2000 WASHINGTON STATE

SALMONID STOCK INVENTORY

COASTAL CUTTHROAT TROUT

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Editors

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

June 2000

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ACKNOWLEDGMENTS

Biologists from federal agencies and western Washington tribes also contributed data and reviewed draft versions of this report. We thank them for their time and efforts.

We extend special thanks for the assistance provided by Lauren Munday, Lori Guggenmos, Larry S. Brown and Darrell Pruett in creating the components of the report and the completed document.

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INTRODUCTION

In 1993, the Washington Departments of Fish and Wildlife (WDFW), along with the Western Washington Treaty Indian Tribes, provided initial results of a stock status inventory for salmon and steelhead (SASSI) in Washington State (Washington Department of Fisheries et al. 1993). WDFW is extending that effort to other salmonid species and has published the 1997 Salmonid Stock Inventory - Bull Trout and Dolly Varden Appendix, updated in 1998. The present report is a stock status report for coastal cutthroat trout (*Oncorhynchus clarki clarki*) in Washington State. This inventory expands upon the Washington Department of Game Sea-Run Cutthroat Status Report (DeShazo 1980).

Resource inventories are key steps in statewide efforts to maintain and restore wild[1] salmonid stocks and fisheries. The primary intent of these efforts is to identify currently available information and to guide future restoration planning and implementation. Assessment of specific management objectives, strategies and implementation alternatives will be among the many subsequent steps (e.g., development of a coastal cutthroat management plan) aimed at improving the status of native trout populations.

BACKGROUND

Species Distribution and Evolution

Coastal cutthroat trout are a subspecies of cutthroat trout (*O. clarki*) which includes three other subspecies, westslope cutthroat (*O. c. lewisi*), Lahontan cutthroat (*O. c. henshawi*) in the western Rocky Mountains and Yellowstone cutthroat (*O. c. bouveri*) in the Snake River basin and its subspecies (Behnke 1997).

Coastal cutthroat trout are distributed along the Pacific coast of North America from Prince William Sound in Alaska to the Eel River in northern California, an area that conforms to the coastal rain forest belt (Trotter 1997). In Washington, they are found in the western part of the state including the coast, Puget Sound and the Columbia River as far east as the Klickitat River.

It is thought that at the beginning of the Pleistocene Era, about two million years ago, a common western trout ancestral species diverged into two lines, one leading to cutthroat trout and another leading to rainbow trout. About a million years ago, the cutthroat line separated into the coastal

[1]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 (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 wild 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" (See Part 1--Stock Definition and Identification).

and westslope forms and the westslope form gave rise to the Lahontan and Yellowstone forms (Behnke 1997).

Life History

Coastal cutthroat have four life history forms. The basic division of life history is between the anadromous (sea-run) form and the forms living strictly in fresh water. The freshwater forms are fluvial (riverine), adfluvial (lacustrine) and resident (headwaters). Depending on specific watershed characteristics, all forms can occur within a single watershed.

Coastal cutthroat exhibit the broadest range of occupied habitats, migratory behavior, age at first spawning and frequency of repeat spawning of any salmonids (Johnston 1981, Northcote 1997). Life histories and ecology of coastal cutthroat have been described in a number of sources including Sumner (1972), Tipping and Springer (1980), Tipping (1981), Johnston (1981), June (1981), Fuss (1982), Michael (1983), Trotter (1989, 1997), and Johnson et al. (1999).

Anadromous coastal cutthroat, or sea-run cutthroat, typically spawn in small streams as do the other life history forms. Unlike juveniles of the life history forms which remain in fresh water, anadromous juveniles undergo the morphological, physiological and behavioral changes required for migration and adaptation to salt water. They return to fresh water to overwinter and spawn. Fish which survive spawning return to salt water, and the cycle is repeated.

In Washington, most anadromous coastal cutthroat spawn from January through April with the peak of spawning in February. Spawning occurs in riffles where the water depth is about 15 to 45 cm, in areas of low gradient and low flow (Johnston 1981, Trotter 1989). Females construct redds in pea-size gravel, usually near pools (Hunter 1973, Jones 1978). Johnston and Mercer (1976) found that females ranging in length from 37 to 41 cm contain 1,000 to 1,200 eggs. Fecundity varies with size and age. Second-time and third-time spawning females produce more eggs and larger eggs than first-time spawning females.

Anadromous females rarely mature before age four (Johnston 1981, Fuss 1982). Fuss (1982) observed that the majority (84%) of anadromous females returning to north Washington coast streams did not mature until age five.

The link between the first return to fresh water and spawning varies among coastal cutthroat populations. In Sand Creek (Oregon), Sumner (1953) found that nearly all migrants returning to fresh water were sexually mature, with most first time spawners maturing during their first winter in fresh water. Fuss (1982) also found that in north coast Washington streams, most fish returning to fresh water for the first time matured during their first winter in fresh water. However, in the Columbia River about half the coastal cutthroat returning to fresh water for the first time did not mature during their first winter (Tipping 1981). In Puget Sound, most first time returning males matured over the winter, however only 20 to 27% of first-time returning females matured in their first winter in fresh water (Johnston 1981). Immature fish are observed overwintering in non-natal streams, however sexually mature fish appear to return to their natal streams to spawn with high fidelity (Trotter 1989)

In Washington adults surviving spawning tend to return to salt water in late March and early April (Trotter 1989). Survival after spawning and the number of times an anadromous fish spawns during its lifetime are variable. Johnston and Mercer (1976) observed that 41% of spawned-out adults survived to return to salt water. Sumner (1953) found that in the absence of fisheries, 39% of anadromous coastal cutthroat returned to spawn a second time, 17% spawned a third time and 12% spawned a fourth time. In the Alsea River, Oregon, where there was an intense fishery, less than 14% of first-time spawners survived to spawn a second time (Giger 1972). Some adults do not spawn every year, and some remain in fresh water for a year rather than returning to salt water after spawning. Individual fish may spawn as often as six times (Johnson et al. 1999).

Eggs hatch within six to seven weeks, depending on water temperature, and alevins remain in the gravel for about two weeks after hatching (Trotter 1989). In Washington, fry emerge from spawning gravels from March through June (Johnson et al. 1999). Survival during the critical time when eggs and alevins are in gravel is reduced by siltation and flooding, which are often exacerbated by land-use activities. Newly-emerged fry move quickly to low velocity water at stream margins and backwaters and remain there through the summer to feed (Trotter 1989). However in the presence of coho juveniles, which emerge earlier and at a larger size, cutthroat are often driven into higher-velocity waters. Johnston (1981) suggested that cutthroat spawning in very small streams may isolate juveniles and minimize potentially harmful interactions with other salmonids. Juveniles tend to move to log jams and overhanging banks to shelter during winter. They tend to remain in small streams for about a year then begin to migrate over longer distances within their natal river system (Johnson et al. 1999).

Most juveniles remain in freshwater for two to four years before smolting and migrating to salt water, though the range extends from one to six years (Giger 1972, Lowery 1975). Emigration occurs in the spring. In the relatively sheltered waters of Puget Sound, smolts are predominantly two years old with a mean fork length of 16 cm (Johnston 1979, Michael 1980). In the Columbia River, with its large estuary, most smolts are two to three years old, also with a mean fork length of 16 cm (Chilcote 1980). However on the coast, where many rivers enter rough ocean waters directly with very little in the way of estuaries, smolts are two to three years old and tend to be larger, 15 to 23 cm (Giger 1972, Sumner 1972, Fuss 1982).

Once reaching salt water, coastal cutthroat are generally thought to remain fairly close to shore or within estuaries. However they are sometimes caught in open marine waters many miles from shore (Loch 1982, Pearcy 1997). It is unclear whether they are carried there by freshwater plumes or migrate volitionally (Johnson et al. 1999).

After feeding in salt water and estuaries for several months, most anadromous coastal cutthroat return to fresh water to overwinter and spawn. Size at freshwater return varies since coastal cutthroat remain at sea for different lengths of time and return at different ages. In Puget Sound, two river entry times, early and late, are seen. Fish returning to larger river systems with higher summer flows tend to enter from August through October (early-entry timing) while those returning to smaller streams with lower summer flows tend to return from November through March (late-entry timing) when flows are higher.

Anadromous coastal cutthroat were probably once present in all coastal and Puget Sound streams accessible to anadromous fish. Before construction of the Bonneville Dam, they are believed to have ascended the Columbia River as far as the Klickitat River (Bryant 1949).

Historical abundance information for anadromous coastal cutthroat is scarce and generally limited to sport catch, fish trap and dam count data from a few river systems. These data, which often provide relative, rather than actual abundances, are presented in individual stock complex reports in this volume. It is believed that historic population levels were never large, especially compared to other anadromous salmon and trout populations. Royal (1972) suggested that anadromous coastal cutthroat abundances are probably less than those of steelhead, which comprise only 2-3% of anadromous fish in Washington.

Fluvial coastal cutthroat feed and grow in mainstem rivers in much the same way that anadromous populations use salt water (Trotter 1989). As with all coastal cutthroat life history forms, fluvial fish tend to move upstream to spawn in small streams (Trotter 1989). Tomasson (1978) found that in the Rogue River (Oregon), fluvial coastal cutthroat spawned higher up in tributaries than the anadromous form, however the spawning areas of the two types frequently overlap. Fluvial fish can be located above or below natural barriers, such as waterfalls.

In Washington, fluvial spawning occurs from January through mid-June. Incubation time and early juvenile life history are thought to be similar to those of anadromous fish, however very little information is available on other fluvial life history details.

Adfluvial coastal cutthroat also spawn in small streams but migrate into lakes rather than into salt water or river mainstems to feed and grow. In Washington, adfluvial spawning time extends from January through July. Time to hatching and early juvenile development are expected to be similar to those in anadromous fish. Juveniles may spend from one to three years in tributaries before migrating to lakes. Pierce (1984), in his study of Crescent Lake (north coast Olympic Peninsula) cutthroat, recorded some first-time spawning at age three, but more commonly first-time spawning occurred at age four. He also found that these fish subsequently spawned nearly every year for the rest of their lives, and used both inlet and outlet tributaries for spawning.

Resident coastal cutthroat are non-migratory and live their entire lives in small streams. Because the productivity of small streams is often low, resident fish tend to be much smaller than the other forms, rarely growing larger than 20 cm. They also tend to have shorter life spans (rarely more than four years) than the other life history forms (Wyatt 1959). As with adfluvial fish, spawning tends to extend later into the spring (May or even July) than with anadromous fish. Resident fish exhibit only limited instream movement. Juvenile fish tend to remain close to their natal redd (Moore and Gregory 1988), and as they grow they may drift downstream 25 to 100 meters (Wyatt 1959, June 1981, Fuss 1982). There may be further downstream movement during the winter to areas that afford more secure habitat, but in the spring resident fish tend to return upstream. These seasonal movements are not extensive. Wyatt (1959) reported that less than three percent of the population ever moved more than 200 meters.

Genetic and behavioral relationships among these four life history types are unclear. In any stream system coastal cutthroat trout are rarely represented by only the anadromous form

(Northcote 1997). Often fish of more than one life history type are commingled in small spawning tributaries, and there may be considerable overlap in spawn time among the different forms. Little is known about the extent to which different life history forms spawn with one another. Size and spawn-timing differences may tend to reduce potential spawning among life-history forms. However, size may be influenced environmental factors such as food supply as well as by genetics. It may be that the life-history forms can buffer one another from adverse conditions. Some researchers have suggested that individuals from resident populations may become anadromous in numbers sufficient to maintain viable anadromous stocks (Royal 1972; Edie 1975; Jones 1979). However, Michael (1983), during his studies of coastal cutthroat in Snow and Salmon creeks near the Strait of Juan de Fuca, found no evidence that this occurred.

Campton (1981) and Johnston (1981) noted that coastal cutthroat behavior is affected by the presence of other salmonids in both the marine and freshwater environment. Hawkins (1997) grouped interactions with other species into three categories: 1) predation on or by cutthroat trout, 2) competition by resource depletion, 3) interference competition. In addition, hybridization occurs between cutthroat trout and steelhead, and this interaction could contribute to local declines of cutthroat trout, assuming some selection against hybrids (Hawkins and Foote 1998).

Management

In Washington State all life-history forms of coastal cutthroat are managed to achieve resource protection goals while providing recreational opportunity consistent with those goals. The general approach to trout management in Washington is presented in "A Basic Fishery Management Strategy for Resident and Anadromous Trout in the Stream Habitats of the State of Washington" (the Basic Stream Management Strategy) (Washington Department of Game (WDG) 1984).

In the past, trout management has been non-specific, i.e., designed for all species collectively in a stream. For example, catch regulations on the Stillaguamish River in the 1930s and 1940s allowed 20 game fish, or ten pounds and one fish. In addition, most of the tributaries were closed to protect spawning fish. By the 1950s, the limit was reduced to fifteen fish, not to exceed 7½ pounds and one fish, and by 1980 it was further reduced to six pounds and one fish, not to exceed eight trout.

Starting in the 1980's, freshwater regulations were made more specific and conservative for cutthroat. The Basic Stream Management Strategy (WDG 1984) sets minimum size limits intended to allow the majority of females to spawn at least once before being subject to harvest. In Puget Sound and north coastal rivers, regulations in most streams with anadromous cutthroat now allow a two-fish daily limit with a 14-inch minimum size limit. Along the south coast and lower Columbia tributaries, wild cutthroat release is generally required. In marine waters, recent regulations have been adopted requiring the release of all cutthroat trout in an attempt to reverse observed reduction in the numbers of larger, older fish. In non-anadromous waters, including headwater tributaries, there is presently a two-fish, eight-inch minimum, which protects the majority of resident coastal cutthroat.

By setting minimum size limits to provide at least one spawning opportunity, management effectively maintains exploitation rates at conservative levels, even in waters where absolute abundance is unknown. Minimum size regulations have been used in many areas with good

success. In some cases they were implemented for “trophy trout” fisheries. However, they can also produce dramatic increases in trout populations, and curb overfishing. An example comes from the upper St. Joe River in Idaho (Bjornn and Johnson 1978). After implementation of a 13-inch minimum-size limit, cutthroat abundance increased by 300% in road-access areas and 600% in trail-access areas, with annual mortality rates dropping from a range of 0.62-0.71 to 0.47-0.56. This resulted in a ten-fold increase in the spawner abundance.

Future fishery regulations will result in active management of all wild stocks as required in the Wild Salmonid Policy, which was adopted by WDFW in December, 1998. The policy includes guidance for harvest and hatchery management designed to achieve spawning escapement goals and maintain genetic diversity.

Washington Coastal Cutthroat Hatchery Program

In comparison with salmon and steelhead, relatively few coastal cutthroat hatchery programs have been established in Washington. Crawford (1979) reviewed the early history of these programs, and much of the information below is from that source.

In 1958 an anadromous coastal cutthroat program was established at the Beaver Creek Hatchery (Elochoman River tributary in the lower Columbia River basin). Wild fish from Beaver Creek , the Nemah River (Willapa Bay tributary), Green River (Toutle River tributary in the lower Columbia basin) and later from the Cowlitz River (lower Columbia basin) were captured to create the Beaver Creek brood stock. In 1963 the stock was augmented with fry from the State of Oregon's Bandon Hatchery on the southern Oregon coast. This stock originated from anadromous coastal cutthroat from the north fork of the Alsea River (Oregon). By 1972 the Beaver Creek brood stock was a mixture of native Washington fish, the Oregon hatchery stock and Beaver Creek coastal cutthroat-steelhead hybrids. Artificial selection favoring fish with cutthroat coloration and speckling was carried out to reduce the contribution of steelhead to the stock. The goal of the program is to provide coastal cutthroat for the recreational fisheries in the Elochoman River and nearby streams and lakes. Currently, goals for annual releases from Beaver Creek are 30,000 into the Elochoman drainage, 5,000 into the Coweeman drainage and 2,000 into Abernathy Creek. For several years in the 1970s, no cutthroat were released from the Beaver Creek Hatchery during an attempt to convert the anadromous program to a captive brood program. That program has since been discontinued. In early 2000, the hatchery was closed due to budget constraints.

A second anadromous coastal cutthroat program was initiated in the lower Columbia basin at the Cowlitz Trout Hatchery in 1968. Brood stock originated primarily from the Beaver Creek Hatchery and from a few wild Cowlitz River fish. The purpose of this program is to provide coastal cutthroat for fisheries in the Cowlitz River drainage (the hatchery releases more than 200,000 cutthroat into the Cowlitz system annually) and to provide eggs to support other coastal cutthroat hatchery programs.

An anadromous coastal cutthroat captive brood stock program was initiated at the Lake Aberdeen Hatchery near Grays Harbor on the Washington coast in the early 1980s to mitigate for lost wild cutthroat production associated with the Wynoochee Dam (Ashbrook and Fuss 1996).

The brood stock is derived from Grays Harbor and coastal streams coastal cutthroat with periodic infusions of wild fish from local streams.

In Puget Sound various programs have been initiated since the late 1940s. An anadromous coastal cutthroat hatchery program in Puget Sound was started in 1973 using coastal cutthroat from the Stillaguamish River and Hood Canal. The operation used saltwater net pen facilities at Manchester in attempt to rear coastal cutthroat in a captive brood program (Johnston and Mercer 1976). Besides testing saltwater net pen rearing for cutthroat, the primary goals were to: 1) increase the number of sea run cutthroat available to saltwater fishers and, 2) increase the natural production in Hood Canal and Puget Sound tributary streams. This program continued into the late 1970s, but was discontinued due to high mortality in the pens.

In the mid-1980s, anadromous cutthroat were collected from two south Puget sound tributaries, McLane and Minter creeks, and reared at a small facility on McAllister Creek, with the intent of developing an anadromous brood stock for enhancement purposes (Washington Department of Wildlife (WDW) 1988). For several years cutthroat juveniles were released, but there was little benefit to local fisheries, and the program was abandoned in 1990.

Presently, most releases of anadromous coastal cutthroat occur within Columbia River tributaries, particularly in the Cowlitz, Lewis and Washougal rivers. Smaller numbers of coastal cutthroat are released into Abernathy Creek on the lower Columbia. Total annual releases approximate 280,000 fish. All hatchery fish are marked with an adipose fin clip. The following table is summarized from the Draft 2000 Future Brood Document (WDFW 2000).

2000 ANADROMOUS CUTTHROAT HATCHERY RELEASES		
HATCHERY	**WATERSHED**	**RELEASE NUMBERS**
Cowlitz Trout Hatchery	Blue Creek	190,000
	Cowlitz River	40,000
Skamania Hatchery	Salmon Creek	12,000
Merwin Hatchery	NF Lewis River	25,000
Skamania Hatchery	Washougal River	10,000

In 1949 non-anadromous wild coastal cutthroat were captured from Lake Whatcom tributaries (north Puget Sound) and placed in a captive brood stock program at the Tokul Creek Hatchery in the Snoqualmie River drainage. Although only fish from Lake Whatcom were used to establish this brood stock, it is possible that there may have been some contribution from west slope cutthroat (*O. clarki lewisi*) from Twin Lakes in the Wenatchee River system following their release into Lake Whatcom in 1907. Lake Whatcom fish currently show no obvious signs of west slope influence. Tokul Creek coastal cutthroat have been widely released in western Washington streams, lakes and beaver ponds. Present releases of Tokul Creek resident cutthroat are limited to lakes which have no access to marine waters. The 1998 releases totaled approximately 170,000 fish into lakes in Whatcom, Skagit, Island, Snohomish, King, Jefferson, Mason, Pierce and Thurston counties. The Tokul Creek brood stock is now maintained at the Tokul Creek and Eells Spring (Skokomish River basin) hatcheries.

Endangered Species Act

Following listing of North Fork Umpqua River (Oregon) sea-run coastal cutthroat as endangered under the federal Endangered Species Act (Johnson et al. 1997)
the National Marine Fisheries Service (NMFS) began a coastwide status review for sea-run coastal cutthroat, including Washington populations. General threats to coastal cutthroat include loss of habitat due to logging practices, road building, passage obstructions (e.g., dams, poorly designed culverts which block fish passage), water diversions, mining, and livestock grazing as well as harvest and poaching. Other threats include interspecific competition (especially with coho), and hybridization with steelhead and rainbow trout. In March 1999 NMFS proposed listing coastal cutthroat as threatened in the Lower Columbia/Southwest Washington ESU. Coastal cutthroat stocks elsewhere in Washington were not proposed for listing. The final listing decision from NMFS is expected during the month of March 2000.

WILD STOCK RESTORATION INITIATIVE AND WILD SALMONID POLICY

Wild fish and their habitats must be protected and restored in order to maintain viable and healthy fisheries and to provide for associated ecological, cultural, and aesthetic values. To accomplish this objective, state and tribal fishery managers have committed to a wide range of activities. One of these, directed initially toward salmon and steelhead, was the Wild Stock Restoration Initiative (WSRI) designed to complement and strengthen ongoing programs to protect and restore healthy stocks and habitats. The managers' overall goal for the WSRI is to:

> **Maintain and restore healthy wild salmon and steelhead stocks and their habitats in order to support the region's fisheries, economies, and other societal values**.

Following formulation of the WSRI, a broad policy framework, the Wild Salmonid Policy (WSP) has been developed by state and tribal managers which encompasses **all wild salmonids** in Washington (WDFW 1997a).

The goal of the WSP is to:

> **Protect, restore, and enhance the productivity, production, and diversity of wild salmonids and their ecosystems to sustain ceremonial, subsistence, commercial, and recreational fisheries, non-consumptive fish benefits, and other related cultural and ecological values.**

The policy guidelines and tasks reflected in both the WSRI and WSP will guide statewide efforts to maintain and restore coastal cutthroat. These tasks include:

- complete and maintain a resource status inventory of Washington's wild salmonids[2] ("where are we now")

[2] While the inventory documented in this report reflects primarily an assessment of wild stock status, a clear need exists to develop complementary salmonid habitat and hatchery stock inventories to develop an integrated ability to systematically evaluate salmonid ecosystems. Work on a joint state/tribal habitat inventory is underway, and a hatchery inventory is planned.

- " identify stocks and determine their status
- " review and prioritize stock status problems
- " identify priority information needs

! review current resource management goals and objectives pertaining to hatchery and wild stocks and the region's fisheries ("where do we want to go")

! develop and implement recovery programs for priority stocks and habitats ("how do we get there")

! maintain adequate monitoring and evaluation programs ("how well did we do, and do we need to modify our approach")

Productive aquatic ecosystems are essential for healthy salmonid populations that provide an important foundation for a strong Northwest economy as well as for a diverse cultural and natural heritage. Managing for stock health and related human benefits requires maintaining adequate resource abundance, productive habitat, and genetically diverse wild stocks. The WDFW and Western Washington Treaty Indian tribes have jointly challenged themselves to create opportunities for a positive future that will feature productive aquatic habitats, healthy wild stocks, and adequate levels of fishing. Clearly, strong public support for solving complex problems will be necessary to realize this vision. The WSRI and WSP will provide additional focus and resources for the State's and tribes' current fishery resource management mandates. The initiative and policy are intended to produce comprehensive management approaches to restore depleted salmonid stocks and avoid intensely disruptive and divisive reactions that can result when the ESA listing process is invoked.

RESOURCE STATUS INVENTORY

This report is the second resource status inventory (the first objective in the statewide Wild Stock Restoration Initiative and consistent with the Wild Salmonid Policy) using SASSI approaches and conventions with some modifications. The name of the original inventory "Salmon and Steelhead Stock Inventory" (SASSI), was changed to **"Salmonid Stock Inventory" (SaSI)**, to reflect the broadened inventory scope encompassing all wild salmonids, first for bull trout and Dolly Varden (WDFW 1997b, 1998) and now for coastal cutthroat.

This coastal cutthroat inventory considers issues that did not need to be addressed for salmon and steelhead (e.g., difficulty of identifying individual stocks, multiple life history forms within stocks, limited available data). Therefore, in this inventory modifications to the SASSI approach have been made to better address issues pertinent to coastal cutthroat. These changes should lend themselves to future inventories for other wild salmonid species whose life history, ecology, and management histories are more similar to those of native char and coastal cutthroat than they are to salmon and steelhead.

The concept of resource inventories is not new - fishery management agencies spend considerable staff time collecting and assessing resource status data, e.g., spawning escapements, harvests, and biological parameters. This information is routinely used for

decision making but often is not well documented or visible outside the "management process." As a result, an objective of SaSI has been to develop a simple and consistent system of collating and reporting statewide salmonid resource assessment information, recognizing that the inventory will change over time. This inventory incorporated information already available in existing documents and information recently compiled for submission to NMFS as part of ESA proceedings. Future updates of SaSI and associated reports will evolve as necessary to accommodate new information and be integrated with developing regional resource information systems. The planned growth and refinement for SaSI is an important point. This report is meant to provide a first glimpse at coastal cutthroat status and build a foundation for future restoration and inventory efforts.

In addition to understanding the inventory's intent, it is important to note that SaSI is <u>not</u>:

- a compendium of all that is known about each salmonid stock
- a historical review of past losses of stocks or habitats
- a detailed review of harvest management
- a habitat inventory
- a detailed review of the impacts of salmonid culture programs on the status of native stocks
- a risk assessment of future threats of extinction or other stock damage
- a report outlining specific stock restoration programs

Clearly these and other steps will be necessary and are anticipated to follow the inventory, but this SaSI report simply is intended to provide information on current status to provide a foundation for salmonid recovery. The subsequent steps and the process envisioned for the overall initiative are presented in <u>Part 3 -- Current and Future Actions</u>.

The status information in this report is based almost entirely on numerical abundance rather than interpretation of genetic fitness. This orientation is not intended to discount the importance of any stock's genetic status but reflects the need to perform genetic risk assessments throughout the state in a systematic manner. Many genetic impacts to the region's wild stocks have occurred over time from cumulative impacts of habitat degradation, harvest policies and hatchery practices. Biologists involved in the inventory have identified current or new genetic impact issues that may require priority attention. Stock origin (native, non-native and mixed) has been presented for each stock complex and discussions about potential genetic influences have been included where known.

Report Content and Organization

As in the 1992 SASSI and the 1997 and 1998 SaSI inventories for bull trout and Dolly Varden, this SaSI report is organized so that the reader proceeds from general discussions to more detailed information used in the process of identifying individual stocks and determining their status. Parts 1, 2, and 3 describe the inventory methodologies and provide a summary of stock status for the reader who may not desire to review the detailed stock status information presented in Part 4. The report is comprised of the following sections:

Part 1 -- Stock Definition and Identification: This section defines the terms stock and stock complex as used in this inventory, compares them with other stock definitions, and discusses their application in this inventory.

Part 2 -- Stock Assessment and Status: This section describes the data types used to assess stock status, and discusses the two-step process that was used to identify stocks that are at low abundance levels. A set of screening criteria, based on negative population trends or changes in fitness, were developed to assess the current status of each stock/stock complex. Individual stocks were then rated using five status categories developed for SASSI/SaSI.

Part 3 -- Current and Future Actions: This section describes the process envisioned for applying the inventory results to the objective of restoring priority stocks and addressing key information needs. This is followed by a description of the review process that will allow for future iterations of SaSI, making it a living inventory of Washington salmonids. The steps and process for developing cooperative state/tribal restoration plans for regions, watersheds or specific stocks are also outlined.

Part 4 -- Stock Reports: In this section, specific information on each coastal cutthroat stock currently identified is organized by river basin and consists of individual Stock Reports. Each Stock Report includes the following two sections:

- Narrative: This section discusses stock definition and origin, and status information. It also provides a brief discussion of habitat, harvest, hatchery and other factors that may be affecting production of each stock.

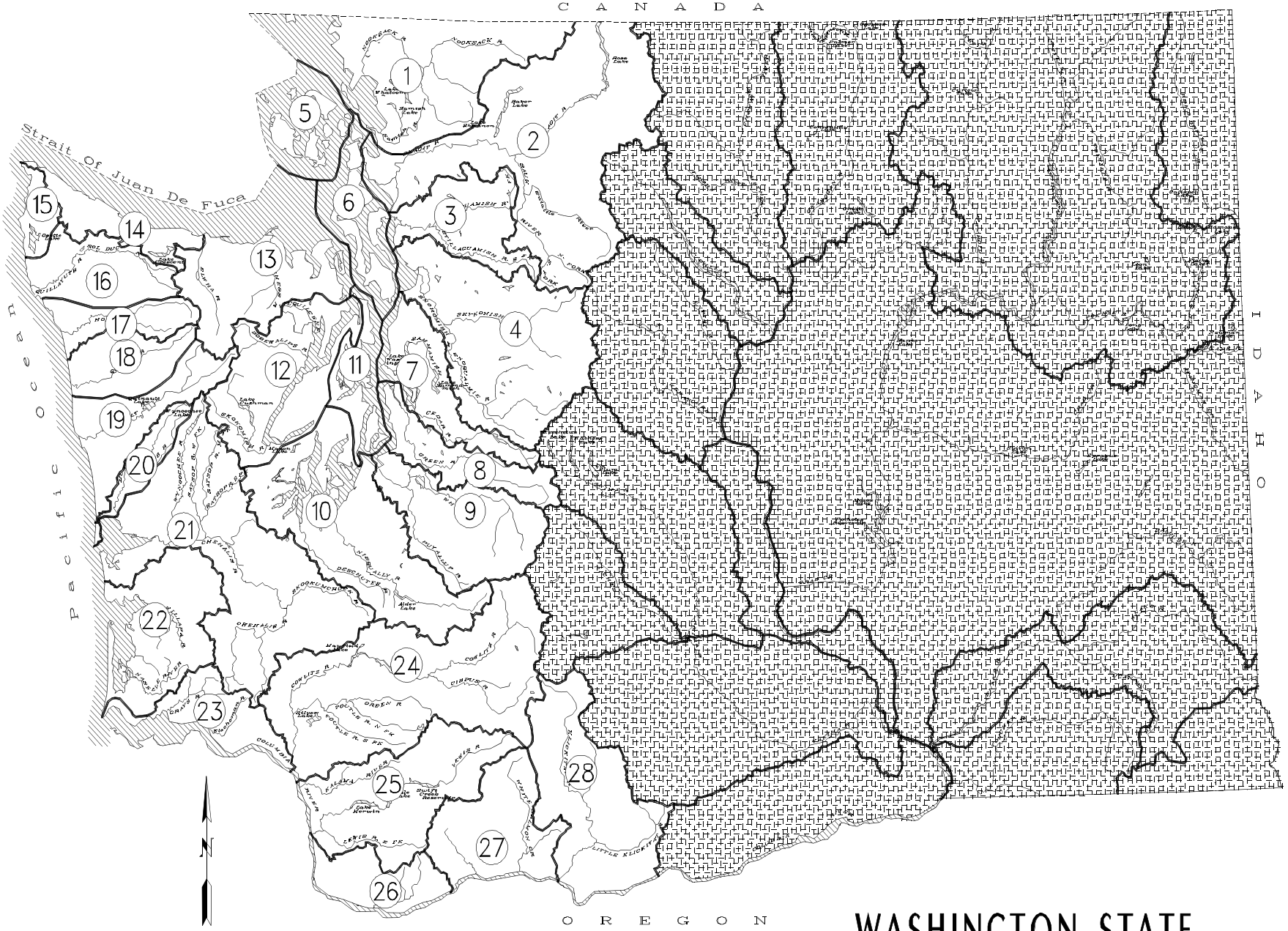
- Stock profiles: This is a visually oriented, two-page summary section that contains the information used to identify and rate the status of each stock. The amount of information included in the profiles provides a general reflection of the data and state of analysis available for any given stock.

The **Literature Cited** section presents a list of publications cited in this inventory volume.

The **Glossary** provides definitions of terms developed specifically for SASSI/SaSI and also defines a number of general terms used in the text.

SaSI RIVER BASINS

SaSI Stock Definition Profiles within each Stock Report display spawning distribution information for salmonid stocks in Washington 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 to adjacent systems. To help orient the reader, the state map on the following page locates all the river basins used in SaSI. These SaSI river basins are similar to, but not the same as Water Resource Inventory Areas (WRIAs), which are used by Washington State natural resource agencies (Williams et al. 1975; Phinney and Bucknell 1975).



WASHINGTON STATE
Coastal Cutthroat Trout River Basins

PUGET SOUND

North Puget Sound

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

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
27- Wind/White Salmon
28- Klickitat

Note: Shaded area is not known to contain coastal cutthroat.

PART 1 -- STOCK DEFINITION AND IDENTIFICATION

STOCK DEFINITION

The first task in developing salmonid resource inventories has been to arrive at a meaningful definition of the units of fish on which to base the assessment. Stocks were chosen as the basis for SaSI for several reasons. They provide the finest resolution of all the units considered and allow assessment of larger units by combination. Stocks form the basic building blocks of Northwest salmonid management, and stock units are widely accepted within the scientific community as a basis for evaluating fish populations.

The definition of the term "stock" and its application frequently present difficulties because the distinctions between different groups of organisms are often difficult to measure, and because the term is used for a variety of purposes. For example, as applied in bottom fish management, a stock is a group of fish that exhibits a homogeneous response to fishing effort in an area, and may be made up of several breeding populations, or be part of a population. However, in salmonid management a stock is generally considered a discrete breeding population. Ricker (1972) defined salmon stocks as temporally or spatially separated breeding populations. The Puget Sound Salmon Management Plan refers to the fish of a single species that migrate at a particular season to a specific hatchery or independent river system as a stock.

At a stock identification workshop (April 1970) W.E. Ricker presented a paper discussing the origin of salmon stocks that used the following definition:

> "...the term *stock* is used here to describe the fish spawning in a particular lake or stream (or portion of it) 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. What constitutes a "substantial degree" is open to discussion and investigation, but I do not mean to exclude *all* exchange of genetic material between stocks, nor is this necessary in order to maintain distinctive stock characteristics that increase an individual's expectation of producing progeny in each local habitat.
>
> In some rivers a number of stocks can be grouped together on the basis of similarity of migration times. The word *run* will be used for such groupings. Thus we may speak of a fall run of chinook salmon or steelhead, for example. Each run may comprise a considerable number of stocks."

We have adopted the following definition for SaSI which is essentially the same as that proposed by Ricker.

> **SaSI STOCK DEFINITION: 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.**

It should be noted that some differing views likely will surround any specific definition of stock. This inventory is not attempting to resolve these views or their applications. The purpose of the

SaSI definition is simply to provide a clear, consistent and meaningful basis for conducting an inventory of the salmonid resources in Washington, and does not imply that this definition should be applied for other uses, that even smaller units of production are unimportant, or that the management of fisheries or fish habitat should be on this basis. Where reproductive isolation has been shown or presumed to exist in this inventory, it may or may not indicate genetic uniqueness from other stocks. The terms stock and spawning population are used synonymously in this inventory.

Even with SaSI's basic stock definition, considerable uncertainty often occurs in applying it to any specific spawning group because limited direct data exist to evaluate the degree of reproductive isolation among such groups. Fish management entities have inventoried fish populations annually as an integral part of the management process. Data collection programs focus primarily on gathering information necessary to manage various salmonid fisheries. Consequently the detailed information needed to identify and evaluate Washington's wild stocks is often quite limited. This lack of detailed data has imposed some restrictions on the development and use of this inventory. It is impossible to ensure that SaSI accurately defines all wild salmonid stocks in the state. Many stocks listed in this inventory have not been studied in enough detail to be designated as discrete stocks with great certainty. Many others need more refined data to determine whether observed differences in timing or distribution actually represent stock differentiation. This inventory must be viewed as a starting point, and its list of stocks should be expected to evolve with future updates. The stock inventory process will continue to be conducted and, as more information is assembled, stocks will be added or deleted based on additional information.

Identifying individual coastal cutthroat stocks has so far proved to be far more challenging than for salmon, steelhead, or bull trout and Dolly Varden. This inventory volume therefore introduces the concept of the **Stock Complex**.

> **SaSI STOCK COMPLEX DEFINITION**: **A group of stocks typically located within a single watershed or other relatively limited geographic area and believed to be closely related to one another.**

The concept of stock complexes was developed in response to genetic analyses (Campton 1981, Campton and Utter 1985, Zimmerman 1995, Williams et al. 1997) which indicated that there is a high degree of genetic diversity among coastal cutthroat populations. In most cases, individual collections of coastal cutthroat are significantly different from one another, even within rather small stream systems (Zimmerman 1995). WDFW biologists concluded at an early stage of coastal cutthroat stock identification that it is difficult to identify individual stocks, particularly in large river systems, with any confidence. This is especially true given the uncertainty about genetic relations among the different life history forms. Consequently stock complexes were identified based on geographic distribution of spawning grounds (as was done for stocks in other salmonid stock inventories). Each complex therefore includes all life forms, and no attempt is made to separate the anadromous, fluvial, adfluvial, and resident components. Numbers of individual stocks within stock complexes are currently unknown, and it may never be possible to identify all stocks within a complex in any but the smallest watersheds or groups of adjacent watersheds.

In this inventory, stock complexes are treated in much the same way as stocks in other SaSI volumes. Stock complexes were identified using the same criteria as stocks. Abundance and survival data were collected and analyzed as they were for stocks, status determinations were assessed in the same way as for stocks, and reports were written for stock complexes using the same format used for stock reports.

The SaSI reports have emphasized **naturally-reproducing** stocks of salmonids regardless of origin (native, non-native and mixed parentage). Future reports will include hatchery stocks as well. Only those stocks that spawn within Washington State are included. Past extinctions have not been included in this status assessment because this is a **current** resource inventory, and the historic information on lost stocks is incomplete and often anecdotal. Where reliable information is available, reference may be made to extinctions in general terms in introductory sections only.

SaSI tends to focus on differences among stocks rather than variability within each stock. However, managing salmonid stocks to maintain historical patterns of genetic variability within spawning populations, as well as genetic diversity among populations, is necessary for the long-term fitness and productivity of each species. This variability and diversity determines the ability of stocks and species to adapt to and successfully reproduce under changing environmental conditions. Resource management practices must address the need to maintain both genetic diversity between stocks and genetic variability within stocks. Species-specific genetic guidelines will need to be developed in the context of species plans, consistent with genetic conservation goals of the WSP.

STOCK DEFINITION CRITERIA

Although individual coastal cutthroat stock complexes, rather than stocks, have been identified in this inventory volume, criteria used to identify both hierachical structures are similar. These criteria are not intended to determine stock origin (i. e., native, non-native or mixed parentage), but rather to identify those groups that appear to represent distinct stocks.

Stock Definition Criteria

1) **Distinct spawning distribution.**

2) **Distinct temporal distribution (including spawning or run-timing).**

3) **Distinct biological characteristics (e.g. size, age structure, gene frequency differences, etc.)**

Each of these criteria is an attribute that can be used to determine whether a group of fish is displaying substantial reproductive isolation. A population meeting any one of the above criteria would be initially classified as a SaSI stock until additional information shows that it should not be considered distinct. The term *distinct* is not intended to imply complete isolation from other stocks. We recognize that some interchange between populations is a natural part of salmonid biology.

Distinct spawning distribution is the most commonly used criterion for identifying individual stocks in the SaSI reports because general information on the geographic location of spawning and spawning habitat is the most readily available. However, spawning distribution often does not show distinct separation and can be difficult to assess. A number of factors must be considered such as: degree of isolation, interchange between spawning groups, and the relationships between spawners in adjacent streams. It is also difficult to measure directly because it requires that spawning distribution of several generations of fish be tracked (i.e., do offspring of each generation return to spawn in the same areas that are substantially separated from areas used by other spawning groups). This criterion must usually be assumed since empirical data are often unavailable and are difficult to collect. In the case of coastal cutthroat trout, this criterion was the primary one used to identify stock complexes.

Distinct temporal distribution identifies stock differences based on variations in timing of critical life stages (e.g. spawn timing). Such differences are sometimes very distinct with no overlap between adjacent stocks. Differences are then generally quite obvious and easy to assess from readily-collected information. Many cases occur, however, where timing does overlap, and the difference between within-stock variation and variation among stocks becomes less clear.

Distinct biological characteristics can include any observable distinctions between stocks in size, color, age structure, scale patterns, parasites, or gene frequencies.

There is a hierarchy of stock relationships within a species, from individual spawning aggregations within stocks (the finest scale) up to the entire species (the broadest scale). Moving

up from the level of individual stocks/stock complexes, WDFW defines **Genetic Diversity Units (GDUs)** as groups of stocks having similar patterns in genetic (or other) characteristics, which have resulted to an important extent from reproductive isolation (WDFW 1995). GDUs form an important focus for genetic conservation goals and objectives of the WSP. In addition, WDFW has combined GDUs into still larger groups, **Major Ancestral Lineages (MALs)** which are reproductively isolated groups of GDUs with a probable distant common ancestor (WDFW 1995).

NMFS (Waples 1991) has incorporated reproductive isolation of breeding populations in its ESA "species" definition but departs from the standard stock definition by requiring a spawning group or groups to represent an evolutionarily significant unit (ESU) of the species. Genetic relationships and evolutionary legacies among stocks, which are central to the species definition used by NMFS under ESA, are second-stage questions not directly bearing on the need by fish managers to define stocks for an ongoing inventory program. SaSI stocks, GDUs and MALs have been defined independently of NMFS' evolutionarily significant units.

GENETIC ANALYSIS

For initial genetic analysis of Washington coastal cutthroat, tissue samples for allozyme electrophoresis (see Genetic Stock Identification section below). A total of 47 collections was made from seven broadly defined geographic regions (North Puget Sound, South Puget Sound, Hood Canal, Strait of Juan de Fuca, North and South Washington coast and Lower Columbia River tributaries). Allozyme data were analyzed by laboratories at WDFW and NMFS. A subset of thirteen WDFW collections was also analyzed for variation at six microsatellite DNA loci by John Wenburg at the University of Washington. Results of the allozyme and microsatellite DNA analyses are presented in individual stock reports. More detailed information about these analyses will be presented in the coastal cutthroat volume (in preparation) of the WDFW Genetic Diversity Units and the Major Ancestral Lineages of Salmonid Fishes in Washington report series.

A preliminary analysis was conducted to identify coastal cutthroat and steelhead hybrids. A total of eight allozyme loci were used to identify individuals as either steelhead, cutthroat or hybrids. Fish exhibiting at least 50% of diagnostic loci as homozygous for steelhead alleles or heterozygous for steelhead and cutthroat alleles were considered to be hybrids. Those individuals identified as steelhead or hybrids were removed from the data set.

High levels of genetic variation were found among sample collections, even within regions. However, genetic analysis also showed that sample collections from a particular region tended to be more similar to one another than to those from other regions of the state. On a broader state-wide scale, the analysis supported the suggestion by Wenburg et al. (1998) that there are two large groupings of coastal cutthroat populations within Washington - an outer coastal and lower Columbia River group and an inner Puget Sound group. The dendrogram on page 28 illustrates relations among all WDFW coastal cutthroat sample collections sampled by WDFW.

Genetic Stock Identification

In SaSI, distinct biological characteristics can include any observable distinctions between stocks such as size or age structure, and for many salmonids, including coastal cutthroat, genetic characteristics which are revealed by **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 (see below for descriptions of these procedures).

Although the GSI characterization of stocks and testing of stock structure provide a direct measure of genetic relationships, it is important to be aware of the limitations of this approach. It is presently possible to investigate only a tiny and restricted fraction of the genetic traits of salmonids by biochemical means. To the extent that the characters that can be investigated do not represent the entire genome, the view of genetic relationships derived from GSI analysis will be incomplete (and could fail to detect evidence of reproductive isolation among stocks--see below). Indeed, there is a large number of genetically-influenced characteristics of salmonids about which there is little or no information. It is assumed that most or all of the genetic variation which can be studied using biochemical means 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 large number of organisms, exceptions could complicate or even invalidate some of our interpretations. It must also be realized that statistical tests (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.

The following description of the GSI applies to investigations of enzyme variants (allozymes) but not to direct examination of DNA variants. As currently applied to the investigation of coastal cutthroat, 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 of tissue extracts, (3) characterize each population sampled by aggregating the individual genetic profiles and computing allele frequency distributions for each population, and (4) conduct statistical tests (G-test or chi-square) on the allele frequencies characterizing each population.

Electrophoresis is a process whereby charged molecules (such as enzymes from tissue samples) are separated in an electric field in slab of gel-like material. The distance which molecule moves through an electric field applied to the gel (its electrophoretic mobility) is a biochemical phenotype determined largely by the genotype (DNA) of the fish from which the tissue samples were taken. After electrophoresis, enzymes can be visualized by biochemical staining. On staining, enzymes appear as colored bands in the gel, and the distance they moved during electrophoresis can be measured. Each enzyme (or enzyme subunit) is encoded by specific segment of DNA - a gene locus - which specifies its structure and electrophoretic

mobility. Variation in the gene locus encoding an enzyme within a population produces two or more alternate forms of the locus called alleles. Much (but not all) of the allelic variation in enzyme-encoding gene loci can be detected by electrophoresis and staining because it results in structural and therefore electrophoretic mobility 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 allele frequencies at many gene loci in different stocks.

The hypothesis being tested in step 4 above (that the allele-frequency distributions of the populations being compared are no more different from one another than multiple independent samples from a single, freely interbreeding population would be) is closely tied to the definition of stocks as reproductively isolated populations. A statistically significant result in this test causes rejection of this hypothesis and typically leads to the conclusion that the populations tested are genetically different and, therefore, represent distinct stocks. The power of the statistical tests is dependent on the numbers of fish in the samples being compared. As a result, differences in allele frequencies that are not significant at small sample sizes can become significant if sample sizes are large enough.

Typically, the genetic testing of stock structure begins with G-tests (or chi-square tests) involving pairs of population sample collections. When the tests reveal significant differences, this is usually considered to be evidence for the existence of two genetically distinct stocks. However, in some cases individual sample 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 collection. Sample collections 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 sample collections of Skagit River coastal cutthroat are collected from different localities (and possibly in different years) and no evidence of significant differences among them is found, they may be combined to characterize coastal cutthroat in the entire river system and this aggregate subsequently tested against collections or similar aggregates from nearby drainages.

In addition to the direct testing of stock structure using the G-test approach, dendrograms based on the average genetic distances among sample collections have been used to summarize the genetic relationships 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 the other stocks in the dendrogram.

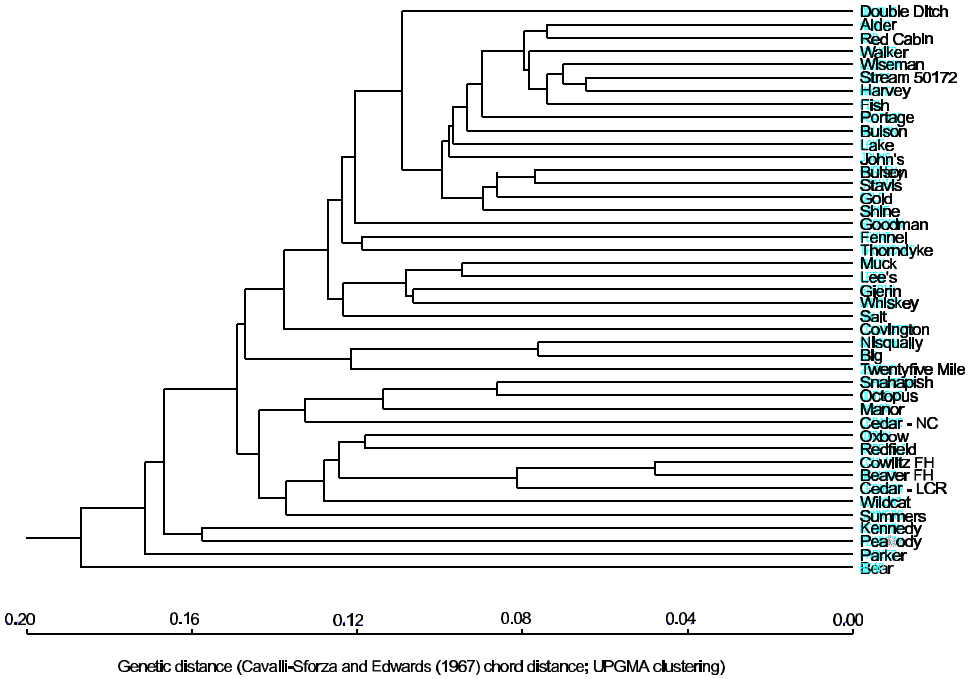
While dendrograms are useful because they simplify the often complex patterns of genetic relationships among stocks, they are not without disadvantages. The absolute magnitude of differences identified by this technique is influenced both by the specific suite of gene loci

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 relationships 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-tests).

In WDFW coastal cutthroat genetic sampling, there has not yet been an attempt to compare fish located above and below barriers, or to compare different life history forms within stream systems.

Analysis of Genetic Information

Preliminary analysis of allozymes and microsatellite DNA (Wenberg et al. 1998) indicates that most Washington coastal cutthroat collections are genetically distinct from one another. There is a separation between the coastal/lower Columbia group and Strait of Juan de Fuca/Puget Sound. Within these two divisions, other genetic groupings are apparent, which coincide, for the most part, with geographical regions. However, there are a few outliers including the Muck Creek (Nisqually River) collection, which groups with Strait of Juan de Fuca collections, and collections from several South Puget Sound tributaries that were particularly divergent. Whether these outliers reflect possible differences in life history forms, hybridization, sampling error, or are the result of some unknown variable, is not known at this time.



THE STOCK COMPLEX IDENTIFICATION PROCESS

The list of coastal cutthroat stock complexes in this SaSI document represents an effort to identify all existing populations that naturally reproduce in Washington waters, regardless of origin, including native and mixed (or presumed hybrid) stocks.

Because of the significant uncertainties regarding the life history, genetic, and evolutionary relationships among life history types in local areas, fish from adjacent areas with common habitat characteristics were generally aggregated into a single stock complex (e.g. East Hood Canal) because of the likelihood of significant interchange of spawners. Additional information on genetics, life histories and ecological relations will be incorporated into future iterations of SaSI as it becomes available. Again, it should be noted that life-history form differences were not used to separate stocks, or populations. Future drafts may support life-history form separations based on genetic information.

To arrive at a preliminary list of stock complexes, biologists used known differences in spatial or temporal distribution. These distinctions were difficult to determine in some cases, particularly where the amount of interchange among adjacent groups of fish was unknown. Identification of individual stock complexes was based primarily on river basins in which spawning is known to occur. This preliminary list of stock complexes was then examined using available information on unique biological characteristics (principally genetic stock identification data). This review confirmed the hypothesis that the number of individual coastal cutthroat stocks may be very large and that identification of stock complexes is appropriate as a first step in understanding coastal cutthroat population structure. More detailed analysis during future inventories may change this approach.

This inventory has identified 40 coastal cutthroat stock complexes statewide, and Table 1 presents a regional summary. Individual regional lists for Puget Sound, Coastal, and Columbia River stocks are provided at the end of Part 2 - Stock Assessment and Status (Tables 3, 4 and 5).

Table 1. Regional and statewide coastal cutthroat stocks/stock complexes.

PUGET SOUND	
North Puget Sound	8
South Puget Sound	4
Hood Canal	2
Strait of Juan de Fuca	3
TOTAL	17
COASTAL	
North Coast	6
Grays Harbor	2
Willapa Bay	4
TOTAL	12
COLUMBIA RIVER	
Lower Columbia	11
TOTAL	11
WASHINGTON STATE TOTAL	40

Stock Origin

Regardless of species, the SaSI process recognizes three categories of stock origin: (1) stocks of fish that are thought to represent native gene pools, (2) stocks that have resulted from the introductions of non-native fish, and (3) stocks that are a mix of native and non-native fish, or are substantially genetically altered native fish. A great deal of uncertainty often exists about the genetic histories of many salmon and steelhead stocks (WDF et al. 1993). The contributions of hatchery-origin coastal cutthroat to native Washington populations have not been rigorously evaluated. However, because of the relatively limited number of cutthroat trout hatchery programs, most Washington coastal cutthroat stock complexes have been characterized as native in origin. In addition to identifying stock complexes which include contributions from non-native hatchery stocks, coastal cutthroat sometimes show evidence of having hybridized with steelhead.

The definitions for stock origin used in SaSI are:

Native -- An indigenous stock of fish that has not been substantially impacted by genetic interactions with non-native stocks 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. This may include species crosses such as hybrids between cutthroat and steelhead, or rainbow trout.

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

Production Type

This inventory attempts to describe the naturally-reproducing coastal cutthroat in the state. The origin of a stock or stock complex refers only to the genetic background of that specific group of fish. To understand more about the nature of an individual stock or stock complex, it is also necessary to describe the type of spawning and rearing that produced the fish. For example, a stock of fish may be a genetic mixture of native and non-native fish, but in the absence of continuing hatchery releases, the stock may be self-sustaining as the result of natural spawning and rearing. These fish would be identified as a stock with a mixed origin and a wild production type. A native stock of fish in a rehabilitation program also can be sustained entirely by fish culture techniques. This situation is typified by Baker River sockeye salmon, a stock that is currently being restored by placing most spawners in an artificial spawning beach. This stock would be characterized as a native stock with a cultured production type. Some stocks may be maintained by both wild and cultured spawning and rearing. For example, the Washougal coastal cutthroat stock complex includes both native fish spawning in the wild and native fish which were

taken into the Skamania Hatchery as broodstock. This stock complex is considered native with composite production.

The terms defining production type are:

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.

Tables 3, 4, and 5 (Part 2 - Stock Assessment and Status) present the origin and production type for each coastal cutthroat stock complex in this inventory. There are relatively fewer composite coastal cutthroat stock complexes than are seen in salmon and steelhead which reflects differences in management approaches and hatchery practices for different species.

OTHER STOCK INVENTORIES

For many fish species, stock inventories are a normal part of the annual state/tribal management process in Washington State. These inventories take the form of annual assessments of various abundance attributes and are used to measure the effectiveness of management actions. SaSI differs from these routine assessments because it looks at smaller units of production, brings this information together in a consistent approach for all wild salmonid stocks statewide, and provides a system for rating stock status. As with other SaSI volumes, information in this inventory is presented by geographic region.

Other examples of regional inventories including other species are the Puget Sound and Adjacent Waters Study - Appendix XI - Fish and Wildlife Appendix (Pacific Northwest River Basin Commission 1970) which was a combined effort of WDG and WDF. In the Columbia River basin examples include Stock Assessment of Columbia River Salmonids (Howell et al. 1985) and the sub-basin plans for each tributary. More recent efforts listed anadromous salmonid stocks at risk of extinction (Nehlsen et al. 1991), while Huntington et al. (1994) listed stocks deemed to be healthiest.

PART 2 -- STOCK ASSESSMENT AND STATUS

Once the stock complexes were identified, the current status of each was assessed based primarily on trends in population size, spawner abundance, or survival. Where possible, age structure, size (body length), survival, and other data have also been used in these determinations. Detailed abundance data for individual stock complexes were frequently non-existent.

A two-step process was used to evaluate the status of the state's coastal cutthroat stock complexes. First, each stock complex was screened to identify negative changes in abundance, production or survival using five separate criteria that were originally developed to describe changes in stock status and fitness for SASSI (Washington Department of Fisheries et al. 1993). For a description of these criteria see the Stock Screening discussion below. Stock complexes that met none of the five criteria and were judged to be experiencing production levels within natural variations in survival and consistent with their available habitat were rated as "Healthy." Second, any stock complex that met one or more of the five negative performance criteria was examined further and subsequently rated in Depressed or Critical status categories to identify the probable level of damage suffered by the stock. An "Unknown" category was used for stock complexes if trend information was unavailable or was insufficient to assess status. The assessment data used for stock complex screening and the rationales for stock complex categorizations are presented in Part 4 -- Stock Reports.

There are several circumstances that complicated the rating process. When a wild stock experiences an extremely low survival, it is sometimes difficult to know if that survival is within the normal range for the stock, or if it is entering a depressed state caused by human impacts (e.g., habitat destruction or over-fishing). Naturally-produced salmonid stocks exhibit wide variations in survival, caused in part by changes in freshwater stream flows (droughts and flooding), ocean conditions (e.g., El Niño events) and biological interactions such as competition and predation (Cooper and Johnson 1992). It is not uncommon for wild stocks to experience one or two extremely low survival years each decade, resulting in low adult returns. This type of natural variation also provides years of above average production.

Some stocks are experiencing survivals that are so low that they are clearly below the level of natural variation. The survivals of other stocks are intermediate between obviously healthy stocks and clearly depressed stocks and are the most challenging to evaluate because they could be experiencing low survivals within the normal range for the stock. Short-term databases often exacerbate the rating problem because with only a few years of observation it is unlikely that the lowest natural survivals have been documented. The evaluation of stocks with intermediate survivals was based on the collective judgment of technical agency staff members most familiar with each stock.

The possibility of cycling in the survival rates of various stocks also can create difficulty in rating stock status. These cycles may be associated with weather-related impacts on fresh water spawning and rearing success. The apparent existence of cycles in survival and production data complicates the task of identifying depleted stocks, since poor stock performance could be the result of natural cyclic variation. Wherever possible, the existence of survival cycles was

considered during the stock evaluation process and stocks with production levels within normal ranges of variation (including cyclic variation) were rated healthy.

STOCK SCREENING

The best available escapement, population size, and survival data were used to screen each coastal cutthroat stock complex for indications of negative production or survival trends. Only stock complex-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 type of data was available to analyze the production trend of a stock complex. When multiple types of data could be used to examine individual stock complex status, the available production or survival data sets were examined individually, and each stock complex's rating was based on the data that best described current status.

The five stock screening criteria initially developed for SASSI were used in the preliminary evaluation of each stock complex for trends in survival, escapement, or production. These criteria do not currently incorporate quantitative formulas because the available stock-complex-specific information was often too limited for statistical evaluation. More subjective criteria were applied, and decisions were based on the collective judgment of the technical reviewers most familiar with each stock complex. While this approach likely can be improved in the future with additional and better information, it facilitated this initial stock complex status classification process. The status of each stock complex will be subject to ongoing review and refinement in subsequent inventories.

The five stock screening criteria are:

(1) Long-Term Negative Trend -- This criterion reflects at least ten years of data showing a consistent drop in a survival or production parameter. The negative trend is the important factor, and several high values would not eliminate a stock complex from being categorized under this criterion. Although most Washington salmon and steelhead escapement and production data bases span periods of ten to twenty-five years, such data time series are currently seldom available for coastal cutthroat.

(2) Short-Term Severe Decline -- A short-term drop in escapement or production is often difficult to distinguish from the amount of natural variation displayed by all naturally produced stocks. It is important, however, to attempt to identify declining stock complexes as early as possible, so that limiting factors can be recognized and, if possible, corrected before serious damage occurs. The most recent five years of production data were examined for evidence of any significant drop in escapement, population size, or survival. If two of the five years display significant production decreases, the stock complex is included in this category.

(3) Chronically Low -- Stock complexes in this category are sustaining themselves at levels significantly below their potential. The determination that a stock complex is chronically low may be based on observed past production levels, or on an assessment that stock complex performance does not meet expected levels based on available habitat. Chronically low stock complexes may display declining, stable, or even increasing trends. For stock complexes that have displayed chronically low production for an extended period, it may be necessary to examine any available data for the years before current stock assessment databases were developed.

(4) Decreases In Fitness -- The ability of wild salmonid stock complexes to sustain themselves can be significantly affected by changes in the fitness of the individuals that make up a given stock complex. These changes can be subtle and include factors like changes in adult size or age structure, inbreeding associated with small numbers of spawners, changes in spawn timing, or other reduction in genetic variability. Any significant changes in fitness may justify the inclusion of a stock in this category. Currently no information is included in this inventory that allows any quantitative assessment of change in fitness. We intend to include data on age structure, size, sex ratios, and other life history characteristics in future updates to allow fitness evaluations.

(5) Unknown -- Many coastal cutthroat stock complexes have not been monitored or enumerated over a sufficient period of years to enable quantitative analysis of status. Stock complexes in this category will have an Unknown status rating. Determination of their status for future inventories will require more intensive stock assessment work.

STOCK ASSESSMENT DATA TYPES

As stated earlier, evaluations of the current status of coastal cutthroat use the best available quantitative information on stock complex abundance, harvest, and survival and consider the four primary life history types (anadromous, fluvial, adfluvial, resident) both individually and in the composite. The data types used are consistent with those used in the 1992 SASSI report and 1997 and 1998 SaSI bull trout and Dolly Varden reports. Since available data are more limited for coastal cutthroat than for salmon and steelhead, fewer data types are used in this inventory. Stock assessment data will be presented in individual reports for each stock complex (see Part 4 -- Stock Reports). Outlined below are stock assessment data types and terms used for this coastal cutthroat inventory. It is important to note that the data types described below are not intended to be all inclusive, but contain those used in this inventory and others with general relevance although they may not appear in this inventory.

Size of Spawning Population/Escapement

For coastal cutthroat, the term escapement refers to mature fish that have returned to fresh water, have survived all fisheries, and constitute the spawning population of a given stock. Escapement data collected during spawning ground surveys are sources of information that may allow direct enumeration of escapement. Counts made at traps and fish passage facilities may be of use. For most coastal cutthroat stock complexes, direct escapements are not estimated, and indirect measures are needed to assess stock status. Indirect escapement information would include counts of spawners in index areas or other measures, preferably collected on an annual basis. Indirect counts do not provide total escapements but instead provide relative data that can be used to determine changes in abundance and long-term trends. Other indirect measures include age-size frequency, proportion of sexually mature fish vs. age, frequency of repeat spawning, percent use of available habitat over time (years).

The following escapement data sets were modified from the 1992 SASSI report for application to coastal cutthroat stock complexes and bull trout and Dolly Varden stocks (WDFW 1997b, 1998).

ESCAPEMENT

Index total	An estimate of total escapement in an index area.
Peak count	The highest daily count of live fish in an index area.
Fish/mile	A spawner count divided by the number of miles surveyed.
Redds	A count of redds in an index area.
Redds/mile	A redd count divided by the number of miles surveyed.
Rack count	A total count of fish destined for spawning grounds upstream of a rack.
Snorkel index	A count of adults observed while snorkeling an index area.
Trap count	A total count of fish destined for spawning areas upstream of a fish trapping facility.
Total	An estimate of all fish of a stock that have survived all fisheries and make up a spawning population.

Harvest Data

The numbers of fish caught or harvested in various fisheries can be used to measure relative abundance and to observe long-term trends. Most of the harvest data used in this inventory apply to the anadromous life history form. Since coastal cutthroat are not the target of commercial fisheries and are not often caught incidentally in nets, harvest data come exclusively from sport fisheries.

HARVEST

Sport	The total catches in a single sport fishery or the combined catches in all sport fisheries in a specific area.

Total Population/Run Size Data

The term total population size may pertain either to anadromous or non-anadromous life history types and refers to the total number of fish enumerated at a particular point in time. Run size pertains primarily to the anadromous form, and refers to the total number of fish enumerated at a particular point in their migration, e.g., total numbers of upstream migrants entering a watershed. These estimates may not include all returning fish, but they are believed to be adequate to represent the relative abundance of the anadromous stock component.

POPULATION/RUN SIZE

Total	The combined abundance/escapement and catch/harvest of a stock of fish in a specific area, 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.

Fresh Water Production Data

Counts of coastal cutthroat at various life stages in fresh water may be used to measure relative abundance and evaluate trends. These data are most commonly collected during fresh water incubation, rearing, or migration periods, and may include any life stage from egg to smolt (anadromous) or repeat spawner (anadromous and non-anadromous). These data would also be used to measure a variety of survival rates. However, because of inconsistencies in data collection methods, sampling locations, and time series, these data may often be of minimal value in quantifying abundance. They may be however, of considerable utility in assessing presence-absence and distribution. As a potential measure of presence-absence, this data category may include the percentage of available habitat use over time (years).

Fresh water PRODUCTION

No./100m^2	The average number of juveniles (of various age classes) produced per 100 square meters of habitat.
No./m^2	The average number of juveniles (of various age classes) produced per square meter of habitat.
Adult snorkel count	The number of adults seen in snorkel surveys.
Snorkel	The number of fish seen during snorkel surveys, usually juveniles.
Fish/hour	The number of fish sampled by hook and line or seine gear divided by the number of hours of sampling.
Fish/day	The number of fish sampled by hook and line or seine gear divided by the number of days of sampling.
Index total	The total number of fish of all age classes sampled within an index area.
Total	The total number of fish of all age classes sampled by hook and line or seine gear.
% Habitat Use	Percentage of coastal cutthroat present in available habitat over time (years); can use index areas/counts.

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 an indication of the success of specific stocks. Recruits per spawner is the most commonly used survival statistic for anadromous fish because it expresses the offspring total survival for a given parent year of spawning. However, it is difficult to apply this statistic without related information on abundance or density. This statistic may be of use in assessing the non-anadromous life history component, but more likely alternate statistics will be applied. These statistics may include data and trends in attributes such as size and age composition. Again, as was the case for fresh water production

information, although these data may be of minimal value in quantifying stock abundance, they may be useful where density effects and harvest relationships are defined.

SURVIVAL

Rec/spawn	The number of adults (recruits) divided by the number of spawners from a brood year.
Age class	The percentage of a given age class surviving from one year to the next (based on size frequency and/or scale analysis data).
Age comp	Age structure of a population, including age at sexual maturity; and percentage of first, second, etc. time female spawners.
% > 12"	Percent of fish sampled which measured over 12 inches in total length. This category generally includes females which are old enough to be sexually mature.
% > 14"	Percent of fish sampled which measured over 14 inches in total length. This category generally includes females which are old enough to have spawned once.

Juvenile Data

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

JUVENILE

Smolts	The number of smolts produced by spawners from a brood year.

No Data

For most coastal cutthroat stock complexes, quantitative data does not exist to determine stock status using the rating criteria in this inventory. The status of these stock complexes would be rated as Unknown.

STOCK STATUS RATING

The stock-screening process is used to place stock complexes into five status categories. Stock complexes with escapement, population size or survival levels within normal ranges were rated as **Healthy**. Those stock complexes that currently display low production or survival values were assigned to one of two separate rating categories: **Depressed** or **Critical**, depending on the current condition of the stock complex. Stock complexes were also rated as **Unknown** when data limitations did not allow assessment of current status. A rating category for **Extinct** stock complexes was also included, although no extinct stock complexes have been identified. Definitions and discussions of each of these rating categories are provided below, along with the number of stock complexes assigned to each category.

The rating of stock complex status was done during a technical review process. The amount and quality of stock data vary among regions within the state, which can result in some differences in the application of the rating categories. These ratings represent the collective judgment of the technical staff most familiar with the individual complexes. The iterative nature of the inventory process will allow these ratings to be changed in the future as more detailed information becomes available, or because of changes in stock complex status.

Healthy Stock Complexes

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

Healthy stock complexes are those currently experiencing stable escapement, survival, and production trends and not displaying a pattern of chronically low abundance. Because wild salmonid stocks experience large natural variations in survival (caused by environmental variations), it is not unusual for even the most robust stock to experience occasional low abundance or even fail to meet escapement goals. Such fluctuations would not necessarily warrant a change in status unless the stock experiences a consistent declining trend, or a sudden significant drop in production. The Healthy category covers a wide range of stock performance levels, from consistently robust production to those stocks that may be maintaining sustainable levels without providing any surplus production for directed harvests. In other words, the fact that a stock complex may be classified as Healthy in the inventory process does not necessarily mean that managers have no current concerns about its production status. State and tribal fishery managers believe very strongly that habitat protection and restoration needs exist for many of the stocks/stock complexes classified as Healthy in SaSI as well as for Critical and Depressed stocks/stock complexes. In addition, due to a lack of information on changes in fitness, some stock complexes were classified as Healthy that may have been significantly influenced by interactions with non-native species.

Considering habitat degradation, or loss, in assessing the status of individual stocks presents a particularly difficult problem. It is probable that all wild salmonid stocks in Washington have been affected by some level of habitat loss. It might be argued that if a stock has suffered any habitat loss, it cannot be judged to be Healthy. Such an argument is unrealistic, but it would still be desirable to identify some level at which the cumulative impacts of habitat loss have taken a stock out of the Healthy category. Unfortunately, it is difficult to accomplish this task, because individual stocks are faced with such a wide range of different habitat impacts. The SaSI report rates the **current status** of each stock based primarily on trends in survival rates and population size, and does not focus directly on causative factors. Habitat loss, over-fishing, or other factors, may be the reason that a stock is Depressed or Critical, but the rating is based on actual stock or stock complex performance.

The consideration of available habitat is included in the stock rating definitions for Healthy and Depressed stocks/stock complexes. This approach is an effort to recognize that there have been irreversible losses of habitat and that if stock/stock complex status were rated against a pristine habitat base, virtually every stock/stock complex could be rated depressed or worse. Such a result would be of little help in addressing the current need to restore our wild salmonid stocks. To provide a meaningful assessment of current stock/stock complex status, a flexible definition of "available" habitat is needed. In SaSI, "available" habitat may be habitat that is currently accessible to wild salmonids or in some cases may include all habitat that salmonids could reasonably be expected to utilize, even if currently inaccessible. For example, if a stock complex lost access to and/or was blocked from utilizing a substantial proportion of the available habitat in a stream, this may have been considered in the rating of stock complex status.

The definition of a Healthy stock complex is not meant to imply that a stock complex rating will remain healthy in the face of continuing habitat loss, even if the stock complex remains in balance with declining habitat. Future inventories will identify those Healthy stock complexes that are in need of attention to help ensure they remain at healthy levels. SaSI will also serve as a baseline against which any future changes in stock complex performance or habitat availability can be measured.

This SaSI report has identified one healthy coastal cutthroat stock complex statewide (Table 2). This stock complex is identified and described in more detail in Table 3, and in Part 4 -- Stock Reports.

This designation of a single Healthy stock complex reflects more the lack of data with which to make status determinations than an actual lack of Healthy stock complexes.

Depressed Stocks Complexes

> **Depressed -- A stock complex 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 complex is likely.**

The category of **Depressed** stock complexes is used to identify those stock complexes that are experiencing difficulties that contribute to lower than expected abundance. These stock complexes met one or more of the negative performance criteria, but are likely above the level where permanent damage has occurred to the stock complex. These stock complexes may

currently be producing relatively large numbers of fish but have experienced a substantial drop in production or are producing well below their potential. Other stock complexes may be represented by relatively small numbers of individuals and are chronically depressed - forced to a low production level by some combination of biological, environmental, or human-caused factors. It is not unusual for a stock complex to stabilize at a low production level by achieving a balance with the particular set of survival pressures controlling its success. While Depressed stock complexes may not immediately be pushed to Critical status or face extinction, they are vulnerable to any additional negative impacts and can potentially change status very rapidly. Additionally, these stock complexes will constrain fishery harvest opportunity because of their low abundance.

This SaSI report has identified seven Depressed coastal cutthroat stock complexes statewide (Table 2). Individual Depressed stock complexes are identified and described in more detail in Table 5 and Part 4 -- Stock Reports.

Critical Stock Complexes

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

The **Critical** category is reserved for those stock complexes that have declined to a level where the stock complex is in jeopardy of significant loss of diversity or, in the worst case, could face extinction. The loss of within-stock complex diversity includes such factors as a reduction of range (e.g., spawning and/or rearing distribution), shifts in age at maturity, changes in body size, reduction in genetic variability, or lowered disease resistance. Major shifts in these or other attributes can all lead to significant reductions in a stock complex's ability to respond to changing conditions. The usual result is reduced survival and population size. Such stressed stocks complexes can be caught in a downward spiral of ever-increasing negative impacts that can lead to eventual extinction. In contrast, stock complexes in this category might reach an equilibrium with those factors controlling their performance and could display consistent population size and escapements for an extended period. While such stock complexes would appear to be stable, they could be delicately balanced, awaiting just one additional negative impact to push them into failure. Any Critical stock complexes would be in need of immediate restoration efforts to ensure their continued existence and to return them to a productive state.

Some other efforts to identify declining stocks of fish have used minimum population sizes as a quantitative measure of poor stock performance. For example, a report on Sacramento River winter chinook (NMFS 1987), identified 200 spawning fish in a single return year to be the minimum population level to avoid permanent genetic damage to a stock. These minimum population sizes are derived from calculations of the lowest possible numbers of reproducing adults needed to maintain an effective genetic population. While minimum effective population size criteria can be useful in assessing stock status and the likelihood of a stock incurring genetic damage, they were not used in the SaSI report for several reasons. First, the selection of a single minimum population size (e.g., 200 spawners) may create the perception that stocks exceeding the threshold value are not Depressed or Critical. SaSI attempts to compare a stock/stock complex's potential population size and the amount of available habitat to its current status, which means that a stock/stock complex with potential for large population size could theoretically still be in Critical status. Second, it is also possible for very small groups of fish to maintain

themselves at productive levels over time, particularly in situations were the population has achieved equilibrium with a limited amount of habitat. Finally, coastal cutthroat stocks composed of small numbers of fish are often extremely difficult to enumerate, particularly in large water bodies. If estimates of escapement or population size have questionable accuracy, using a set minimum population size to measure stock performance makes the criterion difficult or impossible to apply. However, low population estimates can be an important indicator of stock condition and will require more detailed assessments of status and information needs.

No Critical coastal cutthroat stock complexes have been identified in this SaSI report (Table 2). Again, this may be more a reflection of the lack of data with which to make status determinations than lack of critical stock complexes.

Unknown Stock Complexes

Unknown -- There is insufficient information to rate stock complex status.

If sufficient trend information was not available or could not be used to assess current status, stock complexes were rated as **Unknown**. Stock complexes rated as Unknown may be rated as Healthy, Depressed, Critical, or Extinct once more information is available. We do not know to what extent the large number of Unknown stock complexes represent historically small populations.

There is an immediate need to collect information on Unknown stocks. Historically small populations or currently small populations could be especially vulnerable to any negative impacts.

This SaSI report has identified 32 coastal cutthroat stock complexes of Unknown status statewide. Stocks complexes rated as Unknown represent the largest status category of coastal cutthroat in Washington State (Table 2). Unknown stock complexes are identified and described in more detail in Tables 3, 4, and 5 and in Part 4 -- Stock Reports.

Extinct Stock Complexes

Extinct -- A stock complex 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 stock complexes.

This SaSI report identifies extant coastal cutthroat stock complexes and makes no focused effort to identify and assess past extinctions. The past loss of stocks is an important historical fact that challenges resource management effectiveness. It would be difficult, however, to assemble any kind of comprehensive listing of past extinctions because many of these losses occurred prior to the time that enumeration programs were initiated. Since SaSI is an inventory of the current status of wild salmonid stocks/stock complexes, the inclusion of known past extinctions is not emphasized, but is referenced in documented cases as a reminder of the consequences of ignoring stock status.

The Extinct rating is included here to identify any current and future losses of stocks/stock complexes identified during the annual review and inventory of Washington's wild salmonids. No Extinct stock complexes have been identified to date. The Extinct rating will be applied if a stock

complex whose escapement or harvest is currently being tracked is found in the future to have been extirpated within its native range.

STOCK COMPLEX STATUS SUMMARY

Of a statewide total of 40 stock complexes identified in this inventory, 1(2%) was rated as Healthy, 7 (18%) were rated as Depressed, 0 (0%) were rated as Critical, and 32 (80%) were rated as Unknown. The number of stocks in each category in different regions of the state is also presented in Table 2.

More detailed examination and planning will be done for those coastal cutthroat stock complexes requiring priority attention as part of salmonid restoration in Washington (see Part 3 -- Current and Future Actions).

Table 2. Regional summary of Washington State coastal cutthroat stock complex status.

	Healthy	Depressed	Critical	Unknown	Extinct
PUGET SOUND					
North Puget Sound	1	0	0	7	0
South Puget Sound	0	0	0	4	0
Hood Canal	0	0	0	2	0
Strait of Juan de Fuca	0	0	0	3	0
TOTAL	1	0	0	16	0
COASTAL					
North Coast	0	0	0	6	0
Grays Harbor/Willapa Bay	0	0	0	6	0
TOTAL	0	0	0	12	0
COLUMBIA RIVER					
Lower Columbia	0	7	0	4	0
WASHINGTON STATE					
40 TOTAL STOCK COMPLEXES	1	7	0	32	0
PERCENT OF TOTAL	2%	18%	0%	80%	0%

Table 3. Puget Sound and Strait of Juan de Fuca cutthroat stock complex list presented by river basin

PUGET SOUND			
NORTH SOUND	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
Sumas	Unknown	Wild	Unknown
North Puget Sound Tribs.	Native	Wild	Unknown
Nooksack	Native	Composite	Unknown
Whatcom Creek	Unknown	Composite	Unknown
Samish	Unknown	Wild	Unknown
Skagit	Unknown	Wild	Unknown
Stillaguamish	Mixed	Composite	Healthy
Snohomish	Mixed	Composite	Unknown
SOUTH SOUND	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
Duwamish/Green	Native	Wild	Unknown
Puyallup	Native	Wild	Unknown
Nisqually	Native	Wild	Unknown
Western South Sound	Native	Wild	Unknown
HOOD CANAL	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
East Hood Canal	Native	Wild	Unknown
West Hood Canal	Native	Wild	Unknown
STRAIT OF JUAN DE FUCA	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
Eastern Strait	Native	Wild	Unknown
Mid-Strait	Native	Wild	Unknown
Western Strait	Native	Wild	Unknown

Table 4. Coastal Washington cutthroat stock complex list presented by river basin.

WASHINGTON COAST			
NORTH COAST	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
Ozette	Native	Wild	Unknown
Quillayute	Native	Wild	Unknown
Hoh	Native	Wild	Unknown
Queets	Native	Wild	Unknown
Raft/Quinault	Native	Wild	Unknown
Moclips/Copalis	Native	Wild	Unknown
GRAYS HARBOR	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
Humptulips	Native	Wild	Unknown
Chehalis	Native	Wild	Unknown
WILLAPA BAY	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
North/Smith Cr./Cedar	Native	Wild	Unknown
Willapa	Native	Wild	Unknown
Mid-Willapa Bay	Native	Wild	Unknown
Naselle/Bear	Native	Wild	Unknown

Table 5. Columbia River coastal cutthroat stock complex list presented by river basin.

COLUMBIA RIVER			
LOWER COLUMBIA	**STOCK ORIGIN**	**PRODUCTION TYPE**	**STOCK STATUS**
Grays	Native	Wild	Depressed
Abernathy Creek/Germany Cr/ Mill Cr/Coal Cr	Native	Wild	Depressed
Elochoman/Skamokawa Cr	Native	Wild	Depressed
Cowlitz	Native	Wild	Depressed
Coweeman	Native	Wild	Depressed
Toutle	Native	Wild	Depressed
Kalama	Native	Wild	Depressed
Lewis	Native	Wild	Unknown
Salmon Cr	Native	Composite	Unknown
Washougal	Native	Composite	Unknown
Small Tribs from Lewis to Bonneville	Native	Wild	Unknown

PART 3 -- CURRENT AND FUTURE ACTIONS

As previously discussed, stock status inventories such as this volume are the first step in salmonid recovery and provide a foundation for implementation of the Wild Salmonid Policy (WSP). The challenge faced by fish managers, legislators, and concerned citizens is how to implement the WSP to accomplish this goal. This report's introduction outlines some difficult issues affecting the region's wild stocks. Defining and managing future change (e.g., urban growth, land-use activities, fisheries) will be at least as difficult as creating technical solutions. **Because habitat, harvest, hatchery and other species impacts all contribute to wild stock status, coordinated management of these factors provides comprehensive strategies for restoring healthy stocks and fisheries.** Recent calls for an ecosystems approach to the ESA indicate a need for a system-wide look at watersheds and the various species they support to develop a broad, landscape approach to restoring depleted wild stocks. A hierarchy of responses will be needed. Some measures may be designed to reap broad regional benefits (e.g., changes in Canadian and U.S. fishery management regimes); some may be at a watershed level (e.g., habitat protection and restoration); while others may be very stock-specific measures (e.g., targeted habitat restoration and harvest enforcement efforts). Clearly, none of the region's management tools alone will solve the problems facing wild stocks. They must be used in concert to provide a reasonable chance for successful stock restoration, or recovery. State and tribal managers have adopted this integrated management philosophy as an approach to challenging the present and improving the future.

The potential for success will be affected by several key factors. One important element is the availability of adequate funding. Fish managers are faced with the deteriorating ability to maintain their fiscal resource base on the one hand, and a need to improve wild stock status on the other. Potential budget reductions in many programs such as harvest management and habitat protection would result in many of the same negative consequences that wild stock restoration is intended to prevent, including risks to wild stocks and further reductions in harvest opportunity. Fish management entities will have varying abilities to tackle priority wild stock issues, and the scope and degree to which salmonid recovery can be implemented successfully will be limited without significant, new funding support. Besides adequate fiscal resources, a necessary willingness must exist to tackle difficult resource management issues and adapt new approaches to complex problems. For instance, the long-term status of fishery resources ultimately will be determined by public support and willingness of land-use regulators to deal effectively with growth management and land/water-use issues. Resolving conflicts between stock restoration and habitat loss/degradation is central to maintenance of healthy wild stocks and fisheries.

NEXT STEPS: AN INTEGRATED APPROACH

A future task for fish managers will be for fish managers to prioritize stock and habitat restoration needs based on SaSI and identify where important information is lacking. A related activity will be to develop public understanding of the implications of depleted stocks and support for their restoration. The public distribution of the 1992 SASSI report, the 1997 and 1998 SaSI for bull trout and Dolly Varden, and this SaSI report is intended to present information on salmonid stocks and their status to interested citizens.

While the objectives for the subsequent steps have been identified, detailed work planning for related tasks is still being completed. The managers' initial thoughts about next steps in salmonid recovery are briefly presented below to help define needs and solicit additional ideas.

Review of Current Resource Management Goals and Objectives

Resource management review steps have been ongoing and will continue with the intent to make significant progress on the following tasks. Specific tasks will include:

- implementation of the Wild Salmonid Policy;
- completion of a cutthroat trout management plan;
- development of wild stock management/genetics policies and associated guidelines; and
- evaluation of costs and benefits of alternative resource management strategies

Effective partnerships among local, state, and federal governments and the public should be initiated and developed to accomplish critical habitat protection needs.

Recovery Programs

Development of wild stock recovery programs for priority salmonid stocks and habitats began during 1993. The intent of these and other efforts has been to develop early action plans for priority stocks or watersheds so that significant, new restoration efforts can commence. Restoration planning and implementation activities will continue into the foreseeable future, driven by stock/habitat status priorities and limited by fiscal resources. The success of restoration efforts will depend largely on the ability to develop strategies that have sufficient public support to proceed with implementation. An essential aspect of this effort will be a broad “multi-public” approach to developing restoration options and building support for the best approaches for solving wild stock problems.

The specific restoration actions taken for a given problem will be determined during plan development and tailored to the specific region, stock, or habitat. Actions could include such things as: habitat restoration, passage improvements, appropriate monitoring and control of interbreeding with exotic species, new management strategies to further manage wild stock exploitation rates, and collaboration with local governments to ensure that coordinated and comprehensive plans developed under the state's Growth Management Act address wild salmonid habitat needs.

Improved Monitoring and Evaluation

Increased monitoring of wild spawning populations in general will be required to address critical information gaps identified through SaSI and to improve assessment of wild stock abundance trends and stock status. New evaluation efforts will also be an important aspect of determining the effectiveness of restoration actions taken, to ensure that they are having positive rather than negative effects and to modify approaches where needed. Criteria will be defined to gauge success, and evaluation efforts will measure performance of specific actions in both short-term and long-term time-frames. Examples of factors to be evaluated could include: fishery variables (e.g., harvest, regulation effectiveness monitoring, and regulation compliance); stock production

variables (survival rates during different life history stages impacts of disease, competition and predation, population characteristics such as genetics and age composition, and correlation with limiting factors); and habitat characteristics (long-term watershed productivity, changes in flow characteristics such as frequency and magnitude of flood events, and changes in critical physical habitat variables for the different species).

FUTURE INVENTORIES

The state and tribes intend to review and to update salmonid stock/stock complex status periodically. An overriding conclusion of the technical staff who contributed to the earlier SASSI/SaSI reports and this coastal cutthroat SaSI report was that many stock issues are clouded with uncertainty. The lack of specific data for many coastal cutthroat stock complexes continues to make it difficult to answer questions about stock origin, production type, spawning distribution and status, and conclusions are often based on the collective judgment of the participants. Identified critical information needs will receive a high priority in various data collection programs. Many other questions will require longer term study. Inventories will guide future data collection programs by pointing out stock information deficiencies, and will allow updating and revision of stock status designations as better data become available. Additionally, the systematic review process will function as a tool to measure the short-term and long-term success in rehabilitating priority stocks.

Inventory updates will become a part of the salmonid management cycle for the state agencies and tribes. Stock assessment data (e.g., escapement, population size, and survival) will be assembled and analyzed, and future inventories will be completed on a systematic basis.

The envisioned review process will be relatively simple. Any aspect of the inventory is subject to review and modification as better information or new approaches are developed. For example, screening criteria and the system for rating stock status could be refined or the types of inventory information could be expanded. Further, any new information that can be used to refine the stock/stock complex list will be examined and stocks may be added or deleted from the list based on such things as more thorough spawning ground data or more detailed genetic study (e.g., addition of information on individual life history types). The quantitative information on the stock status profiles will be updated for all stocks for each SaSI iteration. Each stock will be screened for any change in stock status since the previous inventory, and the various stock status lists will be amended. New stock reports will be prepared for any stocks which have changed status, and for all new stocks. Finally, the inventory results will be published in SaSI documents.

Besides the update and review process for specific stocks, managers will consider the utility of comprehensive, regionally focused reviews of management performance throughout Washington. This level of assessment would encourage broader evaluation of status trends and resource management strategies in region-wide contexts that would help identify additional, integrated management opportunities.

CURRENT WILD STOCK PROGRAMS

Numerous resource management activities within the state presently contribute to the maintenance and restoration of wild salmonid stocks and their habitats. Fishery management programs for coastal cutthroat trout include providing harvest management and enforcement of

fishery regulations. Other activities that indirectly affect coastal cutthroat include stock assessment, environmental review and permitting, habitat restoration, public information, and education. Many of these efforts are cooperative programs, and often also involve active participation of private citizens; municipal, county, state, and federal agencies; public and private utilities; private businesses; and others. In addition, some programs that affect wild stocks are not the direct responsibility of fishery management agencies, e.g., land-use planning and regulation.

It would be impractical to provide a comprehensive listing in this report of all activities designed to restore and maintain wild salmonid stocks and habitats. However, it is important to highlight several examples of programs that address issues of habitat management and water quality and quantity on a broad scale, which are intended to improve stock status in the region. Numerous governments and agencies share responsibility and regulatory authority for land use actions, but none are responsible for coordinated land-use management designed to benefit anadromous salmonids (PFMC 1992). Improved coordination, funding, implementation, and evaluation of programs designed to protect and restore salmonid habitat are important aspects of any long-term restoration strategies. Examples of existing programs include:

- The Timber/Fish/Wildlife (TFW) forum - This forum involves a number of state, tribal, and federal agencies, as well as forest industry and other groups concerned with forest land management. Important activities include review of forest practice applications, watershed analysis, and in-stream wetlands protection. Several priority watersheds have been designated for intensive TFW studies contain stocks rated as Critical in the 1992 SASSI report.

- The Washington Board of Natural Resources has adopted the Department of Natural Resources's Habitat Conservation Plan. One component of the Habitat Conservation Plan is a riparian conservation strategy to maintain and restore fresh water salmonid habitat through protection of wetland, riparian ecosystems, and unstable hill slopes; improved road network management; and reduction of the impacts of rain or snow floods by maintaining a portion of drainage basins as hydrologically mature forests.

- The WDFW Integrated Landscape Management project in the Lewis and Kalama River basins is a watershed-based, multi-species approach that engages private landowners, the public, and fish and wildlife managers in generating a comprehensive management plan for fish, wildlife, and their habitat. Key fish and wildlife species have been identified, and population and habitat objectives are being developed.

- The Washington State Conservation Commission approved ecosystem standards for state-owned agricultural and grazing lands in 1994 at the direction of the 1993 Washington Legislature. Standards were adopted for stream water temperature, fish passage, riparian zone management, and fine sediments in spawning gravel. These standards will help protect coastal cutthroat trout.

- The Washington Board of Natural Resources has adopted the Forest and Fish Report, an agreement between state natural resource agencies and the timber industry intended to provide more protection for fish habitat on state and private forest lands.

Subsequent steps in salmonid rebuilding will include a specific inventory and review of ongoing habitat, harvest management, and hatchery programs as part of the review of current management goals and objectives. Ongoing programs, including those noted above, will be evaluated in more detail at that time.

PART 4 -- STOCK COMPLEX REPORTS

This section provides detailed information on each coastal cutthroat stock complex presented in this SaSI report. It includes descriptions of the rationales for stock complex definitions, origins, and status ratings. General information is also included on factors affecting production. Information presented is based on the framework and procedures outlined in Part 1 -- Stock Complex Definition and Identification and Part 2 -- Stock Assessment and Status sections of this report.

Stock Complex Reports

In this and subsequent sections, the terms “stock” and “stock complex” are used synonymously . Each stock identified in SaSI is the subject of a report which presents detailed descriptions of the rationales for the stock definitions in a **Stock Definition and Origin** section (which reviews distribution, timing, and biological characteristics) and highlights any related uncertainties or caveats. Stock origin is also addressed with discussions of the probable genetic make-up of each stock, and possible impacts of introduced fish. The **Stock Status** section of these reports assesses trends in survival or production for each stock and discusses the data used to measure current status. Stock status ratings are also presented.

The individual stock reports also contain a two-page "stock profile". The first page of each profile is a **Stock Definition Profile** which summarizes the available evidence relevant to the three criteria used in defining individual stocks. **Spawning distribution** is shown on a generalized basin map, and distinct distribution is noted if applicable. **The spawning distribution maps are not intended to be comprehensive maps of all spawning locations for a stock.** Rather, their purpose is to support stock complex distinction based on differences in geographic distribution of spawners. **These maps should not be used to make fine-scale land-management decisions. Timing** of adult returns (where applicable) and spawning is presented in graphic form, and again any distinctions (differences among stock complexes) are identified. Any information on unique **biological characteristics** is summarized at the bottom of the stock definition page. A **Stock Status Profile** presents stock complex status data in tabular and graphic form. These data sets vary by stock, depending on the nature of available stock-specific information. The purpose of the numerical data is to describe the stock production trends, and these summaries may include data for escapement or other measures of population size. Average run-size distribution, that is, apportionment of the run to escapement and to fisheries or other sources of mortality, is not available for coastal cutthroat. The final section of the stock profiles presents a summary of stock origin, production type, and current status.

The **Factors Affecting Production** section summarizes the possible impacts of harvest management, habitat status, and fish culture programs. The **Harvest Management** section is a general discussion of the fisheries regulations that impact each stock. The **Habitat** section reviews the general condition of the habitat used by each stock, and identifies specific environmental problems known to impact stock production. The **Hatchery** section discusses key fish culture programs in the areas utilized by each stock, and outlines possible interactions between wild fish and hatchery fish. Some stock reports contain a **Species Interactions** section which describe interactions between coastal cutthroat and established native or introduced

species which share coastal cutthroat spawning and rearing habitat. **These discussions on factors affecting production are meant only to provide a very general overview of the type of problems faced by a stock**. More detailed examinations of these topics will be developed for those stocks requiring priority attention as part of the overall salmonid recovery planning and Coastal Cutthroat Management Plan when it is finalized (see Part 3 -- Current and Future Actions).

TRANSBOUNDARY — SUMAS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Sumas coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. The Sumas River is part of the Fraser River (British Columbia) system, however cutthroat spawning does occur within the portion of the river which originates in Washington State.

Anadromous cutthroat in the Sumas as well as the resident form are present and are considered to be native. Both life history forms are sustained by wild production.

Spawn timing information is available only for the anadromous life history form. River entry from salt water occurs from August through October (early-entry migration timing), and spawning takes place from January through April.

STOCK STATUS

The status of the Sumas stock complex is Unknown. Biological surveys for coastal cutthroat have concentrated on geographic range and distribution rather than numerical abundance. The quality of data on locations of spawning and rearing sites of anadromous cutthroat in the Sumas River is good, but quantitative data on abundance or survival related to stock status are lacking.

In most systems the geographic range of anadromous cutthroat has been shrinking for at least the last 13 years. Reduced water quality and quantity, as well as increased instream and near-stream human-related activities are responsible for reductions in cutthroat distribution within the watershed. Although range/distribution has shrunk, the anadromous cutthroat population size may not have declined. However, given the species life history and behavior when forced to interact with other salmonids, it is more likely that reduced distribution equates to reduced numbers.

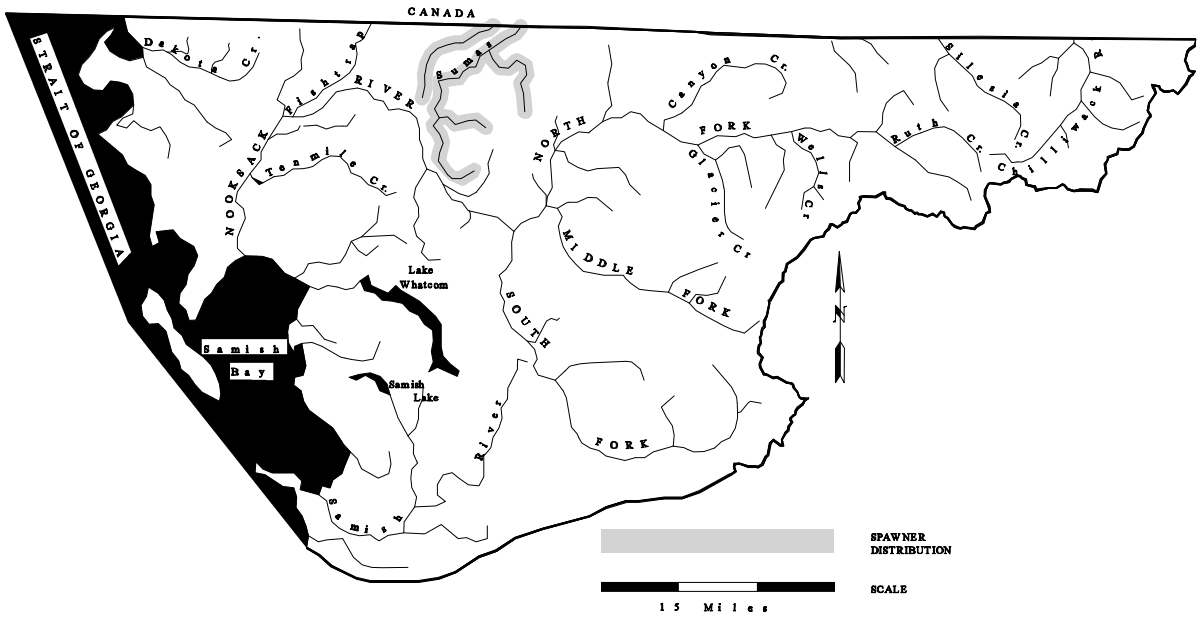
FACTORS AFFECTING PRODUCTION

Habitat--Livestock grazing and agricultural practices that remove streamside vegetation and increase siltation limit spawning areas and production. Water withdrawal for irrigation has reduced stream flows, increased stream temperatures, and concentrated pollutants. Logging activities have altered stream flows, increased siltation of spawning beds, removed shading and increased stream temperatures, and increased rain-on-snow events causing landslides. Road culverts that are impassible to juvenile and adult anadromous cutthroat significantly reduce the river system's fish-production capabilities by blocking access to spawning and rearing habitat. Diking of the river's shoreline has reduced fish-rearing habitat, streamside vegetation, and altered pools and riffles by confining the river channel.

STOCK DEFINITION PROFILE for Sumas Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry								■	■	■			No
Anad Spawning	■	■	■	■									No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Sumas Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Harvest Management--There are no net fisheries targeting Sumas coastal cutthroat. Sport-fishing regulations are designed to minimize the impact of recreational fisheries upon cutthroat populations. There is a two-fish daily limit with an eight-inch minimum size limit intended to protect rearing juveniles, outmigrating smolts and resident spawners from harvest.

Hatchery--There are no current releases of hatchery cutthroat in the Sumas drainage. Historically, hatchery cutthroat have been released, but no record exists. Releases of hatchery coho fry have been made in the past, but that no longer occurs. There is no record of hatchery steelhead releases into this watershed.

NORTH PUGET SOUND--NORTH PUGET SOUND TRIBS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The North Puget Sound Tribs Stock complex includes stocks in several small independent tributaries which are important cutthroat-producing waters. These tributaries include, from north to south: Dakota, California, Terrell, Squalicum, Padden, Chuckanut, and Oyster creeks. All of these creeks have anadromous and resident forms, both of which are generally considered wild in origin. Adfluvial fish are present in Lake Terrell. Some hatchery cutthroat releases may have occurred in the past, but there is no clear record, and no hatchery releases occur presently. Thus it is assumed that cutthroat in these systems are of native origin with wild production.

In general, the anadromous cutthroat returning to these watersheds are late-entry fish, arriving November through March and spawning January through April. Adfluvial fish in Lake Terrell spawn from January through May. The resident form also begins spawning in January, but continues through July. No genetic sampling has been carried out on any North Puget Sound Tribs stocks.

STOCK STATUS

The status of the North Puget Sound Tribs stock complex is Unknown. Historically, there have been no stock assessment surveys conducted on these systems. Thus information on abundance levels and comparisons of historical to present trends, are not available. Catch information and angler effort are not documented. Spawning location of the anadromous form is the only information that is available.

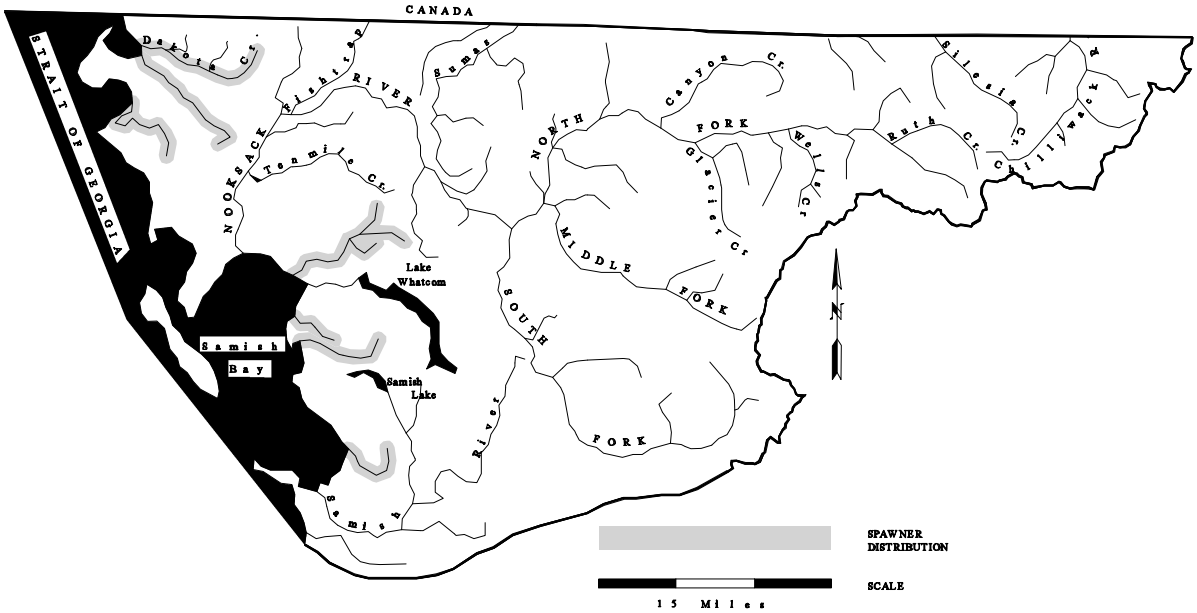
FACTORS AFFECTING PRODUCTION

Habitat--All of these systems have experienced some level of habitat degradation due to human activities such as urbanization, water diversions, diking, pollution discharge, etc. Some such as Squalicum and Padden creeks presently flow through highly developed urban and residential areas, where the streams have been confined and even covered over for much of their lengths. Oil road runoff, septic and drain field failures and other discharges of toxic materials have significantly reduced fish production, to the point that cutthroat trout are now a rarity. California and Dakota Terrell creeks to the north have had fewer impacts, and cutthroat trout are common. Nevertheless, agricultural discharges, diking, road culverts, and siltation have reduced habitat quality there as well. Removal of the forest canopy along most stretches of these creeks has increased water temperatures. To the south, Chuckanut and Oyster creeks still provide fair habitat. However, the creeks are still affected by road building and past and current logging practices that, in some places, have significantly altered the character of the landscape.

STOCK DEFINITION for North Puget Sound Tribs Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■								■	■	No
Anad Spawning	■	■	■	■									No
Adfluvial Spawning	■	■	■	■	■								No
Resident Spawning	■	■	■	■	■	■	■	■					No

Adfluvial spawn timing is for Terrell Cr. fish.
Resident spawn timing is for Padden, Chuckanut and Oyster creeks fish.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for North Puget Sound Tribs Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Harvest Management--There are no directed commercial fisheries for cutthroat trout. However, major commercial operations are directed on salmon species in Bellingham/Samish bays at various times August through December. Although anadromous cutthroat may be taken incidental to salmon, we do not believe that the fisheries significantly impact cutthroat populations. Recreational fisheries in these waters are open from June 1 through October 31, with a two-fish daily bag limit and an eight-inch minimum size. There have been no creel surveys estimating catch or effort within any of these waters.

Hatcheries--Hatchery cutthroat trout are not currently released into any of these tributaries. Information regarding historical releases is unclear, but it is believed that if they occurred, they have had little impact on wild populations. More important, in terms of competition and predation on cutthroat juveniles, are coho releases, which do occur in many of these waters.

Dakota Creek: Coho fry releases have been made in the past. No releases have been made in recent years, and future coho releases are uncertain.

California Creek: Coho fry have been released in the past, but no releases are currently planned.

Terrell Creek: Coho fry releases have occurred in the past, but this program has been discontinued.

Squalicum Creek: Coho have been reared and released into this creek (via K-Mart Ponds), but that program has been discontinued. However, 5,000 hatchery coho continue to be reared in net pens in Squalicum Harbor annually.

Padden Creek: Coho fry have been released in the past, but this program has been discontinued.

Chuckanut Creek: Coho fry releases have been discontinued.

Oyster Creek: Presently, there are no coho releases into Oyster Creek.

Hatchery steelhead traditionally are not released into small independent tributaries such as these, but it is possible that releases were made in the past. The only exception is Squalicum Creek where steelhead smolts are transferred to net pens for subsequent release into the drainage.

NORTH PUGET SOUND — NOOKSACK COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Nooksack coastal cutthroat have been identified as a separate stock complex within the North Sound region based on the geographic distribution of their spawning areas.

All four life history forms (anadromous, fluvial, adfluvial and resident) are present in the Nooksack basin. Anadromous cutthroat occur downstream from Nooksack Falls on the North Fork up to the Middle Fork Bridge on the Middle Fork, and to the RM 31 falls on the South Fork. Most fluvial populations are located upstream of Nooksack Falls on the North Fork and upstream from the Middle Fork Diversion Dam. Adfluvial cutthroat can be found in Maple Creek which flows from Silver Lake on the North Fork. Resident cutthroat exist in many high and low elevation lakes and beaver ponds within the Nooksack watershed as well as in streams.

The anadromous life history form enters the river from salt water from August through October, which is characteristic of early-entry migration timing seen in larger streams. Spawning by anadromous fish takes place from January through April. Fluvial, adfluvial and resident cutthroat spawn from January through July.

Anadromous cutthroat in the Nooksack are native in origin, and production is wild with no hatchery influence. However, resident fish are of mixed native and non-native origin, with historical cutthroat hatchery releases in some of the lakes. Thus, this complex is designated as having composite production. Nooksack cutthroat are represented in the current genetic analysis with a sample originating from Double Ditch Creek. This collection is significantly different from all other Washington collections.

STOCK STATUS

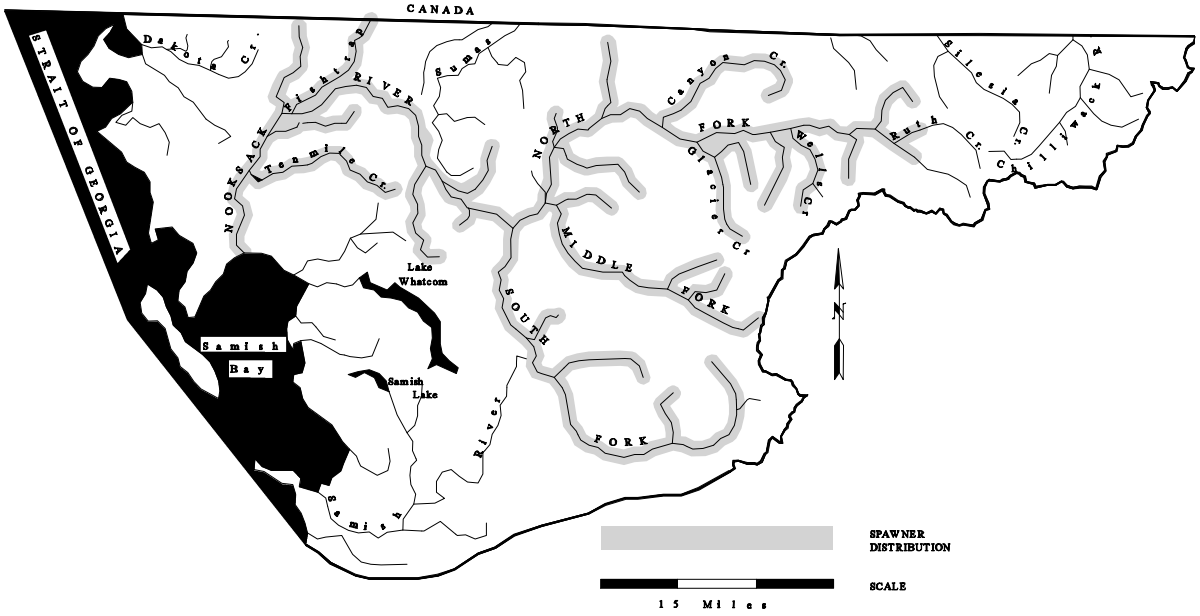
The status of Nooksack coastal cutthroat is Unknown. Biological surveys for coastal cutthroat have concentrated on geographic range and distribution rather than numerical abundance. The quality of data on locations of spawning and rearing sites of anadromous and resident cutthroat throughout the Nooksack and associated lakes is good, but quantitative data on abundance or survival related to stock status are lacking except for some adfluvial populations. These data are insufficient to characterize the status of the entire stock complex.

In most systems the range of anadromous cutthroat has diminished due to reduced water quality and quantity, as well as increased instream and near-stream human-related activities. We do not know if cutthroat abundance has been likewise reduced.

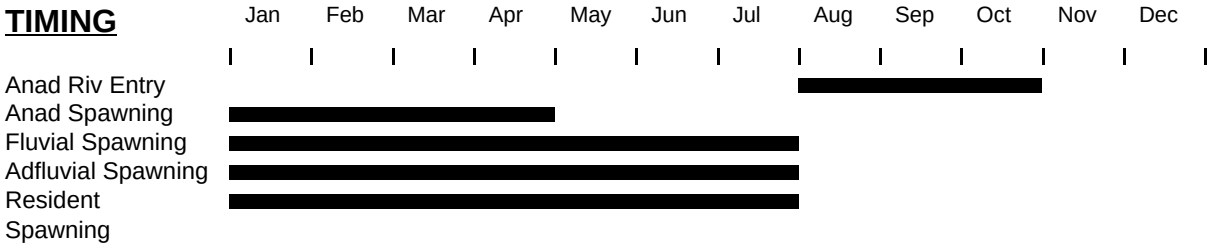
STOCK DEFINITION PROFILE for Nooksack Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



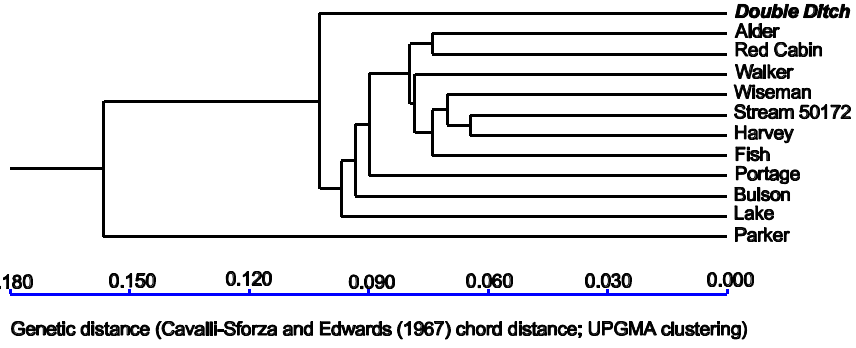
TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Double Ditch Cr. collection (N=47), made in 1995 was significantly different from all other North Sound collections (33 allozyme-locus G-test; *P*<0.001). A DNA collection from Double Ditch was distinct from a Parker Cr. (Skagit stock complex) (6 microsatellite DNA-locus G-tests; *P*<0.0001).



STOCK STATUS PROFILE for Nooksack Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Mixed

Production Type

Composite

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

FACTORS AFFECTING PRODUCTION

Habitat--In general, livestock grazing and agricultural practices have removed streamside vegetation and increased siltation. Water withdrawals for irrigation has reduced stream flows, increased stream temperatures, concentrated pollutants, and resulted in fish kills. Intense logging has also altered stream flows, silt in spawning beds, removed shading and increased stream temperatures, and increased rain-on-snow events causing landslides. Heavy metals entering the river from the Ferndale sewage treatment plant have been shown by Washington Department of Ecology's live box tests to kill fish, and copper levels are high enough to reduce the activity of the enzyme ATPase activity thereby reducing the ability of smolts to adapt to saltwater. Road culverts that are impassible to juvenile and adult resident and anadromous cutthroat significantly reduce the river system's fish-production capability by blocking access to spawning and rearing habitat.

Harvest Management--The recreational fishery is open from June 1 through March 15. There is a two-fish daily limit with a 14-inch minimum size limit. The size limit is intended to permit most females to spawn at least once.

Hatchery-Presently there are no hatchery releases of cutthroat trout in the Nooksack drainage. Hatchery fish may have been released in the past, but there is no evidence that the native population has been affected. Coho smolts are released annually from Kendall Hatchery (300,000) on the North Fork and from Skookum Hatchery (1.65 million) on the South Fork. Coho fry have also been released into various tributaries, but these fry off-station releases have been reduced significantly in recent years, with the intent to eliminate the program completely. Approximately 1.2 million chinook fingerlings and 500,000 fry were also released from Kendall Hatchery. In addition the Lummi Tribe releases 500,000 fall chinook fingerlings into the lower river. Chambers Creek (South Puget Sound) winter steelhead smolts (30,000) are released into the Middle Fork Nooksack annually. Interactions between hatchery-origin fish and wild Nooksack cutthroat have not been examined, however coho juvenile may compete with cutthroat.

NORTH PUGET SOUND — WHATCOM CREEK COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Whatcom Creek coastal cutthroat have been identified as a separate stock complex based on the geographic distribution of their spawning grounds. Whatcom Creek is the outlet stream for Lake Whatcom and flows through the city of Bellingham into Bellingham Bay in north Puget Sound.

Anadromous, adfluvial and resident life history forms are present in the Whatcom Creek drainage. Anadromous cutthroat enter the creek from November through March (late-entry migration timing) and spawn from January through April, while adfluvial and resident fish spawn from January through mid-June.

STOCK STATUS

The status of the Whatcom Creek stock is Unknown. Biological surveys dealing with coastal cutthroat have concentrated on geographic range and distribution rather than numerical abundance. The quality of data on locations of spawning and rearing sites of anadromous and resident cutthroat in Whatcom Creek is good. Spawner surveys of resident populations were conducted in several Lake Whatcom tributaries between 1985 and 1994. The quality of these survey data is good, but they are not considered adequate to characterize the status of the entire stock complex. Whatcom Creek cutthroat are not represented in the present genetic analysis.

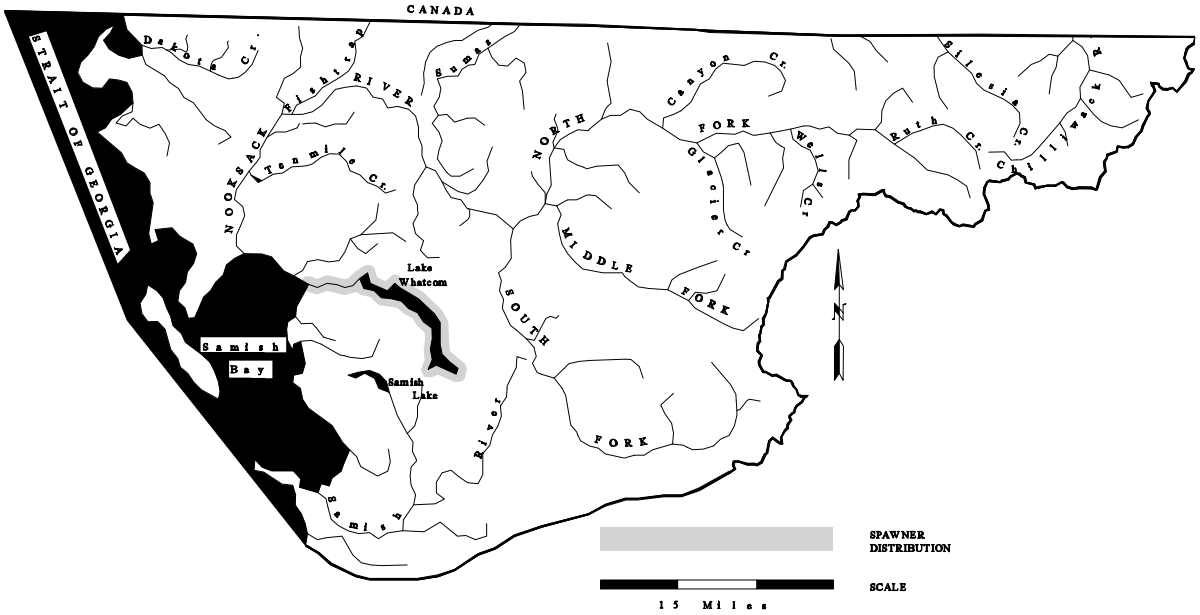
FACTORS AFFECTING PRODUCTION

Habitat--Livestock grazing and agricultural practices that remove streamside vegetation and increase siltation limit spawning areas and fish production in the Lake Whatcom drainage. Logging practices have altered stream flows, increased siltation of spawning beds, removed shading and increased stream temperatures, and increased rain-on-snow events causing landslides. Road culverts that are impassible to juvenile and adult resident and anadromous cutthroat significantly reduce the system's fish-production capability by blocking access to spawning and rearing habitat. Housing developments and road building in the system have altered streams, reduced water quality, and silted stream beds to the point that only Cemetary Creek and lower Lincoln Creek now provide spawning habitat for sea-run cutthroat. Most streams entering the northwest one-third of Lake Whatcom no longer support significant numbers of cutthroat spawners. Sewage spills from the Sudden Valley sewer line along Lake Whatcom Boulevard have degraded water quality, as has street run-off throughout the system.

STOCK DEFINITION PROFILE for Whatcom Creek Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■								■	■	No
Anad Spawning	■	■	■	■									No
Adluvial Spawning	■	■	■	■	■	■							No
Resident Spawning	■	■	■	■	■	■							No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Whatcom Creek Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Harvest Management--The recreational fishery is open from June 1 through February 28. There is a two-fish daily limit with a 14-inch minimum size limit intended to protect first-time spawners and some repeat spawners from harvest.

Hatchery--Lake Whatcom cutthroat trout were used at one time for a broodstock program at Tokul Creek (Snohomish River system) (Crawford 1979). However, there are no hatchery cutthroat releases into Lake Whatcom. Coho releases have been discontinued. Hatchery winter steelhead of Chambers Creek (South Puget Sound) origin are released annually into Whatcom Creek, with recent release numbers of 5,000 smolts per year. Interactions between hatchery-origin fish and Lake Whatcom cutthroat have not been examined, however hatchery fish may compete with wild cutthroat.

NORTH PUGET SOUND — SAMISH COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Samish coastal cutthroat have been identified as a separate stock complex based on the geographic distribution of their spawning grounds.

Anadromous and resident life history forms are present in the Samish River drainage. Adfluvial forms are also thought to exist in the system, using Samish Lake for adult habitat. Anadromous cutthroat enter the river from August through October (early-entry migration timing) and spawn from January through April, while adfluvial and resident fish spawn from January through May. Samish cutthroat are considered to be native, and are maintained through wild production.

No genetic sampling of coastal cutthroat within the Samish basin has been conducted.

STOCK STATUS

The status of Samish coastal cutthroat is Unknown. Biological surveys for coastal cutthroat have concentrated on geographic range and distribution rather than numerical abundance. The quality of data on locations of spawning and rearing sites of anadromous and resident cutthroat in the Samish River is good. Quantitative data related to stock status are lacking, except for sporadic trap data from the Samish Hatchery and some life history and creel survey/hooking mortality data collected in the mid-1980s. However, these data are not considered adequate to determine current status.

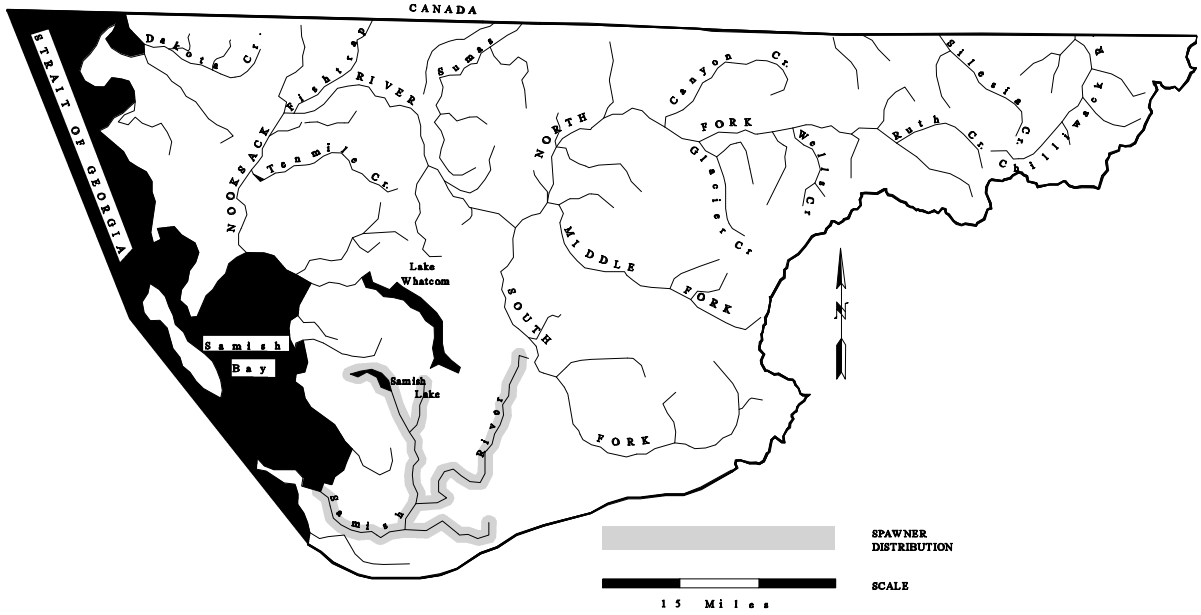
FACTORS AFFECTING PRODUCTION

Habitat--Livestock grazing and agricultural practices that remove streamside vegetation and increase siltation limit spawning areas and production. Water withdrawals for irrigation have reduced stream flows, increased stream temperatures, concentrated pollutants and resulted in fish kills. Logging practices have also altered stream flows, increased siltation of spawning beds, removed shading and increased stream temperatures, and increased rain-on-snow events causing landslides. Road culverts that are impassible to juvenile and adult anadromous cutthroat significantly reduce the river system's fish production capability by blocking access to spawning and rearing habitat. Diking of the river's shoreline has reduced fish-rearing habitat, streamside vegetation, and altered pools and riffles by confining the river channel.

STOCK DEFINITION PROFILE for Samish Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry								■	■	■			No
Anad Spawning	■	■	■	■	■								No
Adfluvial Spawning	■	■	■	■	■	■							No
Resident Spawning	■	■	■	■	■	■							No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Samish Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Harvest Management--The recreational fishery is open from June 1 through March 15. There is a two-fish daily limit with a 14-inch minimum size limit intended to protect rearing juveniles, outmigrating smolts, first-time anadromous spawners and some repeat spawners from harvest.

Hatchery--There are no known releases of hatchery cutthroat into the Samish River. At one time coho were released into Samish River. However, that program was discontinued in the early 1980's, and presently the river is managed for wild coho. Steelhead are released into the Samish River with a current annual planting goal of 30,000 smolts. Samish Hatchery releases 100,000 yearling fall chinook smolts and 5.2 million fall chinook fingerling smolts in the Samish River annually. Interactions between hatchery-origin fish and Samish cutthroat have not been examined, however hatchery-origin steelhead juveniles may compete with wild cutthroat.

SKAGIT — SKAGIT COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Skagit coastal cuthhroat have been identified as a separate stock complex based on the geographic distribution of their spawning grounds. The Skagit River basin is the largest watershed within Puget Sound, and includes such major tributaries as the Sauk, Suiattle, Cascade, and Baker rivers and incorporates numerous habitat types, from fast water, cascading watercourses to slow lowland streams. All life-history forms of cutthroat are found within the system. The anadromous form is found in most mainstem and some tributary waters where passage to salt water is accessible. The adfluvial form can be found in waters of Baker Lake and Lake Shannon, as well as Ross Lake and its tributaries. Stream population work done by WDG in 1977 and 1978 showed that anadromous cutthroat fry were most numerous in the lower tributaries of the Sauk River and north bank tributaries below the Sauk. This distribution also is consistent with angler data, where most cutthroat were caught below the mouth of the Sauk. All forms are considered native in origin, and production is wild.

The anadromous form is an early-entry type, entering the mouth of Skagit River from July through November. Spawning occurs from January through April. Adfluvial fish spawn from June to mid-August while resident fish spawn from January though May. Little is know about the saltwater movements of the anadromous form, but it is believed that they are distributed in Skagit Bay, along the shores of Camano and Hope islands and in Swinomish Slough.

Genetically, Skagit cutthroat are represented by collections from a number of tributaries, including Alder, Red Cabin, Walker, Wiseman, Bulson, Lake and Parker creeks. Each of these collections is genetically distinct from the others and from all other Washington cutthroat collections.

STOCK STATUS

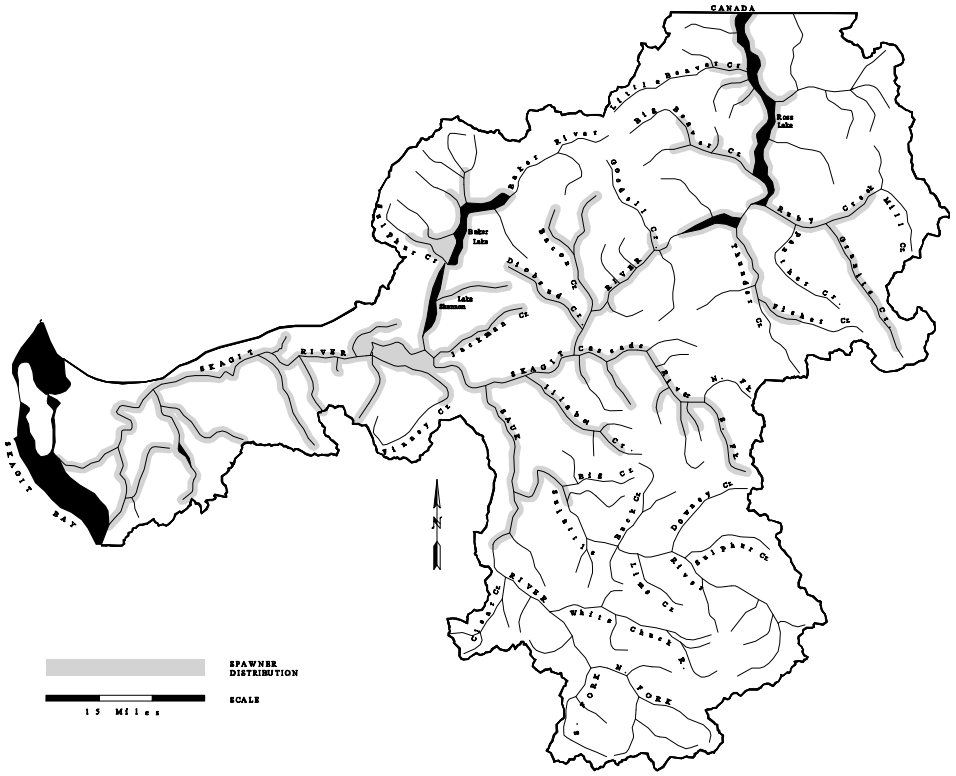
The status of Skagit coastal cutthroat is Unknown. DeShazo (1980) presented data indicating a declining catch of anadromous cutthroat, at least from 1954 through 1976. During the earlier part of this period, average catch per angler for five out of six years was greater than 0.65, while during the latter years it had dropped below 0.5 fish per angler. However, it is uncertain that these data are related to actual abundance. The size of the fish caught was reported to range from ten to twenty-two inches.

A juvenile abundance study was conducted 1977 through 1979 on 14 Skagit tributaries (Freymond 1980). Index areas were electroshocked to obtain densities of coho and steelhead, but cutthroat trout were also recorded. For one-year-old fish and older, the

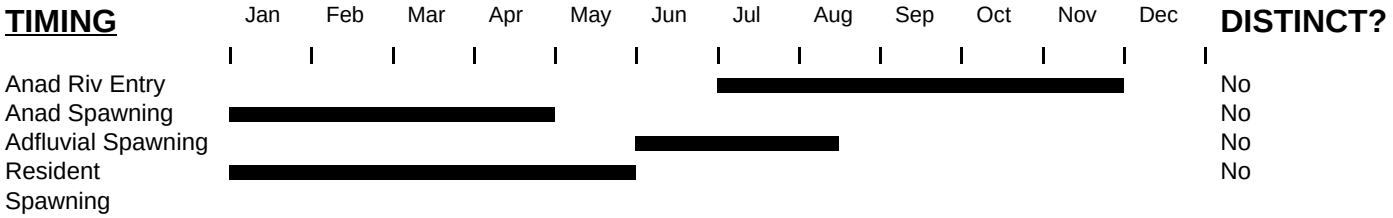
STOCK DEFINITION PROFILE for Skagit Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



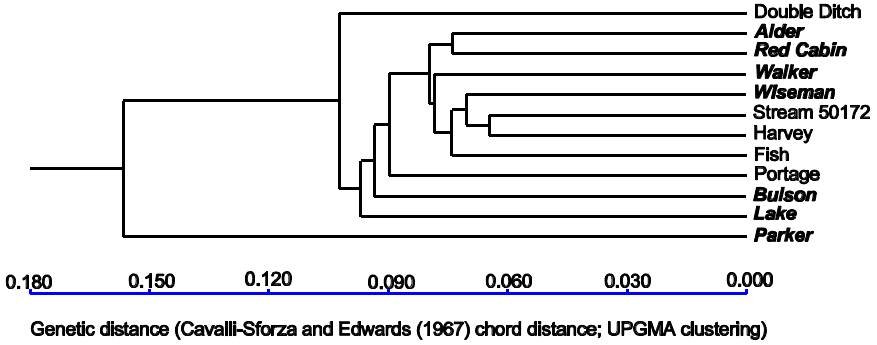
TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - Collections from Parker Cr. (N=50), Red Cabin Cr. (N=50), Lake Cr. (N=50), Bulson Cr. (N=48), Walker Cr. (N=50), Wiseman Cr. (N=51) and Alder Cr. (N=57) made in 1995 were significantly different from one another and from other North Puget Sound collections (33 allozyme locus G-tests; *P*<0.001). A DNA collection from Parker Cr. was significantly different from the Double Ditch Cr. (Nooksack) collection (6 microsatellite DNA-locus G-tests; *P*<0.0001).

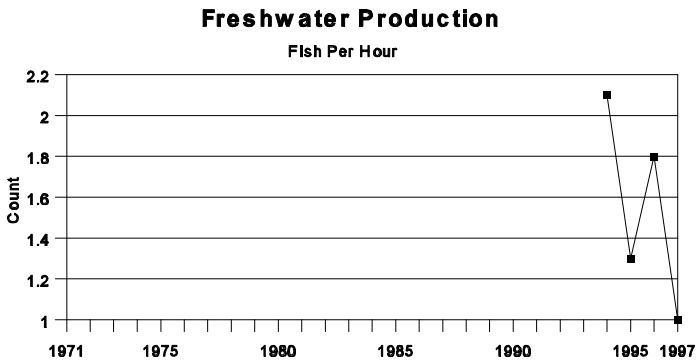


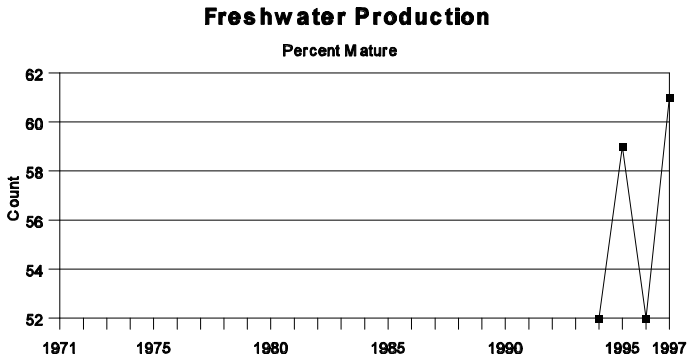
STOCK STATUS PROFILE for Skagit Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Fish/Hr	FW PROD % Mature	FW PROD % Respawn	FW PROD Mat Respawn
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990				
1991				
1992				
1993				
1994	2	52	13	25
1995	1	59	27	47
1996	2	52	17	33
1997	1	61	15	25





AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

average densities for all sample sites for each year were: 1977--0.07/m^2 , 1978--0.05/m^2, 1979--0.07/m^2.

FACTORS AFFECTING PRODUCTION

Habitat--Many Skagit tributaries flow through private timber lands. Thus much of the watershed has been extensively harvested. Earlier logging operations did considerable damage to the watershed, and ultimately to the fish resources. Recent Washington Forest Practices Rules upgrades have helped, but watershed destruction remains a major factor affecting fish production. In addition, culverts, dams, water diversion, urban development, agriculture and diking have all taken their toll on cutthroat production. It is expected that habitat degradation will continue in the future, especially given the increased urbanization that presently occurs throughout Puget Sound.

Harvest Management--Commercial fisheries directed on salmon occur in marine areas and within the mainstem waters. Although these fisheries do occasionally take anadromous cutthroat, they are not thought to be significant sources of cutthroat mortality. The daily sport-fishing limit is two fish with a minimum size limit of 14 inches for mainstem waters. In tributaries there is a two-fish daily limit with an eight-inch minimum size limit intended to protect juveniles and resident fish.

Hatcheries--Although there are no recorded hatchery releases of coastal cutthroat in the Skagit system, it is possible that sporadic, small releases have occurred from time to time. Nevertheless, we believe that there have been no effects of cultured fish on anadromous cutthroat. But given the large scale of the past hatchery program, it is possible that the other forms, particularly resident cutthroat, have been influenced by hatchery-origin fish. The Skagit is managed primarily for wild stocks of other salmonid species, which means that hatchery production is focused on rebuilding and mitigation programs, and we believe that these programs have not resulted in decreased cutthroat production. Major releases of hatchery steelhead smolts do occur on an annual basis. The present annual release goal is 534,000 smolts into the Skagit basin.

STILLAGUAMISH — STILLAGUAMISH COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Stillaguamish coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawners. Coastal cutthroat are found throughout the lower and middle reaches of the Stillaguamish basin, in nearly all of the perennial, and some of the intermittent tributaries of the mainstem and in the North Fork and South Fork.

The cutthroat in the basin are a mixture of life-history forms, and the interactions among them can be complex, perhaps creating multiple stocks. Genetic sampling was conducted in the 1970s and was repeated in 1995 with samples from Portage, Fish, Harvey creeks and unnamed Stream 50172. The Harvey Creek and Stream 50172 collections were not significantly different from one another. The other collections were different from one another and from other North Sound cutthroat collections.

The majority of cutthroat in the basin are anadromous. Major producers of anadromous cutthroat on the mainstem are the Church Creek basin, Pilchuck Creek up to RM 10 and its tributaries, the Portage Creek basin, and Armstrong Creek/Harvey Creek basin. Anadromous fish are found in all the small tributaries of the North Fork up to the barrier falls at RM 35.5 and including Brown's Creek in the Squire Creek drainage and in Jim Creek and lower Canyon Creek in the South Fork. River entry from salt water is from mid-July through October (early-entry migration timing). Anadromous spawning takes place from mid-February through May.

Adfluvial coastal cutthroat are found in several lakes in the basin. The more important of these include Cavanaugh, Upper and Lower Twin Lakes in the Jim Creek drainage, Trout Lake in the Canyon Creek drainage, and Riley Lake. Adfluvial spawning is from January through June.

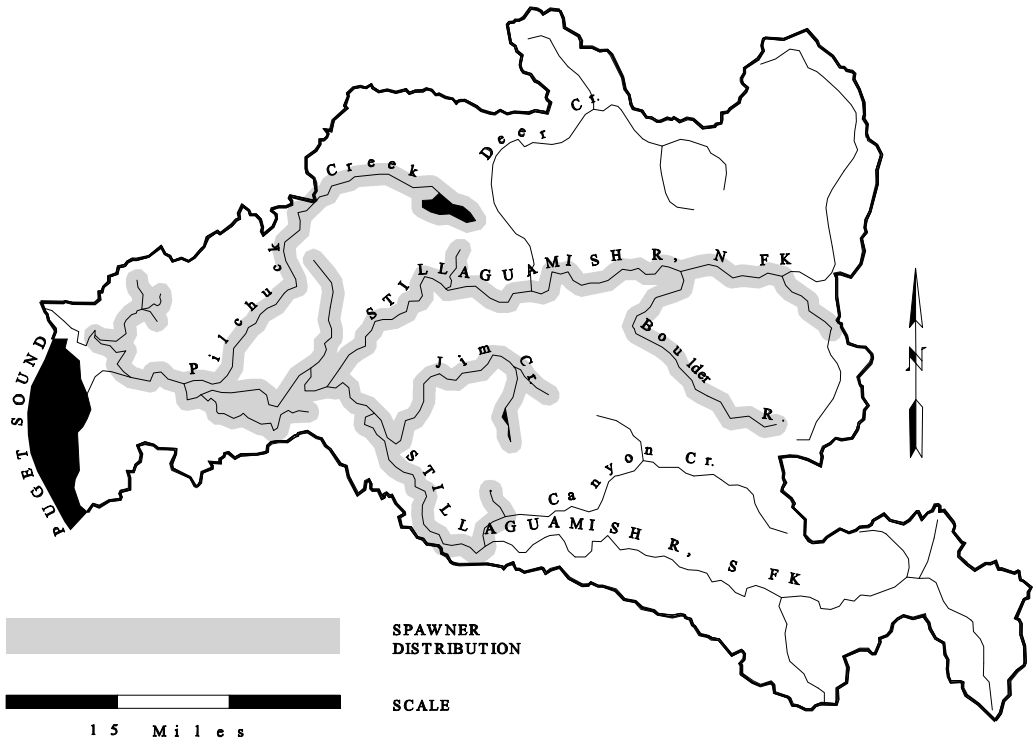
The resident form is found co-mingled with the anadromous form in the headwater areas of the anadromous reaches. Only resident fish are found above anadromous barriers. Few resident coastal cutthroat are found above Granite Falls on the South Fork and the falls at RM 35.5 on the North Fork. Resident cutthroat are also found in a number of beaver ponds in the area. Resident spawning occurs from January through June.

Overall, stock origin is mixed, and production type is wild. The anadromous fish are considered native. There were limited releases of anadromous cutthroat in the late 1960s, and a native brood stock program was established in the early 1980s. The resident fish are considered to be a mixture of native and introduced fish. Many of the

STOCK DEFINITION PROFILE for Stillaguamish Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



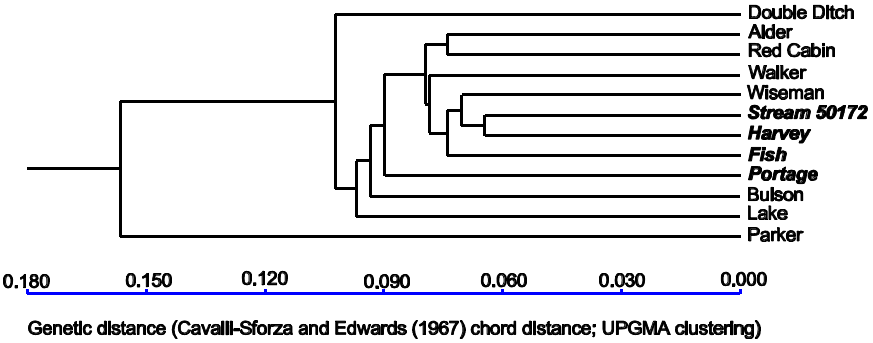
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry							■	■	■	■			No
Anad Spawning		■	■	■	■	■							No
Adfluvial Spawning	■	■	■	■	■	■							No
Resident	■	■	■	■	■	■							No
Spawning													

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - Collections from Portage Cr. (N=52), Fish Cr. (N=52) made in 1995 were significantly different from each other, from the Harvey Cr. (N=75) and Stream 50172 (N=50) collections and from other North Sound Collections (33 allozyme-locus G-tests; *P*<0.001). Harvey Cr. and Stream 50172 were not significantly different from one another (33 allozyme-locus G-Tests; *P*>0.05).

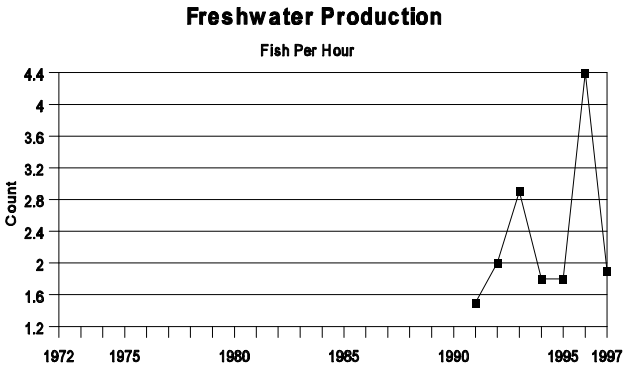


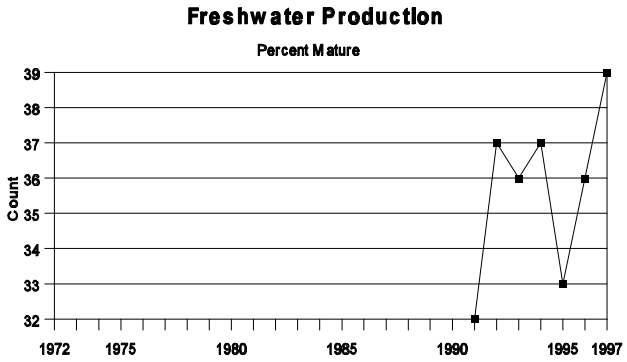
STOCK STATUS PROFILE for Stillaguamish Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Fish/Hr	FW PROD % Mature	FW PROD % Respawn	FW PROD Mat Respawn
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990				
1991	2	32	4	12
1992	2	37	5	12
1993	3	36	3	8
1994	2	37	5	15
1995	2	33	2	7
1996	4	36	3	7
1997	2	39	2	5





AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Mixed

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

small-stream resident populations are native while most of the other resident fish have been influenced by hatchery releases into alpine lakes, lowland lakes, and/or beaver ponds. The adfluvial populations are introduced with some potential natural influence. Most lakes in the basin were treated with rotenone at least once in the past 50 years to eliminate species which compete with trout. Native adfluvial cutthroat were largely replaced with non-local cutthroat. Some contributions from native fish may have been possible from resident populations in upstream tributaries or from anadromous fish migrating into streams flowing into or out of treated lakes.

STOCK STATUS

The status of Stillaguamish coastal cutthroat is believed to be Healthy.

For the anadromous life history form, this determination is based on several factors. Length frequency and sexual maturity information collected through hook and line sampling the last five years in the mainstem Stillaguamish seems to indicate a stable population. About one-third of the fish caught in the mainstem in September and October are mature with a fairly constant portion of repeat spawners in the population. The catch per hour during this sampling varied between 1.5 and 2.9 fish per hour with an average of two fish per hour. In the 1960s and 1970s, angler creel checks were conducted on the Stillaguamish mainstem as well as the North Fork. Catch per angler/per day ranged from 0.07 to 0.85, with an average of about 0.4 (DeShazo 1980). It is uncertain how meaningful this information is in terms of cutthroat abundance, but it does offer some value ranges that could provide future comparisons.

A smolt trap installed and operated by the Tulalip Tribe on lower Church Creek in the late 1980s caught 1,800 to 3,000 cutthroats a year with an average of more than 2,000 smolts a year. The Church Creek basin represents about eight percent of the linear miles available to cutthroat in the basin. This would imply a basin smolt of production of about 25,000, assuming similar habitat quality. Church Creek has been impacted by low flows and development more than other drainages in the Stillaguamish basin. Although the current estimated production level is considered healthy, no comparisons can be made to historical abundance levels, which could have been significantly higher.

The status of fluvial, adfluvial and resident fish is Unknown due to lack of quantitative trend data but is believed to be Healthy. Electofishing sampling by local WDFW field staff found abundant cutthroat parr in all habitats expected to contain cutthroat. Habitat biologists sampling the upper portion of the various watersheds for the presence of fish find cutthroat in most areas. Abundant densities of fish in expected habitats as well as presence in the upper fringe areas are indicators of a healthy population.

The quality of these data is fair for anadromous fish and poor for fluvial, adfluvial and resident fish.

FACTORS AFFECTING PRODUCTION

Habitat--In-stream juvenile rearing is limited for all life history forms by summer low flows. Agricultural, residential, and forestry have contributed to poor water quality in the lower river and many of the tributaries, limiting the success of spawning adults and the rearing of juveniles. The anadromous life-history form is limited by the loss of 90 percent of the lower estuary and associated wetlands and by high stream temperatures during the summer in the lower river.

Harvest Management--Stillaguamish anadromous cutthroat have been under conservative management since 1980. In that year the daily limit was reduced to two fish with a 10-inch minimum size limit intended to protect rearing juveniles, outmigrating smolts, first-time anadromous spawners and some repeat spawners from harvest. As more conservative stream management strategy was developed, the regulations on the Stillaguamish were upgraded to those standards. The minimum size limit is now 14 inches. Upper tributaries are governed under statewide regulations with the season running from June 1 through October 31, eight-inch minimum, and two-fish daily bag limit.

The present management of the anadromous and resident life history forms is intended to encourage adequate recruitment of juvenile cutthroat. Potential problems may arise as current harvest practices may not provide for maintenance of older, larger multiple-spawning adults, especially in face of high fishing effort. Also, in areas of high fishing effort, hooking mortality of sublegal-size fish may become a limiting factor. Current harvest management of the adfluvial life history form does not guarantee recruitment of juvenile fish, and wild production may limit current populations.

There is some potential for incidental harvest of cutthroat stocks in fisheries for other species such as salmon, but there is no evidence that it has significantly impacted the cutthroat population.

Hatchery--No hatchery cutthroat are released into this system. Currently the Washington Department of Fish and Wildlife releases approximately 170,000 winter steelhead smolts in the anadromous mainstem areas of the North Fork and South Fork Stillaguamish annually. They also release rainbow trout in some of the lowland and alpine lakes. The Stillaguamish Tribe rears and releases summer chinook, coho and chum salmon in the basin. Releases of salmon presmolts in cutthroat juvenile-rearing areas could be a concern, as are releases of rainbow trout or other exotic game fish (often illegally) into the lakes supporting adfluvial cutthroat populations. Conflicts can arise through competition for food or incidental harvests.

SNOHOMISH — SNOHOMISH COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Snohomish coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. Coastal cutthroat are found throughout the various reaches of the Snohomish basin including the mainstem Snohomish, Snoqualmie, and Skykomish rivers and nearly all of their tributaries.

All life-history forms (anadromous, fluvial, adfluvial and resident) are present in the Snohomish basin. The anadromous life-history form is found in most perennial streams and in some intermittent streams throughout the anadromous reaches of the system. In the Snohomish, the major anadromous cutthroat producers are Quilceda Creek and the Pilchuck River basin up to and including Worthy Creek. Nearly all of the anadromous cutthroat in the Skykomish portion of the basin are found downstream from the town of Goldbar. Major Skykomish cutthroat producers are Woods Creek and the Wallace River drainage.

Anadromous cutthroat are found in nearly all the tributaries of the Snoqualmie River to Snoqualmie Falls. Major Snoqualmie producers include Cherry Creek, Stossel Creek and Raging River. River entry is from July through October (early-entry timing), and anadromous spawning is from early February through May.

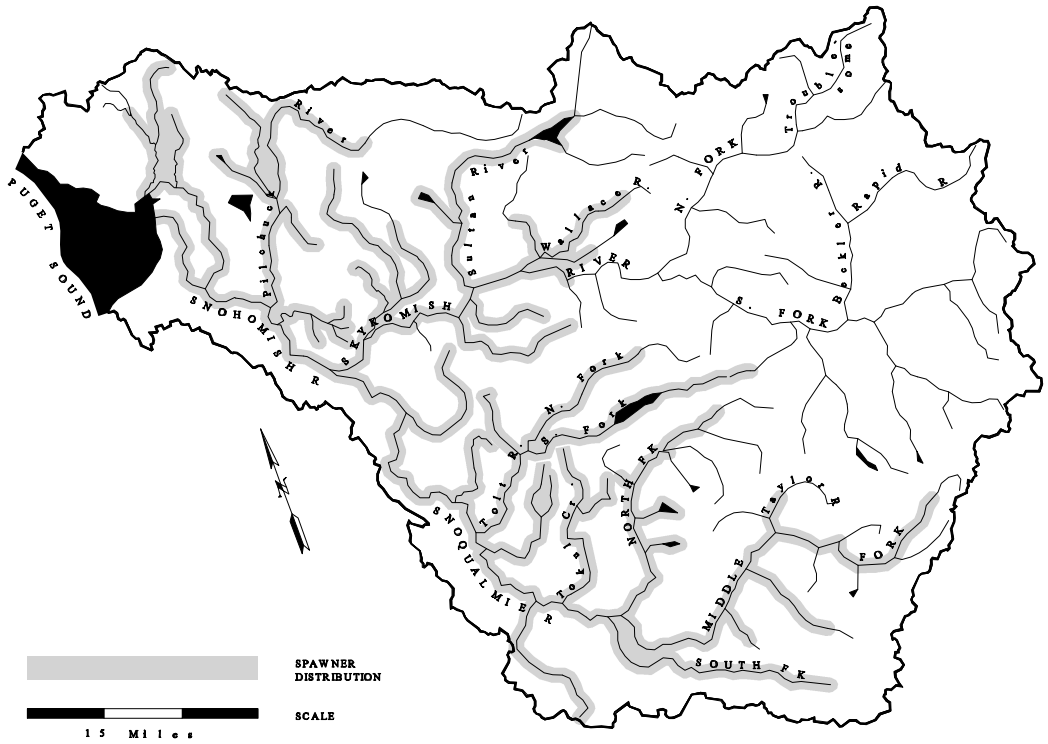
The fluvial life history form is found in the larger rivers above the anadromous reaches. There are limited numbers of fluvial cutthroat in the Snohomish and Skykomish portions of the basin but large numbers in the Snoqualmie portion. In the forks of the Snoqualmie, (Middle, North and South forks) and the upper forks of the Tolt, there are nearly 100 miles of stream supporting fluvial cutthroat. Some fluvial cutthroat may also be found in other scattered areas of the basin. Fluvial spawning occurs from January through mid-June. In some areas of the basin there has been an extensive history of hatchery cutthroat stocking in waters containing fluvial populations (e.g., South Fork Snoqualmie). In other areas there has been little or no stocking (e.g., upper South Fork Tolt). Consequently there are stream reaches with native fluvial populations while others have non-native fish or mixtures of native and non-native fish. Production today is strictly of wild origin.

The adfluvial life history form is found in a number of lakes within the Snohomish basin. They are found in two reservoirs, the South Fork Tolt Water Supply Reservoir and Spada Lake on the Sultan River. They are also found in a number of lowland lakes including Bridges, Boyle, Klaus, Flowing, Storm, Panther and Stevens lakes and in a number of small ponds and sloughs as well as in some alpine or near-alpine lakes (e.g., Hancock and Calligan lakes). Spawning is from January through mid-June.

STOCK DEFINITION PROFILE for Snohomish Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry							■	■	■	■			No
Anad Spawning		■	■	■	■	■							No
Fluvial Spawning	■	■	■	■	■	■							No
Adfluvial Spawning	■	■	■	■	■	■							No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Snohomish Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Fish/Hr	FW PROD % Mature	FW PROD % Respawn	FW PROD Mat Respawn
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990				
1991				
1992				
1993				
1994				
1995				
1996	2.8	4.2	5.2	12.4
1997	3.2	4.3	5.6	8.2

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Mixed

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

The small-sized resident life history forms are found throughout the basin generally occupying the smaller streams often found in conjunction with one or more of the other three larger life history forms. Many of the resident populations are native though some may reflect the stocking history of the fluvial or adfluvial fish where they co-mingle with those life history forms. Because many of the beaver ponds are small in size, we believe that cutthroat inhabiting these areas are most likely resident fish, although the presence of adfluvial, fluvial or anadromous fish is also possible.

No cutthroat genetic samples were collected from this system.

STOCK STATUS

The status of the Snohomish stock complex is Unknown but may be Healthy. There is little quantitative information on abundance or survival for determination of stock status for any life history form of coastal cutthroat in the Snohomish River basin. Angler creel checks have been conducted in the past, but they offer little information regarding abundance. Likewise, electroshocking has also been conducted on various tributaries, but at best, provides only presence/absence information (DeShazo, 1980). (See DeShazo also for specific information on creel check locations and catches.)

For anadromous cutthroat, available data include some information from coho smolt traps and electrofishing information. These data are more useful in providing information on distribution of fish in the basin than on stock status. Good data on distribution, abundance, growth and age at sexual maturity are available from the forks of the Snoqualmie River and the North Fork Tolt River. There is limited creel survey information from Spada Lake, age and sexual maturity information for fish in other lakes, and some spawning-ground survey data. The quality of the Spada Lake data is good. Information on resident fish is primarily presence and absence information.

FACTORS AFFECTING PRODUCTION

Habitat--In-stream juvenile rearing is limited for all life history forms by summer low flows. Agricultural, residential, and forestry land uses have contributed to poor water quality in the larger rivers and many of the tributaries limiting the success of spawning adults and the rearing of juveniles of all life forms. The loss of wetlands and near-estuarine habitat may be limiting anadromous production. The introduction of exotic or non-native fish species in the lake environments is limiting the production of adfluvial populations. Nearly all cutthroat areas are experiencing problems from the growing human populations in the area. Increased development has degraded water quality in small streams, where the majority of production occurs. Increased development has also resulted in stream modifications, such as diking and channeling. All of this has effectively reduced available and usable habitat for cutthroat.

Harvest Management--Anadromous, fluvial and resident fish are managed to allow most females to spawn at least once before reaching the legal minimum size. Current angling regulations in the Snohomish River call for a two-fish daily limit with a 14-inch minimum size limit in the marine waters and the larger mainstem freshwater areas to protect first-time anadromous spawners and some repeat spawners. The smaller spawning and rearing streams are closed during the spawning season and have a two-fish daily limit and an eight-inch minimum size limit during the summer to protect juveniles, outmigrating smolts and resident spawners.

The Snoqualmie River above Snoqualmie Falls and its north and south forks and South Fork Tolt above the dam have a two-fish daily limit with a ten-inch minimum size limit to protect fluvial females. The Middle Fork Snoqualmie and the North Fork Tolt above Yellow Creek are catch-and-release only areas.

Current management of adfluvial populations varies from lake to lake. Adfluvial populations are generally managed with no minimum size limit and a five-fish daily limit. The lack of a minimum size limit means that females are not protected from harvest prior to spawning at least once. This regulation may not provide for recruitment of juvenile fish. However, a number of waters with significant cutthroat populations (Bridges, Boyles, and Klaus lakes and South Fork Tolt Reservoir and others) are managed under the Stream Management concept, populations are protected with a two-fish daily limit and a 14-inch minimum size limit. In Spada Lake there is a five-fish daily limit and a 12-inch minimum size limit.

Potential future problems may arise as current harvest practices may not provide for maintenance of older multiple-spawning adults, especially in face of high fishing effort. Also in areas of high fishing effort, hooking-mortality of sublegally-sized fish may become a limiting factor. In addition, there is potential for some incidental harvest of cutthroat in salmon fisheries.

Hatchery--Currently the Washington Department of Fish and Wildlife releases steelhead smolts as well as chinook and coho smolts in the anadromous portion of the basin. They also release rainbow trout in some beaver ponds as well as in some lowland and alpine lakes. Releases of pre-smolts in cutthroat juvenile rearing areas could be a concern. The introduction of exotic or non-native fish species into lakes is limiting the production of adfluvial cutthroat.

The releases of rainbow trout or other game fish into the lakes supporting adfluvial cutthroat populations or beaver ponds containing resident cutthroat could also impact cutthroat through competition for food or incidental harvests.

GREEN — DUWAMISH/GREEN COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Duwamish/Green coastal cutthroat stock complex is considered distinct based upon the geographic distribution of its spawning grounds. Although coastal cutthroat in the Duwamish/Green drainage are thought to be distinct, there are insufficient data to be absolutely certain. The relative proximity of nearly all river mouths in Puget Sound to each other, along with the presence of numerous smaller direct-entry tributaries in between the major systems, make it likely that some degree of straying occurs among the anadromous fish of many stock complexes as we have defined them. Spatial isolation of fluvial, adfluvial and resident forms is more likely.

The anadromous form inhabits the lower and middle mainstem and its major tributaries, including Spring Brook, Hill, Soos and Newaukum creeks. The number of anadromous cutthroat in the Green River system is not large, but a few (probably fewer than 50) are caught by anglers each year. The fluvial form is probably present throughout the system, but it, too, is thought to be composed of relatively few individuals. Adfluvial cutthroat are present in the Covington Creek drainage (Lake Sawyer and Ravensdale Lake) and in Eagle Gorge Reservoir and Eagle Lake. The resident form is present in all perennial tributaries throughout the system.

River entry timing, spawn timing and biological characteristics are unknown but are thought to be similar to those of other early-entry Puget Sound stocks, such as those in the Snohomish stock complex. That is, anadromous river entry is thought to occur from July through October. Anadromous spawn timing is likely to occur from February through May. Fluvial, adfluvial and resident spawn timing probably occur from January through mid-June.

Few hatchery-reared cutthroat have been stocked in the Green River system, and little hybridization is thought to have occurred between Tokul Creek (north Puget Sound) cutthroat hatchery stock releases which have been made in several lakes and the native stock in the drainage. Consequently Duwamish/Green coastal cutthroat are considered native and are sustained by wild production.

The Duwamish/Green complex was represented by a collection from Covington Creek in the genetic analysis. This collection was significantly different from all other South Sound coastal cutthroat collections.

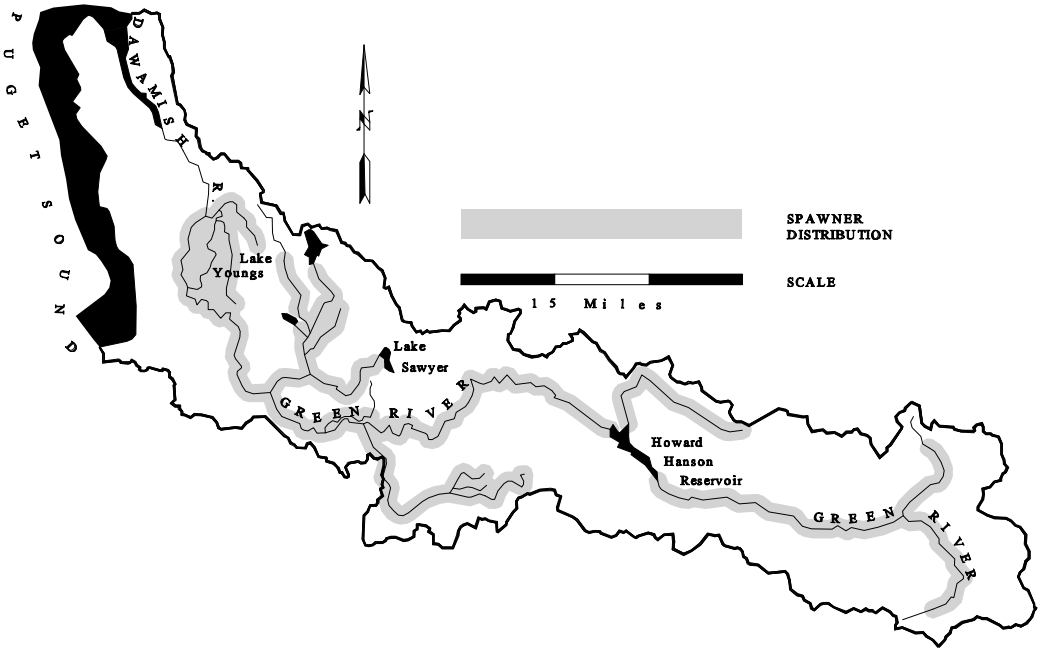
STOCK STATUS

The status of the Duwamish/Green stock complex is Unknown. The only quantitative data available are from electrofishing surveys (all ages) conducted in Newaukum Creek

STOCK DEFINITION PROFILE for Duwamish/Green Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



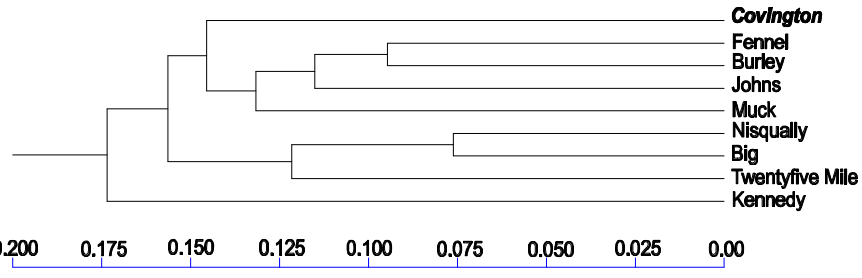
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry							■	■	■	■			Unknown
Anad Spawning	■	■	■	■	■								Unknown
Fluvial Spawning	■	■	■	■	■	■							Unknown
Adfluvial Spawning	■	■	■	■	■	■							Unknown
Resident Spawning	■	■	■	■	■	■							Unknown

Timings are unknown. These timings are based on those for the Snohomish Stock complex.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown



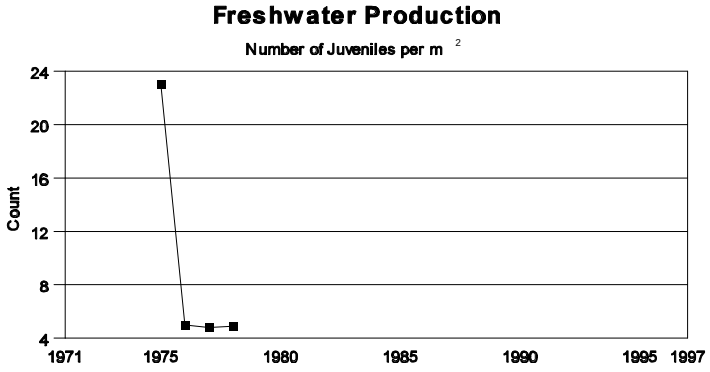
GENETICS - The Covington Cr. collection made in 1995 (N=44) was significantly different from all other South Sound collections (33 allozyme-locus G-test; *P*<0.001). The Covington Cr. collection was different from the Fennel Cr. (Puyallup stock complex) at microsatellite DNA loci (6-locus G-test; *P*<0.0001).

STOCK STATUS PROFILE for Duwamish/Green Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Poor

Return Years	FW PROD No/m2			
1971				
1972				
1973				
1974				
1975	23			
1976	5			
1977	5			
1978	5			
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989				
1990				
1991				
1992				
1993				
1994				
1995				
1996				
1997				



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

in the mid-1970s which are inadequate to assess current status. Historical records regarding Green River cutthroat populations are limited. An anonymous, undated, untitled Washington Department of Game report, probably written in 1942, indicated that adult cutthroat were caught in April and May. The same report indicated that Soos Creek, Mill Creek, and Burns Creek all supported cutthroat populations. Another anonymous report stated that cutthroat, among other species, were caught during the seine hauls at the First Avenue South Bridge in Seattle in 1940 and 1941. Twenty-seven cutthroat, 12 to 21 inches in length, were captured at that time. Moore and Clarke (1947) in their report on the Green River fisheries resource stated that cutthroat use the Green River for spawning and rearing. Run size was not discussed. DeShazo (1980) reported that anadromous cutthroat populations in the Green River are relatively small compared to those in northern Puget Sound rivers.

FACTORS AFFECTING PRODUCTION

Habitat--Anadromous cutthroat populations have undoubtedly declined from historical levels due to many factors. Although there is presently good cutthroat habitat in the Green River and tributaries, habitat reduction cannot be overlooked. The diversion of the Lake Washington system from the Green River in the early 1900s reduced Green River system cutthroat habitat dramatically and undoubtedly resulted in a significant reduction in anadromous cutthroat populations. Howard Hansen Dam and the City of Tacoma water diversion dam block many miles of excellent cutthroat habitat to anadromous fish. Water level fluctuations related to those dams reduce spawning success, and low summer flows reduce rearing area as well as hinder upstream migration. Extensive diking and channel changes that occurred in the late 1940s and early 1950s undoubtedly had a detrimental effect on cutthroat populations, as did the loss of estuarine habitat and degradation of water quality due to industrialization of Elliott Bay. Pollution-related fish kills have occurred, such as in November 1952 between Kent and Renton, and in August 1964 following the use of copper sulfate to control algae. Nonetheless the Duwamish/Green watershed does continue to provide good habitat and supports viable populations.

Harvest Management--The incidental catch of anadromous cutthroat in tribal salmon gillnet fisheries in lower Elliott Bay and the lower Duwamish/Green River is unknown. The annual sport catch of anadromous cutthroat is also unknown, but is thought to be less than 50 fish.

Sport fisheries for non-anadromous forms occur in mainstem reaches below RM 61, above RM 81 and in most perennial tributaries. No estimate of annual catch is available for these fisheries. A game fish creel survey was conducted in 1975 (Collins et al. 1975), trout anglers fished an estimated 18,268 hours and caught 4,287 trout and whitefish. An estimated 116 cutthroat were harvested.

Current regulations limit harvest in tributaries to two trout daily with a minimum-size limit of eight inches to protect rearing juveniles, outmigrating smolts and resident spawners from harvest. The mainstem limit below RM 61 has a two-trout daily limit with a minimum-size limit of 14 inches to protect first-time anadromous spawners and some repeat spawners.

Hatchery--Hatchery cutthroat are not released into anadromous waters in the Green River watershed, but stocking of hatchery-reared rainbow and cutthroat (rarely) trout occurs in many lakes. The potential for hybridization with the wild cutthroat stock in adjoining streams is limited by high fishery catch rates in the lakes and the lack of egress from most lakes. Both summer and winter hatchery steelhead smolts are released annually into the Green River, with annual release goals of 80,000 and 210,000 respectively.

Stocking of hatchery-reared coho fry in many tributaries may have adverse impacts on cutthroat production, particularly during the annual summer-fall low-flow period when competition for food becomes intense.

PUYALLUP — PUYALLUP COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Puyallup coastal cutthroat stock complex is thought to be distinct based upon the geographic distribution of its spawning grounds. It includes the White River, Carbon River and South Prairie Creek systems. Although coastal cutthroat in the Puyallup drainage are thought to be distinct, the relative proximity of nearly all river mouths in Puget Sound to each other, along with the presence of numerous smaller direct-entry tributaries in between the major systems, makes it likely that some degree of straying occurs, particularly among anadromous fish. Spatial isolation of fluvial, adfluvial and resident forms is more likely.

Coastal cutthroat occur in virtually all perennial tributaries and mainstem reaches of this system in one or more life-history forms. The anadromous form inhabits the lower and middle mainstems (Puyallup, Carbon and White rivers) and their major tributaries, including Clarks, Kapowsin, Voights, South Prairie and Boise creeks. The number of anadromous cutthroat in the Puyallup River system is not large, but a few (probably fewer than 50) are caught by anglers each year. The fluvial form is present throughout the system but in relatively small numbers within the mainstem anadromous zones. Adfluvial cutthroat may be present in Kapowsin Lake and in the Greenwater (Meeker) lakes. The resident form is probably present in all perennial tributaries of the Puyallup system.

River entry and spawn timing and other biological characteristics are unknown but are thought to be similar to those of other early-entry Puget Sound stocks, such as those for the Snohomish stock complex. River entry is probably from June through October. Anadromous spawning is probably from February through May. Fluvial, adfluvial and resident spawning is probably from January through mid-June.

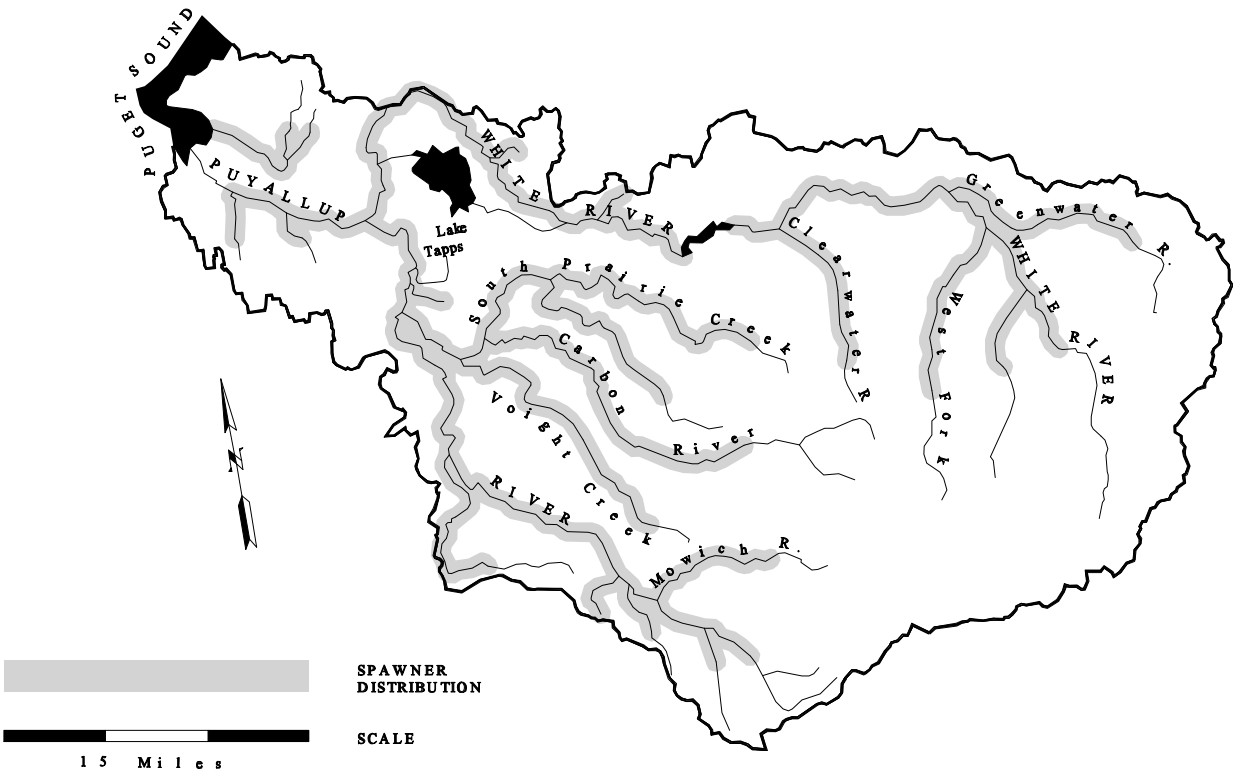
The origin of this stock complex is native. Few hatchery-reared cutthroat have been stocked in the Puyallup River system, and little hybridization is thought to have occurred between Tokul Creek (north Puget Sound) cutthroat stock hatchery releases made into several lakes and the native stock in the drainage. The Puyallup stock complex is sustained by wild production.

This watershed was represented by one collection, Fennel Creek, in the genetic analysis. Fennel Creek cutthroat were significantly different from all other South Sound cutthroat.

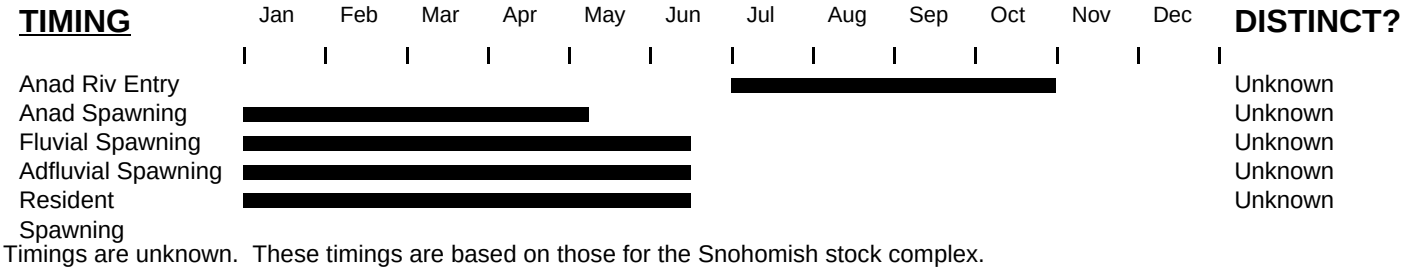
STOCK DEFINITION PROFILE for Puyallup Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



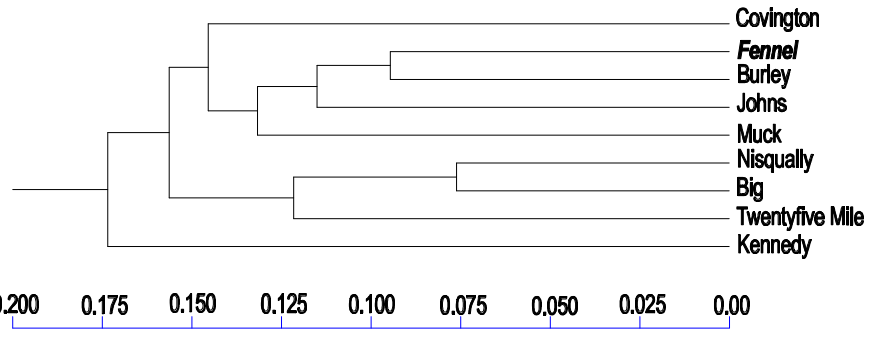
TIMING



Timings are unknown. These timings are based on those for the Snohomish stock complex.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown



GENETICS - The Fennel Cr. collection made in 1995 (N=43) was significantly different from all other South Sound collections (33 allozyme-locus G-tests; *P*<0.001). It shared some allele frequencies with the Thorndyke Cr. (West Hood Canal stock complex) collection. The Fennel Cr. collection was distinct from the Covington Cr. collection (Duwamish/Green stock complex) at microsatellite DNA loci (6 locus G-tests; *P*<0.0001).

STOCK STATUS PROFILE for Puyallup Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

STOCK STATUS

The status of the Puyallup stock complex is Unknown. There are no quantitative data on abundance or survival with which to assess status. Cummins (1980) refers to angler catches in and around the mouth of the Puyallup River. Although sportfishing directed on cutthroat is relatively light, most anglers complain that cutthroat are becoming increasingly difficult to catch, an indication of declining population levels.

FACTORS AFFECTING PRODUCTION

Habitat--Commercial and hobby farms, logging, residential and industrial development, road building and water withdrawal have adversely affected the production of coastal cutthroat in the Puyallup River watershed. The loss of estuarine habitat in the lower Puyallup has undoubtedly led to a significant reduction in the anadromous component of the stock.

Harvest Management--The incidental catch of anadromous cutthroat in tribal gill net fisheries in the lower Puyallup River probably occurs, but the catch is likely insignificant. Sport fisheries for all life history forms are naturally limited in mainstem reaches due to turbidity from glacial melt during the normal stream fishing season. No estimate of catch is available for these fisheries, but it is thought to be less than 50 fish per year.

Current sport fishing regulations limit harvest in tributaries to two trout daily with a minimum size limit of eight inches to protect rearing juveniles, outmigrating smolts and resident spawners from harvest. In the anadromous zone, including mainstem waters the limit is two-trout daily limit with a minimum size of 14 inches for the protection of first-time spawners and some repeat spawners.

Hatchery--Stocking of hatchery-reared rainbow trout and cutthroat (rarely) occurs in many lakes in the Puyallup River watershed. The potential for hybridization with the wild cutthroat stock in adjoining streams is limited by high fishery catch rates on rainbow trout in the lakes and the lack of egress from most lakes. No anadromous cutthroat enhancement programs have been implemented on the Puyallup. Some cutthroat releases did occur in 1960, when a small number of fry were stocked (Cummins 1980).

Stocking of hatchery-reared coho fry in many tributaries may have adverse impacts on cutthroat production, particularly during the annual summer/fall low-flow period when competition for limited food and space become intense. However, coho fry releases have been reduced significantly in recent years throughout south Puget Sound. Winter steelhead are released annually into the Puyallup system, with a release goal of 200,000 smolts.

NISQUALLY — NISQUALLY COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Nisqually coastal cutthroat stock complex is thought to be distinct based upon the geographic distribution of its spawning grounds. However, the relative proximity of nearly all river mouths in Puget Sound to each other, along with the presence of numerous smaller direct-entry tributaries in between the major systems, makes it likely that some degree of between system straying occurs, particularly among anadromous fish. Spatial isolation of fluvial, adfluvial and resident forms is more likely.

Coastal cutthroat are present in virtually all perennial tributaries and mainstem reaches of this system in one or more life-history forms. The anadromous form probably inhabits the lower mainstem and its major tributaries, including Muck Creek, Murray Creek and Yelm Creek. Middle river tributaries may also contain anadromous cutthroat in lesser numbers. The fluvial form is present throughout the system. Adfluvial cutthroat are present in several lakes in the Nisqually drainage, including Chambers Lake (Muck Creek), Ohop Lake (Ohop Creek) and Alder Reservoir. The resident form is probably present in all perennial tributaries in the system.

River-entry timing, spawn timing and other biological characteristics are unknown but are thought to be similar to those of other early entry Puget Sound stocks such as those for the Snohomish stock complex. River entry is probably from July through October, typical of larger stream systems with good summer flows. Anadromous spawning is probably from February through May, while fluvial, adfluvial and resident spawning is probably from January through mid-June.

Relatively few hatchery-origin cutthroat releases have been made into the Nisqually system. Releases of Tokul Creek (north Puget Sound) cutthroat fry have been made in several beaver pond complexes, primarily in the Ohop and Mashel drainages. Beaver Creek (Columbia River) anadromous hatchery cutthroat were released into the Mashel River for 13 years (1965-1978) in an effort to provide a fishery on returning adults. The average annual release was 6,600 fish. Most were caught immediately after release in the river, and few actually migrated to Puget Sound to return as adults.

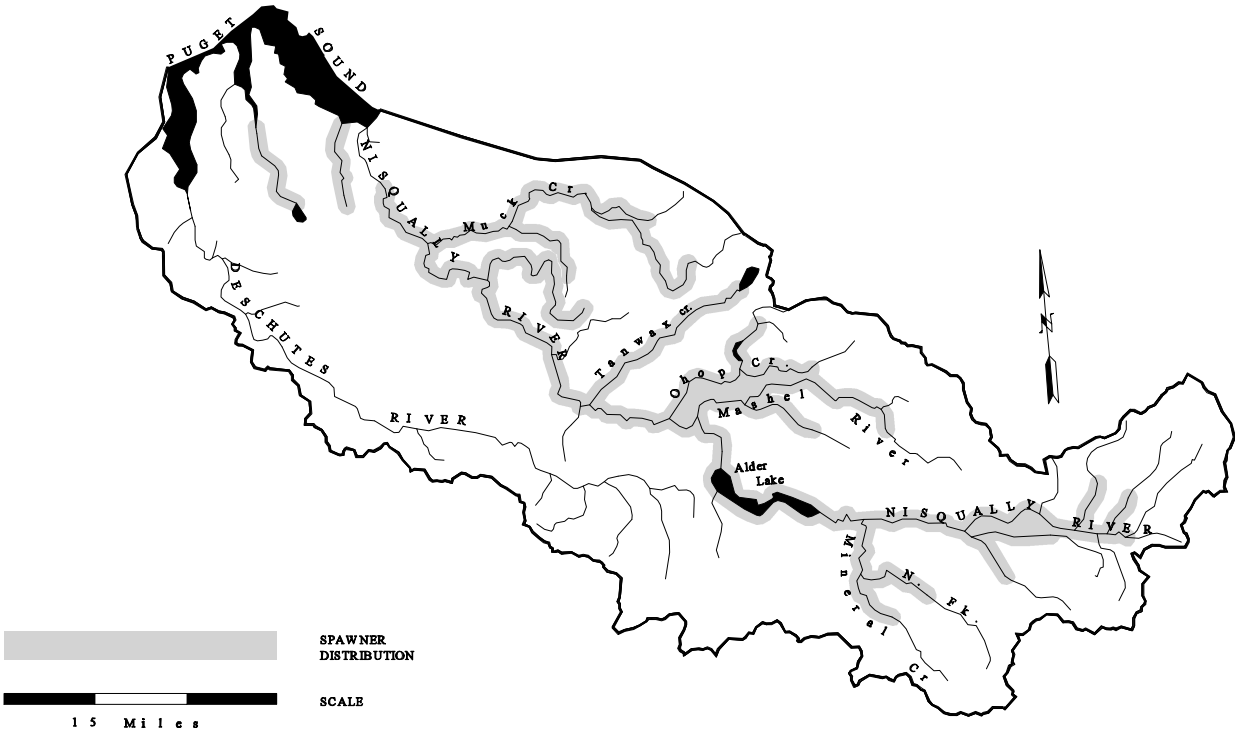
The influence of hatchery-origin cutthroat genes on the Nisqually cutthroat stock complex is thought to be insignificant, and the stock is still considered native, and sustained by wild production.

Nisqually coastal cutthroat are represented by several collections from Muck, Big and Twenty-five Mile creeks and the Nisqually River. All collections within the Nisqually watershed were significantly different from one another and from other South Sound

STOCK DEFINITION PROFILE for Nisqually Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

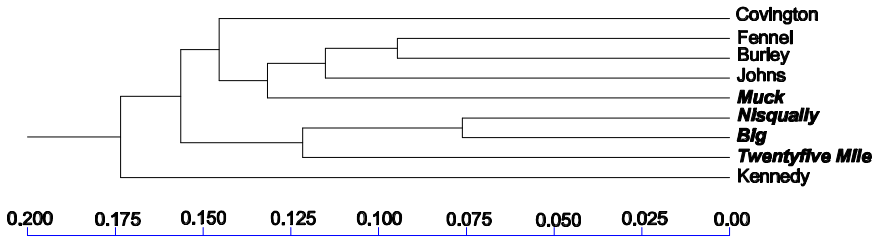
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry							■	■	■	■			Unknown
Anad Spawning	■	■	■	■	■								Unknown
Fluvial Spawning	■	■	■	■	■	■							Unknown
Adfluvial Spawning	■	■	■	■	■	■							Unknown
Resident Spawning	■	■	■	■	■	■							Unknown

Timings are unknown. These timings are based on those for the Snohomish stock complex.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Muck Cr. (N=50), Big Cr. (N=52), Twenty-five Mile Cr. (N=49) and Nisqually River (Rkm 106) collections, made in 1996, were significantly different from one another and from other South Sound collections (33 allozyme-locus G-tests; *P*<0.001).



STOCK STATUS PROFILE for Nisqually Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

collections. One collection, Muck Creek, appears to share genetic similarities with collections from Northwest Hood Canal.

STOCK STATUS

The status of the Nisqually stock complex is Unknown. There are no quantitative data on abundance and survival with which to assess status. Cummins (1980) noted that Muck Creek once had a reputation for good cutthroat fishing, probably on juvenile anadromous fish, but that cutthroat populations declined, possibly due to overharvest.

FACTORS AFFECTING PRODUCTION

Habitat--Farming, logging, road building and water withdrawal have adversely affected the production of cutthroat in the Nisqually system. The estuary is one of only a few of its size left relatively unspoiled by development in Puget Sound, and it provides an excellent environment for anadromous cutthroat. The Alder and LaGrande dams block access to many miles of anadromous spawning and rearing habitat, and imposed perhaps the most significant environmental alteration affecting salmonid species in the Nisqually basin. Other potential problems involve incidental spillage of chemicals such as the 1977 railroad accident which resulted in 600 tons of copper ore going into the river.

Harvest Management--The incidental catch of anadromous coastal cutthroat in tribal gillnet fisheries in the Nisqually River is unknown but is thought to be low. The annual sport catch of anadromous cutthroat is also unknown but is probably less than 100 fish. The glacial character of the mainstem limits sport fishing effort during the likely period of river entry from June through October which coincides with the normal fishing season.

Current sport fishing regulations limit the harvest of resident fish in tributaries and upper mainstem (above RM 41) to a two-fish daily limit with a minimum size limit of eight inches to protect rearing juveniles, outmigrating smolts and resident spawners from harvest. Chambers Lake (Muck Creek) is a catch-and-release only area for all trout, with selective fishery regulations on gear. Regulations for the lower mainstem (below RM 41) limit the daily catch to two fish with a minimum size limit of 14 inches to protect first-time anadromous spawners and some repeat spawners.

Hatchery--Cutthroat trout are not released into the Nisqually system. Stocking of hatchery-reared rainbow trout occurs in many lakes in the Nisqually River watershed. The potential for hybridization with the wild cutthroat in adjoining streams is limited by high fishery catch rates on rainbow in lakes and the lack of egress from most lakes.

Stocking of hatchery-reared coho fry in many tributaries may have adverse impacts on cutthroat production, particularly during the annual summer-fall low-flow period when competition for limited food and space becomes intense. However, coho fry releases

throughout South Puget Sound tributaries are being reduced. Hatchery steelhead are not released into the Nisqually system.

WESTERN SOUTH SOUND COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Western South Sound coastal cutthroat stock complex is thought to be distinct from other South Sound stocks based upon the later timing of freshwater entry exhibited by its anadromous component and its distribution in the small to medium-sized independent streams of south and western Puget Sound. For characteristics such as spawning time, smolt age, age at first spawning and morphology, the differences among stocks are not well-defined.

The anadromous life history form is likely to be found in most of these systems, but presence and distribution in freshwater may be quite seasonal because of summer and fall low flows. It is expected that these fish are late-entry. The fluvial form probably inhabits all of the medium-sized streams, and the adfluvial form may be present in as many as 12 lakes within the range of this stock complex. The resident form of this stock complex is present in virtually all perennial independent streams in western South Puget Sound.

Hatchery-origin cutthroat were released in the Deschutes River and McAllister Creek for several years. Interbreeding between hatchery and wild cutthroat is thought to have been unlikely because of high catch rates on hatchery fish and poor survival of hatchery-origin fish in the wild. Consequently, Western South Sound coastal cutthroat are considered native. The stock is maintained by wild production.

Genetic collections from this region include Kennedy, John's and Burley creeks which are significantly different from one another and from other South Sound collections.

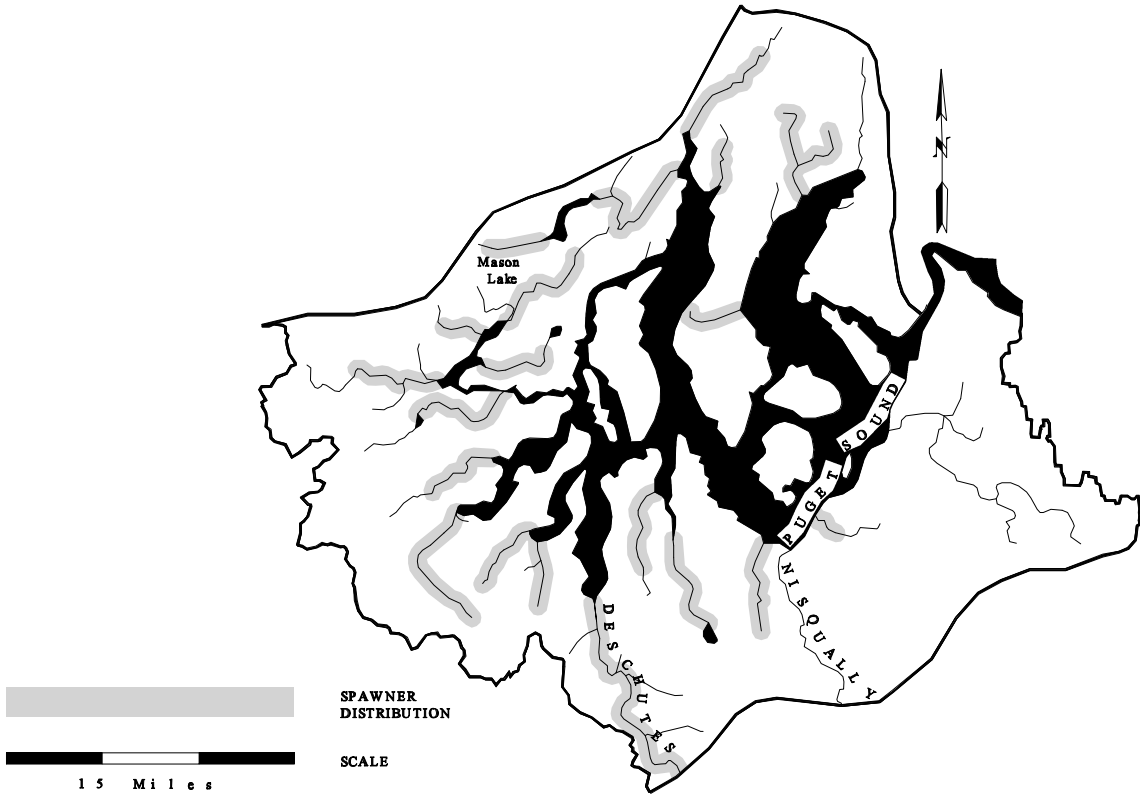
STOCK STATUS

The status of the Western South Sound stock complex is Unknown. We have no current quantitative data on abundance or survival with which to assess status. Smolt counts from Washington Department of Fisheries traps on Perkins Creek (Eld Inlet), Mill Creek (Hammersley Inlet) and Wildcat Creek (Dyes Inlet) are shown in columns 1, 2 and 3 of the stock assessment section of the Stock Status Profile. These data were collected in the 1980s and are not useful in determining current status. Hunter (1980) rated anadromous cutthroat status in many of the tributaries in this region, based on habitat quality. Those Kitsap Peninsula tributaries that were given a good rating included Coulter, Rocky, Minter, Burley, Purdy, Olalla, Curley, Blackjack, Gorst, Chico, Ekur and Barker creeks. Those tributaries with a fair rating included Crescent Valley, Anderson, Parish and Milter creeks. Beaver and Mosher creeks were rated as possibly low. Within more southerly waters the following systems were ranked as good:

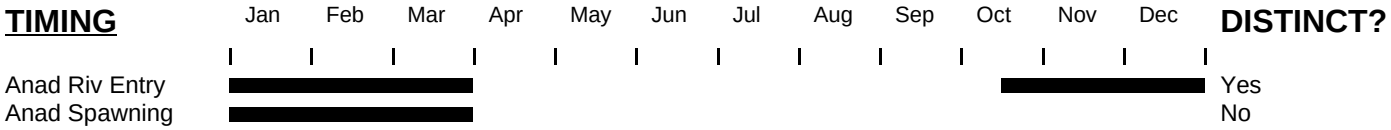
STOCK DEFINITION PROFILE for Western South Sound Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

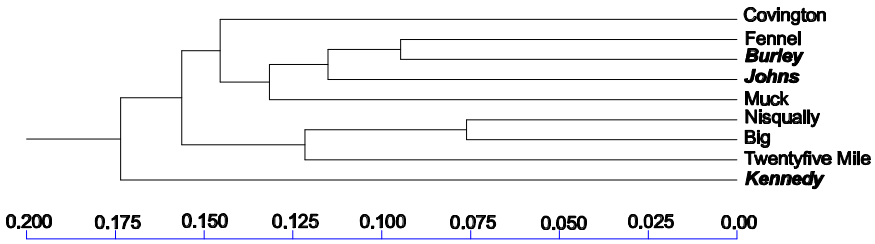


Timings are unknown. These timings are based on those for the North Puget Sound Tribs stock complex.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Kennedy Cr. (N=51), Johns Cr. (N=47) and Burley Cr. (N=26) collections made in 1995 were significantly different from one another and from other South Sound collections (33 allozyme-locus G-tests; *P*<0.001).

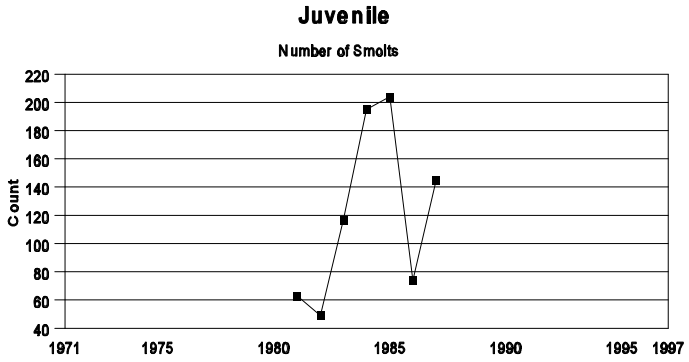


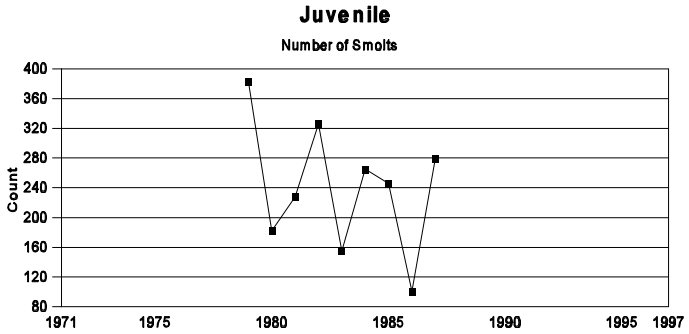
STOCK STATUS PROFILE for Western South Sound Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	JUVENILE Smolts	JUVENILE Smolts	JUVENILE Smolts	
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979		383	305	
1980		182	737	
1981	63	228	670	
1982	49	326	543	
1983	117	155	723	
1984	195	265	823	
1985	204	246	951	
1986	74	101	392	
1987	145	279	264	
1988				
1989				
1990				
1991				
1992				
1993				
1994				
1995				
1996				
1997				





Col. 1= Perkins Creek, Col. 2= Mill Creek, Col. 3= Wildcat Creek

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution, Timing

Stock Status

Unknown

Screening Criteria

Sherwood, Campbell, Millaney, Deer, Cranberry, Kennedy, McLane, Deschutes River, and Woodland creeks. Those identified as fair included Goldsborough, Skookum, and Schneider creeks. Only Perry Creek received a low rating, while Mill Creek was rated "very good."

FACTORS AFFECTING PRODUCTION

Habitat--The primary sources of habitat loss in this part of the Puget Sound basin are residential development and road building. These activities result in loss of riparian vegetation, increased sediment loads, high run-off rates, and blockages to migration. Examples of areas where these impacts have occurred include Chambers, Woodland, Goldsborough and Burley creeks. For the most part, however, the many small streams in the range of this stock still have adequate habitat to support viable populations of cutthroat.

Harvest Management--Within this region there is a mix of regulations, both in opening times and minimum size limits. Some tributaries are closed year-round including: Campbell, Canyon, Cranberry, Johns, Uncle John, and Shelton creeks. Other streams, especially the smaller ones, are open from June 1 through October 31 with an eight-inch minimum size limit. Minter and Sherwood creeks are open from June 1 through October 31 with a 14-inch size limt. Still others, such as Kennedy, Goldsborough, and Mill creeks have extended seasons, closing March 1, with a 14-inch size limit. The Deschutes River is open from June 1 through March 31, also with a 14-inch minimum size limit.

Since the anadromous adults of these stock complexes do not re-enter streams until the season is normally closed, most adults are protected. Those waters with an eight-inch minimum size limit protect most cutthroat through the time of smolting and adult resident cutthroat as well. In all marine waters, wild cutthroat (those with adipose fins) must be released.

Hatchery--Beaver Creek (Elochoman River) coastal cutthroat hatchery smolts were stocked for 13 years in the Deschutes River and for nine years in McAllister Creek, but there have been no hatchery releases into other streams in this part of Puget Sound. Impacts to wild cutthroat from past hatchery releases of rainbow and cutthroat into South Puget Sound lakes and streams are believed to have been minimal. High catch rates by anglers on released hatchery fish, along with poor survival rates of hatchery fish in the wild, have made hybridization and competition with wild fish unlikely.

Stocking of hatchery-reared coho fry in many streams in this area may have adverse impacts on cutthroat production, particularly during the annual summer-fall low flow period when competition for limited food and space becomes intense. Hatchery coho fry have been stocked in most of these systems in past years. However, WDFW has recently made changes in coho programs that have significantly reduced off-station fry plants, especially in South Puget Sound. Deschutes River is the only system that receives releases of hatchery steelhead smolts, with an annual release goal of 25,000.

EAST HOOD CANAL COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The East Hood Canal coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. This stock complex is composed of coastal cutthroat trout in drainages flowing from the Kitsap Peninsula into Hood Canal and in independent tributaries to Hood Canal south of the Union River. Moving from north to south on the Kitsap Peninsula, drainages include several unnamed tributaries, Jump Off Joe Creek, Little Anderson Creek, Big Beef Creek, Little Beef Creek, Seabeck Creek, Stavis Creek, Boyce Creek, Anderson Creek, Dewatto River, Tahuya River, Shoofly Creek, Stimson Creek, Big and Little Mission creeks, and the Union River. Independent tributaries south of the Union River include Twanoh Creek, Alderbrook Creek and several unnamed tributaries. The streams and rivers in this area are typical lowland type streams with generally low to moderate gradients. Many of these streams originate from lakes, ground water run-off, or swamp-like basins. The marine waters of Hood Canal are unique due to the slow exchange and mixing of waters in the extensive length of the canal. Depths generally exceed 90 meters (300 feet) with large areas in the 127 meter (420 feet) and deeper range. There are also shallow shelves and bays that provide warmer water rich in nutrients. Since anadromous cutthroat do not generally cross deep bodies of water, but follow shoreline areas, the East Hood Canal stock complex has been separated from the West Hood Canal stock complex.

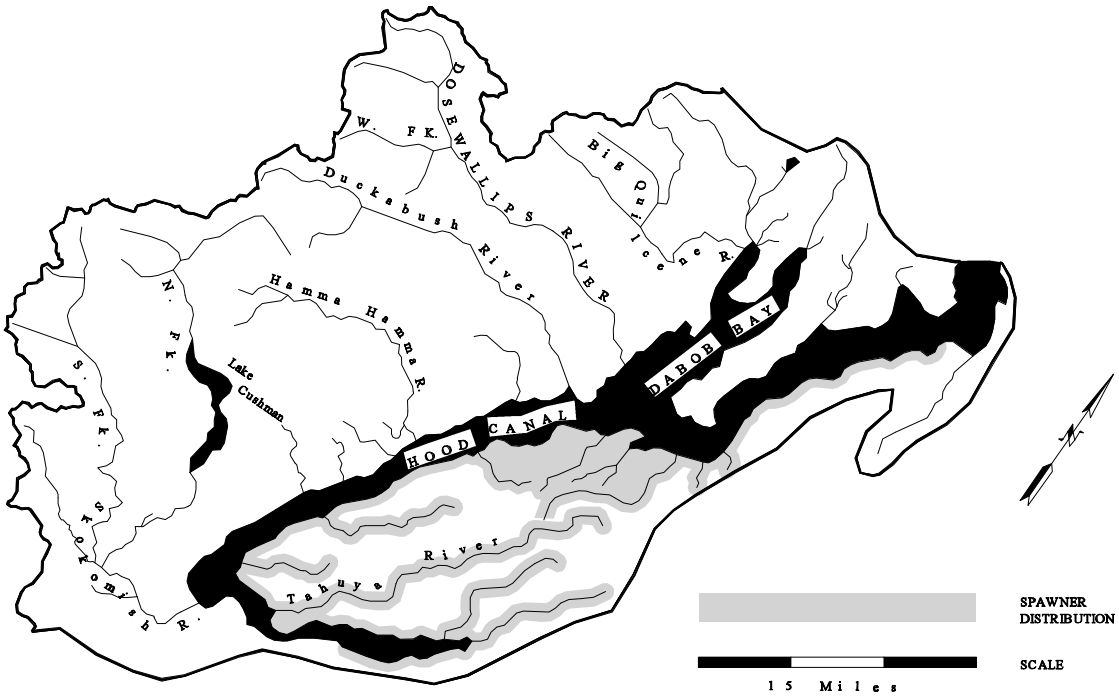
Anadromous and resident cutthroat are present in the East Hood Canal stock complex. McKenna Falls on the Union River is the only known natural barrier to anadromous cutthroat migration for this stock complex. Resident cutthroat are likely present upstream of McKenna Falls. Coastal cutthroat utilize lowland lakes and beaver ponds which are present in this area, but we do not know if there are fluvial or adfluvial forms of coastal cutthroat in this stock complex. Specific spawn timing is unknown but is probably from January through April for all East Hood Canal life history forms.

Wild coastal cutthroat in this stock complex are native and sustained by wild production. Greater or fewer numbers of distinct spawning populations may be identified once comprehensive genetic, life history, and ecological information is available. There is some information which suggests that coastal cutthroat in Hood Canal are genetically distinct. Campton (1981) and Campton and Utter (1987) concluded that anadromous cutthroat inhabiting the Hood Canal and north Puget Sound regions represent two genetically divergent stock complexes which probably reflect a long-term absence of gene flow between these two regions of Puget Sound. In the East Hood Canal stock complex, samples have recently been collected for genetic analysis from Big Beef, Seabeck, Stavis, Gold, Little Anderson, Stimson, Little Mission, Big Mission, unnamed

STOCK DEFINITION PROFILE for East Hood Canal Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

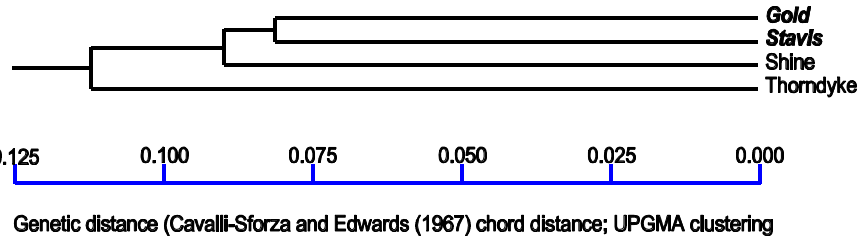
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Spawning	■	■	■	■									No
Resident Spawning	■	■	■	■									No

Timings are unknown. These timings are based on flows in East Hood Canal streams.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Stavis Cr. (N=43) and Gold Cr. (N=55) collections made in 1995 were significantly different from one another (6 microsatellite DNA-locus G-tests; *P*<0.0001; 33 allozyme-locus G-tests; *P*<0.001) and from the West Hood Canal stock complex collections (33-alloyzme locus G-tests; *P*<0.001).

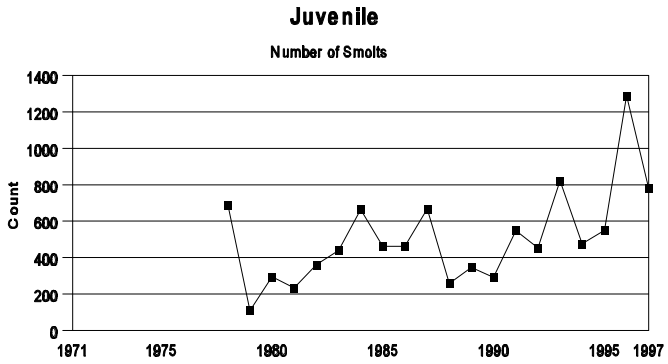


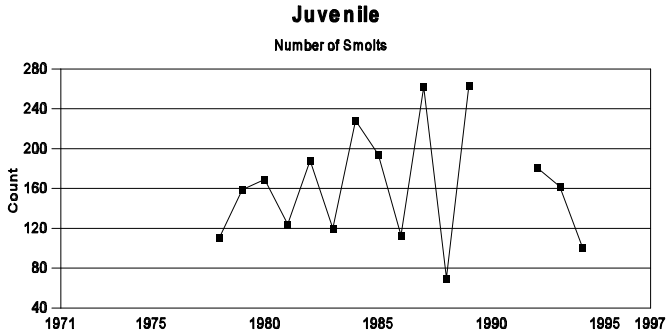
STOCK STATUS PROFILE for East Hood Canal Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	JUVENILE Smolts	JUVENILE Smolts	JUVENILE Smolts	JUVENILE Smolts
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978	691	111		308
1979	110	159		287
1980	294	169		207
1981	233	124		120
1982	361	188	539	233
1983	440	120	887	115
1984	664	228	936	254
1985	462	194	556	244
1986	462	113	159	56
1987	668	262	562	68
1988	259	70	533	64
1989	347	263	311	54
1990	292			
1991	548			
1992	453	181	505	24
1993	823	162	502	355
1994	476	101	180	158
1995	549			
1996	1,289			
1997	780			





Col. 1 Big Beef Cr; Col. 2 Little Tahuya Cr,
Col. 3 Big Mission Cr; Col. 4 Bear Cr.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

stream 15.0498 (Big Mission Creek tributary), unnamed streams 15.0504 and 15.0507, Courtney and Bear creeks (Union River tributaries). Collections used for allozyme analysis included only Stavis and Gold creeks; the rest were taken for DNA analysis. The Stavis Creek and Gold Creek collections were genetically distinct from each other and from collections from the West Hood Canal stock complex.

STOCK STATUS

The status of the East Hood Canal coastal cutthroat stock complex is Unknown. Long-term monitoring information was deemed inadequate to assess the status of this coastal cutthroat stock complex.

Recent anadromous cutthroat smolt abundance information for Hood Canal tributaries is available from outmigrant trapping activities on Big Beef, Little Tahuya, Big Mission, Courtney, Bear, Little Anderson, Seabeck, and Stavis creeks (see Table 1). In Big Beef Creek, it appears that freshwater production of coastal cutthroat smolts has remained relatively stable or is increasing. Further, the ratio of cutthroat smolts to steelhead smolts has also remained relatively stable, suggesting that the community composed of these sympatric species has continued to successfully reproduce in the available freshwater habitat (Leider 1997). In addition, although quantitative data useful for trend analysis are limited, cutthroat were found to be abundant in a variety of streams during the course of recent genetic investigations from 1993 to 1995.

Table 1. Summary of cutthroat trout (CT), steelhead (SH), and coho salmon smolt abundance from outmigrating trapping on tributaries to Hood Canal, 1978 through 1997. Data collected by WDFW except 1992 through 1994 data for Little Tahuya, Big Mission, Courtney and Bear creeks collected by Point No Point Treaty Council.

	Big Beef Creek (15-0389) [a]			Little Tahuya Creek (15-0454) [a]			Big Mission Creek (15-0495) [a]			Courtney Creek (15-0505) [a]			Bear Creek (15-0510) [a]		
Year	CT Smolts	SH Smolts	Coho Smolts	CT Smolts	SH Smolts	Coho Smolts	CT Smolts	SH Smolts	Coho Smolts	CT Smolts	SH Smolts	Coho Smolts	CT Smolts	SH Smolts	Coho Smolts
1978	691	881	17619	111	154	5560	-	-	-	220	42	1147	308	11	571
1979	110	870	45634	159	15	9772	-	-	-	197	9	1130	287	11	604
1980	294	1685	20715	169	97	3748	-	-	-	188	51	1034	207	36	439
1981	233	1578	41054	124	48	9042	461	567	19023	130	24	1436	120	14	508
1982	361	1269	25225	188	116	9615	539	732	15218	171	40	1165	233	31	816
1983	440	1237	25333	120	77	7278	887	614	18716	163	72	1507	115	33	801
1984	664	1770	36636	228	146	10228	936	591	17011	308	130	1039	254	26	251
1985	462	1189	25720	194	85	11027	556	512	15770	187	53	1451	244	10	755
1986	462	1210	24479	113	26	4448	159	143	7318	179	36	1415	56	8	667
1987	668	1153	11510	262	161	1357	562	500	7091	33	37	238	68	13	112
1988	259	990	26534	70	63	2735	533	645	14528	62	27	1483	64	5	636
1989	347	1284	17594	263	200	7761	311	377	13906	110	71	1460	54	3	992
1990	292	1597	19565	-	-	-	-	-	-	-	-	-	-	-	-
1991	548	1089	23646	-	-	-	-	-	-	-	-	-	-	-	-
1992	453	1595	18677	181	449	5946	505	369	18107	66	65	1755	24	13	538
1993	823	1181	13071	162	56	3873	502	424	13010	167	59	1234	355	13	413
1994	476	1592	18431	101	44	3117	180	224	15548	65	15	1041	158	7	138
1995	549	1311	16207												
1996	1289	1417	25242												
1997	780	1289	40830												

[a] WRIA-Stream no.

Table 1 (cont.). Summary of cutthroat trout (CT), steelhead (SH), and coho salmon smolt abundance from outmigrating trapping on tributaries to Hood Canal, 1978 through 1997. Data collected by WDFW except 1992 through 1994 data for Little Tahuya, Big Mission, Courtney and Bear creeks collected b y Point No Point Treaty Council (cont.).

Year	Little Anderson Creek (15-0377) [a]			Seabeck Creek (15-0400) [a]			Stavis Creek (15-0404) [a]		
	CT Smolts	SH Smolts	Coho Smolts	CT Smolts	SH Smolts	Coho Smolts	CT Smolts	SH Smolts	Coho Smolts
1992	625	11	404	--	--	--	--	--	--
1993	823	12	140	330	9	1284	624	4	3501
1994	61	1	151	139	20	2148	874	61	5851
1995	566	268	779	309	100	1326	1196	324	4385
1996	1540	43	343	705	53	866	1355	74	4690
1997	1124	3	100	417	10	1637	1664	34	8351

[a] WRIA-Stream no.

An effort was made to sample systematically adult cutthroat in fisheries on Hood Canal. Volunteer anglers from the Sea-Run Cutthroat Coalition and associated sportsclubs, working with WDFW, participated in “fish-ins” on Hood Canal from 1989 to 1992. Each spring and fall, volunteer anglers collected data on size of cutthroat caught, catch per hour, and presence or absence of adipose fins. Hatchery cutthroat (identified by the absence of adipose fins) made up less than 10% of the total catch, and catch per hour was low for both hatchery and wild cutthroat. Long-term trends in abundance could not be determined, but standardized angling by volunteers and/or agency personnel can be valuable in helping assess the status of coastal cutthroat trout. Beginning in 1995 and continuing for five years, the Sea-Run Cutthroat Coalition plans to collect information on sea-run cutthroat in fisheries by volunteer anglers (Jauquet and Schorsch 1997).

Natural hybridzation between coastal cutthroat and steelhead has been documented in Big Mission Creek in Hood Canal and in Harvey Creek, a tributary to the Stillaguamish River in North Puget Sound (Campton and Utter 1985; Hawkins 1997). Campton (1981) suggested that due to the lack of complete spatial and temporal reproductive isolation, the production of hybrid offspring may not be uncommon in streams where both species occur. While it is believed that present genetic profiles are similar to past populations for both cutthroat and steelhead, care should be taken to minimize potential interbreeding resulting from fish stocking.

FACTORS AFFECTING PRODUCTION

Habitat--Major limiting habitat factors include altered annual instream flow regimes and associated seasonal flooding and low summer flows, loss of access due to human-caused barriers, water quality and quantity problems in the areas of concentrated land development, degraded instream and riparian habitat, land conversions from forest to agricultural or residential use, and alternation and loss of wetlands and estuarine habitats (Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes 1994, Hood Canal Coordinating Council 1995).

Harvest Management--The trout season is open from June 1 through October 31 in streams, rivers and beaver ponds with a two-trout daily limit and an eight-inch minimum size limit to protect juveniles and resident spawners. Where adult anadromous fish and fisheries exist, regulations in freshwater allow a two-fish daily limit, with a 14-inch minimum size limit. This minimum size limit protects first-time spawners and some repeat spawners from harvest. In addition, catch-and-release regulations are in place to protect vulnerable wild cutthroat and steelhead populations.

Hatchery--Johnston and Mercer (1976) successfully developed a late-entry hatchery broodstock from wild anadromous cutthroat captured in Thorndyke and Dabob bays for use in Hood Canal. Between 1970 and 1991, hatchery anadromous cutthroat from this broodstock or other broodstocks were released directly into Hood Canal and into several East Hood Canal streams, including Big Mission Creek and the Dewatto, Tahuya, and Union rivers. Hatchery releases were discontinued in 1991 due to poor survival and failure to provide adequate recreational harvest on the returning anadromous cutthroat adults. No further releases of hatchery sea-run cutthroat are planned in this area. The late-entry broodstock is currently maintained at WDFW's Eells Springs Hatchery in the Skokomish River basin. About 1,500 catchable-sized fish and 100,000 fingerlings are released annually to provide a recreational fishery in Lake Cushman on the North Fork Skokomish River.

Resident cutthroat fry and catchable-sized cutthroat, originating from Tokul Creek (Snohomish River, north Puget Sound) hatchery stock, are annually released in numerous lakes and beaver ponds on the Kitsap Peninsula. The interaction between hatchery and wild cutthroat in these lakes and beaver ponds is believed to be very limited. Hatchery winter steelhead were released into various eastside Hood Canal tributaries, including the Tahuya and Union rivers. However, planting stopped in 1996 as a result of concerns over wild steelhead production. Future management plans are to continue with the no-release direction.

WEST HOOD CANAL COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The West Hood Canal coastal cutthroat stock complex has been identified as distinct based on geographic distribution of its spawning grounds. This stock complex is composed of coastal cutthroat trout in drainages flowing into Hood Canal from the northeastern part of the Olympic Peninsula south to the Skokomish River. The larger drainages and rivers in this area (Skokomish, Hamma Hamma, Duckabush, Dosewallips, Big and Little Quilcene rivers) originate in steep Olympic Mountain terrain and have high to moderate gradients with flow input coming from glacier and snow melt. There are also numerous smaller drainages with lesser gradients that originate from lakes and ground-water runoff. From north to south, these drainages include Shine, Thorndyke, Tarboo, Donovan, McDonald, Fulton, Schaerer, Wacketickeh, Jorsted, Eagle, Lilliwaup, Sund, Miller, Clark, Finch and Hill creeks and numerous unnamed independent drainages.

The marine waters of Hood Canal are unique due to the slow exchange and mixing of waters in the extensive length of the canal. Depths generally exceed 100 meters. There are also shallow shelfs and bays that provide warmer waters rich in nutrients (Williams et al. 1975). Since anadromous cutthroat do not generally cross deep bodies of water, but follow shoreline areas, the West Hood Canal stock complex has been separated from the East Hood Canal stock complex.

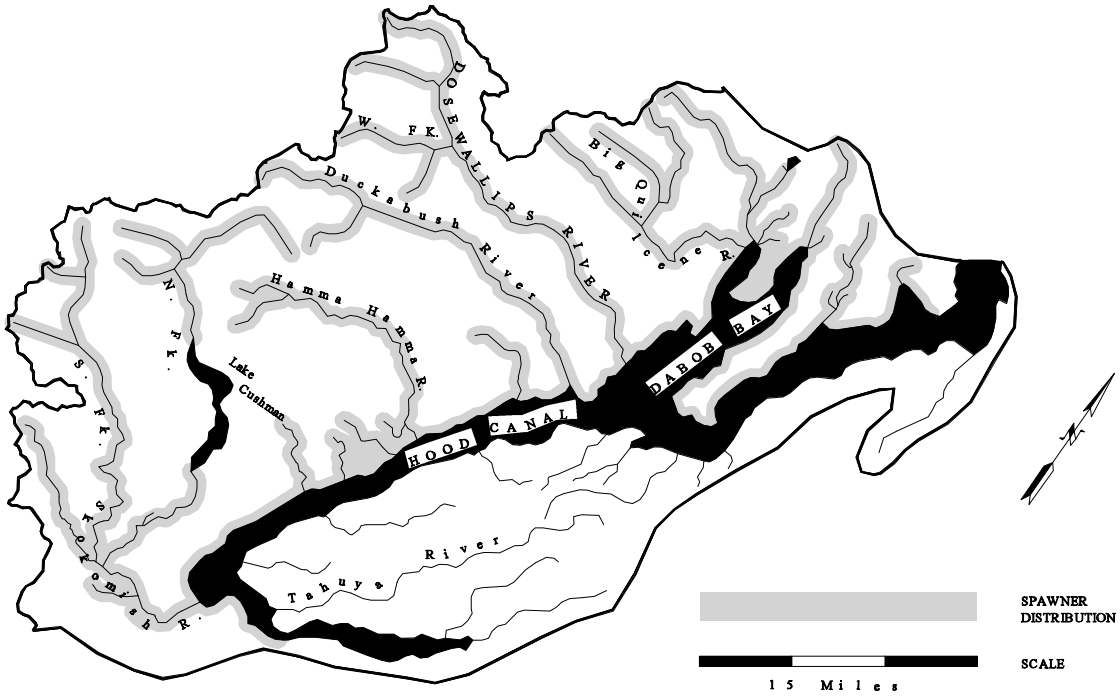
Anadromous and resident life history forms are present in the West Hood Canal stock complex. We do not know if fluvial or adfluvial forms of coastal cutthroat are also present in this stock. Specific spawn timing is unknown, but is probably from January through April for all West Hood Canal life history forms.

Wild coastal cutthroat in this stock complex are native and sustained by wild production. Greater or fewer numbers of distinct spawning populations may be identified once comprehensive genetic, life history, and ecological information is available. There is some information which suggests that coastal cutthroat in Hood Canal are genetically distinct. Campton (1981) and Campton and Utter (1987) concluded that anadromous cutthroat inhabiting the Hood Canal and north Puget Sound regions represent two genetically-diverged stock complexes which probably reflects a long-term absence of gene flow between these two regions of Puget Sound. In the West Hood Canal stock complex, coastal cutthroat samples have recently been collected for genetic analysis from Fulton, Howe, Tarboo, East Tarboo, Thorndyke, and Shine creeks. Samples from Thorndyke and Shine creeks were used for allozyme analysis and were genetically distinct from each other and from samples collected from the East Hood Canal stock complex; the rest were taken for DNA analysis.

STOCK DEFINITION PROFILE for West Hood Canal Coastal Cutthroat

SPAWNWER DISTRIBUTION

DISTINCT? - **YES**



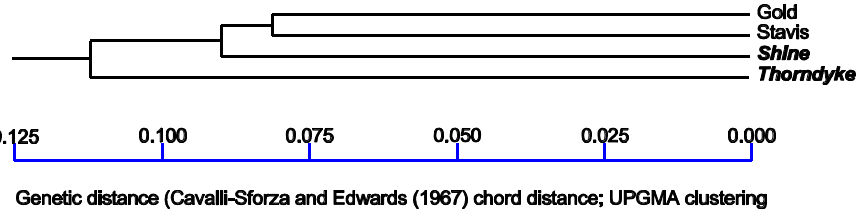
TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Spawning	■	■	■	■									No
Resident Spawning	■	■	■	■									No

Timings are unknown. These timings are based on flows in west Hood Canal streams.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Shine Cr. (N=58) and Thorndyke Cr. (N=57) collections, made in 1995, were significantly different from one another and from the East Hood Canal stock complex collections (33 allozyme-locus G-tests; *P*<0.001).



STOCK STATUS PROFILE for West Hood Canal Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

STOCK STATUS

The status of the West Hood Canal coastal cutthroat stock complex is Unknown. Although quantitative data useful for trend analysis are limited, coastal cutthroat were found to be abundant in drainages sampled during the course of recent genetic investigations from 1993 to 1995. In addition, juvenile abundance and presence/absence information is available from electrofishing in a variety of streams.

An effort was made to sample systematically adult cutthroat in fisheries on Hood Canal. Volunteer anglers from the Sea-Run Cutthroat Coalition and associated sports clubs, working with WDFW, participated in "fish-ins" on Hood Canal from 1989 to 1992. Each spring and fall, volunteer anglers collected data on size of cutthroat caught, catch per hour, and presence or absence of adipose fins. Hatchery cutthroat (identified by the absence of adipose fins) made up less than 10% of the total catch, and catch per hour was low for both hatchery and wild cutthroat. Long-term trends in abundance could not be determined, but standardized angling by volunteers and/or agency personnel can be valuable in helping assess the status of coastal cutthroat trout. Beginning in 1995 and continuing for five years, the Sea-Run Cutthroat Coalition plans to collect information on sea-run cutthroat in fisheries by volunteer anglers (Jauquet and Schorsch 1997).

Natural hybridzation between coastal cutthroat and steelhead has been documented in Big Mission Creek in Hood Canal and in Harvey Creek, a tributary to the Stillaguamish River in North Puget Sound (Campton and Utter 1985, Hawkins 1997). Campton (1981) suggested that due to the lack of complete spatial and temporal isolation between spawning adults, the production of hybrid offspring may not be uncommon in drainages where both species occur. While the genetic integrity of these two species suggests that significant interbreeding has not occurred, care should be taken to minimize potential interbreeding resulting from fish stocking.

FACTORS AFFECTING PRODUCTION

Habitat--Major limiting habitat factors include altered annual instream flow regimes and associated seasonal flooding and low summer flows, loss of access due to human-caused barriers, water quality and quantity problems in the areas of concentrated land developments, degraded instream and riparian habitat, land conversions from forest to agricultural or residential use, and alteration and loss of wetlands and estuarine habitat (Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes 1994, Hood Canal Coordinating Council 1995). Some of the upper watersheds have been impacted by intensive logging, particularly the Skokomish River basin, however, much of the headwater areas are inside the Olympic National Park and are in pristine condition.

Harvest Management--The statewide general fishing season (June 1 through October 31) and standard regulations in streams, rivers, and beaver ponds (two fish per day, eight-inch minimum size limit), protect resident juveniles and migrating smolts from harvest. Where adult anadromous fish and fisheries exist, regulations in fresh and marine waters are catch-and-release. There is a tribal hook-and-line ceremonial and subsistence on the Skokomish River from late March through mid-August (six fish per day, 12-inch minimum size).

Hatchery--Johnston and Mercer (1976) successfully developed a late-entry hatchery broodstock from wild anadromous cutthroat captured in Thorndyke and Dabob bays for use in Hood Canal. From 1985 to 1987 many of the smolts were stocked in Hunter Creek, the outlet of the WDFW Eells Spring Hatchery on the Skokomish River, in an attempt to establish a returning broodstock.

Hatchery releases were discontinued in 1991 due to poor survival and failure to provide adequate recreational harvest on the returning anadromous cutthroat adults. Further releases of hatchery sea-run cutthroat are not planned in this area. This broodstock is currently maintained at WDFW's Eells Springs Hatchery, and about 1,500 catchable-sized fish and 100,000 fingerlings are released annually to provide a recreational fishery in Lake Cushman above Cushman Dam on the North Fork Skokomish River.

Resident cutthroat fry and catchable-size cutthroat, originating from Tokul Creek (Snohomish River, north Puget Sound) hatchery stock, are annually released in some lakes and beaver ponds in West Hood Canal drainages. The interaction between hatchery and wild cutthroat in these waters is believed to be very limited. Hatchery steelhead smolt releases continue in three systems, with annual releases of winter steelhead into the Skokomish (25,000), Duckabush (10,000) and Dosewallips (12,500) rivers.

STRAIT OF JUAN DE FUCA — EASTERN STRAIT COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Eastern Strait coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. This stock complex is composed of coastal cutthroat trout in drainages flowing into Admiralty Inlet and in drainages flowing north into the eastern Strait of Juan de Fuca (from Discovery Bay west to Bagley Creek). Admiralty Inlet drainages include tributaries of Port Ludlow, Mats Mats Bay, Oak Bay, and Port Townsend Bay, namely Ludlow Creek, Chimacum Creek, and several unnamed independent tributaries. Along the eastern Strait of Juan de Fuca, drainages include Snow, Salmon, Contractors, and Eagle creeks and several unnamed independent tributaries in Discovery Bay; Jimmy-Come-Lately, Dean, and Johnson creeks and several unnamed independent tributaries in Sequim Bay; the Dungeness and Gray Wolf rivers; Bell, Gierin, Cassalery, McDonald, Siebert, and Bagley creeks, and several unnamed independent tributaries flowing directly into the eastern Strait of Juan de Fuca.

These drainages originate in the foothills of the Olympic Mountains, with the exception of the Dungeness and Gray Wolf rivers which drain the north slopes of some of the higher peaks of the Olympic Range. Most drainages flowing from the foothills of the Olympic Mountains contain low to moderate gradients in the lower watersheds and steep gradients in the upper watersheds which are often impassable to anadromous fish. However, some drainages in this area are typical lowland streams with generally low to moderate gradients dependent on groundwater run-off for year-round flows. Drainages in this area lie in a rainshadow cast by the Olympic Range which influences streamflow characteristics (Williams et al. 1975, McHenry et al. 1996).

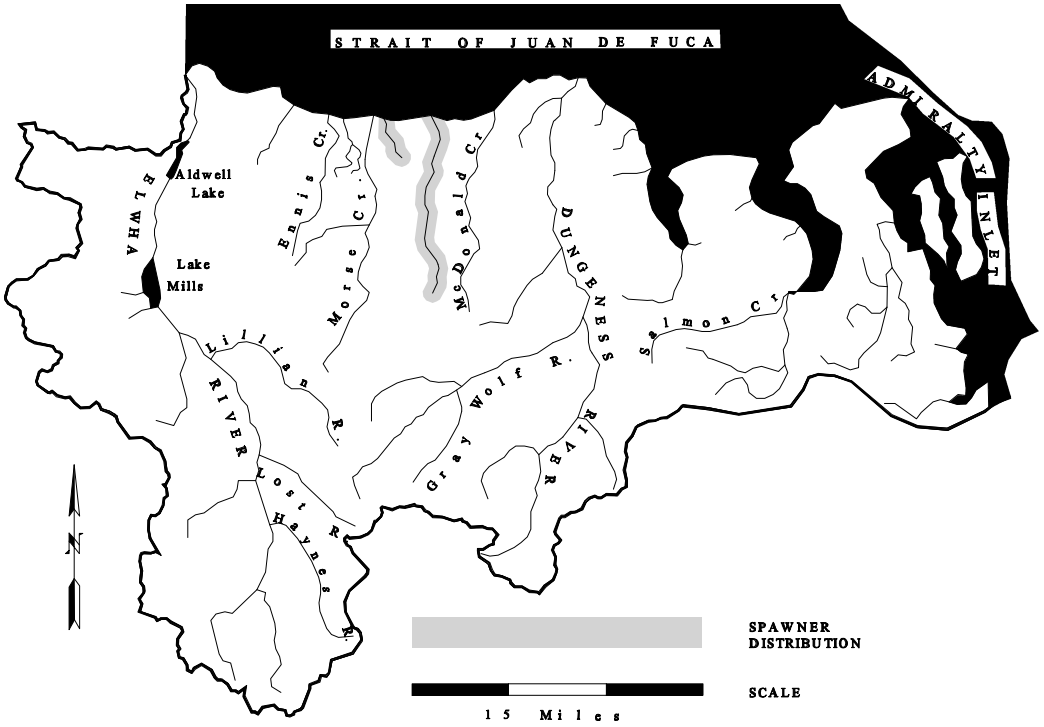
Wild coastal cutthroat in this stock complex are native and sustained by natural production. Greater or fewer numbers of distinct spawning populations may be identified once comprehensive genetic, life history, and ecological information is available. During 1995, coastal cutthroat samples were collected along the Strait of Juan de Fuca for genetic analysis from Gierin Creek (Eastern Strait complex), Lees, Peabody, and Whiskey creeks (Mid-Strait complex), and Bear Creek, a Hoko River tributary (Western Strait complex). The Gierin Creek collection from the Eastern Strait stock complex was genetically distinct from collections from the Mid-Strait and Western Strait stock complexes.

Anadromous coastal cutthroat in the Eastern Strait complex are predominantly late-entry fish, but early-entry cutthroat may be present in the Dungeness River system. Resident cutthroat are likely present upstream of most barriers to anadromous fish. We

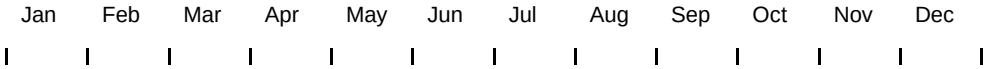
STOCK DEFINITION PROFILE for Eastern Strait Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



TIMING



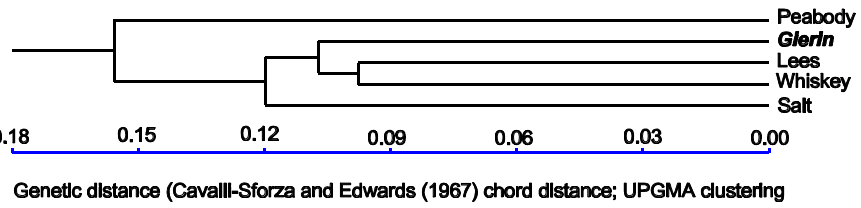
	DISTINCT?
Anad Riv Entry	No
Anad Spawning	No
Resident Spawning	No

Timings are unknown. These timings are based on flows in eastern Strait streams.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Gierin Cr. collection (N=60), made in 1995, was significantly different from all Mid-Strait stock complex collections (33 allozyme-locus G-tests; *P<0.001).*



Genetic distance (Cavalli-Sforza and Edwards (1967) chord distance; UPGMA clustering

STOCK STATUS PROFILE for Eastern Strait Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

do not know if there are fluvial or adfluvial life history forms of coastal cutthroat in this stock complex. Specific spawn timing is unknown but is probably from January through April for all life history forms in most Eastern Strait streams.

STOCK STATUS

The status of the Eastern Strait stock complex is Unknown. Information from trap counts (targeted or incidental) and smolt trapping or electrofishing is available but is insufficient to permit status determination.

Naturally small anadromous cutthroat populations are present in Snow and Salmon creeks. From about 1975 through 1985, fewer than about 25 cutthroat adults were trapped annually in Snow Creek, and fewer than about 80 cutthroat adults were trapped annually in Salmon Creek (WDFW files, Michael 1989). Cutthroat smolt abundance information is available from trap counts at Snow Creek for the 1978 though 1985 outmigration years and at Salmon Creek for the 1978 through 1985 outmigration years. Cutthroat smolt abundance in Snow Creek has remained low (fewer than 50 smolts), but relatively stable. Trapping was discontinued in Salmon Creek in 1985, but cutthroat smolt abundance there showed a declining trend.

While quantitative data useful for trend analysis are limited, coastal cutthroat were found to be abundant in a variety of streams sampled during the course of genetic investigations in 1995. In addition, juvenile abundance and presence/absence information is available in a variety of streams.

FACTORS AFFECTING PRODUCTION

Habitat--Habitat factors limiting production include altered annual instream flow regimes primarily due to water withdrawals, channelization and diking and the associated habitat degradation, seasonal flooding and low summer flows, loss of stream access due to human-caused barriers to migration, water quality and quantity problems in the areas of concentrated land development, degraded instream and riparian habitat, land conversions from forest to agricultural or residential use, and alteration and loss of wetlands and estuarine habitats (Williams et al. 1975; Nelson et al. 1992; Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes 1994; Orsborn and Ralph 1994; McHenry et al. 1996).

Harvest Management--Many of the streams in this complex are closed to all fishing. In waters that are open the statewide general fishing season (June 1 through October 31) and standard regulations in streams, rivers, and beaver ponds (two trout per day, eight-inch minimum size limit), protect resident juveniles and migrating smolts from harvest. Where adult anadromous fish and fisheries exist, regulations in freshwater allow a two-fish daily limit, with a 14-inch minimum size limit. The 14-inch minimum size limit is based on

data on length frequency, age, and sexual maturity, and protects first-time spawners and some repeat spawners from harvest.

Hatchery--There have been no releases of hatchery coastal cutthroat trout in this area. Interactions with other hatchery-origin salmonids have not been examined. The Dungeness River receives annual releases of approximately 10,000 winter steelhead smolts.

STRAIT OF JUAN DE FUCA — MID-STRAIT COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Mid-Strait coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. This stock complex is comprised of coastal cutthroat trout in drainages flowing north into mid-Strait of Juan de Fuca region. From east to west, drainages include Morse, Lees, Ennis, Peabody, Valley, Tumwater, Dry, Colville, Salt, Whiskey, Field, Murdock, Deep, Joe, and Jim creeks and unnamed independent tributaries. Larger rivers include the Elwha, Lyre, East Twin and West Twin.

The mid-Strait of Juan de Fuca region is a transitional zone between the wetter, western strait and the rain shadow of the eastern strait. Drainages comprising the Mid-Strait stock complex originate in the foothills of the Olympic Mountains, with the exception of the Elwha River, which is glacially fed and drains the north slopes of Mount Olympus. Most drainages flowing from the foothills of the Olympic Mountains contain low to moderate gradients in the lower watersheds and steep gradients in the upper watersheds which are often impassable to anadromous fish. However, some drainages in this area are typical lowland streams with generally low to moderate gradients dependent on groundwater run-off for year-round flows. Several of the larger streams have a tidal influence extending upstream for several miles creating extensive estuaries (Williams et al. 1975, McHenry et al. 1996).

Wild coastal cutthroat in this stock complex are native and are sustained by wild production. Greater or fewer numbers of distinct spawning populations may be identified once comprehensive genetic, life history, and ecological information is available. During 1995, WDFW collected coastal cutthroat samples for genetic analysis from Lees, Peabody, and Whiskey creeks in the mid-Strait region. All of these samples were genetically distinct from one another and from a sample from Gierin Creek in the Eastern Strait stock complex. Olympic National Park (ONP) staff initiated genetic sampling of Lake Crescent coastal cutthroat populations in 1995, however, results of these analyses are not yet available.

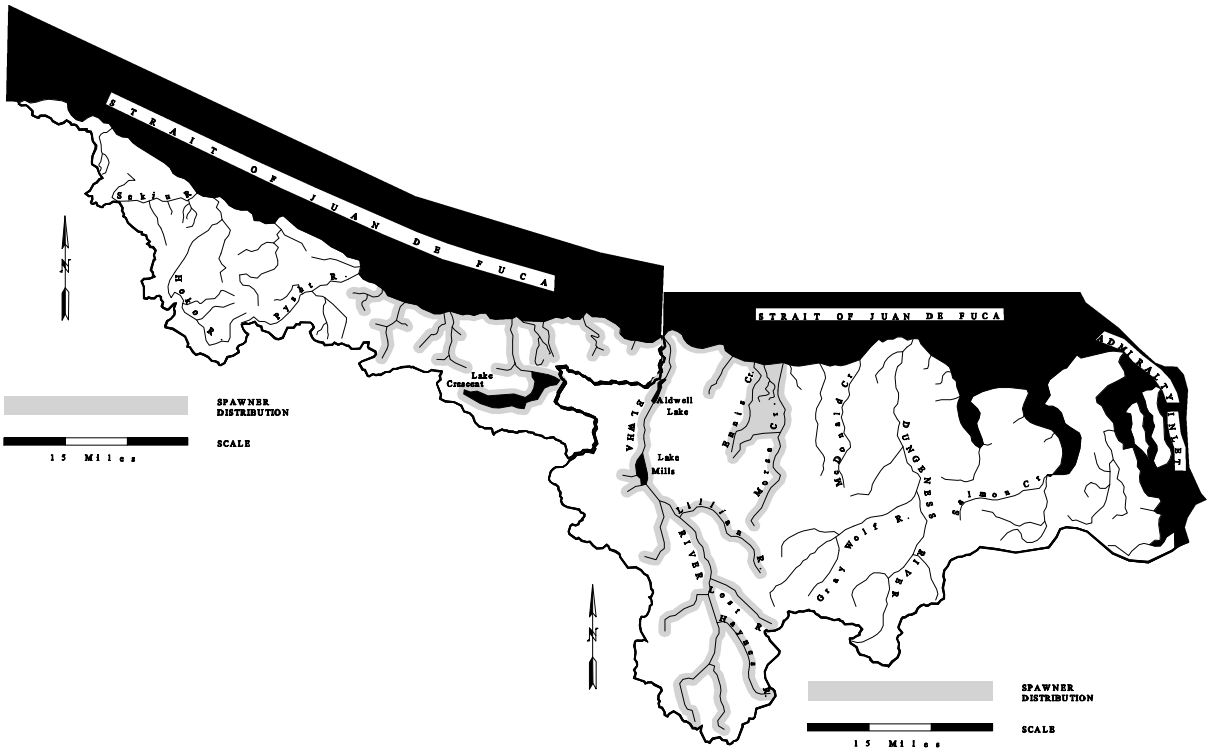
Anadromous coastal cutthroat in the Mid-Strait complex are predominantly late-entry fish, but early-entry cutthroat may be present in the Elwha River. Resident cutthroat are likely present upstream of most barriers to anadromous fish.

Lake Crescent contains unique, locally-adapted coastal cutthroat trout and rainbow trout populations, a hybrid cutthroat-rainbow population (in Barnes Creek), and a cutthroat population in the upper portion of the outlet stream, the Lyre River. Lake Crescent is a large, deep, oligotrophic lake located between the main range of the Olympic Mountains

STOCK DEFINITION PROFILE for Mid-Strait Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



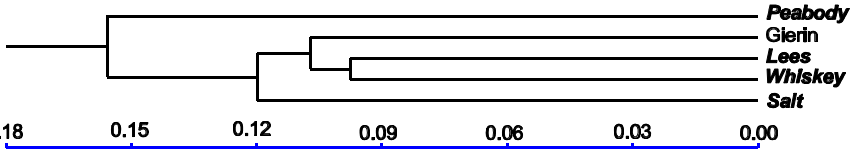
TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■									■	No
Anad Spawning	■	■	■	■	■								No
Resident Spawning	■	■	■	■	■								No

Timings are unknown. These timings are based on flows in mid-Strait streams.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Peabody Cr (N=59), Salt Cr. (N=39), Lee's Cr. (N=55), and Whiskey Cr. (N=48) collections, made in 1995, differed significantly from one another and from the Eastern Strait stock complex collections (33 allozyme-locus G-tests; *P*<0.001).



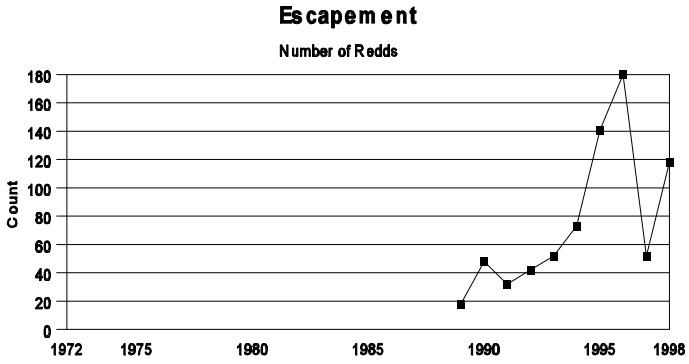
Genetic distance (Cavalli-Sforza and Edwards (1967) chord distance; UPGMA clustering

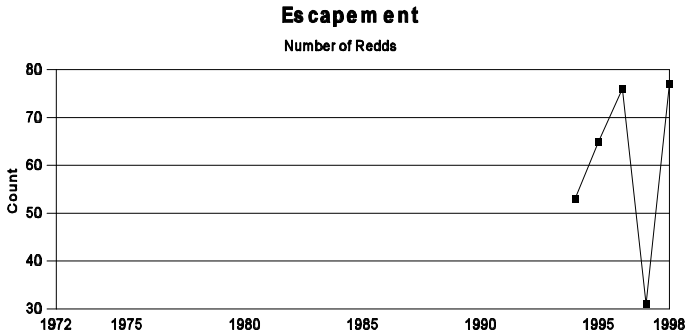
STOCK STATUS PROFILE for Mid-Strait Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Redds	ESCAPE Redds		
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986				
1987				
1988				
1989	18			
1990	48			
1991	32			
1992	42			
1993	52			
1994	73	53		
1995	141	65		
1996	180	76		
19997	52	31		
1998	118	77		





Col. 1 Barnes Cr; Col. 2 Lyre River

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

and the coastal foothills along the Strait of Juan de Fuca. An impassable barrier falls in the Lyre River isolated Lake Crescent about 500 years ago (Behnke 1979, Pierce 1984, McHenry et al. 1996). Lake Sutherland also supports a coastal cutthroat population. We do not know if there are other fluvial or adfluvial forms of coastal cutthroat in this stock complex. Specific spawn timing is unknown, but is probably from January through April for all life history forms in most mid-Strait drainages. Coastal cutthroat have been observed spawning in mid-November downstream from Lake Crescent in the upper Lyre River and Boundary Creek, a tributary to the Lyre River (John Meyer, ONP, personal communication), several months earlier than other cutthroat populations.

STOCK STATUS

The status of the Mid-Strait stock complex is Unknown. While quantitative data useful for trend analysis are limited, coastal cutthroat were found to be abundant in a variety of drainages sampled during the course of genetic investigations in 1995. In addition, juvenile abundance and presence/absence information is available from electrofishing or smolt trapping in a variety of streams.

In the Lake Crescent system, spawner surveys for cutthroat redds have been conducted by ONP staff on Barnes Creek since 1989. In Barnes Creek, a total of 18, 48, 32, 42, 52, 73, 141, 180, and 52 redds were observed from 1989 through 1997, respectively. Since 1994, ONP staff have monitored a previously unknown (presumed cutthroat) spawning population downstream of the park boundary in the Lyre River and Boundary Creek. A total of 53, 65, 76, 31, and 77 redds were observed from 1994 through 1998, respectively (J. Meyer, ONP, personal communication).

FACTORS AFFECTING PRODUCTION

Habitat--Major limiting habitat factors include altered annual instream flow regimes and associated seasonal flooding and low summer flows, loss of access due to human-caused barriers, water quality and quantity problems in the areas of concentrated land development, degraded instream and riparian habitat, land conversions from forest to agricultural or residential use, and alteration and loss of wetlands and estuarine habitats (Williams et al. 1975, McHenry et al. 1996).

Harvest Management--The statewide general fishing season (June 1 through October 31) and standard regulations in streams, rivers, and beaver ponds (two-trout per day, eight-inch minimum size limit), protect resident juveniles and migrating smolts from harvest. Where adult anadromous fish and freshwater fisheries exist, regulations allow a two-fish daily limit, with a 14-inch minimum size limit. The 14-inch minimum size limit is based on data on length frequency, age, and sexual maturity, and is intended to protect first-time spawners and some repeat spawners from harvest. Beginning with the 1994 season, the National Park Service changed the minimum size limit in Lake Crescent from

12 inches to 20 inches to allow a greater proportion of fish to spawn and to shift the size distribution closer to the historic age structure (Olympic National Park 1994).

Hatchery--There have been no releases of hatchery coastal cutthroat trout in this area. Interactions with other hatchery-origin salmonids have not been examined. Elwha River continues to receive plants of winter steelhead, with an annual goal of 155,000 smolts. Summer steelhead are also released annually into the Elwha (10,000) and Lyre (10,000).

STRAIT OF JUAN DE FUCA — WESTERN STRAIT COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Western Strait coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. This stock complex is composed of coastal cutthroat trout in drainages flowing north into the western Strait of Juan de Fuca (from the Pysht River west to Cape Flattery). Drainages include the Pysht, Clallam, Hoko, Sekiu and Sail rivers and Falls, Olsen, Jansen, Rasmussen, Bullman, Snow, Agency, Village, Classet, Middle, and Beach creeks and unnamed independent tributaries.

Drainages comprising the Western Strait stock complex originate in the foothills of the Olympic Mountains and share characteristics such as size, aspect, hydrology, and land use. Most streams contain low to moderate gradients in the lower watersheds and steep gradients in the upper watersheds which are often impassable to anadromous fish. However, some drainages in this area are typical lowland streams with generally low to moderate gradients dependent on groundwater run-off for year-round flows. Several of the larger streams have a tidal influence extending upstream for several miles creating extensive estuaries (Williams et al. 1975, McHenry et al. 1996).

We know that anadromous and resident life history forms are present in the Western Strait stock complex. Resident cutthroat are likely present upstream of most barriers to anadromous fish. It is unknown whether there are fluvial or adfluvial forms of coastal cutthroat in this stock complex.

Anadromous coastal cutthroat in the Western Strait stock complex are predominantly late entry. Specific spawn timing is unknown but is probably from January through April for all life history forms in most western Strait drainages.

Greater or fewer numbers of distinct spawning populations may be identified once comprehensive genetic, life history, and ecological information is available. During 1995, coastal cutthroat samples were collected for genetic analysis from Bear Creek, a Hoko River tributary. Results of this analysis are not yet available.

Wild coastal cutthroat in this stock complex are native and sustained by natural production.

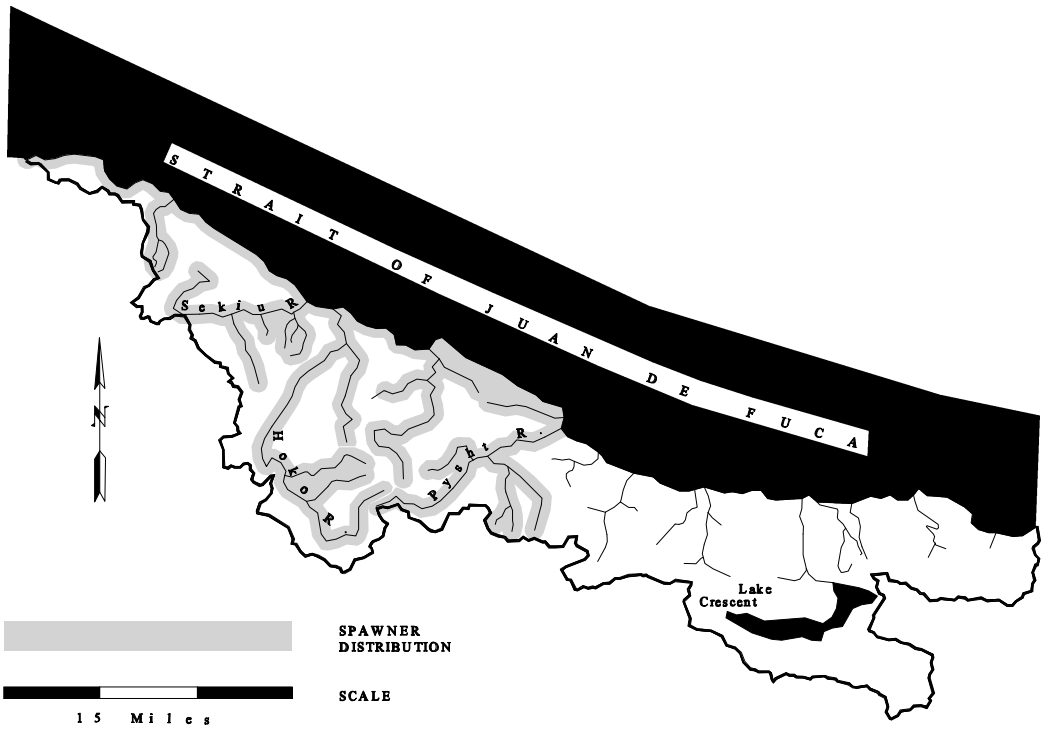
STOCK STATUS

The status of the Western Strait stock complex is Unknown. Available quantitative data on abundance or survival are insufficient to assess stock status. While quantitative data

STOCK DEFINITION PROFILE for Western Strait Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■									■	No
Anad Spawning	■	■	■	■	■								No
Resident Spawning	■	■	■	■	■								No

Timings are unknown. These timings are based on flows in western Strait streams.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Western Strait Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

useful for trend analysis are limited, juvenile abundance and presence/absence information is available for a variety of streams.

FACTORS AFFECTING PRODUCTION

Habitat--Habitat factors limiting production include altered annual instream flow regimes and associated seasonal flooding and low summer flows, loss of access due to human-caused barriers, elevated water temperatures, increased sedimentation and other water quality and quantity problems, degraded instream and riparian habitat, land conversions from forest to agricultural or residential use, and alteration and loss of wetlands and estuarine habitats (Williams et al. 1975, McHenry et al. 1996).

Harvest Management--The statewide general fishing season (June 1 through October 31) and standard regulations in streams, rivers, and beaver ponds (two-trout per day, eight-inch minimum size limit), protect resident juveniles and migrating smolts from harvest. Where adult anadromous populations and freshwater fisheries exist, regulations allow a two-fish daily limit, with a 14-inch minimum size limit. The 14-inch minimum size limit is based on data on length frequency, age, and sexual maturity, and protects first-time spawners and some repeat spawners from harvest.

Hatchery--There have been no releases of hatchery-origin coastal cutthroat trout in this area. Interactions with other hatchery-origin salmonids have not been examined. Hatchery winter steelhead releases include annual releases into the Hoko (20,000), Sail (10,000) and Sekiu (10,000) rivers.

OZETTE — OZETTE COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Ozette coastal cutthroat stock complex has been identified as distinct based on geographic distribution of its spawning grounds. This stock complex includes cutthroat in the Ozette River, Ozette Lake and its 12 tributaries as well as in several smaller independent tributaries to the Pacific Ocean. Streams in this area include the Ozette River, Coal Creek, Umbrella Creek, Big River, Crooked Creek, and Siwash Creek. Ozette Lake is 7,787 acres and is the third largest natural lake in Washington. The Ozette River drains Ozette Lake in a northwesterly direction and enters the Pacific Ocean near Cape Alava.

The number of genetically distinct stocks within the Ozette stock complex, and the relationship of this complex to other stocks and stock complexes are unknown. Genetic sampling and analysis are needed to make these determinations.

Spawner distribution is distinct for this stock complex, but specific spawning locations are unknown. Coastal cutthroat probably spawn in the upper reaches of tributaries throughout the drainage. Coastal cutthroat are also found in lowland lakes and beaver ponds in the watershed.

Life histories of coastal cutthroat in the Ozette drainage are probably similar to those described by June (1981) in Bear Creek, a tributary to the Bogachiel River, located south of the Ozette drainage on the Olympic Peninsula. Anadromous cutthroat in Bear Creek spawn from January through March whereas resident cutthroat spawn in April and May (June 1981). For a description of the life history of Bear Creek coastal cutthroat please refer to the Quillayute stock report.

Coastal cutthroat trout are native to the Ozette River drainage and are sustained by wild production.

STOCK STATUS

The status of the Ozette stock complex is Unknown since there is insufficient quantitative information to identify a trend in abundance or survival.

FACTORS AFFECTING PRODUCTION

Habitat--Ozette Lake is contained entirely within the boundaries of Olympic National Park. However, the majority of the watersheds entering the lake are owned by private timber companies. Thus the original forest has been converted to managed plantations, and road densities are very high (McHenry et al. 1996). As a result,

STOCK DEFINITION PROFILE for Ozette Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**

TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■										■	No
Anad Spawning	■	■	■	■	■								No
Resident Spawning				■	■	■							No

Timings are unknown. These timings are based on those for the Quillayute stock complex.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Ozette Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

considerable habitat degradation associated with intensive logging along the tributaries of Ozette Lake has occurred. Sediment levels in spawning gravels are among the highest on the Olympic Peninsula, and summer temperatures are elevated above state water quality standards in Umbrella Creek, Crooked Creek, and Big River. Siltation of tributary spawning grounds has caused cementing of gravels and appears to be correlated with the number of logging roads in the basin. The logging road systems, particularly in the upper tributaries, have degraded stream habitat in the western Olympic Peninsula for at least 30 years (McHenry et al. 1996).

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The current sport fishing regulations in the Ozette system include a 14-inch minimum size limit in the larger mainstem and catch-and-release in the marine waters. These regulations are intended to protect anadromous first-time spawners and some repeat spawners from harvest. Smaller streams within the drainage are open from June 1 through October 31 with a current daily limit of two fish and a minimum size limit of eight inches to protect resident cutthroat, rearing juveniles and outmigrating smolts. Fishing closures during the spawning season in the smaller streams also protect cutthroat. There are no net fisheries targeting Ozette River coastal cutthroat.

Hatchery--There is no hatchery program for anadromous or resident cutthroat for the Ozette River system. Sockeye salmon fry are released into Ozette Lake, and it is believed that cutthroat prey heavily on the juvenile sockeye. There have been no hatchery steelhead releases into the Ozette system.

QUILLAYUTE — QUILLAYUTE COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Quillayute coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. The Quillayute River Basin is composed of four major watersheds encompassing 629 square miles on the west side of the Olympic Peninsula in Washington State. These watersheds are the Sol Duc, Bogachiel, Calawah, and Dickey river systems. They collectively form the Quillayute River, which empties into the Pacific Ocean at LaPush on the Quileute Indian Reservation.

The number of genetically distinct stocks within the Quillayute stock complex and the relationship of this complex to other stocks and stock complexes are unknown. Genetic sampling and analysis are needed to make these determinations. Genetic collections have been analyzed for Cedar and Bear creeks, both Sol Duc tributaries, and for Goodman Creek on the Quillayute River. All collections are significantly different from one another and from other coastal collections.

With the exception of sites located by June (1981) in another Bear Creek, a tributary to the Bogachiel River, specific spawning locations are unknown. Coastal cutthroat probably spawn in the upper reaches of tributaries throughout the drainage and are also found in lowland lakes and beaver ponds throughout the Quillayute system.

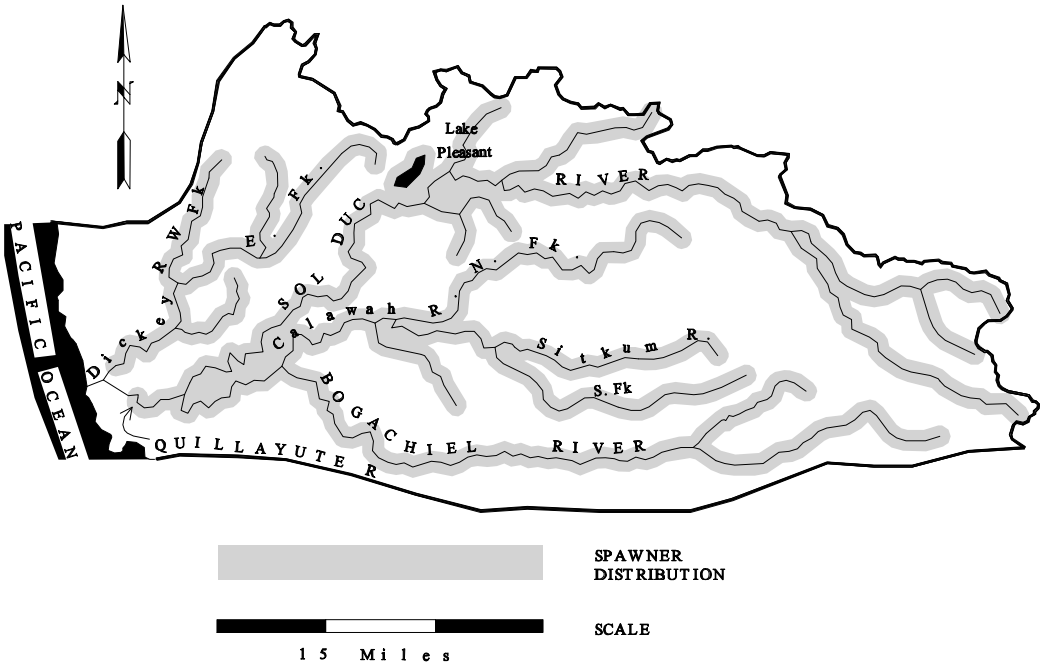
The following life history information on coastal cutthroat in the Quillayute drainage is taken from June's (1981) study of coastal cutthroat in Bear Creek. Bear Creek anadromous cutthroat migrate upstream in December and January. This is similar to the run timing observed for late-entry anadromous cutthroat in Oregon, British Columbia, and elsewhere in Washington. Fish were observed spawning from January through March with peak spawning occurring in February. Similar spawning times have also been observed in Oregon and other Washington streams. Anadromous cutthroat spawned in small tributary streams, choosing the tails of pools for most redd sites with water depths of five to ten cm. Outmigration timing for anadromous cutthroat kelts was generally before the end of April. Mature anadromous spawners averaged 300 mm to 400 mm (12 to 16 inches) in fork length.

Bear Creek resident cutthroat trout spawned in April and May, and the size of redds constructed by resident fish was 50% smaller than that observed for sea-run fish. Timing, location and size of resident redds in Bear Creek compared closely with those reported for other Washington streams (Hunter 1973). Resident cutthroat in Bear

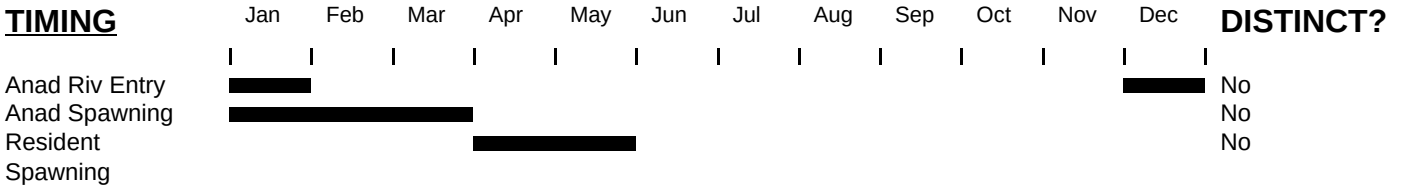
STOCK DEFINITION PROFILE for Quillayute Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



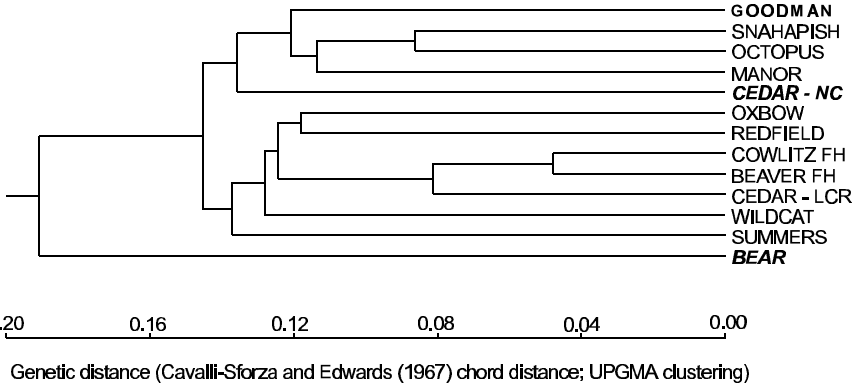
TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Goodman Cr. (N=32) collection, made in 1995, was significantly different from other North Coast collections (33 allzyme-locus G-tests; *P*<0.001). It shows some frequencies similar to those in North Sound collections.



STOCK STATUS PROFILE for Quillayute Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Creek spawned as two year-old fish at a mean length of 122 mm and as three year-old fish at mean length of 144 mm. The observed differences in the timing and spawning of resident and sea-run cutthroat in the Quillayute system would reduce the opportunity for interbreeding and possibly maintain genetic isolation between the life history forms. Mean time to emergence was 9 to 10 weeks, peaking in late May to early June, as in California, Oregon, and other Washington areas. Resident cutthroat trout were found to emerge in early July approximately eight weeks after egg deposition.

Four age groups of cutthroat trout were identified in Bear Creek: first-year, second-year, third-year and fourth-year and older (0, I, II, III+). Numbers and density of cutthroat trout in their first year were dependent upon streamflow during spawning migrations. Increases in the number of one to two-year-old fish cutthroat between April and July may be attributed to immigration of fish from overwintering areas. Young-of-the-year fry either moved or were displaced to these areas during the first fall storms in October and November. The large decrease in fish in their third year fish between April and July was due to smolt outmigration.

Density, biomass, and production of cutthroat in Bear Creek were similar to values reported for cutthroat in other Northwest streams. In five study sections in Bear Creek during 1977-78 the average cutthroat density range from 0.016 to 0.195 fry per m^2, 0.052 to 0.255 juveniles/m^2, and 0.008 to 0.027 adults/m^2. The average cutthroat biomass ranged from 0.027 to 0.494 grams of fry/m^2, 0.578 to 1.003 grams of juveniles/ m^2, 0.107 to 0.982 grams of adults/m^2.

Cutthroat juveniles migrated or were displaced downstream to overwintering areas by fall storms but returned upstream to the study areas as second-year fish between April and July. Cutthroat trout moved very little within the study area during the summer months. However, ripe resident fish moved significantly more than unripe fish. Anadromous juveniles in their second and third years, outmigrated in May and June on the decreasing flows of freshets.

Fuss (1978) studied coastal cutthroat in other Quillayute tributaries. A Sol Duc River sample had a high percentage of large third-year fish in the fall primarily because a high percentage within the sample had migrated to the sea in their third year. Almost all fish in their fourth year or older had migrated. Although the sample size was small, Sol Duc River fish enter the ocean at smaller average sizes in their third and fourth year than do fish from other systems (Fuss 1978). From a sample size of 22 Sol Duc River fish, the average length of fish which initially migrated to the sea in their third, fourth and fifth years was 169 mm, 191 mm, and 212 mm, respectively. The percent age composition from this sample was 64% third-year fish, 27% fourth-year fish, and 5% fifth year and older fish. From a sample size of 12 Dickey River fish the average length of third-year and fourth-year initial ocean migrants was 199 mm and 211, respectively. The percent age composition from this sample was 15% third-year fish and 83% fourth year fish.

Cutthroat trout are native to the Quillayute River system and are sustained by wild production.

STOCK STATUS

The status of the Quillayute River coastal cutthroat stock complex in Unknown since there is insufficient quantitative information to identify a trend in abundance or survival.

FACTORS AFFECTING PRODUCTION

Habitat--The majority of the Quillayute drainage is used for commercial timber production. Land managers include the Washington Department of Natural Resources, United States Forest Service, the National Park Service, large private timber companies and individual property owners. Industrial development is limited to several small saw mills and the Portac mill near Lake Pleasant. The major population center is in the town of Forks. Suburban and rural residential development has occurred primarily along the lower Sol Duc River and mainstem Calawah River (DeCillis 1992).

Along the North Fork Calawah River and Sol Duc River tributaries, riparian habitat has been extensively converted from conifers (spruce and hemlock) to hardwoods (alder) as a result of logging. Alder typically provides short-lived in-stream large woody debris compared with conifers. Throughout the basin, road construction and timber harvest have resulted in excessive erosion, mass wasting, and sedimentation of tributaries and mainstem rivers.

The Sol Duc River has been impacted by high levels of sedimentation as a result of road construction associated with timber harvest and a history of intense fires. The lower-gradient reaches downstream have been unable to transport the increased sediment, resulting in stream bed aggradation and frequent channel migration and braiding.

There is very little woody debris in the aquatic ecosystem as a result of these activities. Consequently the number of pools and amount instream cover for fish have been reduced.

Decreases in salmonid production resulting from changes in habitat quality and quantity have not been directly measured in the Quillayute drainage (DeCillis 1992). Given the reduced amount of harvestable timber due to environmental restrictions and past rates of harvest, the watershed may now be entering a period of dormancy and/or recovery in some basins. Changes in hydrology, sediment input and temperature will occur as replanted conifers mature and roads are abandoned. However, streams currently lacking adequate riparian zones for the recruitment of large wood debris present a more persistent long-term problem. Major log haul routes with multiple stream crossings and improper drainage will remain pathways for sediment transport.

Along the Oregon coast the Alsea Watershed Study evaluated the effects of timber harvest on streams and their salmonid populations. The long-term study compared an unlogged control watershed with one that was completely clear-cut and another that was patch-cut with buffer zones left along the main channel (Hicks et al. 1991). Cutthroat resident in the clear-cut basin during the late summer decreased to about one-third of their prelogging abundance immediately following logging. Their numbers remained low for the entire postlogging study period. Abundance of cutthroat did not change in the patch-cut or control streams. However, in Carnation Creek, British Columbia, cutthroat smolt abundance did not change following logging (Hartman 1987).

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The current sport fishing regulations in the Quillayute system include a two-fish daily limit with a 14-inch minimum size limit in the larger mainstem and in the marine waters. This regulation is intended to protect anadromous first-time spawners and some repeat spawners from harvest. The smaller streams are open from June 1 through October 31 with a current daily limit of two fish and a minimum size limit of eight inches to protect resident cutthroat, rearing juveniles and outmigrating smolts. Fishing closures during the spawning season in the smaller streams also protect resident females. There are no net fisheries targeting Quillayute River coastal cutthroat.

Hatchery--There is no hatchery program for anadromous or resident cutthroat for the Quillayute River system. Releases of hatchery-origin coho fry in streams can reduce the production of cutthroat in the system. Juvenile coho salmon and coastal cutthroat are potential competitors for food and space during the summer season of low stream flows (Glova and Mason 1977). Significant coho fry releases occurred basin-wide in the mid-1980s. This program was eliminated in 1990 because of poor adult returns (WDFW and WWTIT 1994). Tripp and McCart (1983) found that both young-of-the-year and older cutthroat trout populations were adversely affected by the stocking of coho fry. The greatest effects on the survival of cutthroat were associated with high coho stocking densities. Also, high densities and early stocking of coho fry both slowed the growth of cutthroat fry, presumably as a result of interspecific competition.

Approximately 15,000 to 220,000 hatchery winter steelhead smolts and 50,000 hatchery summer steelhead smolts are stocked into the Quillayute system each year. Steelhead smolts are stocked in the lower watershed and migrate downriver to the ocean quickly and therefore should have minimal impact on river-dwelling cutthroat populations. Juvenile steelhead move offshore soon after entering the ocean and begin to move northward as they move away from the coasts of Oregon and Washington (Burgner et al. 1992). The rapid movement of juvenile steelhead to offshore waters reduces interspecific competition with anadromous cutthroat in near-shore waters.

HOH — HOH COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Hoh coastal cutthroat are considered a distinct stock complex based on the geographic distribution of their spawning grounds. The Hoh River is the third largest drainage on the Olympic Peninsula with a total length of 56.1 miles and a watershed area of 299 square miles, 65 percent of which lies within the boundaries of Olympic National Park. The national park boundary on the mainstem Hoh and South Fork Hoh begins at river miles 29.6 and 5.3, respectively, and the upstream anadromous limits for the Hoh River are at RM 48 at Falls Creek and at RM 13 on the South Fork Hoh. The Hoh River drains the east, north and west slopes of Mt. Olympus and is influenced by six active glaciers (McHenry et al. 1996).

The mainstem and South Fork Hoh River valleys are strongly U-shaped, due to glacial carving, and a series of relict river terraces influences the tributaries. Four distinct riverine habitats strongly affect juvenile fish production: (1) main river channel (2) side-channel (3) terrace tributaries and (4) valley tributaries (Sedell et al. 1984). Side channels are subsidiary channels to the main river which are located within the active exposed lower flood plain. Stable side channels are protected at their upstream ends by large woody debris, boulders, bedrock, or living vegetation. Terrace tributaries result from spring networks on the flat valley floor and from tributaries draining the valley side-slopes and continuing across the terraces to the main river on the South Fork Hoh River. Valley-wall tributaries are second- or third-order streams that drop rapidly off the side slopes or valley wall and then enter a larger stream or river.

The number of genetically distinct stocks within the Hoh stock complex and the relationship of this complex to other stocks and stock complexes are unknown. Genetic sampling and analysis has not been done on Hoh River cutthroat.

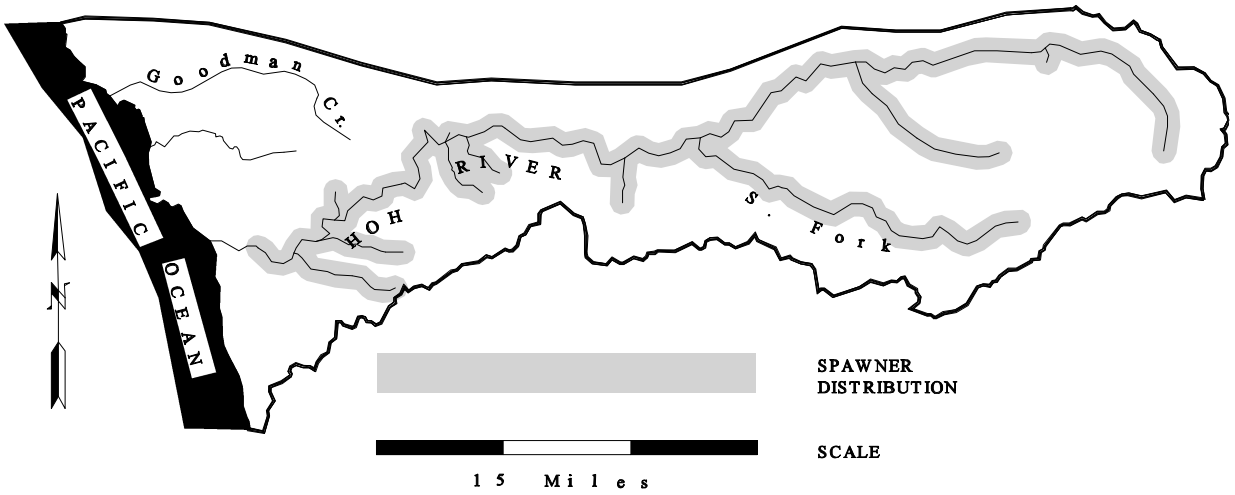
Coastal cutthroat trout are native to the Hoh River drainage. Spawner distribution is distinct for this stock complex, but specific spawning locations are unknown. Coastal cutthroat most likely spawn in the upper reaches of tributaries throughout the drainage. Coastal cutthroat are also found in lowland lakes and beaver ponds in the watershed.

Life histories of coastal cutthroat in the Hoh River drainage are probably similar to those described by June (1981) in Bear Creek, a Bogachiel River tributary with anadromous cutthroat entering the river in December and January and spawning from January through March. Resident cutthroat spawn in April and May (June 1981). For a more complete description of the life history of Bear Creek coastal cutthroat, please refer to the Quillayute River stock report.

STOCK DEFINITION PROFILE for Hoh Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■											■	No
Anad Spawning	■	■	■	■	■								No
Resident Spawning				■	■	■							No

Timings are unknown. These timings are based on those for the Quillayute stock complex.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Hoh Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Hoh River first-time outmigrants were fish in their third (22%) and fourth (78%) years (Fuss 1978). The average length of third-year and fourth-year initial ocean migrants from a sample of 18 fish was 180 mm and 224 mm, respectively.

Hoh coastal cutthroat are native and are sustained by wild production.

STOCK STATUS

The status of the Hoh River coastal cutthroat stock complex is Unknown because there is insufficient quantitative information to identify a trend in abundance or survival.

In 1980 Sedell et al. (1984) reported cutthroat densities of 0.05 fish/m^2 in terrace tributaries and 0.02 fish/m^2 in stable side-channels. In 1978 and 1980 cutthroat densities were 0.05/m^2 and 0.01/m^2 in valley-wall tributaries, respectively.

FACTORS AFFECTING PRODUCTION

Habitat--The Washington Department of Natural Resources initiated an aggressive logging campaign designed to rapidly convert the ancient forest to tree farms during the 1960s and 1970s in the Hoh Basin (McHenry et al. 1996). The logging road systems particularily in the upper tributaries have degraded stream habitat in the western Olympic Peninsula for at least 30 years. From 1981 to 1990 a total of 139 separate mass wasting events occurred along the South Fork Hoh River. In the South Fork Hoh River and estimated 34 percent of the sediment from the slope failures from 1989 to 1990 ended up directly in salmonid habitat of the South Fork Hoh River. Tributaries and side channels had fine sediment (<0.85 mm) levels in spawning gravels of 41 and 21 percent, respectively. Compared to streams in Olympic National Park similar habitats averaged 9.7 and 12.7 percent fine sediment in tributaries and side channels, respectively. In the South Fork Hoh River, macroinvertebrate abundance and diversity were 40 to 75 percent less than in similar habitats in Olympic National Park (McHenry 1991).

Sedell et al. (1984) showed that virtually all juvenile coho salmon and cutthroat trout and 87 percent of juvenile steelhead reared in off-channel habitats along the valley floor of the South Fork Hoh River.

Along the Oregon coast the Alsea Watershed Study evaluated the effects of timber harvest on streams and their salmonid populations. The long-term study compared an unlogged control watershed with one that was completely clear-cut and another that was patch-cut with buffer zones left along the main channel (Hicks et al. 1991). Cutthroat resident in the clear-cut basin during the late summer decreased to about one-third of their prelogging abundance immediately following logging. Their numbers remained low for the entire postlogging study period. Abundance of cutthroat did not change in the patch-cut or

control streams. However, in Carnation Creek, British Columbia cutthroat smolt abundance did not change following logging (Hartman 1987).

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The current sportfishing regulations on the Hoh River have a two-fish daily limit with a 14-inch minimum size limit in the larger mainstem and in the marine waters. This regulation is intended to permit most female anadromous cutthroat to spawn at least once prior to harvest. The smaller streams are open from June 1 through October 31 with a current daily limit of two fish with a minimum size of eight inches to protect resident fish, rearing juveniles and outmigrating smolts. Fishing closures during the spawning season in the smaller streams also protect cutthroat. There are no net fisheries targeting Hoh River coastal cutthroat.

Hatchery--There is no hatchery program for anadromous or resident cutthroat for the Hoh River system. Only limited hatchery activity has occurred with salmon stocks in the Hoh River, and it probably does not affect cutthroat production. Approximately 50,000 hatchery winter steelhead smolts are stocked into the Hoh system each year. Steelhead smolts are released into the mainstem and migrate downriver to the ocean quickly and probably have minimal impact on cutthroat populations. Juvenile steelhead move offshore soon after entering the ocean and begin to move northward as they move westward from the coasts of Oregon and Washington (Burgner et al. 1992). The rapid movement of juvenile steelhead to offshore waters reduces interspecific competition with anadromous cutthroat in near-shore waters.

QUEETS — QUEETS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Queets coastal cutthroat stock complex has been identified as distinct based on geographic distribution of its spawning grounds. The glacially-influenced Queets River originates on the southern slopes of Mt. Olympus and is the second largest drainage on the Olympic Peninsula with a total length of 51.4 miles. The upper Queets River flows through a U-shaped valley within lands managed by Olympic National Park. A mile-wide river corridor of Olympic National Park land continues to protect the Queets downstream to RM 6.8 where the river enters the Quinault Indian Reservation. Major tributaries to the Queets River include the Clearwater River, Salmon River, Sams River and Matheny Creek.

The number of genetically distinct stocks within the Queets stock complex and the relationship of this complex to other stocks and stock complexes are unknown. For genetic analysis Queets cutthroat were represented by three samples, Snahapish River, Manor and Octopus creeks. All three collections were significantly different from one another and from other North Coast cutthroat collections.

Life histories on Queets coastal cutthroat are probably similar to those described by June (1981) in his Bear Creek (Bogachiel River tributary) study, with anadromous river entry in December and January, anadromous spawning from January through March and resident cutthroat spawning in April and May.

Spawning distribution of coastal cutthroat occurs in the upper reaches of tributaries throughout the drainage. Edie (1975) identified the uppermost zone in the basin as the domain of coastal cutthroat. The cutthroat zone in the Clearwater River consists of the headwaters of most tributaries with gradients of 2% to 6% and one to 10 feet wide. The cutthroat zone is infrequently inaccessible to sea-run fish and inhabited mainly by resident cutthroat. Coastal cutthroat are also found in lowland lakes and beaver ponds in the watershed.

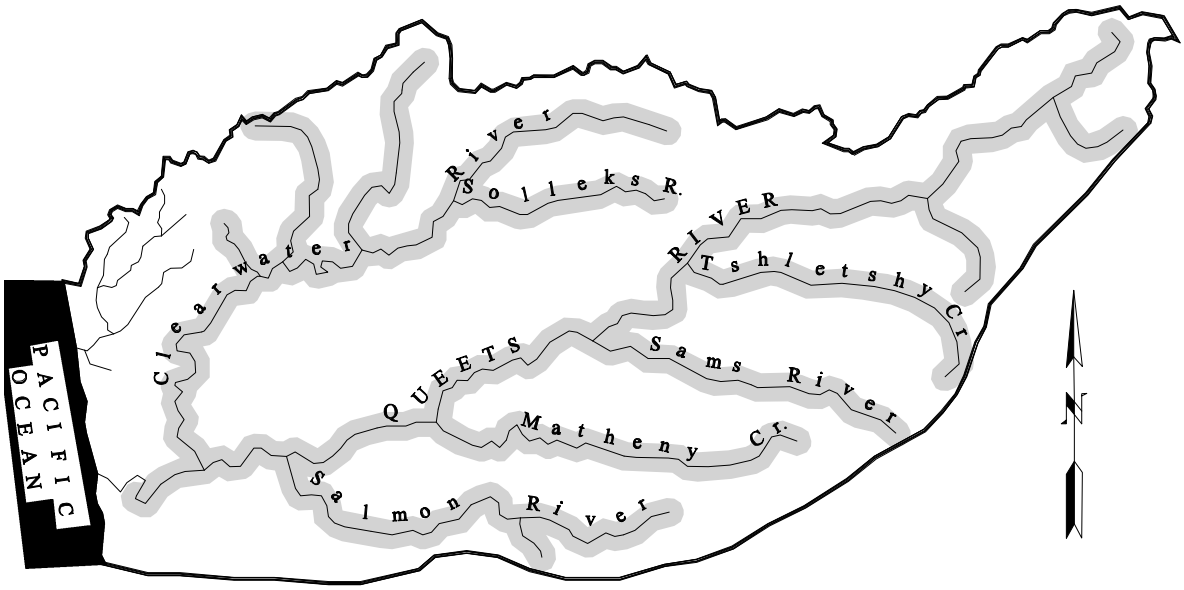
The Snahapish River is a major tributary of the lower Clearwater River and is a large coastal cutthroat producer. Fuss (1978) found that cutthroat smolts ranged from 148 mm to 212 mm in length and consisted primarily of fish in their fourth year. From a sample size of 24 Clearwater River fish the average length of third-year, fourth-year, fifth-year initial ocean migrants was 168 mm, 220 mm, and 235 mm, respectively. The percent age composition from this sample was 33% third-year fish, 63% fourth-year fish, and 4% fifth-year fish.

Sedell et al. (1984) estimated cutthroat densities during 1981 in the upper Queets River from four major habitat types. The cutthroat densities for each habitat type were: (1)

STOCK DEFINITION PROFILE for Queets Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



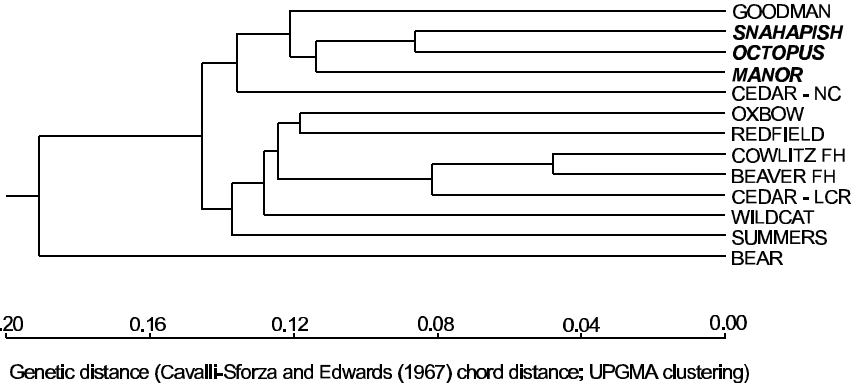
TIMING

Timings are unknown. These timings are based on those for the Quillauyte stock complex.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Snahapish (1995, N=56), Manor Cr. (1997, N=31) and Octopus Cr. (1997, N=42) collections were significantly different from each other and from other North Coast collections (33 allozyme-locus G-tests; *P*<0.001). The Snahapish and Goodman Cr. (Quillayute stock complex) collections also differed at microsatellite DNA loci (6-locus G-tests; *P*<0.0001).



STOCK STATUS PROFILE for Queets Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

terrace tributaries (0.04/m^2; (2) side channels (0.004/m^2); (3) lower valley-wall tributaries (0.05/m^2); (4) major tributary channels (0.001/m^2).

Coastal cutthroat trout in the Queets River drainage are native and are sustained by wild production.

STOCK STATUS

The status of the Queets River coastal cutthroat stock complex is Unknown because there is insufficient quantitative information to identify a trend in abundance or survival.

FACTORS AFFECTING PRODUCTION

Habitat--The majority of the watersheds that lie outside Olympic National Park have been extensively logged and roaded, particularly Matheny Creek and Sams River (McHenry et al. 1996). Road density is positively correlated with fine sediment levels in streambeds including spawning gravels (McHenry et al. 1996). The Clearwater watershed is managed almost entirely for commercial timber production by the Washington Department of Natural Resources and various private timber owners. Approximately 75 percent of the basin has been harvested at least once. Miles of logging roads were constructed to access the timber, and substandard road-building techniques have caused stream habitat to be degraded. Two massive landslides occurred along Stequaleho Creek, a tributary of the upper Clearwater River during the spring of 1971. Cederholm and Reid (1987) reported sediment levels in Clearwater tributaries were 0.5 to 2.4 times higher than in unlogged Olympic National Park streams.

Bisson and Sedell (1984) found streams in logged watersheds contained different species compositions compared to old growth area, with higher proportions of first-year steelhead and cutthroat and lower proportions of first-year coho salmon and second-year and third-year cutthroat compared to streams in old growth forests. Shifts in species and age composition were related to habitat changes that resulted from timber harvesting and debris removal from the channels. Increases in the proportional abundance of underyearling steelhead and cutthroat trout after clearcutting is possibly explained by the preference of these fishes for riffle habitat, while relative decline of coho and older cutthroat may have resulted from the loss of pool volume and large, stable woody debris for cover.

Lestelle and Cederholm (1984) studied the effects of removing in-stream woody debris on resident cutthroat population in two headwater streams of the Clearwater River. Clearing the stream had little or no effect on numbers and biomass of cutthroat immediately after alteration and prior to winter. A decline in numbers of overwintering trout was apparently associated with habitat instability brought on by the removal of large woody debris from the

stream channel. Within one year of wood removal, the cutthroat trout population returned to pretreatment levels.

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The current sportfishing regulations in the Queets drainage include a two-fish daily limit with a 14-inch minimum size limit in the larger mainstem and catch-and-release in marine waters. This regulation is intended to permit female anadromous cutthroat to spawn at least once prior to harvest. The smaller streams are open from June 1 through October 31, with a current daily limit of two fish and a minimum size limit of eight inches to protect resident fish, rearing juveniles and outmigrating smolts. Fishing closures during the spawning season in the smaller streams also protects resident spawning cutthroat. There are no net fisheries targeting Queets coastal cutthroat.

Hatchery--There is no hatchery program for anadromous or resident cutthroat for the Queets River system. Tripp and McCart (1983) found that both young-of-the-year and older cutthroat trout populations were adversely affected by the stocking of coho fry. The greatest effects on the survival of cutthroat were associated with high coho stocking denisities. Also, high densities and early stockings of coho fry slowed the growth of cutthroat fry, presumably as a result of interspecific competition. Hatchery-origin coho releases have occurred in the Queets River to supplement wild coho production (WDFW and WWTIT 1994). The hatchery fish consist of a mixture wild brood stock and introduced Quinault River hatchery stock. Currently, 110,000 coho smolts are stocked into the Queets annually. Wild coho brood stock fry and smolt releases have occurred in the Clearwater River basin where production consists of cultured wild brood stock. A non-native hatchery stock derived from a variety of brood sources has been introduced into the Salmon River. The hatchery coho program for the Salmon River calls for release of 800,000 smolts annually.

Hatchery winter steelhead smolts are released into the Salmon River (800,000 annually) and originate from Queets River and Quinault River stocks each year. Steelhead smolts are released into the mainstem and migrate downriver to the ocean quickly and therefore should have minimal impact on cutthroat populations. Juvenile steelhead move offshore soon after entering the ocean and begin to move northward as they move westward from the coasts of Oregon and Washington (Burgner et al. 1992). The rapid movement of juvenile steelhead to offshore waters reduces interspecific competition with anadromous cutthroat.

QUINAULT — RAFT/QUINAULT COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Raft/Quinault coastal cutthroat stock complex is thought to be distinct based upon the geographic distribution of its spawning grounds. The Raft River is an independent stream located north of the Quinault River and drains lowlands similar to those drained by north side tributaries of the Quinault River below Lake Quinault. Consequently coastal cutthroat trout in the Raft and Quinault rivers have been grouped into the same stock complex. The Raft and Quinault rivers are located within the Quinault Indian Nation Reservation and the Olympic National Park.

The number of genetically distinct stocks within the Raft/Quinault stock complex and the relationship of this complex to other stocks and stock complexes are unknown. Genetic sampling and analysis are needed to make these determinations, however no samples have been collected.

Anadromous and fluvial cutthroat are found in the mainstems and accessible tributaries as well as in the lake. Adfluvial fish are found in Quinault Lake, located at RM 33 on the Quinault River. Quinault Lake provides the opportunity for adfluvial fish to contribute to the anadromous life history form in this drainage. Resident cutthroat are expected to be found throughout the watershed, above barriers to anadromous fish, in most perennial tributaries.

Anadromous cutthroat enter the river from October through April (early and later entry), while spawning occurs from January through April. Fluvial and adfluvial fish spawn from January through March and resident fish early January through early April.

Stock origin is native with wild production.

STOCK STATUS

The status of the Raft/Quinault stock complex is Unknown. WDFW does not conduct surveys on the Quinault Indian Reservation or in the Olympic National Park so no abundance or survival information is available. We expect that cutthroat densities are similar to those in near-by river systems with similar habitats.

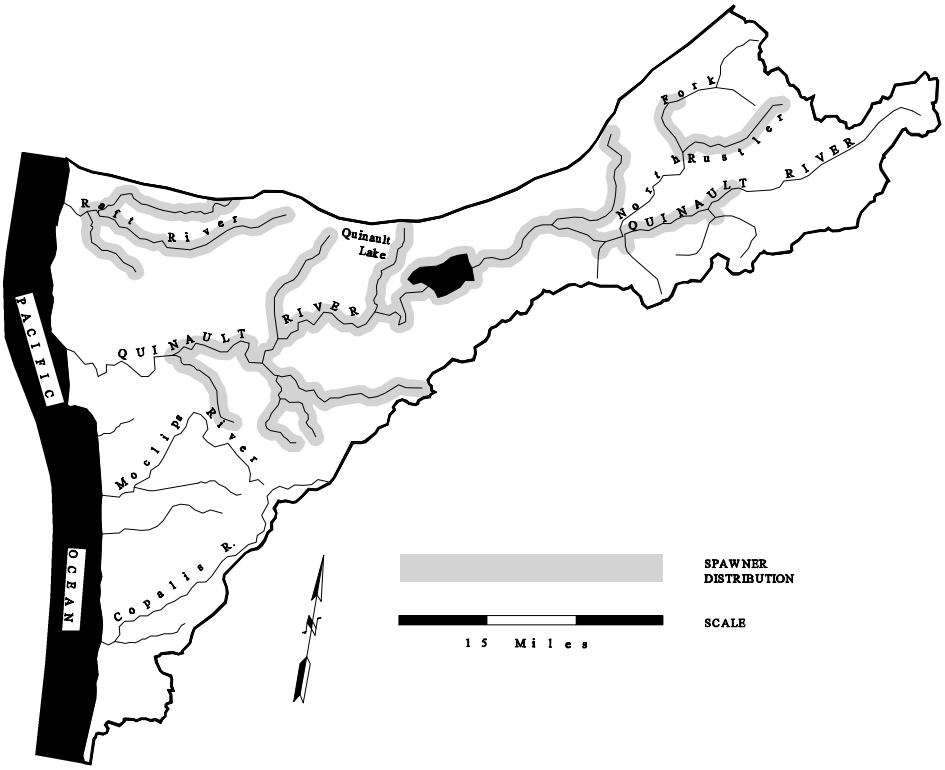
FACTORS AFFECTING PRODUCTION

Habitat--The Quinault River has some of the best fish habitat on the coast of Washington State. Stream habitat above Quinault Lake is a braided mainstem with steep tributaries often accessible to anadromous fish only in their lower reaches. The

STOCK DEFINITION PROFILE for Raft/Quinault Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■						■	■	■	No
Anad Spawning	■	■	■	■									No
Fluvial Spawning	■	■	■										No
Adfluvial Spawning	■	■	■										No
Resident Spawning		■	■	■									No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Raft/Quinault Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

upper Quinault River drains a portion of the west side of the Olympic Mountain range and is located almost entirely within the Olympic National Park.

Below the lake the watershed lies within the Quinault Tribal Reservation. This region contains numerous tributaries many of which have been degraded by logging activities which have produced debris blockages and led to siltation of spawning grounds. WDFW knows very little about the current habitat conditions of these reservation waters.

Harvest Management--The on-reservation Quinault tribal regulations allow for the harvest of 12 cutthroat per day in the Quinault River and Cook Creek, a tributary located below Quinault Lake. A non-tribal anadromous cutthroat sport fishery does occur in Lake Quinault (on reservation). Most lower Quinault tribal and non-tribal fisheries are for salmon and steelhead. Above the lake, the off-reservation regulations allow harvest of two cutthroat per day over 14 inches in length to protect first-time anadromous spawners and some repeat spawners.

The sport and tribal fisheries for anadromous cutthroat in the Quinault River are not believed to affect the production of this stock complex.

Hatchery--No hatchery production of anadromous or resident cutthroat has been pursued by the Quinault Indian Nation or the state of Washington in the Quinault River watershed. The Quinault Tribe does release coho raised in the Quinault Nation Fish Hatchery, with an annual release of 600,000 fish released into Cook Creek. Hatchery steelhead smolts are released into Cook Creek (190,000), Quinault (200,000) and Salmon River (130,000). Steelhead smolts are expected to leave freshwater soon after release and to move quickly offshore. Consequently they are not expected to interact significantly with coastal cutthroat. Excess fry are stocked in the Raft River. Interactions between steelhead fry and coastal cutthroat have not been examined.

MOCLIPS/COPALIS — MOCLIPS/COPALIS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Moclips/Copalis coastal cutthroat stock complex is thought to be distinct based upon the geographic distribution of its spawning grounds. Coastal cutthroat in the Moclips and Copalis rivers have been included in the same stock complex due to the proximity of the two streams and their habitat similarities. This stock complex also includes Wreck Creek and Joe Creek cutthroat, as well as those in independent tributaries to the north and south of the Moclips River. These streams represent a transition zone between the large rivers to the north and Grays Harbor to the south. Most of the Moclips River and Wreck Creek are located within the boundaries of the Quinault Indian Nation Reservation.

The number of genetically distinct stocks with the Moclips/Copalis stock complex and the relationship of this complex to other stocks and stock complexes is unknown. Genetic sampling and analysis are needed to make these determinations, however no samples have been collected.

Cutthroat are present in virtually all perennial tributaries and mainstem reaches of this system in one or more life history forms. The anadromous form inhabits mainstem and accessible tributary reaches, while the resident life history form is found both above and below anadromous barriers overlapping in distribution with anadromous fish.

Anecdotal information from local anglers suggests that the anadromous cutthroat in these streams may enter freshwater earlier than those in Chehalis/Grays Harbor streams to the south. River entry is thought to be nearly year-round, from June through April. Spawning by anadromous and fluvial life-history forms occurs January through March. Spawning of the resident form occurs from February through March.

Stock origin is native with wild production.

STOCK STATUS

The status of Moclips/Copalis stock complex is Unknown. No quantitative data are available for assessing population trends. Anecdotal harvest information from local anglers suggests that this population is stable.

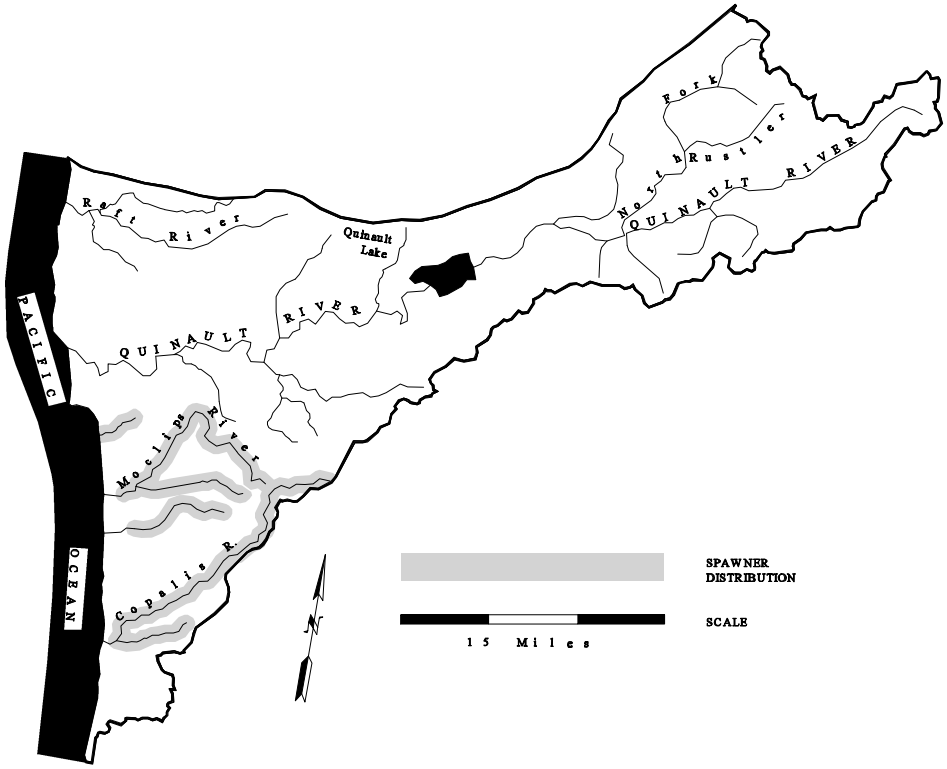
FACTORS AFFECTING PRODUCTION

Habitat--The Moclips and Copalis rivers are small streams that drain lowland areas, generally under 500 feet elevation. The low gradient results in a significant amount of

STOCK DEFINITION PROFILE for Moclips/Copalis Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■	■		■	■	■	■	■	■	Yes
Anad Spawning	■	■	■										No
Fluvial Spawning	■	■	■										No
Resident Spawning		■	■	■									No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Yes

STOCK STATUS PROFILE for Moclips/Copalis Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

fine sediment in the substrate, often with sand predominating. Debris and log-jams are common in tributaries and upper mainstem areas.

The Moclips had a historic block at RM 1.3 that is now gone. Beaver Creek, a tributary of Joe Creek, an independent stream located between the Moclips and Copalis rivers, also has a blockage to upstream passage. For Moclips, we believe that the resident population has provided a source for anadromous re-establishment and has colonized accessible waters.

Harvest Management--The lower Moclips and Copalis rivers are popular with local anglers targeting anadromous cutthroat. Fisheries regulations are designed to minimize harvest impacts on wild production. The daily limit for cutthroat in the Moclips and Copalis drainages is two fish over 14 inches in length. This regulation is intended to permit most anadromous females to spawn at least once prior to harvest. No harvest data are available. Smaller tributaries require eight-inch minimum size limit for the protection of resident cutthroat, juveniles and outmigrating smolts.

Hatchery--No releases of hatchery-origin cutthroat have been made in the Moclips and Copalis rivers or associated streams. Hatchery-origin cutthroat may stray into these waters from the Chehalis Basin to the south, but that has not been observed.

GRAYS HARBOR — HUMPTULIPS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Humptulips River coastal cutthroat stock is believed to be distinct based on its geographic spawning distribution. Grays Harbor is one of the largest estuaries on the west coast of North America and is fed by the Humptulips and Chehalis rivers.

It is possible that cutthroat from the Humptulips River should be included in the Chehalis cutthroat stock complex, but genetic information is lacking to make this determination. Genetic sampling of cutthroat from several south coastal tributaries including the Humptulips was conducted during 1995 as part of a coastwide genetics survey of coastal cutthroat by Washington, Oregon and the National Marine Fisheries Service (NMFS). The Humptulips sample was collected by Oregon State University biologists in Stevens Creek, a tributary of the Humptulips, but the analysis was not compatible with those conducted by WDFW or NMFS, so results are not presented.

River entry by anadromous fish is from January through April (late entry). Spawning by anadromous and fluvial forms occurs January through April and from February through March for the resident form.

No population maturity data are available for this stock.

No hatchery-origin coastal cutthroat have been released into the Humptulips River, however there is some potential for interbreeding with hatchery-origin anadromous cutthroat derived from other native Grays Harbor stocks utilizing the intertidal zone of the Humptulips. The Humptulips stock is considered native and is sustained by wild production.

STOCK STATUS

The status of the Humptulips stock is Unknown. Juvenile densities in Stevens Creek, a Humptulips tributary, are comparable to those of other major river tributaries sampled on the south coast . A local angler reports that the catch rate in Big Creek, a Humptulips tributary, is stable. Based on anecdotal information from local residents, cutthroat population size in the West Fork Humptulips is greatly reduced from historic levels. However, no quantitative data exist for many of these watersheds.

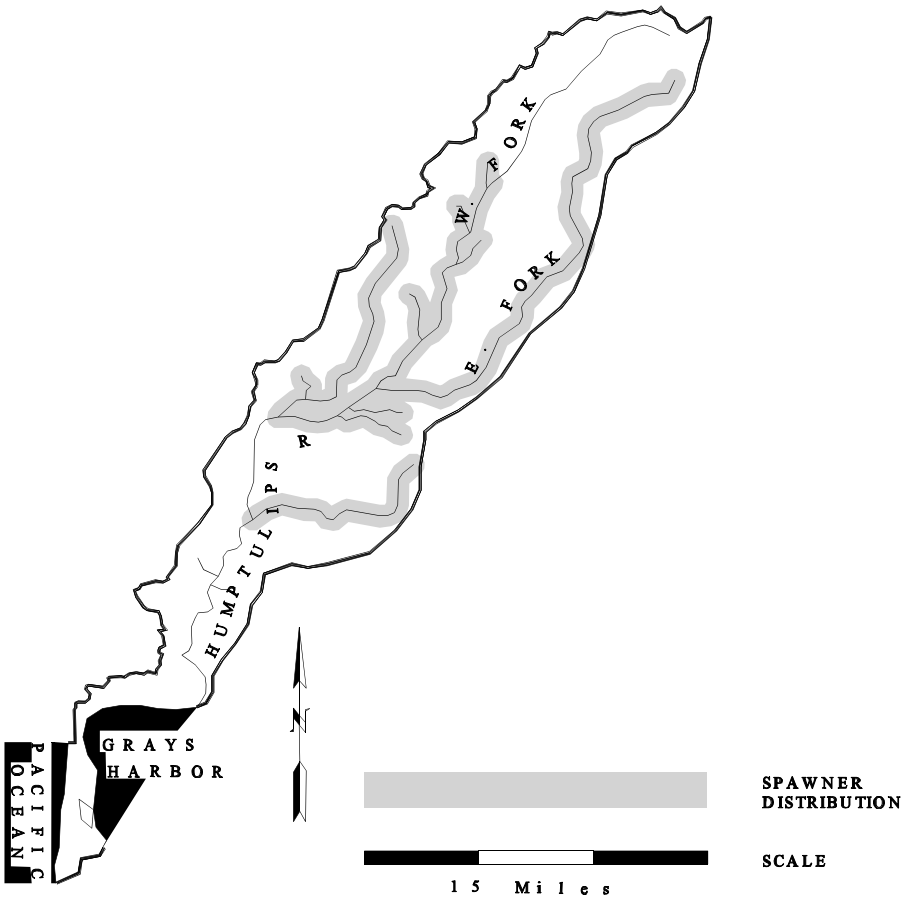
FACTORS AFFECTING PRODUCTION

Habitat--Extensive logging has occurred in this drainage and subsequent siltation from logging and related activities probably has reduced production in several tributaries.

STOCK DEFINITION PROFILE for Humptulips Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■									No
Anad Spawning	■	■	■	■									No
Fluvial Spawning	■	■	■	■									No
Resident Spawning		■	■	■									No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Humptulips Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Both anadromous and resident cutthroat spawn in small headwater tributaries that are sensitive to siltation.

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The daily limit on the Humptulips River is two fish over 14 inches. This regulation is designed to allow anadromous females to spawn at least once before being subject to harvest. The Humptulips has a historic reputation as an outstanding anadromous cutthroat stream. Prior to the current regulation, excessive harvest sometimes occurred. Little is known about current harvest impacts on resident cutthroat except that hooking mortality is approximately 50 percent when baited hooks are used.

Hatchery--There is no hatchery program for anadromous or resident cutthroat on the Humptulips River. Hatchery-origin anadromous strays from other streams entering Grays Harbor could utilize the intertidal zone of the Humptulips. Approximately 2.0 million hatchery-origin coho are released annually into the Humptulips. The majority of coho are released as smolts (1.8 million) while the remainder are eggs transfers and fry releases. Interactions between hatchery coho and wild Humptulips cutthroat have not been examined, however larger coho juveniles may compete with smaller cutthroat juveniles. Both summer and winter steelhead smolts are also released. The annual stocking goal for summer fish is 30,000 smolts and the winter steelhead goal is 150,000 smolts. Steelhead smolts are expected to migrate quickly to the ocean and then to move offshore, minimizing competition with anadromous cutthroat.

GRAYS HARBOR — CHEHALIS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Chehalis coastal cutthroat stock complex is considered distinct based on the geographic distribution of its spawning grounds. The Chehalis coastal cutthroat stock complex includes cutthroat in Johns, Hoquiam, Wishkah, Wynoochee, Satsop, Black, Skookumchuck, and Newaukum rivers, as well as in smaller tributaries and headwaters of the Chehalis.

The number of genetically distinct stocks within the Chehalis complex and the relationship of this complex to other stocks and stock complexes are unknown. Because of the variety of habitat types available to cutthroat in the basin, there may be as much genetic variation within this stock complex as there is among other stocks complexes. Further genetic sampling and analysis are needed to make these determinations. Cutthroat from several sites in the Chehalis basin were sampled for genetic analysis in 1995 as part of a coast-wide genetics survey of coastal cutthroat conducted by Washington, Oregon, and the National Marine Fisheries Service. The Chehalis stock complex is represented by a collection from Wildcat Creek which was found to be significantly different from other South Coast collections.

Cutthroat are present in virtually all perennial tributaries and mainstem reaches of this system in one or more of their life history forms. The anadromous and fluvial forms inhabit mainstem and accessible tributary reaches. The resident form exists both above anadromous barriers and below where they mix with anadromous fish. Adfluvial fish are found in many lakes in the drainage.

River entry is from October through April (early and late entry). Spawning by anadromous and fluvial life history forms occurs from January through mid-March. Adfluvial fish spawn from March through mid-April, and resident fish spawn from February through mid-March.

Until recently the WDFW Aberdeen Hatchery maintained an anadromous coastal cutthroat broodstock derived from native Grays Harbor/Chehalis stocks. Consequently Chehalis coastal cutthroat are considered native with composite production.

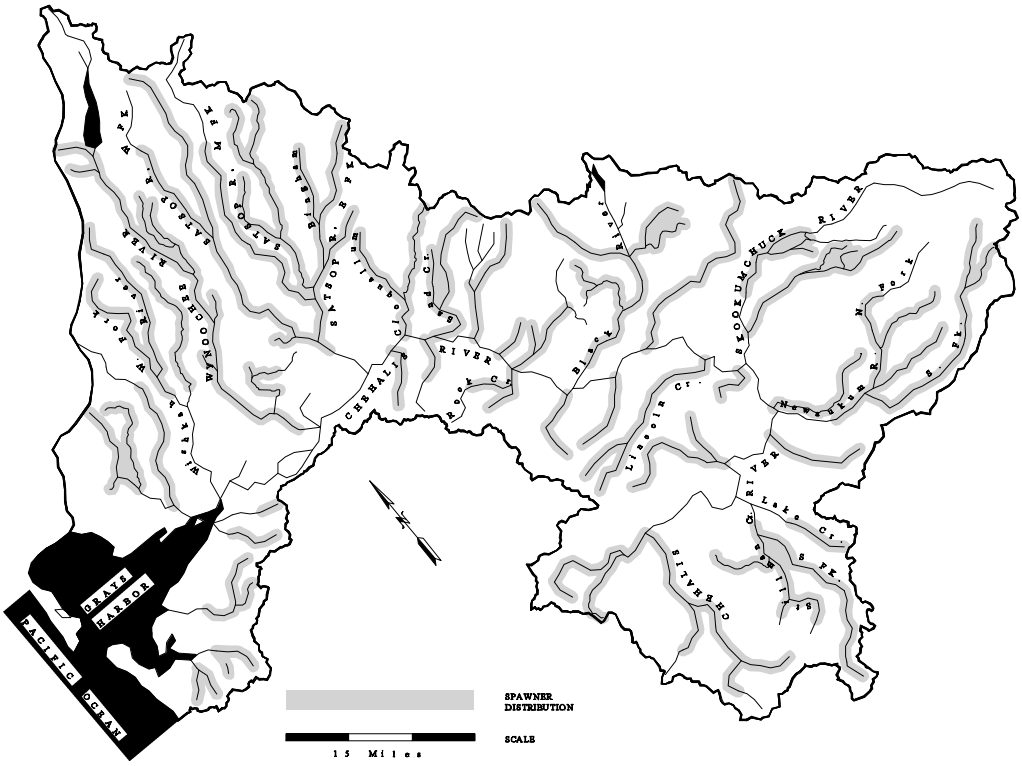
STOCK STATUS

The status of the Chehalis stock complex is Unknown. However, based on juvenile density sampling in the upper basin conducted by the Weyerhaeuser Corporation and returns to the West Branch Hoquiam River trap operated by the Quinault Indian Nation, it is believed that cutthroat are relatively abundant and widely distributed.

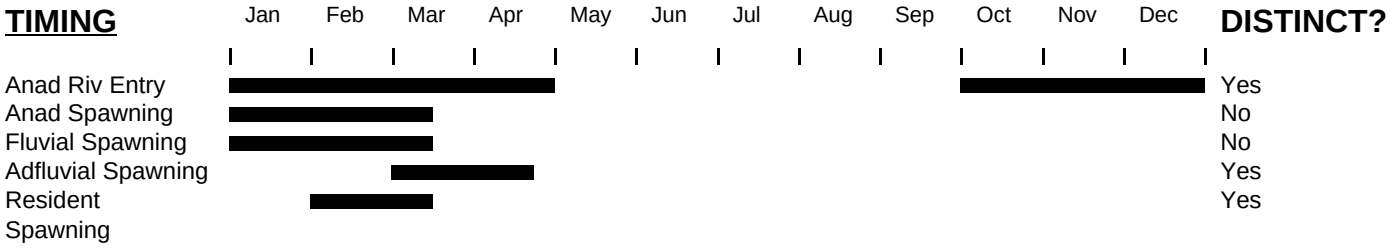
STOCK DEFINITION PROFILE for Chehalis Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



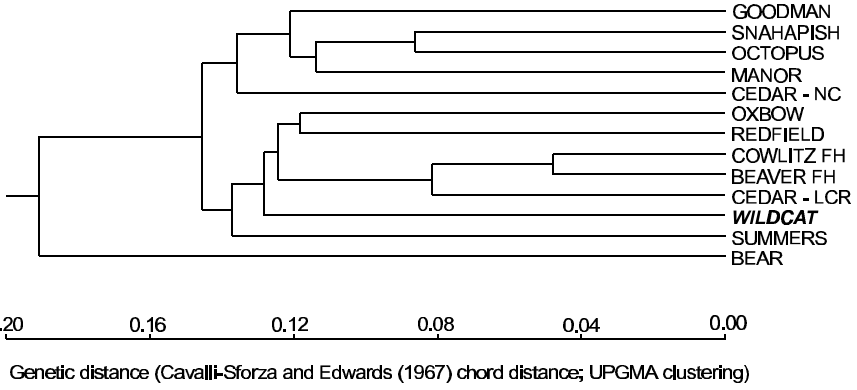
TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Wildcat Cr. collection (N=25), made in 1995, was significantly different from other South Coast collections (33 allozyme-locus G-tests; *P*<0.001).

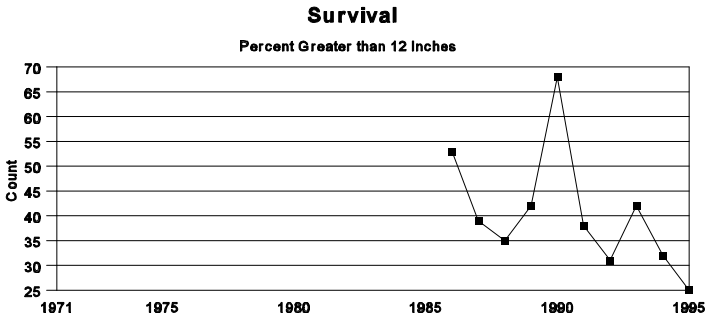


STOCK STATUS PROFILE for Chehalis Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	SURVIVAL % 12 in			
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981				
1982				
1983				
1984				
1985				
1986	53			
1987	39			
1988	35			
1989	42			
1990	68			
1991	38			
1992	31			
1993	42			
1994	32			
1995	25			



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Composite

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Weyerhaeuser has sampled more than eighty sites in the upper basin for species abundance. Cutthroat densities averaged between 0.22 and 0.23 fish/m^2 which is at or above levels observed in other watersheds in western Washington. The Chehalis cutthroat densities were consistently higher than those in the adjacent Willapa Basin. Trap data shown in the Stock Assessment section of the Stock Status Profile are the percent of wild fish over 12 inches long (sexually mature) caught in the trap. Preliminary results from the trap indicates some cutthroat do not spawn until they have attained a size of 16 inches.

FACTORS AFFECTING PRODUCTION

Habitat--Several tributaries of Grays Harbor and the middle and upper Chehalis mainstem have experienced excessive siltation due to historic logging practices, road construction, urbanization and cattle grazing. Logging has severely damaged resident cutthroat spawning streams. Over-appropriation of surface waters for irrigation purposes has occurred in several middle and upper basin tributaries. Decades of wood pulp waste are a permanent part of the substrate in Grays Harbor, creating water quality problems and stress for all salmonids, including anadromous coastal cutthroat.

The middle portion of the Chehalis River mainstem is slow moving with very low oxygen levels in the warm summer months. Northern pikeminnow (squawfish) and suckers thrive in many areas of the Chehalis leading to high levels of predation on salmonid smolts.

Dams on the Skookumchuck and Wynoochee rivers have eliminated access to a high percentage of cutthroat spawning habitat in those upper watersheds. The Skookumchuck Dam eliminated access to about 95% of historic spawning grounds. The Skookumchuck trap is designed to trap steelhead so that they can be trucked around the dam. Cutthroat are not trapped successfully and consequently are not transported in large numbers above the dam.

Fish traps have also been built to transport salmon and steelhead above the Wynoochee Dam. However, as on the Skookumchuck, the traps are not sized for cutthroat and are therefore, of limited usefulness in supplying information on coastal cutthroat abundance.

Harvest Management--Most Grays Harbor tributaries require release of wild cutthroat, allowing the retention of only hatchery cutthroat with a minimum size of 12 inches. Exceptions to this rule include the Humptulips River and several mid- and upper tributaries of the Chehalis River. Within these waters the daily limit is two fish over 14 inches. In upper tributary waters, the statewide rule applies which has an eight-inch minimum size limit. This regulation is designed to help protect resident cutthroat, juvenile and outmigrating smolts.

Hatchery--The Lake Aberdeen Hatchery on the lower Chehalis produced about 25,000 anadromous cutthroat smolts annually from broodstock derived from Grays Harbor native stocks. That program was discontinued in 1999.

Cutthroat from the Beaver Creek Hatchery program (Elochoman River on the lower Columbia River) were released into the Skookumchuck River above the dam, until about 1979. These releases were made to enhance the opening-day sport fishery. Few hatchery-origin fish were expected to have contributed to the naturally spawning stock in the basin beyond the upper Skookumchuck watershed because most were caught in the fishery.

Tokul Creek (north Puget Sound) cutthroat were released into the Black River to enhance the resident trout fishery. This program was discontinued in 1990.

Major annual releases of winter steelhead smolts occur in the Wynoochee (176,200) and Skookumchuck (75,000). Other tributaries where winter steelhead are released include Johns (10,000), Hoquiam (10,600), Wishkah (18,400), Satsop (32,400) and Newaukum (9,000) rivers. Steelhead smolts tend to migrate rapidly to the ocean and then to more offshore which minimizes competition with cutthroat.

WILLAPA BAY — NORTH/SMITH CR/CEDAR COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The North/Smith Creek/Cedar coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. The North River, Smith Creek and Cedar River enter the northern portion of Willapa Bay, the largest estuary on the west coast of the United States. The coastal cutthroat in these streams have been grouped in the same stock complex based on the proximity of the streams and their habitat similarities.

The number of genetically distinct stocks within the North/Smith Creek/Cedar stock complex and the relationship of this complex to other stocks and stock complexes are unknown. It is possible that all Willapa Bay stocks are closely related. Habitat characteristics of freshwater and saltwater zones for all streams in Willapa Bay are very similar, and the extensive intertidal environment within Willapa Bay provides ample opportunity for straying. One collection from this area has been made for genetic analysis (Redfield Creek) and proved to be genetically distinct from the Chehalis collection. Further sampling and analysis are needed to make more complete determinations of genetic relationships.

Coastal cutthroat are present in virtually all perennial tributaries and mainstem reaches of these drainages in one or more of their life history forms. The anadromous form inhabits mainstream and accessible tributary reaches. Resident fish exist both above and below anadromous barriers where they mingle with anadromous fish.

River entry runs from mid-September through April (early and late entry). Spawning of anadromous forms occurs from January through mid-March and from February through March for the resident fish.

Coastal cutthroat in this complex are native and are sustained by wild production.

STOCK STATUS

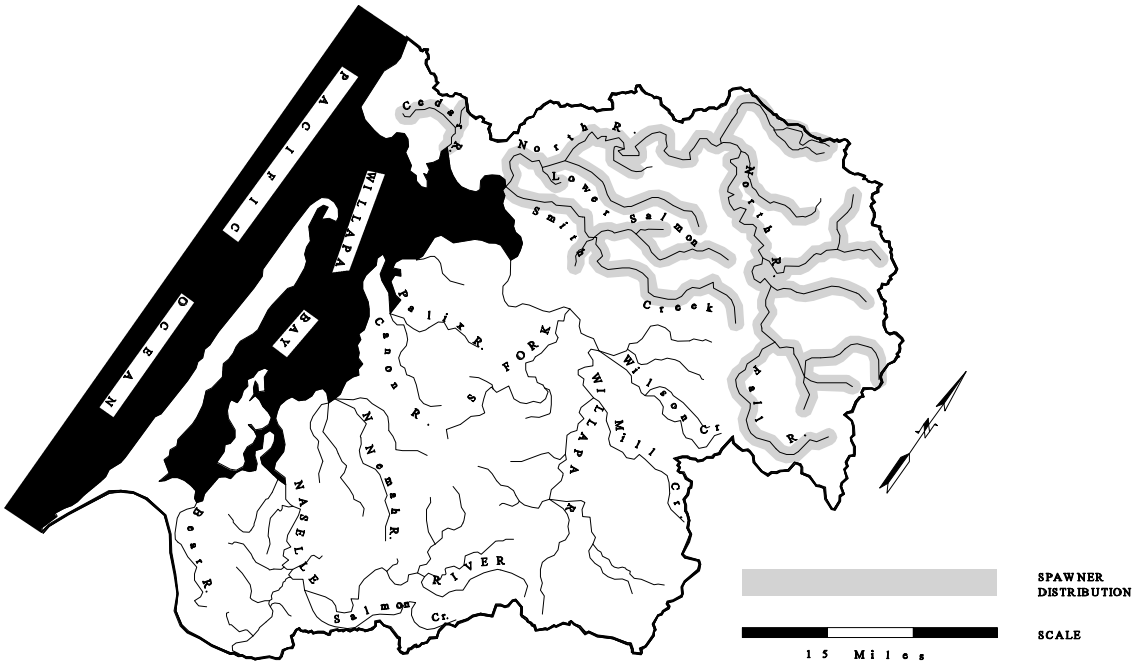
The status of the North/Smith Cr./Cedar stock complex is Unknown. No quantitative data have been collected within these drainages for trends in abundance or survival. Cutthroat densities have been estimated in the Willapa River basin and are similar to those in other western Washington watersheds.

Adult anadromous cutthroat were sampled at the three WDFW hatcheries located within the Willapa Harbor basin during 1995, 1996 and 1997/98. The Willapa, North Nemah, and Naselle rivers are represented in these samples and are thought to be

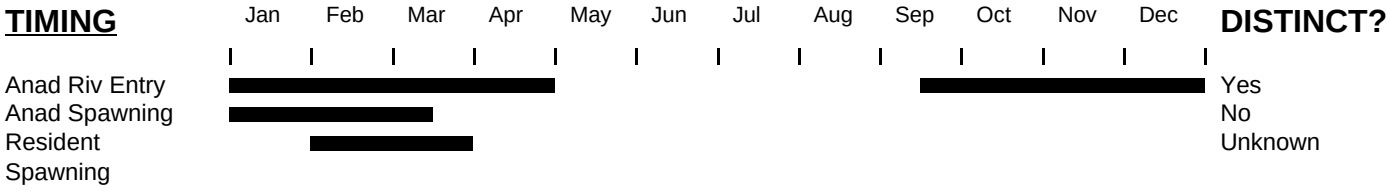
STOCK DEFINITION PROFILE for North/Smith Cr/Cedar Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING



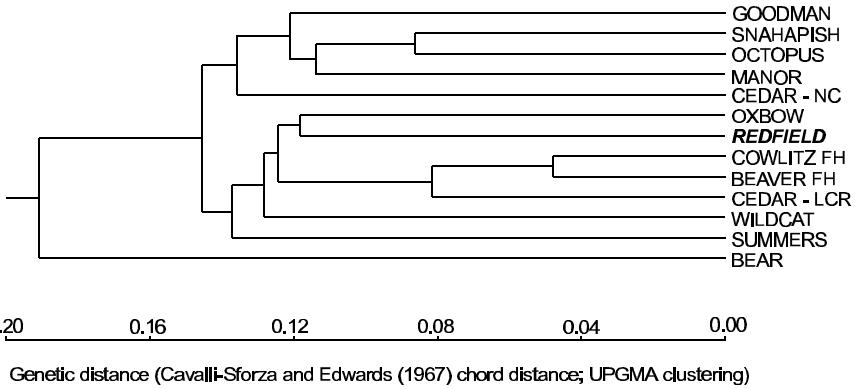
DISTINCT?

Yes
No
Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Redfield Cr. collection (N=36), made in 1995, was significantly different from the other South Coast collections (33 allozyme-locus G-tests; *P*<0.001).



STOCK STATUS PROFILE for North/Smith Cr/Cedar Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

representative of the population structure throughout Willapa Harbor including the North River, Smith Creek, and the Cedar River. The data indicate that the population may have fewer repeat spawners than expected and that some of the population does not spawn until reaching 16 inches. Abundance of coastal cutthroat under 14 inches is good which indicates strong recruitment to the population. On the other hand, there has been extensive habitat damage in the North River and Smith Creek, and those components of the stock complex may be among the weakest in Willapa Bay.

FACTORS AFFECTING PRODUCTION

Habitat--The North and Cedars rivers and Smith Creek enter Willapa Bay, the largest estuary on the west coast of the United States. Extensive intertidal zones and a rich semi-protected environment provide good habitat for anadromous cutthroat. Significant chum, coho and chinook runs are present in Willapa Bay tributaries, providing cutthroat with the opportunity to eat free-drifting salmon eggs during salmon spawning.

The use of the chemical “Sevin” by the oyster industry to kill ghost shrimp may have adversely impacted coastal cutthroat as this substance is concentrated into rivulets when the tide recedes in this extensive tideflat area.

The mainstem portions of these streams have little or no gravel for spawning use. The tributaries to the North River and Smith Creek have been adversely impacted by logging practices which have greatly reduced the amount of smaller clean gravel available for spawning.

Harvest Management--The sport fishery for coastal cutthroat in the North River and Cedar Creek is catch-and-release only. No commercial fishery occurs on this species in Willapa Bay. Statewide regulations apply to resident populations in non-anadromous waters. These rules require release of fish smaller than eight inches to protect resident fish, juveniles and outmigrating smolts.

Hatchery--There are no hatchery releases of anadromous cutthroat into Willapa Bay streams. About three percent of anadromous cutthroat trapped at the North Nemah Salmon Hatchery were of hatchery origin. These fish were probably from Grays Harbor or lower Columbia River anadromous cutthroat hatchery programs. No resident cutthroat releases are made into these waters. Steelhead smolts are released into these and surrounding tributaries, with 25,000 fish released into the North and South rivers, 25,000 into the Willapa River and 10,000 releases into Nemah River. Steelhead smolts tend to migrate quickly to the ocean and then to more offshore which minimizes competition with wild cutthroat. Coho releases also occur throughout the basin with 500,000 smolts going into each of the Willapa and the Nemah rivers and 100,000 into the Naselle River annually. Interactions between hatchery-origin coho smolts and wild cutthroat have not been examined.

WILLAPA BAY — WILLAPA COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Coastal cutthroat in the Willapa River watershed have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. The Willapa River enters northern Willapa Bay at the town of Raymond.

It is possible that all Willapa Bay stocks are closely related. Habitat characteristics of freshwater and saltwater zones for all stream are very similar, and the extensive intertidal environment within Willapa Bay provides ample opportunity for straying. Samples for genetic analysis were taken from one site on Oxbow Creek, a Willapa River tributary. This collection was significantly different from other South Coast cutthroat collections. Additional genetic sampling and analysis are needed to make further determinations of cutthroat relationships within Willapa Bay.

Coastal cutthroat are present in virtually all perennial tributaries and mainstream reaches of these drainages in one or more of their life history forms. The anadromous and fluvial forms inhabit mainstream and accessible tributary reaches. Resident forms exist both above anadromous barriers and below them where they mingle with anadromous fish.

River entry is from mid-September through April (early and late entry). Spawning of the anadromous and fluvial fish occur January through mid-March and from February through March for resident fish.

Willapa coastal cutthroat are native and are sustained by wild production.

STOCK STATUS

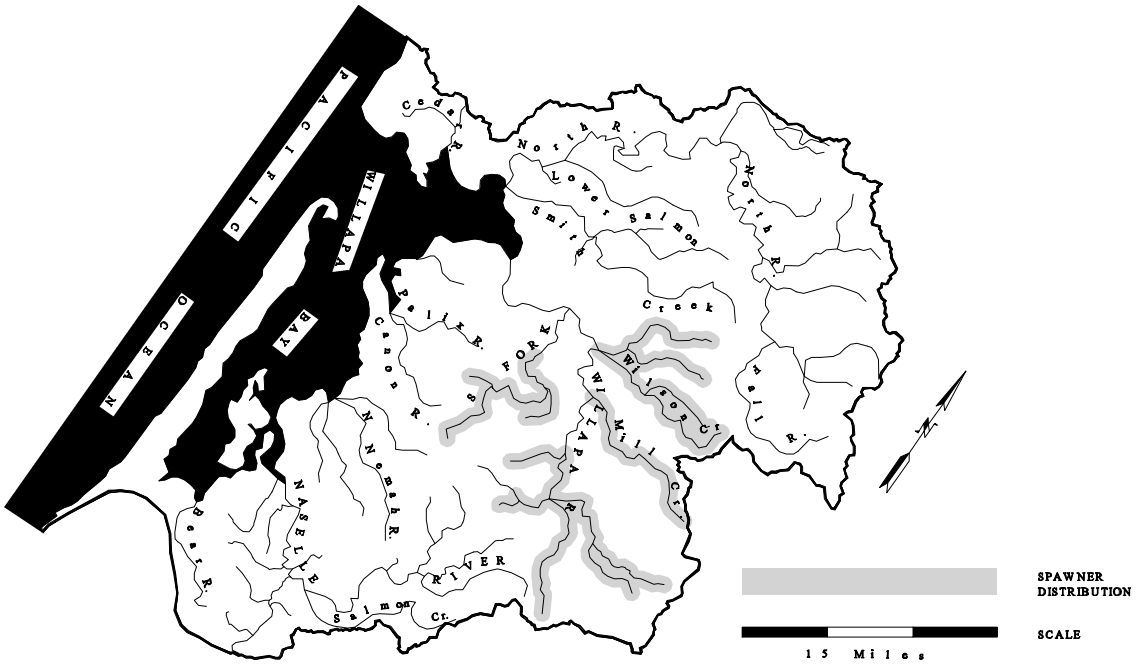
The status of the Willapa stock complex is Unknown. However, some information is available. The Weyerhaueser Corporation has sampled more than 70 sites in the Willapa River basin in both anadromous and resident spawning and rearing areas. Cutthroat densities averaged from 0.09 to 0.13 fish/m^2, which is similar to levels observed in other western Washington watersheds. However, these densities were lower than those observed in the upper Chehalis basin.

Adult anadromous cutthroat were sampled at the three WDFW hatcheries located within the Willapa Harbor basin during 1995, 1996, and 1997/98. The Willapa, North Nemah, and Naselle rivers are represented in these samples and are thought to be representative of the population structure throughout Willapa Harbor. The data indicate that the population may have fewer repeat spawners than expected and that some of the population does not spawn until reaching 16 inches. Abundance of

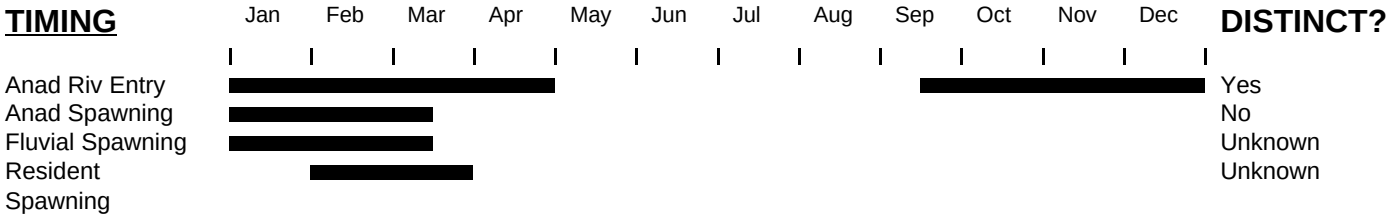
STOCK DEFINITION PROFILE for Willapa Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



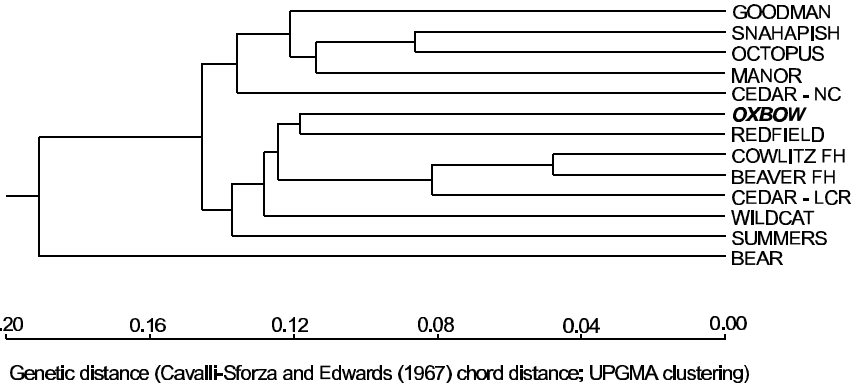
TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Oxbow Cr. collection (N=26), made in 1995, was significantly different from other South Coast collections (33 allozyme-locus G-tests; *P*<0.001).



STOCK STATUS PROFILE for Willapa Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

anadromous cutthroat under 14 inches is good which indicates strong recruitment to the population.

FACTORS AFFECTING PRODUCTION

Habitat--The Willapa River enters Willapa Bay, the largest estuary on the west coast of the United States. Extensive intertidal zones and a rich semi-protected environment provide good habitat for anadromous cutthroat. Significant chum, coho and chinook runs are present in Willapa Bay tributaries, providing cutthroat with the opportunity to eat free-drifting salmon eggs during salmon spawning.

The use of the chemical “Sevin” by the oyster industry to kill ghost shrimp may have adversely impacted coastal cutthroat as this substance is concentrated into rivulets when the tide recedes in this extensive tideflat area.

Small tributary streams in this drainage have been severely damaged by logging activities, impacting both resident and anadromous spawning areas with siltation and high flows which wash away smaller suitable gravels.

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The sport fishery in these Willapa Bay streams is catch-and-release (except hatchery steelhead) to protect cutthroat and wild steelhead. No commercial fishery exists on this species in Willapa Bay. Above anadromous waters, statewide regulations apply, with a minimum size of eight inches.

Hatchery--No hatchery releases of cutthroat are currently made into Willapa Bay tributaries. A small number of hatchery-origin smolt releases were made historically into this basin. About three percent of the cutthroat sampled at the North Nemah Hatchery were of hatchery origin. It is thought that these fish have migrated to Willapa Bay from Grays Harbor or lower Columbia River hatchery programs. Hatchery steelhead and coho are released into various Willapa tributaries. Annual releases of 25,000 steelhead smolts are made in the North and South rivers, along with 10,000 into the Nemah River annually. Steelhead smolts tend to migrate quickly to the ocean and then to more offshore which minimizes comptetion with wild cutthroat. Approximately 500,000 coho smolts are released into the Willapa and Nemah rivers and 10,000 into the Naselle River. Interactions between coho smolts and wild cutthroat have not been examined.

WILLAPA BAY — MID-WILLAPA BAY COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Mid-Willapa Bay stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. This stock complex consists of coastal cutthroat in the Nemah, Canon, Palix and Niawiakum rivers which are small tributaries entering the middle portion of Willapa Bay. Coastal cutthroat spawning in these streams have been grouped in the same stock complex based on the proximity of the streams and their habitat similarities.

The number of genetically distinct stocks within the Nemah/Canon/Palix/Niawiakum stock complex and relationship of this complex to other stocks and stock complexes are unknown. It is possible that all Willapa Bay stocks are closely related. Habitat characteristics of freshwater and saltwater zones for all streams are very similar. The extensive intertidal environment within Willapa Bay provides ample opportunity for straying. Further genetic sampling and analysis are needed to make these determinations.

Coastal cutthroat are present in virtually all perennial tributaries and mainstem reaches of these drainages in one or more of their life history forms. The anadromous form inhabitats mainstem and accessible tributary reaches. Resident forms exist both above anadromous barriers and below them where they mingle with anadromous fish.

Anadromous fish enter the river from mid-September through April (early and late entry). Spawning of anadromous and fluvial fish occurs from January through mid-March and from February through March for resident fish.

Mid-Willapa Bay coastal cutthroat are native and are sustained by wild production.

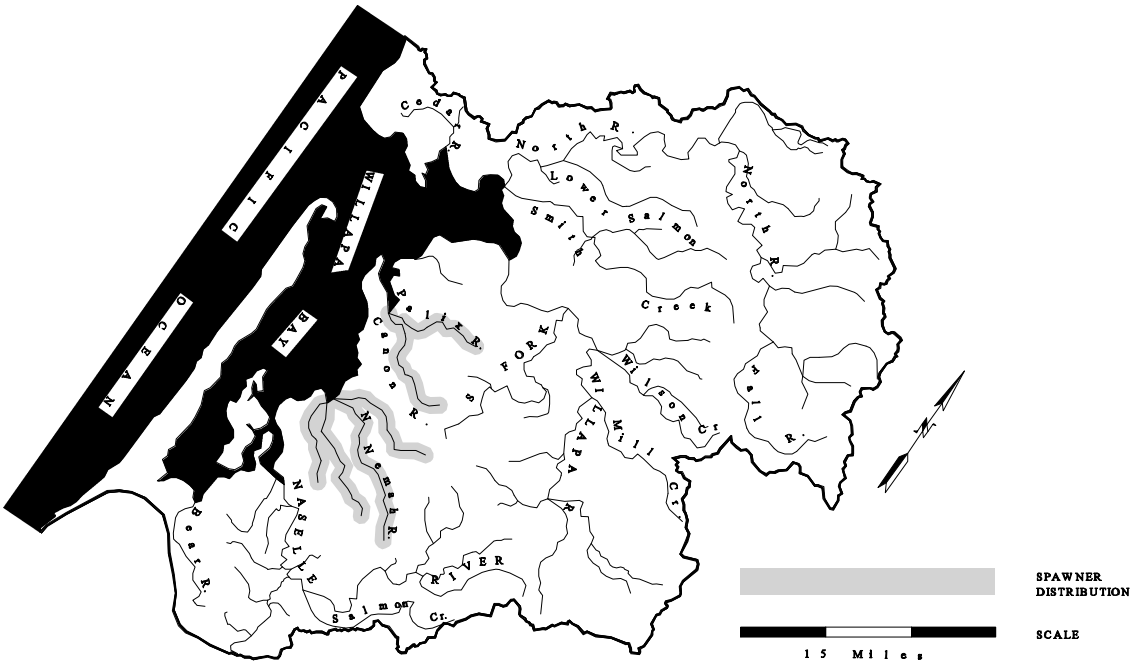
STOCK STATUS

The status of Mid-Willapa Bay coastal cutthroat is Unknown. Adult anadromous cutthroat were sampled at the three WDFW hatcheries located within the Willapa Harbor basin during 1995, 1996 and 1997/98. The Willapa, North Nemah, and Naselle rivers are represented in these samples and are thought to be representative of the population structure throughout Willapa Bay including the Nemah, Canon, Palix and Niawiakum. The data indicate that the population may have fewer than expected repeat spawners and that some of the population does not spawn until reaching 16 inches. The abundance of coastal cutthroat under 14 inches is good which indicates strong recruitment to the population.

STOCK DEFINITION PROFILE for Mid-Willapa Bay Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■					■	■	■	■	No
Anad Spawning	■	■	■										No
Fluvial Spawning	■	■	■										No
Resident Spawning		■	■	■									No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Mid-Willapa Bay Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

FACTORS AFFECTING PRODUCTION

Habitat--Extensive intertidal zones and a rich semi-protected environment in Willapa Bay provide good marine habitat for coastal cutthroat. Significant chum, coho, and chinook runs are present in Willapa Bay, providing cutthroat on feeding runs the opportunity to eat free-drifting salmon eggs during salmon spawning.

However, use of the chemical “Sevin” by the oyster industry to kill ghost shrimp may have adversely impacted anadromous cutthroat as this substance is concentrated into rivulets when the tide recedes in this extensive tideflat area.

Most mid-Willapa headwater tributaries which provide resident and anadromous spawning habitat have been adversely impacted by logging activities which have increased fine sediment and washed away suitable gravels.

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The sport fishery in the Palix, Niawiakum, and Nemah rivers is catch-and-release to protect cutthroat and wild steelhead. There is no commercial fishery on cutthroat in Willapa Bay. Cutthroat in upper tributary waters, where resident fish occur, require release of fish under eight inches to protect resident fish, juveniles and outmigrating smolts.

Hatchery--No hatchery releases of cutthroat are currently made into Willapa Bay tributaries. A small number of hatchery-origin smolt releases were made historically into this basin. About three percent of the cutthroat sampled in 1995 at the North Nemah Hatchery were of hatchery origin, most likely strays into Willapa Bay and the Nemah River from Grays Harbor or lower Columbia tributaries. Both steelhead and coho smolts are released into Willapa Bay tributaries. There has been no evidence that these releases are detrimental to cutthroat populations.

WILLAPA BAY — NASELLE/BEAR COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The Naselle/Bear coastal cutthroat stock complex has been identified as one of four stock complexes within Willapa Bay, based on the geographic distribution of its spawning grounds. The Naselle and Bear rivers enter the southern portion of Willapa Bay. Coastal cutthroat in these streams have been grouped into the same stock complex based on the proximity of the streams and their habitat similarities.

The number of genetically distinct stocks within the Naselle/Bear stock complex and relationship of this complex to other stocks and stock complexes are unknown. It is possible that all Willapa Bay stocks are closely related since habitat characteristics of freshwater and saltwater zones for all streams are very similar. The extensive intertidal environment within Willapa Bay provides ample opportunity for straying. Further genetic sampling and analysis are needed to make these determinations. Samples for genetic analysis were taken from cutthroat in Alder Creek, in the Naselle drainage, in 1995 as part of a coast-wide genetics survey conducted by Washington, Oregon and the National Marine Fisheries Service.

Coastal cutthroat are present in virtually all perennial tributaries and mainstem reaches of these drainages in one or more of their life history forms. The anadromous and fluvial forms inhabitat mainstem and accessible tributary reaches. Resident forms exist both above anadromous barriers and below them where they mingle with anadromous fish.

River entry of the anadromous form occurs from mid-September through April (early and late entry), spawning of anadromous and fluvial fish occurs from January through mid-March. Resident fish generally spawn from February through March.

Naselle/Bear coastal cutthroat are native and are sustained by wild production.

STOCK STATUS

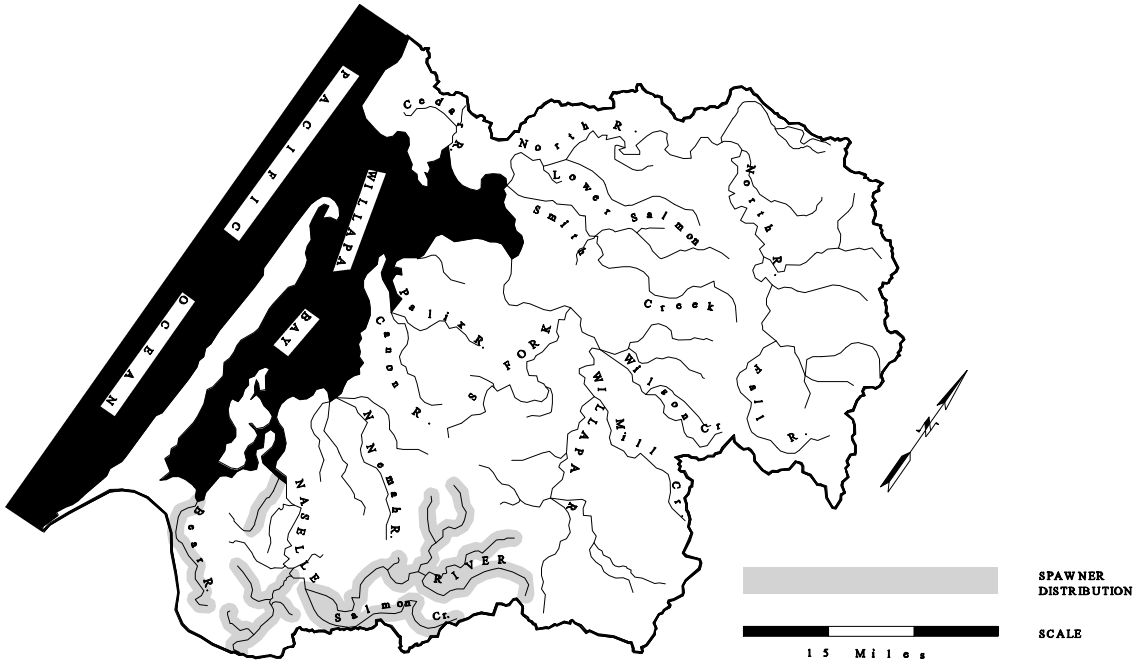
The status of Naselle/Bear coastal cutthroat is Unknown since insufficient quantitative data have been collected to identify trends for either abundance or survival. However, the abundance of cutthroat sampled in upper Alder Creek in 1995 was similar to that in other coastal streams.

Adult anadromous cutthroat were sampled at the three WDFW hatcheries located within the Willapa Bay basin during 1995, 1996 and 1997/98. The Willapa, North Nemah, and Naselle rivers are represented in these samples and are thought to be

STOCK DEFINITION PROFILE for Naselle/Bear Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■	■				■	■	■	■	No
Anad Spawning	■	■	■										No
Fluvial Spawning	■	■	■										No
Resident Spawning		■	■	■									No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Naselle/Bear/Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

representative of the population structure throughout Willapa Bay including the Naselle and Bear rivers. The data indicate that the population may have fewer than expected repeat spawners and some of the population does not spawn until reaching 16 inches. Abundance of anadromous cutthroat under 14 inches is good which indicates strong recruitment to the population.

FACTORS AFFECTING PRODUCTION

Habitat--Extensive intertidal zones and a rich semi-protected environment within Willapa Bay provide good habitat for anadromous cutthroat. Significant chum, coho and chinook runs are present in Willapa Bay, providing cutthroat the opportunity to eat free-floating salmon eggs during salmon spawning.

The use of the chemical “Sevin” by the oyster industry to kill ghost shrimp may have adversely impacted sea-run cutthroat as this substance is concentrated into rivulets where cutthroat reside when the tide recedes in this extensive tideflat area.

Extensive logging in headwater areas has damaged those small streams where resident and anadromous cutthroat spawn.

Harvest Management--Fisheries regulations are designed to minimize harvest impacts on wild production. The sport fishery in these Willapa Bay streams is catch-and-release to protect cutthroat and wild steelhead. There is no commercial fishery on cutthroat in Willapa Bay. Resident cutthroat in upper tributary waters are protected with an eight- inch minimum size limit.

Hatchery--No hatchery releases of cutthroat are currently made into Willapa Bay tributaries. A small number of hatchery smolt releases was made historically into this basin, but the program has since been discontinued. Coho and steelhead smolts are released from various hatcheries throughout the basin, but interactions with native cutthroat have not been examined.

LOWER COLUMBIA — GRAYS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Grays coastal cutthroat are classified as a distinct stock complex based on the geographic distribution of their spawning grounds. Grays River enters the Columbia River at RM 21.

Anadromous, resident and fluvial life history forms distribute themselves throughout the watershed. The anadromous form has access to most of the watershed with the exception of upper tributary reaches, where a combination of steep gradient and high flow can limit passage. The resident forms have been observed throughout the system.

As with other wild Columbia River coastal cutthroat, entry to the Columbia River commences in July and continues through the fall. The data on Grays River anadromous cutthroat are limited, but we believe that the timing of river entry and spawning is similar to that of Elochoman fish which enter the river from late July through Mid-April, with peak entry in the fall and spawning from January through April. Fluvial and resident spawning times have not been documented in this watershed but are believed to be similar to the anadromous spawning time. Size, age, coloration, and genetic data are unavailable for this stock, however, we believe that this information would be similar to that for other Columbia River stocks. Anadromous cutthroat life history data are available for the Kalama, Toutle, and Cowlitz rivers (Hulett 1995; Loch 1982; Loch and Downing 1990; Loch and Pahutski 1991, 1992; Loch and Byrd 1993; Tipping and Springer 1980; Tipping 1982).

The genetic relationship of the Grays stock complex to other stocks and stock complexes is unknown. Genetic sampling and analysis are needed to make this determination, however no sampling has been done.

Grays coastal cutthroat trout are native and are sustained by wild production. There is no record of hatchery cutthroat releases into this drainage.

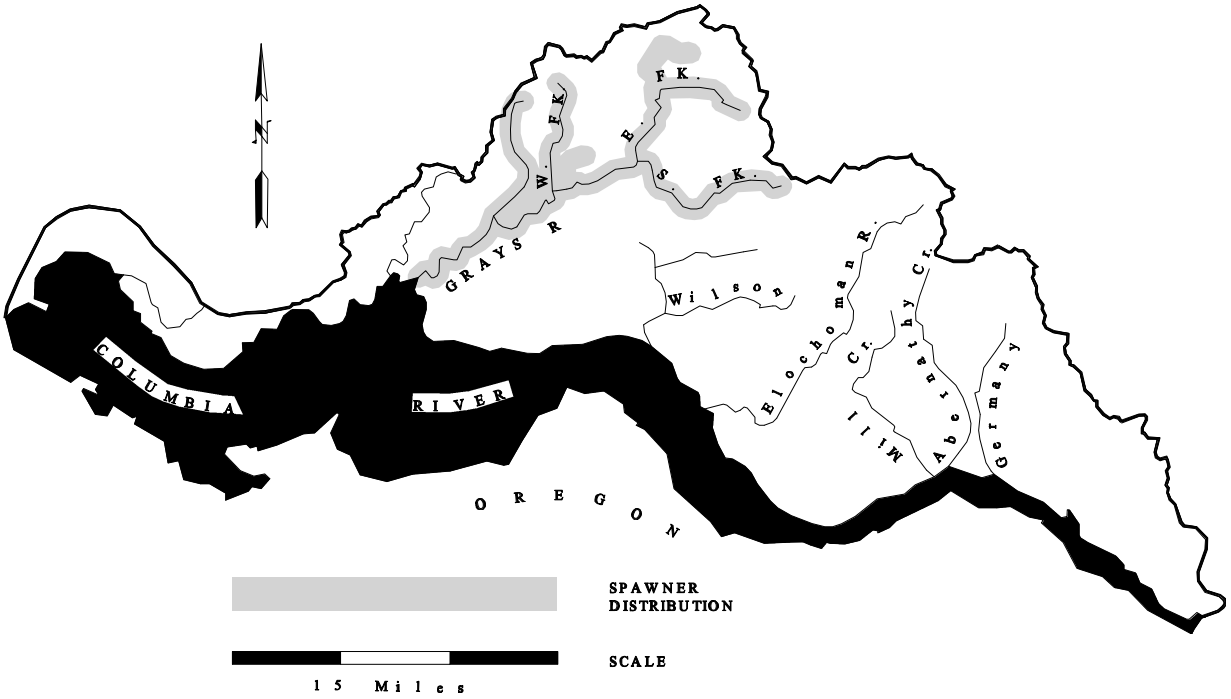
STOCK STATUS

The status of the Grays stock is Depressed based on a long-term decline in the Columbia River recreational catch estimates from RM 0 to RM 38. These sport catch data were collected during a survey conducted from 1972 to 1995 to estimate salmon and steelhead catch, but cutthroat trout were also recorded. No distinctions among life history forms were made, but the numbers probably represent mainly anadromous and fluvial fish. Data quality from the survey is fair. Because the survey targeted salmon and steelhead, changes in angling effort for cutthroat cannot be quantified. Some

STOCK DEFINITION PROFILE for Grays Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■				■	■	■	■	■	No
Anad Spawning	■	■	■	■									No

Timings are unknown. These timings are based on those of the Elochoman stock complex.

BIOLOGICAL CHARACTERISTICS

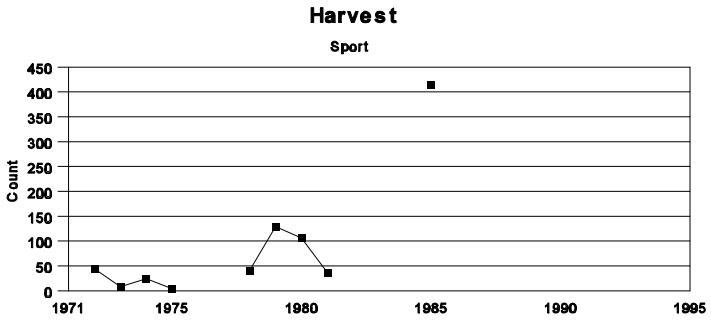
DISTINCT? - Unknown

STOCK STATUS PROFILE for Grays Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	HARVEST Sport			
1971				
1972	44			
1973	8			
1974	24			
1975	4			
1976	0			
1977	0			
1978	41			
1979	129			
1980	106			
1981	36			
1982	0			
1983	0			
1984	0			
1985	416			
1986	0			
1987	0			
1988	0			
1989	0			
1990	0			
1991	0			
1992	0			
1993	0			
1994	0			
1995	0			



AVERAGE RUNSIZE DISTRIBUTION

No data available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Depressed

Screening Criteria

Long-Term negative trend

sampling inconsistencies were apparent in the early to mid-1970s, and in some years sampling was incomplete. More restrictive angling regulations, implemented during the survey, also appear to have reduced cutthroat catch, but the extent of this reduction has not been determined.

The catch between 1971 and 1991 was composed of both hatchery and wild fish. Small samples from this fishery were collected between 1979 and 1982. Tipping (1982) found that 20% of the catch was wild (n = 31). Sampling in 1979 and 1980 indicated that 50% of the catch was wild. Columbia River estuary sampling in 1981 indicated that 21% of the sample (n = 141) was wild (Loch 1982). Columbia River catch data suggest a decline in cutthroat abundance over time.

There are no population-size data, only distribution data, for resident Grays River cutthroat, so the status of this life history form cannot be assessed. WDF et al. (1993) characterized Grays River chum, coho, and winter steelhead as Depressed. Severe habitat degradation had occurred and was identified as one of the key factors limiting wild production. Since resident coastal cutthroat have similar freshwater habitat requirements as anadromous cutthroat, coho, and winter steelhead, we believe that their status is also depressed.

FACTORS AFFECTING PRODUCTION

Habitat--The coastal cutthroat trout's extended freshwater residency and the anadromous form's near-shore migratory patterns require specific and varied freshwater and estuarine habitat types. The Grays River ecosystem has been degraded by past and present human activities that have reduced the habitat quality, quantity, and complexity. The primary land-use activities responsible for these include road building, timber harvesting, agriculture, and rural development. These upslope and riparian activities have increased sediment, reduced woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

Most land in this watershed is managed for timber production. Logging in the riparian zone has produced riparian habitat which is simple and in early successional stages. As a result, summer water temperatures are elevated, and large woody debris is lacking. Increases in fine sediment in streams have decreased survival of trout eggs and alevins, reduced stream productivity and ultimately food availability, and decreased the size and depth of pools which are important as rearing and adult holding areas for cutthroat trout. Large pools (> 50 sq yds and > 6 ft deep) have been reduced by 69% on the Grays River since 1945 (USFS et al. 1993). Increases in large woody debris would increase fish productivity by forming and maintaining pools, providing fish cover, and trapping spawning gravel.

Grays River anadromous cutthroat use the Columbia River estuary primarily during the late winter, spring, and summer. It is estimated that the tidelands, swamps, and wetlands in the

Columbia River estuary were reduced by 40% from 1870 to 1970 (Sherwood et al. 1990). The recent changes in ocean current patterns, such as El Niño, have reduced smolt-to-adult survival of all Columbia River salmonids. Smolt-to-adult survival of hatchery anadromous cutthroat released in the Columbia Basin has decreased since the 1980s (Byrnes 1995; Tipping 1995). Reduction in estuarine habitat and poor near-shore ocean conditions have contributed to the decline of anadromous cutthroat trout.

Harvest Management--There is no directed commercial harvest of coastal cutthroat trout although small numbers have been caught in the lower Columbia River gillnet fishery. Angler harvest of wild coastal cutthroat was high but has tapered off dramatically as sportfishing regulations have become more restrictive. Tributaries are closed to protect spawning adults. A twelve-inch minimum size in mainstem streams was adopted in 1985 to permit most females to spawn at least once. A wild cutthroat release regulation was adopted in 1992, limiting harvest to hatchery fish. In 1992 the minimum size was increased to 14 inches, and in 1994 the mainstem Grays River was closed to fishing for trout (except steelhead). In addition, juvenile protection occurs in the form of stream closures to protect smolts from March 15 to May 31. In 1994 a two-trout daily limit with an eight-inch minimum size limit was adopted for tributaries to protect resident cutthroat. Since wild cutthroat harvest is prohibited in mainstems and limited in tributaries, directed harvest is very low. Wild mortality is unknown but believed to be low from both hooking mortality and illegal harvest.

Hatchery--Grays River Hatchery is located at RM 1 on the West Fork Grays River. It was constructed in the late 1950s under the Mitchell Act to mitigate for the anadromous fish losses caused by the construction and operation of mainstem hydroelectric dams on the Columbia River. It raises coho and fall chinook and has raised chum salmon. About 28,000 hatchery steelhead smolts are released annually into the Grays River from Beaver Creek Hatchery. Ecological impacts to wild coastal cutthroat from hatchery salmon and steelhead releases are unknown.

Other Factors--Marine mammal populations along the west coast including the Columbia River have increased since they continue to be protected under the federal Marine Mammal Protection Act of 1976. Current population estimates are approximately 300-500 sea lions and numbers exceeding 3,000 harbor seals in the Columbia River (NOAA 1997). As these populations have increased, so has their food and fish consumption. Both sea lions and seals are most abundant from late winter through spring and can intercept both anadromous cutthroat smolts and kelts as they move toward the estuary. Anadromous cutthroat adults returning to Beaver Creek Hatchery were examined for marine mammal marks; the percentage of returning adults with marks ranged from 0% to 16% and averaged 7% since 1982. Estimates of cutthroat predation by marine mammals have not been made, but the marine mammal mark rate indicates that in some years it may be high.

LOWER COLUMBIA — ELOCHOMAN/SKAMOKAWA CREEK COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Elochoman/Skamokawa Creek coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. Cutthroat in this stock spawn in the Elochoman River and Skamokawa Creek. Both drainages originate in the Willapa Hills and flow in a generally southwest direction through Wahkiakum County and empty into the Columbia River at RM 38 and RM 33, respectively. Because of their close proximity, small size, and similar drainage characteristics, and the limited biological data available, fish in these two drainages have been combined in a single stock complex.

The Elochoman/Skamokawa cutthroat complex is represented by genetic samples from the Beaver Creek Hatchery. Analysis showed that it was not significantly different from the Cowlitz stock complex. However, it was found to be genetically different from collections from the Kalama and Lewis rivers.

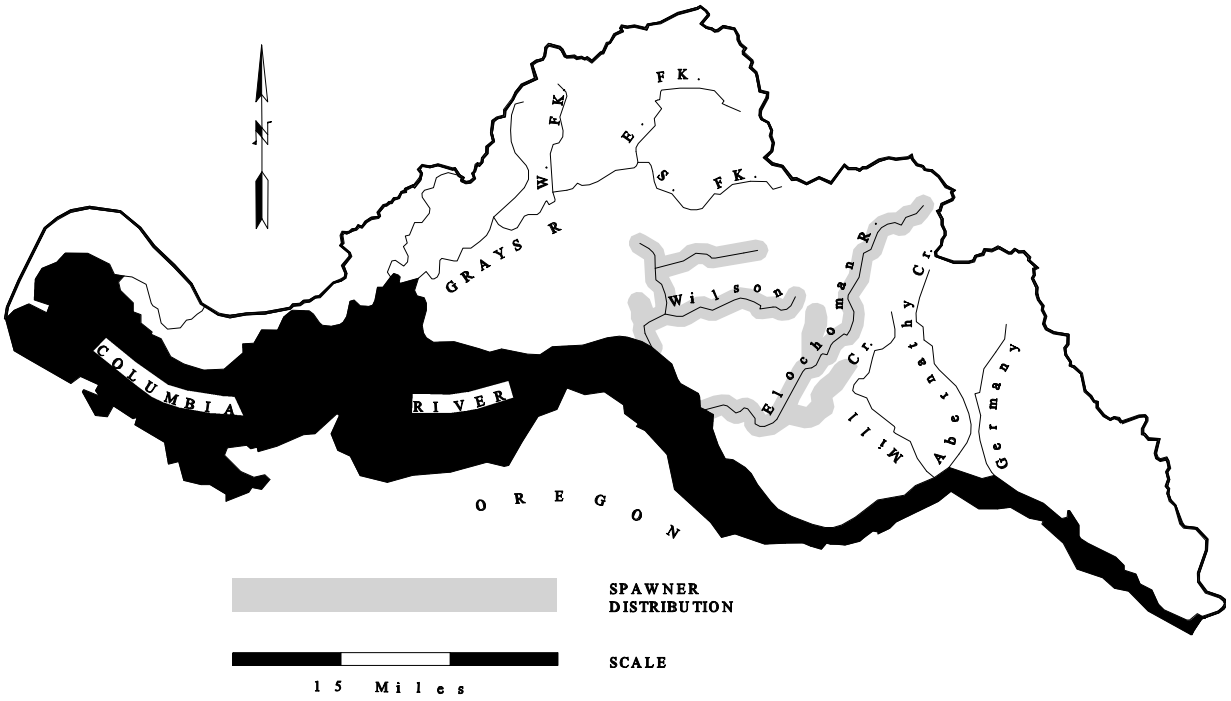
Anadromous, resident and fluvial forms distribute themselves throughout these watersheds. Anadromous cutthroat trout have access to most of the Elochoman watershed with the exception of Beaver Creek, where a WDFW weir blocks fish passage to maintain water quality for the hatchery; Duck Creek where a falls blocks entry; and upper tributary reaches where a combination of steep gradient and high flow can limit passage. Anadromous fish have access to all Skamokawa tributaries with the possible exception of upper stream reaches where high gradient and flows may limit passage. The resident forms have been observed throughout the system.

As with other wild Columbia River anadromolus stocks, entry into the Columbia River commences in July and continues through the fall. Entry into Beaver Creek, an Elochoman River tributary, is from August through March (Lucas 1980). Peak trapping for wild anadromous cutthroat usually occurs from October through January depending on river conditions. Spawning can occur from late December through early June (Lavier 1959), however, in most years spawning activity occurs from January through April (WDFW, unpublished data). The anadromous spawn timing was determined from fish returning to the Beaver Creek Hatchery, located on the Elochoman River, during years of initial anadromous cutthroat brook stock collection. Artificial selection for early spawning time now has hatchery cutthroat spawning from December to February (Byrne 1995). Fluvial and resident spawning times have not been documented in this watershed but are believed to be similar to the wild anadromous spawning time. Size, age, coloration and genetic data are unavailable for this stock, however, we believe that this information would be similar to that for other Columbia River stocks. Anadromous cutthroat trout life history data are available for the Kalama, Toutle, and Cowlitz rivers

STOCK DEFINITION PROFILE for Elochoman/Skamokawa Creek Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



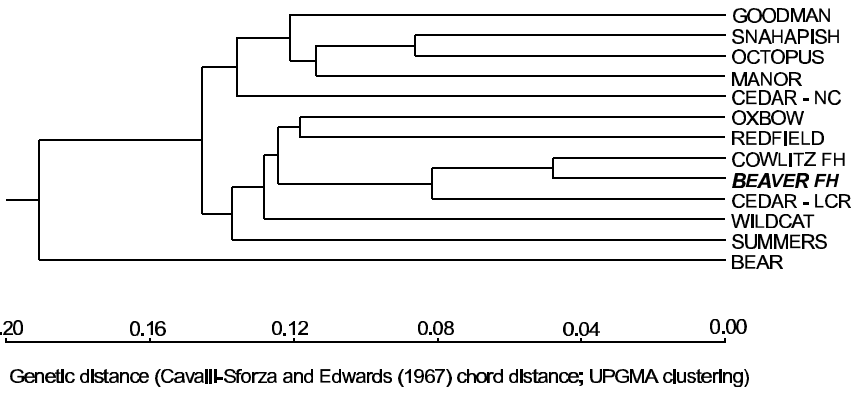
TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■			■	■	■	■	■	■	No
Anad Spawning	■	■	■	■									No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Beaver Cr. collection (N=99), made in 1995, was significantly different from the Kalama and Lewis collections (33 allozyme-locus G-tests; *P*,0.001) but not significantly different from the Cowlitz Hatchery collection (33 allozyme-locus G-tests; *P*>0.05).

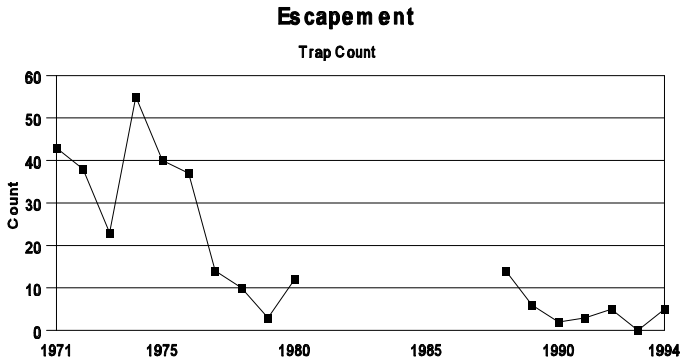


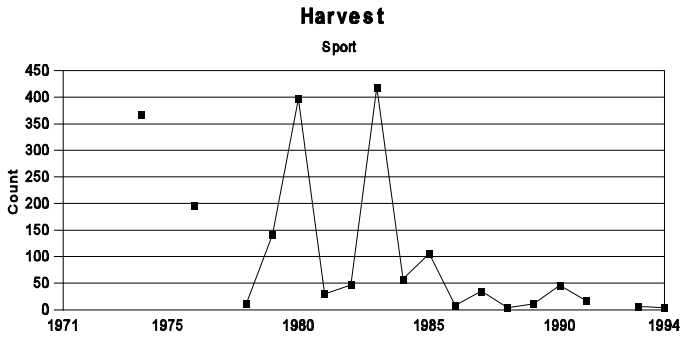
STOCK STATUS PROFILE for Elochoman/Skamokawa Creek Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Trap count	HARVEST Sport	SURVIVAL Smolt/adult	ESCAPE Hat&Nat
1971	43		1	292
1972	38	0	0	98
1973	23	0	0	37
1974	55	368	0	56
1975	40	0		41
1976	37	196		37
1977	14	0		14
1978	10	11		10
1979	3	141		3
1980	12	397	0	50
1981		30	1	928
1982		47	3	1,945
1983		419	5	1,789
1984		58	3	1,020
1985		106	2	726
1986		8	1	637
1987		35	3	929
1988	14	4	1	493
1989	6	11	1	788
1990	2	46	1	282
1991	3	17	2	558
1992	5	0	0	128
1993	0	6	0	49
1994	5	4	1	319





AVERAGE RUNSIZE DISTRIBUTION

No data available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Depressed

Screening Criteria

Chronically low; LT neg trend

(Hulett 1995; Loch 1982; Loch and Downing 1990; Loch and Pahutski 1991 and 1992; Loch and Byrd 1993; Tipping and Springer 1980; and Tipping 1982). Elochoman/Skamokawa Creek coastal cutthroat trout are considered native and are sustained by wild production. It is not known to what degree, if any, hatchery cutthroat have impacted native fish.

STOCK STATUS

The status of the Elochoman/Skamokawa Creek stock is Depressed based on chronically low counts at the Elochoman and Beaver Creek hatcheries and a long-term decline in the Columbia River cutthroat catch from RM 48 to the mouth. Data quality used to make this assessment is fair. Wild anadromous escapement, measured at the Elochoman River Hatchery, has ranged between 10 and 20 sea-run cutthroat trout annually for the last eight years (Dick Aksamit, WDFW, personal communication). The majority of these are wild or unmarked fish. The trap is operated from September through December to capture coho salmon. The efficiency of this trap for cutthroat trout is unknown.

Most of the data in the Stock Assessment section of the Stock Status Profile were taken from Beaver Creek Hatchery records. Although the data are remarkably complete, they were not collected to assess stock status reports and their usefulness in this regard is unknown.

Trap counts of unmarked adult (wild) anadromous cutthroat from the upper and lower traps at Beaver Creek Hatchery are available from 1958 to 1995. This information is presented in column 1 of the Stock Assessment section of the Stock Status Profile in this report and is the best data type to evaluate wild cutthroat status. These data would be deemed excellent if the marking program for hatchery fish were evaluated to determine the quality of the mark, the duration of mark visibility, and the accuracy of the individual responsible for reading the marks. Currently, the data quality is considered fair. There is also a question regarding the efficiency of the two traps for capturing fish and its variability across years.

What is clear from the data is that before hatchery anadromous cutthroat were introduced, 108 and 75 native cutthroat were captured in 1958-59 and 1959-60, respectively in Beaver Creek. Unmarked returns from 1965 to 1970 averaged over 1,000 adults. It is likely that some of these fish were unmarked hatchery fish, offspring of hatchery fish spawning in the wild, and offspring of wild fish. By 1971 the numbers of unmarked fish had been reduced to 43, and by 1980 the return was only 12 fish. After disease outbreaks at the hatchery in the early 1980s, adult cutthroat were not passed above the Beaver Creek traps in order to maintain water quality at the hatchery. By 1990 all smolts released were adipose-fin clipped, and since that time the annual number of unmarked fish returning to the trap has been no more than five and has averaged three fish.

Column 4 in the Stock Assessment section of the Stock Status Profile in this report represents total returns of cutthroat to the hatchery and column 3 is the smolt-to-adult survival for hatchery cutthroat smolts based on return year. In recent years both these measures have also been low.

Columbia River cutthroat sport catch data collected from 1972 to 1995 during a survey conducted to estimate salmon and steelhead catch are also available. Data quality from the survey is fair. Because the survey targeted salmon and steelhead, changes in angling effort for cutthroat cannot be quantified. Some sampling inconsistencies were apparent in the early to mid-1970s, and in some years sampling was incomplete. More restrictive angling regulations, implemented during the survey, also appear to have reduced cutthroat catch, but the extent of this reduction has not been determined.

The catch between 1971 and 1991 was composed of both hatchery and wild fish. Small samples from this fishery were collected between 1979 and 1982. Tipping (1982) found that 20% of the catch was wild (n=31). Sampling in 1979 and 1980 indicated that 50% of the catch was wild. Columbia River estuary sampling in 1981 indicated that 21% of the sample (n=141) was wild (Loch 1982). The catch data suggest a decline in cutthroat abundance over time.

There are no population-size data, only distribution data, for resident Elochoman/Skamokawa Creek cutthroat, so the status of this life history form cannot be assessed. WDF et al. (1993) characterized the Elochoman River and Skamokowa Creek coho and winter steelhead stocks as depressed. Severe habitat degradation has occurred and was identified as one of the key factors limiting wild production. Since resident coastal cutthroat have similar freshwater habitat requirements as anadromous cutthroat, coho, and winter steelhead, we believe that their status is also depressed.

FACTORS AFFECTING PRODUCTION

Habitat--The coastal cutthroat trout's extended freshwater residency and the anadromous form's near-shore migratory patterns require specific and varied freshwater and esturarine habitat types. The Elochoman and Skamokawa ecosystems have been degraded by past and present human activities that have reduced the habitat quality, quantity and complexity. The primary land-use activities responsible for habitat degradation include road building, timber harvesting, agriculture, and rural development. These upslope and riparian activities have increased sediment, reduced woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

Most land in these watersheds is managed for timber production. Logging in the riparian zone has produced riparian habitat which is low in species diversity and remains in early successional stages. As a result, summer water temperatures are elevated, and large woody debris is lacking. North Elochoman River Watershed Analysis indicated that

increased fine sediment limits fish production (DNR 1996). Increases in fine sediment decreases survival of trout eggs and alevins, reduces stream productivity and ultimately food availability, and decrease the size and depth of pools which are important rearing and adult holding areas for cutthroat trout. Large pools (> 50 sq yds and > 6 ft deep) have been reduced by 84% on the Elochoman River since 1945 (USFS et al. 1993). Increases in large woody debris would increase fish productivity by forming and maintaining pools, providing fish cover, and trapping spawning gravel.

Elochoman/Skamokawa Creek anadromous cutthroat use the Columbia River estuary during the late winter, spring and summer. Sherwood et al. (1990) estimated that the tidelands, swamps and wetlands in the Columbia River estuary were reduced by 40% from 1870 to 1970. The recent changes in ocean current patterns, such as El Niño have reduced smolt-to-adult survival of all Columbia River salmonids. Smolt-to-adult survival of hatchery anadromous cutthroat released in the Columbia Basin has decreased since the 1980s (Byrne 1995; Tipping 1995). Reduction in estuarine habitat and poor near-shore ocean conditions have contributed to the decline of anadromous cutthroat trout.

Harvest Management--There is no directed commercial harvest of coastal cutthroat trout although small numbers have been caught in the lower Columbia River gill net salmon fishery. Angler harvest of wild coastal cutthroat was high but has tapered off dramatically as sportfishing regulations have become more restrictive over the years to protect cutthroat. Tributaries are closed to protect spawning adults. A 12-inch minimum size limit in mainstem streams was adopted in 1985 to permit most females to spawn at least once. A wild cutthroat release regulation took effect in 1992 limiting harvest to hatchery fish. In addition juvenile protection occurs in the form of stream closures to protect smolts from March 15 to May 31. In 1994 a two-trout daily limit with an 8-inch minimum size limit was adopted for tributaries to protect resident fish. Since wild cutthroat harvest is prohibited in mainstems and limited in tributaries, directed harvest is not considered significant. The extent of wild cutthroat mortality from hooking and illegal harvest is unknown but is believed to be low.

Hatchery--There are two hatcheries on the Elochoman River. Beaver Creek Hatchery at RM 6 and Elochoman Hatchery at RM 9 were constructed in the late 1950s under the Mitchell Act to mitigate for the anadromous fish losses caused by the construction and operation of mainstem hydroelectric dams on the Columbia River. Beaver Creek Hatchery released steelhead and anadromous cutthroat trout while the Elochoman Hatchery produces coho and fall chinook. Beaver Creek Hatchery was closed in 1999 due to budget constraints. Ecological impacts to wild cutthroat trout from salmon and steelhead hatchery releases are a concern, and they are currently being investigated (Fuss et al. 1996).

Artificial production of coastal cutthroat in southwest Washington began in 1958 from adults captured in the Green, Nemah, and Elochoman rivers (Lavier 1959). In 1963 fry

from a captive brood stock derived from the Alsea River in Oregon were imported. In 1967-68 an anadromous cutthroat/steelhead hybrid was developed. In 1968 all the stocks mentioned above were combined with some Cowlitz basin stocks. Hybridization of stocks, use of captive brood, hybridization with steelhead, and advancement of the spawn timing has likely limited the spawning success of these hatchery fish in the wild. However, when interbreeding with wild stocks does occur the results are likely to be detrimental to wild stocks.

The coastal cutthroat hatchery program consisted of two releases in the lower mainstem of the Elochoman River. The first took place in April and was a release of smolted fish intended to increase the numbers of anadromous fish. The same group of fish was held until late May when many of these fish lost their smolt appearance and were then released. The second release was made to provide catchable fish for the opening day fishery in late May (Lucas 1980). In the early 1980s, the coastal cutthroat program focus switched to the anadromous form and the late May releases were discontinued. No hatchery smolts were released into Skamokawa Creek. From 1989 to 1993 an average of 34,620 anadromous coastal cutthroat smolts were released into the Elochoman River from Beaver Creek Hatchery annually. Interactions between hatchery and wild cutthroat remain a concern.

Other Factors--Marine mammal populations along the west coast including the Columbia River have increased since they were protected under the federal Marine Mammal Protection Act in 1976. Current population estimates are estimated to range from 300-500 sea lions and more than 3,000 harbor seals in the Columbia River. As these populations have increased, so has their food and fish consumption. Both sea lions and seals are most abundant from late winter through spring and can intercept both anadromous cutthroat smolts and kelts as they move toward the estuary. Anadromous cutthroat adults returning to Beaver Creek Hatchery were examined for marine mammal marks. The percentage of returning adults with marks ranged from 0% to 16% and averaged 7% since 1982. Estimates of cutthroat predation by marine mammals have not been made, but the marine mammal mark rate indicates that in some years it may be high.

LOWER COLUMBIA — ABERNATHY CREEK/GERMANY CREEK/MILL CREEK/COAL CREEK COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Abernathy Creek/Germany Creek/Mill Creek/Coal Creek coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. Abernathy, Germany, Mill and Coal creeks enter the Columbia River between RM 53 and RM 56. Because of the proximity of these streams, their similar sizes and drainage characteristics, and the limited biological information available for them, cutthroat in these creeks have been combined into one stock complex. However, as more biological and genetic data become available, cutthroat in these creeks may be classified as separate stocks or stock complexes.

Anadromous, resident and fluvial forms distribute themselves throughout these watersheds. The anadromous form has access to most of the watersheds with the exception of upper tributary reaches where a combination of steep gradient and high flow can limit passage, and the areas above the falls on Slide and Cameron creeks, which are tributaries of Abernathy Creek. The resident forms have been observed throughout the system.

The data on anadromous cutthroat are limited, but we believe that the timing of stream entry and spawning in Abernathy, Germany, Mill and Coal creeks is similar to that of Elochoman fish which enter the river from late July through mid-April, with peak entry in the fall, with spawning occurring January through April. Fluvial and resident spawning times have not been documented in this watershed but are believed to be similar to the anadromous spawning time. Size, age, coloration, and genetic data are unavailable for this stock. However, it is believed that these data would be similar to those for other Columbia River stocks. Anadromous coastal cutthroat life history data are available for the Kalama, Toutle, and Cowlitz River (Hulett 1995; Loch 1982, Loch and Downing 1990; Loch and Pahutski 1991, 1992; Loch and Byrd 1993; Tipping and Springer 1980; Tipping 1982). Genetic sampling within these drainages has not yet been conducted.

Abernathy Creek/Germany Creek/Mill Creek/Coal Creek coastal cutthroat are native and are sustained by wild production.

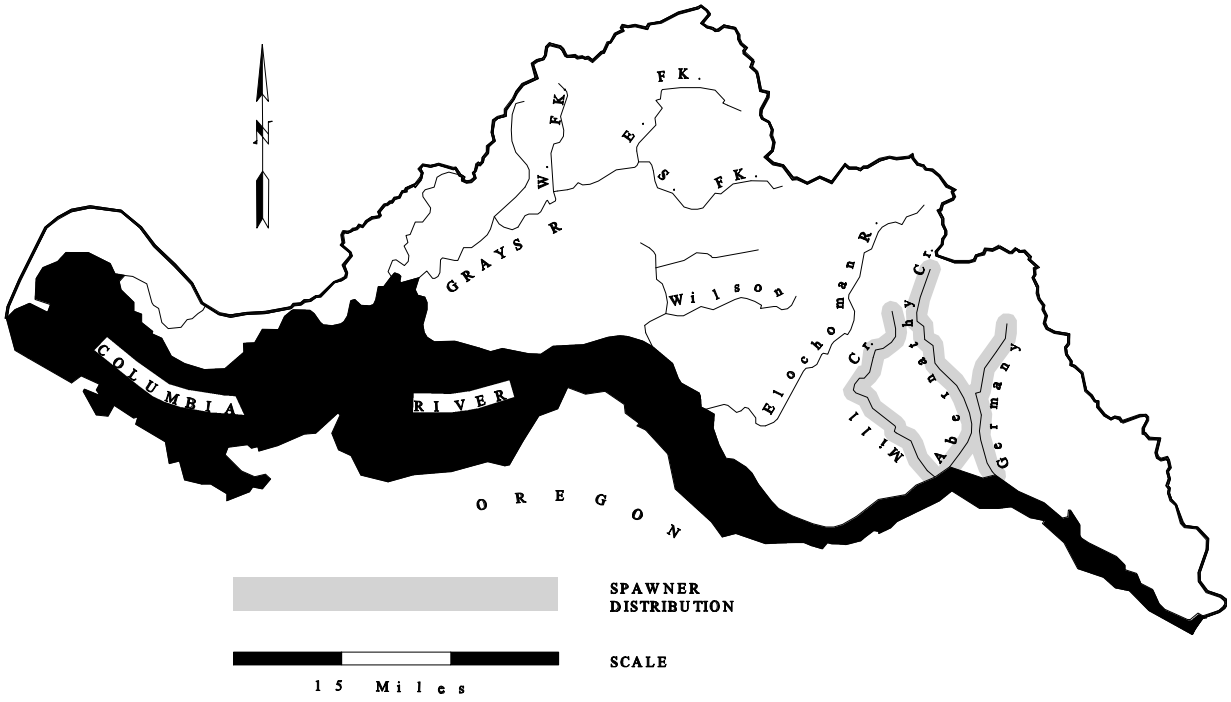
STOCK STATUS

The status of the Abernathy Creek/Germany Creek/Mill Creek/Coal Creek stock is Depressed based on chronically low counts at the Abernathy fish trap and a long-term decline in the Columbia River sport catch from RM 48 to RM 66. Although the surveys did not attempt to estimate trends among the various life history forms, it is thought that they represent mainly anadromous and fluvial types. Wild anadromous escapement

STOCK DEFINITION PROFILE for Abernathy, Germany, Mill, and Coal Creeks Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**DISTINCT?**
Anad Riv Entry	■	■	■	■				■	■	■	■	■	No
Anad Spawning	■	■	■	■									No

Timings are unknown. These timings are based on those of the Elochoman stock complex.

BIOLOGICAL CHARACTERISTICS

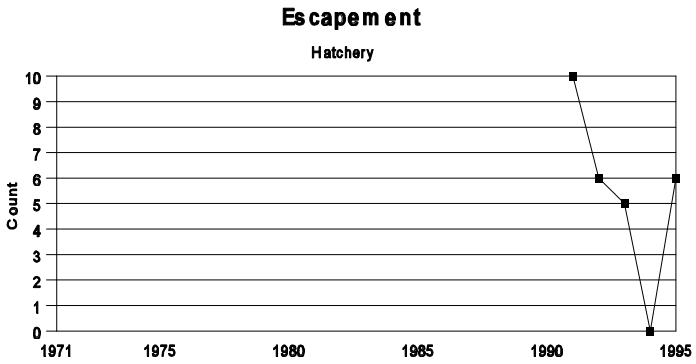
DISTINCT? - Unknown

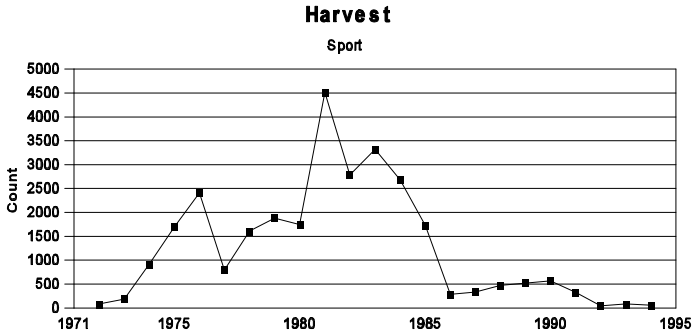
STOCK STATUS PROFILE for Abernathy, Germany, Mill, and Coal Creeks Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Hatchery	HARVEST Sport	ESCAPE Hatchery	
1971				
1972		84		
1973		188		
1974		913		
1975		1,698		
1976		2,410		
1977		797		
1978		1,610		
1979		1,879		
1980		1,744		
1981		4,513		
1982		2,786		
1983		3,322		
1984		2,682		
1985		1,728		
1986		291		
1987		335		
1988		473		
1989		520		
1990		568		
1991	10	328	14	
1992	6	42	1	
1993	5	83	2	
1994	0	61	0	
1995	6		0	





AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Depressed

Screening Criteria

Long-term negative trend

has been measured between zero and ten fish since 1991. The trap on Abernathy Creek is operated to collect chinook salmon brood stock, and to make the escapement estimates of coho and steelhead. Its efficiency for cutthroat is unknown. Columbia River cutthroat sport catch data from 1972 to 1995 are available from a survey conducted to estimate salmon and steelhead catch, but cutthroat trout catches were reported as well. Data quality from the survey is fair. Because the survey targeted salmon and steelhead, changes in angling effort for cutthroat cannot be quantified. Some sampling inconsistencies were apparent in the early to mid-1970s, and in some years sampling was incomplete. More restrictive angling regulations, implemented during the survey, also appear to have reduced cutthroat catch, but the extent of this reduction has not been determined. Angler tag recoveries for Cowlitz Hatchery anadromous cutthroat in this area are high, indicating that both Cowlitz and Abernathy Creek stocks contribute to the catch in this area.

The catch between 1971 and 1991 was composed of both hatchery and wild fish. Small samples from this fishery were collected between 1979 and 1982. Tipping (1982) found that 20% of the catch was wild (n=31). Sampling in 1979 and 1980 indicated that 50% of the catch was wild. Columbia River estuary sampling in 1981 indicated that 21% of the sample (n=141) was wild (Loch 1982). The catch data suggest a decline in cutthroat abundance over time.

There are no population-size data, only distribution data, for resident Abernathy Creek/Germany Creek/Mill Creek/Coal Creek cutthroat, so the status of this life history form cannot be assessed. WDF et al. (1993) characterized Mill, Abernathy, and Germany creeks coho and winter steelhead stocks as Depressed. Severe habitat degradation has occurred and was identified as one of the key factors limiting wild production. Since resident Abernathy Creek/Germany Creek/Mill Creek/Coal Creek coastal cutthroat have similar freshwater habitat requirements as anadromous cutthroat, coho and winter steelhead, we believe that their production is also depressed.

FACTORS AFFECTING PRODUCTION

Habitat--The coastal cutthroat trout's extended freshwater residency and the anadromous form's near shore migratory patterns require specific and varied freshwater and estuarine habitat types. The Mill, Abernathy, and Germany creeks ecosystems have been degraded by past and present human activities that have reduced the habitat quality, quantity, and complexity. The primary land-use activities responsible for habitat degradation include road building, timber harvesting, agriculture, and rural development. These upslope and riparian activities have increased sediment, reduced woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

Most land in these watersheds is managed for timber production. Logging in riparian zones has produced riparian habitat which is simple and in early successional stages. As a result, summer water temperatures are elevated, and large woody debris is lacking. The Elochoman Block Fish and Habitat Analysis, which includes Mill and Abernathy creeks indicated that increased fine sediments in stream and lack of large woody debris limit fish production (Hunter 1995). Increases in fine sediment decrease survival of trout eggs and alevins, reduce stream productivity and ultimately food availability, and decrease the size and depth of pools which are important rearing and adult holding areas for cutthroat trout. Large pools (> 50 sq yds and > 6 ft deep) have been reduced by 44% in Germany Creek since 1945 (USFS et al. 1993). Increases in large woody debris would increase fish productivity by forming and maintaining pools, providing fish cover, and trapping spawning gravel.

Abernathy Creek/Germany Creek/Mill Creek/Coal Creek anadromous cutthroat use the Columbia River estuary primarily during the late winter, spring and summer. Sherwood et al. (1990) estimated that the tidelands, swamps, and wetlands in the Columbia River estuary were reduced by 40% from 1870 to 1990. The recent changes in ocean current patterns, such as El Niño, have reduced smolt-to-adult survival of all Columbia River salmonids. Smolt-to-adult survival of hatchery anadromous cutthroat released in the Columbia Basin has decreased since the 1980s (Byrne 1995; Tipping 1995). Reduction in estuarine habitat and poor near-shore ocean conditions have contributed to the decline of anadromous cutthroat trout.

Harvest Management--There is no directed commercial harvest of coastal cutthroat trout, although small numbers have been caught in the lower Columbia River gill net fishery. Angler harvest of wild coastal cutthroat was high but has tapered off dramatically as sportfishing regulations have become more restrictive over the years to protect cutthroat. Tributaries are closed to protect spawning adults. A twelve-inch minimum size in mainstem streams was adopted in 1985 to permit most females to spawn at least once. A wild cutthroat release regulation took effect in 1992 limiting harvest to hatchery fish. In addition, juvenile protection occurs in the form of stream closures to protect smolts from March 15 to May 31. In 1994 a two-trout daily limit with an eight-inch minimum size was adopted for tributaries. Since wild cutthroat harvest is prohibited in mainstems and limited in tributaries, directed harvest is very low. Wild mortality is unknown but believed to be low from both hooking mortality and illegal harvest.

Hatchery--The Abernathy Fish Technology Center (USFWS) operates a hatchery on Abernathy Creek which raises fall chinook. The hatchery was constructed in the late 1950s under the Mitchell Act to mitigate for the anadromous fish losses caused by the construction and operation of mainstem hydroelectric dams on the Columbia River.

The WDFW coastal cutthroat hatchery program consisted of two releases into Abernathy, Mill and Germany creeks each year. The first took place in April and was a release of

smolted fish intended to increase numbers of anadromous fish. The same group of fish was held until late May when many of these fish lost their smolt appearance and then were released. This second release was made to provide catchable fish for the opening day fishery in late May (Lucas 1980). In the early 1980s, the coastal cutthroat program focus switched to the anadromous form, and the late May releases were discontinued. From 1989 to 1993 an average of 5,700, 5,620, and 5,600 anadromous coastal cutthroat smolts were released annually into Mill, Abernathy, and Germany creeks respectively from Beaver Creek Hatchery. More recent hatchery releases were much smaller, with 2,000 smolts going only into Abernathy Creek. Please see the Elochoman stock report for more information about the Beaver Creek Hatchery stock. Interactions between hatchery and wild cutthroat remain a concern.

Other Factors--Marine mammal populations along the west coast including the Columbia River have increased since they were protected under the federal Marine Mammal Protection Act in 1976. Current population estimates range from approximately 300-500 sea lions and in excess of 3,000 harbor seals in the Columbia River (NOAA 1997). As these populations have increased, so has their food and fish consumption. Both sea lions and seals are most abundant from late winter through spring and can intercept both anadromous cutthroat smolts and kelts as they move toward the estuary. Anadromous cutthroat adults returning to Beaver Creek Hatchery were examined for marine mammal marks. The percentage of returning adults with marks ranged from 0% to 16% and averaged 7% since 1982. Estimates of cutthroat predation by marine mammals have not been made, but the marine mammal mark rate indicates that in some years it may be high.

LOWER COLUMBIA — COWLITZ COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Cowlitz coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds.

Anadromous, resident, fluvial and adfluvial forms distribute themselves throughout the watershed. Historically the anadromous form had access to most of the watershed with the exception of upper tributary reaches, where a combination of steep gradient and high flow can limit passage. However, with the construction of Mayfield and Mossyrock dams in the 1960s, anadromous cutthroat were unable to access historically important rivers such as the Tilton, Cispus and upper Cowlitz rivers. The resident form has been observed throughout the system and presently is the only form above Mayfield Dam. The adfluvial form is present in the three Cowlitz reservoirs of Mayfield, Riffe and Scanewa.

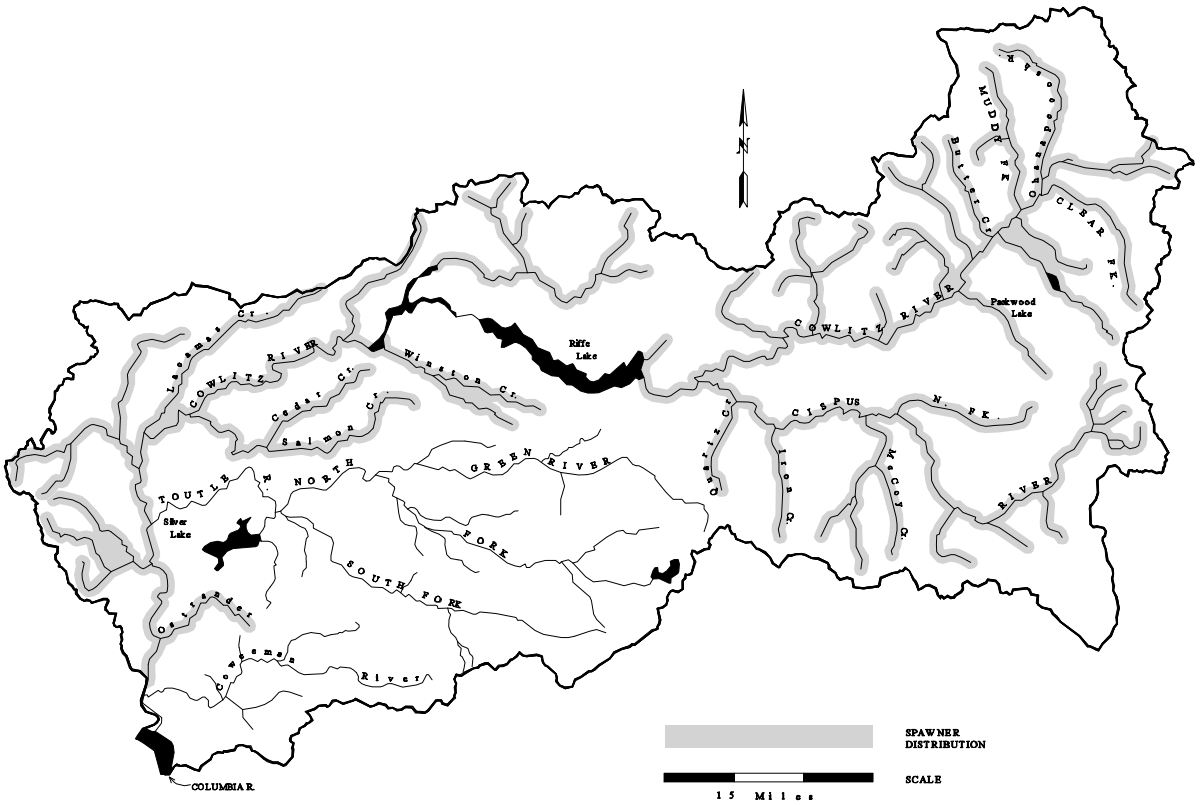
As with other wild Columbia River anadromous cutthroat, entry into the Columbia River commences in late July and continues through October. Peak entry into the Cowlitz occurs in August and September (Jack Tipping, WDFW, personal communication). Spawning activity occurs from January through April. Adfluvial, fluvial and resident spawning times have not been documented in this watershed but are believed to be similar to the anadromous spawning time in the lower river. As elevations increase spawning time is likely to be later because of colder water temperatures. Spawning is likely to occur as late as June in higher elevations. As a result of artificial selection for early spawning, hatchery cutthroat in the Cowlitz watershed now spawn from November to February. Smolt migration occurs in the spring after juveniles have spent two to three years in freshwater (Tipping and Springer 1980). Not all cutthroat spawn on initial entry to freshwater; mature fish represent between 53% and 71.7% of initial-entry fish (Tipping 1981). Tipping and Springer (1980) and Tipping (1982) give age-specific data for this stock.

The relationship of this stock complex to other stocks and stock complexes is unknown. Genetic sampling and analysis are needed to make this determination. In 1981 samples from 10 groups of cutthroat in the Cowlitz were collected for genetic analysis. Two populations were Cowlitz Trout Hatchery populations, and the remaining eight were wild anadromous/resident or resident populations (Tipping 1982). The analysis showed little genetic variation among sample groups. In 1994 and 1995 samples were collected from wild resident and hatchery anadromous populations for allozyme and DNA analysis. The Cowlitz collection proved to be significantly different from other lower Columbia collections except the Elochoman/Skamokawa Creek collection. The Cowlitz Trout Hatchery stock was mixed with the Beaver Creek Hatchery stock, so the similarity of these two hatchery stocks is not surprising.

STOCK DEFINITION PROFILE for Cowlitz Coastal Cutthroat

SPAWNER DISTRIBUTION

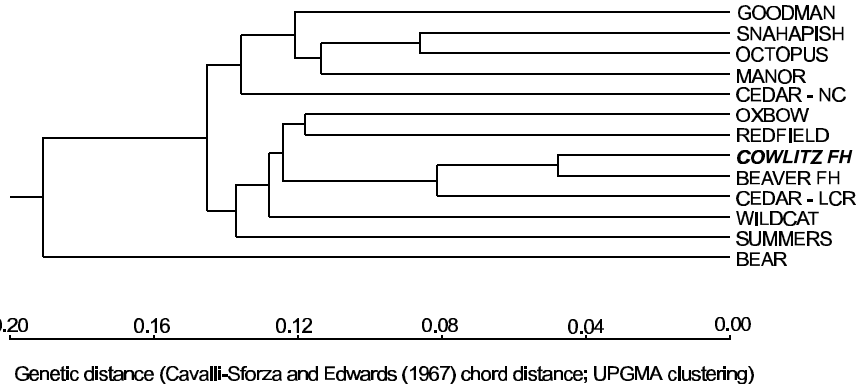
DISTINCT? - **UNKNOWN**



TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry								■	■	■			No
Anad Spawning	■	■	■	■	■								No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown



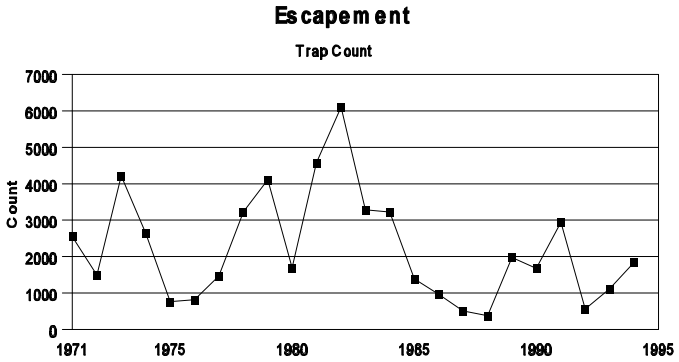
GENETICS - The Cowlitz Hatchery collection (N=119), made in 1995, was not significantly different from the Beaver Creek Hatchery collection (Elochoman/Skamokawa Cr. stock complex) (33 allozyme-locus G-tests; *P*<0.005) but was distinct from the Kalama and Lewis collections (33 alloyzme-locus G-tests; P<0.001).

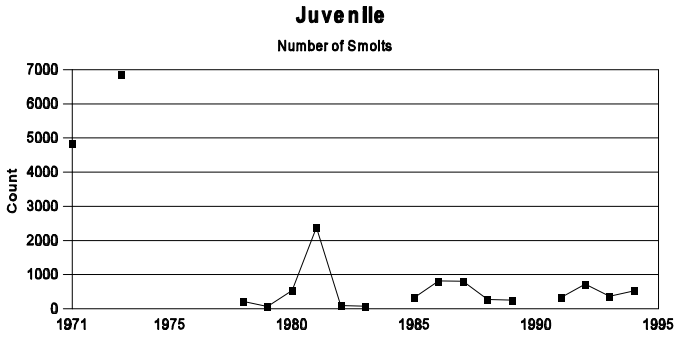
STOCK STATUS PROFILE for Cowlitz Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Trap count	JUVENILE Smolts	HARVEST Sport	
1971	2,546	4,826		
1972	1,495		382	
1973	1,217	6,868	273	
1974	2,652		976	
1975	764		1,707	
1976	816		2,675	
1977	1,465		814	
1978	3,235	213	1,636	
1979	4,111	60	1,879	
1980	1,689	536	1,744	
1981	4,577	2,382	4,513	
1982	6,103	88	3,027	
1983	3,282	78	3,759	
1984	3,323		2,801	
1985	1,385	327	1,732	
1986	965	812	312	
1987	508	804	360	
1988	383	271	483	
1989	1,980	253	727	
1990	1,683		631	
1991	2,937	326	370	
1992	556	716	83	
1993	1,115	364	89	
1994	1,848	531	64	
1995				





AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Depressed

Screening Criteria
Long-term Negative Trend

Cowlitz coastal cutthroat trout are native and are sustained by wild production.

STOCK STATUS

The status of the Cowlitz stock complex is Depressed based on chronically depressed adult and juvenile trap counts and a long-term decline in the Columbia River catch from RM 72 to RM 48. Anadromous cutthroat were counted at Mayfield Dam from 1962 to 1996. Counts ranged from 5,458 to 12,324 and averaged 8,698. The five-year average from 1990 to 1994 was 1,628 hatchery and wild cutthroat. This is only 19% of the 1962-66 average. The Mayfield migrant trap is operated to monitor passage of fish from Mayfield Reservoir into the Cowlitz River. Counts of cutthroat outmigrants from 1964 to 1966 averaged 5,295. The recent five-year average is 484 fish, only 9% of the 1964-66 average.

Columbia River cutthroat sport catch data from 1972 to 1995 were collected during a survey to estimate salmon and steelhead catch (Leider 1997). Data quality from the survey is fair. Because the survey targeted salmon and steelhead, changes in angling effort for cutthroat cannot be quantified. Some sampling inconsistencies were apparent in the early to mid-1970s, and in some years sampling was incomplete. More restrictive angling regulations, implemented during the survey, also appear to have reduced cutthroat catch, but the extent of this reduction has not been determined.

Cowlitz River hatchery cutthroat trout are harvested in the Columbia River fishery. Tipping (1986) found that 31.5% of the tag returns for Cowlitz Hatchery fish were from the Columbia River fishery. The bulk of this fishery takes place along the Washington shore between the mouth of the Cowlitz and the town of Cathlamet. Small samples from this fishery and from the estuary were collected between 1979 and 1982. Tipping (1982) estimated that 20% of the catch was wild in 1981 (n=31). Sampling in 1979 and 1980 indicated that 50% of the catch was wild. Estuary sampling in 1981 indicated that 21% of the sample (n=141) was wild (Loch 1982).

The earliest estimate of sport catch of anadromous cutthroat was at least 20,000 with 6,000 of these caught above Mayfield Dam (Kray 1957). Minimum estimates of sport catch for 1979, 1980, and 1981 ranged from 5,014, 123, and 1,226 fish (Tipping 1982). Scale analysis indicated that the proportion of wild cutthroat in the catch declined from 40% to 20% during this time. Devore (1987) estimated the catch at 3,644, 3,724, and 5,592 for 1983, 1984 and 1985 respectively. Many of the fish were harvested in the lower Cowlitz River, and we do not know what portion of these wild fish were destined for the Toutle, Coweeman, or other rivers in the Cowlitz basin.

There are no population-size data, only distribution data, for resident Cowlitz cutthroat, so the status of this life history form cannot be assessed. WDF et al. (1993) characterized the Cowlitz River chinook, coho, and winter steelhead stocks as depressed. Severe habitat

degradation had occurred and was identified as one of the key factors limiting wild production. Since resident coastal cutthroat have similar freshwater habitat requirements as anadromous cutthroat, coho and winter steelhead, we believe that their status is also depressed.

FACTORS AFFECTING PRODUCTION

Habitat--The coastal cutthroat trout's extended freshwater residency and the anadromous form's near-shore migratory patterns require specific and varied freshwater and estuarine habitat types. The Cowlitz River ecosystem has been degraded by past and present human activities that have reduced fish habitat, quality, quantity, and complexity. The primary land-use activities responsible for habitat degradation include hydroelectric development, road building, timber harvesting, agriculture and rural development. The construction of Mayfield and Mossyrock dams in the 1960s eliminated anadromous fish access to historically productive areas. Upslope and riparian activities have increased sediment, reduced woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

Most land in this watershed is managed for timber production. Logging in the riparian zone has produced riparian habitat which has reduced ecosystem diversity and is locked into early successional stages. As a result, summer water temperatures are elevated, and large woody debris is lacking. Increases in fine sediment in streams in the watershed have decreased survival of trout eggs and alevins, reduced stream productivity and ultimately food availability, and decreased the size and depth of pools which are important rearing and adult holding areas for cutthroat trout. Large pools (> 50 sq yds and > 6 ft deep) have been reduced by 58% on the Cowlitz River since 1945 (USFS et al. 1993). Increases in large woody debris would increase productivity by forming and maintaining pools, providing fish cover, and trapping spawning gravel.

Cowlitz sea-run cutthroat use the Columbia River estuary during late winter, spring and summer. Sherwood et al. (1990) estimated that the tidelands, swamps and wetlands in the Columbia River estuary were reduced by 40% from 1870 to 1970. The recent changes in ocean current patterns, such as El Niño have reduced smolt-to-adult survival of all Columbia River salmonids. Smolt-to-adult survival of hatchery anadromous cutthroat released in the Columbia Basin has decreased since the 1980s (Byrne 1995, Tipping 1995). Reduction in estuarine habitat and poor near-shore ocean conditions have also contributed to the decline of anadromous cutthroat trout.

Harvest Management--There is no directed commercial harvest of coastal cutthroat trout although small numbers have been caught in the lower Columbia River salmon gill net fishery. Angler harvest of wild cutthroat was high but has tapered off dramatically as sportfishing regulations have become more restrictive over the years to protect coastal cutthroat. Tributaries are closed to angling to protect spawning adults. A 12-inch minimum

size limit in the mainstem streams was adopted in 1985 to permit most females to spawn at least once. In 1986 the daily limit on the Columbia River was reduced from eight to two trout In addition, juvenile protection occurs in the form of stream closures from March 15 to May 31 to protect smolts. In 1992 a regulation requiring release of wild cutthroat was adopted, limiting harvest to hatchery fish. In 1994 a two-trout daily limit with an eight-inch minimum size limit was adopted for tributaries to protect resident cutthroat. Since wild cutthroat harvest is prohibited in mainstems and limited in tributaries, directed harvest is very low. The extent of wild cutthroat mortality from hooking and illegal harvest is unknown but believed to be low.

Hatchery--Cowlitz Trout and Cowlitz Salmon hatcheries were constructed in 1967 downstream of Mayfield Dam by Tacoma Public Utilities to mitigate for salmonid losses caused by the construction of Mayfield and Mossyrock dams. These facilities produce and release winter and summer steelhead, spring and fall chinook, and coho salmon. Ecological impacts to wild cutthroat from these hatchery releases are unknown.

Artificial production of anadromous cutthroat on the Cowlitz River began in 1968 at Cowlitz Trout Hatchery. Beaver Creek brood stock were originally imported to start the hatchery program, and they were combined with Cowlitz natives. In 1976 Beaver Creek brood stock importation was discontinued, and eggs were collected only from local wild fish. Females are spawned primarily from November to February. If fish returning to the hatchery are numerous, eggs are collected only from larger repeat migrants (WDW 1988). The goal of the program is 115,000 smolts larger than 210 mm in length to produce a return to the hatchery of 5,000 adults. Fish are released into Blue Creek, the Cowlitz and Coweeman rivers, and Salmon Creek. Advancement of hatchery fish spawning time has reduced the possibility of interbreeding with wild fish. However, hatchery/wild interactions remain a concern.

Other Factors--Marine mammals populations along the West Coast including the Columbia River have increased since they were protected under the federal Marine Mammal Protection Act in 1976. Current population estimates range from 300-500 sea lions, and with more than 3,000 harbor seals in the Columbia River. As these populations have increased, so has their food and fish consumption. Both sea lions and seals are most abundant from late winter through spring and can intercept both sea-run cutthroat smolts and kelts as they move toward the estuary. Anadromous cutthroat adults returning to Beaver Creek Hatchery were examined for marine mammal marks. The percentage of returning adults with marks ranged from 0% to 16% and averaged 7% since 1982. Estimates of cutthroat predation by marine mammals have not been made, but the marine mammal mark rate indicates that in some years it may be high.

LOWER COLUMBIA — COWEEMAN COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Coweeman coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. The Coweeman River enters the Cowlitz River at RM 1. Anadromous, fluvial and resident cutthroat life history forms in the river distribute themselves throughout the watershed. The anadromous form has access to most of the watershed with the exception of the area above Washboard Falls at RM 31 and of upper tributary reaches, where a combination of steep gradient and high flow limits passage. The fluvial and resident forms have been observed throughout the system. There is no record of hatchery cutthroat releases in this drainage.

As with other wild Columbia River sea-run cutthroat, entry into the Columbia River commences in late July and continues through mid-April. Although the data on anadromous Coweeman fish are limited, we believe that river entry timing and spawn timing are similar to those of Cowlitz and Toutle rivers fish. River entry into these streams occurs from August through March, with peak entry in the fall. Spawning activity occurs from January through April. Fluvial and resident spawning times have not been documented in this watershed but are believed to be similar to the anadromous spawning time. Anadromous spawn time was determined from fish returning to the Beaver Creek Hatchery, located on the Elochoman River, during the initial years of anadromous cutthroat brood stock collection. Advancement of spawning time had hatchery cutthroat spawning from December to February (Byrne, 1995). Size, age, and coloration data are unavailable for this stock. However, it is believed that they would be similar to other Columbia River stocks. No genetic sampling has been done in this drainage. Anadromous cutthroat life history data are available for the Kalama, Toutle, and Cowlitz rivers (Hulett 1995; Loch 1982; Loch and Downing 1990; Loch and Pahutski 1991, 1992 and Loch and Byrd 1993; Tipping and Springer 1980; and Tipping 1982).

Coweeman coastal cutthroat are considered native and are sustained by natural production.

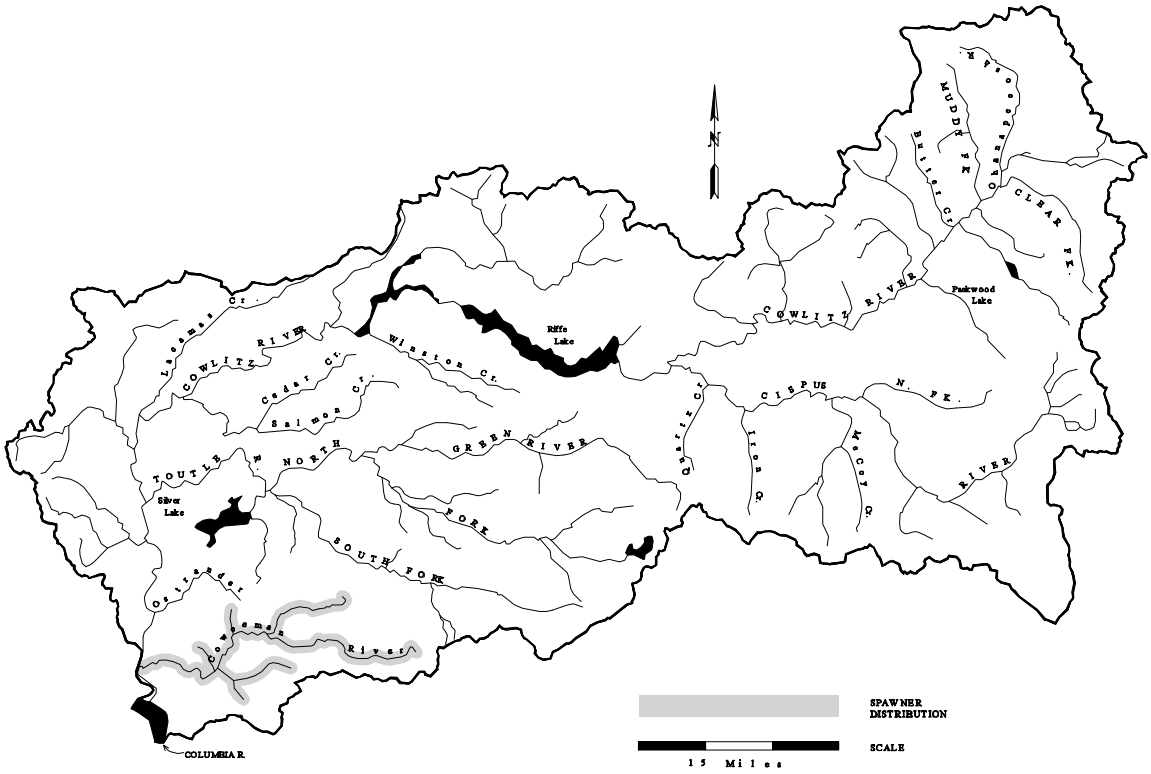
STOCK STATUS

The status of Coweeman coastal cutthroat is Depressed based on a long-term negative trend in the Columbia River (RM 48 to RM 72) cutthroat catch. Catch data are from a 1972 to 1995 survey of Columbia River fisheries designed to estimate salmon and steelhead catch, therefore changes in angling effort for cutthroat cannot be quantified. Some sampling inconsistencies were apparent in the early to mid-1970s, and in some

STOCK DEFINITION PROFILE for Coweeman Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



TIMING	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**DISTINCT?**
Anad Riv Entry	■	■	■	■				■	■	■	■	■	No
Anad Spawning	■	■	■	■									No

Timings are unknown. These timings are based on those for the Cowlitz stock complex.

BIOLOGICAL CHARACTERISTICS

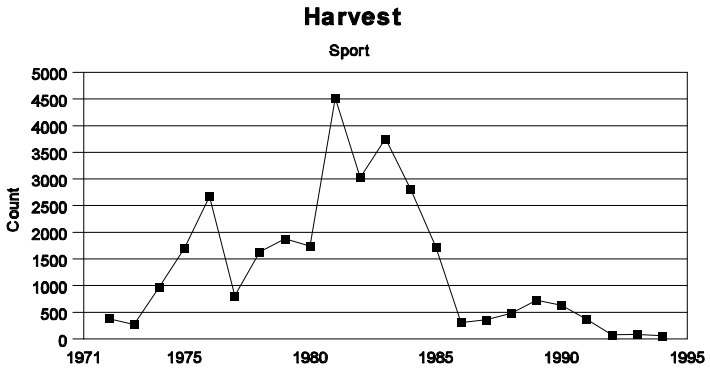
DISTINCT? - Unknown

STOCK STATUS PROFILE for Coweeman Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	HARVEST Sport			
1971				
1972	382			
1973	273			
1974	976			
1975	1,707			
1976	2,675			
1977	814			
1978	1,636			
1979	1,879			
1980	1,744			
1981	4,516			
1982	3,027			
1983	3,759			
1984	2,801			
1985	1,732			
1986	312			
1987	360			
1988	483			
1989	727			
1990	631			
1991	370			
1992	83			
1993	89			
1994	64			
1995				



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Depressed

Screening Criteria

Long-term negative trend

years sampling was incomplete. More restrictive angling regulations during the survey period also appear to have reduced cutthroat catch. Overall, data quality is fair.

The catch between 1971 and 1991 was composed of both hatchery and wild fish. Small samples from this fishery were collected between 1979 and 1982. Sampling for 1979 and 1980 indicated that 50% of the catch was wild. While Tipping (1982) found that 20% of the catch was wild (n=31). Columbia River estuary sampling in 1981 indicated that 21% of the sample (n=141) was wild (Loch 1982). The catch data suggest a decline in cutthroat abundance over time.

There are no population size data, only distribution data, for resident Coweeman cutthroat, so the status of this life history form cannot be assessed. WDF et al. (1993) described the Coweeman River chinook, coho, and winter steelhead stocks as depressed. Severe habitat degradation was identified as one of the key factors limiting wild production. Since resident coastal cutthroat have similar freshwater habitat requirements as anadromous cutthroat, coho, and winter steelhead, we believe that their status is also depressed.

FACTORS AFFECTING PRODUCTION

Habitat--The coastal cutthroat trout's extended freshwater residency and the anadromous form's near-shore migratory patterns require specific and varied freshwater and estuarine habitats. The Coweeman River ecosystem has been degraded by past and present human activities which have reduced the habitat quality, quantity and complexity. The primary land-use activities responsible for habitat degradation include road building, timber harvesting, agriculture and rural development. These upslope and riparian activities have increased sediment in streams, reduced woody debris availability and recruitment into streams, increased water temperatures, changed run-off patterns and reduced river flow.

Most land in this watershed is managed for timber production. The riparian zone is has been simplified following logging and is in early successional stages. As a result, summer water temperatures are elevated and large woody debris is lacking. Portions of the Coweeman mainstem, Baird and Mulholland creeks have been placed on the Environmental Protection Agency's list of waters that fail water quality standards due to elevated water temperatures (Herger 1996). Increases in fine sediment have decreased survival of trout eggs and alevins, reduced stream productivity and food availability, and decreased the size and depth of pools which are important rearing and adult holding areas for cutthroat trout. Large pools (> 50 sq yds in area and > 6 ft deep) have been reduced by 94% on the Coweeman since 1945 (USFS et al. 1993). Large woody debris was lacking in the upper Coweeman and its tributaries (Herger 1996). Increases in large woody debris would increase fish productivity by forming and maintaining pools, providing cover for fish and trapping spawning gravel.

Coweeman anadromous coastal cutthroat use the Columbia River estuary primarily during the late winter, spring and summer. It was estimated that the tidelands, swamps and wetlands in the Columbia River estuary were reduced by 40% between 1870 and 1970 (Sherwood et al. 1990). The recent changes in ocean current conditions such as El Niño have reduced smolt-to-adult survival of all Columbia River salmonids. Smolt-to-adult survival of hatchery-origin anadromous cutthroat released in the Columbia Basin has decreased since the 1980s (Byrne 1995, Tipping 1995). Reduction in estuarine habitat and poor near-shore ocean conditions have contributed to the decline of anadromous coastal cutthroat trout.

Harvest Management--There is no directed commercial harvest of coastal cutthroat trout although small numbers have been caught in the lower Columbia River salmon gill net fishery. Angler harvest of wild coastal cutthroat was high but has tapered off dramatically as sportfishing regulations have become more restrictive over the years to protect coastal cutthroat. Tributaries are closed to angling to protect spawning adults. A 12-inch minimum size limit in the mainstem streams was adopted in 1985 to permit females to spawn at least once. In 1986 the daily limit on the Columbia River was reduced from eight to two trout In addition, juvenile protection occurs in the form of stream closures from March 15 to May 31 to protect smolts. In 1992 a regulation requiring release of wild cutthroat was adopted limiting harvest to hatchery fish. In 1994 a two-trout daily limit with an eight-inch minimum size limit was adopted for tributaries to protect resident cutthroat. Since wild cutthroat harvest is prohibited in mainstems and limited in tributaries, directed harvest is very low. The extent of wild cutthroat mortality from hooking and illegal harvest is unknown but believed to be low.

Hatchery--No hatcheries are present on the Coweeman River. However salmon, steelhead, and anadromous cutthroat are released from two hatcheries on the Cowlitz River. About 30,000 hatchery steelhead smolts were released annually into the Coweeman River from Beaver Creek Hatchery prior to its closure in 1999. Ecological impacts to wild cutthroat trout from hatchery salmon and steelhead releases are unknown.

Anadromous cutthroat smolts from Beaver Creek Hatchery were released into the Coweeman River. From 1989 to 1993 a yearly average of 12,000 smolts was planted. More recently, releases were reduced to 5,000. Most of these smolts were acclimated at a rearing site below Goble Creek. Although spawning time for the Beaver Creek Hatchery stock had been advanced, interactions between hatchery and wild cutthroat remain a concern. Please see the Elochoman River stock report for more information about this hatchery stock.

Other Factors--Marine mammals populations along the West Coast including the Columbia River have increased since they were protected under the federal Marine Mammal Protection Act in 1976. Current population estimates range from 300-500 sea lions, and with more than 3,000 harbor seals in the Columbia River. As these populations

have increased, so has their food and fish consumption. Both sea lions and seals are most abundant from late winter through spring and can intercept both sea-run cutthroat smolts and kelts as they move toward the estuary. Anadromous cutthroat adults returning to Beaver Creek Hatchery were examined for marine mammal marks. The percentage of returning adults with marks ranged from 0% to 16% and averaged 7% since 1982. Estimates of cutthroat predation by marine mammals have not been made, but the marine mammal mark rate indicates that in some years it may be high.

LOWER COLUMBIA — TOUTLE COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Toutle coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. The Toutle River enters the Cowlitz River at RM 20. WDF et al. (1993) identified three separate steelhead stocks in the Toutle Basin, and this may be the case with coastal cutthroat, but because of limited genetic and biological data all Toutle cutthroat are currently considered to be part of one stock complex. Anadromous, resident, fluvial and adfluvial forms distribute themselves throughout the watershed. The anadromous form has access to most of the watershed with the exception of upper tributary reaches, where a combination of steep gradient and high flow limits passage. The resident and fluvial forms have been observed throughout the system. Adfluvial fish have been observed in Silver Lake.

As with other wild Columbia River anadromous cutthroat, entry to the Columbia River commences in late July and continues through mid-April. Entry to the Cowlitz occurs slightly later. Entry into the North Fork Toutle peaks between September to November with a smaller number of fish moving throughout the winter (Loch, WDFW, personal communication April 1994). Spawning activity occurs from January through June. Fluvial and resident spawning times have not been documented in this watershed but are believed to be similar to the anadromous spawning time. Anadromous spawn time was taken from wild anadromous cutthroat captured from Green River, Elochoman River, and Nemah River and held at Vancouver Hatchery and Beaver Creek Hatchery (Lavier 1960). Artificial selection for early spawn timing now has hatchery cutthroat spawning from December to February (Byrne 1995). Specific size and age data are available from the Toutle Fish Collection Facility (Loch and Downing1990; Loch and Pahutski 1991, 1992; Loch and Byrd 1993). Coloration and genetic data are unavailable for this stock complex.

This stock complex is native with wild production.

STOCK STATUS

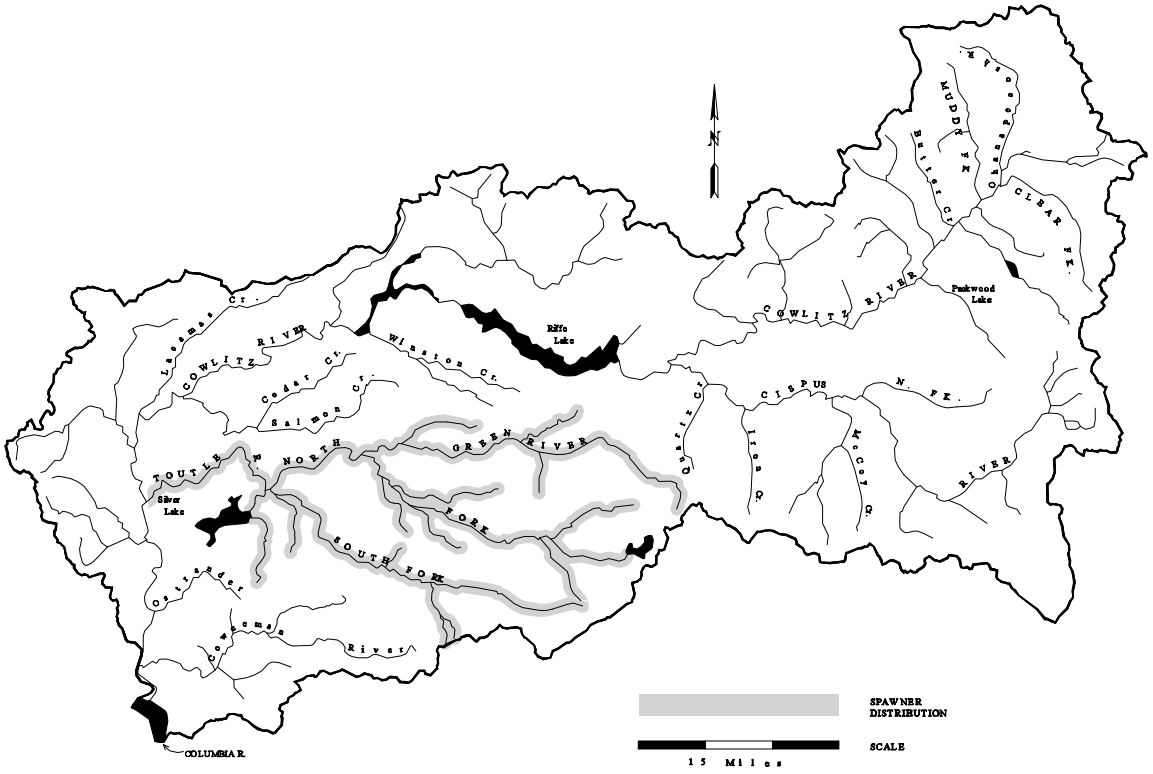
The status of Toutle coastal cutthroat is Depressed based on chronically low escapement measured at the Toutle River Fish Collection Facility and the North Toutle Hatchery, a long-term negative trend in the Columbia River catch from RM 72 to RM 48, and the habitat destruction that occurred as a result of the eruption of Mt. St. Helens in 1980. Overall, the quality of the data used to make this assessment is fair.

In 1989 the US Army Corps of Engineers completed construction of the Sediment Retention Structure and Toutle Fish Collection Facility (TFCF). Anadromous cutthroat

STOCK DEFINITION PROFILE for Toutle Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry	■	■	■	■				■	■	■	■	■	No
Anad Spawning	■	■	■	■	■	■	■						No

BIOLOGICAL CHARACTERISTICS

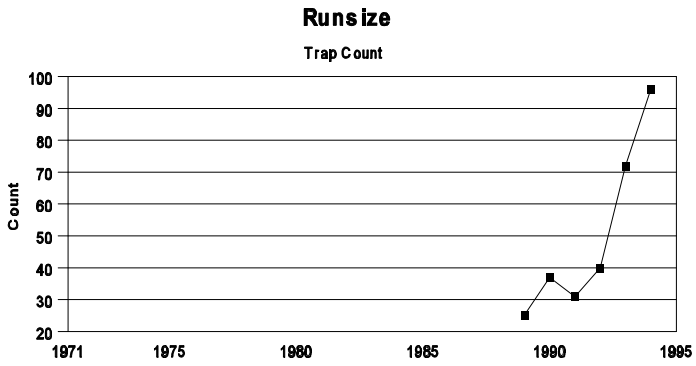
DISTINCT? - Unknown

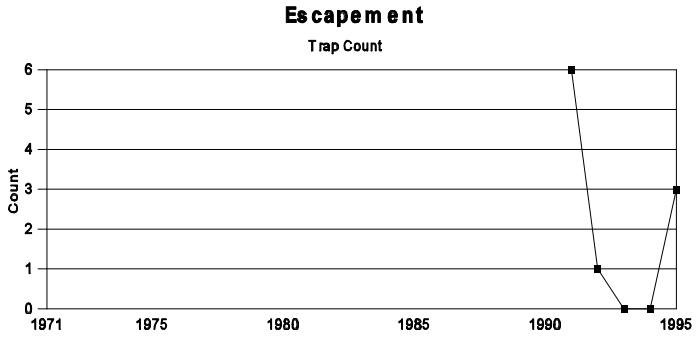
STOCK STATUS PROFILE for Toutle Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	RUNSIZE Trap count	ESCAPE Trap count	HARVEST Sport	
1971				
1972			382	
1973			273	
1974			976	
1975			1,707	
1976			2,675	
1977			814	
1978			1,636	
1979			1,879	
1980			1,744	
1981			4,513	
1982			3,027	
1983			3,759	
1984			2,801	
1985			1,732	
1986			312	
1987			360	
1988			483	
1989	25		727	
1990	37		631	
1991	31	6	370	
1992	40	1	83	
1993	72	0	89	
1994	96	0	64	
1995		3		





AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Depressed

Screening Criteria

Chronically low, LT neg trend

counts have been conducted at the TFCF and are listed in column 1 of the Stock Assessment section of the Stock Status Profile. This stock complex is showing a slow recovery after the Mt. St. Helens eruption, but the escapement is chronically low. Another measure of anadromous cutthroat status is the count at the North Toutle Hatchery. In 1959 a total of 74 wild anadromous cutthroat were captured at this facility during coho and chinook brood stock collections (Lavier 1960). After the reopening of this facility in 1991, annual counts have remained below six fish. There have been trap changes between 1959 and 1991, and the trap is not 100% effective for anadromous cutthroat because these small fish may pass through bar spaces designed to stop salmon and because the trap operates only during salmon collection season. However, the decline from the historic count and the low numbers indicate this stock is depressed.

Columbia River cutthroat sport catch data from 1972 to 1995 from a survey conducted to estimate salmon and steelhead catch are also available (Leider 1997). Because the survey targeted salmon and steelhead catches, changes in angling effort for cutthroat cannot be quantified. Some sampling inconsistencies were apparent in the early to mid-1970s, and in some years sampling was incomplete. More restrictive angling regulations, implemented during the survey, also appear to have reduced cutthroat catch, but the extent of this reduction has not been determined.

The catch between 1971 and 1991 was composed of both hatchery and wild fish. Small samples from this fishery were collected between 1979 and 1982. Tipping (1982) found that 20% of the catch was wild (n=31). Sampling in 1979 and 1980 indicated that 50% of the catch was wild. Columbia River estuary sampling in 1981 indicated that 21% of the sample (n=141) was wild (Loch 1982). The catch data suggest a decline in cutthroat abundance over time.

There are no population-size data, only distribution data, for resident Toutle cutthroat, so the status of this life history form cannot be assessed. WDF et al. (1993) characterized Toutle River chinook, coho, and winter steelhead stocks as depressed. Severe habitat degradation has occurred and was identified as one of the key factors limiting wild production. Since resident coastal cutthroat have similar freshwater habitat requirements as anadromous cutthroat, coho and winter steelhead, we believe that their status is also depressed.

FACTORS AFFECTING PRODUCTION

Habitat--The coastal cutthroat trout's extended freshwater residency and the anadromous form's near-shore migratory patterns require specific and varied freshwater and estuarine habitat types. The Toutle River ecosystem was dramatically altered by the eruption of Mt. St. Helens on May 18, 1980. Ash deposits and mudflows reduced riparian areas, elevated temperatures, and increased sediment in nearby streams.

This ecosystem has also been degraded by past and present human activities that have reduced the habitat quality, quantity, and complexity. The primary land use activities responsible for habitat degradation include road building, timber harvesting, agriculture and rural development. These upslope and riparian activities have increased sediment, reduced woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

Most land in this watershed is managed for timber production. Logging in riparian zones has produced riparian habitat which is simple and in early successional stages. As a result summer water temperatures are elevated, and large woody debris is lacking. Increases in fine sediment have decreased survival of trout eggs and alevins, reduced stream productivity and ultimately food availability, and decreased the size and depth of pools which are important rearing and adult holding areas for cutthroat trout. Increases in large woody debris would increase fish productivity by forming and maintaining pools, providing fish cover, and trapping spawning gravel.

Toutle River anadromous cutthroat use the Columbia River estuary primarily during the late winter, spring, and summer. Sherwood et al. (1990) estimated that the tidelands, swamps, and wetlands in the Columbia River estuary were reduced by 40% from 1870 to 1970. The recent changes in ocean patterns, such as El Niño have reduced smolt-to-adult survival of all Columbia River salmonids. Smolt-to-adult survival of hatchery sea-run cutthroat released in the Columbia Basin have decreased since the 1980s (Byrne 1995; Tipping 1995). Reduction in estuary habitat and poor near-shore ocean conditions have contributed to the decline of anadromous cutthroat trout.

Harvest Management--There is no directed commercial harvest of coastal cutthroat trout although small numbers have been caught in the lower Columbia River gill net fishery. Angler harvest of wild coastal cutthroat was high but has tapered off dramatically as sportfishing regulations have become more restrictive over the years to protect cutthroat. Since the eruption of Mt. St. Helens in 1991 the Toutle River drainage has been closed to trout fishing. Wild mortality is unknown but believed to be low from hooking mortality during the steelhead/salmon season and from illegal harvest.

In 1985 the daily harvest limit on the Columbia River was reduced from eight trout to two trout with a 12-inch minimum size (subsequently increased to 14 inches) was implemented to permit most females to spawn at least once before harvest. In 1992 wild cutthroat release regulations were adopted.

Hatchery--The North Toutle Hatchery is located near the confluence of the Green and Toutle rivers. It raises chinook and coho salmon. Approximately 140,000 summer steelhead smolts had been released annually into the North Fork Toutle, South Fork Toutle and Green rivers from Beaver Creek Hatchery. Currently these releases have been reduced to 12,500 to 13,000 summer steelhead into the Green River and South Fork

Toutle from the Elochoman or Kalama hatcheries. Salmon, steelhead, and anadromous cutthroat are released from two hatcheries on the Cowlitz River. Silver Lake has received rainbow trout releases as part of a lowland lake program, but they were discontinued in the 1980s. Ecological and genetic impacts to wild cutthroat trout from hatchery salmon, steelhead and trout releases are unknown.

Other Factors--Marine mammal populations along the west coast including the Columbia River have increased since they were protected under the federal Marine Mammal Protection Act in 1976. Current population estimates range from 300-500 sea lions and 3,000 or more harbor seals in the Columbia River. As these populations have increased, so has their food and fish consumption. Both sea lions and seals are most abundant from late winter through spring and can intercept both sea-run cutthroat smolts and kelts as they move toward the estuary. Anadromous cutthroat adults returning to Beaver Creek Hatchery were examined for marine mammal marks. The percentage of returning adults with marks ranged from 0% to 16% and averaged 7% since 1982. Estimates of cutthroat predation by marine mammals have not been made, but the marine mammal mark rate indicates that in some years it may be high.

LOWER COLUMBIA — KALAMA COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Kalama coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. Anadromous, fluvial and resident life history forms are present in the watershed. At this time anadromous cutthroat are found in the mainstem river and tributaries below Kalama Falls (RM 10). Adults captured in the trap at Kalama Falls are passed upstream. Fluvial and resident fish are found throughout the Kalama watershed in tributaries such as Elk, Wolf, Summers and Langdon creeks and in small headwater streams above anadromous zone. They are also found in independent drainages of Owl and Schoolhouse creeks.

Anadromous fish enter the river from July through December and spawn from December through June. Fluvial and resident fish spawn from February through June.

In a recent genetic analysis, Kalama cutthroat were represented by one collection (Summers Creek), which was genetically distinct from other lower Columbia collections.

Kalama coastal cutthroat are native and are sustained by wild production.

STOCK STATUS

The status of Kalama coastal cutthroat is Depressed based on declining numbers of wild adults at the Kalama Falls fishway, smolt trapping data and Columbia River sport catch data. Overall, the quality of the data used to make this assessment is good.

Wild adult counts at the Kalama Falls fishway trap ranged from eight to 53 adults per year from 1976 to 1986, with an average of 25 adults per year. From 1987 through 1994, adults counts ranged from two to nine fish per year with an average of five adults per year (Leider 1997).

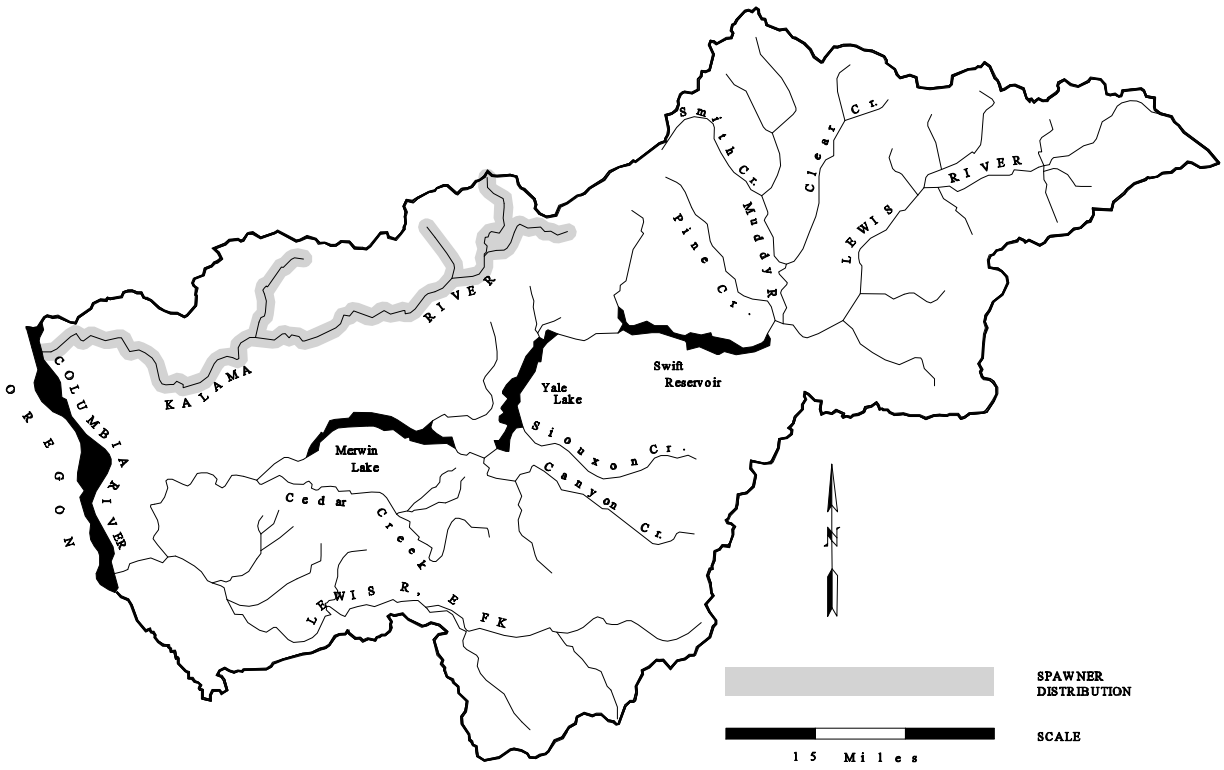
The Kalama Research Team has collected smolt data since 1978. The estimates for the number of smolts produced above Kalama Falls from 1978 through 1984 ranged from 163 to 16,229 with yearly average of 7,737. From 1992 through 1994, the number of smolts ranged from 106 to 1,667 with a yearly average of 749 smolts.

Catch data from the Columbia River sport creel census also shows a decline in anadromous cutthroat abundance (Leider 1997). The average yearly catch of cutthroat by Washington and Oregon anglers from 1969 to 1985 was 4,985 fish. From 1886 through 1993 the yearly average was 521 fish with a low of 96 in 1992 (Dan Rawding, WDFW, personal communication).

STOCK DEFINITION PROFILE for Kalama Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



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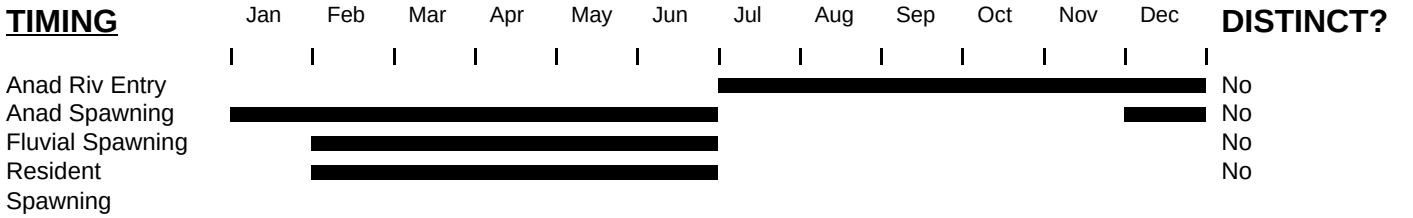
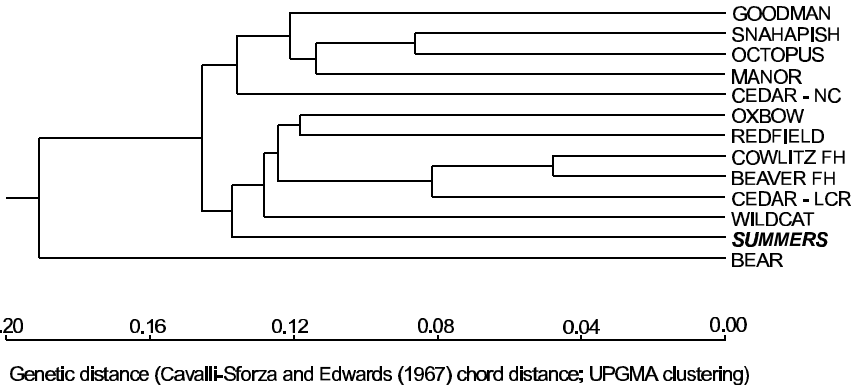


BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Summers Cr. collection (N=60), made in 1996, was significantly different from all other lower Columbia collections (33 allozyme-locus G-tests; *P*<0.001).

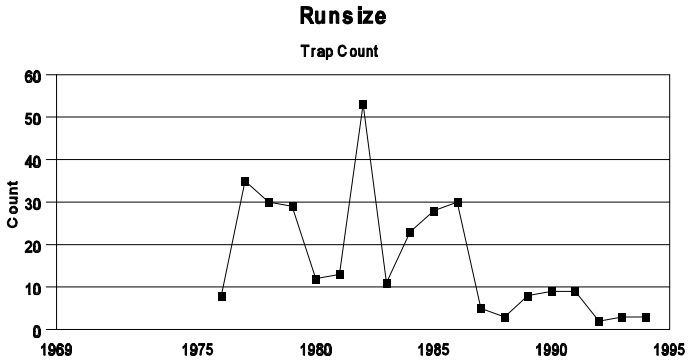


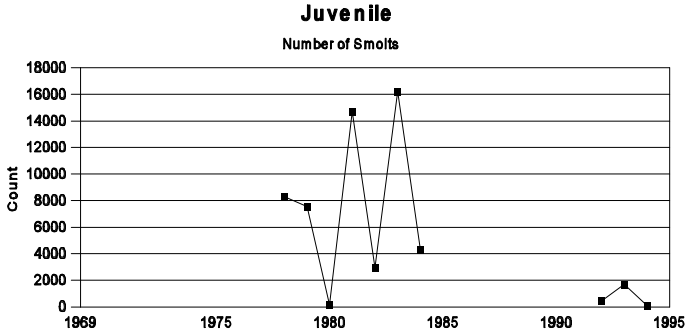
STOCK STATUS PROFILE for Kalama Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	RUNSIZE Trap count	JUVENILE Smolts	HARVEST Sport	
1969			7,756	
1970			13,617	
1971			8,107	
1972			4,342	
1973			1,467	
1974			2,709	
1975			3,911	
1976	8		5,023	
1977	35		1,405	
1978	30	8,296	4,238	
1979	29	7,536	3,474	
1980	12	163	3,822	
1981	13	14,704	5,336	
1982	53	2,943	2,239	
1983	11	16,229	7,379	
1984	23	4,286	3,560	
1985	28		3,355	
1986	30		503	
1987	5		500	
1988	3		683	
1989	8		826	
1990	9		948	
1991	9		497	
1992	2	445	96	
1993	3	1,697	114	
1994	3	106		
1995				





AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Depressed

Screening Criteria

Short-term severe decline

Quantitative data for fluvial and resident fish are not available, but the fish have been affected by severe habitat degradation in the Kalama drainage.

FACTORS AFFECTING PRODUCTION

Habitat--The watershed is managed for timber harvest and has been heavily logged. Approximately 96% of the Kalama River watershed is owned and managed by private timber companies. The Washington Department of Natural Resources manages a few sections scattered throughout the drainage, and the US Forest Service has limited land ownership in Kalama River headwaters. Most of the watershed was logged from the 1960s through the early 1980s. Current timber harvest is minimal in comparison. Past logging has caused dramatic and deleterious changes in riparian cover, pool habitat, temperature, sedimentation and flow regimes.

Increased urbanization of the riparian zone along the mainstem Kalama has also degraded fish habitat. Private home construction and associated bank stabilization projects along the river have reduced riparian vegetation. Contamination by septic systems, fertilizers, herbicides, pesticides and other sources of pollution is a concern, as is excessive water withdrawal from the river.

Harvest Management--Wild cutthroat release regulations are in effect from the mouth of the Kalama River upstream to the 6420 Road (near Arnold Creek) just below Kalama Falls. There is a two-trout daily limit with 14-inch minimum size limit. The lower end of the mainstem is open year-round below Summers Creek. Above the confluence of Summers Creek and Kalama River and up to the 6420 Road the river is open June 1 through March 31 with the 14-inch minimum size limit intended to protect resident fish, juveniles and outmigrating smolts. The fishing season for the river above Kalama Falls and tributaries begins June 1 and runs through October 31, with a two-trout daily limit and eight-inch minimum size limit intended to protect resident fish, juveniles and outmigrating smolts. Cutthroat are not required to be released in the upper river.

Hatchery--No anadromous cutthroat releases have been made into the Kalama in at least the last decade. The Kalama Falls and Fallert Creek hatcheries are located on the Kalama River. They rear and release fall chinook (3.5 million), spring chinook (500,000), coho (1.2 million) and sumer and winter steelhead. Past annual release levels of summer and winter steelhead have been 30,000 and 80,000 fish respectively. Planned releases are for 90,000 winter steehead and 90,000 summer steelhead. Interactions between wild coastal cutthroat and other hatchery-origin salmonids have not been examined.

LOWER COLUMBIA — LEWIS COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Lewis coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds.

Anadromous, fluvial, adfluvial and resident forms of coastal cutthroat reside in the Lewis watershed. Anadromous coastal cutthroat are found in the North Fork Lewis River and its tributaries up to Merwin Dam, which is a blockage to upstream passage. In the East Fork Lewis River anadromous fish are believed to migrate up to Lucia Falls in most years. Passage above the falls is possible when severe flood conditions exist. Anadromous fish are found in many tributaries below Lucia Falls. Fluvial and resident coastal cutthroat are found throughout the watershed, including areas of anadromy. Adfluvial fish have been observed in the Merwin, Yale and Swift reservoirs above Merwin Dam on the North Fork Lewis River. All of these reservoirs have many inlet tributaries where resident fish are found. On the East Fork Lewis River resident cutthroat are found throughout the watershed, especially above Lucia Falls.

Anadromous coastal cutthroat enter the river from July through December and spawn from December through June. Fluvial, adfluvial and resident fish spawn from February through June.

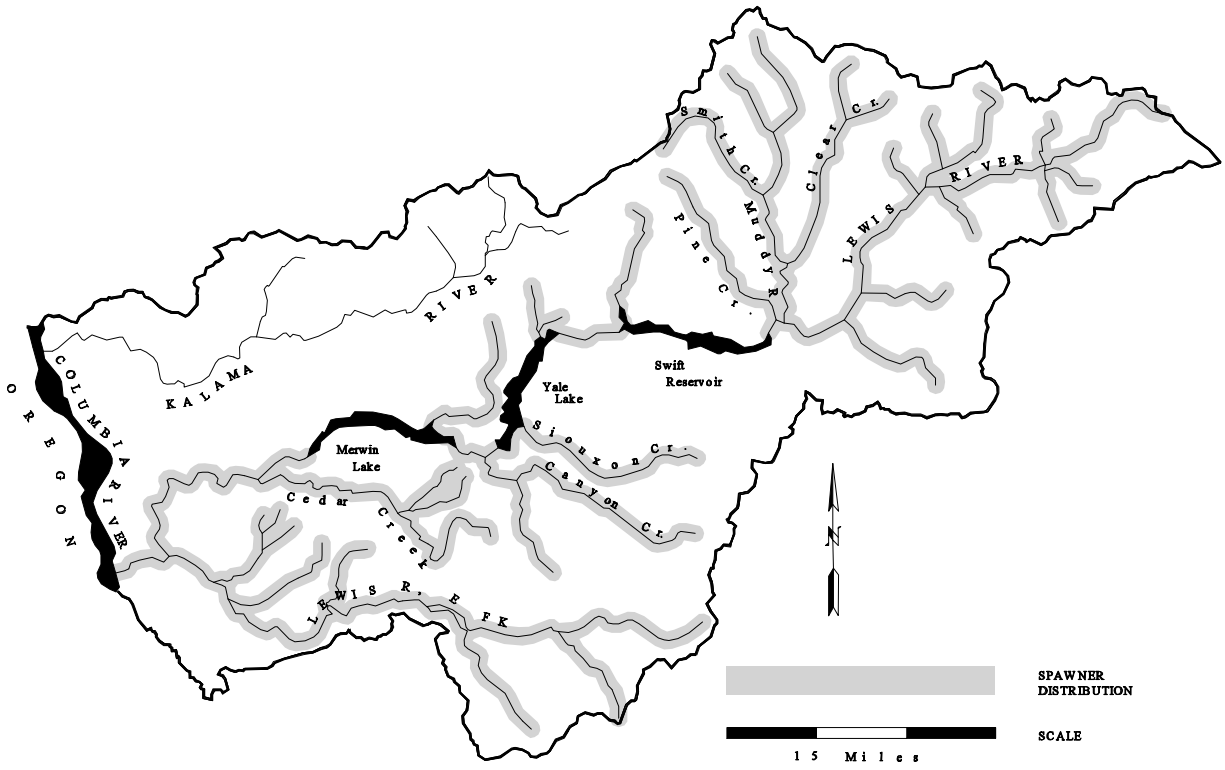
In a recent genetic analysis this complex was represented by one collection (Cedar Creek), which was found to be genetically distinct from other lower Columbia coastal cutthroat collections.

Hatchery-origin anadromous cutthroat are released as smolts into the mainstem North Fork Lewis annually. Native fish inhabitat many areas that are geographically isolated from sites where hatchery releases have taken place. Native cutthroat may also be isolated due to different spawn timing from hatchery cutthroat which have been released into the watershed. Almost all resident cutthroat production is from wild production. Blue Lake, which drains into the upper North Fork Lewis River above Swift Reservoir, contains hatchery-origin Twin Lakes westslope cutthroat, which can successfully reproduce when favorable conditions exist. Although interactions between wild and hatchery-origin coastal cutthroat in the Lewis River system have not been examined, local WDFW staff believe that very few, if any, genetic interactions have occurred between native cutthroat populations and the small number of resident hatchery cutthroat which have been released in the watershed. Consequently, the Lewis coastal cutthroat stock is considered native with wild production.

STOCK DEFINITION PROFILE for Lewis Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



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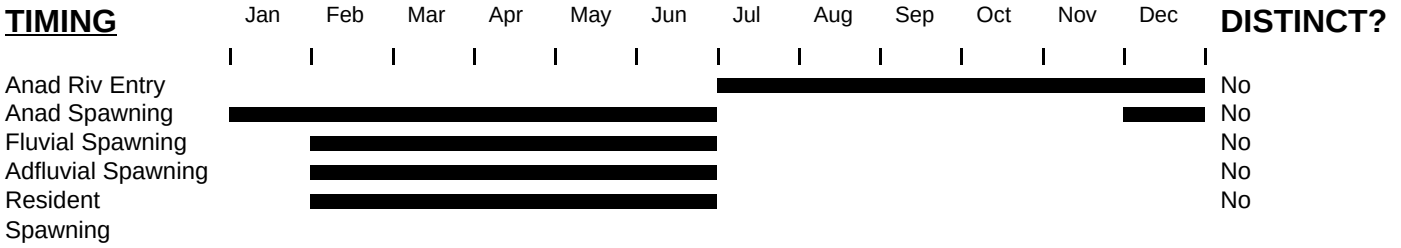
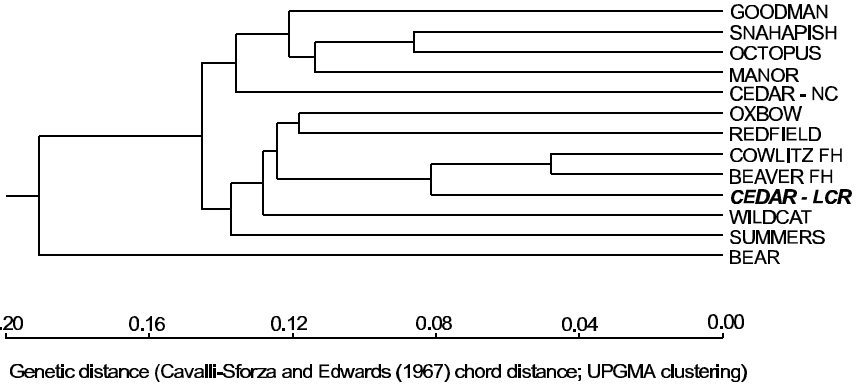


BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

GENETICS - The Cedar Cr. collection, made in 1996, (N=51) was significantly different from all other lower Columbia collections (33 allozyme-locus G-tests; *P*<0.001).



STOCK STATUS PROFILE for Lewis Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

STOCK STATUS

The status of Lewis coastal cutthroat is Unknown because there is insufficient quantitative information to identify a trend in abundance or survival. However, given habitat conditions and declining trends in sport catches in the Columbia River, to which Lewis anadromous cutthroat contribute, it is likely that the stocks are Depressed.

FACTORS AFFECTING PRODUCTION

Habitat--Freshwater habitat continues to decline through human encroachment into the watershed. Three mainstem dams and three fish hatcheries have been built on the North Fork Lewis River. The construction of Merwin Dam in 1929 probably destroyed a significant portion of cutthroat spawning waters, and as a result, runs are below historic levels. The upper North Fork watershed has been under intensive timber management with clearcutting and road construction. These activities have caused changes in riparian cover, pool habitat, temperature, sedimentation and flow regimes.

The eruption of Mt. St. Helens in 1980 caused severe damage to many of the tributaries on the north side of the watershed.

The East Fork Lewis River is experiencing rapid human growth throughout most of the watershed. In addition to housing development, activities such as gravel mining, mineral mining, water withdrawal, and logging occur in the system.

Harvest Management--Sportfishing regulations are in place to protect both resident and anadromous cutthroat throughout the watershed. On the North Fork Lewis River mainstem below Merwin Dam, regulations call for a two-fish daily limit with a 12-inch minimum size limit intended to permit anadromous females to spawn at least once. Wild fish must be released. The same regulations apply to the mainstem Lewis River. In the reservoirs above Merwin Dam there is a five-trout daily limit with no minimum size limit. Merwin and Yale reservoirs are open year-round. Swift Reservoir is open from the end of April through October. Cedar Creek, a tributary of the North Fork Lewis, is open from June 1 through March 15 with two-fish daily limit and a 12-inch minimum size limit. On the East Fork Lewis mainstem there is also a two-fish daily limit with a 12-inch minimum size limit. There are no commercial fisheries on cutthroat trout in the Lewis River system.

Hatchery--Currently about 25,000 anadromous cutthroat raised at Merwin Hatchery are released as smolts into the mainstem North Fork Lewis River annually. No hatchery-origin anadromous cutthroat are released into the East Fork Lewis River. There are no releases of resident coastal cutthroat in the Lewis River watershed. Twin Lakes westslope cutthroat are released into Blue Lake and into lakes in the Indian Heaven Wilderness. Interactions between wild and hatchery-origin anadromous cutthroat in the Lewis River system have not been examined.

The Lewis River, Merwin and Speelyai hatcheries are located on the North Fork Lewis River. In addition to anadromous coastal cutthroat, the hatcheries rear and release 900,000 spring chinook, about three million coho, steelhead and resident rainbow trout. Coho are released both into the river and into Merwin Reservoir to provide a resident fishery. Kokanee were introduced above Merwin Dam in the 1950s and are currently self-sustaining in Yale and Merwin reservoirs although annual releases of about 93,000 kokanee from Speelyai still occur. Rainbow fingerlings (about 500,000 annually) are released into Swift Reservoir. Annual steelhead smolt releases include both winter fish (100,000) and summer fish (230,100). Interactions between these species and native cutthroat have not been examined.

LOWER COLUMBIA — SALMON CREEK COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Salmon Creek coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds. Salmon Creek is an independent tributary which enters the Columbia River upstream from the mouth of the Lewis River.

Both anadromous and resident forms of cutthroat trout are present in Salmon Creek. Anadromous coastal cutthroat enter the river from July through December and spawn from December through June. Resident fish spawn from February through June.

Hatchery-origin anadromous cutthroat have been released into Salmon Creek at least since 1952. The extent of hybridization, if any, between them and native cutthroat is unknown. No genetic sampling has been conducted on Salmon Creek cutthroat.

Salmon Creek coastal cutthroat are considered native and are sustained by composite production.

STOCK STATUS

The status of Salmon Creek coastal cutthroat is Unknown because there is insufficient quantitative information to identify a trend in abundance or survival. However, given the condition of the habitat and declining trends in Columbia River sport catches, to which anadromous Salmon Creek cutthroat contribute, it is likely that the stock complex is Depressed.

FACTORS AFFECTING PRODUCTION

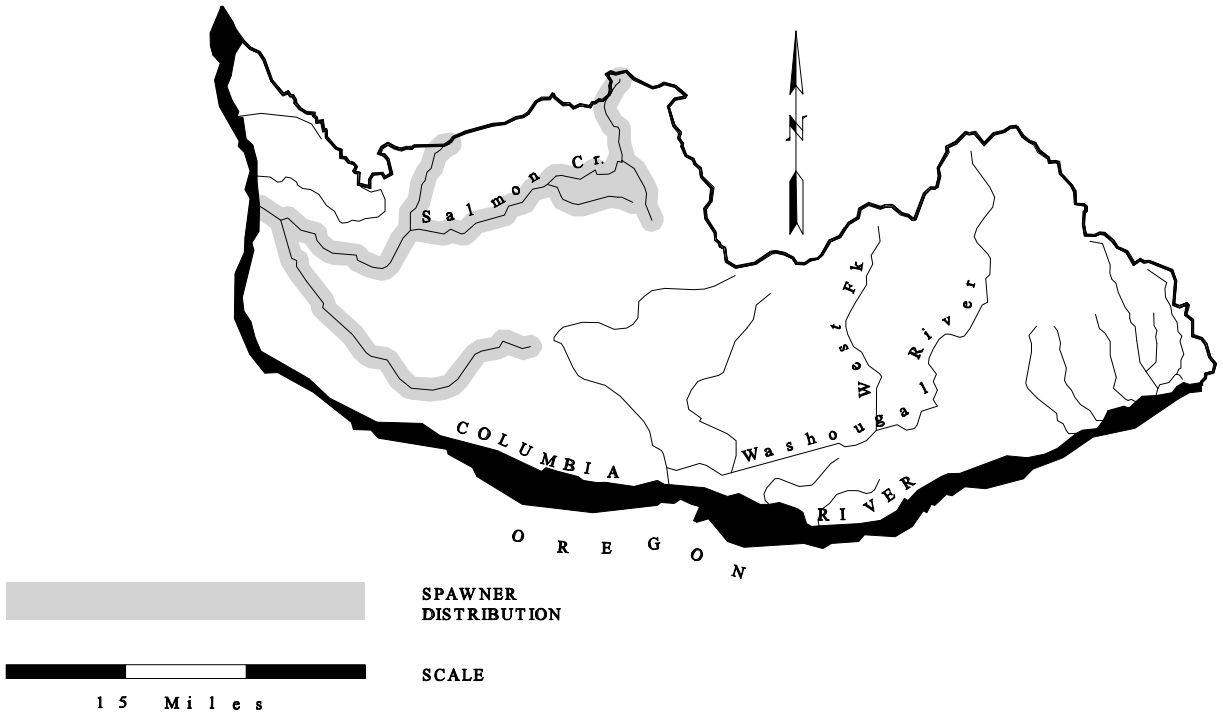
Habitat--Freshwater habitat continues to change through human encroachment throughout this small watershed. Barriers to movement such as improperly placed culverts and damming streams, water withdrawal, contamination from septic systems, fertilizers, herbicides, pesticides and other sources of pollution have continued to be problems. Road and residential development have created flashier runoff and winter flooding which causes erosion and low flow and high water temperature in the summer. All of these factors have combined to reduce the ability of Salmon Creek to support wild fish production.

Harvest Management--There is a June 1 through March 15 recreational fishing season on the mainstem Salmon Creek with a two-trout daily limit and a 12-inch minimum size limit. All wild cutthroat must be released. Tributaries and the upper mainstem are open

STOCK DEFINITION PROFILE for Salmon Creek Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry							■	■	■	■	■	■	No
Anad Spawning	■	■	■	■	■	■						■	No
Resident Spawning		■	■	■	■	■							No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Salmon Creek Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Composite

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

from June 1 through October 31 with a two-fish trout daily limit, an eight-inch minimum size limit to protect resident fish, and no wild cutthroat release.

Hatchery--Although there are no fish hatcheries located in the Salmon Creek drainage, hatchery-origin anadromous coastal cutthroat, steelhead and coho are released into Salmon Creek. Presently 15,000 winter steelhead smolts, 145,000 coho fry, and 12,000 cutthroat smolts are released each year into this system. Interactions between wild cutthroat and hatchery-origin fish have not been examined.

LOWER COLUMBIA — WASHOUGAL COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

Washougal coastal cutthroat have been identified as a distinct stock complex based on the geographic distribution of their spawning grounds.

Anadromous, fluvial, adfluvial and resident forms of cutthroat trout inhabit the Washougal watershed. Anadromous coastal cutthroat are found in the mainstem and most of its tributaries up to Dougan Falls. This waterfall is believed to be a barrier in most years to adult passage. Fluvial and resident coastal cutthroat are found throughout the watershed in the upper mainstem and tributaries such as Lacamas Creek, the upper North Fork Washougal, upper Little Washougal River, Canyon Creek, Timber Creek and Prospector Creek. Adfluvial fish are found in Lacamas Lake.

Anadromous coastal cutthroat enter the river from July through December and spawn from January through June. Fluvial, adfluvial and resident fish spawn from February through June.

A hatchery broodstock program for anadromous cutthroat is located at Skamania Hatchery on the North Fork Washougal River. Washougal coastal cutthroat are considered native with composite production since production of these fish occurs at the hatchery as well as in streams in the watershed.

STOCK STATUS

The status of Washougal coastal cutthroat is Unknown because there is insufficient quantitative information to identify a trend in abundance or survival. However, discussions with local residents who have fished in the watershed for many years coupled with the loss of habitat to urbanization suggest that this stock may be Depressed. Hatchery-origin anadromous cutthroat in the Washougal rebounded in 1995-96.

FACTORS AFFECTING PRODUCTION

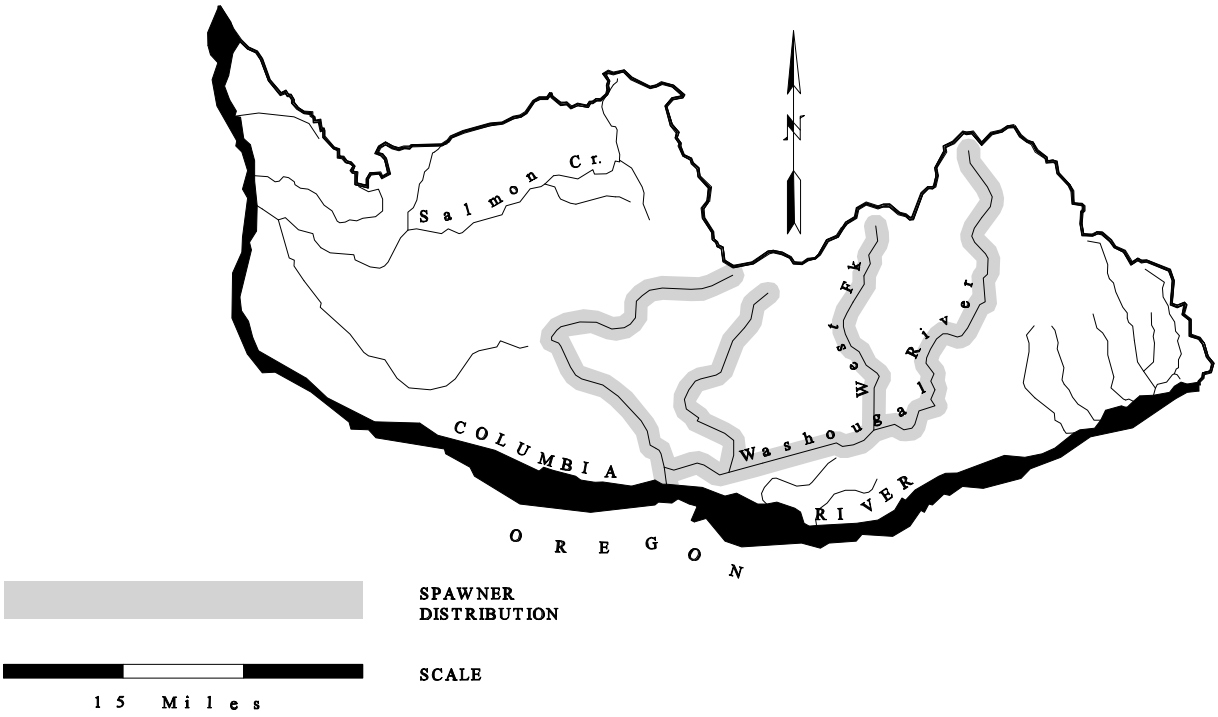
Habitat--Freshwater habitat continues to decline through human encroachment throughout the watershed. Logging, farming, residential construction, road building, barriers to fish movement, water withdrawal and pollution are occurring in the watershed.

Harvest Management--The mainstem Washougal River recreational fishing season is June 1 through March 15, with a two-trout daily limit and a 12-inch minimum size limit. Wild cutthroat must be released. The mainstem is closed from the Salmon Falls bridge

STOCK DEFINITION PROFILE for Washougal Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **YES**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry							■	■	■	■	■	■	No
Anad Spawning	■	■	■	■	■	■	■					■	No
Fluvial Spawning		■	■	■	■	■	■						
Adfluvial Spawning		■	■	■	■	■	■						
Resident Spawning		■	■	■	■	■	■						No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Washougal Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Composite

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

upstream. The same regulations apply to the North Fork Washougal River. Tributary regulations include a June 1 through October 31 open season with a two-trout daily limit and an eight-inch minimum size limit to protect resident cutthroat.

Hatchery--Two fish hatcheries operate in the Washougal River watershed. Washougal Salmon Hatchery is located on the mainstem above Salmon Falls and rears and releases fall chinook, coho, and winter and summer steelhead. Skamania Hatchery is located on the lower end of the North Fork Washougal River. A hatchery anadromous cutthroat broodstock program is maintained at this facility with 29,000 cutthroat released annually into the Washougal. Approximately 500,000 fall chinook, 600,000 coho, 80,000 winter steelhead and 100,000 summer steelhead are released into the Washougal system annually. Interactions between wild coastal cutthroat and hatchery-origin salmonids have not been examined.

LOWER COLUMBIA — SMALL TRIBS BETWEEN LEWIS RIVER AND BONNEVILLE DAM COASTAL CUTTHROAT

STOCK DEFINITION AND ORIGIN

The small tributaries coastal cutthroat stock complex has been identified as distinct based on the geographic distribution of its spawning grounds. The streams included in this stock complex include Whipple Creek, Burnt Bridge Creek, Gee Creek, Gibbons Creek, Lawton Creek, Duncan Creek, Woodward Creek, Hardy Creek and Hamilton Creek. Fish in these streams have been grouped into one stock complex based on the proximity of the streams and their habitat similarities. The number of genetically distinct stocks within this stock complex and the relationship of this complex to other stocks and stock complexes are unknown. Genetic sampling and analysis are needed to make these determinations.

Both anadromous and resident cutthroat inhabit these small watersheds. Anadromous cutthroat enter the streams from September through December and spawn from December through June. Resident fish spawn from February through June.

Hamilton Creek is the only stream to receive releases of hatchery-origin anadromous cutthroat. The extent of hybridization between wild and hatchery cutthroat is unknown. Overall, this stock is considered native and is sustained by natural production.

STOCK STATUS

The status of the small tributaries stock is Unknown because there is insufficient quantitative information to identify a trend in abundance or survival. However based on trend data in the Kalama River, declining sport catches in the Columbia River and habitat problems in several streams which limit their ability to produce fish, stock status is likely to be Critical, especially in Whipple, Burnt Bridge, Duncan and Lawton creeks and Depressed in Hamilton, Woodward, Hardy, Gee, and Gibbons creeks. The streams with the most depleted cutthroat populations have severe habitat problems which limit their ability to produce fish. Problems include no fish passage for cutthroat trout over a dam at the mouth of Duncan Creek and severe water quality and quantity problems on Whipple and Burnt Bridge creeks.

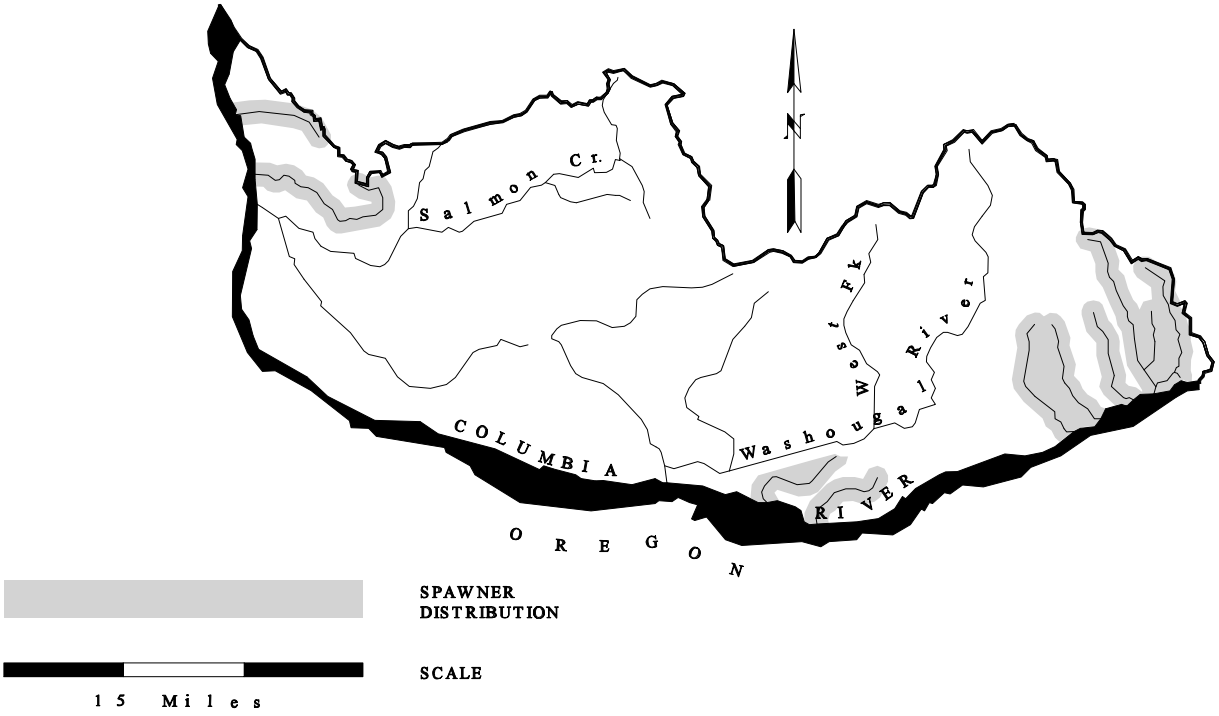
FACTORS AFFECTING PRODUCTION

Habitat--Freshwater habitat throughout the area continues to decline through human encroachment. The land around streams such as Whipple and Burnt Bridge creeks has been urbanized, and the streams suffer from water pollution from chemical runoff from pesticides, herbicides, faulty septic systems, water withdrawals for backyard irrigation, and impassible culverts from road building.

STOCK DEFINITION PROFILE for Small Tribs between Lewis River and Bonneville Dam Coastal Cutthroat

SPAWNER DISTRIBUTION

DISTINCT? - **UNKNOWN**



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad Riv Entry									■	■	■	■	Yes
Anad Spawning	■	■	■	■	■	■	■					■	No
Resident Spawning		■	■	■	■	■	■						No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Small Tributaries between Lewis River and Bonneville Dam Coastal Cutthroat

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Road and residential construction have caused flashier runoff and winter flooding which causes erosion and sedimentation, and low flow and high water temperatures during the summer months. All of these activities have combined to reduce the ability of these creeks to support fish production.

Harvest Management--Angling in most of these streams is regulated by statewide stream regulations which provide for a June 1 through October 31 season with a two-trout daily limit and an eight-inch minimum size limit to protect resident fish. Hamilton Creek has a June 1 through March 15 season with a two-trout daily limit and a 12-inch minimum size limit, and a requirement to release wild cutthroat. All hatchery-origin anadromous cutthroat released into Hamilton Creek are marked with adipose clips so anglers can distinguish them from wild fish.

Hatchery--There are no hatcheries on these streams. However, Hamilton Creek receives about 6,000 winter steelhead smolts annually. Interactions between native, wild coastal cutthroat in these streams and other hatchery-origin salmonids have not been examined.

LOWER COLUMBIA — TRIBUTARIES ABOVE BONNEVILLE DAM COASTAL CUTTHROAT

Historical information suggests that anadromous coastal cutthroat trout utilized the tributaries above Bonneville prior to the construction of the dam, going up to at least the Wind and Klickitat rivers. In addition, resident and fluvial forms probably exist in these and other tributaries. Resident forms apparently are found in Spring Creek on the White Salmon and Rock Creek (Dan Rawding, WDFW, personal communication). Anadromous cutthroat trout have also been landed at the Powerpole facility across the river from the White Salmon in the Hood River Basin, and one was apparently captured on the Wind in 1997 (Dan Rawding, WDFW, personal communication).

Although there is presently no effort to enumerate coastal cutthroat trout above Bonneville Dam (nor is there any documented historic information), coastal cutthroat are occasionally encountered in the course of work on other species. This note is presented in this SaSI to document coastal cutthroat presence for future consideration.

GLOSSARY

ADFLUVIAL -- A life history type in which spawning and rearing occur in streams, but most growth and maturation occur in lakes or reservoirs.

ALEVIN -- Newly hatched fish which remain in gravel until their yolk sacs have been resorbed.

ALLELE -- One of two or more alternate forms of a gene.

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

CASCADE -- a series of small steep drops increasing the velocity of the stream.

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.

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 levels, but above the level where permanent damage to the stock is likely.

ELECTROPHORESIS -- A process whereby charged molecules (such as DNA and enzymes) 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.

EVOLUTIONARILY SIGNIFICANT UNIT (ESU) -- A definition of "species" used by the National Marine Fisheries Service in administering the Endangered Species Act. An ESU is a population (or group of populations) that (1) is reproductively isolated from other

conspecific population units, and (2) represents an important component in the evolutionary legacy of the species.

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.

FINGERLING -- Juvenile salmonids up to nine months of age and generally two to four inches in total length.

FLUVIAL -- A life history type in which spawning and early juvenile rearing occur in smaller tributaries, but most growth and maturation ocur within mainstem rivers.

FRY -- Young salmonids that have emerged from the gravel and are up to one month in age.

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 STOCK IDENTIFICATION (GSI) -- A method that can be used to characterize populations of organisms based on the genetic profiles of individuals. The GSI 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 electrophoresis of proteins or DNA from tissues of sampled individuals; (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.

GLIDE -- A part of a river containing a smooth flow of water with an unbroken surface.

GRADIENT -- The amount of vertical drop a stream experiences over a given distance
Shallow gradient -- A length of stream with predominantly slow-moving pools and few, if any, riffles.
Moderate gradient -- A length of stream with a high proportion of riffles
Steep gradient -- A length of stream with a high proportion of cascades and waterfalls.

HEADWATERS -- The source of a stream or stream system.

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 or species.

INDEPENDENT TRIBUTARY -- A small stream flowing directly into marine waters.

KELT -- A cutthroat, steelhead or other repeat-spawning salmonid which has completed spawning.

LAKE INLET -- The point where a stream flows into a lake.

LAKE OUTLET -- The point where a stream flows out of a lake.

LIFE HISTORY -- The events that make up the life cycle of an animal including migration, spawning, incubation, and rearing. Life history forms of bull trout/Dolly Varden include adfluvial, anadromous, fluvial, and resident.

MAINSTEM -- A major stream channel which is joined by numerous tributaries.

MANAGEMENT UNIT -- A stock or group of stocks which are aggregated for the purposes of achieving a desired spawning escapement objective.

MIGRATION -- The seasonal movement of an animal from one area to another.

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.

NMFS -- National Marine Fisheries Service. A branch of the National Oceanic and Atmospheric Administration, Department of Commerce whose responsibilities include administration of the Endangered Species Act for anadromous and marine fish.

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.

NON-NATIVE STOCK -- A stock that has become established outside of its original range.

PRODUCTION TYPE -- The method of spawning and rearing that produced the fish that constitute a stock.

REDD -- A fish's nest, where eggs are buried in gravels for incubation and hatching.

RESIDENT -- A life history type in which all life stages (e.g. spawning, rearing, growth, maturation) occur in small headwater streams, often upstream from impassable physical barriers.

RIFFLE -- A length of stream with shallow water, a gravel bottom and high water velocity which churns the surface of the water. Frequently used by salmonids for spawning.

RM -- River mile.

SALMONID -- Any member of the taxonomic family Salmonidae, which includes all species of salmon, trout, whitefish and char.

SaSI -- Salmonid Stock Inventory. A compendium of identified salmonid stocks and their status with information on stock origin and history and a description of the factors which affect stock status. Encompasses several salmonid species in Washington State and is not confined to salmon and steelhead.

SASSI -- Salmon and Steelhead Stock Inventory. A component of the Salmonid Stock Inventory.

SMOLT -- A juvenile anadromous salmonid which is undergoing the physiological and behavioral changes required to migrate from fresh water to salt water.

STANDING CROP -- The total amount (in numbers or weight) of fish in a given area at a given time.

STREAM ORDER -- A system for describing streams and their tributaries such that first-order streams are mainstems, second-order streams are major tributaries and third-and higher order streams are lesser tributaries. Headwater streams would be the highest order streams within a river basin.

SPAWNING POPULATION -- Synonymous with the term stock.

STOCK -- The fish spawning in a particular lake or stream(s) at a particular season, which 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.

TREND -- The directional change in a time-series data set.

TRIBUTARY -- A smaller stream which flows into a larger stream.

UNKNOWN STOCK -- A stock for which there is insufficient information to identify stock origin or stock status with confidence.

USFWS -- U.S. Fish and Wildlife Service. A branch of the federal Department of Interior whose responsibilities include administration of the Endangered Species Act as it affects non-anadromous fish and steelhead, wildlife and plants.

USFS -- U. S. Department of Agriculture Forest Service.

WDF -- Washington Department of Fisheries.

WDG -- Washington Department of Game. Became the Washington Department of Wildlife in 1988.

WDFW -- Washington Department of Fish and Wildlife. Created by the merger of the Washington Department of Fisheries and the Washington Department of Wildlife in 1994.

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).

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