1992 WASHINGTON STATE

SALMON AND STEELHEAD STOCK INVENTORY

APPENDIX ONE
PUGET SOUND STOCKS

SOUTH PUGET SOUND VOLUME

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
AND
WESTERN WASHINGTON TREATY INDIAN TRIBES

OLYMPIA, WASHINGTON

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The Puget Sound Appendix covers 209 of the 435 wild salmon and steelhead stocks identified in Washington State. Because of the amount of information presented, this Appendix is published as a three-volume set: North Puget Sound, South Puget Sound, and Hood Canal and the Strait of Juan de Fuca.

THE TECHNICAL STAFFS OF THE FOLLOWING TRIBES AND TRIBAL ORGANIZATIONS CONTRIBUTED TO THE PREPARATION OF THIS REPORT.

MUCKLESHOOT TRIBE
NISQUALLY TRIBE
NORTHWEST INDIAN FISHERIES COMMISSION
PUYALLUP TRIBE
SQUAXIN ISLAND TRIBE
SUQUAMISH TRIBE

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INTRODUCTION

This appendix volume is the South Puget Sound regional supplement to the *1992 Washington State Salmon and Steelhead Stock Inventory* (SASSI),[1] and provides more detailed information on individual salmon and steelhead stocks identified in the inventory. This information was assembled jointly by the Washington State Departments of Fisheries and Wildlife and the Western Washington Treaty Tribes. The Departments of Fisheries and Wildlife merged to form the Washington Department of Fish and Wildlife early in 1994. The general approach used to develop these appendices is described in the above referenced document.

SASSI documents the results of an initial stock status inventory that is the first step in a statewide effort to maintain and restore wild[2] salmon and steelhead stocks and fisheries. The inventory's intent is to help identify currently available information and to guide future restoration planning and implementation.

The SASSI process inventories **naturally reproducing** stocks of salmon and steelhead regardless of origin (including native, non-native, and mixed parentage). Only those stocks that spawn within Washington State were included. The current status of each stock was rated based primarily on trends in survival rates or population size, but the process did not focus directly on causative factors like habitat loss or overfishing. Stocks with escapement, run size, and survival levels within normal ranges and not displaying a pattern of chronically low abundance were rated as **Healthy** stocks. Those stocks that currently display low production or survival values were assigned to one of two separate rating categories: **Depressed** stocks or **Critical** stocks, depending on the current condition of the stock. Stocks were also rated as **Unknown** stocks when data limitations did not allow assessment of current status. A rating category for **Extinct** stocks was also included. However, the only extinctions listed in this inventory are those stocks that were thought to exist, based on recent data, but were subsequently found to be extinct. Past extinctions have not been included because SASSI is a **current** resource inventory and the historic information on lost stocks is incomplete and often anecdotal.

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1 SASSI – Washington Department of Fisheries et al. 1993.

2 The term wild stock as used in this report refers to how fish reproduce, i.e. by spawning and rearing in the natural habitat, regardless of parentage, and does not refer to genetic heritage. The origin (e.g. native, non-native or mixed) and parentage (wild, cultured or composite) of individual stocks are specifically designated in this report where known. This terminology is not intended to diminish the importance of native stocks but rather emphasizes the need to protect a wide range of genetic resources maintained by natural reproduction. The terms natural and wild spawners are used synonymously as are the terms stocks and spawning populations.

Of the 435 total salmon and steelhead stocks identified state-wide, 209 stocks were found in the Puget Sound basin. Of this total, 62 salmon and steelhead stocks are located in the South Puget Sound region and are the subject of this volume. Table 1 presents a summary of stock status for wild Puget Sound salmon and steelhead.

For a more detailed discussion of the methods used to identify individual stocks and rate current status, see the SASSI summary volume.

Two elements of the 1992 SASSI process are presented in this appendix:
(1) Species Overview Reports for each basin in the Puget Sound region, and
(2) Stock Reports for each individual stock. Any comments or questions regarding this information should be directed to the Washington State Department of Fish and Wildlife in Olympia, Washington.

In this volume of Appendix One, only South Puget Sound stocks are presented. There are two other separate volumes in Appendix One which present information for North Puget Sound and Hood Canal/Strait of Juan de Fuca stocks.

Table 1. Summary of stock status for wild salmon and steelhead stocks in the Puget Sound basin.

	HEALTHY	DEPRESSED	CRITICAL	UNKNOWN	EXTINCT
NORTH PUGET SOUND					
Chinook salmon	3	7	2	3	0
Chum salmon	8	0	0	4	0
Coho salmon	4	3	0	7	0
Pink salmon	5	0	0	2	0
Sockeye salmon	0	0	1	0	0
Steelhead	7	2	1	12	0
71 TOTAL STOCKS	27	12	4	28	0
PERCENT OF TOTAL	38%	17%	6%	39%	0%
SOUTH PUGET SOUND					
Chinook salmon	5	0	1	4	0
Chum salmon	18	0	0	4	1
Coho salmon	8	3	0	0	0
Pink salmon	2	0	0	0	0
Sockeye salmon	0	3	0	0	0
Steelhead	7	1	0	5	0
62 TOTAL STOCKS	40	7	1	13	1
PERCENT OF TOTAL	65%	11%	1.5%	21%	1.5%
HOOD CANAL & STRAIT OF JUAN DE FUCA					
Chinook salmon	2	1	1	0	0
Chum salmon	12	1	2	5	0
Coho salmon	8	10	1	2	0
Pink salmon	2	2	2	0	0
Sockeye salmon	–	–	–	–	–
Steelhead	2	11	0	12	0
76 TOTAL STOCKS	26	25	6	19	0
PERCENT OF TOTAL	34%	33%	8	25%	0%
PUGET SOUND					
209 TOTAL STOCKS	93	44	11	60	1
PERCENT OF TOTAL	44%	21%	5%	29%	0%

SPECIES OVERVIEW REPORTS

An Overview Report is presented for each species of salmon or steelhead within a river basin or regional area. These overviews provide discussions of the definition and origin of stocks and review any uncertainties relating to the decisions to list specific stocks. The overviews also present information on trends in escapement and run size for the combined stocks of each species within a river basin or region. The individual Stock Reports follow each Overview Report.

STOCK REPORTS

Each stock of salmon and steelhead identified in SASSI is the subject of a report which presents detailed written descriptions of the rationales for the stock definitions in a **Stock Definition and Origin** section (which summarizes information on distribution, timing, and biological characteristics) and highlights any related uncertainties or caveats. Stock origin is also addressed with some discussion of the probable genetic make-up of each stock, and possible interactions with hatchery fish. The **Stock Status** section of these reports assesses the trends in escapement, production, or survival for each stock, and discusses the data used to measure current status. Stock ratings are also presented.

This document is not intended to provide an assessment of factors that may be limiting production of stocks classified as Healthy, nor does the Healthy category reflect the concern held for some of the stocks classified as such. Additionally, it was not intended to profile factors that could present future risks to stock status. State and tribal fishery managers feel very strongly that habitat protection and restoration needs exist for many stocks classified as Healthy in SASSI as well as for Critical and Depressed stocks. Because of the limitations in the inventory regarding assessment for Healthy stocks, SASSI should not be used as the singular approach for defining restoration needs and priorities. SASSI also does not provide a basis for evaluating the feasibility or likelihood of success of specific restoration projects.

Additional written material was prepared for all stocks whose status was Depressed or Critical, and for some stocks in the Healthy and Unknown categories. The **Factors Affecting Production** section provides a brief description of harvest management, habitat status, and fish culture programs. The **Habitat** section reviews the general condition of the habitat used by each stock, and identifies specific environmental problems known to impact stock survivals. The **Harvest Management** section is a general discussion of the fisheries that impact each stock. The **Hatchery** section discusses salmon and steelhead culture programs in the areas utilized by each stock, and outlines possible interactions between wild fish and hatchery fish. **These discussions on factors affecting production are only meant to provide a very general overview of the type of problems faced by a stock.** More detailed

examinations of these same topics will be developed for those stocks requiring priority attention as part of the overall Wild Stock Restoration Initiative (see SASSI Part 3 -- Current and Future Actions).

The material contained in Overviews, Stock Reports and Stock Profiles is sometimes a brief summary of far more extensive information available about stocks. Readers interested in obtaining more detailed information about specific stocks should contact the Washington Department of Fish and Wildlife or the Northwest Indian Fisheries Commission for referral to appropriate staff.

In some cases, the data available for use in SASSI are inadequate to determine whether naturally-spawning fish represent self-sustaining populations or whether they are maintained by frequent input from hatchery fish.

STOCK PROFILES

It is an objective of SASSI to provide a general presentation of the available information on each stock of salmon and steelhead included in the inventory. To accomplish this, a two-page Stock Profile is included in each Stock Report to provide a quick review of the definition and status of each salmon and steelhead stock.

The first page is a **Stock Definition Profile**, which summarizes the three criteria used in defining individual stocks; including spawning distribution, timing, and biological characteristics.

Spawner distribution is shown on a generalized basin map, and distinct distribution is noted if applicable. These maps are provided to demonstrate differences in distributions between stocks and are not intended to show exact spawning locations. In some cases, spawning distributions are unknown, and the basin maps are left blank. This does not mean that such a stock cannot be distinct based on spawner distribution. The fact that a self-sustaining population is known to be present in a stream or streams can validate the stock, even if exact spawning locations are unknown. Distinct spawning distribution is the most commonly used criterion for identifying individual stocks in the SASSI process because general information on the geographic location of spawning and spawning habitat is the most readily available.

Timing of various life stages is presented in graphic form, and again any distinctions (differences between stocks) are identified. Distinct temporal distribution identifies stock differences based on variations in timing of critical life stages, e.g. spawning or return timing.

Biological characteristics are summarized at the bottom of the stock definition page. Distinct biological characteristics can include any observable distinctions between stocks such as size, age structure, scale patterns, parasites, or genetic differences. This criterion is applied in a number of different ways in this inventory.

For some stocks, the stock differentiation is based on observable physical attributes.

However, genetic distinctions are the most common biological characteristic used in this document. There are indirect and direct approaches in SASSI for using genetic characterizations to distinguish among stocks. The indirect approach makes assumptions about the genetic makeup of a group of fish such as when it has been substantially changed by past or continuing introductions of non-native stocks. The direct approach is based on genetic stock identification (GSI), which is a method that can be used to characterize populations of organisms based on the genetic profiles of individuals. The GSI methodology relies on the combined use of biochemical, genetic, and statistical procedures to discriminate among populations. A more detailed discussion of the methods and applications of the use of GSI in SASSI is presented in the following Genetic Stock Identification section. Where GSI information exists it is graphically presented in the form of a dendrogram.

The second page is a **Stock Status Profile**, which presents current stock status information. The data used to determine stock status are presented in tabular and graphic form. Data quality is also noted. These data sets will vary by species and stock, depending on the nature of available stock-specific information. The purpose of the numerical data is to describe the stock production trends, and may include data sets that are direct measures of abundance (e.g. escapement or run size), as well as less direct statistics like fish/mile and fish days. Both direct and indirect data can be used to express trends. For a discussion of the types of data used in SASSI to evaluate stock status, see the following Stock Assessment Data section.

The distribution (percentage) of harvest and escapement are shown in the form of a pie chart, where stock specific data are available.

The final section of the Stock Profiles presents a summarized description of stock status, including stock origin, type, and current status. The terms used in the Stock Summary section of the profiles are defined below.

Stock Origin - The terms dealing with the origin of stocks identify the genetic history of each stock.

> **Native** -- An indigenous stock of fish that has not been substantially impacted by genetic interactions with non-native stocks, or by other factors, and is still present in all or part of its original range. In limited cases, a native stock may also exist outside of its original habitat (e.g. captive brood stock programs).
>
> **Non-native** -- A stock that has become established outside of its original range.

Mixed -- A stock whose individuals originated from commingled native and non-native parents, and/or by mating between native and non-native fish (hybridization); or a previously native stock that has undergone substantial genetic alteration.

Unknown -- This description is applied to stocks where there is insufficient information to identify stock origin with confidence.

Production Type - The terms defining production type are describing the method of spawning and rearing that produced the fish that constitute each stock.

Wild -- A stock that is sustained by natural spawning and rearing in the natural habitat, regardless of parentage (includes native).

Cultured -- A stock that depends upon spawning, incubation, hatching, or rearing in a hatchery or other artificial production facility.

Composite -- A stock sustained by both wild and artificial production.

Stock Status - These terms describe the current condition of each stock of fish and may be based on escapement, run size, survival, or fitness levels.

Healthy Stock -- A stock of fish experiencing production levels consistent with its available habitat and within the natural variations in survival for the stock.

Depressed Stock -- A stock of fish whose production is below expected levels based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely.

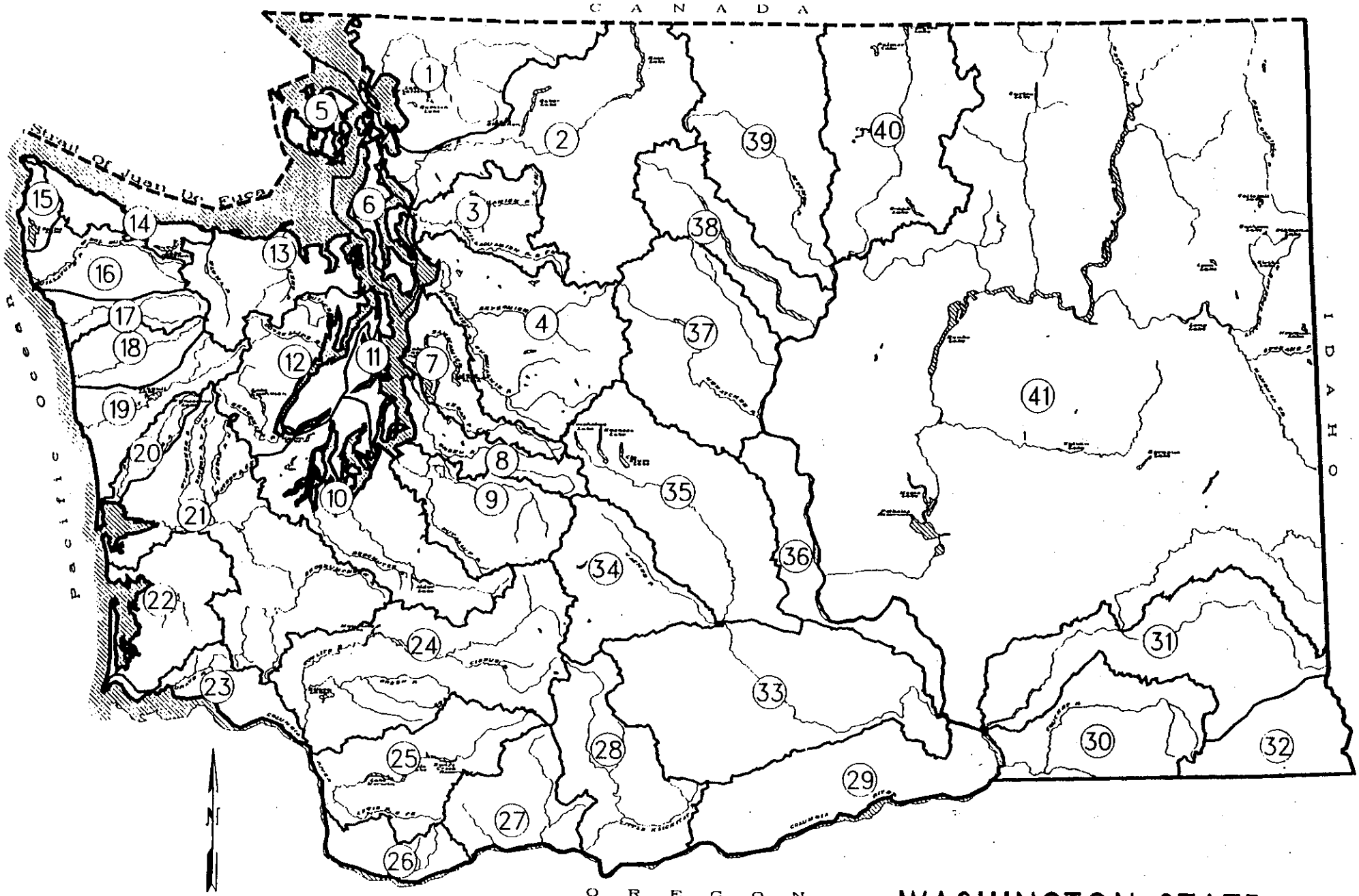
Critical Stock -- A stock of fish experiencing production levels that are so low that permanent damage to the stock is likely or has already occurred.

Extinct Stock -- A stock of fish that is no longer present in its original range, or as a distinct stock elsewhere. Individuals of the same species may be observed in very low numbers, consistent with straying from other stocks.

Unknown Stock -- This description is applied to stocks where there is insufficient information to identify stock status with confidence.

SASSI SALMON AND STEELHEAD RIVER BASINS

SASSI Stock Definition Profiles display spawning distribution information for the salmon and steelhead stocks in Washington State on river basin maps. These maps are scaled not only to present spawner distributions, but must also fit the format of the profile pages. This sometimes makes it difficult to relate a specific river basin map with adjacent systems. To help orient the reader, the state map on the following page locates the river basins used in SASSI. These SASSI river basins are not the same as Water Resource Inventory Areas (WRIA), which are used by Washington State natural resource agencies (Williams et al. 1975).



WASHINGTON STATE
Salmon and Steelhead River Basin

This appendix volume covers the South Puget Sound region.

PUGET SOUND

North Puget Sound

1- Nooksack/Samish
2- Skagit
3- Stillaguamish
4- Snohomish
5- San Juan Islands
6- Whidbey Island

South Puget Sound

7- Lake Washington
8- Duwamish/Green
9- Puyallup
10- Nisqually/Deep South Sound
11- East Kitsap

Hood Canal/Strait of Juan de Fuca

12- Hood Canal
13- Elwha/Dungeness
14- West Strait

COASTAL WASHINGTON

North Coast

15- Sooes/Ozette
16- Quillayute
17- Hoh
18- Queets
19- Quinault

Grays Harbor

20- Humptulips
21- Chehalis

Willapa Bay

22- Willapa/Nemah/Naselle

COLUMBIA RIVER

Lower Columbia River

23- Grays/Elochoman
24- Cowlitz
25- Kalama/Lewis
26- Washougal

Upper Columbia River

27- Wind/White Salmon
28- Klickitat
29- Rock Creek
30- Walla Walla/Touchet
31- Snake/Tucannon
32- Asotin/Grande Ronde
33- Lower Yakima
34- Naches
35- Upper Yakima
36- Hanford Reach
37- Wenatchee/Entiat
38- Lake Chelan
39- Methow
40- Okanogan
41- No anadromous fish

GENETIC STOCK IDENTIFICATION

In SASSI, distinct biological characteristics can include any observable distinctions between stocks such as size or age structure, but are most commonly identified for chinook, chum, pink, and sockeye salmon by screening for genetic differences using a technique called **Genetic Stock Identification** (GSI). GSI is a method that can be used to characterize populations of organisms based on the genetic profiles of individuals. The methodology relies on the combined use of biochemical, genetic, and statistical procedures to characterize and discriminate stocks.

Although the GSI characterization of stocks and testing of stock structure provides a direct measure of genetic interrelationships, it is important to be aware of limitations of this approach. It is presently possible to investigate only a tiny and restricted fraction of the genetic traits of salmon by the electrophoretic analysis of proteins. To the extent that the characters that can be investigated do not represent the entire genome, the view of genetic interrelationships derived from GSI analysis will be incomplete (and could fail to detect existing reproductive isolation among stocks -- see below). Indeed, there are a large number of genetically influenced characteristics of salmon about which there is little or no information. It is assumed that most or all of the genetic variation that can be studied by electrophoresis is not subjected to natural selection, that is, it is selectively neutral. While this assumption seems justified given much of population genetics theory and a considerable amount of empirical data from a number of organisms, exceptions to it could complicate or even invalidate some of our interpretations. It must also be realized that the statistical test (e.g. G-test) of stock structure, can be reasonably used to establish the existence of multiple stocks but not to disprove that multiple stocks exist. While statistically significant differences among samples provide strong evidence for the existence of distinct gene pools (i.e. separate stocks), the absence of significant differences does **not** constitute proof that only a single stock exists.

As currently applied to the investigation of stocks of Pacific salmon, the GSI process consists of a series of steps: (1) Collect selected tissues (usually muscle, heart, eye, and liver) from a representative sample of individuals (usually 100 or more) from the population(s) under investigation, (2) Develop genetic profiles (at 15 or more variable loci) for the individuals in each population by conducting starch-gel electrophoresis and biochemical staining using tissue extracts, (3) Characterize each population sampled by aggregating the individual genetic profiles and computing allele frequency distributions, and (4) Conduct statistical tests (G-tests or chi-square) using the allele counts characterizing each population.

Electrophoresis is a process whereby charged molecules (such as enzymes and other proteins) are separated in an electric field. It is possible to document the genetic characteristics of individuals (and populations) using starch-gel electrophoresis, because of the relationship between the genetic code (DNA) and

enzyme biochemical phenotypes. These phenotypes are expressed, after electrophoresis and enzyme staining, in the form of banding patterns on the gels. Each enzyme (protein) subunit is encoded by a specific segment of DNA - a gene locus - which specifies its structure. When a locus exhibits genetic variation it has two or more alternate forms or alleles. Much, but not all, of the allelic variation of enzyme-coding loci can be detected by electrophoretic analysis because it results in structural changes to the enzymes.

Reproductively isolated populations usually develop significant differences in allele frequencies at one or more loci over time. The power of GSI to identify and characterize stocks is derived from the differential distribution of alleles at many gene loci in different stocks.

The hypothesis being tested in step 4 (see above) - that the allele distributions of the populations being compared are no more different than multiple independent samples from a single, freely interbreeding population - is closely tied to the definition of stocks as reproductively isolated populations. A statistically significant result in this test causes the rejection of the null hypothesis and typically leads to the conclusion that the populations tested are genetically different and, therefore, represent distinct stocks (breeding units). The commonly used 0.05 rejection level is applied as a cutoff value to indicate statistical significance in these tests. The power of the statistical tests is dependent on the numbers of fish in the samples being compared. Because of this, differences in allele counts that are not significant at small sample sizes can become significant if the sample sizes are large enough.

Typically, the genetic testing of stock structure begins with G-tests (or chi-square tests) involving pairs of individual collections. When such tests reveal significant differences, this is usually considered to be evidence for the existence of two genetically distinct stocks. However, in some cases individual collections are combined during the testing process. This is usually done when there are two or more separate collections from the same locality (usually taken in different years). The individual collections are combined in such cases because it is believed that the combination provides a better characterization of the population than does any single sample. Samples may also be combined from adjacent localities after testing of the separate collections has revealed no significant differentiation among them. For example, if six separate samples of Skagit River pink salmon are collected from different localities (and possibly in different years) and no evidence of significant genetic differences among them is found, they may be combined to characterize pink salmon in the entire river system and this aggregate subsequently tested against collections or similar aggregates from nearby drainages (e.g. Nooksack River, Stillaguamish River, etc.).

In addition to the direct testing of stock structure using the G-test approach, dendrograms based on average genetic distances among samples have been used to summarize the genetic interrelationships among stocks. This commonly used

approach provides a simple one-dimensional graphical representation of overall stock similarities and differences. The lengths of the horizontal branches that connect stocks in dendrograms are proportional to the average genetic distances between the stocks. The vertical position of individual stocks in a dendrogram does not necessarily reflect genetic relationships because each branch point is actually a point around which the lower level branches can be rotated without distorting the estimated genetic distances between them and other stocks in the dendrogram.

While dendrograms are useful because they simplify the often complex patterns of genetic interrelationships among stocks, they are not without disadvantages. The absolute magnitude of differences identified by this technique is influenced both by the specific suite of gene loci included in the analysis and the particular genetic distance measure used. As individual stocks that are most similar are connected in the process of building the dendrogram, their relationships to other stocks can be distorted. The dendrogram analysis **is not** a test of stock structure, in part because it is independent of sample size. Thus, while dendrograms can be useful for depicting genetic interrelationships among stocks and for summarizing among-stock diversity, they cannot be used to define or identify distinct stocks genetically; this must be done using the results of the direct statistical tests (e.g. G-test).

STOCK ASSESSMENT DATA

The evaluation of the current status of the stocks of salmon and steelhead identified in SASSI is based on the best available escapement, harvest, run size, and survival data. Only stock specific data were used, which sometimes limited the available data to a short span of recent years. These data were plotted and qualitatively examined for changes in abundance or survival. Often, only a single stock specific statistic was available to analyze the production trend of a stock. When multiple types of data could be used to examine individual stock status, the available production or survival data sets were examined individually and each stock's rating was based on the statistic(s) that best described the current status.

The Stock Reports and Stock Status Profiles present the stock assessment data for individual stocks. The following discussion defines those stock assessment terms used in the evaluation of Puget Sound salmon and steelhead stocks.

ESCAPEMENT DATA

For salmon and steelhead stocks, the term escapement refers to those mature fish that have returned to freshwater, have survived all fisheries, and constitute the spawning population for a given stock. Escapement data collected during spawning ground surveys and by counts made at traps and fish passage facilities are the most frequently used sources of information on the status of salmon and steelhead stocks. Some types of escapement data represent a direct measure of all of the fish making up a spawning population. Examples of direct escapement measurements would include total escapement estimates, and trap and dam counts. For many stocks, direct escapements are not available and indirect escapement numbers are used to evaluate stock status. Indirect escapements are generally actual count data for specific spawning ground reaches (index areas) and are usually collected on an annual basis. Examples would be redd or fish/mile counts. Indirect counts do not provide total escapements, but rather are relative data sets that can be used to indicate changes in abundance and long-term escapement trends.

The following escapement data sets were used to determine the status of various Puget Sound salmon and steelhead stocks.

ESCAPEMENT	
Carcass	The highest daily count of dead fish (carcasses) in an index area.
Dam count	A total count of fish destined for spawning grounds upstream of a dam.

Fish-days	The total number of fish days (one fish present for one day) in an index area over an entire spawning season.
Fish/mile	A spawner count divided by the number of miles surveyed.
Hat & Nat	Total number of hatchery and natural fish escaping to a particular stream area.
Index total	An estimate of total escapement in an index area.
Peak count	The highest daily count of live fish in an index area.
Peak redds	The highest daily count of redds (spawning nests) in a stream index area.
Rack count	A total count of fish destined for spawning grounds upstream of a rack.
Redds	A count of redds (spawning nests) in a stream index area.
Redds/mile	A redd count divided by the number of miles surveyed.
Snorkel Index	A count of adults observed while snorkeling an index area.
Total	An estimate of all fish of a stock that have survived all fisheries and make up a spawning population.
Trap count	A total count of fish destined for spawning grounds upstream of a fish trapping facility.

HARVEST DATA

The numbers of fish harvested in various major fisheries can be used to measure relative abundance and to observe long-term trends. Harvest data sets are typically for specific fisheries or regions and do not necessarily represent all of the catches made everywhere that impact the stock. For example, total harvest might refer only to the combined sport and commercial harvest in the Puget Sound system, but may not include ocean catches.

The following types of harvest data were used to assess the current status of some Puget Sound salmon and steelhead stocks.

HARVEST	
Total	The combined catches of all fisheries in a specific region. In some cases, catch data for some fisheries may be unavailable, but the available catch data are thought to be representative of total harvest trends.
Net	The total net catches in a major fishery or the combined tribal and/or commercial net catches in a specific region.
Sport	The total catches in a single sport fishery or the combined catches in all sport fisheries in a specific region.

RUN SIZE DATA

The term run size refers to the total number of salmon and steelhead measured at a particular point in their return migration, e.g. the total numbers entering Puget Sound. Run size estimates may not include all returning fish (e.g. a small harvest component may not be included), but the run sizes presented in SASSI are believed to be complete enough to represent the relative abundance of the stock. Run-size data are not available for many stocks because of the difficulty in identifying stock specific harvests in mixed stock fisheries.

The following run-size data were used to determine the status of some Puget Sound stocks.

RUN SIZE	
Inside	The total numbers of fish leaving the ocean on their return migration. For Puget Sound stocks, the inside run includes all fish entering the Strait of Juan de Fuca (Washington waters only).
Total	The combined escapement and harvest of a stock of fish in a specific region, but may not include all of the catches made everywhere for a specific stock.
Trap count	A total count of fish destined for areas upstream of a fish trapping facility.

JUVENILE DATA

Counts of juvenile salmon and steelhead at various life stages are used to measure relative abundance and evaluate trends. These count data are most commonly collected during the freshwater incubation, rearing, or migration periods, and may include any life stage from egg to smolt. Juvenile count data are also used to measure a variety of survival rates.

JUVENILE

PS/100m2	The average number of presmolts (juveniles enumerated immediately before the smolt stage) produced per 100 square meters of habitat.
No./100m2	The average number of juveniles (of various age classes) produced per 100 square meters of habitat.
Smolts	The number of smolts produced by spawners from a brood year.

SURVIVAL DATA

The survival of fish of a given brood year can be expressed as a ratio between any two life stages, and when collected over a number of years can provide a measure of the success of specific stocks. Recruits per spawner is the most commonly used survival statistic for salmon and steelhead stocks because it expresses the total survival for a given parent year spawning.

SURVIVAL

PS/spawn	The number of presmolts (juveniles enumerated immediately before the smolt stage) divided by the number of total spawners from a brood year.
Rec/spawn	The number of returning adults (recruits) divided by the number of spawners from a brood year.
Smolt/egg	The survival rate from egg to smolt expressed as a percentage.
Smolt/Fem	The number of smolts divided by the number of female spawners from a brood year.

NO DATA

For many stocks of salmon and steelhead, there are no stock-specific data that can be used as measures of stock status. These stocks are typically small populations and are rated as Unknown status stocks.

SOUTH PUGET SOUND STOCK REPORTS

OVERVIEW -- LAKE WASHINGTON SUMMER/FALL CHINOOK STOCKS

ISSAQUAH
NORTH LAKE WASHINGTON TRIBS
CEDAR

STOCK DEFINITION AND ORIGIN

Lake Washington chinook stocks are distinguished from chinook stocks in other Puget Sound basins by geographical separation. They are summer/fall-timed stocks which spawn primarily from mid-September through October. With the exception of the Issaquah stock, Lake Washington chinook may have had less exposure to non-local hatchery stocks, particularly Green River-origin chinook, than many other South Puget Sound chinook stocks. Genetic data to evaluate the relation between hatchery and naturally-spawning chinook are not yet available.

Spawning in Issaquah Creek occurs in the lower mainstem and East Fork Issaquah Creek from late September through October. Natural spawning levels of this stock may be heavily dependent on yearly straying from the Issaquah Hatchery. Low summer flows in Issaquah Creek can make it difficult for returning adult hatchery-origin fish to reach the hatchery rack, facilitating below-rack spawning.

Chinook spawning in north Lake Washington tributaries utilize North, Swamp, Bear, Little Bear, Thorton, McAleer, and Cottage Lake creeks as well as the Sammamish River. Spawning occurs from September through October. Chinook from Issaquah Hatchery may stray into north Lake Washington tributaries, however, their impacts on the North Lake Washington tributaries are not known.

Cedar River chinook spawning distribution is limited to the lower river by a pipeline crossing at Landsburg (RM 21). Spawning is from mid-September through October. As with the North Lake Washington Tribs stock, the effect of hatchery straying on this stock is unknown.

STOCK STATUS

Lake Washington chinook are caught in sport and commercial fisheries off Vancouver Island and the Washington coast and in fisheries in Puget Sound and Lake Washington. Recoveries of coded-wire tags from chinook released from several South Sound hatcheries, including Issaquah Hatchery, suggest that approximately one-third of the total catch of South Sound chinook, including Lake Washington chinook, occurs in Canadian fisheries, slightly less than two-thirds of the catch occurs in Puget Sound fisheries, and a very small proportion is caught in Washington coastal fisheries.

The interim escapement goal for naturally-spawning chinook in the Cedar River and the North Lake Washington tributaries is 1,550 adult spawners. This goal has not been met since 1987.

More information on the individual stocks is presented in the Stock Reports which follow.

LAKE WASHINGTON -- ISSAQUAH SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was defined as distinct based upon geographic distribution in Issaquah Creek and East Fork Issaquah Creek. Spawn timing begins in late September and peaks in October, a timing similar to that of other chinook stocks in south Puget Sound. There has been no collection of tissues for genetic composition analysis. Stock origin is believed to be non-native due to Green River stock transfers since the 1930s. Other non-local stocks may have also influenced the stock composition. Genetic composition analysis would be useful to help clarify the current stock composition.

STOCK STATUS

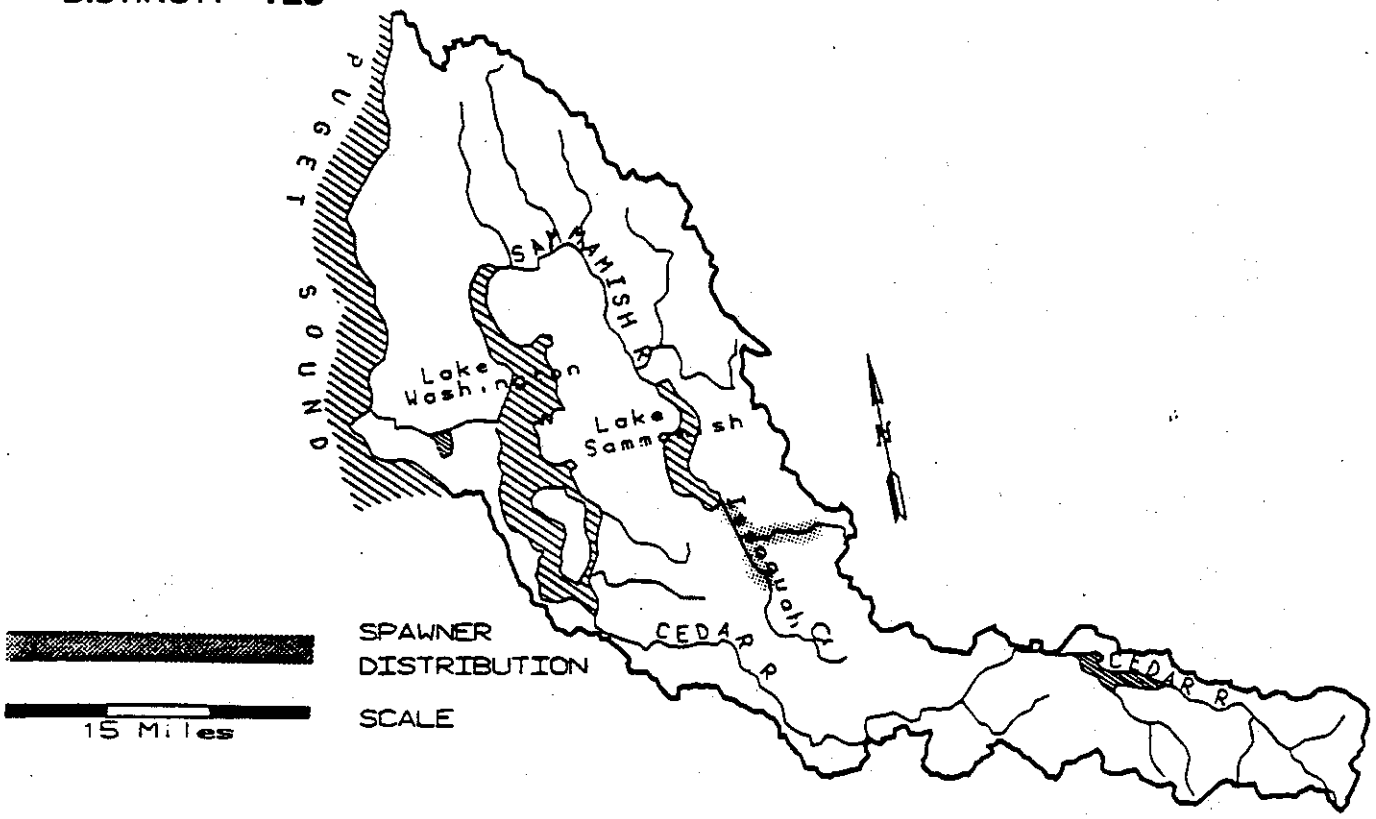
Stock status is Healthy based upon carcass counts.

Relative measurements of abundance are based upon carcass counts throughout the spawning season plus the number of live fish on the last day of the survey. These counts ranged from 844 to 3,337 from 1986 through 1991, with an average of 1,993 per year. The natural spawning population is located primarily below the hatchery rack and is dependent on hatchery production. Water temperatures and flows alter the ability of chinook to reach the hatchery rack and therefore influence the level of natural spawning below the hatchery.

STOCK DEFINITION PROFILE for Issaquah Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING										▬			**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

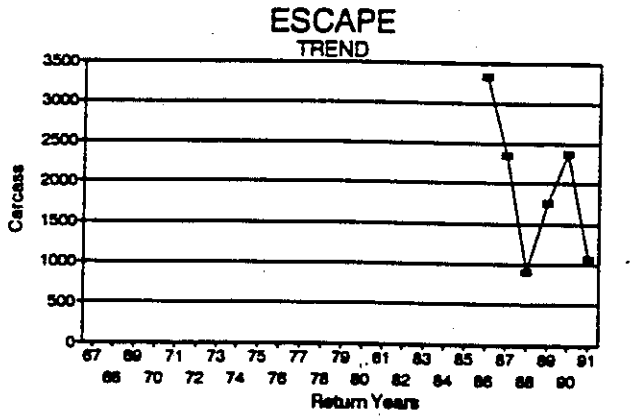
GENETICS - No data available.

STOCK STATUS PROFILE for Issaquah Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY----> Fair

Return Years	ESCAPE Carcass			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86	3337			
87	2353			
88	907			
89	1768			
90	2376			
91	1067			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Non-native

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

LAKE WASHINGTON -- NORTH LAKE WASHINGTON TRIBS SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock is thought to be distinct based upon geographic isolation. Distribution includes North, Swamp, Bear, Little Bear, Thorton, McAleer and Cottage Lake creeks and the Sammamish River. Spawn timing peaks in October and is similar to that of other fall chinook stocks in Puget Sound. No genetic stock identification data are available.

Stock origin is native with possible influence from Issaquah Hatchery strays.

STOCK STATUS

Stock status is Unknown due to a lack of consistent spawning ground data.

All the tributaries of Lake Washington and Lake Sammamish utilized by this stock have been intensively urbanized with a myriad of human-caused habitat impacts which for the most part mask the natural population limiting factors of low summer stream flow and poor spawning gravel quality. Conversion of agricultural and forest lands to more intense land use results in a loss of pervious surfaces to absorb rainwater. Consequently peak winter flows are skewed to shorter run-offs and substantially higher peaks. This translates to increased stream velocities which displace fish and erode the stream bed and banks. Loss of functional flood plains through bed downcutting or flood plain filling worsens the effects of the increased flow. Low flows are also worsened because of loss of wetland water storage and reduced groundwater due to reduced pervious surfaces.

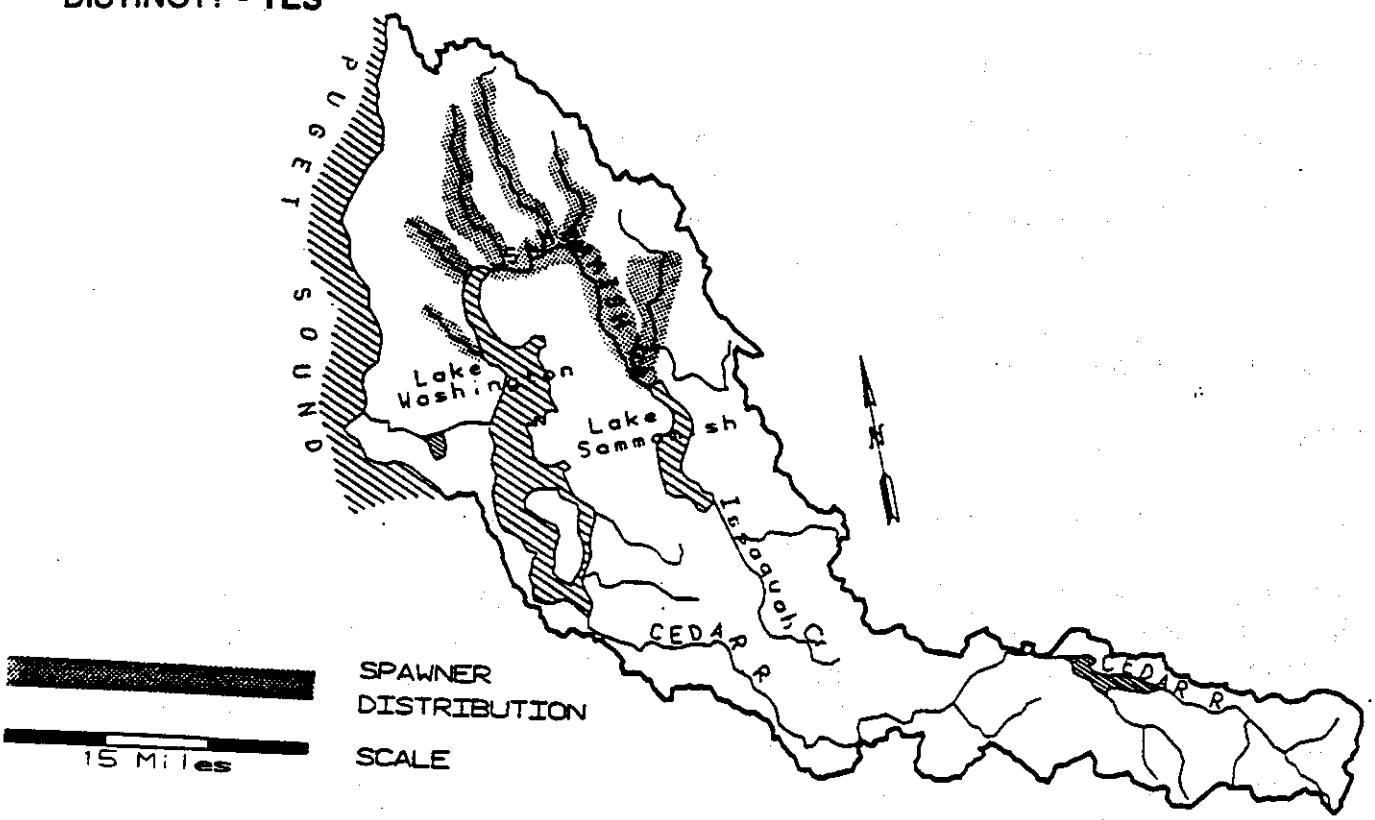
Other impacts of urbanization in these streams include extensive bank protection with rock rip rap or concrete bulkheads, stream channelization which creates a uniform channel shape and cross-section with a reduction in rearing pools and loss of riparian vegetation both for streamside shade and cover and for instream woody debris cover, and active removal of what little large woody debris does enter the stream. Loss of streamside shade and summer low flows in the Sammamish River have resulted in water temperatures as high as 81 degrees F, which would discourage upstream migration. Water quality has diminished, and hazardous material spills with resultant fish kills are not uncommon. Fish passage is difficult or impossible at numerous culverts and other structures in these streams. Many of these problems are manifestations of increased peak run-off.

Disturbance or mortalities to adult spawners by people and domestic animals exacerbates the minimal habitat quality. Nearshore habitats in Lake Washington, Lake Sammamish, Lake Union, the Ship Canal and Shilshole Bay have been diminished by bulkheading and dock and pier construction.

STOCK DEFINITION PROFILE for North Lake Washington Tribs
Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING									■	■			**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

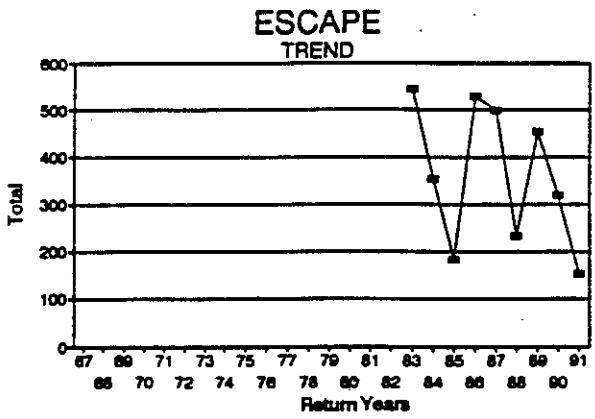
GENETICS -No data available.

STOCK STATUS PROFILE for North Lake Washington Tribs Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY-----> Unknown

Return Years	ESCAPE Total			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83	544			
84	354			
85	183			
86	528			
87	498			
88	233			
89	453			
90	318			
91	153			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

LAKE WASHINGTON -- CEDAR SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was defined as distinct based upon geographic distribution. Spawn timing peaks in October, similar to that of other fall chinook stocks in Puget Sound. Genetic stock identification data are unavailable.

Stock origin is native, and all spawning is natural.

STOCK STATUS

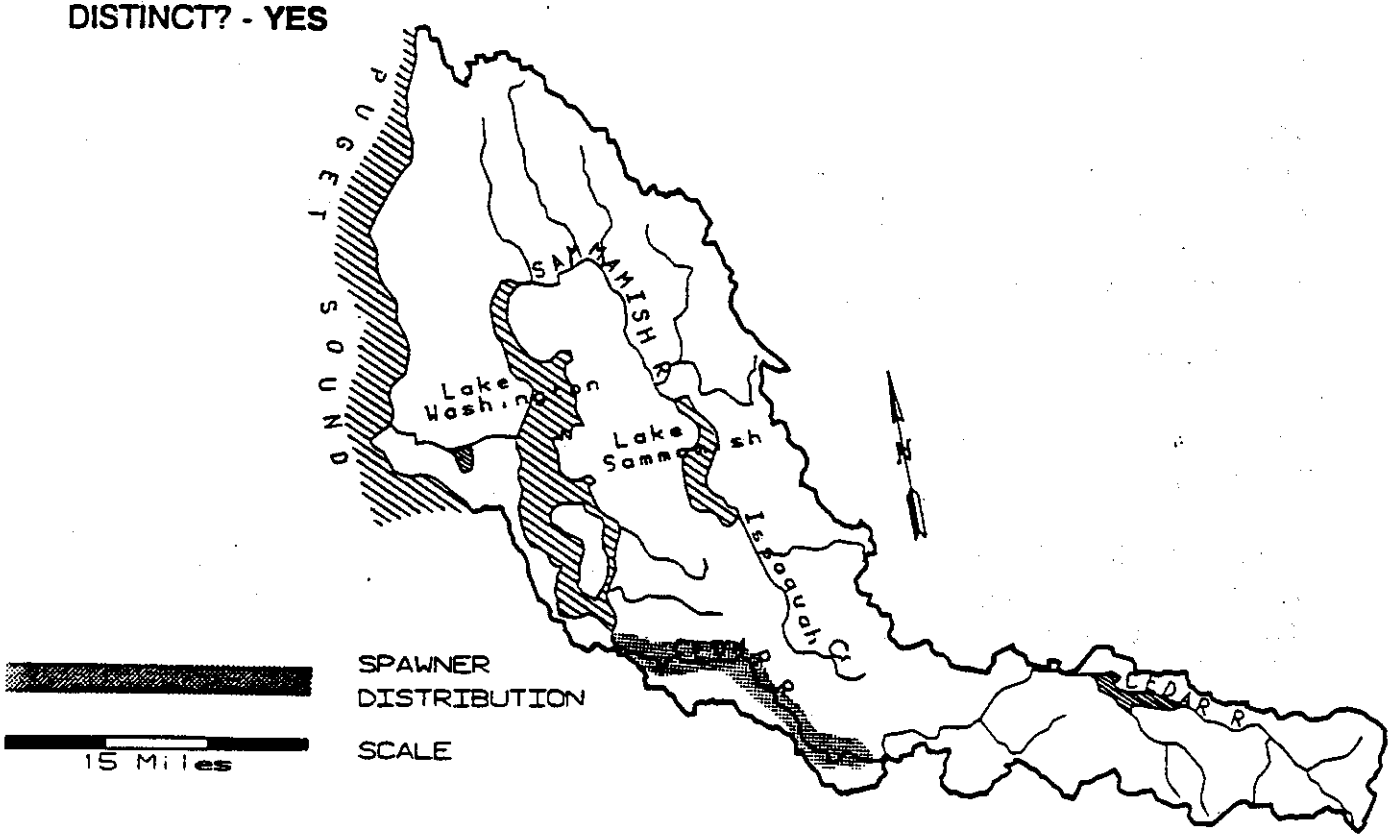
Stock status is Unknown and needs to be closely monitored as a short-term decline may be developing.

The Muckleshoot Tribe believes that this stock is best characterized as Depressed. Relative abundances can be compared across years by examining peak live-spawner counts, but these data are not as reliable as redd counts. Peak live counts have ranged from 100 to 800 with an average of 300 per year.

STOCK DEFINITION PROFILE for Cedar Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING									▬	▬	▬		**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? -**UNKNOWN**

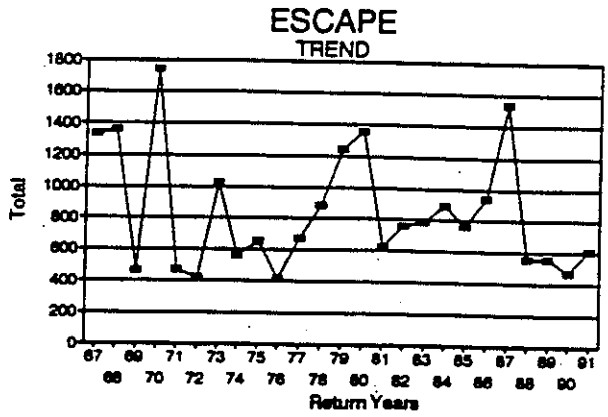
GENETICS - No data available.

STOCK STATUS PROFILE for Cedar Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY——> Fair

Return Years	ESCAPE Total			
67	1335			
68	1363			
69	466			
70	1745			
71	471			
72	419			
73	1025			
74	560			
75	656			
76	416			
77	675			
78	890			
79	1243			
80	1360			
81	624			
82	763			
83	788			
84	898			
85	766			
86	942			
87	1540			
88	559			
89	558			
90	469			
91	614			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

OVERVIEW -- LAKE WASHINGTON COHO STOCKS

LAKE WASHINGTON/SAMMAMISH TRIBS
CEDAR

STOCK DEFINITION AND ORIGIN

For the purposes of this inventory, Lake Washington includes all waters inside of the Ballard Locks at Salmon Bay. Coho salmon utilize, to some degree, almost all of the accessible tributaries draining into Lake Washington. Coho returning to these tributaries typically enter freshwater from mid-September to mid-November and spawn from late October to late February, with some variation observed between streams and between years within streams.

There have been substantial releases of hatchery-origin coho within this area, with significant yearling plants from the early 1950s to the early 1970s and regular fingerling/fry plants from the mid-1970s to present. There are also annual yearling releases from the hatchery facilities on Issaquah Creek and at the University of Washington. It should be noted that many of the early off-station yearling releases were not consistent with current optimal size and time-of-release strategies, and their subsequent contribution to the wild spawning population is unknown. Straying rates from the on-station programs are also unknown, as are the potential survival differentials related to the various stocks introduced into this area.

Additional to those considerations are questions regarding the spawning success in the wild of hatchery-origin coho and any distinctions between native and introduced stocks in terms of either temporal or physical spawning distributions. As a result of these uncertainties, the two stocks in this area have been designated as probable mixtures of native and non-native stocks, without any inference as to the relative influence of those stocks within the current populations. There can be no confident quantification of the genetic impact of non-native stock introductions, regarding either a current presence of hatchery-type components in these populations or hybridization of the native stock, until an effective genetic research tool is developed and implemented for coho salmon.

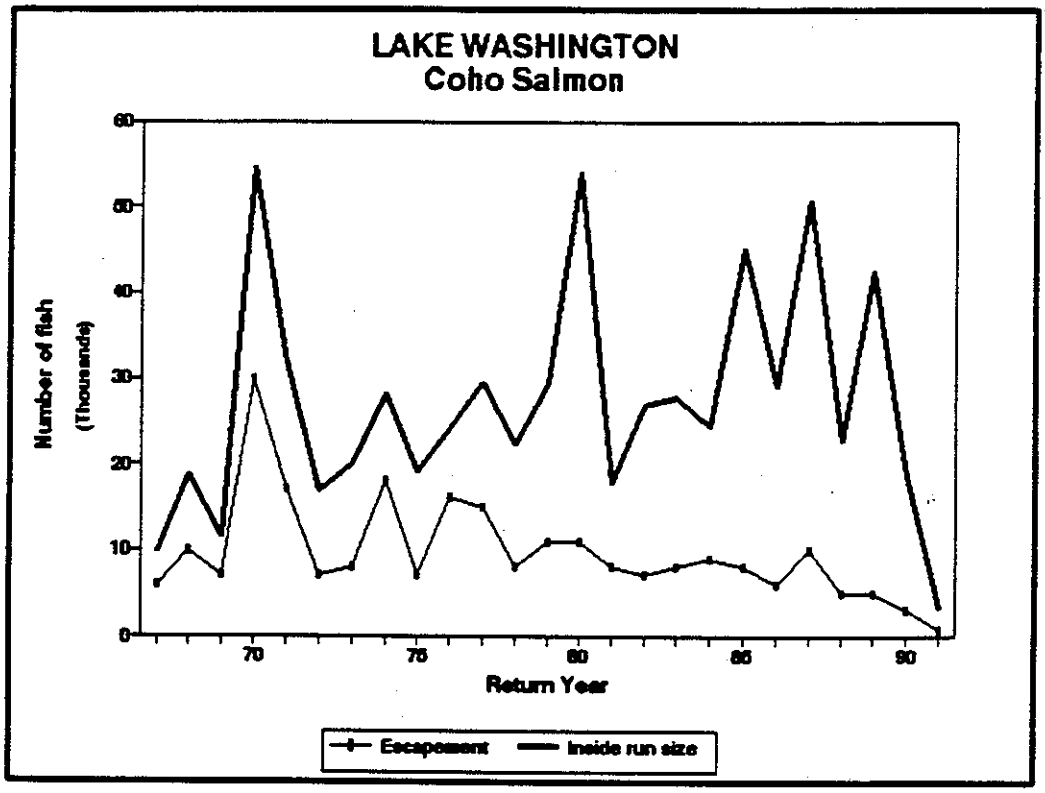
There are significant differences in the range of spawning timing documented for the two stocks in this drainage, with the Cedar River fish sometimes spawning into late February. Their distinction may also be supported by geographic spawning separation, the result of subjective judgements regarding the probability of significant spawner interchange between drainages. Differences in off-station planting histories are assumed to result in dissimilar stock impacts, so those differences have provided additional support for stock distinction. Until a genetic determinant is available and used to evaluate these stocks, these designations are tentative.

STOCK STATUS

Lake Washington basin-origin coho are harvested primarily in Canadian and Washington troll, net and sport fisheries. There are directed terminal net area fisheries on these stocks to harvest surplus hatchery returns.

The total natural escapement goal for Lake Washington tributaries is 15,000. The run reconstruction database shows escapement and run size estimates (the number of fish in escapement and Puget Sound net catches), from 1965 to 1991, fluctuating over a broad range, with escapements varying about the goal. The escapement goal has not been met since 1978; however, the natural escapement goal is not the primary management objective in this basin. Individual stock performance evaluations are dependent upon relatively short stock assessment databases (dating back to 1980) which provide no indication of present production's relationship with historic levels. The Cedar River stock has been classified as Healthy. The coho stock outside of that drainage, Lake Washington/Sammamish tributaries, has been classified as Depressed because of a short-term severe decline in its escapement.

The following figure, which illustrates natural coho production trends in this basin, is derived from the run reconstruction database. Some of the run-size estimates for the last ten to 15 years may be attributable to misallocation of hatchery-origin production to the natural stock. The magnitude of this possible error has not been estimated at this time. The escapement goal is not plotted on this figure since the primary management objective in this basin is to minimize surplus hatchery returns through harvest rates which generally preclude accomplishing the escapement goal.



More information on the individual stocks is presented in the Stock Reports which follow.

LAKE WASHINGTON -- LAKE WASHINGTON/SAMMAMISH TRIBS COHO

STOCK DEFINITION AND ORIGIN

This stock is defined by its distinct geographic spawning distribution. It is believed there is limited straying into this drainage from surrounding systems. This stock does not exhibit a unique spawn timing (most spawning occurring from late October to mid-December, very similar to hatchery timing) or any documented distinct biological characteristics.

This system was consistently planted with Issaquah Creek yearlings from the early 1950s until the early 1970s. Additionally, there were releases of Green River hatchery yearlings into this system in 1952, 1955, 1958 and 1971, Samish yearlings in 1957, Skykomish stock in 1961, Baker stock in 1973 and 1974, and a Toutle x Chambers hybrid in 1973. There have been annual on-station releases of hatchery yearlings at Issaquah Creek to present, and there has been a consistent, comprehensive off-station fry/fingerling release program throughout the drainage since the mid-1970s, primarily utilizing Issaquah hatchery stock (with infrequent introductions of Minter and Skykomish fingerlings). The Issaquah Creek drainage above the hatchery rack is almost entirely dependent upon hatchery-origin adults passed upstream. This stock is likely a mixture of the native and introduced non-native stocks.

STOCK STATUS

The status of the stock is Depressed.

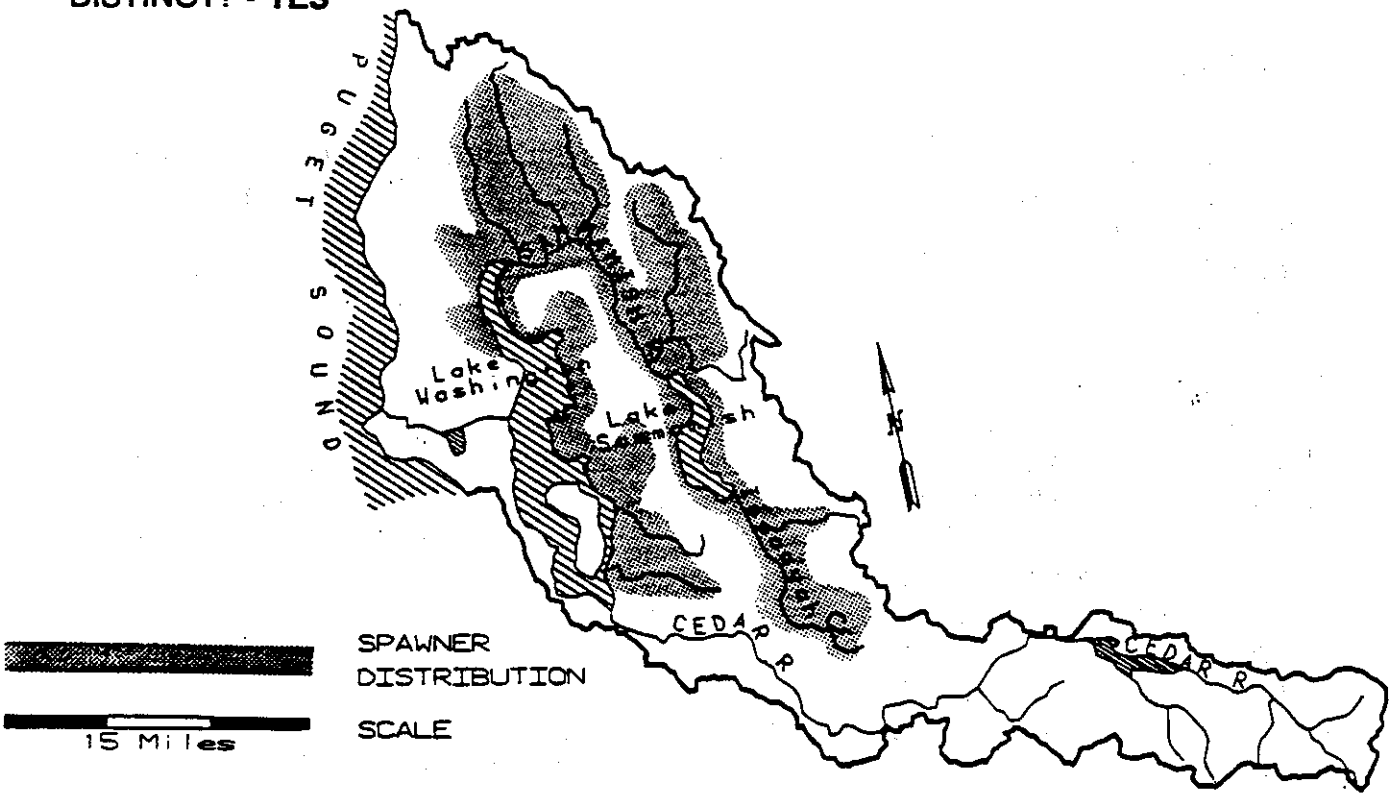
Escapement index data for this stock indicate a short-term severe decline. The last four years have the lowest escapement counts in the database. The 1988 and 1989 values approximate half of the 1980 through 1987 mean, while 1990 and 1991 are only 30 percent and seven percent of that same mean, respectively. The fitness of the native stock may have been affected by non-native stock introductions, but specific changes have not been documented at this time.

Run reconstruction data for Lake Washington combine the Cedar River with all other tributaries. There is no appropriate means of breaking the estimates into sub-basin components, so escapement index counts for the area outside of the Cedar are probably the most valid measure of stock status. Escapement index data are very good back to 1980. However, all of the indices are in the Sammamish drainage, and the Sammamish indices may not accurately reflect trends in production that could be occurring in the other tributaries.

STOCK DEFINITION PROFILE for Lake Washington/Sammamish Tribs Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN								■	■	■			**UNK**
RIVER ENTRY									■	■	■		**UNK**
SPAWNING											■	■	**NO**

BIOLOGICAL CHARACTERISTICS

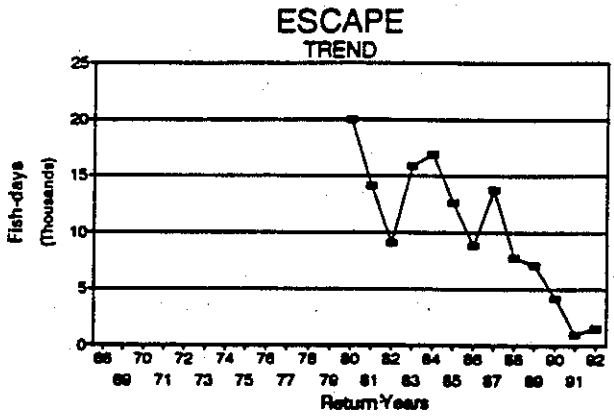
DISTINCT? - **NO**

STOCK STATUS PROFILE for Lake Washington/Sammamish Tribs Coho

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Fish-days			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80	20002			
81	14167			
82	9030			
83	15898			
84	16953			
85	12652			
86	8850			
87	13804			
88	7817			
89	7118			
90	4210			
91	978			
92	1505			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Depressed

SCREENING CRITERIA
Short-Term Severe Decline

FACTORS AFFECTING PRODUCTION

Habitat -- All the tributaries of Lake Washington and Lake Sammamish utilized by this stock have been intensively urbanized with a myriad of human-caused habitat impacts which for the most part mask the natural population limiting factors of low summer stream flow and poor spawning gravel quality. Conversion of agricultural and forest lands to more intense land use results in a loss of pervious surfaces to absorb rainwater. Consequently peak winter flows are skewed to shorter run-offs and substantially higher peaks. This translates to increased stream velocities which displace fish and erode the stream bed and banks. Loss of functional flood plains through bed downcutting or flood plain filling worsens the effects of the increased flow. Low flows are also worsened because of loss of wetland water storage and reduced groundwater due to reduced pervious surfaces.

Other impacts of urbanization in these streams include extensive bank protection with rock rip rap or concrete bulkheads, stream channelization which creates a uniform channel shape and cross-section with a reduction in rearing pools and loss of riparian vegetation both for streamside shade and cover and for instream woody debris cover, and active removal of what little large woody debris does enter the stream. Loss of streamside shade and summer low flows in the Sammamish River have resulted in water temperatures as high as 81 degrees F, which would discourage upstream migration. Water quality has diminished, and hazardous material spills with resultant fish kills are not uncommon. Fish passage is difficult or impossible at numerous culverts and other structures in these streams. Many of these problems are manifestations of increased peak run-off.

Disturbance or mortalities to adult spawners by people and domestic animals exacerbates the minimal habitat quality. Nearshore habitats in Lake Washington, Lake Sammamish, Lake Union, the Ship Canal and Shilshole Bay have been diminished by bulkheading, dock and pier construction.

Harvest Management -- No stock-specific information is available at this time.

Hatchery -- Issaquah Hatchery is located on Issaquah Creek and produces yearling coho, outplants coho fry, and produces fall chinook. Small hatcheries are located on Lake Union and produce coho and fall chinook. These hatcheries are operated by the University of Washington and the National Marine Fisheries Service. The effect of fish from these hatchery programs on the Lake Washington/Sammamish tributaries stock is unknown.

LAST TEN YEARS SALMON RELEASES INTO THE CEDAR - SAMMAMISH BASIN

REL. YEAR	SPRING CHINOOK	FALL CHINOOK	CHUM	COHO	SOCKEYE
1982	0	4,345,552	0	3,302,714	4,567,000
1983	0	5,086,693	0	2,447,684	0
1984	0	8,033,619	42,000	2,717,918	0
1985	0	4,636,569	5,000	5,392,516	0
1986	8,000	4,452,655	7,500	3,363,941	0
1987	0	5,141,303	9,700	2,011,345	0
1988	0	4,459,219	9,000	2,336,443	0
1989	0	3,692,062	10,000	2,736,789	0
1990	0	3,976,832	10,500	3,753,059	0
1991	0	4,187,250	63,900	2,009,462	0
MEAN		4,801,175	19,700	3,007,187	

LAKE WASHINGTON -- CEDAR COHO

STOCK DEFINITION AND ORIGIN

This stock has been defined on the basis of its unique spawning timing within the Lake Washington watershed (late October to early March), as well as by its geographic separation from other significant coho streams within that drainage. This stock does not display any other documented unique biological characteristics.

There were significant off-station releases in this drainage until 1970. Green River yearlings were planted in the Cedar River in 1952, 1953, 1959, 1961, 1962, 1964, 1965, and 1970, along with Issaquah Creek yearling releases in 1952 through 1954, 1956, 1963 and 1965. There were sporadic releases of Green River fingerlings through 1961 and a release of Skykomish fingerlings in 1960 and one of George Adams-origin fish in 1970. This stock is probably a mixture of the native and introduced non-native stocks.

STOCK STATUS

Escapement index data for this stock indicate that this stock is currently Healthy. It should be noted that this stock will fall into the Depressed classification if a figure similar to the 1991 index count total (the lowest total in the database) is observed in the next few years, demonstrating a short-term severe decline.

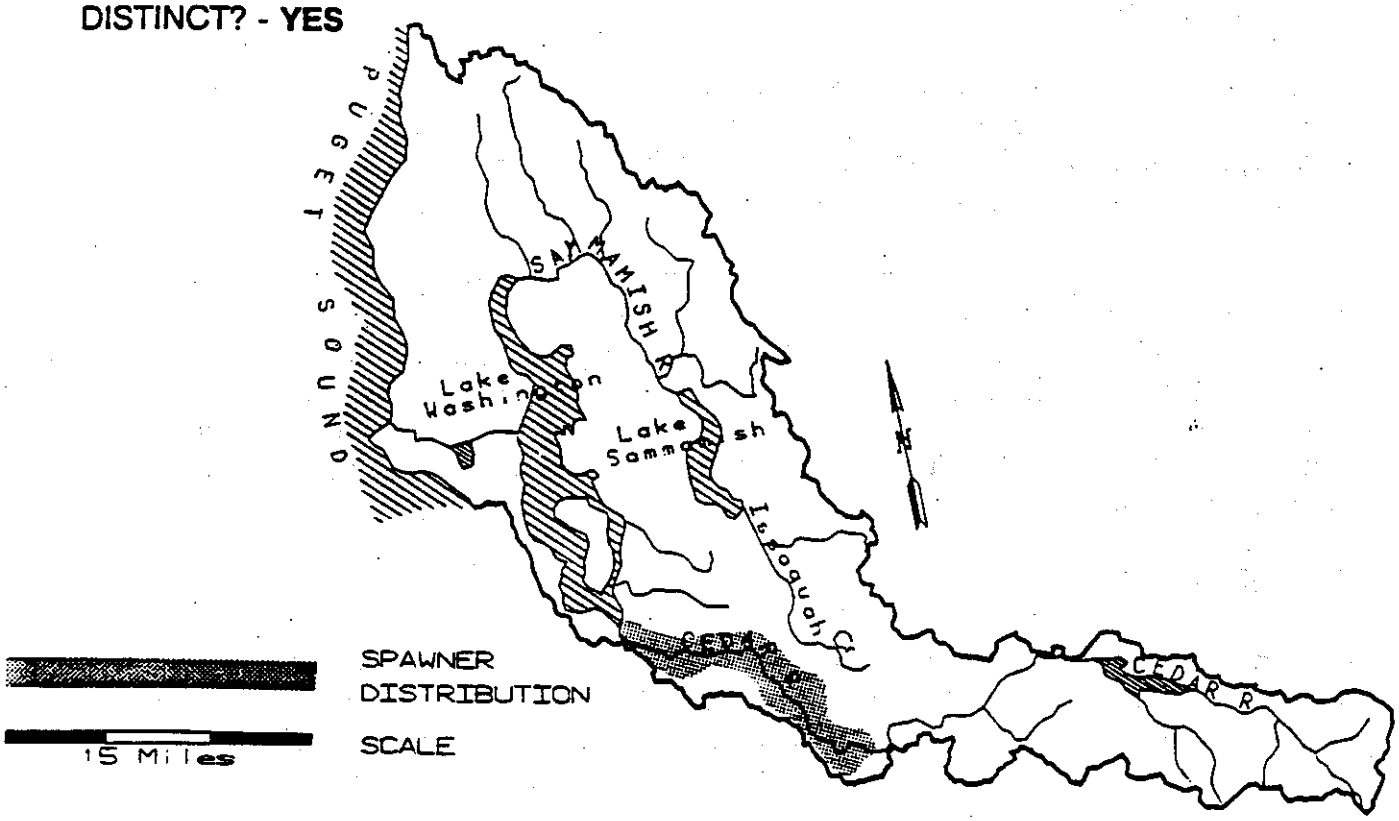
There are good escapement index data available for two index tributaries dating back to 1980.

Natural limiting factors for this stock include spawning gravel quality and stability and lake productivity. Gravel quality is generally quite good. Lake productivity has been in question. Human-caused limiting factors include lack of access to the upper watershed, extensive diking and bank hardening, loss of bank vegetation and instream woody debris. Extreme winter floods, coupled with floodway reductions due to diking have resulted in significant bed and bank scour and channel shifting. Redd scour and or/desiccation with attendant loss of eggs and fry is believed to be substantial during these events. Spawning flows are also affected by storage of water at Chester Morse Lake and by diversion at Landsburg Dam to supply drinking water to the City of Seattle, as well as by hydropower peaking at Masonry Dam. Substantial high- quality spawning habitat not currently accessible to anadromous fish exists between Landsburg and Masonry dam. Poaching and harassment of sockeye salmon throughout their spawning grounds is a serious problem due to their high visibility in low flows at spawning time.

STOCK DEFINITION PROFILE for Cedar Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬	▬			UNK
RIVER ENTRY										▬	▬		UNK
SPAWNING	▬	▬	▬								▬	▬	YES

BIOLOGICAL CHARACTERISTICS

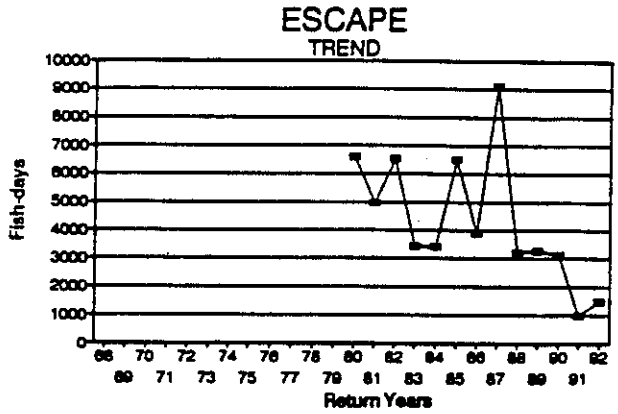
DISTINCT? - **NO**

STOCK STATUS PROFILE for Cedar Coho

STOCK ASSESSMENT

DATA QUALITY——> Good

Return Years	ESCAPE Fish-days			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80	6607			
81	4972			
82	6535			
83	3457			
84	3435			
85	6500			
86	3879			
87	9104			
88	3210			
89	3304			
90	3122			
91	978			
92	1504			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- LAKE WASHINGTON SOCKEYE STOCKS

CEDAR
LAKE WASHINGTON/SAMMAMISH TRIBS
LAKE WASHINGTON BEACH SPAWNING

STOCK DEFINITION AND ORIGIN

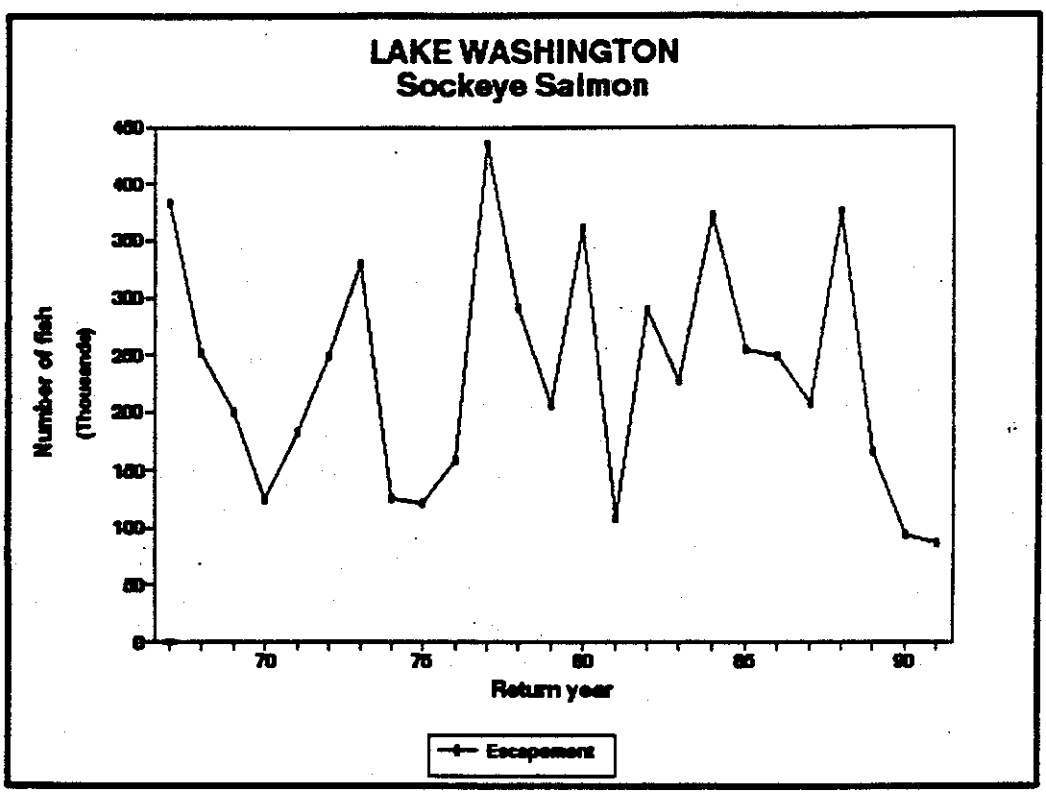
Lake Washington sockeye stocks are distinguished from sockeye stocks in other Puget Sound basins by geographic and reproductive separation. They also collectively comprise the largest sockeye run in the state. They are summer/fall-timed stocks which spawn primarily from early September through November, with the Cedar River and beach spawners spawning into January. Sockeye salmon were first introduced into the Lake Washington basin in 1935, with fingerling releases into the Cedar River and Issaquah Creek of descendants from Baker River stock. Genetic studies suggest that the present run is genetically similar to the Baker sockeye stock, and is significantly different from other Washington sockeye stocks tested. Electrophoretic analysis suggests that the north Lake Washington tributary sockeye are different from introduced stocks and may be of native origin. Lake Washington beach spawners are genetically dissimilar from other sockeye in the basin and likely are native to the system.

STOCK STATUS

Run-size estimates have been made since 1967 and have ranged from a high of 621,000 in 1988 to a low of 98,000 in 1993. Escapement data are shown in the figure below. Escapement estimates for the Cedar River during that same period have ranged from a high of 410,000 in 1977 to a low of 76,000 in 1993. This run is currently Depressed and experiencing a general downward trend in recent years, with four of the last five years' returns being at 100,000 or fewer sockeye. These returns are the lowest since 1964. The tributaries stock and the beach spawners have also exhibited negative trends in escapement.

The estimated number of sockeye returning to the Lake Washington tributaries has ranged from several hundred to over 30,000. Estimated numbers of beach spawning sockeye have ranged from 520 to 8,180 over the past ten years. The basin escapement goal of 350,000 was last met in 1988.

More information on individual stocks is presented in the Stock Reports which follow.


LAKE WASHINGTON
Sockeye Salmon
Number of fish
(Thousands)
0
100
200
300
400
70
75
80
85
90
Return year
Escapement

LAKE WASHINGTON -- CEDAR SOCKEYE

STOCK DEFINITION AND ORIGIN

The Cedar River sockeye salmon make up the primary component of a unique and important Lake Washington sockeye salmon run. This run is isolated reproductively from any other sockeye run in the state.

Sockeye enter the Cedar River beginning in late August or early September and continue through January. Spawning usually begins in mid-September and generally peaks in mid- to late October and continues into January. Spawning takes place from approximately one mile upstream from the mouth to the pipeline diversion at Landsburg, a distance of about 21 miles. Spawning also takes place in several tributaries as well as in the mainstem. Downs and Rock creeks are two of the most heavily-used tributaries.

Sockeye salmon were first introduced into the Lake Washington drainage in 1935 from eggs taken at the former U.S. Bureau of Fisheries Birdsview Hatchery on Grandy Creek, a tributary of the Skagit River. These fish were descendants of the Baker River sockeye stock.

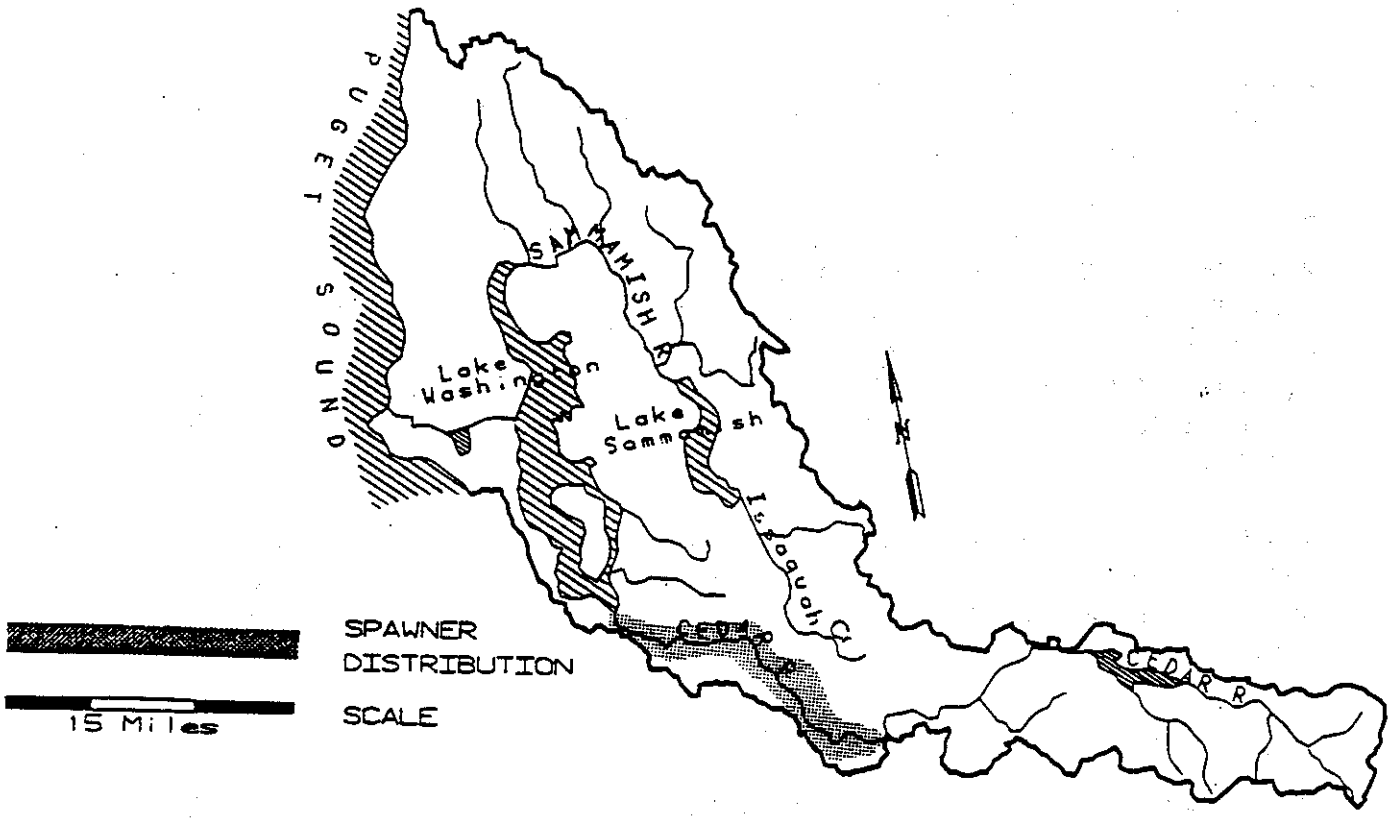
In the spring of 1935, 96,000 fingerlings were released into the Cedar River and 76,000 into Issaquah Creek, a Lake Sammamish tributary. Subsequent releases of Baker River stock were made in 1937 and again from 1942 through 1945. The number of these introductions into the Lake Washington system during this period totaled 3,111,805. In addition, a total of 83,268 sockeye from Cultus Lake, a tributary of the lower Fraser River, were introduced in 1944, 1950 and 1954.

Returns from some of these early introductions were spawned at Issaquah Hatchery. Second- and third-generation plantings brought early artificial releases into the system of 4,956,230 sockeye. Between 1976 and 1982, over 34,500,000 juvenile sockeye were released into the Cedar River from Washington Department of Fisheries and cooperative egg-box projects. The major buildup of the run to its present status, however, has been through natural reproduction, primarily from the Cedar River stock. Recent genetic stock identification studies indicate that the present stock has genetic characteristics indistinguishable from those of Baker sockeye and is significantly different from other sockeye stocks tested.

STOCK DEFINITION PROFILE for Cedar Sockeye

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													UNK
RIVER ENTRY													UNK
SPAWNING													UNK

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Stock is significantly different from all other Washington stocks [collection from Cedar River (N=100) 30-locus G-tests: $p<0.001$] tested.

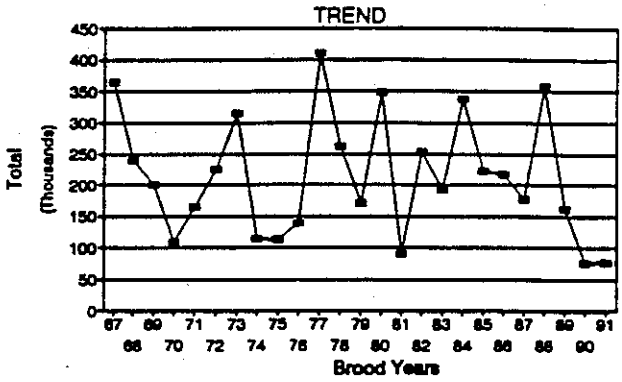
STOCK STATUS PROFILE for Cedar Sockeye

STOCK ASSESSMENT

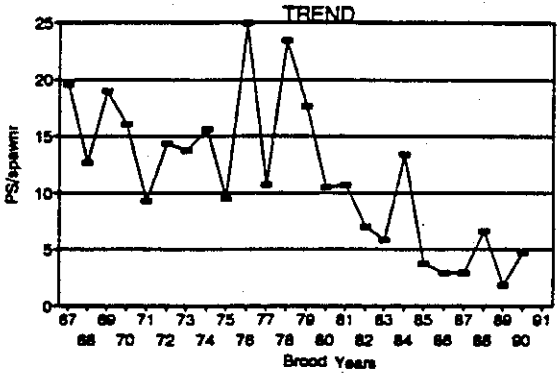
DATA QUALITY——> Very Good

Brood Years	ESCAPE Total	SURVIVAL PS/spawnr	RUNSIZE Total	SURVIVAL Rec/spwnr
67	365000	19.6	521950	1.4
68	240000	12.7	297600	1.2
69	200000	19.0	454000	2.3
70	110000	16.1	154000	1.4
71	166363	9.3	131427	0.8
72	225862	14.4	142293	0.6
73	314194	13.8	562407	1.8
74	114472	15.6	296482	2.6
75	114106	9.5	212237	1.9
76	138949	24.9	475206	3.4
77	410020	10.7	110705	0.3
78	262733	23.4	375708	1.4
79	172300	17.7	230882	1.3
80	347827	10.5	441740	1.3
81	90694	10.7	206782	2.3
82	253658	7.0	256195	1.0
83	193338	5.8	174004	0.9
84	336960	13.4	613267	1.8
85	223745	3.7	80548	0.4
86	217133	2.9	73825	0.3
87	177841	2.9	88920	0.5
88	358771	6.6	143508	0.4
89	161576	1.8		
90	76393	4.7		
91	76906			

ESCAPE
TREND



SURVIVAL
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Non-native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Genetics

STOCK STATUS
Depressed

SCREENING CRITERIA
Long-Term Negative Trend

STOCK STATUS

This stock is considered Depressed.

Escapement estimates for the Cedar River are derived using live spawner counts with the escapement index methodology. The estimates for the Cedar River have ranged from 400 in 1940 to 410,000 in 1977.

Information collected on this stock forms one of the most comprehensive databases of any Washington salmon stock and includes: counts at the fish ladder and locks at Ballard as the fish enter into the lake, spawner float counts in the mainstem and foot surveys on the tributaries. Pre-smolt population estimates are made in Lake Washington using a trawl net towed at various depths. The pre-smolt estimates derived from this exercise have shown a negative downward trend for all but one year since 1984. These pre-smolt estimates are a measure of survival in the freshwater environment.

This run has exhibited a general downward trend over the last several years with the returns in 1990 and 1991 being the lowest since 1964.

FACTORS AFFECTING PRODUCTION

Habitat -- Natural limiting factors for this stock include spawning gravel quality and stability and lake productivity. Gravel quality is generally quite good. Lake productivity has been in question. Human-caused limiting factors include lack of access to the upper watershed, extensive diking and bank hardening, loss of bank vegetation and instream woody debris. Extreme winter floods, coupled with floodway reductions due to diking have resulted in significant bed and bank scour and channel shifting. Redd scour and or/desiccation with attendant loss of eggs and fry is believed to be substantial during these events. Spawning flows are also affected by storage of water at Chester Morse Lake and by diversion at Landsburg Dam to supply drinking water to the City of Seattle, as well as by hydropower peaking at Masonry Dam. Substantial high-quality spawning habitat not currently accessible to anadromous fish exists between the Landsburg Dam and Upper Cedar Falls at RM 35. Poaching and harassment of sockeye salmon throughout their spawning grounds is a serious problem due to their high visibility in low flows at spawning time.

Harvest Management -- Cedar River sockeye are harvested in Canadian and United States preterminal Fraser Panel fisheries in the Strait of Juan de Fuca and the San Juan Islands and in terminal-area commercial net fisheries in the Seattle area (Area 10) and Lake Washington. Fraser Panel fisheries are commercial net fisheries targeting Fraser River sockeye and pink salmon managed jointly by the U.S. and Canada. In Fraser Panel fisheries, Lake Washington sockeye, including the Cedar River stock, are harvested at the rate appropriate for Fraser River sockeye,

specifically the early Stuart stocks. In U.S. terminal-area fisheries, Cedar River sockeye are managed at an exploitation rate necessary to achieve the natural escapement goal for Lake Washington sockeye in aggregate.

The total Fraser catch of U.S.-origin sockeye is estimated by the Pacific Salmon Commission using scale pattern analysis data collected from test and commercial fisheries. These data are further broken out to individual regions of origin using run reconstruction. Terminal area impacts are estimated by run reconstruction only.

Preterminal Areas - This stock may be harvested in Canadian Fraser Panel sockeye fisheries in the Strait of Juan de Fuca (Canadian Area 20) and the area around the mouth of the Fraser River (Canadian Area 29) occurring from early July through early August. Recent Canadian fisheries during this time period have been limited to the Strait of Juan de Fuca test fisheries only, due to the desire to limit marine net harvests of commingled early Stuart sockeye stocks.

The Pacific Salmon Commission catch estimate of all Washington-origin sockeye salmon in Canadian Fraser Panel-regulated commercial fisheries averaged 110 per year between 1985 and 1989 (range zero to 299) (Pacific Salmon Commission Joint Interceptions Committee 1991). Canadian commercial net catches of U.S.-origin sockeye averaged 0.0016 percent of the 1985 through 1989 average Canadian Fraser commercial sockeye catch of 6,720,000. Test fisheries occurring in Canadian waters during the time period when earlier-returning U.S. sockeye stocks are present intercepted an average of 1,511 U.S. sockeye per year between 1985 and 1989 (range 656 to 3,445) (Pacific Salmon Commission Joint Interceptions Committee 1991). Canadian catches of U.S. sockeye are estimated to be predominately of Lake Washington origin (1992 Puget Sound Sockeye Status Report).

Preterminal harvest areas in Washington waters under Fraser Panel management that may impact this stock include the Strait of Juan de Fuca (Areas 4B, 5 and 6C) and the area around the San Juan Islands (Areas 6, 7 and 7A). U.S. fisheries in these areas during the aforementioned time period are managed to minimize impacts on Baker River and Lake Washington sockeye stocks.

The estimated catch of Washington-origin sockeye salmon in Washington Fraser Panel-regulated fisheries averaged 1,497 between 1985 and 1989 (range 268 to 3,464), or 0.07 percent of the average annual sockeye catch of 2,105,072 over the same time period (1992 Puget Sound Sockeye Status Report; Pacific Salmon Commission Joint Interceptions Committee Report 1991). These catches are thought to be almost entirely of Lake Washington origin.

The total Lake Washington sockeye return averaged 99.76 percent of the Washington sockeye run entering Puget Sound between 1985 and 1989 (1992 Sockeye Status Report). The preterminal harvest rate of Lake Washington sockeye in U.S. fisheries averaged 0.5 percent over this same time period (from preterminal catch and terminal run size estimates for Lake Washington sockeye).

Terminal Areas - Directed terminal commercial net and sport fisheries on Lake Washington sockeye are allowed when the stock has returned to the Ballard Locks at levels above escapement needs. These directed fisheries have occurred in the Seattle area (Area 10) and Lake Washington. However, no directed fisheries have been allowed since 1989 due to low stock abundance.

Terminal area commercial net fisheries incidentally impacting Cedar River sockeye include Shilshole Bay (part of Area 10) fall chinook fisheries, Elliott Bay (Area 10A) and the Lake Washington Ship Canal (Area 10F) fall chinook fisheries and northern Lake Washington (Area 10G) fisheries for fall chinook, coho and steelhead. Minimum mesh-size restrictions, test fisheries documenting sockeye clearance and openings in specific subareas are employed to minimize sockeye catches in these fisheries targeting other species.

The terminal incidental commercial net harvest of Lake Washington sockeye averaged 319 in marine fishing areas (Areas 10 and 10A) during from 1985 to 1987 and 1989. In 1988, a directed fishery in marine waters harvested 64,888 Lake Washington sockeye. Harvest rates for the Lake Washington run in terminal marine water fisheries averaged 0.10 percent from 1985 through 1987 and 1989. The marine harvest rate was 10.5 percent during the directed fishery in 1988 (1992 Puget Sound Sockeye Status Report).

Freshwater net fisheries (Areas 10F and 10G) harvested an average of 4,030 fish in years when catches were incidental (1985, 1986 and 1989) and 54,974 during years when directed freshwater fisheries occurred (1987 and 1988). Terminal freshwater run harvest rates averaged 1.77 percent and 14.2 percent for these two year groupings respectively.

Sport fisheries targeting Lake Washington sockeye last occurred in 1987 and 1988. The sport catch in Lake Washington was 3,117 and 71,230 for these two years, equivalent to terminal run harvest rates of 1.4 percent and 13.0 percent respectively.

Hatchery -- Issaquah Hatchery is located on Issaquah Creek, and produces yearling coho, outplants coho fry, and produces fall chinook. Small hatcheries are located on Lake Union and produce coho and fall chinook. These hatcheries are operated by the University of Washington and the National Marine Fisheries Service. WDFW recently began operation of a sockeye hatchery program on the Cedar River at Landsburg Dam. Brood stock is obtained by netting operations on the Cedar River. The eggs are incubated and fry released after acclimation to river water.

LAST TEN YEARS SALMON RELEASES INTO THE CEDAR - SAMMAMISH BASIN

REL. YEAR	SPRING CHINOOK	FALL CHINOOK	CHUM	COHO	SOCKEYE
1982	0	4,345,552	0	3,302,714	4,567,000
1983	0	5,086,693	0	2,447,684	0
1984	0	8,033,619	42,000	2,717,918	0
1985	0	4,636,569	5,000	5,392,516	0
1986	8,000	4,452,655	7,500	3,363,941	0
1987	0	5,141,303	9,700	2,011,345	0
1988	0	4,459,219	9,000	2,336,443	0
1989	0	3,692,062	10,000	2,736,789	0
1990	0	3,976,832	10,500	3,753,059	0
1991	0	4,187,250	63,900	2,009,462	0
MEAN		4,801,175	19,700	3,007,187	

LAKE WASHINGTON -- LAKE WASHINGTON/SAMMAMISH TRIBS SOCKEYE

STOCK DEFINITION AND ORIGIN

Lake Washington/Sammamish sockeye spawn primarily in Big Bear, Cottage Lake (a tributary to Big Bear), and the East Fork of Issaquah creeks. This spawning distribution geographically separates them from the other Washington sockeye stocks. These streams act as a barometer for the rest of the system and provide the bulk of the survey data for the escapement estimates. There are a few other Sammamish tributaries in which sockeye spawn but in considerably smaller numbers.

Lake Washington/Sammamish tributary sockeye spawners enter the streams from September through October. Spawning takes place from early September through November, with the peak generally influenced by stream flows but usually occurring in mid- to late October.

The absence of a collection from the Lake Washington/Sammamish Tributaries stock prevented genetic stock identification testing of the Cedar stock against this stock.

STOCK STATUS

Stock status is Depressed.

The estimated number of sockeye salmon returning to the Lake Washington tributaries has ranged from several hundred to over 30,000. It is felt that these estimates are fairly good since the areas of highest concentration are covered thoroughly. Escapements into the tributaries generally reflect the strength of the run into the Cedar River which has also experienced a similar level of decline over the last several years.

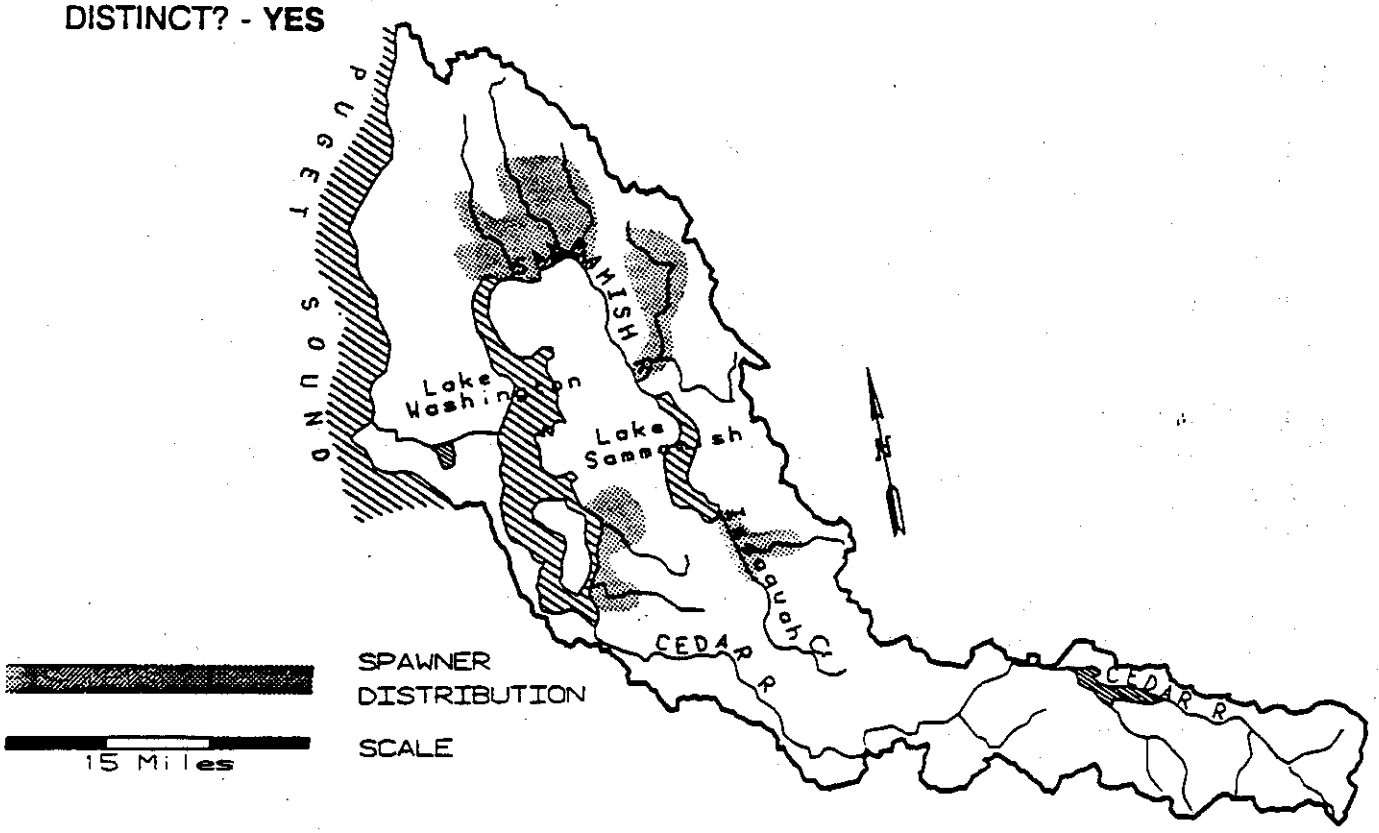
FACTORS AFFECTION PRODUCTION

Habitat -- All the tributaries of Lake Washington and Lake Sammamish utilized by this stock have been intensively urbanized with a myriad of human-caused habitat impacts which for the most part mask the natural population limiting factors of low summer stream flow and poor spawning gravel quality. Conversion of agricultural and forest lands to more intense land use results in a loss of pervious surfaces to absorb rainwater. Consequently peak winter flows are skewed to shorter run-offs and substantially higher peaks. This translates to increased stream velocities which displace fish and erode the stream bed and banks. Loss of functional flood plains through bed downcutting or flood plain filling worsens the effects of the increased flow. Low flows are also worsened because of loss of wetland water storage and reduced groundwater due to reduced pervious surfaces.

STOCK DEFINITION PROFILE for Lake Washington/Sammamish Tribs Sockeye

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN							▬	▬					**UNK**
RIVER ENTRY									▬	▬			**UNK**
SPAWNING									▬	▬	▬		**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

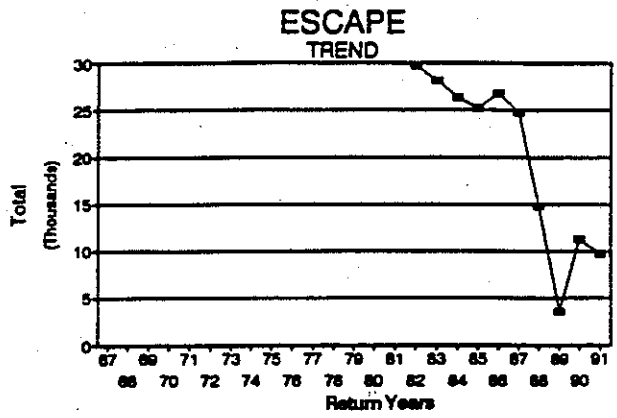
GENETICS - No data available.

STOCK STATUS PROFILE for Lake Washington/Sammamish Tribs Sockeye

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Total			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82	29713			
83	28157			
84	26279			
85	25214			
86	26818			
87	24729			
88	14815			
89	3601			
90	11322			
91	9774			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Unknown

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution

STOCK STATUS
Depressed

SCREENING CRITERIA
Long-Term Negative Trend

Other impacts of urbanization in these streams include extensive bank protection with rock rip rap or concrete bulkheads, stream channelization which creates a uniform channel shape and cross-section with a reduction in rearing pools and loss of riparian vegetation both for streamside shade and cover and for instream woody debris cover, and active removal of what little large woody debris does enter the stream. Loss of streamside shade and summer low flows in the Sammamish River have resulted in water temperatures as high as 81 degrees F, which would discourage upstream migration. Water quality has diminished, and hazardous material spills with resultant fish kills are not uncommon. Fish passage is difficult or impossible at numerous culverts and other structures in these streams. Many of these problems are manifestations of increased peak run-off.

Disturbance or mortalities to adult spawners by people and domestic animals exacerbates the minimal habitat quality. Nearshore habitats in Lake Washington, Lake Sammamish, Lake Union, the Ship Canal and Shilshole Bay have been diminished by bulkheading, dock and pier construction.

The streams used by this stock for spawning all suffer the affects of low intensity agricultural (hobby farms) uses and the effects of urban and suburban development. These include loss of riparian vegetation, and streambed sedimentation and shifting due to increased winter peak flows and bank erosion.

Harvest Management -- Lake Washington/Sammamish Tributary sockeye are harvested in Canadian and United States preterminal Fraser Panel fisheries the Strait of Juan de Fuca and the San Juan Islands and in terminal-area commercial net fisheries in the Seattle area (Area 10), Lake Washington (Areas 10C and 10G) and Lake Sammamish (Area 10D). Fraser Panel fisheries are commercial net fisheries targeting Fraser River sockeye and pink salmon managed jointly by the U.S. and Canada. In Fraser Panel fisheries, Lake Washington sockeye, including the lake tributary stock, are harvested at the rate appropriate for Fraser River sockeye, specifically the early Stuart stocks. In U.S. terminal fisheries, these sockeye are managed at an exploitation rate necessary to achieve the natural escapement goal for Lake Washington sockeye in aggregate.

The total Fraser catch of U.S.-origin sockeye is estimated by the Pacific Salmon Commission using scale pattern analysis data collected from test and commercial fisheries. These data are further broken out to individual regions of origin using run reconstruction. Terminal area impacts are estimated by run reconstruction only.

Preterminal Areas - Sockeye originating in the tributaries may be harvested in Canadian Fraser Panel sockeye fisheries in the Strait of Juan de Fuca (Canadian Area 20) and the area around the mouth of the Fraser River (Canadian Area 29) occurring from early July through early August. Recent fisheries during this time period have been limited to Strait of Juan de Fuca test fisheries only, due to the desire to limit marine net harvests of commingled early Stuart sockeye stocks.

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Preterminal harvest areas in Washington waters under Fraser Panel management that may impact this stock include the Strait of Juan de Fuca (Areas 4B, 5 and 6C) and the area around the San Juan Islands (Areas 6, 7 and 7A). U.S. fisheries in these areas during the aforementioned time period are managed to minimize impacts on Baker River and Lake Washington sockeye stocks.

The estimated catch of Washington-origin sockeye salmon in Washington Fraser Panel-regulated fisheries averaged 1,497 between 1985 and 1989 (range 268 to 3,464), or 0.07 percent of the average annual sockeye catch of 2,105,072 over the same time period (1992 Puget Sound Sockeye Status Report; Pacific Salmon Commission Joint Interceptions Committee 1991). These catches are thought to be almost entirely of Lake Washington origin.

The total Lake Washington sockeye return averaged 99.76 percent of the Washington sockeye run entering Puget Sound between 1985 and 1989 (from 1992 Puget Sound Sockeye Status Report). The preterminal harvest rate of Lake Washington sockeye in U.S. fisheries averaged 0.5 percent over this same time period (from preterminal catch and terminal run size estimates for Lake Washington sockeye).

Terminal Areas - Directed terminal commercial net and sport fisheries on Lake Washington sockeye have been allowed when the stock has returned to the Ballard Locks at levels above escapement needs. These directed fisheries last occurred in Area 10 and Lake Washington in 1987 and 1988 and in Lake Sammamish in 1988. However, no directed fisheries have occurred since then due to low stock abundance.

Terminal area commercial net fisheries incidentally impacting this stock include Shilshole Bay (part of Area 10) fall chinook fisheries, Elliott Bay (Area 10A) and the Lake Washington Ship Canal (Area 10F) fall chinook fisheries, northern Lake Washington (Area 10G) fisheries for fall chinook, coho and steelhead and Lake Sammamish (Area 10D) fall chinook and coho fisheries. Minimum mesh-size restrictions, test fisheries documenting sockeye clearance and openings in specific subareas are employed to minimize sockeye catches in these fisheries targeting other species.

The terminal incidental commercial net harvest of Lake Washington sockeye averaged 319 in marine fishing areas (Area 10, 10A) from 1985 to 1987 and 1989. In 1988, a directed fishery in marine waters harvested 64,888 Lake Washington sockeye. Harvest rates for the Lake Washington run in terminal marine water fisheries averaged 0.10 percent from 1985 through 1987 and 1989. The marine harvest rate was 10.5 percent during the directed fishery in 1988 (1992 Sockeye Status Report).

Freshwater net fisheries (Areas 10F, 10G and 10D) harvested an average of 4,324 fish in years when catches were incidental (1985, 1986 and 1989) and 57,168 during years when directed freshwater fisheries occurred (1987 and 1988). Terminal freshwater run harvest rates averaged 1.9 percent and 14.8 percent for these two year groupings respectively.

Sport fisheries targeting Lake Washington sockeye last occurred in 1987 and 1988. No sport fisheries in Lake Sammamish for sockeye were allowed during these years. The sport catch in Lake Washington was 3,117 and 71,230 for these two years, equivalent to terminal run harvest rates of 1.4 percent and 13.0 percent respectively.

Hatchery -- Issaquah Hatchery is located on Issaquah Creek, and produces yearling coho, outplants coho fry, and produces fall chinook. Small hatcheries are located on Lake Union and produce coho and fall chinook. These hatcheries are operated by the University of Washington and the National Marine Fisheries Service. WDFW recently began operation of a sockeye hatchery program on the Cedar River at Landsburg Dam. Brood stock is obtained by netting operations on the Cedar River. The eggs are incubated and fry released after acclimation to river water.

LAST TEN YEARS SALMON RELEASES INTO THE CEDAR - SAMMAMISH BASIN

REL. YEAR	SPRING CHINOOK	FALL CHINOOK	CHUM	COHO	SOCKEYE
1982	0	4,345,552	0	3,302,714	4,567,000
1983	0	5,086,693	0	2,447,684	0
1984	0	8,033,619	42,000	2,717,918	0
1985	0	4,636,569	5,000	5,392,516	0
1986	8,000	4,452,655	7,500	3,363,941	0
1987	0	5,141,303	9,700	2,011,345	0
1988	0	4,459,219	9,000	2,336,443	0
1989	0	3,692,062	10,000	2,736,789	0
1990	0	3,976,832	10,500	3,753,059	0
1991	0	4,187,250	63,900	2,009,462	0
MEAN		4,801,175	19,700	3,007,187	

LAKE WASHINGTON -- LAKE WASHINGTON BEACH SPAWNING SOCKEYE

STOCK DEFINITION AND ORIGIN

Beach spawning sockeye in Lake Washington spawn between October and January. They utilize specific upwelling and graveled areas around the perimeter of the lake as well as portions of the shoreline around Mercer Island. This spawning distribution geographically separates them from other sockeye stocks.

Beach spawning sockeye are also found in Lake Sammamish, however, it is not known if they are a distinct stock.

STOCK STATUS

Stock status is Depressed.

Beach spawner surveys have been conducted by boat in established index areas for many years. Estimates of escapement for the past ten years have ranged from 520 to 8,180 with the lowest recorded escapement having occurred in 1991. This may be an indication that this stock is suffering the same general decline as other sockeye stocks in the system.

The quality of the existing survey data has been good but is not quite as good as it could be because surveys are not conducted routinely. Insufficient information as to spawning depth and location preference, redd life, and other unknown behavioral patterns account for limited knowledge of this stock of fish.

FACTORS AFFECTING PRODUCTION

Habitat -- This stock utilizes the very upper margins of pea gravel beaches predominately near Mercer Island and along the Southeast margin of the lake. Gravel contamination with fine sediments, changes in groundwater hydrology and encroachment by fills and bulkheads are suspected to degrade spawning habitat. Dock construction may create habitat for sockeye predator fishes. The encroachment of an aquatic weed, milfoil, on spawning beaches is also believed to reduce the quality of the spawning habitat.

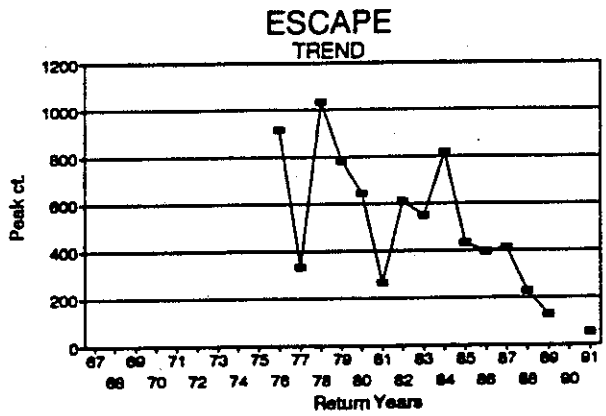
Harvest Management -- Lake Washington beach spawning sockeye are harvested in Canadian and United States preterminal Fraser Panel fisheries targeting on Fraser River sockeye in the Strait of Juan de Fuca and the San Juan Islands and in terminal-area commercial net fisheries in the Seattle area (Area 10) and Lake Washington (Areas 10C and 10G). Fraser Panel fisheries are commercial net fisheries targeting Fraser River sockeye and pink salmon managed jointly by the U.S. and Canada. In Fraser Panel fisheries, Lake Washington sockeye, including the

STOCK STATUS PROFILE for Lake Washington Beach Spawning Sockeye

STOCK ASSESSMENT

DATA QUALITY-----> Fair

Return Years	ESCAPE Peak ct.			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76	914			
77	336			
78	1032			
79	781			
80	643			
81	266			
82	610			
83	551			
84	818			
85	431			
86	396			
87	411			
88	226			
89	130			
90				
91	54			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Unknown

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution

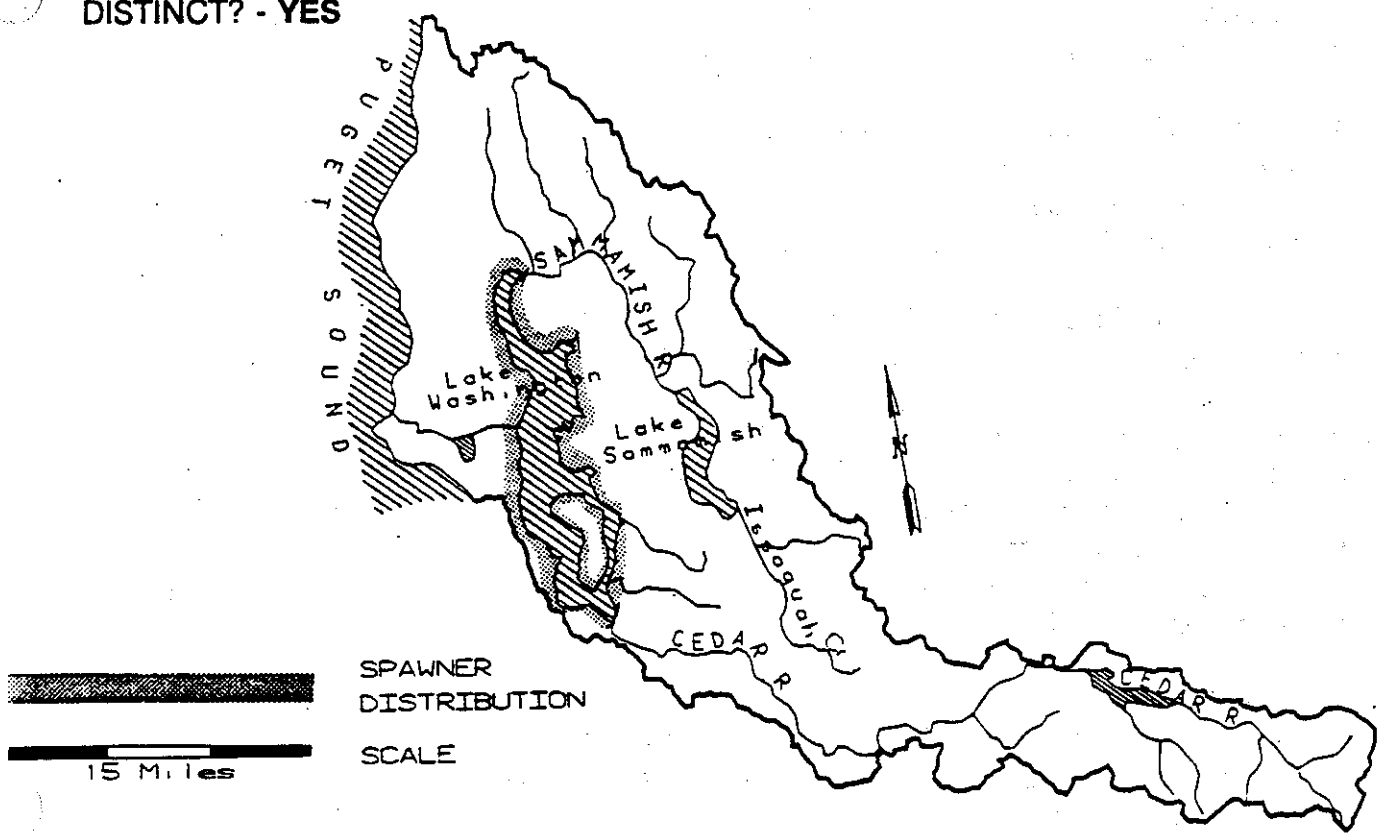
STOCK STATUS
Depressed

SCREENING CRITERIA
Long-Term Negative Trend

STOCK DEFINITION PROFILE for Lake Washington Beach Spawning Sockeye

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN							■	■					UNK
RIVER ENTRY													UNK
SPAWNING	■									■	■	■	UNK

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

GENETICS - No data available.

beach spawning component of that run, are harvested at the rate appropriate for Fraser River sockeye, specifically the early Stuart stocks. In U.S. terminal fisheries, these sockeye are managed at an exploitation rate necessary to achieve the natural escapement goal for Lake Washington sockeye in aggregate.

The total Fraser catch of U.S.-origin sockeye is estimated by the Pacific Salmon Commission using scale pattern analysis data collected from test and commercial fisheries. These data are further broken out to individual regions of origin using run reconstruction. Terminal area impacts are estimated by run reconstruction only.

No stock identification methods are yet employed specifically to resolve beach-spawning Lake Washington sockeye within Fraser fisheries or the terminal area.

Preterminal Areas - This stock may be harvested in Canadian Fraser Panel sockeye fisheries in the Strait of Juan de Fuca (Canadian Area 20) and off the mouth of the Fraser River (Canadian Area 29) from early July through early August. Recent fisheries during this time period have been limited to the Strait of Juan de Fuca test fisheries only, due to the desire to limit marine net harvests of commingled early Stuart sockeye stocks.

The Pacific Salmon Commission catch estimate of all Washington-origin sockeye salmon in Canadian Fraser Panel-regulated commercial fisheries averaged 110 per year between 1985 and 1989 (range zero to 299) (Pacific Salmon Commission Joint Interceptions Committee 1991). Canadian commercial net catches of U.S.-origin sockeye averaged 0.0016 percent of the 1985 through 1989 average Canadian Fraser commercial sockeye catch of 6,720,000. Test fisheries occurring in Canadian waters during the time period when earlier-returning U.S. sockeye stocks are present intercepted an average of 1,511 U.S. sockeye per year between 1985 and 1989 (range 656 to 3,445) (Pacific Salmon Commission Joint Interceptions Committee 1991). Canadian catches of U.S. sockeye are estimated to be predominately of Lake Washington origin (1992 Puget Sound Sockeye Status Report).

Preterminal harvest areas in Washington waters under Fraser Panel management that may impact this stock include the Strait of Juan de Fuca (Areas 4B, 5 and 6C) and the San Juan Islands (Areas 6, 7 and 7A). U.S. fisheries in these areas during the aforementioned time periods are managed to minimize impacts on Baker River and Lake Washington sockeye stocks.

The estimated catch of Washington-origin sockeye salmon in Washington Fraser Panel-regulated fisheries averaged 1,497 between 1985 and 1989 (range 268 to 3,464), or 0.07 percent of the average annual sockeye catch of 2,105,072 over the same time period (1992 Puget Sound Sockeye Status Report; Pacific Salmon Commission Joint Interceptions Committee 1991). These catches are thought to be almost entirely of Lake Washington-stock origin.

The total Lake Washington sockeye return averaged 99.76 percent of the Washington sockeye run entering Puget Sound between 1985 and 1989 (from 1992 Puget Sound Sockeye Status Report). The preterminal harvest rate of Lake Washington sockeye in U.S. fisheries averaged 0.5 percent over this same time period (from preterminal catch and terminal run size estimates for Lake Washington sockeye).

Terminal Areas - Directed terminal commercial net and sport fisheries on Lake Washington sockeye have been allowed when the stock has returned to the Ballard Locks at levels surplus to escapement needs. These directed fisheries have occurred in the Seattle area (Area 10) and Lake Washington. However, no directed fisheries have been allowed since 1989 due to low stock abundance.

Terminal-area commercial net fisheries incidentally impacting this sockeye stock include Shilshole Bay (part of Area 10) fall chinook fisheries, Elliott Bay (Area 10A) and the Lake Washington Ship Canal (Area 10F) fall chinook fisheries and northern Lake Washington (Area 10G) fisheries for fall chinook, coho and steelhead. Minimum mesh size restrictions, test fisheries documenting sockeye clearance and openings in specific subareas are employed to minimize sockeye catches in these fisheries targeting other species.

The terminal incidental commercial net harvest of Lake Washington sockeye averaged 319 in Shilshole Bay and Elliott Bay from 1985 through 1987 and 1989. In 1988, a directed fishery in marine waters harvested 64,888 Lake Washington sockeye. Harvest rates for the Lake Washington run in terminal marine water fisheries averaged 0.10 percent from 1985 through 1987 and 1989. The marine harvest rate was 10.5 percent during the directed fishery in 1988 (1992 Sockeye Status Report).

Freshwater net fisheries in Lake Washington and the Ship Canal harvested an average of 4,030 fish in years when catches were incidental (1985, 1986 and 1989) and 54,974 during years when directed freshwater fisheries occurred (1987 and 1988). Terminal freshwater run harvest rates averaged 1.77 percent and 14.2 percent for these two year groupings respectively.

Sport fisheries targeting Lake Washington sockeye last occurred in 1987 and 1988. The sport take in Lake Washington was 3,117 and 71,230 for these two years, equivalent to terminal run harvest rates of 1.4 percent and 13.0 percent respectively.

Hatchery – Issaquah Hatchery is located on Issaquah Creek, and produces yearling coho, outplants fry, and produces fall chinook. Small hatcheries are located on Lake Union and produce coho and fall chinook. These hatcheries are operated by the University of Washington and the National Marine Fisheries Service.

WDFW recently began operation of a sockeye hatchery program on the Cedar River at Landsburg Dam. Brood stock is obtained by netting operations on the Cedar River. The eggs are incubated and fry released after acclimation to river water.

LAST TEN YEARS SALMON RELEASES INTO THE CEDAR - SAMMAMISH BASIN

REL. YEAR	SPRING CHINOOK	FALL CHINOOK	CHUM	COHO	SOCKEYE
1982	0	4,345,552	0	3,302,714	4,567,000
1983	0	5,086,693	0	2,447,684	0
1984	0	8,033,619	42,000	2,717,918	0
1985	0	4,636,569	5,000	5,392,516	0
1986	8,000	4,452,655	7,500	3,363,941	0
1987	0	5,141,303	9,700	2,011,345	0
1988	0	4,459,219	9,000	2,336,443	0
1989	0	3,692,062	10,000	2,736,789	0
1990	0	3,976,832	10,500	3,753,059	0
1991	0	4,187,250	63,900	2,009,462	0
MEAN		4,801,175	19,700	3,007,187	

OVERVIEW -- LAKE WASHINGTON SUMMER AND WINTER STEELHEAD STOCKS

WINTER:
LAKE WASHINGTON

STOCK DEFINITION AND ORIGIN

In the Lake Washington system, no summer steelhead stocks and one winter steelhead stock have been identified. Wild winter steelhead in the Lake Washington system are a distinct stock and are native.

There is little or no information available to indicate that this is a genetically distinct stock. The stock is treated separately due to the geographic isolation of the spawning population. There may be more or fewer stocks identified once comprehensive genetic, life history, and ecological information is available.

There is a broad overlap in the run timing of the hatchery winter stock (late November through mid-March) and wild winter stock (early December through mid-May). This may be due in part to earlier-entering stocks which spawn in the small tributaries (which exhibit low flows in the late spring), versus Cedar River fish which spawn to mid-June.

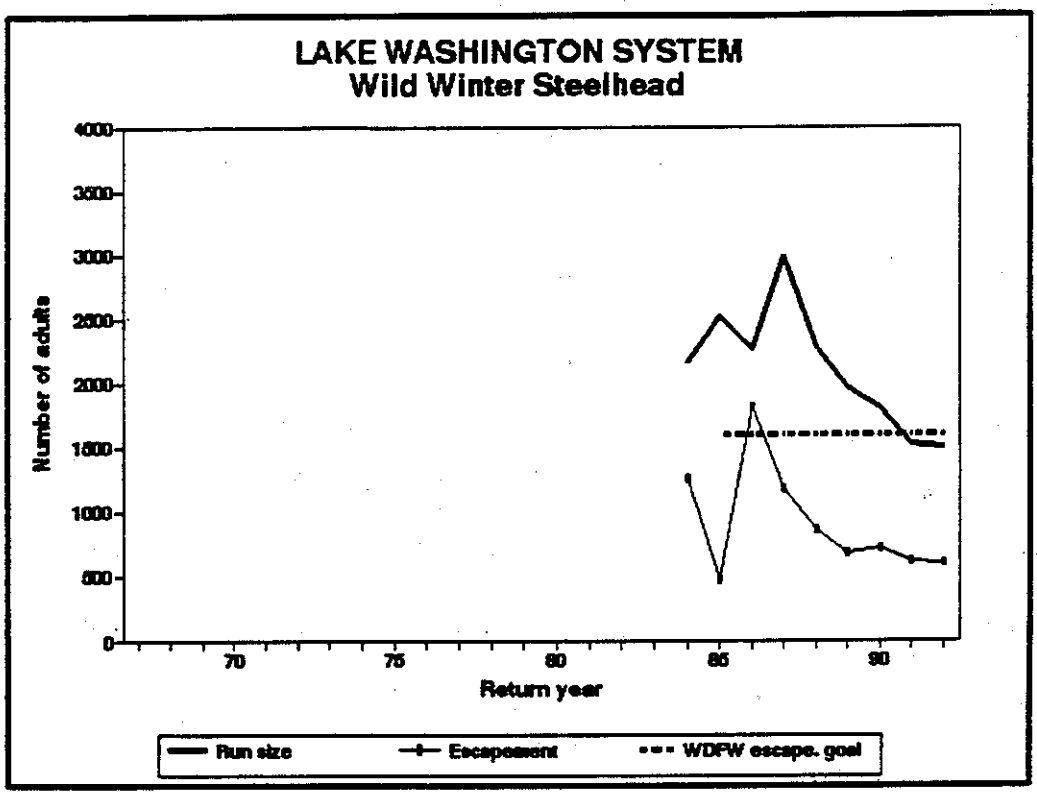
While an average of 55,000 winter smolts have been stocked into the Lake Washington system between 1982 and 1991, there has been little contribution to the wild stock from hatchery fish spawning in the wild. Relatively intense sport and tribal fishing pressure in December through February harvests most of the hatchery fish. This combined with spawn timing differences between the hatchery fish (January and February) and the wild fish (late March through early June) results in little interbreeding potential.

No summer steelhead are stocked in the Lake Washington system.

STOCK STATUS

Wild winter steelhead spawner escapement and run size have been monitored for the Lake Washington system since the 1983-84 season. Wild spawner escapement has ranged from 474 to 1,816 fish and wild run size has ranged from 1,498 to 2,997 fish (see figure).

Beginning with the 1984-85 season, a WDFW spawner escapement goal of 1,600 winter steelhead was set for the Lake Washington system and the fisheries were managed to achieve the goal. This goal is to be achieved by wild adults and does not include hatchery fish spawning in the wild. In the eight seasons since the escapement goal was set, wild spawner escapement has averaged 868 fish and exceeded the goal one time (see figure).



The wild winter steelhead run in the Lake Washington system has historically been fished upon by the Muckleshoot and Suquamish tribes in the lower reaches of the Lake Washington Ship Canal (both tribes), or in Lake Washington (Muckleshoot Tribe only). Sport anglers focus their effort in the lower Ship Canal below the Ballard Locks and spillway dam, in the Sammamish and Cedar rivers, and in Lake Washington to a very small degree. The targeted tribal fishery has occurred primarily during December and early January, and the sport fishery occurs from late November through February. In recent years, a Wild Steelhead Release (WSR) regulation has been in effect during all or a portion of this period. The harvest of wild steelhead has been minimal to non-existent since 1988 due to the WSR regulations, greatly reduced tribal fishing, or complete season closure (1989).

Extremely high rates of predation by marine mammals (California sea lions) at the system mouth are unique to the Lake Washington system. About 60 percent of the annual total wild run has been taken by sea lions at the Ballard Locks area in recent years. No practicable solution has been identified for this problem. This rate of exploitation will lead to an inexorable decline in total returning run size as annual escapements are far below the system goal of 1,600 spawners. There is no evidence to date that the sea lions will vacate the Locks area as the incidence of steelhead at that location diminishes.

During the 1984-85 through 1991-92 return years, the wild winter steelhead run in the Lake Washington system was comprised of 2.8 percent sport harvest, 6.1 percent tribal harvest, 49.9 percent predation by marine mammals, and 41.2 percent spawner escapement (see table).

Lake Washington system wild winter steelhead sport harvest, tribal harvest, predation, spawner escapement, and run size from 1976-77 through 1991-92.

Return year	Sport harvest	Tribal harvest	Predation	Spawner escapement	Run size
1976-77		616			
1977-78		268			
1978-79					
1979-80					
1980-81				1,668	
1981-82					
1982-83				2,575	
1983-84	508	408		1,250	2,166
1984-85	313	241	(1,500)[1]	474	2,527
1985-86	0	116	329	1,816	2,261
1986-87	159	412	1,254	1,172	2,997
1987-88	0	238	1,178	858	2,274
1988-89	0	0	1,287	686	1,973
1989-90	0	27	1,065	714	1,806
1990-91	0	0	899	621	1,520
1991-92	0	0	(899)[1]	599	(1,498)[1]
Mean run size distribution, 1984-85 to 1991-92.					
	59	129	1,051	868	2,107
	2.8%	6.1%	49.9%	41.2%	

[1] Numbers in parentheses are estimates.

More information is presented in a separate Stock Report.

LAKE WASHINGTON -- LAKE WASHINGTON WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead are a distinct stock based on the geographical isolation of the spawning population in tributaries to Lake Washington, and Lake Sammamish, including the Cedar River and Sammamish River. At this time, it is assumed that the breeding units that use the various tributaries are part of a random-mating population within the Lake Washington watershed, but future study may reveal discrete stocks within the watershed, as has been shown for sockeye and kokanee in the system.

Spawning steelhead in at least eight tributaries are geographically isolated, but the degree of straying/mixing between these groups is unknown. (The answer to this question may soon become academic, since some tributary escapements have reached or approached zero in recent years, despite very little change in habitat quality.)

The Lake Washington watershed is the most highly urbanized of any supporting wild winter steelhead in Washington. In addition, its estuary is highly modified with a dam and locks at its mouth, requiring negotiation of a sharp salinity gradient by returning spawners. Wild steelhead have adapted to these unique conditions since 1915. Urbanization and an adverse estuary, plus the presence of two large, rich rearing lakes supporting extremely diverse fish communities (including large predators), may well represent environmental conditions having selective force.

Winter steelhead are native to the basin. While hatchery-origin (Chambers Creek) winter steelhead have been stocked into the system as fry or smolts for many years (smolts since 1958; fry terminated in 1930s), there is little contribution to the wild stock from hatchery fish spawning in the wild.

Run timing is generally from mid-December to mid-May and spawn timing is generally from early March to mid-June for wild winter steelhead in this stock.

STOCK STATUS

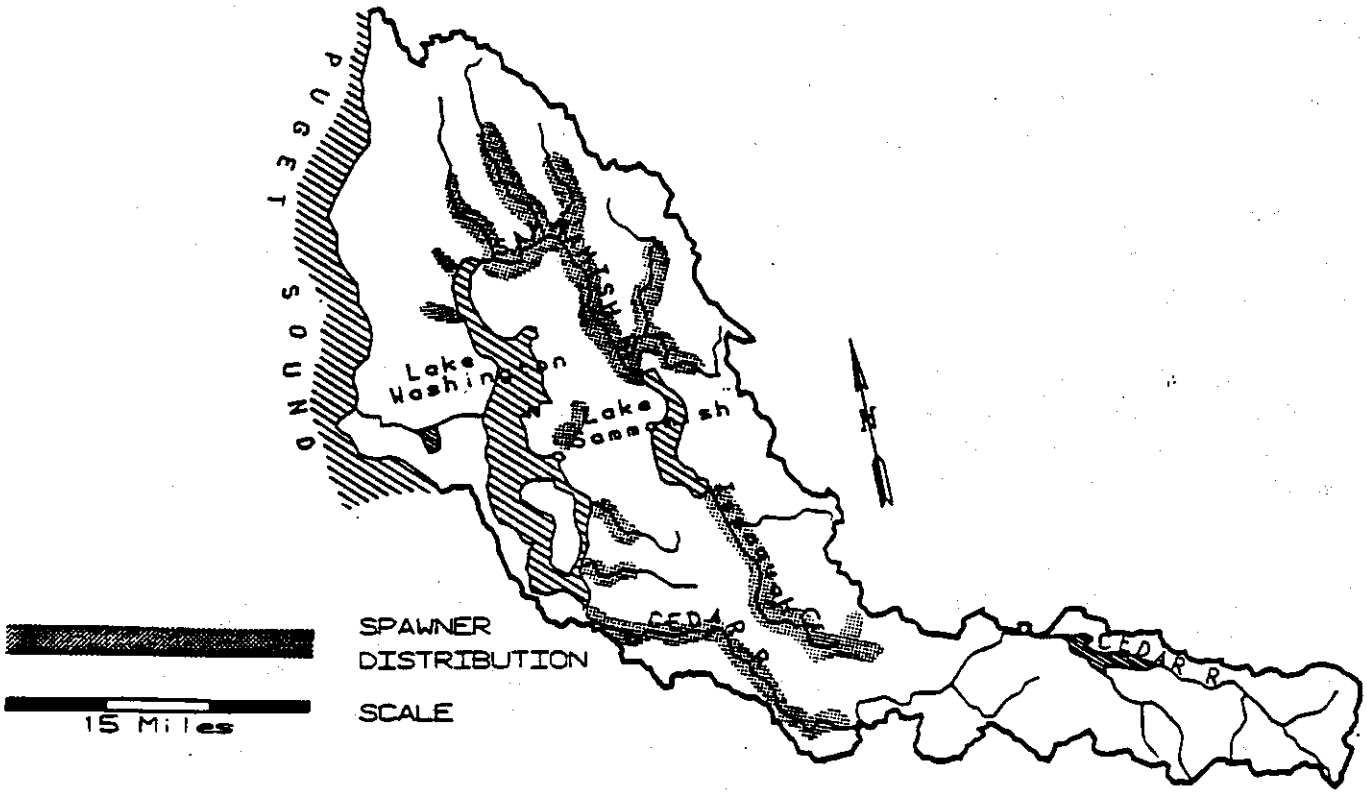
The status of the stock is Depressed.

The stock is exhibiting a short-term severe decline in spawner escapement and run size, although the slope of the curve may be diminishing. Despite adequate run sizes in most years, poor escapements are occurring due to heavy (60 percent) exploitation by marine mammals at the estuary mouth. During the 1984-85 through 1991-92 return years, spawner escapement exceeded the WDFW spawner escapement goal of 1,600 wild steelhead only during 1985-86 and has ranged from 474 to 1,816 wild

STOCK DEFINITION PROFILE for Lake Washington Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	▬	▬	▬	▬	▬							▬	NO
SPAWNING			▬	▬	▬								NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for Lake Washington Winter Steelhead

STOCK ASSESSMENT

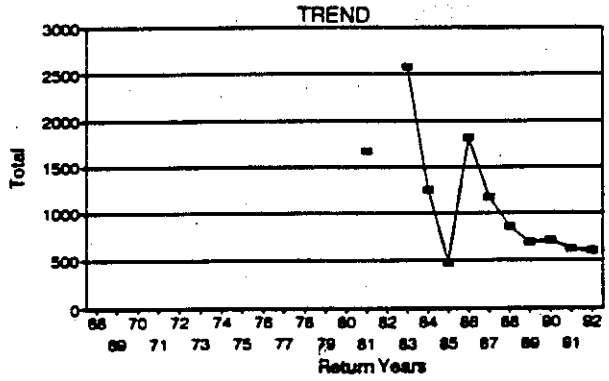
DATA QUALITY----> Good

Return Years	ESCAPE Total	RUNSIZE Total	HARVEST Total	SURVIVAL Rec/spwnr
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81	1668			
82				
83	2575			
84	1250	2166	916	
85	474	2527	554	2.8
86	1816	2261	116	
87	1172	2997	571	6.1
88	858	2274	238	1.8
89	686	1973	0	
90	714	1806	27	4.5
91	621	1520	0	
92	599	1498	0	

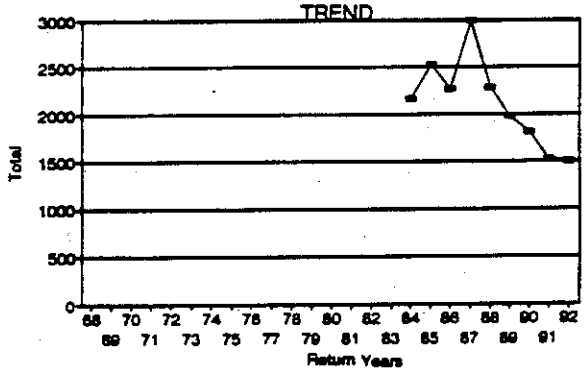
WDFW

Escapement Goal=1600

ESCAPE TREND

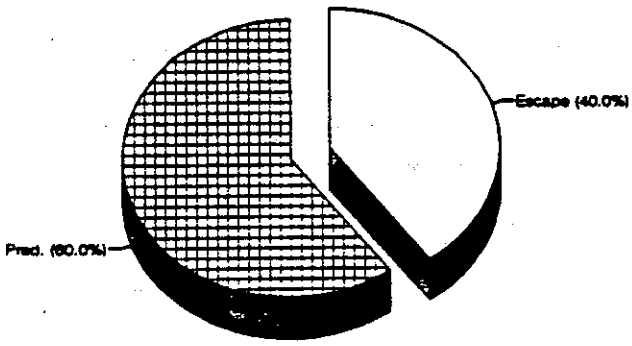


RUNSIZE TREND



AVERAGE RUNSIZE DISTRIBUTION

YEARS 1989-1992



LITTLE OR NO HARVEST SINCE 1989
DUE TO HEAVY (ca. 60%) PREDATION RATE

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Depressed

SCREENING CRITERIA
Chronically Low

steelhead. Spawning and rearing habitat in most of the historic areas has not deteriorated appreciably in this time frame. Harvest mortality has been virtually eliminated in an effort to buffer the high predation rate, but underescapements are chronic, and spawner escapements are expected to continue to decline.

Data quality is excellent on spawner escapements, and fair to very good on age and race breakouts beginning in 1983-84. Tributaries historically used by significant numbers of steelhead are foot-surveyed from March 1 to end of spawning; the Cedar River is surveyed by air from mid-March to end of spawning. Mainstem Cedar redd counts are available for numerous years prior to 1983. Predation was intensively monitored between 1985-86 and 1990-91 (Gearin et al. 1986 and 1988, NOAA et al. 1989, Norberg 1990, Pfeifer 1987, 1988, 1989, 1990, 1991a and 1991b, Pfeifer et al. 1989). Scales have been collected from tribal landings and from the Ballard Locks fishway after closure of the tribal gill net season.

FACTORS AFFECTING PRODUCTION

Habitat -- Habitat problems are discussed in detail in the listed references above.

While some of the minor tributaries of the lakes and Sammamish River have suffered some increased degradation due to urbanization in recent years, the vast majority of the habitat that was utilized by spawners in the early to mid-1980s is unchanged from an empirical appearance standpoint. In addition, about 11 miles of pristine habitat remains unused by adult steelhead in the upper Cedar River. The Lake Washington watershed is the most highly urbanized of any supporting wild winter steelhead in Washington. In addition, its estuary is highly modified with a dam and locks at its mouth, requiring negotiation of a sharp salinity gradient by returning spawners. The fish ladder is fed mostly by a saltwater drain with little freshwater attraction. Fish passage problems and a lack of escape cover at the locks allows sea lions to take a high toll on adult returns. Also, outmigrating smolts are subject to high predation rates by birds as they pass through the locks and over the spillway.

Harvest Management -- The principal factor limiting winter steelhead production within the Lake Washington watershed is the 60 percent exploitation rate due to marine mammal predation at the system mouth. The complex predation problems are discussed in detail in the references cited above. Adult wild winter harvest has been essentially zero in recent years through implementation of Wild Steelhead Release regulations. In addition, all Lake Washington and Lake Sammamish tributaries which are important steelhead spawning and rearing areas have been closed to give pre-smolts and smolts more protection.

Incidental tribal harvests of wild fish have been zero since tribal fishermen have voluntarily opted to not fish in recent years, despite some harvestable hatchery fish. The 1992-93 season will be the last where substantial numbers of hatchery-origin fish

will return and be harvestable, since smolt stocking into the Lake Washington basin was terminated in 1992. That decision will result in elimination of incidental harvest of wild fish during the current holding or run rebuilding process.

As long as the winter season remains open under Wild Steelhead Release regulations, some wild stock could be lost to hooking mortality. With or without a season, some poaching is likely to occur, but local enforcement experience is that poaching levels are somewhat higher when individuals have a legal excuse to be fishing. If escapements continue to decline, a complete wintertime closure may be necessary to give the weakened stock complete protection (except for uncontrollable "background" poaching levels). Hooking mortality and poaching are insignificant compared to the 60 percent predation level experienced at the mouth of the system.

Hatchery -- Hatchery brood stock needs at the University of Washington, and at the National Marine Fisheries Service labs on Montlake Boulevard, are minimal (total about 50 fish annually). With termination of the WDFW smolt stocking program, only small numbers of smolts will be released (about 5,500) from the University program; state or tribal seasons will not be opened to target on the few returnees generated by this release.

In the past couple of years (1990 through 1992), sport effort in the traditional areas within the watershed has been sharply reduced from historic levels. Much of this may be due to angler interest shifting to the far more productive Snoqualmie and Green River fisheries. Reduced angler effort may result in greater escapement of hatchery fish, which poses potential genetic consequences. Concern about "excessive" hatchery escapement and interbreeding with the wild stock was a consideration in the decision to terminate smolt stocking in the Lake Washington system.

OVERVIEW -- DUWAMISH/GREEN SUMMER/FALL CHINOOK STOCKS

DUWAMISH/GREEN
NEWAUKUM CREEK

STOCK DEFINITION AND ORIGIN

The lower ten-mile segment of the Duwamish/Green River system from Tukwila to Elliott Bay is known as the Duwamish River. The rest of the river, upstream from Tukwila, is known as the Green River.

Duwamish/Green River basin summer/fall chinook are distinguished from other Puget Sound summer/fall chinook stocks by geographic distribution. As with other Puget Sound summer/fall stocks, spawning occurs from mid-September through October. Chinook of largely Green River-origin from the Green River Hatchery on Soos Creek have been widely distributed throughout Puget Sound. Hatchery-origin chinook have been documented in the natural spawning populations in the Green River and Newaukum Creek. Genetic impacts from this straying are unknown. Because of straying and geographical proximity, it is possible that chinook spawning in Newaukum Creek are part of the same population as chinook spawning in the Green River. These two populations are currently listed as separate stocks pending genetic analysis.

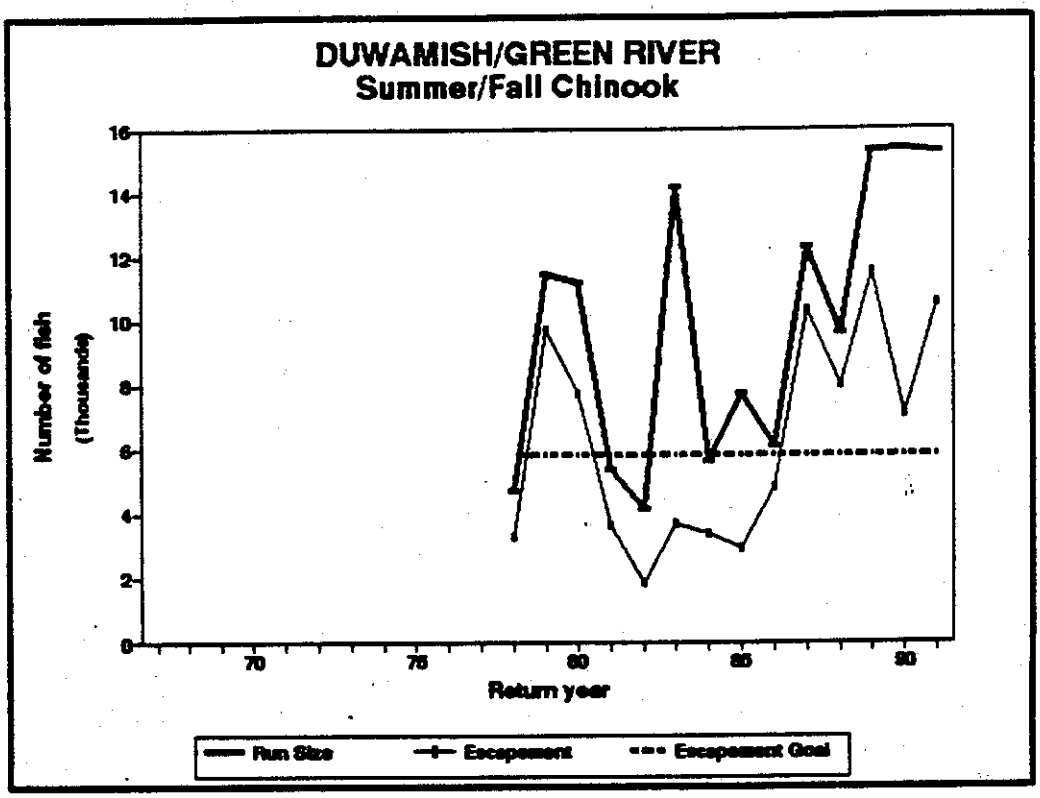
STOCK STATUS

Duwamish/Green River chinook are caught in sport and commercial fisheries off Vancouver Island and the Washington coast and in fisheries in Puget Sound and Lake Washington.

Recoveries of coded-wire tags from chinook released from several South Sound hatcheries, including Green River Hatchery, suggest that approximately one-third of the total catch of South Sound chinook, including Duwamish/Green chinook, occurs in Canadian fisheries, slightly less than two-thirds of the catch occurs in Puget Sound fisheries, and a very small proportion is caught in Washington coastal fisheries.

The escapement goal for all naturally-spawning Duwamish/Green basin chinook (Duwamish/Green plus Newaukum Creek) is 5,800 adult spawners. The escapement database for these stocks dates back only to 1987 (see figure). The aggregate goal was met from 1987 through 1991, however escapement in Newaukum Creek has dropped considerably in recent years.

More information on individual stocks is presented in the Stock Reports which follow.


DUWAMISH/GREEN RIVER
Summer/Fall Chinook
Number of fish
(Thousands)
16
14
12
10
8
6
4
2
0
70
75
80
85
90
Return year
Run Size
Escapement
Escapement Goal

DUWAMISH/GREEN -- DUWAMISH/GREEN SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was classified as distinct based upon geographic distribution. This stock has also been frequently transferred into other Puget Sound basins in the past and is genetically similar to several other Puget Sound chinook stocks such as Samish/Mainstem Nooksack fall chinook, Skykomish hatchery fall chinook, and Skagit hatchery summer and fall chinook. It is also very closely related to Deschutes hatchery fall chinook and Hoodsport hatchery fall chinook.

Stock origin is mixed with hatchery production at Soos Creek and natural spawning throughout the river. Coded-wire tag recoveries show that a significant portion of the natural spawning population is comprised of hatchery strays, indicating that natural escapement levels are partially dependent upon hatchery production.

STOCK STATUS

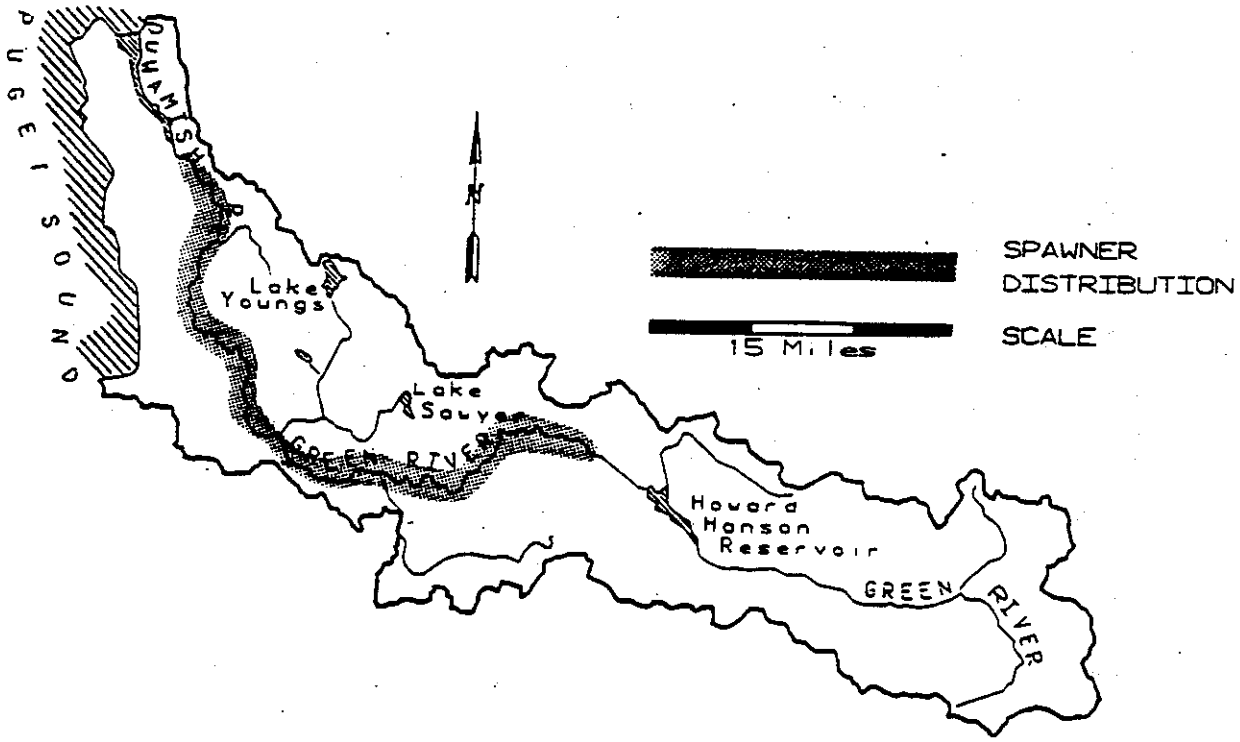
Stock status is Healthy based upon escapement levels.

Escapement levels in the mainstem Green River range from 5,000 to 10,050 with an average of 7,600 (1987 through 1991). These counts are based upon redd counts in specified sections of the river and expanded by a factor to reflect the total spawning habitat of the river. The counts are good indicators for the surveyed areas but may not be accurate when expanded for the entire river. There has been an increasing trend in natural spawning escapement levels, but this increase may partially be due to hatchery contribution. Water temperatures and flows alter the ability of chinook to reach the hatchery rack at Soos Creek, and therefore influence the level of natural spawning below the hatchery.

STOCK DEFINITION PROFILE for Duwamish/Green Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



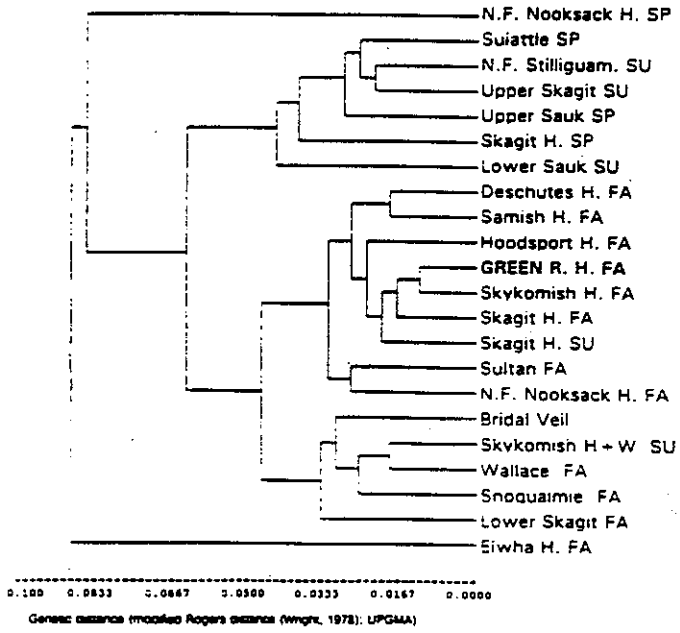
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING									▬	▬			**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

GENETICS - Green River Hatchery chinook sampled in 1981, 1987, 1988 and 1990 show no differences between years in their genetic characteristics and were combined into one data set. These Green R. chinook were not significantly different ($p > .05$) from Skykomish Hatchery falls or Skagit Hatchery summers and falls. No genetic data exist for natural spawners.

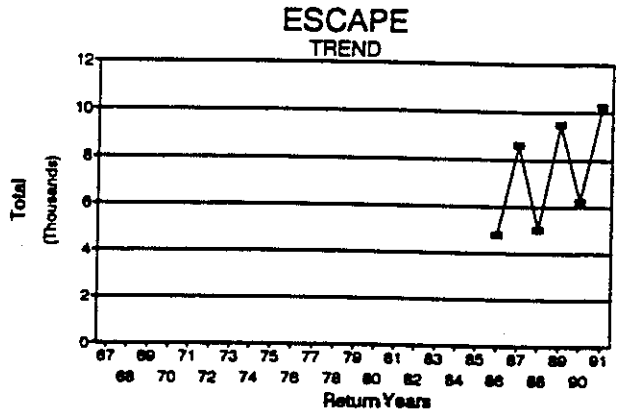


STOCK STATUS PROFILE for Duwamish/Green Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY——> Good

Return Years	ESCAPE Total			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86	4792			
87	8623			
88	5026			
89	9495			
90	6247			
91	10263			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

DUWAMISH/GREEN -- NEWAUKUM CREEK SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was classified as distinct based upon geographic distribution. Spawn timing peaks in October and is similar to that of other Puget Sound fall chinook stocks. Genetic stock identification data are unavailable.

Stock origin is native with likely influence from hatchery strays whose origin is Green River Hatchery and Icy Creek. This is based upon coded-wire tag recoveries in Newaukum Creek during spawning season.

STOCK STATUS

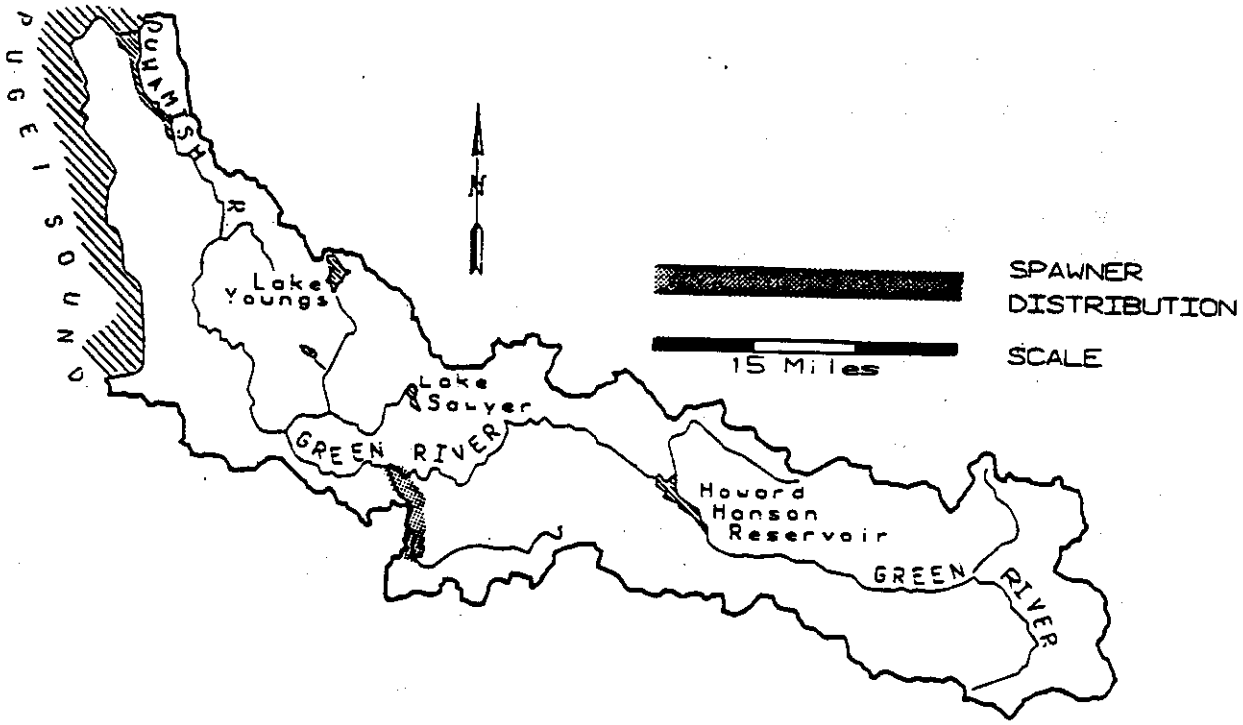
Stock status is Healthy based on escapement estimates.

Escapement levels range from 300 to 3,000 with an average of 1,600 per year. Escapement estimates are based upon redd counts and considered very good measures of relative abundance from 1987 through 1991.

STOCK DEFINITION PROFILE for Newaukum Creek Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING									▬	▬			**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

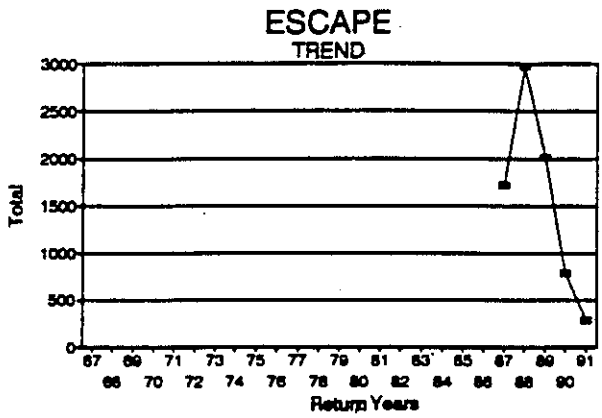
GENETICS - A sample of Newaukum Creek chinook was collected in 1992 and a genetic analysis will be performed.

STOCK STATUS PROFILE for Newaukum Creek Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY----> Very Good

Return Years	ESCAPE Total			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87	1715			
88	2968			
89	2017			
90	788			
91	285			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- DUWAMISH/GREEN FALL CHUM STOCKS

DUWAMISH/GREEN
CRISP CREEK

STOCK DEFINITION AND ORIGIN

The fall chum stocks in this region enter the terminal area between the first week of November and the first week in December. Spawning usually begins around mid-November and continues through December.

As a group these fall chum stocks are isolated from other Puget Sound stocks by geographic distribution. They were separated into two different stocks because the Duwamish/Green chum are thought to have distinct spawning distribution from the Crisp Creek fall stock.

The lower ten-mile segment of the Duwamish/Green River system, from Tukwila to Elliott Bay, is known as the Duwamish River. The rest of the river, upstream from Tukwila, is known as the Green River.

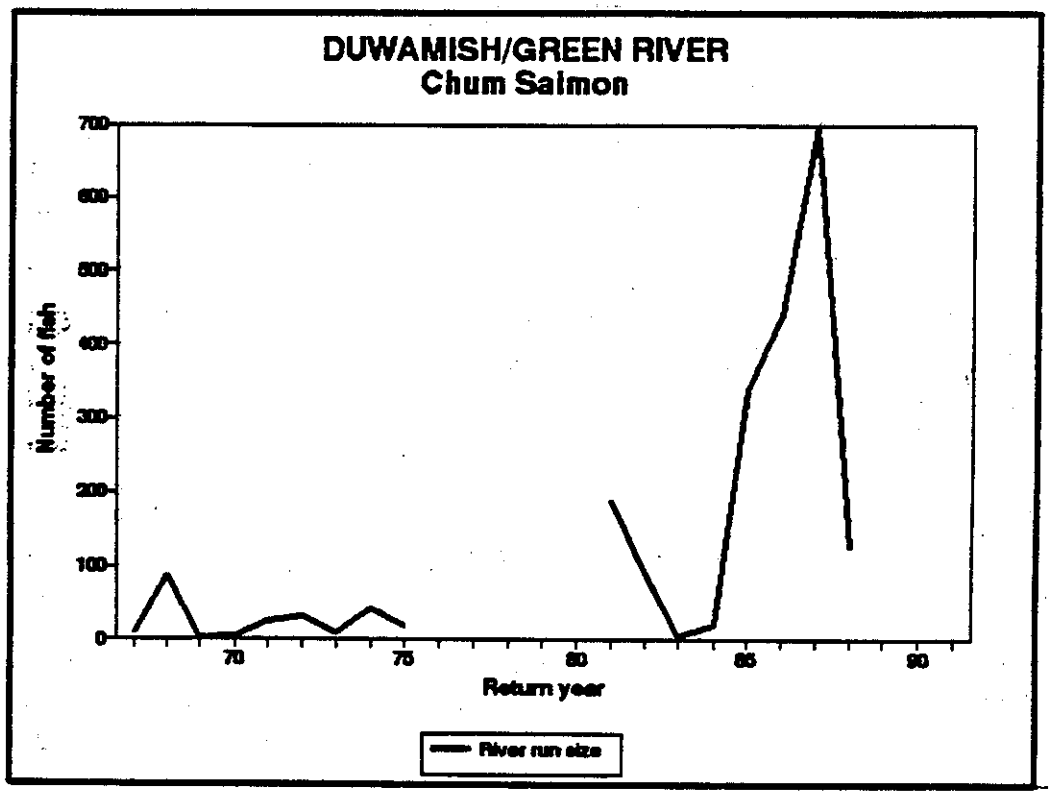
Duwamish/Green fall chum may be a remnant native stock. Spawning is thought to occur in side channels and sloughs off the mainstem river. Spawner survey data are the only available information on this stock. Historical counts were made as far back as 1947 (prior to any hatchery influence) where 452 chum were seen in a tributary to the Green River. Currently, most of the fish are seen between Burns and Crisp creeks. Natural spawning does occur in this reach, but many of these fish may be hatchery fish headed for the Keta Creek facility. In fact, there is some doubt that any native fish exist. These fish were listed as a stock with an unknown origin and status. Efforts are underway to determine if any of the native fish remain.

Fall chum observed spawning in Crisp Creek are probably naturally-spawning hatchery fish (also known as Keta Creek fall chum). They originated from Hood Canal stock (Quilcene and Hood Canal hatcheries). Current efforts are being made to replace these hatchery fish with a south Puget Sound stock.

STOCK STATUS

Duwamish/Green chum are caught in commercial fisheries from the Strait of Juan de Fuca to the river fisheries. There are no escapement goals for these stocks of chum.

Escapement data are shown in the figure below. Wild escapement information is lacking so escapement estimates may not reflect the actual number of wild spawning fish. The graph shows combined peak spawner counts of chum in the Duwamish/ Green mainstem and Crisp (Keta) and Burns creeks. Accurate wild run-size data are not available for these stocks because wild escapement estimates are not made.



More information on individual stocks is presented in the Stock Reports which follow.

DUWAMISH/GREEN -- DUWAMISH/GREEN FALL CHUM

STOCK DEFINITION AND ORIGIN

The Duwamish/Green fall stock is isolated from other Puget Sound stocks by geographic distribution. The Duwamish River enters the Puget Sound via Elliott Bay near the city of Seattle. The location of the Duwamish/Green River itself and distance of the spawning grounds upstream creates a geographic separation from other Puget Sound stocks. Duwamish/Green fall chum are thought to spawn in the mainstem Green River and in side channels and sloughs off the main stem of the Duwamish River. These fish are thought to have a distinct spawning distribution from the Keta Creek hatchery run. The Duwamish/Green Fall stock may be a remnant native stock. However, it is likely that the hatchery plants have affected the gene pool.

STOCK STATUS

The status of this stock is Unknown.

Spawner survey data are the only available information on this stock. Counts were made as far back as 1947 (prior to any hatchery influences) where 452 chum were observed in Burns Creek, a tributary to the Green River. The latest stream surveys (1987) showed nearly 700 in November of 1987, but it is likely that these fish were headed for the hatchery on Keta Creek. Few native chum have been seen upstream of the Burns and Crisp confluence. Spawner survey data on Burns and Crisp creeks are available from 1954 through 1988. However, spawning information on the remnant native fish (Duwamish/Green fall stock) is sparse.

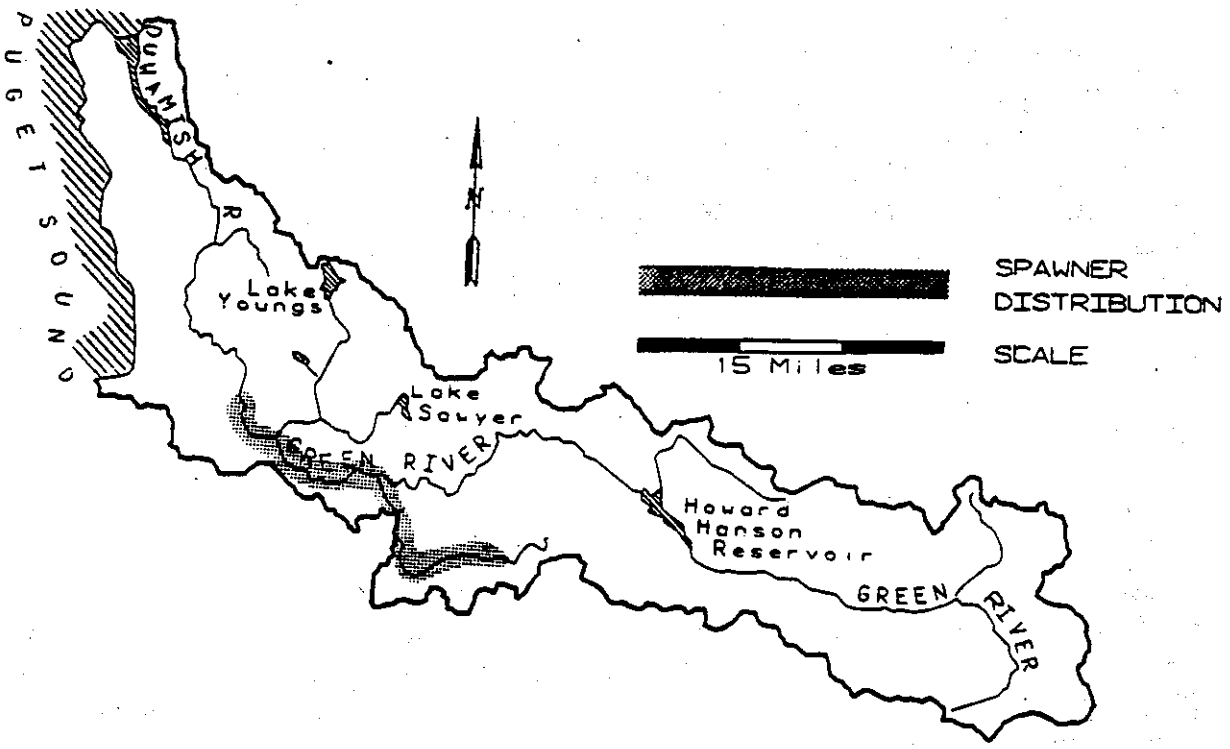
FACTORS AFFECTING PRODUCTION

Habitat -- The lower 40 miles of the Duwamish/Green River from near the confluence of Crisp Creek are subject to a mix of land uses, agricultural and residential in the upper reach and urban and industrial in the lower reaches. Diking, which extends up to about RM 38, has reduced the availability of side channels and sloughs except for a few which exist near the mouth. In addition, the dikes have precluded the introduction of large organic debris which forms rearing and hiding cover for chum salmon. Spawning gravel quality ranges from good in the upper reaches to fairly poor in the lower river. Burns and Crisp creeks, although spring fed, have heavily-silted spawning beds due to agricultural activities and lack cover in the form of instream woody debris and overhanging riparian vegetation. Water quality in the lower river and estuary (Elliott Bay) has been degraded from urban and industrial run-off and spills. Fish kills in the lower river are not uncommon. Almost all of the freshwater and estuarine wetlands and marine nearshore habitat important to juvenile chum salmon have been lost or severely degraded due to construction of bulkheads, piers and docks.

STOCK DEFINITION PROFILE for Duwamish/Green Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN											▬		**NO**
RIVER ENTRY											▬		**NO**
SPAWNING												▬	**NO**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

GENETICS - GSI is underway, but results are not yet available.

STOCK STATUS PROFILE for Duwamish/Green Fall Chum

STOCK ASSESSMENT

DATA QUALITY-----> No Data

Return Years	NO DATA			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

Harvest Management -- Duwamish/Green River chum are harvested in Canadian and United States preterminal areas, the Seattle area (Area 10), Elliott Bay (Area 10A) and Duwamish River terminal commercial net fisheries. In Area 10A and the Duwamish/Green River fisheries, this stock is managed at the exploitation rate necessary to achieve the wild escapement goal. The management strategy for Area 10 attempts to achieve the aggregate escapement goal for all wild South Sound chum stocks. Lack of stock identification data specific for Duwamish/Green River chum prevents a harvest-level impact assessment for this stock within intercepting net fisheries. Estimates of harvest levels on South Sound wild stocks taken as a whole are used to indicate Duwamish/Green stock impacts in preterminal areas. Terminal area impacts are estimated by run reconstruction.

Preterminal Areas - Duwamish/Green wild chum may be harvested in Canadian fall chum fisheries occurring after mid-September in the Strait of Juan de Fuca (Canadian Area 20) and the outer portion of the area off the mouth of the Fraser River (Canadian Area 29). The standardized Canadian estimate of the annual catch of all U.S.-origin fall chum in these fisheries is 100,000.

Existing preterminal harvest areas in U.S. waters that may impact this stock include the U.S. portion of the Strait of Juan de Fuca (Areas 4B, 5 and 6C), the area around the San Juan Islands (Areas 6, 7 and 7A) and Admiralty Inlet (Area 9). Preterminal harvest quotas and catch projections for all South Sound chum in 1992 are estimated as follows:

Catch Area	Total Fall Chum Quota or Catch Projection (US fish)	Percent S. Sound Chum	Number of S. Sound Chum
4B,5,6C	50,000	15.78	7,890
6	0	11.21	0
7	50,400	6.17	3,112
7A	50,400	2.74	1,383
9	1,203	29.65	357
Total	152,003	65.55	12,742

Terminal Areas - The major terminal area commercial chum net fisheries impacting this stock occur in the Seattle area, Elliott Bay and in the Duwamish/Green River.

The 1988-1991 harvest of wild Duwamish/Green chum averaged 157 in Area 10, 8 in Area 10A and 3 in river fisheries. Harvest rates in Area 10, 10A and the river averaged 39.8 percent, 48.8 percent and 56.3 percent respectively over the same time period (data from chum run reconstruction, July, 1992). The combined Areas 10, 10A and Duwamish/Green River terminal harvest rate averaged 80.9 percent between 1988 and 1991.

Hatchery -- No hatchery rearing programs for this species exist in the watershed.

LAST TEN YEARS SALMON RELEASES INTO THE DUWAMISH - GREEN BASIN

REL. YEAR	SPRING CHINOOK	SUMMER CHINOOK	FALL CHINOOK	CHUM	COHO
1982	68,292	638,809	5,979,391	72,000	3,256,084
1983	0	576,200	4,982,435	830,950	6,443,938
1984	0	497,100	4,692,600	251,000	4,718,130
1985	0	0	6,807,100	1,295,600	4,218,966
1986	0	0	9,273,200	1,006,400	3,548,275
1987	0	0	9,254,707	578,488	3,677,590
1988	0	0	8,142,622	681,430	3,949,976
1989	0	0	8,670,688	699,001	3,266,879
1990	0	0	11,103,676	0	3,046,457
1991	0	0	12,178,850	653,401	3,307,410
MEAN		570,703	8,108,527	674,252	3,943,371

DUWAMISH/GREEN -- CRISP CREEK FALL CHUM

STOCK DEFINITION AND ORIGIN

Crisp (Keta) Creek fall chum are reproductively isolated from other Puget Sound fall chum stocks through geographic separation. Some natural spawning may occur in Keta Creek itself but the majority of returning adults are headed for the Keta Creek Hatchery. The Keta Creek run originated from releases of Quilcene and Hood Canal hatchery stocks. The first hatchery brood returned in 1982. Surplus hatchery fish spawn in Crisp (Keta) Creek and are probably also mixing with mainstem native spawners, but this stock is considered an introduced hatchery stock. In 1990 efforts were initiated to replace the Hood Canal stock with Cowlings Creek stock from the Suquamish Tribal hatchery.

STOCK STATUS

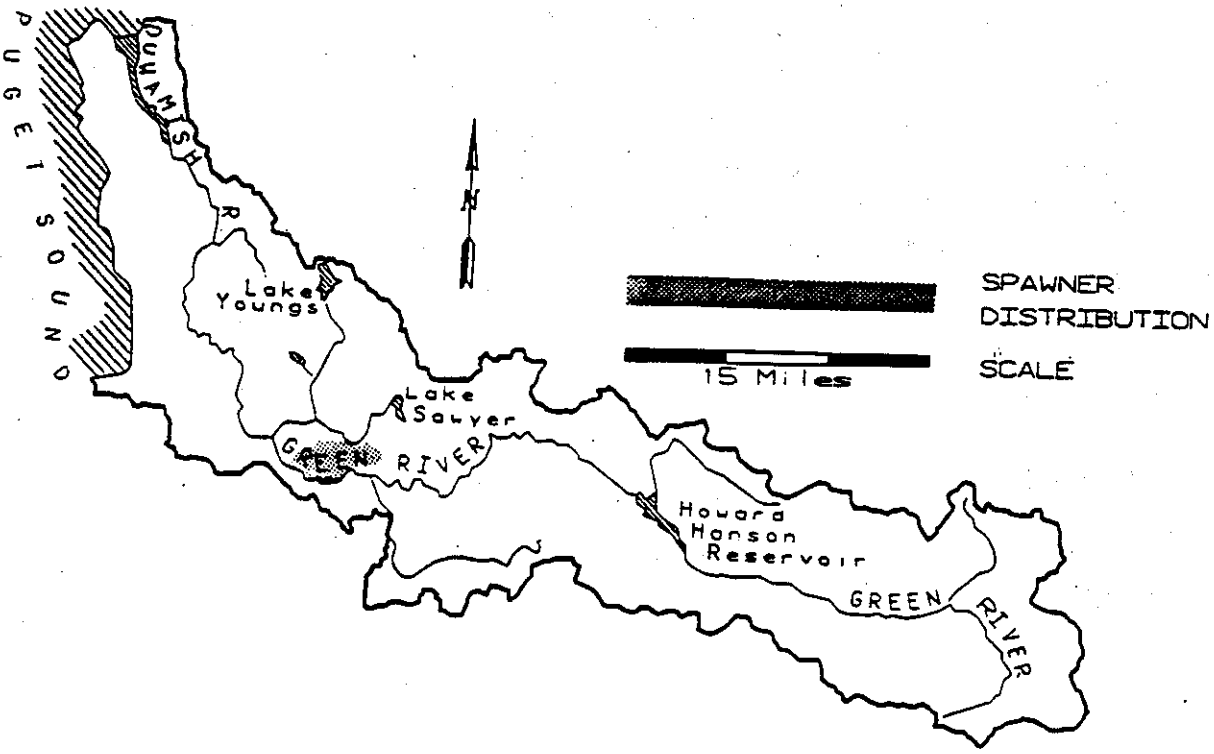
The status of the stock is Healthy.

Stock assessment data available are hatchery rack counts and hatchery planting records.

STOCK DEFINITION PROFILE for Crisp Creek Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY											▬		NO
SPAWNING											▬		NO
												▬	NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **No**

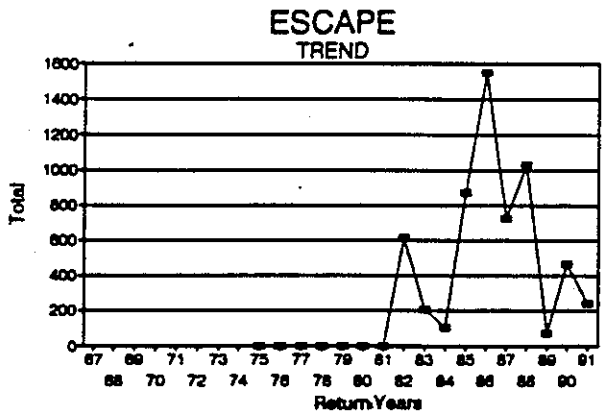
GENETICS - The Keta Creek Hatchery strain originated from Hood Canal, and two collections (1988, N=100 and 1991, N=38) confirmed that these fish are not significantly different from the Hood Canal Hatchery strain (21-locus G-tests: $p > 0.10$).

STOCK STATUS PROFILE for Crisp Creek Fall Chum

STOCK ASSESSMENT

DATA QUALITY----> Fair

Return Years	ESCAPE Total			
67				
68				
69				
70				
71				
72				
73				
74				
75	0			
76	0			
77	0			
78	0			
79	0			
80	0			
81	0			
82	617			
83	208			
84	108			
85	875			
86	1554			
87	728			
88	1032			
89	71			
90	466			
91	245			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Non-native

PRODUCTION TYPE
Cultured

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW – DUWAMISH/GREEN COHO STOCKS

GREEN RIVER/SOOS CREEK
NEWAUKUM CREEK

STOCK DEFINITION AND ORIGIN

The lower ten-mile segment of the Duwamish/Green River system, from Tukwila to Elliott Bay, is known as the Duwamish River. The rest of the river, upstream from Tukwila, is known as the Green River.

For the purposes of this inventory, the Green River basin includes the Green River drainage, the independent tributaries between Alki Point and Poverty Bay and tributaries to Elliott Bay. Coho salmon utilize, to some degree, almost all of the accessible tributaries in this area. Coho returning to these tributaries typically enter freshwater from mid-September to mid-November and spawn from late October to mid-January, with some variation observed between streams and between years within streams.

There have been substantial releases of hatchery-origin coho within this area, with significant yearling plants from the early 1950s to the mid-1960s and sporadic releases thereafter until 1980. Regular fingerling/fry plants occurred from 1952 to 1962 and from the mid-1970s to present. There are also annual yearling releases from the hatchery facilities on Soos and Crisp creeks and from a net pen program in Elliott Bay. It should be noted that many of the early off-station yearling releases were not consistent with current optimal size and time-of-release strategies, and their subsequent contribution to the wild spawning population is unknown. Straying rates from the on-station and pen rearing programs are also unknown, as are the potential survival differentials related to the various stocks introduced into this area.

Additional to those considerations are questions regarding the spawning success in the wild of hatchery-origin coho and any distinctions between native and introduced stocks in terms of either temporal or physical spawning distributions. As a result of these uncertainties, the two stocks in this area have been designated as probable mixtures of native and non-native stocks, without any inference as to the relative influence of those stocks within the current populations. There can be no confident quantification of the genetic impact of non-native stock introductions, regarding either a current presence of hatchery type components in these populations or hybridization of the native stock, until an effective genetic research tool is developed and implemented for coho salmon.

There are significant differences in the range of spawning timing documented for the two stocks in this drainage, with the Newaukum Creek fish sometimes spawning into mid-January. Their distinction may also be supported to some degree by geographic spawning separation, the result of subjective judgments regarding the probability of

significant spawner interchange between drainages. Differences in off-station planting histories are assumed to result in dissimilar stock impacts, so those differences have provided additional support for stock distinction. There have been no documented unique biological characteristics for either of the stocks in this basin. Until a genetic determinant is available and used to evaluate these stocks, these designations are tentative.

STOCK STATUS

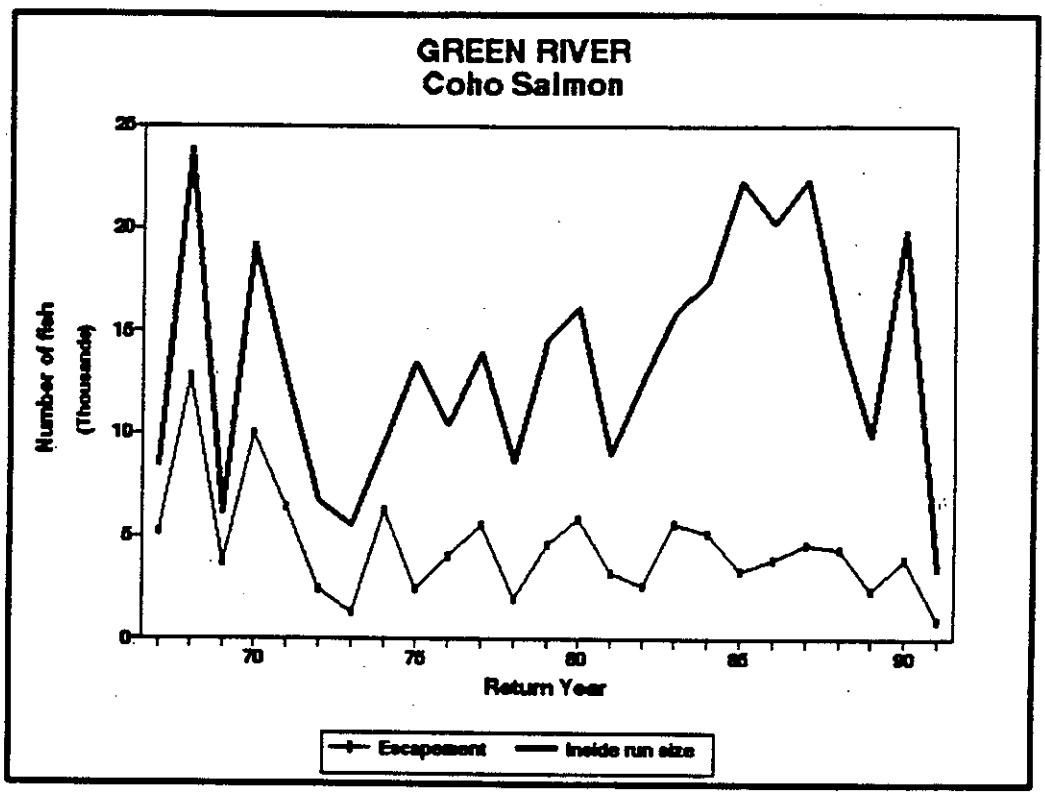
The Newaukum Creek coho stock is classified as Depressed because of a short-term severe decline in its escapement.

Coho of Green River basin origin are primarily harvested in Canadian troll, net and sport fisheries and in Washington troll, net and recreational fisheries. There are directed terminal area fisheries on these stocks to harvest surplus hatchery returns.

The total natural escapement goal for Green River coho stocks is 8,700. The run reconstruction database shows escapement exceeding that goal only three times in 27 years and run-size estimates (the number of fish in escapement and Puget Sound net catches) over that same period, from 1965 to present, fluctuating over a broad range. Newaukum Creek stock performance evaluation is dependent upon a relatively short stock assessment database (dating back to 1980) which provides no indication of present production's relationship with historic levels. The Green River/Soos Creek stock production trend is represented by run reconstruction data (escapement and run-size estimates) which indicate that this stock is Healthy.

The following figure, which illustrates natural coho production trends in this basin, is derived from the run reconstruction database. Some of the run size estimated for the last ten to 15 years may be attributable to misallocation of hatchery-origin production to the natural stock. The magnitude of this possible error has not been estimated at this time. The escapement goal is not plotted on this graph since the primary management objective in this basin is to minimize surplus hatchery returns through harvest rates which generally preclude accomplishing that goal.

More information on individual stocks is presented in the Stock Reports which follow.


GREEN RIVER
Coho Salmon
Number of fish
(Thousands)
25
20
15
10
5
0
70
75
80
85
90
Return Year
Escapement
Inside run size

DUWAMISH/GREEN -- GREEN RIVER/SOOS CREEK COHO

STOCK DEFINITION AND ORIGIN

This stock is classified on the basis of distinct geographic spawning distribution. We do not believe that there is significant straying from outside the drainage. This stock does not exhibit any documented unique biological characteristics, and its spawn timing is similar to that of the Green River Hatchery coho stock (most spawning occurring from late October to mid-December).

The Soos Creek system is almost entirely dependent upon hatchery-origin adults passed above the rack, and production above Howard Hanson Dam on the Green River is all derived from off-station hatchery fry and fingerling releases. There have been annual on-station yearling releases into Soos Creek of Green River stock, as well as Simpson, Toutle, Minter and Skykomish yearling releases between 1973 and 1977. These mid-1970s non-native releases were all adipose marked and every effort was made to remove them from the hatchery brood stock upon return. Their impact on the system should have been limited to whatever straying may have occurred into areas outside the Soos Creek system. Off-station releases throughout the rest of the drainage have been substantial, including fairly consistent plants of Green River yearlings through 1965 and a single release of Puyallup yearlings in 1975, one of Skykomish yearlings in 1976, and an Issaquah release in 1955. Off-station releases of Green River hatchery fingerlings or fry into this system were fairly consistent from 1952 to 1962 and 1976 to present. Importations of other stocks for off-station release have been limited to three Issaquah plants (1952, 1968 and 1969), two broods of Puyallup stock (released in 1976 and 1981) and two releases of Minter Creek stock in 1978 and 1983. This stock is likely a mixture of the native and introduced non-native stocks.

STOCK STATUS

The status of the stock is Healthy.

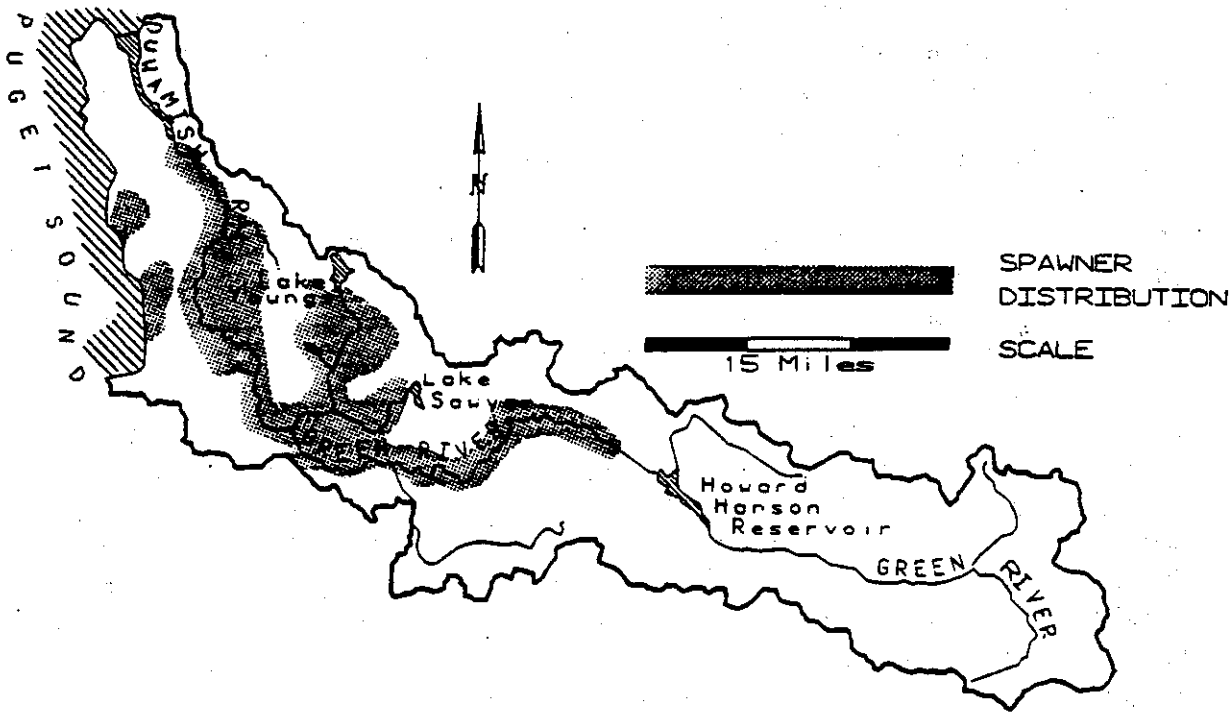
Green River run reconstruction data include production from the Newaukum Creek system, and there is no appropriate way to break those data down into sub-basin components. However, there are very limited escapement data available for areas outside the Newaukum drainage (Hill Creek escapement index data and passage counts at the Black River pumping station), so run reconstruction is used to represent this stock's status.

These data indicate fairly stable escapement and production for this stock, however, it should be noted that the 1991 value is the lowest in the database and that similar values in the near future would bring this stock into the Depressed category due to a short-term severe decline.

STOCK DEFINITION PROFILE for Green River/Soos Creek Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING													**NO**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

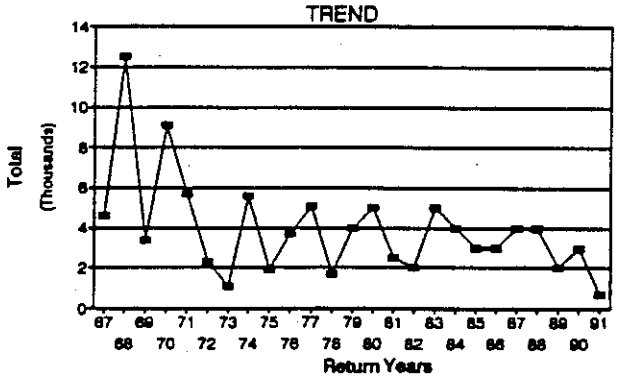
STOCK STATUS PROFILE for Green River/Soos Creek Coho

STOCK ASSESSMENT

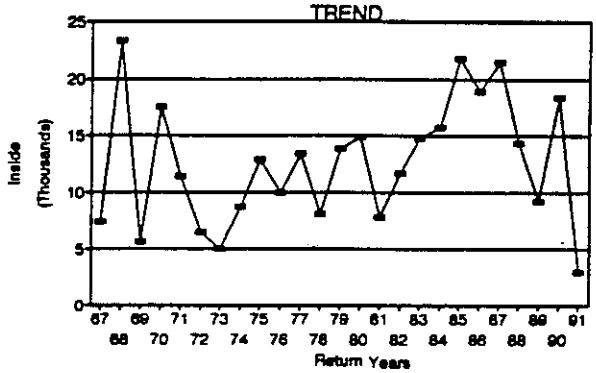
DATA QUALITY-----> Fair

Return Years	ESCAPE Total	RUNSIZE Inside		
67	4600	7400		
68	12500	23300		
69	3400	5600		
70	9100	17600		
71	5700	11400		
72	2300	6500		
73	1100	5000		
74	5600	8700		
75	1900	12900		
76	3700	10000		
77	5100	13400		
78	1700	8085		
79	4000	13900		
80	5000	14900		
81	2500	7600		
82	2000	11700		
83	5000	14800		
84	4000	15800		
85	3000	21800		
86	3000	18900		
87	4000	21500		
88	4000	14400		
89	2000	9200		
90	3000	18400		
91	700	3000		

ESCAPE
TREND



RUNSIZE
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

DUWAMISH/GREEN -- NEWAUKUM CREEK COHO

STOCK DEFINITION AND ORIGIN

Occasional multiple peaks within the spawning curves of this stock and an extended spawning timing (to mid-January in some years) have led us to believe there may be a significant, unique genetic component present in this tributary system. This stock does not display any documented unique biological characteristics, but may experience some degree of spawning segregation from other coho in the Green River drainage.

Most of the hatchery introductions into this drainage have been from Green River, with yearling releases occurring in 1953, 1962 to 1965, 1970, 1977 and 1978. One plant of Puyallup yearlings was made in 1980. Infrequent (seven) off-station releases of Green River fry or fingerlings were made into this system prior to 1980, however, there has been a comprehensive fingerling program there from 1982 to present. One release of Issaquah stock fry (1968) and two of Puyallup stock (1976 and 1978) were made into this drainage. This stock is probably a mixture of the native and introduced non-native stocks.

STOCK STATUS

The status of this stock is Depressed.

Production of this stock is included in the Green River run reconstruction data, and there is no appropriate means of breaking those data down into sub-basin components. There are good spawning escapement index data available for this stock dating back to 1980.

Escapement index totals for 1989 and 1991 are the lowest in the database and of the nine available broods, only three have approached or surpassed spawning replacement. This stock has experienced a short-term severe decline and should be monitored to detect any long-term negative trend.

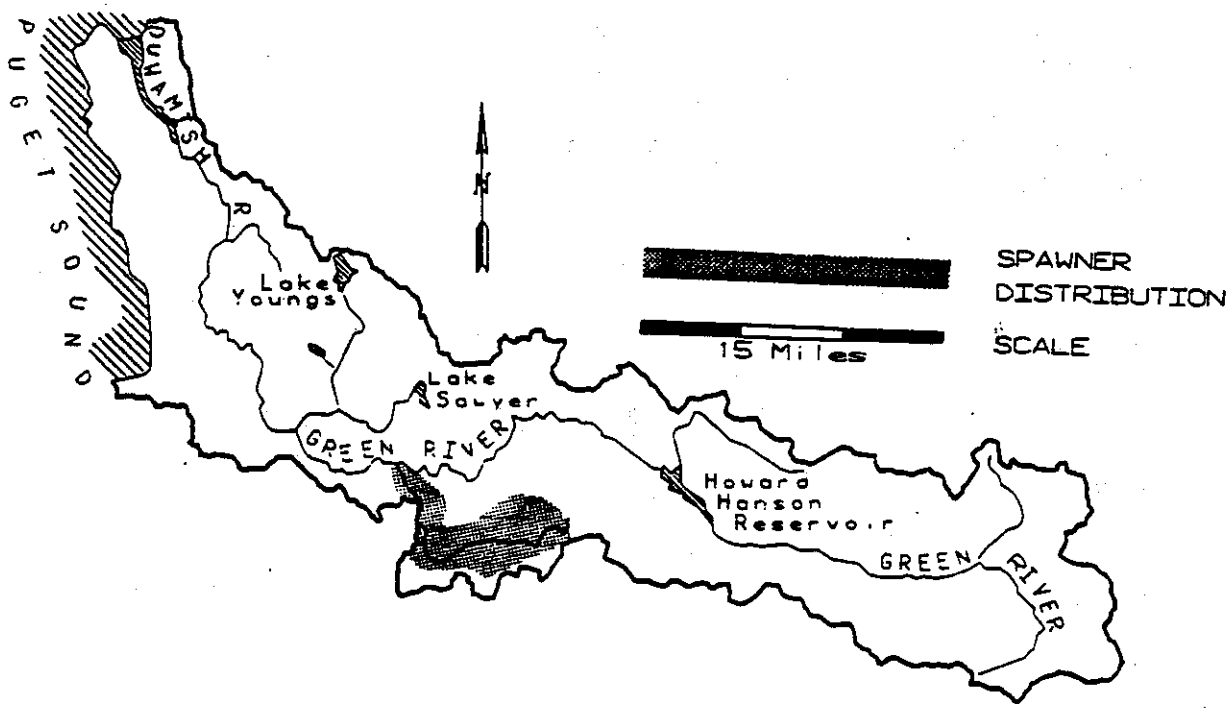
FACTORS AFFECTING PRODUCTION

Habitat -- The primary natural habitat limiting factor is summer low flows. Low flows are exacerbated by agricultural water diversions. Water quality is diminished by agricultural wastes and lack of a well-developed riparian corridor. Much of Newaukum Creek has low bush and grassy vegetation only. Logging in the upper watershed and development increase winter peak flows and decrease summer flows.

STOCK DEFINITION PROFILE for Neuwakum Creek Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN								▬	▬				**UNK**
RIVER ENTRY									▬	▬			**UNK**
SPAWNING	▬										▬	▬	**YES**

BIOLOGICAL CHARACTERISTICS

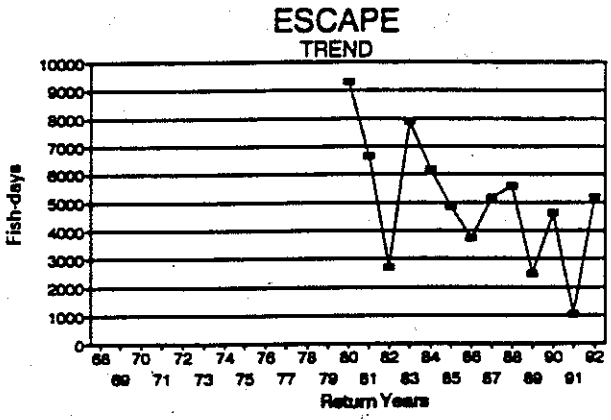
DISTINCT? - **NO**

STOCK STATUS PROFILE for Newaukum Creek Coho

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Fish-days			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80	9300			
81	6641			
82	2700			
83	7887			
84	6150			
85	4857			
86	3752			
87	5174			
88	5591			
89	2475			
90	4627			
91	1034			
92	5195			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution, Timing

STOCK STATUS
Depressed

SCREENING CRITERIA
Short-Term Severe Decline

Newaukum Creek enters the Duwamish/Green River at about RM 41. The lower 40 miles of the Duwamish/Green River from near the confluence of Crisp Creek are subject to a mix of land uses, agricultural and residential in the upper reach and urban and industrial in the lower reaches. Diking, which extends up to about RM 38, has reduced the availability of side channels and sloughs except for a few which exist near the mouth. In addition, the dikes have precluded the introduction of large organic debris which forms rearing and hiding cover for chum. Spawning gravel quality ranges from good in the upper reaches to fairly poor in the lower river. Burns and Crisp creeks, although spring fed, have heavily silted spawning beds due to agricultural activities and lack cover in the form of instream woody debris and overhanging riparian vegetation. Water quality in the lower river and estuary (Elliott Bay) has been degraded from urban and industrial run-off and spills. Fish kills in the lower river are not uncommon. Almost all of the freshwater and estuarine wetlands and marine nearshore habitat important to juvenile chum salmon have been lost or severely degraded due to construction of bulkheads, piers and docks.

Harvest Management -- No stock-specific information is available at this time.

Hatchery -- The Green River Hatchery located on Soos Creek produces yearling coho and chinook (at satellite facilities located upstream), and sub-yearling chinook.

LAST TEN YEARS SALMON RELEASES INTO THE DUWAMISH - GREEN BASIN

REL. YEAR	SPRING CHINOOK	SUMMER CHINOOK	FALL CHINOOK	CHUM	COHO
1982	68,292	638,809	5,979,391	72,000	3,256,084
1983	0	576,200	4,982,435	830,950	6,443,938
1984	0	497,100	4,692,600	251,000	4,718,130
1985	0	0	6,807,100	1,295,600	4,218,966
1986	0	0	9,273,200	1,006,400	3,548,275
1987	0	0	9,254,707	578,488	3,677,590
1988	0	0	8,142,622	681,430	3,949,976
1989	0	0	8,670,688	699,001	3,266,879
1990	0	0	11,103,676	0	3,046,457
1991	0	0	12,178,850	653,401	3,307,410
MEAN		570,703	8,108,527	674,252	3,943,371

OVERVIEW -- DUWAMISH/GREEN SUMMER AND WINTER STEELHEAD STOCKS

SUMMER:
GREEN (DUWAMISH)

WINTER:
GREEN (DUWAMISH)

STOCK DEFINITION AND ORIGIN

In the Duwamish/Green River system, one summer steelhead stock and one winter steelhead stock have been identified. Wild summer and winter steelhead in the Duwamish/Green River are distinct stocks. Wild winter steelhead are native and wild summer steelhead originated from non-native fish.

There is little or no information available to indicate that these are genetically distinct stocks. The stocks are treated separately due to the geographic isolation of the spawning populations. There may be more or fewer stocks identified once comprehensive genetic, life history, and ecological information is available.

Run timing of the summer steelhead stock (May through October) is distinct from run timing of the winter steelhead stock (December through May) in the Duwamish/Green River system.

While about 100,000 to 130,000 hatchery winter steelhead smolts are stocked in the Duwamish/Green River system annually, there is little contribution to the wild stock from hatchery fish spawning in the wild. The returning hatchery adults support tribal and sport fisheries with a combined exploitation rate of about 90 percent. Given the high exploitation of the hatchery fish, healthy wild spawner escapements, and the difference in spawn timing between the hatchery fish (January and February) and the wild fish (mid-February through May), the potential for interbreeding is limited.

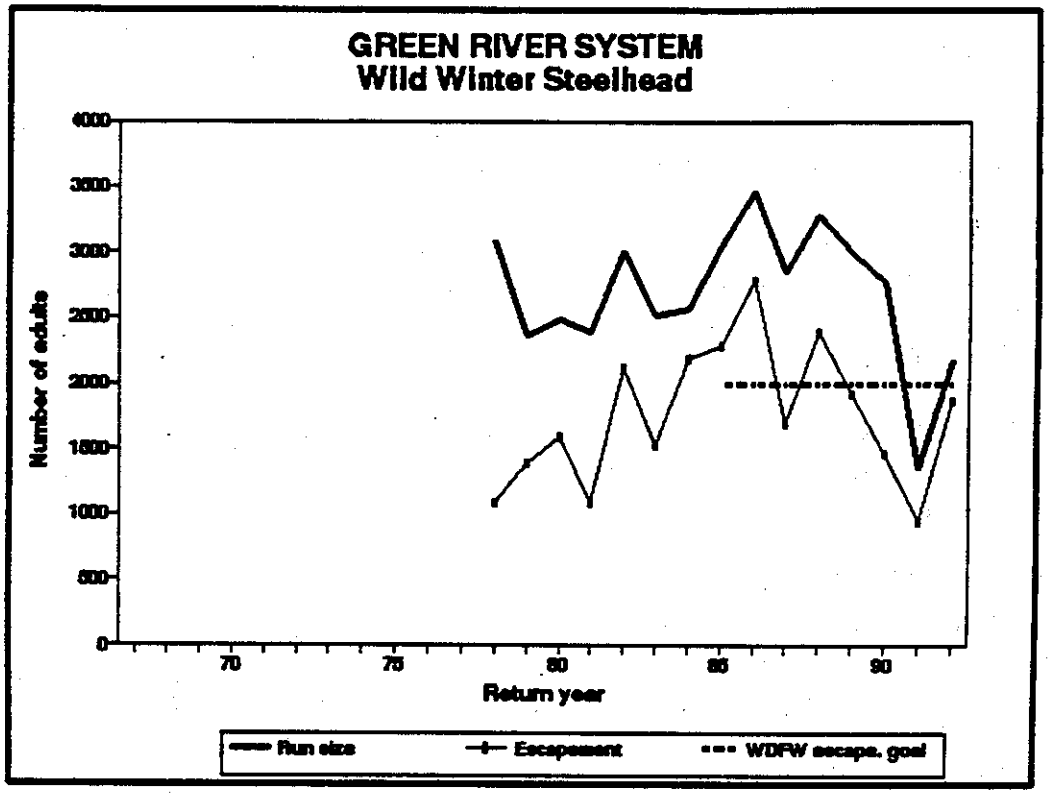
About 70,000 hatchery summer steelhead smolts are stocked in the Duwamish/Green River system annually. Since the summer steelhead stock is of hatchery origin, the stock is managed primarily for recreational benefits and interbreeding between hatchery and wild fish is not a concern.

STOCK STATUS

Wild winter steelhead spawner escapement and run size have been monitored for the Green River since the 1977-78 season. Wild spawner escapement has ranged from 944 to 2,778 fish and wild run size has ranged from 1,350 to 3,464 fish (see figure).

Beginning with the 1984-85 season, a WDFW spawner escapement goal of 2,000 winter steelhead was set for the Green River system and the fisheries were managed to achieve the goal. This goal is to be achieved by wild adults and does not include

hatchery fish spawning in the wild. In the eight seasons since the WDFW escapement goal was set, wild escapement has averaged 1,915 fish and has exceeded the goal three times and was very close to the goal (about 1,900 fish) another two times (see figure).



The wild winter steelhead run in the Green River system is fished upon by the Muckleshoot Tribe and Suquamish Tribe in the lower mainstem Green River and nearby marine waters (Elliott Bay). Sport anglers fish in the mainstem Green River and some tributaries. The tribal fishery occurs primarily during December and January and targets the hatchery stock, while the sport fishery occurs from November through March on the mainstems and through February on the tributaries.

During the 1977-78 through 1991-92 return years, the wild winter steelhead run in the Green River system was comprised of 19.2 percent sport harvest, 15.5 percent tribal harvest, and 65.3 percent spawner escapement (see table).

Green River system wild winter steelhead sport harvest, tribal harvest, spawner escapement, and run size from 1977-78 through 1991-92.

Return year	Sport harvest	Tribal harvest	Spawner escapement	Run size
1976-77	261			
1977-78	789	1,210	1,077	3,076
1978-79	307	662	1,385	2,354
1979-80	492	409	1,586	2,487
1980-81	597	699	1,083	2,379
1981-82	489	399	2,121	3,009
1982-83	658	324	1,526	2,508
1983-84	66	315	2,188	2,569
1984-85	306	448	2,286	3,040
1985-86	568	118	2,778	3,464
1986-87	652	500	1,685	2,837
1987-88	556	340	2,378	3,274
1988-89	882	188	1,916	2,986
1989-90	1,094	207	1,466	2,767
1990-91	155	251	944	1,350
1991-92	113	186	1,868	2,167
Mean run size distribution, 1977-78 to 1991-92				
	515	417	1,752	2,684
	19.2%	15.5%	65.3%	

More information on each stock is presented in separate Stock Reports.

DUWAMISH/GREEN -- GREEN (DUWAMISH) SUMMER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild summer steelhead in the Green River and tributaries are a distinct stock based upon the geographic isolation of the spawning population. Specific run timing and spawn timing are unknown, but run timing is generally from May through October and spawn timing is generally from February through April for wild summer steelhead in this stock.

The stock is of non-native (hatchery) origin. Skamania stock hatchery smolts were first introduced in 1965. Prior to the first return of summer steelhead adults from this plant in 1967, sport angler punchcards indicate an annual summer harvest averaging 12 fish per year (1962-1966). Pautske and Meigs (1940) documented an extensive creel census during the summer of 1938 and reported no adult steelhead caught in over 5,000 angler days of effort. It is likely that summer adults caught in the Green River prior to hatchery introductions were either from other river system stocks, or most likely were wild or hatchery winter stocks caught during the summer steelhead management period, May 1 to October 31.

STOCK STATUS

The status of the stock is Healthy.

This stock is managed primarily to provide a recreational harvest fishery and has no escapement objective since the summer steelhead stock originated from hatchery stocks and may compete with native winter steelhead.

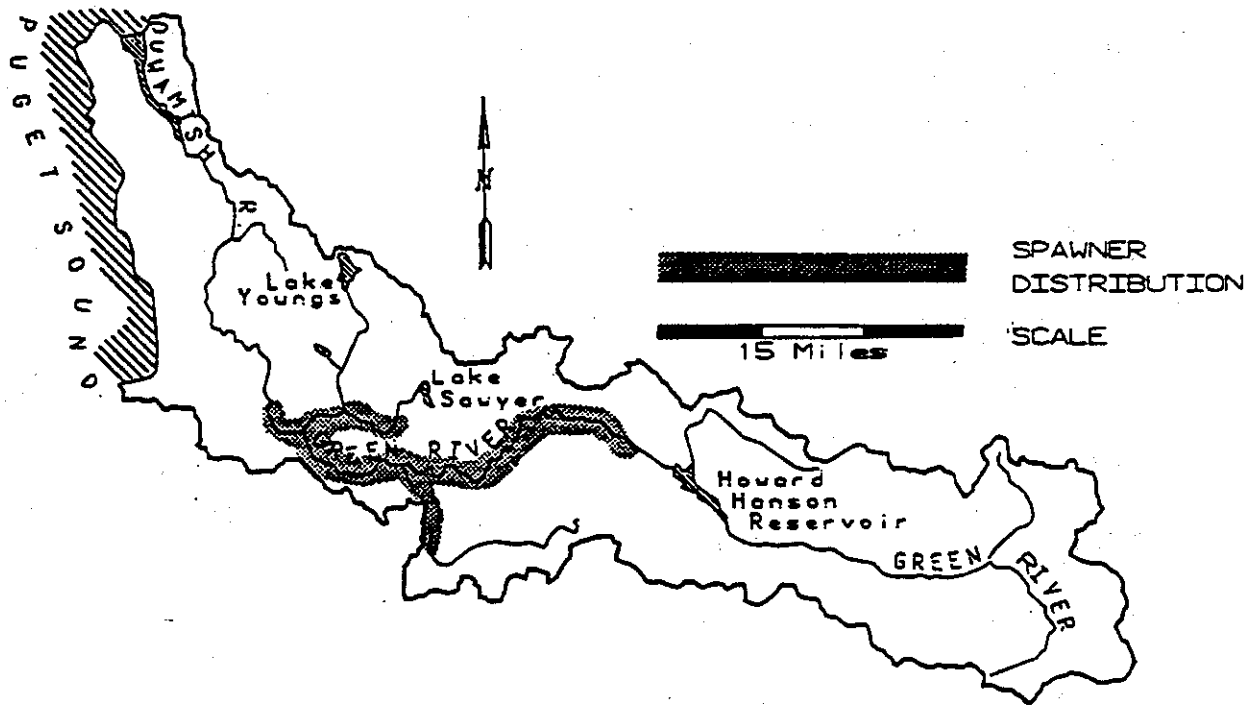
There is no tribal fishery that targets on this stock although incidental harvest of wild steelhead may occur. The stock supports a sport fishery which targets the harvest of summer steelhead in the Green River.

The decline in wild sport harvest for this stock during 1991 and 1992 is likely due in part to recent changes in ocean survival. A recent Washington Department of Wildlife study (Cooper and Johnson 1992) concluded that there have been long-term fluctuations and recent declines in winter, summer, hatchery and wild steelhead abundance and survival in the Puget Sound, Strait of Juan de Fuca, Pacific coast, and Columbia River areas in Washington. There were also similarities in the overall trends and year-to-year trends of steelhead abundance in Washington, British Columbia and Oregon. Similarities in survival trends over widespread geographic areas indicate that common factor(s) to each of these areas are responsible for recent changes in steelhead survival. A combination of factors contributed to the recent decline in steelhead abundance including low ocean productivity, competition for food in the ocean, and harvest of steelhead in authorized and unauthorized high seas drift net fisheries.

STOCK DEFINITION PROFILE for Green (Duwamish) Summer Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - YES



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY													UNK
SPAWNING													UNK

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

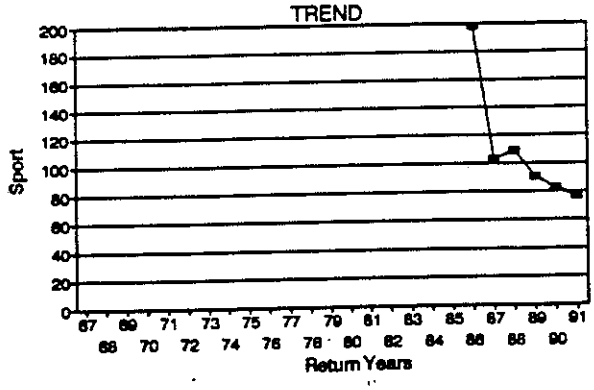
STOCK STATUS PROFILE for Green (Duwamish) Summer Steelhead

STOCK ASSESSMENT

DATA QUALITY----> Fair

Return Years	HARVEST Sport			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86	198			
87	103			
88	109			
89	91			
90	83			
91	77			

HARVEST
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Non-Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

DUWAMISH/GREEN -- GREEN (DUWAMISH) WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in the Green River and tributaries are native and a distinct stock based on the geographic isolation of the spawning population. Run timing is generally from December through May and spawn timing is generally from early March to mid-June.

Hatchery-origin steelhead (from Chambers Creek stock) have been introduced annually as smolt plants from various hatcheries. Interbreeding between hatchery and wild steelhead is limited, however, and the wild stock has remained essentially isolated because of its later time of spawning.

STOCK STATUS

The status of the stock is Healthy.

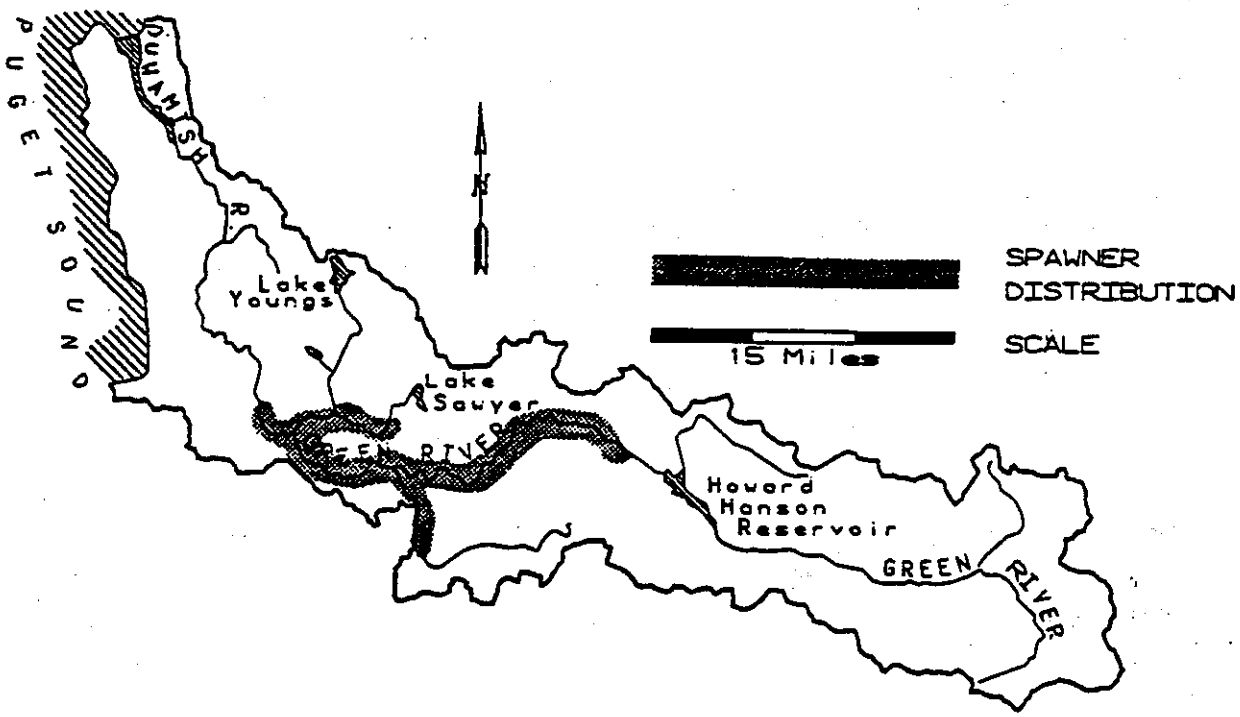
Annual spawner escapements have exceeded the escapement goal of 2,000 in most years. Only 1990-91 escapements dipped below historic lows. Wild spawner escapement has averaged 1,915 fish and has exceeded the goal three times and been very close to goal (about 1,900 fish) another two times since the goal was established in the 1984-85 season.

The recent downward trend in run sizes are a concern, but are most likely due to poor ocean survival being experienced by steelhead stocks coastwide. This stock will be closely monitored and will be reclassified if warranted.

STOCK DEFINITION PROFILE for Green (Duwamish) Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	■	■	■	■	■							■	NO
SPAWNING			■	■	■								NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for Green (Duwamish) Winter Steelhead

STOCK ASSESSMENT

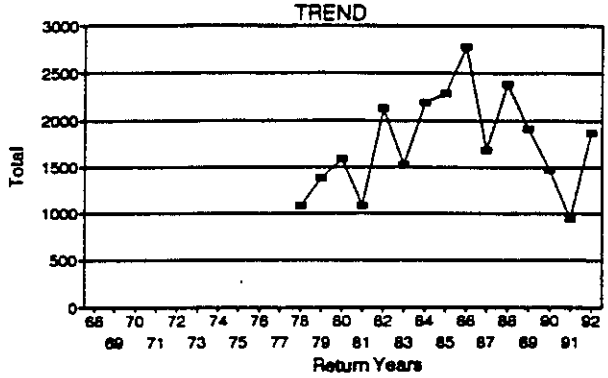
DATA QUALITY——> Good

Return Years	ESCAPE Total	RUNSIZE Total	HARVEST Sport	HARVEST Net
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78	1077	3076	789	1210
79	1385	2354	307	662
80	1586	2487	492	409
81	1083	2379	597	699
82	2121	3009	489	399
83	1526	2508	658	324
84	2188	2569	66	315
85	2286	3040	306	448
86	2778	3464	568	118
87	1685	2837	652	500
88	2378	3274	556	340
89	1916	2986	882	188
90	1466	2767	1094	207
91	944	1350	155	251
92	1868	2167	113	186

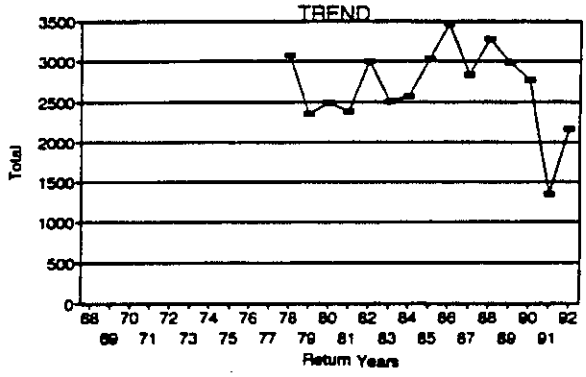
WDFW

Escapement Goal=2000

ESCAPE TREND

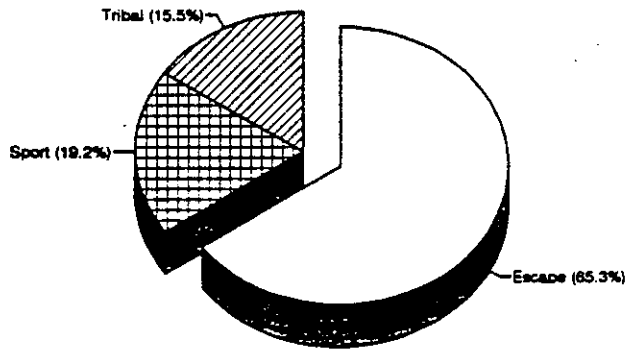


RUNSIZE TREND



AVERAGE RUNSIZE DISTRIBUTION

YEARS 1978-1992



STOCK SUMMARY

STOCK ORIGIN

Native

PRODUCTION TYPE

Wild

STOCK DISTINCTION

Spawning Distribution

STOCK STATUS

Healthy

SCREENING CRITERIA

OVERVIEW -- PUYALLUP CHINOOK STOCKS

WHITE (PUYALLUP) SPRING
WHITE (PUYALLUP) SUMMER/FALL
PUYALLUP FALL

STOCK DEFINITION AND ORIGIN

Puyallup Basin chinook stocks have been grouped together based on geographic separation from other Puget Sound chinook stocks. However, within the basin, there are differences among stocks both in run and spawning timing and in the location of spawning grounds. White River spring chinook spawn primarily in September, while White River summer/fall chinook spawn primarily in October. It is not certain that these two stocks are truly distinct from one another or that White River fall chinook are not simply fall chinook strays from nearby net pens. Fish arriving at the adult trap on the White River at Buckley on or before August 15 are considered spring chinook; those arriving after August 15 are considered fall chinook. Fall chinook strays have been documented at the trap at Buckley through coded-wire tag analysis. However, most fall chinook releases from net pens are untagged so the true rate of straying may be higher than the current estimated rate. The separation between White River spring and fall chinook was made arbitrarily and requires more information on spawn timing, distribution and genetic composition, especially because coded-wire tagged spring chinook returning to the White River hatchery spawn from September through October. Puyallup River fall chinook spawn primarily in the Puyallup River system from September through October. Most natural production comes from South Prairie Creek. Green River chinook have been released extensively in the Puyallup River system. Hybridization with native stocks, particularly in the Puyallup River, may have occurred, and it is possible that the currently identified Puyallup stock may not differ genetically from the Green River hatchery stock. Genetic analysis is needed to answer this question. Non-native chinook releases into the Puyallup system from 1966-1987 were:

Year	Number Released	Stock
1966	150,995	Skykomish
1966	762,564	Green River
1967	1,108,170	Minter Creek
1968	499,590	Green River
1971	642,406	Issaquah
1973	1,199,772	Hood Canal
1973	1,033,500	Green River/Green River Cross
1974	833,025	Green River
1975	678,000	Green River
1976	1,381,801	Deschutes
1976	344,898	University of Washington
1978	438,737	Green River
1978	1,265,213	Green River/Puyallup Cross
1982	786,800	Green River
1986	300,000	Green River
1987	209,400	Green River

The White River spring chinook stock is considered a native stock, but the origin of the White River summer/fall stock is unknown because of the question about its separation from the spring stock or from other fall chinook stocks released from nearby net pens or hatcheries.

STOCK STATUS

The White River spring chinook stock has been characterized as Critical based on chronically depressed spawner escapements. Since the early 1970s most returning adults have been taken for brood stock at the Minter Creek/Hupp Springs hatchery facilities near Carr Inlet, the South Sound net pen complex on Squaxin Island and, more recently, at the White River Hatchery. The number of adults returning to the White River Hatchery has begun to increase over the last three years. The juvenile production in the enhancement program increased beyond the maintenance needs of the program and allows for release and acclimation in the upper White River watershed.

The status of the White River summer/fall and Puyallup fall stocks is Unknown mainly because of a lack of consistent spawner survey information.

More information on individual stocks is presented in the Stock Reports which follow.

PUYALLUP -- WHITE (PUYALLUP) SPRING CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was classified as unique based upon spawn timing and genetic analysis. Entry time begins in late May and continues through mid-October. Spawn timing is primarily in September. This timing differs from all other south Puget Sound chinook stocks. Genetic composition also differs from all other Puget Sound stocks.

Stock origin is native, as the original brood stock was collected from White River. The stock is considered to be a native stock reared in a hatchery setting located at Hupp Springs, a satellite of the Minter Creek hatchery, and the White River hatchery. A segment of the stock is kept in South Sound net pens to provide a captive brood stock. As the White River hatchery program increases, releases in the White River watershed will increase with the intention of re-populating the river. Considerable cooperative effort into the rebuilding program has been undertaken by the Tribes, WDFW and the U.S. Forest Service to rebuild and monitor the population, assess habitat problems and solutions and provide acclimation sites throughout the upper watershed. A small population of native, natural spawners still returns to the White River and is currently transported from the trap below the hydropower facility at Buckley and released into the upper river above the Mud Mountain flood control dam.

STOCK STATUS

Stock status is Critical based upon chronically depressed escapement levels. Escapement levels into the Hupp Springs hatchery have ranged from 10 to 500 with an average of 137 per year (1978 through 1991).

The average percent of the total brood contribution escaping to the Hupp Springs Hatchery was 33.25 percent. The percent escaping fisheries exhibited an increasing trend over the broodyears examined (21.26 percent to 38.71 percent).

There has been an increasing trend in escapement levels during this time period due to the rebuilding efforts. There are inadequate data to assess the level of natural spawners in the White River, but existing data suggest the annual level of spawners is quite low. Long-term hatchery domestication may have altered fitness. Small numbers of brood stock used to initiate the rebuilding program may have created a genetic bottleneck.

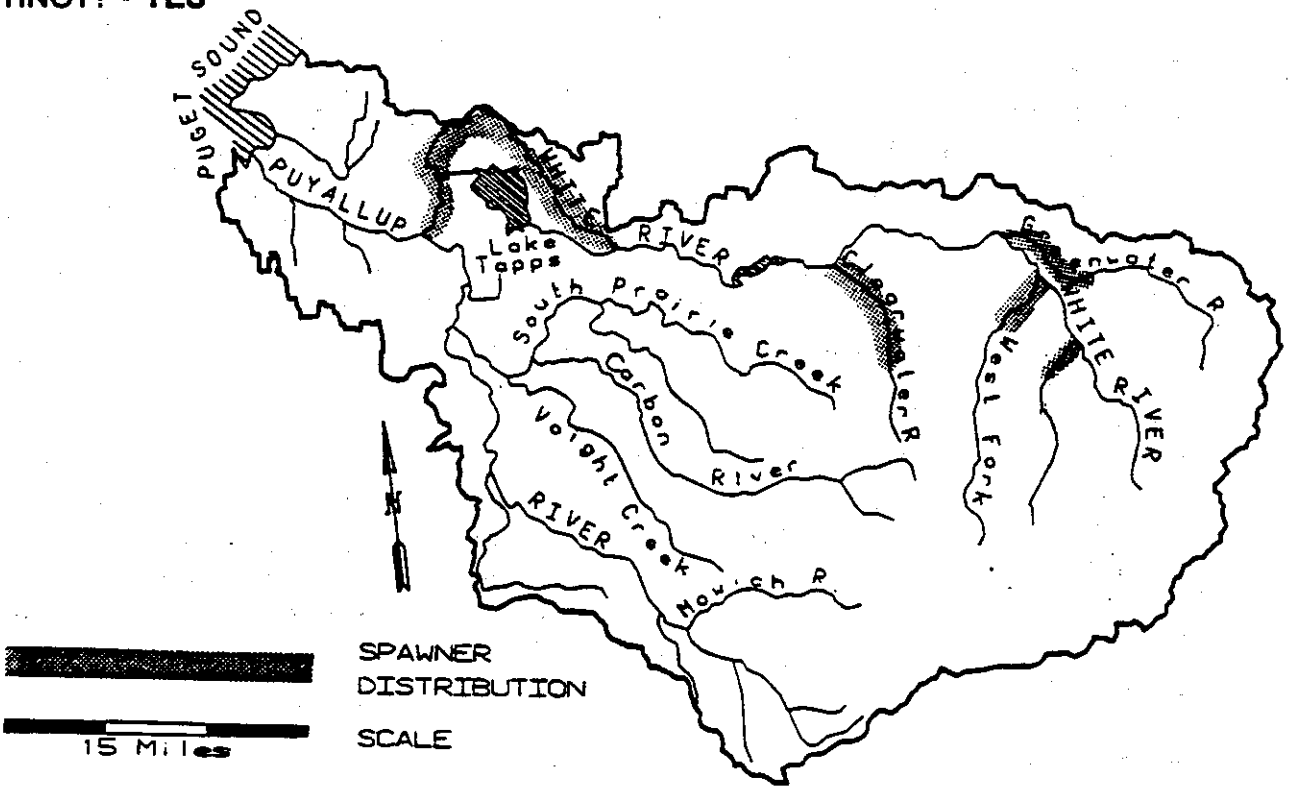
FACTORS AFFECTING PRODUCTION

Habitat -- The primary natural habitat limiting factor for this stock, which spawns in the upper White River, is the glacial nature of the river, with its frequently shifting braided channels, high turbidity and frigid water temperature. However, the natural instability is overwhelmed by significant human-caused perturbations beginning in the

STOCK DEFINITION PROFILE for White (Puyallup) Spring Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													UNK
RIVER ENTRY					▬	▬	▬	▬	▬				UNK
SPAWNING									▬	▬			YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - White River chinook were sampled in 1991 at Hupp Springs Hatchery and South Sound net pens. Their genetic characteristics show them to be significantly different ($p < 0.05$) from all other Puget Sound stocks examined. Genetic analysis will continue with samples taken in 1992.

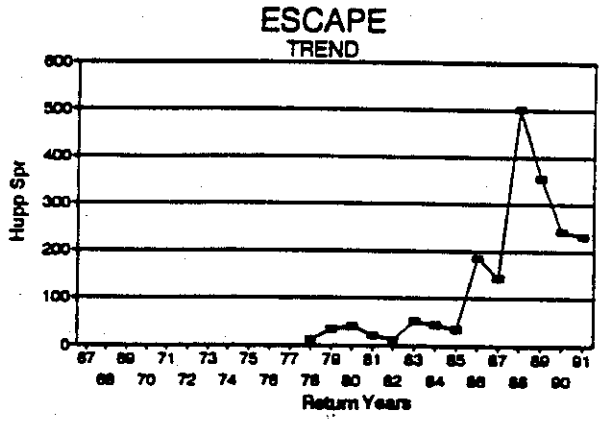
STOCK STATUS PROFILE for White (Puyallup) Spring Chinook

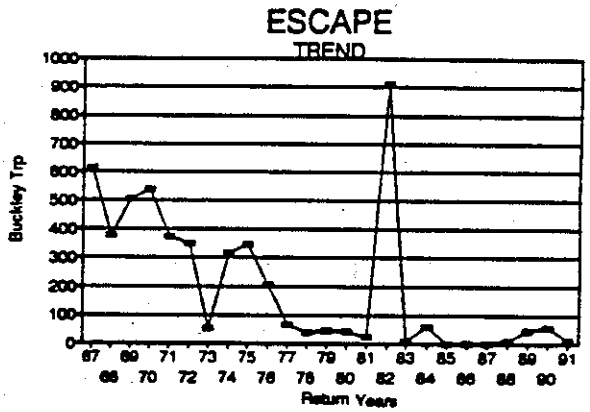
STOCK ASSESSMENT

DATA QUALITY——> Excellent

Return Years	ESCAPE Hupp Spr	ESCAPE Buckley Trp		
67		615		
68		377		
69		504		
70		538		
71		374		
72		349		
73		53		
74		318		
75		346		
76		208		
77		66		
78	13	37		
79	33	47		
80	42	44		
81	22	23		
82	13	910		
83	52	9		
84	44	59		
85	33	0		
86	186	1		
87	144	1		
88	504	9		
89	355	47		
90	242	57		
91	232	13		

An arbitrary cut-off date of August 15 was used to define "spring chinook."





AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution, Timing, Genetic

STOCK STATUS
Critical

SCREENING CRITERIA
Chronically Low

upper watershed and continuing throughout the White River downstream to its confluence with the Puyallup, finally entering Commencement Bay at Tacoma. Land uses include private and governmental logging, a major flood control dam at RM 29.6 and a major hydropower water withdrawal at RM 24.3 in Buckley. Inadequate screens at the hydropower project operated by Puget Power at Buckley have contributed to significant losses of smolts migrating out of the upper White River. Extensive diking has occurred in the White and Puyallup rivers to Commencement Bay. The diking has actually reduced river capacity and led to a need for additional bank protection and constant gravel removal in attempts to prevent that erosion. These activities usually further reduce channel stability and the quality of fish habitat. There have been recent minor improvements in passage and instream flows at the Buckley diversion and some improvements to upper river habitat within the Mount Baker-Snoqualmie National Forest. Gravel removal continues in the lower river and Puyallup River.

Lower river estuarine and freshwater wetlands have been virtually destroyed by the industrial development of the Port of Tacoma. There have been modest attempts to restore this habitat in recent years.

Harvest Management -- White River spring chinook salmon released from WDFW's Hupp Springs Hatchery are harvested in Canadian and United States preterminal area and U.S. terminal area sport, troll and commercial net fisheries. These chinook are intercepted in fisheries as resident fish and as returning adults, from two to seven years old. In preterminal and U.S. terminal fisheries, this stock is managed at an exploitation rate appropriate to meet sport and troll fishing objectives for other chinook stocks. Intercepting preterminal and terminal area commercial net fisheries are managed at rates appropriate for the harvest of commingled sockeye, coho and chum stocks. Extreme terminal net fisheries affecting this stock in Carr Inlet (Area 13A) are managed to minimize impacts within fall chinook fisheries.

Preterminal Areas - Over four broodyears examined (1983 through 1956), interceptions in preterminal sport and commercial fisheries averaged 10.81 percent and 7.44 percent respectively of the total combined broodyear contribution of White River spring brood returns to all fisheries and escapement. Major intercepting preterminal sport fishing areas included Admiralty Inlet (average 4.65 percent of the contribution to fisheries and escapement), the Strait of Juan de Fuca (average 2.65 percent) and combined Canadian areas (average 1.65 percent). Preterminal sport fishery interception percentages of total broodyear contributions showed a decreasing trend over the years reviewed (12.74 percent to 9.38 percent).

Preterminal commercial fisheries intercepting a significant percentage of White River springs included the Strait of Juan de Fuca troll fishery (average 2.88 percent of total contribution - range 1.28 percent to 5.81 percent) and the Skagit Bay/Port Gardner (Area 8/8A) net fishery (average 1.72 percent, range 0 percent to 4.36 percent). Although preterminal commercial fisheries as a whole showed no definite trend over

the years examined, percent contribution in the Strait troll fishery taken alone exhibited an increasing trend (1.28 percent to 5.81 percent).

Terminal Areas - The percent contribution of White River springs in Puget Sound terminal area sport and commercial fisheries averaged 39.25 percent and 9.35 percent respectively over broodyears 1983 through 1986.

Terminal area sport fisheries intercepting a significant percentage of the total combined broodyear contribution included the Tacoma area (Area 11) (average 17.93 percent, range 13.47 percent to 21.82 percent), deep South Sound (Area 13) (average 14.95 percent, range 8.06 percent to 25.30 percent) and the Seattle area (Area 10) (average 6.37 percent, range 4.12 percent to 10.27 percent). A decreasing trend in the percent contribution intercepted in terminal area sport fisheries was evident over the years examined (49.04 percent to 29.99 percent)

Important terminal area net fisheries included coho and chum openings in the Seattle-Tacoma area (average 6.91 percent, range 4.55 percent to 8.85 percent) and Carr Inlet (Area 13A) fall chinook openings (average 1.79 percent, range 0.4 percent to 2.72 percent). No trend in percent contribution rates for terminal commercial net fisheries was evident for the broodyears examined.

Total Percent Contribution to Fisheries - White River spring chinook broodyears 1983-1986, on average, contributed 66.84 percent of the total, combined return to sport and commercial fisheries. A decreasing trend in the percent of the return intercepted in fisheries was apparent over the broodyears examined (78.74 percent to 61.29 percent).

The major intercepting fisheries identified were the Tacoma area and deep South Sound sport fisheries, averaging 17.93 percent and 14.95 percent of the total contribution over all broodyears. The Seattle-Tacoma area net fisheries accounted for the next highest percentage of the average, total contribution (6.91 percent).

Hatchery -- The hatchery program at Minter Creek/Hupp Springs and the South Sound net pens was designed to restore the White River spring chinook to the natal watershed as a self-sustaining population. Recent egg takes have been large enough to outplant this stock to the White River and to a new tribal hatchery on the White River.

LAST TEN YEARS SALMON RELEASES INTO THE PUYALLUP - WHITE BASIN

REL. YEAR	SPRING CHINOOK	FALL CHINOOK	CHUM	COHO	PINK
1982	0	4,381,242	280,000	3,508,160	200,000
1983	0	3,190,061	20,700	3,496,997	0
1984	0	3,142,232	234,188	2,832,745	0
1985	0	1,837,283	526,050	4,146,575	0
1986	0	2,937,210	431,519	2,511,364	0
1987	5,296	3,742,895	52,744	1,753,988	0
1988	0	4,007,335	347,290	2,195,694	0
1989	0	2,448,079	362,167	2,202,366	0
1990	269,394	3,847,982	39,284	1,907,098	118,000
1991	169,842	3,281,841	298,956	1,989,521	0
MEAN	204,791	3,281,616	262,079	2,654,574	159,000

PUYALLUP -- WHITE (PUYALLUP) SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was classified as distinct based upon geographic distribution. The White River is somewhat isolated from the Puyallup streams, although straying from the Puyallup can occur. Analysis of genetic composition would be useful, but unlikely due to the difficulty of fresh carcass recoveries in this system. Spawn timing is primarily in October and is similar to that of other south Puget Sound fall chinook stocks. Because tagged White River spring chinook have returned to White River hatchery throughout October, it is possible that White River summer/fall chinook may actually be the end of the run of White River spring chinook and not a distinct stock. Genetic data would greatly aid in resolving this question.

Stock origin is unknown but thought to be native.

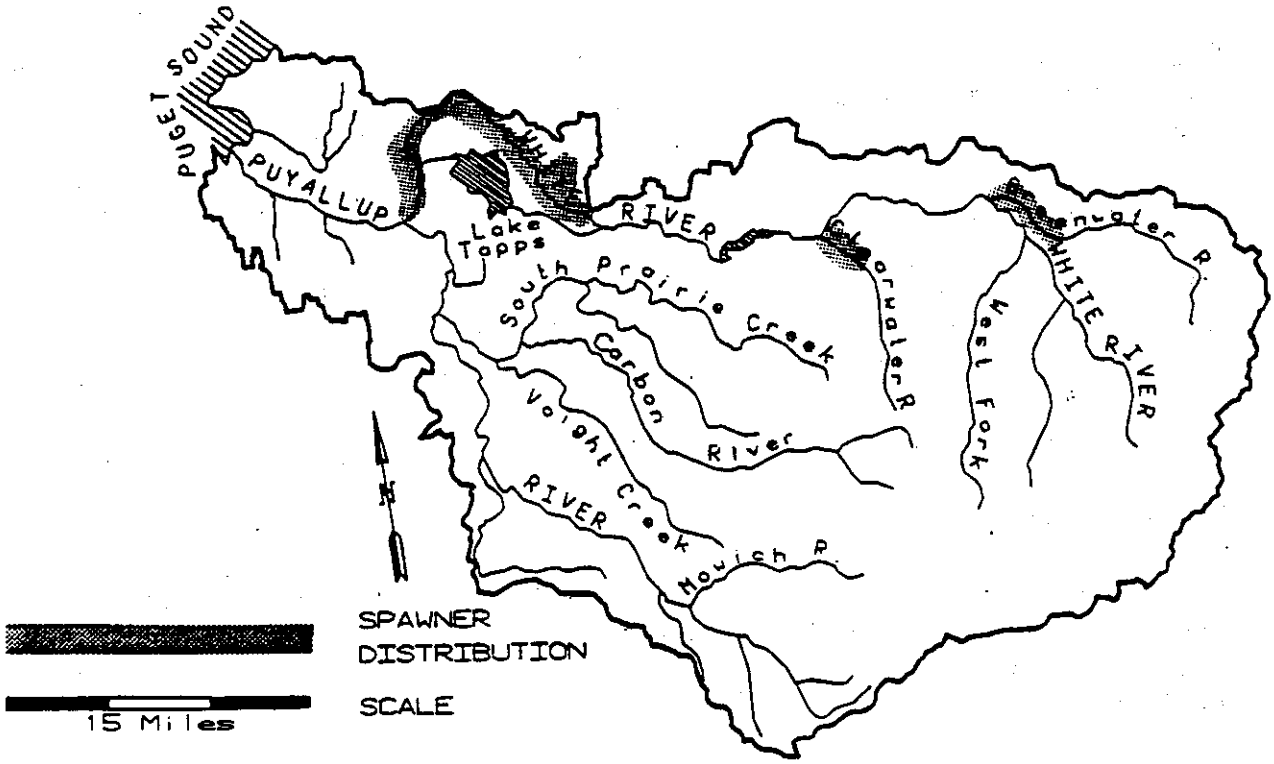
STOCK STATUS

Stock status is Unknown as the mainstem water visibility is poor during spawning season, and some areas of the river are difficult to access. Extensive spawner surveys were started in 1992 throughout the lower White River and associated tributaries.

STOCK DEFINITION PROFILE for White (Puyallup) Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING										▬			**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

GENETICS - No data available.

STOCK STATUS PROFILE for White (Puyallup) Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY——> No Data

Return Years	NO DATA			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Unknown

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

PUYALLUP -- PUYALLUP FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was classified as distinct based upon geographic distribution, but there appears to be significant potential influence from hatchery releases of non-native stocks (especially Green River). Puyallup River chinook may not be classified as a separate stock in the future if genetic composition analysis supports the release information below. Genetic composition has not been analyzed for this drainage, but analysis is currently underway. Most of the spawning population is located in South Prairie Creek. Spawn timing peaks in October and is similar to that of other stocks of fall chinook in Puget Sound.

Stock origin is unknown because of lack of genetic and coded-wire tag information to assess hatchery influence on the natural spawning population. However, because of extensive plants of non-native stocks into this system, it is questionable whether Puyallup River chinook are genetically distinct from other South Sound chinook stocks.

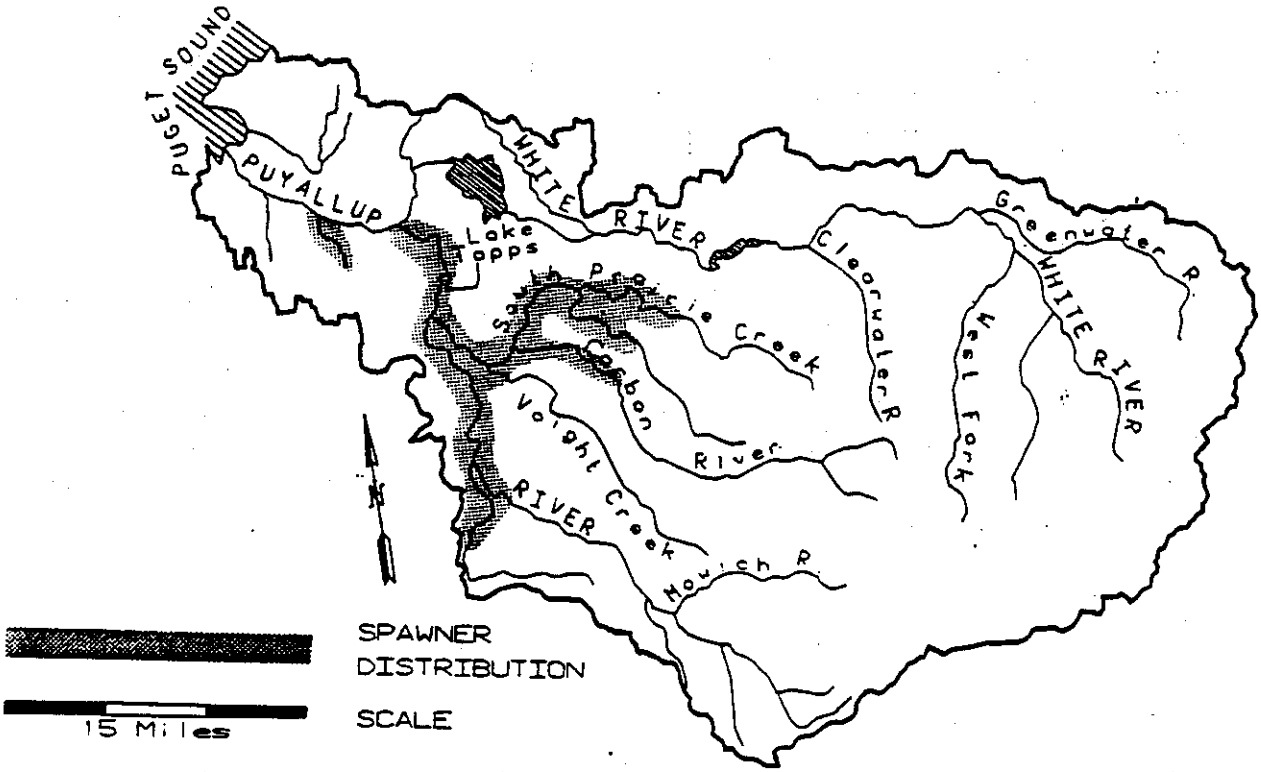
The non-native releases into South Prairie Creek were:

Year	Number	Stock
1973	103,684	Hood Canal
1976	169,692	Deschutes
1976	366,540	University of Washington
1977	611,200	Minter Creek
1979	37,273	Green River
1982	96,958	Green River
1984	69,920	Deschutes
1986	361,800	Green River
1987	284,800	Green River
1988	477,196	Green River

STOCK DEFINITION PROFILE for Puyallup Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY								▬	▬	▬			**UNK**
SPAWNING										▬	▬		**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

GENETICS - No data available.

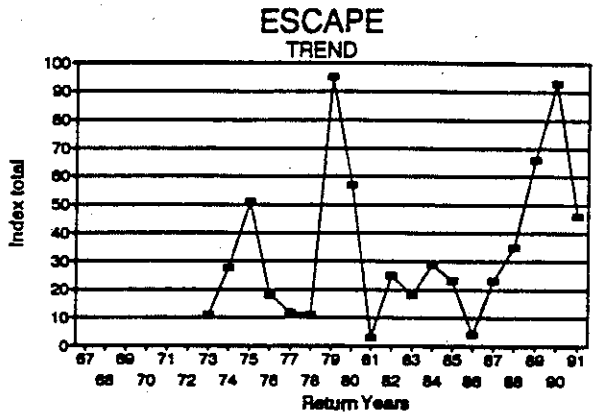
STOCK STATUS PROFILE for Puyallup Fall Chinook

STOCK ASSESSMENT

DATA QUALITY——> Poor

Return Years	ESCAPE Index total			
67				
68				
69				
70				
71				
72				
73	11			
74	28			
75	51			
76	18			
77	12			
78	11			
79	95			
80	57			
81	3			
82	25			
83	18			
84	29			
85	23			
86	4			
87	23			
88	35			
89	66			
90	93			
91	46			

South Prairie Creek index area escapement.



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Unknown

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

The non-native chinook releases into other Puyallup streams were:

Year	Number Released	Stock	Release Site
1979	46,747	Green River	Hylebos Creek
1979	10,964	Green River	Wapato Creek
1987	98,560	Green River	Puyallup River
1979	22,279	Green River	Swan Creek
1982	230,307	Green River	Clarks Creek
1984	301,180	Deschutes	Clarks Creek
1986	190,000	Green River	Clarks Creek
1988	319,175	Green River	Clarks Creek
1982	123,368	Green River	White River
1979	20,884	Green River	Fennel Creek
1979	28,193	Green River	Canyon Falls Creek
1973	104,972	Hood Canal	Carbon River
1986	150,000	Green River	Carbon River
1987	295,400	Green River	Carbon River
1975	500,000	Deschutes	Wilkinson Creek
1977	300,000	Deschutes	Wilkinson Creek
1986	302,500	Green River	Wilkinson Creek
1987	309,500	Green River	Wilkinson Creek
1973	50,232	Hood Canal	Kapowsin Creek
1975	500,000	Deschutes	Kapowsin Creek
1977	300,000	Deschutes	Kapowsin Creek
1979	19,431	Green River	Kapowsin Creek
1982	59,290	Green River	Kapowsin Creek
1984	69,483	Deschutes	Kapowsin Creek
1986	153,500	Green River	Kapowsin Creek
1987	153,000	Green River	Kapowsin Creek
1988	188,848	Green River	Kapowsin Creek
1979	10,000	Green River	Cold Creek
1979	10,000	Green River	Dash Point Creek

Unfed fry releases were not included as their survival was expected to be low.

STOCK STATUS

The stock status of Puyallup fall chinook is Unknown as spawning has only been quantified on a consistent basis in South Prairie Creek. Also, hatchery outplants within the South Prairie Creek index section could alter or mask any overall trends in escapement patterns, making it difficult to justify an expansion of South Prairie Creek data to reflect the system's escapement. Genetic impacts from the hatchery outplants are unknown.

Extensive spawner surveys in other Puyallup basin streams were started in 1991. Based upon limited survey information in other Puyallup streams, it is likely that the spawning distribution within the watershed has been reduced due to habitat problems and poaching.

OVERVIEW -- PUYALLUP FALL CHUM STOCKS

PUYALLUP/CARBON
FENNEL CREEK
HYLEBOS CREEK

STOCK DEFINITION AND ORIGIN

The fall chum stocks in this region enter the terminal area from mid-November through the second week in December. Spawning usually begins in December and continues through most of January.

As a group, these fall chum stocks are isolated from other Puget Sound stocks by geographic distribution. They were separated into three stocks based on differences in spawning distribution and genetic composition. The Puyallup/Carbon chum spawn in the mainstem reaches of the Puyallup, White, and Carbon rivers and South Prairie Creek, while Fennel Creek fall chum spawn in the lower mile of Fennel Creek. Chum have also been observed spawning in Hylebos Creek, but not much is know about this stock. Genetic studies conducted on the Puyallup/Carbon fall chum show them to be a unique stock of fish.

Few hatchery releases have been made into the Puyallup River itself. Most of the hatchery releases have been made into small tributaries of the Puyallup (e.g. Hylebos, Swan, Clarks and Fennel creeks). Genetic studies clearly show that fall chum sampled from the Puyallup and Carbon rivers are a unique stock of fish (i.e. not akin to any hatchery stocks). Accordingly, the Puyallup/Carbon chum were identified as a native stock.

Prior to the introduction of hatchery chum (Hood Canal-origin), the native escapement in Fennel Creek was less than 200. Subsequent to the hatchery plants via an egg box project, escapement levels increased and peaked with over 1,700 in 1987. Preliminary genetic studies show that this stock is similar to Hood Canal stocks. The origin of this stock was identified as a mixture of native and non-native chum.

STOCK STATUS

As a group, these chum contribute to Canadian and U.S. fisheries. In Washington they are caught in commercial fisheries from the Strait of Juan de Fuca to the river fisheries.

Only two years of wild escapement data are available for the Puyallup/Carbon chum so comparisons between escapement and escapement goals are not available.

An aggregate basin-wide escapement estimate for the Puyallup system is calculated using spawning ground indices on Fennel and Canyon Falls creeks, but specific run-size data are not available for the Puyallup/Carbon and Hylebos stocks.

More information on individual stocks is presented in the Stock Reports which follow.

PUYALLUP -- PUYALLUP/CARBON FALL CHUM

STOCK DEFINITION AND ORIGIN

The Puyallup/Carbon fall chum were identified as a stock because they are believed to be geographically isolated from other Puget Sound fall stocks, and they have been identified as a unique stock based on genetic studies. The Puyallup River enters the Puget Sound via Commencement Bay in the city of Tacoma. The location of the Puyallup River itself plus distance of the spawning grounds upstream is thought to provide a geographic separation from other Puget Sound stocks. Recent stream survey data show the presence of spawning chum in the mainstem Puyallup, White and Carbon rivers, South Prairie Creek and tributaries. Genetic studies indicate that these fish are distinct from the non-native stock in the nearby Fennel Creek system. Puyallup/Carbon fall chum are assumed to be a native and wild spawning stock.

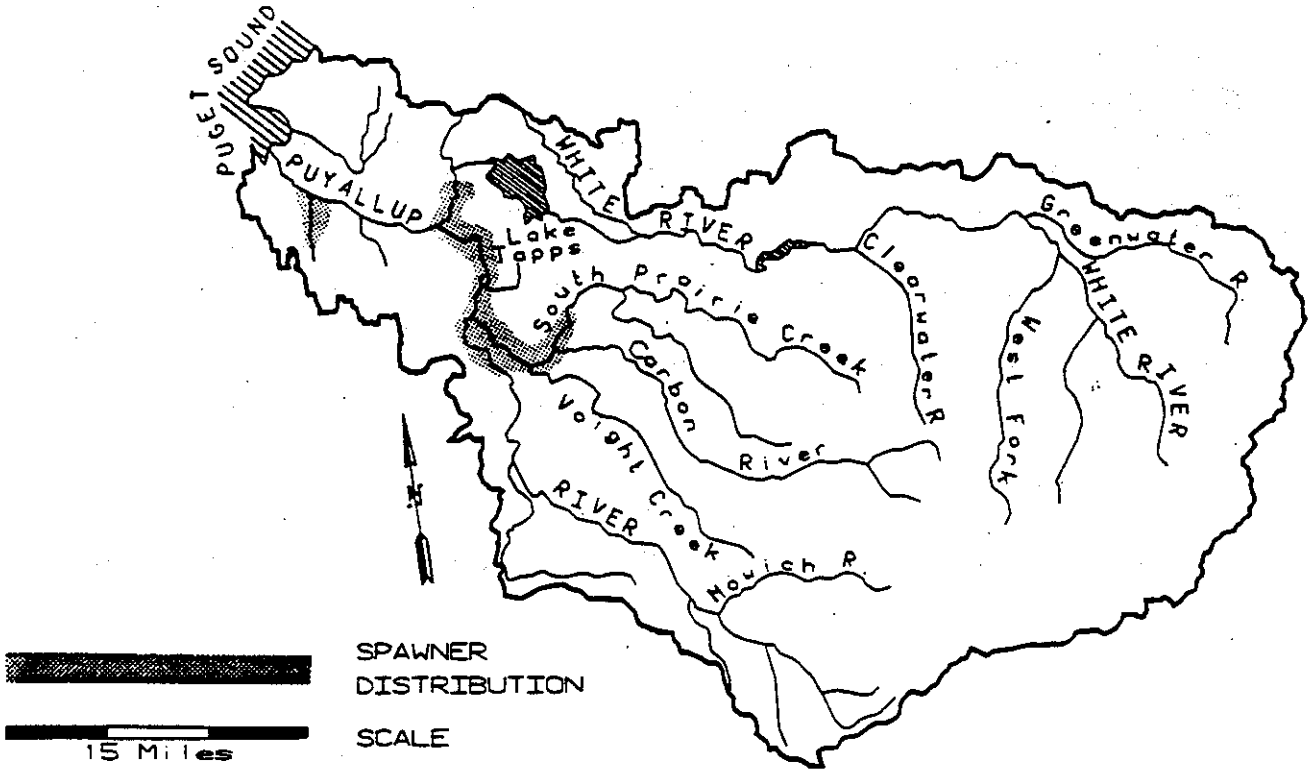
STOCK STATUS

The stock assessment data are very limited (two years), thus the status is Unknown.

STOCK DEFINITION PROFILE for Puyallup/Carbon Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**NO**
RIVER ENTRY	▬											▬	**NO**
SPAWNING	▬											▬	**NO**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Preliminary analysis of a 1991 collection (N=150) from the Carbon River suggests that this stock is a unique stock believed to be native to the Puyallup River.

STOCK STATUS PROFILE for Puyallup/Carbon Fall Chum

STOCK ASSESSMENT

DATA QUALITY——> No Data

Return Years	NO DATA			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Genetics

STOCK STATUS
Unknown

SCREENING CRITERIA

PUYALLUP -- FENNEL CREEK FALL CHUM

STOCK DEFINITION AND ORIGIN

The Fennel Creek fall chum were identified as a stock because they are geographically isolated from other Puget Sound fall stocks. Prior to the introduction of hatchery fish (Hood Canal-origin), the native escapement was less than 200. In 1980 the first returns from a tribal egg box project were seen when an estimated 1,686 chum returned to Fennel Creek. Escapement levels increased and peaked in 1987 with over 1,700 chum. The egg box is no longer in use. Preliminary genetic analysis has shown that the stock is significantly different from the introduced Hood Canal stock, so the origin of the Fennel Creek stock is unknown.

STOCK STATUS

Stock status is Healthy.

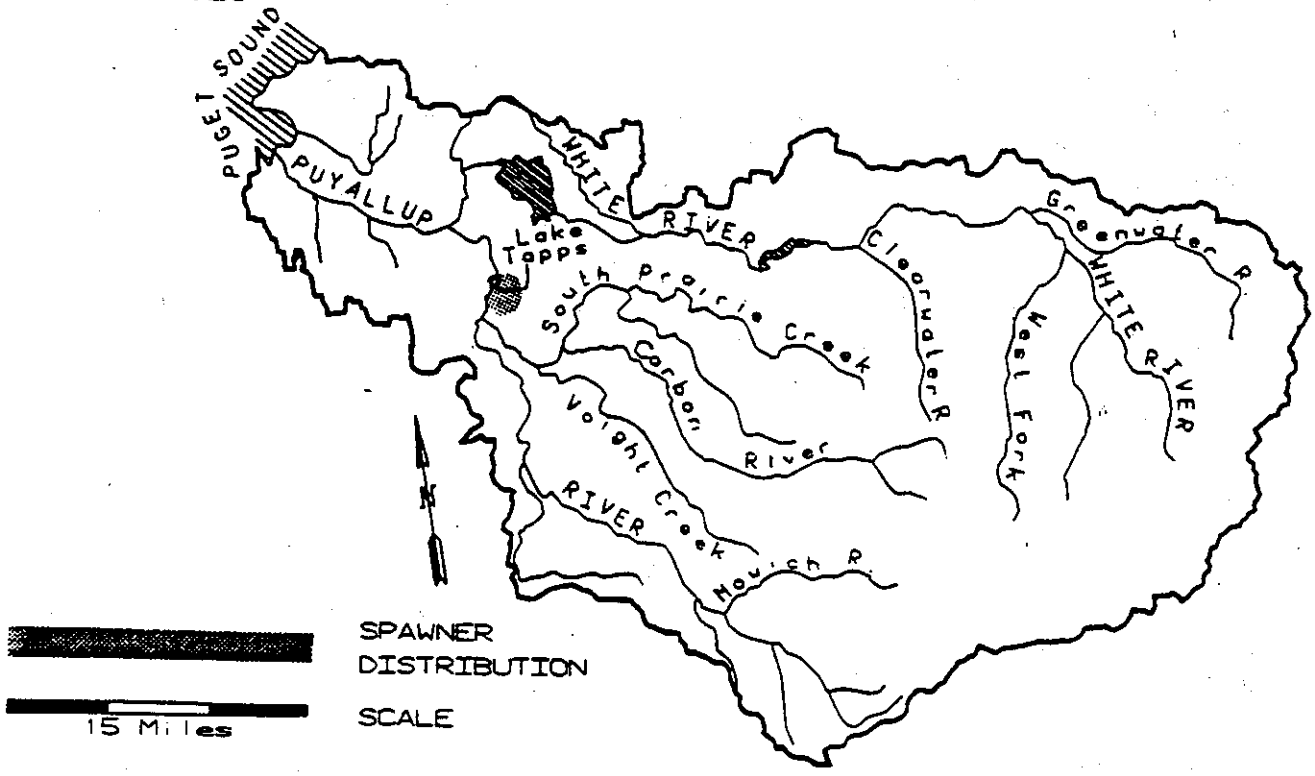
Hatchery stocking information is available starting with the 1976 brood. Spawner escapement data are available back to 1956 and represent the best available stock assessment data. Escapement estimates range from four to 1,700 and show a short-term increase in the mid-1980s and an overall increasing trend.

Although stock status is currently considered Healthy, imminent threats to freshwater habitat in the form of extensive housing and recreational development and stream channel dredging make it imperative that the stock be monitored closely.

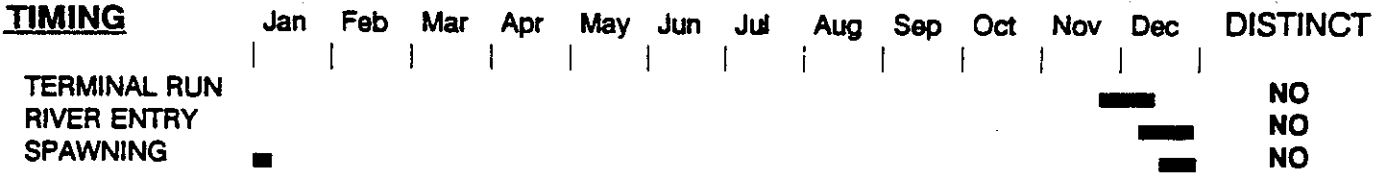
STOCK DEFINITION PROFILE for Fennel Creek Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

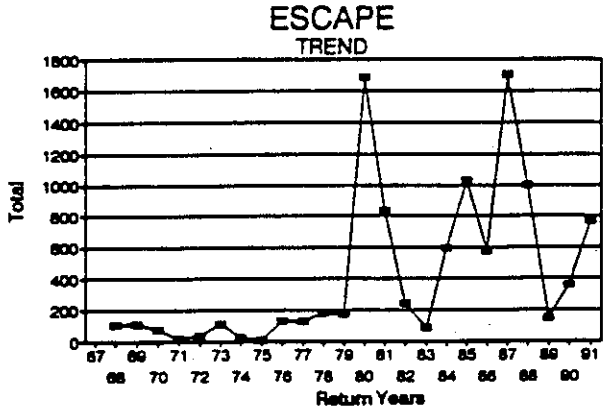
GENETICS - Preliminary analysis of a 1990 + 1991 collection (N=110) from Fennel Creek suggests that this stock is different from the Hood Canal Hatchery strain used in the discontinued egg box program.

STOCK STATUS PROFILE for Fennel Creek Fall Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67				
68	104			
69	109			
70	74			
71	14			
72	38			
73	107			
74	23			
75	4			
76	132			
77	129			
78	181			
79	170			
80	1689			
81	837			
82	238			
83	83			
84	597			
85	1029			
86	573			
87	1703			
88	1002			
89	146			
90	362			
91	769			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Unknown

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Genetics

STOCK STATUS
Healthy

SCREENING CRITERIA

PUYALLUP -- HYLEBOS CREEK FALL CHUM

STOCK DEFINITION AND ORIGIN

The Hylebos Creek chum were identified as a stock because they are geographically isolated from other Puget Sound stocks. Hylebos Creek enters Puget Sound via the Hylebos Waterway in the Port of Tacoma and Commencement Bay. Sporadic spawning surveys over the years indicate the presence of a naturally-spawning population of chum. However, the survey information is not adequate to assess total spawning population, timing, or distribution. Releases of hatchery-reared chum have occurred on an irregular basis in the past, and it is not known what effect this has had on the stock.

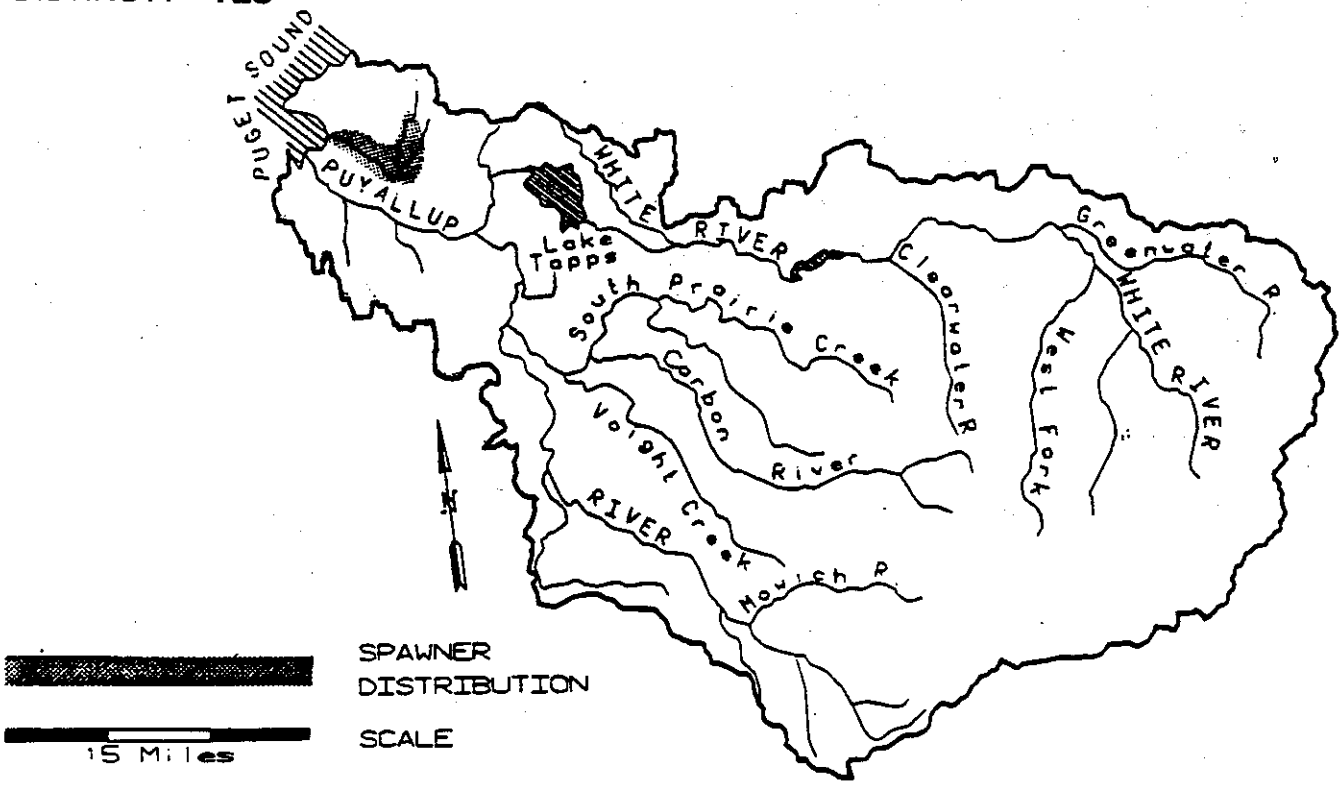
STOCK STATUS

The stock status is Unknown due to a lack of adequate spawning survey data.

STOCK DEFINITION PROFILE for Hylebos Creek Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING													**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

GENETICS - No data available.

STOCK STATUS PROFILE for Hylebos Creek Fall Chum

STOCK ASSESSMENT

DATA QUALITY——> No Data

Brood Years	NO DATA			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Unknown

PRODUCTION TYPE
Unknown

STOCK DISTINCTION
Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

OVERVIEW – PUYALLUP COHO STOCKS

PUYALLUP
WHITE (PUYALLUP)

STOCK DEFINITION AND ORIGIN

The Puyallup River basin includes the Puyallup River drainage and tributaries to Commencement Bay. Coho salmon utilize almost all of the accessible tributaries in this area. Coho returning to these tributaries typically enter freshwater from mid-August to early November and spawn from mid-October through mid-January, with some variation observed between streams and between years within streams.

There have been substantial releases of hatchery-origin coho within this area, with significant yearling releases from the early 1950s to the mid-1980s. Irregular fingerling/fry releases occurred from 1952 to the mid-1970s, with annual releases thereafter. There are also annual on-station yearling releases from the hatchery facility on Voights Creek. It should be noted that many of the early off-station yearling releases were not consistent with current optimal size and time-of-release strategies and their subsequent contribution to the wild spawning population unknown. Straying rates from the on-station releases are also unknown, as are the potential survival differentials related to the various stocks introduced into this area.

Additional to those considerations are questions regarding the spawning success in the wild of hatchery-origin coho and any distinctions between native and introduced stocks, in terms of either temporal or physical spawning distributions. As a result of these uncertainties, the two stocks in this area have been designated as probable mixtures of native and non-native stocks, without any inference as to the relative influence of those stocks within the current populations. There can be no confident quantification of the genetic impact of non-native stock introductions until an effective genetic stock identification tool is developed and implemented for coho salmon.

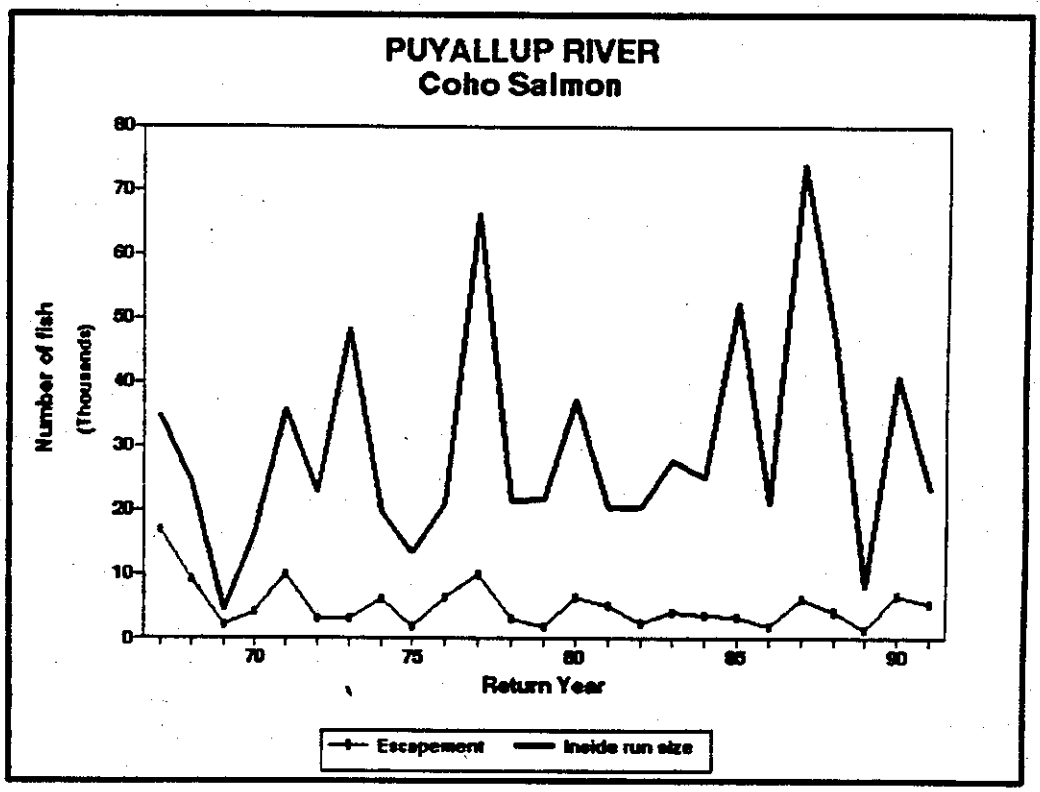
There are no significant differences in timing or any unique biological characteristics documented for either of the stocks in this basin. Their distinction is therefore dependent upon a determination of geographic spawning separation, the result of subjective judgements regarding the probability of significant spawner interchange between drainages. Differences in off-station release histories are assumed to result in dissimilar stock impacts, so any differences would provide additional support for stock distinction. Until a genetic determinant is available and used to evaluate these stocks, these designations are tentative.

STOCK STATUS

Coho of Puyallup River basin origin are primarily harvested in Washington and Canadian troll, net and sport fisheries. There are directed terminal area fisheries on these stocks to harvest surplus hatchery returns. The total natural escapement goal for Puyallup River stocks is 11,000. The run reconstruction database shows

escapement exceeding that goal only twice in 27 years and run size estimates (the number of fish in escapement and Puget Sound net catches) over that same period, from 1965 to present, fluctuating over a broad range. Puyallup stock performance evaluation is dependent upon a relatively short stock assessment database (dating back to 1983) which provides no indication of present production's relationship with historic levels. The Puyallup coho stock has demonstrated a short-term severe decline in its escapement indices, indicating cause for concern. The White River stock production trend is represented by counts of adults passed above Mud Mountain Dam (dating back to 1940) which indicate that this stock is Healthy.

The figure below, which illustrates natural coho production trends in this basin, is derived from the run reconstruction database. Please note that some of the run size estimated for the last ten to 15 years may be attributable to misallocation of hatchery-origin production to the natural stock. The magnitude of this possible error has not been estimated at this time. The escapement goal is not plotted on this graph since the primary management objective in this basin is to minimize surplus hatchery returns through harvest rates which generally preclude accomplishing that goal.



More information on individual stocks is presented in the Stock Reports which follow.

PUYALLUP – PUYALLUP COHO

STOCK DEFINITION AND ORIGIN

This stock was identified as a distinct stock based on its spawning distribution. These fish do not exhibit a distinct temporal distribution (most spawning occurring from mid-October through December, similar to hatchery stock timing) or any documented unique biological characteristics. We believe there is no significant straying from surrounding drainages into this system.

Puyallup hatchery on-station yearling releases of local-origin coho have been consistent over time, with introductions into Voights Creek of Green River stock in 1965, 1969 and 1973, George Adams stock in 1970 and 1976, Minter Creek stock in 1973 and 1975, and Washougal stock in 1974, as well. Off-station releases have been lacking in this system in only four years since 1952. Hatchery yearling releases were made within this system from at least 1952 through the early 1970s, with a few yearling releases in the late 1970s and early 1980s. Puyallup stock was predominant, however there were some off-station releases of Green River- (1952, 1954, 1957, 1959, 1965, 1969, and 1973), and Skagit-origin yearlings (1962). Off-station fingerling releases prior to 1974 utilized Puyallup and Green River fish almost equally, with one year's release each during that period for Minter, George Adams (Hood Canal), Skagit and Samish stocks. In the late 1970s a comprehensive off-station fry/ fingerling release program was begun that continues at this time. Puyallup stock was primarily used, but there are records of occasional releases of Minter Creek- and Green River-origin fingerlings and fry. This stock is likely a mixture of the native and introduced non-native stocks.

STOCK STATUS

The status of this stock is Depressed.

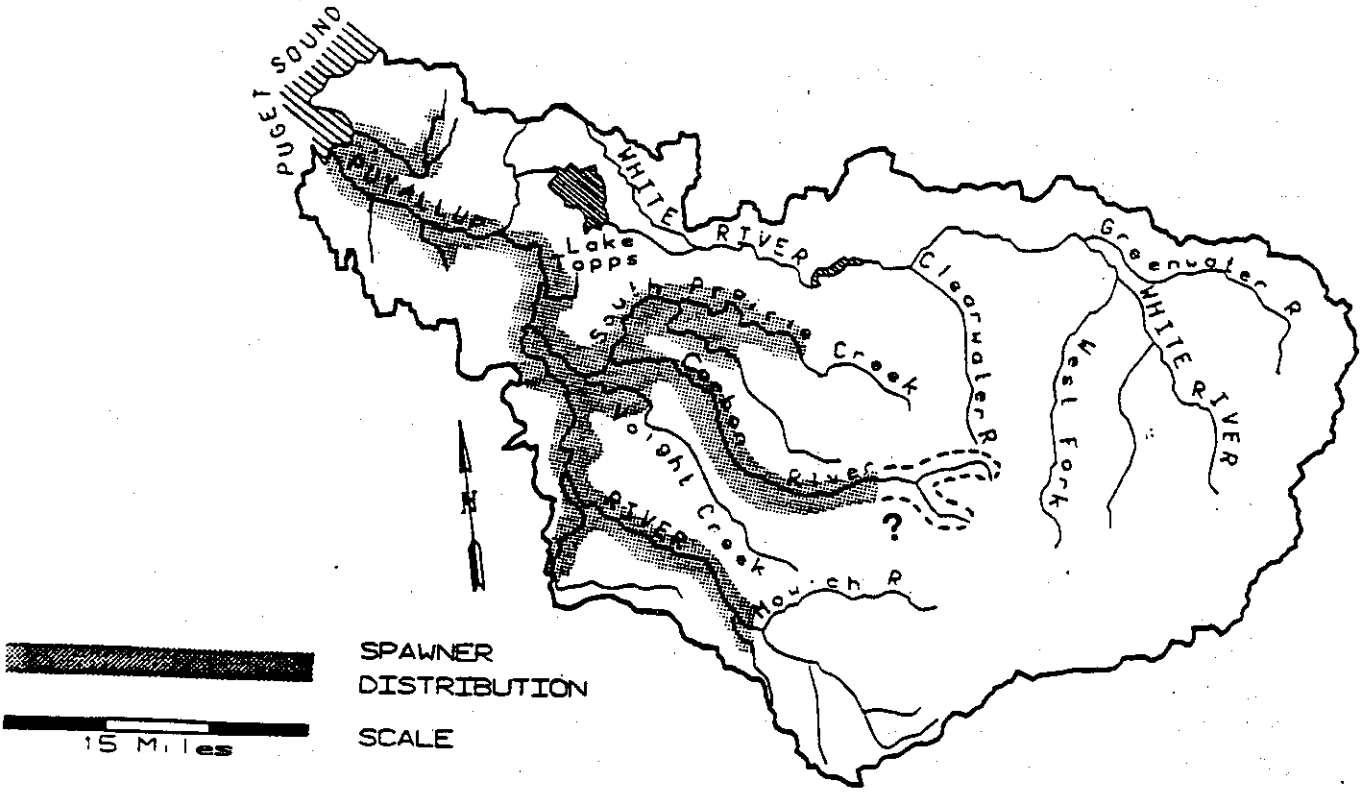
The spawning index count data shown in the Stock Status Profile are the current best indicator of the escapement trend for this stock.

Escapement index data show 1988 and 1989 returns to be the lowest in the database. Additionally, seven of the last eight years' index counts have been less than the remaining three years (1983, 1984 and 1987) in the database. Therefore, an argument for a chronically depressed stock may be justifiable, as well as that for short-term severe decline. The fitness of the native stock may have been affected by non-native stock introductions, but specific changes have not been documented at this time.

STOCK DEFINITION PROFILE for Puyallup Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY								▬	▬	▬			**UNK**
SPAWNING	▬							▬	▬	▬			**UNK**
										▬	▬	▬	**NO**

BIOLOGICAL CHARACTERISTICS

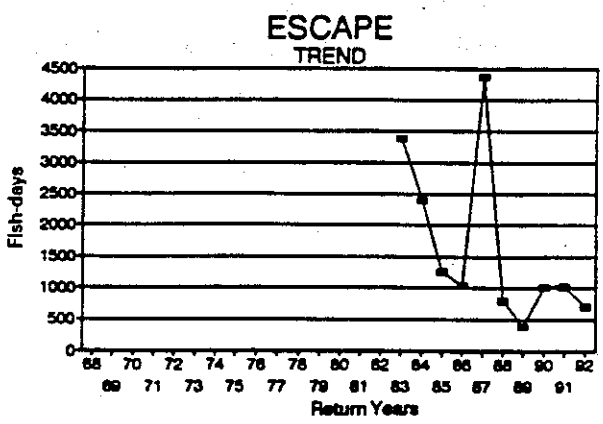
DISTINCT? - **NO**

STOCK STATUS PROFILE for Puyallup Coho

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Fish-days			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83	3393			
84	2394			
85	1269			
86	1037			
87	4381			
88	790			
89	391			
90	1011			
91	1020			
92	702			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Depressed

SCREENING CRITERIA
Short-Term Severe Decline

FACTORS AFFECTING PRODUCTION

Habitat -- Primary tributaries utilized by this stock include the lower ends of Canyon Falls and Fennel creeks, Voights, South Prairie and Wilkinson creeks, and Kapowsin Creek. Independent Commencement Bay tributaries utilized include Hylebos and Wapato creeks. All the tributaries are affected by urban, agricultural, and logging activities which affect summer low flows, riparian canopy (cover and temperature control), winter peak flows (logging and stormwater) and stream sedimentation. Hylebos and Wapato creeks are particularly affected by urban and industrial activities. Overwinter habitats have been lost due to diking.

Diking in the lower Puyallup River has actually reduced river capacity and led to a need for additional bank protection and constant gravel removal in attempts to prevent erosion. These activities usually further reduce channel stability and the quality of fish habitat.

Lower estuarine and freshwater wetlands have been virtually destroyed by the industrial development of the Port of Tacoma. There have been modest attempts to restore this habitat in recent years.

Harvest Management -- Puyallup River coho are primarily harvested in Canadian troll, net and sport fisheries and in Washington net and sport fisheries. From 1988 to 1990, 40 percent of the harvest occurred in Canadian fisheries and 60 percent in Washington fisheries. In the preterminal areas, the harvest rates on Puyallup River coho are determined by the needs for other stocks of coho or by other species. In the Seattle area (Area 10), Tacoma area (Area 11), Commencement Bay (Area 11A) and the Puyallup River, the harvest rate for Puyallup River coho is set to take the full hatchery surplus.

The total harvest rate on Puyallup River coho from 1988 through 1990 was approximately 89 percent (landed catch only), although uncertainties in estimating escapement make this harvest rate estimate less precise than for most other Puget Sound stocks.

Hatchery -- WDFW and the Puyallup Tribe operate hatcheries on the Puyallup River, raising coho, chinook, and steelhead.

LAST TEN YEARS SALMON RELEASES INTO THE PUYALLUP - WHITE BASIN

REL. YEAR	SPRING CHINOOK	FALL CHINOOK	CHUM	COHO	PINK
1982	0	4,381,242	280,000	3,508,160	200,000
1983	0	3,190,061	20,700	3,496,997	0
1984	0	3,142,232	234,188	2,832,745	0
1985	0	1,837,283	526,050	4,146,575	0
1986	0	2,937,210	431,519	2,511,364	0
1987	5,296	3,742,895	52,744	1,753,988	0
1988	0	4,007,335	347,290	2,195,694	0
1989	0	2,448,079	362,167	2,202,366	0
1990	269,394	3,847,982	39,284	1,907,098	118,000
1991	169,842	3,281,841	298,956	1,989,521	0
MEAN	204,791	3,281,616	262,079	2,654,574	159,000

PUYALLUP -- WHITE (PUYALLUP) COHO

STOCK DESCRIPTION AND ORIGIN

This stock was identified on the basis of distinct geographic spawning distribution. These fish do not exhibit any documented unique biological characteristics and their temporal distribution is not distinct. Spawning timing is not available, but passage above Mud Mountain Dam peaks in September and trails off in early November.

Off-station yearling releases were fairly consistent from 1952 to the mid-1980s, with predominantly Green River stock being utilized (1952, 1953, 1956 through 1959, 1962, 1964, 1970 through 1973, 1975 and 1977) as well as Puyallup in 1952 through 1954, 1966 and 1981, Issaquah in 1955, and Skykomish in 1976, 1983 and 1984. There were sporadic off-station fingerling or fry releases in this system from 1955 to the mid-1970s, once again, primarily Green River fish (five years) along with two releases of Puyallup and one each of Minter and Issaquah stocks. There has been a comprehensive fingerling planting program in this system since 1976, which has utilized Puyallup hatchery-origin fish as much as possible (there have been limited releases of Green River fish and one year of Minter stock releases). This stock is probably a mixture of the native and various introduced non-native stocks.

STOCK STATUS

The status of the stock is Healthy.

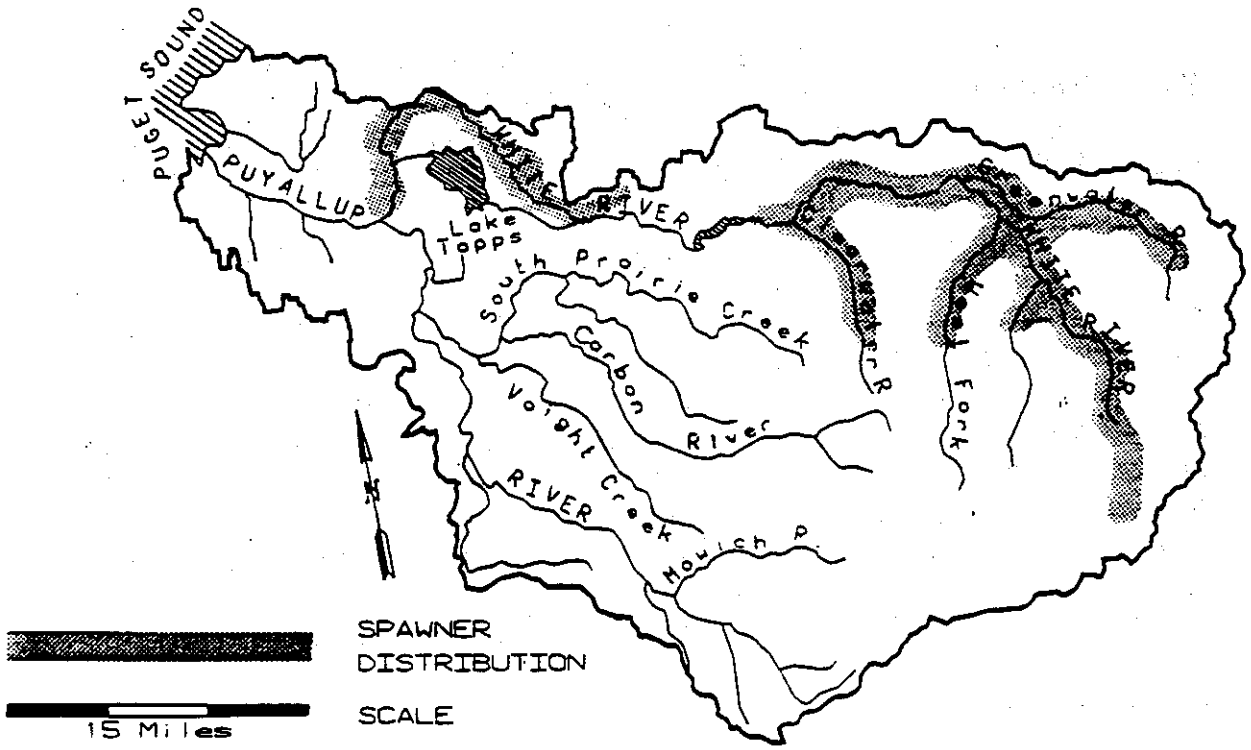
White River coho production is included in Puyallup River run reconstruction data, and there is no appropriate means of breaking those data down into sub-basin components. There are no spawning index areas in this drainage, so relative escapement index data are lacking as well. There are Mud Mountain Dam passage counts that date back to 1940. The potential weakness with this dataset is the question of whether the upper system escapements adequately represent escapements in tributaries below the trap. At the present time, these are the only data directly related to this stock, and we assume that they do reflect the general production trend associated with the entire stock.

Recent passage counts for this stock have shown an increasing trend, indicating stable to increasing production for this stock. The fitness of the native stock may have been affected by non-native stock introductions, but specific changes have not been documented at this time.

STOCK DEFINITION PROFILE for White (Puyallup) Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬	▬			**UNK**
RIVER ENTRY									▬	▬	▬		**NO**
SPAWNING													**UNK**

BIOLOGICAL CHARACTERISTICS

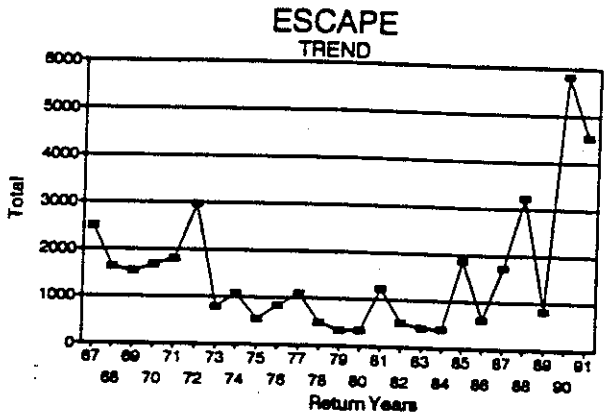
DISTINCT? - **UNKNOWN**

STOCK STATUS PROFILE for White (Puyallup) Coho

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67	2506			
68	1639			
69	1537			
70	1688			
71	1818			
72	2972			
73	796			
74	1081			
75	546			
76	833			
77	1090			
78	493			
79	320			
80	335			
81	1237			
82	519			
83	409			
84	403			
85	1872			
86	616			
87	1746			
88	3231			
89	820			
90	5840			
91	4548			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- PUYALLUP PINK STOCK

PUYALLUP

STOCK DEFINITION AND ORIGIN

Puyallup pink salmon are isolated from other pink stocks by geographic separation of the spawning grounds. Additionally, genetic studies have shown that the Puyallup pink stock is distinct from other Washington pink stocks. Puyallup pink salmon first enter the terminal area in August. Spawning begins about the first week in September and may continue through October.

Puyallup pinks spawn in the mainstem Puyallup and Carbon rivers and some of the larger tributaries, but the majority of the production comes from South Prairie Creek located 24 river miles upstream from Commencement Bay.

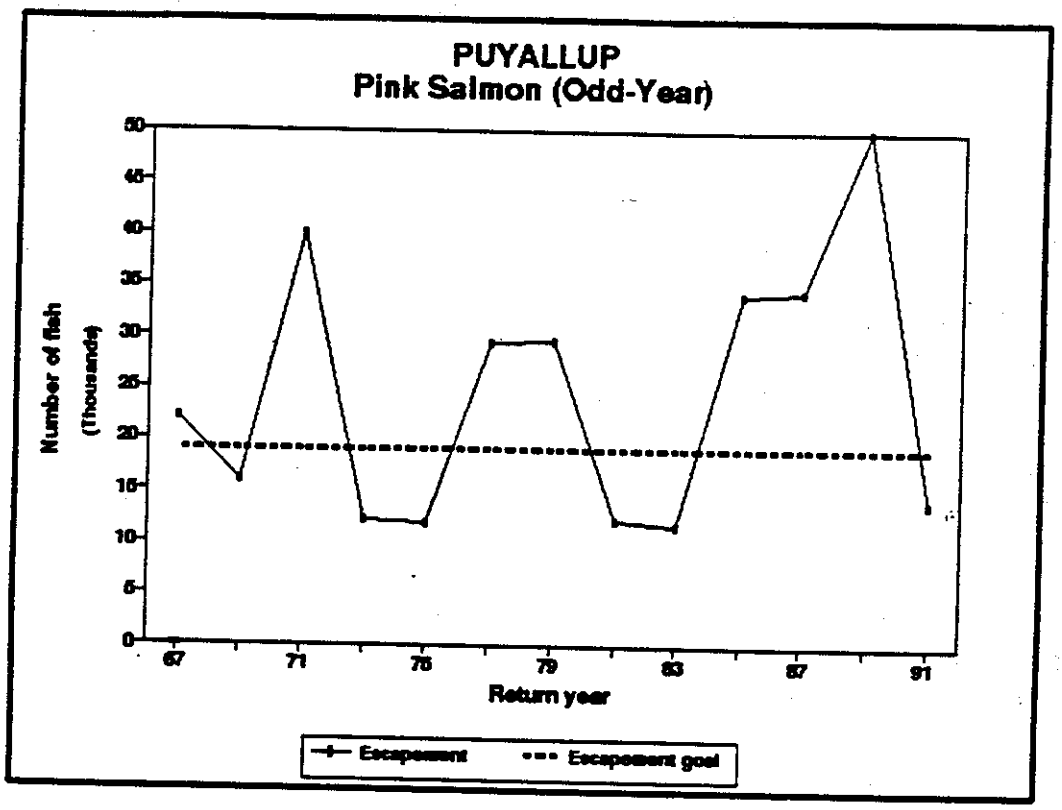
A single hatchery release was made in the Puyallup River (1929) system, but it is unlikely that these fish affected the genetics of the native stock. Because this stock was shown to be unique through genetic studies, it was classified as a native stock.

STOCK STATUS

Puyallup pink salmon contribute to the commercial fishery in Puget Sound. They are harvested in the Strait of Juan de Fuca, in north Puget Sound fisheries and in the Puyallup River.

Puyallup pink salmon escapement levels have exceeded the escapement goal of 19,000 seven out of the last 13 return years. Escapement levels have been healthy during this time.

Escapement data are shown in the figure below. They provide a good representation of the number of spawners in the area.



More information on this stock is presented in the Stock Report which follows.

PUYALLUP -- PUYALLUP PINK

STOCK DEFINITION AND ORIGIN

Puyallup River pink salmon spawn in the mainstem and some of the larger tributaries including Fennel, Voights, and Kapowsin creeks as well as the Carbon River. The majority of the production, however, comes from South Prairie Creek. Spawning in South Prairie Creek takes place from about 1.0 mile upstream from the mouth (near the confluence with the Carbon River), upstream approximately 13.0 miles. Pink salmon begin entering the stream in early August and continue through mid-October, with spawning occurring from early September through October.

Early hatchery records indicate that a release of about a half million pink salmon fry (Alaska stock), was made into the Puyallup system in 1929. There is no reason, based on genetic stock identification work, to indicate that this release produced in any significant way, and it is most likely that the current stock is native to the system. Puyallup River pink salmon are genetically distinct from other Puget Sound pink stocks.

STOCK STATUS

The status of the Puyallup pink stock is Healthy.

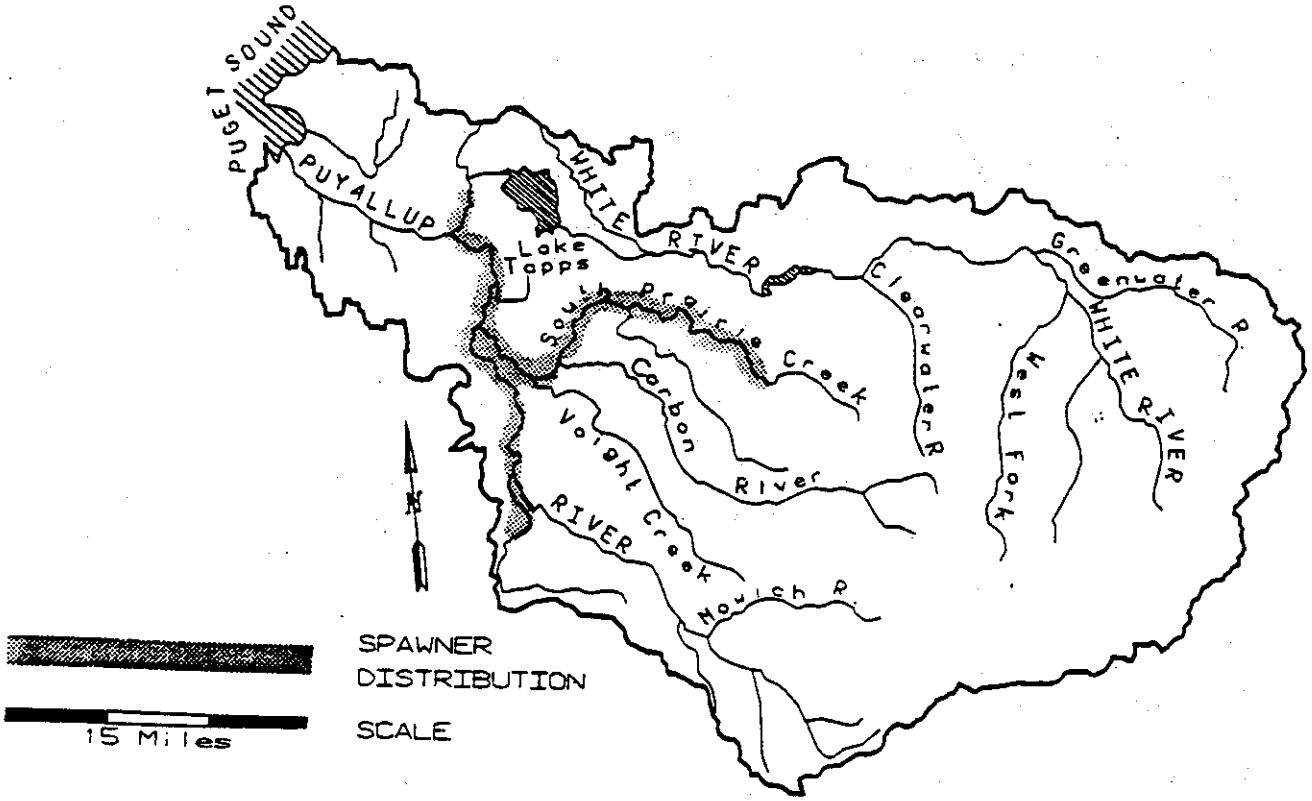
Survey data are felt to be quite good as stream flow conditions are generally very good, and the area surveyed is virtually the entire accessible spawning area (South Prairie Creek).

Estimates of pink salmon returning to the Puyallup River system from 1959 through 1989 have ranged from 10,000 to 49,000, with the record of 49,000 occurring in 1989. Historically, escapements have fluctuated between 10,000 and 35,000, but there seems to be a gradually increasing trend over the last few cycles.

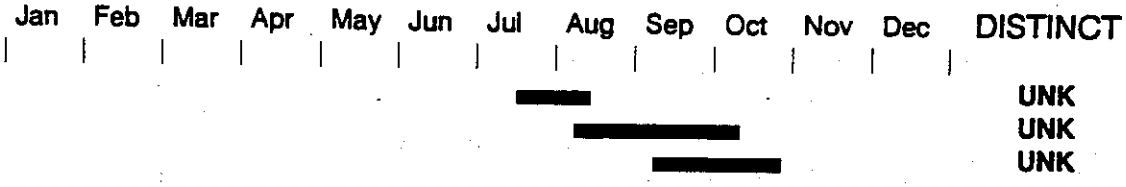
STOCK DEFINITION PROFILE for Puyallup Pink

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



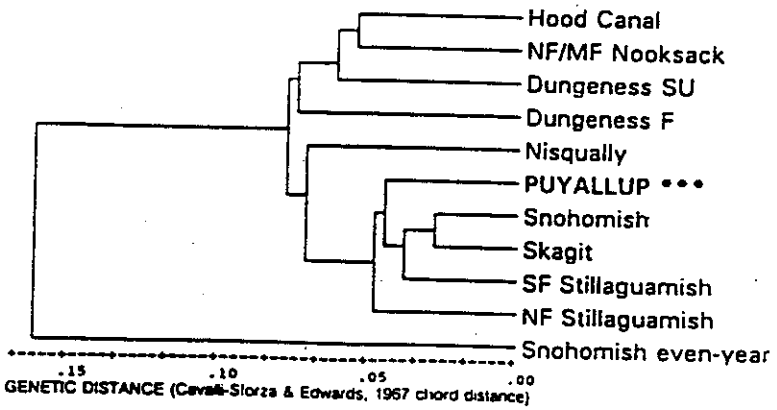
TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Stock is significantly different from all other Washington stocks tested [two collections from South Prairie Creek (N=200); 28-locus G-tests: **p**<0.001].



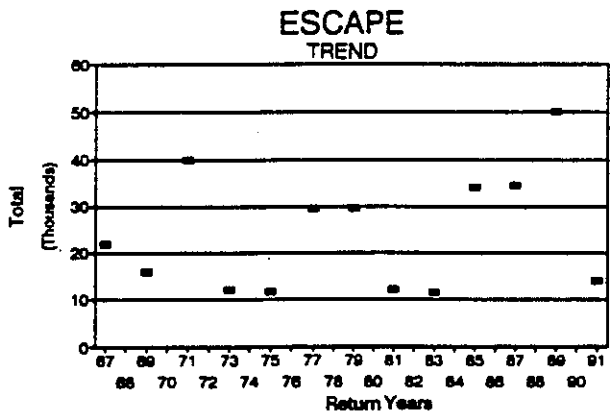
STOCK STATUS PROFILE for Puyallup Pink

STOCK ASSESSMENT

DATA QUALITY——> NOT AVAILABLE

Return Years	ESCAPE Total			
67	22038			
68				
69	16003			
70				
71	40000			
72				
73	12194			
74				
75	11800			
76				
77	29429			
78				
79	29481			
80				
81	12115			
82				
83	11600			
84				
85	34100			
86				
87	34400			
88				
89	50023			
90				
91	14020			

Odd-year returns only.



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN

Native

PRODUCTION TYPE

Wild

STOCK DISTINCTION

Distribution, Genetics

STOCK STATUS

Healthy

SCREENING CRITERIA

OVERVIEW -- PUYALLUP SUMMER AND WINTER STEELHEAD STOCKS

WINTER:
MAINSTEM PUYALLUP
WHITE (PUYALLUP)
CARBON

STOCK DEFINITION AND ORIGIN

In the Puyallup River system, no summer steelhead stocks and three winter steelhead stocks have been identified. Wild winter steelhead in the mainstem Puyallup, White River, and Carbon River are distinct stocks. Wild winter steelhead in each stock are native.

There is little or no information available to indicate that these are genetically distinct stocks. The stocks are treated separately due to the geographical isolation of the spawning populations. There may be more or fewer stocks identified once comprehensive genetic, life history, and ecological information is available.

While about 135,000 to 200,000 hatchery winter steelhead smolts are stocked in the Puyallup River system annually, there is little contribution to the wild stock from hatchery fish spawning in the wild. Given the high exploitation of the hatchery fish in tribal and sport fisheries and the difference in spawn timing between the hatchery fish (January and February) and the wild fish (mid-February through May), the potential for interbreeding is limited.

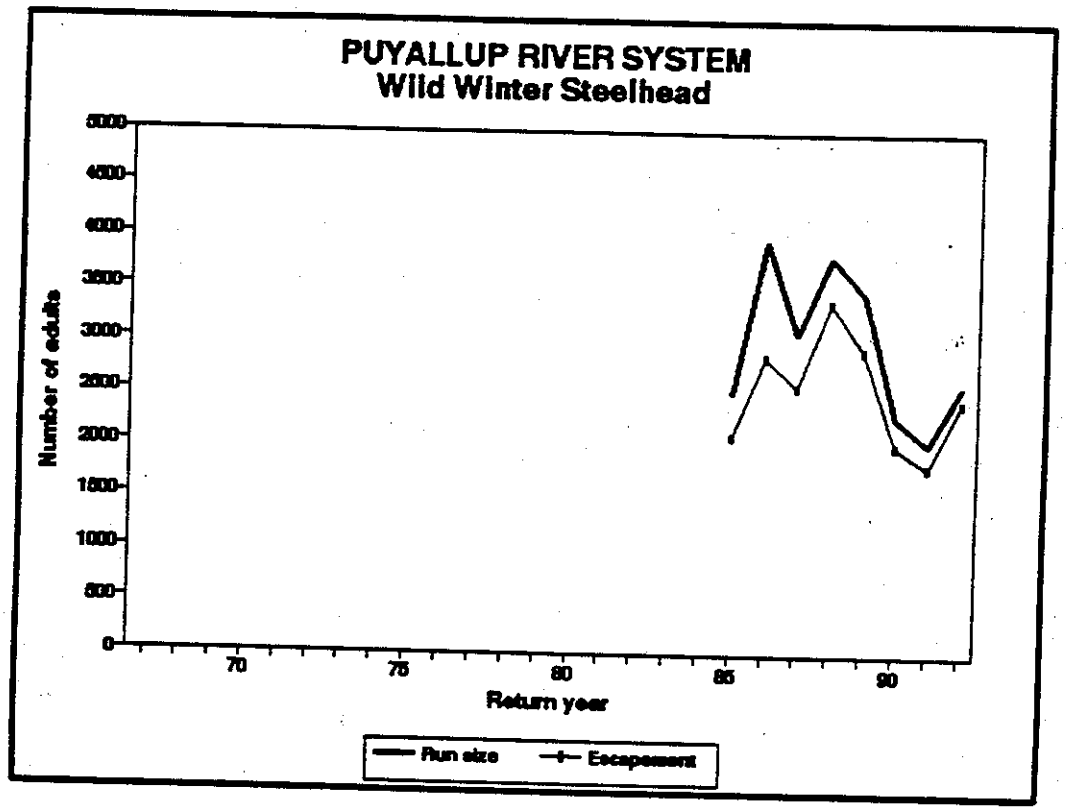
No hatchery summer steelhead smolts are stocked in the Puyallup River system. Hatchery summer steelhead that stray from other systems are observed in small numbers in the Buckley trap on the White River.

STOCK STATUS

Total wild winter steelhead spawning escapement and run size estimates are available for the Puyallup River system since the 1984-85 season. Spawner survey data for the system exists back to the 1973 and harvest information is available back to the 1978-79 season. Wild spawner escapement has ranged from 1,796 to 3,357 fish and wild run size has ranged from 2,024 to 3,960 fish (see figure). The tribes and the Washington Department of Fish and Wildlife are currently developing a spawner escapement goal for the Puyallup River system.

The wild winter steelhead run in the Puyallup River system is fished upon by the Puyallup Tribe in the lower mainstem Puyallup. The Muckleshoot Tribe formerly fished the mainstem Puyallup River and White River but currently fishes the White

River on the reservation. Sport anglers fish in the mainstems of the Puyallup and Carbon rivers. The targeted tribal fishery occurs primarily from December through February while the sport fishery occurs from November through March.



During the 1984-85 through 1991-92 return years, the wild winter steelhead run in the Puyallup River system was comprised of 7.1 percent sport harvest, 8.5 percent tribal harvest, and 84.5 percent spawner escapement (see table). The numbers in the table are subject to revision after state and tribal review.

Puyallup River system wild winter steelhead sport harvest, tribal harvest, spawner escapement, and run size from 1978-79 through 1991-92.

Return year	Sport harvest	Tribal harvest	Spawner escapement	Run size
1978-79	555	32	1/	1/
1979-80	640	62	1/	1/
1980-81	326	195	1/	1/
1981-82	607	395	1/	1/
1982-83	613	479	1/	1/
1983-84	162	336	1/	1/
1984-85	245	177	2,082	2,504
1985-86	297	819	2,844	3,960
1986-87	242	253	2,564	3,059
1987-88	151	299	3,357	3,807
1988-89	290	249	2,909	3,448
1989-90	193	76	2,010	2,279
1990-91	147	81	1,796	2,024
1991-92	110	47	2,416	2,573
Mean run size distribution, 1984-85 to 1991-92.				
	209	250	2,497	2,956
	7.1%	8.5%	84.5%	

1/ Spawner escapement and run size to be calculated by state and tribal biologists at a later date. Numbers in table subject to revision.

More information on each stock is presented in separate Stock Reports.

PUYALLUP -- MAINSTEM PUYALLUP WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in the mainstem Puyallup River and tributaries are native and a distinct stock based on the geographic isolation of the spawning population. Run timing is generally from December through May and spawn timing is generally from early March to mid-June for wild winter steelhead in this stock.

Little is known about the genetic composition of the stock.

Hatchery-origin steelhead (from Chambers Creek and Quinault stocks) have been introduced annually as smolt plants from various hatcheries. Interbreeding between hatchery and wild steelhead is limited, however, and the wild stock has remained essentially isolated because of its later time of spawning and the high exploitation rate on hatchery adults.

STOCK STATUS

The status of the stock is Healthy.

Stock status is based on wild steelhead spawner escapements in index areas in tributaries. Complete spawner surveys are not possible on the mainstem in all years because of the glacial origin of the Puyallup River, but only a small proportion of the total escapement occurs in the mainstem compared to other systems of similar size. Adult escapements in surveyed tributaries have met or exceeded estimated maximum sustainable harvest production potential in each of the past eight years.

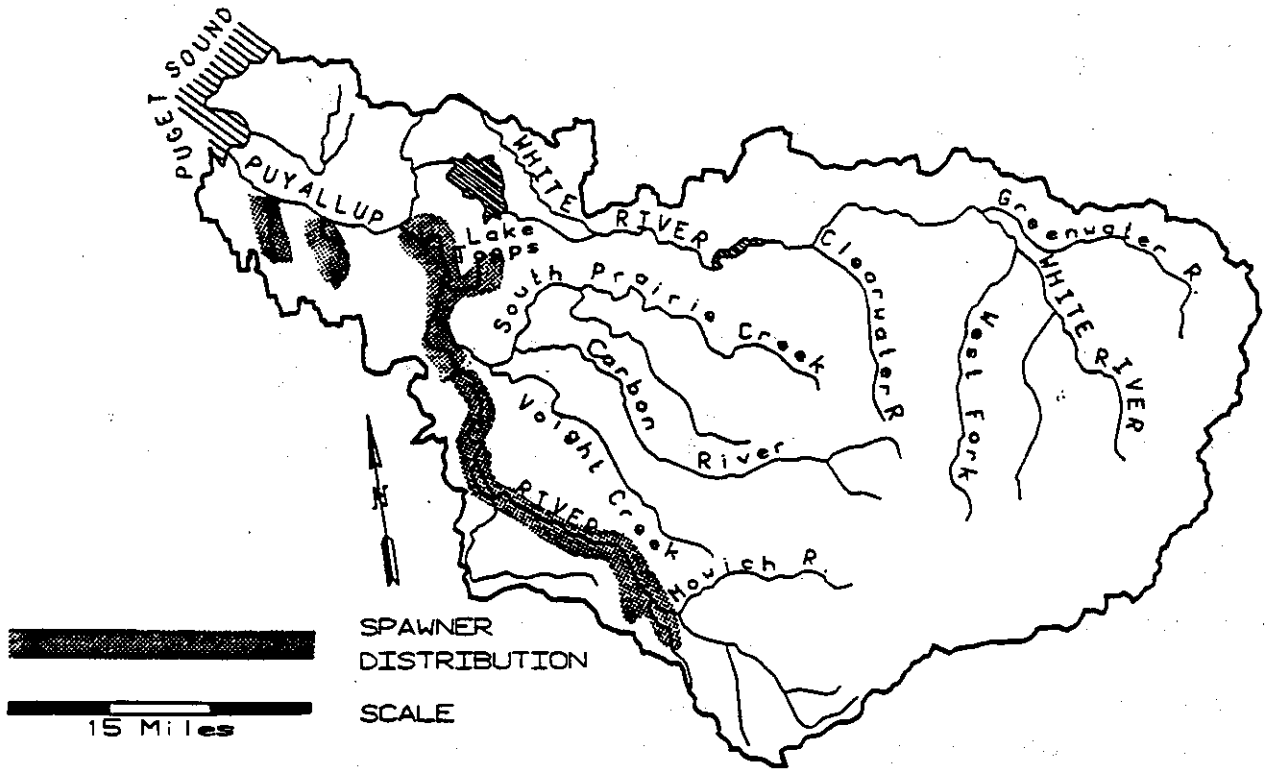
This stock is likely experiencing the same short-term decline in ocean survival as other steelhead stocks coastwide.

In the past, regulations generally precluded the harvest of wild fish after February 1. Current sport and tribal fishing regulations are believed to provide adequate protection for Puyallup system wild stocks, including mainstem Puyallup River winter steelhead.

STOCK DEFINITION PROFILE for Mainstem Puyallup Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - YES



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	▬	▬	▬	▬	▬							▬	NO
SPAWNING			▬	▬	▬								NO

BIOLOGICAL CHARACTERISTICS

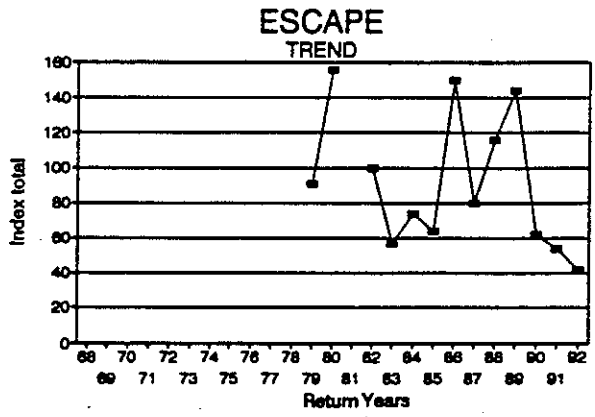
DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for Mainstem Puyallup Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY-----> Fair

Return Years	ESCAPE Index total			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79	91			
80	156			
81				
82	100			
83	57			
84	74			
85	64			
86	150			
87	80			
88	116			
89	144			
90	62			
91	54			
92	42			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

PUYALLUP – WHITE (PUYALLUP) WINTER STEELHEAD

STOCK DEFINITION AND STATUS

Wild winter steelhead in the White River, Clearwater River, Greenwater River, and tributaries are native and a distinct stock based on the geographic isolation of the spawning population. Run timing is generally from December through May and spawn timing is generally from early March to mid-June for wild winter steelhead in this stock.

STOCK STATUS

The status of the stock is Healthy.

The stock status is based on wild steelhead spawner escapements in index areas in tributaries. Complete spawner surveys are not possible on the mainstem in all years because of the glacial origin of the White River, but only a small proportion of total escapement occurs in the mainstem compared to other systems of similar size. Adult escapement has ranged from 130 to 448 wild steelhead in Greenwater River index areas and ranged from 140 to 444 wild steelhead in Clearwater River index areas and has met or exceeded estimated maximum sustainable harvest production potential for those index areas in most years.

Counts of adult steelhead are available at the Corps of Engineers trap at Buckley. Since restrictive harvest regulations were implemented in 1984, escapements past Buckley have increased from a five-year average of 274 fish/year (1979 to 1983) to an average of 935 fish/year (1988 to 1992), despite a coast-wide downward trend in ocean survival rates since 1985.

FACTORS AFFECTING PRODUCTION

Although the stock is Healthy, there are factors which are affecting production.

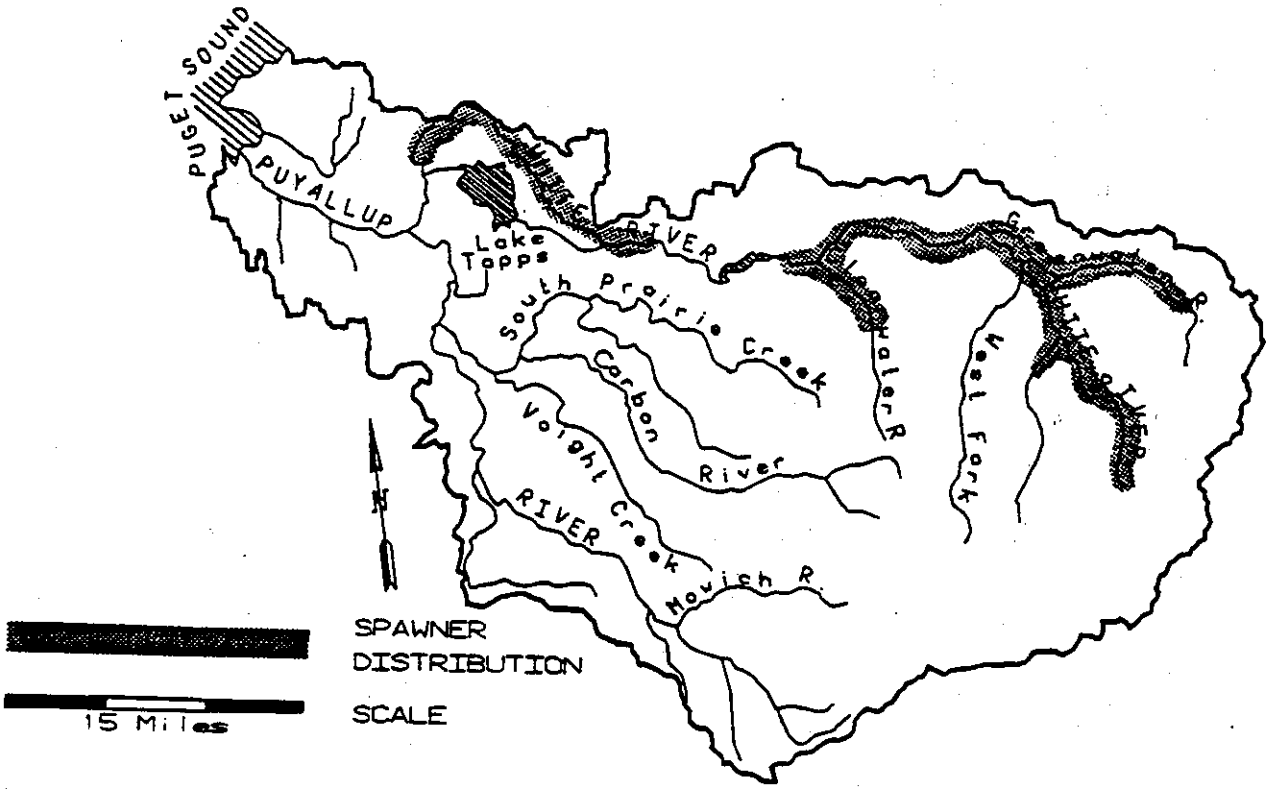
Habitat -- Chronic losses of downstream migrants at the Puget Power diversion near Buckley are thought to be significant, particularly in those years when smolts are migrating at a time when a large percentage of the White River flow is being diverted into Lake Tapps. The installation of effective screens on this diversion could significantly increase adult returns and escapements. Impacts from the Puget Power diversion also include the reduction of flow in the 20-mile bypass reach.

The glacial character of the mainstem and West Fork White River may limit this stock's spawning potential. High gradient and velocity, lack of suitable gravel, and unstable channels are typical in these glacial rivers. The degree to which juvenile steelhead use the glacial mainstem for rearing is unknown.

STOCK DEFINITION PROFILE for White (Puyallup) Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	■	■	■	■	■							■	NO
SPAWNING			■	■	■	■							NO

BIOLOGICAL CHARACTERISTICS

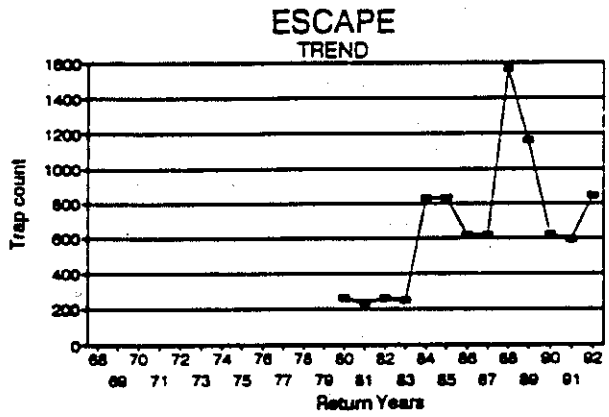
DISTINCT? - **UNKNOWN**

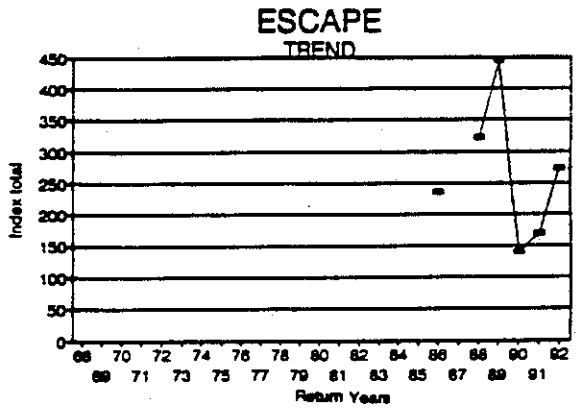
STOCK STATUS PROFILE for White (Puyallup) Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Trap count	ESCAPE Index total Clearwater	ESCAPE Index total Greenwater
68			
69			
70			
71			
72			
73			
74			
75			
76			
77			
78			
79			
80	263		
81	234		
82	263		
83	249		
84	828		
85	832		
86	618	236	
87	619		
88	1566	322	
89	1164	444	180
90	623	140	
91	594	170	130
92	842	274	448





AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

The stock is experiencing the same short-term decline in ocean survival as other steelhead stocks coastwide. A return to average or higher survival rates would improve adult returns and escapement.

Logging impacts have, at times, been severe on major tributaries used by steelhead. The Greenwater River, which is a major steelhead production area, suffered near total loss of large organic debris during the 1977 flood and subsequent clean up operations. Improvements in logging practices and habitat restoration projects have restored the productivity of most major tributaries.

Harvest Management – Harvest rates are currently in the range of 10 percent to 20 percent on the wild winter steelhead stock, which should allow a rapid rebuilding of this stock.

Hatchery – Hatchery-origin steelhead (from Chambers Creek stock) were introduced into the White River until 1982 by the Washington Department of Fish and Wildlife and/or Puyallup Tribe. However, the wild stock has remained essentially isolated because of its preference for spawning areas in upper watershed tributaries, later time of spawning, and because of the high exploitation rate on hatchery adults.

PUYALLUP – CARBON WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in the Carbon River, Voights Creek, South Prairie Creek, and tributaries are native and a distinct stock based on the geographic isolation of the spawning population. Run timing is generally from December through May and spawn timing is generally from early March to mid-June for wild winter steelhead in this stock.

Little is known about the genetic composition of the stock.

Hatchery-origin steelhead (from Chambers Creek stock) have been introduced annually as smolt plants from various hatcheries. However, the wild stock has remained essentially isolated because of its preference for spawning areas higher up in the watershed, later time of spawning, and because of the high exploitation rate on hatchery adults.

STOCK STATUS

The status of the stock is Healthy.

Stock status is based on wild steelhead spawner escapements in index areas in tributaries. Complete spawner surveys are not possible on the mainstem in all years because of the glacial origin of the Carbon River, but only a small proportion of the total escapement occurs in the mainstem compared to other systems of similar size. Adult escapements ranged from 596 to 1,262 wild steelhead in South Prairie Creek and met or exceeded estimated maximum sustainable harvest production potential in each of the past eight years.

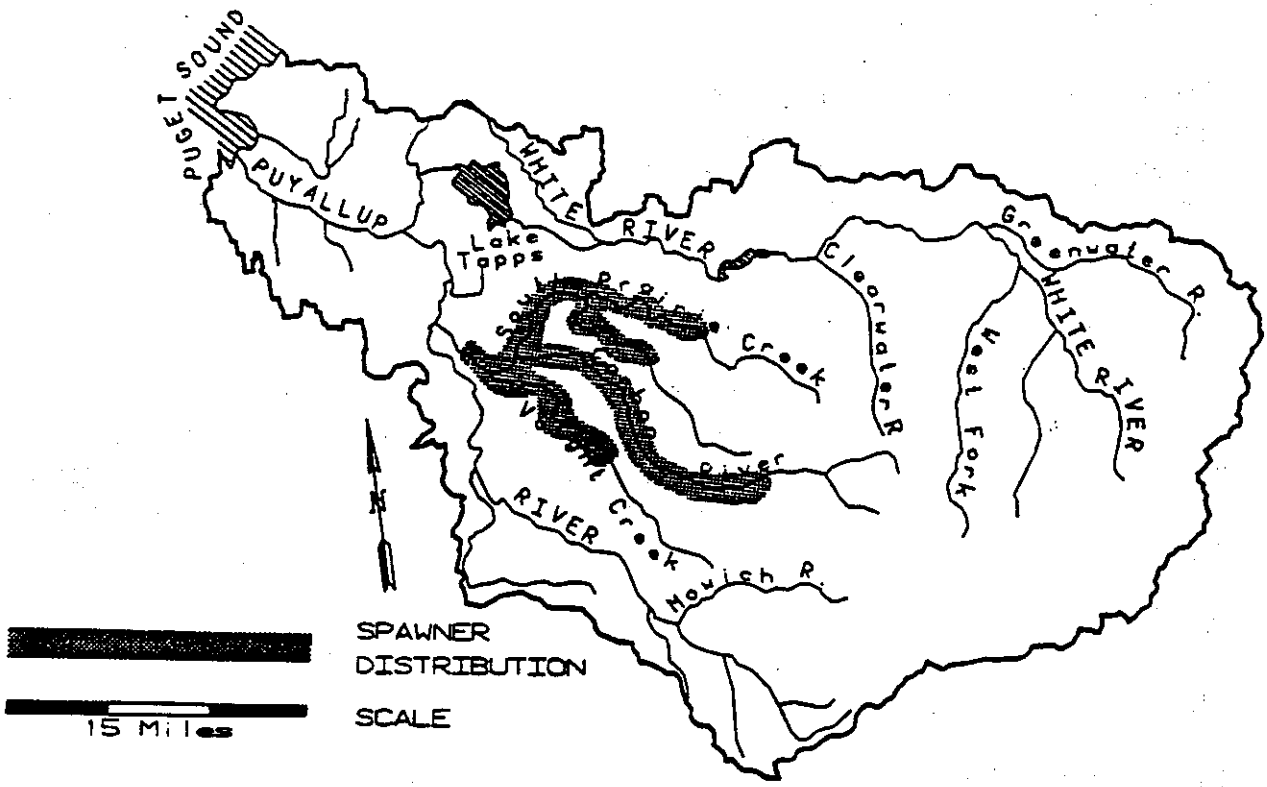
This stock is experiencing the same short-term decline in ocean survival as other steelhead stocks coastwide (Cooper and Johnson 1992).

In the past, regulations generally precluded the harvest of wild fish after February 1. Current sport and tribal fishing regulations are believed to provide adequate protection for Puyallup system wild stocks, including Carbon River winter steelhead.

STOCK DEFINITION PROFILE for Carbon Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	━	━	━	━	━							━	NO
SPAWNING			━	━	━								NO

BIOLOGICAL CHARACTERISTICS

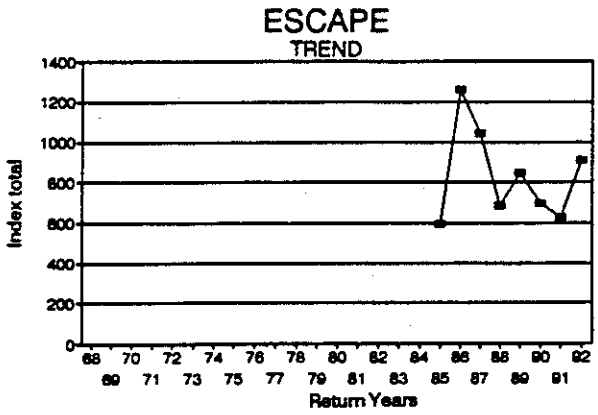
DISTINCT? - **UNKNOWN**

STOCK STATUS PROFILE for Carbon Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY----> Fair

Return Years	ESCAPE Index total			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85	596			
86	1262			
87	1042			
88	684			
89	846			
90	700			
91	628			
92	910			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- NISQUALLY SUMMER/FALL CHINOOK STOCK

NISQUALLY

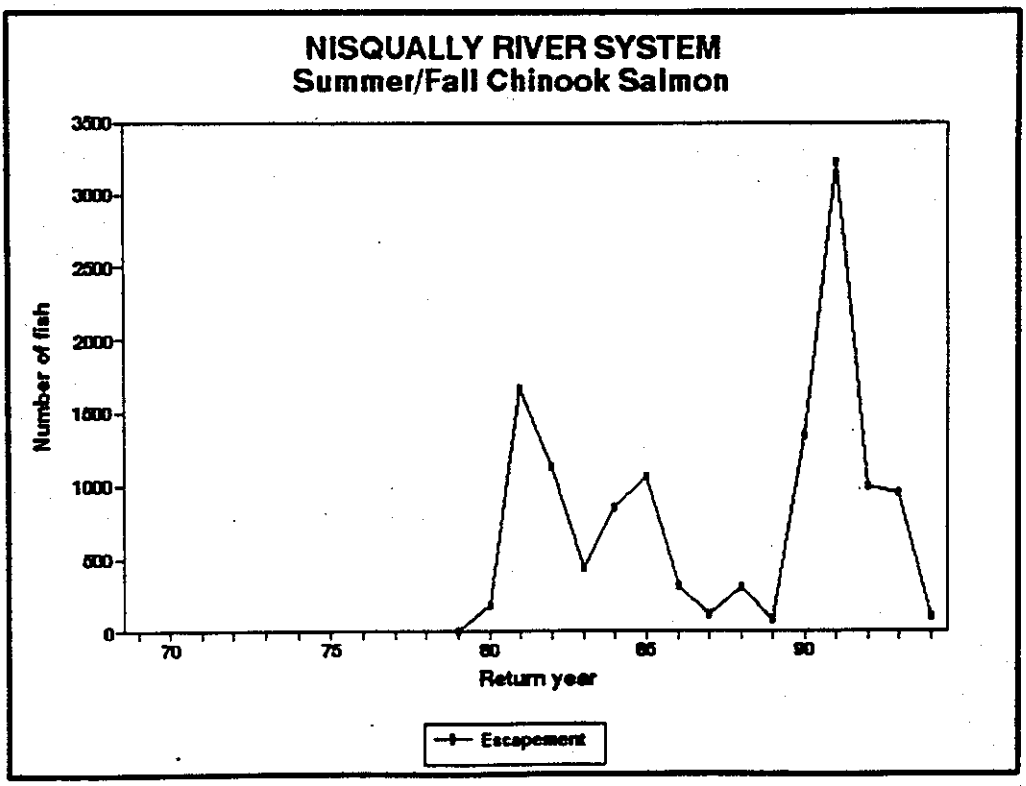
STOCK DEFINITION AND ORIGIN

Although this stock was identified based on geographic separation from other Puget Sound chinook stocks, Nisqually chinook may not be genetically distinct from other south Puget Sound chinook stocks as a result of extensive releases of Green River, Deschutes and other chinook hatchery stocks into the Nisqually River system. Non-native releases of chinook into the Nisqually from 1985 through 1991 are shown in the table on the following page.

STOCK STATUS

Recoveries of coded-wire tagged chinook released from South Sound hatcheries, including those on the Nisqually River, have provided some insight on the harvest distribution of South Sound chinook stocks, including Nisqually. Approximately one-third of all recoveries are made in Canadian fisheries off Vancouver Island, approximately two-thirds are made in Puget Sound fisheries and a very small proportion are recovered in Washington coastal fisheries.

Escapement data are shown in the figure below.



The following table lists releases of hatchery chinook into the Nisqually River basin from 1985 through 1991.

Release Year	Number Released	Stock (see NOTE below)	Release Site
1985	301,856	Kalama Creek	Kalama Creek
1985	1,618,720	Deschutes	Kalama Creek
1985	490,700	Garrison Springs	Schomo Pond
1985	1,596,900	Deschutes	Schomo Pond
1985	9,840	Kalama Creek	Ohop Creek
1985	183,168	Deschutes	Ohop Creek
1985	43,460	Deschutes	Beaver Creek
1986	251,490	Deschutes	Nisqually
1986	1,000,000	Coulter Creek	Nisqually
1986	1,688,665	Deschutes	Kalama Creek
1986	894,000	Deschutes	Schomo Pond
1986	67,555	Deschutes	Ohop Creek
1986	371,800	Deschutes	Mashel River
1987	282,035	Green River	Nisqually
1987	719,479	Green River	Kalama Creek
1987	315,593	Kalama Creek	Kalama Creek
1987	1,868,200	Green River	Schomo Pond
1987	216,435	Green River	Ohop Creek
1987	778,235	Green River	Mashel River
1988	75,600	Green River	Nisqually
1988	34,900	Garrison Springs	Nisqually
1988	83,400	Deschutes	Nisqually
1988	89,300	Green River	Clear Creek
1988	41,300	Garrison Springs	Clear Creek
1988	98,600	Deschutes	Clear Creek
1988	171,364	Green River	Kalama Creek
1988	142,123	Kalama Creek	Kalama Creek
1988	731,513	McAllister	Kalama Creek
1988	75,600	Green River	Schomo Springs
1988	34,900	Garrison Springs	Schomo Springs
1988	83,400	Deschutes	Schomo Springs
1988	96,200	Green River	Powell Creek
1988	44,500	Garrison Springs	Powell Creek
1988	106,100	Deschutes	Powell Creek
1988	75,600	Green River	Ohop Creek
1988	34,900	Garrison Springs	Ohop Creek
1988	83,400	Deschutes	Ohop Creek
1988	185,700	Green River	Mashel River
1988	85,700	Garrison Springs	Mashel River
1988	204,700	Deschutes	Mashel River
1989	682,300	McAllister	Nisqually
1989	900,000	Kalama Creek	Kalama Creek
1990	1,100,000	Kalama Creek	Kalama Creek
1990	1,200,000	Deschutes	Unnamed (0055)
1991	940,000	Kalama Creek	Clear Creek
1991	1,100,000	Kalama Creek	Kalama Creek
1991	850,000	Deschutes	Unnamed (0055)
1991	12,000	Kalama Creek	Ohop Creek

NOTE: The Future Brood Document (1992) lists the stock origins for the above stocks as:
McAllister from Deschutes
Kalama Creek from various South Sound stocks
Garrison Springs from South Puget Sound stocks (Deschutes/Green River)
Coulter Creek from South Puget Sound stocks (Deschutes/Green River)
Deschutes from Puget Sound-probably Green River

More information on this stock is presented in the Stock Report which follows.

NISQUALLY – NISQUALLY SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was classified as distinct based upon geographic distribution, but genetic composition analysis is needed to verify this classification. Spawn timing peaks in October, similar to that of other Puget Sound fall chinook stocks. It is doubtful that Nisqually River chinook are distinct from other south Puget Sound stocks due to extensive releases of non-native stocks into the Nisqually River.

Stock origin appears to be a mixture of other south Puget Sound stocks as the original stock may have significant influence from non-native introductions. Significant Schorno Springs releases occurred from 1975 to 1991 with no adult collection facility. It is assumed that returning adults spawned naturally in adjacent streams in the nearby mainstem. If genetic stock identification analysis supports the hatchery release information, this stock may be removed from the list of distinct stocks and placed in the miscellaneous south Puget Sound chinook category.

STOCK STATUS

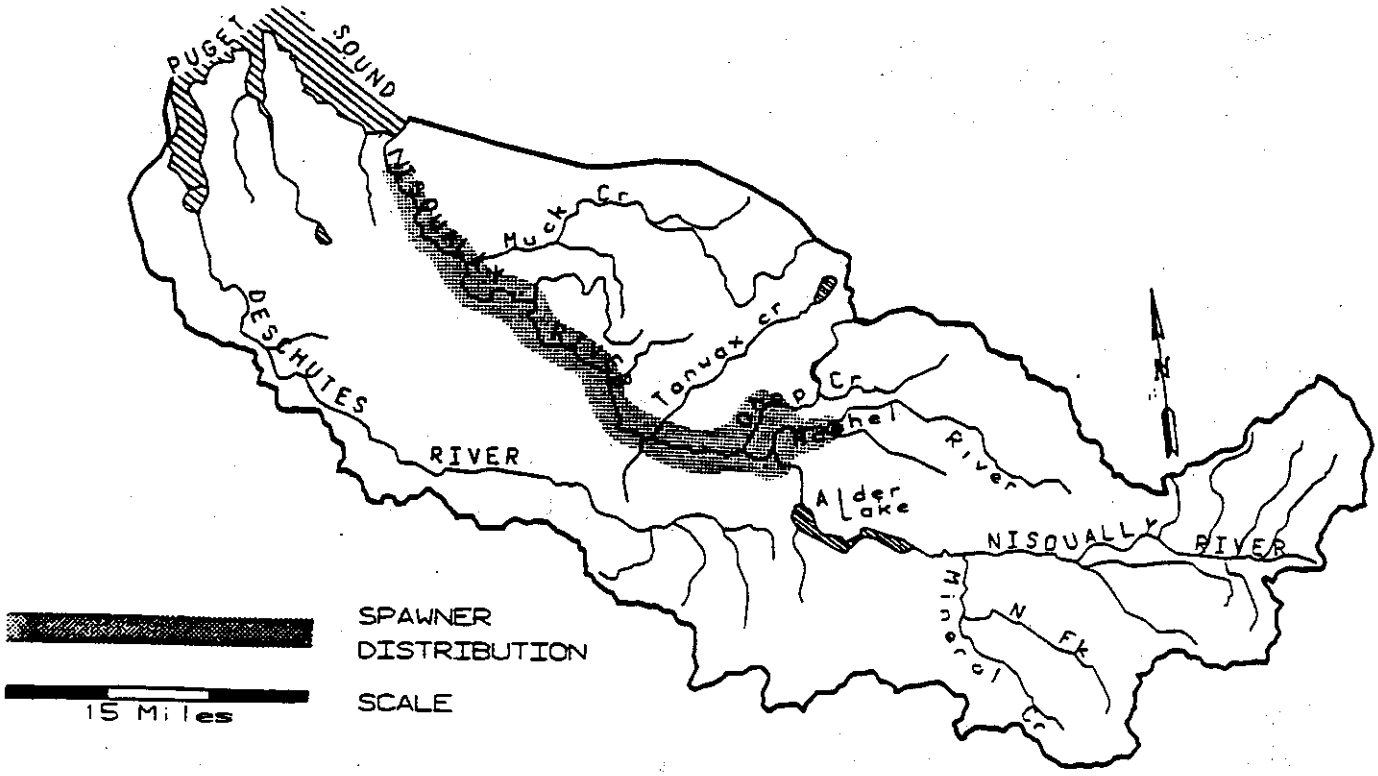
Stock status is Healthy.

Stock status is likely partially dependent upon hatchery production from the Nisqually Hatchery. Natural spawner escapement levels have ranged from 85 to 2,332 from 1977 through 1991. The escapement values are considered to be fairly good estimates of relative abundance.

STOCK DEFINITION PROFILE for Nisqually Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING										▬			**NO**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

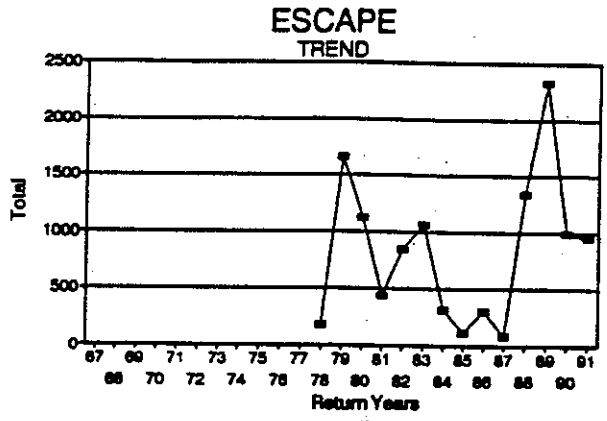
GENETICS - No data available.

STOCK STATUS PROFILE for Nisqually Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY----> Poor

Return Years	ESCAPE Total			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78	178			
79	1665			
80	1124			
81	439			
82	848			
83	1066			
84	313			
85	112			
86	302			
87	85			
88	1342			
89	2332			
90	994			
91	953			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- NISQUALLY WINTER CHUM STOCK

NISQUALLY

STOCK DEFINITION AND ORIGIN

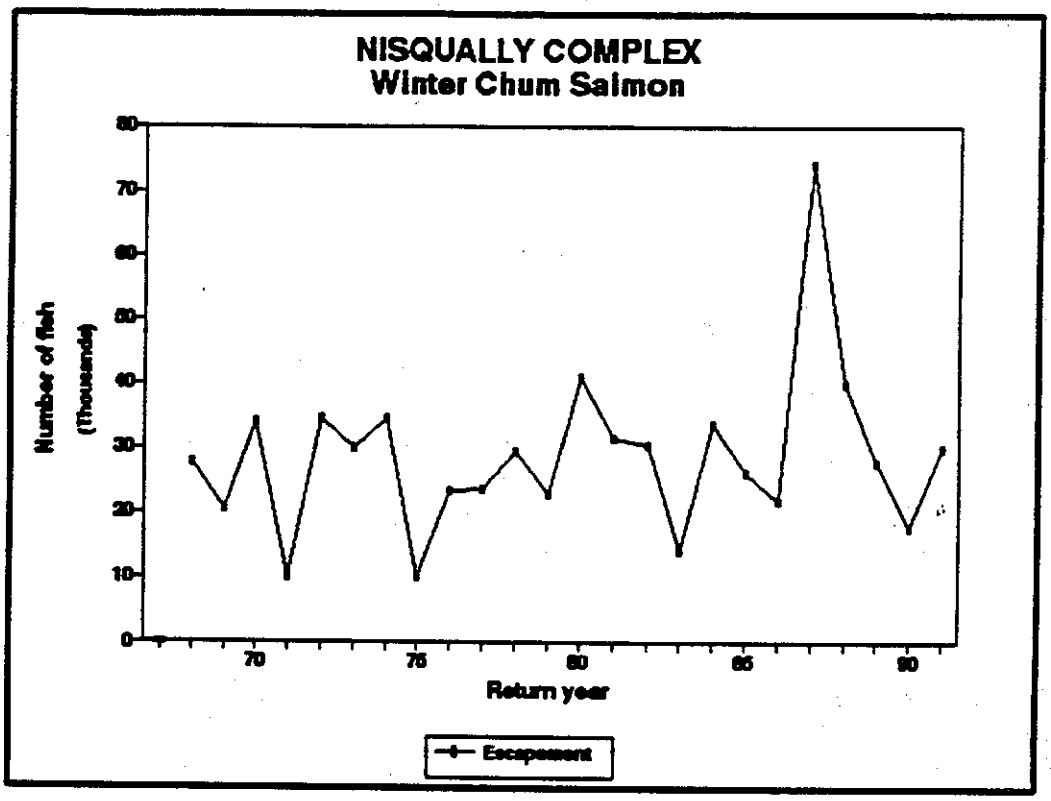
Winter chum spawning in this region are isolated from other Puget Sound chum stocks through geographical separation of the spawning grounds and run timing differences. Additionally, genetic studies using electrophoresis showed that winter chum were distinct from both summer and fall chum stocks. Winter chum enter the terminal area from the first week in December through most of February. Spawning begins about the first week in January and may continue through March.

A few hatchery plants have been made in the Nisqually system but most of these have used a fall chum stock with a different run timing.

STOCK STATUS

Nisqually winter chum contribute relatively few fish in the commercial fishery in Puget Sound. They are principally harvested in the river fishery in the Nisqually. Escapement levels have been healthy and stable.

Escapement data are shown in the figure below. Escapement data give a good representation of the number of spawners in the area. Different escapement goals are used for even and odd years but are not plotted on the graph. The Nisqually winter even-year and odd-year escapement goals are 27,000 and 18,000 respectively.



More information on this stock is presented in the Stock Report which follows.

NISQUALLY -- NISQUALLY WINTER CHUM

STOCK DEFINITION AND ORIGIN

The Nisqually chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic distribution, temporal separation and distinct genetic characteristics. The Nisqually River enters the Puget Sound in the southern end and is the only major river in the area.

The spawning grounds of the Nisqually winter stock are geographically separated from other Puget Sound spawning areas. Primary production occurs in the Nisqually River mainstem, its tributaries and sloughs, as well as in two small independent tributaries (Mounts and McAllister creeks) that enter the Nisqually delta. The Nisqually winter stock is the only identified chum stock in the Nisqually River. This winter stock spawns over a month later than other Puget Sound fall stocks, beginning in January and ending as late as March. Genetic stock identification studies suggest that Nisqually winter chum are a unique stock.

Some enhancement efforts have been made in the Nisqually system but have not had a significant impact on the winter stock. The Nisqually winter stock is a native stock of chum.

STOCK STATUS

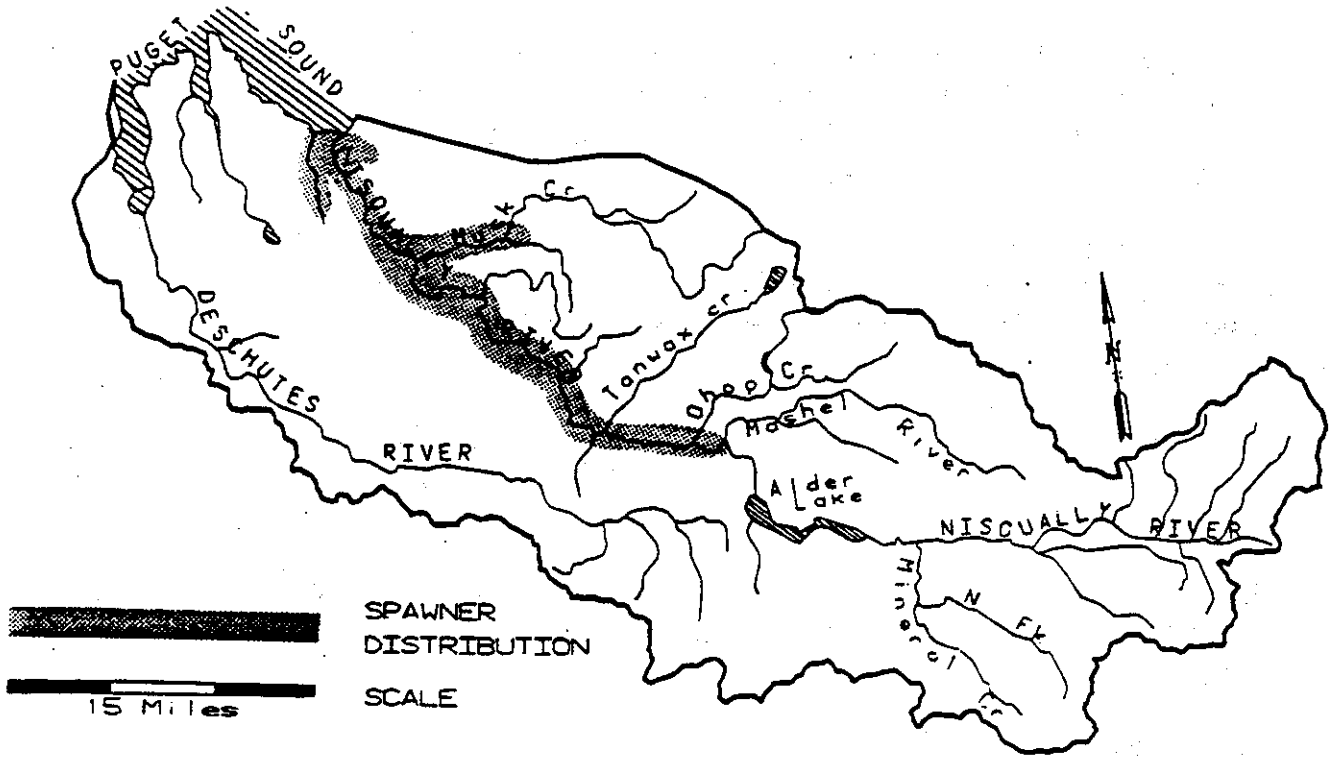
Run-size estimates and escapement levels indicate a Healthy stock of fish.

Over 20 years of commercial harvest records, run-size data and escapement estimates are available for this stock of fish. Run-size data range from 12,491 to 88,496 and indicate a slight increasing trend in run size, while escapements range from 5,282 to 38,083. Recruits per spawner data also indicate a Healthy stock averaging 2.5 since the 1968 broodyear.

STOCK DEFINITION PROFILE for Nisqually Winter Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



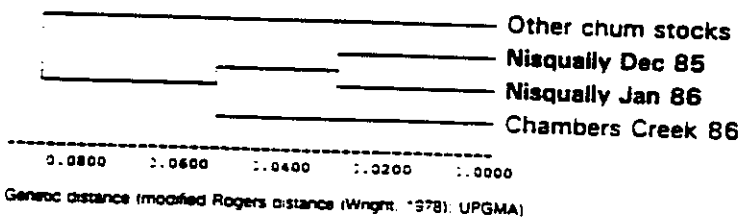
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN	▬	▬										▬	**NO**
RIVER ENTRY	▬	▬										▬	**NO**
SPAWNING	▬	▬	▬										**YES**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Two collections (N=100) taken from the same return year (December, 1985 and January 1986) and a 1991 collection (N= 100) from Yelm Creek were not different from each other. However, this stock complex is very different from all summer-run and fall-run stocks tested (21-locus G-tests: $p<0.05$).



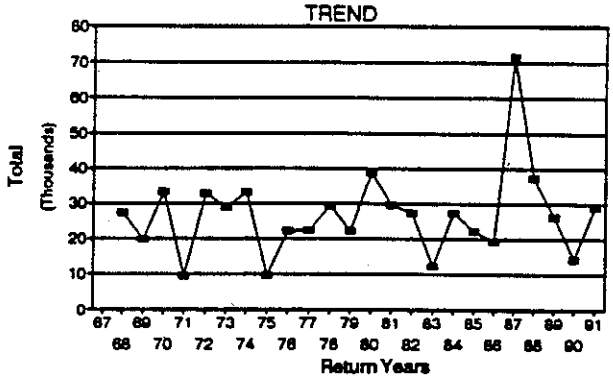
STOCK STATUS PROFILE for Nisqually Winter Chum

STOCK ASSESSMENT

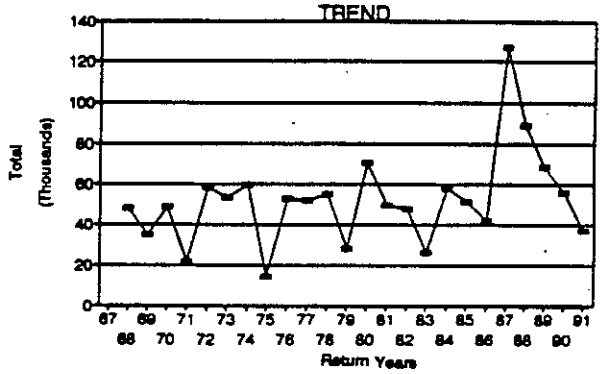
DATA QUALITY-----> Good

Return Years	ESCAPE Total	RUNSIZE Total	SURVIVAL Rec/spwnr	
67				
68	27393	48015	2.5	
69	19939	34792	2.1	
70	33400	48776	1.9	
71	9502	21864	1.9	
72	32862	58393	1.0	
73	28717	53755	2.2	
74	33236	59699	1.3	
75	9644	14406	4.8	
76	22266	53036	1.1	
77	22495	52158	4.2	
78	29436	55237	1.3	
79	22145	28439	1.8	
80	38776	70604	1.4	
81	29640	49976	1.8	
82	27369	47920	1.3	
83	12396	26174	7.5	
84	27439	58103	3.9	
85	22196	51582	2.5	
86	19406	42000	3.5	
87	71642	127289	0.4	
88	37433	88923	1.0	
89	26400	68906		
90	14246	56113		
91	28960	37200		

ESCAPE
TREND



RUNSIZE
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing, Genetics

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- NISQUALLY COHO STOCK

NISQUALLY

STOCK DEFINITION AND ORIGIN

For the purposes of this inventory, the Nisqually River basin includes the Nisqually River drainage and independent tributaries on the south shore of the Nisqually Reach. Coho salmon utilize, to some degree, almost all of the accessible tributaries in this area. Coho returning to these tributaries typically enter fresh water from mid-September through December and spawn from late October to mid-January with some variation observed between streams and between years within streams.

There have been substantial releases of hatchery-origin coho within this area, with significant yearling plants from the early 1950s through 1990. Off-station fingerling/fry plants occurred regularly from 1952 to 1961 and from 1969 to the present time. There are also annual on-station yearling releases from the hatchery facilities on Kalama and Clear creeks. It should be noted that many of the early off-station yearling releases were not consistent with of current optimal size and time-of-release strategies and their subsequent contribution to the wild spawning population is unknown. Straying rates from the on-station releases are also unknown, as are the potential survival differentials related to the various stocks introduced into this area.

Additional to those considerations are questions regarding the spawning success in the wild of hatchery-origin coho and any distinctions between native and introduced stocks in terms of either temporal or physical spawning distributions. As a result of these uncertainties, the stock in this area has been designated as a probable mixture of native and non-native stocks, without any inference as to the relative influence of those stocks within the current population. There can be no confident quantification of the genetic impact of non-native stock introductions, regarding either a current presence of hatchery type components in this population or hybridization of the native stock, until an effective genetic research tool is developed and implemented for coho salmon.

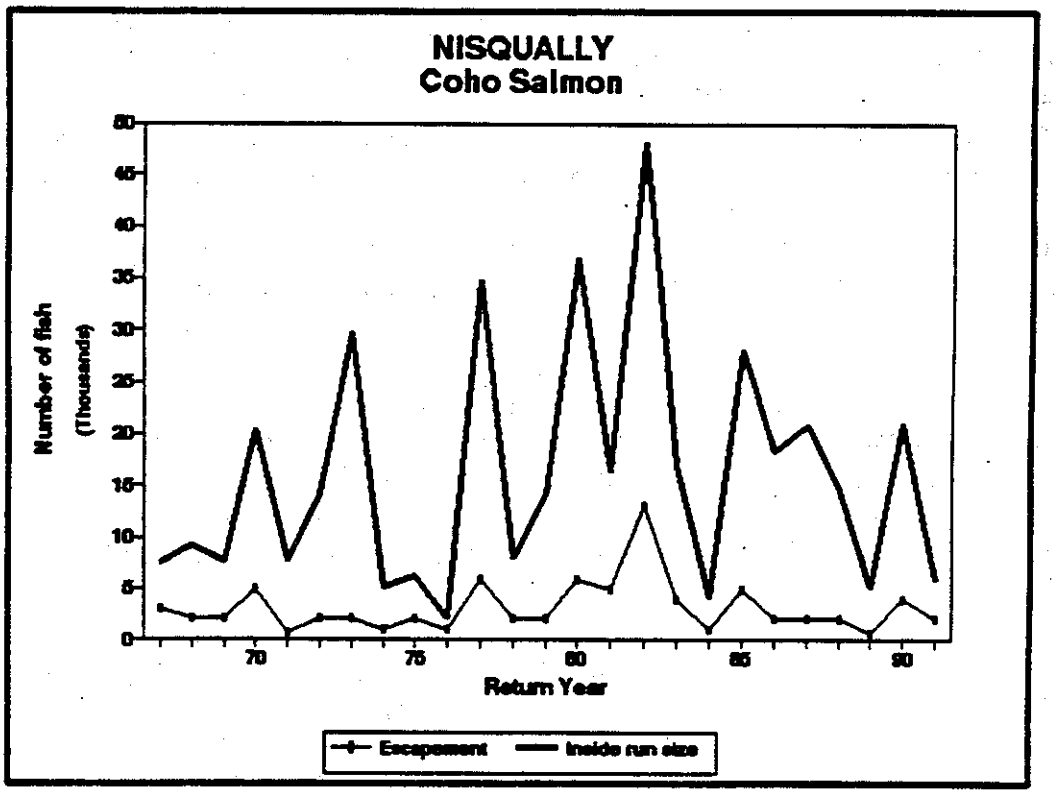
There are no significant differences in timing or any unique biological characteristics documented for the coho in this basin that would suggest multiple stocks. The distinction of this stock from those in surrounding drainages is therefore dependent upon a determination of geographic spawning separation, the result of subjective judgements regarding the probability of significant spawner interchange between those drainages. Until a genetic determinant is available and used to evaluate this stock, this designation is tentative.

STOCK STATUS

Coho of Nisqually River basin-origin are primarily harvested in Canadian and Washington troll, net and sport fisheries. There are directed terminal-area fisheries on this stock to harvest surplus hatchery returns.

The natural escapement goal for Nisqually River coho is 4,000 (does not include escapement for area independent streams). The run reconstruction database shows escapement fluctuating over a wide range about the goal and run size estimates (the number of fish in escapement and Puget Sound net catches) over that same period, from 1965 to present, fluctuating over a broad range, as well. Nisqually stock's performance evaluation is based upon run reconstruction data, and those data indicate fairly stable production and a generally healthy state.

The graph below, which illustrates natural coho production trends in this basin, is derived from the run reconstruction database. Please note that some of the run size estimated for the last ten to 15 years may be attributable to misallocation of hatchery-origin production to the natural stock. The magnitude of this possible error has not been estimated at this time. The escapement goal is not plotted on this graph since the primary management objective in this basin is to minimize surplus hatchery returns through harvest rates which generally preclude accomplishing a wild escapement goal.



More information on this stock is presented in the Stock Report which follows.

NISQUALLY -- NISQUALLY COHO

STOCK DEFINITION AND ORIGIN

This stock has been classified on the basis of distinct geographic spawning distribution. These fish do not exhibit any documented unique biological characteristics, and their spawning timing is typical, however it sometimes extends later than surrounding south Puget Sound stocks (most spawning occurring from mid-November to mid-January).

Off-station hatchery yearling releases have been fairly consistent in this drainage through 1990. Prior to 1982, Green River and Puyallup stocks were predominant, along with releases of Minter (1973), Skagit (1961 and 1962), Issaquah (1971) and George Adams (Hood Canal) stocks (1974). Skykomish yearlings were released into this system in large numbers (400 to 500,000) annually from 1982 through 1984 and 1986 through 1990. Minter, George Adams and Skagit stock yearlings were also utilized during this period, but to a much lesser degree. Off-station fingerling and fry releases in this drainage were common from 1952 to 1961 (primarily Green River stock) and from 1969 to present (mainly Puyallup stock). Limited use was made of Minter and Skagit stocks during those periods, as well. This stock is likely a mixture of the native and various introduced non-native stocks.

STOCK STATUS

The status of the stock is Healthy.

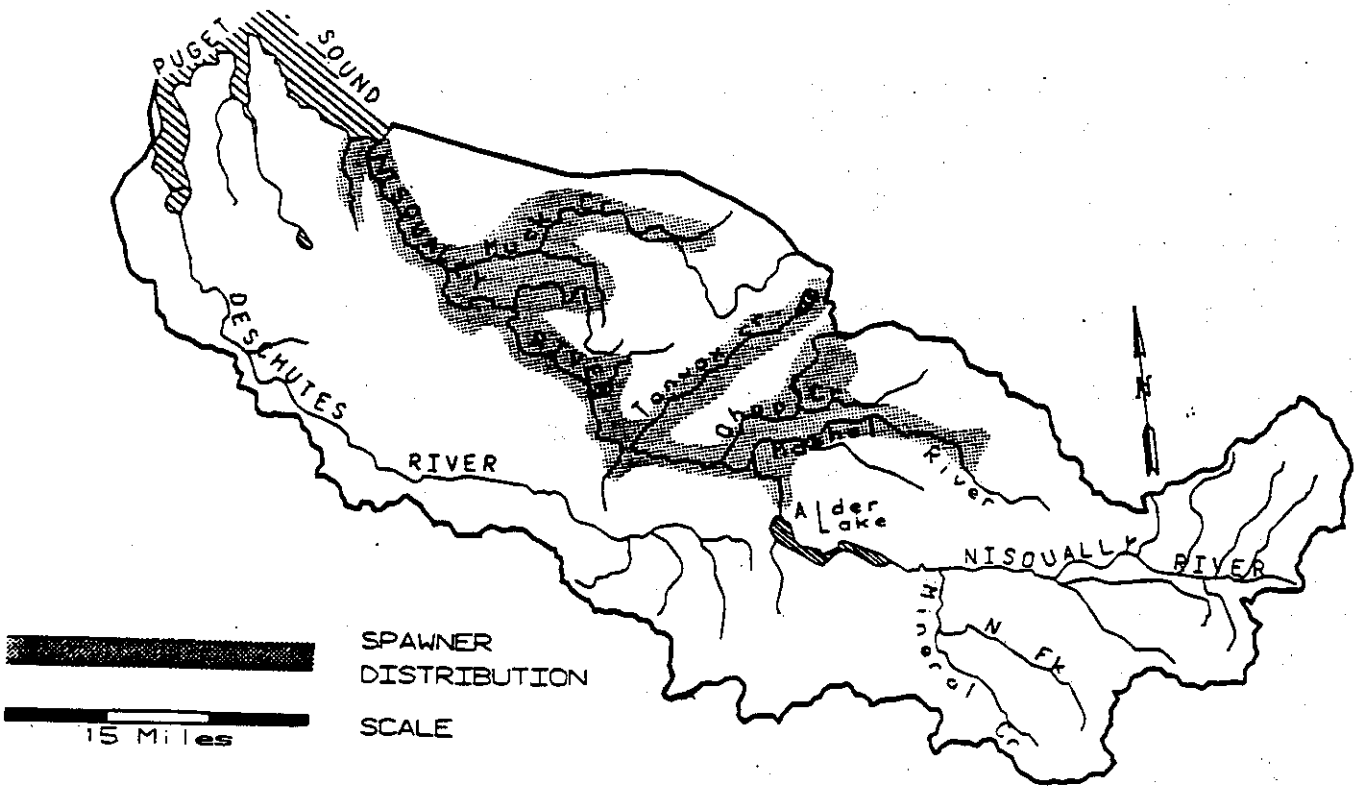
Run reconstruction data are available for this stock and should be used to represent its production trends. Escapement index data in this system are good back to 1981, but the validity of comparing those data between years is questionable given variability in returns of off-station yearling production.

The database shows a wide range of run sizes for this stock, but production is fairly stable within that range.

STOCK DEFINITION PROFILE for Nisqually Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬	▬			UNK
RIVER ENTRY									▬	▬	▬		UNK
SPAWNING	▬										▬		NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

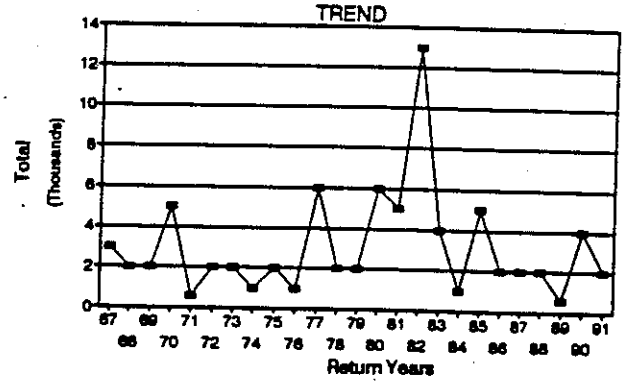
STOCK STATUS PROFILE for Nisqually Coho

STOCK ASSESSMENT

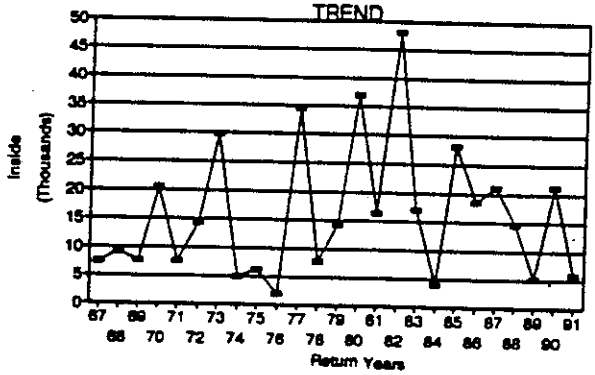
DATA QUALITY——> Good

Return Years	ESCAPE Total	RUNSIZE Inside		
67	3000	7400		
68	2000	9200		
69	2000	7600		
70	5000	20500		
71	600	7500		
72	2000	14300		
73	2000	29800		
74	1000	5000		
75	2000	6200		
76	1000	1900		
77	6000	34500		
78	2000	7900		
79	2000	14300		
80	6000	36900		
81	5000	16400		
82	13000	48100		
83	4000	17100		
84	1000	4100		
85	5000	28300		
86	2000	18500		
87	2000	21100		
88	2000	14600		
89	600	5200		
90	4000	21200		
91	2000	5900		

ESCAPE
TREND



RUNSIZE
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- NISQUALLY PINK STOCK

NISQUALLY

STOCK DEFINITION AND ORIGIN

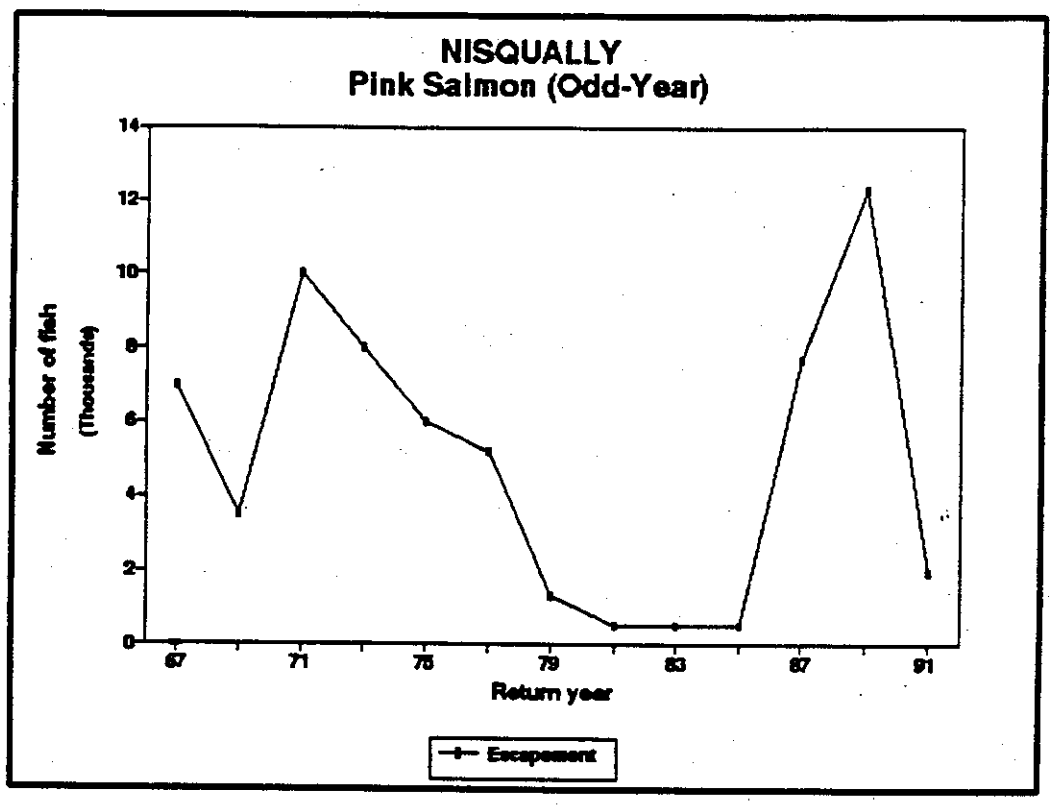
Nisqually pink salmon are isolated from other Washington pink stocks through geographic separation of the spawning grounds. Additionally, genetic studies have shown that the Nisqually stock is distinct from other Washington pink stocks. Nisqually pink salmon first enter the terminal area in August. Spawning begins about the first week in September and may continue through October. Nisqually pink salmon spawn throughout the free flowing section of the river below LaGrande Dam.

A single hatchery plant was made in the Nisqually (1917) system, but it is unlikely that these fish affected the genetics of the native stock. Because the stock was shown to be unique through genetic studies, it was classified as a native stock.

STOCK STATUS

Nisqually pink salmon contribute to the commercial fishery in Puget Sound. They are harvested in the Strait of Juan de Fuca, and in north Puget Sound fisheries. They are also harvested in the river fisheries in the Nisqually River.

Extremely low pink escapement in 1981 resulted in chinook fishery management changes for pink conservation concerns. Stock abundance returned to historic levels in 1987. Escapement data are shown in the figure below.


NISQUALLY
Pink Salmon (Odd-Year)
Number of fish
(Thousands)
14
12
10
8
6
4
2
0
67
71
75
79
83
87
91
Return year
Escapement

NISQUALLY -- NISQUALLY PINK

STOCK DEFINITION AND ORIGIN

Nisqually River pink salmon are primarily mainstem spawners with additional spawning occurring in Ohop Creek and the Mashel River tributaries to the Nisqually. The mainstem spawning takes place from the powerhouse near LaGrande (approximately RM 40.0), downstream throughout the reach of the river above McKenna (RM 22).

Pink salmon enter the Nisqually from early September to mid-October with the peak in late September. Spawning usually begins in mid-September and generally peaks in mid-October.

A plant of 224,000 Elwha pink stock was made in the Nisqually River in 1917 but it is unlikely that these fish had any influence on the native stock. Genetic studies indicate that the Nisqually pink stock is distinct from other Puget Sound stocks.

STOCK STATUS

The status of this stock is Healthy.

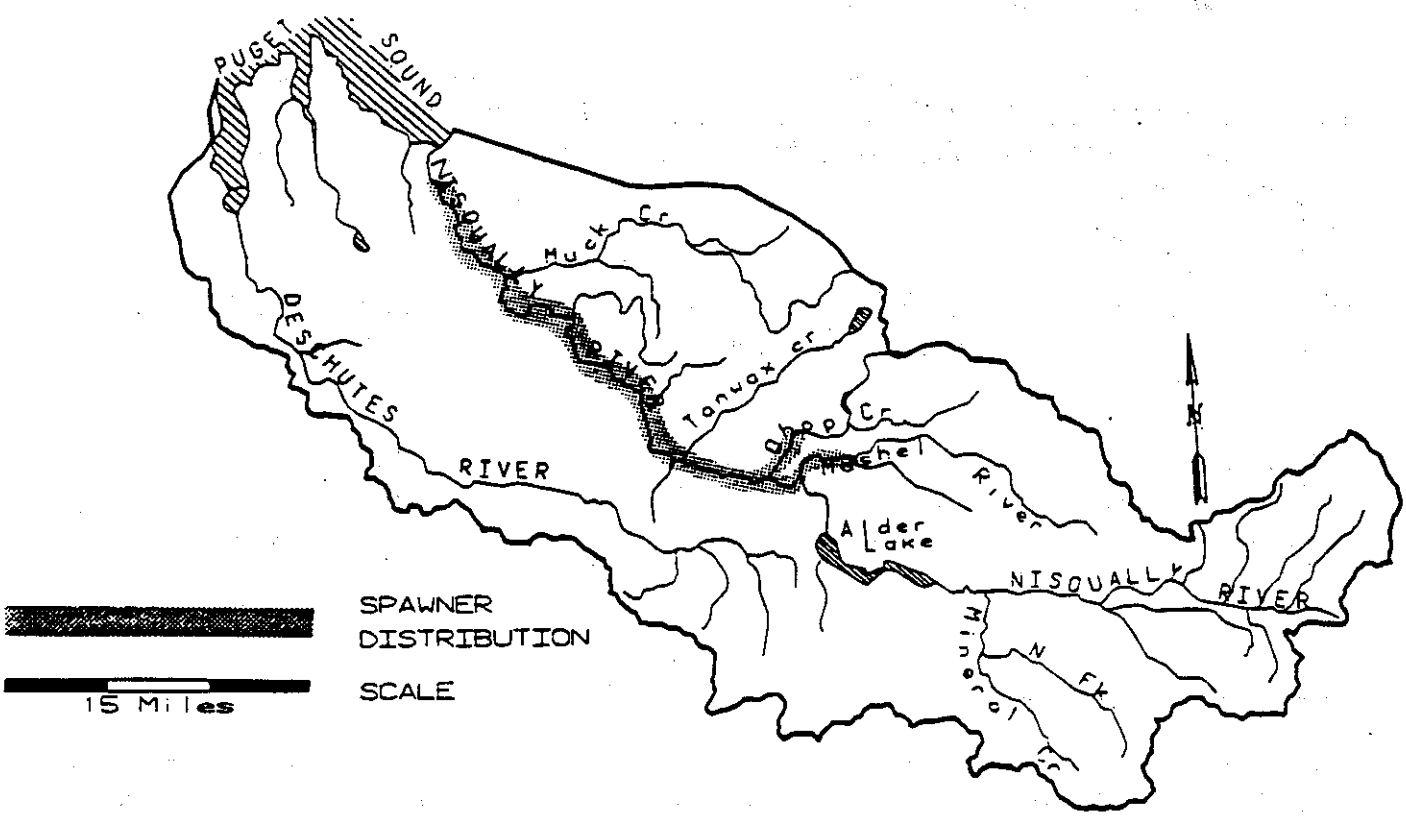
The estimated pink salmon escapement over the past 30 years has ranged from 500 to 12,000 fish. The escapement has increased from record lows (500) in 1985 to a record high (12,300) in 1989.

Spawning ground survey data can be difficult to obtain at times because the water clarity is affected by glacial run-off. This run has fluctuating run sizes but appears to be increasing.

STOCK DEFINITION PROFILE for Nisqually Pink

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



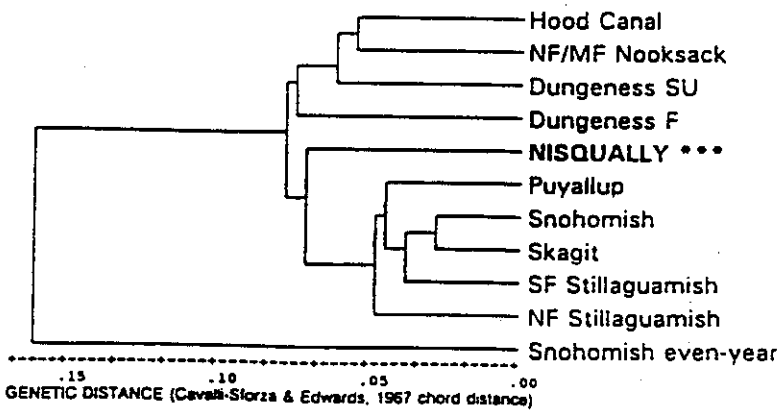
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													UNK
RIVER ENTRY													UNK
SPAWNING													UNK

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Stock is significantly different from all other Washington stocks [one collection (N=100); 28-locus G-tests: $p<0.001$].



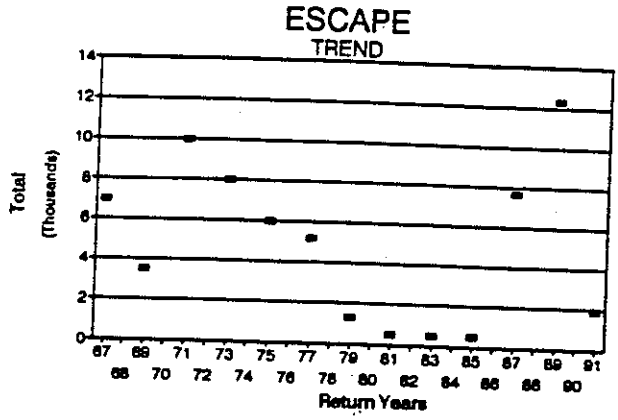
STOCK STATUS PROFILE for Nisqually Pink

STOCK ASSESSMENT

DATA QUALITY——> Fair

Return Years	ESCAPE Total			
67	7000			
68				
69	3500			
70				
71	10000			
72				
73	8000			
74				
75	6000			
76				
77	5200			
78				
79	1300			
80				
81	500			
82				
83	500			
84				
85	500			
86				
87	7700			
88				
89	12300			
90				
91	1900			

Odd-year returns only.



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Genetics

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- NISQUALLY SUMMER AND WINTER STEELHEAD STOCKS

WINTER:
NISQUALLY

STOCK DEFINITION AND ORIGIN

In the Nisqually River, no summer steelhead stocks and one winter steelhead stock have been identified. Wild winter steelhead in the Nisqually River are a distinct stock and are native.

The stock is treated separately due to the geographical isolation of the spawning population. There may be more or fewer stocks identified once comprehensive genetic, life history, and ecological information is available.

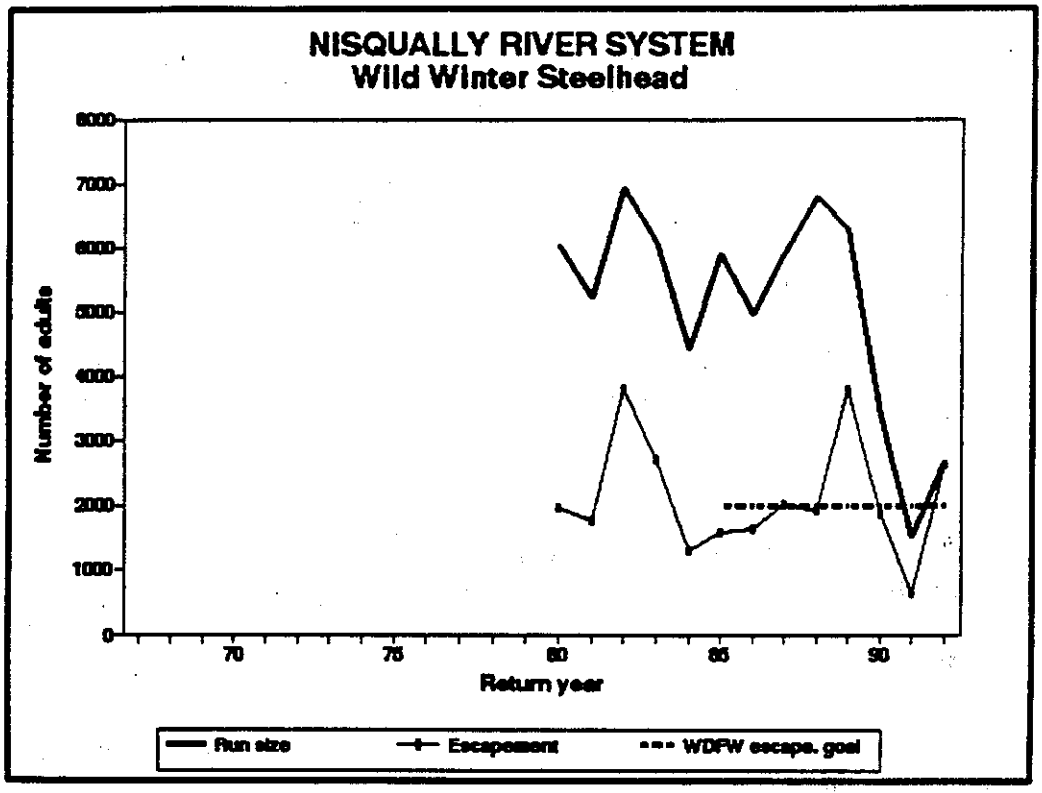
STOCK STATUS

Wild winter steelhead spawner escapement and run size have been monitored for the Nisqually River since the 1979-80 season. Wild escapement has ranged from 642 to 3,817 fish and wild run size has ranged from 1,519 to 6,934 fish (see figure and table).

Beginning with the 1984-85 season, a WDFW spawner escapement goal of 2,000 winter steelhead was set for the Nisqually River system and the fisheries were managed to achieve the goal. This goal is to be achieved by wild adults and does not include hatchery fish spawning in the wild. Since the escapement goal was set, wild spawner escapement has averaged 2,011 fish and exceeded the goal three times and was very close to goal (about 1,900 fish) another two times (see figure).

During the 1979-80 through 1991-92 return years, the wild winter steelhead run in the Nisqually River system was comprised of 27.7 percent sport harvest, 30.5 percent tribal harvest, and 41.8 percent spawner escapement (see table)

More information on this stock is presented in a separate Stock Report.



Nisqually River system wild winter steelhead sport harvest, tribal harvest, spawner escapement, and run size from 1979-80 through 1991-92.

Return year	Sport harvest	Tribal harvest	Spawner escapement	Run size
1979-80	2,764	1,317	1,972	6,053
1980-81	1,326	2,114	1,782	5,222
1981-82	1,329	1,798	3,807	6,934
1982-83	1,311	2,073	2,705	6,089
1983-84	1,251	1,864	1,304	4,419
1984-85	1,898	2,404	1,599	5,901
1985-86	1,857	1,482	1,620	4,959
1986-87	2,008	1,863	2,022	5,893
1987-88	2,333	2,560	1,916	6,809
1988-89	1,202	1,269	3,817	6,288
1989-90	776	787	1,853	3,416
1990-91	240	637	642	1,519
1991-92	15	36	2,618	2,669
Mean run size distribution, 1979-80 to 1991-92.				
	1,408	1,554	2,127	5,089
	27.7%	30.5%	41.8%	

NISQUALLY -- NISQUALLY WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in the mainstem Nisqually River, Muck Creek, Tanwax Creek, Ohop Creek, Mashel River, and tributaries are a distinct stock based on the geographic isolation of the spawning population. Nisqually winter steelhead is a native stock of large fish which have not been significantly impacted by interbreeding with hatchery-origin fish. Run timing is generally from late January through May and spawn timing is generally from early March to mid-June for wild winter steelhead in this stock. McAllister Creek is considered part of this stock.

No winter steelhead hatchery smolts are currently stocked into this system. Historic plants of early returning Chambers Creek smolts would not have significantly interbred with wild fish due to the differences in spawn timing.

STOCK STATUS

The status of the stock is Healthy.

Spawner escapements have exceeded or been near the WDFW escapement goal of 2,000 wild steelhead in most years. Due to reductions in the sport and tribal harvest, escapement numbers have remained strong and only dipped below historic lows during 1990-91.

Although the stock is Healthy, there are factors which are affecting production. The Centralia power diversion diverts water around 13.5 miles of mainstem with occasional low flow problems in the bypassed section. The powerhouse construction allows damage to fish swimming into the turbine outlet area. This stock is enhanced by increased summer flows provided by the upstream hydroelectric project.

A major landslide occurred in 1991, temporarily blocking the river and resulting in heavy sedimentation into the river. The river quickly cut a new channel around the slide site. Impacts of this event were not permanent.

An increasing number of seals and predatory birds are being found in intertidal and mainstem reaches of this river.

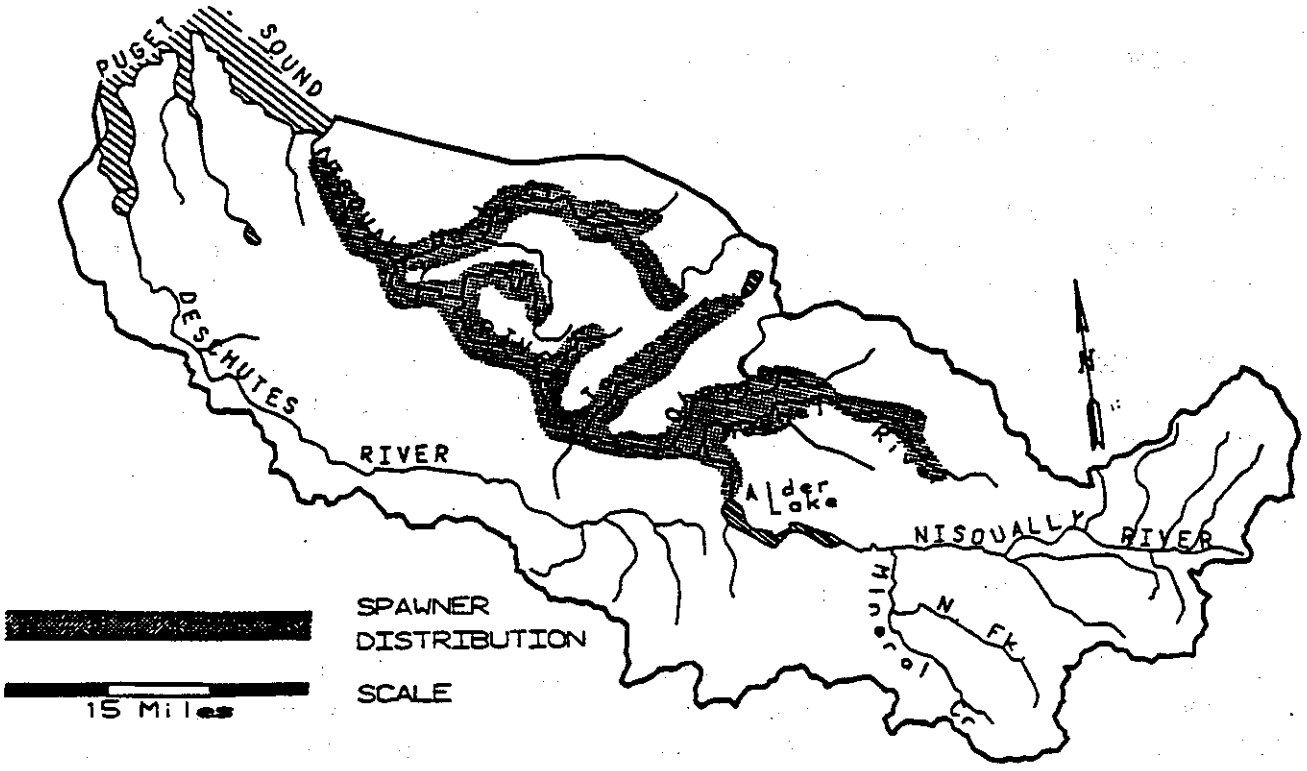
Sport fishing regulations are set to prevent the targeted harvest of steelhead parr and smolts, but some incidental harvest may occur in resident trout fisheries.

The recent downward trend in run sizes are a concern, but are most likely due to poor ocean survival being experienced by steelhead stocks coastwide. This stock will be closely monitored and will be reclassified if warranted.

STOCK DEFINITION PROFILE for Nisqually Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													NO
RIVER ENTRY		■	■	■	■								
SPAWNING			■	■	■								NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for Nisqually Winter Steelhead

STOCK ASSESSMENT

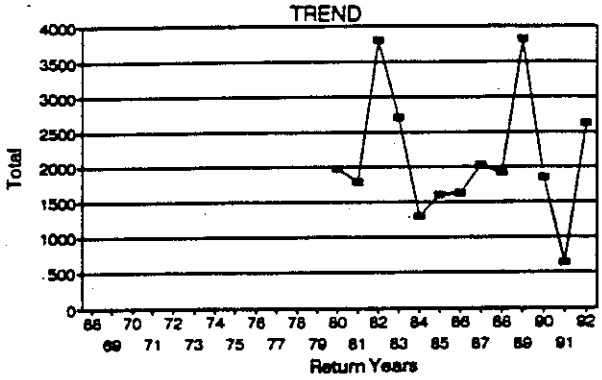
DATA QUALITY----> Good

Return Years	ESCAPE Total	RUNSIZE Total	HARVEST Sport	HARVEST Net
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80	1972	6053	2764	1317
81	1782	5222	1326	2114
82	3807	6934	1329	1798
83	2705	6089	1311	2073
84	1304	4419	1251	1864
85	1599	5901	1898	2404
86	1620	4959	1857	1482
87	2022	5893	2008	1863
88	1916	6809	2333	2560
89	3817	6288	1202	1269
90	1853	3416	776	787
91	642	1519	240	637
92	2618	2669	15	36

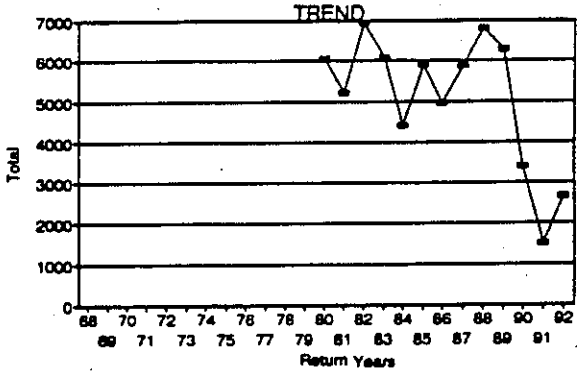
WDFW

Escapement Goal=2000

ESCAPE TREND

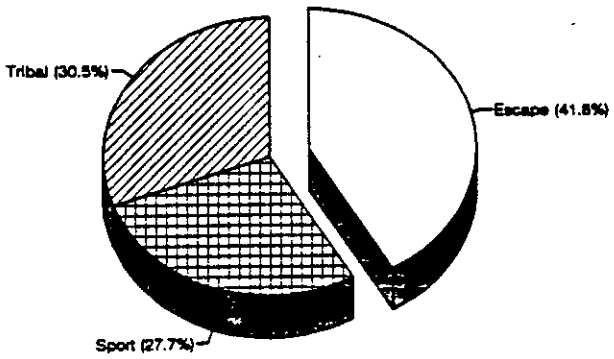


RUNSIZE TREND



AVERAGE RUNSIZE DISTRIBUTION

YEARS 1980-1992



STOCK SUMMARY

STOCK ORIGIN

Native

PRODUCTION TYPE

Wild

STOCK DISTINCTION

Spawning Distribution

STOCK STATUS

Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND SUMMER/FALL CHINOOK STOCK

SOUTH SOUND TRIBS SUMMER/FALL

STOCK DEFINITION AND ORIGIN

This stock is composed of chinook originating in a number of South Puget Sound tributaries including the Deschutes River, McAllister Creek, Minter Creek and other Carr Inlet streams, Chambers Creek, Coulter Creek, Gorst Creek and Grovers Creek. Chinook from these streams were aggregated into a single stock because Green River hatchery stock is released regularly into these streams or supports natural production in these streams. Stock transfers occur regularly among these streams.

STOCK STATUS

Recoveries of coded-wire tagged chinook released from South Sound hatcheries including Deschutes and Grovers Creek, have provided some insight on the harvest distribution of South Sound Tribs chinook. Approximately one-third of the recoveries are from Canadian fisheries off Vancouver Island, approximately two-thirds of the recoveries are from Puget Sound fisheries, and a very small proportion of recoveries are made in Washington coastal fisheries.

The status of South Sound Tribs chinook is Healthy. Although sustained natural production occurs in some streams, the status of this stock depends largely on hatchery production.

More information on this stock is presented in the Stock Report which follows.

SOUTH SOUND -- SOUTH SOUND TRIBS SUMMER/FALL CHINOOK

STOCK DEFINITION AND ORIGIN

This stock was tentatively classified as distinct based upon geographical distribution, but reflects populations of chinook in several rivers. Distribution spans McAllister, Grovers, Gorst, and Chambers creeks, Carr Inlet streams, Deschutes River and other smaller streams in south Puget Sound. The genetic composition of Deschutes Hatchery chinook was examined (1981, 1987), and the baseline was not significantly different from the Skagit Hatchery fall baseline (1987). There are no genetic stock identification data for naturally-spawning South Sound chinook. Spawn timing peaks in October and is similar to that of the Green River stock. This grouping of seemingly widely distributed chinook was warranted by extensive stock transfers from basin to basin and considerable hatchery outplantings and straying in south Puget Sound.

Stock origin is believed to be a mixture of stocks in south Puget Sound due to extensive egg transfers. An example of non-native transfers can be illustrated by the non-native releases into the Deschutes River. From 1960 through 1988 these transfers were:

Year	Number	Stock
1967	914,314	Minter Creek
1977	301,920	Hood Canal
1978	599,866	Deschutes/Minter Creek
1988	898,100	McAllister

STOCK STATUS

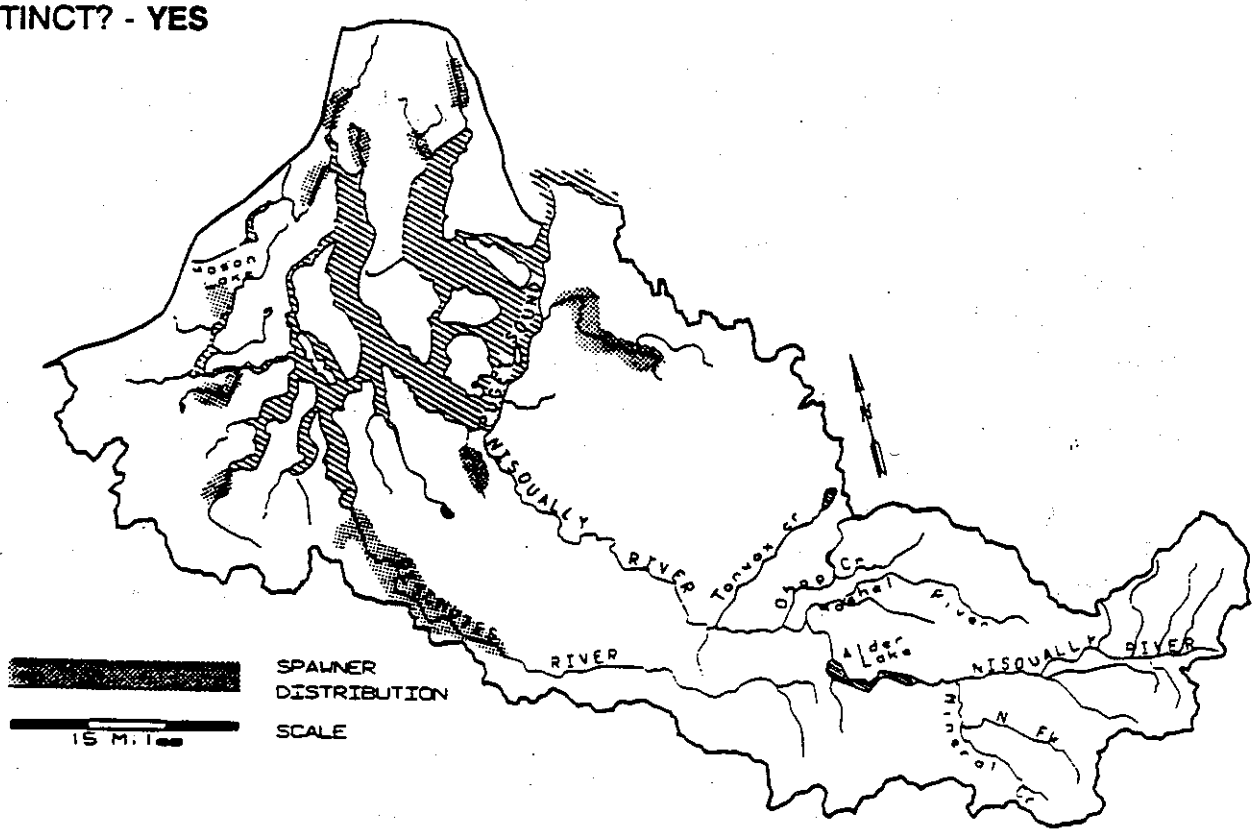
The status of the stock is Healthy.

Stock status is dependent upon hatchery production and escapement levels have ranged from 9,600 to 37,000 fish per year with an average of 19,700 natural spawners. Some of these fish may be part of a self-sustainable population of natural spawners, but no data are available to quantify that portion.

STOCK DEFINITION PROFILE for South Sound Tribs Summer/Fall Chinook

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



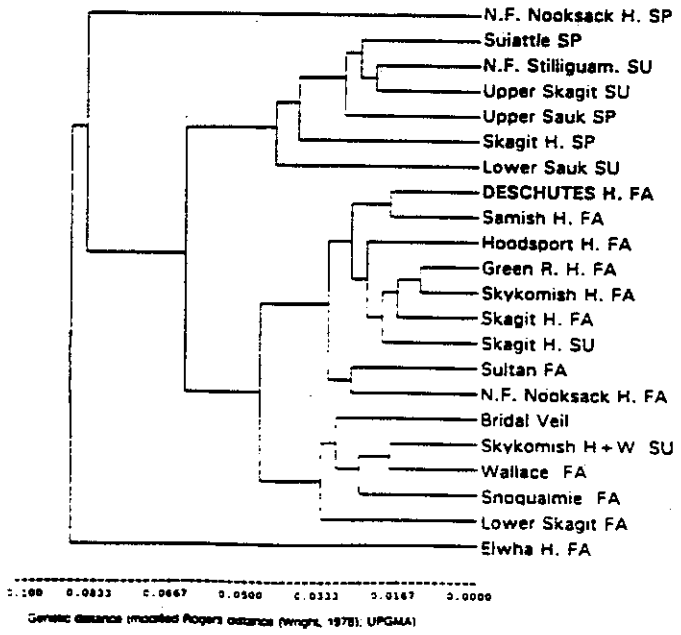
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													**UNK**
RIVER ENTRY													**UNK**
SPAWNING									▬	▬			**UNK**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

GENETICS - No genetic data exist for the various natural spawners in South Sound. However, the genetic characteristics of Deschutes Hatchery chinook (samples from 1981 and 1987) are very similar to those of Skagit Hatchery fall chinook (1987 sample).

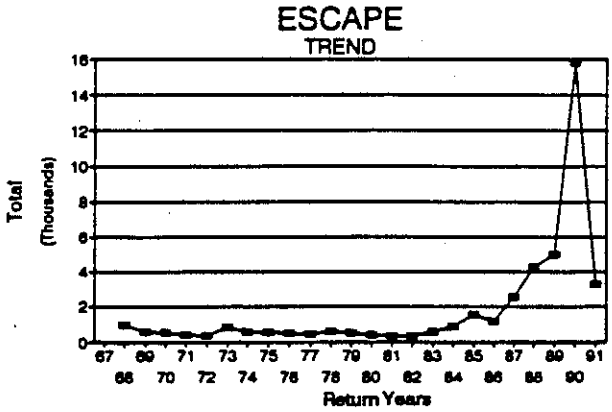


STOCK STATUS PROFILE for South Sound Tribs Summer/Fall Chinook

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67				
68	980			
69	565			
70	530			
71	405			
72	365			
73	820			
74	563			
75	535			
76	520			
77	441			
78	598			
79	501			
80	401			
81	291			
82	295			
83	579			
84	867			
85	1562			
86	1161			
87	2560			
88	4257			
89	4979			
90	15814			
91	3300			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN

Mixed

PRODUCTION TYPE

Composite

STOCK DISTINCTION

Distribution

STOCK STATUS

Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND SUMMER CHUM STOCKS

CHAMBERS CREEK **CASE INLET**
HAMMERSLEY INLET **BLACKJACK CREEK**

STOCK ORIGIN

The summer chum stocks in this region enter the south Puget Sound between the first week of August through the first week in September. Spawning usually begins around the first week of September and continues through October. This early run timing creates a temporal separation from the fall chum stocks spawning in the same area, allowing for reproductive isolation between the summer and fall stocks.

Summer chum have not been seen in Chambers Creek since 1983 when a total of three were seen in October. This is a special case, and will be addressed in more detail in the individual Stock Report. The following description pertains only to the remaining south Puget Sound summer chum stocks.

Puget Sound summer chum were separated into three stocks based on two criteria: (1) geographical separation of the spawning grounds, and (2) genetic distinction.

Blackjack Creek empties into Sinclair Inlet on the east side of the Kitsap Peninsula. The distance from the spawning area in Blackjack Creek and the other two south Puget Sound summer stocks strongly suggests a geographic separation between the stocks. Additionally, electrophoretic studies conducted on the Blackjack summer chum shows them to be a unique stock of fish. These two criteria indicate that the Blackjack Creek summer chum are a separate stock of fish.

Blackjack Creek summer chum depend on wild spawning for production. Hatchery introductions have occurred in the area but are directed at fall stocks with distinctly different run timing so they have not affected the origin of the stock. Accordingly, Blackjack summer chum were identified as a native stock with a high level of certainty.

The spawning areas of Hammersley Inlet and Case Inlet summer chum are located in small streams near the terminus of the respective inlets. The distance between the spawning tributaries creates a geographic separation between chum spawning in each inlet as well as the Blackjack Creek summer chum stock. Results from electrophoretic studies show that both of these stocks are distinct from other Puget Sound chum stocks.

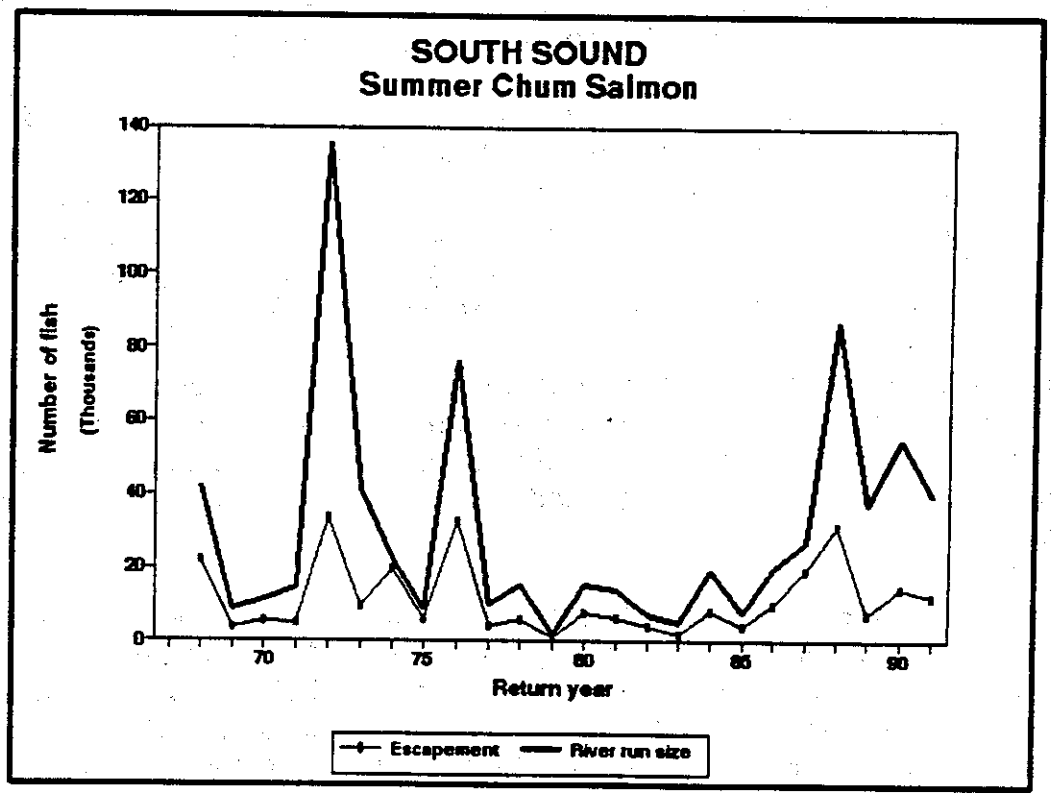
Hammersley Inlet and Case Inlet summer chum stocks were complemented with artificial production from Johns Creek and Coulter Creek hatcheries respectively. These programs used their respective native fish as brood stock. The programs were discontinued in 1992. These fish were identified as native chum stocks.

Electrophoretic studies showed that both Hammersley Inlet and Case Inlet summer chum were distinct stocks of fish.

STOCK STATUS

Puget Sound Summer chum stocks are not targeted in any directed commercial chum fishery. However, they are taken incidentally in other fisheries from the Strait of Juan de Fuca to the terminal areas and are especially heavily impacted by mid-Sound coho net fisheries. As a group, escapement levels have been fairly stable but the wild escapement goals are seldom met. This stock needs to be closely monitored due to the shift from hatchery to natural production.

Run-size and escapement data are shown in the figure below. Escapement data give a good representation of the number of wild spawners on the spawning grounds. Different escapement goals are used for even- and odd-year returns but are not plotted on the graph. The even-year and odd-year wild escapement goals are 32,000 and 9,300 respectively. Run-size data reflect the number of returning south Puget Sound summer chum as they enter Washington waters. The difference between the run size and escapement represents the harvest within Washington waters.



More information on individual stocks is presented in the Stock Reports which follow.

SOUTH SOUND -- CHAMBERS CREEK SUMMER CHUM

Until the SASSI screening process began, any chum returning to Chambers Creek prior to December 10 was considered a fall chum. However, a review of the Chambers Creek hatchery rack data shows that historically there were two native stocks in Chambers Creek, a winter and a summer stock. November-timed fish (hatchery-origin) began showing up in the late 1970s and early 1980s and make up the Chambers Creek "fall" stock, which included the then unrecognized summer chum stock. Although the winter chum run remains healthy, the Chambers Creek summer chum are the only Washington salmon stock that fits the criterion of an extinct stock. The following description of the stock refers to conditions when the summer chum were present.

STOCK DEFINITION AND ORIGIN

The Chambers Creek summer chum were identified as a stock because they were isolated from other Puget Sound chum stocks by geographic separation and run timing differences. Chambers Creek is the only tributary entering just south, and on the east side of the "Narrows" of south Puget Sound and the distribution of the spawning ground is geographically separated from other Puget Sound chum stocks. The Chambers Creek summer stock first entered the creek around the third week in September. Peak counts occurred around the third week of October. This river entry timing is more than two months earlier than the Chambers Creek winter chum run timing, showing clear temporal difference between the summer and winter stocks.

Hood Canal hatchery chum were introduced in Chambers Creek in 1974 and again from 1976 through 1979. Thousands of pounds of fed-fry were released into the system and resulted in small returns for a short period of time. The spawning run timing of the hatchery releases was similar to that of many fall stocks (November-December) and resulted in the grouping of all non-winter chum (i.e. chum returning prior to December 10) as a Chambers Creek fall stock. By default, the native summer chum were included in this group. November chum have not been seen in Chambers Creek since 1986.

Weir counts from the mid-1970s clearly show a group of chum returning with the timing of a summer chum stock (September-October) rather than a fall stock. These fish were assumed to be a native summer stock because no stocking efforts were made in Chambers Creek prior to this time.

STOCK STATUS

This stock is Extinct.

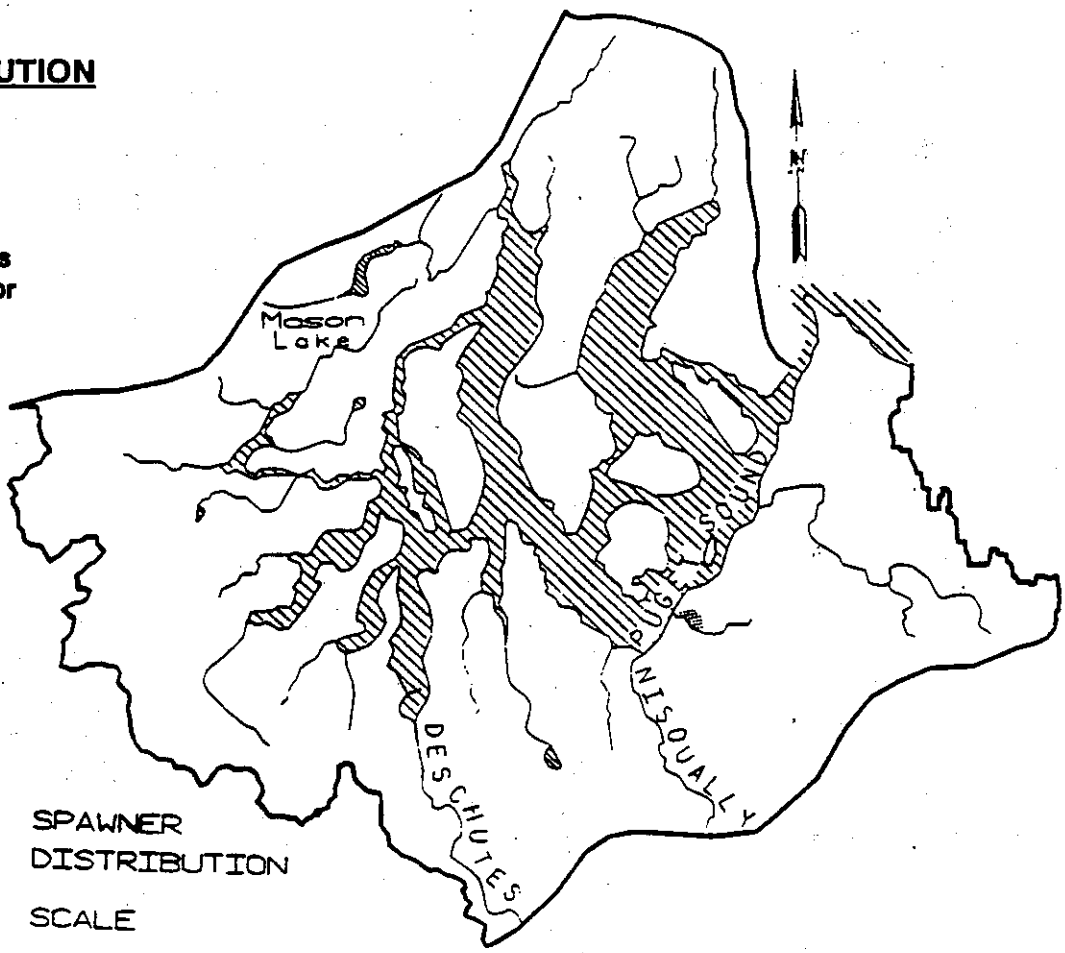
The Garrison Springs hatchery rack is located near the confluence at Chambers Bay. Cumulative counts from this rack provides a good picture of Chambers Creek chum returns from 1975 to 1991. The last time the summer chum were seen in the Chambers Creek was October 1983, when a total of three were seen.

STOCK DEFINITION PROFILE for Chambers Creek Summer Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**

The historic distribution is shown and was distinct for this stock.



SPAWNER DISTRIBUTION

15 Miles SCALE

TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													UNK
RIVER ENTRY										▬	▬		YES
SPAWNING										▬	▬		YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

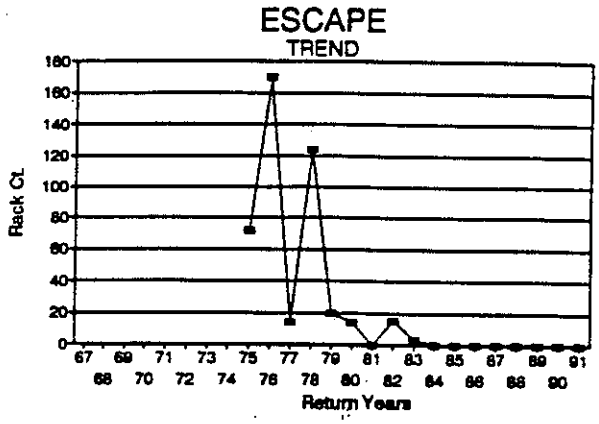
GENETICS - Data not available.

STOCK STATUS PROFILE for Chambers Creek Summer Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Rack Ct.			
67				
68				
69				
70				
71				
72				
73				
74				
75	72			
76	170			
77	14			
78	124			
79	20			
80	14			
81	0			
82	15			
83	3			
84	0			
85	0			
86	0			
87	0			
88	0			
89	0			
90	0			
91	0			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing

STOCK STATUS
Extinct

SCREENING CRITERIA

SOUTH SOUND -- HAMMERSLEY INLET SUMMER CHUM

STOCK DEFINITION AND ORIGIN

The Hammersley Inlet summer chum were identified as stock because they are separated from other Puget Sound stocks by geographic and temporal separation and can be distinguished by a genetic characteristic. Hammersley Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow fingers that branch off the rest of South Sound and are fed by independent tributaries located near their termini. The distances among the spawning tributaries creates a geographic separation among chum stocks in each inlet as well as the rest of the Puget Sound.

The Johns Creek Hatchery was used to supplement the wild spawning in Hammersley Inlet and was a major contributor to the stock. This supplemental project was discontinued in October of 1992. Abundance of summer chum in other streams that depend primarily on natural escapement is relatively low, but significant production still occurs in both Cranberry and Deer creeks. Spawning occurs from September to late October. This early spawning season creates a temporal separation from the Hammersley Inlet fall stock. Furthermore genetic stock identification studies show that the Hammersley summer stock is a unique stock of chum.

The hatchery used the native Johns Creek summer stock as its brood stock source, so the existing fish may be considered a native stock.

STOCK STATUS

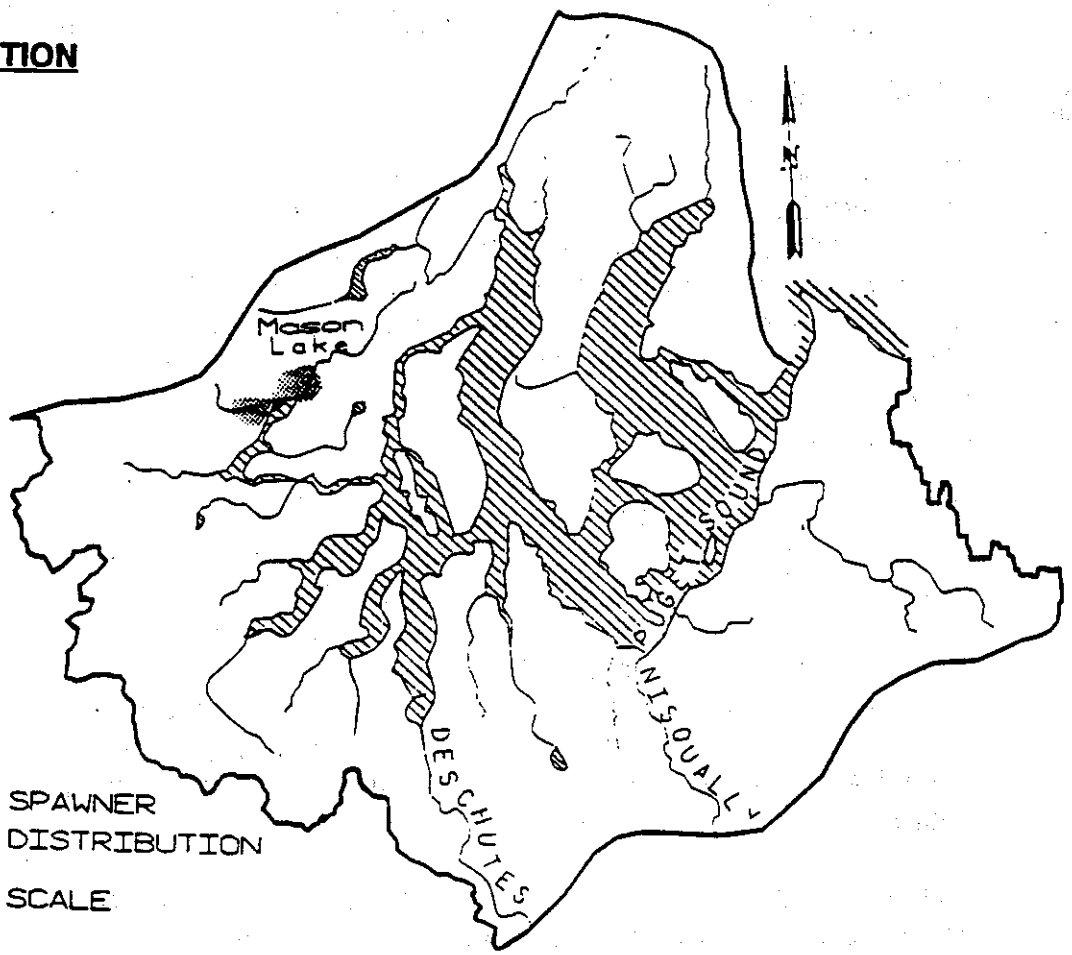
The status of this stock is Healthy at present.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 150 to 10,000. There is no directed net fishery on this stock, however, these fish are impacted by mid-Sound coho net fisheries. Wild spawning escapements dropped in 1977 when the hatchery rack was installed in Johns Creek. Escapements remained low because spawners were taken for hatchery brood stock from 1977 through 1981. Offspring from the brood stock program were released into Johns Creek. Subsequent increases in run size may have been the result of the brood stock and release program. Now that hatchery support has been removed, the run size may decline and needs to be closely monitored.

STOCK DEFINITION PROFILE for Hammersley Inlet Summer Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



SPAWNER DISTRIBUTION

15 Miles SCALE

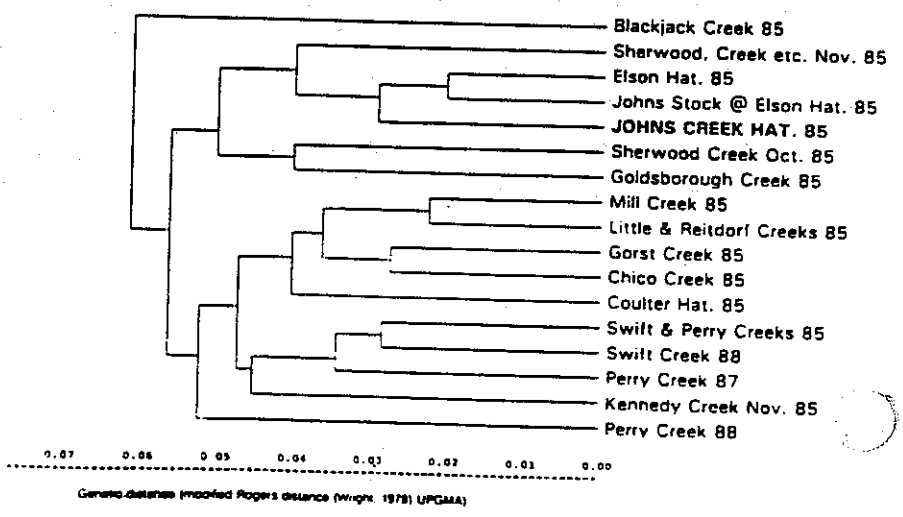
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬				NO
RIVER ENTRY									▬	▬			NO
SPAWNING									▬	▬	▬		YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Analysis of a 1985 collection (N=100) from Johns Creek Hatchery indicated that these fish are significantly different from all other chum collections (21-locus G-tests: $p<0.05$).

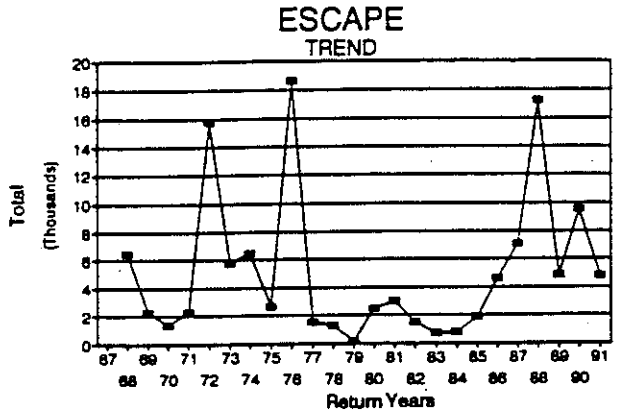


STOCK STATUS PROFILE for Hammersley Inlet Summer Chum

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Total			
67				
68	6490			
69	2303			
70	1398			
71	2290			
72	15747			
73	5799			
74	6509			
75	2633			
76	18662			
77	1554			
78	1274			
79	149			
80	2464			
81	3053			
82	1513			
83	732			
84	817			
85	1862			
86	4597			
87	7092			
88	17273			
89	4864			
90	9582			
91	4828			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN

Native

PRODUCTION TYPE

Composite

STOCK DISTINCTION

Distribution, Timing, Genetics

STOCK STATUS

Healthy

SCREENING CRITERIA

SOUTH SOUND -- CASE INLET SUMMER CHUM

STOCK DEFINITION AND ORIGIN

Case Inlet summer chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic and temporal separation and are genetically distinct. Case Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow bodies of water that branch off the rest of South Sound and are fed by independent tributaries located near their termini. The distances between the spawning tributaries creates a geographic separation between chum spawning in each inlet as well as the rest of the Puget Sound. Most of the production comes from Coulter and Sherwood creeks. The Coulter Creek Hatchery was used to supplement the wild spawning in Case Inlet. This supplementation was a major contributor to the run and complemented a large wild escapement into Coulter Creek. The supplementation project was discontinued in 1992. Escapement in Sherwood Creek depends primarily on natural escapement which has been stable over the last 20 years. There may be straying from Sherwood Creek into Coulter Creek. Spawning occurs from September to late October. This early run timing creates a temporal separation from the Case Inlet fall stocks. Genetic stock identification studies on Coulter Creek chum show them to be a unique stock of fish.

The Coulter Creek Hatchery uses the native Coulter Creek summer chum as its brood stock source so the existing fish are still considered to be a native stock.

STOCK STATUS

Currently, the status of this stock is Healthy.

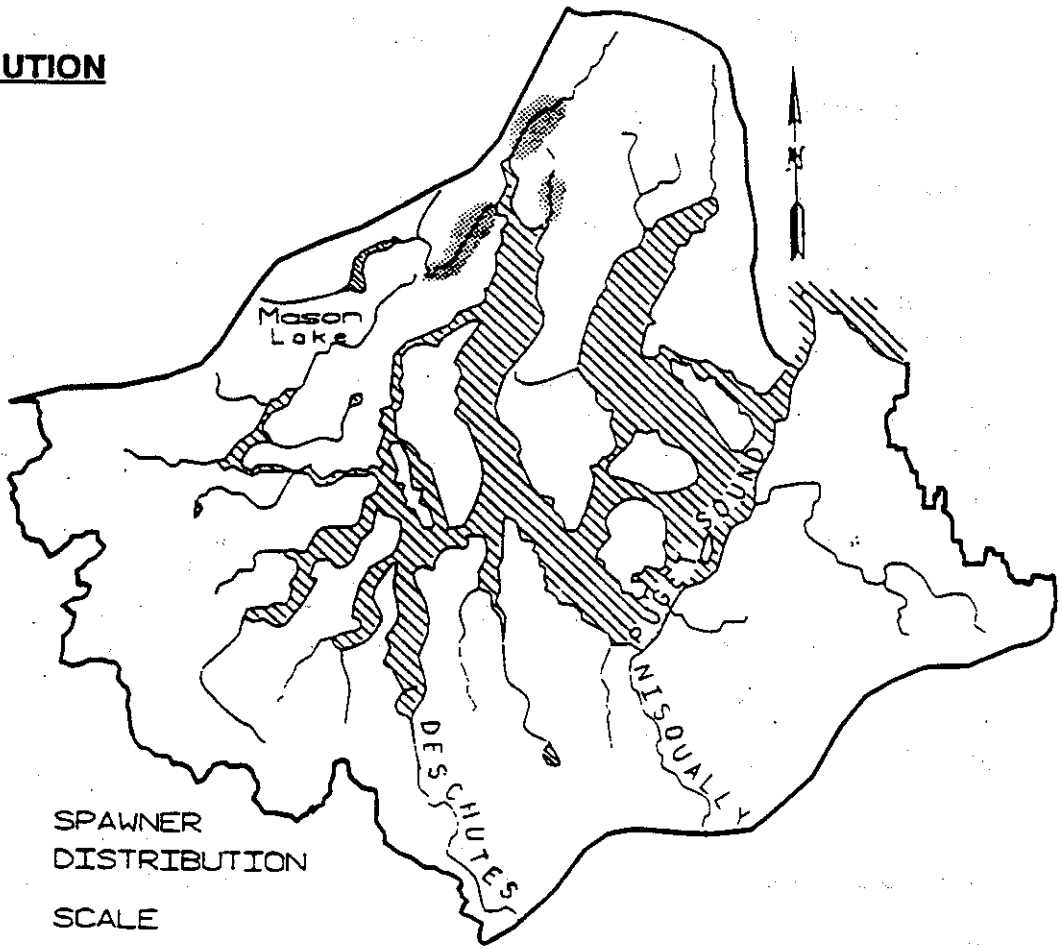
Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 400 to 10,000. Escapement levels are stable. Now that hatchery support has been removed, the run size may decline and needs to be closely monitored.

There is no directed net fishery on this stock, however, these fish are impacted by mid-Sound coho net fisheries.

STOCK DEFINITION PROFILE for Case Inlet Summer Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



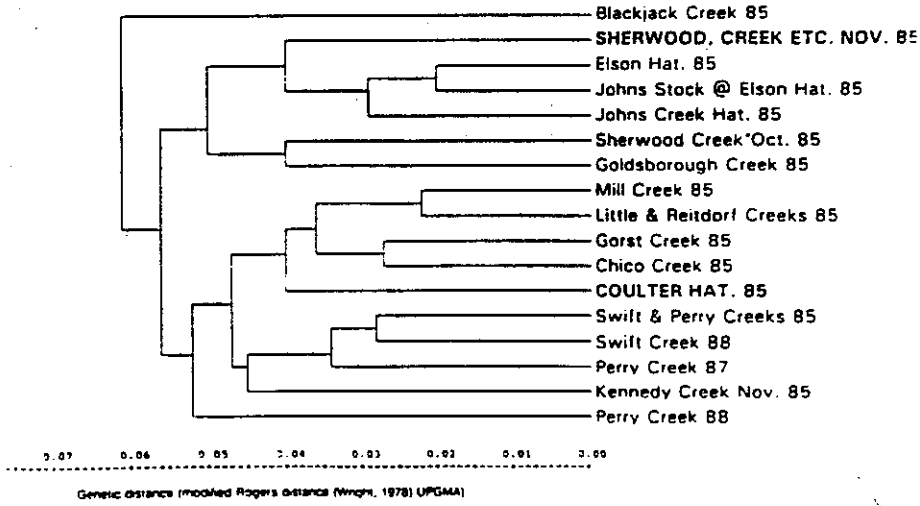
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬				NO
RIVER ENTRY										▬			NO
SPAWNING										▬	▬		YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Analysis of two 1985 GSI collections (N = 100) from Sherwood Creek and Coulter Creek Hatchery indicated that these two collections were significantly different from all other chum collections. In addition, they were significantly different from each other (21-locus G-tests: $p < 0.05$).

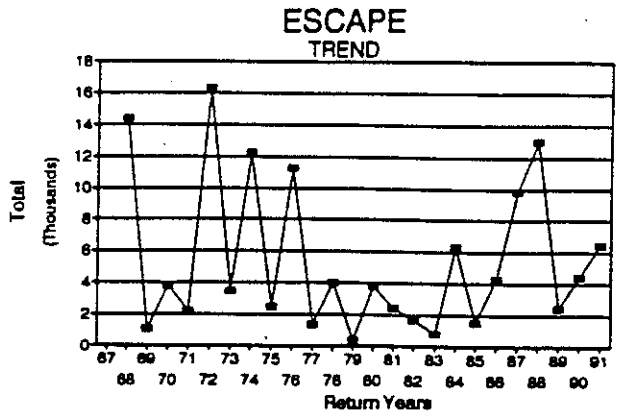


STOCK STATUS PROFILE for Case Inlet Summer Chum

STOCK ASSESSMENT

DATA QUALITY——> Good

Return Years	ESCAPE Total			
67				
68	14379			
69	1030			
70	3801			
71	2218			
72	16342			
73	3469			
74	12232			
75	2467			
76	11294			
77	1367			
78	4012			
79	357			
80	3800			
81	2410			
82	1676			
83	780			
84	6332			
85	1508			
86	4310			
87	9857			
88	13024			
89	2414			
90	4433			
91	6436			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN

Native

PRODUCTION TYPE

Composite

STOCK DISTINCTION

Distribution, Timing, Genetics

STOCK STATUS

Healthy

SCREENING CRITERIA

SOUTH SOUND -- BLACKJACK CREEK SUMMER CHUM

STOCK DEFINITION AND ORIGIN

Blackjack Creek summer chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic and temporal separation and have distinct genetic characteristics. Blackjack Creek is located in the end of Sinclair Inlet. This inlet is a long narrow finger that branches off the South Sound creating a geographic separation from the rest of the Puget Sound. Blackjack summer chum spawn during October creating a temporal separation from the other area fall chum stocks. In fact, it is the only known summer chum returning to the mid-Sound area. Genetic stock identification studies clearly show these fish to be a unique stock.

Some hatchery introductions have been made in the area but are directed at fall stocks with distinctly differently run timing, so they have not affected the composition of the native stock. Wild escapement in Blackjack Creek is the sole producer of this native stock.

STOCK STATUS

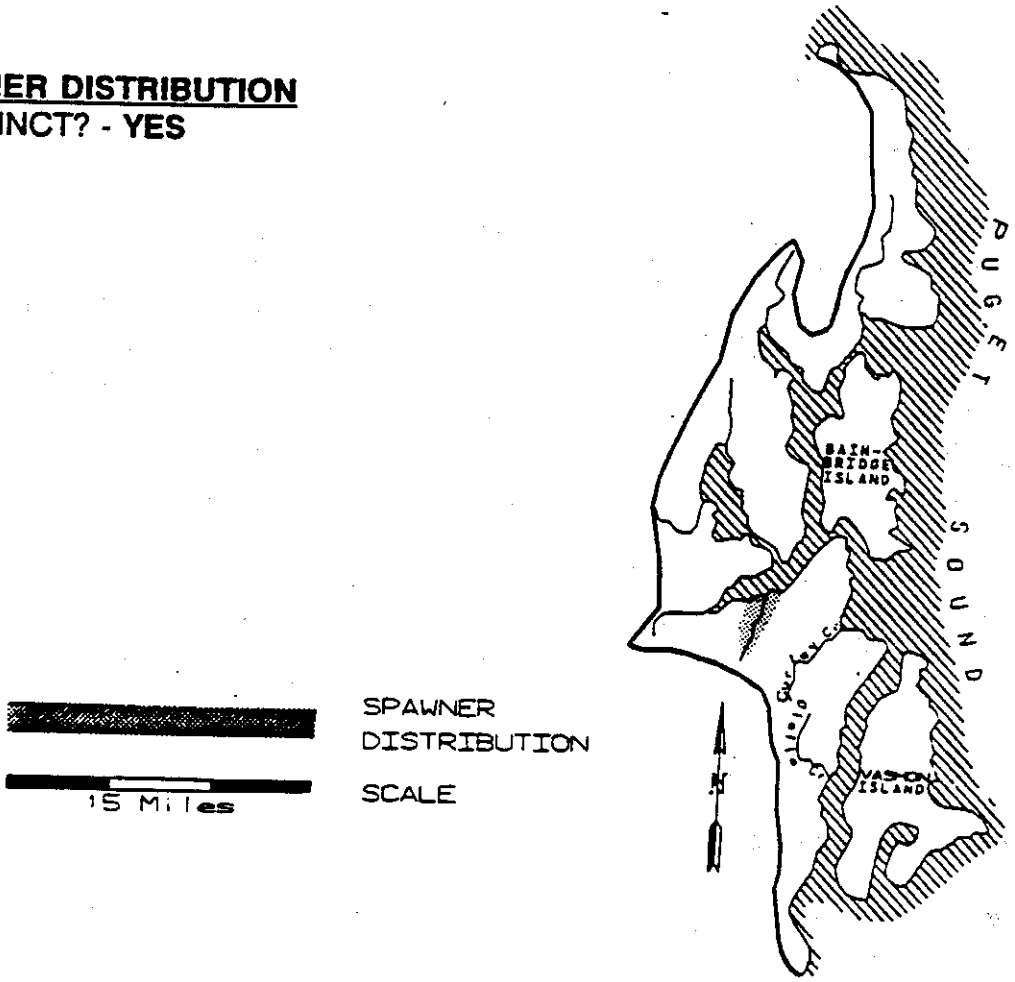
The status of this stock is Healthy.

Estimates of total run size entering Washington waters are available from 1968 and range from 188 to nearly 5,000. Most recent run sizes are around 2,000. Escapement estimates, derived from spawning ground surveys, are determined using primarily the escapement index method and in some cases peak counts. Escapement estimates are available from 1968 to the present and range from 100 to 2,800. A record low escapement of 146 summer chum was observed in 1989, but escapement increased in the following two years to 570 and 918 respectively.

STOCK DEFINITION PROFILE for Blackjack Creek Summer Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



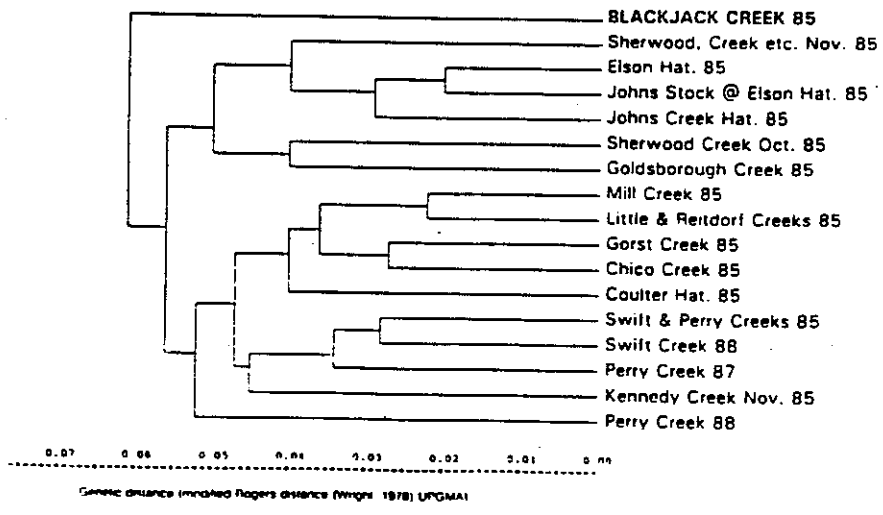
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													NO
RIVER ENTRY													NO
SPAWNING													YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? -**YES**

GENETICS - Analysis of a 1985 GSI collection (N=100) indicated that this collection was significantly different from all other chum collections (21-locus G-tests: $p<0.05$).

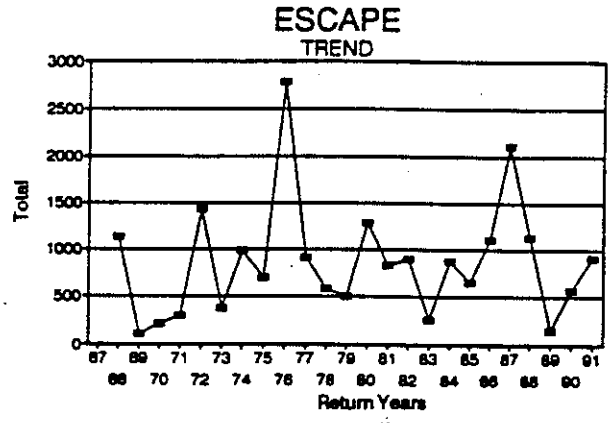


STOCK STATUS PROFILE for Blackjack Creek Summer Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67				
68	1139			
69	106			
70	211			
71	300			
72	1433			
73	376			
74	989			
75	703			
76	2787			
77	914			
78	589			
79	500			
80	1291			
81	831			
82	900			
83	258			
84	884			
85	651			
86	1112			
87	2109			
88	1136			
89	146			
90	570			
91	918			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing, Genetics

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND FALL CHUM STOCKS

HENDERSON INLET
ELD INLET
TOTTEN INLET
SKOOKUM INLET
UPPER SKOOKUM CREEK
JOHNS/MILL CREEKS
GOLDSBOROUGH/SHELTON CREEKS
CASE INLET
CARR INLET

STOCK DEFINITION AND ORIGIN

Fall chum in this region enter the terminal area between the first week in October and the first week in January. Spawning begins about the third week in October and may continue through January. This long duration is a result of run-timing differences among the nine fall chum stocks in the area.

Fall chum spawning in this region are isolated from other Puget Sound chum stocks through geographic separation and, to some degree, run-timing differences. Some stocks show genetic differences as well.

South Puget Sound fall chum were separated into nine stocks based primarily on geographic separation of the spawning grounds. However, in some cases run-timing differences were large enough to consider separation of stocks. About half of the stocks were shown to be genetically distinct.

The following stocks were identified as separate stocks with a high level of certainty because not only are their spawning grounds geographically separated, but also because they were found to be genetically distinct through electrophoretic analysis.

Totten Inlet Fall Chum
Eld Inlet Fall Chum
Goldsborough/Shelton chum
Case Inlet Fall chum

The following stocks were identified as separate stocks with a moderate level of certainty because their separation was based solely on geographic distribution of their spawning grounds. The geographic separation among Carr Inlet, Johns/Mill creeks and the Skookum area is considered sufficient to separate the stocks.

Carr Inlet fall chum
Johns/Mill creek fall chum
Henderson Inlet fall chum
Skookum Inlet Fall chum
Upper Skookum Creek chum

The distance between the spawning areas of the Skookum Inlet stock and the upper Skookum Creek stock leaves some uncertainty as to whether they are separate stocks. However, there is some evidence that the Skookum Creek stock may be native fish, while the Skookum Inlet stock is a mixed stock. Genetic analysis of these stocks should be conducted.

The following stocks were identified as being of native origin either because impacts from hatchery plants have not had significant genetic impacts on the native populations, demonstrated by genetic analysis, or because hatchery plants have not occurred in the natal streams. In all cases production depends on wild spawning.

Eld Inlet chum	Totten Inlet chum	
Upper Skookum Creek	Goldsborough/Shelton	Case Inlet chum

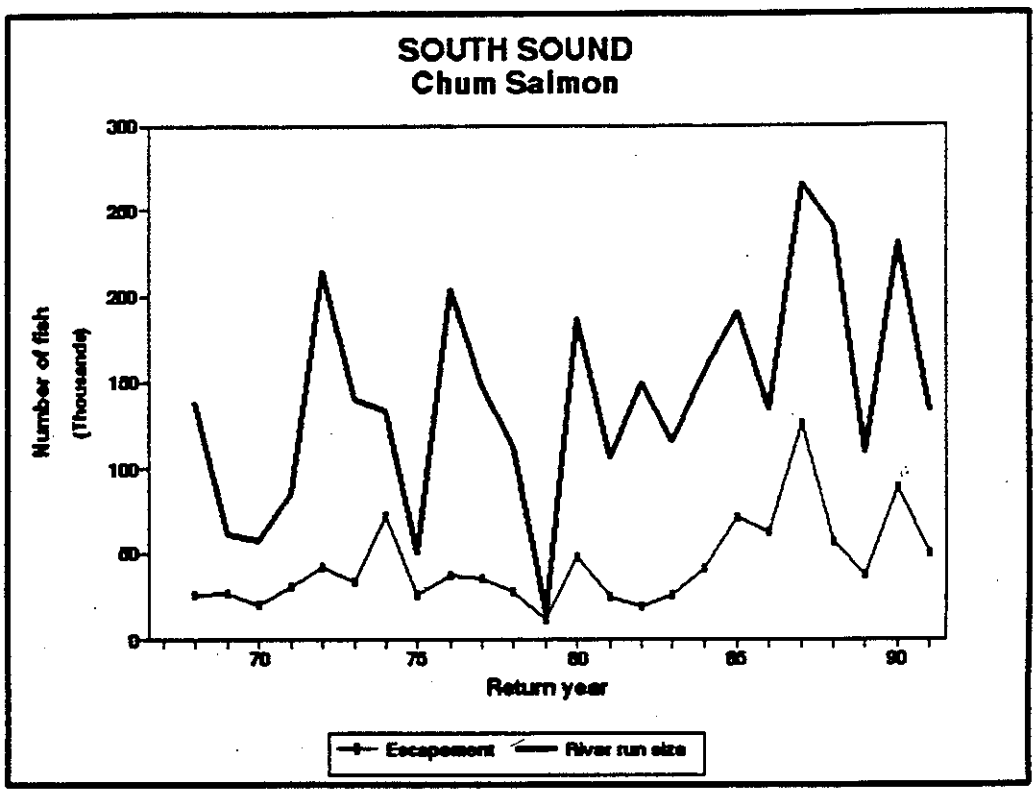
The Elson Creek hatchery chum were developed from a mixture of a local stock (Elson Creek), and Johns Creek fall chum. Releases from the Elson Creek Hatchery have been made into the streams of Skookum Inlet, Cranberry Creek and Budd Inlet tributaries. Accordingly, these stocks are classified as a mixed stocks with native influence.

Hatchery releases from Minter Creek Hatchery (Hood Canal-origin) have been made in most of the streams in Carr Inlet, so the Carr Inlet stock has been described as a mixed stock of native and non-native fish. The Hood Canal-origin stock at the Minter Creek Hatchery has been replaced with Elson Creek hatchery stock.

STOCK STATUS

Fall chum from the south Puget Sound region contribute to the commercial fishery in Puget Sound from the Strait of Juan de Fuca to the individual inlets. As a group, the south Puget Sound fall chum escapements have exceeded their escapement goals in six out of the last seven years and exhibit an increasing trend in escapement levels. The same positive trend is seen on a few individual stocks as well (Skookum, Eld, Totten and Case inlet stocks). Over the same time period, Hammersley Inlet fall chum escapement has been below escapement goal five out of the last seven years, while Carr Inlet chum have not met the escapement goal for seven years. However, there are fairly large numbers of spawners in all area streams.

Run-size and escapement data are shown in the figure below. Escapement data give a good representation of the number of spawners in the area. Different escapement goals are used for even and odd years but are not plotted on the graph. The total south Puget Sound even-year and odd-year escapement goals are 55,700 and 44,000 respectively. Run-size data reflect the number of returning south Puget Sound fall chum as they enter Washington waters. The difference between the run size and escapement represents the harvest within Washington waters.



More information on individual stocks is presented in the Stock Reports which follow.

SOUTH SOUND -- HENDERSON INLET FALL CHUM

STOCK DEFINITION AND ORIGIN

The Henderson Inlet fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic separation. Henderson Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow fingers that branch off the rest of South Sound and are fed by independent tributaries located at their termini. The distances among the spawning tributaries creates a geographic separation among the inlets as well as from the rest of the Puget Sound. The primary spawning tributaries in Henderson Inlet are Woodland and Woodard creeks.

Elson and Minter creek hatchery chum stocks have been planted in both Woodard and Woodland creeks so they could be described as mixed stock from a composite production, however Woodard Creek may still have remnant native run.

STOCK STATUS

The status of this stock is Unknown.

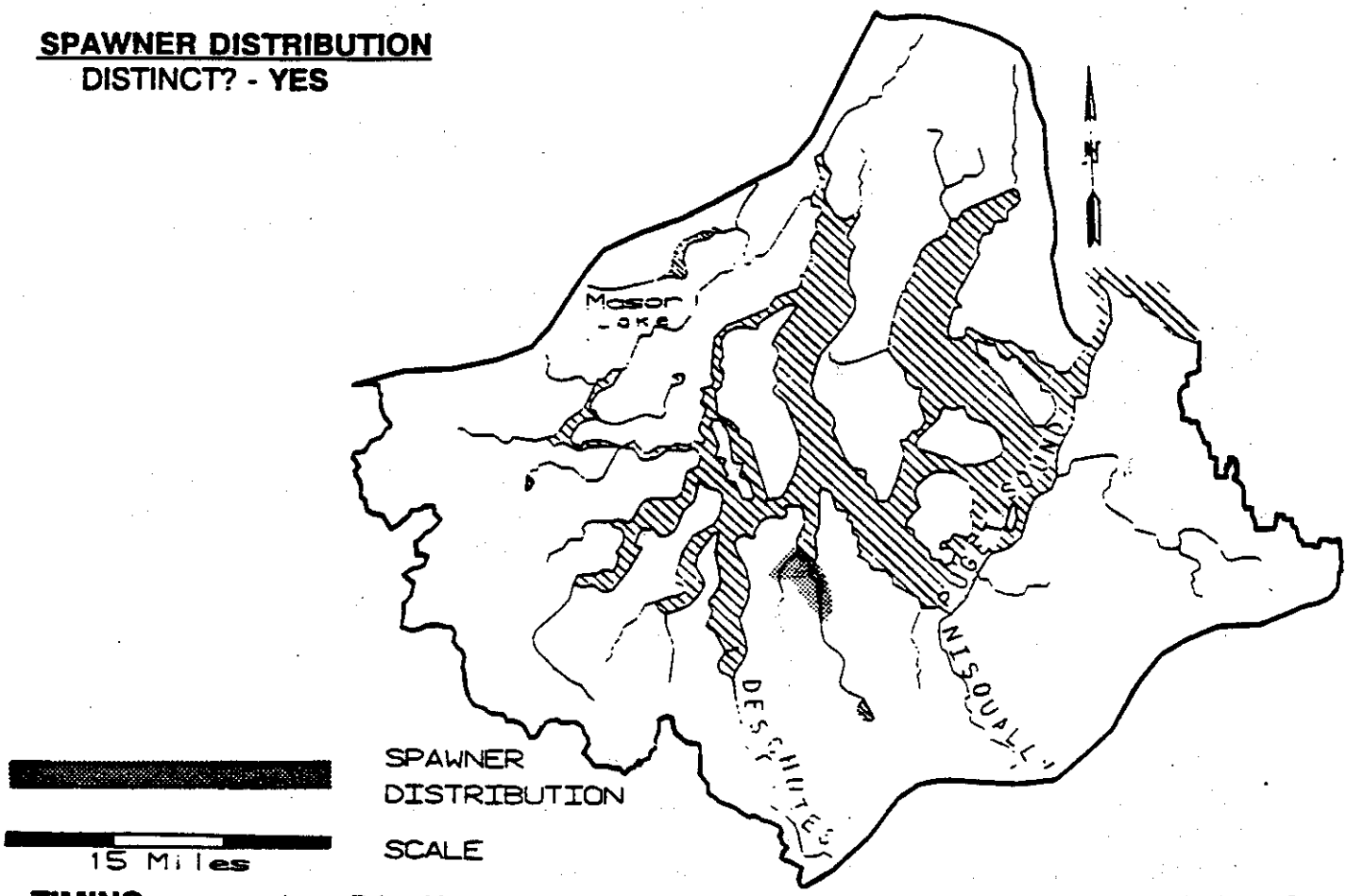
From the late 1950s through the 1960s, spawning of the native chum in Woodard Creek occurred throughout December, where several hundred chum could be observed on mid-December peak counts. In the 1970s, as chum escapement began to decline, the frequency of stream surveys declined as well. From 1980 through the present, only a few spawner surveys were conducted in either stream so the current escapement levels are unknown.

Severe habitat degradation due to development and alteration of flow regimes has impacted the productivity of salmonid species in this basin.

STOCK DEFINITION PROFILE for Henderson Inlet Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													UNK
RIVER ENTRY													UNK
SPAWNING												▬	UNK

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

GENETICS - No data available.

STOCK STATUS PROFILE for Henderson Inlet Fall Chum

STOCK ASSESSMENT

DATA QUALITY——> No Data

Brood Years	NO DATA			
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

SOUTH SOUND -- ELD INLET FALL CHUM

STOCK DEFINITION AND ORIGIN

The Eld Inlet fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic separation and are genetically distinct. Eld Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow fingers that branch off the rest of South Sound and are fed by independent tributaries located at their termini. The distances among the spawning tributaries creates a geographic separation among the inlets as well as from the rest of the Puget Sound. The primary spawning tributaries in Eld Inlet are McLane, Swift and Perry creeks. Spawning occurs late-November to early January, a relatively broad timing compared to most fall chum stocks but much later than the Puget Sound summer stocks.

Genetic stock identification studies show that the Eld Inlet fall stock is genetically distinct from other Puget Sound fall chum stocks.

Hatchery plants in McLane Creek using Hood Canal chum were made from 1976 through 1983, but it is not known whether these plants were successful. There are no records of chum plants in either Swift or Perry creeks so the stock should be considered a native stock.

STOCK STATUS

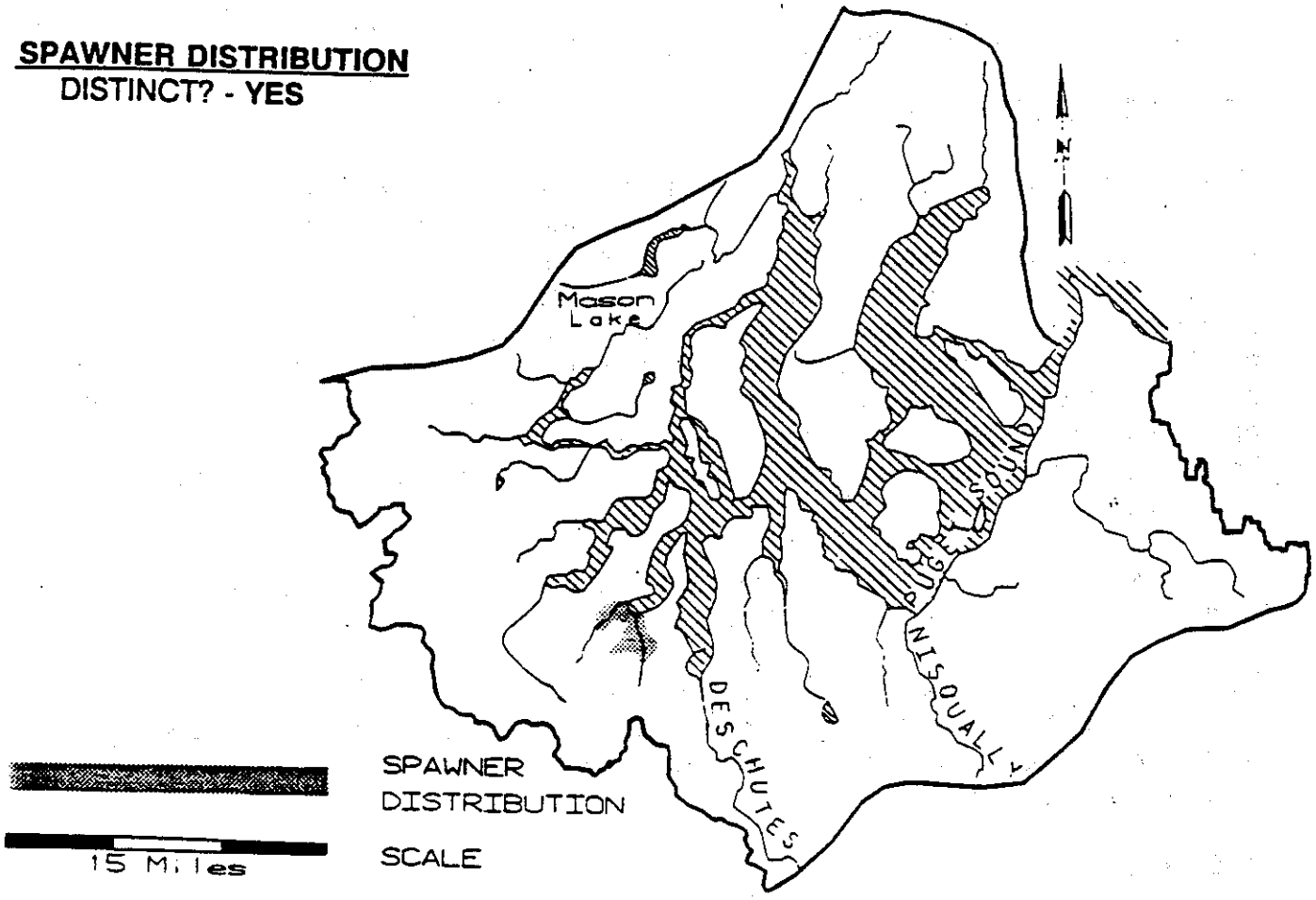
The status of this stock is Healthy.

Evaluation of the status of the stock is dependent on the spawner escapement levels. Escapement estimates are available since 1968 and range form 4,300 to 37,400. Based on escapement levels the stock abundance is stable and shows signs of increasing, probably due to fishery management and habitat improvement efforts.

STOCK DEFINITION PROFILE for Eld Inlet Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



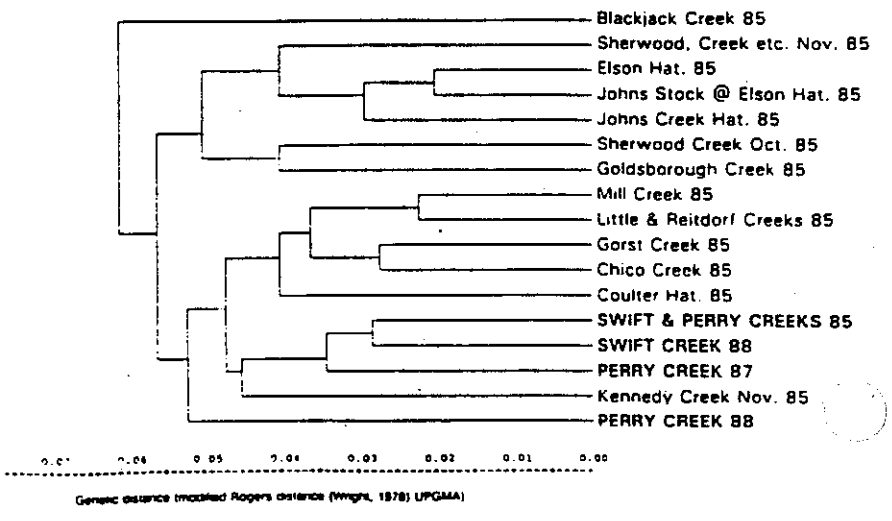
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN											▬		NO
RIVER ENTRY	▬											▬	NO
SPAWNING	▬											▬	NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Analysis of four GSI collections from Swift Creek [1985, (N=50); 1986, (N=50); 1987, (N=100); 1988, (N=50)] and five collections from Perry Creek [1985, (N=50); 1986, (N=50), 1987, (N=100); 1988, (N=50), 1991, (N=80)] indicated that these fish are genetically distinct from other fall-run stocks tested (21-locus G-tests: $p < 0.05$). Significant year-to-year variation was observed in the genetic profiles of Perry Creek, but not Swift Creek.

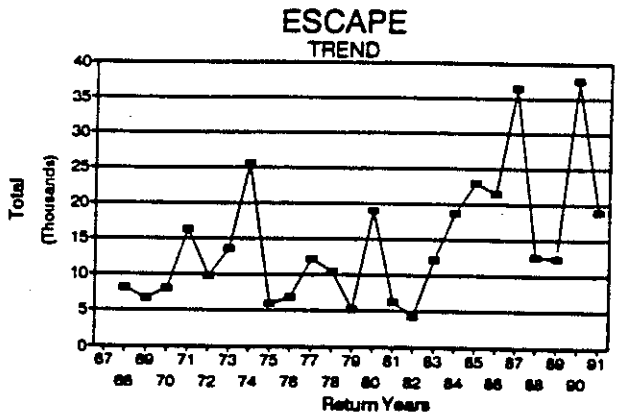


STOCK STATUS PROFILE for Eld Inlet Fall Chum

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Total			
67				
68	8208			
69	6676			
70	8078			
71	16322			
72	9859			
73	13602			
74	25621			
75	5947			
76	6876			
77	12198			
78	10432			
79	5270			
80	19080			
81	6352			
82	4356			
83	12208			
84	18691			
85	22881			
86	21517			
87	36424			
88	12661			
89	12395			
90	37567			
91	18966			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Genetics

STOCK STATUS
Healthy

SCREENING CRITERIA

SOUTH SOUND -- TOTTEN INLET FALL CHUM

STOCK DEFINITION AND ORIGIN

Totten Inlet fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic separation, run timing and genetic characteristics. Totten Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow fingers that branch off the rest of South Sound and are fed by independent tributaries located at their termini. The distances among the spawning tributaries creates a geographic separation among the inlets as well as from the rest of the Puget Sound.

Wild spawning of native fish in Kennedy Creek accounts for most of the production of Totten Inlet fall chum. These fish spawn during November with a peak by mid-November, early for fall chum. This unique run timing provides a temporal separation from the Skookum Creek stocks. Genetic stock identification studies indicate that the Kennedy Creek fall chum are a unique stock of fish.

The Kennedy Creek fall stock was subjected to a genetic marking program. Native fish with specific genotypes at two loci were selected, spawned and reared. Hatchery efforts were used to increase the proportion of these fish in the population for management purposes. Although this artificial selection pressure was placed on this stock, genetically marked Kennedy Creek chum are not considered significantly different from the unmarked form and are thus classified as a native fish stock.

STOCK STATUS

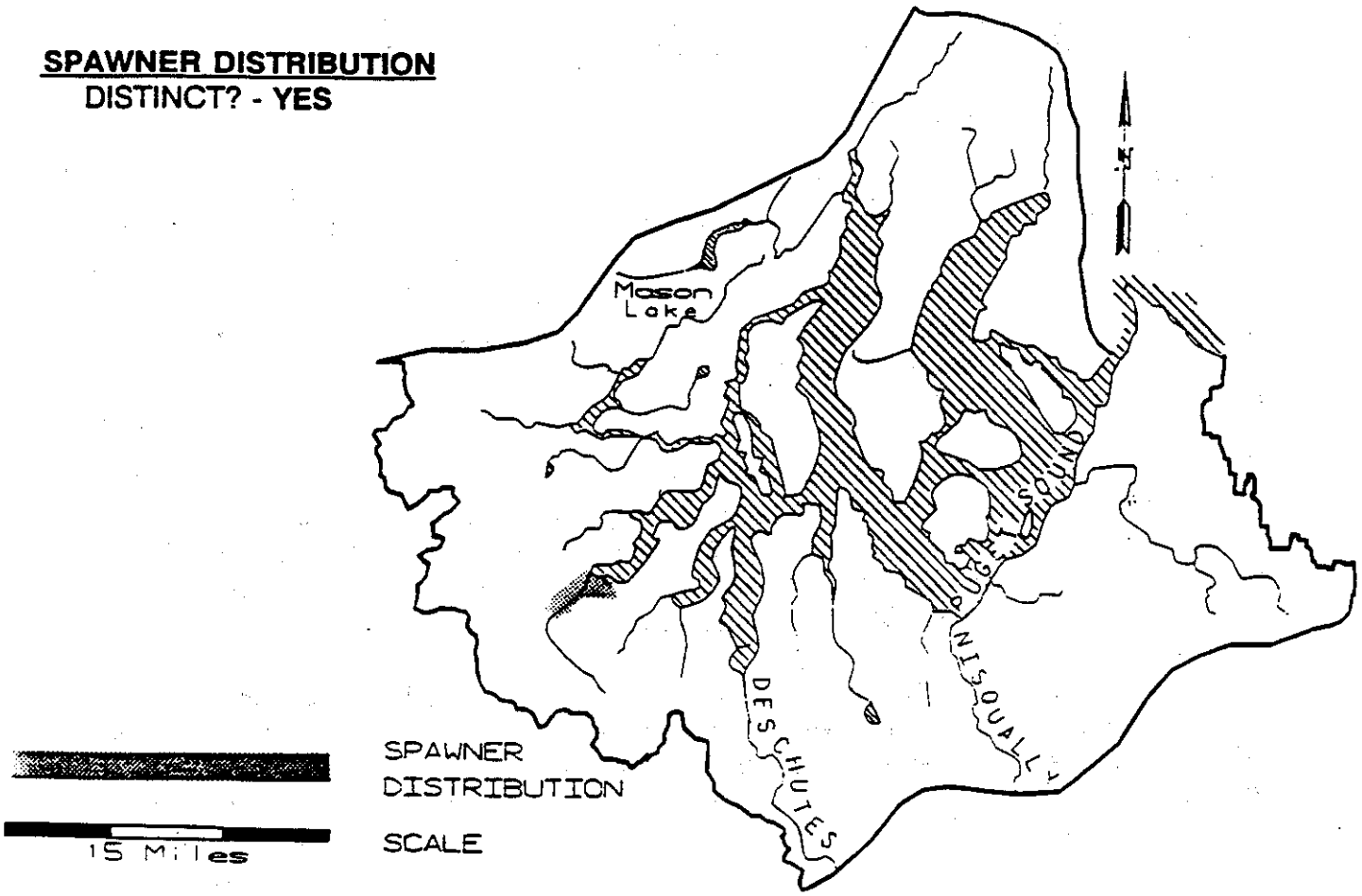
The status of this stock is Healthy.

Spawning ground survey data are available as far back as 1944. Escapement estimates, since 1968, range from 1,100 to 22,400. Escapement estimates are determined using spawning ground survey information and the escapement index method. Escapement levels declined in the late-1970s. A drop in wild escapement was observed from 1975 to 1984 following installation of a hatchery rack in Kennedy Creek. Brood stock were collected for use in a South Sound chum enhancement program. The program has been discontinued. However, primarily through management practices, the run has recovered and stabilized, averaging nearly 16,000 during the last eight years.

STOCK DEFINITION PROFILE for Totten Inlet Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



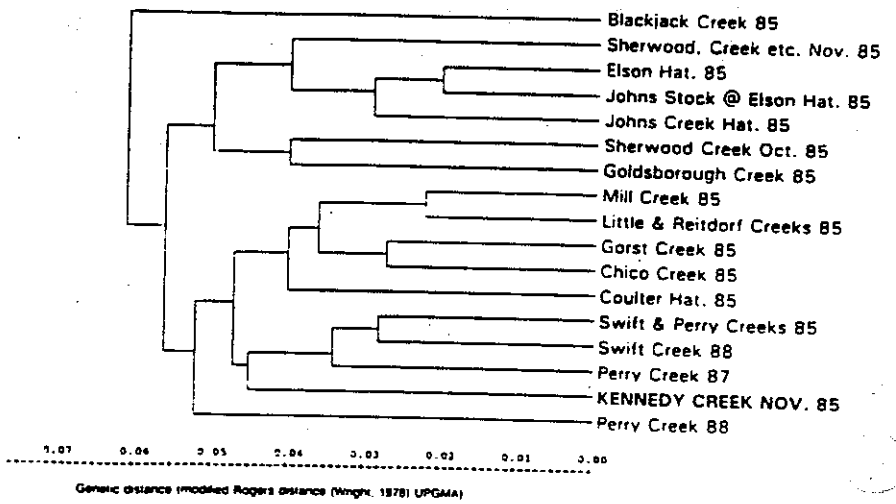
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN										▬			NO
RIVER ENTRY											▬		NO
SPAWNING											▬	▬	YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? -**YES**

GENETICS - Analysis of two collections [1985 (N=100); 1991, (N=100)] from Kennedy Creek indicated that these fish are genetically distinct from other fall-run stocks tested (21-locus G-tests: $p<0.05$). A genetic mark (intentional change of the allele frequency) at two loci was placed on this stock from 1975-1980 and still persists.

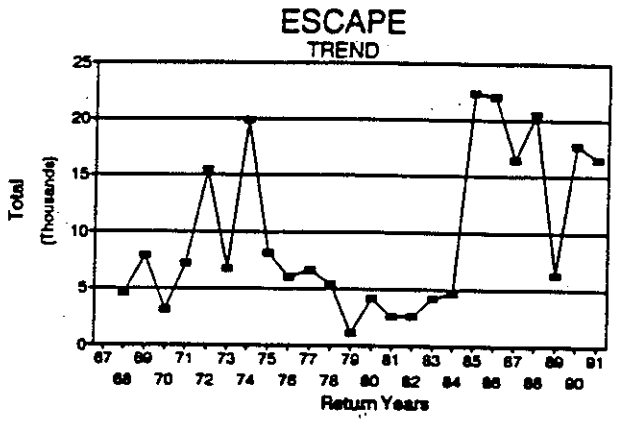


STOCK STATUS PROFILE for Totten Inlet Fall Chum

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Total			
67				
68	4585			
69	7905			
70	3171			
71	7264			
72	15448			
73	6762			
74	19819			
75	8177			
76	6035			
77	6667			
78	5420			
79	1141			
80	4160			
81	2606			
82	2632			
83	4210			
84	4704			
85	22411			
86	22095			
87	16433			
88	20483			
89	6316			
90	17736			
91	16493			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing, Genetics

STOCK STATUS
Healthy

SCREENING CRITERIA

SOUTH SOUND -- SKOOKUM INLET FALL CHUM

STOCK DEFINITION AND ORIGIN

Skookum Inlet fall chum are defined as a separate stock because they are isolated from other Puget Sound stocks by geographic distribution. This stock spawns in the lower portion and tributaries of Skookum Creek. The location of the spawning grounds of this stock is distinct from all other Puget Sound stocks with the exception of the Upper Skookum Creek stock which spawns in the upper portion of Skookum Creek. The proximity of the spawning grounds of the Skookum Inlet and the Upper Skookum Creek fall stocks suggests some overlap in spawning distribution between stocks.

Elson Creek Hatchery chum releases plus natural spawning in Little Creek and Reitdorf Creek account for most of the production of this stock. Genetic stock identification studies show that fall chum from lower Skookum Creek tributaries (Little and Reitdorf creeks) are closely related to the Elson Creek hatchery stock. Hatchery plants and straying from the Elson Creek facility may have affected the native population of Lower Skookum/Skookum Inlet fall chum creating a hybrid stock or replaced the native population with an introduced hatchery stock.

STOCK STATUS

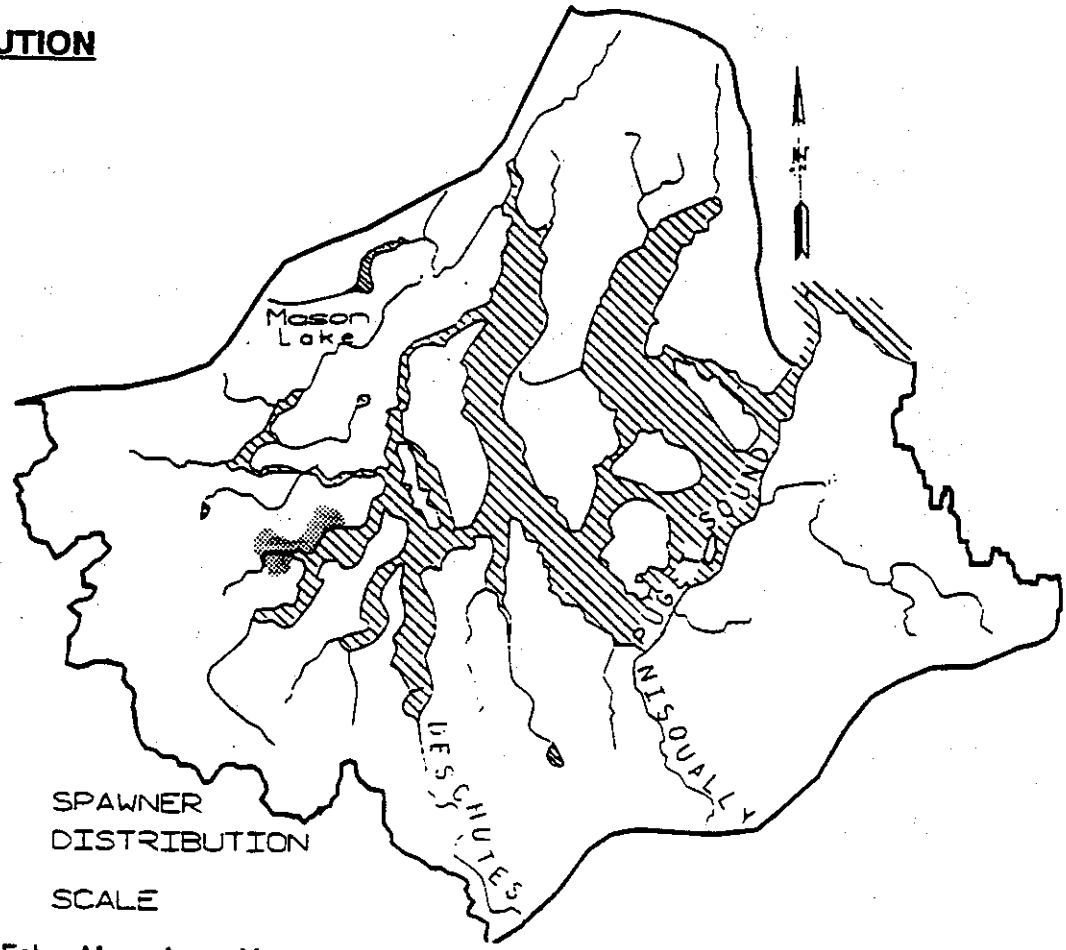
The status of the stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 100 to 6,700. Escapement levels have increased since 1979 reaching a record high in 1990.

STOCK DEFINITION PROFILE for Skookum Inlet Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



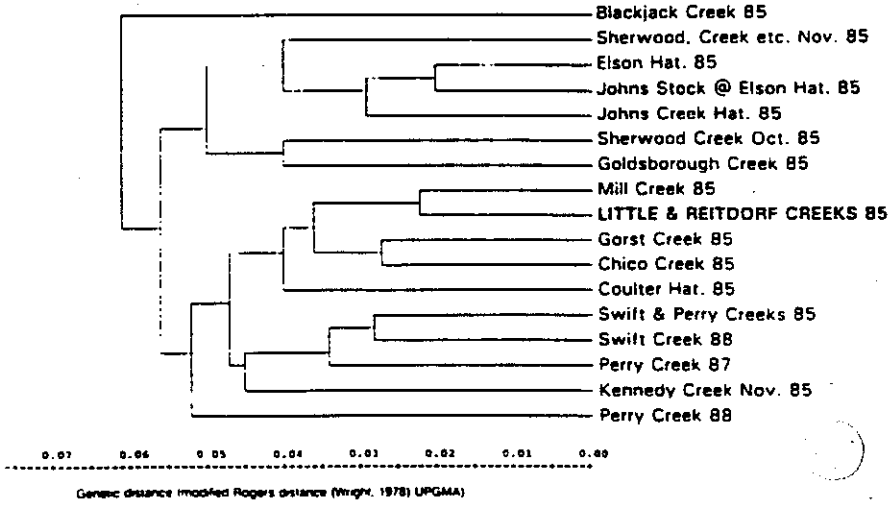
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN											▬	▬	NO
RIVER ENTRY											▬	▬	NO
SPAWNING	■										▬	▬	NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

GENETICS - Analysis of two GSI collections [Little Creek + Reitdorf Creek (N=101) and lower Skookum Creek, N=90] from 1985 indicated that these fish add to the significant genetic heterogeneity of Puget Sound chum. However, individual pairwise tests with other collections were not always significant (21-locus G-tests: $p > 0.1$ between Mill Creek, 1985, and Little Creek + Reitdorf Creek).

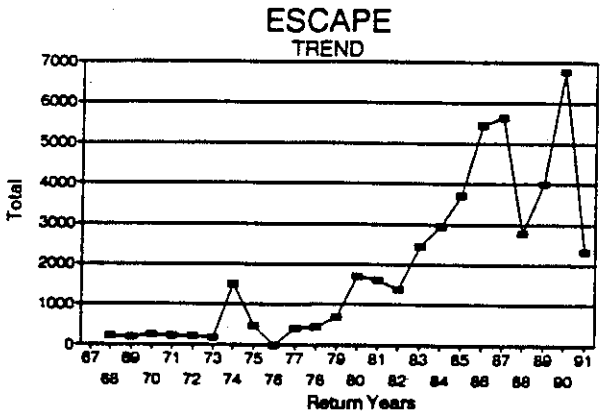


STOCK STATUS PROFILE for Skookum Inlet Fall Chum

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Total			
67				
68	217			
69	186			
70	253			
71	225			
72	221			
73	181			
74	1508			
75	475			
76	0			
77	399			
78	457			
79	682			
80	1713			
81	1594			
82	1379			
83	2439			
84	2953			
85	3716			
86	5449			
87	5643			
88	2779			
89	4010			
90	6783			
91	2339			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

SOUTH SOUND -- UPPER SKOOKUM CREEK FALL CHUM

STOCK DEFINITION AND ORIGIN

Upper Skookum Creek fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic distribution and run timing. Skookum Creek enters the extreme end of Skookum Inlet. Most of the spawning takes place between RM 6.0 and 8.0 in Skookum Creek. While the Upper Skookum Creek spawning area is geographically separated from other Puget Sound stocks, the proximity of the Skookum Inlet stock in lower Skookum Creek suggests an overlap in spawning distribution between the two stocks.

The timing of spawning is later than for the Totten Inlet fall stock, providing a temporal separation. Wild spawning in Skookum Creek accounts for most of the production for this stock. Historically, (prior to hatchery influences) the spawning run was characterized by two peaks, the first in December and a smaller second peak in January. This unique two-phase spawner season is still present today.

Hatchery plants and strays from the Elson Creek facility may have affected the earlier segment of the Skookum Creek native stock, but the later segment is believed to be primarily native stock.

STOCK STATUS

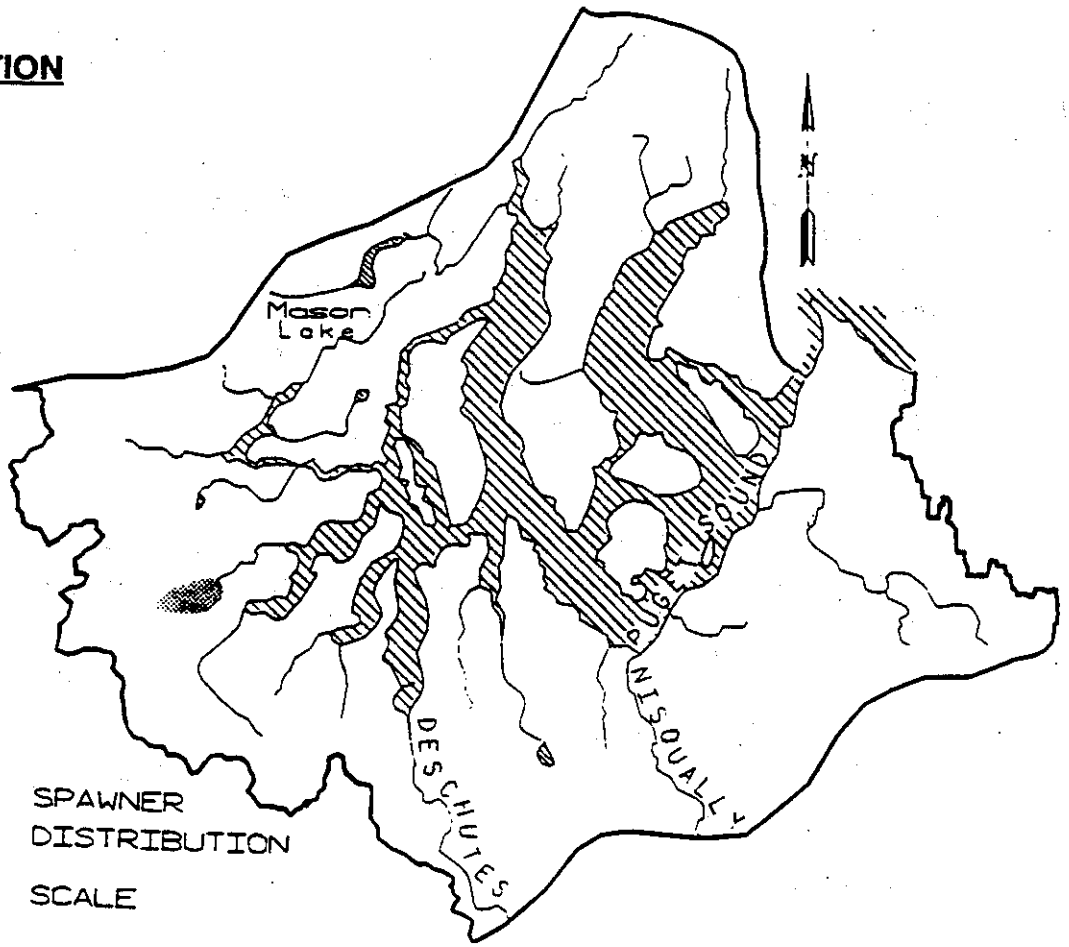
The status of this stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 200 to 4,400. The status of the stock is described as healthy, as indicated by an increasing escapement trend over the last eight years.

STOCK DEFINITION PROFILE for Upper Skookum Creek Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



SPAWNER DISTRIBUTION

15 Miles SCALE

TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN	▬												
RIVER ENTRY	▬										▬		NO
SPAWNING	▬										▬		NO
												▬	YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

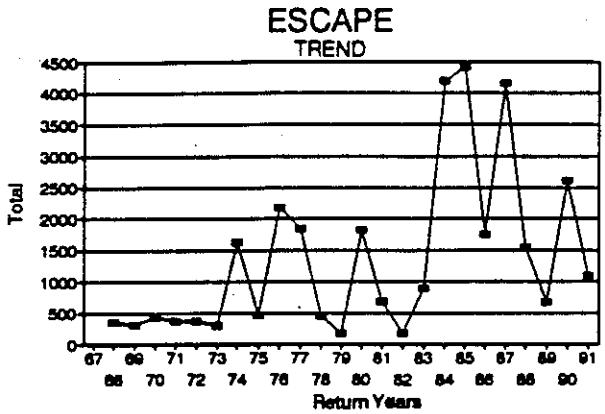
GENETICS - No GSI sampling of wild-spawning populations has occurred.

STOCK STATUS PROFILE for Upper Skookum Creek Fall Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67				
68	359			
69	307			
70	424			
71	371			
72	366			
73	300			
74	1628			
75	459			
76	2178			
77	1855			
78	450			
79	172			
80	1841			
81	688			
82	172			
83	903			
84	4198			
85	4414			
86	1759			
87	4152			
88	1555			
89	679			
90	2612			
91	1095			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing

STOCK STATUS
Healthy

SCREENING CRITERIA

SOUTH SOUND – JOHNS/MILL CREEKS FALL CHUM

STOCK DEFINITION AND ORIGIN

Hammersley Inlet fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic separation and to some degree a difference in run timing. Hammersley Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow fingers that branch off the rest of South Sound and are fed by independent tributaries located near their termini. The distances among the spawning streams creates a geographic separation among chum stocks of each inlet as well as from the rest of the Puget Sound.

Most of the production in this area comes from wild spawning in Johns and Mill creeks. Mill Creek's escapement depends primarily on wild spawning fish that have a narrower run timing (November-December spawner) than Johns Creek. Electrophoretic studies suggest that Mill Creek may have a remnant native run. However, because of the overlap between the run timing and their close geographic proximity they are being considered as the same stock. The Johns Creek chum have a broad spawner season from November to February with a peak in December. The broad spawner season suggests that the Johns Creek chum run may have components from introduced stocks.

At one point, the Hood Canal Hatchery stock was introduced into the system. Wipe-out fisheries were conducted in attempts to remove these fish but were not considered to be effective. Hatchery plants from Hood Canal and other facilities (Minter Creek) may have affected the genetic make-up of the native stock creating a mixed stock.

STOCK STATUS

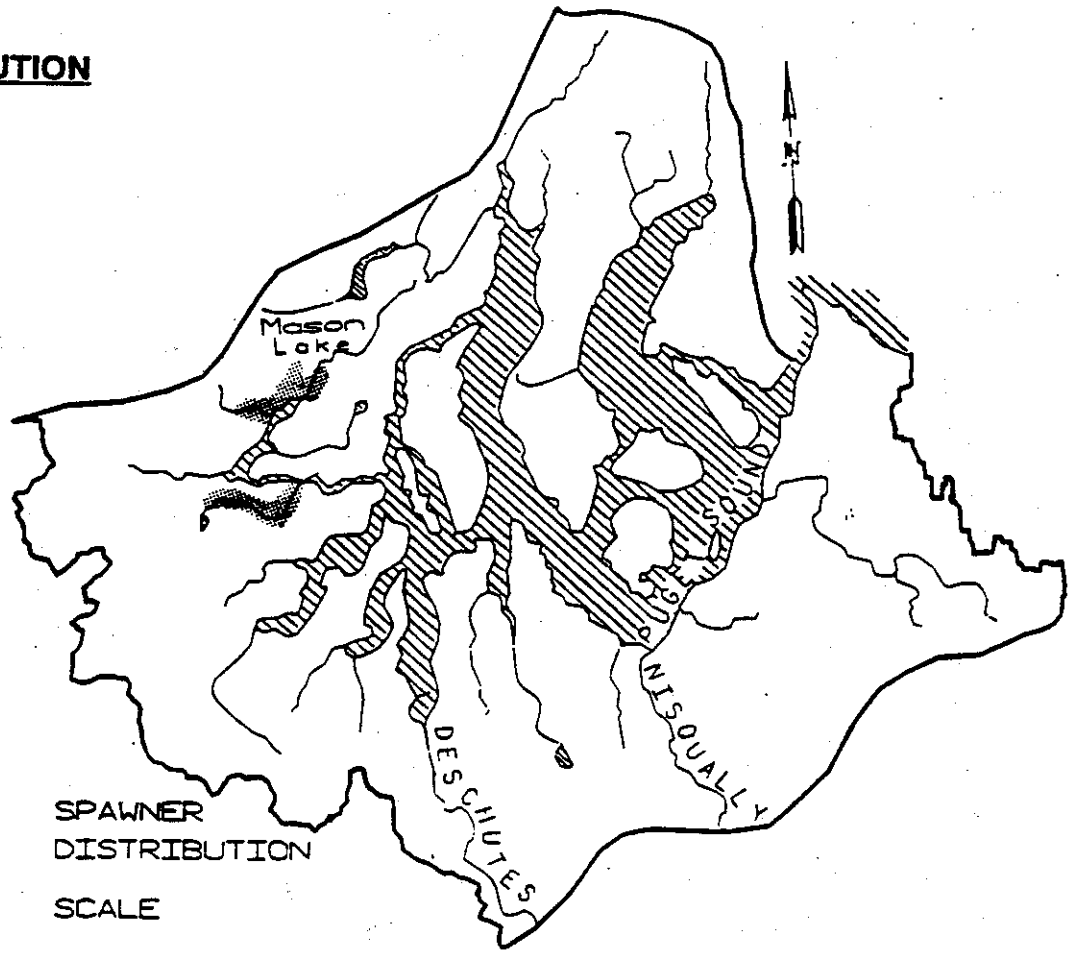
The status of the stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 3,000 to 40,000. With the exception of a record escapement (nearly 40,000) in 1987, escapement levels have been stable.

STOCK DEFINITION PROFILE for Johns/Mill Creeks Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



SPAWNER DISTRIBUTION

SCALE

15 Miles

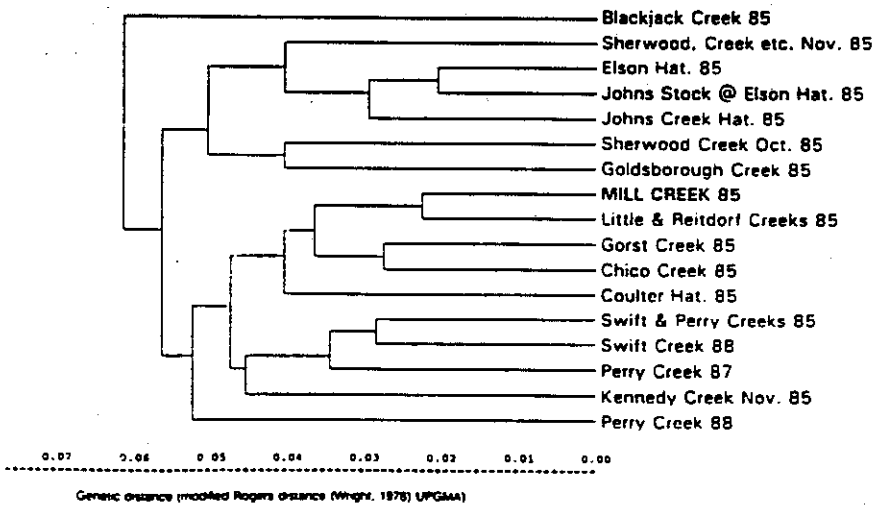
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN	■												
RIVER ENTRY	▬										▬		NO
SPAWNING	▬										▬		NO
											▬		YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

GENETICS - Analysis of two GSI samples [1985 (N=100) and 1991 (N=58)] indicates these fish add to the significant genetic heterogeneity of Puget Sound chum. However, individual pairwise tests with other collections were not always significant.

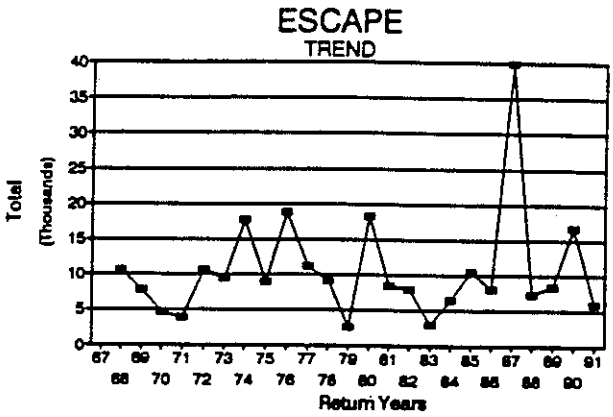


STOCK STATUS PROFILE for Johns/Mill Creeks Fall Chum

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Total			
67				
68	10595			
69	7840			
70	4652			
71	3863			
72	10592			
73	9474			
74	17727			
75	8989			
76	18820			
77	11256			
78	9107			
79	2644			
80	18373			
81	8504			
82	8030			
83	2993			
84	6480			
85	10564			
86	8115			
87	39856			
88	7301			
89	8444			
90	16767			
91	6035			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN

Mixed

PRODUCTION TYPE

Wild

STOCK DISTINCTION

Distribution, Timing

STOCK STATUS

Healthy

SCREENING CRITERIA

SOUTH SOUND -- GOLDSBOROUGH/SHELTON CREEKS FALL CHUM

STOCK DEFINITION AND ORIGIN

Hammersley Inlet fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic and temporal separation and are genetically distinct. Hammersley Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow fingers that branch off the rest of South Sound and are fed by independent tributaries located near their termini. The distances among the spawning streams creates a geographic separation among chum spawning in each inlet as well as from the rest of the Puget Sound. Shelton Creek is independent of Goldsborough Creek, but because the chum have identical run timing and the streams are so close together, they are considered to be a single stock. These fish spawn from early December to early February, about a month later than the Hammersley Inlet fall stock. Genetic stock identification studies show this stock to be distinct from other Puget Sound stocks.

Hatchery plants from the Elson Creek Hatchery have been made in Shelton Creek. It is not known how successful they have been. Because of its unique (relatively late) run timing the stock is considered to be native.

STOCK STATUS

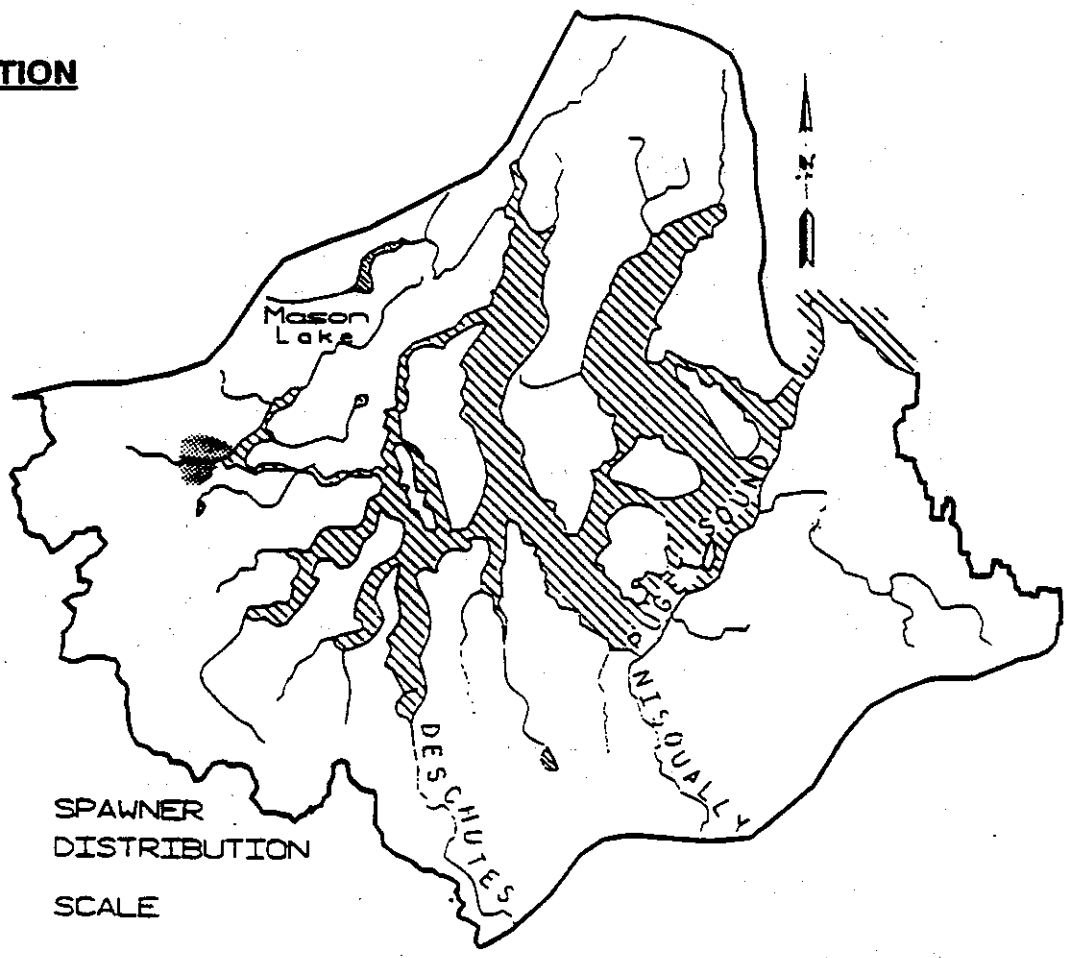
The status of the stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available for Shelton Creek from 1968 to the present. Spawner surveys were conducted in Goldsborough Creek in the mid-1970s but, few fish were seen. Recently the runs in Goldsborough started showing larger escapements. The number of spawners range from 200 (Shelton Creek alone) to 15,000 (combined Goldsborough and Shelton). The run size appears to be stable.

STOCK DEFINITION PROFILE for Goldsborough/Shelton Creeks Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



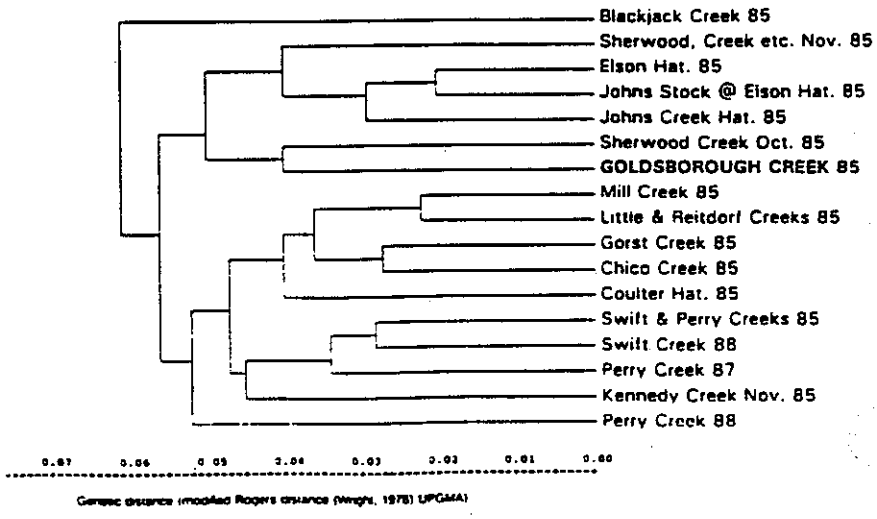
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN	■										▬	▬	**NO**
RIVER ENTRY	▬	▬										▬	**NO**
SPAWNING	▬	▬										▬	**YES**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

GENETICS - Analysis of a 1985 collection from Goldsborough Creek + Shelton Creek (N=100, and a 1991 collection from Goldsborough Creek, N=100) indicated that these fish add to the significant genetic heterogeneity of Puget Sound chum. However, individual pairwise tests with other collections were not always significant (21-locus G-tests: **p** <0.1).

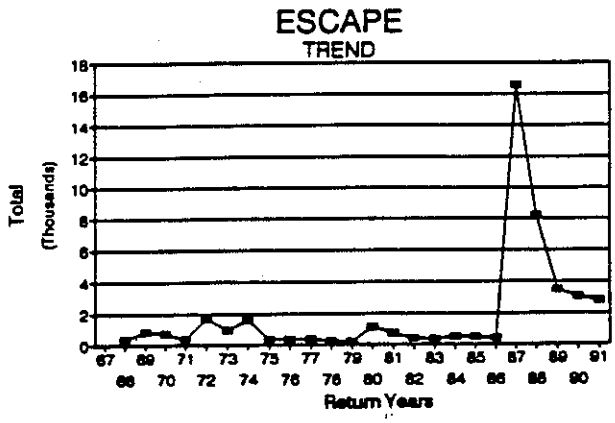


STOCK STATUS PROFILE for Goldsborough/Shelton Creeks Fall Chum

STOCK ASSESSMENT

DATA QUALITY——> Fair

Return Years	ESCAPE Total			
67				
68	385			
69	831			
70	741			
71	355			
72	1670			
73	917			
74	1579			
75	351			
76	392			
77	370			
78	236			
79	167			
80	1149			
81	716			
82	420			
83	368			
84	523			
85	502			
86	398			
87	16576			
88	8266			
89	3528			
90	3061			
91	2819			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing

STOCK STATUS
Healthy

SCREENING CRITERIA

SOUTH SOUND -- CASE INLET FALL CHUM

STOCK DEFINITION AND ORIGIN

Case Inlet fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic separation and run timing and have distinct genetic characteristics. Case Inlet is one of five inlets located in the extreme southern end of Puget Sound. The inlets are long narrow fingers that branch off the rest of South Sound and are fed by independent tributaries located near their termini. The distances among the spawning tributaries creates a geographic separation among chum spawning in each inlet as well as from the rest of the Puget Sound.

Wild escapement in Coulter, Sherwood and Rocky creeks make up most of the production in the run. Spawning occurs from early December to mid-January. This late timing creates a temporal separation from the Case Inlet summer stocks.

Genetic stock identification studies indicate that the Case Inlet fall stock is different from other Puget Sound stocks.

Hatchery releases have been made into most area streams possibility contributing to increased escapement levels. Hatchery records indicate that plants in Sherwood Creek used local native fish as the brood stock, so it is likely that this population is not significantly different from its original form and may be considered a native stock. However, hatchery records also show that Coulter Creek has received significant plants of non-local fish from Minter Creek Hatchery for two years. It is not known how successful these introductions have been, but it is possible that they have changed the native stock from its original form.

STOCK STATUS

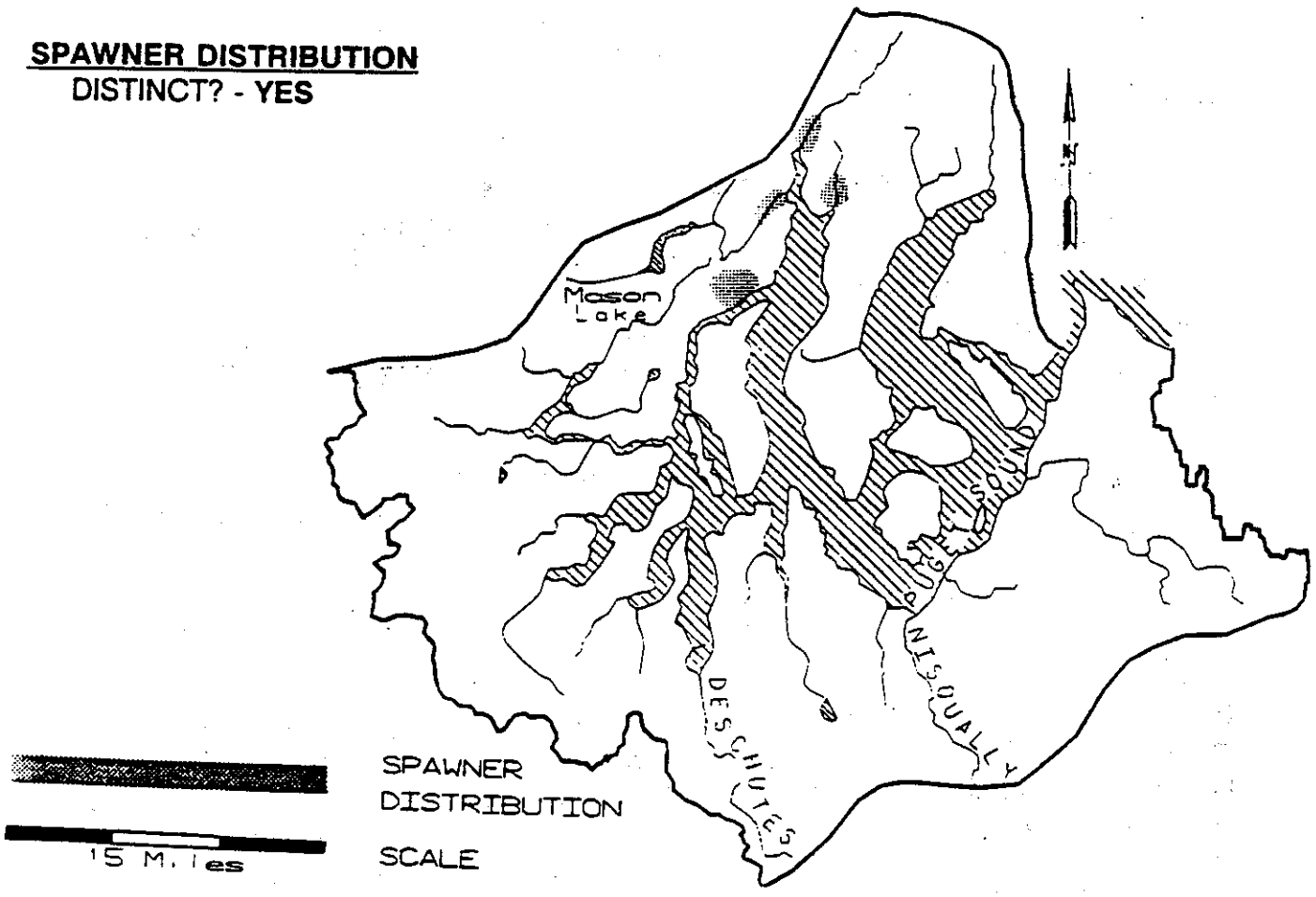
The status of the stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 500 to 6,000. Escapement levels are stable with a slight increasing trend since 1979.

STOCK DEFINITION PROFILE for Case Inlet Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



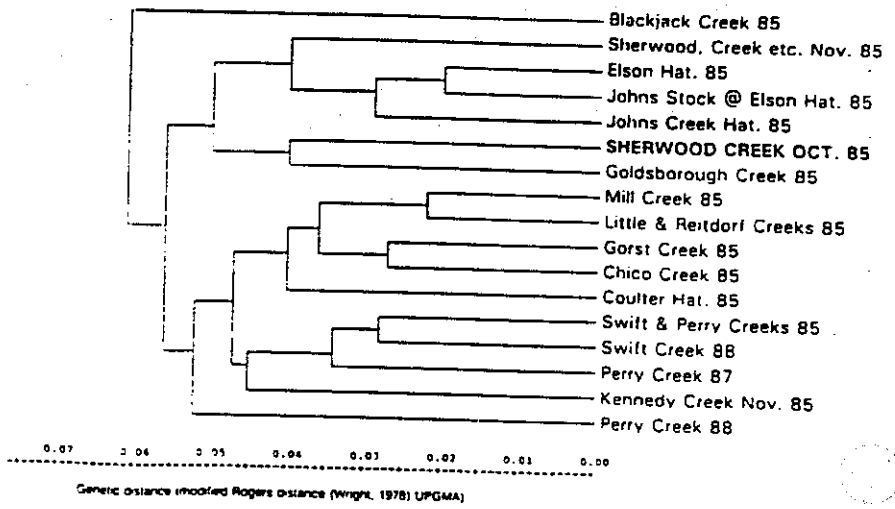
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN											■	■	NO
RIVER ENTRY											■	■	NO
SPAWNING	■	■	■									■	YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Analysis of a 1985 GSI collection (N=106) from Sherwood Creek + Rocky Creek + Coulter Creek indicated that these collections were significantly different from all other chum collections (21-locus G-tests: $p < 0.05$).

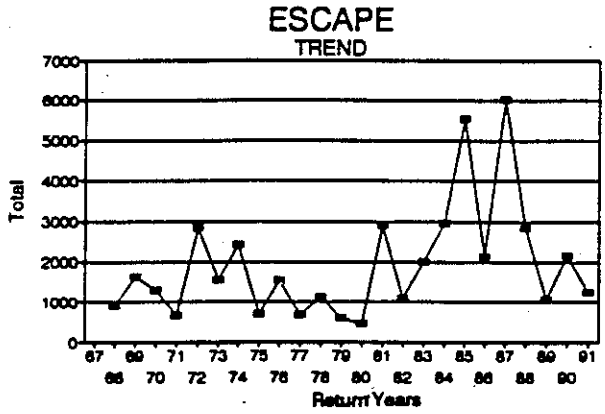


STOCK STATUS PROFILE for Case Inlet Fall Chum

STOCK ASSESSMENT

DATA QUALITY——> Good

Return Years	ESCAPE Total			
67				
68	907			
69	1638			
70	1299			
71	660			
72	2841			
73	1549			
74	2430			
75	702			
76	1536			
77	685			
78	1131			
79	607			
80	463			
81	2922			
82	1118			
83	2020			
84	2957			
85	5534			
86	2130			
87	6021			
88	2835			
89	1081			
90	2150			
91	1241			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN

Native

PRODUCTION TYPE

Wild

STOCK DISTINCTION

Distribution, Timing, Genetics

STOCK STATUS

Healthy

SCREENING CRITERIA

SOUTH SOUND -- CARR INLET FALL CHUM

STOCK DEFINITION AND ORIGIN

Carr Inlet fall chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic distribution. Carr Inlet is different from the other five inlets located in south Puget Sound in that it is oriented south to north and is closer to central Puget Sound than the other inlets in south Puget Sound. Tributaries that enter Carr Inlet come from the Kitsap Peninsula. These streams are characterized by a relatively low gradient and small drainage. The distances among the spawning streams in Carr Inlet and other south Puget Sound natal streams creates a geographic separation. Carr Inlet fall stocks spawn from mid-November to early January.

Heavy hatchery introductions and strays from Minter Creek hatchery have probably influenced the genetic makeup of wild spawning fish in most streams. Prior to 1992, the Minter Creek Hatchery reared and released fall chum of Hood Canal-origin. By 1992, this stock was replaced with the South Sound-origin Elson Creek Hatchery stock. Burley Creek chum have an earlier spawning peak (November) than other chum in streams but Burley Creek has been receiving plants from Minter Creek Hatchery (Elson Creek stock) so the origin of those chum is questionable. Lackey Creek escapement has been stable and may be the lone remaining stream containing fall chum native to Carr Inlet. The aggregate Carr Inlet stock should be considered to be either a hybrid or an introduced hatchery stock.

STOCK STATUS

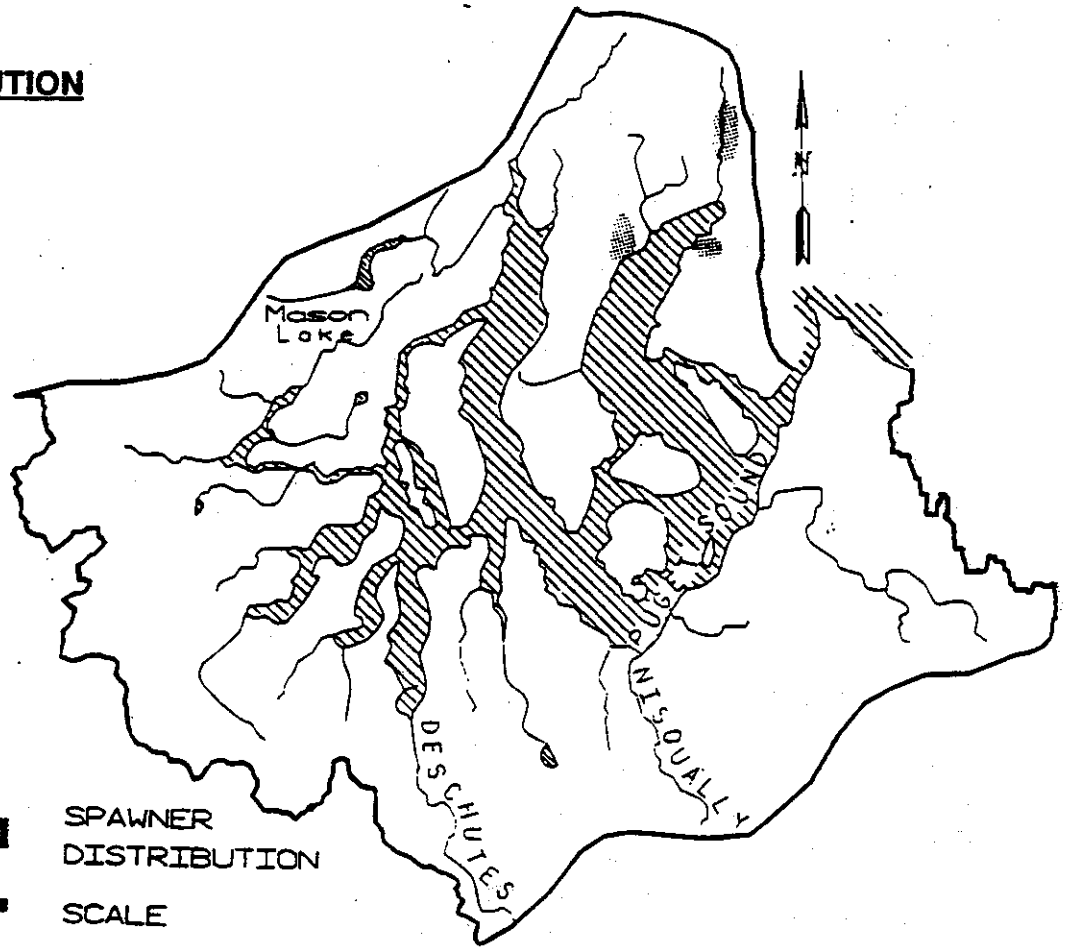
The status of the stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 200 to 2,000. Escapement levels indicate a healthy stock but have a slight decreasing trend.

STOCK DEFINITION PROFILE for Carr Inlet Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN										■	■		NO
RIVER ENTRY											■		NO
SPAWNING	■											■	NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

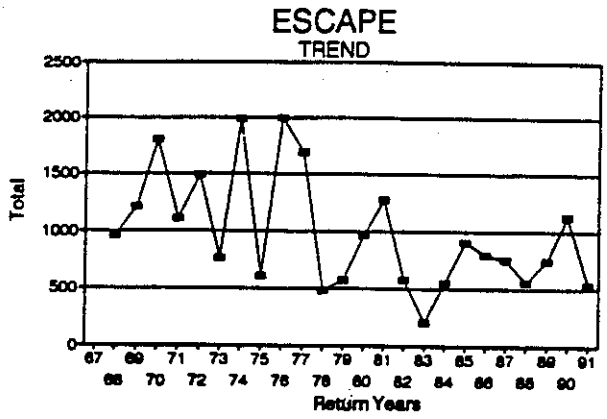
GENETICS - The Minter Creek hatchery strain (formerly a Hood Canal strain) was recently replaced with a South Puget Sound (Elson) strain. GSI sampling of wild spawning aggregations was initiated in 1992.

STOCK STATUS PROFILE for Carr Inlet Fall Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67				
68	959			
69	1210			
70	1805			
71	1109			
72	1489			
73	761			
74	1988			
75	611			
76	2002			
77	1694			
78	483			
79	569			
80	964			
81	1275			
82	575			
83	203			
84	549			
85	904			
86	797			
87	751			
88	555			
89	745			
90	1135			
91	537			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND -- EAST KITSAP FALL CHUM STOCKS

GIG HARBOR/OLLALA CREEK
DYES INLET/LIBERTY BAY
SINCLAIR INLET

STOCK DEFINITION AND ORIGIN

Fall chum in this region enter the terminal area between the first week in October and the first week in December. Spawning begins about the third week in October and can continue through mid-January. This long duration is a result of run-timing differences among the three fall chum stocks in the area.

The spawning grounds for the East Kitsap fall chum are located in small east-side streams on the Kitsap Peninsula. This geographic separation provides a mechanism for reproductive isolation from other Puget Sound stocks. These streams are characterized by a relatively small drainage and low gradient. Although chum may spawn as much as five miles upstream in Chico Creek, spawning usually takes place in the lower two miles of the streams.

Dyes Inlet/Liberty Bay fall chum are isolated from the other East Kitsap chum stocks through geographic separation and to some degree by run timing. Dyes Inlet chum spawn almost a month earlier than the Sinclair Inlet and Gig Harbor fall chum. The location of the spawning grounds, together with the difference in run timing, suggests that the Dyes Inlet/Liberty Bay chum are distinct from other East Kitsap chum stocks.

Sinclair Inlet chum and Gig Harbor/Ollala chum were separated into two stocks solely on the basis of geographical separation. The Sinclair Inlet chum spawn in streams located within the inlet, while Ollala Creek, a tributary to Colvos Passage, is ten miles south of Sinclair Inlet. The distance between these spawning areas was enough to consider them separate stocks. However, lacking differences in run timing, the degree of certainty about stock designations is less than with the Dyes Inlet/Liberty Bay stock.

ORIGIN OF THE STOCKS

Chum spawning in Dyes Inlet and Liberty Bay were identified as a single stock for two reasons: (1) similar spawner timing between native fish allows for the possibility of co-mingling of spawners on the spawning grounds, and (2) Dyes Inlet stock from Cowlings Creek Hatchery has been planted in the tributaries of Liberty Bay and has established non-native runs in those streams. Accordingly, this stock is classified as a mixed stock with native influence.

The spawning ground survey information provides good evidence of similar run timing in Dyes Inlet and Liberty Bay chum. Ongoing hatchery plants into Liberty Bay streams are assumed to have been successful and to have established runs in Liberty Bay. Evidence supporting this assumption is derived from the increasing escapements closely correlated with hatchery releases.

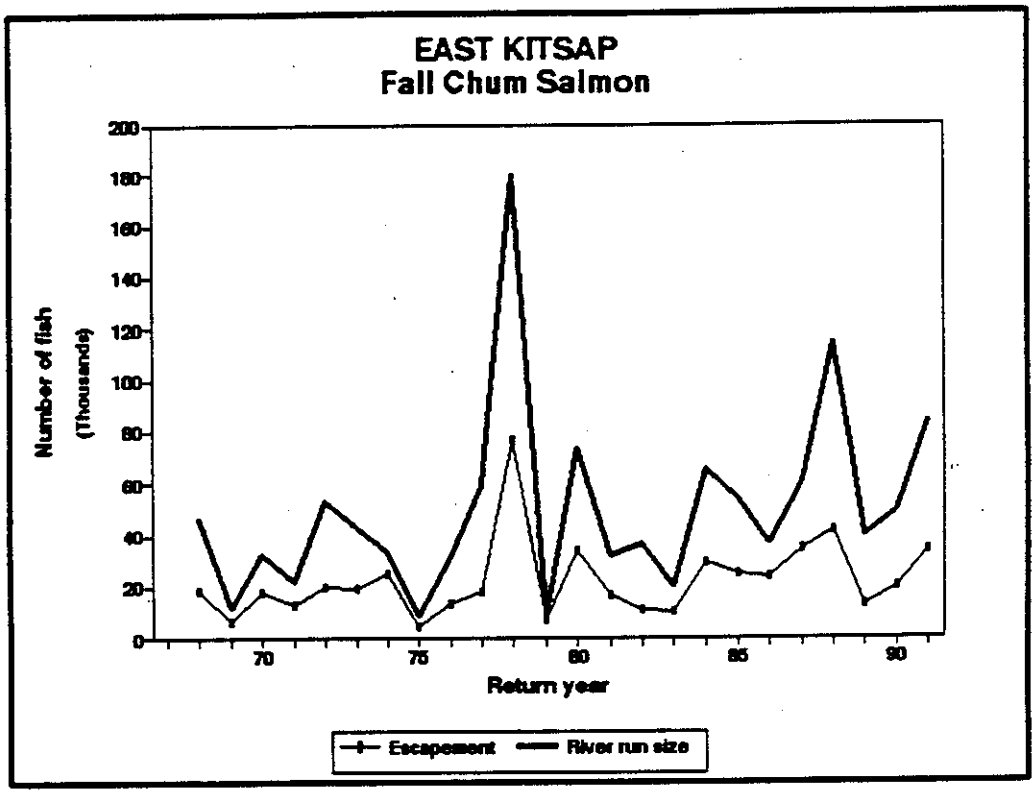
The Sinclair Inlet chum depend primarily on natural spawning for production. The few hatchery plants that have occurred in these streams used native fish as the brood stock. Accordingly, these fish are classified as a native stock with a fairly high level of certainty.

Gig Harbor/Ollala chum depend primarily on natural spawning for production. Ollala Creek has had two plants (1989 and 1990 from Minter Creek Hatchery and Elson Creek Hatchery respectively) totaling 12 pounds of eggs. It is unlikely that these small plants have significantly affected the genetic component of the native stock. The Gig Harbor streams have received plants from Minter Creek Hatchery and Elson Creek Hatchery, possibly affecting the gene pool. The Gig Harbor/Ollala Chum are considered a mix of native and non-native fish.

STOCK STATUS

Fall chum from the East Kitsap region contribute to the commercial fishery in Puget Sound from the Strait of Juan de Fuca through Colvos Passage. As a group, the East Kitsap chum escapements have exceeded the escapement goals (revisited in 1984) in six out of the last eight years. As a group, there is an increasing trend in escapement levels. The same trend is seen for individual stocks with the greatest relative increase in the Gig Harbor/Ollala stock.

Run-size and escapement data are shown in the figure below. Escapement data give a good representation of the number of spawners in the area. Different escapement goals are used for even and odd years, but are not plotted on the graph. The even-year and odd-year escapement goals are 21,000 and 18,000 respectively. Run-size data reflect the number of returning East Kitsap fall chum as they enter Washington waters. The difference between the run size and escapement represents the harvest within Washington waters.



More information on individual stocks is presented in the Stock Reports which follow.

SOUTH SOUND -- GIG HARBOR/OLLALA CREEK FALL CHUM

STOCK DEFINITION AND ORIGIN

The Gig Harbor/Ollala fall chum were identified as a stock because they are isolated from other Puget Sound fall stocks by geographic and temporal differences. The spawning streams of this stock drain the Kitsap Peninsula and enter Puget Sound just southwest of The Narrows. The spawning streams in the Gig Harbor/ Ollala area are geographically separated from other Puget Sound spawning streams. These streams characteristically have relatively low gradients and small drainages. The closest spawning tributary is Chambers Creek (across The Narrows), but the Gig Harbor/Ollala fall stock complex spawns earlier (late November-December), creating a temporal separation among the Chambers winter stock. Ollala chum may spawn as late as mid-January but are also separated from the Chambers winter stock by geography. The Gig Harbor/Ollala Creek fall chum stock may be influenced by fall chum strays from the Minter Creek Hatchery. Prior to 1989, the Minter Creek Hatchery released fall chum of Hood Canal-origin. These fish were replaced by Elson Creek Hatchery fall chum (South Sound-origin) in 1992. Consequently, the Gig Harbor/ Ollala Creek stock is considered a mixed stock.

STOCK STATUS

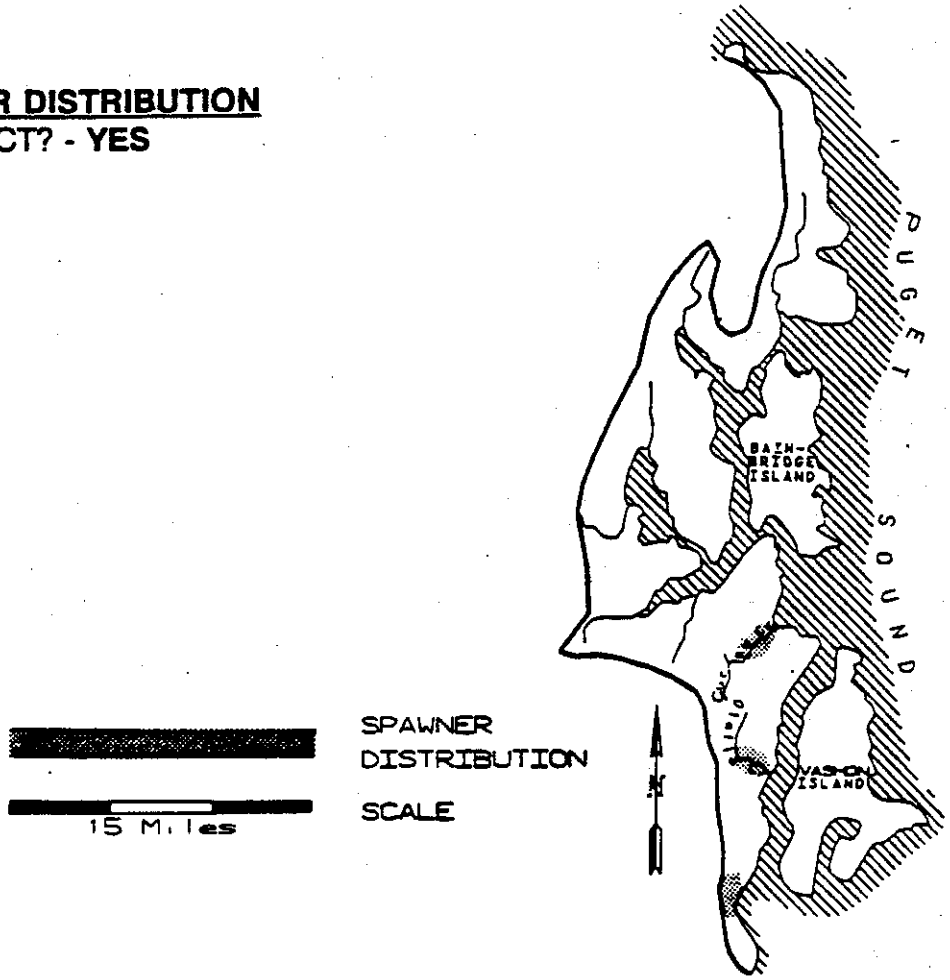
The status of the stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 600 to 7,300. Escapement levels have been increasing since 1984.

STOCK DEFINITION PROFILE for Gig Harbor/Ollala Creek Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN										■	■		NO
RIVER ENTRY	■										■	■	NO
SPAWNING	■										■	■	YES

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

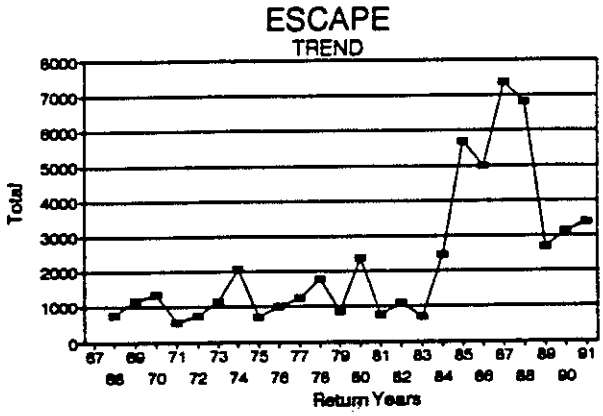
GENETICS - GSI sampling of wild spawning aggregations was initiated in 1992.

STOCK STATUS PROFILE for Gig Harbor/Ollala Creek Fall Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67				
68	757			
69	1160			
70	1358			
71	561			
72	748			
73	1155			
74	2066			
75	707			
76	1009			
77	1244			
78	1779			
79	858			
80	2371			
81	763			
82	1098			
83	705			
84	2451			
85	5693			
86	5001			
87	7360			
88	6825			
89	2682			
90	3123			
91	3389			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN

Mixed

PRODUCTION TYPE

Composite

STOCK DISTINCTION

Distribution, Timing

STOCK STATUS

Healthy

SCREENING CRITERIA

SOUTH SOUND – DYES INLET/LIBERTY BAY FALL CHUM

STOCK DEFINITION AND ORIGIN

The Dyes Inlet/Liberty Bay fall chum complex was identified as a single stock because it is isolated from other Puget Sound stocks by geographic distribution and to some degree temporal separation, and because spawn timing between the two inlets is very similar. Dyes Inlet and Liberty Bay are two small inlets off Port Orchard within the Kitsap Peninsula. Their tributaries are characterized by the relatively low gradient and small drainage of Kitsap Peninsula streams. As a group, these streams are geographically separated from other Puget Sound spawning streams. The major spawning tributaries for this complex are Chico Creek and associated tributaries, Barker Creek and Dogfish Creek.

The Dyes Inlet/Liberty Bay stock spawns in November (peak in mid-November), which is somewhat early for fall chum. This unique run timing creates a temporal separation from most of the other Puget Sound fall chum stocks as well as from the later-spawning Sinclair Inlet fall stock.

The tributaries of both Dyes Inlet and Liberty Bay have had significant hatchery plants from the Cowlings Creek tribal hatchery. The origin of the Cowlings Creek Hatchery stock was Chico Creek fish, so this hatchery stock could be considered a native stock within Dyes Inlet. Releases of the Cowling Creek Hatchery stock into the tributaries of Liberty Bay have probably established a mixed stock with native remnant components.

STOCK STATUS

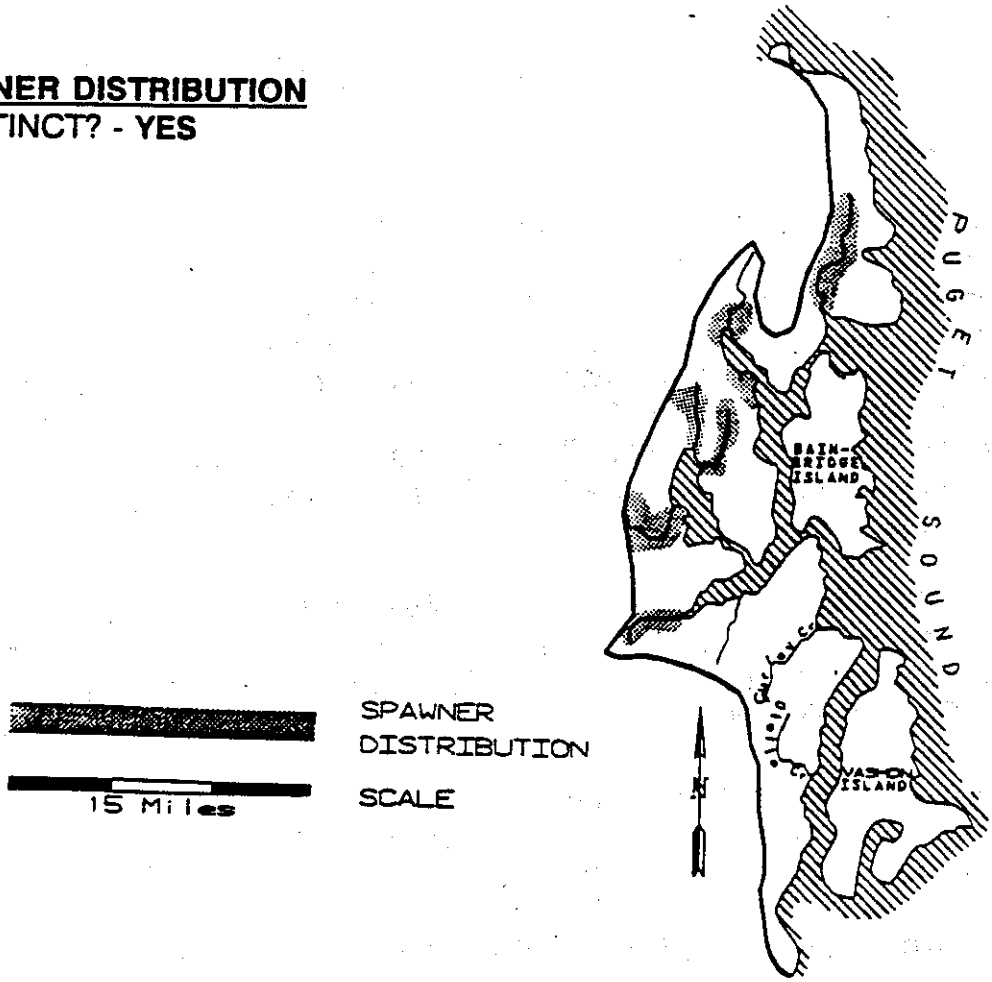
The status of this stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 2,500 to 74,000. Natural spawning is stable and has shown an increasing trend since the mid-1970s.

STOCK DEFINITION PROFILE for Dyes Inlet/Liberty Bay Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



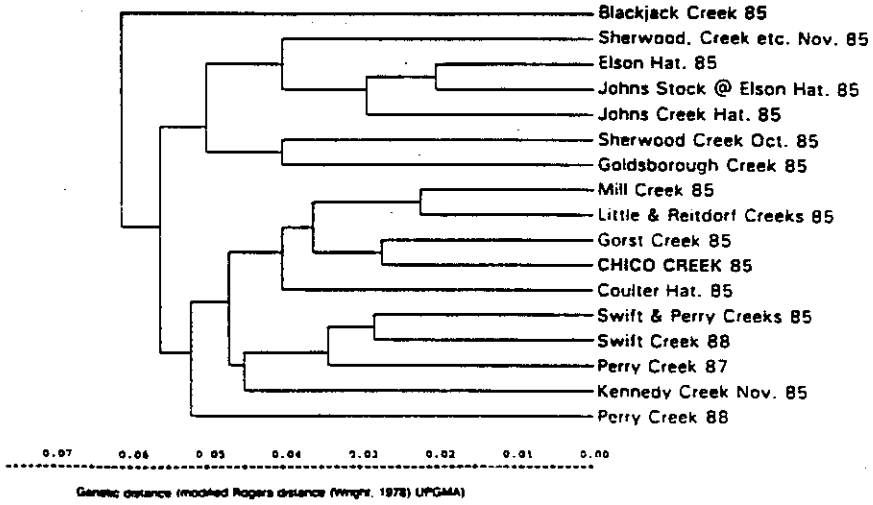
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN											▬		**NO**
RIVER ENTRY											▬	▬	**NO**
SPAWNING											▬	▬	**YES**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

GENETICS - Analysis of a 1985 GSI collection from Chico Creek (N=100) indicated that these fish were not different from a 1985 Gorst Creek chum collection (21-locus G-tests: **p>0.1**).

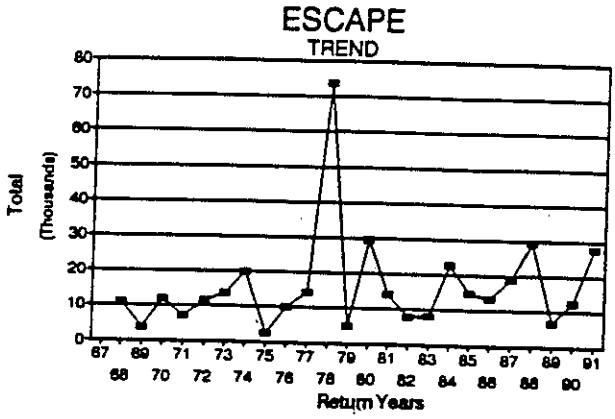


STOCK STATUS PROFILE for Dyes Inlet/Liberty Bay Fall Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Total			
67				
68	10865			
69	3758			
70	11945			
71	7139			
72	11447			
73	13805			
74	19965			
75	2521			
76	10079			
77	14314			
78	73619			
79	4779			
80	29649			
81	14163			
82	7711			
83	8218			
84	22776			
85	14800			
86	13398			
87	18933			
88	29484			
89	6691			
90	12537			
91	27841			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution, Timing

STOCK STATUS
Healthy

SCREENING CRITERIA

SOUTH SOUND -- SINCLAIR INLET FALL CHUM

STOCK DEFINITION AND ORIGIN

Sinclair Inlet fall chum were identified as a single stock because they are isolated from other Puget Sound stocks by geographic distribution. In addition, fish from individual streams within Sinclair Inlet all exhibit similar spawn timing from December through early January, creating a temporal separation from the earlier-spawning Dyes Inlet/Liberty Bay fall stock. Sinclair Inlet is located off Port Orchard within the Kitsap Peninsula. Its tributaries are characterized by the relatively low gradient and small drainage typical of Kitsap Peninsula streams. The major spawning tributaries for this stock complex are Gorst Creek, Anderson Creek, Ross Creek and Blackjack Creek.

Production is primarily by natural spawning with little hatchery influence. The stock should be considered a native stock.

STOCK STATUS

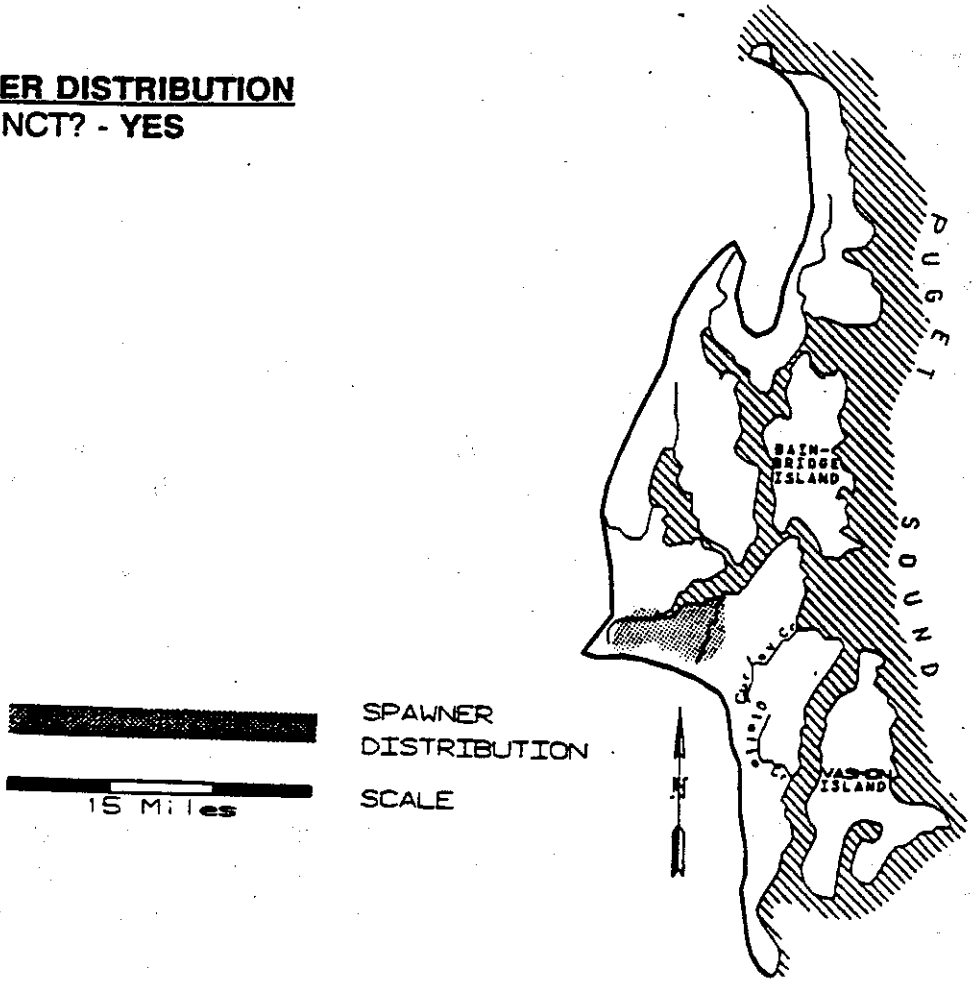
The status of the stock is Healthy.

Escapement data derived from spawning ground surveys are the only consistent information available on the stocks status. Escapement estimates are available from 1968 to the present and range from 500 to 7,200. Wild escapement has been stable over the last ten years.

STOCK DEFINITION PROFILE for Sinclair Inlet Fall Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



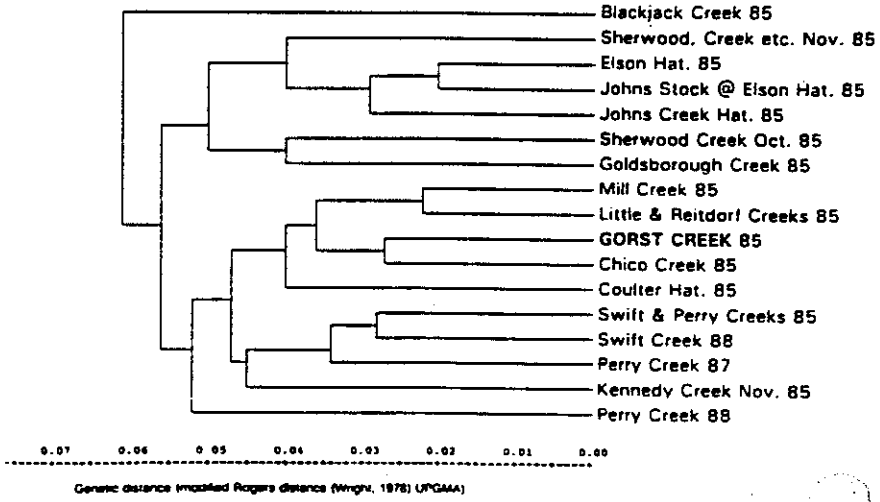
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN											▬	▬	**NO**
RIVER ENTRY	▬											▬	**NO**
SPAWNING	▬											▬	**YES**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

GENETICS - Analysis of a 1985 GSI collection from Gorst Creek (N = 100) indicated that these fish were not different from a 1985 Chico Creek chum collection (21-locus G-tests: **p** > 0.1).

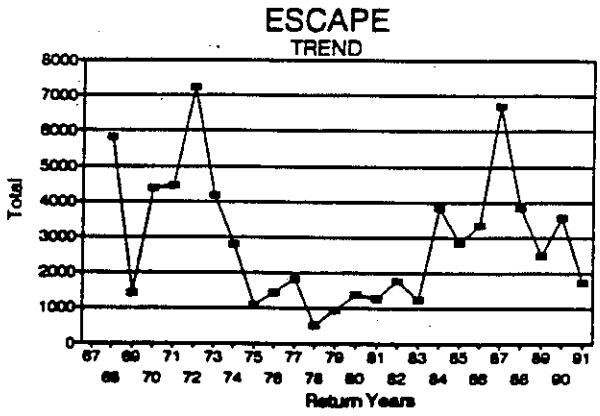


STOCK STATUS PROFILE for Sinclair Inlet Fall Chum

STOCK ASSESSMENT

DATA QUALITY-----> Good

Return Years	ESCAPE Total			
67				
68	5813			
69	1421			
70	4392			
71	4459			
72	7228			
73	4169			
74	2815			
75	1096			
76	1444			
77	1827			
78	529			
79	948			
80	1390			
81	1279			
82	1776			
83	1251			
84	3849			
85	2841			
86	3360			
87	6690			
88	3840			
89	2486			
90	3561			
91	1736			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND WINTER CHUM STOCK

CHAMBERS CREEK

STOCK DEFINITION AND ORIGIN

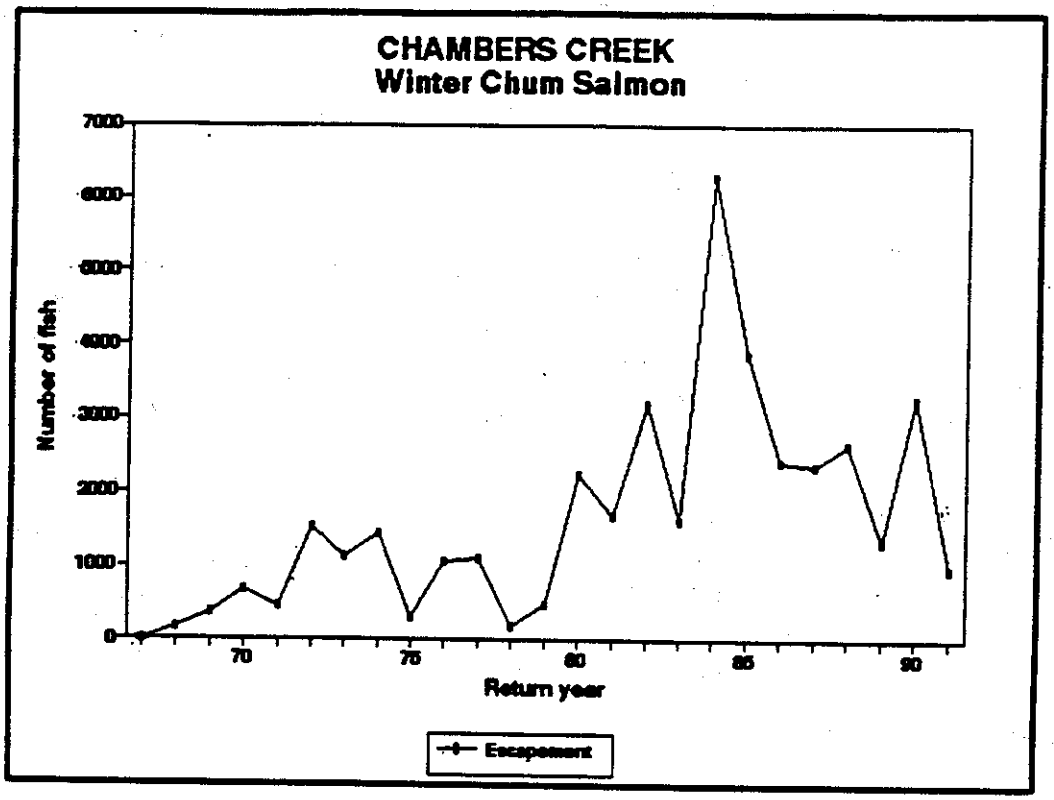
Winter chum spawning in this region are isolated from other Puget Sound chum stocks through geographic separation of the spawning grounds and run-timing differences. Additionally, genetic studies have shown that winter chum are distinct from both summer and fall chum stocks. Winter chum enter the south Puget Sound from the first week in December through most of February. Chambers Creek winter chum usually have completed spawning by the end of February.

Garrison Springs Hatchery, located near the mouth of Chambers Creek, uses wild fish as brood stock. A portion of these fish is released back into Chambers Creek while another portion is released into Puyallup River system (Clarks Creek). Since the fish used in the hatchery operation are trapped wild fish from Chambers Creek, the wild stock is considered to be native.

STOCK STATUS

South Sound winter chum contribute relatively few fish to the commercial fishery in Puget Sound. The combined Chambers Creek and Nisqually winter chum escapements have exceeded or nearly met (less than five percent difference) the escapement goals (revised in 1984) 12 out of the last 15 years. Escapement levels have been healthy and stable during this time.

Run-size and escapement data are shown in the figure below. The escapement data for this stock give a good representation of the number of spawners in the area. Different escapement goals are used for even and odd years but are not plotted on the graph. The total Puget Sound winter even-year and odd-year escapement goals are 30,000 and 20,150 respectively.



More information on this stock is presented in the Stock Report which follows.

SOUTH SOUND -- CHAMBERS CREEK WINTER CHUM

STOCK DEFINITION AND ORIGIN

Chambers Creek winter chum were identified as a stock because they are isolated from other Puget Sound stocks by geographic and temporal separation. Chambers Creek is the only tributary entering just south and on the east side of The Narrows region of south Puget Sound. Its spawning area is geographically separated from that of other Puget Sound stocks. Although there may be some overlap in adult appearance in the creek of fall and winter stocks, there is a temporal separation in their spawning. Chambers Creek fall stock spawn from November to December while the winter spawning season is from December through February with a peak in January. Genetic stock identification studies show the Chambers winter stock to be similar to, but distinguishable from, the Nisqually winter stock.

The Garrison Springs Hatchery is located on a small tributary of Chambers Creek. The hatchery uses the fish ladder located at tide water to collect Chambers Creek winter chum for their brood stock. Wild escapement goals are met prior to taking of brood stock fish. The Chambers Creek winter stock is considered a native group of fish.

STOCK STATUS

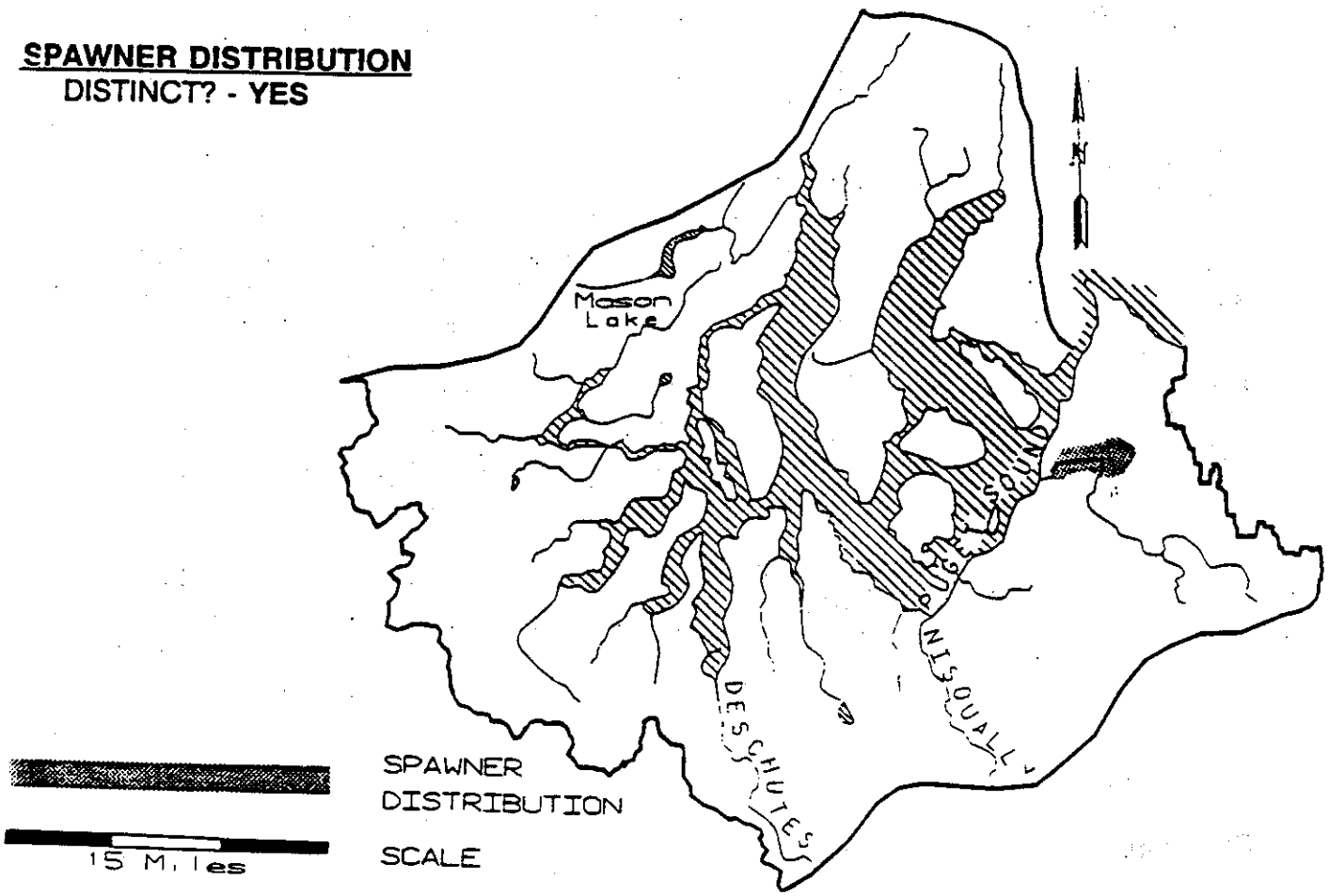
The status of this stock is Healthy.

Stock assessment data include hatchery rack counts and stream survey information. The stream surveys are used to monitor the escapement into Leach Creek. The hatchery rack counts provide the best escapement estimates for the Chambers Creek system and range from 200 to 6,300. Escapement of Chambers Creek winter stock has been stable over the last ten years with a slight increasing trend.

STOCK DEFINITION PROFILE for Chambers Creek Winter Chum

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



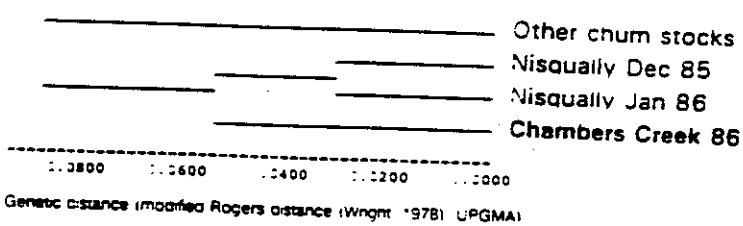
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN	▬											▬	**NO**
RIVER ENTRY	▬											▬	**NO**
SPAWNING	▬											▬	**YES**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **YES**

GENETICS - Analysis of a 1985 collection (N = 100) from the Chambers Creek Hatchery indicated that this stock is very different from all summer and fall chum stocks tested. This stock is most similar to Nisqually winter-run stock (21-locus G-tests: $p < 0.05$).

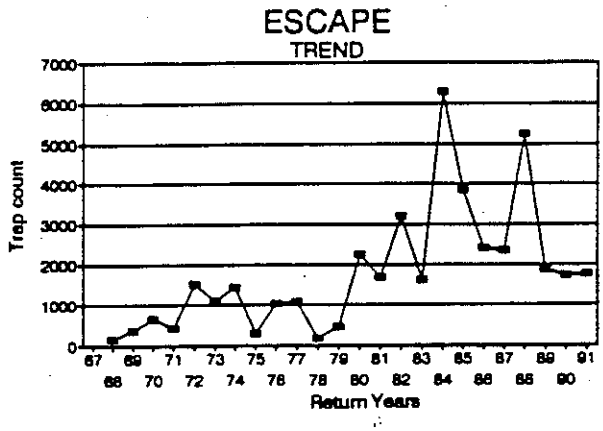


STOCK STATUS PROFILE for Chambers Creek Winter Chum

STOCK ASSESSMENT

DATA QUALITY----> Good

Return Years	ESCAPE Trap count			
67				
68	160			
69	353			
70	668			
71	435			
72	1526			
73	1108			
74	1440			
75	292			
76	1045			
77	1095			
78	172			
79	468			
80	2239			
81	1686			
82	3204			
83	1617			
84	6287			
85	3872			
86	2420			
87	2348			
88	5248			
89	1878			
90	1744			
91	1776			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution, Timing, Genetics

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND - CHAMBERS CREEK COHO STOCK

CHAMBERS CREEK

STOCK DEFINITION AND ORIGIN

The Chambers Creek basin includes the Chambers Creek and Sequalitchew Creek drainages. Coho salmon utilize, to some degree, almost all of the accessible tributaries in this area. Coho returning to these tributaries typically enter freshwater from late August to late December, with some variation observed between years. Spawning timing has not been documented by surveys specific to this stock.

There have been substantial releases of hatchery-origin coho within this area, with significant yearling plants in the 1950s. Fingerling/fry plants have occurred from 1978 to the present. There are also annual yearling releases from Lake Sequalitchew and the net pen program at Fox Island that contribute adults to the Chambers Creek spawning population. It should be noted that many of the early off-station yearling releases were not consistent with current optimal size and time-of-release strategies, and their subsequent contribution to the wild spawning population is unknown.

Additional to that consideration are the potential survival differentials to various stocks introduced into this area, questions regarding spawning success in the wild of hatchery-origin coho and any distinctions between native and introduced stocks in terms of either temporal or physical spawning distributions. As a result of these uncertainties, the coho stock in this area has been designated as probable mixture of native and non-native stocks, without any conclusion as to the relative influence of those stocks within the current population. There can be no confident quantification of the genetic impact of non-native stock introductions until an effective genetic research tool is developed and implemented for coho salmon.

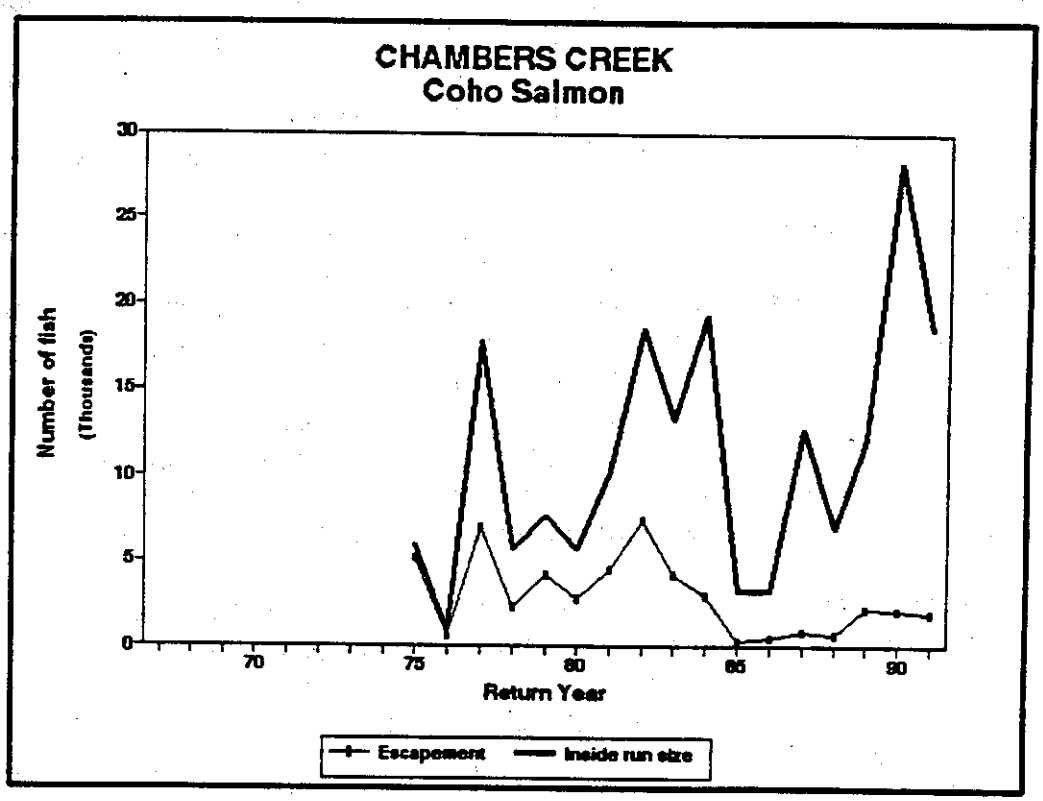
There are no significant differences in timing or any unique biological characteristics documented for the coho in this basin that would suggest multiple stocks. The distinction of this stock from those in surrounding drainages is therefore dependent upon a determination of geographic spawning separation, the result of subjective judgements regarding the probability of significant spawner interchange between those drainages. It is possible that this stock is not truly distinct, as a result of hatchery releases and straying of hatchery fish, from deep South Sound Tributary coho, and its status as a separate stock may change. Until a genetic determinant is available and used to evaluate this stock, this designation is tentative.

STOCK STATUS

Coho of Chambers Creek basin origin are harvested primarily in Canadian and Washington troll, net and sport fisheries. There are directed terminal area fisheries on this stock to harvest surplus hatchery returns.

There is no stated natural escapement goal for the Chambers Creek stock, given the impact of hatchery-origin adults on the naturally spawning population. Hatchery rack counts are available, however, they include strays from local hatchery and net pen projects. Consequently, accurate escapement estimates for naturally-spawning Chambers Creek coho are not available.

Run-size and escapement data are shown in the figure below.



More information on this stock is presented in the following Stock Report.

SOUTH SOUND -- CHAMBERS CREEK COHO

STOCK DESCRIPTION AND ORIGIN

This stock is classified on the basis of distinct geographic spawning distribution. These fish do not exhibit any documented unique biological characteristics and their temporal distribution is not distinct. Spawning timing is not available, but arrival at the Chambers Creek hatchery rack generally peaks in mid- to late October and trails off through December.

The native stock in this system has likely been influenced by hatchery-origin stocks. From 1952 to 1959, annual releases of Green River hatchery yearlings were made into Chambers Creek. A comprehensive off-station fingerling release program began in this system in 1978 and continues to present, utilizing Minter Creek hatchery stock. Additionally, since 1977, there has been substantial straying (approaching 75 percent) of adults to this drainage from the Lake Sequalitchew rearing program and the Fox Island Net Pens (Darrell Mills, personal communication). These programs have utilized a variety of hatchery stocks (including Minter, Puyallup, Skykomish, Hood Canal, Baker, Issaquah, George Adams, Skagit, Nooksack, Samish and some hybrids) over their history. This stock is probably a mixture of the native fish and the introduced non-native stocks.

STOCK STATUS

The status of Chambers Creek coho appears to be Healthy based on trap counts.

Although the trap counts are available, they reflect significant numbers of stray fish (see above), and therefore may represent regional extended rearing programs more than the actual natural production of this system. Trap counts show that total escapement into the system is fairly stable.

These data account for the nominal Healthy status of the stock.[3] The fitness of the native stock may have been affected by non-native stock introductions, but specific changes have not been documented at this time.

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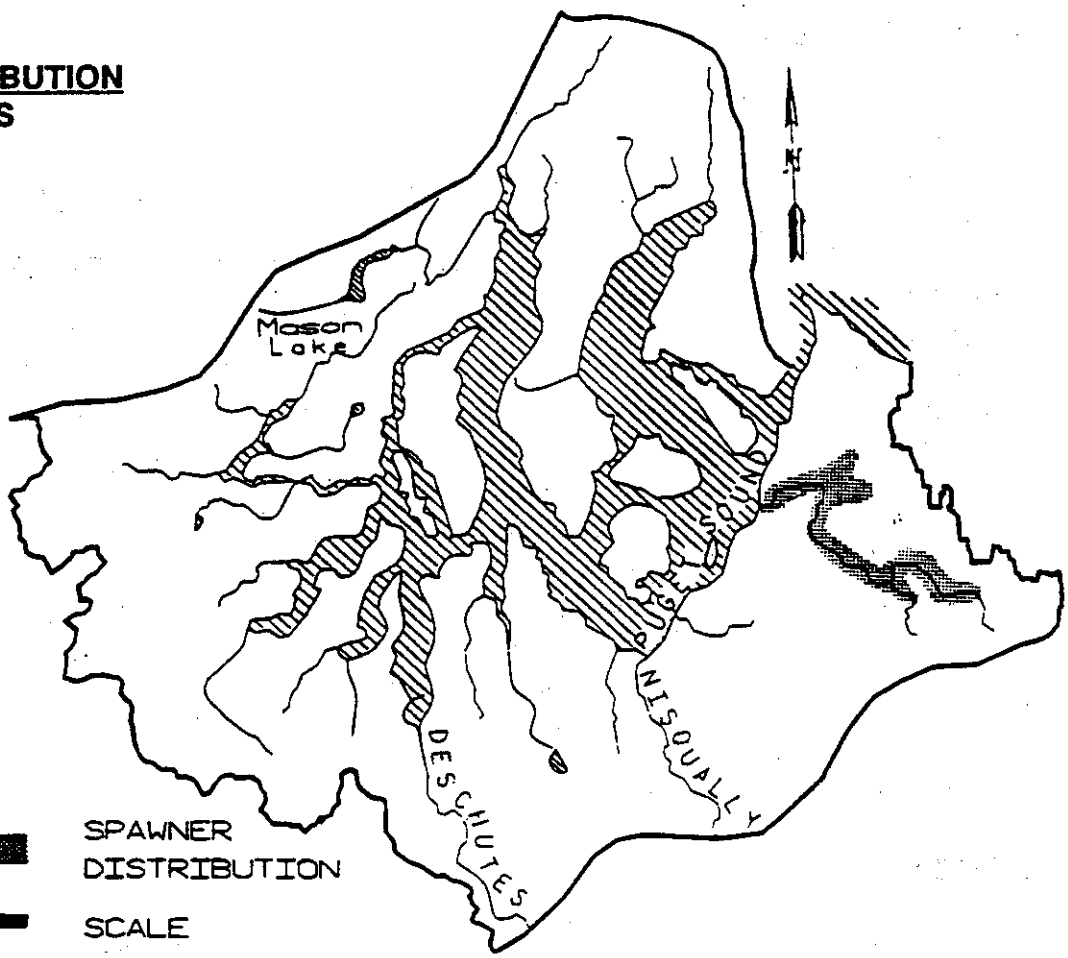
[3] Based on analysis of data subsequent to the publication of this SASSI report, the status of Chambers coho is more appropriately described as "unknown". Stock status will be re-evaluated in the next edition of the SASSI report.

STOCK DEFINITION PROFILE for Chambers Creek Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬	▬			**UNK**
RIVER ENTRY									▬	▬	▬	▬	**UNK**
SPAWNING									▬	▬	▬	▬	**UNK**

BIOLOGICAL CHARACTERISTICS

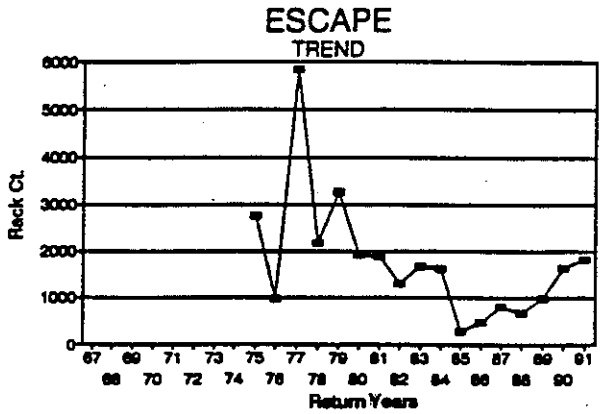
DISTINCT? - **NO**

STOCK STATUS PROFILE for Chambers Creek Coho

STOCK ASSESSMENT

DATA QUALITY——> Excellent

Return Years	ESCAPE Reck Ct.			
67				
68				
69				
70				
71				
72				
73				
74				
75	2764			
76	983			
77	5848			
78	2171			
79	3282			
80	1931			
81	1884			
82	1309			
83	1689			
84	1622			
85	287			
86	473			
87	804			
88	677			
89	991			
90	1641			
91	1828			



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND - DEEP SOUTH SOUND COHO STOCK

DEEP SOUTH SOUND

STOCK DEFINITION AND ORIGIN

The Deep South Sound basin includes the tributaries south of the Tacoma Narrows, excluding the Chambers Creek, Nisqually River and Deschutes River basins. Most of the streams utilized by this stock drain into Case, Carr, Henderson, Eld, Totten, Skookum, and Hammersley inlets, Oakland Bay and into the passages between islands in deep South Sound and the mainland. Coho returning to these streams typically enter freshwater from mid-September to mid-November and spawn from late October to mid-December with some variation observed between streams and between years within streams.

There have been substantial releases of hatchery-origin coho within this area, with significant off-station yearling plants from the early 1950s to the mid-1970s. Off-station fingerling/fry plants occurred annually from the mid-1950s to the present time. There are also annual on-station yearling releases from the hatchery facility on Minter Creek and from various pen rearing programs throughout the basin. It should be noted that many of the early off-station yearling releases were not consistent with of current optimal size and time-of-release strategies, and their subsequent contribution to the wild spawning population is unknown. Straying rates from one net-pen facility were examined in a study conducted in the 1974-1979 brood years (Rensel et al. 1988). It estimated that 0.3-0.6 percent of the coho salmon released escaped annually to local streams. This represents a range of 10-20 percent of the average total escapement to these systems. While there is known to be variability in migration patterns, run timing, and other traits, differences in survival among various hatchery-origin stocks are unknown.

Additional to those considerations are questions regarding the spawning success in the wild of hatchery-origin coho and any distinctions between native and introduced stocks in terms of either temporal or physical spawning distributions. As a result of these uncertainties, the stock in this area has been designated as a probable mixture of native and non-native stocks, without any inference as to the relative influence of those stocks within the current population. There can be no confident quantification of the genetic impact of non-native stock introductions until an effective genetic research tool is developed and implemented for coho salmon.

There are no significant differences in timing or any unique biological characteristics documented for the coho in this basin that would suggest multiple stocks. The distinction of this stock from those in surrounding drainages is therefore dependent upon a determination of geographic spawning separation, the result of subjective judgements regarding the probability of significant spawner interchange between

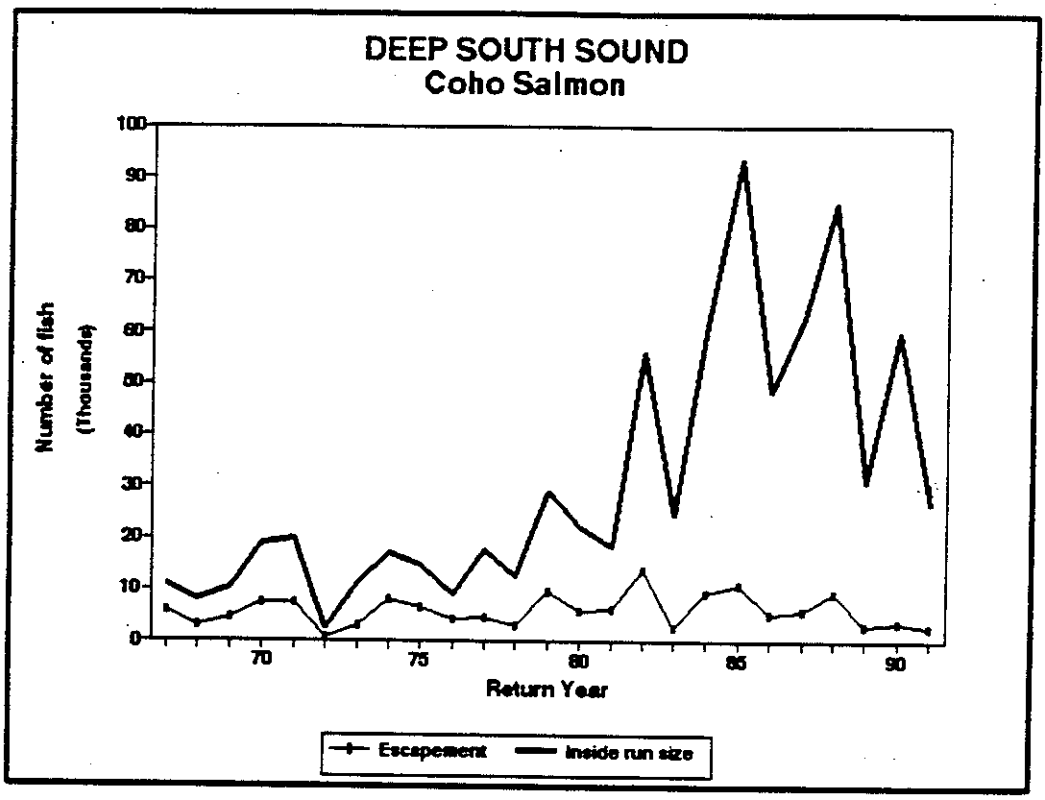
those drainages. The off-station hatchery release history is fairly uniform throughout this basin, suggesting that there may be some common impact of hatchery-origin coho introductions. Until a genetic determinant is available and used to evaluate this stock, this designation is tentative.

STOCK STATUS

Coho of deep South Sound basin-origin are harvested primarily in Canadian and Washington troll, net and sport fisheries. There are directed terminal area fisheries on this stock to harvest surplus hatchery returns.

The natural escapement goal for Deep South Sound coho is 9,200. The run reconstruction database shows escapement fluctuating over a wide range about the goal and run size estimates (the number of fish in escapement and Puget Sound net catches), from 1965 to present, fluctuating over a broad range, as well. The escapement goal has been accomplished five times in that 27 year period. The Deep South Sound stock's performance evaluation is based upon this run reconstruction data. Those data indicate, despite very low escapements in 1989 and 1991, fairly stable production (based on run size estimates) and a generally healthy state.

The figure below, which illustrates natural coho production trends in this basin, is derived from the run reconstruction database. Please note that some of the run size estimated for the last ten to 15 years may be attributable to misallocation of hatchery-origin production to the natural stock. The magnitude of this possible error has not been estimated at this point in time. The escapement goal is not plotted on this graph since the primary management objective in this basin is to minimize surplus hatchery returns through harvest rates which generally preclude accomplishing that goal.



More information on this stock is presented in the Stock Report which follows.

SOUTH SOUND -- DEEP SOUTH SOUND TRIBS COHO

STOCK DEFINITION AND ORIGIN

This stock is defined on the basis of geographic spawning distribution. This stock does not exhibit any documented unique biological characteristics, and its spawning timing is typical of hatchery timing (most spawning occurring from late October to mid-December).

This geographic area has been heavily planted with hatchery-origin coho. Off-station yearling releases occurred almost annually from 1952 to the mid-1970s within this area, with Green River and Minter Creek stocks predominant. There were also releases of Issaquah (1955), Hood Canal (1963 and 1965), George Adams (1971-1973) and Skykomish (1957) yearlings. There have also been significant releases of pen-reared yearlings in this area that have probably contributed to the spawning population of this stock. These projects have primarily utilized Skykomish, Skagit and Issaquah stocks with lesser use of a variety of others. There have been off-station fingerling or fry releases in almost every year since the mid-1950s. Once again, Minter and Green River were used most frequently, with almost every other Puget Sound hatchery represented to some degree. Since the mid-1970s, there has been an effort to consistently use Minter stock in this area, which has been accomplished with only a few exceptional releases of Green River and George Adams stocks. This stock is probably a mixture of the native and various introduced non-native stocks.

STOCK STATUS

This stock is currently considered Healthy.

Index data are good for this stock back to 1981. Run reconstruction should represent the production trends of this stock fairly well, although there may be some attribution of hatchery production to the natural stock.

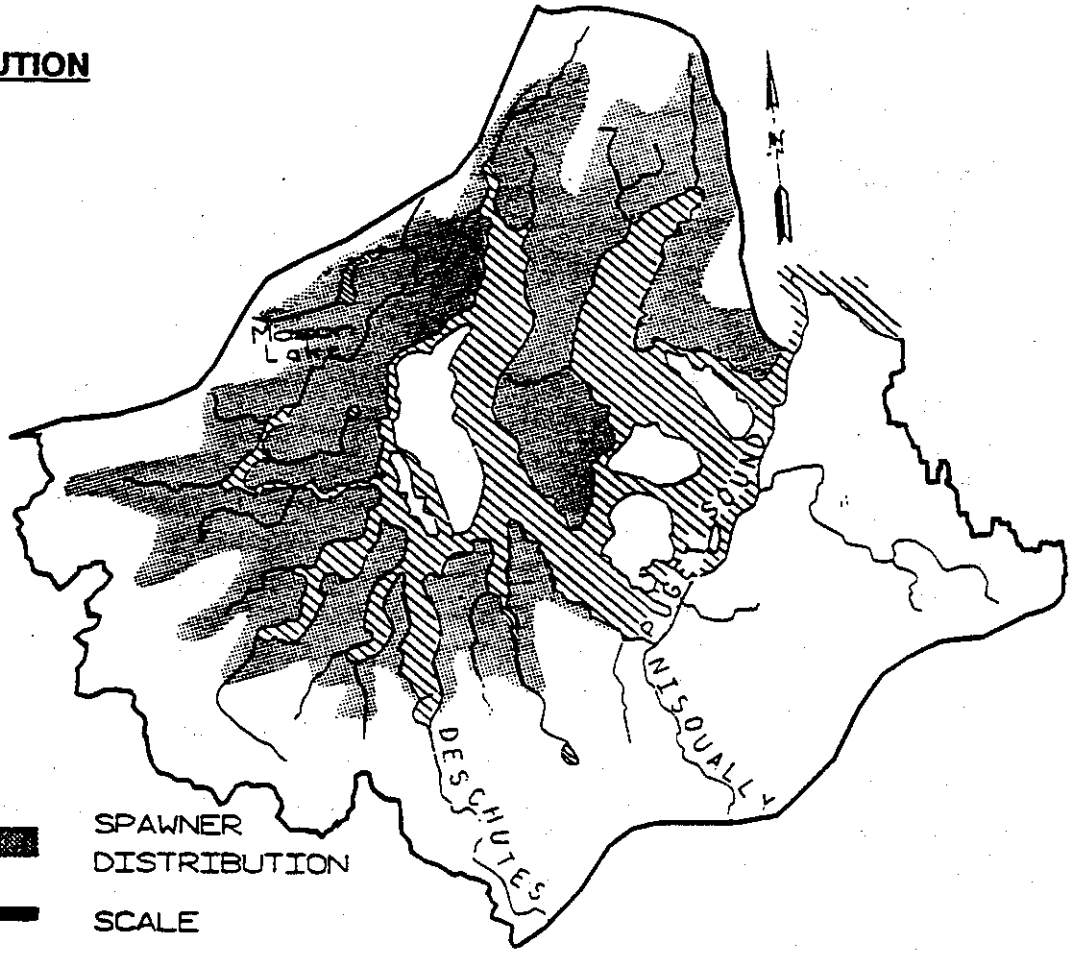
This stock should be closely monitored and, if escapements continue to track the current trend or run size estimates fall, its status be reevaluated.

Coho habitat in the deep South Sound area is being affected by increasingly intensive land-use activities, including timber management, Christmas tree farming, agriculture, rural development and urbanization. Large tracts of land in this area are currently being converted from forest to residential development. Information on habitat conditions is available for only some South Sound streams, however, there is evidence of widespread habitat degradation. Spawning/incubation habitat is being destabilized by increased peak stream flows associated with urban development and wetland loss. Spawning gravel is being degraded by fine sediments from timber

STOCK DEFINITION PROFILE for Deep South Sound Tribs Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



SPAWNER DISTRIBUTION

SCALE

15 Miles

TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													NO
RIVER ENTRY													NO
SPAWNING													NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

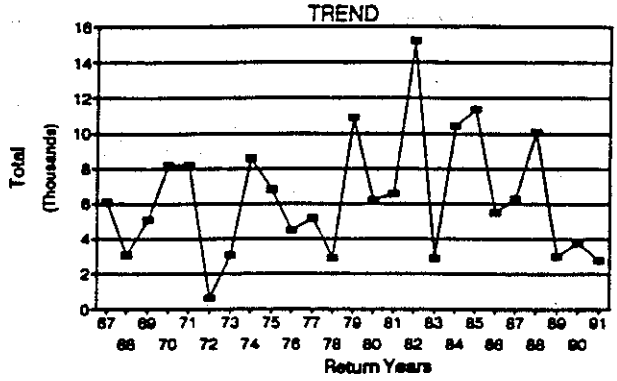
STOCK STATUS PROFILE for Deep South Sound Tribs Coho

STOCK ASSESSMENT

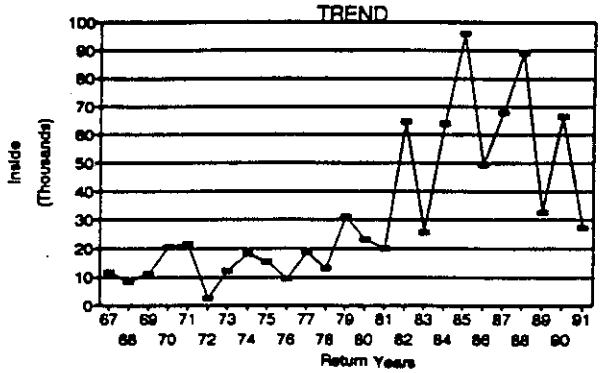
DATA QUALITY-----> Good

Return Years	ESCAPE Total	RUNSIZE Inside	ESCAPE Fish-days	
67	6100	11900		
68	3100	8600		
69	5100	11100		
70	8200	20500		
71	8200	21600		
72	600	2600		
73	3100	12200		
74	8600	18100		
75	6800	15300		
76	4500	9400		
77	5200	18500		
78	2900	13000		
79	10900	31100		
80	6200	23200		
81	6600	20000	6723	
82	15200	64800	114351	
83	2900	25700	3047	
84	10400	63900	9221	
85	11400	96000	11411	
86	5500	49300	4475	
87	6300	67800	16825	
88	10100	89000	8839	
89	3000	32500	2607	
90	3800	66700	3723	
91	2800	27300	2901	

ESCAPE
TREND



RUNSIZE
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

harvest, land clearing and development. The productivity of rearing habitat is affected by increased water temperatures associated with removal of riparian vegetation, filling of pools with coarse and fine sediment, reduction in large woody debris recruitment and summer low flows. Winter refuge habitat has been reduced due to channelization and disturbance of off-channel habitats and wetland systems. Because of the intensive development pressure in this region, future coho production will depend on successful maintenance of natural habitat-forming processes as these watersheds undergo rapid development, as well as restoration of habitat affected by past land use.

OVERVIEW -- SOUTH SOUND - DESCHUTES COHO STOCK

DESCHUTES

STOCK DEFINITION AND ORIGIN

The Deschutes River basin includes the Deschutes River drainage and several independent tributaries to Capitol Lake. Coho salmon utilize, to some degree, almost all of the accessible tributaries in this area. Coho returning to these tributaries typically enter freshwater from mid-September through mid-November and spawn from late October to early January with some variation observed between streams and between years within streams.

The Deschutes River above Tumwater Falls was inaccessible to anadromous fish prior to the construction of a passage facility in 1954. There were substantial releases of hatchery-origin coho within this area, with significant yearling plants from the late 1940s to 1954. Off-station fingerling/fry plants occurred regularly from 1955 to 1964 and in 1981. Since 1981, there have been no off-station coho releases into the Deschutes basin, unlike other deep South Sound tributaries where releases of Minter Creek hatchery coho are made annually. There are annual yearling releases from local salt water pen rearing programs that provide a low level adult contribution (strays) to this spawning population. The stock in this basin has been designated as an introduced stock.

There are no significant differences in timing or any unique biological characteristics documented for the coho in this basin that would suggest multiple stocks. The distinction of this stock from those in surrounding drainages is therefore dependent upon a determination of geographic spawning separation, the result of subjective judgements regarding the probability of significant spawner interchange between those drainages. Additionally, the dissimilarity in planting histories between this and surrounding stocks would suggest different impacts, further supporting separation. Until a genetic determinant is available and used to evaluate this stock, this designation is tentative.

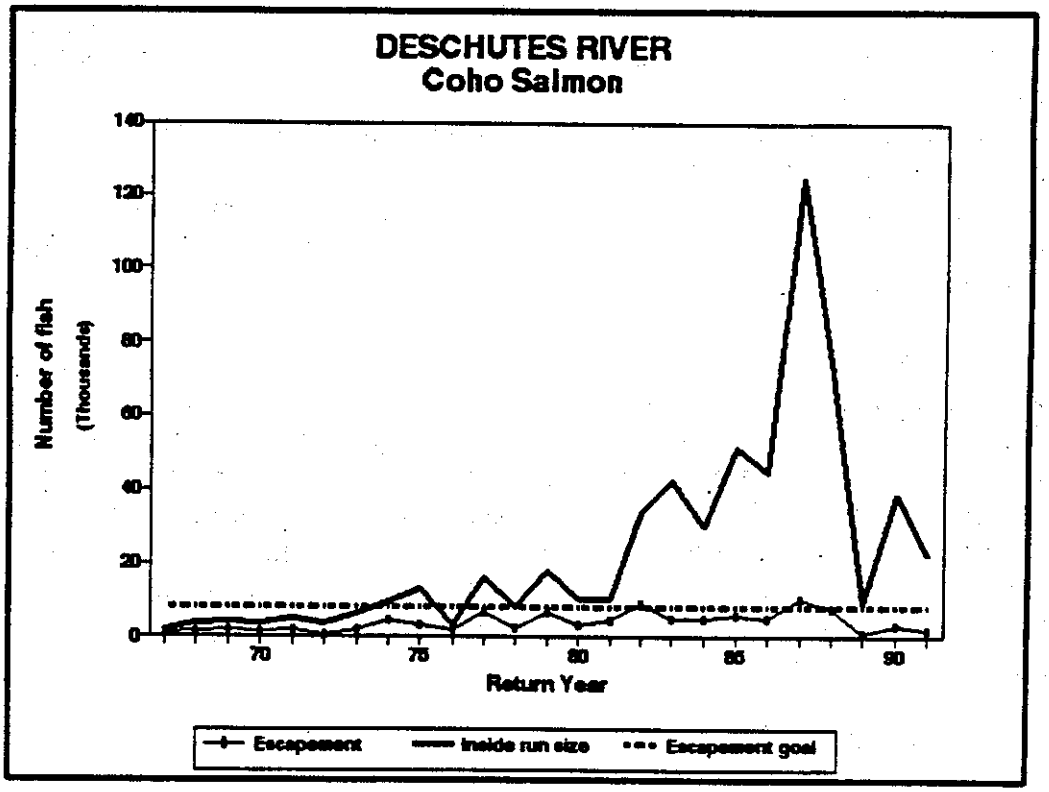
STOCK STATUS

Coho of Deschutes River basin-origin are harvested primarily in Canadian and Washington troll, net and sport fisheries. There are directed terminal area fisheries on this stock to harvest surplus net pen program returns, however, extreme terminal fisheries have been limited to minimize impact on this stock.

The natural escapement goal for Deschutes River coho is 8,100 (does not include escapement for basin independents). The run reconstruction database shows escapement fluctuating over a wide range about the goal and run size estimates (the number of fish in escapement and Puget Sound net catches) over that same period,

from 1965 to present, fluctuating over a broad range, as well. This stock's performance evaluation is based upon this run reconstruction data, however, this stock has been the subject of an intense production study, and those data are also useful in assessing performance over a shorter time span (1977 to the present). These sources indicate a short-term decline, and unless this trend continues, the fairly stable production over the long-term suggests a generally healthy state.

The graph below, which illustrates natural coho production trends in this basin, is derived from the run reconstruction database. Some of the run size estimated for the last ten to 15 years may be attributable to misallocation of hatchery-origin production to the natural stock. The magnitude of this possible error has not been estimated at this point in time. The current escapement goal is plotted across this graph. Even though this area is primarily managed to minimize surplus hatchery returns, this stock is afforded some protection by the lack of an extreme terminal fishery in Budd Inlet.



More information on this stock is presented in the stock Report which follows.

SOUTH SOUND -- DESCHUTES COHO

STOCK DEFINITION AND ORIGIN

This stock is defined on the basis of distinct geographic spawning distribution. This stock does not exhibit any unique biological characteristics, and its spawning timing is typical (most spawning occurring from late October to early January).

The Deschutes River above Tumwater Falls was inaccessible until the construction of the fish passage facility in 1954. Green River yearlings were released in the lower system beginning in the late 1940s and continuing to 1954. Fingerlings were released into the system from 1955 to 1964, primarily utilizing Green River stock as well as single year release of Skagit stock (1961). This stock has been the subject of an intensive production study (beginning with the 1977 brood) and there have been limited releases of hatchery yearlings (Skykomish, Sol Duc, George Adams (Hood Canal) and Puyallup stocks) to calibrate smolt trap efficiency. There were significant off-station releases of Minter and Puyallup fingerlings into this system in 1981 with very limited introductions after that time. This stock is an introduced non-native stock. This system has not experienced the same degree of off-station releases as the remainder of the South Sound systems, both in terms of the variety of stocks used and in terms of the magnitude and the widespread distribution of plants in the South Sound program.

STOCK STATUS

The stock is currently considered Healthy.

The database derived from the production study is excellent and provides the best indication of this stock's recent production trend. There are also run reconstruction data for this stock which are useful over a broader time frame.

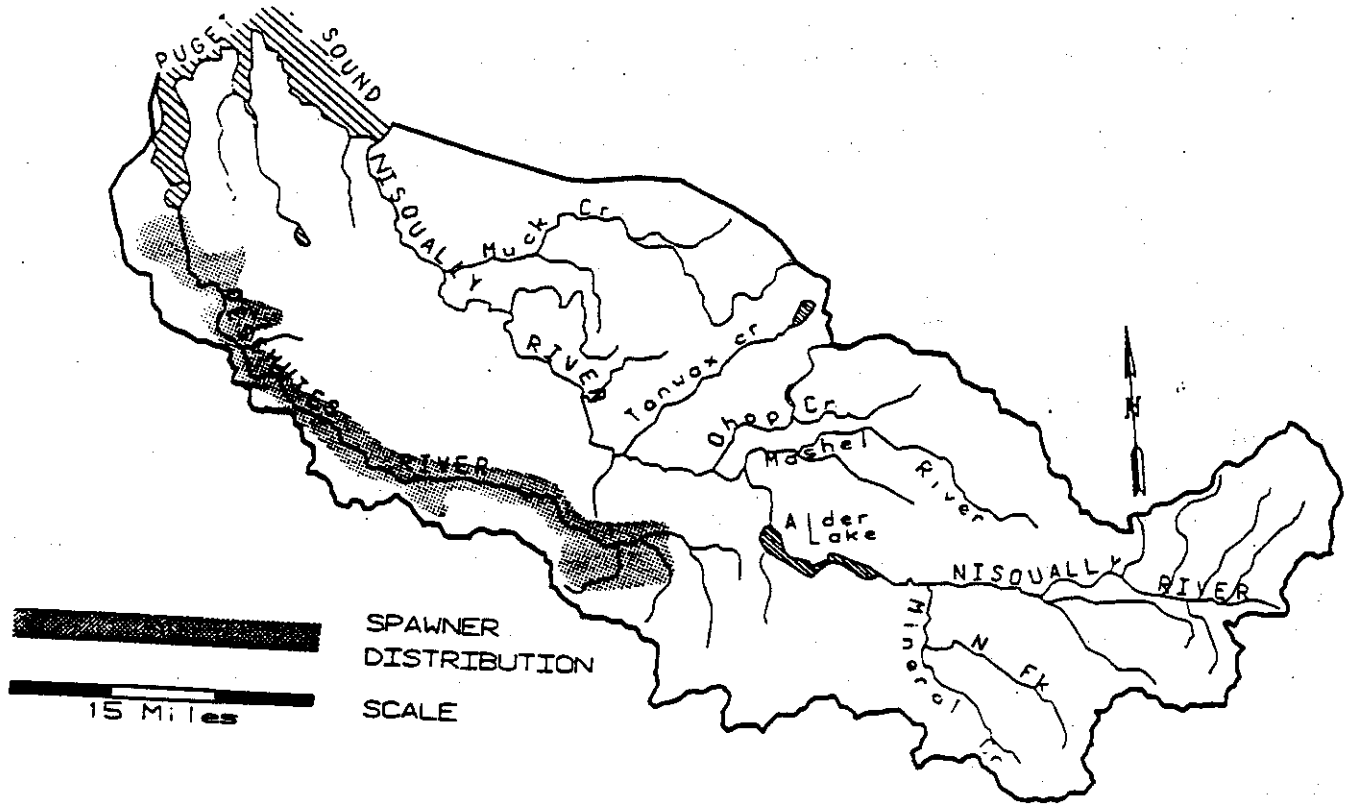
The 1989 and 1991 escapements are the lowest in the production study dataset (1977 through 1991) and would indicate a short-term severe decline. However, run reconstruction data show several years with returns near or below these levels and indicate that recent run sizes for this stock are not atypically low. If escapements continue to track recent levels, this stock's performance should be more closely scrutinized, primarily within the context of the production study database.

Habitat used by coho in the Deschutes River system is being affected by processes including accelerated sediment transport, extensive bank erosion, disturbance of riparian vegetation and isolation of the floodplain from the river channel. These processes are associated with natural sensitivities (such as unstable soils) and increasingly intensive land use, including widespread timber harvest in the upper watershed, agriculture and residential development further downstream and urban and industrial development in the lower river and estuary. No comprehensive study

STOCK DEFINITION PROFILE for Deschutes Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬	▬			**UNK**
RIVER ENTRY										▬	▬		**UNK**
SPAWNING	■										▬	▬	**NO**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

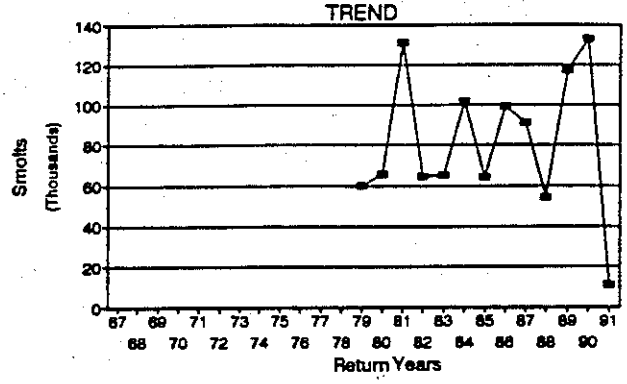
STOCK STATUS PROFILE for Deschutes Coho

STOCK ASSESSMENT

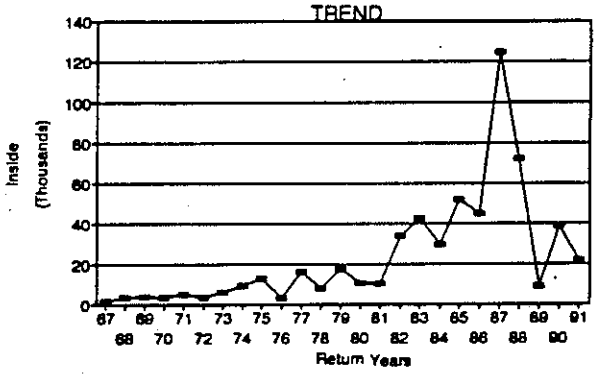
DATA QUALITY<-----> Very Good

Return Years	JUVENILE Smolts	RUNSIZE Inside	SURVIVAL Smolt/fem.	ESCAPE Total
67		1600		
68		3700		
69		4000		
70		3500		
71		5100		
72		3700		
73		6100		
74		9400		
75		12900		
76		3400		
77		16100		6790
78		7900		2319
79	60275	17800	21.7	6706
80	65776	10400	72.7	2757
81	131261	10200	42.3	3712
82	64757	34200	57.1	7775
83	65518	42600	41.0	4200
84	101901	29800	27.8	4178
85	64452	51900	33.1	5622
86	99241	44900	53.0	4333
87	91057	124700	34.9	9932
88	54397	72400	26.3	7094
89	117087	9000	22.6	904
90	133066	39000	41.7	2778
91	11248	22000	23.8	1874

JUVENILE
TREND



RUNSIZE
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Non-native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

of habitat factors limiting coho production has been performed in the Deschutes watershed, however, habitat problems that affect various coho life history stages can be identified from existing information. Spawning/incubation habitat has been destabilized by debris flows in streams such as Huckleberry Creek, and spawning gravel has been degraded by fine sediment from sources such as landslides and bank erosion. The quantity and quality of rearing habitat has been affected by summer low flows, filling of pools with sediment and reduction in large woody debris recruitment and loading. In addition, clearing of riparian vegetation has reduced canopy shading, increasing summer water temperatures. Availability of off-channel winter refuge habitat appears to have been reduced by floodplain development and channelization. Improvement of natural coho production in the Deschutes system will require reduction of land-use impacts and recovery of productive habitat conditions for all coho life history stages.

OVERVIEW -- SOUTH SOUND -- EAST KITSAP COHO STOCK

EAST KITSAP

STOCK DEFINITION AND ORIGIN

The East Kitsap basin includes tributaries to the west side of Puget Sound, north of the Tacoma Narrows to the north end of the Kitsap Peninsula. Coho salmon utilize, to some degree, almost all of the accessible streams in this area. Coho returning to these streams typically enter fresh water from early September to mid-November and spawn from late October through December with some variation observed between streams and between years within streams.

There have been substantial releases of hatchery-origin coho within this area, with significant off-station yearling plants from the early 1950s to the early 1970s. Sporadic off-station fingerling/fry plants also occurred during that time frame, with a comprehensive program beginning in the mid-1970s and continuing to the present. There are also annual yearling releases from various pen rearing programs throughout the basin. It should be noted that many of the early off-station yearling releases were not consistent with current optimal size and time-of-release strategies, and their subsequent contribution to the wild spawning population is unknown. Straying rates from the pen rearing projects are also unknown, as are the potential survival differentials related to the various stocks introduced into this area.

Additional to those considerations are questions regarding the spawning success in the wild of hatchery-origin coho and any distinctions between native and introduced stocks in terms of either temporal or physical spawning distributions. As a result of these uncertainties, the stock in this area has been designated as a probable mixture of native and non-native stocks, without any inference as to the relative influence of those stocks within the current population. There can be no confident quantification of the genetic impact of non-native stock introductions, regarding either a current presence of hatchery type components in this population or hybridization of the native stock, until an effective genetic research tool is developed and implemented for coho salmon.

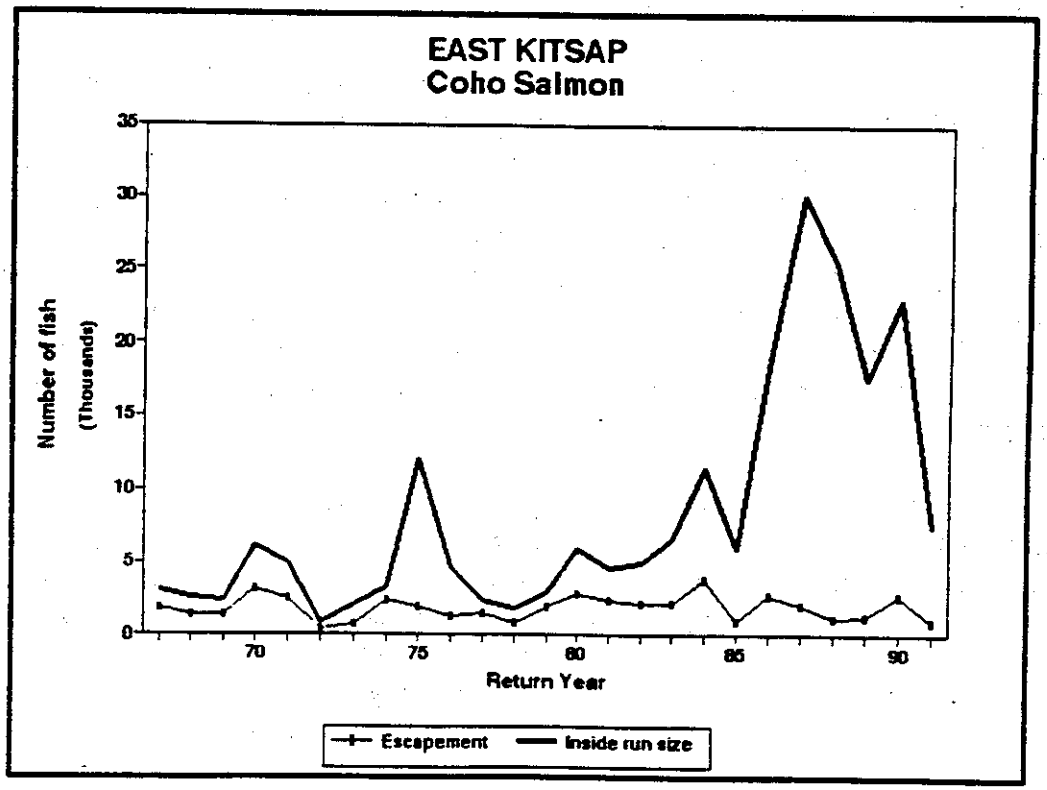
There are no significant differences in timing or any unique biological characteristics documented for the coho in this basin that would suggest multiple stocks. The distinction of this stock from those in surrounding drainages is therefore dependent upon a determination of geographic spawning separation, the result of subjective judgements regarding the probability of significant spawner interchange between those drainages. The off-station planting history is fairly uniform throughout this basin, suggesting that there may be some common impact of hatchery-origin coho introductions. Until a genetic determinant is available and used to evaluate this stock, this designation is tentative.

STOCK STATUS

Coho of East Kitsap basin origin are primarily harvested in Canadian and Washington troll, net and sport fisheries. There are directed terminal area fisheries on this stock to harvest surplus hatchery returns.

The natural escapement goal for East Kitsap coho is 2,400. The run reconstruction database shows escapement fluctuating over a wide range about the goal and run size estimates (the number of fish in escapement plus Puget Sound net catches), from 1965 to 1991, fluctuating over a broad range, as well. The East Kitsap stock's performance evaluation is based upon this run reconstruction data which indicate fairly stable production and a generally healthy state.

The figure below, which illustrates natural coho production trends in this basin, is derived from the run reconstruction database. Please note that a significant portion of the run size estimated for the last ten to 15 years is attributable to misallocation of net pen-origin production to the natural stock. The magnitude of this possible error has not been estimated at this time. Specifically, the inside run size in 1975, 1976 and from 1981 to the present contains significant net pen production. The escapement goal is not plotted on this graph since the primary management objective in this basin is to minimize surplus hatchery returns through harvest rates which generally preclude accomplishing that goal.



More information on this stock is presented in the Stock Report which follows.

SOUTH SOUND -- EAST KITSAP COHO

STOCK DEFINITION AND ORIGIN

This stock is defined on the basis of geographic spawning distribution. Unique biological characteristics have not been documented for this stock, and its spawning timing is not remarkable (most spawning occurring from late October to late December).

Yearling releases were common from 1952 to the early 1970s in this region. These yearling plants were predominantly Minter Creek stock, although there were single year releases of Dungeness (1966), Issaquah (1955), George Adams (1973), Quilcene (1955), and Skykomish (1976) stocks, as well as three years of Green River utilization (1956, 1960, and 1965). Fingerling releases for that same time period were sporadic, with Minter Creek once again the apparent stock of choice. Since the mid-1970s there has been a comprehensive off-station fry/fingerling program in this area which has used Minter stock almost exclusively. There may be some straying of adult production from the Agate Pass Pen program into this spawning population, as well. This stock is likely a mixture of native stock and introduced non-native stocks.

STOCK STATUS

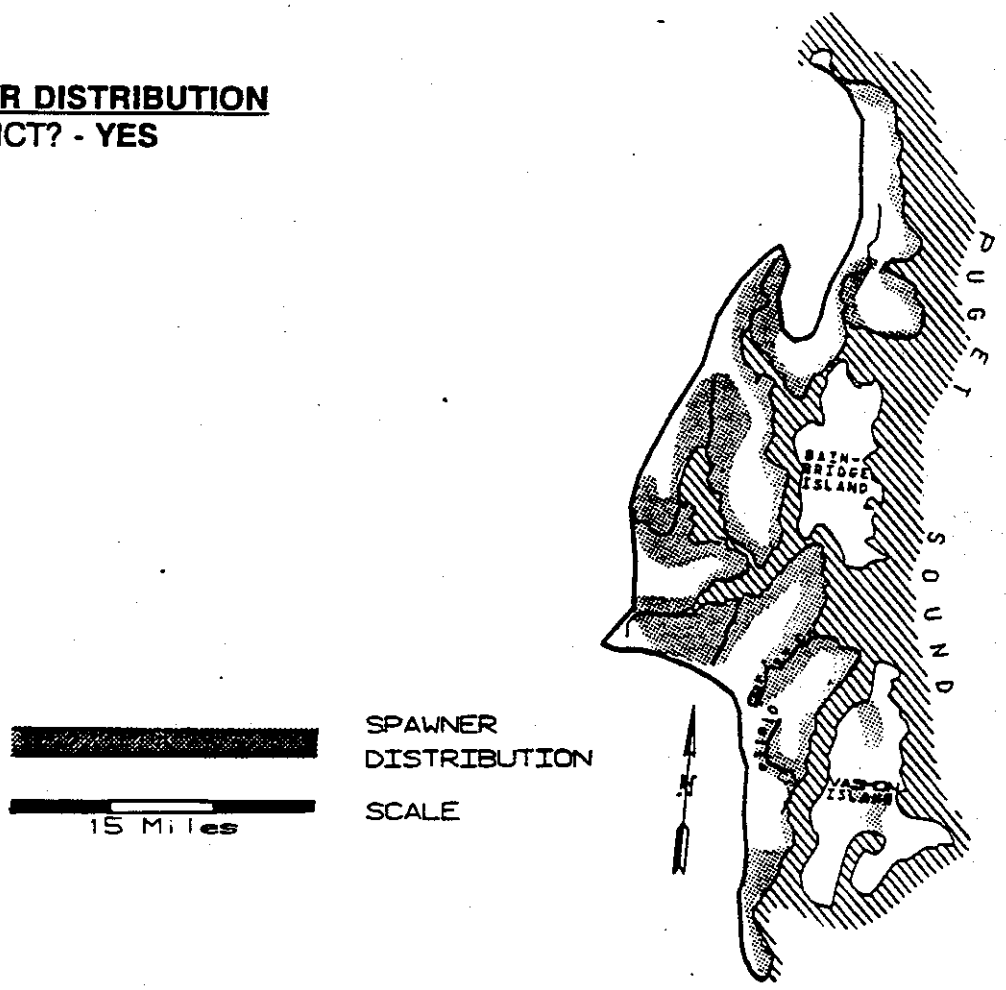
The status of this stock is Healthy.

Index escapement data are good, dating back to 1983. Run reconstruction data are also available and should reasonably represent this stock's production trends. Both of these datasets indicate that production of this stock is fairly stable.

STOCK DEFINITION PROFILE for East Kitsap Coho

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN									▬	▬			**UNK**
RIVER ENTRY									▬	▬	▬		**UNK**
SPAWNING										▬	▬	▬	**NO**

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **NO**

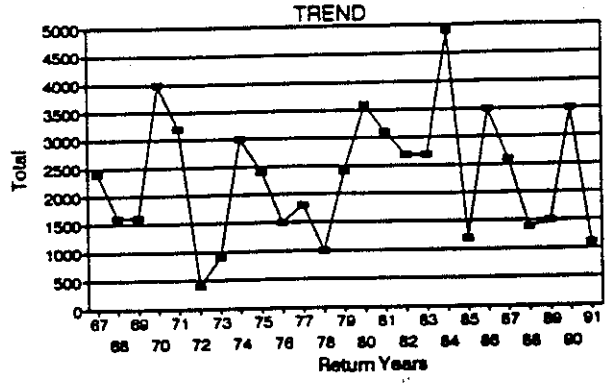
STOCK STATUS PROFILE for East Kitsap Coho

STOCK ASSESSMENT

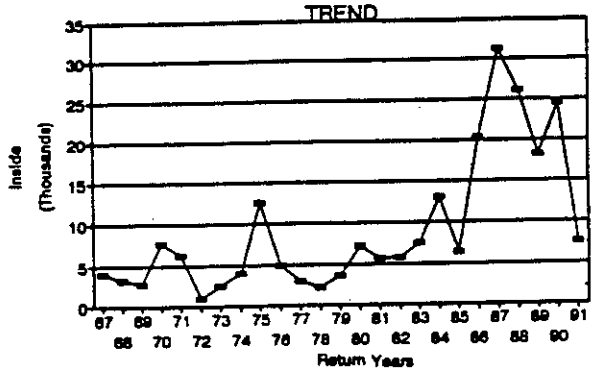
DATA QUALITY----> Good

Return Years	ESCAPE Total	RUNSIZE Inside		
67	2400	4000		
68	1600	3200		
69	1600	2800		
70	4000	7700		
71	3200	6300		
72	400	1000		
73	900	2500		
74	3000	4000		
75	2400	12600		
76	1500	4900		
77	1800	3000		
78	1000	2200		
79	2400	3600		
80	3600	7200		
81	3100	5700		
82	2700	5800		
83	2700	7600		
84	4900	13100		
85	1200	6400		
86	3500	20300		
87	2600	31200		
88	1400	26100		
89	1500	18200		
90	3500	24500		
91	1100	7600		

ESCAPE
TREND



RUNSIZE
TREND



AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Mixed

PRODUCTION TYPE
Composite

STOCK DISTINCTION
Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

OVERVIEW -- SOUTH SOUND SUMMER AND WINTER STEELHEAD STOCKS

WINTER:

DESCHUTES	**HAMMERSLEY INLET**
ELD INLET	**CASE / CARR INLETS**
TOTTEN INLET	**EAST KITSAP**

STOCK DEFINITION AND ORIGIN

In South Puget Sound, no summer steelhead stocks and six winter steelhead stocks have been identified. Wild winter steelhead in the Deschutes River, Eld Inlet, Totten Inlet, Hammersley Inlet, Case/Carr Inlets, and East Kitsap are distinct stocks. Wild winter steelhead in each stock are native, except the Deschutes River stock which originated from non-native steelhead.

There is little or no information available to indicate whether these are genetically distinct stocks. The stocks are treated separately due to the geographical isolation of the spawning populations. There may be more or fewer stocks identified once more comprehensive genetic, life history, and ecological information is available.

More information on each stock is presented in separate Stock Reports.

SOUTH SOUND -- DESCHUTES WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in the Deschutes River and tributaries are a distinct non-native stock based on the geographical isolation of the spawning population. Run timing is generally from November to mid-March and spawn timing is generally from early January to early April for wild winter steelhead in this stock.

The Deschutes River steelhead run was developed from a South Puget Sound early-returning stock from Chambers Creek near Steilacoom. The Deschutes River was impassable to anadromous fish until laddered in 1954. Winter steelhead smolt plants from Chambers Creek stock have been near 25,000 annually for about 50 years. Offspring from spawning hatchery fish have produced a small "wild" run of fish returning to the Deschutes.

STOCK STATUS

This status of the stock is Healthy.

This stock is managed primarily to provide a recreational harvest fishery and has no escapement objective since the stock originated from hatchery stocks.

Sport harvest data are available since the early 1960s but wild winter steelhead were not reported separately on steelhead permit cards until the 1986-87 winter steelhead season. Information on sport harvest of wild winter steelhead is available over the majority of the run because the sport steelhead season is open through March 31. The stock is exhibiting a short-term decline in wild steelhead sport harvest.

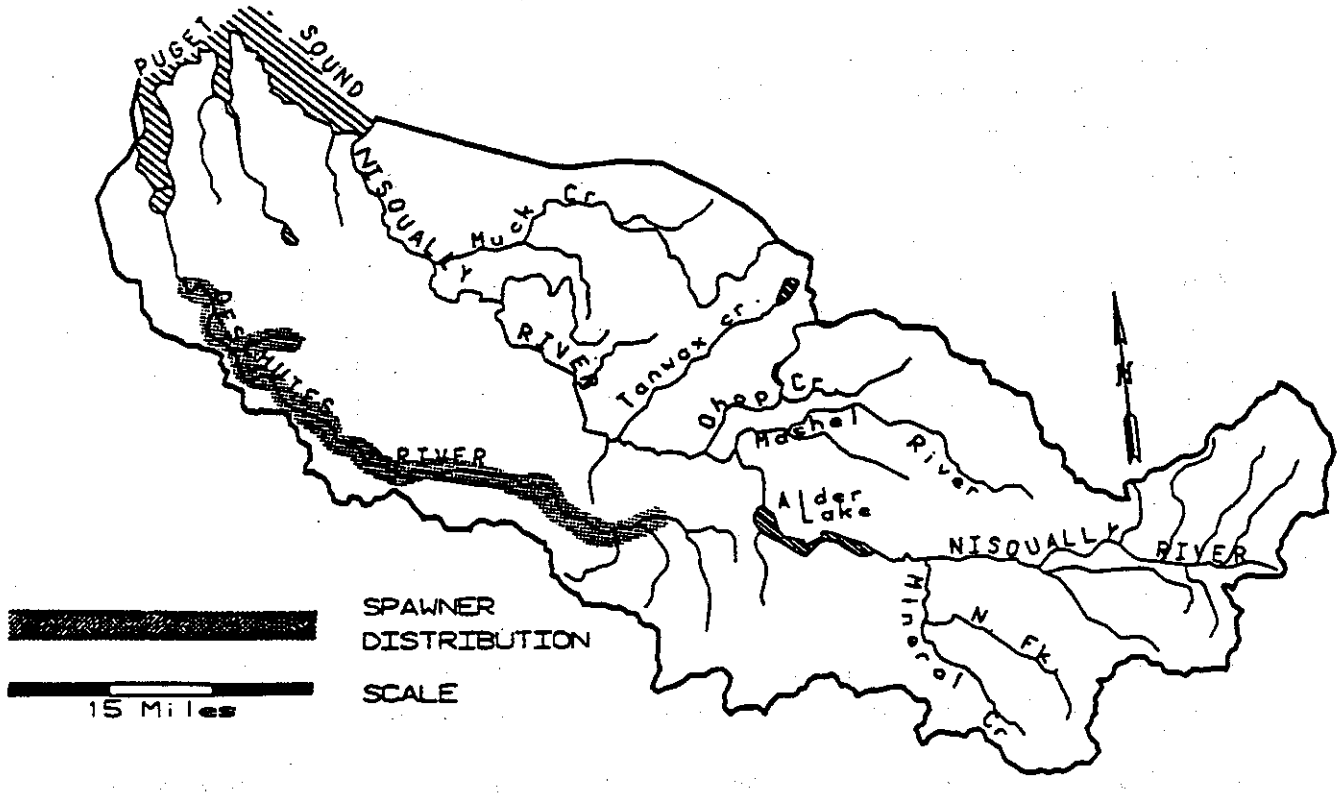
FACTORS AFFECTING PRODUCTION

Habitat -- The short-term decline for this stock is likely due, in part, to recent changes in ocean survival. A recent Washington Department of Wildlife study (Cooper and Johnson 1992) concluded that there have been long-term fluctuations and recent declines in winter, summer, hatchery and wild steelhead abundance and survival in the Puget Sound, Strait of Juan de Fuca, Pacific coast, and Columbia River areas in Washington. There were also similarities in the overall trends and year-to-year trends of steelhead abundance in Washington, British Columbia and Oregon. Similarities in survival trends over widespread geographic areas indicate that common factor(s) to each of these areas are responsible for recent changes in steelhead survival. A combination of factors contributed to the recent decline in steelhead abundance including low ocean productivity, competition for food in the ocean, and harvest of steelhead in authorized and unauthorized high seas drift net fisheries.

STOCK DEFINITION PROFILE for Deschutes Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	▬	▬	▬								▬	▬	NO
SPAWNING	▬	▬	▬	▬									NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

STOCK STATUS PROFILE for Deschutes Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY-----> Fair

Return Years	HARVEST Sport			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87	81			
88	31			
89	24			
90	36			
91	11			
92	4			

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Non-Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Healthy

SCREENING CRITERIA

The estuary at the mouth of the Deschutes was excavated to create Capitol Lake. Material fill was used to create buildable land and a port. These turn-of-the-century activities continue to limit the Deschutes system productivity.

Currently, sedimentation in the river and blocks to fish passage at the fish ladders are major in-stream habitat concerns.

Predation on migrating wild steelhead smolts and returning wild adults may also affect production.

Harvest Management -- No directed tribal fishery occurs on the Deschutes winter steelhead. The sport fishery is concentrated in the lower river and downstream of Deschutes Falls. The sport fishery harvest has been under 50 fish for the past five years with a steadily declining trend since 1984.

Hatchery -- This non-native run benefits from hatchery-origin returning adults. Levels of returns are so low that habitat seeding needs are probably not being met. Chambers Creek and Bogachiel hatchery stocks are appropriate enhancement in this watershed to maintain the gene pool developed over the past 50 years.

Characteristic of a supplemented artificial run, the percent of wild fish remains fairly constant by month from December through March. November returns are low for both hatchery and wild fish.

SOUTH SOUND -- ELD INLET WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in Eld Inlet tributaries are native to the drainages and a distinct stock based on the geographical distribution of the spawning populations in Perry Creek and McLane Creek.

Run timing is generally from December through mid-March and spawn timing is generally from early February to early April for wild winter steelhead in this stock.

STOCK STATUS

The status of the stock is Unknown. This stock is comprised of a historically small number of steelhead, but there is insufficient information to classify its status as either Healthy, Depressed, or Critical.

Spawning escapement is not monitored for this stock nor has an escapement goal been identified.

Sport harvest data are not available since no steelhead fisheries occur.

FACTORS AFFECTING PRODUCTION

Habitat -- Perry Creek has very low flows during summer months limiting the ability to produce a two-year-old steelhead smolt. McLane Creek heads in beaver ponds and has relatively good habitat which is limited in length. Fish returning to these streams in deep South Puget Sound must navigate a gauntlet of predators and fisheries which may be partially responsible for declining returns. Saltwater survival has been poor for steelhead from all Puget Sound streams/rivers for the past few years.

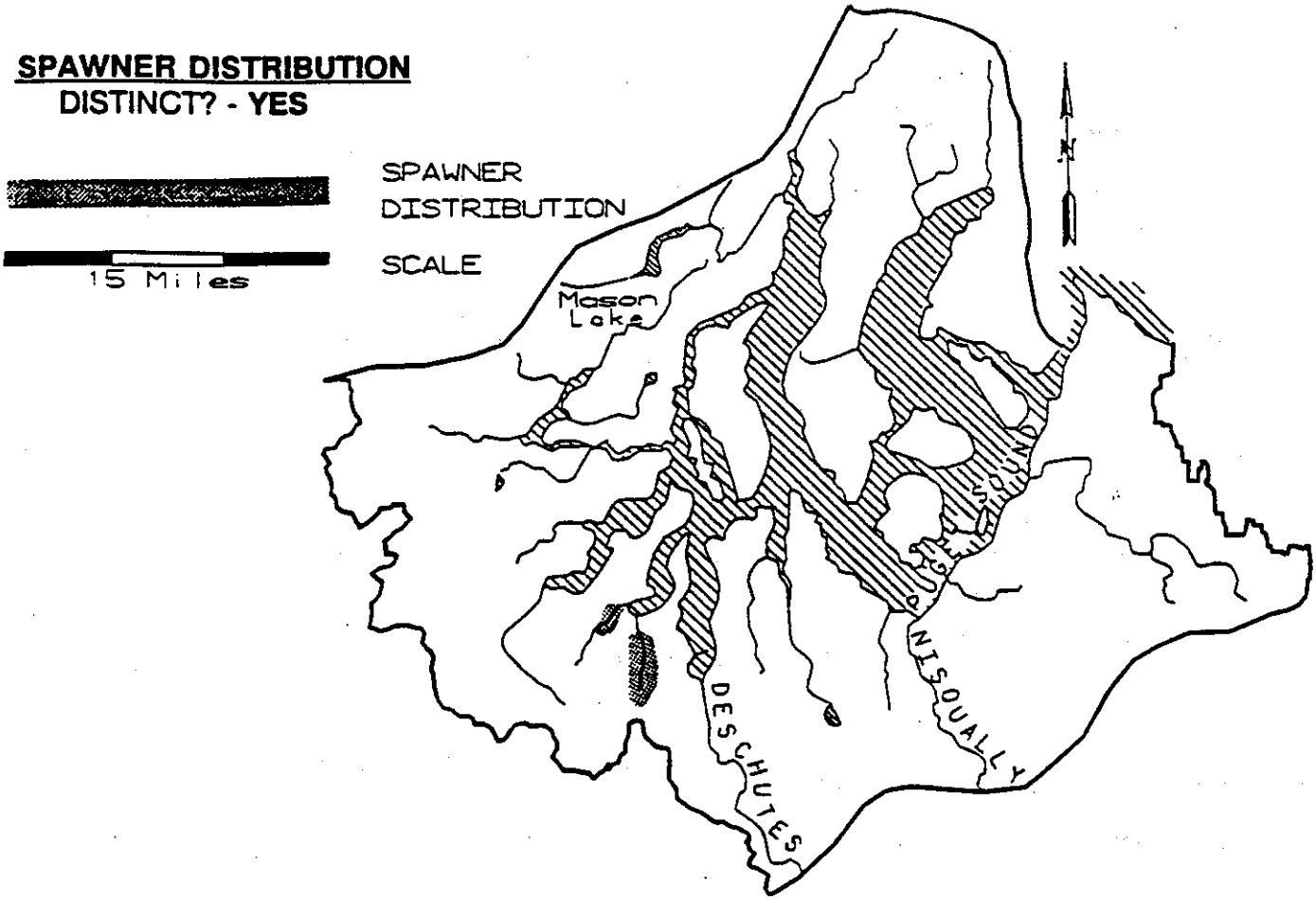
Harvest Management -- There is no targeted tribal or sport fishery on Perry or McLane creeks. Saltwater interceptions during the migration to this area are possible.

Hatchery -- Hatchery steelhead smolts are not stocked in these streams.

STOCK DEFINITION PROFILE for Eld Inlet Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	■	■	■									■	NO
SPAWNING		■	■	■									NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for Eld Inlet Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY-----> No Data

Return Years	NO DATA			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

SOUTH SOUND -- TOTTEN INLET WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in Totten Inlet tributaries are native and a distinct stock based on the geographical isolation of the spawning population in Skookum, Kennedy, and Schneider creeks.

Run timing is generally from December through mid-March and spawn timing is generally from early February to early April for wild winter steelhead in this stock.

STOCK STATUS

The status of the stock is Unknown. This stock is comprised of a historically small number of steelhead, but there is insufficient information to classify its status as either Healthy, Depressed, or Critical.

Spawning escapement is not monitored for this stock nor has an escapement goal been identified.

Sport harvest data are available since the early 1960s, but wild winter steelhead were not reported separately on steelhead permit cards until the 1986-87 winter steelhead season. Information on sport harvest of wild winter steelhead is available for only the early portion of the run because the sport steelhead season closes on February 28. As a result, sport harvest data cannot be used to assess the status of the wild stock.

More information needs to be collected on this stock so that stock status can be determined. As a small stock, it could be especially vulnerable to any negative impacts.

FACTORS AFFECTING PRODUCTION

Habitat -- Low flows during summer rearing months and limited spawning habitat characterize these streams. Steelhead returning from the ocean to these streams have to pass through a gauntlet of predators and fisheries in Puget Sound. Kennedy Creek has a falls at RM 2.5 which blocks anadromous passage.

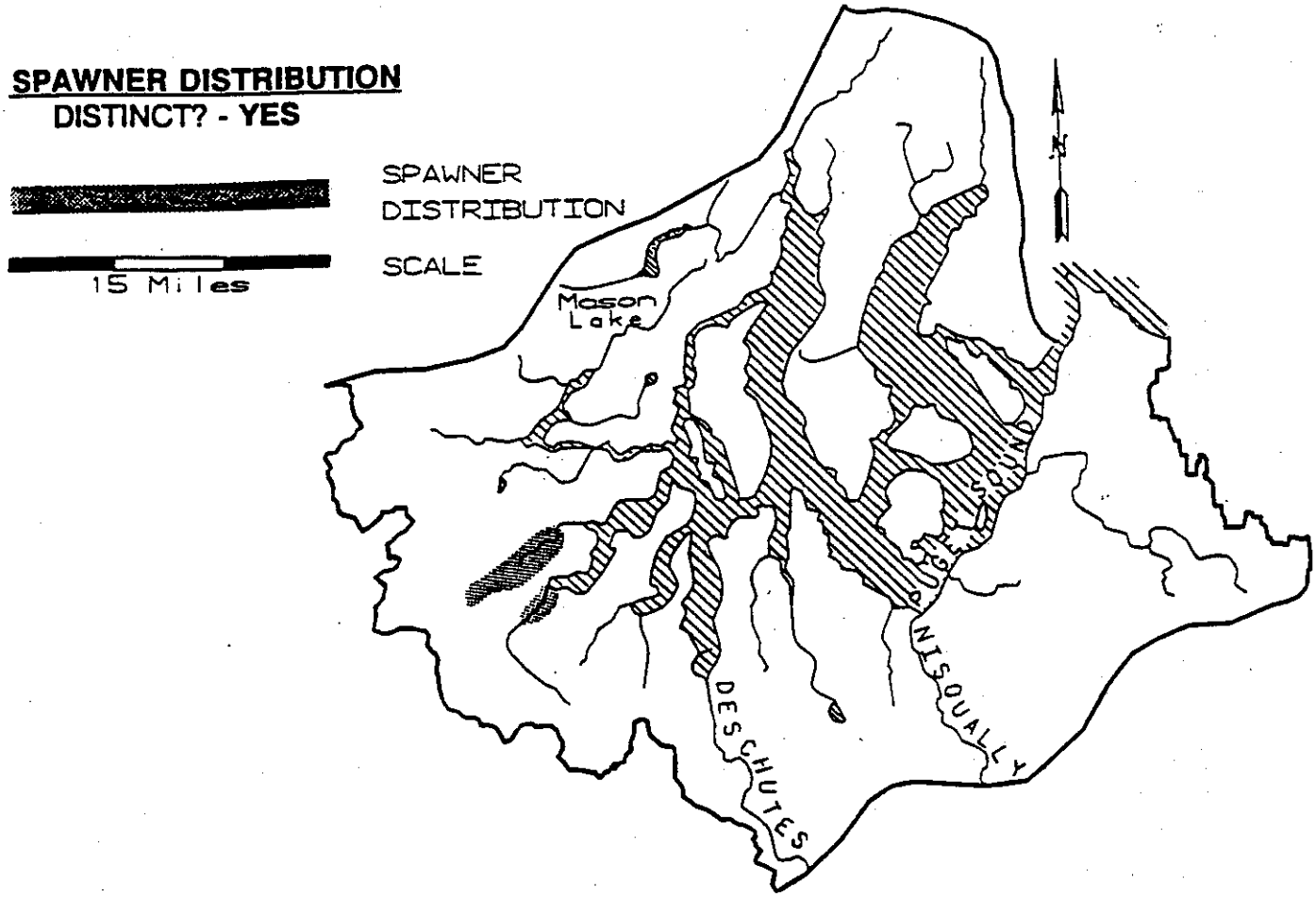
Harvest Management -- There is no tribal harvest directed at returning wild adult steelhead. Sport harvest extends from November through February on Skookum Creek and through March on Kennedy Creek. Harvest of wild steelhead in the sport fishery is very low.

Hatchery -- Kennedy Creek has received plants of hatchery steelhead smolts which returned successfully until the past few years.

STOCK DEFINITION PROFILE for Totten Inlet Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	▬	▬	▬									▬	NO
SPAWNING		▬	▬	▬									NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - **UNKNOWN**

STOCK STATUS PROFILE for Totten Inlet Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY-----> Fair

Return Years	HARVEST Sport			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87	14			
88	6			
89	4			
90	0			
91	2			
92	0			

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

SOUTH SOUND -- HAMMERSLEY INLET WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead in Hammersley Inlet tributaries are native and a distinct stock based on the geographical isolation of the spawning population in Mill, Goldsborough, Johns, Cranberry, Deer, Spring, Malaney, Uncle John, and Campbell creeks.

Run timing is generally from December through mid-March and spawn timing is generally from early February to early April for wild winter steelhead in this stock.

STOCK STATUS

The status of the stock is Unknown. This stock is comprised of a historically small number of steelhead, but there is insufficient information to classify its status as either Healthy, Depressed, or Critical.

Spawning escapement is not monitored for this stock nor has an escapement goal been identified.

Sport harvest data are available since the early 1960s, but wild winter steelhead were not reported separately on steelhead permit cards until the 1986-87 winter steelhead season. Information on sport harvest of wild winter steelhead is available for only the early portion of the run because the sport steelhead season closes on February 28 and the wild harvest is very low. As a result, sport harvest data cannot be used to assess the status of the wild stock.

More information needs to be collected on this stock so that stock status can be determined. As a small stock, it could be especially vulnerable to any negative impacts.

FACTORS AFFECTING PRODUCTION

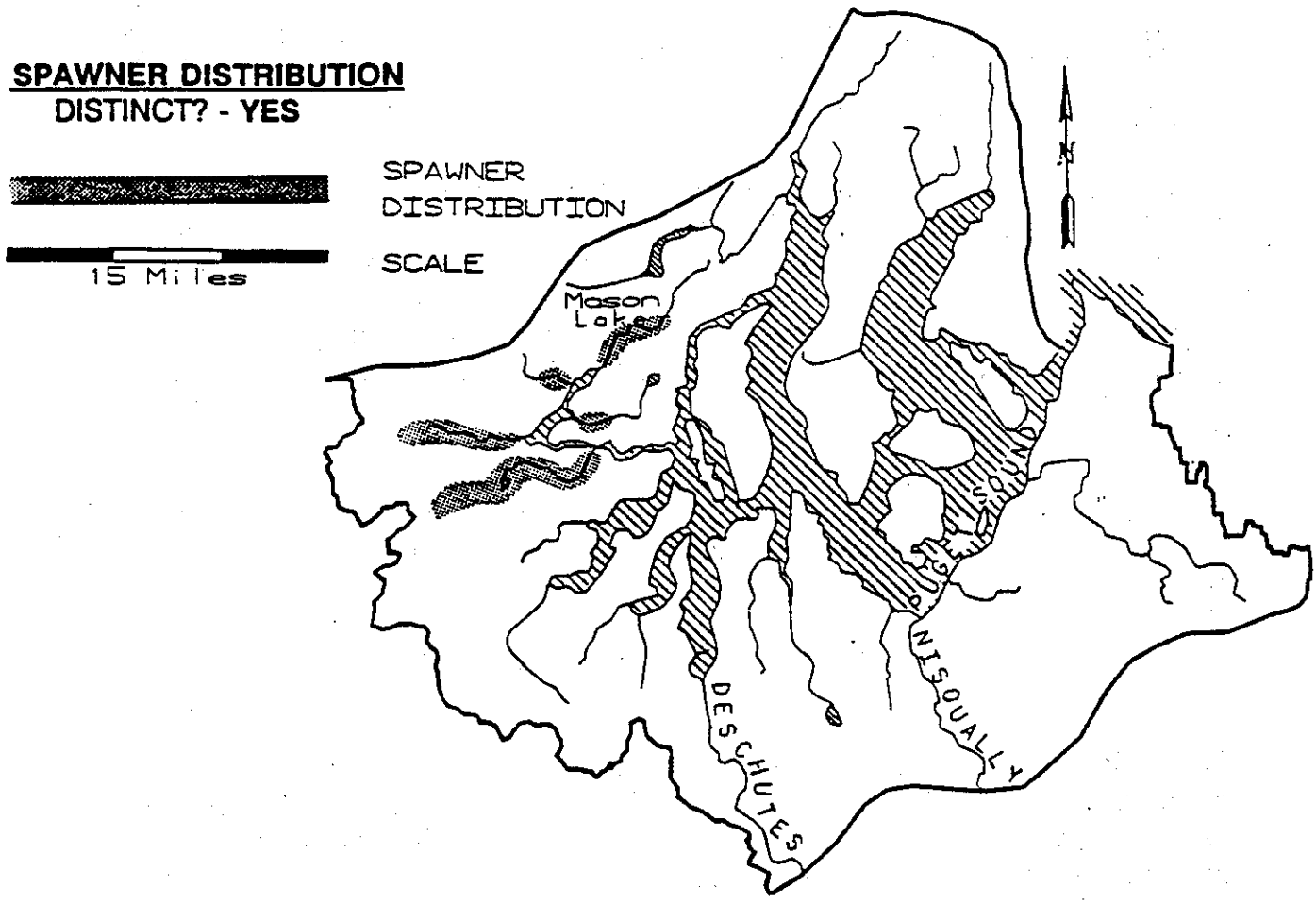
Habitat -- A former diversion dam (RM 5.2) and poor fish passage facilities at the present dam (RM 2.3) until recent years significantly limited the production of anadromous fish rearing and spawning in Goldsborough Creek. Extensive water withdrawals by Simpson Timber Company during periods of low flow also limit the production of juvenile steelhead in the lower Goldsborough Creek watershed.

Harvest Management -- There is no tribal fishery directed towards this stock. Sport harvest seasons are from November through February on Mill Creek and through March on Goldsborough Creek.

STOCK DEFINITION PROFILE for Hammersley Inlet Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	■	■	■									■	NO
SPAWNING		■	■	■									NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for Hammersley Inlet Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY-----> Fair

Return Years	HARVEST Sport			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87	12			
88	2			
89	9			
90	0			
91	0			
92	2			

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

Marine mammal predation on migrating wild steelhead smolts and returning wild adults may also affect production.

Hatchery -- Goldsborough Creek has received hatchery smolt plants for many years from an early-returning stock.

SOUTH SOUND -- CASE / CARR INLETS WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead are native and a distinct stock based on geographical isolation of the spawning population in tributaries to Case Inlet and Pickering Passage (Sherwood, Coulter, Rocky, Dutcher, Artondale, and Jones creeks) and tributaries to Henderson Bay and Carr Inlet (Minter, Burley, Purdy, McCormick, and Lackey creeks).

Run timing is generally from December through mid-March and spawn timing is generally from early February to early April for wild winter steelhead in this stock.

STOCK STATUS

The status of the stock is Unknown. This stock is comprised of a historically small number of steelhead, but there is insufficient information to classify its status as either Healthy, Depressed, or Critical.

Spawning escapement is not monitored for this stock nor has an escapement goal been identified.

Sport harvest data are available since the early 1960s, but wild winter steelhead were not reported separately on steelhead permit cards until the 1986-87 winter steelhead season. Information on sport harvest of wild winter steelhead is available for only the early portion of the run because the sport steelhead season closes on February 28. As a result, sport harvest data cannot be used to assess the status of the wild stock.

More information needs to be collected on this stock so that stock status can be determined. As a small stock, it could be especially vulnerable to any negative impacts.

FACTORS AFFECTING PRODUCTION

Habitat -- Low flows through summer months and limited spawning and rearing habitat impact production in these streams. Urban development has also impacted several of these streams.

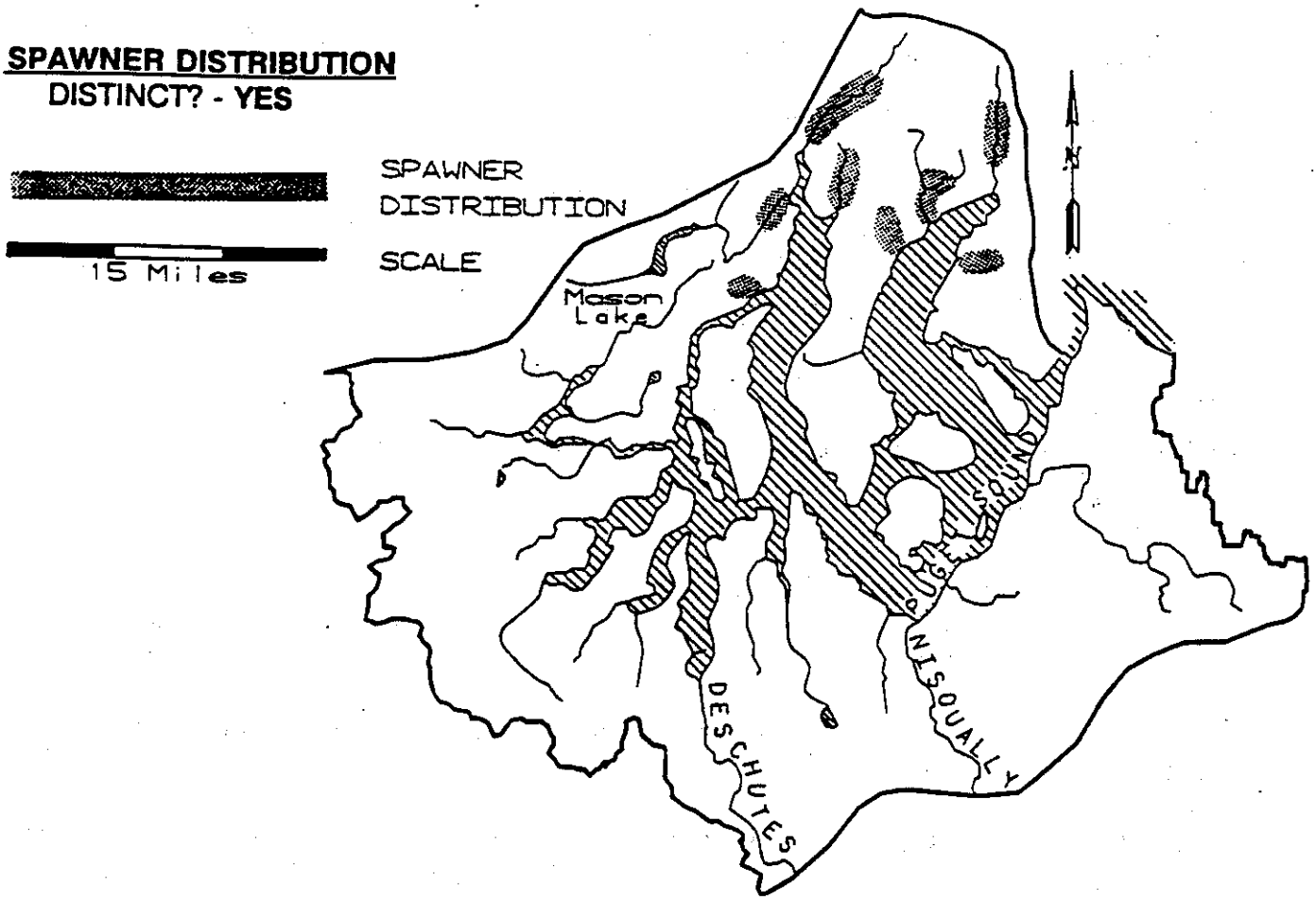
Harvest Management -- No tribal harvest is directed at this stock. A sport season extending from November through February exists on Sherwood, Coulter, and Burley creeks. Sport harvest seasons are protecting later-returning stocks of wild fish. Sport harvest of wild steelhead is very low.

Hatchery -- Few of these streams have been planted with hatchery steelhead smolts.

STOCK DEFINITION PROFILE for Case/Carr Inlets Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	▬	▬	▬									▬	NO
SPAWNING		▬	▬	▬									NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for Case/Carr Inlets Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY----> Fair

Return Years	HARVEST Sport			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87	14			
88	6			
89	2			
90	4			
91	4			
92	6			

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

SOUTH SOUND -- EAST KITSAP WINTER STEELHEAD

STOCK DEFINITION AND ORIGIN

Wild winter steelhead are a distinct stock based on the geographical isolation of the spawning population in tributaries to Colvos Passage (Ollala and Crescent creeks), Yukon Harbor (Curley Creek), Sinclair Inlet (Gorst, Blackjack, and Ross creeks), Dyes Inlet (Barker, Clear, and Chico creeks), Liberty Bay (Scandia and Dogfish creeks), and Miller Bay (Grovers Creek). Little is known about the genetic composition of the stock. Wild winter steelhead are native to the majority of East Kitsap streams.

Run timing is generally from December through mid-March and spawn timing is generally from early February to early April for wild winter steelhead in this stock.

STOCK STATUS

The status of the stock is Unknown. Due to the relatively small size of the majority of drainages in East Kitsap, this stock is comprised of a historically small number of steelhead.

Spawning escapement is not monitored for this stock nor has an escapement goal been identified.

Sport harvest information is only available for Curley Creek but wild winter steelhead were not reported separately on steelhead permit cards until the 1986-87 winter steelhead season. Information on sport harvest of wild winter steelhead is available for only the early portion of the run because the sport steelhead season closes on February 28. As a result, sport harvest data cannot be used to assess the status of the wild stock.

More information needs to be collected on this stock so that stock status can be determined. As a small stock, it could be especially vulnerable to any negative impacts.

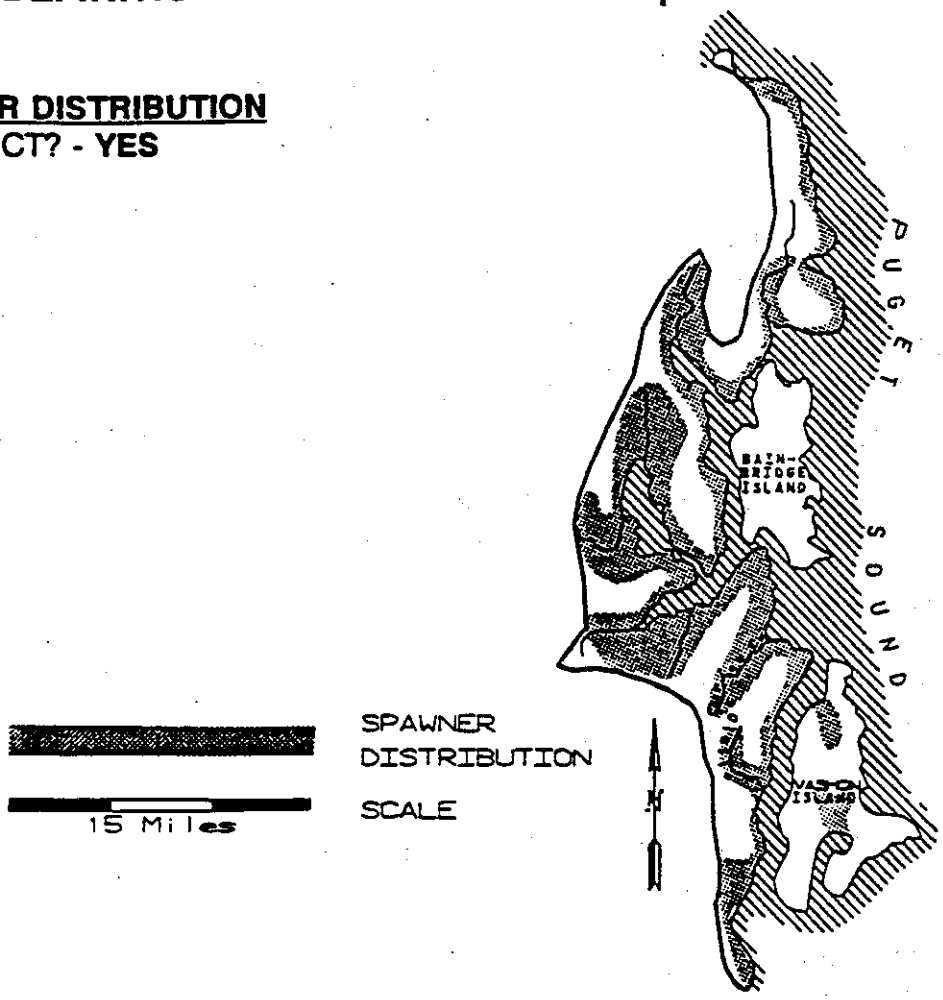
FACTORS AFFECTING PRODUCTION

Habitat -- Freshwater habitat has been impacted by land-use activities, although quantitative data are limited. Low flows during the summer months and limited spawning and rearing habitat affect production in these streams.

STOCK DEFINITION PROFILE for East Kitsap Winter Steelhead

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT
TERMINAL RUN													
RIVER ENTRY	▬	▬	▬									▬	NO
SPAWNING		▬	▬	▬									NO

BIOLOGICAL CHARACTERISTICS

DISTINCT? - UNKNOWN

STOCK STATUS PROFILE for East Kitsap Winter Steelhead

STOCK ASSESSMENT

DATA QUALITY——> Fair

Return Years	HARVEST Sport			
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88	28			
89	8			
90	10			
91	0			
92	2			

AVERAGE RUNSIZE DISTRIBUTION

DATA NOT AVAILABLE.

STOCK SUMMARY

STOCK ORIGIN
Native

PRODUCTION TYPE
Wild

STOCK DISTINCTION
Spawning Distribution

STOCK STATUS
Unknown

SCREENING CRITERIA

Harvest Management -- There is no directed tribal fishery on this stock. A steelhead sport fishery is open only on Curley Creek and closes on February 28 before the majority of the wild stock enters the stream.

Hatchery -- Only Curley Creek has been planted with hatchery steelhead smolts, but it has not been stocked for many years.

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GLOSSARY

ALLELE -- One of two or more alternative forms of a gene.

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

BROOD STOCK -- Those adult salmonids that are destined to be the parents for a particular stock or smaller group of fish.

CRITICAL STOCK -- A stock of fish experiencing production levels that are so low that permanent damage to the stock is likely or has already occurred.

COMPOSITE STOCK -- A stock sustained by both wild and artificial production.

CULTURED STOCK -- A stock that depends upon spawning, incubation, hatching, or rearing in a hatchery or other artificial production facility.

DENDROGRAM -- A graphic summary of the genetic relationships among populations. The horizontal distance at which the stock branches connect indicates the degree of similarity/dissimilarity. The longer the distance at which the branch points connect, the greater the average genetic differences among stocks.

DEPRESSED STOCK -- A stock of fish whose production is below expected levels based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely.

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

ENDANGERED SPECIES ACT (ESA) -- A 1973 Act of Congress that mandated that endangered and threatened species of fish, wildlife, and plants be protected and restored.

ESCAPEMENT -- Those fish that have survived all fisheries and will make up a spawning population.

ESCAPEMENT FLOOR -- The lower bound of an escapement range.

ESCAPEMENT GOAL -- A predetermined biologically derived number of salmonids that are not harvested and will be the parent spawners for a wild or hatchery stock of fish.

ESCAPEMENT OBJECTIVE -- A predetermined number of salmonids that varies from the escapement goal, and are not harvested and will be the parent spawners for a wild or hatchery stock of fish.

EXTINCT STOCK -- A stock of fish that is no longer present in its original range, or as a distinct stock elsewhere. Individuals of the same species may be observed in very low numbers, consistent with straying from other stocks.

FISHERY -- The act, process, or occupation of attempting to catch fish, which may be retained or released.

FRY -- Young salmonids that have emerged from the gravel and are up to one month of age or any cultured salmonid from hatching through fourteen days after being ponded.

GENE -- A specific unit of genetic material (DNA) that encodes the information for a single genetic trait.

GENE POOL -- The total variety and proportions of alleles within a population.

GENETIC DISTANCE -- A statistical measure that summarizes the detectable genetic differentiation among collections or stocks based on allele frequency differences across all gene loci screened. There are a variety of different genetic distance statistics in the published literature (e.g. Nei, Rogers, Cavalli-Sforza & Edwards), each with its strengths and weaknesses.

GENETIC STOCK IDENTIFICATION (GSI) -- A method that can be used to characterize populations of organisms based on the genetic profiles of individuals. The genetic stock identification process consists of a series of steps: (1) collect selected tissues from a representative sample of individuals from the population(s) under investigation; (2) develop genetic profiles for the individuals in each population by conducting starch-gel electrophoresis and histochemical staining using tissue extracts; (3) characterize each population by aggregating the individual genetic profiles and computing allele frequency distributions; and (4) conduct statistical tests using the allele counts characterizing each population to identify significantly different populations.

GENOME -- The total genetic composition of an individual. The complete genetic information possessed by an organism.

HABITAT -- An area that supplies food, water, shelter, and a space necessary for a particular animal's existence.

HARVEST -- Fish that are caught and retained in a fishery (consumptive harvest).

HARVEST RATE -- The proportion of a returning run or total population of salmonids that is taken by fisheries, usually expressed as a catch to escapement ratio.

HATCHERY PRODUCTION -- The spawning, incubation, hatching, or rearing of fish in a hatchery or other artificial production facility (e.g. spawning channels,, egg incubation boxes, or pens).

HEALTHY STOCK -- A stock of fish experiencing production levels consistent with its available habitat and within the natural variations in survival for the stock.

HYBRIDIZATION -- The interbreeding of fish from two or more different stocks.

LARGE WOODY DEBRIS (LWD) -- Conifer or deciduous logs, limbs or root wads twelve inches or larger in diameter.

LOCUS (LOCI) -- The site of a specific gene on a chromosome. Often used to refer to a gene and its alleles.

MAXIMUM SUSTAINED HARVEST (MSH) -- The maximum number of fish of a management unit that can be harvested on a sustained basis, measured as the number of fish that would enter fresh water to spawn in the absence of fishing after accounting for natural mortality. MSH is intended to mean maximum sustained harvest to Washington fisheries.

MIXED STOCK -- A stock whose individuals originated from commingled native and non-native parents, and/or by mating between native and non-native fish (hybridization); or a previously native stock that has undergone substantial genetic alteration.

MIXED STOCK FISHERIES -- Any fishery that catches fish that represent a number of commingled stocks.

NATIVE STOCK -- An indigenous stock of fish that has not been substantially impacted by genetic interactions with non-native stocks or by other factors, and is still present in all or part of its original range. In limited cases, a native stock may also exist outside of its original habitat (e.g. captive brood stock programs).

NET PEN -- A fish rearing enclosure used in lakes and marine areas.

NMFS -- National Marine Fisheries Service.

NON-NATIVE STOCK -- A stock that has become established outside of its original range.

OFF-STATION RELEASES -- Releases of juvenile hatchery-reared fish into streams or lakes at some distance from the hatchery where they were reared.

ON-STATION RELEASES -- Releases of juvenile hatchery-reared fish from hatchery facilities.

PRODUCTION TYPE -- The method of spawning and rearing that produced the fish that constitute a stock.

PRODUCTIVITY -- A measure of the capacity of a biological system. Also used as a measure of the efficiency with which a biological system converts energy into growth and production.

REMOTE SITE INCUBATOR -- A lightweight, dark-colored poly barrel incubator that employs plastic substrate (hatching medium), and can be sized to accommodate 5,000 to 125,000 eggs per incubator. They are used for incubating chum salmon eggs.

RIPARIAN HABITAT -- The aquatic and terrestrial habitat adjacent to streams, lakes, estuaries, or other waterways.

RM -- River mile.

RUN -- The sum of stocks of a single salmonid species which migrates to a particular region, river, or stream of origin at a particular season.

SALMONID -- Any member of the taxonomic family Salmonidae, which includes all species of salmon, trout, and char. SASSI deals only with the Pacific salmon (chinook, chum, coho, pink, and sockeye) and with steelhead trout.

SASSI -- Salmon and Steelhead Stock Inventory.

SMOLT -- A juvenile salmonid that is silvery with distinct parr marks and is undergoing the physiological change to migrate from fresh to salt water.

SPAWNING POPULATION -- Synonymous with the term stock.

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

STOCK ORIGIN -- The genetic history of a stock.

STOCK STATUS -- The current condition of a stock, which may be based on escapement, run size, survival, or fitness level.

SUPPLEMENTATION -- The release and management of artificially propagated fish in streams with the intent to increase or establish wild fish populations while minimizing associated genetic and ecological risks.

TERMINAL AREA -- A fishing area where a salmonid stock or run has separated from other stocks/runs.

TREATY TRIBES -- Any Indian tribe recognized by the United States government, with usual and accustomed fishing grounds, whose fishing rights were reserved under a treaty and have been affirmed by a federal court.

TREND -- The directional change in a time series data set.

UNKNOWN STOCK -- This description is applied to stocks where there is insufficient information to identify stock origin or stock status with confidence.

USFWS -- United States Fish and Wildlife Service.

WATERSHED -- A basin including all water and land areas that drain to a common body of water.

WILD STEELHEAD RELEASE (WSR) -- A hook-and-line fishery that requires wild steelhead (defined by not having fin clips) to be released. Hatchery steelhead (defined by having fin clips) may be retained.

WDF -- Washington Department of Fisheries.

WDFW -- Washington Department of Fish and Wildlife.

WDW -- Washington Department of Wildlife.

WILD STOCK -- A stock that is sustained by natural spawning and rearing in the natural habitat, regardless of parentage (includes native).