Rear 150,000 rainbow trout fry for planting in lowland lakes.
4. Rear 225,000 cutthroat trout for planting in lowland lakes.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

No adult fish are captured at this facility.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Trout are reared under standard conditions and either planted into local lakes or ponds as fry, or at legal retention size (catchables), or transferred to other hatcheries for additional rearing. Acclimation to receiving waters before stocking is not done. Kokanee are reared on Lake Whatcom water before planting into Lake Whatcom.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

No adult fish are trapped.

Spawning Protocol

No fish are spawned at this hatchery.

Acceptable Stocks

<u>Kokanee</u>
1. Lake Whatcom

<u>Cutthroat Trout</u>
1. Any strain or stock currently in Washington

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Therapeutic and Prophylactic Treatments

- Fish are not spawned at this facility.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). Because the discharge pipe is located on a cliff, the hatchery has a verbal deferment from sampling discharge water due to the danger to staff in attaining the sample. Future plans include connection to the city of Bellingham sewage treatment plant.

Hatchery Water Supply

Lake Whatcom: Warm water temperatures in the summer cause disease problems. Withdrawals from the lake result in low flows to the hatchery reducing rearing capacity.

Whatcom Creek: Same as above.

Hatchery Water Temperature Profile

Not available.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption, etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Bellingham Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	NA	NA	NA	NA	1
Adult Prespawning Survival	NA	NA	NA	NA	1
Eggtake	NA	NA	NA	NA	1
Fecundity	NA	NA	NA	NA	1
Eyed Egg-to-Fry Survival	Goldendale RBT	85%	95.6%	94.7%; 96.9%	
	Tokul Cr. RBT[1]	85%	96.7%	90.8-98.5%	
	S. Tacoma RBT	85%	73.7%	34.3-97.5%	
	Tokul Cr. RCT	85%	92.2%	90.5%; 95.8%	
	Lk. Whatcom KOK	85%	99.1%[2]	99.0; 99.2%	
Survival (Fry to Plant or Transfer)	Goldendale RBT	85%	59.0%	39.8-87.1%	2,3
	S. Tacoma RBT	85%	52.0%	41.1-92.6%	2,3
	Tokul Cr. RBT	85%	60.7%	45.7-69.0%	2,3
	Tokul Cr. RCT	85%	58.5%	21.5-80.4%	2,3
	Lk. Whatcom KOK	85%	85.3%	72.0-92.1%	
	Chambers Cr. WSH	85%	97.3%	95.1-99.9%	
Plants	Goldendale RBT	NA	92,031	81,185-101,347	4,8
	S. Tacoma RBT	NA	308,882	168,287-486,389	4,8
	Tokul Cr. RBT	NA	87,095	25,350-146,442	4,8
	Tokul Cr. RCT	NA	120,618	54,595-165,585	4,8
	Lk. Whatcom KOK	NA	128,128	0-256,256	4,8
	Chambers Cr. WSH	NA	66,996	47,852-106,952	
Transfers Out (eggs/fish)	Goldendale RBT	NA	11,349	0-33,048	4,8
	S. Tacoma RBT	NA	74,574	0-349,085	4,8
	Tokul Cr. RBT	NA	9,130	0-35,518	4,8
	Tokul Cr. RCT	NA	43,410	0-190,688	4,8
	Lk. Whatcom KOK	NA	324,630	0-649,260	4,8
	Chambers Crk. WSH	NA	100	0-500	4,8
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	NA	NA	NA	NA	

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1 Mt. Whitney strain

2 Three year average: 1991-'93.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	WSH-Chambers Ck. or derivative	NA	NA	NA	
Acclimation	Trout Spp. Kokanee	No Yes	No Yes	No Yes	
Volitional Release	NA	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	NA	NA	NA	NA	1
Spawning Pop. >500	NA	NA	NA	NA	1
Spawning Ratio Male:Female	NA	NA	NA	NA	1

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	NA	NA	5
TSS Max Effluent	15 mg/L	NA	NA	5
SS Effluent	0.1 ml/L	NA	NA	5
TSS PA Effluent	100 mg/L	NA	NA	6
SS PA Effluent	1.0 ml/L	NA	NA	6
Downstream Temp (^{0}F)	Varies	NA	NA	5
Maximum Temp	<63^{0}F	NA	NA	5
Minimum Temp	>32^{0}F	NA	NA	5
Downstream DO(mg/L)	>8.0	NA	NA	5
Continuous Monitoring of Other Parameters	Yes	NA	NA	5

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	7
Develop and Review Equil. Brood Doc.	All	Yes	No	No	8
Develop and Review Future Brood Doc.	All	Yes	No	No	8
Develop and Review Current Brood Doc.	All	Yes	No	No	8

Constraints/Comments- Bellingham Hatchery

1. No adult capture or captive broodstocks maintained at this hatchery.

2. Low flows result in high flow and density indices which negatively affect fish health.

3. High summer water temperatures cause high levels of "Ich" and Columnaris disease. This results in long duration treatment programs and high fish mortality.

4. Each year, fish management biologists determine the number of resident trout to plant in lakes within each region of the state. They also determine at what size and time of year these fish should be planted. This number is termed an allotment. For the hatcheries within the region to supply each allotment, they use one or more of the four available domestic rainbow trout broodstocks, and the different water temperature regimes unique to each hatchery. Using both the different times of year that fry are available and the different growth rates achievable at each hatchery due to water temperature, hatcheries can produce the requested sized fish at the appropriate time of year.

5. The hatchery is exempted from sampling discharge waters because of safety concerns related to location of the effluent discharge pipe.

6. The hatchery does not have a pollution abatement pond. The hatchery is scheduled to be connected to the city of Bellingham sewage treatment system.

7. Lack of adequate funding to provide sufficient office support staff.

8. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus comparison of hatchery goals with programming goals cannot be made in years before 1994.

Stock Profile:

South Tacoma Rainbow Trout: This stock apparently originated from a commercial fish farm in Meeder, Utah. The origin of the Utah strain is somewhat hazy, but may have been from the McCloud River, Shasta County, California. Although originally a spring spawning strain, through manipulation of both warmer rearing temperatures and selection of early spawners, these fish now spawn predominantly between August and October with peak spawning in September. This shift in spawn timing was done to provide catchable size trout for planting into lowland lakes prior to the opening of the general trout season in April, and fingerling trout plants in May for the next trout season. This strain has experienced heavy artificial selection for both spawn timing and coloration. In recent years egg mortality appears to be on the increase indicating a possible genetic bottleneck.

Goldendale Rainbow Trout: This strain originated in 1948 from the interbreeding of Yakima (a mixture of McNott and Meader stocks) and Meader (see S. Tacoma strain) strains of rainbow trout. This strain was chosen for early spawning, large size, high fecundity, and overall color and vigor. Spawning takes place from October to February with peak egg production in November and December.

Tokul Creek Resident Cutthroat: This strain of resident cutthroat was derived from wild broodstock spawning in tributary creeks of Lake Whatcom. Although this strain may have some influence from Lake Chelan cutthroat, it maintains the morphology of coastal cutthroat strains. The parent stock spawned in December -March but the current captive brood spawns primarily in January and February. The captive brood was "revitalized" in the early 1980s with wild cutthroat from Lake Whatcom. Broodstock is currently maintained at the Tokul Creek Hatchery.

Mt. Whitney Rainbow Trout: Eggs from this strain were obtained in June, 1962 from the Mt. Whitney Hatchery at Independence, California. The strain is apparently a mixture of Sacramento River rainbow, Klamath River steelhead, and possibly a small contribution of Lahonton cutthroat trout. Spawning occurs from December through March with peak spawning in January. This strain produces a deep bodied fish with a relatively small head that is ideally suited to alpine lakes because it grows well, over-winters well, and reproduces naturally where conditions allow.

Lake Whatcom Kokanee: This stock has remained virtually unchanged since the first egg taking operations in 1915. This stock enter Brannion Creek, a tributary of Lake Whatcom, in October and November which are also the primary months of spawning. An egg taking station at Lake Whatcom takes several million eggs and releases approximately 2.5 million fry back into the lake to maintain the stock. This stock has been used extensively throughout the state and in some lakes may be mixed with other kokanee stocks. This stock is best described as a native stock only in the Lake Whatcom watershed.

Skagit Complex

Marblemount Hatchery
Barnaby Slough
Baker Lake Spawning Beaches
Arlington Hatchery
Whitehorse Rearing Ponds

Marblemount Hatchery

Introduction

Marblemount Hatchery is located at the confluence of the Cascade River, Clark Creek and Jordan Creek near Marblemount, Washington. The hatchery began operation in 1945. The hatchery has twenty-one standard raceways, four large channels, three incubation raceways, two Capilano starting troughs, and two large rearing ponds which also serve as adult holding ponds. Incubation facilities include shallow troughs, deep troughs, freestyle incubators, and vertical incubators. Eyeing capacity is 20 million, hatching capacity is 13 million. Water is supplied from five wells, gravity flow from Jordan Creek, and pumps on Clark Creek and the Cascade River.

Purpose

The hatchery was built to increase production of coho and chinook salmon in Puget Sound. The hatchery currently helps restore runs of spring and summer chinook stocks in the Skagit River basin. The hatchery also rears normal timed (Clark Creek) and early timed (Baker River) coho for enhancement of Puget Sound fisheries, although production of this species is well below capacity for the hatchery due to conflicts with management goals for wild coho escapement in the Skagit River system. The hatchery also rears on an interim basis coho or chinook bound for other hatcheries, and provides coho eggs or fish for cooperative rearing projects.

Goals

1. Maintain local spring and summer chinook stocks, and Baker and Clark coho stocks..
2. Produce coho and chum for NE Pacific and Puget Sound fisheries.
3. Produce coho and fall chinook for cooperative rearing projects.
4. Rear steelhead to enhance the Skagit River run.

Objectives

Objective 1: 1993 Hatchery Production

Spring Chinook

Collect 590,000 1993 brood eggs.

Rear and release 500,000 1991 brood yearlings on-station.

Rear 500,000 1992 brood fingerlings for release in 1994.

Summer Chinook

Collect 490,000 1993 brood eggs.

Rear and release 400,000 1991 brood yearlings on-station.

Rear 400,000 1992 brood fingerlings for release in 1994.

Fall Chinook

Collect 430,000 1993 brood eggs.

Transfer 382,000 1992 brood Samish fall chinook fingerlings to cooperative rearing projects.

Clark Creek Coho

Collect 950,000 1993 brood eggs.

Rear and release 250,000 1991 brood yearlings on-station.

Transfer 100,000 1991 brood fingerlings to Skagit System Cooperative and 236,000 fingerlings to cooperative rearing projects.

Transfer 176,000 1992 brood eggs to cooperative rearing projects.

Baker River Coho

Collect 480,000 1993 brood eggs.

Rear and release 100,000 1991 brood yearlings on-station.

Transfer 120,000 1992 brood fingerlings to Puget Power.

Minter Creek Coho

Rear and transfer 1,500,000 1992 brood fingerlings to Skookumchuck Rearing Ponds.

Chum Salmon

Collect 236,000 eggs.

Rear and release 400,000 1992 brood fingerlings on-station.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Marblemount Hatchery is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to tribal or cooperative rearing programs. The hatchery has a weir on Clark Creek but not on the Cascade River. Fish reared on Cascade River water are not imprinted to Clark Creek and therefore a large percentage of returning adults bypass the hatchery upon return.

Fall Chinook: Fall Chinook return to the hatchery in mid- to late September. Spawning occurs from October to early November. Fall chinook will not be captured in the future.

Spring Chinook: Broodstock was originally obtained from adults captured in the Suiattle River and tributaries. Recently broodstock from the Cascade River has been used as well. Adults return to the Skagit River from mid-April through July. Adults are captured in the hatchery beginning in June. Spawning occurs from early August to September with the peak usually in late August or early September. Adults are collected at the Clark Creek weir and held at the hatchery until spawning.

Summer Chinook: Adults return to the river from August to September. Spawning occurs from mid-September to mid-October with the peak in late September. Adults are captured from the river.

Clark Creek Coho: Coho begin arriving at the hatchery in mid-October and peak by mid-November. Spawning occurs from mid-November to late December. Peak spawning is in late November.

Baker River Coho: Baker coho arrive at the hatchery from mid-August to late September. Spawning occurs primarily in late December.

Chum: Adults return to the hatchery in December. Spawning occurs primarily in mid-December.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done only with spring and summer chinook and coho because of operational constraints relating to the plumbing of the hatchery. The object of acclimation to parent river water is to ensure strong homing to the hatchery thus reducing straying into other areas.

Spring Chinook: Fish are reared to at least 15 fish/pound and released on-station (acclimated) in April.

Summer Chinook: Fish are reared to at least 80 fish/pound and released on station (acclimated) in April.

Fall Chinook: The previous fall chinook program released fish in late-May or June at sizes of at least 80 fish/pound. This program will be discontinued due to conscerns of cross breeding with spring chinook. Currently fall chinook are reared for transfer to saltwater net pens in October at 25 fpp.

Clark Creek Coho: Coho are reared to 17 fish/pound and released into Clark Creek in May. For the previous five years these fish were released in June to accommodate wild stock trapping studies. This change in release timing may have impacted survival during this time period.

Baker River Coho: Rear to 17 fish/pound and release into Clark Creek in May.

Chum: Rear to 450/pound and release in May.

Pinks: Rear to 600 fish/pound and release in March or April.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained. For the spring and summer chinook programs, tagged fish are scanned prior to spawning, however because these fish are not tagged at a 100% rate there is no assurance that spring and summer fish are spawned completely separate, thus an arbitrary spawn cut-off date is used, (Aug. 31 spawning date) to help separate these fish. For coho an arbitrary cut-off date is used to separate Baker and Clark Creek stocks.

Spawning Protocol

The intent is to utilize a spawning population of at least 500 adults. When fewer than one million eggs are collected in a day, the male to female ratio will be 1:1 for all stocks. When more than one million eggs are collected in a day, the ratio will not be less than 0.33. A portion of each day's eggtake is used for on-site hatchery production. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Eggs from hatchery-returning adults are always given priority for station use. The stocks approved for use at the Marblemount Hatchery are listed below.

Fall Chinook
1. Any suitable Puget Sound fall chinook stock, since no fish are released on-station

Clark and Baker Coho
1. Only Clark and Baker Stock

Spring Chinook
1. Marblemount spring chinook

Summer Chinook
1. Skagit summer chinook

Chum
1. Skagit River chum salmon

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at Marblemount Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month, during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

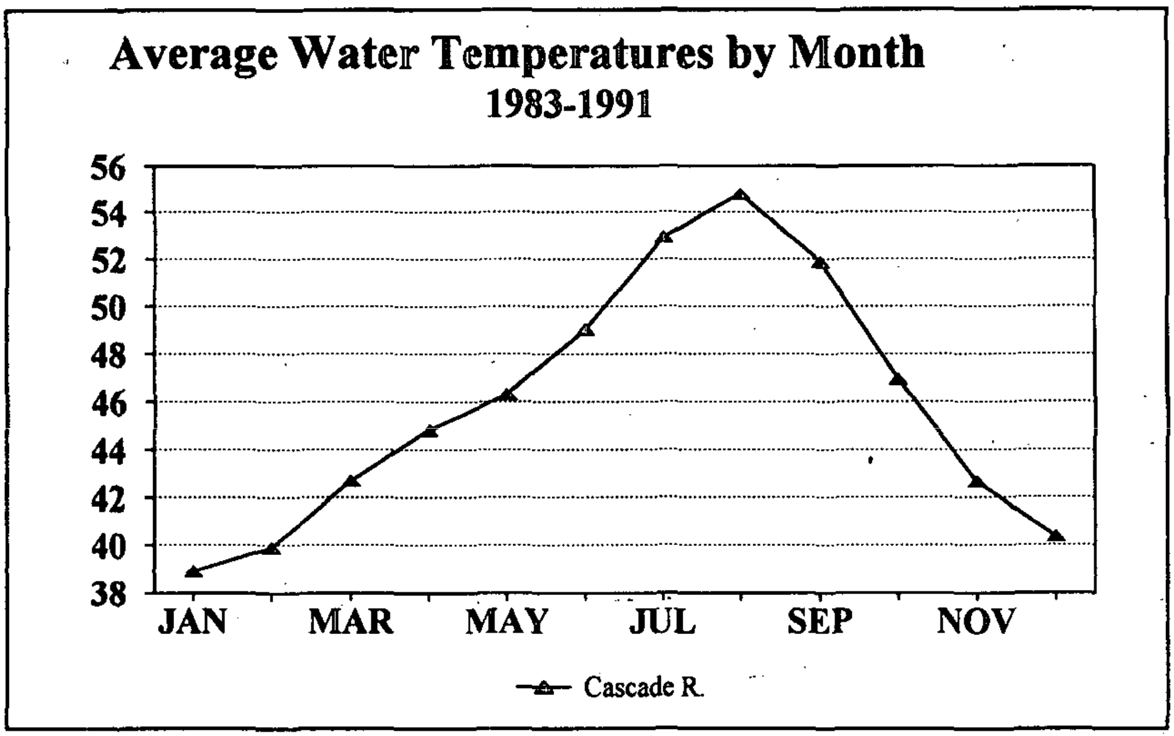
Jordan Creek: Logging practices in this already unstable watershed have exacerbated a historically bad situation. During high flows huge rocks are transported downstream and pose a large threat of damaging capital structures at the hatchery. Water rights are 15 cfs.

Clark Creek: This stream has been very stable and without appreciable amounts of silt. Recent logging in the headwaters may change this situation by increasing silt loads and temperatures and decreasing summer flows. Water rights are 25 cfs.

Cascade River: Heavy bed load movements have occurred in recent years causing stream channel shifts and increased silt loads. This has required additional expenditures in gravel removal. Water rights are 30 cfs.

Domestic Water: Water rights are 35 gpm.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Skagit watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Skagit System Cooperative, Upper Skagit Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Standards—Marblemount Hatchery

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adult Capture	Spring Chinook	1989	292	303	NA	
		1990	292	308	NA	
		1991	292	386	NA	
		1992	292	249	NA	
		1993	292	1,574	NA	
	Summer Chinook	1989	436	198	NA	1
		1990	436	609	NA	1
		1991	436	402	NA	1
		1992	220	797	NA	1
		1993	220	884	NA	1
	Fall Chinook	1989	597	216	NA	1
		1990	597	686	NA	
		1991	597	513	NA	1
		1992	243	1,415	NA	
		1993	218	300	NA	
	Clark Creek Coho	1989	1,945	4,626	NA	
		1990	1,945	6,417	NA	
		1991	1,857	2,848	NA	
		1992	792	5,360	NA	
		1993	841	5,366	NA	
	Baker Coho	1989	297	285	NA	1
		1990	297	437	NA	
		1991	297	34	NA	1
		1992	297	1,064	NA	

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adult Capture	Baker Coho	1993	549	823	NA	
	Clark Creek Chum	1989	437	70	NA	1
		1990	437	102	NA	1
		1991	437	4	NA	1
	Clark Creek Pinks	1989	NA	5	NA	1
Adult Prespawning Survival	Spring Chinook	Avg.	90%	89.4%	80.2.-97.1%	2
	Summer Chinook	Avg.	90%	97.2%	91.0-100%	
	Fall Chinook	Avg.	90%	83.7%	54.3-97.6%	
	Clark Creek Coho	Avg.	90%	96.6%	92.2-99.4%	
	Baker Coho	Avg.	90%	83.5%	77.5-94.9%	2
	Clark Creek Chum	Avg.	90%	83.1%[1]	70.0-100%	
	Clark Creek Pinks	1989	90%	40.0%	40.0%	
Eggtake	Spring Chinook	1989	590,000	477,300	NA	3
		1990	590,000	449,165	NA	3
		1991	590,000	815,461	NA	
		1992	590,000	420,500	NA	3
		1993	590,000	1,507,800	NA	
	Summer Chinook	1989	950,000	567,800	NA	1
		1990	950,000	633,800	NA	1
		1991	950,000	1,113,737	NA	
		1992	480,000	649,000	NA	
		1993	480,000	0[2]	NA	

1 Three year average; 1989-1991.

2 Program has been discontinued.

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Eggtake	Fall Chinook	1989	1,180,000	565,137	NA	1
		1990	1,180,000	1,343,600	NA	
		1991	1,180,000	1,043,500	NA	
		1992	480,000	2,360,000	NA	
		1993	430,000	478,400	NA	
	Clark Creek Coho	1989	1,780,000	4,216,600	NA	
		1990	1,780,000	3,896,200	NA	
		1991	1,700,000	2,628,894	NA	
		1992	770,000	3,102,600	NA	
		1993	950,000	1,365,300	NA	
	Baker Coho	1989	260,000	84,700	NA	4,13
		1990	260,000	105,500	NA	4,13
		1991	260,000	60,070	NA	4,13
		1992	260,000	213,800	NA	4,13
		1993	480,000	180,400	NA	4,13
	Chum	1989	480,000	57,500	NA	1
		1990	480,000	131,400	NA	1
		1991	480,000	2,000	NA	1
		1992	480,000	0	NA	1
		1993	236,000	0	NA	1
	Pinks	1989	NA	3,000	NA	1
		1991	236,000	0	NA	1

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Fecundity	Spring Chinook	Avg.	NA	4,063	3,940-4,338	
	Summer Chinook	Avg.	NA	4,483[3]	3,961-4,801	
	Fall Chinook	Avg.	NA	4,595	3,980-5,091	
	Clark Creek Coho	Avg.	NA	1,893	1,564-2,109	
	Baker Coho	Avg.	NA	2,038	1,356-3,754	
	Chum	Avg.	NA	2,534[4]	2,000-3,205	
	Pinks	Avg.	NA	3,000	3,.000	
Green Egg-to-Fry Survival	Spring Chinook	Avg.	90%	86.7%	76.6-92.6%	
	Summer Chinook	Avg.	90%	90.5%	85.1-94.8%	
	Fall Chinook	Avg.	90%	92.5%	88.6-96.6%	
	Clark Creek Coho	Avg.	90%	89.3%	85.0-95.4%	
	Baker Coho	Avg.	90%	85.2%	71.0-94.0%	
	Chum	Avg.	90%	90.1%	79.7-95.3%	
	Pinks	Avg.	90%	96.7%	96.7%	
	Suiattle Spring Chinook	Avg.	90%	95.0%	95.0%	
	Samish Fall Chinook	Avg.	90%	93.1%	82.9-99.1%	
	Minter Coho	Avg.	90%	95.6%	89.8-98.2%	
	Soos Creek Coho	Avg.	90%	99.6%	99.6%	
Fry to Smolt Survival	Spring Chinook	Avg.	90%	87.7%	70.7-94.8%	5
	Summer Chinook	Avg.	90%	93.7%	89.7-96.0%	
	Fall Chinook	Avg.	90%	93.6%[5]	87.5-98.0%	
	Clark Creek Coho	Avg.	90%	54.3%	11.8-93.3%	
	Baker Coho	Avg.	90%	88.9%	70.5-96.5%	5

3 Four year average; 1989-1992.

4 Three year average; 1989-1991.

5 Average of four broods; 1988, 1989, 1990, and 1992.

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Fry to Smolt Survival	Chum	Avg.	90%	96.3%[6]	88.1-100%	
	Pinks	1989	90%	96.6%	96.6%	
	Suiattle Spring Chinook	1988	90%	86.4%	86.4%	
	Soos Creek Fall Chinook	1988	90%	77.3%	77.3%	
	Samish Fall Chinook	1989	90%	93.2%	93.2%	
Fish Releases	Spring Chinook Yearling	1988	400,000	25,550	NA	3,5
		1989	400,000	419,300	NA	
		1990	500,000	284,523	NA	3,5
		1991	500,000	641,700	NA	
	Summer Chinook Yearling	1988	400,000	374,600	NA	
		1989	200,000	194,000	NA	
		1990	400,000	382,800	NA	
		1991	400,000	423,100	NA	
	Summer Chinook Subyearling	1988	400,000	421,700	NA	
		1989	400,000	320,700	NA	
		1990	400,000	111,120	NA	
		1991	400,000	603,280	NA	
		1992	400,000	160,000	NA	
	Fall Chinook Yearling	1988	NA	17,880	NA	
	Fall Chinook Subyearling	1988	1,000,000	1,229,000	NA	
		1989	1,000,000	236,600	NA	1
		1990	1,000,000	1,144,500	NA	
	Clark Creek Coho	1988	150,000	156,465	NA	

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[6] Four year average: 1988-1991.

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Fish Releases	Yearlings	1989	150,000	163,600	NA	
		1990	150,000	148,700	NA	
		1991	250,000	321,614	NA	
	Clark Creek Coho	1991	NA	879,744	NA	
	Subyearlings					
	Baker Coho	1988	100,000	8,585	NA	1,4
		1989	100,000	89,800	NA	1,4
		1990	100,000	151,000	NA	
		1991	100,000	54,358	NA	1,4
	Chum	1988	400,000	72,000	NA	1
		1989	400,000	52,600	NA	1
		1990	400,000	101,970	NA	1
		1991	400,000	1,900	NA	1
		1992	400,000	0	NA	1
	Pinks	1989	0	2,800	NA	1
		1991	200,000	0	NA	1
	Suiattle Spring Chinook	1988	NA	41,900	NA	
	Soos Creek Fall Chinook	1988	NA	14,150	NA	
	Samish Fall Chinook	1989	NA	1,170,800	NA	
Transfers to Tribal Facilities (Eggs/Fish)	Clark Creek Coho	1988	950,000	0	NA	6
		1989	950,000	1,059,100	NA	
		1990	950,000	588,800	NA	6
		1991	100,000	400,000	NA	6

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Transfers within WDFW (Eggs/Fish)	Clark Creek Fall Chinook	1988	0	52,560	NA	
		1989	0	21,000	NA	
	Soos Creek Fall Chinook	1988	0	85,200	NA	
	Minter Coho	1988	1,400,000	1,561,400	NA	
		1989	1,400,000	0	NA	7
		1990	1,400,000	1,262,352	NA	5
		1991	1,400,000	1,482,000	NA	5
		1992	1,400,000	1,307,410	NA	5
	Soos Creek Coho	1989	NA	1,351,000	NA	
Transfers to Co-ops (Eggs/Fish)	Fall Chinook (all stocks)	1988	175,000	182,860	NA	6
		1989	187,500	252,037	NA	6
		1990	277,500	246,099	NA	6
		1991	337,500	502,461	NA	6
		1992	347,500	299,650	NA	6
	Clark Creek Coho	1988	460,000	3,442,969	NA	6
		1989	427,000	443,854	NA	6
		1990	407,000	598,253	NA	6
		1991	235,000	743,300	NA	6
	Baker Coho	1988	120,000	0	NA	1
		1989	120,000	250	NA	1
		1990	120,000	0	NA	1
		1991	120,000	120	NA	1
		1992	120,000	0	NA	1

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adults Passed Upstream	Spring Chinook	NA	NA	NA	NA	
	Summer Chinook	NA	NA	NA	NA	
	Fall Chinook	NA	NA	NA	NA	
	Clark Crk Coho	1989	NA	1,000	NA	
	Clark Creek Coho	1990	NA	1,370	NA	
Percent Survival Smolt to Adult	Spring Chinook	Avg.	5.0%	0.66%	0.6-2.4%	
	Summer Chinook	Avg.	5.0%	ND	ND	8
	Fall Chinook	Avg.	NA	NA	NA	8
	Clark Coho	Avg.	10.0%	4.9%	2.2-7.7%	9
	Baker Coho	Avg.	10.0%	ND	ND	8
	Chum	Avg.	1.0%	NA	NA	8
	Pinks	Avg.	0.5%	NA	NA	8

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Spr. Chinook	Yes	11.6	7.3-13.0[7]	10
	Sum. Chinook	Yes	ND[8]	ND	8
	Fall Chinook	Yes	ND	ND	8
	Clark Coho	Yes	4.7	4.2-5.0[9]	
	Baker Coho	Yes	5.0[10]	5.0	8
	Skagit Chum	Yes	ND	ND	8
	Skagit Pinks	Yes	ND	ND	8
Acclimation	Spr. Chinook	Yes	Yes	Yes	
	Sum. Chinook	Yes	No	No	11
	Fall Chinook	Yes	No	No	11
	Clark Coho	Yes	Yes	Yes	
	Baker Coho	Yes	Yes	Yes	
	Skagit Chum	Yes	No	No	11
	Skagit Pinks	Yes	No	No	11
Volitional Release	Spr. Chinook	No	No	No	
	Sum. Chinook	Yes	Yes	No	
	Fall Chinook	No	No	No	
	Clark Coho	No	No	No	
	Baker Coho	No	No	No	
	Skagit Chum	No	No	No	
	Skagit Pinks	No	No	No	

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7 Data for 4 years only (one year missing).

8 No CV data in files.

9 Records of CV determination for two of five broods only.

10 Records for only one brood.

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Spr. Chinook	Yes	No	No	1
	Sum. Chinook	Yes	No	No	1
	Fall Chinook	Yes	Yes	Yes	
	Clark Coho	Yes	Yes	Yes	
	Baker Coho	Yes	Yes	Yes	
	Skagit Chum	Yes	Yes	Yes	
	Skagit Pinks	Yes	Yes	Yes	
Spawning Pop. >500	Spr. Chinook	Yes	372	215-787	12
	Sum. Chinook	Yes	380	159-569	12
	Fall Chinook	Yes	557	162-1,199	12
	Clark Coho	Yes	3,277	1,726-4,304	
	Baker Coho	Yes	228	32-354	12
	Skagit Chum	Yes	46	4-81	12
	Skagit Pinks	Yes	2	2	12
Spawning Ratio Male:Female	Spr. Chinook	1.0	1.0	0.7 - 1.2	
	Sum. Chinook	1.0	1.1	0.3-1.8	
	Fall Chinook	>0.33	0.9	0.4 - 1.1	
	Clark Coho	>0.33	1.0	0.7 - 1.3	
	Baker Coho	>0.33	2.2	1.0-4.0	13
	Skagit Chum	>0.33	1.6	1.0-3.0	
	Skagit Pinks	>0.33	1.0	1.0	

Objective 4: Maximize survival at all life stages using disease control and prevent techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures		Hatchery Goal	Three Yr. Ave.	Range	Comments
TSS Effluent Composite		5 mg/L	-1.25	-30.4-2.4	
TSS Max Effluent		15 mg/L	-0.16	-24.0-6.0	
SS Effluent		0.1 ml/L	0.01	0.0-0.02	
TSS PA Effluent		100 mg/L	NA	NA	14
SS PA Effluent		1.0 ml/L	NA	NA	14
Downstream Temp (°F)		Varies	53.4°	51.8-54.5°	
Maximum Temp	Cascade R.	<63°F	64.0°,[11]	55.9-68.0°	
	Clark Ck.	<63°F	68.0°	51.8-68.0°	
	Jordan Ck.	<63°F	68.0°	55.9-68.0°	
Minimum Temp	Cascade R.	31°	30.0°	30.01-37.4°	
	Clark Ck.	32°	36.0°	36.0-39.9°	
	Jordan Ck.	32°	37.0°	37.0-50.0°	
Downstream DO (mg/L)		>9.5	9.9[12]	9.2-11.1	
Continuous Monitoring of Other Parameters		Yes	NA	NA	

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11 Average of several water sources from 1984-1991.

12 Average of three months (June-August) from one year.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	15
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Marblemount Hatchery

1. Poor smolt to adult survivals result in too few returning adults to meet program. Also, because there is no weir on the Cascade River, adult fish can bypass hatchery, particularly if they werre not imprinted to Clark Creek water prior to release.

2. Length of holding time prior to spawning affects mortality, as does handling while sorting fish to determine ripe from unripe fish. Spring chinook are given a prophylactic antibiotic treatment during holding. Because of otter predation these fish are moved from holding ponds to rearing ponds which induces additional stress.

3. The hatchery may meet adult escapement goal, but in some of those years a high proportion of males may result in the eggtake goal not being met.

4. Baker Coho are held for a long time at hatchery which increases their mortality rate. Also these fish are moved to raceways to separate them from Clark Creek Coho and protect them from otter predation. This increases handling stress and causes higher mortality of females, thus reducing eggtake potential.

5. Bird predation prior to installation of wire covers over rearing ponds caused higher mortality rate.

6. Changes to program after the Future Brood Document is developed, or changes in availability of eggs may cause dicrepancy in program versus realized goal.

7. Soos Creek coho were substituted for Minter Creek coho for this brood.

8. Lack of current and continuous coded wire tagging program. Mean lengths and CV's are calculated for coded-wire tagged groups only.

9. Release date was delayed several weeks in each of the previous five broods to accomodate wild stock trapping. This change in programmed release date also coincided with poor ocean conditions which affected broods 1989 and 1990.

10. Spring chinook juvenile populations occasionally show bimodality in length.

11. Hatchery lacks the ability to acclimate some groups of fish to Clark Creek water prior to release.

12. Hatchery goal is for less than 500 adults in the spawning population.

13. Baker stock usually returns at a higher male:female ratio than most Puget Sound coho stocks.

14. Hatchery lacks a pollution abatement pond.

15. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

Stock Profile:

Marblemeount Spring Chinook: Clark Creek spring chinook appear to have originated from local Skagit stock. References to Skagit spring chinook were found in planting records in 1952. These fish may have originated from the Cascade River. Plants of spring chinook were discontinued until the 1974 brood when Buck Creek (Suiattle Tributary) stock was introduced at the hatchery. Introductions of this stock were stopped in 1988. From 1976-1982 other tributaries of the Suiattle were trapped and broodstock collected for the hatchery. In 1981 the first returns of Buck Creek stock returned to the hatchery. These progeny along with progeny from tributary streams were combined and released. From 1983 on, Clark Creek stock should be considered a mixture of Suiattle tributary stocks (mostly Buck Creek) and hatchery returns. In recent years GSI analysis has identified the Clark Creek stock as different from other chinook stocks in the sub-basin. **Stock Description: Mixed.**

Marblemount Summer Chinook: Clark Creek summer chinook were first planted in 1979 (1977 brood) and has been planted every year thereafter, with the exception of the 1981 brood. The stock originated from adults captured in the Skagit River, until returning broodstock could be used to perpetuate the run. There is some indication that Wallace River summer chinook were planted at this hatchery in one year. GSI analysis indicates the strong possibility of interbreeding with fall chinook in the hatchery, because allelle frequencies closely resemble Samish fall chinook. Beginning in 1994, only adults gaffed in the river will be used for this program. **Stock Description: Unknown.**

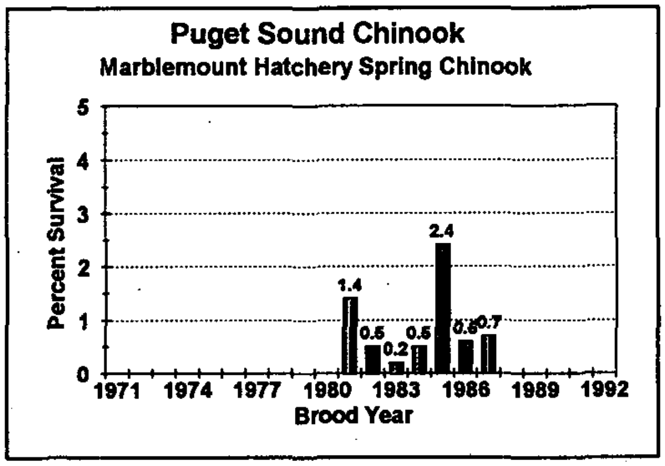
Clark Creek Fall Chinook: This stock most likely originated from Soos Creek stock. However, since 1957 numerous other fall chinook stocks have been planted at Marblemount Hatchery. These include Samish, Kendall Creek, Issaquah, Minter, and a hybrid cross of Willapa and Humptulips (1972) stocks. **Stock Description: Introduced, non-adapted.**

Clark Creek Coho: Plantings of coho were made at Marblemount Hatchery soon after completion in 1945. It is likely these plants originated from local Skagit stock. It is possible that these coho have hybridized to some extent with Baker Coho. **Stock Description: Native.**

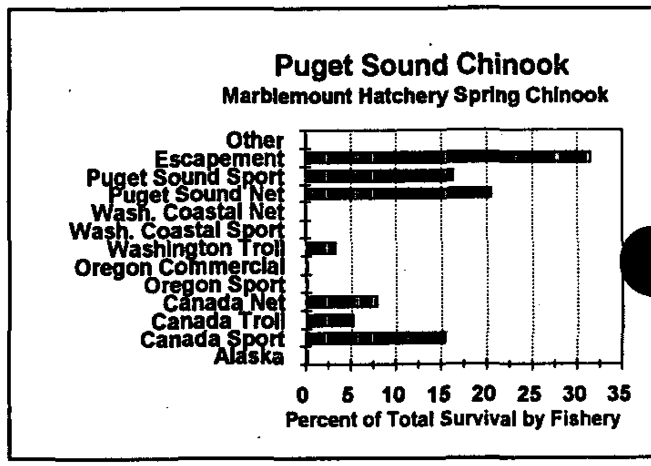
Baker River Coho: Baker River stock coho were first planted at Marblemount Hatchery in 1973. Coho adults from other stocks were released into the Baker River system and therefore hybridization may have occurred prior to introduction to the hatchery. Additional hybridization may have occurred at the hatchery because both Baker and Clark Creek stocks were held together in the adult pond. Cut-off dates have been used for stock separation, but this may have been inadequate to prevent hybridization. Coded wire tag analysis indicates that adults tagged as Baker River juveniles actually were spawned and classified as Clark Creek stock. **Stock Description: Introduced, adapted.**

STOCK STATUS PROFILE FOR: Marblemount Spring Chinook

Survival:



Distribution:

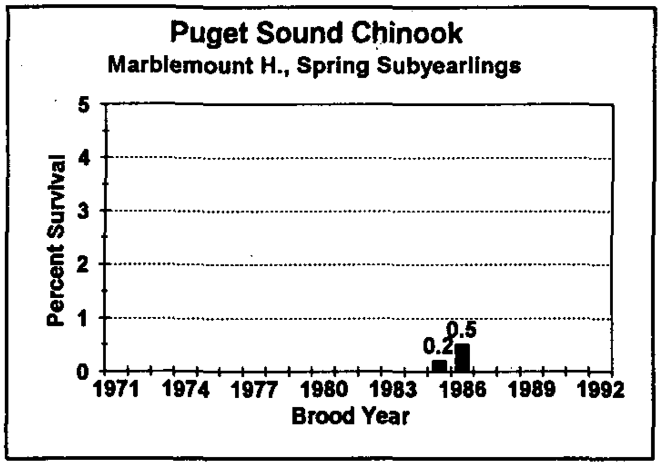


Two Year Average Survival: 0.65 %
Catch to Escapement Ratio: 3.0:1

AR049508

STOCK STATUS PROFILE FOR: **Marblemount Spring Chinook- *subyearlings***

Survival:



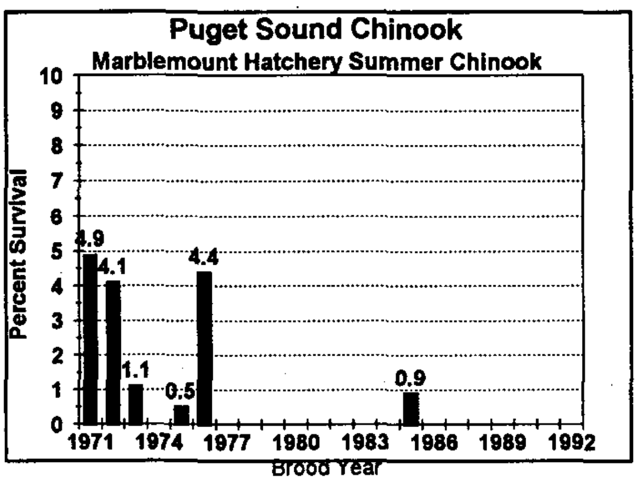
Distribution: ND

Five Year Average Survival: ND

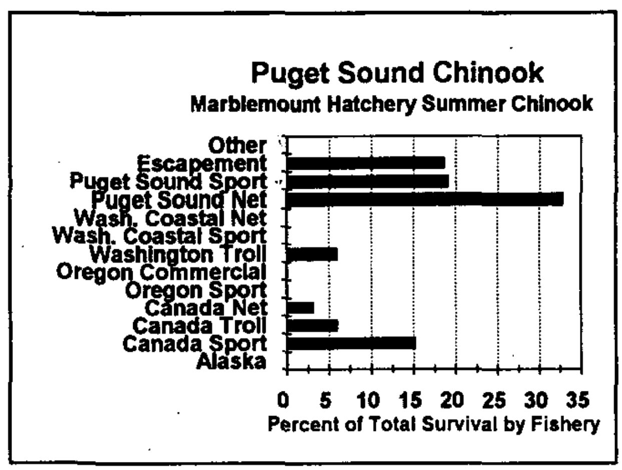
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Marblemount Summer Chinook

Survival:



Distribution: (1985 brood year)

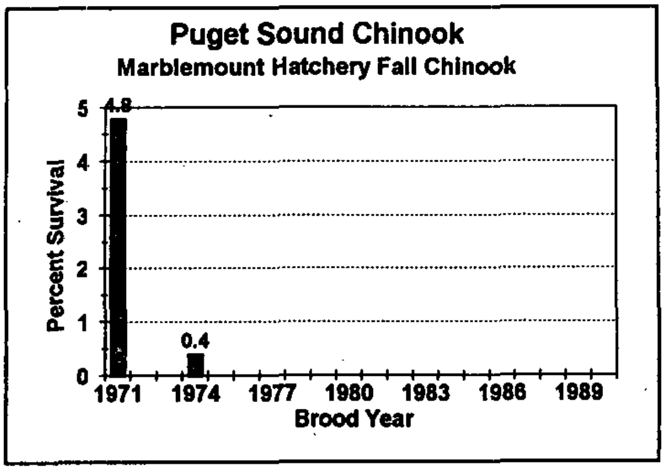


Five Year average Survival: ND

Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Clark Creek Fall Chinook

Survival:



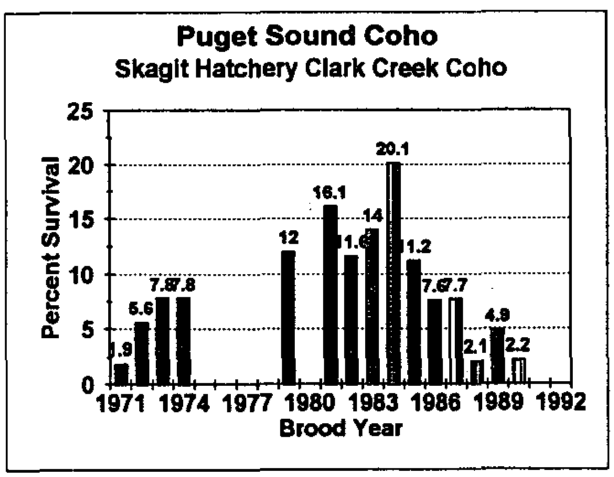
Distribution: ND

Five Year Average Survival: ND

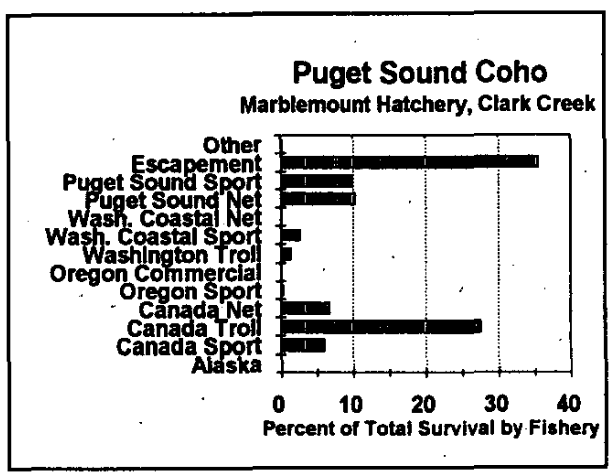
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Clark Creek Coho

Survival:



Distribution:



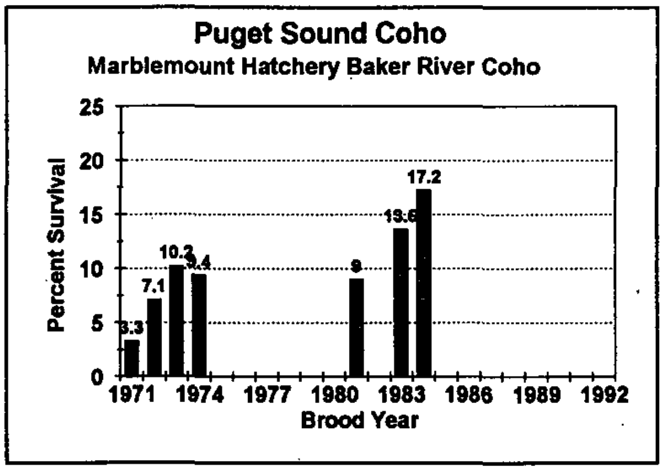
Five Year Average Survival: 4.9%

Catch to Escapement Ratio: 2.9:1

AR049510

STOCK STATUS PROFILE FOR: Baker River Coho

Survival:



Distribution: ND

Five Year Average Survival: ND

Catch to Escapement Ratio: ND

Barnaby Slough Rearing Ponds

Introduction

Barnaby Slough is at river mile 70 on the Skagit River, approximately 2 miles east of Rockport, WA. Barnaby pond began as a natural type pond in the mid-1960s and has been modified several times since. In 1987, the pond was reduced to five acres, then to one acre in 1993. Funding for this facility has been through state wildlife funds and donations from the Wildcat Steelhead Club. The facility has an incubation building with 96 isolation buckets. Some rearing is done in two raceways at Harrison slough. One raceway is 12' x 80' and the second is 12' x 48'. There is also one large rearing pond (70' x 500') with an outlet smolt trap (12' x 60'). Water is supplied by river perks, spring water, and well water, with a total potential of 8.3 cfs. Some rearing of steelhead is now done at the Marblemount Hatchery. The Davis Slough acclimation pond is operated in cooperation with the Wildcat Steelhead Club and produces 20,000 to 40,000 smolts.

Purpose

The Barnaby Slough Rearing ponds were built to rear and release winter steelhead smolts in the Skagit River system.

Goals

1. Produce Chambers Creek winter steelhead for tribal and recreational fisheries in the Skagit River.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear and release approximately 288,000 Chambers Creek stock winter steelhead smolts on-station.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, steelhead and trout producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Barnaby Slough Rearing Ponds is to collect enough adults to sustain the rearing program at the facility and to supply, if needed, eggs to other regional programs. A fish trap at the hatchery and at the Baker Dam collects returning adults.

Winter Steelhead: Winter steelhead return to the hatchery from late November through February. Peak spawning is in mid-January.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared on-station with a portion planted directly into the Skagit River and another portion from Davis slough and other rearing sites. Prior acclimation to receiving water does not occur at Barnaby Slough but does occur at Davis Slough.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adult winter steelhead are collected throughout the entire run to ensure that run timing for these stock is maintained.

Spawning Protocol

Gametes from 5 male and 5 female steelhead are pooled and fertilized. The effective population size (N_e) is not known due to this pooling of gametes.

Acceptable Stocks

Winter Steelhead

1. Marblemount Hatchery or any Chambers Creek derivative

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Barnaby Slough Rearing Pond:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

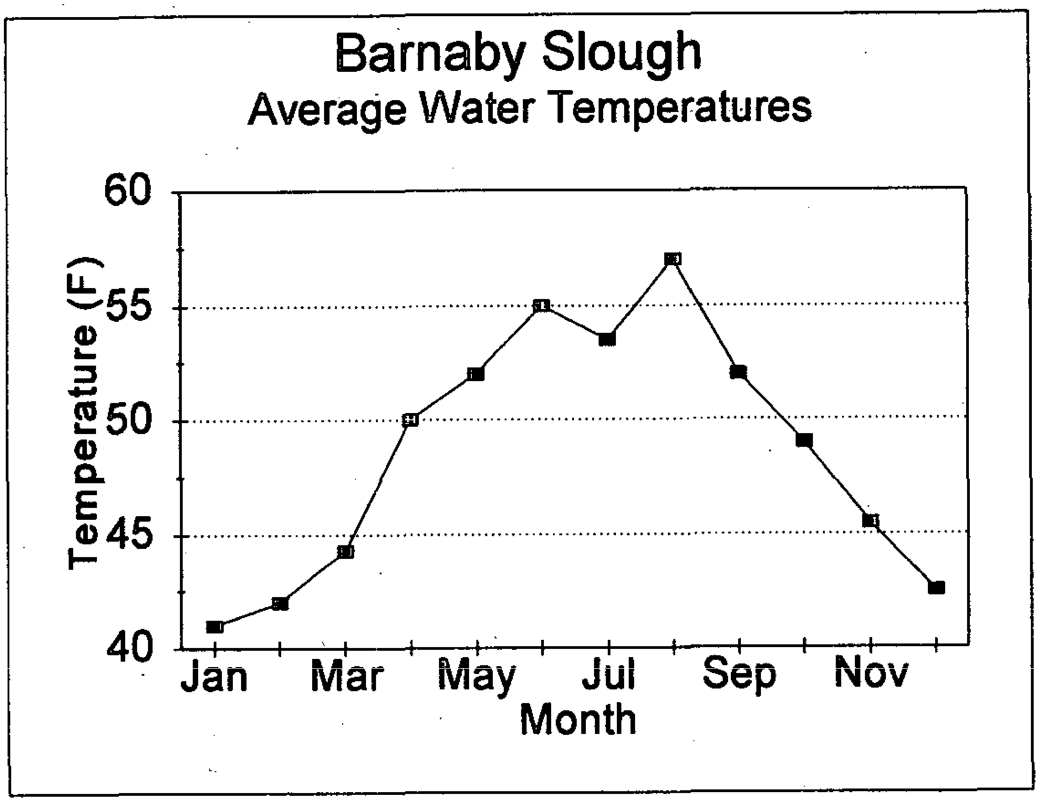
- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Barnaby Slough spring water: During summer months flow and temperature fluctuates making rearing of fish difficult at times. Water rights are 8.3 cfs.

Hatchery Water Temperature Profile



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Barnaby Slough Rearing Ponds

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	Skagit WSH	NA	53[1]	35; 70	1, 9
Adult Prespawning Survival	Skagit WSH	85%	NA	NA	2
Eggtake	Skagit Hatch. WSH	NA	245,175[2]	150,000-340,350	9
	Skagit Wild WSH	NA	76,744[3]	73,000-82,910	9
Fecundity	Skagit Hatch. WSH	NA	4,467	4,081-4,848	
	Skagit Wild WSH	NA	NA	NA	
Eyed Egg-to-Fry	Skagit Hatch. WSH	75%	73.0%	47.5-84.2%	
Survival	Skagit Wild WSH	75%	67.5%	49.6-85.1%	
Survival	Skagit Hatch. WSH	85%	93.0%	93.0%	
(Fry to Plant	Skagit Wild WSH	85%	64.5%	46.7-78.6%	3
or Transfer)	Chambers Cr. WSH	85%	43.7%	18.7-93.6%	3
Plants	Chambers Cr. WSH	NA	152,384	56,871-240,777	9
	Skagit Hatch. WSH	NA	14,817	29,634	9
	Skagit Wild WSH	NA	31,488	11,934-46,592	9
Transfers Out	Skagit Hatch. WSH	325,000	178,952[4]	71,187-367,337	
(eggs/fish)	Skagit Wild WSH	NA	51,765[5]	37,428-70,010	
Adults Passed Upstream	NA	NA	NA	NA	

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[1] Average of two return rears, 1992-'93 & 1993-'94

[2] Average of three broods: 1990, 1992, 1993.

[3] Average of four broods: 1988-1991.

[4] Eggs only, three broods: 1990,1992,1993

[5] Eggs or fry were shipped to either Skagit Salmon Hatchery or South Tacoma Trout Hatchery and then returned to Barnaby Rearing ponds for additional rearing. Although reared at Barnaby Slough these fish are part of a cooperative rearing project.

Objective 1: (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Percent Survival Smolt to Adult	NA	NA	NA	NA	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	Skagit Hatch. WSH	NA	NA	NA	
	Skagit Wild WSH	NA	NA	NA	
	Chambers Cr. WSH	NA	NA	NA	
Acclimation	Skagit Hatch-WSH	No	No	No	4
Volitional Release	Skagit Hatch.-WSH	Yes	Yes	Yes	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Skagit Hatch.-WSH	Yes	Yes	Yes	
	Skagit Wild WSH	NA	NA	NA	
Spawning Pop. >500	Skagit Hatch-WSH	No	53	35-70	1,5
Spawning Ratio Male:Female	Skagit Hatch. WSH	1.0	NA	NA	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	NA	NA	6
TSS Max Effluent	15 mg/L	NA	NA	6
SS Effluent	0.1 ml/L	NA	NA	6
TSS PA Effluent	100 mg/L	NA	NA	7
SS PA Effluent	1.0 ml/L	NA	NA	7
Downstream Temp (°F)	Varies	NA	NA	6
Maximum Temp	<63°F	NA	NA	6
Minimum Temp	>32°F	NA	NA	6
Downstream DO(mg/L)	>8.0	NA	NA	6
Continuous Monitoring of Other Parameters	Yes	NA	NA	6

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	8
Develop and Review Equil. Brood Doc.	All	Yes	No	No	9
Develop and Review Future Brood Doc.	All	Yes	No	No	9
Develop and Review Current Brood Doc.	All	Yes	No	No	9

Constraints/Comments- Barnaby Slough Rearing Pond

1. Adult capture was not emphasized in previous years because fish came from one or two hatcheries in Puget Sound region.

2. Records not kept due to lack of directed egg take program.

3. Heavy losses have occurred due to a multitude of factors including: predation, disease outbreaks, and flooding. Heavy algae growth in summer months causes poor water quality and stresses fish making them more susceptible to disease.

4. No river intake to supply water for acclimation. Fish reared in Davis Slough are acclimated prior to release.

5. Poor collection facility in previous years made trapping of adult steelhead very difficult. Improvements have been made such that increased trapping efficiency should occur.

6. Data not taken or missing.

7. No pollution abatement pond.

8. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

9. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus comparison of hatchery goals with programming goals cannot be made in years prior to 1994.

Stock Profile:

Skagit Hatchery Winter Steelhead: This stock of steelhead originated from Chambers Creek and native steelhead in 1960 (see stock profile for Chambers Creek Hatchery). A mixture of fry transferred from Chambers Creek parentage and returns to Skagit are currently used to maintain this program. When sufficient broodstock returning to the hatchery is available to meet program release goals, then imports of Chambers Creek steelhead are unnecessary. **Stock Description: Introduced, non-adapted.**

STOCK STATUS PROFILE FOR: Skagit Hatchery Winter Steelhead

No data available.

Baker Lake Sockeye Spawning Beaches

Introduction

The Baker Lake sockeye spawning beaches are located on the shores of Lakes Baker and Shannon near the town of Concrete, Washington. The facilities were built to mitigate for lost spawning habitat in Baker Lake as the result of the completion of upper Baker Dam. The spawning beaches are operated by the habitat program of WDFW, but both trapping and net pen operations are handled by Puget Power. Beginning in 1995, the Hatchery Program of WDFW will operate the spawning beaches.

Three spawning beaches are located on the upper end of Baker Lake. Beach 1 was constructed in 1957 and consists of a small pond with concrete sides and gravel bottom. This spawning beach has not been in use since 1963. Beaches 2 and 3 were put into operation in 1959 and 1967, respectively. Both Beaches 2 and 3 measure 100' x 150', with earthen sides and a gravel bottom. They are supplied by an upwelling water system fed by a small reservoir on Channel Creek which can supply 6-8 cfs water. Normal operating flow is 5 cfs per beach. Two diesel pumps can supply a total of about 4 cfs should gravity flow fall below the required amount. Beach 4 (200' x 150') is located on the west shore of Lake Shannon and was built to replace Beaches 2 and 3. The latter two beaches are in some jeopardy due to the potential of flooding from the Baker River. Spawning Beach 4 is surrounded on three sides by an earthen wall and on one side by a concrete wall. Beach 4 is fed by a spring which can supply about 20 cfs flow. Because of concern over turbidity in the water supply, a turbidity meter was installed which can shut off flow if turbidity is too high. A backup recirculation system could be installed to prevent egg loss.

Beaches 2 and 3 can hold up to 1,500 adults each and Beach 4 can hold 3,000 adults. Current operation is at half of the designed capacity due to problems with IHN. Adults are trapped on the lower Baker River and trucked to each spawning beach. Fry from Beaches 2 and 3 are allowed to volitionally emigrate to Baker Lake, but fry from Beach 4 are captured and trucked by Puget Power to Baker Lake. Approximately 130,000 of these fry are captured for transfer to net pens on Lake Shannon for rearing and release one year later. In 1993 an experimental zero-age smolt program was started at the Sulphur Springs trout facility.

Purpose

The Baker Lake sockeye spawning beaches and rearing program mitigates for lost production of sockeye salmon in the Baker River system as the result of hydroelectric development.

Goals

1. Maintain Baker Lake sockeye run.

Objectives

Objective 1: 1993 Hatchery Production

Seed Spawning Beaches 2-4 with 1,500-3,000 adults from returns in 1993.
Transfer and rear 130,000 1992 brood fry to Lake Shannon Cooperative Net Pens and release as yearling smolts.
Transfer 25,000 1992 brood fry to Sulfur Springs cooperative rearing program as part of an experimental zero-age smolt program.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures for the Baker Lake Spawning Beaches is to collect enough adults to sustain the incubation and rearing program, while meeting guidelines designed to maintain genetic diversity of this stock. Adult collection occurs at the trap located on the lower Baker River Dam.

Baker River Sockeye: Return to the Baker River is from mid-June to mid-August with spawning occurring from late-September through December.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to maximize survival of a portion of the total brood spawning in the system. Acclimation to the parent lake water is done for most of the rearing period.

Sockeye: Sockeye fry are allowed to emigrate from the spawning beaches from February to June (peak is late March to early April) at 3,000 fish per pound. A group of fish are captured and reared in net pens for one year and released from April to June at 18-9 fish per pound. An experimental group is reared and released at 90 fish per pound in May of the year of emergence.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

In recent years run size has been at or below the capacity of the spawning beaches, and thus, the entire run has been transferred to the spawning beaches.

Spawning Protocol

Fish are allowed to spawn without intervention from humans.

Acceptable Stocks

<u>Sockeye</u>
1. Baker River

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

<u>Health Monitoring</u>

- Fish are not spawned at this facility.

<u>Disease Prevention</u>

- Fish are not checked by WDFW personnel.

<u>Sanitation</u>

- Eggs are not incubated at this facility

- Fish are not handled by WDFW personnel.

Therapeutic and Prophylactic Treatments

Fish are not checked by WDFW personnel.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. Net pen operations are not currently required to operate under the NPDES permit system. This facility does not produce more than 20,000 pounds of production and therefore is not required to operate under a NPDES permit.

Hatchery Water Supply

Channel Creek: Water quality has remained good. Flows occasionally drop below adequate levels to supply Beaches 2 and 3.

Spring Water: A large land slide occurred during the construction of the intake. This caused sedimentation problems and reduced the productivity of Beach 4. The potential exists for future landslides and increased turbidity which could cause the loss of an entire brood due to the turbidity meter shutting down flow to the spawning beach. A backup system is needed to protect future broods.

Hatchery Water Temperature Profile:

Current data is unavailable.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Development and Review of Brood Documents

Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken and finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Skagit System Cooperative, the Upper Skagit Tribe, Northwest Indian Fisheries Commission, U.S. Fish and Wildlife Service, Puget Power, and the Baker Committee, takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at these facilities.

Performance Summaries—Baker Lake Spawning Beaches

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	Baker Sockeye	1,500-3,000	1,821	480-3,689	
Adult Prespawning Survival	Baker Sockeye	ND	ND	ND	
Fry Production	Baker Sockeye	NA	550,571[1] 479,961[2] 56,634[3]	433,600-702,727 479,961 18203; 95,065	1
Fecundity	Baker Sockeye	NA	2,955[4]	NA	
Green Egg-to-Fry Survival	Baker Sockeye	NA	ND	ND	
Fry to Smolt Survival	Baker Sockeye	NA	6.7%	1.1-21.7%	
Fish Releases	Baker Lake Sockeye Lk. Shannon Net Pens	NA NA	476,188[5] 104,653[6]	291,923-642,727 60,000-141,677	
Transfers to Co-ops (Eggs/Fish)	Baker Sockeye	155,000	104,653	60,000-141,677	
Adults Passed Upstream	Baker Sockeye	NA	ND	ND	
Percent Survival Smolt to Adult	Baker Sockeye	NA	ND	ND	

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1 Beach 2 average, years 1988-1991.

2 Beach 3.

3 Beach 4 average, years 1991 and 1992.

4 Estimated by dividing fry production from several beaches by total spawned females.

5 Four year average, 1988-1991.

6 Five year average, 1988-1992.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	Baker Sockeye	NA	NA	NA	
Acclimation	Baker Sockeye	Yes	Yes	Yes	
Volitional Release	Baker Sockeye	Yes	Yes	Yes	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Baker Sockeye	Yes	Yes	Yes	
Spawning Pop. >500	Baker Sockeye	Yes	2,996[7]	2,344; 3,648	
Spawning Ratio Male:Female	Baker Sockeye	NA	0.77[7]	0.69-0.90	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	Baker Sockeye	No	No	No	

7 Average for 1992 and 1993.

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Two Year Average	Range	Comments
TSS Effluent Composite	NA	NA	NA	2
TSS Max Effluent	NA	NA	NA	2
SS Effluent	NA	NA	NA	2
TSS PA Effluent	NA	NA	NA	3
SS PA Effluent	NA	NA	NA	3
Downstream Temp (°F)	NA	ND	ND	
Maximum Temp	<63°F	ND	ND	
Minimum Temp	>32°F	ND	ND	
Downstream DO (mg/L)	NA	ND	ND	2
Continuous Monitoring of Other Parameters	NA	ND	ND	2

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	4
Develop and Review Equil. Brood Doc.	Sockeye	Yes	No	NA	
Develop and Review Future Brood Doc.	Sockeye	Yes	Yes	NA	
Develop and Review Current Brood Doc.	Sockeye	Yes	Yes	NA	

Constraints/Comments—Baker Lake Spawning Beaches

1. A set number of spawners are placed in each spawning beach. These fish are allowed to spawn naturally, therefore data on prespawning survival, total egg deposition, egg to fry survival, or fecundity are not available.

2. Puget Power operates the net pen programs. No transfer number was available, therefore the average number of fish released was substituted for the number transferred.

3. Because the fish are allowed to spawn naturally, ovarian fluids are not collected and screened for presence of virus. Progeny are inspected for disease and antibiotic treatments prescribed when appropriate.

4. Operation of this facility is not under NPDES permit regulation.

5. No pollution abatement pond.

6. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

<u>Baker River Sockeye</u>: **Stock Description: Native.**

***STOCK STATUS PROFILE FOR:* Baker River Sockeye**

<u>Survival:</u> No current survival data available
<u>Distribution</u>: No current distribution data available.
Catch to Escapement Ratio: NA

Arlington Hatchery

Introduction

The Arlington Hatchery is located ten miles east of Arlington, Washington near the North Fork of the Stillaguamish River. The hatchery rears primarily rainbow and cutthroat trout for planting into lowland lakes, beaver ponds, and some alpine lakes. The hatchery rears three strains of rainbow trout, one of which (Mt. Whitney) is planted into alpine lakes and two strains of cutthroat, Tokul Creek and Twin Lakes, which are used for planting alpine lakes. No fish are released at the hatchery site. The hatchery is fed by four small springs, a single well, and a small unnamed creek. Total flow during the wet portion of the year is about 6.3 cfs, but during late summer and early fall (particularly in dry years) the flow from all sources will not exceed 1 cfs. Funding for the hatchery is from state wildlife funds.

The hatchery receives eyed eggs or fry from other hatcheries and incubates and hatches them in shallow trough incubators (56 total). Rearing takes place in nine 10' x 100' concrete raceways and twelve 40' diamater round ponds. There are also three deep troughs (4' x 30'). The rearing capacity of the hatchery depends primarily on water flow availability.

Purpose

The Arlington Hatchery was built to plant trout in various lowland lakes, alpine lakes, and beaver ponds.

Goals

1. Produce rainbow trout fry and catchable size fish for planting into lowland lakes or alpine lakes.
2. Produce cutthroat trout fry and fingerlings for planting into lowland lakes or alpine lakes.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear 150,000 rainbow trout catchables for planting in local lowland lakes.
2. Rear 500,000 rainbow trout fry for planting in lowland lakes or alpine lakes.
3. Rear 130,000 cutthroat trout fingerlings and fry for planting of local lakes, beaver ponds, or alpine lakes.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, steelhead, and trout producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

No adult fish are captured at this facility.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Trout are reared under standard conditions and either planted into local lakes or ponds as fry, or at legal retention size (catchables), or transferred to other hatcheries for additional rearing. Acclimation to receiving waters prior to stocking is not done.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

No adult fish are trapped.

Spawning Protocol

No fish are spawned at this hatchery.

Acceptable Stocks

<u>Rainbow trout or Cutthroat trout</u>
1. Any suitable strain or stock.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Health Monitoring

- Fish are not spawned at this facility.

Therapeutic and Prophylactic Treatments

- No eggs are collected at this facility.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The hatchery is supplied via well water and therefore there is no "upstream" to sample. The following parameters are currently monitored at the Arlington Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Downstream Temperatures**— Record downstream temperatures twice per month, June through September, as required under NPDES permit. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Springs/ Well: Due to low rainfall over the past few years the flows in the wells and springs feeding the hatchery have decreased.

Hatchery Water Temperature Profile

The water temperature is nearly constant year round and ranges from 46°-47° F.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Arlington Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	NA	NA	NA	NA	
Adult Prespawning Survival	NA	NA	NA	NA	
Eggtake	NA	NA	NA	NA	
Fecundity	NA	NA	NA	NA	
Eyed Egg-to-Fry Survival	Goldendale RBT	85%	92.7%	85.9-96.9%	
	Tokul Crk. RBT	85%	83.6%	77.3-90.3%	
	Tokul Crk. RCT	85%	92.9%	80.8-97.3%	
	Twin Lakes RCT	85%	90.1%	77.9-98.5%	
	Wyoming Grayling	NA	40%	40%	1
Survival (Fry to Plant or Transfer)	Goldendale RBT	85%	72.3%	48.3-85.9%	2
	S. Tacoma RBT	85%	59.2%	50.3-72.8%	2
	Tokul Crk. RBT	85%	80.3%	66.7-98.0%	2
	Tokul Crk. RCT	85%	77.8%	65.2-96.7%	2
	Twin Lk. RCT.	85%	77.0%	57.8-97.6%	2
	Ford EBT	85%	97.9%	97.9%	
	Wyoming Grayling	85%	4.4%	4.4%	1
	Kings Lk. Grayling	85%	0.6%	0.6%	1
	Lk. Whatcom KOK	85%	99.8%	99.8%	
	Chambers Crk WSH	85%	72.4%	69.8%; 93.6%	
	Tokul Cr. Sterile RBT	NA	99.6%	99.6%	
Plants	Goldendale RBT	NA	420,976	315,183-537,213	
	S. Tacoma RBT	NA	146,003	112,356-209,758	
	Tokul Cr. RBT	NA	41,716	24,898-55,512	
	Tokul Cr. RCT	NA	120,877	74,546-166,064	
	Twin Lk. RCT	NA	20,038	2,325-30,825	
	Tokul Cr. Sterile RBT	NA	27,697	27,697	
	Wyoming Grayling	NA	1,732	1,732	
	Kings Lk. Grayling	NA	500	500	
	Lk. Whatcom KOK	NA	10,440	10,440	

Objective 1:(cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Transfers Out (eggs/fish)	Goldendale RBT	NA	170,035	78,422-427,204	
	S. Tacoma RBT	NA	6,073	0-27,367	
	Tokul Crk. RBT	NA	4,605	0-19,624	
	Twin Lk. RCT	NA	6,062	4,700-8,400	
	Chambers Crk. WSH	NA	87,420	24,800; 150,040	
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	NA	NA	NA	NA	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	WSH-Chambers Ck. or derivative	NA	NA	NA	
Acclimation	Trout Spp./ Kokanee	No	No	No	
Volitional Release	NA	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	NA	NA	NA	NA	
Spawning Pop. >500	NA	NA	NA	NA	
Spawning Ratio Male:Female	NA	NA	NA	NA	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	NA	NA	3
TSS Max Effluent	15 mg/L	NA	NA	3
SS Effluent	0.1 ml/L	NA	NA	3
TSS PA Effluent	100 mg/L	NA	NA	3
SS PA Effluent	1.0 ml/L	NA	NA	3
Downstream Temp (°C)	Varies	NA	NA	3
Maximum Temp	<63°F	NA	NA	3
Minimum Temp	>32°F	NA	NA	3
Downstream DO(mg/L)	>8.0	NA	NA	3
Continuous Monitoring of Other Parameters	Yes	NA	NA	3

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	4
Develop and Review Equil. Brood Doc.	All	Yes	No	No	5
Develop and Review Future Brood Doc.	All	Yes	No	No	5
Develop and Review Current Brood Doc.	All	Yes	No	No	5

Constraints/Comments- Arlington Hatchery

1. Grayling eggs have low fertility and low hatching rates.

2. Unpredictable flows can increase loading and flow indices resulting in higher disease incidence and higher mortalities.

3. No NPDES data available. Some data on file with Washington Department of Ecology.

4. Lack of adequate funding to provide sufficient office support staff.

5. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus, comparison of hatchery goals with programming goals cannot be made for years prior to 1994.

Stock Profile:

South Tacoma Rainbow Trout: This stock apparently originated from a commercial fish farm in Meeder, Utah. The origin of the Utah strain is somewhat hazy, but may have been from the McCloud River, Shasta County, California. Although originally a spring spawning strain, through manipulation of both warmer rearing temperatures and selection of early spawners, these fish now spawn predominantly between August and October with peak spawning in September. This shift in spawn timing was done to provide catchable size trout for planting into lowland lakes prior to the opening of the general trout season in April, and fingerling trout plants in May for the next trout season. This strain has experienced heavy artificial selection for both spawn timing and coloration. In recent years egg mortality appears to be on the increase indicating a possible genetic bottleneck.

Goldendale Rainbow Trout: This strain originated in 1948 from the interbreeding of Yakima (a mixture of McNott and Meader stocks) and Meader (see S. Tacoma strain) strains of rainbow trout. This strain was selected for early spawning, large size, high fecundity, and overall color and vigor. Spawning takes place from October to February with peak egg production in November and December.

Tokul Creek Resident Cutthroat: This strain of resident cutthroat was derived from wild broodstock spawning in tributary creeks of Lake Whatcom. Although this strain may have some influence from

Lake Chelan cutthroat, it maintains the morphology of coastal cutthroat strains. The parent stock spawned in December -March but the current captive brood spawns primarily in January and February. The captive brood was "revitalized" in the early 1980s with wild cutthroat from Lake Whatcom. Broodstock is currently maintained at the Tokul Creek Hatchery.

Twin Lakes Resident Cutthroat: This resident cutthroat is thought to be an intermontane (i.e., between the crests of the Cascade and Rocky Mountains) strain very similar to "Montana west slope" cutthroat. The parent stock may have originated from either the Lake Wenatchee system or Lake Chelan. The founding "stock" of Twin Lakes cutthroat are trapped at Twin Lakes (alpine lakes located near Leavenworth, WA) . There have been no introductions of other stocks to Twin Lakes thus the genetic integrity of the stock has been maintained for over 70 years. Spawning of this stock occurs at ice-out in June.

Ford Eastern Brook Trout: Eastern brook trout were introduced into several Washington lakes in 1894 by the U.S. Bureau of Fisheries. Subsequent plantings occurred near the towns of Wilbur and Republic in eastern Washington. Most of the early plantings were from stock obtained from the Paradise Brook Trout company, Henryville, Pennsylvania. By 1913, most of the eggs used in Washington were from established populations. The Ford stock of eastern brook trout originated from Owhi Lake on the Colville Indian Reservation and by 1964 were part of a captive broodstock maintained initially at the Spokane Hatchery and later transferred to the Ford Hatchery (located near Spokane) in 1966. The parent stock originated from 3,000 individuals and has not been mated with other stocks or strains of brook trout.

Whitehorse Rearing Ponds

Introduction

The Whitehorse Rearing Ponds are located 25 miles east of Arlington on highway 530, and 6 miles west of Darrington. The ponds are located at river mile 29 of the North Fork of the Stillaguamish River. The hatchery was built in 1955 and is funded by the state. There are 3 earthen rearing ponds (ranging in size from 20' x 60' to 175' x 334'), 2 rectangular raceways, 1 smolt trap and 1 adult trap, 4 shallow troughs, and 48 isolation units. At full capacity, the hatchery can hold 700,000 eyed eggs. Hatching is not done at the facility; after eggs are certified they are shipped to South Tacoma Hatchery for hatching and early rearing. A spring water source provides flows ranging from 1.1 cfs in summer to 6.7 cfs in winter.

A conditioning pond is used for summer run steelhead and is supervised by this facility.

Purpose

The Whitehorse Rearing Ponds were built to rear winter run and summer run steelhead for planting both on- and off-station. Additionally, the facility has been used to rear and plant summer chinook.

Goals

1. Produce winter and summer run steelhead smolts to provide for tribal and recreational fisheries in the Stillaguamish River basin.
2. Produce winter and summer-run steelhead smolts for the Skagit and Skykomish rivers and other local rivers.
3. Rear and release summer chinook in cooperation with the Stillaguamish Tribe.
4. Rear rainbow trout for planting in local lakes.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear and release approximately 35,000 summer run steelhead smolts on-station and at various points along the river.
2. Rear and release approximately 100,000 winter run steelhead smolts on-station and at various points along the river.
3. Rear 45,000 summer run and 80,000 winter run steelhead for release in local rivers.
4. Rear and release 220,000 summer chinook on-station in June.
5. Rear 35,000 rainbow trout and plant in local lakes.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at the Whitehorse Rearing Ponds is to collect enough adults to supply, if needed, eggs for the Whitehorse hatchery program. A fish trap at the hatchery collects returning adults.

Winter Steelhead: Winter steelhead return to the hatchery from late November through February. Peak spawning is in mid-January.

Summer Steelhead: Summer steelhead return to the hatchery from May through December. Peak spawning is in December.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared on-station and planted as smolts directly into the North Fork Stillaguamish River both at the hatchery site and at various points along the river. Prior acclimation to receiving water is not done for fish released either on or off-station. Rainbow Trout are reared under standard conditions and planted in local lakes. Summer chinook are reared and released on-station.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adult winter and summer run steelhead are collected throughout the entire run to ensure that run timing for these stock is maintained. Before 1993 priority was not given to releasing progeny of adults returning to the "natal" hatchery. Regional production needs were determined and the progeny from spawning operations at several regional hatcheries were "pooled" together at a central hatchery, because they shared common ancestral parentage. Mixtures of each hatchery's fish were then transferred to hatcheries throughout the region for additional rearing and release, either on-station or within the river basin, or transported to other river systems for release. Since 1993, priority has been given to releasing progeny of adults that returned to the station.

Spawning Protocol

Gametes from 5 male and 5 female steelhead are pooled and fertilized. The effective population size (N_e) is not known due to this pooling of gametes.

Acceptable Stocks

Winter Steelhead
1. Stillaguamish (Chambers derivative)
2. Chambers Creek
3. Any Chambers Creek derivative

Summer Steelhead
1. Stillaguamish (Skamania derivative)
2. Skykomish or any Skamania derivative

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Whitehorse Rearing Ponds:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Springs: Flows have been unstable because of low rainfall periods since 1987. Low flows occur in summer (1.1 cfs) and high flows in the winter (6.7 cfs). Dissolved oxygen is a problem with this water source. In winter, dissolved oxygen levels can fall to 6-8 ppm.

Hatchery Water Temperature Profile

No water temperature available.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Whitehorse Rearing Ponds

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	Stillaguamish WSH	NA	215	80-593	1
	Stillaguamish SSH	NA	124[1]	78-213	1
Adult Prespawning Survival	Stillaguamish WSH	85%	85.9%	56.8-100%	2
	Stillaguamish SSH	85%	37.1%	12.3-91.5%	3
Eggtake	Stillaguamish WSH	NA	309,512	69,000-586,142	
	Stillaguamish SSH	NA	128,728	49,248-333,192	
Fecundity	Stillaguamish WSH	NA	NA	NA	4
	Stillaguamish SSH	NA	NA	NA	4
Eyed Egg-to-Fry Survival	Stillaguamish WSH	85%	68.2%	74.9-100%	5
	Stillaguamish SSH	85%	79.5%	58.7-100%	
Survival (Fry to Plant or Transfer)	Chambers Cr. WSH	85%	77.2%	69.0-83.8%	
	Skykomish SSH	85%	84.5%	77.0-98.6%	
	Goldendale RBT	85%	89.8%	89.8%	
	S. Tacoma RBT	85%	91.0%	91.0%	
	Stillaguamish SUCH	85%	99.3%[2]	98.9- 99.7%	
Plants	Chambers Cr. WSH	NA	174,211	69,853-241,464	1,10
	Skykomish SSH	NA	63,721	0-110,000	1,10
	Stillaguamish SUCH	NA	113,997	68,992-173,000	1,10
Transfers Out (eggs/fish)	Stillaguamish WSH	NA	211,089[3]	69,000-439,518	1,10
	Stillaguamish SSH	NA	94,647	0-267,520	1,10
	S. Tacoma RBT	NA[4]	27,286	27,286	6,10
	Goldendale RBT	NA	57,730	57,730	6,10
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	NA	NA	NA	NA	

1 Four year average, 1989-1992.

2 Three year average, 1990-1992.

3 Eggs only.

4 The hatchery goal is 30,000 rainbow trout of any strain. Both strains have been reared at the facility.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	Stillaguamish WSH	NA	NA	NA	
	Stillaguamish SSH	NA	NA	NA	
	Stillaguamish SUCH	NA	NA	NA	
Acclimation	Stillaguamish-WSH	No	No	No	
	Stillaguamish -SSH.	No	No	No	
	Stillaguamish SUCH	No	No	No	
Volitional Release	Stillaguamish-WSH	No	No	No	
	Stillaguamish-SSH	No	No	No	
	Stillaguamish SUCH	Yes	Yes	Yes	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Stillaguamish-WSH	Yes	Yes	No	
	Stillaguamish-SSH	Yes	Yes	No	
Spawning Pop. >500	Stillaguamish-WSH	NA	107	90; 128	7
	Stillaguamish-SSH	NA	109	35; 163	7
Spawning Ratio Male:Female	Stillaguamish-WSH	1.0	1.0	NA	7
	Stillaguamish-SSH	1.0	1.0	NA	7

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	NA	NA	4
TSS Max Effluent	15 mg/L	NA	NA	4
SS Effluent	0.1 ml/L	NA	NA	4
TSS PA Effluent	100 mg/L	NA	NA	8
SS PA Effluent	1.0 ml/L	NA	NA	8
Downstream Temp (°F)	Varies	NA	NA	4
Maximum Temp	<63°F	NA	NA	4
Minimum Temp	>32°F	NA	NA	4
Downstream DO(mg/L)	>8.0	NA	NA	4
Continuous Monitoring of Other Parameters	Yes	NA	NA	4

Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers.

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	9
Develop and Review Equil. Brood Doc.	All	Yes	No	No	10
Develop and Review Future Brood Doc.	All	Yes	No	No	10
Develop and Review Current Brood Doc.	All	Yes	No	No	10

Constraints/Comments- Whitehorse Rearing Ponds

1. For winter and summer steelhead, a regional planting goal is established. Because of operational constraints such as adipose fin clipping all hatchery releases and providing uniform sized fish to all rearing programs, high priority is placed on meeting the entire eggtake from a single hatchery (Chambers Creek Hatchery). In years when this cannot be accomplished at Chambers Creek Hatchery, Chambers Creek stock returning to other hatcheries are captured and spawned, and the eggs and subsequent fish are incubated and reared at either the South Tacoma or Puyallup Trout hatcheries. Thus, at Whitehorse Rearing Ponds, the goal for the number of adults to capture and the subsequent eggtake, and the the number of fish to transfer, changes based on the number of eggs taken at Chambers Creek, and other Puget Sound hatcheries.

2. Average is affected by a number of males (31) sacrificed in 1990 for virology sampling.

3. High losses due to poaching, and in one year, an electrical accident that killed fish.

4. Records not kept.

5. Low average the result of 102,000 excess eggs being discarded in 1988.

6. Each year, fish management biologists determine the number of resident trout to plant in lakes within each region of the state. They also determine at what size and time of year these fish should be planted. This number is termed an allotment. For the hatcheries within the region to supply each allotment, they utilize one or more of the four available domestic rainbow trout broodstocks, and the different water temperature regimes unique to each hatchery. Using both the different times of year that fry are available and the different growth rates achievable at each hatchery due to water temperature, hatcheries can produce the requested sized fish at the appropriate time of year.

7. Incomplete records for number of adult fish spawned, thus in some years there is recorded eggtakes but no corresponding number of adults to produce this number of eggs. Also, there is no data for the male to female spawning ratio.

8. No pollution abatement pond at this facility.

9. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

10. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus comparison of hatchery goals with programming goals cannot be made in years prior to 1994.

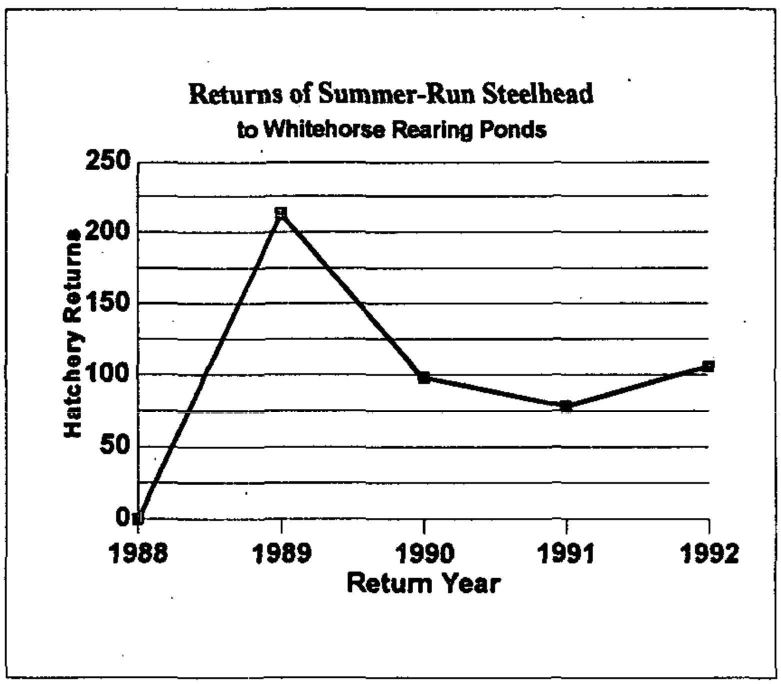
Stock Profile:

Stillaguamish Summer Steelhead: Origins of this stock are Skamania (Washougal River) summer steelhead which were developed into a hatchery stock in the mid-1950s. The Skamania stock is a mixture of native Washougal and Klickitat summer runs which have been selectively bred for early maturation. Until 1993, priority was not given to returning broodstock to support the hatchery program. Fish most often came from the Reiter Ponds rearing program. **Stock Description: Introduced, non-adapted.**

Stillaguamish Winter Steelhead: This stock of steelhead originated from Chambers Creek (see stock profile for Chambers Creek Hatchery). Until 1993 priority was not given to returning broodstock. Eggs were taken and put in a regional "pool" of eggs at South Tacoma Hatchery. Fish of Chambers Creek origin were then returned to the hatchery to meet program release goals. This stock is best described as a non-native introduced stock. **Stock Description: Introduced, non-adapted.**

Stillaguamish Summer Chinook: This stock originated from broodstock gaffed from the North Fork Stillaguamish river. The eggs are taken to the Stillaguamish Tribal hatchery and hatched. Fingerlings are brought to the Whitehorse Rearing Ponds for additional rearing before release. **Stock Decription: Native.**

STOCK STATUS PROFILE FOR: Stillaguamish (Skamania) Summer Steelhead



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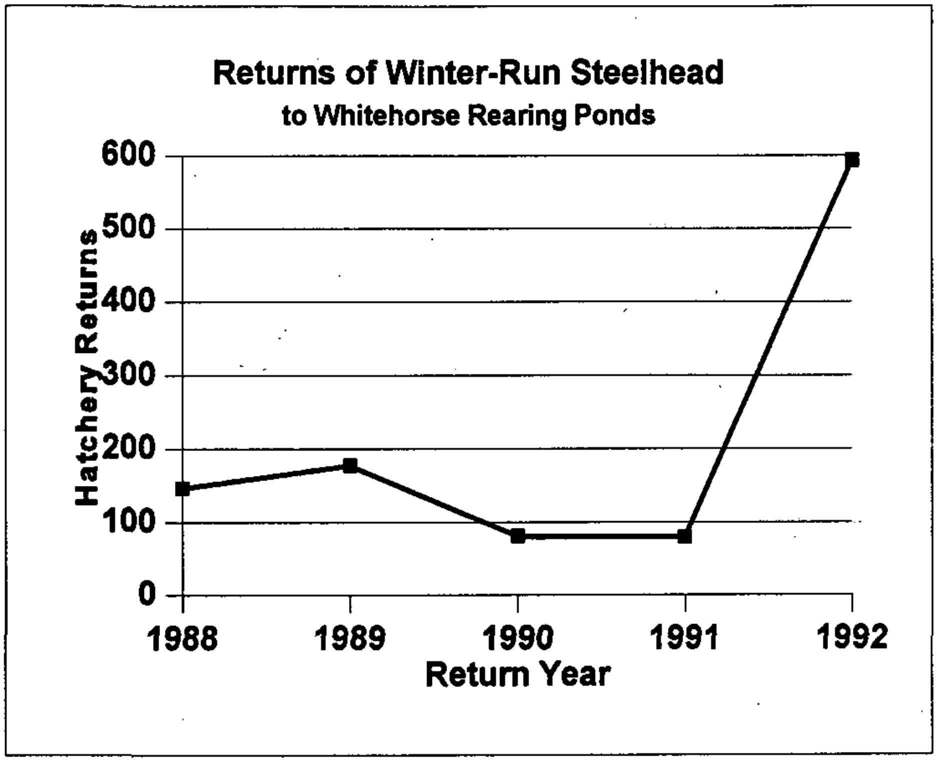
STOCK STATUS PROFILE FOR: Stillaguamish (Chambers Creek) Winter-Run Steelhead



STOCK STATUS PROFILE FOR: Stillaguamish Summer Chinook

No data available.

Snohomish Complex

Wallace River Hatchery
Reiter Ponds
Tokul Creek Hatchery

Wallace River Hatchery

Introduction

Wallace River Hatchery is located at the confluence of the Wallace River and May Creek, near the town of Startup, WA. The station has six 10' x 100' raceways, four 20' x 80' raceways, three large rearing and release channels, three 15' x 120' ponds used for rearing and/or adult holding, and an in-stream adult holding pond in May Creek. The hatchery has 66 stacks of vertical incubators with a hatching capacity of 12-13 million fry. Water is supplied from pumps on the Wallace River and May Creek.

Purpose

The hatchery was built to increase production of coho and chinook salmon in Puget Sound. The hatchery currently operates to provide opportunity for harvest of both summer and fall chinook, coho and pink salmon. The hatchery also serves as an interim rearing site for fish destined for other hatchery programs, including marine net pen operations, and for cooperative rearing programs.

Goals

1. Enhance and maintain the Wallace River summer chinook stock.
2. Produce chinook, coho, chum and pink salmon for N.E. Pacific and Puget Sound fisheries.
3. Incubate and rear fall chinook for other hatchery programs.
4. Rear coho eggs for cooperative programs and yearling coho for WDFW and cooperative saltwater net pen programs.
5. Maintain the Wallace River coho stock.

Objectives

Objective 1: 1993 Hatchery Production

Summer Chinook

Collect 1,500,000 eggs from 1993 brood adults.

Rear and release, 1,000,000 1992 brood subyearlings on-station.

Rear and release, 200,000 1991 brood yearlings on-station.

Fall Chinook

Collect 1,700,000 eggs from 1993 brood adults, and transfer 1,600,000 to Tulalip tribe.

Receive and incubate 2,360,000 eggs from George Adams and later transfer 2,000,000 fry to the Deschutes Hatchery

Coho

Collect 5,200,000 eggs from 1993 brood adults.

Transfer 1,300,000 eggs for transfer to the Tulalip Tribe and 400,000 to the Nisqually tribe.

Incubate 262,000 eggs for later transfer to cooperative rearing projects.

Release 300,000 1991 brood yearlings on-station.

Transfer 360,000 1991 brood yearlings to the Fox Island Net Pens, and 540,000 1991 brood yearlings to cooperative rearing projects.

Transfer 1,100,000 1992 brood fingerlings to Skookumchuck Rearing Ponds and 850,000 to Coulter Creek Hatchery.

Pinks

Collect 236,000 eggs.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, steelhead and trout producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

The primary intent of the adult collection procedures at Wallace River Hatchery is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. Secondary goals include supplying fish to cooperative rearing programs and passing adults of some species upstream. Temporary weirs are located on May Creek and the Wallace River to block upstream passage of chinook adults for enumeration or diversion into holding ponds. The weir on the Wallace River is removed after the chinook run, allowing coho to pass upstream or enter the hatchery on their own volition. The weir on May Creek remains in operation, although passage of adults has been allowed in some years. Because May Creek supplies water for rearing, passage of adults can cause disease problems in the hatchery later on.

Adult Collection

Wallace River Summer Chinook: Summer chinook return to the hatchery from June to September with peak spawning in late September. Summer chinook are separated from fall chinook by arrival time. However, there is considerable overlap in run and spawn timing with fall chinook.

Fall Chinook: Fall chinook return to the hatchery from September to October, with peak spawning in early October.

Wallace River Coho: Coho return from late-September to December with peak spawning in mid-November.

Wallace River Pinks: Wallace River pink salmon return from mid-August to early October, with peak spawning in early October.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas.

Rearing and Release Strategies

Summer Chinook: Rear sub-yearlings to 70 fish/pound and plant in late June or early July. Rear yearlings to 10 fish/pound and release in late-March or early-April.

Wallace River Coho: Rear yearling coho and release in May at 17 fish/pound.

Wallace River Pinks: Rear pink salmon and release when they attain a size of at least 600 fish/pound.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for each stock is maintained. Summer chinook and fall chinook have overlapping spawn times. To separate these two stocks, arrival time at the hatchery is used along with an arbitrary cut-off date. However the cut-off date is not always accurate, and some hybridization is likely to occur between the two stocks.

Spawning Protocol

The intent is to use a spawning population of at least 500 adults for each species. When fewer than one million eggs are collected in a day, the male to female spawning ratio is 1:1. On days when more than one million eggs are collected, the male to female spawning ratio is not be less than 1:3 (0.33). The effective population size (N_e) is not known for these species because gametes are pooled.

Acceptable Stocks

Summer Chinook
1. May/Wallace Summer Chinook

Fall Chinook
1. May/Wallce Fall Chinook
2. Green River derivative

Wallace River Coho
1. May/Wallace Coho

Wallace River Pinks
1. Wallace River Pinks

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES), as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored the Wallace River Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperature daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

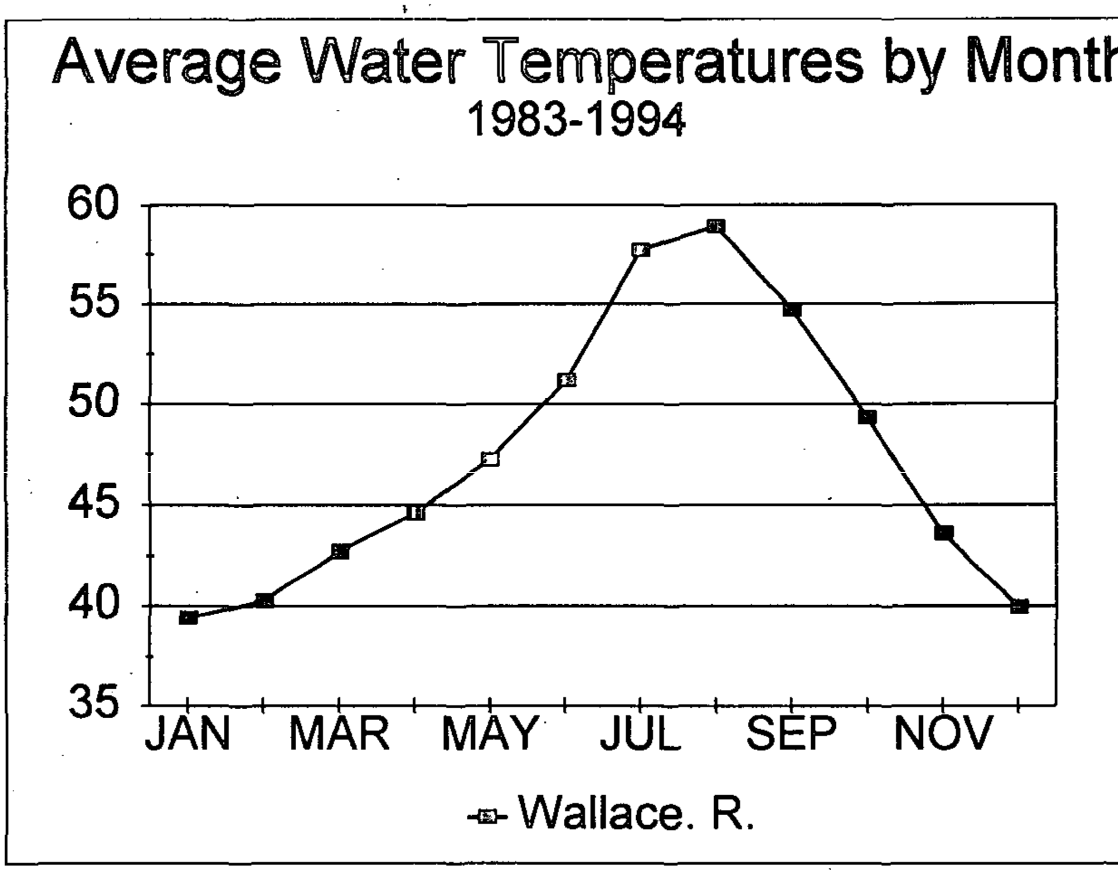
May Creek- This water source can contain large amounts of Cryptobia Spp. when large numbers of coho adults are passed upstream to spawn. Water rights are 14 cfs.

Wallace River- Migrating chinook have had a difficult time migrating up this river during drought years because of decreased river flow. Water Rights are 10 cfs.

Domestic Water- Water Rights are 55 gpm

Skykomish River- Not used as a water source at this hatchery.

Hatchery Water Temperature Profile



Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Skykomish watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Tulalip Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries—Wallce River Hatchery

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adult Capture	Summer Chinook	1989	755	727	NA	
		1990	755	169	NA	1,2,3
		1991	714	218	NA	1,2,3
		1992	714	405	NA	1,2,3
		1993	714	566	NA	1,2,3
	Fall Chinook	1989	1,394	734	NA	1,2,3
		1990	585	815	NA	1,2,3
		1991	1,419	332	NA	1,2,3
		1992	843	538	NA	1,2,3
		1993	843	1,363	NA	
	Coho	1989	6,968	23,704	NA	
		1990	6,872	12,698	NA	
		1991	7,178	16,183	NA	
		1992	1,313	20,467	NA	
		1993	4,552	12,316	NA	
	Pinks	1989	NA	192	NA	
		1991	364	467	NA	
		1993	364	135	NA	1
Adult Prespawning Survival	Summer Chinook	Avg.	90%	86.5%	71.4-98.0%	2
	Fall Chinook	Avg.	90%	87.4%	77.8-97.7%	2
	Coho	Avg.	90%	97.8%	96.8-99.0%	
	Pinks	Avg.	90%	90.3%	88.9; 91.7%	
Eggtake	Summer Chinook	1989	1,570,000	1,439,700	NA	
		1990	1,570,000	231,300	NA	1,2,3
		1991	1,500,000	462,800	NA	1,2,3

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Egg Take	Summer Chinook	1992	1,500,000	901,400	NA	1,2,3
		1993	1,500,000	1,454,100	NA	
	Fall Chinook	1989	2,810,000	824,600	NA	1,2,3
		1990	1,180,000	1,069,300	NA	
		1991	2,860,000	428,700	NA	1,2,3
		1992	1,700,000	723,100	NA	1,2,3
		1993	1,700,000	1,000,200	NA	1,2,3
	Coho	1989	7,960,000	31,282,950	NA	
		1990	7,850,000	14,304,400	NA	
		1991	8,200,000	13,414,900	NA	
		1992	1,500,000	18,779,000	NA	
		1993	5,200,000	7,362,100	NA	
	Pinks	1991	236,000	318,600	NA	
		1993	236,000	78,800	NA	1
Fecundity	Summer Chinook	Avg.	NA	4,772	4,675-4,864	
	Fall Chinook	Avg.	NA	4,539	4,122-5,057	
	Coho	Avg.	NA	2,335	1,727-2,645	
	Pinks	Avg.	NA	1,408	1,313;1,503	
Green Egg-to-Fry Survival	Summer Chinook	Avg.	90%	90.6%	89.4-92.3%	
	Fall Chinook, Wallace R.	Avg.	90%	89.3%	82.5-93.3%	
	Fall Chinook, Deschutes	Avg.	90%	96.0%	95.0-96.7%	
	Coho	Avg.	90%	95.9%	91.6-98.5%	
	Pinks	Avg.	90%	88.5%	88.5%	
Fry to Smolt Survival	Summer Chinook	Avg.	90%	84.4%	46.2-97.2%	4
	Fall Chinook	Avg.	90%	74.5%	36.4-97.6%	4
	Deschutes Fall Chinook	Avg.	90%	60.4%	46.8-97.8%	4
	Coho	Avg.	90%	23.4%	13.1-30.9%	4
	Pinks	Avg.	90%	98.6%	98.6%	

Measures	**Species**	**Brood Year**	**Hatchery Goal**	**Realized**	**Range**	**Comme**
Fish Releases	Summer Chinook	1988	200,000	219,500	NA	
(On-station)	Yearling	1989	200,000	251,400	NA	
		1990	200,000	178,900	NA	
		1991	200,000	213,500	NA	
	Summer Chinook	1988	1,100,000	18,000	NA	5
	Subyearling	1989	1,100,000	993,700	NA	5
		1990	1,100,000	0	NA	5
		1991	1,100,000	125,600	NA	5
		1992	1,100,000	404,500	NA	5
	Fall Chinook Subyearling	1988	1,000,000	364,000	NA	5
		1989	1,000,000	500,000	NA	5
		1990	1,000,000	2,795,000[1]	NA	5
		1991	1,000,000	1,351,800[2]	NA	5
		1992	1,000,000	2,560,000[3]	NA	5
	Coho- Yearling	1988	300,000	300,000	NA	
		1989	300,000	300,000	NA	
		1990	300,000	300,000	NA	
		1991	300,000	303,000	NA	
	Coho- Subyearling	1990	NA	800,000	NA	
		1991	NA	2,168,100	NA	
		1992	NA	1,294,200	NA	
	Pink	1991	200,000	278,100	NA	

1 Includes releases of 1,880,000 Deschutes stock.
2 Includes release of 931,800 Deschutes stock.
3 Includes release of 2,280,000 Deschutes stock.

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Fish Releases	Coho- Subyearling	1988	2,200,000	440,000	NA	6
(Off-station releases)		1989	500,000	26,000	NA	6
		1990	1,700,000	22,000	NA	6
		1991	1,200,000	21,000	NA	6
		1992	0	16,700	NA	6
	Coho Yearling	1991	200,000	278,100	NA	
Transfers to Tribal	Fall Chinook	1988	1,550,000	680,600	NA	5
Facilities		1989	1,550,000	0	NA	5
(Eggs/ Fish)		1990	0	0	NA	5
		1991	1,600,000	0	NA	5
		1992	1,600,000	0	NA	5
	Coho	1988	2,700,000	2,517,600	NA	
		1989	1,300,000	2,025,020	NA	
		1990	1,800,000	3,899,500	NA	
		1991	2,150,000	5,582,000	NA	
		1992	2,150,000	2,850,000	NA	
Transfers within	Deschutes Fall Chinook	1988	2,450,000	2,425,500	NA	
WDFW		1989	2,250,000	0	NA	
(Eggs/Fish)		1990	2,000,000	300,000	NA	7
		1991	2,000,000	256,000	NA	7
		1992	2,000,000	0	NA	7
	Coho	1988	2,450,000	6,802,600	NA	
		1989	1,200,000	7,148,500	NA	
		1990	2,760,000	1,605,500	NA	
		1991	3,095,000	1,490,000	NA	
		1992	2,495,000	1,200,000	NA	

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comme
Transfers to Co-ops (Eggs/Fish)	Summer Chinook	1988	30,000	31,000	NA	
		1989	30,000	24,180	NA	
		1990	30,000	0	NA	5
		1991	30,000	0	NA	5
		1992	0	0	NA	
	Coho	1988	411,000	450,504	NA	
		1989	303,400	1,297,190	NA	
		1990	461,400	914,700	NA	
		1991	647,300	1,970,880	NA	
		1992	618,800	795,610	NA	
Adults Passed Upstream	Fall Chinook[4]	1988	0	0	NA	
		1989	0	9	NA	
		1990	0	0	NA	
		1991	0	0	NA	
		1992	0	0	NA	
	Coho[5]	1988	All	200	NA	
		1989	All	0	NA	
		1990	All	7,000	NA	
		1991	All	800	NA	
		1992	All	104	NA	
	Pinks	1989[6]	0	176	NA	
		1991	0	48	NA	

4 After the adult capture goal is met, all fish are passed upstream.

5 The Snohomish River system is managed on a wild coho basis. Thus, all coho are given access to areas upstream of the hatchery, and the hatchery only traps fish that enter volitionally from the Wallace River. Because the rack is not operated it is impossible to enumerate fish passed upstream on the Wallace River. On May Creek, all fish are trapped, but in some years coho have been passed upstream which is reflected in the above numbers.

6 All pinks were passed upstream this year.

Measures	**Species**	**Brood Year**	**Hatchery Goal**	**Realized**	**Range**	**Comments**
Percent Survival Smolt to Adult	Summer Chinook	Avg.	2.5%	NA	NA	8
	Fall Chinook	Avg.	1.0%	NA	NA	8
	Coho	Avg.	10.0%	13.2%	4.0-18.0%	
	Pinks	Avg.	1.0%	NA	NA	8

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Sum. Chinook	Yes	NA	NA	8
	Fall Chinook	Yes	NA	NA	8
	Coho	Yes	5.9%	5.6-6.4%	
	Pinks	Yes	NA	NA	8
Acclimation	Sum. Chinook	Yes	Yes	NA	
	Fall Chinook	NA	NA	NA	
	Coho	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
Volitional Release	Sum. Chinook	No	No	NA	9
	Fall Chinook	No	No	NA	9
	Coho	No	No	NA	9
	Pinks	No	No	NA	9

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults	Sum. Chinook	Yes	No	NA	2
Throughout Run	Fall Chinook	Yes	No	NA	2
	Coho	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
Spawning Pop.	Sum. Chinook	Yes	274	96-522	
>500	Fall Chinook	Yes	499	197-883	
	Coho	Yes	13,986	7,659-21,557	
	Pinks	Yes	156	122;347	10
Spawning Ratio	Sum. Chinook	1.0	1.1	0.8-1.8	
Male:Female	Fall Chinook	0.33	1.4	0.9-2.3	
	Coho	0.33	0.8	0.5-0.9	
	Pinks	0.33	0.8	0.6;1.0	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All Species	Yes	Yes	NA	11

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Three Year Average	Range	Comments
TSS Effluent				
May Creek	5 mg/l	0.58	-6.0-5.2	
Wallace River	5 mg/l	0.32	-3.6-3.2	
TSS Max Effluent				
May Creek	15 mg/l	1.78	-6.4-14.9	
Wallace River	15 mg/l	1.13	-3.6-11.2	
SS Effluent				
May Creek	0.1 ml/L	0.07	0-1.4	
Wallace River	0.1 ml/l	0.05	0-1.4	
TSS PA Effluent	100 mg/L	59.9[7]	8.0-164	
SS PA Effluent	1.0 ml/L	1.9	0-37.5	
Downstream Temp (°F)				
May Creek[8]		62.6°	61.0-64.0°	
Wallace River		62.1°	60.1-64.0°	
Maximum Temp	>63°F			
May Creek[9]		70.0°	64.0-70.0°	
Wallace River		69.1°	60.1-69.1°	
Minimum Temp	>32°F			
May Creek		28.0°	28.0-39.0°	
Wallace River		30.0°	30.0-37.9°	
Downstream DO (mg/l)				
May Creek	>8.0	9.9[15]	9.5-10.5	
Wallace River	>8.0	9.6[15]	9.0-10.0	
Continuous Monitoring of Other Parameters	Yes	NA	NA	

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7 Average for May Creek and Wallace River.

8 One year (1992) of data only.

9 Average of 1984-1993.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraint
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	12
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Wallace River Hatchery

1. Poor survival and low escapements have reduced the number of adults returning to the hatchery.

2. In some years, low river flows prevent adults from reaching the hatchery. Poaching of fish from the Wallace River while they hold in pools for extended periods can reduce adult returns and prevent collection of adults from every portion of the run.

3. Low river flows and high water temperatures can cause outbreaks of *Ichthyophthirius* which result in heavy mortalities of adults in the holding pond.

4. Heavy bird predation due to lack of netting over rearing containers. This problem has been rectified and higher survival is expected starting with the 1993 brood.

5. Insufficient quantity of eggs to meet this program goal, due to factors outlined in numbers 1-3 above.

6. Program goal change after Future Brood Document goals were finalized.

7. This group was originally destined to return to Deschutes but a portion was kept for an on-station release to make up shortfalls in the local stock.

8. Lack of current and continuous coded-wire tag data. Only coded-wire tag groups are measured and mean length and CVs calculated.

9. Design of rearing pond is not conducive to volitional release.

10. Egg take goal precludes the need for more than 500 adults.

11. The hatchery discharge outlet is located 40 feet downstream from the pump intake on May Creek. During incubation, water in May Creek is pulled upstream to the pump and recirculated through the hatchery making isolation of groups of eggs or fry impossible.

12. Insufficient funding to provide complete data quality control before inclusion in hatchery data base.

Stock Profile:

Wallace River Summer Chinook: This stock originated from native Wallace River summer chinook. In recent years there has been some concern about hybridizing with fall chinook due to overlapping run and spawn timing. At the time of the last GSI analysis (1988) the summer chinook had significantly different allele frequencies compared with introduced fall chinook. **Stock Description: Native**

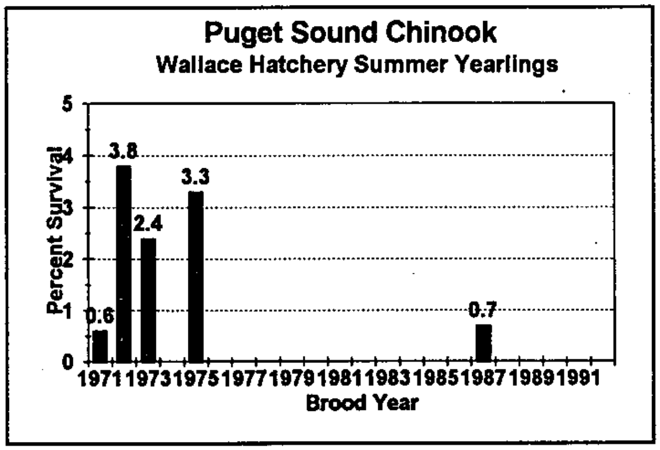
Wallace River Coho: This stock was derived from the local native stock. There has been only one introduction of non-native coho made at the hatchery when a plant of Issaquah coho was made in 1954. **Stock Description: Native.**

Wallace River Fall Chinook: This stock was introduced from several Puget Sound hatcheries and is primarily of Soos Creek origin. Introductions have continued throughout the period fall chinook have been released here. Because of overlapping run and spawn timing with summer chinook this stock might be somewhat hybridized. **Stock Description: Introduced, non-adapted.**

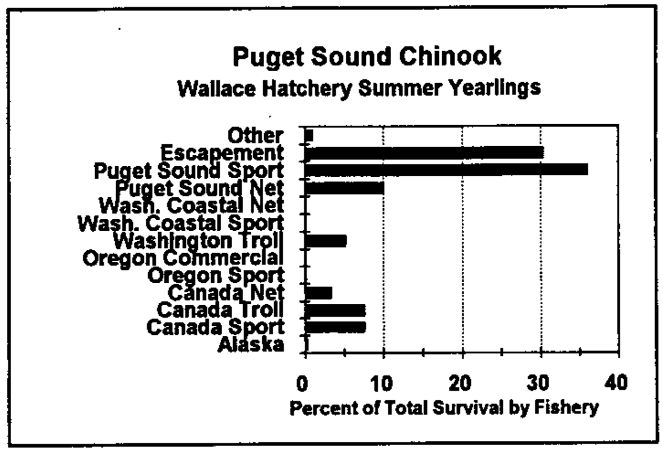
Wallace River Pinks: **Stock Description: Native.**

STOCK STATUS PROFILE FOR: Wallace River Summer Chinook Yearlings

Survival:



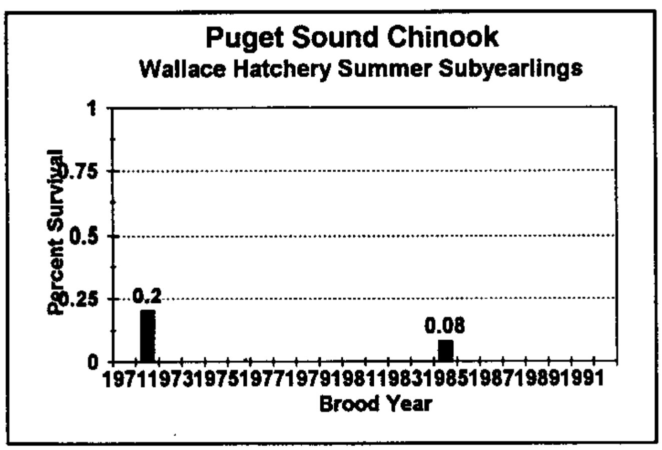
Distribution:



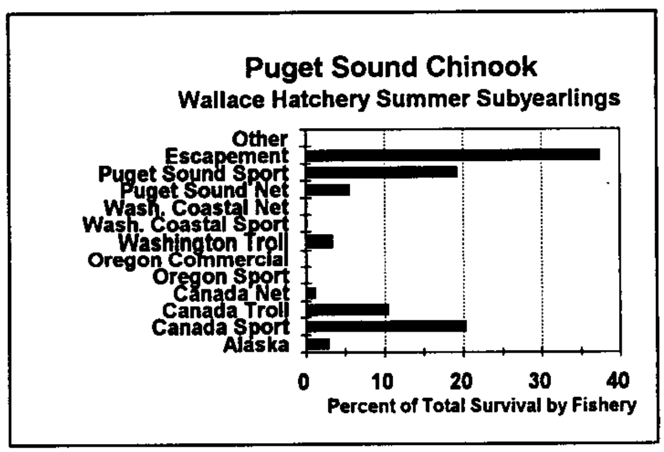
Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Wallace River Summer Chinook Subyearlings

Survival:



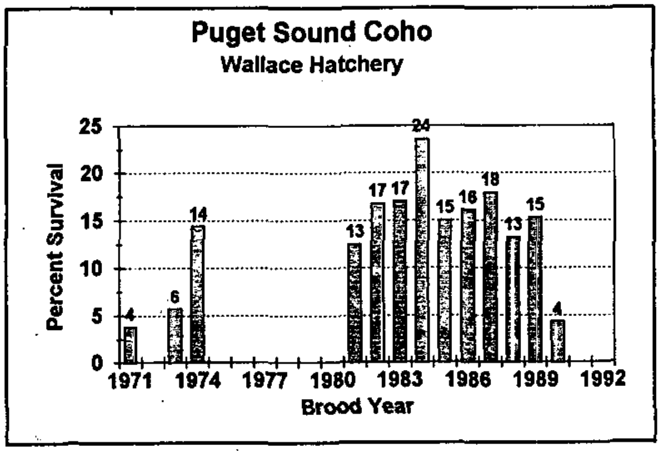
Distribution:



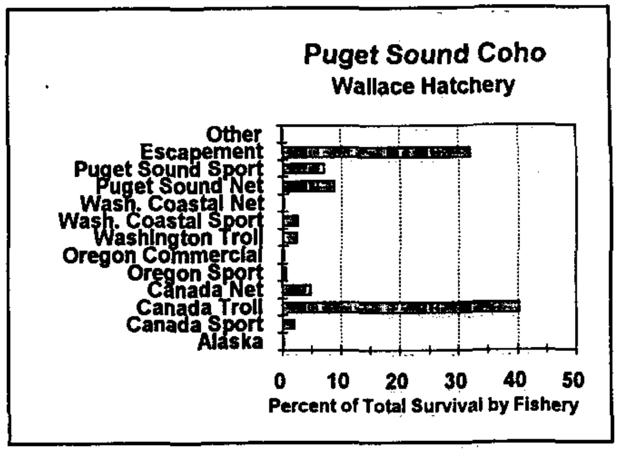
Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Wallace River Coho

Survival:



Distribution:



Five Year Average Survival: 13.2%
Catch to Escapement Ratio: 3.13:1

STOCK STATUS PROFILE FOR: Wallace River Pinks

Five Year Average Survival: ND
Catch to Escapement Ratio: ND

AR049584

Reiter Rearing Ponds

Introduction

The Reiter Rearing Ponds are located on the Skykomish River at river mile 46, just east of the town of Goldbar. They were constructed with Dingle-Johnson funds, but are currently operated with state funds. The rearing ponds, migrant fish traps, and residence were constructed in 1973 and 1974. In 1988 an incubation building, adult holding raceway, and fish ladder were added. There are eight shallow troughs in the incubation building. These troughs can hold 92 four gallon isolation buckets. The facility is currently borrowing a ten stack Heath incubator which is used with a recirculating, heated water system. There are two 2 acre rearing ponds, each with a capacity of 475,000 steelhead. The incubation capacity is about 1.5 million eggs. There are also three 6 foot round tubs in the incubation building that hold golden trout broodstock. Austin Creek is the main water source for the hatchery and provides about 9 cfs in the spring. Hogerty Creek serves as a backup water source and can produce 4-5 cfs.

Additionally, the Sultan High School Fish Hatchery and four imprint ponds are supervised through this facility.

Purpose

The Reiter Rearing Ponds were constructed to rear and plant summer run and winter run steelhead in the Snohomish River system. In recent years the hatchery has maintained a golden trout broodstock for spawning and planting of local alpine lakes.

Goals

1. Produce winter and summer run steelhead to provide for tribal and recreational fisheries in the Snohomish and Stillaguamish basins.
2. Collect sufficient winter steelhead eggs to provide for regional production needs.
3. Collect sufficient summer steelhead eggs to provide for regional production needs.
4. Maintain a golden trout broodstock and plant progeny into alpine lakes throughout the state.

OBJECTIVES

Objective 1: 1993 Hatchery Production

1. Rear and release approximately 125,000 Chambers Creek stock winter steelhead smolts on-station.
2. Rear and release approximately 150,000 Skykomish summer steelhead smolts on-station
3. Plant approximately 150,000-180,000 winter run and 150,000-180,000 summer run steelhead in local rivers and streams.
4. Maintain captive golden trout broodstock and release approximately 5,000 fingerlings in alpine lakes.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through *proper management of genetic resources.*

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at the Reiter Rearing Ponds is to collect enough adults to sustain the rearing program at the facility and to supply, if needed, eggs to other regional programs. A fish trap at the hatchery collects returning adults.

Winter Steelhead: Winter steelhead return to the hatchery from late November through February. Peak spawning is in February.

Summer Steelhead: Summer steelhead return to the hatchery from May through December. Peak spawning is in March.

Golden Trout: These fish are raised until mature at the hatchery. Peak spawning is in April.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared on-station with a portion planted directly into the Skykomish River and another portion released in several north Puget Sound rivers. Prior acclimation to receiving water occurs for those fish released on-station but no acclimation is done for fish transported off-station. Golden Trout are reared under standard conditions and either planted into alpine lakes as fry, or held at the hatchery as broodstock. Acclimation to receiving waters prior to stocking is not done with the golden trout planted off-station.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adult winter and summer run steelhead are collected throughout the entire run to ensure that run timing for these stock is maintained. Approximately 200 golden trout are maintained as broodstock at the hatchery.

Spawning Protocol

Gametes from 5 male and 5 female steelhead are pooled and fertilized. The effective population size (N_e) is not known due to this pooling of gametes.

Acceptable Stocks

Winter Steelhead
1. Skykomish (Chambers derivative)
2. Chambers Creek
3. Any Chambers Creek derivative

Summer Steelhead
1. Skykomish (Skamania derivative)
2. Any Skamania derivative

Golden Trout
1. Skykomish (Tokul Creek derivative)
2. Tokul Creek (Montana derivative)
3. Any Golden Trout derivative

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Reiter Rearing Ponds:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Austin Creek: During winter the water is often muddy due to high flows. Cold water during the winter makes incubation difficult. Water rights are 9 cfs.

Hogerty Creek: Water rights are 5 cfs.

Hatchery Water Temperature Profile

No water temperature data available.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Reiter Rearing Ponds

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	Skykomish WSH	NA	250	0-649	1
	Skykomish SSH	NA	544	183-855	1
Adult Prespawning Survival	Skykomish WSH	85%	70.0%	0-100%	2
	Skykomish SSH	85%	77.2%	60.9-96.0%	2
Eggtake	Chambers WSH	NA	390,108	0-743,792	1
	Chambers SSH	NA	777,181	296,364-1006.2K	1
	Skykomish GT	14,000	10,534	0-25,027	
Fecundity	NA	NA	NA	NA	
Eyed Egg-to-Fry Survival	Skykomish WSH	NA	NA	NA	
	Skykomish SSH	NA	NA	NA	
	Skykomish GT	85%	48.5%	18.6-90.5%	3
Survival (Fry to Plant or Transfer)	Skykomish WSH	85%	74.6%	71.0-97.0%	4
	Skykomish SSH	85%	64.5%	46.7-78.6%	4
	Skykomish GT	85%	45.6%	0.9-88.7%	5
Transfers Out (eggs/fish)	Skykomish WSH	NA	16,014	0-64,055	
	Skykomish SSH	NA	23,040	0-91,910	
	Skykomish GT	NA	729	0-2,649	
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	NA	NA	NA	NA	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Skykomish WSH	NA	NA	NA	
CV less than 10%	Skykomish SSH	NA	NA	NA	
Acclimation	Skykomish-WSH	Yes	Yes	Yes	
	Skykomish -SSH.	Yes	Yes	Yes	
	Skykomish- GT	No	No	No	
Volitional Release	Skykomish-WSH	NA	NA	NA	
	Skykomish-SSH	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults	Skykomish-WSH	Yes	Yes	Yes	
Throughout Run	Skykomish-SSH	Yes	Yes	Yes	
Spawning Pop.	Skykomish-WSH	NA	NA	NA	
>500	Skykomish-SSH	NA	NA	NA	
	Skykomish-GT	No	No	No	
Spawning Ratio	Skykomish-WSH	1.0	ND	ND	
Male:Female	Skykomish-SSH	1.0	ND	ND	
	Skykomish-GT	1.0	ND	ND	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	3.58	2.0-6.0	
TSS Max Effluent	15 mg/L	3.48	2.0-6.0	
SS Effluent	0.1 ml/L	0.0	0.0	
TSS PA Effluent	100 mg/L	NA	NA	6
SS PA Effluent	1.0 ml/L	NA	NA	6
Downstream Temp (⁰F)	Varies	44.2⁰	35.6-59.0⁰	
Maximum Temp	<63⁰F	NA	NA	7
Minimum Temp	>32⁰F	NA	NA	7
Downstream DO(mg/L)	>8.0	12.1	9.0-13.0	
Continuous Monitoring of Other Parameters	Yes	NA	NA	

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	8
Develop and Review Equil. Brood Doc.	All	Yes	No	No	9
Develop and Review Future Brood Doc.	All	Yes	No	No	9
Develop and Review Current Brood Doc.	All	Yes	No	No	9

Constraints/Comments- Reiter Rearing Ponds

1. No set goal because regional production goals were prioritized based on returns to Chambers Creek hatchery. If shortfalls occurred at Chambers Creek, then additional eggs were obtained from either Tokul Creek or Reiter Ponds.

2. Long holding period prior to spawning causes higher mortality.

3. Egg viability is related to age of spawning fish. Older age fish have better egg viability. In some years there are more younger age fish being spawned, due to a lack of older age fish, and in these years, egg to fry survival is lower.

4. Outbreaks of some diseases cause higher mortalities is some years. Lack of bird netting causes higher mortalities due to predation.

5. Unaccounted for loss drives down the calculated survival rate. In reality, this "loss" may not have occurred. Instead the number of initial fry may not have been accurate due to difficulties in determining inventory.

6. No pollution abatement pond at this facility.

7. No data available.

8. Because former Department of Wildlife hatcheries were not operated from a central organization structure, there was no staff dedicated to checking hatchery records for accuracy.

9. Former Department of Wildlife hatcheries were not subject to programming under the brood document format.

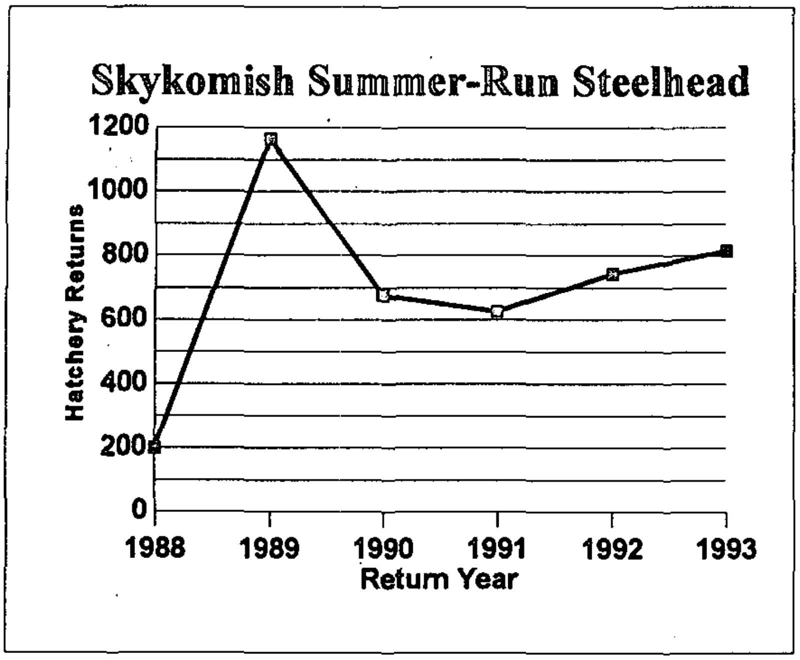
Stock Profile:

Skykomish Summer Steelhead: Origins of this stock are Skamania (Washougal River) summer steelhead which were developed into a hatchery stock in the mid-1950s. The Skamania stock is a mixture of native Washougal and Klickitat summer -runs which have been selectively bred for early maturation. Apparently, native summer run steelhead in the Skykomish River were bred with returning Skamania stock. Similar to the winter steelhead program, priority is given to returning broodstock to support the hatchery program. **Stock Description: Introduced, non-adapted.**

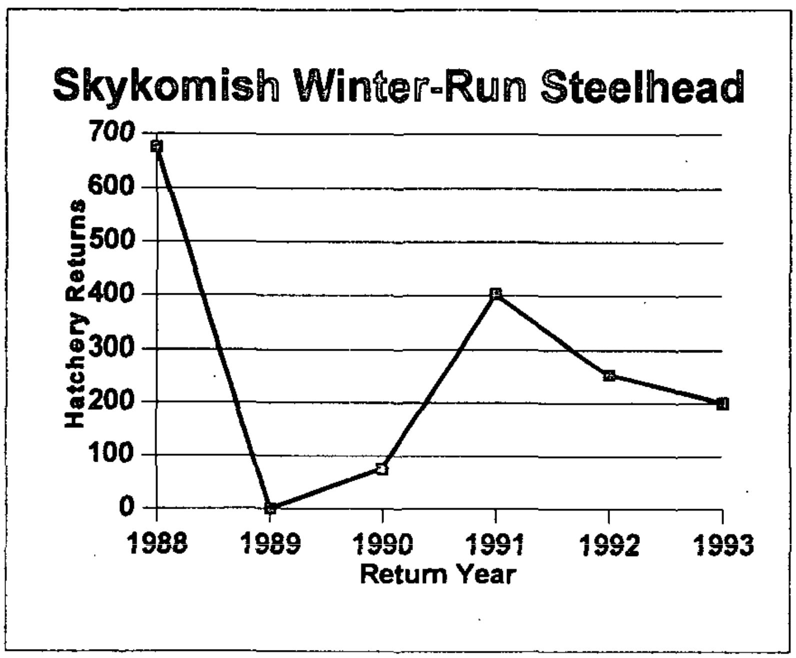
Skykomish Winter Steelhead: This stock of steelhead originated from Chambers Creek in 1974 (see stock profile for Chambers Creek Hatchery). A mixture of fry transferred from Chambers Creek parentage and returns to Skykomish are currently used to maintain this program. When sufficient broodstock returning to the hatchery is available to meet program release goals, then imports of Chambers Creek steelhead are unnecessary. **Stock Description: Introduced, non-adapted.**

Skykomish Golden Trout: The parent stock for Washington State golden trout (Salmo aquabonita, Jordan) came from the Wyoming Department of Fish and Game hatchery at Daniel in July, 1958. The first hatchery to receive these eggs was the Goldendale trout hatchery. A small broodstock is maintained at this facility. The broodstock was formerly located at the Tokul Creek trout hatchery. These fish are used for planting some alpine lakes in the state.

STOCK STATUS PROFILE FOR: Skykomish (Skamania) Summer Steelhead



STOCK STATUS PROFILE FOR: Skykomish (Chambers Creek) Winter-Run Steelhead



Tokul Creek Hatchery

Introduction

Tokul Creek Hatchery is situated 2-1/2 miles east of Fall City and 2-1/2 miles west of Snoqualmie. It is adjacent to Tokul creek, a tributary of the Snoqualmie river. This facility was constructed in the early 1900s and receives funding through State Wildlife Funds. There are 96 1' x 15' x 0.5' shallow trough incubators fed by pathogen free underground springs that have a constant 8.9^0 C temperature. Outside rearing units consist of six 10' x 80' concrete raceways and a single one acre semi-natural rearing pond. All rearing units are gravity fed using Tokul Creek (11.8 cfs) water. There are also 5 concrete rearing structures on the upper grounds but these are in poor condition and no longer used. At capacity, this facility can produce 1.2 million rainbow trout eggs and fry, 1.2 million steelhead eggs and 225,000 smolts , 600,000 cutthroat eggs and fry, and 50,000 eastern brook trout eggs and fry, and about 31,600 rainbow and cutthroat broodstock.

Purpose

The Tokul Creek Trout Hatchery was built to rear and release, winter steelhead smolts, as well as various species of trout for planting in local lakes, alpine lakes, and ponds. The hatchery maintains as captive broodstocks, both Tokul Creek cutthroat and Mt. Whitney rainbow trout. The hatchery previously maintained Wyoming golden trout, but this program was moved to the Reiter Rearing Ponds.

Goals

1. Produce winter steelhead smolts for planting both on-station and in local rivers.
2. Produce rainbow, cutthroat, golden trout, and eastern brook trout fry for stocking of local or alpine lakes.
3. Maintain Tokul Creek and Mt. Whitney strain captive broodstocks,.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear 60,000 winter steelhead smolts for release on-station.
2. Rear 120,000 winter steelhead smolts for outplanting in local rivers.
3. Rear 40,000 Goldendale strain rainbow trout fry for stocking of local lakes, and 150,000 fry for transfer to Puyallup hatchery.
4. Rear 30,000 Mt. Whitney strain rainbow trout fry for stocking of local alpine lakes, 2,500 catchables for stocking of local lakes. Transport 900,000 eyed eggs and 10,000 fry to the Naches Hatcheries.
5. Stock local lakes with 3,000 unneeded-needed Mt. Whitney strain rainbow trout broodstock.
6. Rear and plant 8,300 Tokul Creek cutthroat trout fry, 3,000 unneeded-needed broodstock, and 1,000 catchables for stocking in local lakes. Transport 475,000 eyed eggs to other hatcheries.
7. Rear 5,000 Twin Lakes cutthroat fry for stocking into local lakes.
8. Rear 10,000 eastern brook trout fry for stocking in local lakes.
9. Maintain 15,800 Tokul Creek cutthroat, and 15,800 Mt. Whitney rainbow, as captive broodstock.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: *Communicate effectively with other salmon, trout and steelhead* producers and managers in the Puget Sound

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

Winter steelhead are captured upon return to the hatchery and held for spawning in the event that returns to Chambers Creek hatchery are insufficient to supply needed eggs/fish for regional production goals. Captive rainbow and cutthroat trout brood are reared under standard conditions and spawned when they reach maturity at two or three years of age.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared until smolts and then released on-station or stocked into local rivers. Prior acclimation to receiving water is done only with those fish released on-station. inter steelhead are allowed to leave the rearing pond over a two-three week period. Trout are reared under standard conditions and either planted into local lakes or ponds as fry, or at legal retention size (catchables), or transferred to other hatcheries for additional rearing. Acclimation to receiving waters prior to stocking is not done.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adult winter steelhead are captured throughout the run to maintain run timing for this strain of fish. Captive broodstock are maintained at this hatchery. At least two age classes are found at this facility.

Spawning Protocol

Winter steelhead and captive broodstock are spawned similarly. Gametes from 5 males and 5 females are pooled together prior to fertilization. Steelhead or captive brood males may be spawned more than once depending on whether there are adequate numbers of ripe males available on a given spawning day for the number of females being spawned. The effective population size (N_e) is not known due to pooling of gametes and multiple use of individual males.

Acceptable Stocks

<u>Winter Steelhead</u>
1. Chambers Creek
2. Any Chambers Creek derivative

<u>Cutthroat Trout</u>
1. Tokul Creek
2. Twin Lakes
3. Any strain of cutthroat trout

<u>Rainbow Trout</u>
1. Mt. Whitney
2. Goldendale
3. Any strain of rainbow trout

<u>Golden Trout</u>
1. Wyoming strain

<u>Eastern Brook Trout</u>
1. Any suitable strain

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Tokul Creek Trout hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Springs: Due to low rainfall over the past few years the flows in the springs feeding the hatchery have decreased.

Tokul Creek: No substantial problems.

Hatchery Water Temperature Profile

No water temperature available.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Tokul Creek Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	WSH	Varies	657	513-900	1
Adult Prespawning Survival	NA	NA	NA	NA	
Eggtake	Chambers Cr.. WSH	NA	1,249,217[1]	899,452-1456.3K	1
	Tokul Cr.. WSH	NA	1,555,019	1,555,019	1
	Skykomish WSH	NA	343,090	343,090	
	Skykomish SSH	NA	296,364	296,364	
	Golden Trout	NA	420,849	260,090-568,706	2
	Mt. Whitney RBT	Varies	1,208,066	655,080-1212.4K	3
	Tokul Cr.. RCT	Varies	697,364	447,614-828,043	3
Fecundity	Chamb./Tokul WSH	NA	3,360[2]	3,200-3,500	
	Mt. Whitney RBT	NA	2,902	1,279-6,002	
	Tokul Cr. RCT	NA	903	501-1,203	
	Golden Trout	NA	NA	NA	4
Eyed Egg-to-Fry Survival	Golden Trout	85%	89.5%	89.0-98.0%	
	Mt. Whitney RBT	85%	94.3%	83.6-99.9%	
	Tokul Crk. RCT	85%	92.1%	87.4-95.2%	
	Ford EBT	85%	97.1%	95.8-98.0%	
	Lk. Whatcom KOK	85%	65.8%	65.8%	
	Chambers Crk. WSH	85%	95.4%	92.7-96.7%	
	Tokul Crk. WSH	85%	97.6%	97.6%	
Survival (Fry to Plant or Transfer)	Golden Trout	85%	83.0%	73.7-96.8%	
	Mt. Whitney RBT	85%	46.6%	22.7-79.7%	
	Tokul Crk. RCT	85%	77.7%	47.4-88.5%	
	Twin Lk. RCT.	85%	50.5%	13.5-91.2%	
	Ford EBT	85%	73.0%	62.6-91.1%	
	Chambers Crk. WSH	85%	74.3%	74.0-86.8%	
Plants	Golden Trout	Varies	244,748	12,863-446,418	3
	Mt. Whitney RBT	Varies	27,700	7,428-37,271	3
	Tokul Cr. RCT	Varies	32,265	15,599-46,661	3
	Tokul Cr. RCT	Varies	3,867[3]	700-7,660	3
	Ford EBT	Varies	17,526	7,499-32,359	
	Chambers WSH	Varies	170,777	163,109-177,044	

1 Three year average, 1990-1992.

2 Estimated fecundity.

3 Releases of unneeded broodstock.

Objective 1: (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Transfers Out (eggs/fish)	Golden Trout	Varies	68,509	0-139,962	3
	Mt. Whitney RBT	Varies	647,637[4]	455,113-957,986	3
	Tokul Crk. RCT	Varies	78,986	0-223,240	3
	Ford EBT	Varies	44,184	1,080-65,710	
	Chambers Cr. WSH	Varies	874,041	836,860-1395.9 K	1
	Tokul Crk. WSH	Varies	1,492,035[5]	1,492,035	1
	Skykomish WSH	Varies	342,590	342,590	1
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	WSH	NA	NA	NA	5

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	WSH-Chambers Ck. or Tokul Creek	No	No	No	6
Acclimation	WSH-Chambers Ck.	Yes	Yes	Yes	
	Trout Spp.	No	No	No	
Volitional Release	WSH	Yes	Yes	Yes	

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4 On average 839 K eggs and 134 K fish.

5 Eggs only, 1988.

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	WSH	NA	Most Years	Most Years	2
Spawning Population >500 Adults	WSH	NA	678	570-900	7
	Tokul Cr.. RCT	Yes	2,062	1,044-2,378	7
	Mt. Whitney RBT	NA	828	404-1,024	7
Spawning Ratio Male:Female	All	1.0	1.0	1.0	7

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	NA	NA	8
TSS Max Effluent	15 mg/L	NA	NA	8
SS Effluent	0.1 ml/L	NA	NA	8
TSS PA Effluent	100 mg/L	NA	NA	9
SS PA Effluent	1.0 ml/L	NA	NA	9
Downstream Temp (°F)	Varies	NA	NA	9
Maximum Temp	<63°F	NA	NA	9
Minimum Temp	>32°F	NA	NA	9
Downstream DO(mg/L)	>8.0	NA	NA	9
Continuous Monitoring of Other Parameters	Yes	NA	NA	9

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	10
Develop and Review Equil. Brood Doc.	All	Yes	No	No	11
Develop and Review Future Brood Doc.	All	Yes	No	No	11
Develop and Review Current Brood Doc.	All	Yes	No	No	11

Constraints/Comments- Tokul Creek Hatchery

1. For winter and summer steelhead, a regional planting goal is established. Because of operational constraints such as adipose fin clipping all hatchery releases and providing uniform sized fish to all rearing programs, high priority is placed on meeting the entire egg take from a single hatchery (Chambers Creek Hatchery). In years when this cannot be accomplished at Chambers Creek Hatchery then Chambers Creek derivatives returning to other hatcheries are captured and spawned, and the eggs and subsequent fish are incubated and reared at either South Tacoma or Puyallup hatcheries. Thus, the goal for the number of adults to capture and the subsequent eggtake, and the number of fish to transfer, changes based on the number of eggs taken at Chambers Creek, and other Puget Sound hatcheries.

2. No set goal for this species. The hatchery would take as many eggs as possible each year, and the number of eggs collected would be dependent on the number of ripe females. The captive brood program for golden trout has since been moved to the Reiter Rearing Ponds.

3. Each year, fish management biologists determine the number of resident trout to plant in lakes within each region of the state. They also determine at what size and time of year these fish should be planted. This number is termed an allotment. For the hatcheries within the region to supply each allotment, they utilize one or more of the four available domestic rainbow trout broodstocks, different water temperature regimes unique to each hatchery. Using both the different times of year that fry are available and the different growth rates available at each hatchery due to water temperature, hatcheries can produce the requested sized fish at the appropriate time of year. Because allotments vary from year to year, the egg take goal at this hatchery may vary as well.

4 No data available.

5. Steelhead survivals are not estimated.

6. Steelhead are not routinely measured at release.

7. These numbers represent only the number of females spawned. There is no separation by age class. Data on the number of individual males spawned is not collected. It is not uncommon for individual males to be used several times on several different females over the spawning period.

8. No data available.

9. No pollution abatement pond at this facility.

10. Lack of adequate funding to provide sufficient office support staff.

11. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus comparison of hatchery goals with programming goals cannot be made in years prior to 1994.

Stock Profile:

Tokul Creek Resident Cutthroat: This strain of resident cutthroat was derived from wild broodstock spawning in tributary creeks of Lake Whatcom. Although this strain may have some influence from Lake Chelan cutthroat, it maintains the morphology of coastal cutthroat strains. The parent stock spawned in December -March but the current captive brood spawns primarily in January and February. The captive brood was "revitalized" in the early 1980s with wild cutthroat from Lake Whatcom. Broodstock is currently maintained at the Tokul Creek Hatchery.

Mt. Whitney Rainbow Trout: Eggs from this strain were obtained in June, 1962 from the Mt. Whitney Hatchery at Independence, California. The strain is apparently a mixture of Sacramento River rainbow, Klamath River steelhead, and possibly s small contribution of Lahonton cutthroat trout. Spawning occurs from December through March with peak spawning in January. This strain produces a deep bodied fish with a relatively small head that is ideally suited to alpine lakes because it grows well, over-winters well, and reproduces naturally where conditions allow.

Wyoming (Tokul Creek) Golden Trout: The parent stock for Washington State golden trout (Oncorhynchus aquabonita) came from the Wyoming Department of Fish and Game hatchery in Daniel, Wyoming, in July, 1958. The first hatchery to receive these eggs was the Goldendale trout hatchery. A small broodstock is maintained at the Reiter Rearing Ponds. This broodstock was formerly held at Tokul Creek, but it was found that they did poorly here because there were too many visitors to the hatchery. This stock is cultured to produce fish for planting of some alpine lakes.

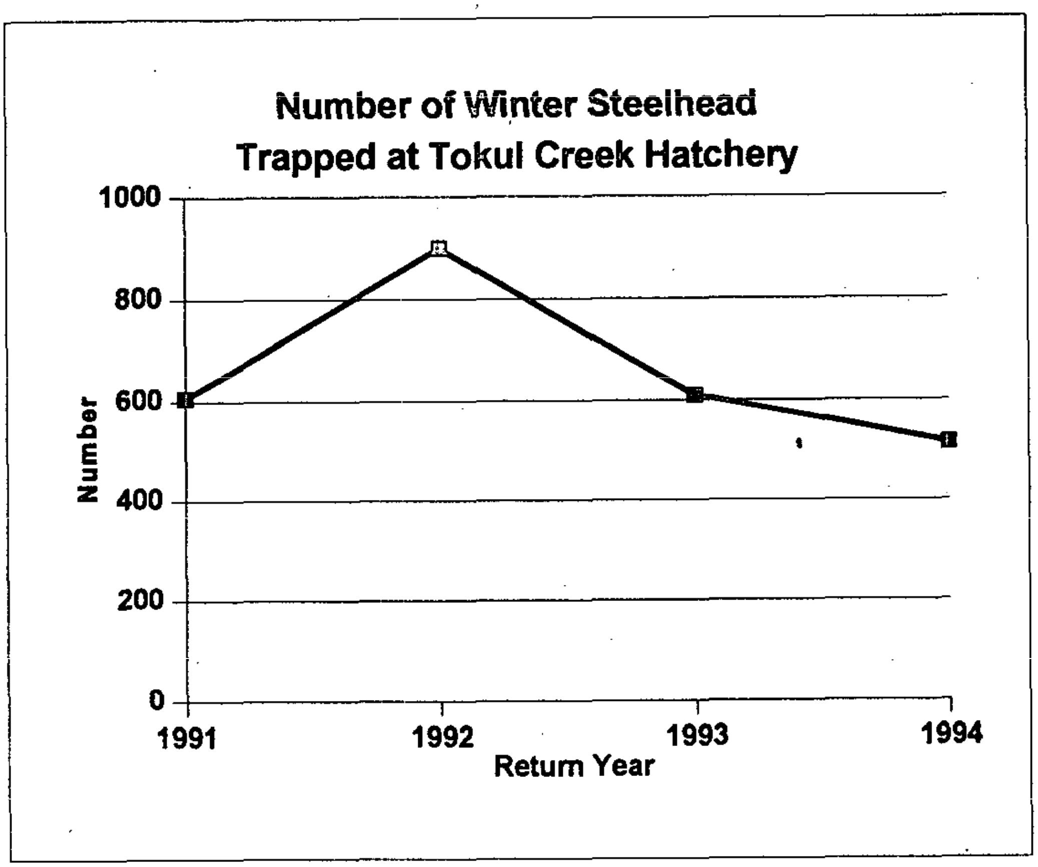
Ford Eastern Brook Trout: Eastern brook trout were introduced into several Washington lakes in 1894 by the U.S. Bureau of Fisheries. Subsequent plantings occurred near Wilbur and Republic in eastern Washington. Most of the early plantings were from stock obtained from the Paradise Brook Trout company, Henryville, Pennsylvania. By 1913 most of the eggs used in Washington were from established populations. The Ford stock of eastern brook trout originated from Owhi Lake on the

Colville Indian Reservation and by 1964 were part of a captive broodstock maintained initially at the Spokane Hatchery and later transferred to the Ford Hatchery (located near Spokane) in 1966. The parent stock originated from 3,000 individuals and has not been mated with other stocks or strains of brook trout.

Tokul Creek Winter Steelhead: This is a Chambers Creek stock derivative. In recent years eggs taken from adults returning to this hatchery have been used for this program. **Stock Description: Introduced, non-adapted.**

Skykomish Summer Steelhead: See Reiter Rearing Ponds for information.

STOCK STATUS PROFILE FOR: Tokul Creek (Chambers Creek) Winter Steelhead



Green River Complex

Soos Creek Hatchery
Issaquah Hatchery
Palmer Ponds
Cedar River

Soos Creek Hatchery and Satellites

Introduction

Soos Creek Hatchery is located on Soos Creek, a tributary of the Green River, 3.5 miles east of Auburn. It was constructed in 1901 and was originally known as the White River Hatchery. It has eight 10' x 80' concrete raceways, eight 17.5' x 95' concrete ponds, three 0.14 acre asphalt rearing ponds, and an in-creek pond which can be used for adult holding or juvenile rearing. The hatchery has 160 shallow and 56 deep troughs available for incubation. This station is the major supplier of fall chinook and coho eggs, and sometimes fry, for other Puget Sound facilities. Water is supplied by pumps on Soos Creek. The facility sometimes serves as the distribution point for medicated fish food to other area hatcheries. The Auburn Maintenance Facility is located adjacent to this facility. Release capacity for the hatchery is approximately 5 million salmon.

Crisp Creek is located approximately seven miles upstream of the Soos Creek Hatchery. The pond is about five acres in size and has a release capacity of about 1 million fish. Water is supplied by gravity flow from Crisp Creek. No incubation is done at this facility.

Icy Creek Ponds (also known as Pautzke Ponds) are located on Icy Creek and are satellite rearing ponds to the Soos Creek Hatchery. Release capacity for the two ponds is approximately 1 million salmon. Water is supplied by gravity flow from springs and Icy Creek. No incubation is done at this facility.

The Cedar River incubation facility is located at Landsburg Dam on City of Seattle property. The facility began operation in 1991 as part of an effort to increase the run of sockeye salmon to the Cedar River. It consists of a converted semi-truck trailer which houses 20 half stacks of vertical incubators. Four (5' diameter) plastic circular rearing containers are located outside the trailer and are used for acclimating fry. Three 13' diameter circulars are also available for holding adults prior to spawning. Water is pumped from a small spring fed pond. About 75% of the sockeye fry are released either on-site or downstream in the vicinity of Renton. These fry are acclimated to Cedar River water for several hours prior to release.

Purpose

The hatchery was built to increase production of salmon in the Green River watershed and Puget Sound. The hatchery currently operates to provide opportunity for harvest of chinook and coho salmon. Subyearling fall chinook are reared at the Soos Creek site, and yearling chinook at the Icy Creek site. Yearling coho are reared at both the Soos Creek site and at Crisp Creek. The hatchery also provides eggs or fry to the Muckleshoot Tribe, numerous cooperative rearing groups, and to the Fish Management Program of WDFW for outplanting into various local streams.

The Cedar River facility was established to aid in the rebuilding of the Cedar River sockeye run by increasing fry production reaching Lake Washington.

All production at this hatchery is jointly agreed upon by various treaty tribes and the WDFW.

Goals

1. Produce chinook and coho for N.E. Pacific and Puget Sound fisheries.
2. Aid in rebuilding the run of Lake Washington sockeye.
3. Incubate and rear fall chinook and coho eggs/fish for other hatchery programs, cooperative rearing programs or outplanting programs.
4. Provide adequate numbers of adult chinook and coho for upstream passage.

Objectives

Objective 1: 1993 Hatchery Production

Fall Chinook

Release 3,200,000, 1992 brood subyearlings on-station.
Release 300,000, 1991 brood yearlings at Icy Creek.
Transfer 330,000, 1992 brood fingerlings to Icy Creek for release in 1994.
Collect 6,650,000 1993 brood eggs.
Transfer 2,200,000 1992 brood eggs to the Muckleshoot tribe.
Transfer 159,000 eggs and 5,000 fry to cooperative rearing programs.

Coho

Release 600,000, 1991 brood yearlings on-station.
Transfer 600,000, 1992 brood subyearlings to Crisp Creek.
Transfer 2,000,000, 1992 brood subyearlings to the Muckleshoot tribal hatchery.
Provide 300,000, 1992 brood fry for outplanting into local area streams.
Collect 4,500,00 1993 brood eggs.
Produce 300,000 eggs for transfer to cooperative rearing programs.

Sockeye

Release 8.3 million, 1992 brood sockeye fry into the Cedar River.
Collect 8.3 million 1993 brood sockeye eggs.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of adult collection procedures at the Soos Creek Hatchery and Cedar River rearing site, is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply chinook and coho eggs or fish to tribal and cooperative rearing programs. A temporary weir is used to block upstream passage of adults in Soos Creek. On the Cedar River, a temporary weir traps adult sockeye Fish not ready to spawn at capture may be transported to circular holding ponds at the Landsburg site until ripe.

Fall Chinook (Soos Creek) : Fall chinook return to the river from late August to November with peak spawning in October.

Coho (Soos Creek): Soos Creek coho return from October to January with peak spawning in November.

Sockeye (Cedar River): Sockeye begin entering Lake Washington in May and peak around July 4. Adults return to the Cedar River from August through November. There appear to be several different components in the stock such that peak run and spawn timing is somewhat difficult to ascertain. Adults for the Landsburg Hatchery are collected throughout the run by installing a temporary weir.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks before release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas.

Fall Chinook: Fish are reared to 80 fish/pound and released on-station in late May or June. Fish are reared at Icy Creek to 10 fish/pound and released on station in April and May. At Crisp Creek the fish are reared to 60 fish/pound and released from April to June. Fish at Crisp Creek or Icy Creek are not acclimated to river water prior to release.

Coho: Fish are reared to 17 fish/pound and released on station in April and May. The fish reared at Crisp Creek are released at 17 fish/pound from April to June.

Sockeye: Sockeye alevins are reared until the Kd index drops below 1.94. Fry are then removed from the incubator and acclimated in river water for several hours prior to release either at the Landsburg site or transported downstream and released in the river just above Renton, Washington.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection
Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol
The intent is to use a spawning population of at least 500 adults. On days when fewer than one million eggs are collected, the male to female spawning ratio is 1:1. On days when over 1 million eggs are taken, the male to female ratio will be no lower than 0.33. The effective population size (N_e) is not known for chinook and coho due to pooling of gametes. The Cedar River sockeye are spawned at a 1:1 male to female ratio, although males may be used more than once if they are less abundant than females.

Acceptable Stocks

<u>Fall Chinook</u>
1. Soos Creek

<u>Coho</u>
1. Soos Creek

<u>Sockeye</u>
1. Cedar River

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Sanitation

- Equipment (nets, tanks, rain gear) is not necessarily disinfected with iodophor between different fish/egg lots.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Soos Creek Hatchery and satellite rearing facilities:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.
- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

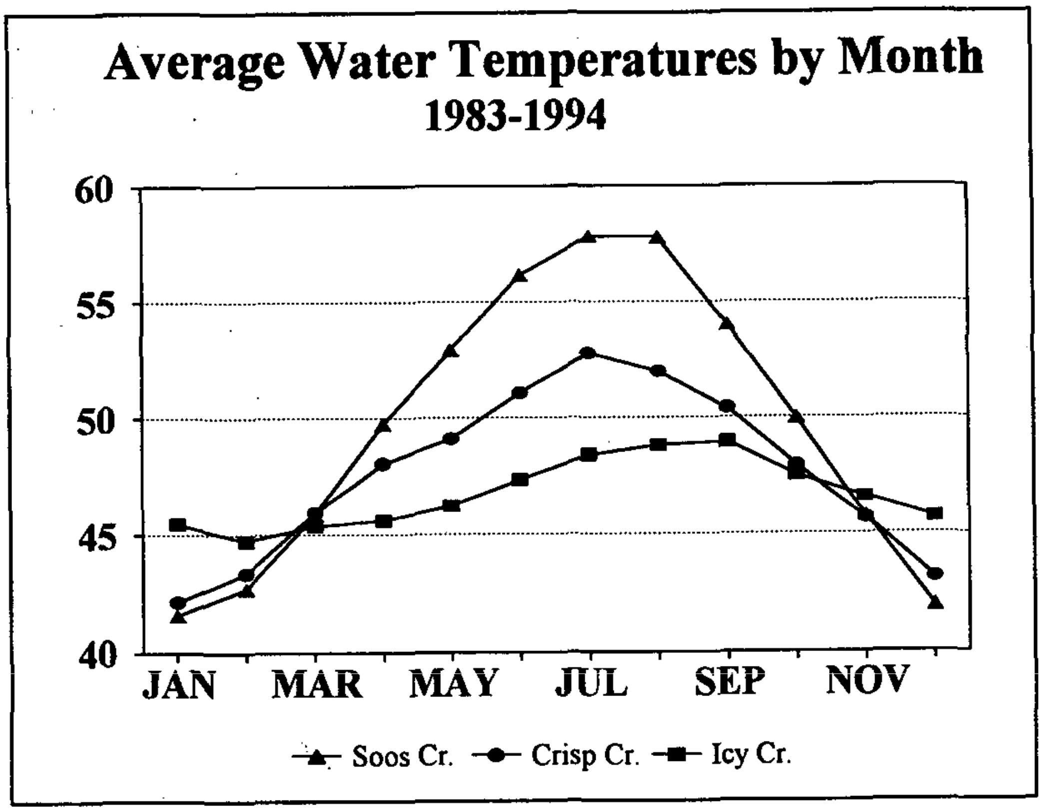
Soos Creek: Water quality and quantity have deteriorated markedly over the past 10 years mainly due to upstream urbanization. In the past several years, two major floods have hit the hatchery causing loss of property and fish. Water rights are 35 cfs.

Domestic Water: Water rights are 25 gpm.

Crisp Creek: No major problems. Flows during recent drought years have decreased.

Icy Creek: Similar to Crisp Creek.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Soos Creek and Cedar River watersheds has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Muckleshoot Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals for these facilities.

Performance Summaries—Soos Creek Hatchery

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Fall Chinook	1989	4,890	13,178	NA	
		1990	4,332	9,322	NA	
		1991	3,999	4,813	NA	
		1992	2,775	4,428	NA	
		1993	3,218	3,656	NA	
	Coho	1989	5,222	12,879	NA	
		1990	5,232	15,120	NA	
		1991	5,182	11,010	NA	
		1992	4,572	13,671	NA	
		1993	4,572	19,359	NA	
	Chum	1991	NA	100	NA	
		1992	NA	336	NA	
	Sockeye	1991	NA	877	NA	1
		1992	NA	1,123	NA	1
		1993	NA	5,702	NA	1
	Natural Coho	1992	NA	100	NA	
Adult Prespawning Survival	Fall Chinook	Avg.	90%	97.6%	93.9-99.9%	
	Coho	Avg.	90%	98.4%	96.5-99.8%	
	Chum	'91,92	90%	100%	100%	
	Sockeye	Avg.	NA[1]	96.7%[2]	93.7;100%	
	Wild Coho	1992	90%	94.0%	94.0%	
Eggtake	Fall Chinook	1989	11,740,000	23,908,800	NA	
		1990	10,400,000	18,389,300	NA	
		1991	9,600,000	8,084,800	NA	
		1992	6,650,000	11,005,000	NA	
		1993	6,650,000	5,432,600	NA	2

1 Represents green fish held in net pens until ripe. Most fish are spawned at river capture site. Males are often live spawned and returned.

2 Three years of data; 1991-1993.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Coho	1989	5,140,000	10,090,000	NA	
		1990	5,150,000	6,321,600	NA	
		1991	5,100,000	9,133,760	NA	
		1992	4,500,000	8,021,000	NA	
		1993	4,500,000	9,678,000	NA	
	Sockeye	1991	NA	2,326,900	NA	1
		1992	NA	3,269,266	NA	1
		1993	NA	8,750,446	NA	1
	Wild Coho	1992	NA	48,100	NA	
Fecundity	Fall Chinook	Avg.	NA	4,917	4,524-5,087	
	Coho	Avg.	NA	2,000	1,352-2,277	
	Chum	Avg.	NA	3,036	2,957;3,114	
	Wild Coho	1992	NA	1,300	1,300	
	Sockeye	Avg.	NA	3,306	2,957-3,114	
Green Egg-to-Fry Survival	Fall Chinook	Avg.	90%	86.5%	82.7-89.7%	
	Coho	Avg.	90%	88.9%	82.6-94.8%	
	Wild Coho	1992	90%	85.6%	85.6%	
	Sockeye	Avg.	90%	91.9%	89.6;94.1%	
Fry to Smolt Survival	Fall Chinook	Avg.	90%	95.4%	88.8-99.3%	
	Coho	Avg.	90%	81.2%	64.8-92.6%	3
	Sockeye	Avg.	NA[3]	97.6%	95.1;100%	
	Crisp Creek Coho	Avg.	90%	99.8%[4]	99.5-99.9%	
	Icy Creek Chinook	Avg.	90%	91.7%	65.1-99.5%	
	Crisp Creek Chinook	Avg.	90%	100%[5]	100%	
Fish Releases	Fall Chinook	1988	4,200,000	5,108,066	NA	
	Subyearling	1989	4,200,000	3,773,556[6]	NA	

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3 Fry are held for only a few hours after removal from incubators.
4 Four year average; 1988-1991.
5 Three year average; 1988-1990.
6 Does not include a fry plant prior to 45 days of 4.5 million.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Fall Chinook	1990	4,200,000	4,858,800[7]	NA	
	Subyearling	1991	3,200,000	3,793,000	NA	
		1992	3,200,000	3,763,700	NA	
	Coho	1988	600,000	599,126	NA	
		1989	600,000	569,700	NA	
		1990	600,000	706,000	NA	
		1991	600,000	605,100	NA	
		1992	600,000	622,180	NA	
	Coho --Offstation Plants	1988	500,000	401,196	NA	
		1989	500,000	370,000	NA	
		1990	500,000	1,040,000	NA	
		1991	500,000	0	NA	4
		1992	500,000	268,900	NA	
	Coho Subyearling plants	1990	NA	315,000	NA	
		1991	NA	1,574,400	NA	
	Sockeye	1991	NA	2,079,100	NA	
		1992	NA	3,067,404	NA	
	Crisp Creek Coho	1988	550,000	596,250	NA	
	Yearling	1989	550,000	526,800	NA	
		1990	550,000	599,100	NA	
		1991	550,000	610,083	NA	
	Icy Creek Chinook	1988	500,000	149,450	NA	
	Yearling	1989	500,000	264,050	NA	
		1990	300,000	293,771	NA	
		1991	300,000	310,000	NA	
	Icy Creek Chinook	1988	1,000,000	1,581,800	NA	
	Subyearling	1989	1,000,000	1,287,984	NA	
		1990	1,200,000	1,295,600	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Icy Creek Chinook Subyearling	1991	1,200,000	0	NA	4
	Crisp Creek Chinook Subyearlings	1989	300,000	401,100	NA	
		1990	300,000	299,850	NA	
		1991	300,000	0	NA	4
		1992	300,000	0	NA	4
Transfers to Tribal Facilities (eggs/fish)	Fall Chinook	1988	650,000	0	NA	5
		1989	2,800,000	5,350,000	NA	5
		1990	2,800,000	6,693,230	NA	5
		1991	2,800,000	1,400,000	NA	5
		1992	2,800,000	4,044,400	NA	5
	Coho	1988	0	0	NA	
		1989	0	0	NA	
		1990	0	0	NA	
		1991	1,000,000	1,025,000	NA	
		1992	1,000,000	2,563,900	NA	
Transfers within WDFW (eggs/fish)	Fall Chinook	1988	1,885,000	7,945,726	NA	
		1989	1,885,000	8,290,100	NA	
		1990	1,885,000	3,336,200	NA	
		1991	1,885,000	1,786,600	NA	
		1992	1,885,000	1,330,200	NA	
	Coho	1988	1,100,000	4,556,546	NA	
		1989	2,000,000	2,457,680	NA	
		1990	NA	3,251,554	NA	
		1991	NA	610,000	NA	
		1992	NA	1,170,000	NA	
	Sockeye	1992	NA	8,003	NA	
	Wild Coho	1992	NA	48,900	NA	
Transfers within WDFW (eggs/fish)	Deschutes Fall Chinook	1988	NA	1,071,475	NA	

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers within WDFW (eggs/fish)	Crisp Creek Coho	1991	NA	80,000	NA	
	Icy Creek Chinook	1989	NA	401,200	NA	
		1990	NA	300,000	NA	
Transfers to Co-ops (eggs/fish)	Fall Chinook	1988	162,000	156,460	NA	
		1989	162,000	165,250	NA	
		1990	162,000	326,100	NA	
		1991	NA	10,500	NA	
		1992	NA	3,600	NA	
	Icy Creek Fall Chinook	1988	NA	5,746	NA	
	Coho	1988	340,000	2,792,600	NA	5
		1989	353,500	272,510	NA	
		1990	353,500	368,200	NA	
		1991	353,500	384,205	NA	
		1992	NA	566,200	NA	
Adults Passed Upstream	Fall Chinook	1990	NA	101	NA	
		1993	NA	153	NA	
	Coho	1990	NA	8,000	NA	6
		1991	NA	3,048	NA	6
		1992	NA	3,348	NA	6
		1993	NA	4,200	NA	6
	Chum	1991	NA	100	NA	
		1992	NA	336	NA	
	Wild Coho	1992	NA	20	NA	
Percent Survival	Fall Chinook Subyearl.	Avg.	1.0%	0.9%[8]	0.1-2.4%	
	Coho	Avg.	10.0%	5.5.%	2.6-11.0%	7
	Sockeye	Avg.	NA[9]	NA	NA	

[8] Three years of data; 1985, 1986, & 1987.

[9] These fish are released as unfed fry and survival information is not yet available.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Percent Survival	Fall Chinook Yearling	Avg.	5.0%	1.8%	1.8%	7

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Fall Chinook	Yes	6.9%	5.9-7.7%	
CV<10%	Coho	Yes	11.1%	7.7-17.9%	8
	Sockeye	NA	NA	NA	
Acclimation	Fall Chinook	Yes	Yes	NA	
	Coho	Yes	Yes	NA	
	Sockeye	Yes	Yes	NA	
Volitional Release	Fall Chinook	No	No	NA	9
	Coho	No	No	NA	9
	Sockeye	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults	Fall Chinook	Yes	Yes	NA	
Throughout Run	Coho	Yes	No	NA	6
	Sockeye	Yes	Yes	NA	
Spawning Pop.	Fall Chinook	Yes	4,247	2,417-7,324	
>500	Coho	Yes	6,974	3,027-13,231	
	Sockeye	Yes	2,476	877-5,501	
Spawning Ratio	Fall Chinook	>0.33	0.6	0.4-0.9	
Male:Female	Coho	>0.33	0.6	0.4-0.9	
	Sockeye	1.0	0.1[10]	0.4	10

Objective 4: Maximize survival at all life stages using disease control and prevention policies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

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10 In many years the fish are live spawned and returned to the river. Records have not been kept on numbers spawned in some years.

Objective 5: Conduct Environmental monitoring

Measures	Hatchery Goal	Four Year Ave.	Range	Comments
TSS Effluent Composite	5 mg/L	-2.74	-75.6-24.5	
TSS Max Effluent	15 mg/L	-1.85	-78.4-29.5	
SS Effluent	0.1 ml/L	0.03	0.0-0.12	
TSS PA Effluent	100 mg/L	32.5	3.2-201	
SS PA Effluent	1.0 ml/L	1.2	0.0-18	
Downstream Temp (°F)	Varies	53.6°	43.0-62.0°	
Maximum Temp	<63°F	66.0°	64.0-66.0°	
Minimum Temp	>32°F	26.1°	26.1-37.0°	
Downstream DO(mg/L)	>8.0	10.2	8.5-11.5	
Continuous Monitoring of Other Parameters	Yes	NA	NA	

Objective 6: Communicate effectively with other salmon producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	11
Develop and Review Equil. Brood Doc.	All	Yes	Yes	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Soos Creek Hatchery and Satellites

1. Sockeye program has no established eggtake goals.

2. Too few females and lower fecundity has resulted in lower than expected eggtake.

3. Chronic disease problems have occurred in coho fry during early portion of rearing.

4. Program was discontinued due to budget limitations.

5. Programmed transfers to tribal or cooperative rearing programs can change after establishment of Future Brood Document goals based on availability of eggs, or changes in management of fish or fisheries.

6. Flooding in several winters has resulted in coho escaping above the weir uncounted.

7. Survivals dropped between 1989 and 1991 brood years apparently because of poor ocean conditions.

8. The CV of the lengths was higher than is desirable because different aged fish were combined into a single pond, and smaller, naturally produced coho fry entered the ponds through the intake.

9. Some groups of fish are released volitionally from this hatchery complex. Some of the rearing containers at this complex are not amenable to this type of release and therefore fish are not released in this manner from these containers.

10. In some years, males were live spawned and not counted in total number of spawned fish.

11. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

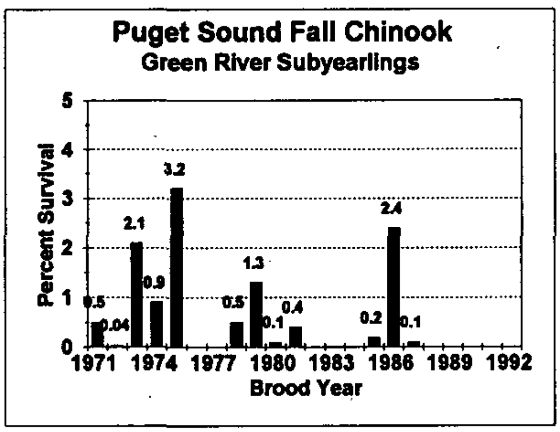
Soos Creek Fall Chinook: This stock originated from adults trapped in the Green River. It has been self-sustaining for many years. **Stock Description: Native.**

Soos Creek Coho: This stock originated from native fish trapped either in Soos Creek or the Green River. There have been minimal introductions of non-native stocks to the hatchery. **Stock Description: Native.**

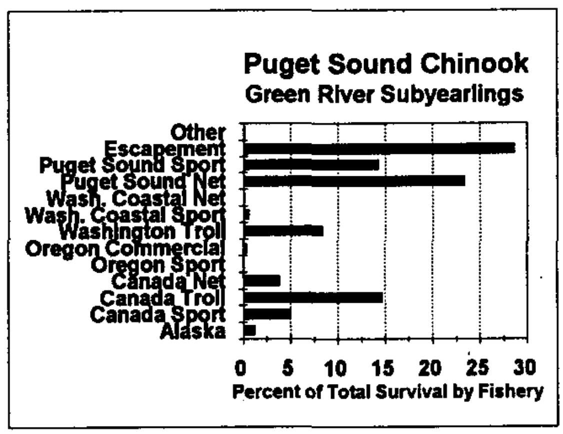
Cedar River Sockeye: Sockeye were introduced to the Lake Washington drainage in 1935, when 96,000 Baker Lake fingerlings were released into the Cedar River, and 76,000 into Issaquah Creek. Releases of this stock were made again in 1937 and 1942-1945. Additional plants of Cultus Lake sockeye were made in the 1944, 1950 and 1954. Genetic stock identification studies indicate that the present stock is indistinguishable from Baker River sockeye. **Stock Description: Introduced, adapted.**

STOCK STATUS PROFILE FOR: Soos Creek Fall Chinook Sub Yearlings

Survival:



Distribution:



Three Year Average Survival: 0.90%
Catch to Escapement Ratio: 3.6:1

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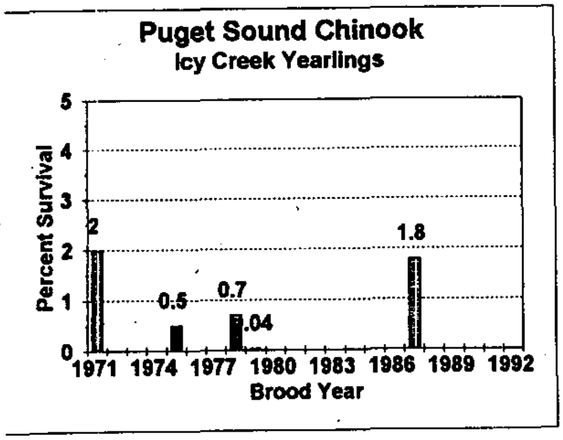
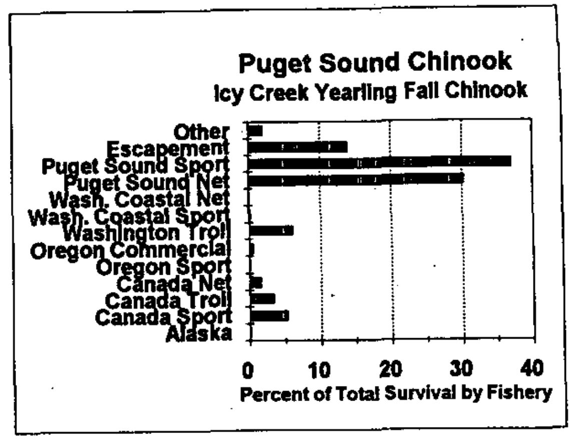
STOCK STATUS PROFILE FOR: Icy Creek Yearling Fall Chinook

Survival:



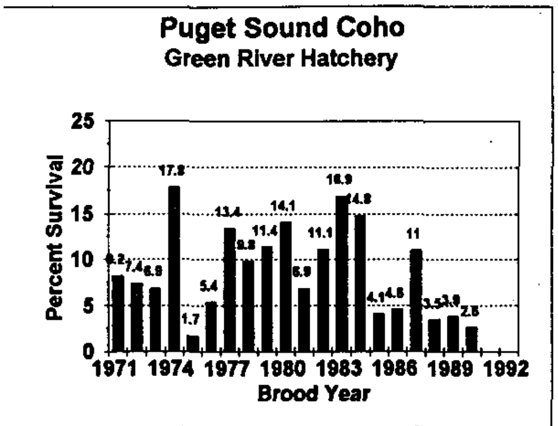
Distribution:



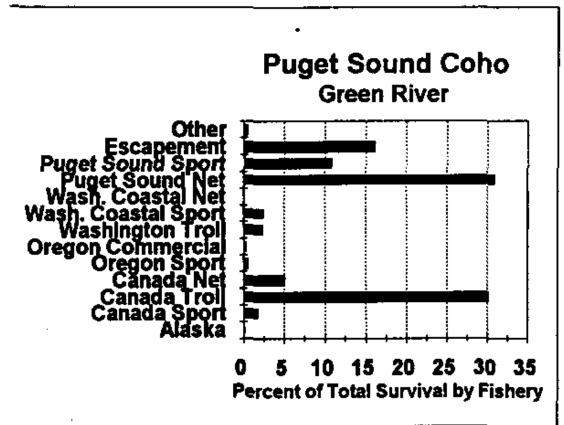
One Year Survival: 1.8%
Catch to Escapement Ratio: 6.7:1

STOCK STATUS PROFILE FOR: Soos Creek Coho

Survival:



Distribution:



Five Year Average Survival: 5.5%
Catch to Escapement Ratio: 5.9:1

STOCK STATUS PROFILE FOR: Cedar River Sockeye

Survival: No data available.

Distribution: No data available.

AR049634

Issaquah Hatchery

Introduction

The Hatchery is located in the town of Issaquah on Issaquah Creek, a tributary to Lake Sammamish. The hatchery was constructed in 1936. The hatchery currently has eight 10' x 100' raceways, two 20' x 100' ponds, and three 1/3 acre ponds (one is also used for adult holding). Release capacity is approximately 5 million juveniles. Incubation includes 52 shallow troughs and 20 deep troughs and 14 stacks of vertical incubators. Hatching capacity is approximately 6 million fry. Water is supplied from Issaquah Creek by pumps and gravity flow from an upstream intake.

Purpose

The hatchery is used to increase the production of chinook and coho salmon contributing to commercial and recreational fisheries in Puget Sound and the NE Pacific Ocean. It also supplies eggs or fry to cooperative rearing projects or for WDFW coho fry outplanting programs.

Goals

1. Produce chinook and coho for the NE Pacific and Puget Sound fisheries.
2. Provide chinook and coho eggs for cooperative rearing programs.
3. Produce coho for outplanting into local streams.

Objectives

Objective 1: 1993 Hatchery Production

Fall Chinook

Rear 2,000,000 1992 brood subyearlings for release on station.

Collect 2,425,000 eggs from 1993 brood adults.

Transfer 65,500 1992 brood eggs to cooperative rearing groups.

Coho

Rear and release 500,000 1991 brood yearlings on-station.

Collect 2,025,000 eggs from 1993 brood adults.

Transfer 797,400 1992 brood eggs co-operative rearing projects..

Produce 500,000 1992 brood subyearlings for outplanting in local streams.

Rear 500,000 1992 brood subyearlings for release in 1994.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Issaquah Hatchery is to collect enough adults to sustain each species' rearing program while meeting proper genetic guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. A permanent weir is located at the hatchery which prevents upstream migration and diverts returning adults into the holding pond.

Fall Chinook: Fall chinook return to Issaquah Hatchery from August to October with peak spawning in October.

Issaquah Coho: Coho begin returning to the hatchery in September through December, with peak spawning in November.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks before release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas.

Fall Chinook: Rear 2,000,000 subyearlings and plant in May or June at 80 fish/pound.

Issaquah Coho: Rear 500,000 yearlings and plant in April at 17 fish/pound.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

No separation by stock or species is necessary at this facility. On days when fewer than one million eggs are collected, a spawning ratio of one male to one female is used. On days when more than 1 million eggs are collected the male to female ratio is not less than 0.33. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Fall Chinook
1. Issaquah
2. University of Washington
3. Soos Creek

Coho
1. Issaquah
2. Soos Creek

Objective 4: Maximize survival at all life history stages using disease control and prevention techniques. Prevent introduction, spread, or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Sanitation

- Equipment (nets, tanks, rain gear) is not necessarily disinfected with iodophor between different fish/egg lots.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at Issaquah hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

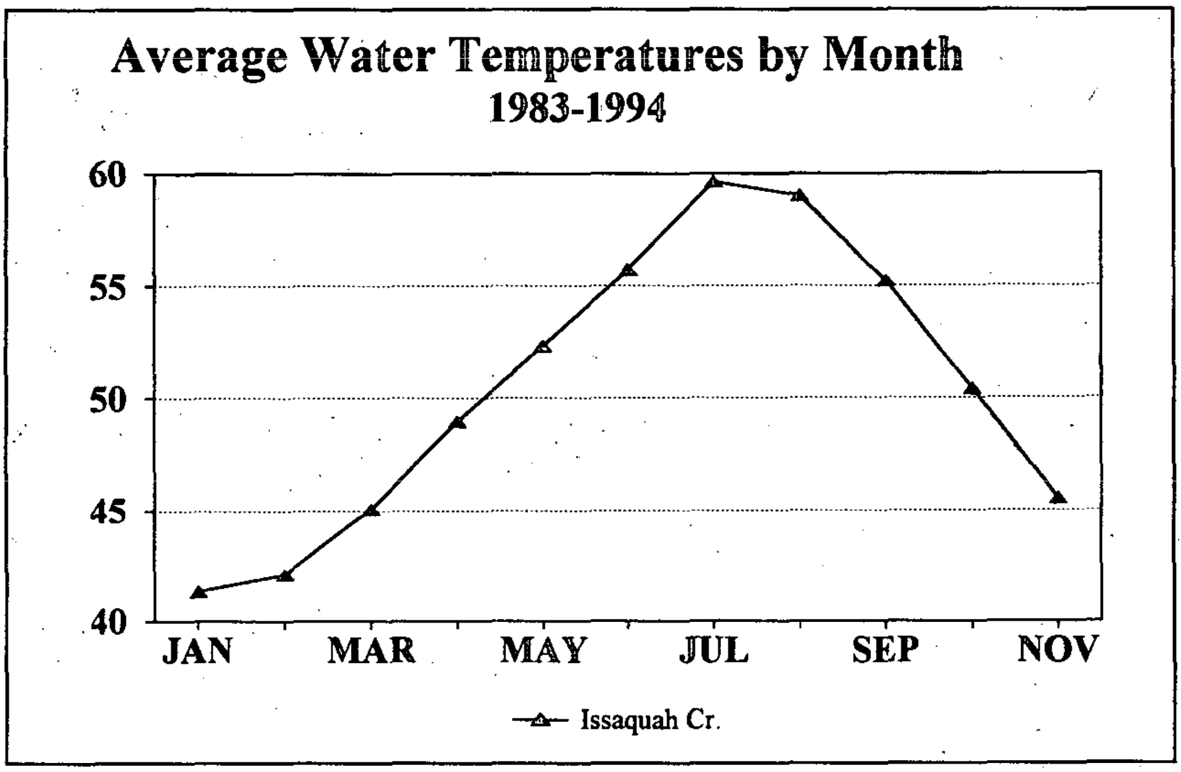
- **In-hatchery Water Temperatures**— Record maximum and minimum temperature daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Issaquah Creek: The water quality of Issaquah Creek has deteriorated markedly over the past 20 years. Large quantities of nutrients make their way into the creek from agriculture and urban development, as well as from a landfill upstream. High winter flows are common due to land use activities upstream of the hatchery. Rearing capacity of the hatchery has been reduced at least 25% because of the change in water quality. Water rights are 45 cfs.

Hatchery Water Temperature Profile



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Issaquah Creek watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Muckleshoot and Suquamish Tribes, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries—Issaquah Hatchery

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Fall Chinook	1989	2,061	3,473	NA	
		1990	2,093	5,541	NA	
		1991	2,093	1,489	NA	1
		1992	1,204	797	NA	1
		1993	1,204	3,159	NA	
	Coho	1989	3,224	7,174	NA	
		1990	3,309	926	NA	1
		1991	2,151	4,853	NA	
		1992	1,914	1,598	NA	1
		1993	1,914	12,758	NA	
Adult Prespawning	Fall Chinook	Avg.	90%	82.3%	58.4-90.8%	2
Survival	Coho	Avg.	90%	97.9%	94.2-99.4%	
Eggtake	Fall Chinook	1989	4,150,000	3,811,100	NA	2
		1990	4,215,000	5,028,600	NA	
		1991	4,215,000	1,562,000	NA	1,2
		1992	2,425,000	916,800	NA	1,2
		1993	2,425,000	2,016,000	NA	2
	Coho	1988	3,410,000	8,471,300	NA	
		1989	3,410,000	7,938,600	NA	
		1990	3,500,000	1,055,500	NA	1
		1991	2,275,000	3,655,450	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Coho	1992	2,025,000	1,451,350	NA	1
		1993	2,025,000	4,795,150	NA	
Fecundity	Fall Chinook	Avg.	NA	4,498	4,174-4,880	
	Coho	Avg.	NA	2,160	1,510-2,978	
Green Egg-to-Fry Survival	Fall Chinook	Avg.	90%	87.5%	83.4-91.6%	
	Coho	Avg.	90%	94.7%	84.6-96.8%	
	Soos Creek Fall Chinook	Avg.	90%	96.0%[1]	92.0-98.3%	
	Soos Creek Coho	Avg.	90%	84.4%	72.6; 80.6%	
Fry to Smolt Survival	Fall Chinook	Avg.	90%	98.2%	94.2-99.6%	
	Coho	Avg.	90%	89.4%	80.0-96.4%	
	Soos Creek Fall Chinook	Avg.	90%	99.4%	99.2-99.6%	
	Soos Creek Coho	Avg.	90%	91.7%	90.4; 93.0%	
Fish Releases (On-Station)	Fall Chinook Subyearling	1988	3,500,000	1,149,200	NA	1,2
		1989	3,500,000	2,832,200	NA	1,2
		1990	3,500,000	3,561,800	NA	
		1991	2,500,000	1,103,600	NA	1,2
		1992	2,000,000	826,300	NA	1,2
	Soos Creek Fall Chinook	1988	NA[2]	1,891,200		
		1989	NA	912,200		

1 Four year average: 1988, 1989, 1991, and 1992. See Soos Creek for escapement information.

2 No established goal because these fish are transferred in to make-up shortfalls due to lower than needed eggtakes from adults returning to the hatchery.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Soos Creek Fall Chinook	1990	NA	0	NA	
(On-Station)		1991	NA	1,282,500	NA	
		1992	NA	1,009,800	NA	
	Coho	1988	920,000	968,200	NA	
		1989	920,000	469,500	NA	2
		1990	920,000	501,100	NA	1,3
		1991	500,000	563,900	NA	
		1992	500,000	660,000	NA	
	Coho Subyearling	1988	NA	237,500	NA	
		1989	NA	1,963,841	NA	
		1991	NA	277,300	NA	
(Off-Station)	Chinook Fry Plants	1988	500,000	466,900	NA	
		1989	500,000	0	NA	4
		1990	500,000	573,100	NA	
		1991	500,000	501,800	NA	
		1992	0	0	NA	
	Coho Fry Plants	1988	1,000,000	666,500	NA	
		1989	1,000,000	634,820	NA	
		1990	0	0	NA	
		1991	0	1,305,000	NA	5
		1992	500,000	661,900	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers within WDFW (eggs/fish)	Coho	1988	60,000	36,000	NA	6
		1989	60,000	65,500	NA	6
		1990	60,000	19,200	NA	6
		1991	60,000	0	NA	6
		1992	0	0	NA	6
Transfers to Co-ops (eggs/fish)	Fall Chinook	1988	15,000	9,700	NA	
		1989	30,000	0	NA	
		1990	76,000	60,000	NA	
		1991	0	0	NA	
		1992	65,500	0	NA	4
	Univ. of Washington Fall Chinook	1988	NA	33,400	NA	
	Soos Creek Fall Chinook	1991	NA	50,000	NA	
	Coho	1988	1,035,000	2,078,000	NA	
		1989	1,072,250	1,694,710	NA	
		1990	1,155,600	24,100	NA	4
		1991	964,450	1,114,500	NA	
		1992	801,250	686,500	NA	4
	Soos Creek Coho	1992	NA	828,650	NA	
Adults Passed Upstream	Fall Chinook	1990	NA	500	NA	
		1991	NA	20	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adults Passed Upstream	Coho	1989	NA	2,000	NA	
		1991	NA	566	NA	
		1992	NA	221	NA	
		1993	NA	2,.000	NA	
Percent Survival	Fall Chinook	Avg.	1.0%	0.3%[3]	0.1-1.2%	
Smolt to Adult	Coho	Avg.	10.0%	ND	ND	7

3 Data for three years; 1985-1987.

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Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Fall Chinook	Yes	5.4%	5.3-5.6%	
	Coho	Yes	NA	NA	7
Acclimation	Fall Chinook	Yes	Yes	NA	
	Coho	Yes	Yes	NA	
Volitional Release	Fall Chinook	No	No	NA	
	Coho	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	No	NA	8
	Coho	Yes	Yes	NA	
Spawning Pop. >500	Fall Chinook	Yes	978	343-1,805	
	Coho	Yes	2,820	687-4,829	
Spawning Ratio Male:Female	Fall Chinook	>0.33	0.7	0.6-0.7	
	Coho	>0.33	0.6	0.5-1.0	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Four Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	-3.65	-93.0-6.2	
TSS Max Effluent	15 mg/L	-3.8	-93-8.4	
SS Effluent	0.1 ml/L	0.01	0-0.1	
TSS PA Effluent	100 mg/L	130.3	4-1,557	9
SS PA Effluent	1.0 ml/L	0.82	0-5	
Downstream Temp(°F)	Varies	63^{0},[4]	57.2^{0}-68.0^{0}	
Maximum Temp	<63°F	69.1^{0}	62.1-69.1^{0}	
Minimum Temp	>32°F	28.0^{0}	28.0-36.0^{0}	
Downstream DO(mg/l)	>8.0	10.0	8-11.5	
Continuous Monitoring of Other Parameters	Yes	NA	NA	

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4 Average for 1991 and 1992.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	10
Develop and Review Equil. Brood Doc.	All	Yes	Yes	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Issaquah Hatchery

1. Low adult returns due to poor survival, overharvest, or inability of fish to reach hatchery due to low flows. These factors reduce the egg take potential.

2. Fingerlings made up most of the planting goal.

3. In some years, warm water and low flows cause adult mortalities, which can reduce egg take. Also, the poor design of the holding pond causes water flow problems during low flow in the creek, further increasing mortality.

4. Lack of available eggs.

5. Fry plants occurrred without established Future Brood Document goal due to excess numbers.

6. These are fish destined to South Sound Net Pens as part of the two-year-old coho release program. In some years adequate space to hold the programmed transfer number was not available at the pens.

7. Lack of a current and continuous coded-wire tag data base. Only tagged fish are measured and mean length and CVs determined.

8. Because of low stream flows during the adult migration, some returning fish are unable to reach the hatchery.

9. The sediment load of the incoming water is very high and the hatchery acts as a settling basin for sediments, which causes the high negative values for the solids averages. The high sediment loads fills the pollution abatement pond causing it to overflow, which violates the NPDES permit. To remedy this problem when it occurs, would require continual pumping of the pollution abatement pond into a septic truck, which is very costly.

10. Lack of adequate funding to provide sufficient office support staff.

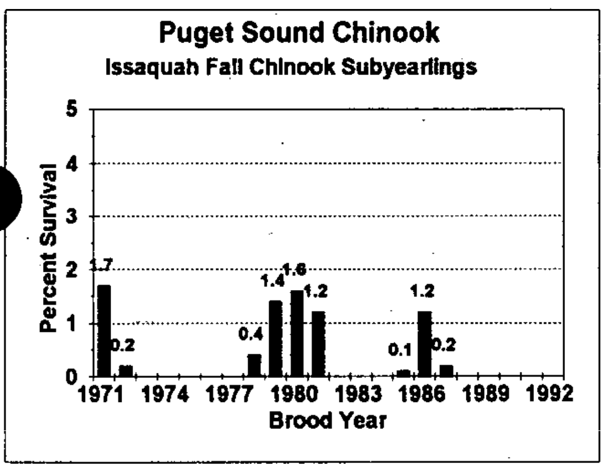
Stock Profile:

Fall Chinook: This stock originated from introductions of Soos Creek fall chinook. Significant plants of both Soos Creek and University of Washington fall chinook, have been made periodically since 1970. There has not been three or more contiguous generations of progeny released that originated solely from Issaquah returning adults. **Stock Description: Introduced, non-adapted.**

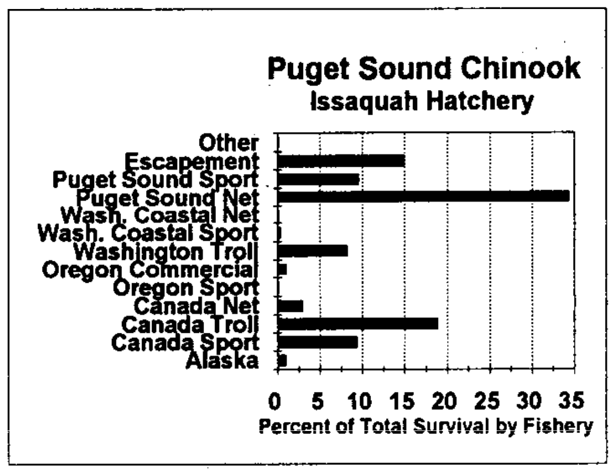
Coho: This stock originated from Soos Creek coho. Although introductions of other stocks have occurred in the past, the majority of fish released in recent years come from Issaquah returnees. **Stock Description: Introduced, adapted.**

STOCK STATUS PROFILE FOR: Issaquah Fall Chinook

Survival:



Distribution:



Three Year Average Survival: 0.3%
Catch to Escapement Ratio: 6.7:1

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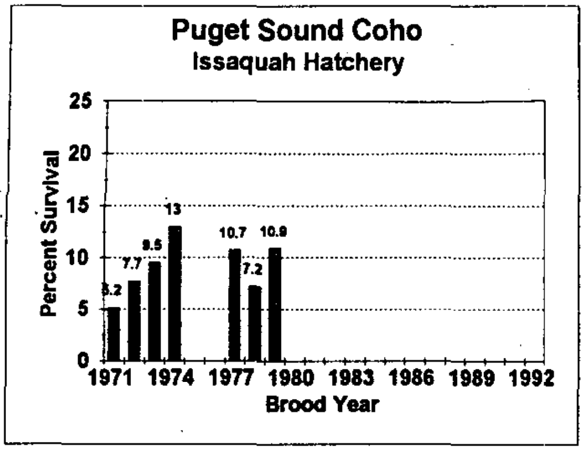
STOCK STATUS PROFILE FOR: Issaquah Coho

Survival:



Five Year Average Survival: ND

Catch to Escapement Ratio: ND

Distribution: No current data available.

Palmer Rearing Ponds

Introduction

The Palmer Rearing Ponds are located on the Green River at river mile 56, 11 miles north of Enumclaw, near the old town site of Palmer. This facility was completed in 1969 and is funded by state Wildlife funds. The rearing facilities consist of a single 1 acre pond and one 0.4 acre pond. The hatchery rears winter and summer run steelhead. Water is supplied from springs (2-15 cfs) and from the Green River (4 cfs), although this latter source is not currently used due to disease concerns.

Associated facilities include imprint ponds at Flaming Geyser State Park operated in conjunction with Trout Unlimited, and a diversion dam to trap steelhead operated in conjunction with Tacoma City Light.

Purpose

The Palmer Rearing Ponds were built to rear and release winter and summer run steelhead smolts and provide fish to cooperative rearing projects. The hatchery crew also operates the fish trap at the City of Tacoma diversion dam. Adult native steelhead are enumerated and passed upstream and a portion of the run is taken to the Keta Creek hatchery for spawning.

Goals

1. Produce Chambers Creek winter steelhead to provide for tribal and recreational fisheries in the Green River.
2. Trap native Green River winter steelhead for spawning at the Keta Creek hatchery, and also to transport a portion of these fish to the upper watershed for natural spawning.
3. Produce Reiter summer run steelhead to provide for recreational fisheries in the Green River.
4. Produce winter steelhead for cooperative rearing projects.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear and release approximately 205,000-215,000 winter steelhead smolts on-station.
2. Rear and release approximately 80,000 Reiter summer run steelhead smolts on-station
3. Rear and release approximately 15,000 winter run steelhead smolts for cooperative rearing projects.
4. Trap native Green River winter steelhead for spawning at Keta Creek hatchery and for transfer to the upper watershed.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, steelhead and trout producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at the City of Tacoma Diversion Dam is to provide enough adults to sustain the rearing program at the Keta Creek facility, and to enumerate the number of adult steelhead passed into the upper watershed.

Winter Steelhead: Winter steelhead return to the hatchery from late November through February. Peak spawning is in mid-January.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared on-station and planted directly into the Green River as smolts. Because there is a high risk of infection with IHNV and bacterial pathogens carried in river water, fish are not acclimated before release.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adult steelhead are not collected for the rearing program at this facility.

Spawning Protocol

Adult steelhead are not spawned at this facility.

Acceptable Stocks

Winter Steelhead
1. Tokul Creek (Chambers Creek derivative)
2. Any Chambers Creek derivative

Summer Run Steelhead
1. Skykomish (Skamania derivative)
2. Any Skamania derivative

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Health Monitoring

- Fish are not spawned at this facility.

Sanitation

- Eggs are not incubated at this facility.

Therapeutic and Prophylactic Treatments

- No eggs are collected at this facility.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Palmer Rearing Ponds:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Springs: During drought periods flows from spring decline as do levels of dissolved oxygen. Water rights are 15 cfs.

Green River: Pathogen load can introduce disease into rearing ponds and thus this water is not currently used for rearing. Water rights are 4 cfs.

Hatchery Water Temperature Profile

Temperatures of the spring water remain constant most of the year. Fluctuations in temperature occur due to flows and temperatures. Temperature ranges from 46^0-52^0 F.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries- Palmer Rearing Ponds

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	Chambers Cr. WSH	NA	NA	NA	1,8
	Green R. Wild WSH	NA	NA	NA	1,8
Adult Prespawning Survival	Chambers Cr. WSH	NA	100%	100%	
	Cedar R. Wild WSH	NA	NA	NA	
Eggtake	Chambers Cr. WSH	NA	57,352[1]	57,352	8
	Cedar R. Wild WSH	NA	28,781[2]	28,871	8
Fecundity	Chambers Cr. WSH	NA	3,300	NA	
Eyed Egg-to-Fry Survival	Chambers Cr. WSH	85%	84.3%	84.3%	
Survival (Fry to Plant or Transfer)	Chambers Cr. WSH	85%	84.7%	71.9-94.6%	
	Skykomish SSH	85%	65.1%	20.7-91.9%	2
	Cedar R. Wild WSH	85%	68.1%[3]	68.1%	
	Coop. Proj. WSH	85%	97.8%	95.9-99.0%	
Plants	Chambers Cr. WSH	NA	181,839	99,347-212,275	8
	Skykomish SSH	NA	65,077	5,200-107,409	8
	Cedar R. Wild WSH	NA	18,500	18,500	8
	Coop. Proj. WSH	NA	15,390[4]	14,543-16,788	8
	S. Tacoma RBT	NA[5]	39,417	39,417	8
Transfers Out (eggs/fish)	Chambers Cr. WSH	Varies	48,344	48,344	3,8
	Goldendale RBT	NA[6]	161,767	161,767	8
Adults Passed Upstream	Chambers Cr. WSH	0	0	0	4,8
	Skykomish SSH	0	0	0	8
	Green R. Wild WSH	NA	NA	NA	8

1 Eggs taken in 1992 only.

2 Eggs taken in 1989 and 1990 only.

3 1989 brood only.

4 Three broods: 1990-'92.

5 Reared only one year to replace summer steelhead which were not available.

6 Reared for only a short period during renovations at Puyallup Trout Hatchery.

Objective 1: Cont.

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Percent Survival Smolt to Adult	Chambers Cr. WSH	NA	NA	NA	
	Skykomish SSH	NA	NA	NA	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	Chambers Cr. WSH	NA	NA	NA	
	Skykomish SSH	NA	NA	NA	
Acclimation	Chambers Cr. WSH	No	No	No	
	Skykomish SSH.	No	No	No	
Volitional Release	Chambers Cr. WSH	No	No	No	
	Skykomish SSH	No	No	No	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Chambers Cr. WSH	NA	NA	NA	1
Spawning Pop. >500	Chambers Cr. WSH	NA	NA	NA	1
Spawning Ratio Male:Female	Chambers Cr. WSH	1.0	NA	NA	
	Cedar R. Wild WSH	1.0	NA	NA	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	1.0	0.5-2.0	
TSS Max Effluent	15 mg/L	1.0	0.8-3.0	
SS Effluent	0.1 ml/L	0	0	
TSS PA Effluent	100 mg/L	NA	NA	5
SS PA Effluent	1.0 ml/L	NA	NA	5
Downstream Temp (°F)	Varies	57.0°	54.9-59.0°	6
Maximum Temp	<63°F	60.1°	13.4-17.8°	6
Minimum Temp	>32°F	ND	ND	
Downstream DO(mg/L)	>8.0	12.0	11.5-13.0	6
Continuous Monitoring of Other Parameters	Yes	NA	NA	

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	7
Develop and Review Equil. Brood Doc.	All	Yes	No	No	8
Develop and Review Future Brood Doc.	All	Yes	No	No	8
Develop and Review Current Brood Doc.	All	Yes	No	No	8

Constraints/Comments- *Palmer* Rearing Ponds

1. Adult steelhead of hatchery origin have not been captured in recent years because fish have been supplied from other regional hatcheries. Also, because of the location of the trap, it is very difficult to actually trap fish. Exploitation rates of winter steelhead on the Green River are estimated at 87-90%, thus few hatchery fish return to the trapping facility.

2. Bird predation has lowered survivals in some years. Also, not as many fish may be transferred to the rearing ponds as recorded in the books. The combination of predation and shortages lowers the apparent survival rate.

3. The number varies according to stocking allotments.

4. Established policy does not allow hatchery fish into upper watershed. Only Green River wild fish are passed upstream.

5. No pollution abatement pond.

6. Data for June-September only.

7. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

8. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus, comparison of hatchery goals with programming goals cannot be compared before 1994.

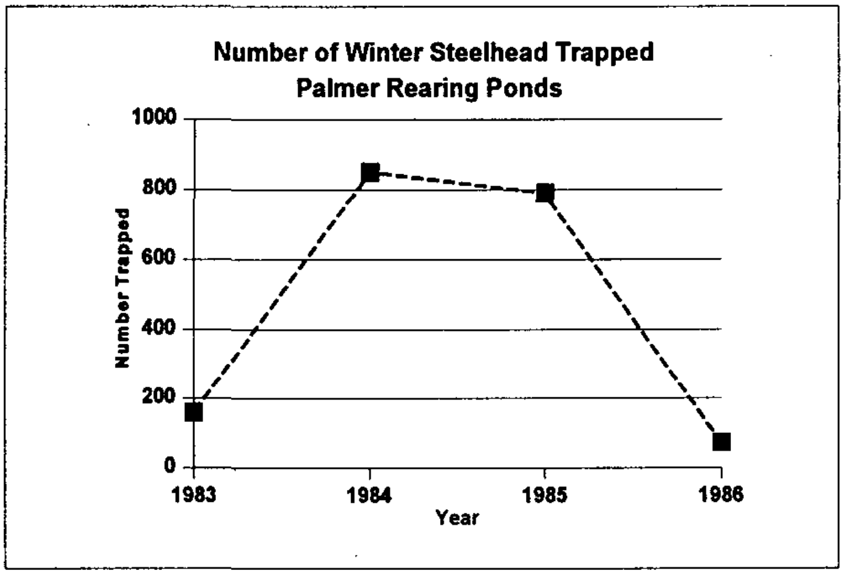
Stock Profile:

Chambers Creek Winter Steelhead: See Chambers Creek Trout and Steelhead Hatchery for information on this stock. **Stock Description: Introduced, non-adapted.**

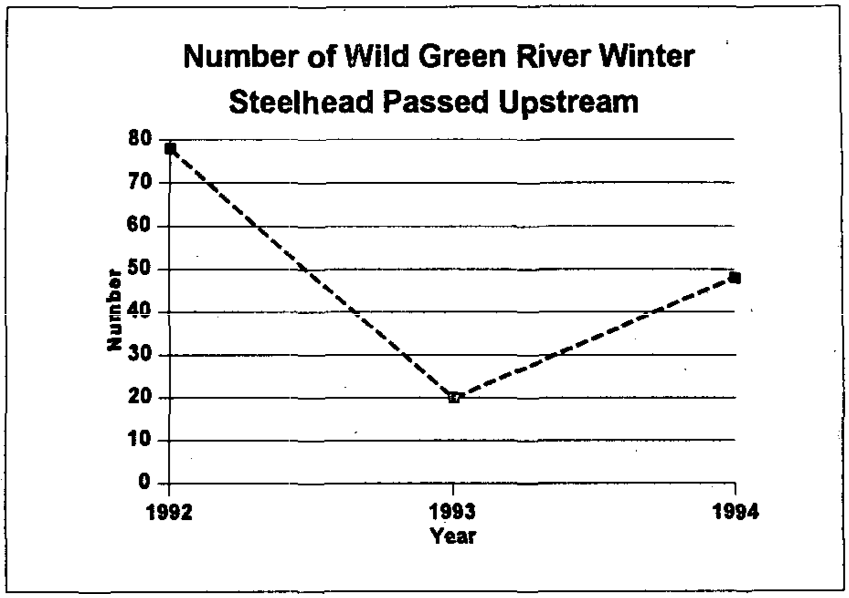
Skykomish Summer Steelhead: See Skykomish Rearing Ponds for information on this stock. **Stock Description: Introduced, non-adapted.**

Green River Wild Winter Steelhead: See SASSI document for information on these fish.

STOCK STATUS PROFILE FOR: Chambers Creek Winter Steelhead



STOCK STATUS PROFILE FOR: Green River Wild Winter-Run Steelhead



Puyallup Complex

Puyallup Hatchery
Voights Creek Hatchery

Puyallup Hatchery

Introduction

The Puyallup Hatchery is located in downtown Puyallup, just south of Clark's Creek. It is funded through State Wildlife funds with some additional funding through the Puyallup Lands Settlement. The hatchery was built in 1947 and production started in 1948. Water is supplied from Clark's Creek. Although the water right is for 15 cfs, the supply has been about 13-13.5 cfs in recent years due to drought conditions and water withdrawals. The Puyallup hatchery serves two main functions: (1) As a nursery station for rearing Chambers Creek strain winter steelhead and Skykomish (Skamania strain) summer steelhead. These fish are brought in from other hatcheries for additional rearing at Puyallup to take advantage of slower growing conditions in the cooler water of this facility. A portion of the steelhead (approx. 150 K) production is outplanted into the Puyallup River system. (2) As an incubation and rearing station for kokanee and three species of trout. These fish are reared for stocking in western Washington lakes. No fish are released directly from the hatchery. The hatchery building contains 112 shallow troughs for incubation. There are sixteen 40' diam. round ponds, eight 9' x 75' raceways, two 130' raceways, and 2 large rearing ponds. Rearing capacity is approximately 3 million juvenile trout. The hatchery rears rainbow, brown, and brook trout, winter and summer run steelhead, and kokanee.

The hatchery also serves four cooperative rearing projects, which are located at Silver Lake, Tanwax Lake, and American Lake.

For winter and summer steelhead, regional goals are established for the number of smolts to be released. These goals are predicated on meeting the management objective of separating hatchery fish from wild fish to prevent hybridization on the spawning grounds (early vs. late run timing differences) and to defer harvest from wild fish to the hatchery portion of the run. Meeting this management objective requires that hatchery origin fish return and spawn earlier than wild fish and that hatchery fish can be differentiated from wild fish by a missing adipose fin. To achieve the first part of the objective required procuring a source of steelhead eggs, and through selective breeding, produce offspring with an early run timing. This was accomplished using Chambers Creek winter steelhead and Skamania summer steelhead. Thus, the regional smolt planting goal was set with the first priority of taking eggs at Chambers Creek Hatchery to fulfill production needs. However, in years when the entire production was not met from Chambers Creek returns, adults of Chambers Creek ancestry returning to other hatcheries, were captured and spawned.

This occurred primarily at only one or two of the several hatcheries with adequate adult returns. To meet the remainder of the management objective entails the logistics of fin marking all hatchery releases while ensuring that each hatchery receives it's allotment of fish to meet on-station or outplanting goals. Due to differences in water temperatures among hatcheries, there can be several weeks differences between spawn timing at regional facilities and those at Chambers Creek hatchery. Thus, to ensure uniform fish size (to facilitate fin clipping) within the region, various lots of fish would be moved between hatcheries to take advantage of warm or cool water temperatures to program appropriate growth rates. Both the South Tacoma Hatchery and the Puyallup Hatchery are central rearing and fin clipping points for Puget Sound steelhead production.

Purpose

The Puyallup Hatchery was built to rear winter steelhead for planting in various local rivers or transfer to other hatcheries, and rear and plant various species of trout in local lakes and beaver ponds.

Goals

1. Produce winter steelhead smolts for planting in the Puyallup River system, and rear winter steelhead fry for transfer to other hatcheries.
2. Produce rainbow trout fry and catchables for planting and transfer to other hatcheries.
3. Rear kokanee fry and plant in local lakes.
4. Produce brown trout and eastern brook trout fingerlings for planting in local lakes.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear 150,000 winter steelhead smolts for outplanting to the Puyallup River system.
2. Rear 760,000 winter steelhead fry for transfer to other hatcheries.
3. Rear 320,000 rainbow trout catchables for stocking of local lakes.
4. Rear 120,000 rainbow trout to 12 fpp and transfer to Silver Lake, American Lake, and Tanwax Lake net pens.
5. Rear 150,000 rainbow trout to 100 fpp and transfer to local lakes and plant in May.
6. Rear 1,300,000 kokanee to 700 fpp to plant local lakes in April and May.
7. Rear 70,000 brown trout to 12 fpp and transfer to net pens on Silver Lake, and other local lakes in the fall.
8. Rear 40,000 eastern brook trout to 12 fpp and transfer to net pens in Silver Lake during the fall.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, steelhead and trout producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

No adult fish are captured at this facility.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared to smolts and then stocked into the Puyallup River system. There is no prior acclimation to receiving water. Trout are reared under standard conditions and either planted into local lakes or ponds as fry, or at legal retention size (catchables), or transferred to other hatcheries for additional rearing. There is no acclimation to receiving waters before stocking.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

No adult fish are trapped.

Spawning Protocol

No fish are spawned at this hatchery.

Acceptable Stocks

<u>Winter Steelhead</u>
1. Chambers Creek
2. Any Chambers Creek derivative

<u>Rainbow trout, Eastern Brook trout, or Brown trout</u>
1. Any suitable strain or stock

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Health Monitoring

- Fish are not spawned at this facility.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Puyallup Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Springs: Due to low rainfall over the past few years the flows in the springs feeding the hatchery have decreased.

Hatchery Water Temperature Profile

No data available.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Puyallup Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	NA	NA	NA	NA	1
Adult Prespawning Survival	NA	NA	NA	NA	2
Eggtake	NA	NA	NA	NA	2
Fecundity	NA	NA	NA	NA	2
Eyed Egg-to-Fry Survival	Goldendale RBT	85%	96.1%[1]	94.6-98.4%	
	S. Tacoma RBT	85%	70.8%	59.6-87.0%	
	Spokane RBT	85%	90.9%	90.9%	
	Tokul Cr. RCT	85%	96.0%	96.0%	
	Lk. Whatcom KOK	85%	97.2%	93.0-100%	
	Chambers Cr. WSH	85%	99.3%	99.3%	
	Tokul Cr. WSH	85%	95.8%	94.4%; 97.2%	
	Green R. WSH	85%	99.5%	99.5%	
	S. Tacoma WSH[2]	85%	88.0%	86.1-90.6%	
Survival (Fry to Plant or Transfer)	Goldendale RBT	85%	67.7%	36.1-89.1%	
	S. Tacoma RBT	85%	81.0%[3]	70.0-91.1%	
	Mt. Whitney RBT	85%	95.5%	95.5%	
	Spokane RBT	85%	92.5%	91.8%; 94.5%	
	Tokul Cr. RCT	85%	91.1%	82.7-96.3%	
	Twin Lk. RCT.	85%	65.0%	30%; 100%	
	Ford EBT	85%	99.9%	99.9-100%	
	Lake Whatcom KOK	85%	77.3%	66.6-82.9%	
	Chambers Cr. WSH	85%	39.0%	39.0%	
	Tokul Cr. WSH	85%	76.3%	72.4% ; 83.2%	
	Green R. WSH	85%	100%	100%	
	Skykomish WSH	85%	95.5%	95.3%; 99.3%	
	S. Tacoma WSH	85%	93.1%	86.6%; 99.5%	

1 Four year average, 1988-1991.

2 Chambers Creek stock.

3 Three broods: 1988-'90.

Objective 1: (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Plants	Goldendale RBT	NA	293,704	190,754-417,306	3,5
	S. Tacoma RBT	NA	659,551	571,492-1127.8K	3,5
	Spokane RBT	NA	46,185	23,832-68,538	3,5
	Tokul Cr. RCT	NA	2,763	0-6,255	3,5
	Twin Lk. RCT	NA	300	0-600	3,5
	Ford EBT	NA	NA	NA	3,5
	Chambers Cr. WSH	NA	72,320	72,320	3,4
	Tokul Cr. WSH	NA	28,376	0; 56,752	3,4
	S. Tacoma WSH	NA	241,757	174,750-308,763	3,4
	Lk. Whatcom KOK	NA	532,138	391,771-667,867	3,5
Transfers Out (eggs/fish)	Goldendale RBT	NA	264,856	73,811-485,386	3,5
	S. Tacoma RBT	NA	100,611	0-285,561	3,5
	Spokane RBT	NA	71,269	0; 142,537	3,5
	Tokul Cr. RCT	NA	68,908	0-206,724	3,5
	Twin Lk. RCT	NA	10,669	0; 21,338	3,5
	Ford EBT	NA	21,839	16,443; 27,035	3,5
	Chambers Cr. WSH	NA	243,394	243,394	4,5
	Tokul Cr. WSH	NA	618,633	453,265; 784,000	4,5
	Green R. WSH	NA	37,265	37,265	4,5
	Skykomish WSH	NA	57,654	7,392; 107,915	4,5
	S. Tacoma WSH	NA	139,933	119,994-299,854	4,5
	Lk. Whatcom KOK	NA	12,954	0-41,910	3,5
Adults Passed Upstream	NA	NA	NA	NA	1,2
Percent Survival Smolt to Adult	NA	NA	NA	NA	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	WSH-Chambers Ck. or derivative	NA	NA	NA	
Acclimation	WSH-Chambers Ck.	No	No	No	6
	Trout Spp.	No	No	No	6
Volitional Release	NA	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	NA	NA	NA	NA	1
Spawning Pop. >500	NA	NA	NA	NA	1,2
Spawning Ratio Male:Female	NA	NA	NA	NA	1,2

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	3.76	0.5-12.5	
TSS Max Effluent	15 mg/L	14.58	0.5-49.0	
SS Effluent	0.1 ml/L	0.49	0.49	
TSS PA Effluent	100 mg/L	26.31	3.0-79.0	
SS PA Effluent	1.0 ml/L	1.0	0.10-2.5	
Downstream Temp (°F)	Varies	47.8°	47.8-48.4°	
Maximum Temp	<63°F	NA	NA	7
Minimum Temp	>32°F	NA	NA	7
Downstream DO(mg/L)	>8.0	9.0	9.0	
Continuous Monitoring of Other Parameters	Yes	NA	NA	7

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	8
Develop and Review Equil. Brood Doc.	All	Yes	No	No	5
Develop and Review Future Brood Doc.	All	Yes	No	No	5
Develop and Review Current Brood Doc.	All	Yes	No	No	5

Constraints/Comments- Puyallup Hatchery

1. No adult collection facilities therefore no adults are spawned.

2. No captive brood maintained.

3. Each year, fish management biologists determine the number of resident trout to plant in lakes within each region of the state. They also determine at what size and time of year these fish should be planted. This number is termed an allotment. For the hatcheries within the region to supply each allotment, they use one or more of the four available domestic rainbow trout broodstocks which produce fry at different times of the year, and program the growth rates of these fry by using the different water temperature regimes unique to each hatchery. This hatchery participates in the grow-out phase of meeting regional allotments.

4. For winter and summer steelhead, a regional planting goal is established. Because of operational constraints, such as adipose fin clipping all hatchery releases, and providing uniform sized fish to all rearing programs, high priority is placed on meeting the entire eggtake from a single hatchery (Chambers Creek Hatchery). Eggs or fry are transferred to other hatcheries to use the unique water temperature at that hatchery to control growth rates and produce a uniform size juvenile that can be transferred to other hatcheries or rivers for release.

5. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus, comparison of hatchery goals with programming goals cannot be made in years before 1994.

6. Fish at this hatchery are reared entirely on groundwater.

7. No data available.

8. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

South Tacoma Rainbow Trout: This stock apparently originated from a commercial fish farm in Meader, Utah. The origin of the Utah strain is unclear, but may have been from the McCloud River, Shasta County, California. Although originally a spring spawning strain, through manipulation of both warmer rearing temperatures and selection of early spawners, these fish now spawn predominantly between August and October with peak spawning in September. This shift in spawn timing provides catchable size trout for planting into lowland lakes before the opening of the general trout season in April, and fingerling trout plants in May for the next trout season. This strain has experienced heavy artificial selection for both spawn timing and coloration. In recent years egg mortality appears to be on the increase indicating a possible genetic bottleneck.

Goldendale Rainbow Trout: This strain originated in 1948 from the interbreeding of Yakima (a mixture of McNott and Meader stocks) and Meader (see S. Tacoma strain) strains of rainbow trout. This strain was selected for early spawning, large size, high fecundity, and overall color and vigor. Spawning takes place from October to February with peak egg production in November and December.

Mt. Whitney Rainbow Trout: Eggs from this strain were obtained in June, 1962 from the Mt. Whitney Hatchery at Independence, California. The strain is apparently a mixture of Sacramento River rainbow, Klamath River steelhead, and possibly a small contribution of Lahonton cutthroat trout. Spawning occurs from December through March with peak spawning in January. This strain produces a deep bodied fish with a relatively small head that is ideally suited to alpine lakes because it grows well, over-winters well, and reproduces naturally where conditions allow.

Spokane Rainbow Trout: This stock originated from the Cape Cod Trout Company of Wareham, Massachusetts. Approximately 2.3 million eggs were purchased and shipped to the Spokane Hatchery in September, 1942. The Cape Cod Trout Company obtained eggs from the McCloud River in 1882. At the Spokane Hatchery, selection for size, fecundity and appearance took place over several generations. Although not purposely interbred with other stocks or strains of rainbow, it is possible that rainbows from the Little Spokane River entered brood holding ponds and were mated with captive brood. Spawning of this strain takes place in November and December.

Tokul Creek Resident Cutthroat: This strain of resident cutthroat was derived from wild broodstock spawning in tributary creeks of Lake Whatcom. Although this strain may have some influence from Lake Chelan cutthroat, it maintains the morphology of coastal cutthroat strains. The parent stock spawned in December -March but the current captive brood spawns primarily in January and February. The captive brood was "revitalized" in the early 1980s with wild cutthroat from Lake Whatcom. Broodstock is currently maintained at the Tokul Creek Hatchery.

Twin Lakes Resident Cutthroat: This resident cutthroat is thought to be an intermontane (i.e., between the crests of the Cascade and Rocky Mountains) strain very similar to "Montana west slope" cutthroat. The parent stock may have originated from either the Lake Wenatchee system or Lake Chelan. The founding "stock" of Twin Lakes cutthroat are trapped at Twin Lakes (alpine lakes located near Leavenworth, WA). There have been no introductions of other stocks to Twin Lakes thus the genetic integrity of the stock has been maintained for over 70 years. Spawning of this stock occurs at ice-out in June.

Ford Eastern Brook Trout: Eastern brook trout were introduced into several Washington lakes in 1894 by the U.S. Bureau of Fisheries. Subsequent plantings occurred near Wilbur and Republic in eastern Washington. Most of the early plantings were from stock obtained from the Paradise Brook Trout company, Henryville, Pennsylvania. By 1913 most of the eggs used in Washington were from established populations. The Ford stock of eastern brook trout originated from Owhi Lake on the Colville Indian Reservation and by 1964 were part of a captive broodstock maintained initially at the Spokane Hatchery and later transferred to the Ford Hatchery (located near Spokane) in 1966. The parent stock originated from 3,000 individuals and has not been mated with other stocks or strains of brook trout.

Lake Whatcom Kokanee: This stock has remained virtually unchanged since the first egg taking operations in 1915. This stock enters Brannion Creek, a tributary of Lake Whatcom, in October and November which are also the primary months of spawning. An egg taking station at Lake Whatcom takes several million eggs and releases approximately 2.5 million fry back into the lake to maintain the stock. This stock has been used extensively throughout the state and in some lakes may be mixed with other Kokanee stocks. This stock is best described as a native stock only in the Lake Whatcom watershed.

Chambers Creek Winter Steelhead: See Chambers Creek HOPPS for information on this stock.

Tokul Creek Winter Steelhead: See Tokul Creek HOPPS for information on this stock.

Skykomish Winter Steelhead: See Skykomish Rearing Ponds Operation Plan for information on this stock.

Voights Creek Hatchery

Introduction

Voights Creek Hatchery is located 1.5 miles southeast of Orting on Voight's Creek, a tributary of the Carbon River. Rearing containers include nine standard raceways, two 1/4 acre ponds, and one large creek pond (also used for adult holding). Incubation utilizes 68 vertical incubators and several freestyle incubators. Eyeing capacity is 11 million and hatching capacity is 8 million fry. Release capacity for the facility is 5.5 million salmon. Water is supplied from Voight's Creek with pumps and by gravity from an upstream intake.

Purpose

The Voights Creek Hatchery was built to increase production of coho and chinook salmon in Puget Sound and the Puyallup River basin. The original purpose of the hatchery has not changed, but in recent years has been expanded to include providing eggs or fish to tribal or cooperative rearing projects, and to increase production of pink salmon in the Puyallup River. The hatchery also serves as an interim rearing facility for other WDFW hatchery programs such as the Lake Sequalitchew net pens.

All production at this hatchery is agreed to by co-managers with the WDFW, the Puyallup Tribe, and the Northwest Indian Fisheries Commission.

Goals

1. Produce fall chinook, coho, and pink salmon for the N.E. Pacific and Puget Sound fisheries.
2. Produce coho fry for WDFW's fry outplanting program.
3. Produce fall chinook and coho eggs for transfer to cooperative rearing groups and the Puyallup Tribe.

Objectives

Objective 1: 1993 Hatchery Production

Fall Chinook

Release 1,600,000, 1992 brood subyearlings on-station.

Collect 2,525,000 eggs from adults returning in 1993.

Transfer 600,000 eggs to the Puyallup Tribe and 400 eggs to cooperative rearing projects.

Coho

Release 1,180,000, 1991 brood yearlings on-station.

Rear 900,000, 1992 brood subyearlings for release into streams.

Collect 3,333,000 eggs from adults returning in 1993.

Transfer 350,000 eggs to the Puyallup Tribe and 208,400 eggs cooperative rearing projects.

Rear 230,000 1991 brood subyearlings for transfer to Puyallup Tribe and cooperative rearing projects.

Pinks

Collect 236,000 pink salmon eggs.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of adult collection procedures at Voights Creek Hatchery is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. A permanent weir on Voight's Creek blocks upstream passage of adult salmon and diverts the fish into the adult holding pond.

Fall Chinook: Fall Chinook return to Voight's Creek from late August to November. The peak spawning period is in October.

Coho: Coho return to Voight's Creek from September to January. Peak spawning is in mid-November.

Pink Salmon: Pink salmon return to Voight's Creek from September to November with peak spawning in October.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size such that time spent in the stream after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas.

Fall Chinook: Fish are reared to 80 fish/pound and released on-station in June.

Coho: Fish are reared to 17 fish/pound and released on station in May. Fish destined for Lake Sequalitchew are reared to 35 fish/pound and transferred in November. Fish reared for transfer to cooperative rearing projects are transferred in April of the first year of rearing at 150 fish/pound.

Pink Salmon: Fish are reared to 450 fish/pound and released in April.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

On days when fewer than one million eggs are collected the male to female spawning ratio will be 1:1. On days when more than one million eggs are collected the male to female spawning ratio will be no lower 0.33. Because gametes of both sexes are pooled, the effective spawning population (N_e) is not known.

Acceptable Stocks

Fall Chinook
1. Voights Creek
2. Soos Creek

Coho
1. Voight's Creek

Pinks
1. Puyallup River (including South Prairie Creek)
2. Minter Creek
3. Garrison Springs

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Voights Creek Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

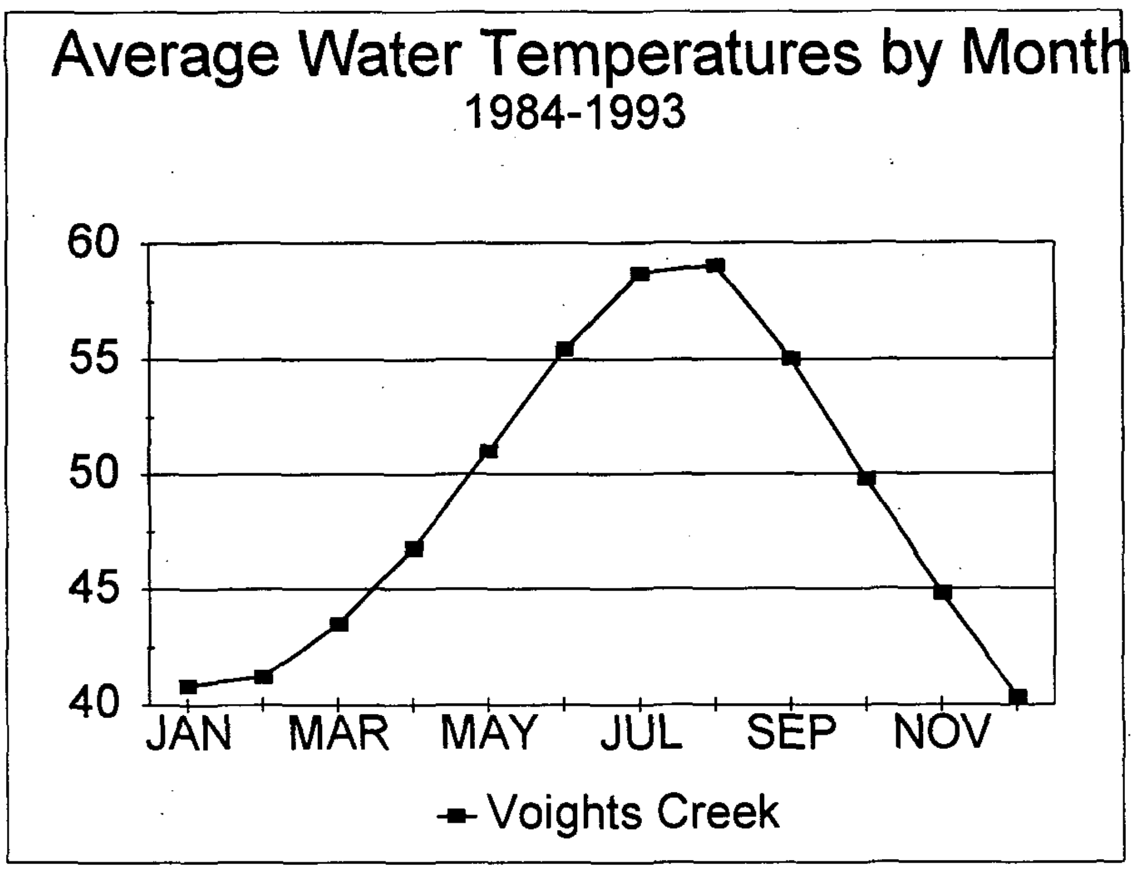
- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Voight's Creek: Increased use by agriculture upstream of hatchery has decreased amount of flow available to hatchery, especially during drought years. Gravel deposition has increased which requires more frequent dredging at hatchery intake to maintain flows, and at weir to effectively trap returning adults. Water rights are 27 cfs.

Hatchery Water Temperature Profile:



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Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Puyallup River watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Puyallup Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries—Voights Creek Hatchery

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Fall Chinook	1989	821	762	NA	
		1990	821	1,970	NA	
		1991	1,097	1,273	NA	
		1992	1,097	1,740	NA	
		1993	1,097	1,550	NA	
	Coho	1989	4,223	20,836	NA	
		1990	4,223	15,241	NA	
		1991	4,247	14,955	NA	
		1992	4,063	52,465	NA	
		1993	4,103	38,095	NA	
	Pinks	1989	NA	123	NA	
		1991	330	21	NA	1
		1993	330	5	NA	1
Prespawning Survival	Fall Chinook	Avg.	90%	96.2%	94.4-98.0%	
	Coho	Avg.	90%	98.0%	93.9-99.7%	
	Pinks	Avg.	90%	73.8%[1]	0.0-100%	
Eggtake	Fall Chinook	1989	1,890,000	1,888,000	NA	
		1990	1,890,000	3,697,000	NA	
		1991	2,525,000	2,280,100	NA	
		1992	2,525,000	3,688,000	NA	
		1993	2,525,000	2,254,000	NA	
	Coho	1989	3,430,000	16,994,000	NA	
		1990	3,430,000	7,781,000	NA	

1 Three year average; 1989, 1991, and 1993.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Coho	1991	3,450,000	8,132,980	NA	
		1992	3,300,000	13,753,400	NA	
		1993	3,333,000	13,234,600	NA	
	Pinks	1989	NA	144,700	NA	1
		1991	236,000	12,000	NA	1
		1993	236,000	0	NA	1
Fecundity	Fall Chinook	Avg.	NA	4,779	3,689-5,289	
	Coho	Avg.	NA	1,657	1,301-2,311	
	Pinks	Avg.	NA	1,806	1,200;2,412	
Green Egg to Fry Survival	Fall Chinook	Avg.	90%	91.5%	84.6-93.5%	
	Coho	Avg.	90%	93.8%	85.2-96.7%	
	Pinks	'89,91	90%	88.2%	84.8; 91.7%	
	Soos Creek Fall Chinook	1989	90%	82.2%	82.2%	
	Deschutes Fall Chinook	'88,89	90%	93.7%	91.2; 96.2%	
	South Prairie Pinks	1989	90%	98.0%	98.0%	
Fry to Smolt Survival	Fall Chinook	Avg.	90%	98.0%	93.6-99.4%	
	Coho	Avg.	90%	76.6%	65.9-86.9%	2
	Pinks	Avg.	90%	97.6%	96.2; 99.1%	
	Deschutes Fall Chinook	1989	90%	98.5%	98.5%	
Fish Releases (On- station)	Fall Chinook Subyearlings	1988	1,600,000	1,364,300	NA	
		1989	1,600,000	1,756,900	NA	
		1990	1,600,000	2,231,900	NA	
		1991	1,600,000	1,552,700	NA	
		1992	1,600,000	1,913,300	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases (On-station)	Coho	1988	2,680,000	1,147,090	NA	2
		1989	2,080,000	1,117,600	NA	2
		1990	2,080,000	1,249,300	NA	2
		1991	2,080,000	1,132,735	NA	2
	Pinks	1989	NA	118,000	NA	1
		1991	200,000	10,900	NA	1
	Soos Creek Fall Chinook	1989	NA	NA	NA	
	Desch. Fall Chin. Subyear.	1989	NA	278,000	NA	
Fish Releases (Off-station)	Coho	1988	1,500,000	1,263,600	NA	
		1989	1,180,000	1,732,000	NA	
		1990	900,000	0	NA	3
		1991	900,000	2,956,200	NA	
		1992	900,000	1,107,800	NA	
	Fall Chinook	1990	NA	381,000	NA	
	Deschutes Fall Chinook	1989	NA	720,000	NA	
Transfers to Tribal Facilities (Eggs/Fish)	Fall Chinook	1988	600,000	270,000	NA	
		1989	0	0	NA	
		1990	600,000	602,000	NA	
		1991	600,000	500,000	NA	
		1992	600,000	750,000	NA	
	Coho	1988	350,000	0	NA	
		1989	350,000	350,000	NA	
		1990	350,000	558,500	NA	2
		1991	350,000	401,900	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Tribal Facilities (Eggs/Fish)	Coho	1992	400,000	350,000	NA	
	Deschutes Fall Chinook	1989	NA	200,000	NA	
	Clark Creek Coho	1991	850,000	0	NA	4
Transfers Within WDFW (Eggs/Fish)	Fall Chinook	1990	0	399,000	NA	
		1992	0	1,391,000	NA	
	Coho	1988	200,000	709,300	NA	
		1989	200,000	190,250	NA	
		1990	200,000	0	NA	4
		1991	200,000	214,000	NA	
		1992	200,000	340,000	NA	
	Minter Creek Coho	1991	1,400,000	0	NA	4
	Desch. Fall Chin. Subyear.	1988	700,000	1,830,000	NA	
		1989	700,000	391,000	NA	5
	McAllister Fall Chinook	1988	NA	882,500	NA	
	South Prairie Pinks	1989	NA	196,000	NA	
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	1988	0	150	NA	4
		1989	400	250	NA	4
		1990	900	63,000	NA	4
		1991	400	0	NA	4
		1992	400	0	NA	4
	Coho	1988	361,000	361,110	NA	
		1989	357,400	147,500	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Co-ops	Coho	1990	359,200	1,883,000	NA	
(Eggs/Fish)		1991	372,400	380,400	NA	
		1992	208,400	230,876	NA	
	Clark Creek Coho	1991	407,000	0	NA	4
Adults Passed	Fall Chinook	1990	NA	319	NA	
Upstream		1992	NA	14	NA	
	Coho	1988	NA	700	NA	
		1989	NA	100	NA	
		1990	NA	500	NA	
		1991	NA	710	NA	
		1992	NA	828	NA	
Smolt to Adult	Fall Chinook	Avg.	1.0%	ND	ND	6
Survival	Coho	Avg.	10.0%	11.0%	8.9.-15.4%	
	Pinks	Avg.	0.5%	ND	ND	6

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Fall Chinook	Yes	NA	NA	6
CV<10%	Coho	Yes	6.3%	5.5-7.1%	
	Pinks	Yes	NA	NA	6
Acclimation	Fall Chinook	Yes	Yes	NA	
	Coho	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
Volitional Release	Fall Chinook	No	No	NA	
	Coho	No	No	NA	
	Pinks	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	Yes	NA	
	Coho	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
Spawning Pop. >500	Fall Chinook	Yes	1,237	725-1,644	
	Coho	Yes	14,773	6,744-25,577	
	Pinks	Yes	65	10-120	1
Spawning Ratio Male:Female	Fall Chinook	0.33	1.1	0.9-1.4	
	Coho	0.33	0.8	0.5-1.3	
	Pinks	1.0	0.5	0.0;1.0	1

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Four Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	-7.4	-112-9.2	7
TSS Max Effluent	15 mg/L	-5.8	-107.6-28	7
SS Effluent	0.1 ml/L	0.01[2]	-0.3-0.7	
TSS PA Effluent	100 mg/L	19.4	6.4-110	
SS PA Effluent	1.0 ml/L	0.28	0.2-1.0	
Downstream Temp (°F)	Varies	58.8°	50.0-63.9°	
Maximum Temp	<63°F	70.0°	64.0-70.0°	
Minimum Temp	>32°F	33.0°	33.0-35.1°	
Downstream DO (mg/l)	>8.0	9.1	8.0-10.1	8
Continuous Monitoring of Other Parameters	Yes	NA	NA	

2 Five year average.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	9
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Voights Creek Hatchery

1. Poor adult returns are likely due to low smolt to adult survival. This reduces the number of adults needed to produce programmed egg take, and reduces egg take potential.

2. Initial rearing of coho fry is done at high densities in a small number of raceways to provide more raceways for rearing chinook. This scenario provides a better rearing environment for chinook fry, but creates a high density rearing environment for coho fry and makes them more susceptible to disease, thus increasing mortality. When higher mortality occurs, fewer smolts are produced and there can be shortages in the numbers of subyearlings for transfer.

3. No fry plants made this year.

4. Change in program after Future Brood Document goals were established.

5. Eggs or fish not available.

6. Lack of current continuous coded-wire tag data base. Average lengths and coefficient of variation are not recorded except from coded wire tagged fish.

7. Water quality in Voight's Creek has declined over time due to agricultural development. Negative values for TSS effluent indicate high silt loads of incoming water.

8. At times dissolved oxygen levels are higher below the hatchery than above, which is unexpected.

9. Lack of sufficient funding to provide adequate office support staff.

Stock Profile:

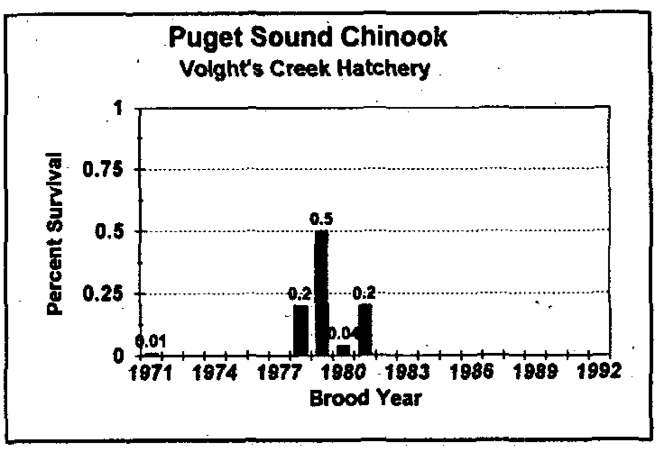
Voights Creek Fall Chinook: This stock originated from native fish, but it is likely there has been significant introgression from other hatchery stocks, primarily Soos Creek stock. **Stock Description: Mixed.**

Voight's Creek Coho: This stock originated from coho native to the watershed. There have been a few introductions of Soos Creek coho, Washougal Type-S coho, and Minter Creek Coho. In two of every three years, run timing is early suggesting that this cycle consists of either the original native stock or possibly hybrids with the Type-S coho. **Stock Description: Native.**

Puyallup Pinks: This stock originated from South Prairie Creek, a nearby creek. **Stock Description: Native.**

STOCK STATUS PROFILE FOR: Voights Creek Fall Chinook

Survival:



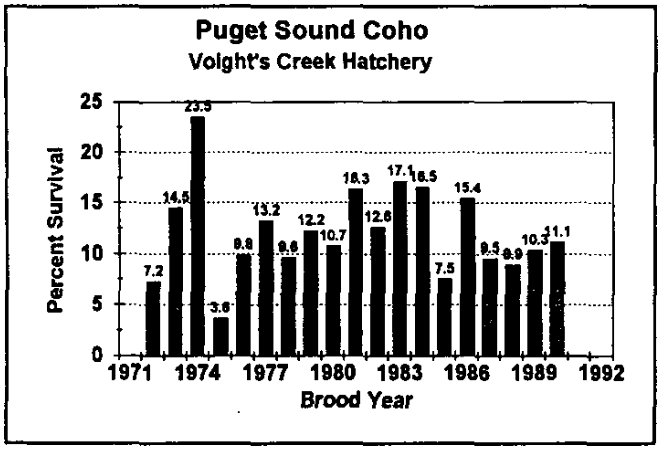
Distribution:

No current data available.

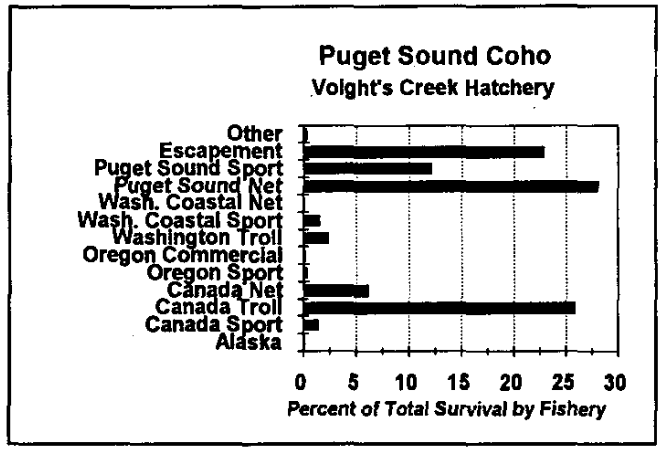
Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Voight's Creek Coho

Survival:



Distribution:



Five Year Average Survival: 11.0%
Catch to Escapement Ratio: 4.3:1

STOCK STATUS PROFILE FOR: Voights Creek Pinks

Five Year Average Survival: ND
Catch to Escapement Ratio: ND

Minter Creek Complex

Minter Creek Hatchery
Coulter Creek Hatchery
Hupp Springs Hatchery
Fox Island Net Pens

Minter Creek Salmon Hatchery and Satellites

Introduction

Minter Creek Hatchery is located on Minter Creek a tributary to south Puget Sound, approximately 10 miles west of Gig Harbor. The station was constructed in 1936 under a Works Progress Administration contract, with the federal government furnishing materials and labor. Beginning in 1993 the hatchery was renovated, which resulted in program reductions for some species during 1992 and 1993. Adults returning in these years will be captured and spawned. Scheduled completion of the renovation is in 1997.

Before 1993, the hatchery had nine standard raceways, five 5' x 90' raceways, eight 4' x 40' raceways, one 40' circular pond, an asphalt rearing pond also used for adult holding, and two earthen ponds. Release capacity was approximately 5 million juveniles per year. Incubation facilities included vertical incubators, deep troughs, and shallow troughs with a hatching capacity of 10 million fry. Water was supplied by one well and gravity flow from Minter Creek.

The newly renovated hatchery has twelve 10' x 100' x 4' raceways, each supplied with 500 gpm of creek water. These raceways are used for rearing fry and fingerlings and do not have the capacity to use re-use water. A second group of larger raceways (20' x 140' x 5') are used to rear fish to release, and four of these raceways are also used to hold returning adults. Each is supplied with up to 1,500 gpm creek or a mixture of creek and re-use water. Approximately 1.5 million coho smolts (17 fpp), 2 million chinook smolts (75 fpp) and 2 million chum (450 fpp) can be reared in these raceways. The raceways used for rearing coho and holding adults receive a combination of creek water and re-use water. Eight new incubation rooms were built to replace the single incubation building. Each species or stock can be incubated in a separate room, allowing for isolation and reduction of contamination from virus. Each incubation room has 40 half stacks (8 trays) of vertical incubators with a capacity to incubate 2,250,000 eggs or alevins. Thus, the total hatching capacity is 18 million alevins. The incubation room is supplied with both well water and creek water, and approximately 75% of the total flow can be well water.

The Minter Creek Hatchery serves as the hub for several satellite facilities, including Coulter Creek Hatchery, Hupp Springs Hatchery, and the Fox Island Net Pens. The hatchery traps returning White River spring chinook adults and transports them to Hupp Springs Hatchery.

Hupp Springs Hatchery is located on Minter Creek approximately 3/4 mile upstream from the Minter Creek Hatchery. There are four incubation raceways which are now used for rearing spring chinook. A 1/5 acre pond is also used for rearing and release. Spring chinook adults are captured at Minter Creek or brought to the facility from the captive brood rearing program at the SSNP. The maximum release capacity for the facility is approximately 90,000 yearling chinook and 280,000 subyearling chinook. Water is supplied by gravity from Hupp Springs. This station supports the White River spring chinook restoration program.

Coulter Creek Hatchery is located approximately 2 miles north of Allyn. There are two 1/3 acre rearing and release ponds and an adult holding pond. The hatchery rears and releases fall chinook, and traps returning adults. The hatchery has no incubation capability, and all eggs taken from returning adults are incubated at Minter Creek Hatchery. Water is pumped from Coulter Creek. Release capacity is approximately 2 million juveniles.

The Fox Island Net Pens are located in Echo Bay. This station consists of eight - 40' x 40' x 20' floating net pens. The total release capacity is 320,000 yearling salmon per year. The rearing strategy for chinook and coho is to delay release past normal migratory time so that a higher proportion of these fish will reside in Puget Sound.

Purpose

The Minter Creek Biological Station was established in 1937 to determine the minimum spawning escapement of coho salmon needed to obtain the best production from a stream and to evaluate various methods of rearing and planting young salmon. The research station consisted of a weir, residences and laboratory, a hatchery building, and rearing ponds. The research station was abandoned in favor of a production hatchery in the 1960s. Currently, the purpose of the Minter Creek Hatchery and satellites is to aid in the restoration of the White River spring chinook, and produce fall chinook, coho, and chum for various Puget Sound fisheries. The hatchery also provides coho fry to the Fish Management Program of WDFW for outplanting in local streams, and eggs or fish to various tribal or cooperative rearing projects.

Goals

1. Aid in the restoration of the native run of White River spring chinook in the White River watershed.
2. Produce fall chinook, coho, chum and pink salmon for the NE Pacific and Puget Sound

fisheries.

3. Provide coho fry for WDFW fry outplanting program.
4. Produce fall chinook, coho, and chum eggs for tribal and cooperative rearing projects.
5. Incubate and rear salmon eggs/fry for other WDF hatchery programs.

Objectives

Objective 1: 1993 Hatchery Production

Minter Creek Hatchery

Fall Chinook

Plant 1,800,000 1992 brood subyearlings on-station.
Transfer 1,600,000 1992 brood Deschutes fingerlings to Coulter Creek.
Transfer 1,000,000 1992 brood Coulter Creek fingerlings to Coulter Creek.
Transfer 1,150,000 1992 brood Gorst Creek fingerlings to Garrison Springs Hatchery and 1,100,000 fingerlings to Gorst Creek Hatchery.
Transfer 45,000 1992 brood eggs and 5,000 fingerlings to cooperative rearing projects.
Collect 2,175,000 eggs from the 1993 returning adults.

Coho

Plant 1,000,000 1991 brood yearlings on-station.
Plant 500,000 1991 brood Soos Creek yearlings on-station.
Transfer 560,000 1992 brood eggs and fingerlings to cooperative rearing projects.
Transfer 50,000 1992 brood eggs to the Suquamish Tribe.
Transfer 1,500,000 1992 brood eggs to Skagit Hatchery and 350,000 fingerlings to Garrison Hatchery.
Provide 3,500,000 1992 brood fry for outplanting in local streams.
Collect 7,100,000 eggs from adults returning in 1993.

Chum

Plant 2,000,000 1992 brood Elson Creek chum on station.
Transfer 1,210,000 1992 brood Elson Creek chum to cooperative rearing projects.
Transfer 120,500 1992 brood Minter Creek (Hood Canal stock) chum to cooperative rearing projects.
Collect 8,000,000 eggs from adults returning in 1993.

Pink Salmon

Collect 100,000 eggs from pink salmon adults returning in 1993.

Hupp Springs

Spring Chinook

Plant 76,5000 1991 brood White River yearlings on-station.

Plant 220,000 1992 brood White River subyearlings on-station.

Transfer 324,300 1992 brood White River spring chinook eggs to Muckleshoot tribe.

Transfer 3,500 1991 brood White River yearling to captive broodstock program at South Sound Net Pens.

Collect 725,000 eggs from adults returning to Minter Creek Hatchery in 1993 and from captive broodstock maturing in 1993.

Coulter Creek

Fall Chinook

Plant 1,000,000 1992 brood Coulter Creek subyearlings on-station.

Transfer 1,500,000 1992 brood Deschutes stock subyearlings to Deschutes Complex.

Coho

Transfer 500,000 1991 brood Wallace River yearlings to the Suquamish cooperative rearing project.

Rear 1,100,000 1992 brood Wallace River fingerlings and transfer 400,000 fingerlings in 1993 to Lake Sequalitchew and 500,000 in 1994 to Suquamish.

Transfer 1,500 1992 brood fingerlings to cooperative rearing projects.

Fox Island

Fall Chinook

Plant 245,000 1991 brood Deschutes stock yearlings on-station.

Rear 320,000 1992 brood Deschutes stock fingerlings for release in 1994.

Coho

Plant 330,000 1991 brood Wallace River coho on-station.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Minter Creek Hatchery and satellites is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. A permanent weir at Minter Creek Hatchery and at Coulter Creek Hatchery blocks upstream passage and diverts adults into holding ponds.

Fall Chinook: Fall chinook return to Minter Creek and Coulter Creek from August to November, with peak spawning in October.

White River Spring Chinook: Spring chinook return from June to September, with peak spawning in late September. Adults from the captive brood stock program are transferred from the SSNPs primarily in September and are spawned from early-October to November with peak spawning in mid-October.

Coho: Coho return to Minter Creek from September to December with peak spawning in mid-November. A permanent weir blocks upstream passage of adults and diverts these fish into the adult holding pond.

Chum: Chum return to Minter Creek from November to December. Because Elson Creek chum are replacing the Hood Canal stock that was previously reared at this hatchery peak spawning time is unknown.

Pink Salmon: Pink salmon return to Minter Creek Hatchery from late August to October with peak spawning in October.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to the parent river for several weeks prior to release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas.

Fall Chinook: Fall chinook at Minter Creek and Coulter Creek are reared to 80 fish/pound and released in June. Two groups of fall chinook are reared at the Fox Island Net Pens. One group (200,000) is reared to 8 fish/pound and released in March or April and the second group (25,000) is reared to 4 fish/pound and released in May as part of a delayed release program.

Spring Chinook: Spring chinook are reared at Hupp Springs hatchery and released in two groups. The first group is released as yearling fish at 8 fish/pound in April and May. The second group is released as sub-yearlings in June at 60 fish/pound.

Coho: Coho are reared at Minter Creek hatchery and released in May at 17 fish/pound.

Chum: Chum are reared and released at Minter Creek hatchery at 500 fish/pound in March and April.

Pinks: Pinks are reared and released at Minter Creek hatchery at 500 fish/pound in late March.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

Return timing and coded-wire tags are used to separate spring and fall chinook at Minter Creek Hatchery. Most White River spring chinook return to the hatchery before August and most fall chinook return after August. Because 100% of the White River spring chinook are tagged at release and none of the Minter Creek fall chinook are tagged, any tagged fish trapped at Minter Creek Hatchery after August is taken to the Hupp Springs facility. At spawning, the coded-wire tag is removed and deciphered to verify that the fish is a White River spring chinook. These precautions prevent the accidental mating of other chinook with White River spring chinook.

All spring chinook are spawned at a 1:1 male to female ratio. For fall chinook, coho, chum, and pinks, a spawning ratio of one male to one female is used when fewer than one million eggs are collected in a single day. On days when more than 1 million eggs are collected the male to female spawning ratio is no lower than 0.33. The effective population size (N_e) is not known for the latter species due to pooling of gametes.

Acceptable Stocks

Fall Chinook (Minter Creek, Coulter Creek)

1. Minter Creek/Coulter Creek
2. Deschutes
3. Voights Creek
4. Any south Puget Sound stock

White River Spring Chinook

1. White River Spring Chinook

Coho

1. Minter Creek
2. Soos Creek

Chum

1. Minter (of Elson Creek stock returns)
2. Elson Creek

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Minter Creek Hatchery and satellites:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement (PA) pond. Minter Creek Hatchery has a newly constructed PA pond, but data from this pond are currently unavailable. Satellite facilities do not have PA ponds. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.
- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Minter Creek: Water quality and quantity has declined due to urban development. The creek has experienced several episodic events of low pH due to acidic runoff. Water rights are 42 cfs.

Minter Creek Wells: Water rights are 1,100 gpm.

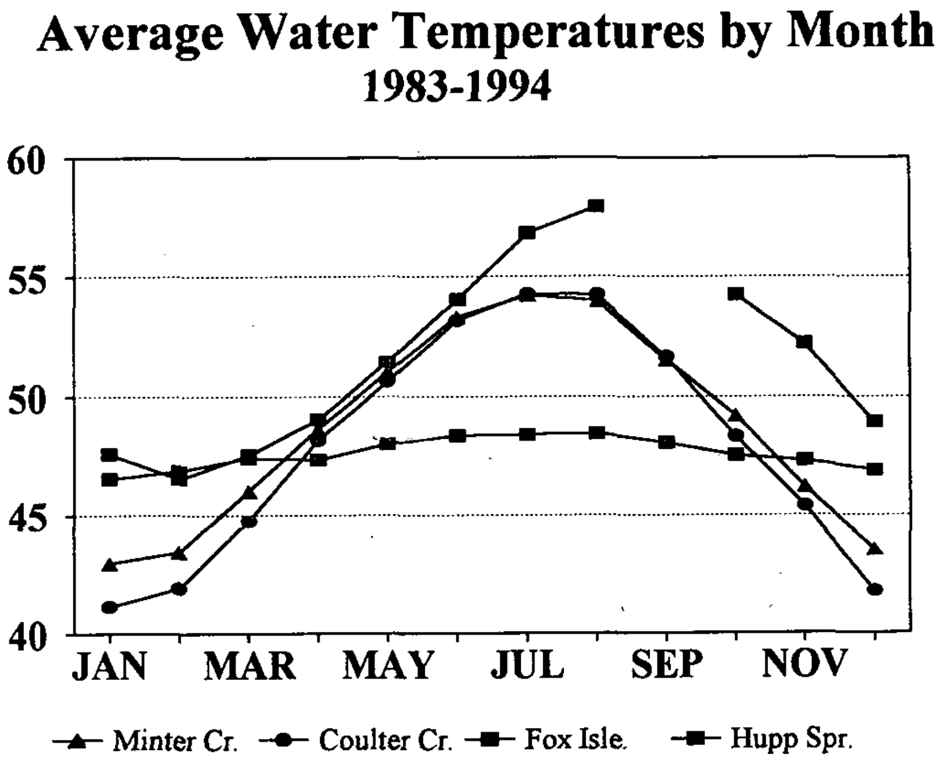
Coulter Creek: Water quality and quantity remains stable despite some logging occurring in the upper watershed. Water rights are 27 cfs.

Hupp Springs: Water rights are 6.8 cfs

Fox Island Pens: Water quality appears to have remained stable.

Domestic Water: Water rights are 0.5 cfs.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Minter Creek and Coulter Creek watersheds has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Muckleshoot and Puyallup Tribes, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at these facilities.

Performance Summaries—Minter Creek Hatchery & Satellites

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	White River Spring Chinook	1989	584	441	NA	
		1990	577	315	NA	
		1991	596	1,206	NA	
		1992	596	1,436	NA	
		1993	596	1,152	NA	
	Minter Fall Chinook	1989	1,042	2,132	NA	
		1990	1,047	3,260	NA	
		1991	1,057	3,121	NA	
		1992	1,057	2,004	NA	
		1993	3,934	2,013	NA	1
	Coulter Creek Fall Chinook	1989	550	1,306	NA	
		1990	550	3,238	NA	
		1991	550	1,698	NA	
		1992	550	1,260	NA	2
		1993	0	1,465	NA	2
	Minter Coho	1989	7,825	5,775	NA	1
		1990	7,733	9,455	NA	
		1991	7,340	13,056	NA	
		1992	NA	22,170	NA	
		1993	8,833	16,100	NA	
	Minter Chum	1989	NA	1,833	NA	
		1990	NA	421	NA	
		1991	NA	9,569	NA	
		1992	4,003	7,014	NA	
		1993	NA	14,200	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Coulter Creek Chum	1989	965	1,797	NA	
		1990	965	1,991	NA	
		1991	965	1,488	NA	
		1992	NA	5,089	NA	2
		1993	NA	5,771	NA	2
	Pinks	1989	NA	17	NA	
		1991	221	286	NA	
		1993	221	16	NA	
	Donkey Creek Chum	1992	NA	92	NA	
	Minter Creek Early Chum	1993	NA	280	NA	
Adult Prespawning Survival	White River Spring Chinook	Avg.	90%	86.0%	72.1-94.9%	3
	Minter Fall Chinook	Avg.	90%	88.6%	83.8-96.8%	
	Coulter Creek Chinook	Avg.	90%	90.6%[1]	83.9-94.1%	
	Minter Coho	Avg.	90%	91.7%	86.7-94.7%	
	Minter Pinks	Avg.	90%	54.6%[2]	43.8-67.1%	
	Coulter Creek Chum	Avg.	90%	94.8%[3]	93.4-97.1%	
	Minter Chum	Avg.	90%	91.2%	80.0-99.7%	
	Donkey Creek Chum	1992	90%	100%	100%	
Eggtake	White River Spring Chinook	1989	710,000	802,519	NA	
		1990	702,000	503,500	NA	
		1991	725,000	1,609,065	NA	4
		1992	725,000	1,503,500	NA	4
		1993	725,000	1,477,800	NA	4

1 Three year average; 1989-1991.

2 Three year average; 1989,1991, and 1993.

3 Three year average; 1989-1991.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Minter Fall Chinook	1989	2,120,000	1,792,000	NA	
		1990	2,130,000	4,391,000	NA	
		1991	2,150,000	4,163,900	NA	
		1992	2,150,000	3,903,400	NA	
		1993	2,175,000	1,632,000	NA	1
	Coulter Creek Fall Chinook	1989	1,180,000	1,688,000	NA	
		1990	1,180,000	1,411,000	NA	
		1991	1,180,000	3,422,200	NA	
		1992	NA	0	NA	
		1993	NA	0	NA	
	Minter Coho	1989	6,290,000	4,146,500	NA	1
		1990	6,216,000	8,369,000	NA	
		1991	5,900,000	7,548,300	NA	
		1992	7,120,000	12,329,000	NA	
		1993	7,100,000	6,532,000	NA	1
	Minter Pinks	1989	NA	10,000	NA	
		1991	100,000	140,500	NA	
		1993	100,000	2,350	NA	1
	Coulter Creek Chum	1989	1,180,000	1,497,000	NA	
		1990	1,180,000	1,338,700	NA	
		1991	1,180,000	1,217,100	NA	
	Minter Chum	1992	3,725,000	6,007,400	NA	
	Donkey Creek Chum	1992	NA	302,000	NA	
Fecundity	White River Spring Chinook	Avg.	NA	2,772	2,361-2,983	
	Minter Fall Chinook	Avg.	NA	4,531	4,414-4,766	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fecundity	Coulter Creek Fall Chinook	Avg.	NA	4,692[4]	4,442-4,882	
	Minter Coho	Avg.	NA	1,741	1,290-2,156	
	Minter Pinks	'89,91	NA	1,313	588-2,000	
	Coulter Creek Chum	Avg.	NA	2,689[5]	2,562-2,818	
	Minter Chum	'92,93	NA	2,025	1,691;2,359	
	Donkey Creek Chum	1992	NA	3,283	3,283	
Green Egg-to-Fry Survival	White River Spring Chinook[6]	Avg.	90%	91.4%	88.6-92.0%	
	White River Spring Chinook[7]	1989	90%	86.7%	86.7%	5
	White River Spring Chinook[8]	Avg.	90%	74.3%	67.1-83.5%	5
	Minter Fall Chinook	Avg.	90%	89.6%	85.3-94.3%	
	Coulter Creek Fall Chinook	Avg.	90%	84.8%	79.2-87.7%	
	Deschutes Fall Chinook at Coulter	1988	90%	97.2%	97.2%	
	Deschutes Fall Chinook	Avg.	90%	91.1%[9]	80.7-96.7%	
	Soos Creek Fall Chinook	1988	90%	85.9%	85.9%	
	Grover Creek Fall Chinook	'88,89	90%	84.2%	81.6; 86.7%	
	Minter Coho	Avg.	90%	92.5%	89.0-95.6%	
	Minter Pinks	'89,91	90%	91.1%	87.3; 95.0%	
	Coulter Creek Chum	Avg.	90%	88.9%	83.1-94.8%	
	Elson Creek Chum	Avg.	90%	90.6%	83.7-98.5%	
	South Prairie Pinks	1989	90%	98.0%	98.0%	
	Donkey Creek Chum	1992	90%	0.0%[10]	0.0%	

4 Three year average; 1989-1991.

5 Three year average; 1989-1991.

6 Egg to fry survival while at Minter Creek. Does not include an average of 8,000 additional mortalities that occur during transfer to Hupp Springs.

7 Progeny of captive brood held at Manchester Net Pens by NMFS.

8 *Three year average (1990-1992) of progeny of captive brood held at SSNP.*

9 Three year average: 1990-1992.

10 Eggs destroyed because spawning guidelines were not followed.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fry to Smolt Survival	White R. Sp. Chinook, Hupp Spr.	Avg.	90%	93.3%	82.4-98.5%	
	White R. Sp. Chinook, SSNP	Avg.	90%	93.9%	89.7;98.0%	
	Minter Fall Chinook	Avg.	90%	95.7%[11]	93.6-98.3%	
	Fall Chinook, Coulter Creek	Avg.	90%	90.3%	67.2-99.6%	
	Minter Fall Chinook at Coulter	1992	90%	93.9%	93.9%	
	Fall Chinook, Fox Island	Avg.	90%	88.6%	80.1-94.8%	
	Soos Creek Fall Chinook at Minter	1988	90%	98.4%	98.4%	
	Soos Creek Fall Chinook at Coulter	1988	90%	99.7%	99.7%	
	Grover Creek Fall Chinook	1989	90%	93.6%	93.6%	
	Deschutes Fall Chinook	'90,91	90%	92.7%	87.5;98.0%	
	Minter Coho	Avg.	90%	78.9%	54.2-90.7%	6
	Fox Island Coho[12]	Avg.	90%	97.9%	95.8-99.1%	
	Soos Creek Coho	'88,90	90%	99.1%	98.9;99.4%	
	Minter Pinks	'89,91	90%	82.7%	82.1;83.4%	
	South Prairie Pinks	1989	90%	85.0%	85.0%	
	Coulter Creek Chum	Avg.	90%	97.0%	92.4-99.8%	
	Elson Creek Chum	Avg.	90%	94.9%	82.9-99.8%	
Fish Releases (On-station)	White River Spring Chinook Yearling Releases	1988	80,000	89,737	NA	
		1989	80,000	91,172	NA	
		1990	80,000	81,023	NA	
		1991	86,500	84,493	NA	
	Subyearling Releases[13]	1988	200,000	95,526	NA	7
		1989	200,000	249,773	NA	
		1990	200,000	189,800	NA	
		1991	275,000	252,439	NA	

11 Four year average: 1988-1991. The 1992 brood fish were shipped to Coulter Creek.

12 Four year average: 1987-1990. Program did not occur in 1991 because space was needed to release more chinook.

13 Also, 98,700 and 56,000 unfed fry were planted in 1992 and 1993, respectively.

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases (On-station)	Subyearling	1992	220,000	240,178	NA	
	Minter Fall Chinook	1988	1,800,000	1,014,500	NA	
		1989	1,800,000	1,540,700	NA	
		1990	1,800,000	1,986,200	NA	
		1991	1,800,000	2,070,000	NA	
		1992	1,800,000	0	NA	7
	Coulter Creek Fall Chinook	1988	1,000,000	499,000	NA	1
		1989	1,000,000	1,273,000	NA	
		1990	1,000,000	1,044,000	NA	
		1991	1,000,000	900,000	NA	
		1992	1,000,000	1,082,500	NA	
	Minter Fall Chinook at Coulter	1992	1,000,000	1,082,500	NA	
	Deschutes Fall Chinook Yearling	1991	NA	35,000	NA	
	Soos Creek Fall Chinook at Coulter	1988	NA	641,000	NA	
	Soos Creek Fall Chinook at Minter	1988	NA	896,200	NA	
	Deschutes Fall Chinook at Minter	1990	NA	38,600	NA	8
	Grover Creek Fall Chinook [14]	1989	NA	1,109,000	NA	8
	Deschutes Fall Chinook at Coulter	1990	NA	13,000	NA	
	Fox Island Fall Chinook[15]	1988	230,000	205,700	NA	
		1989	230,000	198,900	NA	
		1990	230,000	204,400	NA	
		1991	245,000	303,082	NA	
		1992	245,000	270,553	NA	
	Minter Coho	1988	1,000,000	1,019,700	NA	

14 Released at Minter Creek. 772,000 of the release were unfed fry.

15 Receives fish via Hood Canal, George Adams, or Mckernan.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases (On-station)	Minter Coho	1989	2,800,000	1,042,300	NA	
		1990	1,000,000	989,000	NA	
		1991	1,000,000	328,000	NA	
	Minter Coho Subyearling releases	1988	NA	220,900	NA	8
		1989	NA	225,000	NA	8
		1990	NA	40,000	NA	8
		1991	NA	140,000	NA	8
		1992	NA	150,100	NA	8
	Soos Creek Coho	1988	500,000	454,400	NA	
		1989	500,000	521,700	NA	
		1990	500,000	548,000	NA	
	Fox Island Coho[16]	1988	335,000	380,200	NA	
		1989	335,000	208,200	NA	
		1990	330,000	297,400	NA	
		1991	330,000	0	NA	9
	Elson Creek Chum	1988	2,000,000	2,119,800	NA	
		1989	2,000,000	1,808,000	NA	
		1990	2,000,000	1,906,900	NA	
		1991	2,000,000	1,970,700	NA	
		1992	2,000,000	3,886,000	NA	
	Pinks	1989	NA	7,800	NA	
		1991	95,000	102,200	NA	
	South Prairie Pinks	1989	95,000	83,300	NA	

16 Receives fish from Skykomish Hatchery.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Coulter Creek Chum	1988	1,000,000	1,230,600	NA	
(On-station)		1989	1,000,000	1,150,000	NA	
		1990	1,000,000	1,152,700	NA	
		1991	1,000,000	1,035,000	NA	
Fish Releases	Minter Fall Chinook	1990	NA	518,400	NA	
(Off-station)		1991	NA	50,000	NA	
	Coulter Creek Fall Chinook	1989	NA	56,000	NA	
		1990	NA	131,000	NA	
	Grover Creek Fall Chinook[17]	1989	NA	299,000	NA	
	Minter Creek Coho	1988	2,000,000	2,404,600	NA	
	Subyearlings	1989	1,800,000	1,730,200	NA	
		1990	1,800,000	1,797,700	NA	
		1991	1,800,000	3,107,200	NA	
		1992	3,500,000	3,379,000	NA	
	Minter Coho at Coulter Creek	1992	NA	150,000	NA	
	Elson Creek Chum at Minter	1988	NA	10,000	NA	
		1989	NA	10,000	NA	
		1990	NA	30,000	NA	
		1991	NA	30,000	NA	
		1992	NA	58,000	NA	
Transfers to Tribal	White River Spring Chinook	1988	0	0	NA	
Facilities		1989	350,000	381,000	NA	
(Eggs/Fish)		1990	350,000	125,022	NA	

17 Planted as unfed fry.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Tribal Facilities (Eggs/ Fish)	White River Spring Chinook	1991	350,000	756,000	NA	
		1992	324,300	353,140	NA	
		1993	324,300	179,600	NA	
	Minter Fall Chinook	1991	NA	600,000	NA	
		1992	NA	350,000	NA	
	Coulter Creek Fall Chinook	1991	NA	204,000	NA	
	Deschutes Fall Chinook	1991	NA	149,700	NA	
	Grovers Creek Fall Chinook	1988	1,100,000	0	NA	10
		1989	1,100,000	1,055,400	NA	
		1990	1,100,000	0	NA	10
		1991	1,100,000	0	NA	10
		1992	1,100,000	0	NA	10
	Minter Coho	1988	650,000	250,000	NA	10
		1989	650,000	1,200	NA	10
		1990	50,000	59,500	NA	
		1991	50,000	0	NA	10
		1992	50,000	50,000	NA	
	Coulter Creek, Wallace River Coho	1990	NA	504,500	NA	
	Elson Creek Chum	1991	NA	854,000	NA	
Transfers Within WDFW (Eggs/Fish)	White River Spring Chinook	1988	3,500	3,500	NA	
		1989	3,500	3,500	NA	
		1990	3,500	3,500	NA	
		1991	3,500	3,500	NA	
	Deschutes Fall Chinook at Coulter	1988	1,800,000	1,694,000	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers Within WDFW (Eggs/Fish)	Deschutes Fall Chinook at Coulter	1989	1,800,000	1,004,600	NA	
		1990	1,800,000	1,754,600	NA	
		1991	1,800,000	555,200	NA	
		1992	1,800,000	0	NA	11
	Deschutes Fall Chinook at Minter	1990	1,800,000	1,624,000	NA	
		1991	1,600,000	612,500	NA	
		1992	1,600,000	1,725,000	NA	
	Grovers Creek Fall Chinook	1988	1,150,000	1,585,000	NA	
		1989	1,150,000	1,063,000	NA	
	Minter Creek Coho	1988	2,010,000	1,810,000	NA	
		1989	1,810,000	350,000	NA	9
		1990	1,850,000	1,880,050	NA	
		1991	1,500,000	4,621,200	NA	
		1992	1,850,000	3,150,000	NA	
	Minter Creek Coho at Coulter	1989	NA	75,000	NA	12
		1990	NA	85,500	NA	12
		1991	NA	679,400	NA	12
		1992	NA	325,000	NA	12
	Wallace River Coho at Coulter	1988	400,000	377,000	NA	
		1989	400,000	225,000	NA	
		1990	400,000	289,500	NA	
	Coulter Chum	1988	1,100,000	1,230,600	NA	13
		1989	1,100,000	1,150,000	NA	13
		1990	1,100,000	1,152,700	NA	13
		1991	1,100,000	1,035,000	NA	13

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers Within WDFW (Eggs/Fish)	Elson Creek Chum	1988	NA	3,185,000	NA	
		1989	2,250,000	3,002,000	NA	
		1990	120,500	3,480,000	NA	
		1991	NA	2,810,000	NA	
Transfers to Co-ops (Eggs/Fish)	Minter Fall Chinook	1988	0	10,000	NA	
		1989	100	0	NA	
		1990	10,100	500	NA	
		1991	25,000	5,841	NA	
		1992	50,000	10,000	NA	
	Deschutes Fall Chinook	1990	NA	600	NA	
		1992	NA	1,641,900	NA	
	Minter Coho[18]	1988	214,000	499,500	NA	
		1989	330,600	229,900	NA	
		1990	394,000	1,436,600	NA	
		1991	850,900	1,430,013	NA	
		1992	560,100	467,600	NA	
	Elson Creek Chum	1988	771,000	990,750	NA	
		1989	1,018,000	979,000	NA	
		1990	972,000	894,000	NA	
		1991	1,272,000	86,400	NA	
		1992	1,209,500	1,500	NA	
	Minter Creek Chum	1990	0	112,000	NA	
		1992	120,500	1,373,900	NA	

18 Includes Minter Creek coho transferred from Coulter Creek.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adults Passed Upstream	Fall Chinook at Minter Creek	1989	100	0	NA	
		1990	100	464	NA	
		1991	100	8	NA	
		1992	100	20	NA	
		1993	100	10	NA	
	Coho at Minter Creek	1989	1,200	955	NA	
		1990	1,200	70	NA	
		1991	1,200	1,328	NA	
		1992	1,200	2,000	NA	
		1993	1,200	4,746	NA	
	Chum at Minter Creek	1989	1,500	0	NA	
		1990	1,500	0	NA	
		1991	1,500	0	NA	
		1992	1,500	2,000	NA	
		1993	1,500	8,266	NA	
	Fall Chinook at Coulter Creek	1989	100	18	NA	
		1990	100	700	NA	
		1991	100	0	NA	
		1992	100	1,260	NA	
		1993	100	1,465	NA	
	Chum at Coulter Creek	1989	1,500	60	NA	14
		1990	1,500	800	NA	14
		1991	1,500	200	NA	14
		1992	1,500	5,089	NA	
		1993	1,500	5,771	NA	
Smolt to Adult Survival	Fall Chinook	Avg.	1.0%	ND	ND	15,16
	Coulter Fall Chinook	Avg.	1.0%	ND	ND	15

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Smolt to Adult	Fox Island Fall Chinook	Average	5.0%	2.4%	1.8%; 3.0%	15
Survival	White River Spring Chinook					
	Yearlings	Average	5.0%	1.5%	0.5-5.0%	
	Subyearlings	Average	1.0%	0.27%	0.07-0.46%	
	Minter Creek Coho	Average	10.0%	ND	ND	15
	Fox Island Coho	Average	10.0%	2.0%	0.2-2.9%	
	Minter Creek Chum	Average	0.5%	ND	ND	15
	Minter Pinks	Average	0.5%	ND	ND	15

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Minter F. Chin.	Yes	NA	NA	15
CV less than 10%	Coulter F. Chin.	Yes	NA	NA	15
	Fox Is. F. Chin.	Yes	NA	NA	15
	White R.Sp.Ch.	Yes	8.9%[19]	7.6-10.8%	
	Minter Cr. Coho	Yes	NA	NA	15
	Fox Is. Coho	Yes	12%[20]	10-14%	
	Minter Chum	Yes	NA	NA	15
	Minter Pinks	Yes	NA	NA	15
Acclimation					
Minter Creek	All Species	Yes	Yes	NA	
Coulter Creek	All Species	Yes	Yes	NA	
Hupp Springs	Spring Chinook	No	No	NA	17
Fox Island	All Species	Yes	Yes	NA	
Volitional Release	Fall Chinook	No	No	NA	
	Spr. Chinook	No	Partial	Partial	18
	Coho	No	No	NA	
	Chum	No	No	NA	
	Pinks	No	No	NA	

19 Three years of data, 1987-1989 broods. Includes combined CVs for yearling and subyearling releases.

20 Two years of data 1984 & 1985 broods. Data for other brood missing.

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Minter F. Chin.	Yes	Yes	NA	
	Coulter F. Chin.	Yes	Yes	NA	
	White R.Sp.Ch.	Yes	Yes	NA	
	Coho	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
Spawning Pop. >500	Minter F. Chin.	Yes	1,335	678-1,837	
	Coulter F. Chin.	Yes	911	288-1,347	
	White R.Sp.Ch.				
	Hupp Springs	Yes	274	179-353	
	Captive Brood[21]	Yes	470	50-822	
	Coho	Yes	8,206	3,414-15,364	
	Pinks	Yes	70	9-191	
	Minter Chum	Yes	NA	NA	19
	Coulter F. Chin.	Yes	911	270-1,347	
	Coulter Chum	Yes	1,332	1,098-1,679	
Spawning Ratio Male:Female	Minter F. Chin.	>0.33	1.0	0.9-1.0	
	Coulter F. Chin.	>0.33	1.3	0.7-2.2	
	White R.Sp.Chinook				
	Hupp Springs	1.0	0.9	0.5-1.3	20
	Captive Brood	1.0	0.5	0.1-0.8	20
	Coho	>0.33	0.7	0.6-0.8	
	Pinks	>0.33	1.0	0.8-1.3	
	Minter Chum	>0.33	0.55	0.5; 0.6	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

21 Prior to 1990, captive brood fish came from NMFS Manchester Net Pens.

Objective 5: Conduct environmental monitoring

Measures		Hatchery Goal	Two Year Average	Range	Comments
TSS Effluent Composite	Minter Crk.	5 mg/L	1.8	-7.0-8.5	
	Coulter Crk.[22]	5 mg/L	1.4	-4.8-8.0	
TSS Max Effluent	Minter Crk.	15 mg/L	12.5	0-47.0	
	Coulter Crk.	15 mg/L	3.5	-4.0-20.0	
SS Effluent	Minter Crk.	0.1 ml/L	0.2	0-2.4	
	Coulter Crk.	0.1 ml/L	-0.09	-3.2-0.05	
TSS PA Effluent	Minter Crk.	100 mg/L	NA	NA	21
	Coulter Crk.	100 mg/L	NA	NA	22
SS PA Effluent	Minter Crk.	1.0 ml/L	NA	NA	21
	Coulter Crk.	1.0 ml/L	NA	NA	22
Downstream Temp (°F)	Minter Crk.	Varies	NA	NA	
	Coulter Crk.	Varies	56.7	54.9-57.9	
Maximum Temp	Minter Crk.	<63°F	60.1°	57.0-60.1°	
	Coulter Crk.	<63°F	61.0°	59.0-61.0°	
Minimum Temp	Minter Crk.	>32°F	34.0°	34.0-39.0°	
	Coulter Crk.	>32°F	32.0°	32.0-37.9°	
Downstream DO(mg/L)	Minter Crk.	>8.0	8.2	7.5-8.5	
	Coulter Crk.	>8.0	11.0	11.0-11.0	
Influent pH	Minter Crk.	Varies	7.11[23]	7.11-7.12	
Continuous Monitoring of Other Parameters		Yes	NA	NA	

22 Three year average for all Coulter Creek data.

23 Three year average.

Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	23
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Minter Creek Hatchery and Satellites

1. Poor returns of adults due to low marine survival or overharvest. Either cause will reduce the egg take potential.

2. Stream survey data from the Fish Management Program. No chinook or chum were captured for spawning due to elimination of rearing program caused by budget cutbacks.

3. Spring chinook are held for several months before spawning which increases the mortality rate from stress. Also, fish transferred from SSNP captive brood program experience increased stress because they move immediately from saltwater to freshwater.

4. Egg collections have increased markedly in past few broods due to the captive brood program.

5. Progeny of adults reared in SSNP captive brood program suffer higher mortality. The eggs from these adults have a higher incidence of "softshell disease."

6. Low four-year average due to high mortality in one year.

7. Program discontinued for this brood due to renovation of hatchery rearing ponds.

8. Fish were not transferred to originally scheduled site and therefore had to be released on-station because of lack of rearing space.

9. Rearing program was changed after goal was established in the Future Brood Document. The Fox Island coho program was changed from a release of yearling age fish to releases of two-year-old fish.

10. Adequate numbers of eggs were taken at Tribal rearing facility, thus negating need for eggs from this hatchery.

11. Transferred from Minter Creek Hatchery instead.

12. If numbers of Wallace River coho are lacking then Minter Creek coho are used to make up the difference.

13. Eggs are transferred from Coulter Creek, incubated at Minter Creek, and fry transferred back to Coulter Creek for additional rearing and release.

14. Numbers reflect only fish that are captured in trap during the time fall chinook are trapped. Since the chum rearing program was discontinued the hatchery does not intentionally trap chum. The numbers for 1992 and 1993 represent stream survey estimates made by the Fish Management Program.

15. Lack of current continuous coded wire tag data base. Only tagged groups are measured to calculate mean length and CV.

16. Fall chinook released from Minter Creek are not coded-wire tagged because returning adults could be confused with returning White River spring chinook (tagged at 100%). Having both races in the same pond at spawning time would necessitate decoding CWTs from every spawned chinook before fertilizing eggs.

17. Fish are reared entirely on spring water.

18. Fish are volitionally released during the early part of the migration during which time they are enumerated as they pass through an electronic fish counter.

19. From 1989-1991 chum returning to Minter Creek were not spawned because it was determined that this stock (Hood Canal ancestry) was inappropriate for release at this hatchery. Imports of Elson Creek chum were made during this period and future returns and eggtakes will be from this stock.

20. Fewer males due to higher mortality relative to females.

21. Minter Creek Hatchery lacked a pollution abatement pond before renovation, beginning in 1994 data will be available.

22. A portion of the effluent from Coulter Creek Hatchery is settled in a small pond before discharge.

23. Lack of adequate funding for office support staff.

Stock Profile:

White River Spring Chinook: This stock originated from the White River (Puyallup tributary). Because of chronically low escapements in the White River, broodstock was obtained in 1978 and a small number these fish were reared at Hupp Springs Hatchery for release into Minter Creek. During the early restoration period, a portion of each brood's juvenile fish were taken to Manchester Net Pens, operated by NMFS, to develop a captive brood program. After the 1986 brood, the captive brood program was moved to the South Sound Net Pens. In 1991 and 1992, sufficient progeny were available for transfer, rearing, and release at the recently completed Muckleshoot tribal hatchery on the White River. There has been at least three contiguous generations returning to Minter Creek without supplementation by other stocks. **Stock Description: Introduced, adapted.** .

Fall Chinook: Both Minter Creek and Coulter Creek fall chinook originated from Soos Creek fall chinook. Supplementation from other stocks has occurred repeatedly in recent years. In the early 1970s several exotic stocks were introduced to the hatchery, including Rivers Inlet, BC fall chinook. Coded-wire tag data indicate little if any survival of these fish. **Stock Description: Introduced, non-adapted.**

Minter Creek Coho: Minter Creek coho existed as a native stock before the hatchery became a production scale hatchery. From 1939-1953, and 1973-1989 Soos Creek coho have also been planted along with progeny of adults returning to the hatchery. It is likely that native coho have become hybridized with these imported stocks. **Stock Description: Mixed.**

Minter/Elson Creek Chum: Before 1991, a run of chum with Finch Creek ancestry was sustained at this hatchery. Because of stock management concerns this stock was eliminated in 1991 and replaced with a south Puget Sound stock originating from Elson Creek Hatchery. **Stock Description: Introduced, non-adapted.**

Coulter Creek Chum: Coulter Creek chum are run in the summer and are native to the watershed. They have been cultured off and on at this hatchery. They are currently passed upstream. **Stock Description: Native.**

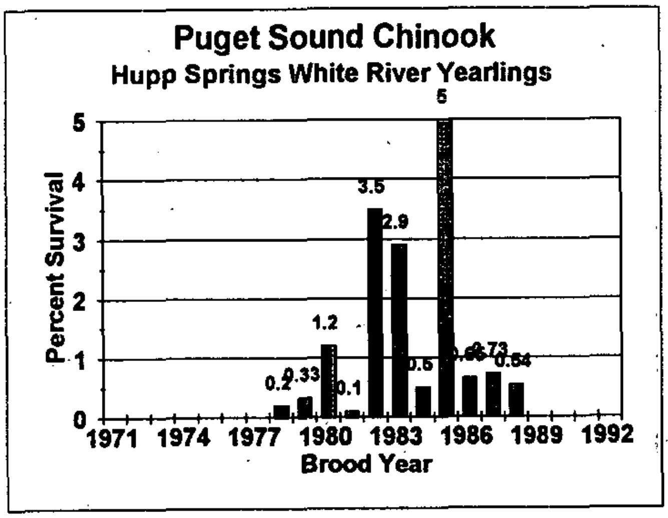
Pink Salmon: These fish originated from South Prairie Creek, a Puyallup River tributary. This stock was introduced as part of the Recreation Fishery Enhancement Program. **Stock Description: Introduced, non-adapted.**

STOCK STATUS PROFILE FOR: Minter Creek Fall Chinook

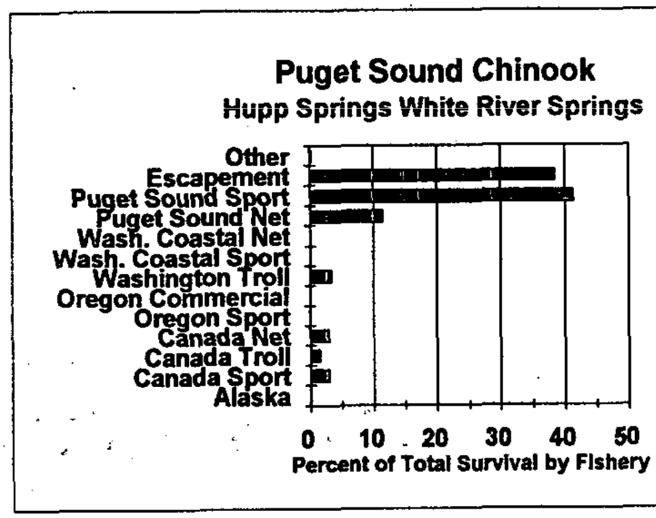
Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: White River Spring Chinook Yearlings

Survival:



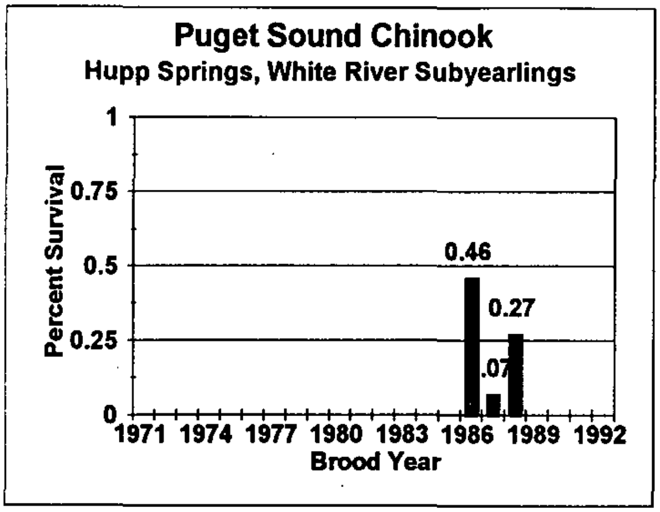
Distribution:



Five Year Average Survival: 1.5%
Catch to Escapement Ratio: 2.6:1

STOCK STATUS PROFILE FOR: White River Spring Chinook Subyearlings

Survival



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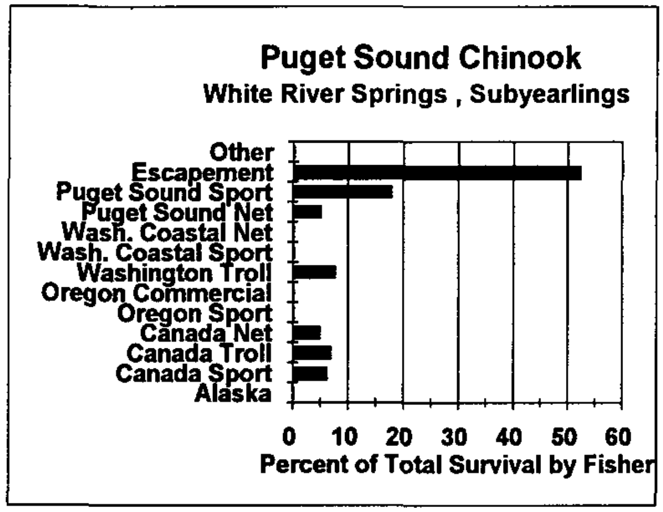


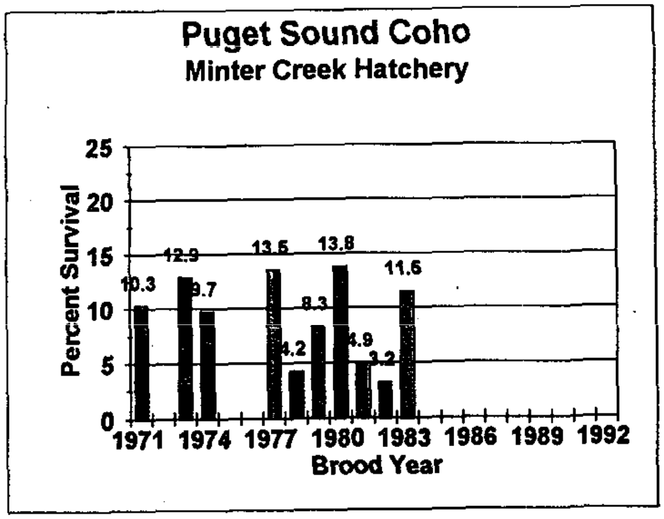
Three Year Average Survival: 0.27%
Catch to Escapement Ratio: 1.9:1

STOCK STATUS PROFILE FOR: Minter Creek Coho

Survival:

Distribution:

No current data available.



Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Minter/Elson Creek Chum

Five Year Average Survival: ND
Catch to Escapement Ratio: ND

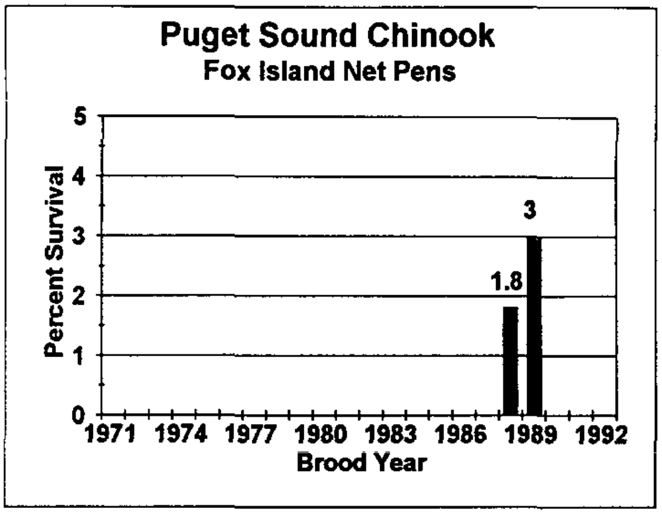
STOCK STATUS PROFILE FOR: South Prairie Creek Pinks

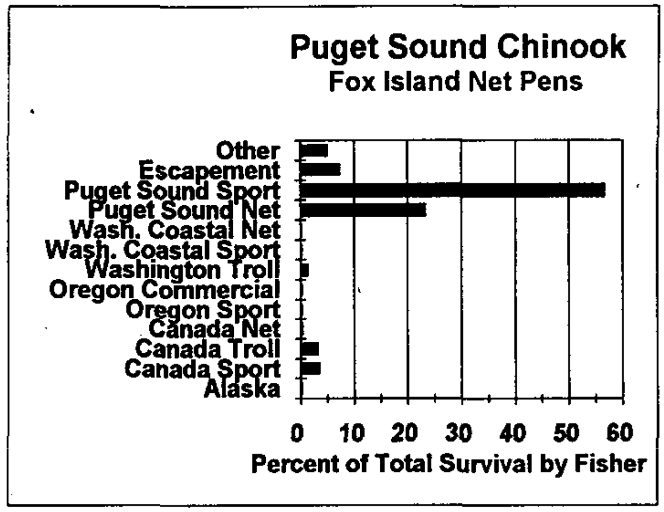
Five Year Average Survival: ND
Catch to Escapement Ratio: ND

STOCK STATUS PROFILE FOR: Fox Island Fall Chinook

Survival:

Distribution:



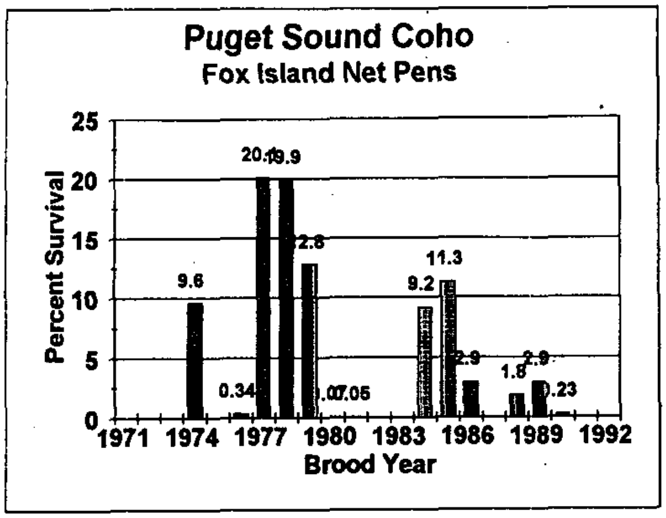


Two Year Average Survival: 2.4%

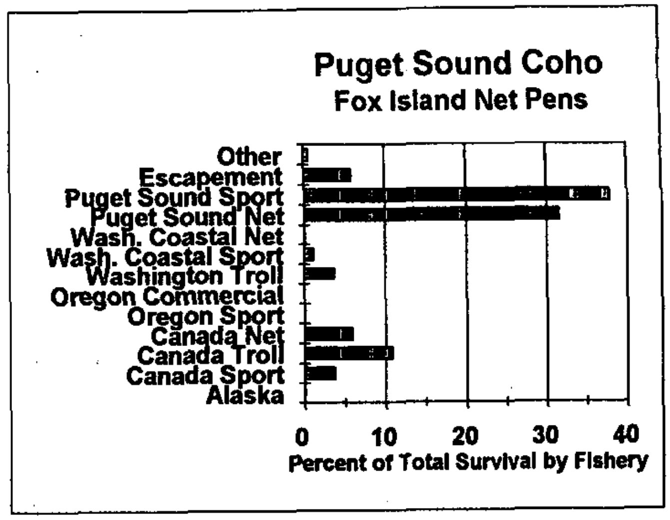
Catch to Escapement Ratio: 13.7 : 1

STOCK STATUS PROFILE FOR: Fox Island Coho

Survival:



Distribution:

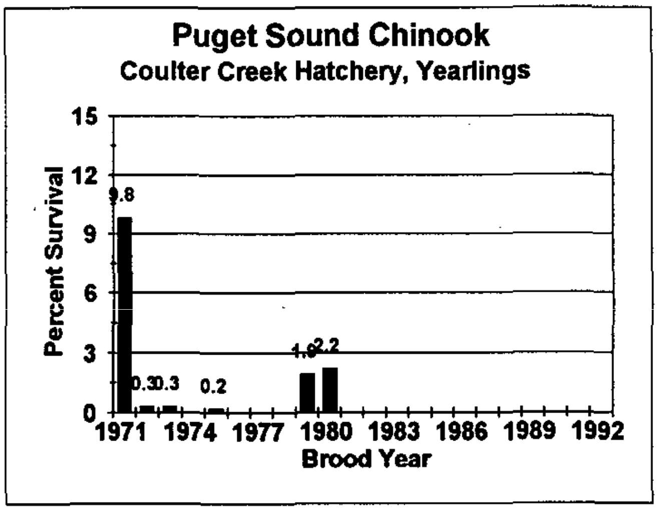


Four Year Average Survival: 2.0%

Catch to Escapement Ratio: 20.0:1

STOCK STATUS PROFILE FOR: Minter Creek/ Coulter Creek Yearling Fall Chinook

Survival:



Five year Average Survival: ND
Catch to Escapement Ratio: ND

Distribution:

No current data available.

Lakewood Complex

South Tacoma Hatchery
Garrison Springs Hatchery
Chambers Creek Hatchery

South Tacoma Hatchery

Introduction

South Tacoma Hatchery is in Lakewood, a suburb of south Tacoma, near the north shore of Steilacoom Lake. The hatchery discharges into Chambers Creek, a tributary of south Puget Sound. The hatchery was built before 1900, and renovated in 1930. Other renovations, additions, and improvements took place in 1955, 1967, and 1982. Funding for the hatchery is provided through State Wildlife Funds (80%) and the remaining 20% (approximately $500,000) is mitigation from Pacific Power and Light for rearing Skookumchuck winter steelhead. The hatchery has 140 incubation buckets, 120 shallow troughs, and 3 vertical stack incubators. For rearing the hatchery has twelve 4' x 30' raceways , ten 40' diam. round ponds, one 8' x 100' first-use raceway, eight 10' x 100' serial reuse raceways, four 10' x 100' brood holding raceways, and one 60' x 500' rearing pond. Water is supplied by two springs and four wells with a combined flow of approximately 6.5 cfs. Skookumchuck rearing pond is a satellite facility that rears and releases 90,000 winter steelhead smolts.

For winter and summer steelhead, regional goals are established for the number of smolts to be released. These goals are predicated on meeting the management objective of separating hatchery fish from wild fish to prevent hybridization on the spawning grounds (early vs. late run timing differences) and to defer harvest from wild fish to the hatchery portion of the run. Meeting this overall management objective requires that both hatchery origin fish return and spawn earlier than wild fish and that hatchery fish can be differentiated from wild fish by a missing adipose fin. Achieving the first part of the objective required procuring a source of steelhead eggs, and through selective breeding, produce offspring with an early run timing. This was accomplished using Chambers Creek winter steelhead or Skamania summer steelhead. Thus, the regional smolt planting goal was the first priority of taking eggs at Chambers Creek Hatchery. However, if the entire production can not be met from Chambers Creek returns, then adults of Chambers Creek ancestry returning to other hatcheries, are captured and spawned. This occurs primarily at only one or two of the several hatcheries with adequate adult returns.

To meet the remainder of the management objectives, all hatchery releases are fin maarked. Due to differences in water temperatures among hatcheries, there can be several weeks difference between spawn timing at regional facilities and those at Chambers Creek hatchery. Thus, to ensure uniform fish size (to facilitate fin clipping) within all regional production, various lots of fish would be moved between hatcheries to take advantage of warm or cool water temperatures to program appropriate growth rates. Both the South Tacoma Hatchery and the Puyallup Hatchery are central rearing and fin clipping points for Puget Sound regional production.

The resident trout program for the state uses four strains of rainbow trout each of which spawns at a different time of year. Using the differences in time of year at which fry are produced, along with the differences in water temperatures found at each hatchery, fish are produced at the appropriate size and time of year for planting in lowland lakes. This hatchery maintains the South Tacoma strain rainbow trout broodstock which is the earliest spawning strain. This stock is desirable because legal size rainbows can be produced by the following spring.

Purpose

The South Tacoma Hatchery was built to incubate and rear winter steelhead and to maintain a captive rainbow trout broodstock to supply eggs or fry to other area hatcheries. The hatchery also rears catchable sized trout, fry and fingerlings used to stock local lakes.

Goals

1. Incubate and rear Puget Sound hatchery winter steelhead for eventual transfer to other hatcheries or for outplanting into local rivers to meet regional production goals.
2. Incubate and rear Skookumchuck winter steelhead for transfer to the Skookumchuck rearing ponds.
3. Maintain the South Tacoma strain of rainbow trout broodstock and produce sufficient eggs and fry to supply statewide production needs.

Objectives

Objective 1: 1993 Hatchery Production

1. Incubate and rear approximately 1.5 million Puget Sound hatchery winter steelhead for transfer to other area hatcheries. Release approximately 40,000 smolts on-station, and 100,000 in the Puyallup River.
2. Rear approximately 90,000 Skookumchuck winter steelhead for transfer to the Skookumchuck rearing pond.
3. Maintain South Tacoma strain rainbow trout captive broodstock.
4. Produce approximately 5 million rainbow trout eggs and fry for transfer to other area hatcheries.
5. Plant local lakes with approximately 30,000 catchables.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

No adult fish are captured at this facility. Adults are supplied via the trap at the mouth of Chambers Creek.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared and transferred to other hatcheries as fry. A portion of the production is reared until fingerlings and transferred to other hatcheries. Those released at the hatchery are reared until the smolt stage and then released into Chambers Creek. Prior acclimation to receiving water is not done for either fish transported to other rivers or released on-station. Trout are reared under standard conditions and either planted into local lakes or ponds as fry, or at legal retention size (catchables), or transferred to other hatcheries for additional rearing. Acclimation to receiving waters prior to stocking is not done.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

No adult fish are trapped at the facility. The South Tacoma strain of rainbow trout are maintained at this hatchery. Approximately 3,500 juveniles are selected for broodstock from the main population of fingerlings and reared until maturity.

Spawning Protocol

Gametes from 5 males and 5 females are pooled and fertilized. The effective population size (N_e) is not known due to this pooling of gametes. Both two- and three-year-old captive brood fish are used as spawners.

Acceptable Stocks

Winter Steelhead
1. Chambers Creek
2. Any Chambers Creek derivative (includes Skykomish, Stillaguamish, Tokul Creek, Skagit, Skykomish, and Bogachiel)

Rainbow Trout
1. South Tacoma strain
2. Any rainbow trout strain

Brown Trout
1. Any available stock or strain

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the South Tacoma Trout hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.
- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Springs: Due to low rainfall over the past few years the flows in the springs feeding the hatchery have decreased.

Hatchery Water Temperature Profile

The hatchery is fed by springs which maintain a near constant temperature year round. The large rearing lake is subject to extreme temperatures ranging from 0-21^{0} C in some years.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—South Tacoma Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	NA	NA	NA	NA	1
Adult Prespawning Survival	NA	NA	NA	NA	2
Eggtake	Chambers Cr. WSH	NA	707,203[1]	0-3,536,016	3,4
	S. Tacoma RBT	NA	5,344,108	5013.9-6620.0K	3,5
Fecundity	NA	NA	NA	NA	
Eyed Egg-to-Fry Survival	S. Tacoma RBT	85%	67.4%	56.9-73.5%	6
	Chambers Cr. WSH	85%	88.1%	63.9-88.1%	
	Skookumchuck WSH	85%	76.5%[2]	68.9-85.6%	7
	Skykomish SSH	85%	82.0%	74.8-92.3%	
Survival (Fry to Plant or Transfer)	S. Tacoma RBT	85%	51.3%[3]	37.9-70.3%	8
	Chambers Cr. WSH	85%	64.4%	73.8-87.6%	
	Skookumchuck WSH	85%	54.0%	50.3-58.8%	8
	Skykomish SSH	85%	78.7%	58.2-90.9%	
	Ford BT	85%	90.4%	90.4%	
Plants	S. Tacoma RBT	NA	29,801	14,375-117,809	3,5
	Chambers Cr. WSH	NA	130,553	45,949-203,827	3,4
	Skookumchuck. WSH	NA	6,786	0-27,142	3,4
	Skykomish SSH	NA	5,389	0-26,946	3,4
Transfers Out (eggs/fish)	S. Tacoma RBT	NA	2031K[4]	325,336-4338 K	3,5
	Chambers Crk. WSH	NA	1949.5K[5]	1155.2-2386.7K	3,4
	Skookumchuck WSH	NA	91,474	82,228-97,4263,4	3
	Skykomish SSH	NA	571,341[6]	148,879-918,219	3,4
	Ford BT	NA	73,246	73,246	

1 Only one brood year , 1989.

2 Four broods, 1988-'91.

3 Three broods, 1988-'90. Other broods are still being reared.

4 On average 2,657 eggs and 386,000 fry each year.

5 On average 123,768 eggs and 1,825,733 fry each year.

6 On average 29,666 eggs and 541,675 fry each year.

Objective 1 (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	NA	NA	NA	NA	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	WSH-Chambers Ck. or derivative	NA	NA	NA	
Acclimation	WSH-Chambers Ck.	No	No	No	
	Trout Spp.	No	No	No	
Volitional Release	Yes	Yes	Yes	Yes	9

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	NA	NA	NA	NA	
Spawning Pop. >500	S. Tacoma RBT	Yes	1,740	1,589-1,850	
Spawning Ratio Male:Female	S. Tacoma RBT	1.0	1.0	1.0	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	3.37	0.09-16.0	
TSS Max Effluent	15 mg/L	46.01	0.09-1400.0	10
SS Effluent	0.1 ml/L	0.05	0.01-0.30	
TSS PA Effluent	100 mg/L	NA	NA	11
SS PA Effluent	1.0 ml/L	NA	NA	11
Downstream Temp (°F)	Varies	61.3°	57.9-66.0°	
Maximum Temp	<63°F	69.8°	69.8°	11
Minimum Temp	>32°F	32.0°	32.0°	
Downstream DO(mg/L)	>8.0	9.77	8.5-11.0	
Continuous Monitoring of Other Parameters	Yes	NA	NA	

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	12
Develop and Review Equil. Brood Doc.	All	Yes	No	No	3
Develop and Review Future Brood Doc.	All	Yes	No	No	3
Develop and Review Current Brood Doc.	All	Yes	No	No	3

Constraints/Comments- South Tacoma Hatchery

1. No adult capture at this facility. Steelhead are trapped at the mouth of Chambers Creek and trucked to Chambers Creek Hatchery.

2. Records on pre-spawning survival are not maintained.

3. Former Department of Wildlife hatcheries were not subject to programming under the brood document format. Thus, comparison of hatchery goals with programming goals cannot be made before 1994.

4. For winter and summer steelhead, a regional planting goal is established. Because of operational constraints such as adipose fin clipping all hatchery releases and providing uniform sized fish to all rearing programs, meeting the entire eggtake from a single hatchery (Chambers Creek Hatchery) is a high priority. In years when this cannot be accomplished at Chambers Creek Hatchery, then Chambers Creek stock returning to other hatcheries are captured and spawned, and the eggs and subsequent fish are incubated and reared at either the South Tacoma or Puyallup Trout hatcheries. Thus, the goal for the number of adults to capture, the subsequent egg take, and the number of fish to transfer, changes based on the number of eggs taken at Chambers Creek, and other Puget Sound hatcheries.

5. Each year, fish management biologists determine the number of resident trout to plant in lakes within each region of the state. They also determine at what size and time of year these fish should be planted. This number is termed an allotment. For the hatcheries within the region to supply each allotment, they use one or more of the four available domestic rainbow trout broodstocks which produce fry at different times of the year, and program the growth rates of these fry by using the different water temperature regimes unique to each hatchery. This hatchery participates in both the broodstock and grow-out phases of meeting regional allotments.

6. Water quality can be poor due to low dissolved oxygen content of incoming water and high ammonia concentrations in reuse water (caused by rearing too many fish). These factors can cause increased mortality and in conjunction with high water temperatures affecting captive brood, can cause poor egg quality and lower fertility and survival.

7. Adults were injected with hormones to induce earlier spawning. This apparently affected egg fertility and resulted in higher mortalities of eggs.

8. Predation by blue herons has increased in recent years because regulations no longer allow hatchery crews to ward these birds off.

9. Volitional release used only for steelhead released on-station.

10. Error in sampling or in analysis by laboratory. High value is well beyond reasonable expectation for this type of sample.

11. No pollution abatement pond at this hatchery.

12. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

South Tacoma Rainbow Trout: This stock apparently originated from a commercial fish farm in Meeder, Utah. The origin of the Utah strain is somewhat hazy, but may have been from the McCloud River, Shasta County, California. Although originally a spring spawning strain, through manipulation of both warmer rearing temperatures and selection of early spawners, these fish now spawn predominantly between August and October with peak spawning in September. This shift in spawn timing was done to provide catchable size trout for planting into lowland lakes prior to the opening of the general trout season in April, and fingerling trout plants in May for the next trout season. This strain has been heavyily selected for spawn timing and coloration. In recent years, egg mortality appears to be increasing, indicating a possible genetic bottleneck.

Goldendale Rainbow Trout: This strain originated in 1948 from the interbreeding of Yakima (a mixture of McNott and Meeder stocks) and Meeder (see S. Tacoma strain) strains of rainbow trout. This strain was selected for early spawning, large size, high fecundity, and overall color and vigor. Fish spawn from October to February with peak egg production in November and December.

Spokane Rainbow Trout: This stock originated from the Cape Cod Trout Company of Wareham, Massachusetts. Approximately 2.3 million eggs were purchased and shipped to Spokane Hatchery in September, 1942. The Cape Cod stock originated from McCloud River in 1882 before selection and culture in Massachusetts. At Spokane Hatchery, selection for size, fecundity and appearance took place over several generations. Although not purposely interbred with other stocks or strains of rainbow, rainbows from the Little Spokane River may have entered brood holding ponds and were mated with captive brood. Spawning of this strain takes place in November and December.

Mt. Whitney Rainbow Trout: Eggs from this strain were obtained in June, 1962 from the Mt. Whitney Hatchery at Independence, California. The strain is apparently a mixture of Sacramento River rainbow, Klamath River steelhead, and possibly a small contribution of Lahonton cutthroat trout. Spawning occurs from December through March with peak spawning in January. This strain produces a deep bodied fish with a relatively small head that is ideally suited to alpine lakes because it grows well, over-winters well, and reproduces naturally where conditions allow.

Chambers Creek Winter Steelhead: This stock was first cultured in the mid-1940s from fish returning to Chambers Creek. Returning adults were taken to the South Tacoma Hatchery where they were held in warmer water than would have been experienced in the wild. As a result, maturation time was accelerated over the wild spawning component. With advances in fish culture techniques, returns of hatchery reared fish increased to the point where offspring were transplanted into other streams in the region, or used to start runs of steelhead at other regional hatcheries. The first hatcheries to use this stock were Green River, Tokul Creek, and Puyallup. Early maturation time was continually selected to meet several management objectives. First, it allowed for the production of a one-year-old smolt which increased the number of smolts an individual hatchery could release each year. Second, it provided an early returning adult (November-January) that could be harvested at high rates with minimal effects on later returning native fish. Lastly, the early spawn time of the Chambers Creek stock reduced the likelihood of spawning with the native stock. In the early stages of the outplanting program, Chambers Creek fish were transplanted yearly into rivers or hatcheries for subsequent release throughout the state. Due to genetic differences among populations inhabiting coastal and Columbia River drainages (58 chromosomes) and the Chambers Creek stock (50% of population with 59 chromosomes and 50% with 60 chromosomes), there was less success in establishing Chambers Creek stock in these rivers than in Puget Sound rivers. For many years of the outplant program successful returnees to non-natal hatcheries were not used to supply that hatchery with smolts. The program shifted in later years, due to both genetic considerations and declining runs at Chambers Creek, to spawning returning adults at the hatcheries where they were released. Initially, egg production from hatcheries other than Chambers Creek was done solely to augment deficiencies in smolt production at Chambers Creek needed for regional production. Thus, eggs were mixed at a central hatchery and distributed to each hatchery in accordance with programmed release numbers. However, this program was modified in 1993 so that eggs/fry were returned to the hatchery they originated from. If insufficient eggs were taken for that program they were supplemented with Chambers Creek stock or a Chambers Creek derivative. **Stock Description: Native.**

Skykomish Summer Steelhead: See Reiter Rearing Pond for information on this stock.

Skookumchuck Winter Steelhead: The source of this stock of steelhead originated from returning native Skookumchuck steelhead. This stock is unique to most hatchery reared winter steelhead in that it returns in February through May with peak return times in April. The stock was first cultured in 1973 *when the Skookumchuck rearing ponds were constructed under mitigation for the* Skookumchuck Dam. Eggs are taken to South Tacoma Hatchery were they are incubated and hatched, with resulting fingerlings returned to Skookumchuck for additional rearing and acclimation prior to release. **Stock Description: Native** (to Skookumchuck River).

Ford Brown Trout: This broodstock came from the McLoud hatchery in Shasta, California. It is not clear what strain it originated from. Approximately, 10,000 eggs were shipped to Spokane Hatchery in 1979, and in 1980 the resulting fry were transferred to Ford Hatchery. The latter hatchery currently keeps a captive broodstock of about 2,000 adults. Only three year old fish are spawned. Current production statewide is about 750,000 fry.

Garrison Springs Hatchery

Introduction

Garrison Springs Hatchery is a complex of three rearing sites. The main hatchery is located immediately north of Western State Hospital at Fort Steilacoom, Tacoma. At this site there are eight standard raceways and two large earthen rearing ponds. At Chambers Creek Trap, (located one mile north of Steilacoom at the mouth of Chambers Creek), there is an adult trapping facility and holding area which is also used for short term rearing and release. Within the Fort Lewis Military Reservation, there is an 80-acre lake (Lake Sequalitchew) which has 11 net pens that are used for rearing coho. Rearing capacity for the Garrison complex is approximately 2.5 million salmon. This facility also supplies fish for additional rearing at McAllister Hatchery and the Gorst Creek cooperative rearing facility. Fish eggs at Garrison Springs are incubated in vertical incubators, freestyle incubators, pond trays, 60 isolation buckets and 10 barrel incubators. Hatching capacity is 6 million fry. Water is supplied to the Garrison Springs facility by gravity flow from springs. The Chambers Creek Trap uses creek water and Lake Sequalitchew is fed by springs and some surface flow.

Purpose

The Garrison Springs Hatchery was built to produce coho, chinook, chum, and pink salmon for harvest in Puget Sound, and various ocean fisheries. It also serves as an intermittent rearing facility for other rearing programs which either lack rearing space, or want to take advantage of favorable growth conditions at Garrison Springs which result from the warmer rearing temperatures.

All production at this hatchery is agreed to among the treaty tribes and WDFW.

Goals

1. Produce fall chinook, coho, chum and pinks for the NE Pacific and Puget Sound fisheries.
2. Produce chinook, coho, and chum for the cooperative rearing projects and tribal programs.

Objectives

Objective 1: 1993 Hatchery Production

Garrison Springs

Fall Chinook
Release 820,000 1992 brood subyearlings into Chambers Creek.
Transfer 1,200,000, 1992 brood Deschutes stock subyearlings to McAllister Creek Hatchery.
Transfer 1,100,000, 1992 brood Grovers Creek stock subyearlings to Gorst Creek Hatchery.
Collect 970,000 eggs from adults returning in 1993, incubate and rear fish until release in 1994.

Coho
Collect 76,000 coho eggs from adults returning in 1993, and transfer to cooperative rearing projects.

Late Chum
Collect 740,000 1992 brood eggs for transfer to Puyallup tribe and cooperative rearing projects.

Pinks
Collect 100,000 eggs from adults returning in 1993 for rearing and release in 1994.

Lake Sequalitchew

Coho
Release 325,000, 1991 brood Minter Creek stock yearlings at Lake Sequalitchew net pens.
Release 425,000, 1991 brood Wallace River stock yearlings at Lake Sequalitchew net pens.
Release 190,000, 1991 brood Voights Creek stock yearlings at Lake Sequalitchew net pens.
Transfer 350,000 1992 brood Minter Creek stock subyearlings to Lake Sequalitchew.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout, and steelhead producers and managers in the Puget sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Garrison Hatchery is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. A permanent weir is located at the mouth of Chambers Creek which prevents upstream passage of adults and allows for efficient trapping of broodstock or enumeration upstream.

Fall Chinook: Adults return to the hatchery trap located at the mouth of Chambers Creek from mid-August to October. The peak spawning at this hatchery is in October.

Coho: Adults return to the hatchery trap located at the mouth of Chambers Creek from late-August to early December. Most of these fish are passed upstream, but some are captured and spawned.

Chum: Adults are trapped at the mouth of Chambers Creek from December to February with peak spawning in January. About 20% of the fish are retained for spawning, with the rest passed upstream.

Pinks: Adults return to the hatchery trap located at the mouth of Chambers Creek from August to November with peak spawning in October.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery thus reducing straying into other areas. Fish released at Lake Sequalitchew cannot return upstream and are therefore either harvested near the mouth of Sequalitchew Creek or stray to another system.

Fall Chinook: Fish are reared to two release sizes, 45 and 17 fish/pound, respectively, and released in April and May.

Lake Sequalitchew Coho: Fish are reared to 17 fish/pound and released in May.

Pink Salmon: Fish are released at 500 fish/pound in February and March.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

On days when fewer than one million eggs are collected the male to female spawning ratio is 1:1. On days when more than one million eggs are collected the male to female spawning ratio will be no lower than 0.33. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Fall Chinook

1. Garrison
2. Minter Creek
3. Deschutes

Coho (Lake Sequalitchew)

1. Minter Creek
2. Any south Puget Sound stock

Chum Salmon

1. Chambers late

Pink Salmon

1. Garrison
2. Voights Creek (including south Prairie Creek)
3. Minter Creek

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at Garrison Springs Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperature daily.

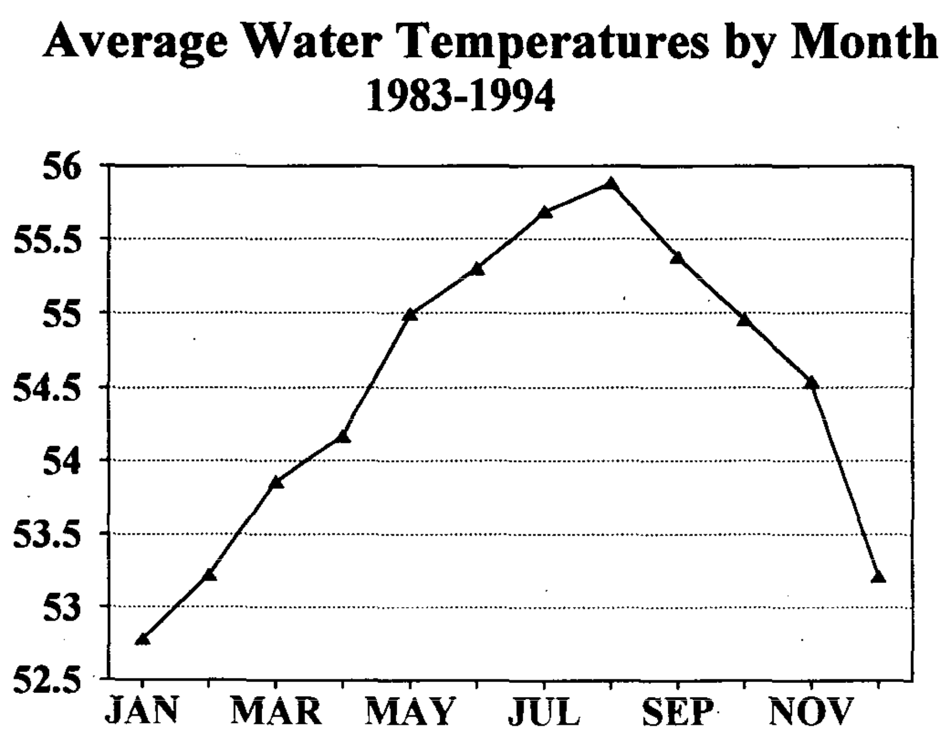
- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Garrison springs: Water rights are 12 cfs.

Chambers Creek: Industrial chemicals have been leaching into the Chambers Creek watershed for many years. Of particular concern is copper that is found in Lake Steilacoom from herbicides used to control aquatic growth. Water rights are 8 cfs.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Chambers Creek and Lake Sequalitchew watersheds have not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Puyallup and Nisqually Tribes, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries—Garrison Springs Hatchery

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adult Capture	Fall Chinook	1989	514	491	NA	1
		1990	514	710	NA	
		1991	509	630	NA	
		1992	509	387	NA	
		1993	509	514	NA	2
	Coho[1]	1989	NA	1,001	NA	
		1990	NA	2,232	NA	
		1991	NA	1,914	NA	
		1992	14	1,939	NA	
		1993	98	1,593	NA	
	Pinks	1989	245	9	NA	1
		1991	245	26	NA	1
		1993	245	1	NA	1
	Late Chum	1989	71	1,987	NA	
		1990	592	2,113	NA	
		1991	537	2,328	NA	
		1992	556	2,348	NA	
		1993	282	5,802	NA	
Adult Capture	Sockeye	1991	NA	45	NA	

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1 Majority are passed upstream.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adult Capture	Sockeye	1992	NA	8	NA	
		1993	NA	42	NA	
	Voights Creek Coho	1992	NA	210	NA	
Adult Prespawning Survival	Fall Chinook	Avg.	90%	96.6%	89.3-99.6%	
	Coho	Avg.	90%	100%	100-100%	
	Pinks	Avg.	90%	66.7%	0-100%	
	Late Chum	Avg.	90%	99.8%	99.1-100%	
	Sockeye	Avg.	90%	99.0%[2]	98.0-100%	
	Voights Creek Coho	Avg.	90%	87.1%	87.1%	
Eggtake	Fall Chinook	1989	980,000	884,260	NA	1,2
		1990	980,000	1,719,500	NA	
		1991	970,000	1,374,000	NA	
		1992	970,000	1,009,000	NA	
		1993	970,000	843,000	NA	2
	Coho	1989	0	0	NA	
		1990	0	0	NA	
		1991	0	0	NA	
		1992	11,000	34,000	NA	3
		1993	76,000	0	NA	3

[2] Three years; 1991-1993.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Eggtake	Chambers Creek Pinks	1989	NA	5,000[3]	NA	3
		1991	NA	22,400	NA	3
		1993	100,000	0	NA	3
	South Prairie Pinks	1989	100,000	0	NA	1
		1991	100,000	0	NA	1
	Late Chum	1988	NA	104,000	NA	3
		1989	95,000	112,000	NA	
		1990	788,000	518,500	NA	4
		1991	715,000	651,400	NA	4
		1992	740,000	457,000	NA	4
		1993	375,000	597,700	NA	
	Voights Creek Coho	1991	NA	190,000	NA	3
Fecundity	Fall Chinook	Avg.	NA	3,942	3,399-4,484	
	Coho	1992	NA	1,545	1,545	
	Pinks	89,91	NA	1,090	1,000; 1,179	
	Late Chum	Avg.	NA	2,667	2,450-2,872	
	Voights Creek Coho	1992	NA	1,583	1,583	
Green Egg to	Chambers Fall Chinook	Avg.	90%	76.3%	58.2-88.0%	5
Fry Survival	Deschutes Fall Chinook	Avg.	90%	87.0%	87.0%	5

[3] All eggs were destroyed; they were not certified as "virus clean."

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Green Egg to	Various Fall Chinook	Avg.	90%	93.3%[4]	92.8-94.8%	
Fry Survival	McAllister Fall Chinook	Avg.	90%	76.3%	58.2-88.0%	5
	Chambers Coho	Avg.	90%	75.9%[5]	41.4-93.8%	5
	Voight's Coho	1992	90%	95.6%	95.6%	
	Chambers Pinks	1991	90%	74.6%	74.6%	5
	South Prairie Pinks	1989	90%	78.1%	78.1%	5
	Late Chum	Avg.	90%	86.9%	76.9-94.0%	5
Fry to Smolt	Chambers Fall Chinook	Avg.	90%	91.8%[6]	81.2-96.0%	
Survival	Deschutes Fall Chinook	1989	90%	98.5%[7]	98.5%	
	May/Wallace Coho	Avg.	90%	99.1%	98.5-99.7%	
	Minter Coho	Avg.	90%	95.0:%	89.0-99.0%	
	Voight's Coho	Avg.	90%	96.1%	86.5-99.7%	
	Pinks	1991	90%	91.0%	91.0%	
	Late Chum	Avg.	90%	99.5%	97.6-100%	
Fish Releases	Fall Chinook Subyearling	1988	820,000	843,390	NA	
(Garrison Springs)		1989	820,000	491,800	NA	5
		1990	820,000	944,800	NA	
		1991	820,000	839,060	NA	
		1992	820,000	552,650	NA	5
	Deschutes Fall Chinook	1988	NA	3,500	NA	

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4 Eyed egg to fry survival.

5 Three year average, 1988,1991,1992.

6 In 1989, 250,00 eggs were destroyed due to possible IHN contamination.

7 Lake Sequalitchew program.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Fish Releases	Deschutes Fall Chinook	1989	NA	502,349	NA	3,7
(Garrison Springs)	(Subyearling)					
	Deschutes Chinook	1988	NA	6,520	NA	3,7
	(Yearling)	1990	NA	57,310	NA	3,7
		1991	NA	18,630	NA	3,7
	Voights Creek Fall Chinook	1990	NA	23,000	NA	3,7
	(Subyearling)	1992	NA	287,500	NA	3,7
(Lake Sequalitchew)	Wallace River Coho	1988	570,000	576,450	NA	
		1989	550,000	10,591	NA	6
		1990	570,000	386,100	NA	6
		1991	370,000	114,600	NA	6
	Minter Coho	1988	400,000	213,200	NA	
		1989	200,000	268,905	NA	
		1990	350,000	410,200	NA	
		1991	350,000	680,000	NA	
	Voights Creek Coho	1988	NA	196,000	NA	3,7
		1989	180,000	187,700	NA	
		1990	190,000	207,900	NA	
		1991	190,000	212,900	NA	
(Garrison Springs)	Chambers Pinks	1991	NA	15,200	NA	
	South Prairie Pinks	1989	95,000	43,590	NA	1
		1991	95,000	0	NA	1

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Fish Releases	Late Chum	1988	NA	97,800	NA	8
(Garrison Springs)		1989	NA	95,400	NA	8
		1990	NA	63,000	NA	8
		1991	NA	127,800	NA	8
		1992	NA	52,200	NA	8
Fish Releases	Skagit Fall Chinook	1988	NA	42,800	NA	3,7
(Off-station)	(Yearling)	1989	NA	20,000	NA	3,7
	Voights Creek Fall Chinook	1992	NA	298,240	NA	3,7
	Deschutes Fall Chinook	1989	NA	136,950	NA	3,7
	Garrison Fall Chinook	1988	NA	100,250	NA	3,7
		1990	NA	305,600	NA	3,7
	Clark Creek Coho	1989	NA	13,650	NA	3,7
	Wallace River Coho	1989	NA	10,591	NA	3,7
Transfers to	Garrison Fall Chinook	1988	NA	447,500	NA	7
Tribal Facilities						
(Eggs/Fish)	Soos Creek Fall Chinook	1988	2,850,000	81,600	NA	7
		1989	2,800,000	0	NA	7
	Coulter Creek Fall Chinook	1991	NA	736,000	NA	7
	Minter Creek Fall Chinook	1991	NA	368,000	NA	7
		1992	NA	1,069,300	NA	7
	Deschutes Fall Chinook	1989	NA	1,274,400	NA	7

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Transfers to Tribal Facilities (Eggs/Fish)	Chambers Creek Late Chum	1990	1,200,000	748,000	NA	3,4
		1991	600,000	368,500	NA	3,4
		1992	600,000	0	NA	3,4
Transfers Within WDFW (Eggs/Fish)	Deschutes Fall Chinook	1988	220,000	182,880	NA	7
		1989	220,000	0	NA	7
		1990	1,420,000	0	NA	7
		1991	1,200,000	406,300	NA	7
		1992	1,200,000	0	NA	7
	Soos Creek Fall Chinook	1989	1,850,000	111,150	NA	7
		1990	0	1,001,000	NA	7
	Grovers Creek Fall Chinook	1988	1,100,000	0	NA	9
		1989	1,100,000	0	NA	9
		1990	1,100,000	0	NA	9
		1991	1,100,000	0	NA	9
		1992	1,100,000	0	NA	9
	McAllister Fall Chinook	1988	0	1,745,000	NA	10
		1989	0	1,194,000	NA	10
		1990	0	1,030,200	NA	10
		1991	0	948,000	NA	10
		1992	0	1,068,000	NA	10
	Voights Creek Fall Chinook	1990	0	343,400	NA	10
		1992	0	670,000	NA	10

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Transfers Within WDFW (Eggs/Fish)	Voights Creek Coho	1992	0	498,400	NA	10
	Soos Creek Coho	1988	0	758,285	NA	10
	Chambers Creek Late Chum	1991	0	4,000	NA	3
		1992	0	326,000	NA	3
Transfers to Co-ops (Eggs/Fish)	Chambers Creek Coho	1992	10,500	31,500	NA	
	Chambers Creek Late Chum	1989	75,000	0	NA	3
		1990	75,000	500	NA	3
		1991	76,000	500	NA	3
		1992	100,500	50,500	NA	3
	Chambers Fall Chinook	1988	0	800	NA	3
		1990	0	100	NA	3
	Deschutes Fall Chinook	1989	0	150	NA	3
Adults Passed Upstream	Fall Chinook	1989	100	405	NA	
		1990	100	0	NA	1
		1991	100	830[8]	NA	
		1992	100	0	NA	1
		1993	100	125	NA	

[8] These were all jacks.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adults Passed Upstream	Coho	1989	All	2,331	NA	
		1990	All	2,567	NA	
		1991	All	2,202	NA	
		1992	All	2,491	NA	
		1993	All	1,850	NA	
	Late Chum	1989	1,300	1,912	NA	
		1990	1,700	1,744	NA	
		1991	1,300	1,861	NA	
		1992	1,700	2,089	NA	
		1993	1,300	5,349	NA	
	Sockeye	1991	NA	16	NA	
		1992	NA	9	NA	
		1993	NA	44	NA	
Percent Survival Smolt to Adult	Fall Chinook	1987	1.0%	0.1%	0.1%	1,11
	Coho	2 yr. Avg.	10.0%	1.5%	1.1-1.8%	1,11
	Pinks	Avg.	0.5%	ND	ND	11
	Late Chum	Avg.	0.5%	ND	ND	11

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Chinook	Yes	NA	NA	11
CV<10%	Coho	Yes	NA	NA	11
	Pinks	Yes	NA	NA	11
	Chum	Yes	NA	NA	11
Acclimation	Chinook	Yes	No	NA	12
	Coho	Yes	No	NA	12
	Pinks	Yes	No	NA	12
	Chum	Yes	No	NA	12
Volitional Release	Chinook	No	No	NA	
	Coho	Yes	Yes	NA	
	Pinks	No	No	NA	
	Chum	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults	Chinook	Yes	Yes	NA	
Throughout Run	Coho	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
	Chum	Yes	Yes	NA	
Spawning Pop.	Chinook	Yes	510	327-689	
>500	Coho	No	7[9]	0-22	13
	Pinks	No	9	0-26	13
	Chum	No	320	75-467	13
Spawning Ratio	Chinook	>0.33	0.7	0.5-0.9	
Male:Female	Coho	1.0	0.0[10]	0.0	
	Pinks	1.0	0.6	0-0.8	
	Chum	1.0	0.8	0.4-1.0	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	14

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9 Three broods: 1988, 91, & 92.

10 Males were live spawned and returned to creek. No record of numbers of males used.

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Four Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	1.3	0-5	
TSS Max Effluent	15 mg/L	2.2	0-6.6	
SS Effluent	0.1 ml/L	0.15	0-3.3	
TSS PA Effluent	100 mg/L	NA	NA	15
SS PA Effluent	1.0 ml/L	NA	NA	15
Downstream Temp (°F)	Varies	NA	NA	
Maximum Temp	<63°F	57.0°	55.0-57.0°	16
Minimum Temp	>32°F	51.1°	51.1-52.0°	16
Downstream DO (mg/L)	>8.0	10.7	9.3-11.5	
Continuous Monitoring of Other Parameters	Yes	NA	NA	

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	17
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments- Garrison Springs Hatchery Complex

1. Poor marine survivals or overharvest, can result in too few adults returning to supply programmed egg take. Poor returns also limit the number of fish which can be passed upstream.

2. In some years there is a higher proportion of one sex than the other. If there are more males than females, egg take goals may not be met even though adult capture goals are met.

3. Change in program goals after these goals were established in Future Brood Document.

4. Egg takes in some years are below stated goal in FBD because of a smaller than predicted run.

5. This hatchery lacks a good incubation system, thus higher than normal mortalities occur due to coagulated yolk syndrome during early rearing. Adult holding facilities are also poor, and high water temperatures during holding of adults prior to spawning can cause increased mortality of eggs.

6. Wallace River coho fingerlings are transported from Coulter Creek Hatchery. Coulter Creek rears these fish in large rearing ponds, which are difficult to remove all fish for transfer from. Thus, the Sequalitchew rearing program often receives fewer than the programmed number of fish from Coulter Creek.

7. Garrison Hatchery is used for interim rearing of fish for other programs. In some years programmed rearing of some stocks does not occur because of shortfalls of those stocks, or because the program the stock is intended for has enough eggs. Thus, the FBD reflects a rearing program that only takes place in special cases.

8. Excess eggs used in a remote streamside incubator located in the drainage.

9. Grovers Creek chinook is part of the Suquamish Tribe rearing program. Garrison Hatchery rears these fish if the eggs are available or if other hatcheries don't have space.

10. If one stock is not available, another stock will be substituted.

11. Lack of current continuous coded-wire tag data base. Only groups receiving a coded-wire tag are measured to determine mean length and CV.

12. Chinook and pink salmon are trucked from Garrison Hatchery to the rearing site in Chambers Bay for rearing and release which may stress the fish enough to affect marine survival.

13. These programs have very small eggtake requirements and do not require a large adult spawning base.

14. Pink salmon adults were not sampled for IHN virus in one year, thus all eggs were destroyed.

15. The hatchery does not have a pollution abatement pond.

16. Water temperatures of spring source do not vary by more than 3° around a mean temperature of 50° F.

17. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

Fall Chinook: This stock is a composite of many different south Puget Sound hatchery fall chinook stocks, all of which are of Soos Creek ancestry. **Stock Description: Introduced, non-adapted.**

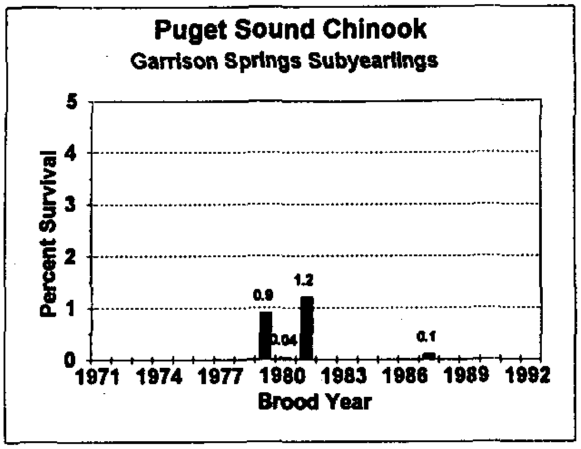
Sequalitchew Coho: Coho released from this facility represent several different hatchery stocks combined together in a common rearing environment. Stocks released from Lake Sequalitchew include Minter, Voights Creek, and Wallace River. Because there is no collection of eggs from returning adults, the coho released from this facility have no opportunity to adapt. **Stock Description: Introduced, non-adapted.**

Late Chum: **Stock Description: Native.**

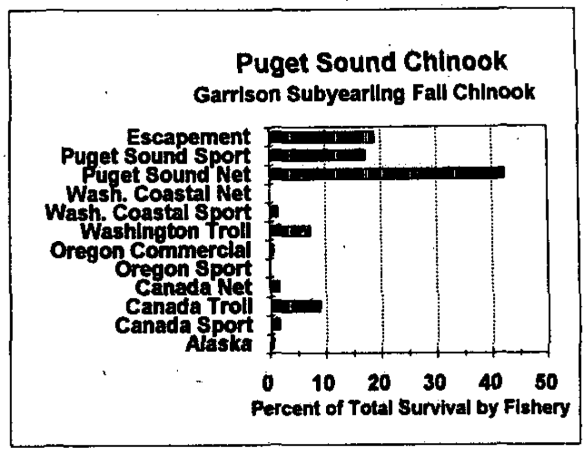
Pink Salmon: Pink salmon were reared at this hatchery in the 1970's. The current stock originated from South Prairie Creek, a tributary to the Puyallup River. **Stock Description: Introduced, non-adapted.**

STOCK STATUS PROFILE FOR: Garrison Fall Chinook

Survival:



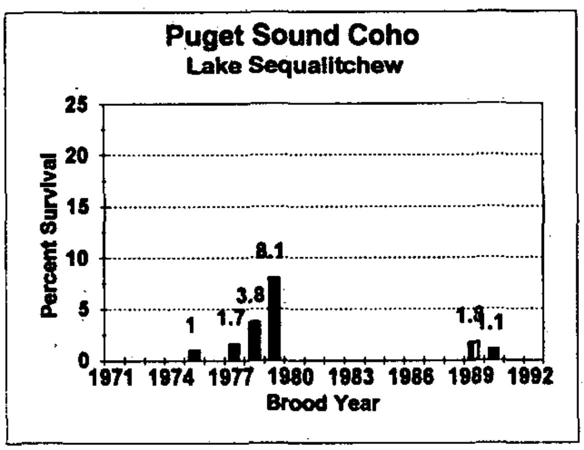
Distribution:



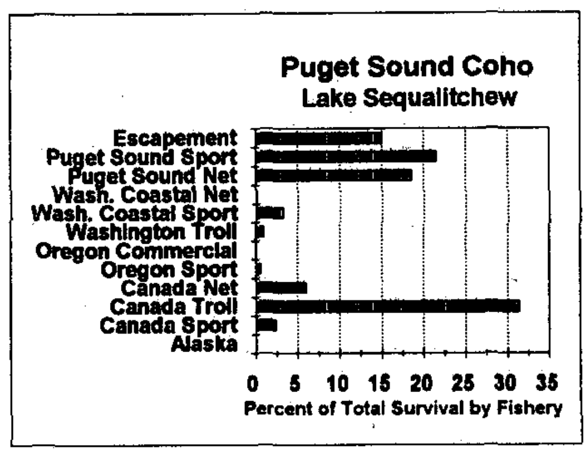
One Year Survival: 0.1%.
Catch to Escapement Ratio: 5.1:1

STOCK STATUS PROFILE FOR: Sequalitchew Coho

Survival:



Distribution:



Two Year Average Survival: 1.5%
Catch to Escapement Ratio: 6.71:1

STOCK STATUS PROFILE FOR: Chambers Late Chum

Survival: No data available.
Distribution: No data available.

STOCK STATUS PROFILE FOR: Chambers Pink Salmon

Survival: No data available.
Distribution: No data available.

Chambers Creek Hatchery

Introduction

Chambers Creek Hatchery is located in Tacoma, Washington, approximately 1/2 mile downstream of Steilacoom Lake. The hatchery was built in 1972 and is funded by state Wildlife funds. The hatchery is the major source of winter run steelhead broodstock for Western Washington. The hatchery has reared summer run steelhead, coastal cutthroat trout, rainbow trout, and eastern brook trout. The hatchery has 120 shallow trough incubators and four 88 x 20 foot rearing ponds. The hatchery has a water right for 3.4 cfs and draws water from local springs and Chambers Creek, but in recent years low flows have prevented the hatchery from operating at full capacity. The hatchery routinely plants 15,000-20,000 winter steelhead on-site and over 100,000 trout (mixed-species) are planted as catchable (legal sized) fish in local lakes. The hatchery has supplied approximately 70,000 steelhead to cooperative rearing projects at times.

Purpose

Chambers Creek Hatchery was built to collect as many winter steelhead eggs as possible to fill regional production needs for this species and to maintain the winter steelhead broodstock. It also serves as a rearing facility for trout to be transferred to other hatcheries or planted in lowland lakes or beaver ponds.

Goals

1. Maintain the Chambers Creek winter steelhead broodstock by rearing and releasing sufficient numbers of smolts, and collecting sufficient numbers of returning adults.
2. Produce trout to help supply lowland lakes stocking programs.

Objectives

Objective 1: 1993 Hatchery Production

1. Collect and spawn as many returning winter steelhead as possible.
2. Rear catchable rainbow trout for outplanting to local lakes.
3. Rear Hood Canal cutthroat trout for later transfer back to Hood Canal.
4. Rear winter run steelhead for cooperative rearing projects.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of adult collection procedures at Chambers Creek Hatchery is to capture all fish in the run. The stock of winter steelhead returning to this hatchery serves as the primary source of fish for outplanting into western Washington streams to meet management objectives of providing tribal fisheries and broad based non-tribal sport fisheries. There is no captive broodstock (trout) maintained at this hatchery.

Winter Steelhead: Winter steelhead return to Chambers Creek Hatchery from mid-December to February with peak run timing and spawning occurring in early January.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Winter steelhead have been reared and released on-station without prior acclimation to creek water. In recent years these fish have also been released on a later date than in past years. Due to concerns arising from a declining run size, the rearing program has been shifted to included acclimation to creek water and a historical planting date. Rainbow trout are planted into local lakes at a size designed to provide immediate harvest by sport anglers.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adult winter steelhead are collected throughout the entire run.

Spawning Protocol

Winter steelhead are spawned at a 1:1 male to female ratio. In recent years live spawning has been utilized. Spent adults are returned to the creek. Gametes from five females are pooled and fertilized with sperm pooled from five males. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Winter Steelhead
1. Chambers Creek
2. Any Chambers Creek derivative

Rainbow Trout
1. Any stock or strain meeting fish health guidelines

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). This hatchery does not meet the permit requirements for NPDES because it rears less than 20,000 pounds of fish. Thus, water quality parameters specified under the NPDES permit system are not monitored at this facility. Other water quality parameters such as dissolved oxygen, temperature, etc. are monitored as needed.

Hatchery Water Supply

Chambers Creek: Water quality and quantity has deteriorated over the past few years. Chambers Creek flows from Lake Steilacoom which has numerous homes along the shoreline. This has resulted in increased eutrophication from nutrient influx. Due to low rainfall over the past few years the lake level has dropped, reducing flows in the creek.

Springs: Due to low rainfall over the past few years the flows in the springs feeding the hatchery have decreased. Springs are under some risk of contamination from adjacent landowners.

Hatchery Water Temperature Profile

No data available.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs for these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Chambers Creek Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	WSH-Chambers	NA[1]	335	100-500	1
Adult Prespawning Survival	WSH-Chambers	85%	NA	NA	2
Eggtake	WSH-Chambers	NA[1]	801,275	441,600-1348.2K	
Fecundity	WSH-Chambers	NA	NA	NA	2
Green Egg-to-Fry Survival	WSH-Chambers	85%	86.8%	70.8-98.1%	
	WSH-Bogachiel	85%	86.0%[2]	80.1-91.5%	
	SSH-Skykomish	85%	98.9%	98.9%	
	SSH-Van Winkle	85%	96.0%	96.0%	
	SSH-Bogachiel	85%	82.9%	82.9%	
	SSH-Quilleyute	85%	94.8%	94.8%	
	WSH-Cook Ck.	85%	98.7%	98.7%	
	WSH-Green R.	85%	90.9%	90.9%	
	WSH-Hoko R.	85%	72.0%	72.0%	
	WSH-Skykomish	85%	67.2%	67.2%	
	WSH-Soleduck	85%	96.1%	96.1%	
	WSH-Tokul Ck.	85%	94.8%	94.8%	
	WSH-Van Winkle	85%	78.7%	68.3%; 94.9%	
	WSH-Wynoochee	85%	45.3%	58.3%; 42.4%	
	RBT- S. Tacoma	85%	78.5%	72.6-89.8%	
	CCT-Ashley Ck.	85%	81.1%	81.1%	
	CCT- Unident.	85%	69.9%[3]	54.5-96.0%	
	CCT-Hood Canal	85%	94.9%	94.9%	

1 There is no set egg take goal for this hatchery. The intent of the program is to maintain this stock of winter steelhead and provide other rearing programs with fish to meet regional production goals

2 Four year average, 1988-'92 broods.

3 Three year average, 1988-'90 broods.

Objective 1: (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Survival	WSH-Chambers	85%	70.2%	50.4-87.9%	
(Fry to Plant or	WSH-Bogachiel	85%	76.6%	69.1-88.7%	
Transfer)	SSH-Skykomish	85%	68.8%	46.2%, 82.1%	
	SSH-Van Winkle	85%	95.4%	95.4%	
	SSH-Bogachiel	85%	60.5%	60.5%	
	SSH-Quilleyute	85%	90.8%	90.8%	
	WSH-Green R.	85%	97.3%	97.3%	
	WSH-Hoko R.	85%	80.8%	80.8%	
	WSH-Skykomish	85%	89.7%	89.7%	
	WSH-Tokul Ck.	85%	96.1%	96.1%	
	WSH-Van Winkle	85%	96.8%	94.4%; 98.9%	
	WSH-Wynoochee	85%	90.9%	90.1%; 91.1%	
	RBT- S. Tacoma	85%	60.5%	29.2-76.5%	
	CCT-Ashley Ck.	85%	61.1%	48.0-77.9%	
	CCT- Unident.	85%	77.5%[4]	69.3-81.2%	
	CCT-Hood Canal	85%	74.6%	74.6%	
Fish Releases	WSH-Chambers Ck.	20,000	28,648	13,602-74,063	
	RBT-S. Tacoma	NA	90,865	0-368,644	3
	CCT-Unidentified	NA	9,065[5]	0-18,130	3
Transfers Out	WSH-Chambers	NA	387,651	162,678-816,003	3
(eggs/fish)	WSH-Bogachiel	NA	696,558	222,737-923,260	3
	SSH-Skykomish	NA	136,236	67,752; 204,720	3
	SSH-Van Winkle	NA	60,000	60,000	3
	SSH-Bogachiel	NA	119,497	119,497	3
	SSH-Quilleyute	NA	82,195	82,195	3
	WSH-Green R.	NA	43,108	43,108	3
	WSH-Hoko R.	NA	157,570	157,570	3
	WSH-Soleduck	NA	28,512	28,512	3
	WSH-Tokul Ck.	NA	464,520	464,520	3
	WSH-Van Winkle	NA	92,265	85,500; 99,750	3
	WSH-Wynoochee	NA	60,850	28,000; 93,700	3
	RBT- S. Tacoma	NA	400,714	155,462-676,660	3
	CCT-Ashley Ck.	NA	17,970	15,900-20,040	3
	CCT- Unident.	NA	68,075	0-112.360	3
	CCT-Hood Canal	NA	6,400	6,400	3

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4 Two year average, 1988 &'89 broods.

5 Two years of data, but fish were planted in one year only (1988).

Objective 1: (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adults Passed Upstream	WSH-Chambers Ck.	NA	NA	NA	
Percent Survival Smolt to Adult	WSH-Chambers Ck.	5.0%	Unknown	Unknown	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	WSH-Chambers Ck.	NA	NA	NA	2
Acclimation	WSH-Chambers Ck.	Yes	Yes/No	Yes/No	4
	RBT-S. Tacoma	No	No	No	
Volitional Release	WSH-Chambers Ck.	Yes	No	No	5

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	WSH.	Yes	Yes	Yes	
Spawning Pop. >500	WSH	Yes	137[6]	46-210	1
Spawning Ratio Male:Female	WSH	1.0	1.0[7]	1.0	

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6 Average number of females spawned from 1990-'91 and 1993-'94 returns.

7 Individual males may be spawned several times during the spawning season if they are in short supply. Thus, the effective spawning population size is not known, but the daily male to female ratio is 1:1.

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Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	NA	NA	NA	6
TSS Max Effluent	NA	NA	NA	6
SS Effluent	NA	NA	NA	6
TSS PA Effluent	NA	NA	NA	7
SS PA Effluent	NA	NA	NA	7
Downstream Temp (°F)	Varies	NA	NA	2
Maximum Temp	<63°F	NA	NA	2
Minimum Temp	>32°F	NA	NA	2
Downstream DO(mg/L)	NA	NA	NA	2
Continuous Monitoring of Other Parameters	Yes	Yes	Yes	

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	8
Develop and Review Equil. Brood Doc.	All	Yes	No	No	9
Develop and Review Future Brood Doc.	All	Yes	No	No	9
Develop and Review Current Brood Doc.	All	Yes	No	No	9

Constraints/Comments- Chambers Creek Trout and Steelhead Hatchery

1. Poor adult returns in recent years have hampered the facility from achieving adult collection and egg take goals. Poor returns are probably due to poorer marine survivals in recent years. The rearing and release program has also changed during this period and may have affected survivals.

2. No data taken or data not required.

3. The priority for rearing space at this hatchery is for winter steelhead. When fewer steelhead juveniles are available, there can be space for rearing additional fish from other hatcheries.

4. Due to disease concerns in recent years, steelhead were not reared on Chambers Creek water before release. Full term rearing on constant temperature spring water may adversely affect smoltification and possibly lower survival of smolts.

5. Rearing containers are not designed to allow for volitional release.

6. The hatchery is exempt from sampling water quality parameters as specified under NPDES permit requirements. The hatchery routinely samples dissolved oxygen and temperature of the incoming water.

7. The hatchery does not have a pollution abatement pond.

8. Because former Department of Wildlife hatcheries were not operated from a central organization structure, there was no staff dedicated to checking hatchery records for accuracy.

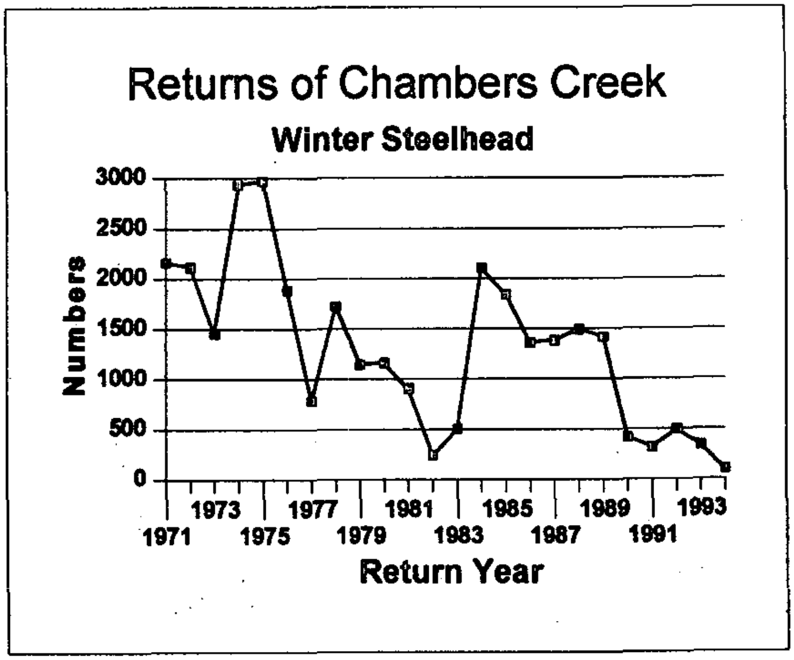
9. Former Department of Wildlife hatcheries were not subject to programming under the brood document format.

Stock Profile:

Chambers Creek Winter Steelhead: This stock was first cultured in the mid-1940s from fish returning to Chambers Creek. Returning adults were taken to the South Tacoma Hatchery where they were held in warmer water than would have been experienced in the wild. As a result, maturation time was accelerated over the wild spawning component. With advances in fish culture techniques, returns of hatchery reared fish increased to the point where offspring were transplanted into other streams in the region, or used to start runs of steelhead at other regional hatcheries. The first hatcheries to use this stock were Green River, Tokul Creek, and Puyallup. Early maturation time was continually selected to meet several management objectives. First, it allowed for the production of a one-year-old smolt which increased the number of smolts an individual hatchery could release each year. Second, it provided an early returning adult (November-January) that could be harvested at high rates with minimal effects on later returning native fish. Lastly, the early spawn time of the Chambers Creek stock reduced the likelihood of spawning with a native stock. In the early stages of the outplanting program, Chambers Creek fish were transplanted yearly into rivers or hatcheries for subsequent release throughout the state. Due to genetic differences among populations inhabiting coastal and Columbia River drainages (58 chromosomes) and the Chambers Creek stock (50% of population with 59 chromosomes and 50% with 60 chromosomes), there was less success in establishing Chambers Creek stock in these than in Puget Sound rivers. For many years of the outplant program, successful returnees to non-natal hatcheries were not used to supply that hatchery with smolts. The program shifted in later years, due to both genetic considerations and declining runs at Chambers Creek, to spawning returning adults at the hatcheries where they were released. Initially, egg production from hatcheries other than Chambers Creek was done solely to augment deficiencies in smolt production at Chambers Creek needed for regional production. Thus, eggs were mixed at a central hatchery and distributed to each hatchery in accordance with programmed release numbers. However, this program was modified in 1993 so that eggs/fry were returned to the hatchery they originated from. If insufficient eggs were taken for that program they were supplemented with Chambers Creek stock or a Chambers Creek derivative. **Stock Description: Native** (significant change possible due to selective breeding).

South Tacoma Rainbow Trout: This stock apparently originated from a commercial fish farm in Meeder, Utah. The origin of the Utah strain is unclear, but may have been from the McCloud River, Shasta County, California. Although originally a spring spawning strain, through manipulation of both warmer rearing temperatures and selection of early spawners, these fish now spawn predominantly between August and October with peak spawning in September. The spawn timing was shifted to provide catchable size trout for planting into lowland lakes before the opening of the general trout season in April, and fingerling trout plants in May. This strain has experienced heavy artificial selection for both spawn timing and coloration. In recent years egg mortality has increased, indicating a possible genetic bottleneck.

STOCK STATUS PROFILE FOR: Chambers Creek Winter Steelhead



AR049794

South Puget Sound Complex

Tumwater Falls Hatchery
McAllister Hatchery
South Sound Net Pens
Skookumchuck Rearing Ponds
Johns Creek Hatchery

Tumwater Falls Rearing Complex

Introduction

The Tumwater Falls Rearing Complex consists of a group of four satellite facilities located in the Olympia area. The complex consists of: (1) Tumwater Falls Holding Ponds and Trap, (2) Percival Cove net pens (formerly Percival Cove rearing pond), (3) Capitol Lake, (4) South Sound Net Pens (SSNP).

Tumwater Falls Holding Ponds and Trap: From 1952-54, three fishways were constructed in the lower Deschutes River to allow salmon to migrate upstream to potential spawning areas that were devoid of salmon. In 1961, the adult trap and two holding ponds were constructed at the top of the third fishway. The facility is located in Tumwater Falls Park. Fall chinook adults are collected and spawned at this site. Coho, and small numbers of chum and sockeye salmon, are enumerated passed upstream for natural production.

Percival Cove: Percival Cove is located adjacent to Capitol Lake in Olympia. It is formed by the backwaters of Percival Creek as it enters Capitol Lake. It has been used by WDFW as a chinook rearing and release pond since 1971, when up to 1 million yearling fall chinook were reared and released from the cove. Water quality has deteriorated since the early 1980's and resulted in a lower production capability. The fish are now reared in net pens to control predation by birds and otters. A total of 200,000 yearling , and 2,000,000 subyearling fall chinook are reared in net pens at this site.

Capitol Lake: The South basin of the lake is used as a rearing area for fingerling fall chinook. Sub-yearlings are planted in the lake during the spring, and fed while in this natural lake environment. They are allowed to emigrate from the lake volitionally.

South Sound Net Pens: This net pen complex is located in Peale Passage, and is jointly operated by the Squaxin Island Tribe and WDFW. Currently three pen complexes, totalling 73 net pens, are available for fall chinook and coho rearing programs including the White River spring chinook captive broodstock program (which currently utilizes 14 pens). The SSNP has been used for several experimental rearing programs in recent years, including the rearing of subyearling fall chinook and two-year-old coho.

The Tumwater Falls Rearing Complex relies on incubation and early rearing support from other hatcheries in the region. Chinook salmon for this program are reared at the George Adams hatchery complex (yearlings and subyearlings) and the McAllister, Coulter, and Wallace River hatcheries (sub-yearlings). Coho for the SSNP program are reared at several Puget Sound hatcheries prior to transfer to the Skookumchuck rearing facility. After rearing at Skookumchuck fingerlings are transported to the SSNP in early spring. Developing additional freshwater support facilities in the south Puget Sound area is considered a high priority in the near future.

Purpose

The Tumwater Falls Rearing Complex was built to increase production of fall chinook and coho in Puget Sound and coastal fisheries. Egg collection goals reflect the use of this stock to supply other south Puget Sound hatcheries with eggs to fulfill rearing programs at these hatcheries. The White River Spring Chinook Captive Brood Program was switched from the National Marine Fisheries Service net pen complex at Manchester, WA, to the SSNP. At maturity these adults are moved to the Hupp Springs hatchery for freshwater acclimation, maturation and spawning.

Production at this facility is by joint agreement of the treaty tribes of Puget Sound and WDFW.

Goals

1. Maintain the White River spring chinook captive broodstock program.
2. Produce fall chinook and coho for the N.E. Pacific and Puget Sound fisheries.
3. Provide fall chinook for the Nisqually tribal hatchery, if necessary.

Objectives

Objective 1: 1993 Hatchery Production

Tumwater Falls

Fall Chinook
Collect 12,100,000 eggs from 1993 adult returns and transfer to McKernan Hatchery.
Plant 200,000, 1991 brood yearling fall chinook from Percival Cove net pens.
Plant 7,100,000, 1992 brood subyearling fall chinook into Capital Lake.

South Sound Net Pens

Fall Chinook
Plant 800,000 1991 brood yearlings.
Rear 500,000 1992 brood subyearling for release as yearlings in 1994.

Spring Chinook
Rear 3,500 White River stock to maturity. Transfer adults (ages 3,4, and 5) to Hupp Springs for final maturation and spawning.
Rear 3,500, 1991 brood yearlings to until mature (1994-1996).

Coho
Release 1,200,000 1991 brood Minter Creek stock yearlings.
Release 400,000 1991 brood Wallace River stock yearlings.
Release 10,000 1990 brood Wallace River stock two-year-old coho.
Release 20,000 1990 brood Issaquah stock two-year-olds.
Rear 1,300,000 1992 brood Minter Creek stock fingerlings for release in 1994.

Allison Springs
Fall Chinook
Rear 200,000, 1991 brood yearlings and transfer to Percival Cove net pens.
Rear 1,500,000, 1992 brood subyearlings and transfer to Capital Lake.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at the Tumwater Falls Rearing Complex is to collect enough adults to sustain each specie's rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. A permanent fish ladder and trap exists on the Deschutes River to hold or enumerate returning adults prior to spawning or upstream passage. A temporary trap at the entrance to Capitol Lake is used to trap early returning adults for disbursement to the Squaxin Island Tribe. Only male salmon are captured and retained for this operation.

<u>Fall Chinook</u>: Fall chinook return to Capitol Lake as early as July. Fish can be seen milling off the Capitol Lake Dam in June. Most fish return from September to November with peak spawning in October.

<u>Coho</u>: Deschutes coho return to the Deschutes River from September to January with peak spawning in late November to early December. These fish are passed upstream to spawn naturally. Coho used in the SSNP programs come from other Puget Sound stocks.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery thus reducing straying into other areas. Fish reared at the SSNP are not acclimated to a local source of freshwater and therefore can stray into adjacent streams.

Fall Chinook: These fish are released as either yearlings from the Percival Cove net pens (freshwater) or the South Sound Net Pens (seawater). Yearling fish (4-8 fish/pound) are released in April and May and subyearling (50-100 fish/pound) fish are released in May and June. The subyearling fish are not reared in a controlled environment, thus the size and date they exit Capital Lake is not precisely known.

Coho: The coho program at the SSNP involves multiple release dates ranging from April to August. The majority of these fish are released in May and June at sizes larger than 20 fish/pound.

White River Captive Broodstock: Yearling fish are transferred to the SSNP in April, at 9 fish/pound. These fish are reared to maturity while in captivity. Adults mature at ages 3-6. Adults are checked for maturity in August each year, and those individuals showing signs of maturity are transferred to freshwater (Hupp Springs) in late summer or early fall for spawning.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained. A permanent trap at the Deschutes River fish ladder is used to trap returning fall chinook for spawning, and coho for enumeration prior to passage upstream and sampling for coded-wire tags.

Spawning Protocol

On days when fewer than one million eggs are collected the male to female spawning ratio is 1:1. On days when more than one million eggs are collected the male to female ratio will not be lower than 0.33. Because 1,500-2,500 males are removed at the Capital Lake trap to satisfy an allocation contract with the Squaxin Tribe, there can be insufficient numbers of males at spawning to achieve a 1:1 ratio. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Fall Chinook
1. Deschutes
2. McAllister
3. Any south Puget Sound stock, including Finch Creek

Coho (SSNP)
1. Minter Creek
2. Wallace River
3. Any Puget Sound stock

Spring Chinook
1. White River Spring Chinook

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Sanitation

- Eggs are not incubated at this facility.
- Equipment (nets, tanks, rain gear) is not necessarily disinfected with iodophor between different fish/egg lots.

Therapeutic and Prophylactic Treatments

- After spawning, eggs are transported to the McKernan Hatchery where they are water-hardened in 100 ppm iodophor for one hour.
- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs while incubating at the McKernan Hatchery.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The Tumwater Falls Rearing Complex does not monitor any of the parameters specified under the NPDES permit because each production component rears less than 20,000 pounds of fish.

Hatchery Water Supply

Percival Cove: Water quality at Percival Cove has steadily deteriorated over the past several years. Urban and agricultural runoff into Percival Creek and the Deschutes River has increased silt and nutrient loads. Low dissolved oxygen levels have occurred in recent years.

South Sound Net Pens: In recent years large numbers of caprellids have fouled nets and in severe years, caused fish mortalities. Water samples are continuously monitored for the presence of certain toxic algae that cause fish mortalities in saltwater net pens.

Hatchery Water Temperature Profile:

No current data available.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Deschutes River watershed and lower Puget Sound has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Squaxin Island Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at these facilities.

Performance Summaries—Tumwater Falls Rearing Complex

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Fall Chinook, Deschutes	1989	6,846	16,477	NA	
		1990	6,109	17,876	NA	
		1991	6,109	7,076	NA	
		1992	6,109	6,404	NA	
		1993	5,642	5,176	NA	1
	Wild Coho	1989	NA	972	NA	
		1990	NA	2,916	NA	
		1991	NA	1,978	NA	
		1992	NA	472	NA	
		1993	NA	659	NA	
	Fall Chinook, Percvival Cove	1989	NA	71	NA	
		1990	NA	1,097	NA	
		1991	NA	0	NA	
		1992	NA	65	NA	
	Percival Creek Chum	1989	NA	62	NA	
		1990	NA	9	NA	
		1991	NA	21	NA	
		1992	NA	68	NA	
		1993	NA	4	NA	
Adult Pre-spawning	Fall Chinook	Avg.	90%	98.1%	97.0-99.4%	
Survival	Wild Coho	Avg.	NA	99.4%[1]	98.2-99.9%	
Eggtake	Fall Chinook	1989	14,680,000	19,056,200	NA	

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1 This figure represents trap mortalities, as all fish are passed upstream. Average for 1989-1992.

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Fall Chinook	1990	13,100,000	20,944,900	NA	
		1991	13,100,000	11,274,800	NA	
		1992	13,100,000	13,913,900	NA	
		1993	12,100,000	5,743,100	NA	1
Fecundity	Fall Chinook	Avg.	NA	4,370	4,323-4,640	
Green Egg-to-Fry Survival	Fall Chinook	NA	NA	NA[2]	NA	2
Fry to Smolt Survival	Capitol Lake Chinook Subyear.	Avg.	90%	91.8%	92.1-100%	
	Percival Cove Chinook Yearling	Avg.	90%	95.9%	91.4-98.9%	
	SSNP, Chinook Yearling	Avg.	90%	84.7%[3]	49.7-95.8%	3
	SSNP, Wallace River Coho	Avg.	90%	96.8%[4]	89.5-99.4%	
	SSNP, Coho Two Year-Old	Avg.	90%	80.9%	90.2;93.8%	3
	SSNP, Issaquah Coho	Avg.	90%	87.2%	67.3-95.3%	
	SSNP, Minter Coho	Avg.	90%	97.8%	95.5-98.7%	
	White River Spring Chinook	Avg.	NA	47.1%[5]	40.7-55.6%	4
Fish Releases	Capitol Lake Chinook Subyear.	1988	7,800,000	5,860,000	NA	5
		1989	7,100,000	3,101,900	NA	5
		1990	7,100,000	7,348,715	NA	5
		1991	7,100,000	4,497,800	NA	5
		1992	5,600,000	3,835,400	NA	5

2 Fry are transferred to Tumwater Falls Rearing Complex from other hatcheries.

3 Weighted average of several rearing groups over broods 1988-1992.

4 Weighted average of 1988-1992. Survival estimates ignore 32,000 fish for the two year-old release program.

5 1988 and 1989 broods are missing 6 year-old fish. This value is smolt-to-maturity survival.

Objective 1:	**Hatchery Production**					
Measures	**Species**	**Brood Year**	**Goal**	**Realized**	**Range**	**Comments**
Fish Releases	Capitol Lake Chinook Yearling	1988	50,000	269,000	NA	6
	(Percival Cove)	1989	50,000	185,000	NA	6
		1990	50,000	181,000	NA	6
		1991	200,000	166,800	NA	6
	SSNP, Chinook Yearling	1988	800,000	838,800	NA	
		1989	800,000	656,850	NA	7
		1990	800,000	487,162	NA	7
		1991	500,000	99,400	NA	7
	SSNP, Chinook Subyearling	1990	500,000	479,900	NA	
	SSNP, Wallace River Coho	1988	200,000	181,200	NA	
		1989	200,000	141,335	NA	
		1990	0	1,230,400	NA	8
		1991	400,000	0	NA	
	SSNP, Wallace River	1989	10,000	2,100	NA	
	Two year old coho	1991	10,000	18,585	NA	
	SSNP, Issaquah Coho	1988	55,000	34,300	NA	
	Two year old coho	1989	55,000	44,050	NA	
		1990	55,000	18,200	NA	
		1991	55,000	0	NA	
	SSNP, Minter Coho	1988	1,200,000	1,374,000	NA	
		1989	1,200,000	0	NA	9
		1990	1,200,000	0	NA	9
		1991	1,200,000	1,182,500	NA	
	SSNP, Soos Creek Coho	1989	0	831,824	NA	8

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Allison Springs Chinook	1988	70,000	93,900	NA	
	Yearling	1989	70,000	0	NA	9
		1990	0	31,500	NA	10
	Subyearling	1991	0	969,400	NA	10
Transfers to Tribal Facilities (Eggs/Fish)	Fall Chinook	1991	1,000,000	0	NA	11
		1992	1,000,000	0	NA	11
Transfers Within WDFW (Eggs/ Fish)	Fall Chinook	1989	14,680,000	19,056,200	NA	
		1990	12,100,000	20,571,800	NA	
		1991	12,100,000	11,273,900	NA	
		1992	12,100,000	12,622,900	NA	
		1993	12,100,000	5,752,000	NA	1
	White River Spring Chinook	1987	NA	1,247	NA	12
	Adult Broodstock	1988	NA		NA	12
	Allison Springs, Deschutes	1988	80,000	69,000	NA	9
	Fall Chinook Yearling	1989	80,000	0	NA	9
		1990	200,000	93,000	NA	9
		1991	200,000	0	NA	13
	Allison Springs, Deschutes	1990	1,500,000	1,538,715		11
	Fall Chinook Subyearling	1991	1,500,000	0		13
		1992	1,500,000	0		13
	Allison Springs, Soos Creek Fall Chinook	1989	NA	201,000	NA	8

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Co-ops	Allison Springs, Deschutes	1989	NA	138,000	NA	
(Eggs/Fish)	Fall Chinook	1990	NA	2,500	NA	
Adults Passed	Fall Chinook, Deschutes	1989	1,500	1,557	NA	
Upstream		1990	1,500	6,159	NA	
		1991	1,500	428	NA	1
		1992	1,500	1,087	NA	
		1993	1,500	93	NA	1
	Percival Creek, Fall Chinook	1989	NA	72	NA	
		1990	NA	1,083	NA	
		1991	NA	500	NA	
		1992	NA	67	NA	
		1993	NA	0	NA	
	Percival Creek Chum	1989	All	62	NA	
		1990	All	9	NA	
		1991	All	21	NA	
		1992	All	68	NA	
		1993	All	4	NA	
	Deschutes Wild Coho	1989	All	1,058	NA	
		1990	All	2,878	NA	
		1991	All	1,949	NA	
		1992	All	487	NA	
		1993	All	604	NA	
	Deschutes Chum	1992	All	134	NA	
		1993	All	24	NA	
	Deschutes Sockeye	1992	NA	7	NA	
		1993	NA	3	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Smolt to Adult	Fall Chinook, Subyearling	Avg.	1%	0.9%	0.04-2.3%	14,15
Survival	Percival Cove, Chinook Yearling	Avg.	5%	3.4%	2.5%; 4.2%	14,15
	SSNP, Chinook Yearling	Avg.	5%	0.87%	0.6-1.2%	14,15
	SSNP, Coho	Avg.	10%	5.6%[6]	1.7-10.7%	15

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Fall Chinook, subyearlings	Yes	ND	ND	14
CV<10%	Fall Chinook, yearlings	Yes	ND	ND	14
	SSNP, Coho	Yes	9.2%	7.1-11.4%	
Acclimation	Fall Chinook	Yes	Yes	NA	
Volitional Release	Fall Chinook	No	Partial	NA	16

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	Yes	NA	
Spawning Pop. >500	Fall Chinook	Yes	4,907	2,239-6,941	
Spawning Ratio Male:Female	Fall Chinook	>0.33	0.5	0.4-0.6	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	Fall Chinook	Yes	Yes	NA	

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6 Average of all release types over three broods.

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Average	Range	Comments
TSS Effluent Composite (mg/L)	5 mg/L	NA	NA	17
TSS Max Effluent	15 mg/L	NA	NA	17
SS Effluent	0.1 ml/L	NA	NA	17
TSS PA Effluent	100 mg/L	NA	NA	18
SS PA Effluent	1.0 ml/L	NA	NA	18
Downstream Temp (°C)	Varies	NA	NA	17
Maximum Temp (17.2°C)		NA	NA	17
Minimum Temp (0°C)		NA	NA	17
Downstream DO(mg/L)	>8.0	NA	NA	17
Continuous Monitoring of Other Parameters	Yes	NA	NA	17

Objective 6: Communicate effectively with other salmon,trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	19
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Tumwater Falls Rearing Complex

1. Poor marine survival or overharvest reduces adult returns, thus reducing the number of eggs that can be collected. In some years most or all adults that return are required to make eggtake goal. This reduces the number of fish available for passage upstream.

2. Eggs are transferred to one or more hatcheries for incubation and initial rearing because the Tumwater Falls Complex does not have the capability of doing either.

3. In some years heavier than normal mortality can occur from disease or predation.

4. There is no way of establishing a realistic goal for this program until there are several more broods of rearing and transfer data. These data along with practical knowledge of how to operate this program will allow establishment of a realistic goal.

5. It is difficult to estimate the actual number of fish emigrating from Capital Lake. In some years the programmed numbers of fish planted in the lake have not been attained.

6. The net pen program at Percival Cove was being tested during these broods, thus the goal reflects a minimum number to release.

7. This program was reduced because of poor marine survivals and increased capability of rearing yearling fish at Percival Cove.

8. Make-up group for the intended stock which did not have adequate eggs or fish available to meet program goals.

9. Adequate numbers of fish were unavailable for program.

10. Fish escaped from pond after extreme high tides ruptured outlet screen.

11. Program was changed after establishment of goals in Future Brood Document.

12. Only two broods have been transferred in entirety. The goal is to transfer all mature adults regardless of age.

13. Use of Allison springs as a rearing station was discontinued in 1993 due to a shortage of water.

14. Lack of current continuous coded wire tag data base.

15. Poor marine survival in some years, particularly during El Nino events from 1991-1993.

16. The subyearling group is a volitional release group. The Percival Cove yearlings are released from the pens but emigrate from the lake volitionally.

17. NPDES permit has not been required at this facility because fewer than 20,000 pounds of fish are reared at any of the freshwater rearing sites. A permit is required for net pen programs rearing over 20,000 pounds of fish. Currently, efforts are underway to obtain this permit.

18. No pollution abatement pond at this facility.

19. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

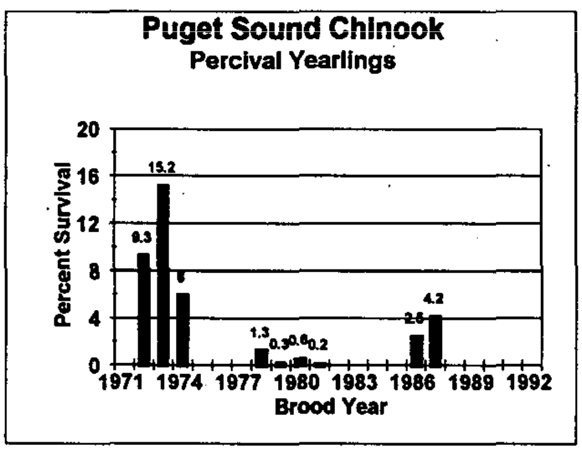
Spring Chinook: White River spring chinook are reared at Hupp Springs Hatchery. Please refer to the Minter Creek Hatchery Operations Plans for that hatchery.

Fall Chinook: Soos Creek fall chinook is the ancestral donor for thist stock. There have been numerous introductions of fall chinook from Soos Creek, Grovers Creek, and Finch Creek as well as several plants of fall chinook/spring chinook hybrids. Because there has not been three or more contiguous generations where only progeny of Deschutes fall chinook have been released, it is likely that this stock has not become locally adapted. **Stock Description: Introduced, non-adapted.**

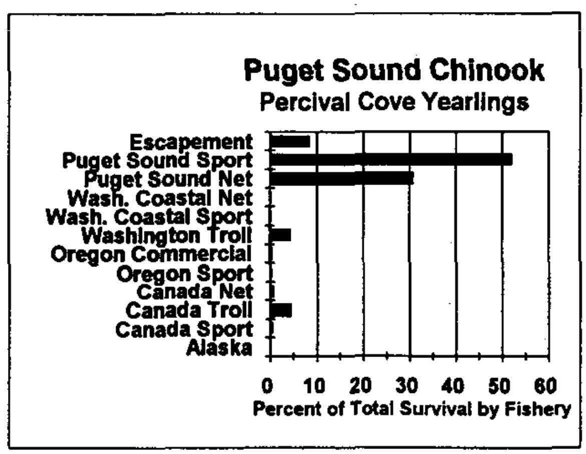
Coho (SSNP): The coho released from SSNP's represent several different Puget Sound stocks. See Operational Plans for Wallace River, Minter, Issaquah, and Voights Creek hatcheries, for information on the origins of these stocks. The SSNP coho are harvested in a heavy terminal area fishery, thus reducing the numbers of coho available to stray into local streams. Tag recoveries of SSNP coho in the Deschutes River have been minimal. **Stock Description: Introduced, non-adapted.**

STOCK STATUS PROFILE FOR: Percival Cove Fall Chinook Yearlings

Survival:



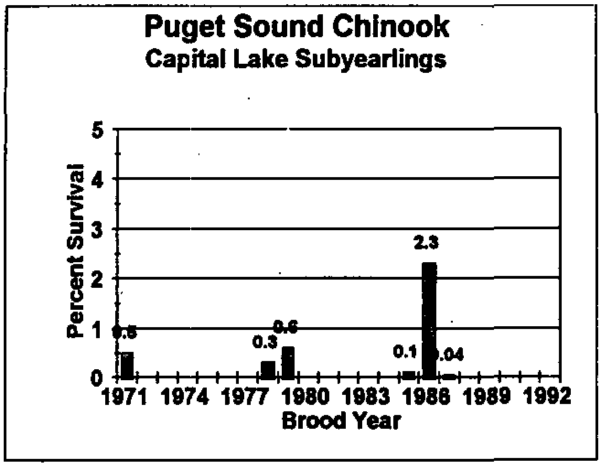
Distribution:



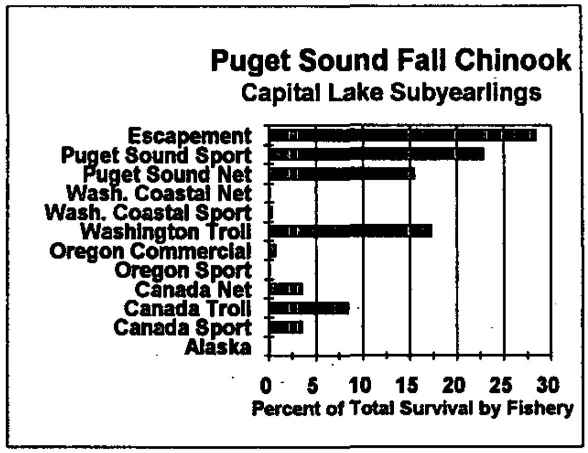
Two Year Average Survival: 3.4%
Catch to Escapement Ratio: 12.5:1

STOCK STATUS PROFILE FOR: Capital Lake Fall Chinook Subyearlings

Survival:



Distribution:

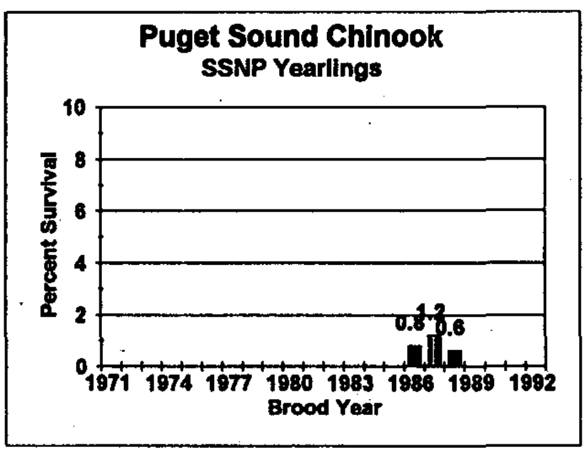


Three Year Average Survival: 0.93%

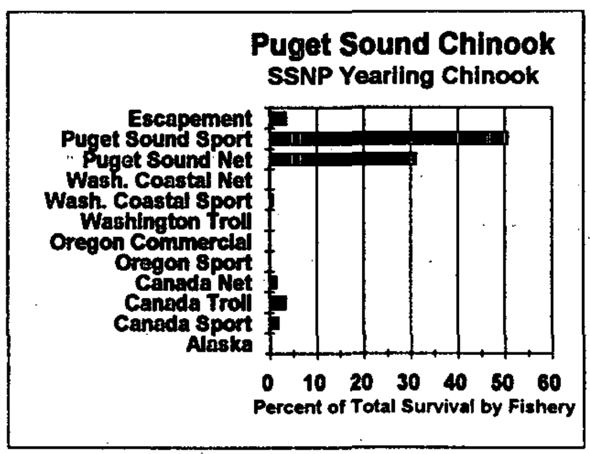
Catch to Escapement Ratio: 3.6 : 1

STOCK STATUS PROFILE FOR: SSNP Yearling Fall Chinook

Survival:



Distribution:

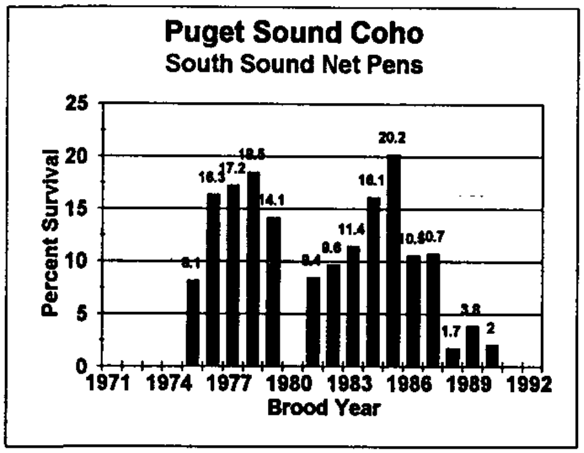


Three Year Average Survival: 0.86%

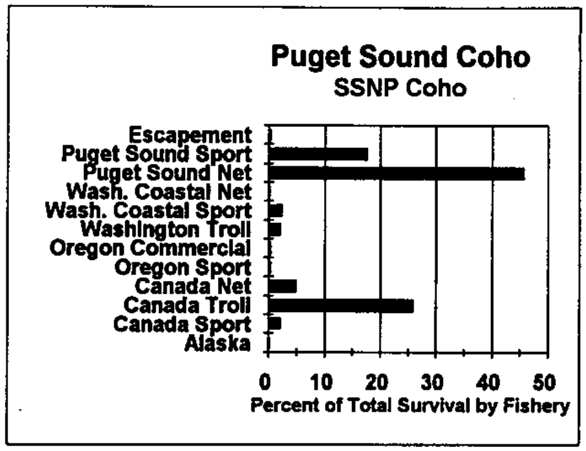
Catch to Escapement Ratio: 25.0:1

STOCK STATUS PROFILE FOR: SSNP Coho

Survival:



Distribution:



Five Year Average Survival: 5.7%

Catch to Escapement Ratio: 1000:1

McAllister Hatchery

Introduction

McAllister Hatchery is located on McAllister Creek, a tributary to south Puget Sound, approximately 10 miles north of Olympia, Washington. The hatchery has eighteen 10' x 100' raceways and one large rearing and release pond which also serves as an adult holding pond. Incubation is done in vertical incubators, with an eyeing capacity of 8 million and a hatching capacity of 7.1 million fry. Water is pumped from McAllister Creek for rearing and one well is available to supply incubation water. This facility was closed soon after opening due to budget constraints, and was then reopened for several years prior to closure again in 1993 and 1994. During this last closure period the facility was operated to trap and spawn adults and to incubate eggs. This facility has served as a support facility for the Tumwater Falls rearing complex.

Production is hampered by the presence of metacercarids (of the digenetic trematode *Nanophyetus salmincola)* in the creek water supply. These parasites eliminate any long term rearing capability at the hatchery. The quality of the creek water is further reduced by high levels of nutrients, which reduces the production capacity of the hatchery.

Purpose

McAllister Hatchery was built with enhancement funds to increase the production of chum or chinook salmon that contribute to fisheries in the N.E. Pacific and Puget Sound.

Goals

1. Rear and release fall chinook for the N.E. Pacific and Puget Sound fisheries.
2. Incubate and rear Deschutes fall chinook for transfer to Capital Lake for release as subyearlings. Incubate fall chinook eggs for Nisqually Tribe and cooperative rearing projects.

Objectives

Objective 1: 1993 Hatchery Production

Fall Chinook

Capture and spawn fall chinook returning in 1993 to supply eggs to the Nisqually Tribe hatchery program.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at McAllister Hatchery is to collect enough adults to sustain each specie's rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. The hatchery has no weir and therefore adults can by-pass the hatchery and spawn naturally. In recent years morpholine has been used to imprint juveniles just prior to release, and attract these fish into the hatchery as adults. This program has been discontinued. In some years efforts have been made to collect eggs from adults spawning near McAllister Springs.

Fall Chinook: Fall chinook return to McAllister Creek from mid-August to November. Peak spawning occurs in October.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery thus reducing straying into other areas.

Fall Chinook:
Fish are reared to 45 fish/pound and released in May and June. Fish destined for Capitol Lake are reared to 95 fish/pound and released from April to June.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained. Because not all portions of the run enter the hatchery voluntarily, some eggs are obtained from naturally spawning fish which are captured in the creek upstream of the hatchery.

Spawning Protocol

On days when fewer than one million eggs are collected the male to female spawning ratio is 1:1. On days when more than one million eggs are collected the male to female spawning ratio is no lower than 0.33. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Fall Chinook
1. McAllister
2. Deschutes
3. Soos Creek
4. Any south Puget Sound fall chinook

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored McAllister Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

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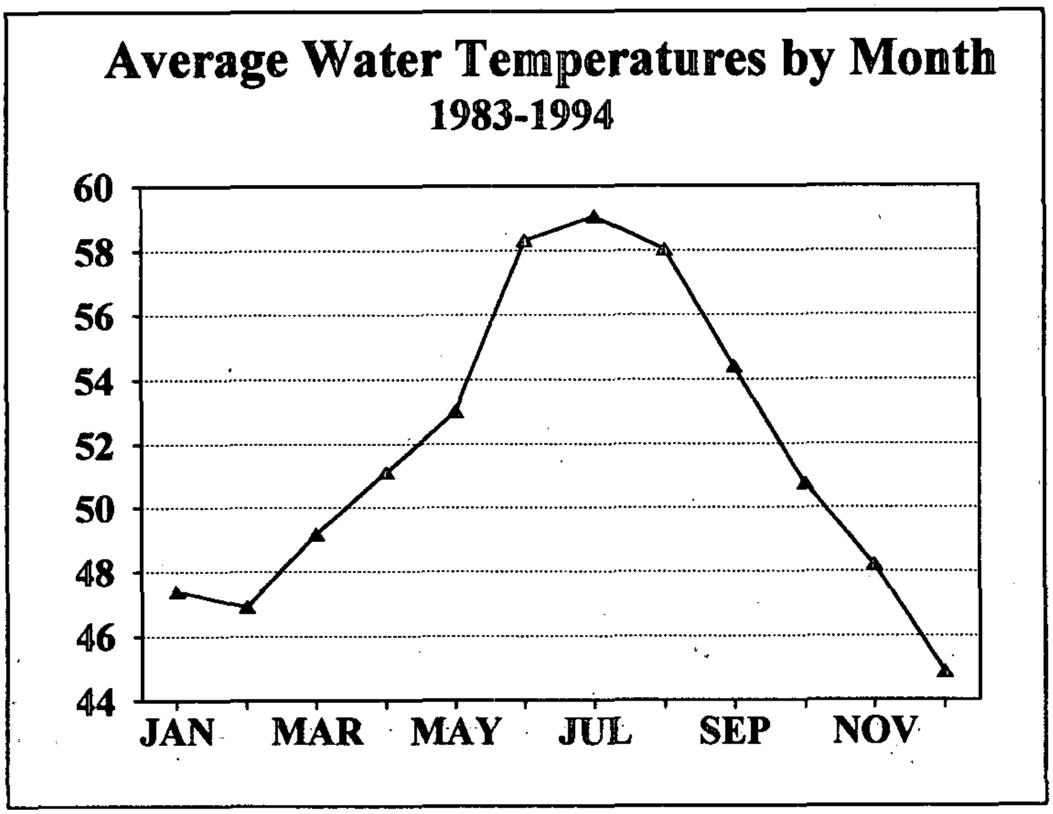
Hatchery Water Supply

McAllister Creek: McAllister Creek water quality has become degraded due to agricultural runoff which has increased the nutrient load. Also, coliform and nutrient levels have also increased due to wintering waterfowl concentrated in wildlife refuge. The water supply has suffered from saltwater intrusion at some times due to domestic water withdrawals and changes in flow regime due to the construction of Interstate 5. Water rights are 46 cfs.

McAllister wells: Water rights are 900 gpm.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the McAllister Creek watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Nisqually Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals for this facility.

Performance Summaries—McAllister Hatchery

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Fall Chinook	1989	2,248	1,500	NA	
		1990	2,246	1,481	NA	
		1991	2,538	594	NA	
		1992	1,606	372	NA	
		1993	NA	719	NA	
Adult Prespawning Survival	Fall Chinook	Avg.	90%	97.2%	96.6-98.2%	
Eggtake	Fall Chinook	1989	4,340,000	2,573,600	NA	
		1990	4,335,000	3,037,000	NA	
		1991	4,900,000	1,030,000	NA	
		1992	3,110,000	1,502,000	NA	
		1993	NA	789,000	NA	
Fecundity	Fall Chinook	Avg.	NA	3,969	3,386-4,414	
Green Egg-to-Fry Survival	Fall Chinook	Avg.	90%	93.4%	91.1-95.3%	
	Deschutes Fall Chinook	Avg.	90%	92.7%[1]	88.1-98.8%	
Fry to Smolt Survival	Fall Chinook	Avg.	90%	92.2%	66.7-99.7%	
	Deschutes Fall Chinook	'91,92	90%	90.4%	81.9;-98.8%	

[1]Three year average; 1989, 1991, and 1992.

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Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Fall Chinook[2]	1988	1,000,000	2,103,900	NA	
	Subyearling	1989	1,000,000	1,190,200	NA	
		1990	1,000,000	1,024,100	NA	
Fish Releases	Fall Chinook	1991	1,000,000	937,000	NA	
		1992	1,000,000	1,053,100	NA	
	Deschutes Fall Chinook[3]	1991	NA	402,800	NA	
		1992	NA	3,397,900	NA	
Transfers to Tribal Facilities (Eggs/Fish)	Fall Chinook	1988	1,000,000	1,000,800	NA	
		1989	3,000,000	989,500	NA	
		1990	3,000,000	1,528,400	NA	
		1991	3,600,000	0	NA	
		1992	1,900,000	0	NA	
	Deschutes Fall Chinook	1990	0	1,237,400	NA	
Transfers Within WDFW (Eggs/Fish)	Deschutes Fall Chinook	1988	3,000,000	3,921,000	NA	
		1989	3,000,000	3,134,450	NA	
		1990	3,000,000	3,367,900	NA	
		1991	3,500,000	2,394,532	NA	
		1992	3,000,000	0	NA	
	Soos Creek Fall Chinook	1989	0	1,579,000	NA	

[2]An average of 8,240 fish were released prior to 45 days.
[3]In 1989 67,000 unfed fry were planted.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Co-ops	Fall Chinook	1989	500	0		
(Eggs/Fish)		1990	1,000	1,085		
		1991	500	0		
		1992	0	348,600		
	Deschutes Fall Chinook	1990	1,000	1,000		
		1991	1,000	7,500		
	Deschutes Fall Chinook	1992	1,500	500		
Adults Passed Upstream	Fall Chinook	1989	NA	6	NA	
		1991	NA	263	NA	
Smolt to Adult Survival	Fall Chinook	Avg.	1.0%	ND	ND	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Fall Chinook	Yes	NA	NA	5
Acclimation	Fall Chinook	Yes	Yes	NA	
Volitional Release	Fall Chinook	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	No	NA	2
Spawning Pop. >500	Fall Chinook	Yes	940	567-1,464	
Spawning Ratio Male:Female	Fall Chinook	>0.33	1.2	0.8-1.4	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	Fall Chinook	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	2-Year Average	Range	Comments
TSS Effluent Composite (mg/L)	5 mg/L	0.64	-4.9-4.0	6
TSS Max Effluent	15 mg/L	1.49	-0.4-6.0	6
SS Effluent	0.1 ml/L	0.05	0.0-0.1	6
TSS PA Effluent	100 mg/L	41.0	25.0-56.0	7
SS PA Effluent	1.0 ml/L	0.0	0.0	7
Downstream Temp (°C)	Varies	10.9	8.0-17.2	8
Maximum Temp (17.2°C)		20.0°	16.1-20.0°	

Objective 5: Conduct environmental monitoring, continued

Measures	Hatchery Goal	2-Year Average	Range	Comments
Minimum Temp (0°C)		-1.7°	-1.7-5.0°	
Downstream DO(mg/l)	>8.0	10.3	9.0-11.0	8
Continuous Monitoring of Other Parameters	Yes	NA	NA	9

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	10
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—McAllister Hatchery

1. Poor survivals or overharvest result in low escapements to the hatchery, which can lead to fewer eggs collected than needed to meet program goals.

2. Because there is no weir on the creek at the hatchery site, a portion of the returning fish bypass the hatchery and spawn upstream.

3. Hatchery closed due to budget constraints. Because of this closure, there are no official program goals for operation in 1993.

4. Change in rearing program after establishment of program goals in the Future Brood Document.

5. Fish released at this hatchery have never been coded-wire tagged. Only groups receiving CWT's are measured to determine mean length and coefficient of variation.

6. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

Fall Chinook: This stock originated from Deschutes Fall chinook and has received introductions from other Puget Sound hatcheries. **Stock Description: Introduced, non-adapted.**

STOCK STATUS PROFILE FOR: McAllister Fall Chinook

Five Year Average Survival: ND
Catch to Escapement Ratio: ND

Skookumchuck Rearing Ponds

Introduction

Skookumchuck Rearing Ponds are located on the Skookumchuck River, a tributary of the Chehalis River. The facility consists of two 1/2 acre rearing ponds and one 8' x 80' raceway which is divided into sections to hold groups of fish for tagging. This facility does not have the capability to incubate eggs or alevins. Approximately 20 cfs of water is supplied by gravity flow from Skookumchuck Reservoir. Water temperature can be regulated (40-56° F) by three intake levels in the reservoir. Rearing capacity is approximately 2.5 million yearling coho. Currently fish are not released from this facility due to wild stock coho management in the upper Chehalis basin. This facility supports the South Sound Net Pen (SSNP) coho program.

Purpose

This facility was built to mitigate for lost natural production after the construction of the Skookumchuck Dam. Because of conflicts between management of hatchery and natural production in the upper Chehalis River basin, fish releases have not been made from the facility into the Skookumchuck River. Instead, the rearing ponds have been used as an interim rearing facility for the SSNP coho program. Skookumchuck receives fingerling coho salmon from Puget Sound hatcheries and rears these fish into the spring of their release year prior to transfer to the seawater pens. In recent years only Skykomish and Minter Creek coho have been reared at the facility.

Goals

1. Produce 2,300,000 coho yearlings for transfer to the South Sound Net Pens.

Objectives

Objective 1: 1993 Hatchery Production

Coho

Rear 1,100,000 1991 brood Wallace River stock yearlings for transfer to Squaxin cooperative rearing program at SSNP.

Rear 1,300,000 1991 brood Minter Creek stock yearlings for transfer to SSNP.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

No adult collection takes place at this facility.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Fingerlings from Puget Sound hatcheries are transferred to this facility in the spring of the year prior to transfer to seawater net pens. The fish are reared through the winter and transferred to the South Sound Net Pens as yearlings (larger than 30 fish/pound). No releases are made into the Skookumchuck River.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

No adult collection or spawning takes place at this facility.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

<u>Health Monitoring</u>

- Fish are not spawned at this facility.

<u>Sanitation</u>

- Eggs are not incubated at this facility.

<u>Therapeutic and Prophylactic Treatments</u>

- No eggs are collected at this facility.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES), as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Skookumchuck Rearing Ponds:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

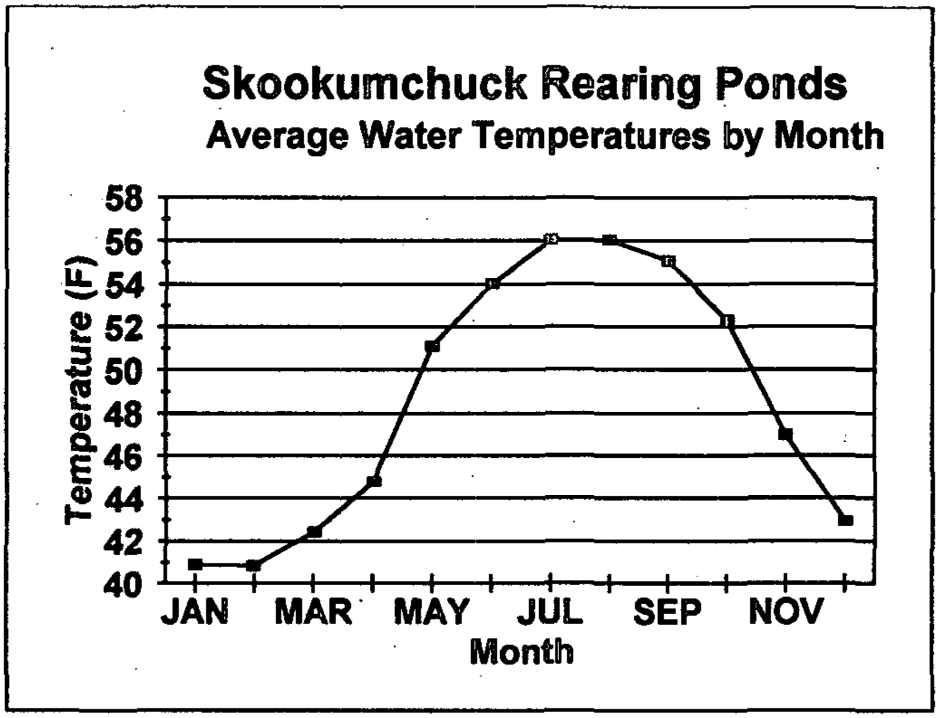
- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Skookumchuck Reservoir- Water rights are 20 cfs.
Domestic water- Water rights are 15 gpm.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Chehalis River watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Squaxin Tribe, Northwest Indian Fisheries Commission and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Standards—Skookumchuck Rearing Ponds

Objective 1: **Hatchery Production**

Measures	Species	Year	Goal	Realized	Range	Comments
Fry to Smolt Survival	Minter Coho	Avg.	90%	81.5%[1]	63.5-91.1%	1
	Wallace River Coho	Avg.	90%	87.3%	80.0-98.2%	1
	Soos Creek Coho	1989	90%	91.5%	91.5%	1
Transfers to Tribal Facilities (Fish)	Wallace River Coho	1988	1,000,000	1,083,100	NA	1
		1989	1,000,000	899,150	NA	1
		1990	1,000,000	816,090	NA	1
		1991	1,000,000	1,150,575	NA	1
		1992	1,000,000	960,225	NA	1
Transfers Within WDFW (Fish)	Minter Creek Coho	1988	1,300,000	1,422,900	NA	1
		1989	1,300,000	0	NA	1
		1990	1,300,000	942,600	NA	1
		1991	1,300,000	1,238,400	NA	1
		1992	1,200,000	830,250	NA	1
	Soos Creek Coho	1990	NA	841,637	NA	1

[1] Four years of data; 1988; 1990, 1991, and 1992.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Coho	NA	NA	NA	
Acclimation	Coho	NA	NA	NA	
Volitional Release	Coho	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Coho	NA	NA	NA	
Spawning Pop. >500	Coho	NA	NA	NA	
Spawning Ratio Male:Female	Coho	NA	NA	NA	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	Coho	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	4 Yr. Average	Range	Comments
TSS Effluent Composite (mg/L)	5 mg/L	1.06	-12.4-5.1	
TSS Max Effluent	15 mg/L	1.42	-14.0-6.2	
SS Effluent	0.1 ml/L	0.0	0.0	
TSS PA Effluent	100 mg/L	NA	NA	2
SS PA Effluent	1.0 ml/L	NA	NA	2
Downstream Temp(°F)	Varies	47.7°	47.3-49.1°	
Maximum Temp(°F)	63°	66.0°	58-66°	
Minimum Temp(°F)	32°	33°	33-40°	
Downstream DO(mg/l)	8.0	8.7	8.7	
Continuous Monitoring of Other Parameters	Yes	NA	NA	

Objective 6: Communicate effectively with other salmon, trout, steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	3
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Skookumchuck Rearing Ponds

1. Numbers of fish transferred to facility are occasionally overestimated, thus causing a shortage in numbers of fish shipped out after disease related mortalities occur. This problem can inflate mortality figures.

2. No pollution abatement pond.

3. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

Minter Coho: See HOPPS for Minter Creek Hatchery.

Wallace River Coho: See HOPPS for Wallace River Hatchery.

Hood Canal Complex

George Adams Hatchery
Eells Spring Hatchery
Mckernan Hatchery
Hoodsport Hatchery

George Adams Hatchery and Satellites

Introduction

George Adams Hatchery is located on Purdy Creek, a tributary of the Skokomish River, eight miles north of Shelton on Highway 101. It has six standard raceways, two large rearing and release ponds, and a combination adult holding and rearing pond. In addition there are eight Japanese keeper channel raceways and two 10' X 100' collection raceways for fry emigrating from the keeper channels. Incubation methods include vertical incubators, deep troughs, freestyle incubators, magnum deeps, barrel incubators and the Japanese keeper channels. The hatchery can incubate up to 90 million eyed eggs, hatch 14 million fry, and release 13 million fish of various species. This facility supports the Hoodsport Hatchery, the Tumwater Falls Rearing Complex, Hood Canal remote site incubators, and various cooperative rearing projects. Satellite facilities include McKernan and Johns Creek hatcheries.

McKernan Hatchery is located on Weaver Creek, 2 miles west of George Adams Hatchery on the Skokomish Valley Road. It was constructed with 1977 enhancement funds. The original design incorporated Japanese incubation techniques using ten incubation gravel raceways that could be converted into rearing ponds by increasing their water level. There was also one large gravel bottom rearing pond and an asphalt holding pond that could used for rearing. RSI barrel style incubators and freestyle incubators were used for eyeing. The hatchery could incubate up to 25 million eyed eggs and hatch 20 million fry. In 1994 the hatchery was renovated. The Japanese style incubation raceways were replaced with an incubation building containing 84 double stack vertical incubators (12 million hatching capacity). In addition, three new rearing ponds were built. Two of the ponds are 17' x 140' x 3' and the third pond 22' x 140' x 3'. Release capacity for the facility is approximately 11 million chum. Water is supplied by gravity flow from Weaver Creek and pumps on the creek. Two wells supplement the creek water.

Johns Creek Hatchery is located on Johns Creek, approximately four miles northeast of Shelton on State Highway #3. There are two large rearing and release ponds with one serving as an adult holding pond. Water is delivered by gravity from Johns Creek. The lower rearing pond is fed with water through a series of gabion weirs from the upper pond. There is no incubation at this facility. Rearing capacity is approximately 6 million fish. The hatchery has been closed due to budget shortfalls since 1991. Previous production included 2,000,000 chum released on-site and the rearing of 1,000,000 fall chinook for the Capitol Lake rearing program. Beginning in 1995 this hatchery will be included in the South Sound Complex.

Purpose

George Adams Hatchery was built to increase production of chinook, coho, and chum in the Hood Canal and Puget Sound region. In recent years the production at this hatchery has been agreed upon through a Memorandum of Understanding between WDFW and the Point No Point Treaty Council. This agreement, "Hood Canal Salmon Management Plan" sets forth production of all species from Hood Canal area hatcheries. George Adams Hatchery also serves as an incubation or short term rearing station for other hatchery programs (such as Tumwater Falls or Hoodsport Hatchery), because of an abundant supply of pathogen free well water. The hatchery also supplies eggs or fish to cooperative rearing projects, and is responsible for maintaining the remote streamside incubator program (RSI) which enhances chum production on some Hood Canal tributaries.

The McKernan Hatchery was built with enhancement funds allocated by the state legislature. It's primary purpose is to increase production of adult chum in Hood Canal and the Skokomish River. It also serves as an incubation and rearing facility for the Tumwater Falls program.

The Johns Creek Hatchery was built with enhancement funds to increase production of chum salmon in south Puget Sound. Because of the digenetic trematode, *Nanophyetes salmincola*, rearing through the spring and summer months is not possible without heavy mortalities or an expensive water treatment system. The hatchery has been used to rear fall chinook during the fall and winter for later transportation to the Tumwater Falls program. The hatchery has not been operated since 1991 due to budget constraints.

Goals

1. Produce fall chinook, coho, and chum for the NE Pacific and Puget Sound fisheries.
2. Incubate or rear fall chinook, coho, and chum for other hatchery programs.
3. Incubate or rear fall chinook, coho, and chum for tribal and cooperative rearing projects.

Objectives

Objective 1: 1993 Hatchery Production

George Adams Hatchery

Fall Chinook

Rear and release 3,800,000 1992 brood subyearlings on-station.

Rear 500,000 1992 brood subyearlings for release into local streams.

Transfer 15,000 1992 brood eggs to Hood Canal regional enhancement groups.

Collect 5,100,000 eggs from adults returning in 1993.

Transfer 10,000 eggs and 45,000 subyearling Finch Creek stock, to Hood Canal regional enhancement groups.

Transfer 200,000 1992 brood Finch Creek stock subyearlings to Sund Rock net pens.

Receive and incubate 10,840,000 Deschutes fall chinook eyed eggs from McKernan Hatchery, and transfer 4,160,000 eyed eggs to WDFW Puget Sound hatcheries[1]. Additionally, rear and transfer 1,800,000 fingerlings to Allison Springs and 225,000 fingerlings to Hoodsport Hatchery.

Coho

Release 300,000 1991 brood Purdy Creek stock yearlings on-station.

Release 110,000 1991 brood Capilano stock yearlings on-station.

Transfer 500,000 1991 brood fingerlings to Nisqually Tribe.

Transfer 140,000 1991 brood fingerlings to cooperative rearing groups.

Plant 500,000 1992 brood Purdy Creek stock fry into Purdy Creek.

Transfer 11,000 1992 brood eyed eggs to cooperative rearing programs.

Collect 1,025,000 eggs from Purdy Creek stock adults returning in 1993.

Chum

Release 5,000,000 1992 brood fingerlings into Purdy Creek.

Transfer 10,800,000 1992 brood eyed eggs to McKernan Hatchery.

Transfer 2,000,000 1992 brood Finch Creek stock eyed eggs to Port Gamble Tribe.

Transfer 2,020,000 1992 brood Finch Creek stock eyed eggs to cooperative rearing projects.

Transfer 10,000,000 1992 brood Finch Creek stock fingerlings to Hoodsport Hatchery.

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1 These eggs are in support of the Tumwater Falls rearing program; 1,800,000 to Minter Creek, 2,360,000 to Wallace River, and 3,700,000 to McAllister.

Chum (cont.)

Transfer 7,125,000 1992 brood Finch Creek stock eyed eggs to RSI program on various Hood Canal tributaries.

Transfer 500 1992 brood fry to cooperative rearing programs.

Collect 5,900,000 eggs from adults returning in 1993.

Receive 11,800,000 1993 brood eggs from McKernan Hatchery.

Receive 23,600,000 1993 brood eggs from Hoodsport Hatchery.

McKernan Hatchery

Fall Chinook

Rear 1,110,000 1992 brood Deschutes fingerlings and transfer 300,000 fingerlings to Capital Lake and 800,000 fingerlings to the South Sound Net Pens.

Receive and incubate 12,100,000 1993 brood Deschutes fall chinook eggs, and transfer 10,840,000 eyed eggs to George Adams.

Rear 810,000 1992 brood Deschutes fall chinook for transfer to various net pen programs.

Chum

Plant 10,000,000 1992 brood fingerlings on-station.

Collect 11,800,000 eggs from adults returning in 1993.

Johns Creek Hatchery

Not currently in operation.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at George Adams and satellite hatcheries is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. A permanent weir on Purdy creek, Weaver creek, and Johns creek blocks upstream passage of returning adults, diverting these fish into holding ponds where they can be enumerated and either held for spawning or passed upstream..

Fall Chinook: Fall chinook return to Purdy Creek from August to October with peak spawning in October.

Coho: Purdy Creek coho return to the hatchery from September to January with peak spawning in November. Baker or Capilano stock coho return to the hatchery primarily in October.

Chum: Both Purdy Creek and McKernan chum return from October to December with peak spawning in mid-to late-November.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas.

Fall Chinook: Fall chinook are reared at George Adams to a size of 65 fish/pound and released from May to June. Screens are pulled as maximum poundage in the rearing pond is reached and those fish ready to migrate are allowed to do so.

Purdy Creek Coho: Two groups are released from George Adams hatchery. The first group is released in May and June at 17 fish/pound, and the second group (delayed release) in July at 10 fish/pound.

Baker River Coho: The total release is split, with one group released in May and the other in June. both groups are released at 15 fish/pound.

Chum: Chum reared at George Adams are planted in March and April at 700 fish/pound. At McKernan hatchery the chum are reared to 450 fish/pound and planted in March and April. Chum reared at remote incubation sites (various streams in the Hood Canal region) are allowed to emigrate from the incubators at their own volition, usually at about 1,100 fish/pound.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

On days when fewer than one million eggs are collected chinook, coho, and chum are spawned at a 1:1 male to female ratio. On days when fewer than one million eggs are collected the male to female spawning ratio is not less than 0.33. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

<u>Fall Chinook</u>
1.George Adams or Finch Creek
2. Skokomish
3. Port Gamble

<u>Coho</u>
1. George Adams

<u>Chum</u>
1. George Adams, Finch Creek, McKernan
1. Johns Creek early chum (at Johns Creek only)

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at both the George Adams and McKernan hatcheries:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperature daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Some facilities monitor rainfall and air temperature on a daily basis.

Hatchery Water Supply

Purdy Creek: Because of it's proximity to U.S. 101, Purdy Creek is at risk for contamination from spills on the highway. One spill of zinc occurred several years ago. The creek in recent years has had diminished flows because of drought conditions and related development in the watershed. Water rights are 21.3 cfs.

Ellis Creek: Was recently developed to provide additional rearing water. Similar to Purdy Creek, flows have diminished due to drought conditions and development in the watershed. Water rights are 2.5 cfs.

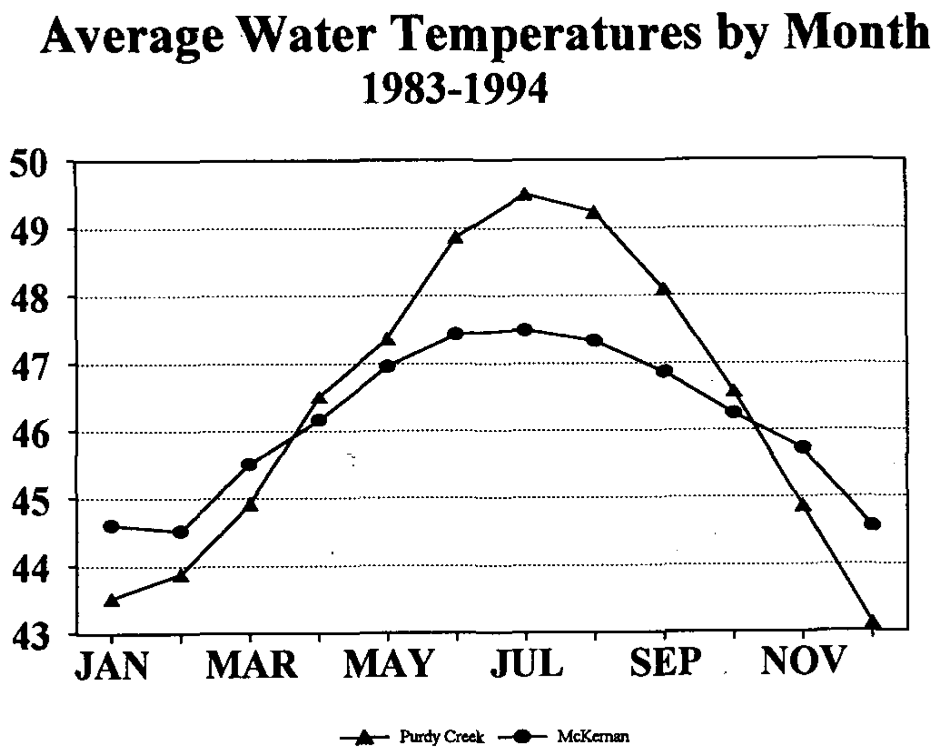
George Adams Wells: The wells have not been producing the volume of water that was thought to exist. They must be shut down for periods of time to allow the aquifer to recharge. Iron rust bacteria problems existed in the past. Water rights are 6.4 cfs.

Weaver Creek (McKernan): Water rights are 12 cfs.

McKernan Wells: Water rights are 6.9 cfs.

Johns Creek: The creek is infested with *Nanophyetus salmincola* which makes long term rearing impossible. Water rights are 20 cfs.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to allow for documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Skokomish River watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Point No Point Treaty Council, and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at these facilities.

Performance Summaries—George Adams Hatchery and Satellites

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Fall Chinook, Purdy Creek	1989	2,456	2,523	NA	
		1990	2,456	2,186	NA	
		1991	2,475	3,086	NA	
		1992	2,478	294	NA	1
		1993	2,478	612	NA	1
	Purdy Creek Coho	1989	1,937	3,097	NA	
		1990	1,937	2,582	NA	
		1991	2,046	3,381	NA	
		1992	1,398	2,664	NA	
		1993	1,398	2,788	NA	
	Chum, Purdy Creek	1989	5,359	3,460	NA	1
		1990	5,359	2,727	NA	1
		1992	5,359	21,231	NA	
		1993	5,359	10,601	NA	
	John's Creek Early Chum	1989	2,045	3,406	NA	
		1990	2,184	4,201	NA	
		1991	2,325	3,741	NA	
	Fall Chinook, Johns Creek	1988	NA	4	NA	
	Capilano Coho	1989	NA	53[2]	NA	
	Baker Coho	1992	NA	68	NA	
	Fall Chinook, McKernan	1989	NA	33	NA	

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[2] All adults were transferred to Hoodsport Hatchery.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Coho, McKernan	1989	NA	8	NA	
	Chum, McKernan	1989	10,486	2,206	NA	1
		1990	10,486	1,859	NA	1
		1991	10,486	7,141	NA	1
		1992	10,486	20,150	NA	
		1993	10,486	9,350	NA	1
Adult Prespawning Survival	Fall Chinook, Purdy Creek	Avg.	90%	96.4%	94.5-98.4%	
	Purdy Creek Coho	Avg.	90%	98.1%	94.8-99.8%	
	Chum, George Adams	Avg.	90%	96.7%[3]	94.3-98.8%	
	Capilano Coho	1989	90%	93.5%	93.5%	
	Fall Chinook, McKernan	1989	90%	89.7%	89.7%	
	Coho, McKernan	1989	90%	100%	100%	
	Chum, McKernan	Avg.	90%	96.7%	92.9-98.4%	
Eggtake	Fall Chinook, Purdy Creek	1989	5,060,000	5,260,200	NA	
		1990	5,060,000	2,545,100	NA	1
		1991	5,100,000	7,342,200	NA	
		1992	5,250,000	443,000	NA	1
		1993	5,250,000	1,151,600	NA	1
	Purdy Creek Coho	1989	1,420,000	1,324,300	NA	
		1990	1,420,000	2,229,300	NA	
		1991	1,500,000	2,073,700	NA	
		1992	1,025,000	1,256,800	NA	
		1993	1,025,000	718,500	NA	
	Chum, Purdy Creek	1989	5,900,000	2,198,800	NA	1

[3] Four year average; 1989, 1990, 1992, and 1993.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Chum, Purdy Creek	1990	5,900,000	3,061,100	NA	1
		1992	5,900,000	9,895,100	NA	
		1993	5,900,000	7,027,600	NA	
	John's Creek Early Chum	1989	2,200,000	2,196,000	NA	
		1990	2,350,000	2,101,000	NA	
		1991	2,500,000	2,043,000	NA	
	Fall Chinook, McKernan	1989	NA	37,000	NA	
	Chum, McKernan	1989	11,800,000	1,716,500	NA	1
		1990	11,800,000	2,192,900	NA	1
		1991	11,800,000	3,176,400	NA	1
		1992	11,800,000	11,960,000	NA	
		1993	11,800,000	3,810,000	NA	1
Fecundity	Fall Chinook, Purdy Creek	Avg.	NA	4,269	3,971-4,554	
	Purdy Creek Coho	Avg.	NA	1,494	1,111-1,827	
	Chum, Purdy Creek	Avg.	NA	2,422[4]	2,123-2,640	
	John's Creek Early Chum	Avg.	NA	2,367	2,072-2,812	
	Fall Chinook, McKernan	1989	NA	5,286	5,286	
	Chum, McKernan	Avg.	NA	2,325	1,964-2,726	
Green Egg-to-Fry Survival	Fall Chinook, Purdy Creek	Avg.	90%	92.4%	89.2-94.6%	
	Fall Chinook(McKernan) at George Adams	1989	90%	95.0%[5]	95.0%	

[4] Four year average; 1989,1990,1992, and 1993.

[5] Fry to smolt survival.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Green Egg-to-Fry Survival	Deschutes Fall Chinook	Avg.	90%	89.9%	82.7-98.2%	
	Finch Creek Fall Chinook	Avg.	90%	91.8%[6]	82.9-99.2%	
	McAllister Fall Chinook	1989	90%	98.9%	98.9%	
	Soos Creek Fall Chinook	1989	90%	98.7%	98.7%	
	Purdy Creek Coho	Avg.	90%	90.3%	87.0-93.0%	
	Hood Canal, Baker Coho	'90,91	90%	79.4%	70.5;88.4%	
	Chum, Purdy Creek	Avg.	90%	91.2%	88.9-94.9%	
	Finch Creek Chum	Avg.	90%	88.0%	82.0-91.5%	
	Chum (McKernan) at George Adams	Avg.	90%	92.2%[7]	89.9-94.8%	
	John's Creek Early Chum	Avg.	90%	83.1%[8]	68.6-92.1%	6
	Deschutes Fall Chinook at McKernan	Avg.	90%	97.5%	92.7-99.8%	
	Chum, McKernan	Avg.	90%	96.2%	88.8-99.4%	
Fry to Smolt Survival	Fall Chinook, Purdy Creek	Avg.	90%	98.2%	97.1-98.9%	
	McKernan Fall Chinook at George Adams	'88,89	90%	98.5%	97.7;98.8%	
	Deschutes Fall Chinook	1990	90%	97.9%	97.9%	
	Finch Creek Fall Chinook	Avg.	90%	97.2%	95.8-99.2%	
	McAllister Fall Chinook	1989	90%	0.0%	0.0%	
	Purdy Coho	Avg.	90%	58.3%	45.6-75.0%	2
	Capilano Coho	'88,91	90%	99.5%	99.4;99.6%	
	Baker Coho	'90;91	90%	99.7%	99.6;99.7%	
	Chum, Purdy Creek	'89,92	90%	88.8%	81.5;96.1%	
	John's Creek Early Chum	1988	90%	97.8%	97.8%	

6 Four year average; 1988-1991.

7 Three year average; 1988,1991, and 1992.

8 Three year average; 1989-1991.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fry to Smolt	Finch Creek Chum	Avg.	90%	93.5%[9]	91.7-96.8%	
Survival	John's Creek Early Chum	Avg.	90%	98.2%[10]	97.1-100%	
	Deschutes Fall Chinook at McKernan	Avg.	90%	83.9%[11]	74.7-97.9%	
	Chum at McKernan	Avg.	90%	92.6%[12]	81.9-99.7%	
Fish Releases	Fall Chinook, Purdy Creek	1988	3,800,000	3,291,056	NA	
(On-Station,		1989	3,800,000	4,143,300	NA	
George Adams)		1990	3,800,000	1,831,100	NA	1
		1991	3,800,000	5,603,958	NA	
		1992	3,800,000	350,089	NA	1
	Finch Creek Fall Chinook	1988	NA	4,750,965	NA	
		1989	NA	5,635,200	NA	
		1990	NA	832,600	NA	
	Deschutes Fall Chinook	1990	NA	1,363,900	NA	
		1992	NA	3,576,823	NA	3
	Fall Chinook, McKernan	1988	NA	240,179	NA	
		1989	NA	40,000	NA	3
	Purdy Creek Coho	1988	300,000	310,700	NA	
		1989	550,000	300,200	NA	2
		1990	550,000	307,300	NA	2
		1991	550,000	304,197	NA	2

9 Three year average; 1989,1991, and 1992.

10 Three year average; 1989-1991.

11 Four year average; 1988,1989, 1990, and 1992.

12 Four year average; 1989-1992.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases (On-station at George Adams)	Purdy Creek Coho Subyearling	1988	0	875,600	NA	
		1989	500,000	0	NA	4
		1990	500,000	810,000	NA	
		1991	500,000	668,000	NA	
	Capilano Coho	1988	110,000	32,200	NA	4
		1991	110,000	81,646	NA	4
	Baker Coho	1989	110,000	77,800	NA	4
		1990	110,000	98,300	NA	4
	Chum, Purdy Creek	1988	5,000,000	5,075,200	NA	
		1989	5,000,000	5,014,600	NA	
		1990	5,000,000	0	NA	1,4,5
		1991	5,000,000	5,003,100	NA	
		1992	5,000,000	5,012,000	NA	
Off-Station Releases from George Adams	Fall Chinook, Purdy Creek	1988	500,000	555,000	NA	
		1989	500,000	500,100	NA	
		1990	500,000	499,800	NA	
		1991	500,000	1,947,100	NA	
	Finch Creek Fall Chinook	1989	NA	672,200	NA	
		1991	NA	99,800	NA	
	Deschutes Fall Chinook	1992	NA	82,000	NA	
	Purdy Creek Coho	1988	250,000	85,000	NA	4
	Finch Creek Chum	1989	6,750,000	6,824,000	NA	
		1990	7,125,000	0	NA	5
		1991	7,125,000	7,893,000	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Off-Station Releases from George Adams	Finch Creek Chum	1992	7,125,000	8,963,800	NA	
On-Station Releases from McKernan	Deschutes Fall Chinook	1989	NA	40,000	NA	
	Chum	1988	10,000,000	10,064,100	NA	
		1989	10,000,000	9,790,700	NA	
		1990	10,000,000	4,496,600	NA	1,4
		1991	10,000,000	10,651,000	NA	
		1992	10,000,000	10,573,200	NA	
Off-Station Releases from McKernan	Deschutes Fall Chinook	1989	NA	233,000	NA	
	Fall Chinook, Yearling	1990	NA	74,000	NA	
	Chum	1992	NA	272,500	NA	
On-Station Releases Johns Creek Hatchery	John's Creek Early Chum	1988	2,000,000	1,975,000	NA	6
		1989	2,000,000	1,956,000	NA	6
		1990	2,000,000	1,958,900	NA	6
		1991	2,000,000	1,382,700	NA	6
Transfers to Tribal Facilities (Eggs/Fish)	Purdy Creek Coho	1988	500,000	492,000	NA	
		1989	500,000	500,000	NA	
		1990	500,000	500,000	NA	
		1991	500,000	447,800	NA	
		1992	500,000	0	NA	7
	Finch Creek Chum	1988	2,000,000	750,000	NA	7
		1989	2,000,000	2,000,000	NA	
		1990	2,000,000	0	NA	5,7

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Tribal Facilities (Eggs/Fish)	Finch Creek Chum	1991	2,000,000	2,000,000	NA	
		1992	2,000,000	2,000,000	NA	
	Deschutes Fall Chinook	1989	NA	1,509,250	NA	7
		1990	NA	80,000	NA	7
		1991	NA	49,200	NA	7
Transfers Within WDFW (Eggs/Fish) (George Adams)	Finch Creek Fall Chinook	1988	200,000	0	NA	
		1989	200,000	188,300	NA	
		1990	200,000	45,700	NA	
		1991	215,000	1,986,400	NA	7
		1992	200,000	0	NA	7
	Deschutes Fall Chinook	1988	12,050,000	9,220,700	NA	7,8
		1989	9,950,000	1,000,000	NA	7,8
		1990	8,170,000	6,893,300	NA	7,8
		1991	9,885,000	3,309,220	NA	7,8
		1992	9,885,000	9,021,510	NA	
	Finch Creek Chum	1988	0	5,997,800	NA	7
		1989	22,000,000	13,065,400	NA	7,8
		1990	10,000,000	15,127,500	NA	7
		1991	10,000,000	18,165,200	NA	7
		1992	10,000,000	6,924,600	NA	7,8
	Johns Creek Early Chum	1988	0	1,975,000	NA	7
		1989	2,000,000	1,956,000	NA	
		1990	2,000,000	1,958,900	NA	
		1991	2,000,000	1,382,700	NA	6
	Baker Coho	1990	NA	180,000	NA	7

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers Within WDFW (Eggs/Fish) (George Adams)	Purdy Creek Coho	1990	NA	50,000	NA	7
	Elson Chum	1988	NA	500,000	NA	7
	Soos Creek Chinook	1989	NA	1,000,000	NA	7
	Finch Creek Pink	1991	NA	310,000	NA	7
(From McKernan)	Deschutes Fall Chinook	1988	700,000	1,018,390	NA	
		1989	11,940,000	17,790,400	NA	7,9
		1990	11,940,000	7,444,300	NA	7,8
		1991	11,940,000	12,204,100	NA	
		1992	11,940,000	14,658,250	NA	
	Chum	1988	0	8,940,400	NA	7
		1989	0	0	NA	
		1990	10,800,000	0	NA	7,8
		1991	10,800,000	3,189,400	NA	7,8
		1992	10,800,000	402,600	NA	7,8
Transfers to Co-ops (Eggs/Fish)	Purdy Creek Coho	1988	160,000	132,400	NA	7
		1989	150,000	65,000	NA	7
		1990	168,000	95,770	NA	7
		1991	191,000	1,048,000	NA	7
		1992	321,000	11,000	NA	7
	Finch Creek Chum	1988	1,260,000	2,560,000	NA	7
		1989	650,500	195,000	NA	7,8
		1990	1,400,500	0	NA	7
		1991	1,821,000	609,000	NA	7,8
		1992	3,236,000	1,455,000	NA	7,8
	Chum, McKernan	1988	NA	50,000	NA	7
		1990	NA	500	NA	7

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to	Chum, McKernan	1991	NA	1,448,000	NA	7
Co-ops (Eggs/Fish)		1992	NA	125,000	NA	7
	Chum, Purdy Creek	1991	NA	4,080	NA	7
		1992	NA	630,000	NA	7
	Deschutes Fall Chinook	1988	115,000	122,522	NA	
		1989	70,000	0	NA	7
		1991	20,000	20,000	NA	
		1992	20,000	135,102	NA	7
	Finch Creek Fall Chinook	1989	40,000	0	NA	7,8
		1990	40,000	0	NA	7,8
		1991	50,000	674,600	NA	7
		1992	40,000	0	NA	7,8
	Fall Chinook, Purdy Creek	1990	NA	120	NA	7
		1991	NA	157,045	NA	7
		1992	NA	30,548	NA	7
Adults Passed	John's Creek Early Chum	1988	1,500	700	NA	10
Upstream		1989	5,000	0	NA	10
		1990	1,500	590	NA	10
		1991	5,000	400	NA	10
Smolt to Adult	Purdy Fall Chinook	Avg.	1.0%	0.7%[13]	0.5-0.9%	
Survival	Purdy Coho	Avg.	10.0%	2.8%	1.9-9.2%	11
	Baker Coho	Avg.	5.0%	1.1%	0.7%; 1.4%	11
	Chum	Avg.	1.0%	ND	ND	12

[13] Three years of data; 1985-1987.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Smolt to Adult	McKernan Chum	Avg.	1.0%	ND	ND	12
Survival	RSI Chum	Avg.	1.0%	ND	ND	12
	John's Creek Chum	Avg.	1.0%	ND	ND	12

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts	Fall Chinook	Yes	8.0%	7.6-8.4%	
CV<10%	Coho	Yes	10.8%	7.4-13.2%	
	Baker Coho	Yes	ND	ND	12
	Chum	Yes	NA	NA	12
	McKernan Chum	Yes	NA	NA	12
	RSI Chum	Yes	NA	NA	12
	Johns Cr. Chum	Yes	NA	NA	12
Acclimation	Fall Chinook	Yes	Partial	Partial	13
	Coho	Yes	Yes	NA	
	Baker Coho	Yes	Yes	NA	
	Chum	Yes	No	NA	13
	McKernan Chum	Yes	Yes	NA	
	RSI Chum	Yes	Yes	NA	
	Johns Cr. Chum	Yes	Yes	NA	
Volitional Release	Fall Chinook	Yes	Yes	Partial	14
	Coho	No	No	NA	
	Baker Coho	No	No	NA	
	Chum	No	No	NA	
	McKernan Chum	Yes	Yes	NA	
	Johns Cr. Chum	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	Yes	NA	
	Coho	Yes	Yes	NA	
	Baker Coho	NA	NA	NA	
	Chum	Yes	Yes	NA	
	McKernan Chum	Yes	Yes	NA	
	Johns Cr. Chum	Yes	Yes	NA	
Spawning Pop. >500	Fall Chinook	Yes	1,397	204-2,726	
	Coho	Yes	1,984	1,230-2,631	
	Baker Coho	Yes	NA	NA	
	Chum	Yes	3,574	570-7,617	
	McKernan Chum	Yes	3,566	1,265-7,821	
	Johns Cr. Chum	Yes	2,057	1,652-2,705	
Spawning Ratio Male:Female	Purdy Chinook	>0.33	0.9	0.7-1.0	
	Purdy Coho	>0.33	1.0	0.9-1.1	
	Purdy Chum	>0.33	0.9	0.7-1.2	
	John's Crk E Chum	>0.33	1.1	1.0-1.4	
	McKernan Chum	>0.33	0.9	0.8-1.2	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures		Hatchery Goal	Four-Year Average	Range	Comments
TSS Effluent Composite	George Adams	5 mg/L	-0.47	-6.6-3.0	
	McKernan	5 mg/L	-0.05	-5.4-1.0	
TSS Max Effluent	George Adams	15 mg/L	1.23	-2.4-12.8	
	McKernan	15 mg/L	0.35	-8.0-2.8	
SS Effluent	George Adams	0.1 ml/L	0.01	0.0-0.15	
	McKernan	0.1 ml/L	0	0	
TSS PA Effluent	George Adams	100 mg/L	NA	NA	15
	McKernan	100 mg/L	NA	NA	15
SS PA Effluent	George Adams	1.0 ml/L	NA	NA	15
	McKernan	1.0 ml/L	NA	NA	15
Downstream Temp (°F)	George Adams	Varies	51.3°	47.5-56.1°	
	McKernan	Varies	48.0°	46.9-48.2°	
Maximum Temp	George Adams	<63°F	60.1°	48.0-60.1°	
	McKernan	<63°F	55.0°	48.0-55.0°	
Minimum Temp	George Adams	>32°F	34.0°	34.0-43.0°	
	McKernan	>32°F	37.9°	37.9-44.1°	
Downstream DO(mg/L)	George Adams	>8.0	9.7	8.5-10	
	McKernan	>8.0	8.5	6.0-10.0	
Continuous Monitoring of Other Parameters		Yes	NA	NA	

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	16
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—George Adams Hatchery and Satellites

1. Poor marine survival or high harvest rates reduce the number of returning adults and subsequent egg take.

2. Low survival of fry/fingerlings and inventory shortages due to heavy bird predation and in some years to cold water disease. Bird netting was installed after 1991 to curb predation by numerous species of birds.

3. Released as unfed fry.

4. Shortage of eggs or fish of this stock.

5. Shortfalls in programmed number of eggs or fish of this stock at this hatchery are made up with eggs or fish from other sources.

6. Lower than normal egg to fry survival due to transporting of unfertilized or newly fertilized eggs from Shelton Hatchery to George Adams Hatchery.

7. Change in program after established goals in Future Brood Document.

8. Either eggs or fish were unavailable, or they were incubated, reared at, or transferred from, another hatchery to meet program goals.

9. At McKernan rather than George Adams.

10. Represents only those fish hand counted above weir. Does not include fish passing upstream uncounted.

11. Poor marine survival during El Nino events in 1991-1993.

12. Lack of current continuous coded-wire tag data base.

13. Fish are reared primarily on well water. Some rearing ponds use Purdy Creek water for rearing.

14. Only about one-third of this production is reared on well water for the entire rearing period. In the

large rearing pond, where two-thirds of the chinook production is reared, well water is used to supplement creek water. Volitional release occurs from this pond.

15. No pollution abatement pond.

16. Lack of sufficient funding to provide adequate office support staff.

Stock Profile:

Fall Chinook: Fall chinook released at George Adams originated from Hoodsport Hatchery. The current stock at George Adams has been greatly influenced from additional transfers of Puget Sound and Finch Creek chinook. There has not been three contiguous generations of releases of progeny from adults returning to the hatchery. **Stock Description: Introduced, non-adapted.**

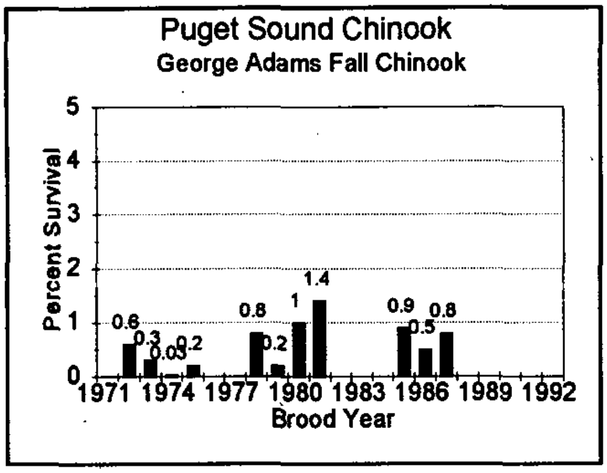
Purdy Creek Coho: The ancestral lineage for this stock is unclear. The stock was established with Hood Canal and Quilcene stock coho, and possibly with local coho. The Hood Canal coho originated from Dungeness and possibly Quilcene. There were also plants of Soos Creek and wild stock coho fry in the first years of the hatchery's operation. Purdy Creek stock has been sustained at the hatchery since initial operation. **Stock Description: Introduced, adapted.**

Baker or Capilano Coho: These stocks were brought into the Hood Canal region to provide an early retuning coho. They have been released at this hatchery for only a few years. **Stock Description: Introduced, non-adapted.**

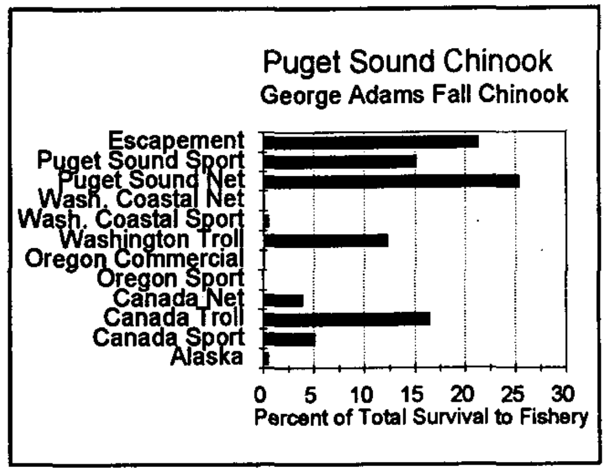
Purdy Creek/ McKernan Chum: Chum released at both George Adams and McKernan originated from Hoodsport Hatchery (Finch Creek). McKernan Hatchery has released progeny of adults returning to the hatchery but a large percentage of the release in most years consists of Finch Creek stock. **Stock Description: Introduced, non-adapted.**

STOCK STATUS PROFILE FOR: George Adams Fall Chinook

Survival:



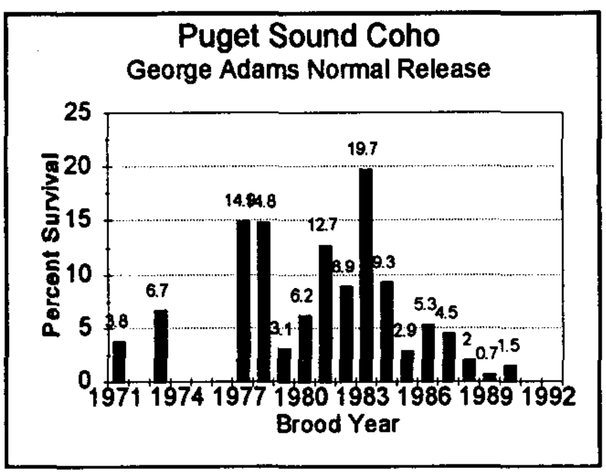
Distribution:



Three year Average Survival: 0.73%
Catch to Escapement Ratio: 4.5 : 1

STOCK STATUS PROFILE FOR: Purdy Creek Coho

Survival:



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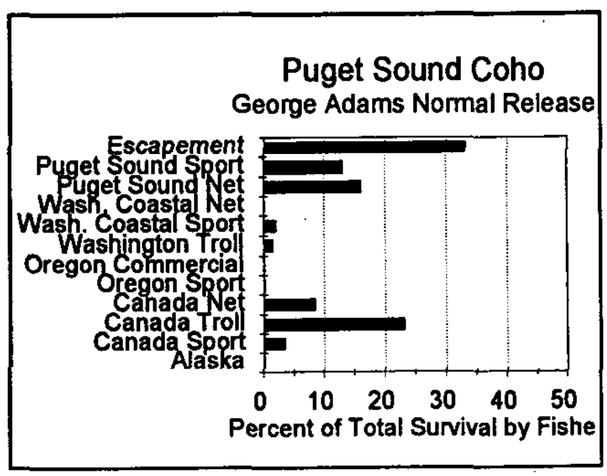

Five Year Average Survival: 2.8%
Catch to Escapement Ratio: 3.0 : 1

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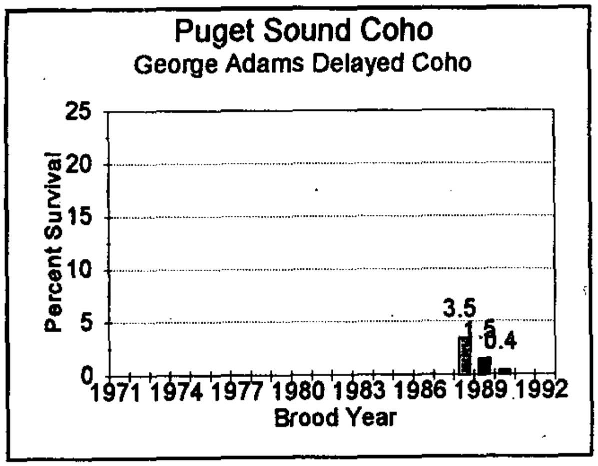
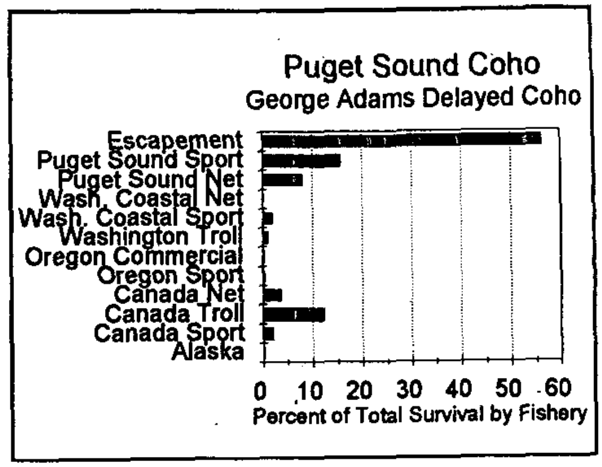
STOCK STATUS PROFILE FOR: George Adams Delayed Release Coho

Survival:



Distribution



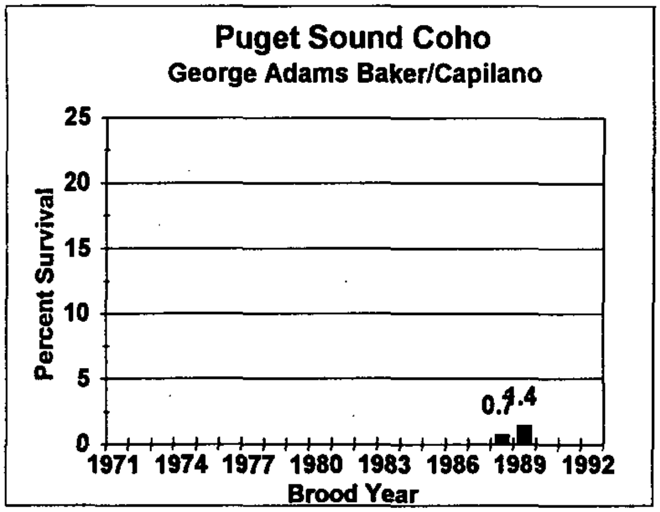
Five Year Average Survival: 1.8%

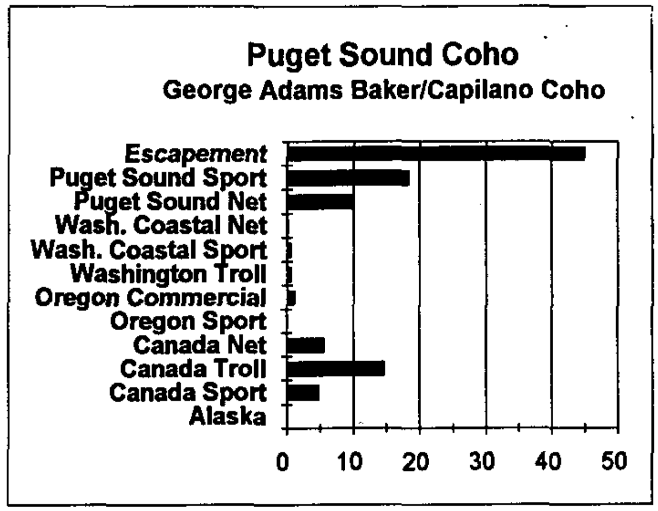
Catch to Escapement Ratio: 0.75: 1

STOCK STATUS PROFILE FOR: Baker River or Capilano Coho

Survival:

Distribution:





Two Year Average Survival: 1.1%

Catch to Escapement Ratio: 2.2:1

STOCK STATUS PROFILE FOR: Purdy Creek/ McKernan Chum

Five Year Average Survival: No data available.

Catch to Escapement Ratio: No data available.

STOCK STATUS PROFILE FOR: Johns Creek Early (summer) Chum

Five Year Average Survival: No data available.

Catch to Escapement Ratio: No data available.

Eells Spring Hatchery

Introduction

Eells Spring Hatchery is located on Hunter Creek, a tributary of the Skokomish River, approximately four miles upstream of the George Adams Hatchery. The hatchery was constructed in 1946-1947 and is funded through State Wildlife funds. Additional funding is provided by the Shelton Nimrod Club which pays for feed to rear approximately 4,000 rainbow trout, and during 1994-95, Tacoma City Light will provide approximately $1400.00 toward feed costs to rear Hood Canal coastal cutthroat trout.

The hatchery consists of 112 shallow trough incubators with an eyeing capacity of 2 million eggs, 8 concrete raceways (10' x 85'), 12 round concrete rearing ponds (40' diameter), and one large (1.75 acres) and one medium size (1.25 acres) earthen pond. Water is supplied by four springs with a combined flow of 22 cfs. In recent years a declining water table has reduced flow potential to the hatchery during some periods.

Purpose

The Eells Spring Hatchery was built to rear, and plant winter steelhead smolts in various local rivers and streams. The hatchery rears various species of trout for planting into local lakes or transfer to other hatcheries for additional rearing.

Goals

1. Produce winter steelhead for planting in various western Washington rivers.
2. Produce Hood Canal anadromous cutthroat for planting into Lake Cushman.
3. Produce various species of trout to help supply lowland lakes stocking programs or cooperative rearing programs.

Objectives

Objective 1: 1993 Hatchery Production

1. Rear 200,000-220,000 winter steelhead for outplanting to various rivers in western Washington..
2. Rear 800,000 rainbow trout fry for stocking of local lakes.
3. Rear 445,000 one-year-old, and 4,000 two-year-old rainbow trout catchables..
4. Rear 80,000 anadromous Hood Canal cutthroat for stocking in Lake Cushman.
5. Maintain anadromous cutthroat broodstock to supply Lake Cushman program, and for later stocking in area lakes after spawning.
6. Rear 100,000-150,000 resident cutthroat trout for stocking of local lowland and alpine lakes.
7. Rear and release 500,000 kokanee for stocking in local lakes and reservoirs.
8. Rear 25,000 eastern brook trout for stocking in local lakes.
9. Rear and plant 25,000 rainbow trout fry in local lowland and alpine lakes.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, steelhead, and trout producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

No adult fish are captured at this facility. Captive broodstock (anadromous coastal cutthroat) are maintained at the facility for two and three years. At three years of age the broodstock are spawned and then stocked into local lakes to provide trophy fisheries.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Steelhead are reared until smolts and then transported to local rivers for stocking. Prior acclimation to receiving water is not done. Trout are reared under standard conditions and planted into local lakes or ponds as fry, or at legal retention size (catchables). Acclimation to receiving waters prior to stocking is not done.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

No adult fish are trapped. Captive broodstock are maintained until three-years-old when they are spawned and then outplanted to local lakes to provide fishing opportunity.

Spawning Protocol

Only captive broodstock are spawned at this facility. Gametes from 15 females are pooled and fertilized with sperm pooled from 15 males. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

<u>Winter Steelhead</u>
1. Bogachiel Stock
2. Any Chambers Creek derivative

<u>Cutthroat Trout (anadromous)</u>
1. Hood Canal (for Lake Cushman mitigation)

<u>Cutthroat trout, Rainbow trout, Eastern Brook trout, and Kokanee salmon</u>
1. Any suitable strain or stock

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for complete Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES) as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Eells Spring Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month and once per month on pollution abatement pond. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week and influent and effluent samples from pollution abatement pond once per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Springs: Due to low rainfall over the past few years the flows in the springs feeding the hatchery have decreased.

Hatchery Water Temperature Profile

No data available. Hatchery is fed by springs which typically have a fairly constant temperature throughout the year.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Hatchery records pertaining to fish production, feed or antibiotic usage, fuel consumption etc., are kept in a consistent manner employing standard formats to provide for long term documentation of hatchery activities and monitoring of performance.

Development and Review of Brood Documents

Former Wildlife hatcheries were not included in the brood document development and review process. Currently, WDFW is reviewing rearing programs at these facilities for future inclusion in the brood document process.

In-season Communication for Fish and Egg Transfers

Communication with appropriate entities occurred each year to facilitate basin-wide production goals at these facilities.

Performance Summaries—Eells Spring Hatchery

Objective 1: Hatchery production

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adult Capture	NA	NA	NA	NA	1
Adult Prespawning Survival	NA	NA	NA	NA	2
Eggtake	Hood Canal ACT	NA	341,440	209,616-681,210	
Fecundity	NA	NA	NA	NA	
Eyed Egg-to-Fry Survival	Goldendale RBT	85%	93.5%	90.6-96.1%	
	S. Tacoma RBT	85%	82.0%	80.7-83.8%	
	Mt. Whitney RBT	85%	93.8%[1]	83.8-99.0%	
	Spokane RBT	85%	96.3%	96.3%	
	Creston NFH ELRB	85%	92.8%	92.8%	
	Hood Canal RCT	85%	77.1%	50.5-83.6%	3
	Tokul Cr. RCT	85%	86.9%	58.1-97.4%	
	Twin Lakes RCT	85%	95.5%	89.5-98.1%	
	Ford EBT	85%	95.6%	93.5-97.9%	
	Lk. Whatcom KOK	85%	96.0%	90.7-99.4%	
	Rimrock Lk. KOK	85%	95.3%	95.3%	
	Summit Lk. KOK	85%	78.4%	75.1-90.6%	

1 Four year average, 1988-1991.

Objective 1: (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Survival (Fry to Plant or Transfer)	Goldendale RBT	85%	71.5%[2]	67.2-78.5%	4,5
	S. Tacoma RBT	85%	74.8%	66.9-86.3%	4,5
	Mt. Whitney RBT	85%	78.4%	73.1-83.1%	
	Spokane RBT	85%	91.3%	86.9%; 95.7%	
	Creston NFH ELRB	85%	74.0%	74.0%	
	Hood Canal ACT	85%	71.3%[3]	59.1-79.3%	4,5
	Tokul Cr. RCT	85%	91.3%	83.4-96.2%	
	Twin Lk. RCT.	85%	92.9%	84.5-96.2%	
	Ashley Cr. ACT	85%	90.3%	80.3%; 98.8%	
	Ford EBT	85%	94.9%	91.9-98.5%	
	Tokul Cr. GT	85%	100%	100%	
	Lake Whatcom KOK	85%	86.4%	81.8-97.4%	
	Rimrock Lk. KOK	85%	49.6%	26.1%; 88.0%	
	Summit Lk. KOK	85%	60.1%	43.6%; 76.5%	
	Bogachiel WSH	85%	75.8%	65.8-99.1%	5,6
	Quinault WSH	85%	75.0%	75.0%	
Plants	Goldendale RBT	NA	814,820	292,799-1141.8K	7,13
	S. Tacoma RBT	NA	464,879[4]	418,026-562,729	7,13
	Mt. Whitney RBT	NA	23,559	10,962-56,708	7,13
	Spokane RBT	NA	403,857	135,697; 672,017	7,13
	Hood Canal ACT	NA	148,607	4,908-352,050	
	Tokul Cr. RCT	NA	139,179	107,318-183,385	7,13
	Twin Lakes RCT	NA	10,530	7,936-15,377	7,13
	Ashley Cr. ACT	NA	16,317	13,840; 18,793	
	Ford EBT	NA	35,392	0-50,031	
	Tokul Cr. GT	NA	240	240	
	Lake Whatcom KOK	NA	434,958	200,055-605,552	7,13
	Rimrock Lk. KOK	NA	119,247	112,968; 125,526	
	Summit Lk. KOK	NA	39,092	12,160; 66,024	
	Bogachiel WSH	NA	217,505[5]	207,200-237,471	13
	Quinault WSH	NA	25,833	0; 51,665	

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2 Four year average, 1988-1990, and 1992.

3 Three year average, 1988, 1989, 1991.

4 Four years of data, 1988-1991 broods.

5 Three broods: 1989,'91,'92.

Objective 1: (cont.)

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Transfers Out (eggs/fish)	Goldendale RBT	NA	64,209	0-129,684	8,13
	S. Tacoma RBT	NA	8,778	0-17,864	8,13
	Creston NFH ELRB	NA	107,300	107,300	8
	Hood Canal ACT	NA	392	0-1,568	8
	Ashley Cr. ACT	NA	508	0-1,015	8
	Ford EBT	NA	7,694	0-25,235	8
	Bogachiel WSH	NA	1,339	0-4,018	8,13
	Quinault WSH	NA	31,050	0; 62,100	8
Adults Passed Upstream	NA	NA	NA	NA	
Percent Survival Smolt to Adult	NA	NA	NA	NA	

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV less than 10%	WSH-Bogachiel or derivative	NA	NA	NA	
Acclimation	WSH-Bogachiel Trout Spp.	No No	No No	No No	
Volitional Release	NA	NA	NA	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	NA	NA	NA	NA	
Spawning Pop. >500	ACCT-captive brood	No	No	No	
Spawning Ratio Male:Female	ACCT-captive brood	1.0	1.0[6]	1.0	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

6 Some males may be spawned several times with different females thus true 1:1 spawning is not achieved.

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Year Average	Range	Comments
TSS Effluent Composite	5 mg/L	0.40	0.04-1.15	
TSS Max Effluent	15 mg/L	1.25	0.04-6.29	
SS Effluent	0.1 ml/L	0.02	0.0-0.10	
TSS PA Effluent	100 mg/L	NA	NA	9
SS PA Effluent	1.0 ml/L	NA	NA	9
Downstream Temp(°F)	Varies	52.0°	48.0-52.9°	
Maximum Temp	<63°F	NA	NA	10
Minimum Temp	>32°F	NA	NA	10
Downstream DO(mg/L)	>8.0	10.3	10.0-10.5	
Continuous Monitoring of Other Parameters	Yes	NA	NA	11

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	No	12
Develop and Review Equil. Brood Doc.	All	Yes	No	No	13
Develop and Review Future Brood Doc.	All	Yes	No	No	13
Develop and Review Current Brood Doc.	All	Yes	No	No	13

Constraints/Comments- Eells Spring Hatchery

1. Adults are not captured at this facility.

2. Records not maintained on pre-spawning survival of captive broodstock.

3. Lower than normal survivals on captive brood fish due to rearing in seawater net pens until maturity. Egg viability appears to be reduced under this scenario.

4. Low dissolved oxygen occurs during low flow periods. This stresses fish and makes them more susceptible to disease. Low flows occur from November-March.

5. Bacterial gill disease is becoming more prevalent at this hatchery.

6. Heavy predation by birds and otters occurs in the two large rearing ponds from November through March.

7. Each year, fish management biologists determine the number of resident trout to plant in lakes within each region of the state. They also determine at what size and time of year these fish should be planted. This number is termed an allotment. For the hatcheries within the region to supply each allotment, they utilize one or more of the four available domestic rainbow trout broodstocks, and the different water temperature regimes unique to each hatchery. Using both the different times of year that fry are available and the different growth rates achievable at each hatchery due to water temperature, hatcheries can produce the requested sized fish at the appropriate time of year. This hatchery is used to help meet these allotments.

8. Transfers at this hatchery are not programmed. In some years the hatchery has room to rear other hatchery's fish for a short period, but these short term rearing assignments are not mandatory, thus hatchery has no transfer goal.

9. No pollution abatement pond at this hatchery.

10. Hatchery is supplied with near constant temperature spring water.

11. Not sampled at this hatchery.

12. Lack of adequate funding to provide sufficient office support staff.

13. Former Department of Wildlife hatcheries were not subject to programming under the brood

document format. Thus comparison of hatchery goals with programming goals cannot be made in years prior to 1994.

Stock Profile:

South Tacoma Rainbow Trout: This stock apparently originated from a commercial fish farm in Meeder, Utah. The origin of the Utah strain is somewhat hazy, but may have been from the McCloud River, Shasta County, California. Although originally a spring spawning strain, through manipulation of both warmer rearing temperatures and selection of early spawners, these fish now spawn predominantly between August and October with peak spawning in September. This shift in spawn timing was done to provide catchable size trout for planting into lowland lakes prior to the opening of the general trout season in April, and fingerling trout plants in May for the next trout season. This strain has been heavily selected for spawn timing and coloration. In recent years, egg mortality appears to be increasing, indicating a possible genetic bottleneck.

Goldendale Rainbow Trout: This strain originated in 1948 from the interbreeding of Yakima (a mixture of McNott and Meeder stocks) and Meeder (see S. Tacoma strain) strains of rainbow trout. This strain was selected for early spawning, large size, high fecundity, and overall color and vigor. Fish spawn from October to February with peak egg production in November and December.

Mt. Whitney Rainbow Trout: Eggs from this strain were obtained in June, 1962 from the Mt. Whitney Hatchery at Independence, California. The strain is apparently a mixture of Sacramento River rainbow, Klamath River steelhead, and possibly s small contribution of Lahonton cutthroat trout. Spawning occurs from December through March with peak spawning in January. This strain produces a deep bodied fish with a relatively small head that is ideally suited to alpine lakes because it grows well, over-winters well, and reproduces naturally where conditions allow.

Spokane Rainbow Trout: This stock originated from the Cape Cod Trout Company of Wareham, Massachusetts. Approximately 2.3 million eggs were purchased and shipped to Spokane Hatchery in September, 1942. The Cape Cod Trout Company obtained eggs from the McCloud River in 1882. At Spokane Hatchery, selection for size, fecundity and appearance took place over several generations. Although not purposely interbred with other stocks or strains of rainbow, rainbows from the Little Spokane River may have entered brood holding ponds and were mated with captive brood. Spawning of this strain takes place in November and December.

Hood Canal Anadromous Coastal Cutthroat: This stock consists of anadromous cutthroat from late entering stocks captured in Hood Canal. Broodstock was kept captive in saltwater pens at the National Marine Fisheries Service's Aquaculture Experimental Station, near Manchester, WA. More recently this broodstock has been transferred to freshwater. Spawning takes place in February and

March.

Tokul Creek Resident Cutthroat: This strain of resident cutthroat was derived from wild broodstock spawning in tributary creeks of Lake Whatcom. Although this strain may have some influence from Lake Chelan cutthroat, it maintains the morphology of coastal cutthroat strains. The parent stock spawned in December -March but the current captive brood spawns primarily in January and February. The captive brood was "revitalized" in the early 1980's with wild cutthroat from Lake Whatcom. Broodstock is currently maintained at the Tokul Creek Hatchery.

Twin Lakes Resident Cutthroat: This resident cutthroat is thought to be an intermontane (i.e., between the crests of the Cascade and Rocky Mountains) strain very similar to "Montana west slope" cutthroat. The parent stock may have originated from either the Lake Wenatchee system or Lake Chelan. The founding "stock" of Twin Lakes cutthroat are trapped at Twin Lakes (alpine lakes located near Leavenworth, WA) . There have been no introductions of other stocks to Twin Lakes thus the genetic integrity of the stock has been maintained for over 70 years. Spawning of this stock occurs at ice-out in June.

Ford Eastern Brook Trout: Eastern brook trout were introduced into several Washington lakes in 1894 by the U.S. Bureau of Fisheries. Subsequent plantings occurred near Wilbur and Republic in eastern Washington. Most of the early plantings were from stock obtained from the Paradise Brook Trout company, Henryville, Pennsylvania. By 1913 most of the eggs used in Washington were from established populations. The Ford stock of eastern brook trout originated from Owhi Lake on the Colville Indian Reservation and by 1964 were part of a captive broodstock maintained initially at the Spokane Hatchery and later transferred to the Ford Hatchery (located near Spokane) in 1966. The parent stock originated from 3,000 individuals and has not been mated with other stocks or strains of brook trout.

Lake Whatcom Kokanee: This stock has remained virtually unchanged since the first egg taking operations in 1915. This stock enter Brannion Creek, a tributary of Lake Whatcom, in October and November which are also the primary months of spawning. An egg taking station at Lake Whatcom takes several million eggs and releases approximately 2.5 million fry back into the lake to maintain the stock. This stock has been used extensively throughout the state and in some lakes may be mixed with other Kokanee stocks. This stock is best described as a native stock only in the Lake Whatcom watershed.

Chambers Creek Winter Steelhead: See Chambers Creek HOPPS for information on this stock.

Hoodsport Hatchery

Introduction

Hoodsport Hatchery is located on Finch Creek, a tributary of Hood Canal, in the town of Hoodsport. The hatchery began operation in February 1953. Hoodsport Hatchery is unique among WDFW hatcheries, because it can use either freshwater or seawater for rearing. Thirteen standard ponds, one large rearing pond, and a combination rearing and adult holding pond (Zuider Zee) are available for rearing. Release capacity for the facility is 15 to 17 million fish, the majority of which are chum fry. Vertical incubators are used for incubation. Hatching capacity is approximately 11 million fry. Freshwater is supplied by gravity flow from Finch Creek and seawater from pumps taking water from Hood Canal, directly offshore of the hatchery.

The hatchery has one satellite facility, the Sund Rock Net Pens. There are four Viking net pens capable of rearing and releasing 200,000 yearling fall chinook. However, the net pens are permitted to rear only 150,000 (20,000 pounds) of fish under the NPDES.

Purpose

The hatchery was built to increase production of salmon in the Hood Canal region. The hatchery currently operates to provide opportunity for harvest of several different species, including fall chinook, coho (summer type), chum, pink, and Soleduck spring chinook. The hatchery is also used for an egg bank program to increase the production of two stocks of spring chinook which are currently in decline (Dungeness and Quilcene) in their respective watersheds.

All production at this hatchery is agreed to under the Hood Canal Management Plan which is a joint agreement between the WDFW and the Point No Point Treaty Council.

Because the hatchery has the capability to rear fish in freshwater, brackish water, or seawater, it has been used extensively in a wide variety of research projects.

Goals

1. Maintain the Quilcene and Dungeness spring chinook egg bank programs.

2. Produce spring and fall chinook, chum, pinks, and coho for the N.E. Pacific and Puget Sound fisheries.
3. Provide fall chinook, chum, and pink eggs to various WDFW hatcheries, tribal, and cooperative rearing programs.
4. Provide Baker or Capilano stock coho for the Hood Canal and George Adams rearing programs.

Objectives

Objective 1: 1993 Hatchery Production

<u>Fall Chinook</u>
Release 800,000 1992 brood Finch Creek stock subyearlings.
Release 200,000 1991 brood Finch Creek stock yearlings at Sund Rock Net Pens.
Collect and incubate 2,640,000 eggs from fall chinook returning in 1993 to support future production and for transfer of 700,000 eggs to the Skokomish Tribe and 990,000 eggs to cooperative rearing projects.

<u>Spring Chinook</u>
Release 100,000, 1991 brood Quilcene stock spring chinook yearlings.
Release 100,000, 1991 brood Soleduck stock spring chinook yearlings.
Release 40,000, 1991 brood Dungeness spring chinook yearlings.
Collect as many eggs of each spring chinook stock as possible from adults returning in 1993.
Rear 100,000, 1992 brood Quilcene stock spring chinook for release in 1994.
Rear 100,000, 1992 brood Soleduck stock spring chinook for release in 1994.
Rear 40,000, 1992 brood Dungeness stock spring chinook for release in 1994.

<u>Chum</u>
Rear and release 15 million 1992 brood chum salmon on-station.
Collect at least 29,900,000 eggs for various rearing programs in the Hood Canal region from adults returning in 1993.

<u>Coho</u>
Release 40,000, 1991 brood Capilano stock coho.
Collect 180,000 eggs from Baker River coho adults returning in 1993.
Rear and transfer, 110,000 1992 brood Baker River coho to George Adams Hatchery.

Pinks

Collect 1,180,000 eggs from adults returning in 1993 and release 1,000,000 fry in 1994.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout, and steelhead producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Hoodsport Hatchery is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to cooperative rearing programs. A permanent weir diverts returning fish into the "Zuider Zee" holding pond where they are held to maturity. In years when there are inadequate amounts of freshwater to the hatchery, the holding pond will be supplied with a mixture of fresh and saltwater.

Fall Chinook: Fall chinook return to Finch Creek from August through October with peak spawning in October.

Spring Chinook: Three stocks of spring chinook return to Hoodsport Hatchery between April and July, with the peak return in mid- to late-May. Peak spawning occurs in mid-September. Separation of these stocks does not occur until coded-wire tags are deciphered when the fish are killed for spawning, which makes return times for each stock difficult to ascertain. External tagging with numbered visible tags could aid in determining run-timing for each stock by comparing these tags with the coded-wire tag information.

Baker River/ Capilano Coho: These coho return to the hatchery in late August and continue through mid-November. Spawning occurs primarily in December.

Chum: This stock is considered a normal timed chum, and returns from late-October into December. Spawning occurs from early November to December with the peak around Thanksgiving.

Pinks: This stock returns from July to September in odd years only. Spawning occurs from September to October with the peak in late September.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas. Fish planted off-station often do not receive prior acclimation to receiving waters.

Fall Chinook: Fall chinook are reared to at least 80 fish/pound and released on-station in late May or early June. These fish are acclimated to saltwater prior to release. Yearling chinook are transferred from the hatchery to the Sund Rock Pens where they are reared for several months prior to release in early May at 5 fish/pound.

Spring Chinook: All three stocks of spring chinook are reared and released as yearlings in April and May at 5 fish/pound. Fish are acclimated to saltwater prior to release.

Baker River/ Capilano Coho: Fish are reared in freshwater and then released in May and June as 15 fish/pound yearlings. These fish are acclimated to saltwater prior to release.

Chum: Chum are reared and released from April to May at sizes ranging from 800-350 fish/pound. Fish are acclimated to seawater prior to release.

Pinks: Pinks are reared to a size of about 500 fish/pound and released in late March or early April.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

Separation between spring chinook and fall chinook is accomplished using a combination of return timing and coded wire tags. Fish arriving by July are considered "springs", and those arriving after September are considered falls. Separation among spring chinook stocks is accomplished by deciphering coded wire tags prior to fertilizing eggs, thus ensuring that hybrids of the three spring chinook stocks do not occur. (Note: each stock of spring chinook is tagged at the 100% level to ensure stock separation at spawning). The effective population size for chinook, coho, chum, and pink salmon (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Fall Chinook
1. Finch Creek (Hood Canal) and George Adams
2. Skokomish
3. Port Gamble

Spring Chinook
1. Quilcene
2. Soleduck
3. Dungeness (only from Hood Canal returns)

Baker/ Capilano Coho
1. Baker Coho from Hood Canal
2. Capilano Coho from Hood Canal

Chum
1. Finch Creek
2. George Adams or Mckernan

Pinks
1. Hood Canal

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

<u>Therapeutic and Prophylactic Treatments</u>

- Formalin is not used for control of parasites and fungus.
- Hydrogen peroxide is not dispensed into water for control of parasites and bacterial gill disease.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES), as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Hoodsport Hatchery:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.
- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week.
- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100

feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperature daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

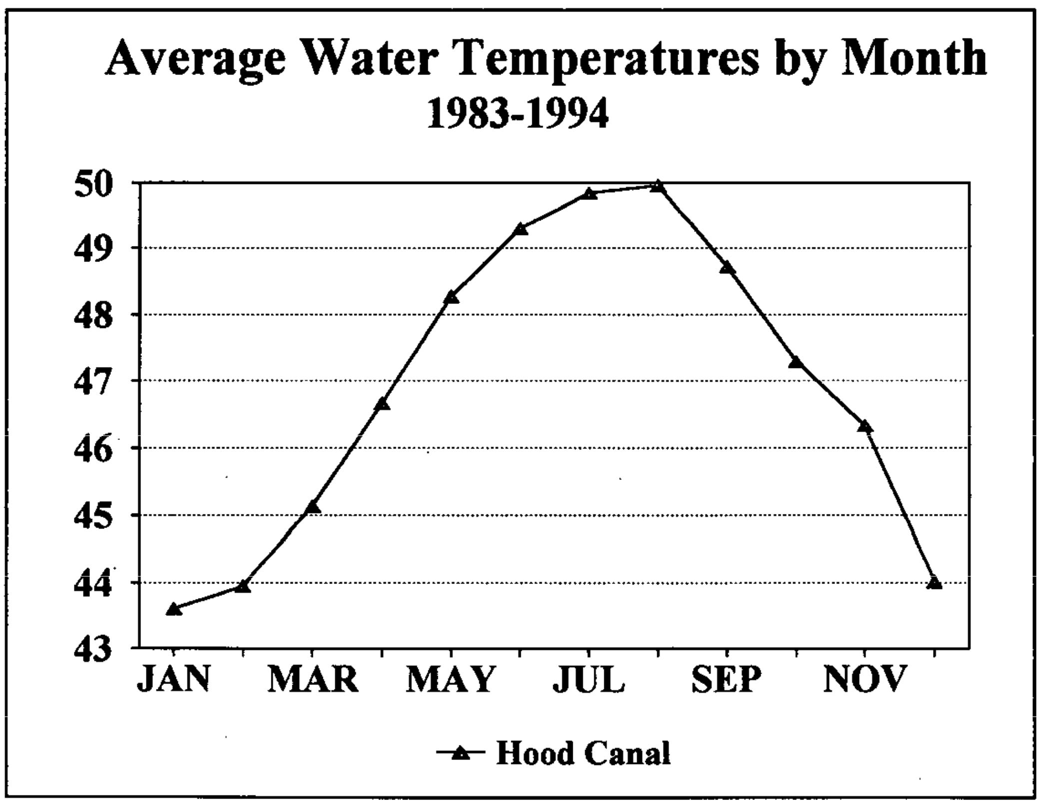
Hatchery Water Supply

Finch Creek: High creek flows produce large bed load movements in the fall/winter, and low flows in late summer reduce rearing capacity. Bed load movement, exacerbated by an upstream landslide, has caused the intake to fill with gravel, and requires frequent gravel removal during high flow periods. Water rights are 17.4 cfs.

Saltwater: Water rights are 8.8 cfs.

Domestic Water: Water rights are 14 gpm.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Finch Creek watershed and Hood Canal has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals and is reviewed and updated each spring, and finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Point No Point Treaty Council and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries: Hoodsport Hatchery

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Fall Chinook	1989	897	3,538	NA	
		1990	865	1,211	NA	
		1991	1,030	2,567	NA	
		1992	1,116	931	NA	1
		1993	1,116	2,005	NA	
	Quilcene Spring Chinook	1992	NA	55	NA	2
		1993	NA	25	NA	2
	Dungeness Spring Chinook	1992	NA	5	NA	2
		1993	NA	2	NA	2
	Soleduck Spring Chinook	1992	NA	21	NA	2
		1993	NA	15	NA	2
	Baker Coho	1989	NA	7,437	NA	
		1990	349	5,124	NA	
		1992	215	782	NA	
		1993	215	1,607	NA	
	Capilano Coho	1988	201	2,131	NA	
		1991	235	608	NA	
	Chum	1989	26,650	36,040	NA	3
		1990	26,650	14,809	NA	1
		1991	26,650	72,987	NA	3
		1992	26,650	90,785	NA	3
		1993	26,650	71,648	NA	3

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Pinks	1989	4,146	1,385	NA	1
		1991	1,964	3,287	NA	
		1993	2,768	11,497	NA	
Adult Prespawning Survival	Fall Chinook	Avg.	90%	99.0%	98.2-99.9%	
	Spring Chinook[1]	Avg.	90%	92.1%	90.5; 93.6%	
	Baker Coho	Avg.	90%	96.9%[2]	92.9-99.6%	
	Capilano Coho	Avg.	90%	92.9%	88.7; 97.0%	
	Chum	Avg.	90%	99.2%	98.6-99.8%	
	Pinks	Avg.	90%	93.8%	93.4;94.2%	
Eggtake	Fall Chinook	1989	2,090,00	9,523,800	NA	4
		1990	2,015,00	1,946,500	NA	
		1991	2,400,00	5,220,400	NA	4
		1992	2,600,00	1,713,000	NA	1
		1993	2,640,00	3,271,000	NA	4
	Soleduck Spring Chinook	1992	>100,00	31,150	NA	1,2
		1993	>100,00	34,600	NA	1,2
	Dungeness Spring Chinook	1992	>40,000	13,585	NA	1
		1993	>40,000	0	NA	1
	Quilcene Spring Chinook	1992	>100,00	93,848	NA	1
		1993	>100,00	72,000	NA	1
	Baker Coho	1989	NA	217,500	NA	
		1990	300,000	304,000	NA	

[1] Average of all three stocks for 1992 and 1993 combined.

[2] Three year average; 1989, 1990, and 1992.

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Eggtake	Baker Coho	1992	NA	194,000	NA	
		1993	180,000	406,300	NA	
	Capilano Coho	1988	360,000	382,000	NA	
		1991	210,000	220,000	NA	
	Chum	1989	23,000,0	38,232,800	NA	3
		1990	27,700,0	16,292,800	NA	1,3
		1991	27,700,0	38,235,000	NA	3
		1992	27,700,0	27,388,200	NA	3
		1993	29,500,0	35,626,000	NA	3
	Pinks	1989	2,360,00	1,034,700	NA	1
		1991	1,118,00	2,157,000	NA	
		1993	1,180,00	5,192,000	NA	
Fecundity	Fall Chinook	Avg.	NA	4,705	4,485-4,909	
	Soleduck Spring Chinook	Avg.	NA	3,893	3,461; 4,325	
	Quilcene Spring Chinook	1992	NA	4,251	4,266; 4,235	
	Dungeness Spring Chinook	1992	NA	4,528	4,528	
	Baker Coho	Avg.	NA	1,841	1,740-1,987	
	Capilano Coho	Avg.	NA	1,902	1,785; 2,018	
	Chum	Avg.	NA	2,318	2,035-2,715	
	Pinks	Avg.	NA	1,209	1,053;1,365	
Green Egg-to-Fry Survival	Fall Chinook	Avg.	90%	93.4%	92.0-96.2%	
	Chum	Avg.	90%	99.4%	99.2-99.8%	
	Pinks	Avg.	90%	89.5%	87.0;92.0%	
	Soleduck Spring Chinook	Avg.	90%	96.3%[3]	91.1-98.1%	

[3] Eyed egg to fry survival. Data for brood years 1989-1992.

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Green Egg-to-Fry Survival	Dungeness Spring Chinook	Avg.	90%	97.8%[4]	95.0-100%	
	Quilcene Spring Chinook	Avg.	90%	94.0%[5]	87.9;100%	
	Capilano Coho	1988	90%	93.7%	93.7%	
	Baker Coho	Avg.	90%	93.2%	91.0; 95.4%	
Fry to Smolt Survival	Fall Chinook	Avg.	90%	92.4%	86.8-98.8%	
	Chum	Avg.	90%	98.4%	98.0-99.6%	
	Pinks	Avg.	90%	95.0%	91.9; 96.3%	
	Soleduck Spring Chinook	Avg.	90%	84.0%	78.7-91.6%	
	Dungeness Spring Chinook	Avg.	90%	93.5%	91.7-95.5%	
	Quilcene Spring Chinook	Avg.	90%	94.6%[6]	90.4-98.0%	
	Baker Coho	Avg.	90%	74.5%	54.8-99.2%	5
	Capilano Coho	Avg.	90%	76.7%	54.8; 98.6%	
	Chum	Avg.	90%	99.6%[7]	99.5-99.7%	
	Deschutes Fall Chinook	Avg.	90%	87.1%[8]	70.3-99.7%	
	Sund Rock, Fall Chinook	Avg.	90%	96.2%[9]	93.9-99.5%	
Fish Releases	Fall Chinook	1988	2,000,00	2,133,900	NA	
		1989	800,000	828,500	NA	
		1990	800,000	863,700	NA	
		1991	800,000	804,500	NA	
		1992	800,000	809,900	NA	

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4 Transferred to hatchery as fingerlings.

5 Transferred as fingerlings.

6 Data for 1989-1992 broods.

7 Data for 1989, 1990, and 1992 broods.

8 Data for 1987, 1991, and 1992 broods.

9 Data for 1989 and 1990 broods.

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Chum	1988	10,000,0	14,495,300	NA	
		1989	15,000,0	13,234,700	NA	
		1990	15,000,0	15,122,500	NA	
		1991	15,000,0	14,617,500	NA	
		1992	15,000,0	14,948,000	NA	
	Pinks	1989	2,000,00	827,900	NA	1
		1991	1,000,00	1,910,100	NA	
	Soleduck Spring Chinook	1988	100,000	74,800	NA	2
		1989	100,000	89,396	NA	2
		1990	100,000	105,223	NA	
		1991	100,000	106,871	NA	
	Dungeness Spring Chinook	1988	40,000	11,100	NA	2
		1989	40,000	50,345	NA	2
		1990	40,000	4,872	NA	2
		1991	40,000	9,141	NA	2
	Quilcene Spring Chinook	1988	100,000	97,200	NA	
		1989	100,000	53,279	NA	2
		1990	100,000	15,791	NA	2
		1991	100,000	32,196	NA	2
	Capilano Coho	1988	40,000	30,500[10]	NA	
		1989	40,000	0	NA	6
		1991	40,000	39,377	NA	
	Baker Coho	1989	40,000	26,000	NA	
		1990	40,000	40,000	NA	

10 Also, 93,000 fry were released before 45 days.

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fish Releases	Baker Coho	1991	40,000	39,377	NA	
	Deschutes Fall Chinook	1992	NA	28,800	NA	
	Sund Rock, Fall Chinook	1989	200,000	186,700	NA	
		1990	200,000	201,100	NA	
		1991	200,000	178,220	NA	
Transfers to Tribal Facilities (Eggs/Fish)	Fall Chinook	1988	700,000	700,000	NA	
		1989	700,000	700,000	NA	
		1990	700,000	0	NA	7
		1991	700,000	700,000	NA	
		1992	700,000	700,000	NA	3
Transfers Within WDFW (Eggs/ Fish)	Fall Chinook	1988	NA	6,926,000	NA	8
		1989	NA	6,670,800	NA	8
		1990	285,000	960,700	NA	8
		1991	NA	2,944,000	NA	8
		1992	NA	39,400	NA	8
	Deschutes Fall Chinook	1988	NA	346,000	NA	8
		1990	NA	223,800	NA	8
		1991	NA	108,500	NA	8
	Clark Creek Fall Chinook	1988	NA	47,200	NA	8
	Soos Creek Fall Chinook	1989	NA	28,641	NA	8
	Fall Chinook, Purdy Creek	1991	NA	73,200	NA	8
	Chum	1988	9,920,00	46,546,000	NA	
		1989	9,920,00	38,232,800	NA	
		1990	22,800,0	16,292,800	NA	

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers Within	Chum	1991	22,800,0	38,235,000	NA	
WDFW (Eggs/ Fish)		1992	22,800,0	27,388,200	NA	
	Pinks	1991	NA	312,000	NA	9
	Capilano Coho	1988	300,000	265,000	NA	
		1991	180,000	302,000	NA	
	Baker Coho	1989	NA	30,500	NA	8
		1990	280,000	98,700	NA	
		1992	110,000	0	NA	
	Minter Coho	1988	400,000	208,900	NA	
		1989	200,000	98,000	NA	1,8
	Coho, Finch Creek	1988	NA	265,000	NA	8
		1989	NA	177,000	NA	8
Transfers to Co-ops	Fall Chinook	1988	NA	675,000	NA	8
(Eggs/ Fish)		1989	50,000	607,000	NA	8
		1990	50,000	0	NA	8
		1991	635,000	514,000	NA	8
		1992	575,000	100	NA	8
	Deschutes Fall Chinook	1991	NA	6,000	NA	8
		1992	NA	15,000	NA	8
	Chum	1991	NA	255,000	NA	8
		1992	235,000	0	NA	8,10
	Pinks	1991	NA	3,000	NA	

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adults Passed	Chum	1988	NA	5,500	NA	11
Upstream		1989	NA	100	NA	11
		1990	NA	500	NA	11
		1991	NA	500	NA	11
		1992	NA	300	NA	11
Percent Survival	Fall Chinook Yearling	Avg.	2.0%	0.5%[11]	0.01-0.8%	
	Fall Chinook, Subyearling	Avg.	1.0%	ND	ND	12
	Sund Rock Net Pens,	Avg.	2.0%	ND	ND	12
	Quilcene Spring Chinook	NA	1.5%	0.1%	0.1%	12
	Dungeness Spring Chinook	NA	1.5%	0.1%	0.1%	12
	Soleduck Spring Chinook	NA	1.5%	0.1%	0.1%	12
	Baker Coho	NA	5.0%	ND	ND	12
	Chum	NA	1.0%	ND	ND	12
	Pinks	NA	1.0%	ND	ND	12

[11] Three brood years of data; 1985, 1986, & 1987.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Fall Chinook	Yes	9.7%	7.3-11.6%	
	Spring Chinook	Yes	ND	ND	12
	Baker Coho	Yes	ND	ND	12
	Chum	Yes	ND	ND	12
	Pinks	Yes	ND	ND	12
Acclimation	Fall Chinook	Yes	Yes	NA	
	Spring Chinook	Yes	Yes	NA	
	Baker Coho	Yes	Yes	NA	
	Chum	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
Volitional Release	Fall Chinook	No	No	NA	
	Spring Chinook	No	No	NA	
	Baker Coho	No	No	NA	
	Chum	No	Partial	Partial	13
	Pinks	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	Yes	NA	
	Spring Chinook	Yes	Yes	NA	
	Baker Coho	Yes	No	NA	14
	Chum	Yes	Yes	NA	
	Pinks	Yes	Yes	NA	
Spawning Pop. >500	Fall Chinook	Yes	1,646	658-3,288	
	Spring Chinook	No	NA	NA	1
	Baker Coho	No	315	210-471	15
	Capilano Coho	No	282	216-348	15
	Chum	Yes	21,855	10,972-34,150	
	Pinks	Yes	4,915	1,304-7,638	
Spawning Ratio Male:Female	Fall Chinook	>0.33	0.8	0.7-1.1	
	Spring Chinook	1.0	1.0[12]	0.6-1.4	
	Baker Coho	>0.33	0.9	0.5-1.1	
	Capilano Coho	>0.33	0.8	0.6-1.0	
	Chum	>0.33	0.5	0.3-0.8	
	Pinks	>0.33	0.5	0.4-0.7	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraint
Adhere to Disease Policy	All Species	Yes	Yes	NA	

12 Two years of data (1992,1993) combined for all three stocks.

Objective 5: Conduct environmental monitoring

Measures	Hatchery Goal	Four Year Ave.	Range	Constraint
TSS Effluent Composite	5 mg/L	1.5	-6.0-18.0	
TSS Max Effluent	15 mg/L	7.6	-1.2-128.0	
SS Effluent	0.1 ml/L	0.09	0.0-1.6	
TSS PA Effluent	100 mg/L	NA	NA	16
SS PA Effluent	1.0 ml/L	NA	NA	16
Downstream Temp (°F)	Varies	51.3°	48.6-54.5°	
Maximum Temp	<63°F	59.0°	54.0-59.0°	
Minimum Temp	>32°F	34.0°	34.0-41.0°	
Downstream DO(mg/L)	>8.0	9.5	7.5-11.0	
Continuous Monitoring of Other Parameters	No	ND	ND	

Objective 6: Communicate effectively with other salmon trout, and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	17
Develop and Review Equilibrium Brood Document	All	Yes	No	NA	
Develop and Review Future Brood Document	All	Yes	Yes	NA	
Develop and Review Current Brood Document	All	Yes	Yes	NA	

Constraints/Comments—Hoodsport Hatchery

1. Low marine survival or overharvest results in lower than needed escapement, thus, egg take and fish release goals may not be realized.

2. Rearing of spring chinook at this hatchery is new. In 1993, only one brood of the three stocks will have returned to the hatchery, making evaluation of the program premature. Adult capture goal is undefined to date, but poor survivals have resulted in small numbers of returning adults.

3. The combined chum egg take goal for Hoodsport, George Adams, Mckernan hatcheries, the RSI program, and cooperative rearing program, is 46 million eggs. The egg take goal at Hoodsport Hatchery is the minimum number needed to supply the on-station releases at the three hatcheries. In some years, too few adults return to Mckernan or George Adams Hatchery, so, to ensure adequate egg takes to meet all program goals, Hoodsport hatchery usually collects more eggs than stated in the Future Brood Document.

4. Additional eggs collected at this hatchery are used to makeup shortages at other Hood Canal hatcheries.

5. Two years of poor survivals after transfer from another hatchery have reduced the average for all broods.

6. No program goal for this stock. Baker stock was used instead.

7. No surplus eggs of Finch Creek stock were available. These transfers were made up with eggs from other stocks or hatcheries or did not occur.

8. Change in program after development of goals in Future Brood Document. Fish may have been reared at this hatchery because there was no rearing space at intended hatchery.

9. Transferred eggs to George Adams for otolith marking.

10. Transfer was made from another hatchery.

11. No goal for upstream passage due to limited amount of habitat above hatchery.

12. Lack of current continuous coded wire tag data base. Mean length and CV are determined only on groups of fish that have been coded-wire tagged.

13. Many different groups (representing different egg collection dates) of chum are reared in the large rearing pond (Zuider Zee). Outlet screens in this pond are raised during each week to allow those fish ready to migrate to leave volitionally.

14. Only the earliest portion of the run is collected to help ensure run timing differences between the summer and fall coho stocks.

15. Programmed egg take requirement precludes the need to spawn 500 adults.

16. No pollution abatement pond at this hatchery.

17. Inadequate funding to provide sufficient office support staff.

Stock Profile:

Spring Chinook: Three non-native stocks of spring chinook are currently reared and released at Hoodsport Hatchery. Quilcene spring chinook were transferred to the hatchery to determine if survivals of this stock were similar at Hoodsport Hatchery as at Quilcene National Fish Hatchery (QNFH). This stock originated from a hybrid of Nooksack, Cowlitz and Umpqua stocks that were propagated at the QNFH. Dungeness spring chinook were transferred to the hatchery to increase adult returns with the potential for subsequent progeny to be re-introduced into the Dungeness River. Soleduck spring chinook is a composite of non-native, hybridized spring chinook stocks (see Soleduck HOP). This stock was brought into the hatchery as part of the recreational enhancement program for Hood Canal and Puget Sound. **Stock Description (all three stocks): Introduced, non-adapted**

Fall Chinook: Finch Creek fall chinook originated from numerous plantings of Soos Creek and other plantings of Dungeness, Elwha, Deschutes, and Trask River (OR) stocks. Since 1959, releases consist of progeny of adults returning to the hatchery. **Stock Description: Introduced, adapted**.

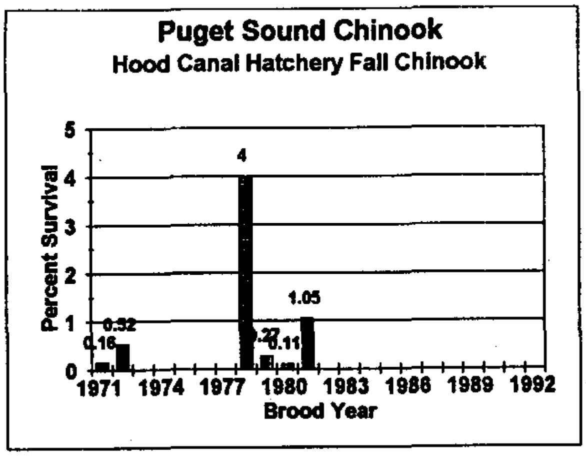
Baker River Coho: This stock originated from the Baker River via Skagit Hatchery, and has been planted at Hood Canal for several years. It was introduced primarily to provide a fishery during the summer months. There is some question about whether this stock has been hybridized with normal timed coho at the Skagit Hatchery. **Stock Description: Introduced, non-adapted.**

Hood Canal (Finch Creek) Chum: This stock originated at Finch Creek and was incorporated into the hatchery in 1953, when the hatchery began operation. The stock has been perpetuated at the hatchery since that date, and has been used to start several local hatchery runs, as well as being used for remote site incubation projects. **Stock Description: Native.**

Pink Salmon: Pink salmon were introduced to Hood Canal in the mid-1950s from two sources: Dungeness River and Dosewallips River. A group of even year spawning Skeena River pink salmon was also introduced in the 1950s, but did not reproduce in subsequent years. GSI analysis indicates that the Hood Canal stock are somewhat similar to fall run Dungeness pinks. There have been at least three generations of releases without introduction of outside sources. **Stock Description: Introduced, adapted.**

STOCK STATUS PROFILE FOR: Finch Creek Fall Chinook Sub-Yearlings

Survival:



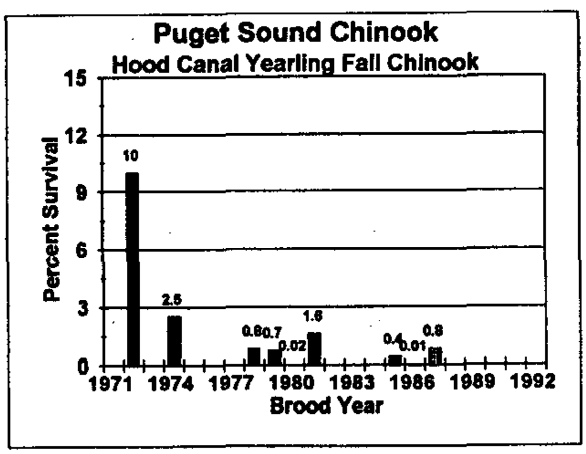
Distribution:

No current data available.

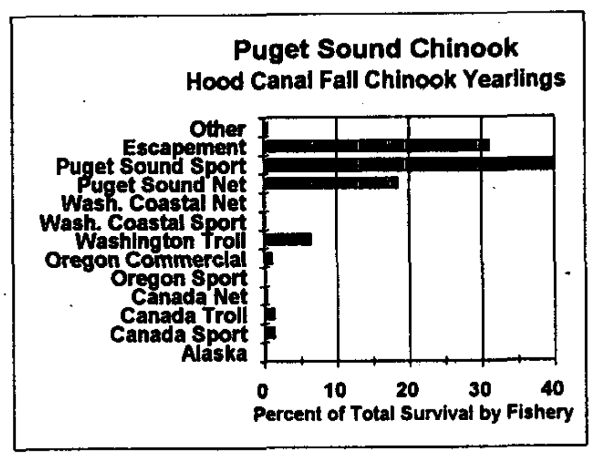
Five Year Average Survival: NA
Catch to Escapement Ratio: NA

STOCK STATUS PROFILE FOR: Finch Creek Fall Chinook Yearlings

Survival:



Distribution:



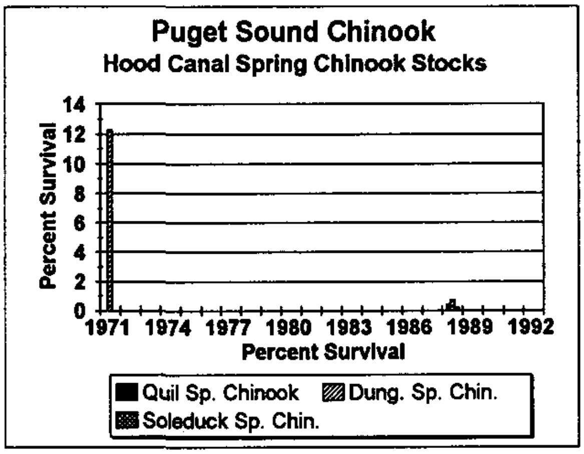
Two Year Average Survival: 0.5%
Catch to Escapement Ratio: 3.6:1

STOCK STATUS PROFILE FOR: Sund Rock Net Pens Fall Chinook- Yearlings

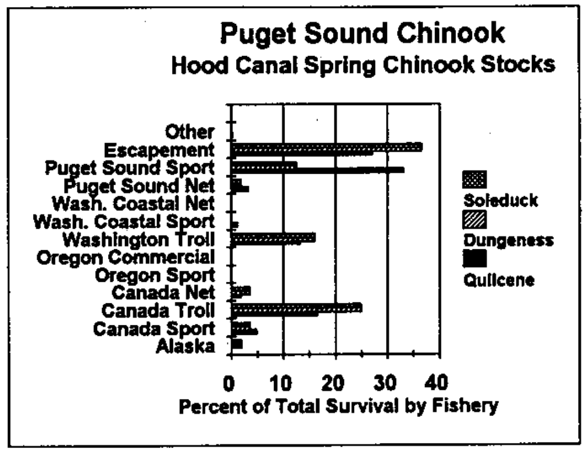
Survival: No current data available.
Distribution: No current data available.

STOCK STATUS PROFILE FOR: Quilcene, Dungeness, and Soleduck Spring Chinook

Survival:



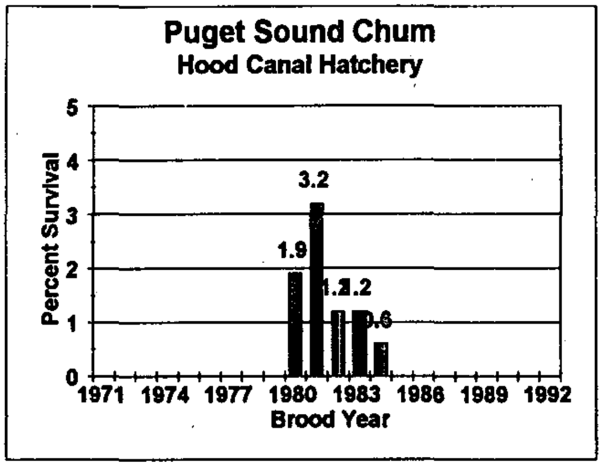
Distribution:



One Year Average Survival (all stocks): 0.41
One Year Catch to Escapement Ratio: 3.5 : 1

STOCK STATUS PROFILE FOR: Finch Creek Chum

Survival:



Distribution:

No current data available.

Five Year Average Survival: NA
Catch to Escapement Ratio: NA

STOCK STATUS PROFILE FOR: Finch Creek Pinks

Survival: **No data available.**
Distribution: **No data available.**

Dungeness Complex

Dungeness Hatchery
Hurd Creek Hatchery
Elwha Rearing Ponds

Dungeness and Hurd Creek Hatcheries

Introduction

Dungeness Hatchery is on the Dungeness River, 6 miles southwest of Sequim, Washington. The facility has ten 10' x 100' raceways, one 1/2-acre rearing and release pond, and an adult holding pond. Incubation includes 17 shallow and 10 deep troughs and a few vertical incubators. The total hatching capacity is approximately 5 million fry. Release capacity for the station is approximately 2 million fish. Water is supplied by gravity flow from Canyon Creek and the Dungeness River.

Hurd Creek Hatchery is approximately 4 miles north of Sequim off the Old Olympic Highway on Hurd Creek (Epperson Creek). Hurd Creek is a satellite facility of the Dungeness Hatchery. Useable rearing ponds include four large raceways and one large creek pond. Incubation is done in deep troughs, which have a capacity of approximately 12 million eggs to the eyed stage and 2 million fry. Release capacity is 2.6 million. Water is supplied from both Hurd Creek and wells. Hurd Creek is currently being used to rear spring chinook for the Dungeness Spring Chinook Restoration Project. Wild spring chinook fry are captured in the Dungeness River and reared at Hurd Creek Hatchery until maturity. The goal of the restoration project is to increase the natural runs in the river.

Purpose

Dungeness Hatchery was built to increase production of coho, chinook, and pink salmon in the Straits of Juan de Fuca. It is currently used to rear and release coho salmon, and will be used in the future to help restore declining runs of pink salmon. The hatchery also has reared fall chinook for the Elwha Rearing Channel, and coho for other WDFW, tribal, and cooperative rearing projects.

The Hurd Creek Hatchery was built to increase production of salmon the Straits of Juan de Fuca. Currently, it has two primary purposes. The first is to support the Elwha fall chinook program by incubating eggs, and rearing a portion of the fry before transfer to Elwha Rearing Channel. The second is to rear progeny of Dungeness spring chinook to maturity as part of a captive brood program. In 1993, Hurd Creek began rearing approximately 2,500 Dungeness spring chinook juveniles which were captured in the Dungeness River. These progeny which come from single family units or of mixed families, are to be reared in captivity until they reach maturity in 3-5 years.

Goals

1. As part of the ongoing restoration project for Dungeness spring chinook, rear to maturity a minimum of 30 families of 150-200 fish each.
2. Produce coho for the NE Pacific and Puget Sound fisheries.
3. Maintain the Dungeness coho broodstock.
4. Produce coho eggs/fish for cooperative rearing programs.
5. Rear Elwha fall chinook for transfer to Elwha Rearing Channel.

Objectives

Objective 1: 1993 Hatchery Production

Dungeness

Fall Chinook
Rear 200,000 1992 brood Elwha stock subyearlings for transfer to Elwha.

Coho
Release 350,000 1991 brood yearlings on-station.
Rear 30,000 1991 brood yearlings for transfer to Peninsula College.
Rear 350,000 1992 brood subyearlings for release as yearlings in 1994 and 250,000 fry for release into streams as part of the WDFW Fish Management fry plant program.
Transfer 43,000 eggs to cooperative rearing projects.
Collect 615,000 eggs from adults returning in 1993.

Hurd Creek

Spring Chinook
Rear 2,500 1992 brood Dungeness spring chinook until maturity.
Rear 2,500 1993 brood Dungeness spring chinook until maturity.

Fall Chinook
Transfer 3,200,000 1992 brood Elwha stock fry to Elwha Rearing Channel, 250,000 fry to Dungeness Hatchery and 250,000 fingerlings to Elwha in the fall.
Receive and incubate, 4,300,000 Elwha fall chinook eggs from adults captured at the Elwha Rearing Channel in 1993.

Objective 2: **Minimize interactions with other fish populations through proper rearing and release strategies.**

Objective 3: **Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.**

Objective 4: **Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.**

Objective 5: **Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.**

Objective 6: **Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.**

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Dungeness Hatchery is to collect enough adults to sustain each species' rearing program while meeting guidelines designed to maintain genetic diversity of stocks. A secondary goal is to supply fish to tribal or cooperative rearing programs. Because there is no weir on the Dungeness River, adults can by-pass the hatchery. The primary intent of the captive brood program for Dungeness spring chinook is to provide adequate numbers of juveniles to restore the naturally spawning population in the river. Progeny are collected by either pumping identified redds (single family unit) or by seining the river to collect progeny of mixed families. The restoration program is a joint venture between WDFW, the Jamestown Klallam Tribe, U.S. Fish and Wildlife Service, and the North Olympic Wild Salmon Coalition.

There is no adult collection at Hurd Creek Hatchery.

Dungeness Coho: Dungeness coho return to the hatchery from October to November. Spawning occurs from November to December with peak spawning in mid-November.

Dungeness Spring Chinook: Adults are not collected at the hatchery. Members of the Fish Management Division of WDFW collect fry of this stock by pumping redds and use of beach seines.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river water for several weeks prior to release, is done to ensure strong homing to the hatchery, thus reducing straying into other areas. Fish planted off-station do not receive prior acclimation to receiving waters.

Dungeness Coho: Dungeness coho are reared to 17 fish/pound and released in late May or early June depending on water temperature during the rearing cycle.

Elwha Fall Chinook: These fish are reared until November when they reach 20 fish/pound and transferred back to the Elwha Rearing Channel as part of the yearling release program at that facility.

Dungeness Spring Chinook: These fish are progeny of naturally spawned eggs. They are marked to keep families separated, and reared in freshwater until mature at ages 3-5. A portion of the production will eventually be reared in seawater net pens until mature.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

Adults of all species are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

Coho are spawned at a 1:1 male to female ratio on days when fewer than one million eggs are collected. On days when more than one million eggs are collected, the male to female spawning ratio is no lower than 0.33. The effective population size (N_e) for coho is not known due to pooling of gametes.

Spring chinook are not currently spawned at either hatchery.

Acceptable Stocks

Coho
1. Dungeness

Spring Chinook
1. Dungeness

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Please see the introduction for Objective 4 methodology.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES), as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). A pollution abatement pond and wetland meadow filtration system is scheduled for completion at Dungeness in 1995. The following parameters are currently monitored at both Dungeness and Hurd Creek hatcheries:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.

- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

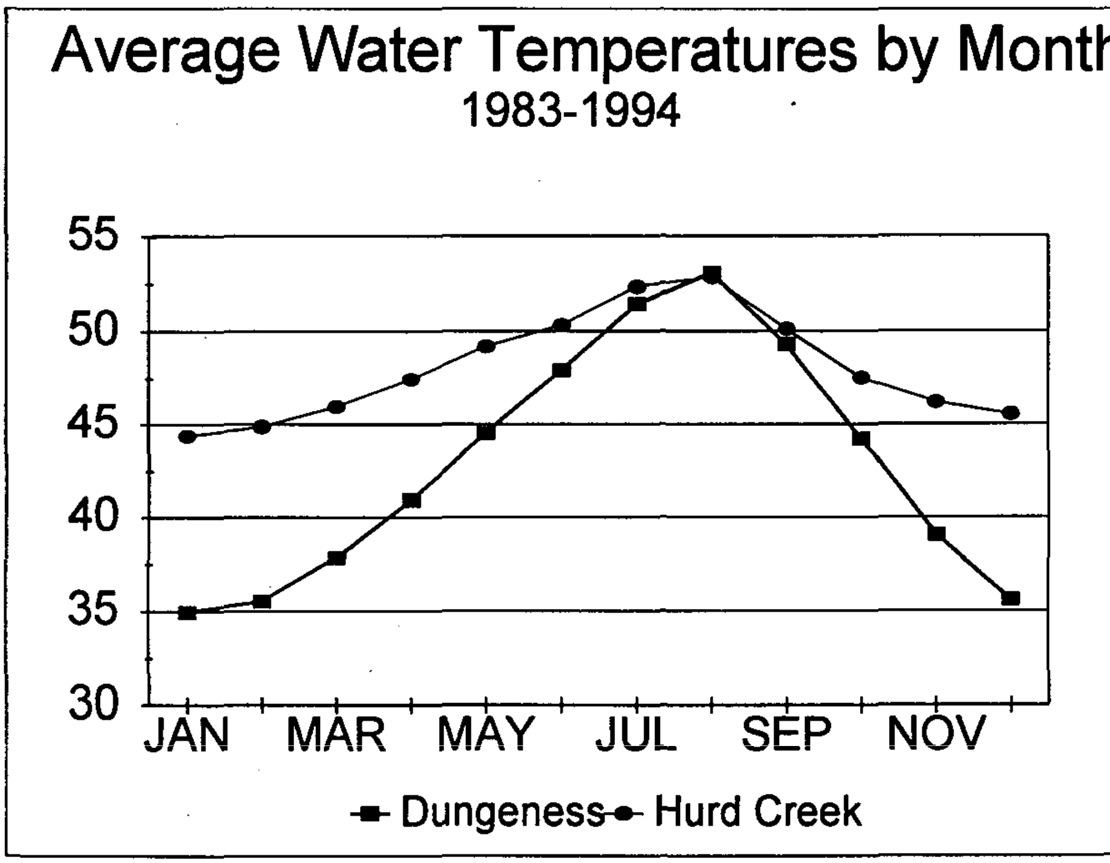
Dungeness River: Out-of-channel water withdrawals for irrigation reduces the flow in the river below the hatchery. This may cause some delays in upstream migration of salmon. During extreme winters the water feeding the hatchery may become slushy and cause some mortality problems as well as operational problems. Water Rights are 15 cfs.

Canyon Creek: Water rights are 8.7 cfs

Domestic Water: Water Rights are 28 gpm.

Hurd Creek: Water Rights are 6.4 cfs. Domestic well water rights are 28 gpm.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Dungeness River watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Elwha Tribe, the Jamestown Klallam Tribes, and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at these facilities.

Performance Summaries—Dungeness and Hurd Creek Hatcheries

Objective 1: **Hatchery Production**

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Adult Capture	Coho	1989	1,080	1,258	NA	
		1990	1,457	1,526	NA	
		1991	1,457	2,016	NA	
		1992	1,457	1,590	NA	1
		1993	540	2,731	NA	
	Pink	1987	NA	57	NA	
Adult Prespawning Survival	Coho	Avg.	90%	98.6%	94.7-100%	
	Pink	1987	90%	96.5%	96.5%	
Eggtake	Coho	1989	1,230,000	1,812,661	NA	
		1990	1,660,000	2,032,900	NA	
		1991	1,660,000	1,800,000	NA	
		1992	1,600,000	1,458,300	NA	1
		1993	615,000	1,179,000	NA	
Fecundity		Avg.	NA	2,310	1,851-2,689	
Green Egg-to-Fry Survival	Coho	Avg.	90%	92.0%	NA	
	Elwha Fall Chinook	Avg.	90%	92.1%[1]	82.7-97.9%	1
	Elwha Coho	1992	90%	77.4%	77.4%	
	Baker Coho	'89,90	90%	96.4%	94.4;98.3%	
	Capilano Coho	1988	90%	99.2%	99.2%	
	Elwha Fall Chinook at Hurd	Avg.	90%	81.0%[2]	78.0-83.5%	2

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[1] Four year average; 1988, 1990-1992.

[2] Three year average; 1990-1992.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Fry to Smolt Survival	Coho	Avg.	90%	62.4%	50.2-82.6%	3
	Baker Coho	1989	90%	74.2%	74.2%	
	Capilano Coho	1988	90%	62.9%	62.9%	
Fish Releases (On-station)	Coho (Yearlings)	1988	350,000	342,700	NA	3
		1989	350,000	296,402	NA	3
		1990	350,000	433,675	NA	
		1991	350,000	340,000	NA	3
	(Subyearlings)	1988	NA	221,700	NA	4
		1991	NA	806,750	NA	4
		1992	NA	323,400	NA	4
(Off-station, fry or fingerlings)	Coho	1988	NA	150,400	NA	4
		1989	250,000	100,386	NA	4
		1990	250,000	79,917	NA	4
		1991	250,000	150,400	NA	4
		1992	250,000	212,700	NA	4
Transfers to Tribal Facilities (Eggs/Fish)	Coho	1988	760,000	698,025	NA	4
		1989	760,000	918,285	NA	4
		1990	760,000	757,563	NA	
		1991	760,000	106,800	NA	4
	Elwha Fall Chinook	1990	NA	500,000	NA	4
		1991	NA	350,000	NA	4
Transfers Within WDFW (Eggs/Fish)	Elwha Fall Chinook @ Dungeness	1988	200,000	782,500[3]	NA	4
		1989	180,000	163,310	NA	4

[3] Includes 565,000 eggs and 217,500 fingerlings.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers Within WDFW (Eggs/Fish)	Elwha Fall Chinook @ Dungeness	1990	200,000	250,400	NA	
		1991	200,000	1,055,500[4]	NA	4
		1992	200,000	460,200	NA	4
	Elwha Fall Chinook @ Hurd Creek	1989	200,000	0	NA	4
		1990	3,450,000	3,126,500	NA	2
		1991	3,450,000	3,891,300	NA	
		1992	3,950,000	852,555	NA	4
	Dungeness Coho	1990	NA	3,400	NA	4
	Elwha Coho, Hurd Creek	1992	NA	63,750	NA	4
	Elwha Coho, Dungeness	1992	NA	197,700	NA	4
	Baker Coho	1988	40,000	0	NA	4
		1989	150,000	197,130	NA	
		1990	150,000	153,900	NA	
	Capilano Coho	1988	0	63,327	NA	4
		1989	150,000	0	NA	4
		1991	150,000	0	NA	4
	Finch Creek Chum	1989	11,000,000		NA	4
		1990	5,500,000		NA	4
Transfers to Co-ops (Eggs/Fish)	Dungeness Coho	1988	35,000	109,325	NA	4
		1989	55,000	92,066	NA	4
		1990	73,500	44,140	NA	4
		1991	73,500	74,100	NA	4

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[4] Includes 855,500 eggs and 200,000 fingerlings.

Objective 1: Hatchery Production

Measures	Species	Brood Year	Goal	Realized	Range	Comments
Transfers to Co-ops (Eggs/Fish)	Dungeness Coho	1992	73,500	49,000	NA	4
	Elwha Fall Chinook	1990	NA	3,000	NA	4
	@ Hurd Creek	1991	NA	3,000	NA	4
Adults Passed Upstream	Coho	1989	NA	20	NA	5
		1990	NA	7	NA	5
		1991	NA	75	NA	5
Smolt to Adult Survival	Coho	Avg.	7.5%	3.0%	2.7%; 3.3%	6

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Coho	Yes	NA	NA	6
Acclimation	Coho	Yes	Yes	NA	
Volitional Release	Coho	No	No	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Coho	Yes	No	NA	7
Spawning Pop. >500	Coho	Yes	1,402	1,243-1,735	
Spawning Ratio Male:Female	Coho	>0.33	0.9	0.8-1.0	
	Pinks	>0.33	0.9	NA	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	All	Yes	Yes	NA	

Objective 5: Conduct environmental monitoring

Measures		Hatchery Goal	2-Year Average	Range	Comments
TSS Effluent	Dungeness	5 mg/L	0.26[5]	-1.0-2.0	
Composite	Hurd Creek	5 mg/L	NA	NA	7
TSS Max Effluent	Dungeness	15 mg/L	0.9	-0.4-6.0	
	Hurd Creek	15 mg/L	NA	NA	7
SS Effluent	Dungeness	0.1 ml/L	0.03	0.01-0.06	
	Hurd Creek	0.1 ml/L	NA	NA	7
TSS PA Effluent	Dungeness	100 mg/L	NA	NA	8
	Hurd Creek	100 mg/L	NA	NA	7,8
SS PA Effluent	Dungeness	1.0 ml/L	NA	NA	8
	Hurd Creek	1.0 ml/L	NA	NA	7,8
Downstream Temp (°F)	Dungeness	Varies	45.5°	44.6-46.4°	
	Hurd Creek	Varies	ND	ND	
Maximum Temp	Dungeness	<63°F	62.0°	57.9-62.0°	
	Hurd Creek	<63°F	ND	ND	
Minimum Temp	Dungeness	>32°F	28.0°	28.0-33.0°	
	Hurd Creek	>32°F	ND	ND	
Downstream DO (mg/L)	Dungeness	>8.0	10.9	10.0-13.5	
	Hurd Creek	>8.0	NA	NA	8
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

[5] One year of data only.

Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	9
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Dungeness and Hurd Creek Hatchery

1. A higher than normal proportion of males returned this year and therefore even though adult capture goal was achieved, there were too few female coho to provide programmed egg take.

2. Adult fall chinook are gaffed in the Elwha River and the unfertilized eggs transferred to Hurd Creek where they are fertilized and incubated in isolation buckets until the eyed stage. In recent years, warm water temperatures in the Elwha River at the time of spawning have caused high egg mortalities because of poor fertilization. Transfer to Hurd Creek also increases mortalities, as does incubation in the isolation buckets. In 1990, a large number of eggs were lost.

3. In the past few years, the raceways at the Dungeness Hatchery have been renovated. During this renovation, coho were reared in the large rearing pond starting at an earlier age than would normally occur if the raceways were available. Starting, and then later rearing, this many coho has exceeded several rearing parameters and may have contributed to heavy mortalities from disease. Also, bird netting was not installed until two years ago and heavy predation losses resulted. In most recent years, the raceways have been available for rearing, numbers in the large release pond have been reduced, and bird netting has been installed so fry to smolt survival will improve, and the number of fish released will closely match programmed release goals.

4. Change in program goals after development of goals in the Future Brood Document or fish/eggs were not available to meet program.

5. Because there is no rack on the Dungeness River, adults are free to pass upstream so, there is no need for an upstream escapement goal. This situation also presents the possibility that fish returning the hatchery do not represent all portions of the escapement. Numbers of fish passed upstream represent fish removed from the adult holding pond and placed back in the river.

6. Lack of current continuous coded wire tag data base. Only coded wire tag groups are measured and mean length and CVs calculated.

7. Less than 20,000 pounds of production at this hatchery, therefore NPDES permit not required.

8. Hatchery lacks a pollution abatement pond.

9. Insufficient funding to provide complete data quality control before inclusion in hatchery database.

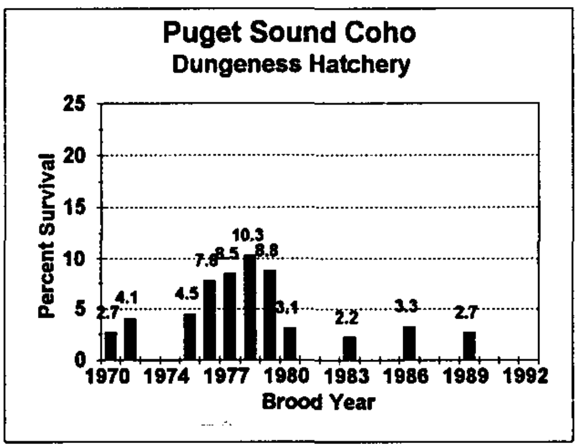
Stock Profile:

Dungeness Coho: This stock originated from native wild stock and has been perpetuated at the hatchery since the hatchery was built. There have been some introductions of coho from the Elwha River, but these are likely to be of Dungeness ancestry. **Stock Description: Native**

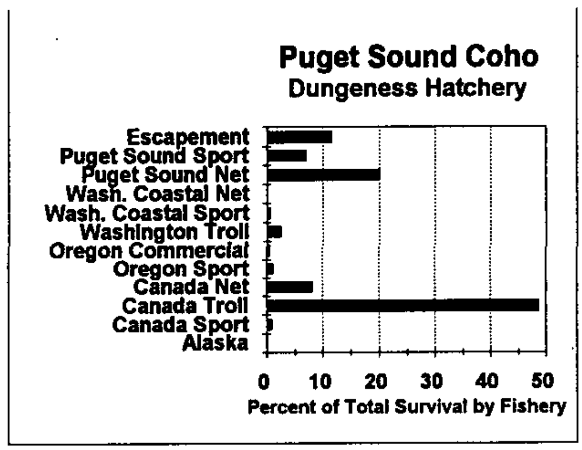
Dungeness Spring Chinook: This stock is being reared to maturity at the Hurd Creek facility. It is not clear if this stock is a true spring chinook stock or a composite of spring and summer chinook stocks. **Stock Description: Native.**

STOCK STATUS PROFILE FOR: Dungeness Coho

Survival:



Distribution:



Two Year Average Survival: 3.0%
Catch to Escapement Ratio: 9.1 : 1

AR049939

Elwha Rearing Channel

Introduction

The Elwha Rearing Channel is on the Elwha River, 6 miles west of Port Angeles. It was built in 1974, originally as a spawning channel, through a joint effort of Crown Zellerbach, the City of Port Angeles and the Department of Fisheries. The spawning channel was ineffective and was converted into a large rearing channel which can be separated into individual rearing compartments by using screens. The channel has a release capacity of approximately 5 million subyearling and yearling chinook. Water is supplied by gravity flow from the Elwha River. Maximum flow supplied to the channel is 33 cfs. This facility has no incubation capability, and depends on Hurd Creek and Dungeness hatcheries for incubation and early rearing. Adult returns to the facility are sometimes below what is needed to meet the egg take program. This is due to poor attraction water from the adult holding pond, and the lack of a weir in the river to trap fish. To secure adequate eggs to meet program goals, chinook are gaffed from the spawning beds and spawned at the gaff sites. The eggs are then transported to Hurd Creek for incubation.

Purpose

The spawning channel was built to increase production and harvest opportunities of the unique stock of fall chinook native to the Elwha River. The intent of the spawning channel was to provide additional high quality spawning area because two dams built in the early 1900s blocked access to over 60 miles of river. The spawning channel was ineffective and converted to a rearing channel. The rearing channel is used to rear and release both subyearling and yearling chinook to contribute to Puget Sound and NE Pacific fisheries.

Production at this hatchery is agreed upon by joint consensus among the Lower Elwha Tribe, Jamestown Klallam Tribe, and the WDFW.

Goals

1. Maintain the Elwha River stock of fall chinook.
2. Produce fish for the NE Pacific and Puget Sound fisheries.
3. Provide chinook and coho eggs to cooperative and tribal rearing operations.

Objectives

Objective 1: 1993 Hatchery Production

<u>Fall Chinook</u>

Collect 4,750,000 eggs from adults returning in 1993.
Release 2,900,000, 1992 brood subyearlings on-station.
Release 750,000, 1991 brood yearlings on-station.
Produce up to 450,000 eggs (120,000 guaranteed) for transfer to the Lower Elwha Tribe and 3,000 for cooperative rearing projects.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers in the Puget Sound region.

Current Practices To Achieve Objectives

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at the Elwha Rearing Channel is to obtain enough adults to sustain the fall chinook rearing program while meeting guidelines designed to maintain genetic diversity of the stock. A secondary goal is to supply eggs to the Lower Elwha Tribe and cooperative rearing programs. No weir exists on the Elwha River, thus adult returns to the hatchery are dependent on fish being attracted to outflow water from the adult holding pond. The outflow from the adult holding pond does not adequately attract sufficient numbers of returning adults to support program needs. Gaffing adults from the river to supply the remainder of the needed eggs has been done for many years. In recent years a chemical was used to imprint the juveniles at release and attract returning adults to the holding pond. The imprinting program does not appear to have been effective.

Fall Chinook: Fall chinook return to the Elwha River from early August to October. Spawning occurs from mid-September to mid-October with the peak in late September.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are intended to limit the amount of ecological interaction occurring between hatchery and naturally produced fish. Fish are reared to sufficient size to encourage a high proportion of smolts so that residualism after release is minimized. Rearing on parent river water, or acclimation to parent river for several weeks prior to release, is done to ensure strong homing to the parent river, thus reducing straying into other areas.

Fall Chinook: Fall chinook are reared at Elwha in a large asphalt rearing channel. Two groups are released, the first in June as 70 fish/pound subyearlings and the second as 7 fish/pound yearlings in March and April of the following year. Fish for the Elwha rearing program are transferred from Hurd Creek and Dungeness hatcheries because the quality of the Elwha River water deteriorates during the summer months and causes high mortalities to fish being reared in the summer. Subyearlings are transferred in March and yearlings in November.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

An attempt is made to collect adults throughout the entire run to ensure that the run timing for these stocks is maintained. However, because of the poor homing to the holding pond and the difficulty in gaffing adults, it is possible that the egg takes do not represent the full run time.

Spawning Protocol

Roughly half the egg take originates from adults gaffed from the river. Gaffing occurs throughout the spawning season. Adults are spawned at a 1:1 male to female ratio. On some days, the daily spawning ratio may be less than 1:1, due to insufficient numbers of males being gaffed. The effective population size (N_e) is not known due to pooling of gametes.

Acceptable Stocks

Fall Chinook
1. Elwha Fall Chinook

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Differences between the generic Objective 4 (see introduction) and what occurs at this facility are:

Sanitation

- Eggs are not incubated at this facility.

Therapeutic and Prophylactic Treatments

- Eggs are disinfected at Hurd Creek Hatchery.
- At spawning, eggs are water-hardened in 100 ppm iodophor for a one hour period. This is done at Hurd Creek Hatchery.
- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs or fish, as needed. This is done at Hurd Creek Hatchery only.

Objective 5: Conduct environmental monitoring

Environmental Monitoring

Environmental monitoring is conducted at WDFW facilities with more than 20,000 pounds of annual production to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit System (NPDES), as administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at the Elwha Rearing Channel:

- **Total Suspended Solids (TSS)**— Monitor composite effluent, maximum effluent, and influent samples one to two times per month. Negative net values of TSS indicate the hatchery is acting as a settling basin for solids entering the hatchery through the intake water.
- **Settleable Solids (SS)**— Monitor hatchery effluent and influent samples one to two times per week.

- **Upstream and Downstream Temperatures**— Record upstream and downstream temperatures twice per month, June through September, as required under NPDES permit. Upstream temperatures refer to ambient temperature without influence from the hatchery. Downstream temperature refers to ambient temperature of receiving water approximately 100 feet below hatchery discharge point.

- **Upstream and Downstream Dissolved Oxygen (DO)**— Determine dissolved oxygen content of stream waters above and below the hatchery, twice per month during the period June through September.

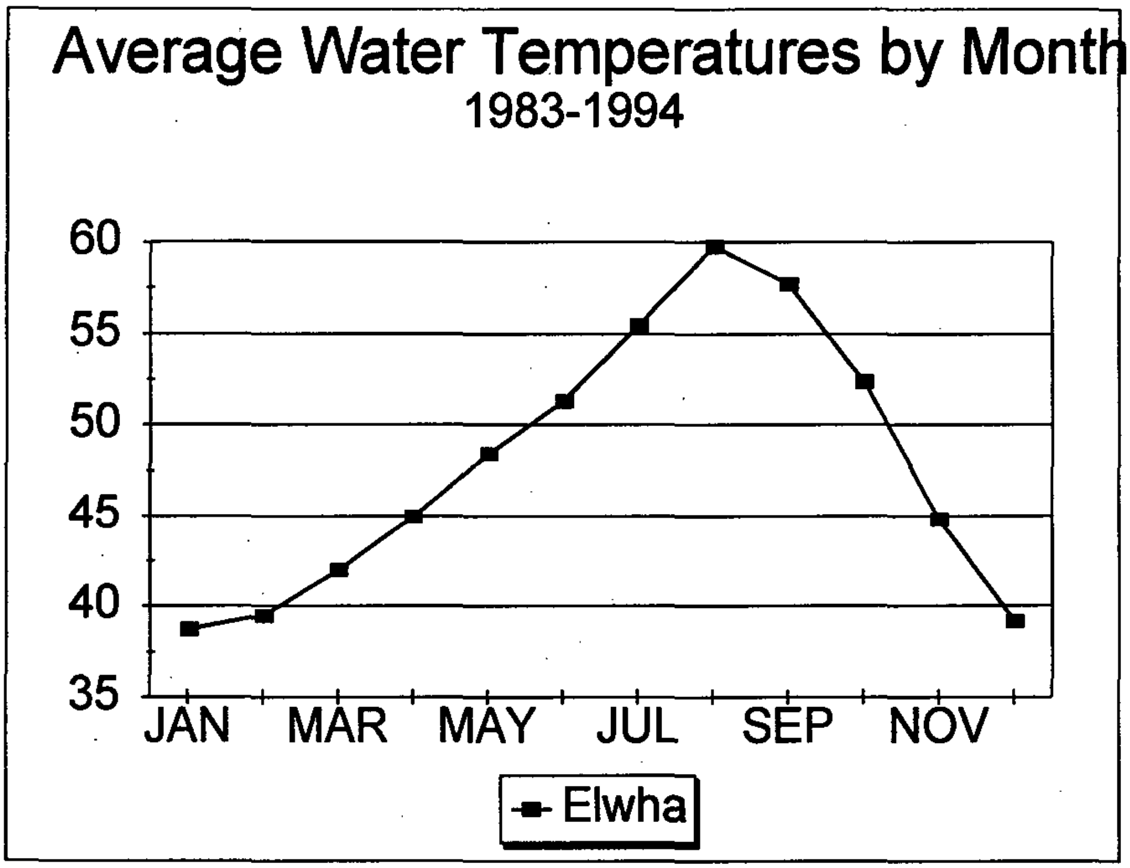
- **In-hatchery Water Temperatures**— Record maximum and minimum temperatures daily.

- **In-hatchery Dissolved Oxygen**— Determine dissolved oxygen content of incubation or rearing water as dictated by stream flow or weather conditions.

Hatchery Water Supply

Elwha River: Silt loads in the Elwha River have caused some operational problems at the rearing channel. A well field is being developed for use in future incubation and possibly for holding adult salmon. Water rights are not yet determined.

Hatchery Water Temperature Profile:



Objective 6: Communicate effectively with other salmon, trout and steelhead producers and managers.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring.

Development and Review of Brood Documents

The **Equilibrium Brood Document** for the Elwha River watershed has not yet been developed. It would document existing baseline production and current management. Two brood documents are reviewed and agreed to annually. The **Future Brood Document** is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The **Current Brood Document** reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

In-season Communication for Fish and Egg Transfers

Communication with the Lower Elwha Tribe, the Jamestown Klallam Tribe and the U.S. Fish and Wildlife Service takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at this facility.

Performance Summaries: Elwha Rearing Channel

Objective 1: **Hatchery**

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Adult Capture	Fall Chinook[1]	1989	1,758	2,025	NA	
		1990	1,827	1,450	NA	1
		1991	1,965	1,886	NA	1
		1992	1,779	399	NA	1
		1993	1,965	923	NA	1
	Coho	1991	NA	425	NA	2
		1992	NA	888	NA	2
Adult Prespawning	Fall Chinook	Avg.	90%	94.0%	90.0-99.2%	
Survival	Coho	'91,92	90%	98.6%	97.1;100%	
Eggtake	Fall Chinook	1989	4,250,000	5,193,000	NA	
		1990	4,420,000	4,395,000	NA	1
		1991	4,750,000	4,861,000	NA	
		1992	4,300,000	825,000	NA	1
		1993	4,750,000	2,379,500	NA	1
	Coho	1991	NA	198,000	NA	
		1992	NA	300,000	NA	
Fecundity	Fall Chinook[2]	Avg.	NA	5,125	NA	

1 The average number spawned from gaffing was 694 (231 males and 463 females). The average number spawned from the trap was 699 (351 males and 348 females).

2 Includes both gaffed and trapped fish. The average fecundity of gaffed and trapped fish was, respectively, 4,920 and 5,941.

Objective 1: **Hatchery**

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Green Egg-to-Fry Survival	Fall Chinook	NA	NA[3]	NA	NA	
	Coho	NA	NA[4]	NA	NA	
Fry to Smolt Survival	Fall Chinook	Avg.	90%	98.7%	98.2-99.3%[5]	
	Coho	1992	90%	98.5%	98.5%	
Fish Releases	Fall Chinook	1988	600,000	719,500	NA	
		1989	800,000	160,300[6]	NA	3
		1990	750,000	686,400	NA	1,4
		1991	750,000	419,400	NA	4
	Fall Chinook	1988	2,900,000	3,010,300	NA	
		1989	2,900,000	0	NA	3
		1990	2,900,000	2,031,500	NA	4
		1991	2,900,000	2,918,000	NA	
		1992	2,900,000	212,600	NA	1,4
Transfers to Tribal Facilities (Eggs/Fry)	Fall Chinook	1988	120,000	400,000	NA	5
		1989	120,000	275,000	NA	5
		1990	120,000	220,000	NA	5
		1991	450,000	125,000	NA	5
		1992	450,000	0	NA	1,5
	Coho	1991	NA	198,000	NA	5

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[3] All eggs are transferred to Hurd Creek or Dungeness Hatcheries. See these facilities for information on egg-to-fry survival. For broods 1988-1991 see Soleduck Hatchery.

[4] All 1991 eggs were shipped to Lower Elwha Tribe. All 1992 brood eggs were shipped to Dungeness Hatchery.

[5] Includes both subyearling and yearling releases.

[6] Most of the eggs were destroyed due the presence of VHS at Soleduck Hatchery.

Objective 1: **Hatchery**

Measures	Species	Brood Year	Hatchery Goal	Realized	Range	Comments
Transfers Within WDFW (Eggs/ Fry)	Fall Chinook	1988	4,100,000	9,740,000	NA	
		1989	4,250,000	4,915,000	NA	
		1990	4,420,000	4,175,000	NA	
		1991	4,300,000	4,741,000	NA	
		1992	4,300,000	825,000	NA	1
	Coho	1992	NA	300,000	NA	5
Transfers to Co-ops (Eggs/ Fry)	Fall Chinook	1988	3,000	103,000	NA	5
		1989	3,000	3,000	NA	5
		1990	3,000	20,000	NA	5
		1991	3,000	0	NA	5
		1992	3,000	0	NA	5
Adults Passed Upstream	Fall Chinook	NA	NA	NA	NA	6
	Coho	NA	NA	NA	NA	6
Percent Survival	Fall Chinook[7]	Avg.	1.0%	0.37%	0.23-0.50%	7
	Fall Chinook[8]	Avg.	5.0%	0.50%	0.38-0.62%	7

7 Subyearling goal.
8 Yearling goal.

Objective 2: Minimize interactions through proper rearing and release strategies

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Release smolts CV<10%	Fall Chinook	Yes	NA	NA	8
Acclimation	Fall Chinook	Yes	Yes	NA	
Volitional Release	Fall Chinook	Yes	Yes	NA	

Objective 3: Maintain stock integrity and genetic diversity

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Collect Adults Throughout Run	Fall Chinook	Yes	No	NA	6
Spawning Pop. >500	Fall Chinook	Yes	1,337	399-2,025	
Spawning Ratio Male:Female	Fall Chinook	>0.33	0.76[9]	0.7-1.0[10]	

Objective 4: Maximize survival at all life stages using disease control and prevention techniques

Measures	Species	Hatchery Goal	5-Year Average	Range	Comments
Adhere to Disease Policy	Fall Chinook	Yes	Yes	NA	

9 This includes the gaffed fish average, which is 0.6 and the trapped fish average which is 1.1..

10 The gaffed fish range is 0.3-0.7 and the trapped fish range is 0.9-1.5..

Objective 5: Conduct environmental monitoring

Measures		Hatchery Goal	Four-Year Ave.	Range	Constraint
TSS Effluent Composite		5 mg/L	-0.04	-15.5--3.7	
TSS Max Effluent		15 mg/L	0.9	-2.0-8.4	
SS Effluent		0.1 ml/L	0.01	0.0-.05	
TSS PA Effluent		100 mg/L	NA	NA	9
SS PA Effluent		1.0 ml/L	NA	NA	9
Downstream Temp (^{0}F)		Varies	55.0^0	52.0-61.0^0	
Maximum Temp		<63^{0}F	68.0^0	57.0-68.0^0	
Minimum Temp		>32^{0}F	30.0^0	30.0-37.9^0	
Downstream DO(mg/L)	>8.0	10.7	10-12		
Continuous Monitoring of Other Parameters	Yes	NA	NA		

Objective 6: Communicate effectively with other salmon, trout, and steelhead producers and managers

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraint
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	NA	10
Develop and Review Equil. Brood Doc.	All	Yes	No	NA	
Develop and Review Future Brood Doc.	All	Yes	Yes	NA	
Develop and Review Current Brood Doc.	All	Yes	Yes	NA	

Constraints/Comments—Elwha Rearing Channel

1. Poor returns to the hatchery are due to a combination of factors. They include no in-stream weir to trap adults, poor attraction water to the adult holding pond, low smolt to adult survivals, or high harvest rates. Imprinting of smolts and subsequent attraction of adults to phenethyl alcohol was not successful at increasing returns.

2. Coho that are trapped in the adult holding pond are spawned and eggs used for transfers to tribal or cooperative rearing programs.

3. Most of the eggtake for this brood was destroyed due to potential exposure to VHSV while eggs were incubating at Soleduck Hatchery.

4. Losses have occurred at other hatcheries due to lowered fertility of adults holding in warm river water prior to spawning. This results in a shortage of fish returned to Elwha Hatchery.

5. Change in program goal after development of goals in Future Brood Document.

6. Because the hatchery has no weir, and because attraction water from the hatchery is poor, adults can bypass the hatchery. Sufficient broodstock must be obtained by gaffing adults from the spawning grounds. These factors may result in inadequate egg takes from all segments of the run.

7. Two year average. More recent tag data are not available. The tag data listed here are from experimental releases. Not included are groups that were tagged as they volitionally emigrated from the rearing pond in the fall. These groups had no measured survival rate. Causes of poor survivals of subyearling and yearling groups are not known.

8. Difficult to sample juveniles at release. Only releases that have fish with coded-wire tags in the population are sampled and a mean length and CV determined.

9. The Elwha Rearing Channel does not have a pollution abatement pond.

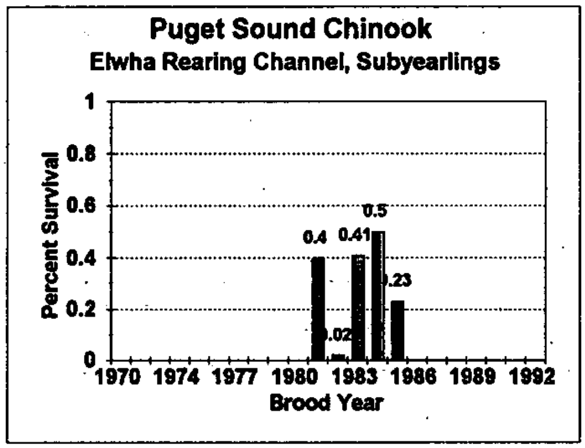
10. Lack of adequate funding to provide sufficient office support staff.

Stock Profile:

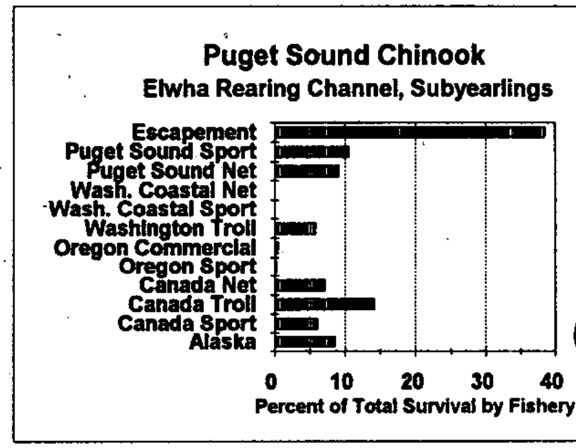
Fall Chinook: Fall chinook originated from native adults gaffed from the Elwha River. Originally, Dungeness Hatchery reared Elwha fall chinook which were later outplanted back into the Elwha River and other local rivers. Elwha Rearing Channel has released progeny of returning adults fo over three generations without imports of other stocks. **Stock Description: Native.**

STOCK STATUS PROFILE FOR: Elwha Subyearling Fall Chinook

Survival:



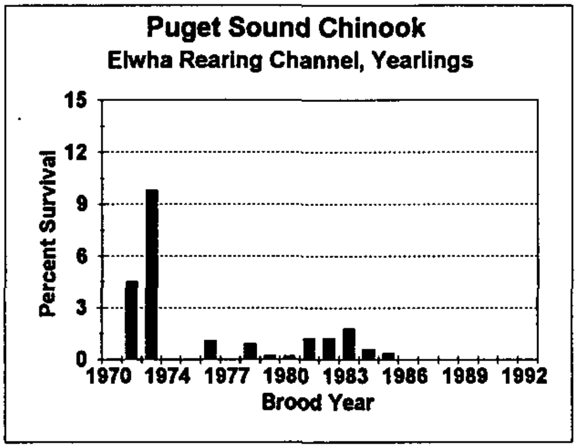
Distribution:



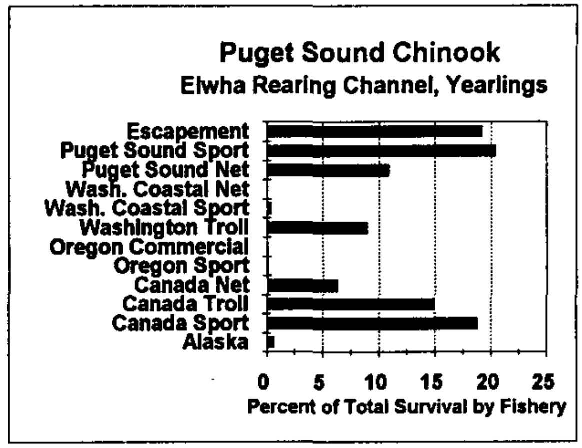
Two Year Average Survival: 0. 37%
Catch to Escapement Ratio: 2.6 : 1

STOCK STATUS PROFILE FOR: Elwha Yearling Fall Chinook

Survival:



Distribution:



Two Year Average Survival: 0.5%

Catch to Escapement Ratio: 5.5 : 1