

Changes to the bull trout and Dolly Varden stock inventory in 2004

Genetic analyses of several populations of Washington native char have been conducted since the publication of the 1998 bull trout/Dolly Varden stock inventory. In some cases, we have determined that populations can be identified as bull trout or Dolly Varden. Where species identification has been made, the name of the stock has been changed from bull trout/Dolly Varden to bull trout or Dolly Varden. The basis for these changes is discussed in the introduction to the inventory (p. 2) and at the beginning of each stock report in which the name of the stock was changed.

WASHINGTON STATE
SALMONID STOCK INVENTORY
BULL TROUT/DOLLY VARDEN

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

October 2004

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REPORT AVAILABILITY

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The members of this genus (*Salvelinus*) are by far the most active and handsome of the trout, they live in the coldest, cleanest and most secluded waters. No higher praise can be given to a Salmonid than to say, it is a charr.

Jordan and Evermann, 1896

INTRODUCTION

In 1993, the Washington Departments of Fisheries and Wildlife, 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). The Washington Department of Fish and Wildlife (WDFW) is now extending that effort to other wild salmonid species. The present report is a stock status report for bull trout (*Salvelinus confluentus*) and Dolly Varden (*S. malma*), two closely-related char species native to Washington State. Separate inventories for each species were not performed due to two major factors: (1) considerable biological similarities exist between the species, and the methodologies to reliably separate them where they coexist have only recently been developed and have not been widely applied, and (2) strong similarities between species exist with respect to life history, habitat, hatchery and fishery management history. The inventory for these two species applies the same conceptual approaches, definitions, criteria, and organizational format that were developed for the earlier inventory for salmon and steelhead. This inventory utilized and extended the earlier inventory effort of Mongillo (1993).

Resource inventories are key steps in statewide efforts to maintain and restore wild¹ salmonid stocks and fisheries. The primary intent of these efforts is to help 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 bull trout/Dolly Varden management plan) aimed at improving the status of native char resources.

BACKGROUND

In Washington State bull trout and Dolly Varden coexist and are managed to achieve resource protection goals while providing recreational opportunity consistent with resource protection goals. In the past, coastal native char were considered to be Dolly Varden whereas those in inland areas were considered to be bull trout. Cavender (1978) believed the range of the two species overlapped in the Puget Sound area and along the British Columbia coast. Investigators using morphometric techniques found no clear delineation between the species in the state and that bull trout or an intermediate

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 (e.g. native, non-native or mixed) and parentage (wild, cultured or composite) of individual stocks are specifically designated in this report where known. This terminology is not intended to diminish the importance of native stocks but rather emphasizes the need to protect a wide range of genetic resources maintained by natural reproduction. The terms natural and wild spawners are used synonymously as are the terms stocks and spawning populations (see [Part 1 -- Stock Definition and Identification](#) for further discussion).

or hybrid form predominated, even in coastal waters (Johnson and Mongillo 1991; Kraemer 1991). Crane et al. (1994) and Utter (1994) demonstrated that genetic data can differentiate the two species. Use of genetic methods is just beginning to document the presence of pure Dolly Varden stocks in Washington and to indicate that pure bull trout are present both east and west of the Cascade crest (Robb Leary, Montana State University, unpublished data). The taxonomic relationships among char have long been a subject of investigation (e.g., Crane et al. 1994). Genetic investigations of native char identity, distribution, and hybridization have been initiated in several labs in the Pacific Northwest. These efforts should ultimately help resolve outstanding taxonomic questions. Until information becomes available suggesting otherwise, WDFW intends that management of bull trout and Dolly Varden will be responsive to the characteristics and requirements of currently identified stocks. Combining the two species into a common inventory at this time should not compromise management and conservation intent. Future inventories may be compiled for each taxonomic species separately.

2004 Addendum

In the 1997 and 1998 inventories, all stocks were referred as “bull trout/Dolly Varden” stocks due to uncertainty as to whether both species or only one was present in each population. Although a morphometric approach to distinguishing the two species exists (Haas and McPhail 1991), WDFW has undertaken a genetic approach to species distinction based on microsatellite DNA analysis. WDFW uses two sets of duplicated loci designated *FTG3a* and *b* and *BTμ60a* and *b* to distinguish bull trout and Dolly Varden. *FGT3* is duplicated in Dolly Varden (that is, both *FGT3a* and *FGT3b* exist) but not in bull trout, and *BTμ60* is duplicated in bull trout but not in Dolly Varden. Characteristic allelic size ranges (numbers of base pairs) at each locus in each species are shown in Table 1 (Sewall Young, WDFW, unpublished data).

Table 1. Diagnostic loci and alleles for distinguishing bull trout and Dolly Varden.

	Alleles and Allelic Sizes Ranges (number of base pairs)			
Species	<i>FGT-3a</i>	<i>FGT-3b</i>	<i>BTμ60a</i>	<i>BTμ60b</i>
Bull Trout	143-169	Not detected	144-176	211-249
Dolly Varden	127-159	288-342	Not detected	217-241

Analyses performed by the WDFW Genetics Lab and other labs using other loci have indicated that some stocks may be composed solely or primarily of one species or another. In these cases, we have decided to rename some stocks as bull trout stocks or Dolly Varden stocks, rather than bull trout/Dolly Varden stocks. The renamed stocks to date are:

Lower Skagit bull trout	Mill Creek bull trout
Skykomish bull trout	Tucannon bull trout
White River (Puyallup) bull trout	Rimrock Lake bull trout
South Fork Skokomish bull trout	Bumping Lake bull trout
Upper Dungeness Dolly Varden	Kachess Lake bull trout
Upper Elwha bull trout	Ingalls Creek bull trout
Sol Duc Dolly Varden	Rock Creek bull trout
Hoh bull trout	Phelps Creek bull trout
Queets bull trout	Goat Creek bull trout
Lewis bull trout	Early Winters Creek bull trout

More stocks will probably be designated bull trout or Dolly Varden stocks as more analyses are completed.

When a stock has been renamed as being bull trout or Dolly Varden, rather than bull trout/Dolly Varden, we cannot be certain that no fish of the other species exist sympatrically with the stock. However the genetic analyses for all the stocks listed above indicated that all fish in each collection analyzed belonged to a single species. Both species have been found in the South Fork Nooksack (WDFW unpublished data), Upper Skagit River (McPhail and Taylor 1995) and upper Quinault (Leary and Allendorf 1997). We continue to refer to these stocks and to those whose species composition has not yet been determined as bull trout/Dolly Varden stocks.

Due to concerns regarding population status throughout their range, in 1992 bull trout were petitioned for listing as endangered under the federal Endangered Species Act. In 1994 the U.S. Fish and Wildlife Service (USFWS) found that bull trout were at moderate, yet imminent, threat of extinction in five western states, including Washington. At the time, the USFWS found that listing was warranted, but that the urgency of considering other higher priority species at risk precluded listing of bull trout. More recently, USFWS re-examined the available data, and in June 1997, published a proposed rule in the Federal Register to list two of five distinct population segments of bull trout. In Washington the Columbia River segment was proposed for listing as threatened under the Endangered Species Act. The Coastal/Puget Sound segment was found not to warrant listing at the time but is currently under review.

Washington's native char exhibit four life histories; anadromous, adfluvial, fluvial, and resident. These four life history strategies are common in various forms of char evolutionary derivatives and stocks worldwide. The four life history types have different

life history and habitat characteristics. However, there is a high degree of uncertainty regarding interrelationships, genetic or behavioral, among life history types.

Since native char reproduce only in clean, cold, relatively pristine streams, they have been recognized as sensitive species by various state, federal, and tribal entities. Because of their relationship to habitat quality, bull trout and Dolly Varden are considered indicators of environmental health of Washington's watersheds and reductions in the distribution or abundance of stocks (in the absence of other factors) is inferred to represent strong evidence of environmental degradation. General threats to native char include loss of habitat due to logging practices, road building, passage obstructions (e.g., dams), water diversions, mining, and livestock grazing as well as harvest and poaching. Other threats include risks associated with isolation and fragmentation of stocks, overharvest, interspecific competition, and hybridization with non-native fishes (i.e., with brook trout, *S. fontinalis*).

With one verified historical exception, management of bull trout or Dolly Varden in Washington has not included the use of hatchery fish. The single instance in the state involved the release of 14,500 Dolly Varden hatchery-origin fry from southeast Alaska into Lake Chelan in 1966. These fish were not detected after their release. The virtual absence of hatchery propagation of native char in Washington contrasts substantially to the circumstance with salmon and steelhead. Consequently, readers familiar with the Washington State Salmon and Steelhead Stock Inventory (WDF et al., 1993) will note reduced discussion and presentation of hatchery information in this stock inventory.

Since the early 1980s the health of native char stocks in the state has been a priority concern of WDFW. In the 1980s, data collection efforts were increased, and by 1984, restrictive fishing regulations were implemented for some stocks to reduce or eliminate potential over-harvest concerns. However, concerns about stock status have continued to lead to more restrictive fishing regulations, consistent with WDFW's Basic Stream Management Strategy (WDG 1984). This strategy specifies that minimum size restrictions should allow the majority (greater than 50%) of females to spawn at least once before being subject to harvest. Recent regulations have resulted in closure of recreational fishing for both species throughout the state, with a few exceptions allowing harvest on certain healthy stocks.

In the future, improved and better-coordinated management of habitat protection, harvest management, and hatchery production programs for other species will be the key for designing comprehensive strategies to restore wild stocks and fisheries. Evaluation and public support of these strategies will be essential to ensure success.

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 toward salmon and steelhead, was the formulation of a Wild Stock Restoration Initiative (WSRI) that would complement and strengthen ongoing programs to protect and restore healthy stocks and habitats. The managers' overall goal regarding 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.

Subsequent to and consistent with the WSRI, a broadly applicable policy framework is now being developed by tribal and state authorities whose scope encompasses **all wild salmonids** in Washington. The goal of this effort as stated in the Wild Salmonid Policy (WSP) (WDFW 1997) is similar to the goal of the WSRI. 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 related cultural and ecological values.

The policy guidelines and implementation considerations reflected in both the WSRI and WSP will guide statewide efforts to maintain and restore bull trout and Dolly Varden. These considerations include:

- ! complete and maintain a resource status inventory of Washington's wild salmonids² ("where are we now")
 - " 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")

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. This need is part of this objective's future intent.

- ! 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.

In 1992, a draft management plan for native char stocks in Washington was developed by WDFW (WDW 1992). This plan was based on WDFW's mandate to preserve, protect, and perpetuate Washington's diverse wildlife and habitats and to maximize the recreational and aesthetic benefits of wildlife for all citizens. The plan was consistent with the Washington Fish and Wildlife Commission's resource management policies, goals, and objectives, and the WDFW's Fisheries Management Principles (WDW 1991). The principles provide a framework within which to systematically identify management alternatives, evaluate relative benefits and impacts, and select actions to meet the Fish and Wildlife Commission's policies and WDFW's legislative mandate. The principles state that for "vulnerable stocks" resource protection is the primary management emphasis, and that recreation will be promoted only within a resource protection context. A draft bull trout/Dolly Varden management plan is being developed with input from the tribes, federal agencies, other state agencies and the public.

RESOURCE STATUS INVENTORY

This report is the second summary of a combined bull trout and Dolly Varden inventory using the approach and conventions developed for SASSI - the first step in the statewide Wild Stock Restoration Initiative and consistent with the draft Wild Salmonid Policy. The name of the original inventory "Salmon and Steelhead Stock Inventory" (SASSI), has been changed to "**Salmonid Stock Inventory" (SaSI), to reflect the broadened inventory scope encompassing all wild salmonids.**

The original SASSI approach for salmon and steelhead contained elements that were not applicable to native char (e.g., hatchery production, commercial fisheries). In addition, this native char inventory needs to address complicated inventory issues that did not need to be addressed for salmon and steelhead (e.g., composite species management approach, multiple life history forms within stocks [resident, adfluvial, fluvial, anadromous], limited available data). Therefore, where appropriate, modifications were made from SASSI to better address inventory issues pertinent to native char. These changes should lend themselves to future inventories for other wild salmonid species (e.g., trouts) whose life history, ecology, and management histories are more similar to native char than they are to salmon and steelhead.

This inventory provides an approach for developing a list of bull trout/Dolly Varden stocks and a process for rating their current status. Stock lists, classifications and ratings will be updated as additional information becomes available.

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 the inventory will change over time. This inventory incorporated information already available in existing documents and information recently compiled for submission to the USFWS 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, and related data collation, was developed in a short time period. Given the large number of stocks in the inventory, the amount of detailed data and depth of analysis has been limited. This report is meant to provide a first glimpse of current stock status and build a foundation for future restoration and inventory efforts.

In addition to highlighting the inventory's intent, it is important to note that SaSI is not:

- 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 build a foundation for the WSRI and WSP. The subsequent steps and the process envisioned for the overall initiative are presented in Part 3 -- Current and Future Actions.

The status information in this report is based largely 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. Most stock abundance problems identified in the 1992 SASSI report and in Mongillo (1993) for bull trout/Dolly Varden have related genetic concerns that will be carefully evaluated during the restoration development phase. 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 and discussions about potential genetic influences have been included where known.

Report Content and Organization

Consistent with the format used in the 1992 SASSI report, 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. This report highlights the general background of the inventory effort and provides a summary of stock status for the reader who may not desire to review stock status information in detail. The report is comprised of the following sections:

Part 1 -- Stock Definition and Identification: This section defines the term stock as used in this inventory and compares it with other stock definitions that are commonly used. The process of applying this SaSI stock definition to the region's spawning populations to create an inventory stock list is also described.

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 population trends or changes in fitness, were developed to assess the current status of each stock. Individual stocks were then rated using five stock status categories developed specifically for SASSI/SaSI production.

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 modifications of SaSI, making SaSI a living inventory of salmonid stocks. 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 stock currently listed in SaSI is organized by basins, and in some cases an overview description of several related stocks within a larger geographical area is provided, followed by individual Stock Reports. Each Stock Report includes a:

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

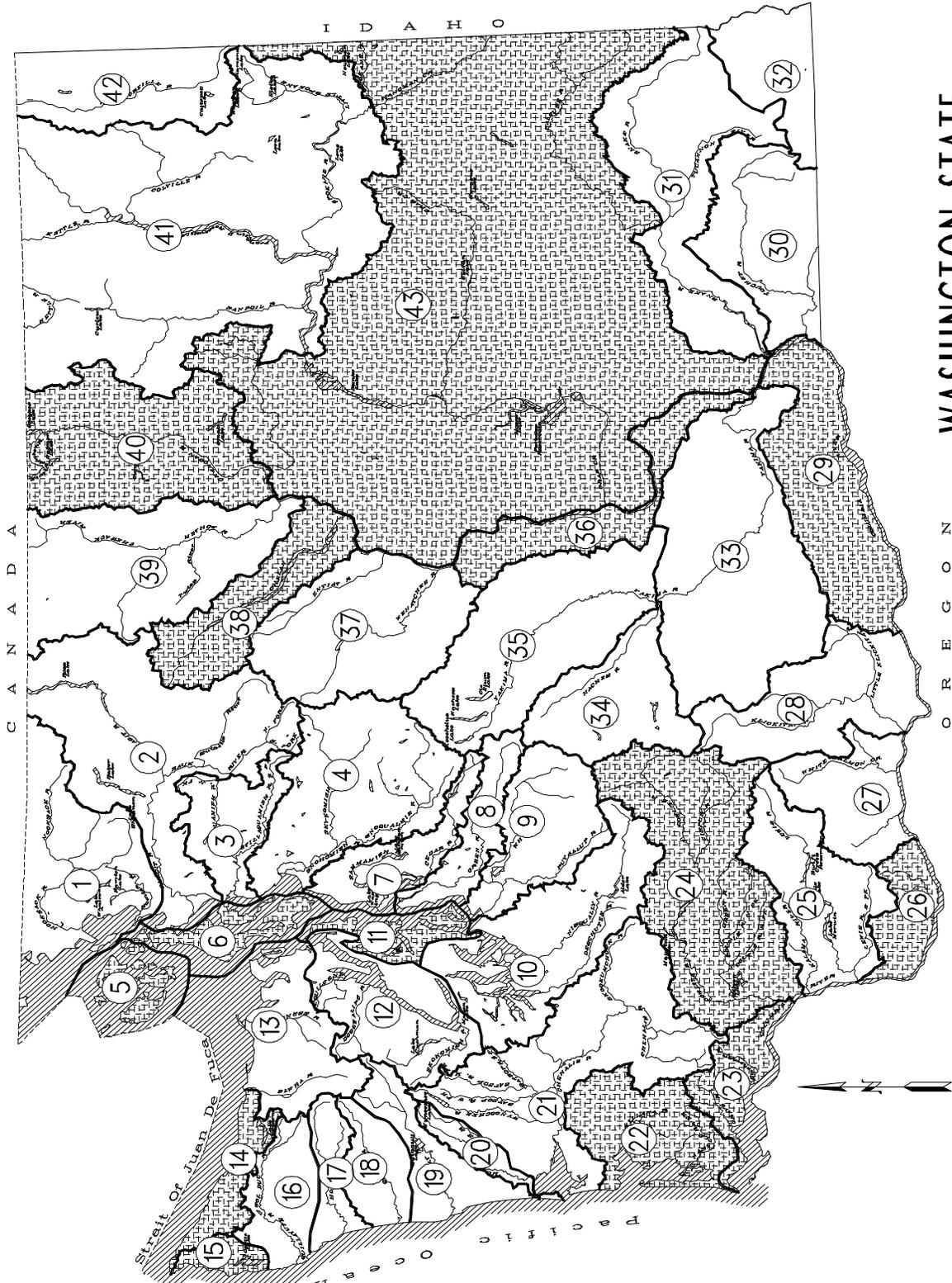
- ! Stock profiles: This is a visually oriented, two-page summary section that contains information used to identify individual stocks and to rate their status. The amount of information included in the stock profiles provides a general reflection of the data and state of analysis available for any given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

The **Literature Cited** section presents a list of publications cited in SaSI.

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

SASI RIVER BASINS

SaSI Stock Definition Profiles 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 not the same as Water Resource Inventory Areas (WRIA), which are used by Washington State natural resource agencies (Williams et al. 1975).



WASHINGTON STATE
 Bull Trout/Dolly Varden 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/Neselle

COLUMBIA RIVER

Lower Columbia River

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

Upper Columbia

- 27- Wind/White Salmon
- 28- Klickitat
- 29- Rock Creek
- 30- Walla Walla/Touchet
- 31- Snake/Tucannon
- 32- Asotin/Grande Ronde
- 33- Lower Yakima
- 34- Naches
- 35- Upper Yakima
- 36- Hanford Reach
- 37- Wenatchee/Entiat
- 38- Lake Chelan
- 39- Methow
- 40- Okanogan
- 41- Spokane
- 42- Pend Oreille
- 43- CrabCreek

Note: Shaded areas are not known to contain bull trout/Dolly Varden.

PART 1 -- STOCK DEFINITION AND IDENTIFICATION

STOCK DEFINITION

The first task in developing this resource inventory was to arrive at a meaningful definition of the units of fish on which to base the assessment. A number of options were considered: watersheds; genetic diversity units (GDUs, as defined by Busack and Shaklee 1995), and stocks (or spawning populations). Stocks were chosen as the basis for this inventory 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. As discussed in the Introduction, stock units represented composites of both bull trout and Dolly Varden char within specific areas. This designation should not be interpreted as a failure by WDFW to recognize the two species as separate and distinct.

The definition of the term "stock" and its application frequently present difficulties because the distinctions between different groups of animals are often difficult to measure, and because the term is used for a variety of purposes. For example, as applied in bottomfish 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. The draft Wild Salmonid Policy acknowledges a hierarchy of stock relationships within a species, from the finest scale (individual spawning aggregations within stocks) up to an entire species (the broadest scale) (WDFW 1995). Genetic diversity units are comprised of stocks or groups of stocks having similar patterns in genetic (or other) characteristics, which have resulted to an important extent from reproductive isolation. These GDUs form an important focus for genetic conservation goals and objectives of the policy (WDFW 1995). National Marine Fisheries Service (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. Strictly speaking, the USFWS has not used the ESU concept in its ESA deliberations regarding bull trout. However, in February 1996, the USFWS and NMFS adopted a joint policy to clarify their interpretation of "distinct population segments" under the ESA (61 FR 4722-4725; Feb. 7, 1996). That policy states that using ESUs is consistent with the joint policy and forms a detailed extension of it. In the joint NMFS-USFWS policies, a common concept exists pointing to a group of freely interbreeding individuals that are at least partially isolated reproductively from other such groups.

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."

For the purpose of this inventory we have adopted the following definition 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 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. 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 have **not** been defined to represent NMFS' definition of evolutionarily significant units. 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 spawning 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. Much of the available data is designed to describe the status of stocks, and 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 this inventory 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.

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 information is available, reference may be made to extinctions in general terms in introductory sections only.

The current inventory tends to focus on differences among stocks rather than variability within each stock (e.g., individual differences in traits such as the age at maturity, size, shape, spawning time, and disease resistance). But 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 addressed in the context of species plans, consistent with genetic conservation goals of the WSP.

SaSI STOCKS and MANAGEMENT

Maintaining healthy and productive stocks of salmonids and managing fisheries to achieve specific population levels are both important elements of comprehensive resource management programs. As mentioned earlier, with a few exceptions where stock health is deemed to be robust, fishery regulations currently preclude harvest of bull trout/Dolly Varden in Washington. In instances where bull trout/Dolly Varden fisheries do occur, the principle of "guaranteed recruitment" is applied as outlined in the Basic Stream Management Strategy (WDG 1984) through minimum size-limit regulations.

STOCK DEFINITION CRITERIA

Three criteria were used to determine whether a bull trout/Dolly Varden population was a distinct stock for the purpose of this inventory. These criteria are not intended to determine stock origin (i. e. native, non-native or mixed parentage), but rather attempt to identify those groups that appear to represent distinct stocks. The question of stock origin of each identified stock is addressed in a subsequent report section (see Part 2 -- Stock Status).

Stock Definition Criteria

- 1) Distinct spawning distribution.**
- 2) Distinct temporal distribution (including spawning or run-timing).**
- 3) Distinct biological characteristics (e.g., genetics, size, age structure, 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.

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 distinct stocks becomes less clear.

Distinct biological characteristics can include any observable distinctions between stocks such as size, age structure, scale patterns, parasites, or genetic differences.

Although genetic distinctions were the most common biological characteristic used to delineate stocks in the SASSI document for salmon and steelhead (WDF et al. 1993), genetic information for Washington's native char is extremely limited at this time. Where genetic data are available, genetic characterizations can utilize both indirect and direct approaches to distinguish among stocks. The indirect approach assumes that in some cases the genetic makeup of a group of fish has been substantially changed by past or continuing introductions of non-native stocks (i.e., bull trout interbreeding with brook trout). If these introductions have represented a major impact on the native gene pool, the resulting fish are presumed to be hybridized. The extent to which this hybridization may have led to reduced genetic variation between stocks is currently unknown, but is resolvable using direct methods, as outlined below.

The direct approach is based on genetic stock identification (GSI), which is a method that can be used to characterize populations of organisms based on the genetic profiles of individuals. The GSI methodology relies on the combined use of biochemical, genetic, and statistical procedures to discriminate among populations. While the GSI characterization of stocks and testing of stock structure provide a direct measure of genetic interrelationships, it is important to be aware of this approach's limitations. Geneticists currently can investigate only a tiny and restricted fraction of the genetic traits of salmonids using the electrophoretic analysis of proteins or DNA. To the extent that characters investigated do not represent the entire genome, the view of genetic interrelationships could be incomplete. Also, while statistically significant differences among samples provide 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 STOCK IDENTIFICATION PROCESS

The list of combined bull trout/Dolly Varden stocks in this SaSI document represents an effort to identify all existing stocks that naturally reproduce in Washington waters, regardless of origin, including native and/or presumed hybrid stocks. In waters with a history of large-scale releases of non-native char (e.g., brook trout), genetic hybridization could be assumed, and stocks were more broadly defined. However, no hybridized stocks were formally identified for this inventory.

A significant problem was encountered where various life history types utilize the same or different habitats in the same watershed. Life history types are anadromous, adfluvial, fluvial, and resident. Typically, different life history forms in the same local area, when not physically isolated from one another, were aggregated in a single stock. Additionally, 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 sometimes aggregated into a single stock because of the likelihood of significant interchange of spawners, and because it seemed likely that the selective pressures in individual waters would not be different enough to create unique stocks. More studies will be necessary to determine whether multiple stocks exist in situations where spawning areas were combined, or if only a single stock exists where spawning areas were separated. Moreover, improved delineation of each species distribution may be available in the future. All available information will be utilized in future iterations of SaSI.

Under some circumstances, very small groups of bull trout/Dolly Varden were not considered to be distinct stocks. While no minimum population size criterion is used in the SaSI process, it is common to observe very low numbers of native char in some waters. These fish may be strays from adjacent stocks and may not represent self-sustaining populations. Native char have been observed in non-natal streams possibly for feeding and/or overwintering. In other situations, very small streams may contain low numbers of successfully reproducing char which are probably being constantly subjected to hybridization with strays from larger adjacent stocks. Even if successful reproduction is likely, these small groups of fish are considered to be a part of the larger stock. It is still desirable, however, to ensure their continued existence and protect the habitats of these numerically small groups because they contribute to the overall genetic diversity and productivity of the state's salmonid resources.

To arrive at a preliminary list of stocks, biologists identified individual stocks based on the first two criteria - known differences in spatial or temporal distribution. These distinctions were difficult to determine in some cases, particularly in situations where the amount of interchange among adjacent groups of fish was unknown. Fish were split into individual stocks based primarily on river basins (spawner distribution: major tributaries or smaller independent drainages to saltwater). This preliminary list of stocks was then

examined using any available information on unique biological characteristics (e.g., available genetic stock identification data). This review resulted in few changes to the list, where additional groups of fish were identified based on observed biological characteristics. More detailed analysis during future inventories likely will change some stock designations.

This inventory has identified 80 bull trout/Dolly Varden stocks statewide, and Table 1 presents a regional summary by species. 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 bull trout/Dolly Varden stocks.	
PUGET SOUND	
North Puget Sound	9
South Puget Sound	6
Hood Canal	3
Strait of Juan de Fuca	4
TOTALS	22
COASTAL	
North Coast	6
Grays Harbor	1
Willapa Bay	0
TOTALS	7
COLUMBIA RIVER	
Lower Columbia	1
Upper Columbia	50
TOTALS	51
WASHINGTON STATE TOTAL	80

Stock Origin

An understanding of the genetic background of bull trout and Dolly Varden stocks in Washington State is important for the development of any future efforts to restore and maintain these resources. Regardless of species, the SaSI process recognizes three

categories of stock origin: (1) those stocks of fish that are thought to represent native gene pools, (2) those stocks that resulted from the introductions of non-native fish, and (3) those 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 (Washington Department of Fisheries et al. 1993), but such uncertainties are greatly reduced for native char because hatchery programs or transplantations have been virtually absent.

Stock origin definitions for this inventory are the same as those developed for the previous inventory of salmon and steelhead. The definitions attempt to categorize the genetic history of stocks (based on estimates of the probable genetic interactions with known releases of hatchery fish in the areas used by each stock). The identification of native stocks considered information on stock distribution, timing, genetics, and known releases of hatchery fish and, in the final analysis, was based on the technical judgment of the authors of this inventory. The assessments of stock origin presented in this inventory should be considered preliminary until such time as more detailed information confirms or refutes the current origin designations. Again, only native stocks are found in this inventory.

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, or by other factors, and is still present in all or part of its original range. In limited cases, a native stock may also exist outside of its original habitat (e.g., captive brood stock programs).

Non-native -- A stock that has become established outside of its original range.

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

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

Production Type

This inventory attempts to describe the naturally-reproducing stocks of bull trout/Dolly Varden in the state. The origin of a stock refers only to the genetic background of that specific group of fish. To understand more about the nature of an individual stock, it is also necessary to describe the type of spawning and rearing that produced the fish. For example, a stock of native char may be a genetic mixture of native and non-native fish, but in the absence of continuing hatchery releases, the stock may currently be self-sustaining as the result of natural spawning and rearing. These fish would be identified as a stock with a mixed origin of 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 maintained by placing most spawners in artificial spawning beaches. This stock would be characterized as a native stock with a cultured production type. Again, it is important to emphasize that hatchery programs have been virtually absent for bull trout/Dolly Varden, and all stocks are currently considered to be of the wild production type.

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 stock origin and production type for each bull trout/Dolly Varden stock in this inventory. It should be noted that there are some distinct differences between salmon, steelhead, and native char species in the proportions of the three production types, which is indicative of different management approaches and hatchery practices utilized for each species. Again, for this inventory all stocks are wild.

OTHER INVENTORIES

Stock inventories are a normal part of the annual 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, it brings this information together in a consistent approach for all wild salmonid stocks statewide, and it provides a system for rating stock status.

As mentioned previously, there has only been one focused statewide effort to inventory bull trout/Dolly Varden stocks in Washington (Mongillo 1993). Regional examples including other species are the Puget Sound and Adjacent Waters Study - Appendix XI - Fish and Wildlife Appendix (Pacific Northwest River Basins Commission 1970) which was a combined effort of WDW and WDF, and the WDF report: A Catalog of Washington Streams And Salmon Utilization (Williams et al. 1975). In the Columbia River Basin, examples have been the 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), and Huntington et al. (1994) listed stocks whose status was deemed to be healthiest.

PART 2 -- STOCK ASSESSMENT AND STATUS

Once the stock units were identified, the current status of each stock was assessed based primarily on trends in fish population or spawner abundance, or survival. Detailed abundance data for individual stocks were frequently not available. However, spawner abundance (redd count) data were available for some stocks listed in this inventory, and they were most frequently used to determine status. Where possible, juvenile population size, survival, and other data have also been used in these determinations.

A two-step process was used to evaluate the status of the state's bull trout/Dolly Varden stocks. First, five separate criteria were developed to describe changes in stock status and fitness, and each stock was screened to identify any negative trends in spawner abundance, production, or survival. Stocks that met none of the 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, stocks meeting one or more of the negative criteria were examined further and placed into categories that rated each stock based on the current condition of the stock.

There are several circumstances that complicated the rating process. When a wild stock experiences 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 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 freshwater 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 bull trout/Dolly Varden stock for indications of negative production or survival trends. Only stock-specific data were used, which sometimes limited the available data to a short span of recent years. These data were plotted and qualitatively examined for changes in abundance or survival. Often, only a single stock-specific statistic was available to analyze the production trend of a stock. When multiple types of data could be used to examine individual stock status, the available production or survival data sets were examined individually, and each stock's rating was based on the statistic(s) that best described current status.

Five stock screening criteria were developed and used in the initial evaluation of each stock for trends in survival, escapement, or production. These criteria do not currently incorporate quantitative formulas because the available stock 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. While this approach likely can be improved in the future with additional and better information, it facilitated this initial stock status classification process. The status of each stock will be subject to ongoing review and refinement in subsequent inventories.

Any stock that met one or more of the five negative performance criteria was subsequently rated in Depressed or Critical categories to identify the probable level of damage suffered by the stock. An "Unknown" category was used for stocks if trend information was unavailable or could not be used to assess stock status. The stock assessment data used for stock screening and the rationales for stock categorizations are presented in Part 4 -- Stock Reports.

The five stock screening criteria are:

(1) Long-Term Negative Trend -- Whereas most Washington salmon and steelhead escapement and production databases span periods of ten to twenty-five years, such data time series are generally not available for bull trout/Dolly Varden. Where they exist, data representing a long-term negative trend would be 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 did not eliminate a stock from being categorized under this criterion.

(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 of fish. It is important, however, to attempt to identify declining stocks 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 is included in this category.

(3) Chronically Low -- Stocks in this category are sustaining themselves at levels significantly below their potential. The determination that a stock is chronically low may be based on observed past production levels, or on an assessment that stock performance does not meet expected levels based on available habitat. Chronically low stocks may display declining, stable, or even increasing trends. For stocks 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 stocks to sustain themselves can be significantly affected by changes in the fitness of the individuals that make up a given stock. 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 bull trout/Dolly Varden stocks have not been monitored or enumerated over a sufficient period of years to enable quantitative analysis of status. Stocks 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 current stock status of bull trout/Dolly Varden use the best available quantitative information providing insight to stock abundance, harvest, and survival considering the four primary life history types (anadromous, fluvial, adfluvial, resident), both individually and in the composite. The data types used will be consistent with those used in the 1992 SASSI report. Since available data are more limited for bull trout/Dolly Varden than for salmon and steelhead, fewer data types are used in this inventory. Stock assessment data will be presented in stock reports for each stock

consistent with the life history forms present (see Part 4 -- Stock Reports). Outlined below are stock assessment data types and terms that may be used for this bull trout/Dolly Varden inventory. It is important to note that the data types described below are not intended to be all inclusive, but will contain those used in this inventory and others with general relevance.

Size of Spawning Population/Escapement

For bull trout/Dolly Varden, the term escapement refers to mature fish that have returned to freshwater, have survived all fisheries, and constitute the spawning population of a given stock. Escapement data collected during spawning ground surveys are sources information that may allow direct enumeration of escapement. Counts made at traps and fish passage facilities may be of use. For most bull trout/Dolly Varden stocks, direct escapements are not available, 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 bull trout/Dolly Varden stocks.

ESCAPEMENT

Fish/mile	A spawner count divided by the number of miles surveyed.
Index total	An estimate of total escapement in an index area.
Peak count	The highest daily count of live fish in an index area.
Redds	A count of redds in an index area.
Rack count	A total count of fish destined for spawning grounds upstream of a rack.
Redds/mile	A redd count divided by the number of miles surveyed.
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

No harvest data were used to assess stock status in this inventory. However, the numbers of fish caught or harvested in various fisheries can be used to measure relative abundance and to observe long-term trends. Of particular importance to this inventory is a need to assess life history forms for a stock independently, as well as in aggregate. The following types of harvest data could potentially be used to assess the status of bull trout/Dolly Varden stocks:

HARVEST

Total	The combined catches in a specific geographic area. In most cases, catch data for some fisheries may be unavailable, but the data that are available are thought to be representative of total harvest trends.
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 anadromous forms, 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 complete enough 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.

Freshwater Production Data

Counts of bull trout/Dolly Varden at various life stages in freshwater may be used to measure relative abundance and evaluate trends. These data are most commonly

collected during freshwater 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 stock 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).

FRESHWATER 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 count	The number of adults seen usually 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.
Percent habitat use	Percentage of bull trout/Dolly Varden present in available habitat over time (years); can use index areas/counts.
Population estimate	The total number of fish of all age classes expanded from sample data.

Survival Data

No specific survival data were included in this inventory, but a description is provided here to express the potential future use of this category. 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 freshwater 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.

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 freshwater 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 many stocks quantitative data may not exist or may not exist over sufficient time periods to measure stock status under the rating criteria in this inventory. The status of these stocks would be rated as Unknown.

STOCK STATUS RATING

The stock- screening process was used to rate stocks into five status categories. Stocks with escapement, population size and survival levels within normal ranges were rated as **Healthy** stocks. Those stocks that currently display low production or survival values were assigned to one of two separate rating categories: **Depressed** stocks or **Critical** stocks, depending on the current condition of the stock. Stocks were also rated as **Unknown** stocks when data limitations did not allow assessment of current status. A rating category for **Extinct** stocks was also included. Definitions and discussions of each of these rating categories are provided below, along with the number of stocks assigned to each category.

The rating of stock status was done during a technical review process. The amount and quality of stock data vary between geographic area, 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 stocks. The interactive nature of the inventory process and its review will allow these ratings to be changed in the future as more detailed information becomes available, or because of changes in stock status.

Healthy Stocks

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

Healthy stocks 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 may be classified as Healthy in the inventory process does not necessarily mean that

managers have no current concerns about its production status. In addition, due to a lack of information on changes in fitness, some stocks were classified as Healthy that may have been significantly influenced by interactions with non-native species. Much current resource management activity focuses on resolving problems for productive stocks to ensure they remain healthy and again provide harvest opportunity.

Approaches to considering habitat degradation, or loss, in assessing the status of individual stocks present a particularly difficult problem. It is probable that all wild salmonid stocks in Washington State 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 performance.

The consideration of available habitat is included in the stock rating definitions for Healthy and Depressed stocks. This approach is an effort to recognize that there have been irreversible losses of habitat and that if stock status were rated against a pristine habitat base, virtually every stock 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 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 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 status.

This definition is not meant to imply that a stock rating will remain Healthy in the face of continuing habitat loss, even if the stock remains in balance with declining habitat. Future inventories will identify those Healthy stocks 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 performance or habitat availability can be measured.

This SaSI report has identified 13 bull trout/Dolly Varden stocks in the Healthy category statewide. Stocks rated as Healthy represent the second largest category of bull trout/Dolly Varden stocks in Washington State (Table 2). Healthy stocks are described in more detail in Tables **3, 4, and 5** and in Part 4 -- Stock Reports.

Depressed Stocks

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

The category of **Depressed** stocks is used to identify those stocks that are experiencing difficulties that contribute to lower than expected abundance. These stocks met one or more of the negative performance criteria, but are likely above the level where permanent damage has occurred to the stock. These stocks 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 stocks 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 to stabilize at a low production level by achieving a balance with the particular set of survival pressures controlling its success. While Depressed stocks 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 stocks will constrain fishery harvest opportunity because of their low abundance.

This SaSI report has identified two bull trout/Dolly Varden stocks in the Depressed category statewide (Table 2). Depressed stocks are described in more detail in Tables 3, 4, and 5 and Part 4 -- Stock Reports.

Critical Stocks

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

The **Critical** stock category is reserved for those stocks that have declined to a level where the stock is in jeopardy of significant loss of within-stock diversity or, in the worst case, could face extinction. The loss of within-stock 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's ability to respond to changing conditions. The usual result is reduced survival and population size. Such stressed stocks can be caught in a downward spiral of ever-increasing negative impacts that can lead to eventual extinction. In contrast, stocks 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 stocks would appear to be stable, they could be delicately balanced, awaiting just one additional negative impact to push them into failure. The Critical stocks identified in the SaSI report are all 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 recent 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's potential population size and the amount of available habitat to its current status, which means that a stock 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 where the population has achieved equilibrium with a limited amount of habitat. Finally, bull trout/Dolly Varden stocks comprised 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.

This SaSI report has identified five bull trout/Dolly Varden stocks in the Critical category statewide (Table 2). Critical stocks are described in more detail in Tables 3, 4, and 5 and in Part 4 -- Stock Reports.

Unknown Stocks

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

If sufficient trend information was not available or could not be used to assess stock status, stocks were rated as **Unknown**. Stocks 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 stocks 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 60 bull trout/Dolly Varden stocks in the Unknown category statewide. Stocks rated as Unknown represent the largest status category of bull trout/Dolly Varden in Washington State (Table 2). Unknown stocks are described in more detail in Tables 3, 4, and 5 and in Part 4 -- Stock Reports.

Extinct Stocks

Extinct -- 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.

This SaSI report identifies extant bull trout/Dolly Varden stocks and makes no focused effort to identify and assess past extinctions. The past loss of many 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, the inclusion of known past extinctions was not emphasized, but is referenced in some 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 identified during the annual review and inventory of Washington's wild salmonid stocks. The Extinct category is applied in this inventory if a stock that is currently being tracked in escapement or fishery management databases is found to have been extirpated within its native range.

STOCK STATUS SUMMARY

Of a statewide total of 80 bull trout/Dolly Varden stocks identified during this SaSI, 14 (18%) were rated as Healthy, 2 (3%) were rated as Depressed, 6 (8%) were rated as Critical, and 58 (72%) were rated as Unknown. The number of stocks in each category in different regions of the state is also presented in Table 2. Of the 19 stocks with known status, 63% were rated as Healthy, 11% were rated as Depressed, and 20% were rated as Critical.

While 14 of the bull trout/Dolly Varden stocks in the state were rated as Healthy, they include many medium to large spawning populations and thus represent a large

proportion of the total production of bull trout/Dolly Varden in Washington. Depressed stocks have not likely experienced permanent damage, but they may need active efforts to return them to more productive levels. Three stocks were rated as Critical. A large number of stocks (58) were rated as Unknown which emphasizes the need to obtain stock assessment information for these stocks. More detailed examination and planning will be done for stocks requiring priority attention as part of the Wild Stock Restoration Initiative and the Bull Trout/Dolly Varden Management Plan, once it is finalized (see [Part 3 -- Current and Future Actions](#)).

	<u>HEALTHY</u>	<u>DEPRESSED</u>	<u>CRITICAL</u>	<u>UNKNOWN</u>	<u>EXTINCT</u>
Table 2. Regional and statewide summary of bull trout/Dolly Varden stock status.					
PUGET SOUND					
North Puget Sound	2	0	0	7	0
South Puget Sound	0	0	0	6	0
Hood Canal	1	0	0	2	0
Strait of Juan de Fuca	1	0	0	3	0
TOTALS	4	0	0	18	0
COASTAL					
North Coast	1	0	0	5	0
Grays Harbor	0	0	0	1	0
TOTALS	1	0	0	6	0
COLUMBIA RIVER					
Lower Columbia	0	1	0	0	0
Upper Columbia	9	1	6	34	0
TOTALS	9	2	6	34	0
WASHINGTON STATE					
80 TOTAL STOCKS	14	2	6	58	0
PERCENT OF TOTAL	18%	3%	8%	72%	0%

Table 3. Washington State bull trout/Dolly Varden stock list presented by river basin.

PUGET SOUND			
TRANSBOUNDARY INDEPENDENTS	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Chilliwack/Selesia Cr	Native	Wild	Unknown
NOOKSACK	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Lower Nooksack	Native	Wild	Unknown
Canyon Cr (Nooksack)	Native	Wild	Unknown
Upper MF Nooksack	Native	Wild	Unknown
SKAGIT	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Lower Skagit	Native	Wild	Healthy
Baker Lake	Native	Wild	Unknown
Upper Skagit	Native	Wild	Unknown
STILLAGUAMISH	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Stillaguamish	Native	Wild	Unknown
SNOHOMISH	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Skykomish	Native	Wild	Healthy
CEDAR	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Chester Morse Lake	Native	Wild	Unknown
DUWAMISH/GREEN	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Green R	Native	Wild	Unknown
PUYALLUP	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Puyallup	Native	Wild	Unknown
White R (Puyallup)	Native	Wild	Unknown
Carbon	Native	Wild	Unknown
NISQUALLY	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Nisqually	Native	Wild	Unknown

HOOD CANAL	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
SF Skokomish	Native	Wild	Unknown
Lake Cushman	Native	Wild	Healthy
Upper NF Skokomish	Native	Wild	Unknown
STRAIT OF JUAN DE FUCA	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Dungeness/Gray Wolf	Native	Wild	Unknown
Upper Dungeness	Native	Wild	Healthy
Lower Elwha	Native	Wild	Unknown
Upper Elwha	Native	Wild	Unknown

Table 4. Washington State bull trout/Dolly Varden stock list presented by river basin.			
WASHINGTON COAST			
QUILLAYUTE	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Sol Duc	Native	Wild	Unknown
HOH	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Hoh	Native	Wild	Unknown
QUEETS	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Queets	Native	Wild	Healthy
QUINAULT	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Quinault	Native	Wild	Unknown
MOCLIPS/COPALIS	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Moclips	Native	Wild	Unknown
Copalis	Native	Wild	Unknown
GRAYS HARBOR	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Chehalis/Grays Harbor	Native	Wild	Unknown

Table 5. Washington State bull trout/Dolly Varden stock list presented by river basin.

COLUMBIA RIVER			
LOWER COLUMBIA	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
Lewis	Native	Wild	Depressed
UPPER COLUMBIA	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
White Salmon	Native	Wild	Unknown
Klickitat	Native	Wild	Unknown
Touchet	Native	Wild	Unknown
Mill Cr	Native	Wild	Healthy
Upper Tucannon	Native	Wild	Healthy
Asotin Cr	Native	Wild	Unknown
Wenaha	Native	Wild	Unknown
Yakima	Native	Wild	Critical
Ahtanum Cr	Native	Wild	Critical
Naches	Native	Wild	Critical
Rimrock Lake	Native	Wild	Healthy
Bumping Lake	Native	Wild	Depressed
NF Teanway	Native	Wild	Critical
Cle Elum/Waptus Lake	Native	Wild	Unknown
Kachess Lake	Native	Wild	Critical
Keechelus Lake	Native	Wild	Critical
Ingalls Cr	Native	Wild	Unknown
Icicle Cr	Native	Wild	Unknown
Chiwaukum Cr	Native	Wild	Unknown
Chiwawa Cr	Native	Wild	Unknown
Chikamin Cr	Native	Wild	Healthy
Rock Cr	Native	Wild	Healthy
Phelps Cr	Native	Wild	Healthy
Nason Cr	Native	Wild	Unknown
Little Wenatchee	Native	Wild	Unknown

Table 5 continued

UPPER COLUMBIA (cont.)	STOCK ORIGIN	PRODUCTION TYPE	STOCK STATUS
White R (Wenatchee)	Native	Wild	Unknown
Panther Cr	Native	Wild	Healthy
Entiat	Native	Wild	Unknown
Mad R	Native	Wild	Healthy
Gold Cr	Native	Wild	Unknown
Beaver Cr	Native	Wild	Unknown
Twisp	Native	Wild	Unknown
EF Buttermilk Cr	Native	Wild	Unknown
WF Buttermilk Cr	Native	Wild	Unknown
Reynolds Cr	Native	Wild	Unknown
Lake Cr	Native	Wild	Unknown
Wolf Cr	Native	Wild	Unknown
Goat Cr	Native	Wild	Unknown
Early Winters Cr	Native	Wild	Unknown
Cedar Cr (Methow)	Native	Wild	Unknown
Lost R	Native	Wild	Healthy
Monument Cr	Native	Wild	Unknown
Cougar Lake	Native	Wild	Unknown
First Hidden Lake	Native	Wild	Unknown
Middle Hidden Lake	Native	Wild	Unknown
WF Methow	Native	Wild	Unknown
FDR Lake	Native	Wild	Unknown
Pend Oreille	Native	Wild	Unknown
S Salmo	Native	Wild	Unknown
Granite Cr	Native	Wild	Unknown

PART 3 -- CURRENT AND FUTURE ACTIONS

As previously discussed, SaSI is the first step in a Wild Stock Restoration Initiative (WSRI) and provides a foundation for a Wild Salmonid Policy (WSP) that has an ultimate goal of maintaining healthy wild salmonid stocks and their habitats in order to support the region's fisheries, economies and other societal values. The challenge faced by fish managers, legislators, and concerned citizens is how to design and implement the WSRI 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 same 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. 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 for the WSRI as an approach to challenging the present and improving the future.

As outlined earlier, the objectives for the WSRI are to:

- complete and maintain a resource status inventory of Washington's wild salmonid stocks ("where are we now" [SaSI])
- review current resource management goals and objectives for 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")

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 the WSRI 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

This SaSI report represents another part of the WSRI inventory phase. During the next year, fish managers will 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. The public distribution of the 1992 SASSI report and this SaSI report is intended to serve as a basis for discussing and gathering input on wild stock restoration issues. Citizen participation activities will be used as needed for the foreseeable future to maintain an effective public dialogue about restoration plan development and implementation. Specific strategies will be developed for establishing complementary habitat inventories.

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 the WSRI 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:

- ! completion of a bull trout/Dolly Varden 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 foundation of a recovery plan for bull trout/Dolly Varden was laid by the drafting of a statewide management plan for the species. The draft plan is currently being reviewed. The intent of this 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: 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 systematically update salmonid stock status. An overriding conclusion of the technical staff who contributed to the earlier SASSI report and this SaSI report was that many stock issues are clouded with uncertainty. The lack of specific data for many stocks continues to make it difficult to answer questions about stock origin, production type, spawning distribution and stock status; and conclusions are often based on the collective judgment of the participants. SaSI reports will continue to highlight areas of uncertainty while the status of many stocks will be listed as "unknown." 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 and population size 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 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). It is conceivable that if in the future sufficient technology were available and data were obtained, it might be possible to inventory each char species separately. 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 supplemental documents.

Besides the update and review process for specific stocks, managers will consider the utility of comprehensive, regionally focused reviews of management performance in periodic cycles 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 contribute to the maintenance and restoration of bull trout/Dolly Varden stocks and their habitats. Fishery management programs for bull trout/Dolly Varden include harvest management, stock assessment, applied research and evaluation, enforcement of fishery regulations, 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 and 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 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 freshwater 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 (including bull trout) 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 regarding stream water temperature, fish passage, riparian zone management, and fine sediments in spawning gravel. These standards will help protect bull trout/Dolly Varden habitat.

Subsequent steps of the Wild Stock Restoration Initiative 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 REPORTS

This section provides detailed information on each bull trout/Dolly Varden stock presented in this SaSI report. It includes written descriptions of the rationales for stock 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 Definition and Identification and Part 2 -- Stock Assessment and Status sections of this report.

The report summarizes information for each stock but in some cases may include overview sections encompassing information pertaining to stock aggregates.

Overviews

In some cases an overview is presented for bull trout/Dolly Varden stocks within a river basin or a complex of independent streams. These overviews provide discussions of the definition and origin of stocks and review any uncertainties relating to the decisions regarding status determinations for specific stocks. The overviews also present information on trends in escapement and population size for aggregates of stocks within a basin, and include other information not referenced in individual stock reports.

Stock Reports

Each stock identified in SaSI is the subject of a report which presents detailed written descriptions of the rationales for the stock definitions in a **Stock Definition and Origin** section (which 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 the trends in survival or production for each stock and discusses the data used to describe 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 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 stocks) are identified. Any information on unique **biological characteristics** is summarized at the bottom of the stock definition page. A The **Stock Status Profile**

presents stock 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 bull trout/Dolly Varden. 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 habitat status, harvest management, 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 bull trout/Dolly Varden and established native or introduced species which share bull trout/Dolly Varden spawning and rearing habitat. **These discussions on factors affecting production are meant to provide only a very general overview of the type of problems faced by a stock.** More detailed examinations of these same topics will be developed for those stocks requiring priority attention as part of the overall Wild Stock Restoration Initiative and Bull Trout/Dolly Varden Management Plan when it is finalized (see Part 3 -- Current and Future Actions).

TRANSBOUNDARY INDEPENDENTS -- CHILLIWACK/SELESIA CREEK **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

The Chilliwack River flows from its origin in the North Cascades Mountains across the Canadian/U.S. border into Chilliwack Lake in Canada. The lake outlet is the Vedder River which then enters the Fraser River. Selesia Creek is a major tributary of the Chilliwack and also enters Canada from Washington State. The Chilliwack River and Selesia Creek contain a population of bull trout/Dolly Varden which has been identified as distinct based on its geographic distribution.

Little is known about the genetic composition or life history of this stock. However, it could probably be assumed that spawn timing is similar to that in nearby streams such as the Nooksack River where spawning occurs as water temperatures drop in the fall (September through November). This stock could be composed of resident, fluvial, and/or adfluvial life history forms.

This stock is assumed to be native in origin as there is no known stocking of bull trout/Dolly Varden in these rivers.

STOCK STATUS

The status of the stock is Unknown. Spawning escapement and relative abundance information are not available.

FACTORS AFFECTING PRODUCTION

Habitat--The Washington State portions of both the Chilliwack River and Selesia Creek are located in the North Cascades National Park and the Mt. Baker Wilderness, respectively, which contain pristine habitat and remote locations.

Harvest Management--From 1990 to 1994, the portion of these streams that originate in Washington was protected with a 20-inch minimum size limit intended to permit females to spawn at least once. In 1994 fishing for bull trout/Dolly Varden in these streams was closed.

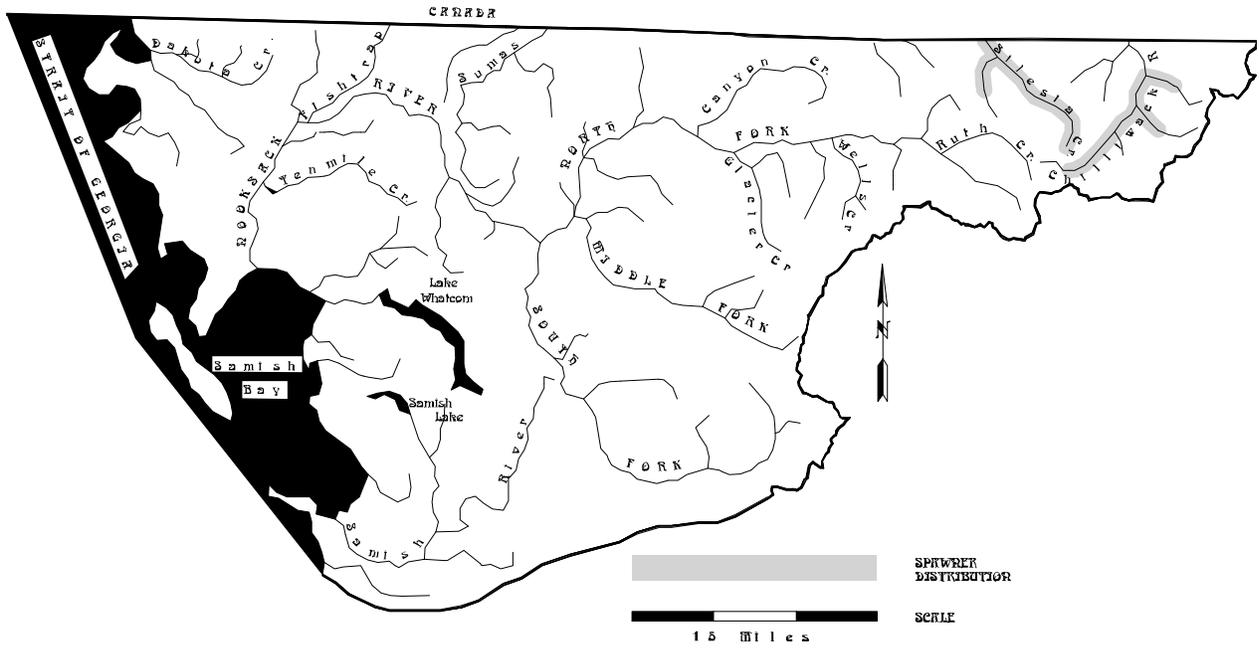
Hatchery--Interactions with hatchery-origin salmonids have not been examined.

STOCK DEFINITION PROFILE for Chilliwack/Selesia Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

<u>TIMING</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?



Spawn timing is unknown for this stock.

Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Chilliwack/Selesia Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
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- 73
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AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

OVERVIEW -- NOOKSACK BULL TROUT/DOLLY VARDEN STOCKS

LOWER NOOKSACK CANYON CREEK UPPER MIDDLE FORK

STOCK DEFINITION AND ORIGIN

The historical record of bull trout/Dolly Varden resources and fisheries in the Nooksack is incomplete. Little, if any, comprehensive information exists concerning escapement levels, population size, or past harvest levels. Bull trout/Dolly Varden in the Nooksack system are native and are probably composed of anadromous, fluvial, and resident populations which, in many of the spawning areas, have the potential to commingle.

While there has been no comprehensive genetic analysis of stocks in the Nooksack system, samples of juveniles were collected in 1995 from Canyon creek on the North Fork Nooksack. Results from this effort were unusual in that analysis showed only Dolly Varden genetic material in the sample. For this reason, Canyon Creek was identified as a separate stock in this report. This classification could change as more genetic information becomes available.

Based upon field experience of local WDFW biologists, five areas were identified as possibly containing discrete stocks. These areas were the North Fork Nooksack below the falls (R.M. 65), Canyon Creek, Middle Fork Nooksack below the City of Bellingham diversion dam, Middle Fork Nooksack above the City of Bellingham diversion dam, and the South Fork Nooksack. However, because of migration information developed on other systems, until future genetic sampling is accomplished only three stocks are delineated in this report. These are Canyon Creek; upper Middle Fork Nooksack (above an impassable fish barrier); and the Lower Nooksack (including the North Fork, lower Middle Fork, and South Fork). All bull trout/Dolly Varden stocks in the Nooksack basin are native and are maintained by wild production.

Life histories of the stocks in the Nooksack, in areas accessible to anadromous and non-anadromous fish, are complex. Spawning occurs in the up-river areas as water temperatures decrease to around 8° C. In many cases, fluvial, anadromous, and resident adults spawn in the same areas. After spawning, while resident adults remain in the area, fluvial adults move throughout the upper river areas and remain in pools throughout the winter, spring, and early summer. They return to their spawning staging areas in late summer. Anadromous adults, after spawning, begin the downriver migration from late fall through the winter and enter the estuary area in the spring. They remain in the estuary until late spring/early summer when they begin their up-river

spawning run again. Dolly Varden sub-adults from the estuary also enter the river in late winter/early spring, returning to the lower river in the summer during salmon runs. These fish usually remain in the lower river reaches until returning to the estuary areas in late winter/early spring (Curt Kraemer, WDFW, personal communication).

STOCK STATUS

The status of all stocks tentatively identified in the Nooksack system is Unknown. Bull trout/Dolly Varden in the Nooksack River and all tributaries were protected from potential excessive sport harvest in 1990 by implementation of a 20-inch minimum size limit intended to allow females to spawn at least once. In 1994 the Nooksack and all its tributaries were closed to fishing for bull trout/Dolly Varden. The effect of these changes has apparently resulted in increases in population size based upon random sightings in spawning areas and reported incidental catch and release during sport fisheries targeting other species.

NOOKSACK -- LOWER NOOKSACK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Lower Nooksack bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. Bull trout/Dolly Varden are known to spawn in areas of the North Fork below the waterfall at about RM 65 and in tributary and mainstem areas down to Maple Falls Creek (RM 50); in the lower Middle Fork in the canyon area below the dam; and in the South Fork both above and below the waterfall at approximately RM 31 down to Edfro Creek. Spawning in the South Fork area has been confirmed in Bells Creek, Wanlick Creek, Howard Creek and in mainstem areas. In the North Fork, spawning has been observed in Wells Creek, Deadhorse Creek and in all tributaries and mainstem areas down to Maple Falls Creek.

This stock could be composed of anadromous, fluvial and resident life history forms. To date, no genetic sampling has been done on this population.

Anadromous bull trout/Dolly Varden enter fresh water from salt water in early June. Spawning is from September through mid-November.

The lower Nooksack stock is native and is maintained by wild production.

STOCK STATUS

Stock status is Unknown. Apparent increases in population size have occurred over the last several years based upon miscellaneous observations of adults and juveniles.

FACTORS AFFECTING PRODUCTION

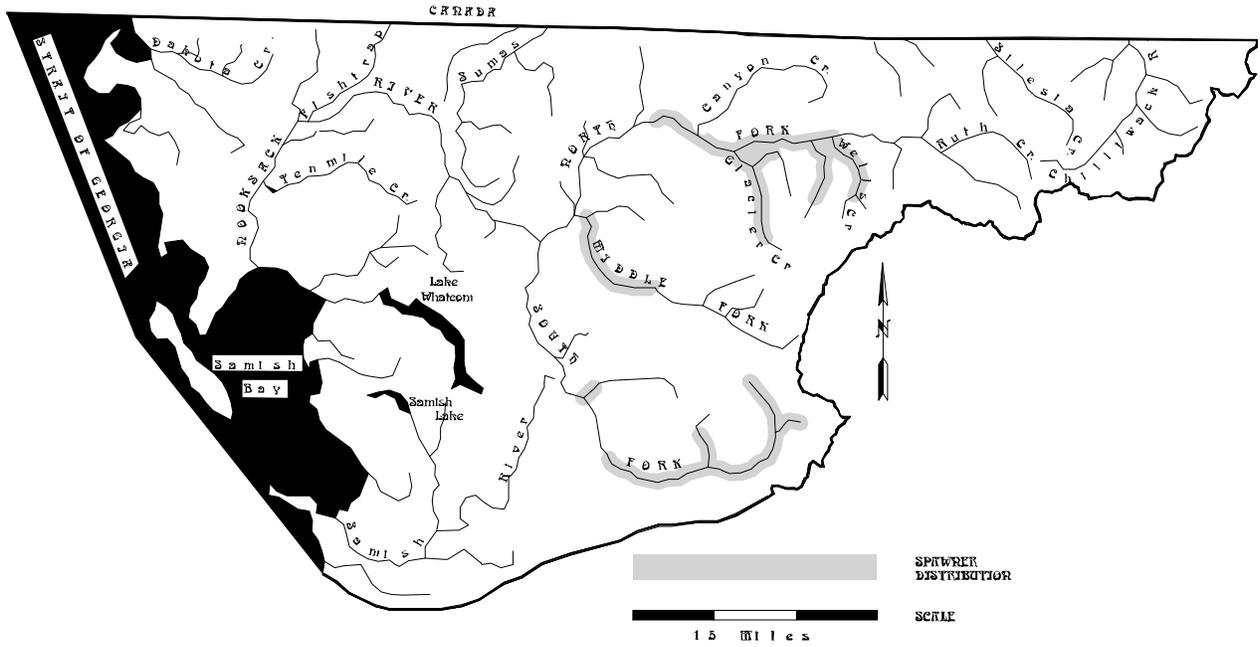
Habitat--In 1982 to 1983, several tributaries in the North Fork and Middle Fork were studied because of their importance as spawning areas for salmon (Schuett-Hames and Schuett-Hames 1984). The study concluded that stream instability was widespread and appeared to be the most important factor affecting stream productivity in the Nooksack. More than three-fourths of the streams were ranked unstable. Moderate to high levels of fine sediments combined with instability indicated that there was a high likelihood of low juvenile survival to emergence from gravel in most of the streams surveyed. Debris torrents which directly destroy both habitat and developing eggs were also identified as a major problem.

In the South Fork, a joint study by the Lummi Nation, Nooksack Tribe and the U.S. Fish and Wildlife Service (Schuett-Hames et al. 1988) examined the quality and availability of adult holding and spawning habitat for chinook. Habitat quality problems were

STOCK DEFINITION PROFILE for Lower Nooksack Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Lower Nooksack Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
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AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

attributed to logging and associated road-building on steep hill slopes adjacent to the river. Impacts to habitat used for holding included decreased pool depth, increased water temperature and lack of large woody debris to create habitat diversity. There are numerous instances of landslides along clay banks in the mainstem South Fork, often adjacent to clearcut areas, and many tributaries show evidence of landslides (WDFW and WWTIT 1994).

The habitat problems described in these areas all relate to past and present land-use patterns. Extensive logging and associated road building in the watershed has resulted in massive slope failures and has denuded much of the North Fork Nooksack basin. In addition, a high percentage of watersheds within the basin lack sufficient canopy cover which has led to increases in peak stream flows and scouring due to decreased slope stability.

In addition, heavy metals entering the river from the Ferndale sewage treatment plant have been shown by Washington Department of Ecology live box tests to kill fish. Copper levels could be high enough to affect the ability to smolts to adapt to salt water (Jim Johnston, WDFW, personal communication)

Harvest Management--From 1990 to 1994, bull trout/Dolly Varden in the Nooksack and tributaries were protected with a 20-inch minimum size limit intended to permit females to spawn at least once. In 1994 recreational fishing for bull trout/Dolly Varden in the Nooksack was closed.

Hatchery--Hatchery-origin chinook, chum, coho, and steelhead have been released into the Nooksack basin for decades, but possible interactions between them and wild bull trout/Dolly Varden have not been examined.

NOOKSACK -- CANYON CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Canyon Creek is a major tributary to the North Fork Nooksack River and enters the river at approximately RM 55. A significant population of bull trout/Dolly Varden exists in Canyon Creek. This population has been identified as a distinct stock based on its geographic distribution and preliminary genetic sampling in 1995. Anadromous fish could access the lower two to three miles of stream, and a resident population apparently exists above the Forest Service road bridge near stream mile 7.

The Canyon Creek stock could be composed of anadromous, resident, and fluvial life history forms. Genetic samples taken from juvenile fish collected by the U.S. Forest Service in 1995 contained only Dolly Varden.

Spawn timing is unknown.

All bull trout/Dolly Varden within Canyon Creek are of native origin, and their production type is wild.

STOCK STATUS

Stock status is Unknown. Spawning escapement and relative abundance information are not available.

FACTORS AFFECTING PRODUCTION

Habitat--Canyon Creek was surveyed for quality and quantity of salmon spawning habitat in 1982 to 1983 (Schuett-Hames and Schuett-Hames 1984). Habitat within the Canyon Creek watershed has been severely degraded by logging and associated road building within the watershed. These activities have led to streambed instability, scouring, and increased sedimentation which reduce egg-to-fry survival (WDFW and WWTIT 1994).

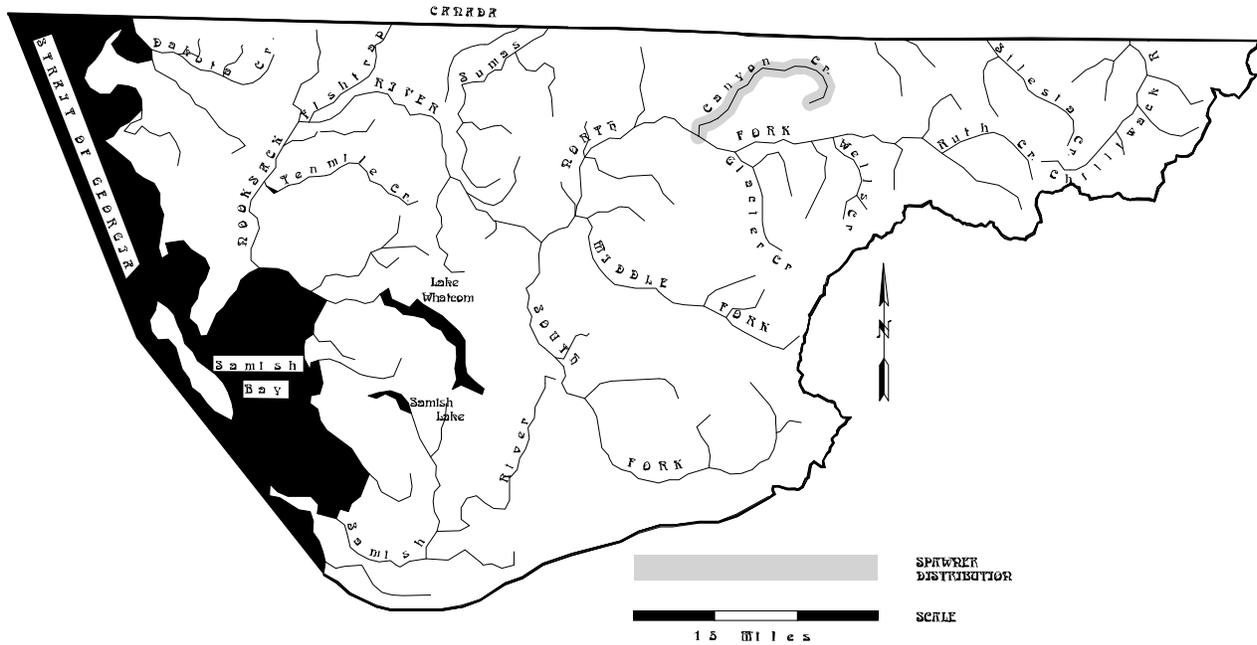
Harvest Management--From 1990 to 1994, Canyon Creek bull trout/Dolly Varden were protected with a 20-inch minimum size limit intended to permit most females to spawn at least once. In 1994, recreational fishing for bull trout/Dolly Varden in the Nooksack basin was closed.

Hatchery--Hatchery-origin chinook, chum, coho, and steelhead have been released into the Nooksack basin for decades, but possible interactions between them and wild bull trout/Dolly Varden have not been examined.

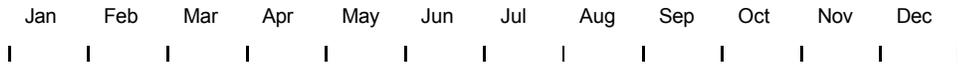
STOCK DEFINITION PROFILE for Canyon Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING



Spawn timing is unknown for this stock.

DISTINCT?

Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Canyon Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
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- 73
- 74
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AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

NOOKSACK -- UPPER MIDDLE FORK NOOKSACK **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

The Middle Fork Nooksack River is broken into two sections by the City of Bellingham water diversion dam. The section above the dam contains a population of bull trout/Dolly Varden which utilizes both mainstem areas and tributaries. Upper Middle Fork Nooksack bull trout/Dolly Varden have been identified as a distinct stock based upon their geographic distribution. Fish above the dam are reproductively isolated from those below the dam. Bull trout/Dolly Varden have been observed in Ridley, Rankin, Green and Clearwater creeks and in several unnamed tributaries. The population in this area could well be descended from anadromous fish which spawned in the upper Middle Fork Nooksack prior to dam construction.

Spawning is from early September to mid-November.

Upper Middle Fork Nooksack bull trout/Dolly Varden are native, and production type is wild.

STOCK STATUS

Stock status is Unknown. Spawning escapements and population abundance estimates are not available for this stock.

FACTORS AFFECTING PRODUCTION

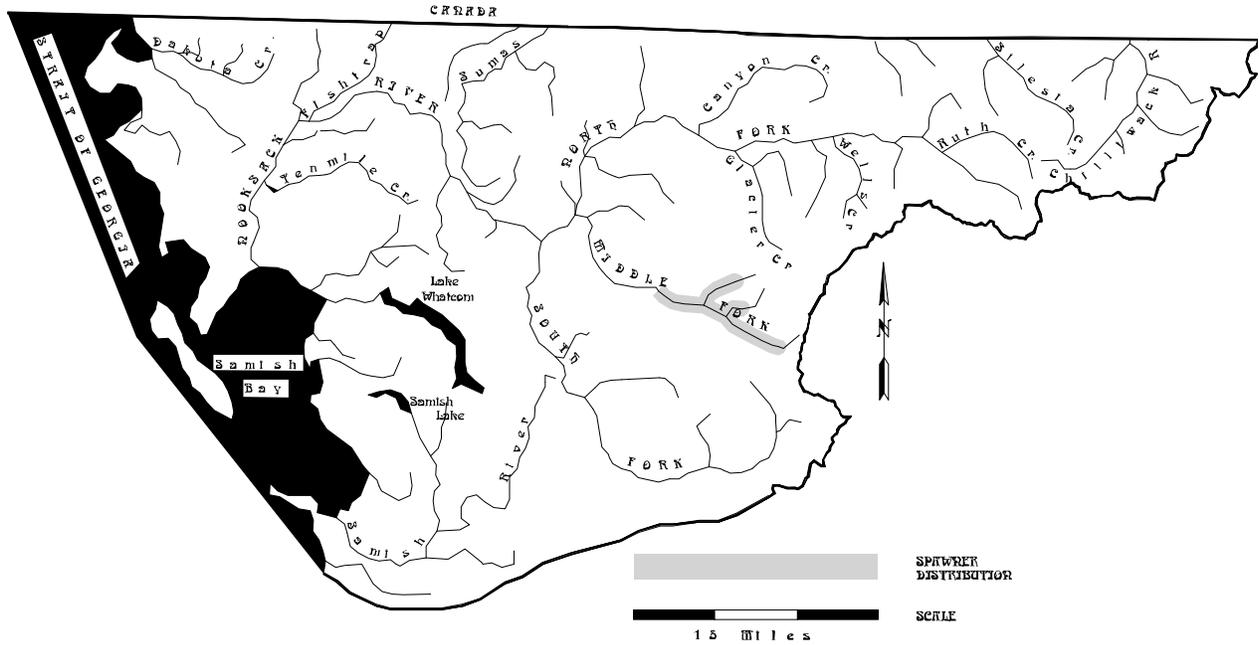
Habitat--The Middle Fork Nooksack has been adversely impacted by land-use practices, including timber harvest and road building. In 1982 to 1983, several tributaries in the North Fork Nooksack and the Middle Fork Nooksack were studied because of their importance as spawning areas for salmon (Schuett-Hames and Schuett-Hames 1984). The study concluded that stream instability was widespread and appeared to be the most important factor affecting stream productivity in the Nooksack. More than three-fourths of the streams were ranked unstable. Moderate to high levels of fine sediments combined with instability indicated that there was a high likelihood of low juvenile survival to emergence from gravel in most of the streams surveyed. Debris torrents which directly destroy both habitat and developing eggs were also identified as a major problem.

These problems all relate to past and present land-use patterns. Extensive logging and associated road building in the watershed have resulted in massive slope failures. In addition, a high percentage of watersheds within the basin lack sufficient canopy cover

STOCK DEFINITION PROFILE for Upper MF Nooksack Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



<u>TIMING</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning													No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Upper MF Nooksack Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
73				
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AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

which has led to increases in peak stream flows and scouring due to decreases in slope stability.

Harvest Management--From 1990 to 1994, the Middle Fork Nooksack population was protected with a 20-inch minimum size limit intended to permit most females to spawn at least once. In 1994, recreational fishing for bull trout/Dolly Varden in the Nooksack basin was closed.

Hatchery--Interactions between upper Middle Fork Nooksack bull trout/Dolly Varden and hatchery-origin salmonids have not been examined.

OVERVIEW -- SKAGIT BULL TROUT/DOLLY VARDEN STOCKS

LOWER SKAGIT UPPER SKAGIT BAKER LAKE

STOCK DEFINITION AND ORIGIN

The Skagit River supports the largest natural population of bull trout/Dolly Varden in Puget Sound. Bull trout/Dolly Varden spawn in most, if not all, of the accessible upriver areas in the drainage. Anadromous, fluvial, adfluvial, and resident fish all exist in the watershed and, in many cases, overlap geographically. All stocks are native and are maintained by wild production.

Genetic analysis of some juvenile populations began in 1995. Samples were collected in a joint effort by the WDFW and the U.S. Forest Service. This initial sampling effort occurred in the South Fork Sauk River. The sample appeared to be composed of bull trout only (Leary and Allendorf 1997).

Stock identification within the Skagit River basin was initially based on local fisheries biologists' experience and included individual stocks in the Baker River (and reservoir), Cascade River, Sauk River, Skagit River above Gorge Dam, Skagit River below Gorge Dam, and the Suiattle River. However, as more life history and movement information from fish in the Skagit and other systems was compiled, stocks were separated based upon likely reproductive isolation within the same geographical area. Also, field surveys combined with tagging of individual fish show a great deal of overlap between fluvial, resident, and anadromous fish in upstream areas. This approach identified three stocks within the Skagit; Baker Lake (now a reservoir), upper Skagit River (above Gorge Dam), and lower Skagit River and tributaries. This stock identification will undoubtedly change as more life history and genetic information becomes available.

Life histories of the stocks in the Skagit, in the areas accessible to anadromous and non-anadromous fish, are complex. Spawning occurs in the upriver areas as water temperatures decrease to around 8° C. In many cases, fluvial, anadromous, and resident adults spawn in the same areas. After spawning, while resident adults remain in the area, fluvial adults move throughout the upper river area and remain in pools throughout the winter, spring, and early summer. They return to their spawning staging areas in late summer. Anadromous adults, after spawning, begin the downriver migration from late fall through the winter and enter the estuary area in the spring. They remain in the estuary until early to mid-summer to begin the upriver spawning run again. Anadromous char migrate as smolts in the spring, return to the lower river in the fall,

overwinter in the lower river, then move to the estuary and Puget Sound in late winter and early spring (Curt Kraemer, WDFW, personal communication).

STOCK STATUS

The status of the Baker Lake and Upper Skagit stocks is Unknown. The status of the lower Skagit stock is Healthy based upon historical escapement counts in the South Fork Sauk, miscellaneous spawner/redd counts in other tributaries, sightings of adult fish in tributary areas during the spawning season, incidental smolt capture during salmon smolt enumeration efforts in the lower river, and age structure/adult movement tagging studies on adult fish that has been on-going since 1991. Currently, over 750 adult fish have been tagged in the Skagit and its tributaries.

Bull trout/Dolly Varden in the Skagit system have been protected from excessive sport angling mortalities since 1990 by a 20-inch minimum size limit. Since 1994, only the mainstem areas of the Skagit, Cascade, Sauk, Suiattle, and Whitechuck rivers have remained open to angling for bull trout/Dolly (with the 20-inch protective regulation). All other areas, including tributaries, have been closed to fishing for bull trout/Dolly Varden. Sport catch information is not available except as anecdotal information collected during fisheries targeting other species, in random angler checks, or as part of the tagging effort. That information indicates that the protective measures instituted since 1990 have, apparently, had a dramatic effect in increasing population size within the drainage. This conclusion is based upon spawner surveys in the Sauk drainage, sightings of individual adult fish and schools of fish in other areas of the system, and continuing angler information.

Many of the upper Skagit areas used for spawning by adults lie within either the North Cascades National Park boundary or within U.S. Forest Service boundaries designated as wilderness areas. These areas contain excellent habitat for spawning, incubation, and juvenile rearing.

SKAGIT -- LOWER SKAGIT BULL TROUT

In the 1998 inventory this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of several collections from the lower Skagit including Illabot Creek (N=21 in 1997, N=13 in 1998, analyzed by WDFW), Suiattle River tributaries (N=2 in 1998, analyzed by WDFW), the upper Sauk River (N=3 in 1996, analyzed by WDFW), South Fork Sauk (N=25 in 1995, Leary and Allendorf 1997) indicated that all fish in all collections were bull trout.

STOCK DEFINITION AND ORIGIN

Lower Skagit bull trout have been identified as a distinct stock based on their geographic distribution. The Skagit River, below Gorge Dam (excluding the Baker River), is composed of several major tributaries (Sauk, Cascade, Suiattle, and Whitechuck rivers) and numerous "minor" tributaries, which range in size and length from small rivers to small creeks. Much of this extensive area is utilized by bull trout populations as spawning and rearing areas.

These populations are apparently composed of anadromous, fluvial, and resident life history forms.

Spawning is from early September November.

All fish within the Skagit system are of native origin, and there have been no known hatchery introductions. Production type is wild.

STOCK STATUS

This stock is classified as Healthy. Part of the difficulty in assessing the status of this stock is due to the size of the Skagit system, the remoteness of the upper watershed, the extensive geographic overlap among life history forms, and the overlap between bull trout and salmon spawning areas.

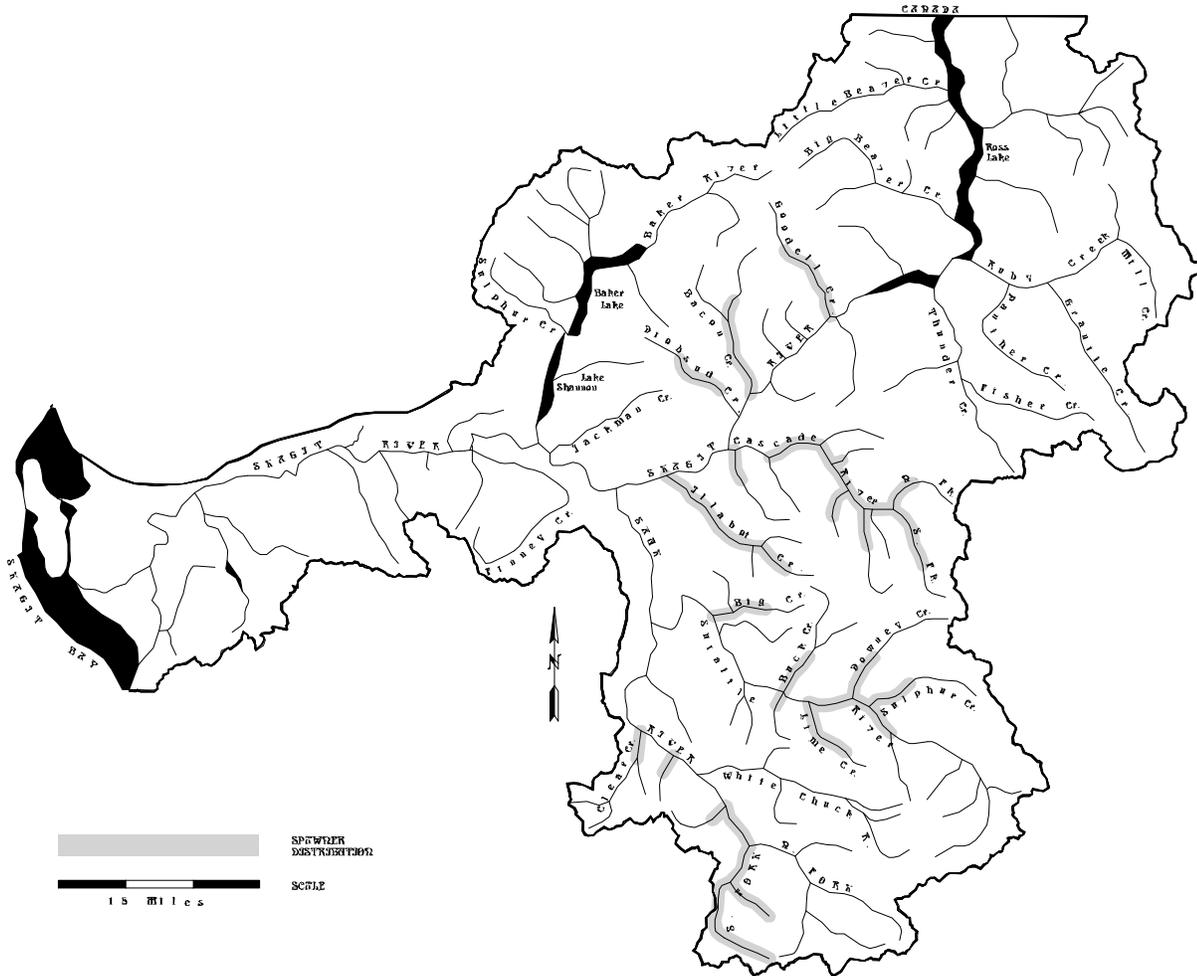
Data quality is good. Information which was reviewed in the assessment process included:

Escapement - The only area in the Skagit system which has historically been surveyed for total spawner escapement estimates is an approximately 3.5-mile section of the upper South Fork Sauk River. These estimates started in 1988, at which time the total count was estimated at 16 redds. This was followed by redd counts of seven in 1989 and four in 1990. After implementation of the 20-inch minimum size limit in recreational fisheries in 1990, the estimate was 55 redds in 1991, 46 redds in 1992, 54 redds in 1993, 34 redds in 1994, and 56 redds in 1996. Results from those surveys show an

STOCK DEFINITION PROFILE for Lower Skagit Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Lower Skagit Bull Trout

STOCK ASSESSMENT

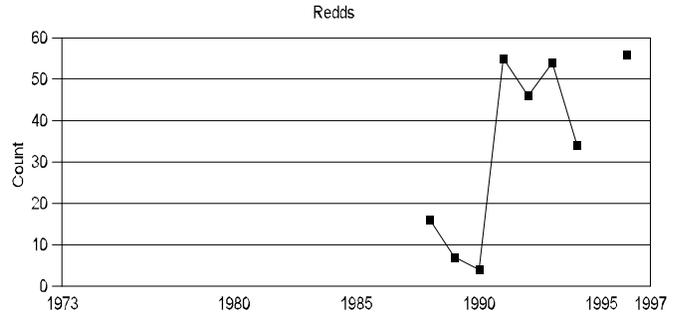
DATA QUALITY -----> Good

Return Years	ESCAPE Redds	FW PROD Fish/Day	JUVENILE Smolts	
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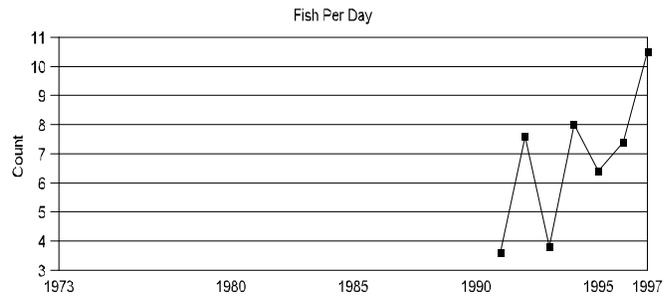
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90	4		18,732	
91	55	3.6	21,538	
92	46	7.6	32,195	
93	54	3.8	16,791	
94	34	8.0	48,965	
95		6.4	29,276	
96	56	7.9	27,844	
97		10.5	14,490	

Column 1 SF Sauk redd survey. No survey in 1997 due to high water.
 Column 3 Lower mainstem Skagit smolt trap data.

Escapement



Freshwater Production



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

apparently stable, robust population utilizing that section of river. 1996 was also the first time that one survey was accomplished by helicopter observation and was successful in counting both redds and adult fish. This technique, currently used extensively in both steelhead and salmon surveys, has the potential to greatly expand the area of the Skagit which can be successfully surveyed in the future if species differentiation can occur from the air.

In addition to the standardized surveys done on the South Fork Sauk River section, numerous smaller tributaries throughout the Skagit basin were periodically checked for spawner utilization over a period covering several years in the early 1990s. These surveys showed wide distribution of spawning adults throughout the upper watershed in many of the tributaries of the upper Skagit, Cascade River, Suiattle River, Whitechuck River, and the Sauk River. Tributaries included Camp Creek, Downey Creek, Fire Creek, Lime Creek, Milk Creek, Pumice Creek, Straight Creek, Sulphur Creek, Texas Creek, Weeden Creek and Bedal Creek. Two brief foot surveys into upper Illabot Creek in 1994 and 1995 estimated 100+ adult char in pool areas in the early fall prior to the onset of spawning. Surveys were not conducted in 1995 or 1997 because of high stream flows.

Adult Tagging Studies - Starting in 1991, a tagging program on adult fish caught by hook and line was initiated. The program was started to document adult fish movement within the Skagit Basin while collecting scale age information on captured fish. To date, over 700 adult fish have been "spaghetti" tagged from 1991 to the present. These fish have been captured and tagged in up-river areas as well as in the lower river. While this information is still being collected and analyzed, preliminary assessment includes the following (Curt Kraemer, WDFW, personal communication):

1. Time between captures ranged from 2 to 1,313 days.
2. Average time between captures was 259 days
3. Range of growth between captures was from 0 to 254 mm
4. Average growth was 48 mm between captures
5. Average annual growth was 68 mm
6. Movement ranged from 0 to 110 miles between captures
7. Movement averaged seven miles between captures
8. One fish tagged in January on the Sauk River was recaptured six months later in the lower Snohomish River
9. Two fish that were tagged in spawning areas were recaptured the following year in the same spawning areas, and one was in the same pool.

Kraemer found that adult fluvial fish showed high fidelity to a home pool. In his study, 13 fish over 472 mm which were tagged and recaptured at least 175 days apart between December 1, 1991 and June 15, 1992 were considered capable of having left their home pool, spawned, and returned to the mainstem river. Of these fish, 10 were recaptured in

their home pools. The three remaining fish were recaptured 0.2, 6.4 and 7.5 miles from their home pools.

This tagging effort also showed a consistent catch of “older” (greater than 20 in. (500 mm)) fish by the same anglers, in the same area of the river, over the same two-day period in early June, indicating a stable population. The CPUE (fish/angler day) and percent of the catch over 20 inches was as follows:

<u>Year</u>	<u>CPUE (fish/angler day)</u>	<u>% of catch over 20"</u>
1991	3.6	38
1992	7.6	29.5
1993	3.8	27
1994	8.0	34
1995	6.4	42.6
1996	7.9	34.2

Smolt Trapping - For the last several years, WDFW personnel have operated smolt traps, during the spring of the year, in the lower Skagit River near the town of Burlington. Both scoop and screw type traps were operated in order to enumerate migrating juvenile salmon smolts. During this sampling effort, bull trout/Dolly Varden smolts were captured and released as incidental catch. By assuming that trap efficiency is at a lower level (50%) than that measured for coho, a rough estimate for bull trout/Dolly Varden smolt out-migration since 1990 can be computed. This would probably be a minimum estimate since capture avoidance would be greater because char migrate at a much larger size and probably use lower areas in the water column during migration than coho. Estimates ranged from of 14,490 smolts in 1997 to 48,965 in 1994.

The following table shows those estimates, by year:

<u>Trap Year</u>	<u>Char smolts captured</u>	<u>Total smolt estimate</u>
1990	133	18,732
1991	112	21,538
1992	132	32,195
1993	76	16,791
1994	197	48,965
1995	187	29,276
1996	142	27,844
1997	142	14,490

Note that although the numbers of smolts captured were the same in 1996 and 1997, the total smolt estimates are different because trap efficiencies differed in these years.

FACTORS AFFECTING PRODUCTION

Habitat--As described in the overview, most of the habitat used by Skagit River bull trout populations for spawning and in-river rearing areas lies within U.S. Forest Service wilderness boundaries and is in excellent condition.

Detrimental land-use activities occur with greater frequency in lower watershed areas where extensive diking and channelization have reduced habitat diversity.

In the Skagit, pink and chum salmon eggs and juveniles are food for post-spawning and older bull trout. Mainstem flow control at Gorge Dam, particularly reduced flow, may reduce the availability of this food source by keeping spawning salmon and juvenile salmon away from low-flow reaches.

Harvest Management--From 1990 to 1994, bull trout in the Skagit and its tributaries were protected from potential recreational over-harvest by a 20-inch minimum size limit intended to permit most females to spawn at least once. That 20-inch minimum size limit remains in effect on the mainstem Skagit, Cascade, Suiattle, Whitechuck, and Sauk Rivers while all other tributary areas are closed to fishing for bull trout or Dolly Varden.

Hatchery--Various hatchery programs have released both juvenile salmon and steelhead smolts for several decades. Interactions between these hatchery fish and wild bull trout have not been examined.

SKAGIT -- UPPER SKAGIT BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

The upper Skagit River above Gorge Dam contains three reservoirs, each impassable to migrating fish, before entering Canada. Each of the three reservoirs, Gorge, Diablo, and Ross, now contains an isolated population of bull trout/Dolly Varden. These populations may be in the process of becoming distinct stocks. Because they would have been able to commingle prior to dam construction, we are currently treating them as a single stock. Within Gorge Reservoir, the primary spawning area is the lower 1.7 miles of Steattle Creek and that portion of the Skagit from the reservoir up to Diablo dam. Within Diablo Reservoir, most spawning occurs in the Thunder Arm area including Fisher Creek. Within Ross Reservoir, spawning occurs within many of the lower tributary areas, such as Big Beaver, Little Beaver, Silver, Hozemeen, Lightning and Ruby creeks, as well as the portion of the upper mainstem Skagit River in Canada.

These populations are assumed to be adfluvial with the possible exception of the portion in Canada which might be resident and/or fluvial.

Spawning is from early September to late October.

Upper Skagit bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The status of this stock is Unknown.

FACTORS AFFECTING PRODUCTION

Habitat--The entire upper Skagit and its major tributaries contain some of the best salmonid spawning and rearing habitat in Puget Sound. This area lies entirely within the boundaries of either the Mt. Baker/Snoqualmie National Forest, with much of it in wilderness designated areas, or within the North Cascades National Park. While there have been some historical habitat impacts, most spawning and rearing areas would be classified as excellent. All three reservoirs are located within the North Cascades National Recreation Area and, as such, are afforded habitat protection in the spawning areas.

Harvest Management--From 1990 to 1994, these populations were protected from potential excessive recreational harvest by a 20-inch minimum size limit intended to permit most females to spawn at least once. From 1994 to the present bull trout/Dolly Varden fishing in the upper Skagit has been closed.

STOCK STATUS PROFILE for Upper Skagit Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Hatchery--Rainbow trout were released into both Diablo and Gorge reservoirs, but that program was discontinued in the mid-1980s. No other hatchery-origin salmonids have been released into the upper Skagit basin.

SKAGIT -- BAKER LAKE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Baker Lake, now a reservoir, contains a native population of bull trout/Dolly Varden which has been identified as a distinct stock based on its geographic distribution. Bull trout/Dolly Varden are found in both the reservoir and tributary areas, such as the upper Baker River. This population is probably composed of both adfluvial and resident life history forms.

There are two large dams on the lower Baker River. An adult trap-and-haul facility at the lower Baker Dam transports adult anadromous salmonids above the dams to Baker Lake. Small numbers of bull trout/Dolly Varden are trapped and transported each year. In addition, bull trout/Dolly Varden smolts have been captured during salmon smolt enumeration in the Baker river trap below the dams. We do not know if these smolts originated above or below the dams. It is possible that there is an anadromous component of the Baker population or that some fish from the other rivers, such as the Skagit, are being introduced into Baker Lake if they stray into the adult trap.

Spawning is from early September through mid-November.

We have no information on the genetic composition of this stock, however, a small number of fin ray samples for DNA analysis was collected in the spring of 1996. Baker bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

Stock status is Unknown. We have no spawning escapement estimates or information on relative abundance for this stock.

FACTORS AFFECTING PRODUCTION

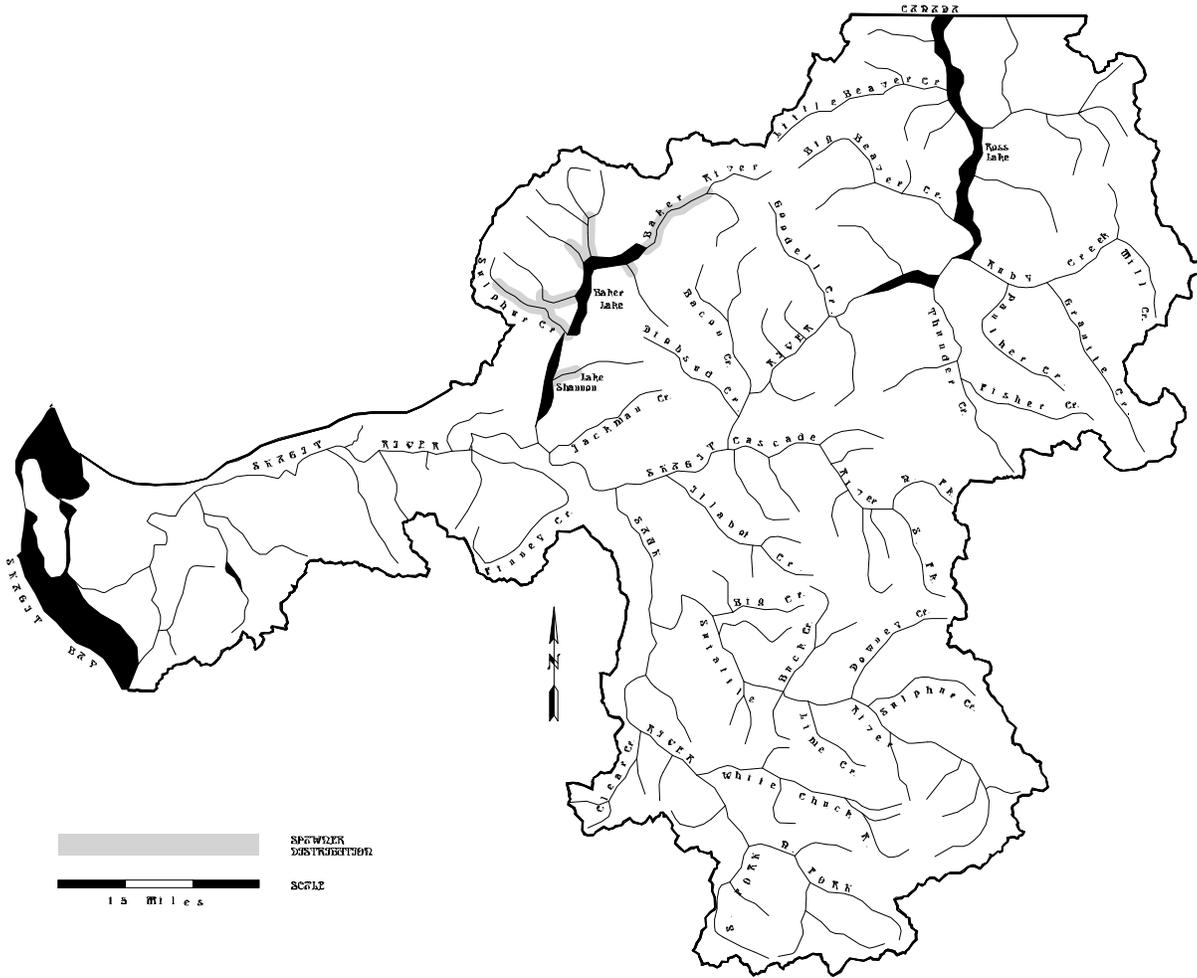
Habitat--The two hydroelectric dams operated by Puget Sound Energy on the lower Baker River have greatly limited fish movement in the Baker system. The dams have created two large reservoirs, Lake Shannon and Baker Lake. Lake Shannon, formed by the lower dam, has inundated nine miles of previously free-flowing river and the lower portions of tributaries in the flooded reach, destroying some potential spawning habitat. The upper dam greatly enlarged the original Baker Lake and flooded the lower portions of its tributaries, also destroying some potential spawning habitat.

Harvest Management--From 1990 to 1994 bull trout/Dolly Varden in Baker Lake and its tributaries, were protected from possible excessive angler harvest by a 20-inch

STOCK DEFINITION PROFILE for Baker Lake Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



<u>TIMING</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	<u>DISTINCT?</u>
Spawning									█				No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Baker Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
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- 89
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- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

minimum size limit intended to permit females to spawn at least once. From 1994 to the present, fishing for bull trout/Dolly Varden in Baker Lake has been closed.

Hatchery--Hatchery rainbow trout are released into Baker Lake, and kokanee stocking occurs in Shannon Reservoir, however, interactions between these species and wild bull trout/Dolly Varden have not been examined.

STILLAGUAMISH -- STILLAGUAMISH BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Stillaguamish bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. They are found throughout the Stillaguamish River basin with spawning areas in the North Fork and its tributaries including Deer Creek, Boulder River and Squire Creek and in the South Fork and its tributaries including Canyon, Millardy, Deer and Coal creeks. Bull trout/Dolly Varden are seen in the North Fork and its tributaries each fall during routine snorkel surveys to enumerate adult chinook salmon. In the South Fork, the waterfall near the town of Granite Falls was impassable to anadromous fish including bull trout/Dolly Varden until a fishway was constructed in the 1950s. However anecdotal information from fish surveys in the 1920s and 1930s suggests a "char" population existed in the South Fork at that time. Since construction of the fishway, large adult bull trout/Dolly Varden are commonly seen in the upper South Fork.

Anadromous, fluvial and resident fish all exist in the watershed and, in many cases, overlap geographically. Because of this overlap and the lack of detailed information on fish movement within the basin, all bull trout/Dolly Varden in the Stillaguamish basin are currently considered to be a single stock. This determination may change as more information becomes available.

Spawn timing is unknown.

Stillaguamish bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

Stock status is Unknown. There are insufficient quantitative abundance or survival data to assess status. However, with the exception of the Deer Creek segment of the population, the Stillaguamish stock appears to be stable or expanding and to be making use of the available habitat, based on limited spawner surveys of Boulder Creek and the upper Stillaguamish and anecdotal catch information.

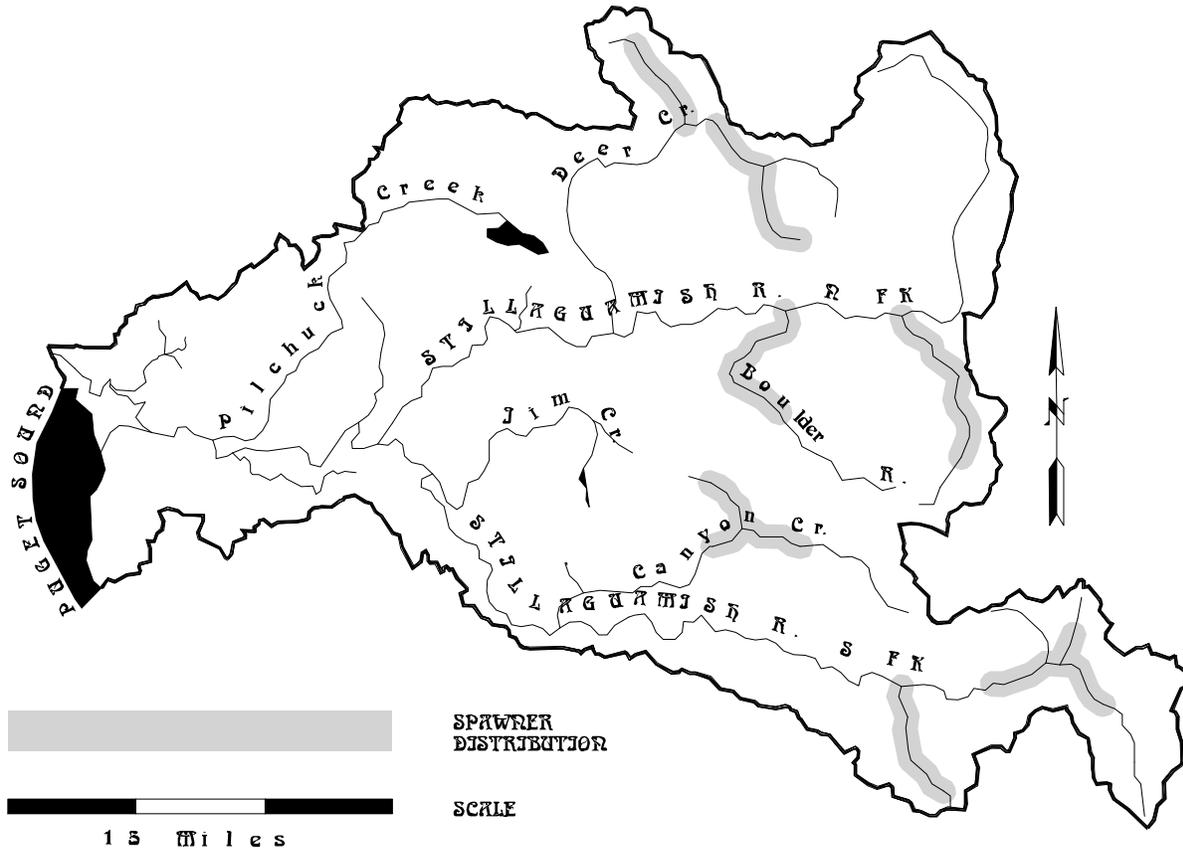
FACTORS AFFECTING PRODUCTION

Habitat--Fish habitat in the Stillaguamish basin has been degraded by logging, road-building, poor agriculture practices and development.

STOCK DEFINITION PROFILE for Stillaguamish Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Stillaguamish Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
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- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Agriculture and residential development have contributed to poor water quality in the lower river (Paulsen, Thornburgh and Rawson 1991). Water pollution from agricultural chemicals and manure is common and sometimes severe. Anadromous adult and sub-adult migration holding habitat in the mainstem Stillaguamish suffers from summer low flows and high temperatures, especially in the lower river sloughs which have slow-moving water without significant riparian cover.

A major limiting factor in the North Fork Stillaguamish is high sediment which reduces survival of all salmonid eggs. A major clay-ridden landslide near Hazel, which occurred in the 1950s, affected mainstem salmon spawning for several years (Williams, Laramie and Ames 1975). Deer Creek has experienced catastrophic landslides and sedimentation. A major landslide near DeForest Creek, believed to be natural, but arguably aggravated by extensive logging, has generated massive sediment loads in Deer Creek. Numerous smaller slides also deliver sediment to Deer Creek (WDFW and WWTIT 1994). Impacts have been severe and have affected all fish species in Deer Creek. Other limiting factors in the North Fork include loss of deep pools for adult holding, low summer flows and high water temperature.

Access to the South Fork Stillaguamish above Granite Falls is limited by poor attraction to the Granite Falls fishway, poor entrance conditions at the fishway, sedimentation and flow problems, and by a rock fall in Robe Canyon which may be a migration barrier. There is a coho trapping and hauling program which also transports small numbers of bull trout/Dolly Varden around Granite Falls and Robe Canyon.

Sedimentation from a major landslide in the Gold Basin area limits fish production in the South Fork Stillaguamish. Extensive logging has added to the sedimentation problem as well as contributing to the loss of large woody debris recruitment to the river channel and possibly to elevated water temperature as well.

Bank protection projects designed to protect homes near the South Fork mainstem and larger tributaries have removed or damaged riparian vegetation, restricted flow and resulted in loss of pool habitat.

Harvest--In 1990 a 20-inch minimum size limit for bull trout/Dolly Varden, intended to allow most females to spawn at least once before harvest, was implemented. Since 1994, fishing for bull trout/Dolly Varden in the Stillaguamish has been closed.

Hatchery--Hatchery-origin chinook, chum, coho, and steelhead are released annually into the Stillaguamish basin. Interactions between them and wild bull trout/Dolly Varden have not been examined.

SNOHOMISH -- SKYKOMISH BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Reproducing populations of bull trout/Dolly Varden have been documented in the upper Skykomish River basin. Field searches for native char in the Skykomish River system in the 1980s located them in the upper North Fork Skykomish mainstem and its tributaries between Bear Creek Falls and Deer Creek Falls. A 1993 radio-tagging study of bull trout/Dolly Varden collected at the Sunset Falls fishway on the South Fork Skykomish revealed that almost all of the fish spawned in the lower East Fork Foss River. Bull trout/Dolly Varden utilizing the South Fork Skykomish are not considered separate from those in the North Fork Skykomish.

Anadromous, fluvial, and resident life history forms are all found in the Skykomish River system, at times spawning at the same time and place (Kraemer 1994). Only resident fish are found in upper tributary reaches that lie above fish-barrier falls (e.g. Troublesome Creek). Genetic exchange probably occurs among these forms, based on spawning observations and the sizes of spawners. The demonstrated tendency of the three life history forms to spawn together, to stray (both within and between river systems), and to occupy new habitat, has caused at least one investigator to question whether bull trout/Dolly Varden found in a river system such as the Snohomish should be considered a unique stock (Curt Kraemer, WDFW, personal communication). However, until shown otherwise through genetic analysis or other procedures, all native char in the Snohomish River basin will be considered a single stock.

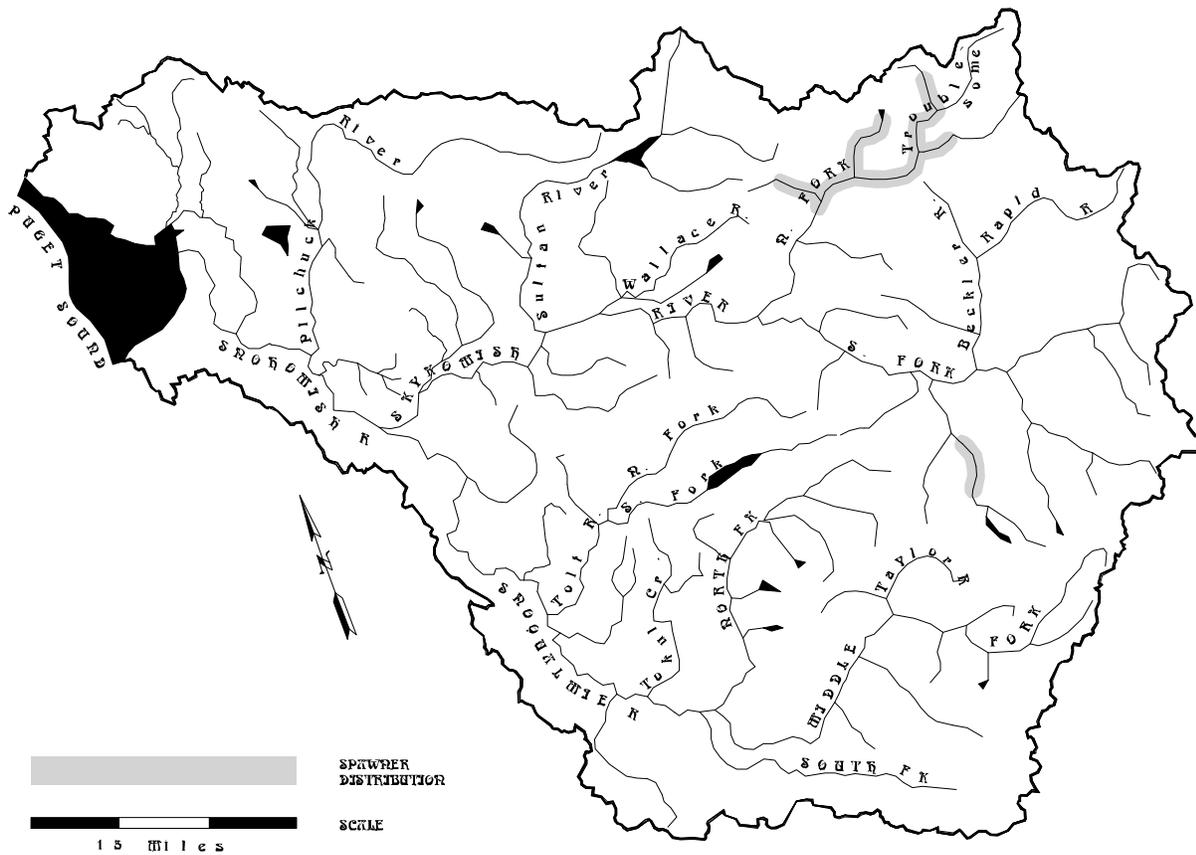
Spawning occurs from late August to early or mid-November but is more typically seen between the first week in October and the first week in November. Spawning commences as the temperature drops to about 8° C and decreases when the water temperature increases above 8°.

Skykomish bull trout/Dolly Varden are native and are maintained by wild production, although bull trout/Dolly Varden found in the South Fork Skykomish have only recently invaded that subbasin with the construction of the Sunset Falls trap-and-haul fishway in the mid-1950s.

Kraemer (1994) gives a complete review and discussion of other life history characteristics such as timing of movements, feeding, etc. for the Skykomish stock.

STOCK DEFINITION PROFILE for Skykomish Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION



D I S T I N C T ? - Y e s

TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Anad. Riv Entry													Unknown
Anad. Spawning													Unknown

Fluvial Spawning
Resident Spawning



Unknown
Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Skykomish Bull Trout/Dolly Varden

STOCK ASSESSMENT

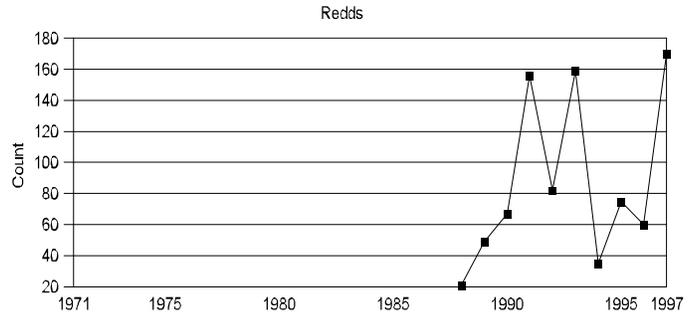
DATA QUALITY -----> Good

Return Years	ESCAPE Redds	ESCAPE Peak ct.	ESCAPE Trap count	
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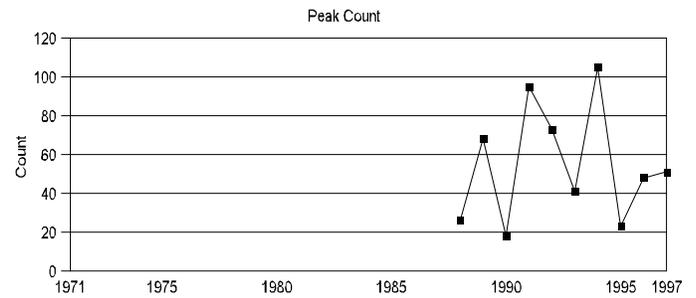
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88 21 26
89 49 68
90 67 18
91 156 95
92 82 73
93 159 41
94 35 105 18
95 75 23 40
96 60 48 45
97 170 51 42

Escapement



Escapement



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

STOCK STATUS

Stock status is Healthy. Available quantitative data are from fall adult and redd counts initiated in 1988. Adult/redd counts are from the upper North Fork Skykomish, plus several tributaries in that area; South Fork adult counts are from the Sunset Falls truck and haul fishway. Data quality is good. Counts of adults are also made during these surveys, but sudden weather changes causing high flows and deep water have, at times, made it very difficult to obtain complete data. Available data quality is good.

FACTORS AFFECTING PRODUCTION

Habitat--Habitat is in generally good to excellent condition in the reaches of the North Fork Skykomish and its tributaries used by bull trout/Dolly Varden, although there has been some loss of side-channel habitat due to diking and bank protection for floodplain roads. North Fork Skykomish water quality is generally excellent. Recently, winter floods in 1995-1997 caused localized impacts to side channel spawning areas, including deposition of finer sediments due to bank erosion. North Fork Skykomish water quality is generally excellent, and within normal variation.

Habitat in the portion of the South Fork Skykomish subbasin which could be occupied by bull trout/Dolly Varden has been impacted by human activity to a greater extent than in the North Fork subbasin. Logging and road construction is extensive in the Beckler and Tye watersheds. However, the East Fork Foss River drainage, to which tagged fish migrated in 1993, lies almost entirely within the pristine Alpine Lakes Wilderness.

It seems likely that bull trout/Dolly Varden will colonize those South Fork Skykomish streams which drain basins with large snow fields or glaciers in their headwaters which keep water temperature below the species' thermal maximum. The most likely streams to support bull trout/Dolly Varden in the South Fork Skykomish subbasin are the Foss, Tye and Miller rivers and Deception Creek.

Logging and road construction have had major impacts on habitat in the North Fork Tolt River subbasin. We do not know if bull trout/Dolly Varden have inhabited this area now or in the past. Current Tolt River water quality and high temperature may be prohibitive to their survival.

Harvest Management--Bull trout/Dolly Varden were over-harvest in the past, but very restrictive regulations have facilitated their recovery in recent years. Native char may not be kept if caught in the Snoqualmie sub-basin. Two char over 20 inches may be kept per day if caught in the Skykomish River below its forks, or in the Snohomish River. The 20-inch minimum size assures that all resident or fluvial, and most anadromous females will have had the opportunity to spawn at least once.

Poaching of holding adult char in the upper North Fork Skykomish, which is open to fishing through October, is a problem, and may be limiting their recovery to some degree. This situation is being monitored.

Hatchery--Brook trout have been introduced into many lakes in the Skykomish subbasin. Emigration of brook trout fry from some of these lakes and subsequent hybridization with native bull trout/Dolly Varden is a possibility but has not been documented in the Skykomish system. However, field surveys of the appropriate intensity have not yet been conducted.

Hatchery-origin chinook, pink, coho, chum and steelhead are released annually into the Skykomish basin. Interactions between these fish and wild bull trout/Dolly Varden have not been examined.

CEDAR -- CHESTER MORSE LAKE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Reproducing populations of bull trout/Dolly Varden, principally the latter, occur in the upper Cedar River basin in Chester Morse Lake, but have not been confirmed in the lower Cedar River, Lake Washington, Lake Sammamish or their tributaries. Reports of Dolly Varden from Lake Washington are rare. None were seen in a one-year survey on Lake Sammamish (Bradbury and Pfeiffer 1992), however one was identified during a two-year creel survey on Lake Washington (Pfeiffer and Bradbury 1992). This was a 370 mm fish taken by a shore angler near Kirkland in April 1981. Two bull trout/Dolly Varden were reported holding below a culvert in the headwaters of Issaquah Creek in the fall of 1993 (Bob Fuerstenburg, King Co. Surface Water Management., personal communication). It is possible that these three fish were anadromous fish which had strayed into Lake Washington system via the Ballard Locks and were not part of local spawning population within the lower two-lake system. Water temperatures in the lower Cedar River and Issaquah Creek are probably too high to support bull trout/Dolly Varden.

The Chester Morse Lake stock is geographically and reproductively isolated from stocks found in adjacent river systems. Only one life history form, adfluvial, has been found, although the resident form may exist in extreme headwater areas of the Cedar or Rex (the principal tributary to the upper Cedar River) rivers.

The adfluvial bull trout found within Chester Morse Lake, and its tributaries, are glacial relicts. Cedar Falls is a complete barrier to anadromous fish, and is located a short distance below Chester Morse Lake. The waterfall was created when the lake's outlet was forced to the south, away from its former connection with the Snoqualmie River system, by a lobe of the Puget Glacier during the Vashon (Pleistocene) glaciation, roughly 10,000 years ago (Mackin 1941). Whether any emigration or entrainment of bull trout occurs from Chester Morse Lake to the lower Cedar River is unknown.

Spawning occurs from early October to early or mid-December, but the actual start and end points of river entry and spawning are poorly documented. To date, all observed spawning has been in the lower few miles of Cedar and Rex rivers or near the mouths of a few steep tributaries of the lake/reservoir. No lake spawning has been observed.

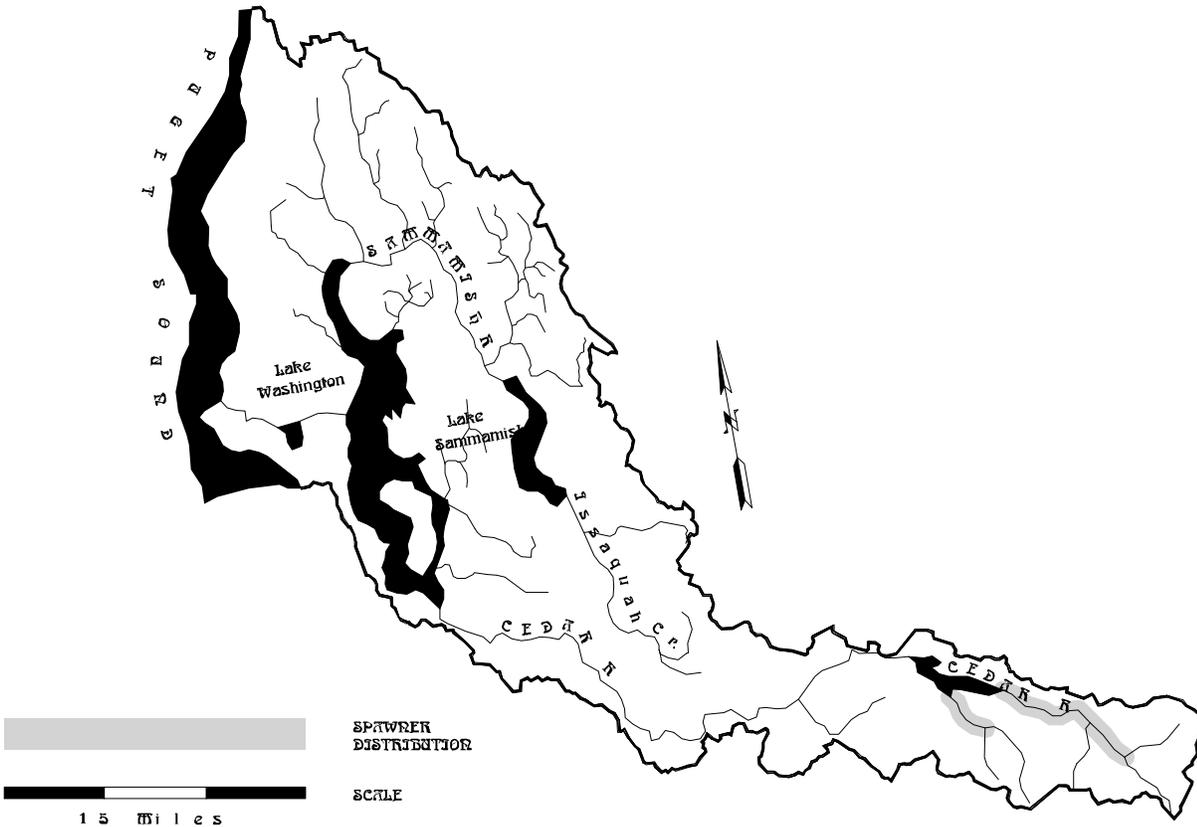
The Chester Morse stock is native and is maintained by wild production.

R2 Resource Consultants, Inc. (1995) give additional details on the life history and juvenile production of bull trout in the Chester Morse Lake subbasin.

STOCK DEFINITION PROFILE for Chester Morse Lake Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

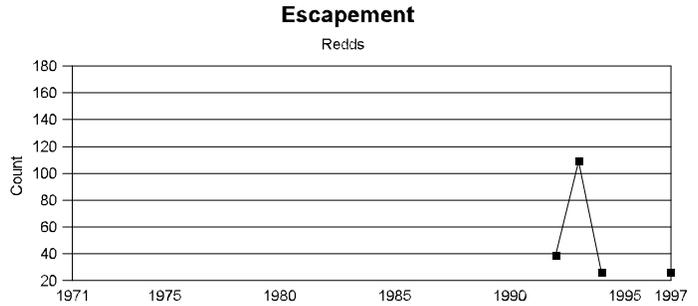
DISTINCT? - Unknown

STOCK STATUS PROFILE for Chester Morse Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Redds	ESCAPE Total		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92	39			
93	109	3,100		
94	26			
95				
96				
97	26			



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

STOCK STATUS

Stock status is rated Unknown due to the chronic problem of incomplete spawning run enumeration and uncertainties surrounding the Chester Morse Lake hydroacoustic estimate (see below). Bull trout/Dolly Varden are relatively abundant both as juveniles in the tributaries and in Chester Morse Lake. There are no data suggesting a chronically low condition, or short-term severe decline. However, the best measure of stock health needs to be established, and a long-term monitoring program set in motion. Current data quality is fair.

Field studies on the life history, abundance, and production of bull trout/Dolly Varden in Chester Morse Lake have been on-going since 1992 (R2 Resource Consultants, Inc. 1995). An attempt has been made to estimate their abundance in Chester Morse Lake itself (2,300 char), but the hydroacoustic-based estimate has limitations due to an inability to sample effectively in shallow water. This estimate was combined with Wyman's (1975) littoral estimate of 800 fish to yield an overall lake population estimate of 3,100 char. The legitimacy of melding data collected 20 years apart is certainly debatable. A more useful and reliable estimate of the adult population is based on annual counts of spawners migrating out of the lake. Redd counts have been made since 1992, however they, too, have been incomplete. Efforts are underway by the Seattle Water Department to develop weir methods to annually enumerate all fish ascending Cedar and Rex rivers. If they are unsuccessful, more intensive foot surveys will be required.

Redd counts from the Cedar and Rex rivers made to date may or may not be a reliable estimate of mature char abundance. Foot surveys began after the start of spawning in three of the past four years, and not all accessible stream reaches were surveyed. In addition, the stream reaches surveyed varied among years, so data are not directly comparable. The available "total" redd counts of 39, 109, and 26 for the years 1992 through 1994 respectively, seem low given the probable abundance of bull trout in the lake. However, they could be complete if certain levels of fecundity, egg-to-fry survival, and successive annual in-lake mortality are assumed. These key life-history parameters need to be determined, as well as the age structure of the lake population to place the escapement redd counts in proper perspective. Surveys were not conducted in 1995 and 1996.

The number of juvenile fish/100m² has been determined from index reaches established in Cedar and Rex rivers. While these are a poor estimate of overall population status, they do indicate the qualitative nature of tributary seeding. Bull trout/Dolly Varden in Cedar and Rex rivers exhibited growth rates "typical for trout and char in streams and rivers throughout the western United States.....", and were deemed "relatively abundant.....when compared with other river and stream systems in western Washington...."(R2 Resource Consultants, Inc. 1995).

Studies are underway to measure egg-to-fry survival, and the timing and magnitude of fry entry in Chester Morse Lake. This work could lead to repeatable methods that would yield very useful annual measures, such as fry produced per spawner.

None of these methods have been fully developed for the Chester Morse population/environment, but could lead to a very useful monitoring methodology. Since the methods are incomplete, and the time series is very short, the status of this stock is poorly understood.

FACTORS AFFECTING PRODUCTION

Habitat--In-stream habitat is generally in good condition in sections of the Cedar and Rex rivers used for population abundance estimation, although both watersheds have experienced substantial logging and road building. Extremely low flow in the Rex River in later summer is a concern as a potential limiting factor for juvenile production as well as for upstream migration by spawners.

Drawdown of Chester Morse Lake by the City of Seattle for municipal water supply during drought years could result in exposed river deltas with steep fronts and high stream gradients. Under these conditions maturing bull trout/Dolly Varden spawning may be delayed or may be unsuccessful in reaching preferred spawning areas (R2 Resource Consultants, Inc. 1995).

Harvest Management--Since Chester Morse Lake and its tributaries lie entirely within a municipal watershed which is closed to recreational use, angling is not an important source of mortality. However, very limited poaching does occur in the Rex and Cedar rivers, particularly during the spawning period.

Hatchery--No hatchery-origin fish are released into Chester Morse Lake or the upper Cedar River.

GREEN -- GREEN (DUWAMISH) BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Information on the presence, abundance, distribution, and life history of bull trout/Dolly Varden in the Green River basin is unavailable or extremely limited. Watson and Toth (1994) stated:

It is unclear whether the Green River supports a population of bull trout. Native char have been harvested in the Green River as far upstream as River Mile (RM) 40; however, there is insufficient evidence to determine if these fish are fluvial, or anadromous bull trout. The assessment team felt these fish are likely Dolly Varden charNo spawning of this char species has ever been documented.

There are no records to suggest that bull trout have ever occupied habitat upstream of RM 70 or in the HCP project area. Plum Creek has conducted extensive presence/absence surveys for bull trout in the upper Green River watershed, but none have ever been found.

Mongillo (1993) indicated that bull trout/Dolly Varden are "Present" in the Green River below Howard Hanson Dam, and the Green River falls within a group of populations having "Immediate Data Needs." Populations in that group "are either remnant with unknown status....or are declining with no knowledge as to whether the population is remnant or not."

There is no information on the timing or distribution of spawning, if any, in the Green River. Howard Hanson Dam has been a complete barrier to upstream passage of salmonids since its construction in 1961. The City of Tacoma's municipal water diversion has also been an anadromous fish barrier since 1911. The anecdotal reports of bull trout/Dolly Varden harvested in the Green River may refer to fish which have strayed into the Green but were produced in a different river basin.

Cropp (1989) set vertical and horizontal gill nets in Eagle Gorge (Howard Hanson) Reservoir in August, 1989, and collected only hatchery-origin chinook, coho and steelhead, plus native cutthroat trout and whitefish. No bull trout/Dolly Varden were collected.

STOCK STATUS

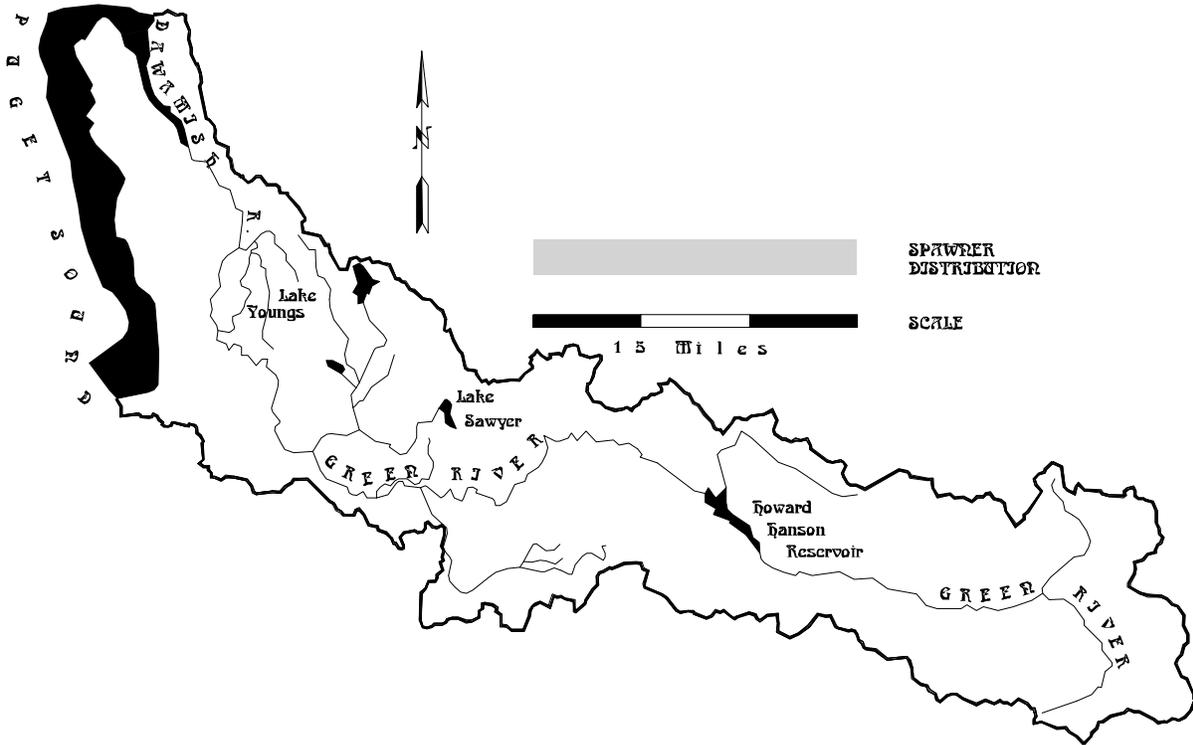
Stock status is Unknown. Field studies with which to characterize or assess population/run-size status are lacking, or unavailable to WDFW staff. No studies confirm reproduction of bull trout/Dolly Varden in the Green River basin. There is no

STOCK DEFINITION PROFILE for Green (Duwamish) Bull Trout/Dolly Varden

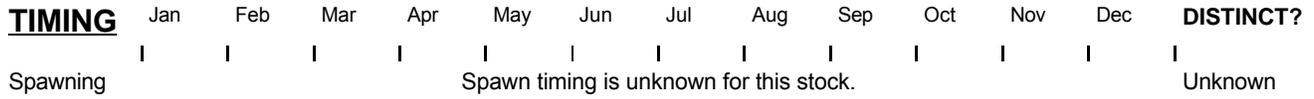
SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Green (Duwamish) Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
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- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

confirmation or quantitative measure of bull trout/Dolly Varden natural production or juvenile rearing in the Green River basin.

FACTORS AFFECTING PRODUCTION

Habitat--The Green River watershed has been heavily impacted by human activity, including clearcut logging, road construction, flood control and municipal water supply diversion dams, agricultural development, flood control diking, river channelization, intensive industrial and residential development, and estuarine dredging and filling. We do not know if the habitat can currently support bull trout/Dolly Varden. Suitable habitat may still be available in the upper watershed above Howard Hanson Dam. We do not know if bull trout/Dolly Varden occupied the upper watershed in the past; they do not appear to be present now (Watson and Toth 1994).

Harvest Management--Retention of bull trout/Dolly Varden caught in the Green/Duwamish River has been illegal since 1994.

Hatchery--Brook trout have been introduced into the Green River basin and are now self-sustaining in Lizard Lake in the headwaters of Sunday Creek (Stampede Pass). Brook trout may have been introduced into other subalpine lakes or tarns in the watershed.

Hatchery-origin chinook, coho and steelhead are released annually into the Green River. Interactions between them and wild bull trout/Dolly Varden, if any, have not been examined.

OVERVIEW -- PUYALLUP BULL TROUT/DOLLY VARDEN STOCKS

PUYALLUP WHITE RIVER CARBON

STOCK DEFINITION AND ORIGIN

The bull trout/Dolly Varden in the Puyallup River system have been separated into three stocks, Puyallup, White River and Carbon. These stocks are considered distinct due to the probable geographic isolation of their spawning populations. We do not know if they are genetically distinct. More or fewer stocks may be identified once comprehensive genetic, life history and ecological information is available. The stocks are Puyallup, Carbon and White River. These stocks are native. We have no life history information, however, habitat for anadromous, fluvial and resident forms is available. Spawn timing and location have not been determined.

STOCK STATUS

Stock status for the three stocks is Unknown. There is insufficient information to assign stock status with confidence. The only information available is very limited electrofishing data and angler catch reports which verify their presence in all three rivers and some trap data from the Puget Sound Energy diversion dam on the White River at Buckley. Available data are presented in each of the Stock Reports which follow.

PUYALLUP -- PUYALLUP BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Puyallup River have been identified as a distinct stock based on their geographic distribution. Life histories are unknown, but habitat is available for anadromous, fluvial and resident forms.

Spawn timing and locations have not been determined.

Puyallup bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

The only information available is electrofishing data from late summer of 1994. Two bull trout/Dolly Varden were sampled incidental to steelhead parr surveys at RM 41 and in Mowich Creek. They were 115 mm and 250 mm in length (the larger fish was collected in Mowich Creek). Haas (1988) bull trout/Dolly Varden species differentiation formula measurements were not made on these fish, so their identity as bull trout or Dolly Varden could not be determined.

FACTORS AFFECTING PRODUCTION

Habitat--Urban development, agriculture and logging activities have reduced summer flows, decreased riparian canopy (needed for hiding cover and temperature control), increased winter peak flows and increased stream sedimentation. Impacts have, at times, been severe on major tributaries used by steelhead. It is assumed that bull trout/Dolly Varden have also experienced severe impacts. As an example, the Greenwater River, a tributary of the White River in the Puyallup drainage, which is thought to be a major bull trout/Dolly Varden tributary, suffered total loss of large woody debris during the 1977 flood and subsequent clean-up operations. Improvements in logging practices and habitat restoration projects have gone a long way to restoring productivity of most major tributaries.

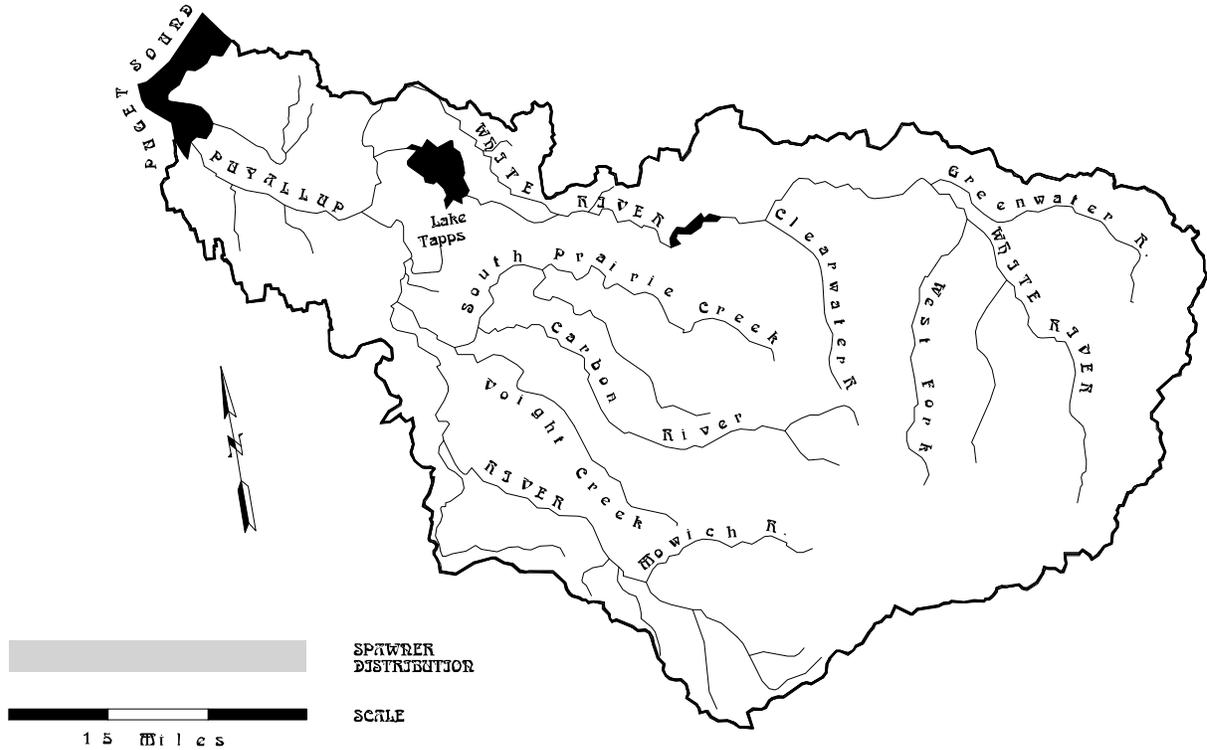
Diking in the lower Puyallup has actually reduced river capacity and led to a need for additional bank protection and constant gravel removal in attempts to prevent erosion. These activities usually further reduce channel stability and the quality of fish habitat.

STOCK DEFINITION PROFILE for Puyallup Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Puyallup Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
73				
74				
75				
76				
77				
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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 Puyallup River has been closed to fishing for bull trout/Dolly Varden since 1994. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

Hatchery--Hatchery-origin chinook, chum, coho and steelhead juveniles are released into the Puyallup basin annually. Interactions between them and wild bull trout/Dolly Varden have not been examined.

PUYALLUP -- WHITE (PUYALLUP) BULL TROUT

In the 1998 inventory this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of collections made at the US Army Corps of Engineers adult fish trap on the White River near Buckley (RM 24.3) in 1998 (N=24, analyzed by WDFW), 1999 (N=24, Baker et al. 2003), 2000 (N=40, Baker et al. 2003), and 2001 (N=33, Baker et al. 2003) indicated that all fish in all collections were bull trout.

STOCK DEFINITION AND ORIGIN

White River bull trout have been identified as a distinct stock based on their geographic distribution. Life histories are unknown, but habitat is available for anadromous, fluvial and resident forms.

Spawn timing and location are unknown.

Bull trout in the White River are native, and production type is wild.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

Three types of information are available for this stock: electrofishing (WDFW, U.S. Forest Service) and trap counts (Puyallup Tribe) and angler reports (Hal Beecher, WDFW, personal communication). The electrofishing data are from late summer, 1993. A total of nine native char were sampled incidental to steelhead parr surveys between river miles 43 and 53.3. They ranged in length from 99 mm to 300 mm. Four bull trout/Dolly Varden were electrofished in the West Fork White River ranging in length from 127 mm to 203 mm. Haas (1988) bull trout/Dolly Varden species differentiation formula measurements were not made on these fish, so their identity as bull trout or Dolly Varden could not be determined.

Data from the adult fish trap at the Puget Sound Energy diversion dam at Buckley from 1987 to 1991 show bull trout (believed to be anadromous) in the counts. Counts are variable and sometimes occur once in a month and at other times up to three times a month. Consequently, data quality is poor.

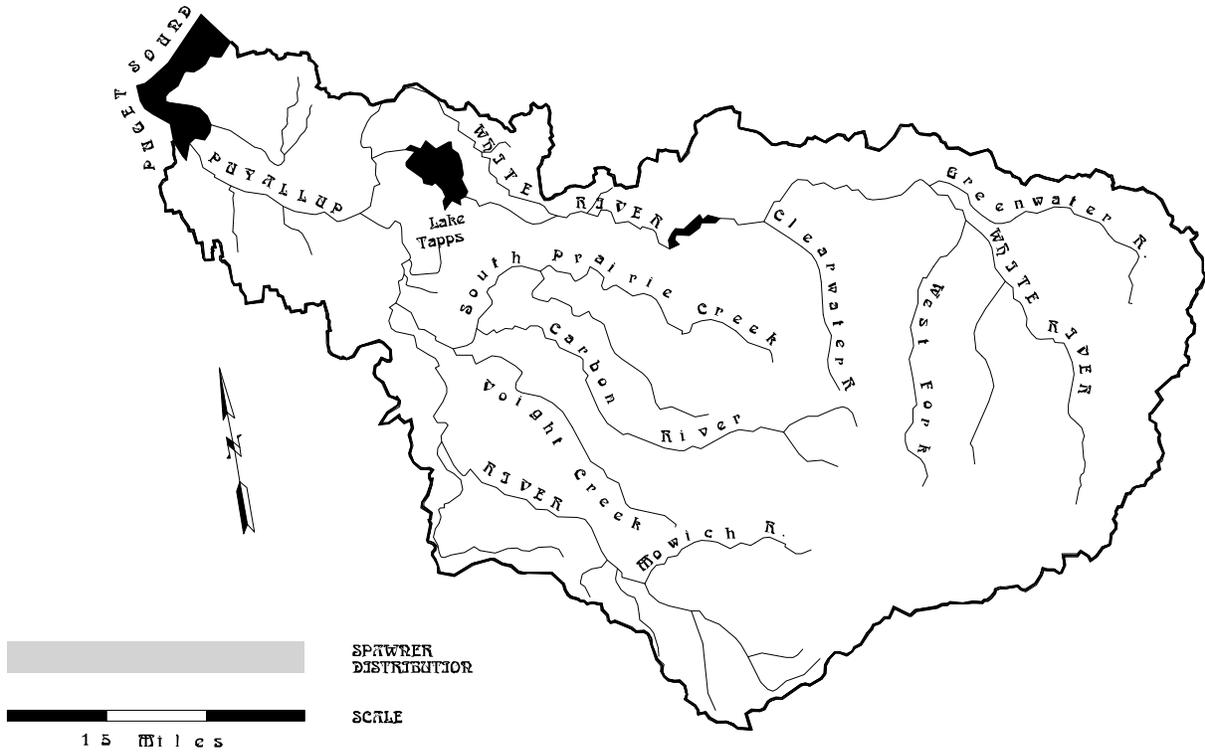
Four char ranging in size from 152 mm to 457 mm were caught on hook and line by a WDFW biologist in the late 1970s and early 1980s in the White River in Mt. Rainier National Park (Hal Beecher, WDFW, personal communication)

STOCK DEFINITION PROFILE for White (Puyallup) Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

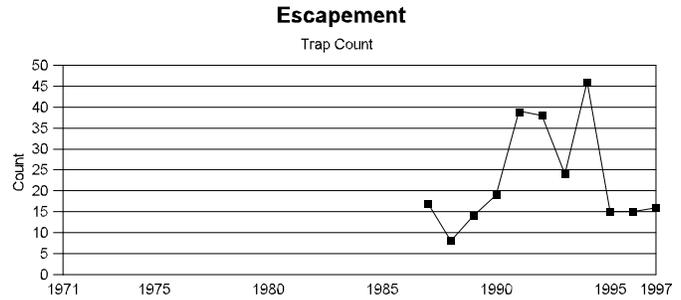
STOCK STATUS PROFILE for White (Puyallup) Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Poor

Return Years	ESCAPE Trap Count			
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73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	17
88	8
89	14
90	19
91	39
92	38
93	24
94	46
95	15
96	15
97	16



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--Urban development, agriculture and logging activities have reduced summer flows, decreased riparian canopy (needed for hiding cover and temperature control), increased winter peak flows and increased stream sedimentation. Impacts have, at times, been severe on major tributaries used by steelhead. It is assumed that bull trout have also experienced severe impacts. As an example, the Greenwater River, a tributary of the White River, which is thought to be a major bull trout producer, suffered total loss of large woody debris during the 1977 flood and subsequent clean-up operations. Improvements in logging practices and habitat restoration projects have gone a long way to restoring productivity of most major tributaries. Losses of downstream migrants at the Puget Sound Energy diversion near Buckley are thought to be significant for steelhead in years when smolts are migrating at a time when a large percentage of the White River flow is being diverted into Lake Tapps. It is assumed that anadromous bull trout smolts and possibly migrating fluvial bull trout are also affected.

Impacts from the Puget Sound Energy water diversion and Mud Mountain Dam also included drastically-reduced flow in the 21-mile bypass reach of the White River and high ramping rates, both of which can strand fish and impede migration. The glacial character of the mainstem and West Fork White River may limit spawning potential. However, the high gradient and stream velocities favor bull trout production.

Harvest Management--The White River has been closed to fishing for bull trout since 1994. There may be some mortality from hook and release of bull trout in fisheries targeting other species.

Hatchery--Hatchery-reared native spring chinook are released into the White River as part of the WDFW/tribal White River spring chinook rebuilding program. Interactions between them and bull trout have not been examined.

PUYALLUP -- CARBON BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Carbon River have been identified as a distinct stock based on their geographic distribution. Life histories are unknown, but habitat is available for anadromous, fluvial and resident forms.

Spawn timing and location are unknown.

Carbon bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

Two types of information are available: electrofishing data from later summer, 1994 (WDFW) and angler reports from the late 1970s and early 1980s (Hal Beecher, WDFW, personal communication). Sixteen native char were sampled incidental to steelhead parr surveys between river miles 18.6 and 22. They ranged in length from 112 mm to 310 mm. Two ripe males were collected, one each at river miles 18.6 and 19.9, respectively. They each measured 210 mm in length. Haas (1988) bull trout/Dolly Varden species differentiation formula measurements were not made on these fish, so their identity as bull trout or Dolly Varden could not be determined.

Several char ranging in length from 254 mm to 406 mm were caught on hook and line by a WDFW biologist in the Carbon River in Mt. Rainier National Park (Hal Beecher, WDFW, personal communication).

FACTORS AFFECTING PRODUCTION

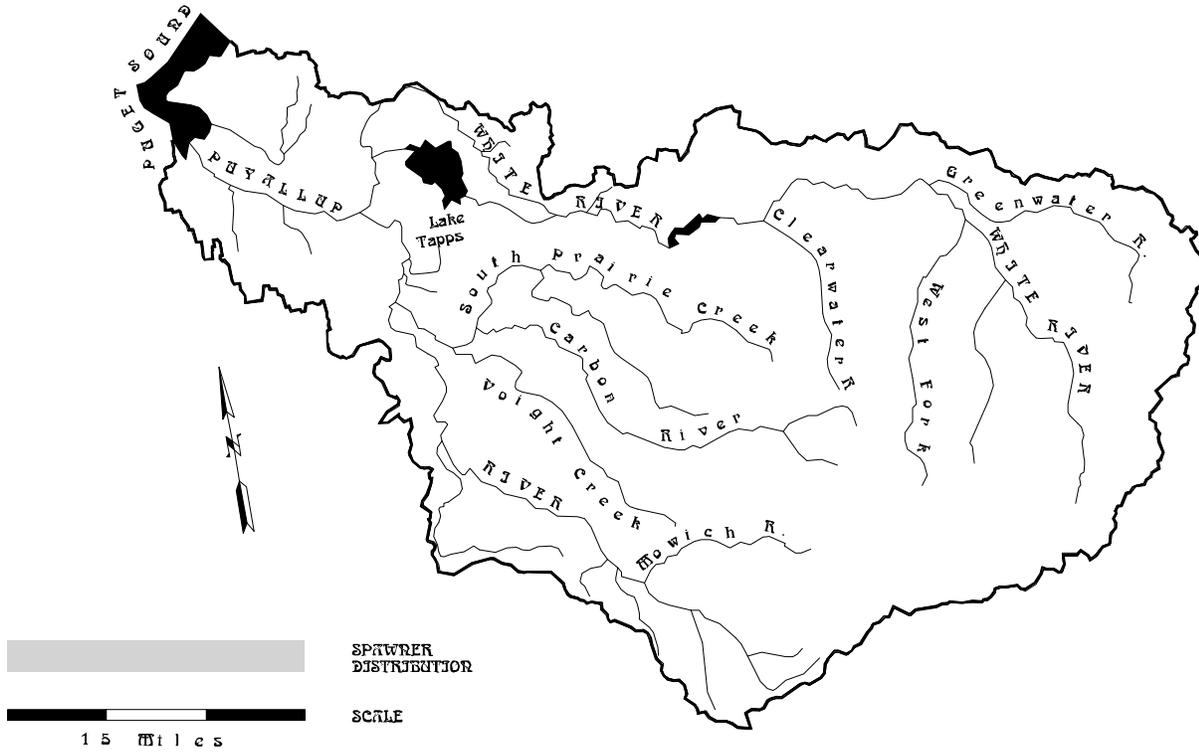
Habitat--Urban development, agriculture and logging activities have reduced summer flows, decreased riparian canopy (needed for hiding cover and temperature control), increased winter peak flows and increased stream sedimentation. Impacts have, at times, been severe on major tributaries used by steelhead. It is assumed that bull trout/Dolly Varden have also experienced severe impacts. Improvements in logging practices and habitat restoration projects have gone a long way to restoring productivity of most major tributaries.

STOCK DEFINITION PROFILE for Carbon Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? -

STOCK STATUS PROFILE for Carbon Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

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

Harvest Management--The Carbon River has been closed to fishing for bull trout/Dolly Varden since 1994. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

Hatchery--Hatchery-origin chinook, chum, coho and steelhead juveniles are released into the Puyallup basin annually. Interactions between them and wild bull trout/Dolly Varden have not been examined.

NISQUALLY -- NISQUALLY BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Nisqually River have been identified as a distinct stock based on their geographic distribution. Habitat is available for all life history forms: anadromous, fluvial, adfluvial and resident. The only information available is the collection of one juvenile bull trout/Dolly Varden by Nisqually tribal biologists while stream sampling in the mid-1980s. No bull trout/Dolly Varden have been reported in the Nisqually tribal commercial fisheries.

Spawn timing and locations are unknown.

Nisqually bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. No data are available for this stock.

FACTORS AFFECTING PRODUCTION

Habitat--Headwater habitat is in Mt. Rainier National Park and is characterized by steep gradient and glacial runoff. Logging and land development have negatively impacted the mid- to lower river habitat. Logging near unstable slopes has created major landslides which have increased sedimentation and temperature and degraded spawning and rearing habitat. A major landslide occurred in 1991, temporarily blocking the river and resulting in heavy sedimentation into the river.

Alder Dam, operated by Tacoma City Light, at RM 44.2 limits upstream passage of the anadromous form. Alder Lake, formed by the dam, provides habitat for the adfluvial life history form of this stock, although there is no documentation of bull trout/Dolly Varden in the reservoir at this time. We do not know if bull trout/Dolly Varden exist above Alder Lake. Surveys are now underway. Habitat in the upper watershed is available; habitat in Mt. Rainier National Park is in excellent condition.

The Centralia Power Canal hydropower diversion near Yelm diverts water around 13.5 miles of mainstream with occasional low-flow problems in the bypassed section. Damage to fish swimming into the turbine outlet area can occur.

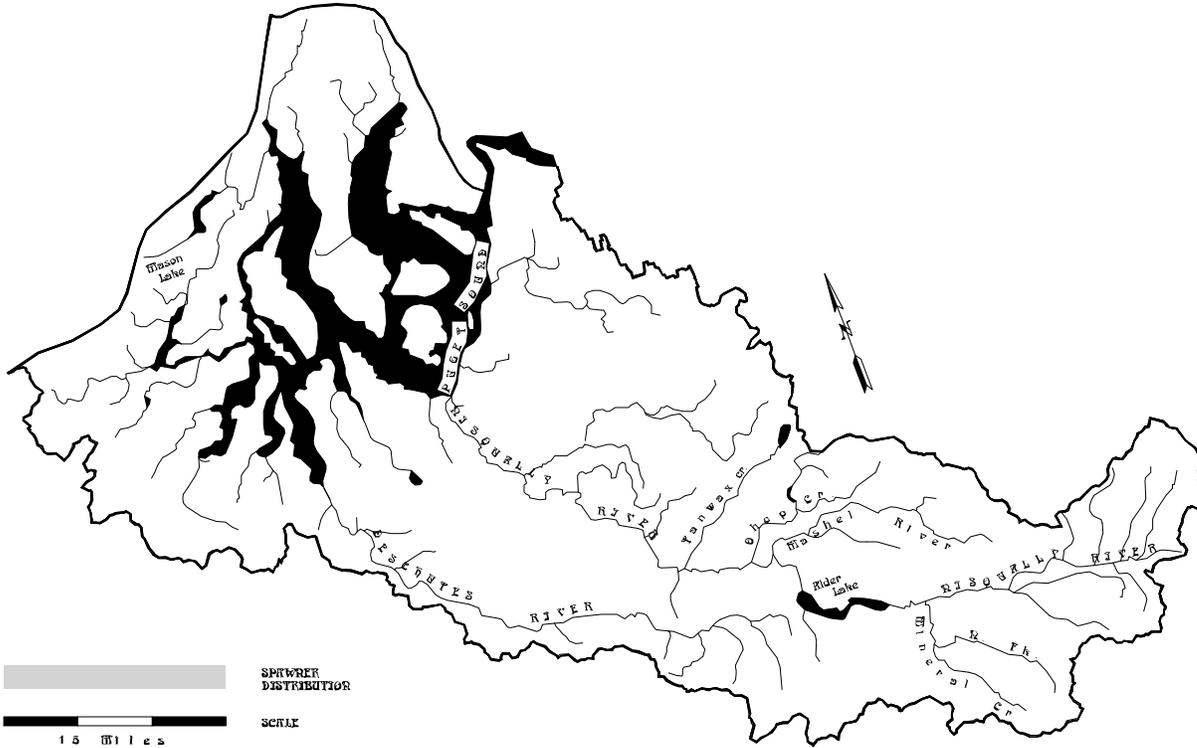
Harvest Management--The Nisqually River has been closed to fishing for bull trout/Dolly Varden since 1994. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

STOCK DEFINITION PROFILE for Nisqually Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Spawn timing is unknown for this stock.

DISTINCT?

Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Nisqually Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
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- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
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- 85
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- 89
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- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Hatchery--Hatchery-origin chinook and coho are released into the lower Nisqually annually, however interactions between them and wild bull trout/Dolly Varden have not been examined.

OVERVIEW -- HOOD CANAL BULL TROUT/DOLLY VARDEN STOCKS

SOUTH FORK SKOKOMISH LAKE CUSHMAN UPPER NORTH FORK SKOKOMISH

STOCK DEFINITION AND ORIGIN

Hood Canal is a large fjord that branches off Admiralty Inlet and is separated from Puget Sound by the Kitsap peninsula. Hood Canal bull trout/Dolly Varden are currently separated into three distinct stocks, all located within the Skokomish River basin, but geographically separated from one another. The stocks are South Fork Skokomish, Lake Cushman (Cushman Reservoir) (on the North Fork Skokomish River) and Upper North Fork Skokomish. All stocks are native. Results from genetic studies have identified the stock in the South Fork Skokomish River as bull trout. Genetic samples were taken from four Lake Cushman adults and identified as bull trout (Brenkman 1996). No genetic samples have been collected in the upper North Fork Skokomish River.

Extensive work has been conducted in the upper North Fork Skokomish River (above Lake Cushman) by WDFW and Olympic National Park (ONP) biologists. Data are presented in the Lake Cushman stock report. A master's thesis project has also been conducted in the North Fork Skokomish (Brenkman 1996). This work is summarized in the Lake Cushman and North Fork Skokomish stock status profiles. The thesis, unpublished at the time of this writing, will provide important data on these stocks.

Although two bull trout/Dolly Varden have been reported in the Big Quilcene River (Mongillo 1992), none have been trapped at the Quilcene National Fish Hatchery in recent years, nor have any been observed in recent snorkel surveys conducted by WDFW and U.S. Forest Service biologists (Mike Donald, Quilcene Ranger District, personal communication). Consequently, we do not believe that there is a distinct bull trout/Dolly Varden stock in the Big Quilcene River.

STOCK STATUS

The status of the Lake Cushman stock is Healthy. The number of spawners has increased since the fishery closure in 1986. The status of other Hood Canal bull trout/Dolly Varden stocks is Unknown.

Information on individual bull trout/Dolly Varden stocks is presented in the Stock Reports which follow.

HOOD CANAL -- SOUTH FORK SKOKOMISH **BULL TROUT**

In the 1998 inventory this stock was called a bull trout/Dolly Varden stock. Genetic analysis was conducted on native char (N = 25) in the South Fork Skokomish in 1995. All fish were bull trout (Leary and Allendorf 1997). The Haas (1988) bull trout/Dolly Varden species differentiation formula was also applied to these 25 fish, and all were determined to be “strongly” bull trout.

STOCK DEFINITION AND ORIGIN

Bull trout in the upper South Fork Skokomish River have been identified as a distinct stock based on their geographical distribution. It is possible that the fluvial, anadromous and resident life history forms are present. Emigrating anadromous smolts have been observed.

The U.S. Forest Service has conducted trapping, snorkeling, electrofishing and spawner surveys in the mainstem South Fork Skokomish River and tributaries since 1994. The results of their surveys indicate that bull trout/Dolly Varden are found in the anadromous reaches of the South Fork and in Church, Pine, Cedar, LeBar, Brown, Rock, Flat and Vance creeks. No bull trout have been observed in the resident zones of the areas mentioned above.

Spawn timing has not been documented but is assumed to be from mid-September through December. Spawning grounds have not been located.

South Fork Skokomish bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

There are no harvest, escapement or run-size data for this stock. The 25 bull trout genetically analyzed in 1994 ranged in length from 65 mm to 362 mm. At least four size classes were represented in the sample: 19 fish were between 65 and 81 mm; three fish were between 107 and 113 mm; two fish were between 252 and 259 mm, and one fish measured 362 mm.

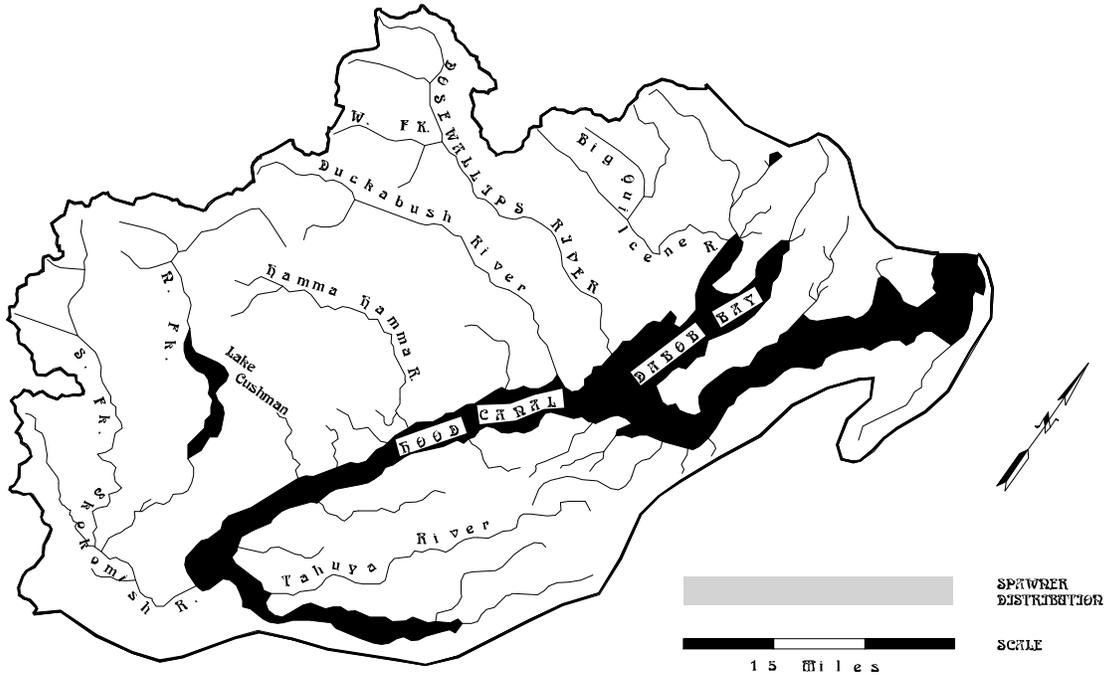
The highest concentration of bull trout was found by U.S. Forest Service biologists in the area from the anadromous barrier (falls) at RM 25, down to the

STOCK DEFINITION PROFILE for South Fork Skokomish Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for South Fork Skokomish Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
73				
74				
75				
76				
77				
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AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

confluence of Church Creek (RM 21.5). Sizes of observed bull trout ranged from 13 mm to 356 mm in length. No redds have been observed.

FACTORS AFFECTING PRODUCTION

Habitat--Fish habitat in the South Fork Skokomish has been severely degraded. Extensive road building and logging in the upper watershed on steep, unstable slopes contributed to numerous slope failures which have increased sediment in the stream channel. Removal of trees in riparian zones has reduced the availability of large woody debris. The mainstem is prone to flooding and scouring in the winter, but flows tend to be very low in the summer, which likely elevates stream temperature. Diking for flood control in the lower river has reduced habitat complexity.

Harvest Management--The South Fork Skokomish has been closed to fishing for bull trout since 1994. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

Hatchery--Hatchery-origin chinook, chum and coho are released into the lower mainstem Skokomish River annually, however interactions between them and wild bull trout in the South Fork Skokomish have not been examined.

HOOD CANAL -- LAKE CUSHMAN BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in Lake Cushman have been identified as a distinct stock based on their geographic distribution. This is an adfluvial stock. The Haas (1988) bull trout/Dolly Varden species differentiation formula was applied to a sample of 30 adults. The adults ranged in length from 355 mm to 688 mm. All measured as bull trout with Haas values ranging from +0.65 to +4.13. A genetic analysis was conducted on four adult females ranging in size from 530 mm to 635 mm. All four fish were determined to be bull trout (Brenkman 1996).

Mature adult bull trout/Dolly Varden spawn in the North Fork Skokomish River above Lake Cushman from mid-September through mid-December. Peak spawning generally occurs between mid-October and mid-November.

Electrofishing and night snorkel surveys have shown that bull trout/Dolly Varden fry and older juveniles inhabit the mainstem North Fork Skokomish during the late summer months (Brenkman 1996). The size, age and timing of bull trout/Dolly Varden migration into Lake Cushman is unknown. Adult bull trout/Dolly Varden are caught and released by anglers incidental to fishing for other species in the reservoir.

Bull trout/Dolly Varden in Lake Cushman are native and are maintained by wild production.

STOCK STATUS

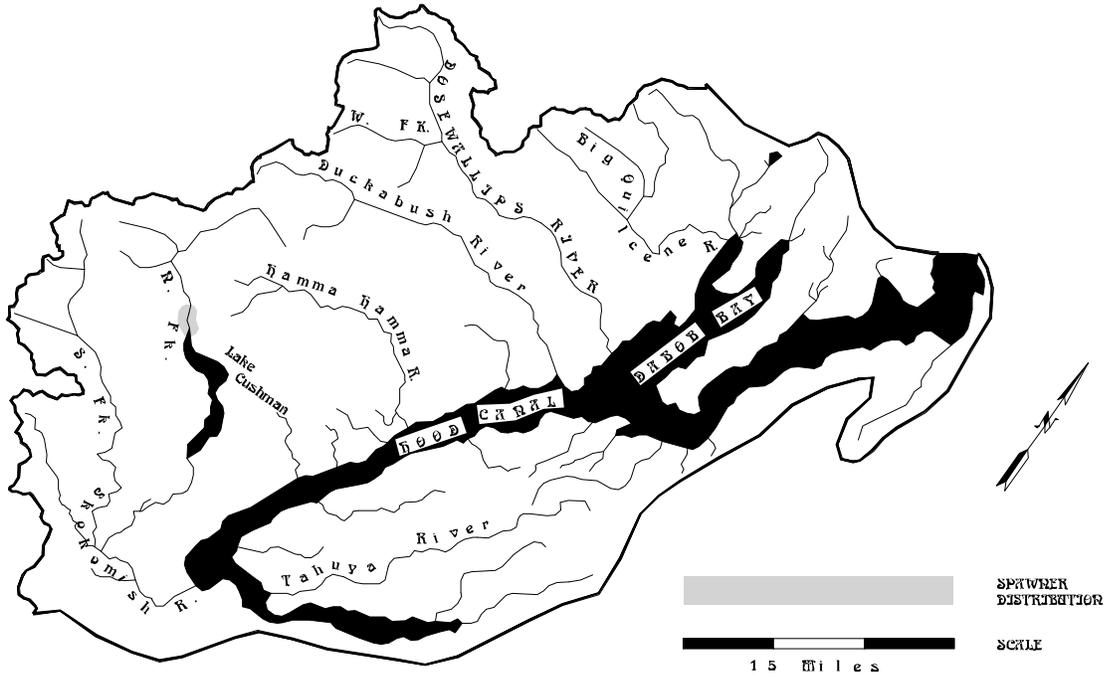
The stock status is Healthy. Snorkel surveys by WDFW biologists in the North Fork Skokomish River above Lake Cushman documented a significant increase in the number of adults counted from 1985 through 1990. The population has been relatively stable from 1990 to the present in 1996. Brenkman (1996) conducted snorkel surveys from April through early December. The total count of adults from Four Streams to the Causeway Bridge was 292. These surveys included some areas above Staircase Falls which is upstream from the area normally surveyed by WDFW. This count was similar to the average adult count of over 303 for the area below Staircase from 1990 through 1996. Total population size is unknown. Data quality is excellent.

Two earlier snorkel surveys conducted from Four Stream Creek (RM 31.4) to the footbridge at RM 30.2 in October 1988 and October 1995 produced counts of ten char (five males and five females) and five char respectively. These counts yielded fish densities of 8.3 and 4.2 fish per mile, respectively.

STOCK DEFINITION PROFILE for Lake Cushman Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

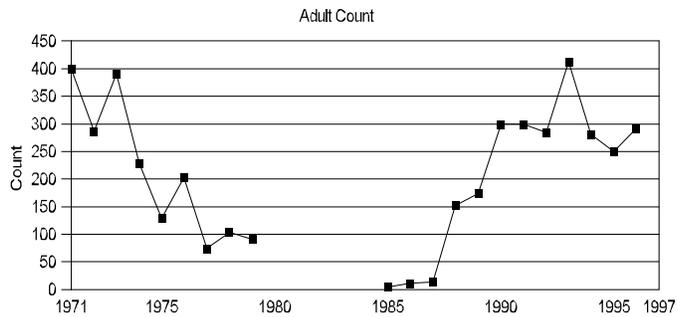
STOCK STATUS PROFILE for Lake Cushman Bull Trout/Dolly Varden

STOCK ASSESSMENT

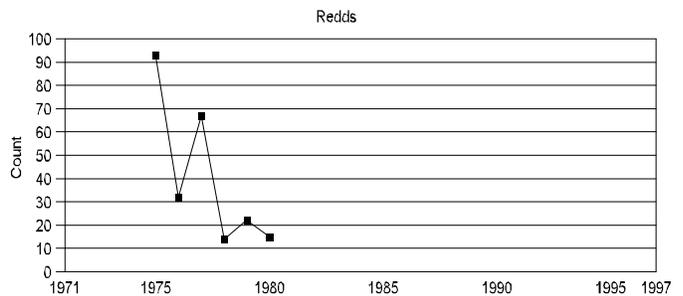
DATA QUALITY -----> Excellent

Return Years	FW PROD Adult Count	ESCAPE Redds		
71	400			
72	287			
73	391			
74	228			
75	129	93		
76	203	32		
77	74	67		
78	104	14		
79	81	22		
80		15		
81				
82				
83				
84				
85	4			
86	11			
87	14			
88	152			
89	174			
90	299			
91	299			
92	285			
93	412			
94	281			
95	250			
96	292			
97				

Freshwater Production



Escapement



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

Redd surveys were conducted from 1975 through 1980 but were discontinued in favor of snorkel surveys which WDFW biologists believe are less subjective and more accurate.

Otoliths were collected by WDF in 1968 and 1969. The otoliths were aged by Dr. Edward B. Brothers, EFS Consultants, in 1990. All but one fish were mature. The immature fish measured 440 mm in length and was three years old. Lengths ranged from 440 to 850 mm and ages ranged from three to 16 years. Length and weight at specific ages were very variable. Some examples are: 57 cm - 2.0 kg (4.4 lb.), age 7; 62 cm - 2.5 kg (5.5 lb), age 16; 71 cm - 4.4 kg (9.9 lb), age 12 and 73 cm - 4.5 kg (10 lb), age 5.

There are no harvest data for this stock.

FACTORS AFFECTING PRODUCTION

Habitat--Virtually all of the critical spawning and early-rearing habitat is in the North Fork Skokomish River within the Olympic National Park boundary. Most of the habitat is in excellent condition. Lake Cushman is now a reservoir, following construction of the Cushman Dam by Tacoma City Light. Large fluctuations in water level occur in the reservoir which is managed for power generation and flood control. Water level fluctuations have inundated the lower half-mile of the river above the reservoir. There is a higher percentage of fine sediment in this reach which makes it less desirable for spawning. Olympic National Park biologists have observed very few redds in this section in contrast to the area immediately upstream which is heavily utilized for spawning.

The Olympic National Park boundary will be moving upstream approximately 0.5 miles in the near future as a result of an impending land exchange between the Park and Tacoma City Light. The Park will acquire about 30 acres of river and riparian habitat. This portion of the river is important for adult holding and spawning and for juvenile rearing.

Lake Cushman appears to provide good to excellent habitat and food base for the bull trout population.

Harvest Management--The Olympic National Park has catch-and-release regulations for bull trout/Dolly Varden in all park waters. Harvest of bull trout/Dolly Varden has been closed in Lake Cushman since 1986 and in the North Fork Skokomish River since 1982. Some bull trout/Dolly Varden are caught and released incidentally to a chinook fishery which is open in the reservoir year-round.

Hatchery--Hatchery-reared cutthroat trout, kokanee and rainbow trout have been released into the reservoir over the years. Stocking of kokanee may actually enhance the bull trout population by providing an additional food source. Interactions between wild bull trout/Dolly Varden and the other hatchery-origin salmonids have not been examined.

Species Interactions--Other species are present in the North Fork Skokomish above the reservoir which could affect bull trout/Dolly Varden. Three hundred juveniles and one adult largemouth bass were observed during snorkel surveys (Brenkman 1996). Juvenile largemouth bass could serve as prey for adult bull trout/Dolly Varden, especially in the reservoir where adult char are more likely to be found than juveniles. Adult largemouth bass in the river above Lake Cushman could prey on juvenile bull trout/Dolly Varden. Brenkman also reported a brook trout in Donahue Creek in the upper basin. Brook trout can hybridize with bull trout/Dolly Varden and pose a genetic threat to the species.

HOOD CANAL -- UPPER NORTH FORK SKOKOMISH **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the upper North Fork Skokomish River above Staircase have been identified as a distinct stock based on their geographic distribution. Fluvial and resident life history forms may be present.

Staircase Falls at RM 1.5 is assumed to be a barrier to migration of the Lake Cushman stock into the upper North Fork Skokomish. Snorkel surveys above the falls from Four Stream Creek (RM 31.4) to the foot bridge at RM 30.2 on October 25, 1988 have documented bull trout/Dolly Varden presence. Five male and five female char were collected. Females exhibiting spawning coloration were observed on October 25, 1988. They were estimated to be 250 to 350 mm in length (Thom Johnson, WDFW, personal communication).

WDFW biologists snorkel surveyed the same area on October 26, 1995. No fish were seen during the day, but five bull trout/Dolly Varden were counted at night. All were assumed to be juveniles less than 200 mm in length (Scott Bonar, WDFW, personal communication).

Spawn timing and locations are unknown.

Upper North Fork Skokomish bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There are no harvest, escapement or run-size data for this stock.

FACTORS AFFECTING PRODUCTION

Habitat--All of the critical spawning and early-rearing habitat in the North Fork Skokomish above Staircase is within the Olympic National Park boundary. The habitat is in excellent condition.

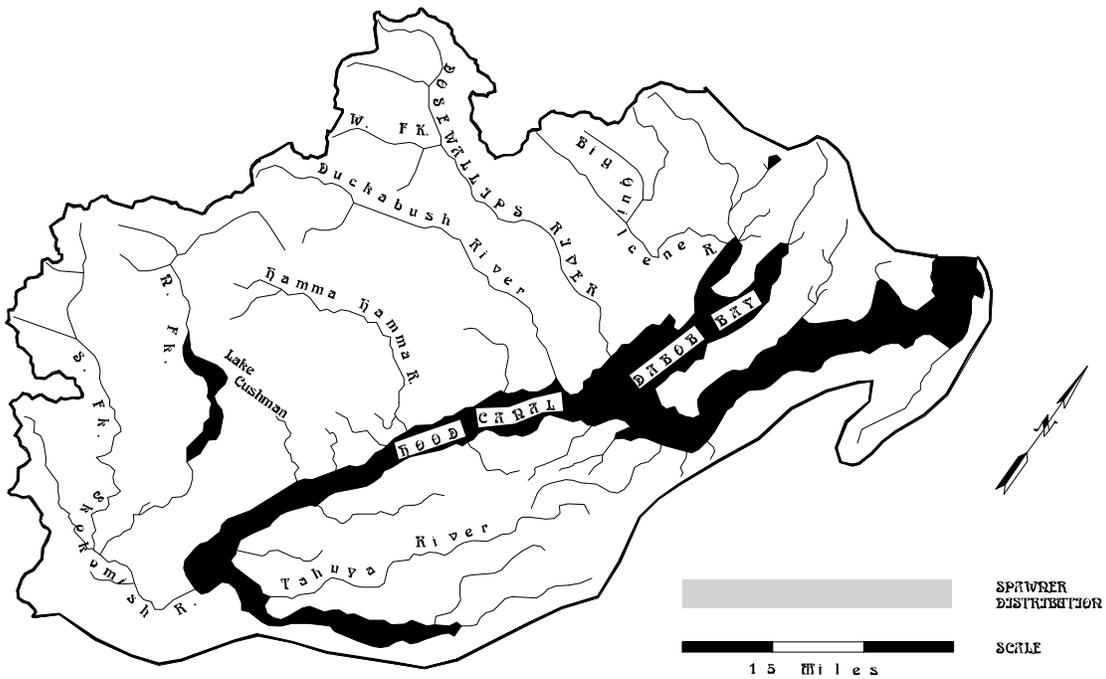
Harvest Management--The Olympic National Park has catch-and-release regulations for bull trout/Dolly Varden in all park waters. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

STOCK DEFINITION PROFILE for Upper NF Skokomish Bull Trout/Dolly Varden

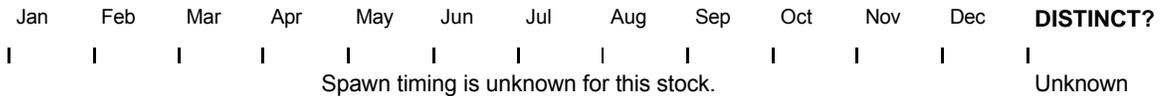
SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Upper NF Skokomish Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
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95
96
97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Hatchery--No hatchery-origin fish are released into the upper North Fork Skokomish.

OVERVIEW--STRAIT OF JUAN DE FUCA **BULL TROUT/DOLLY VARDEN STOCKS**

DUNGENESS/GRAY WOLF **UPPER DUNGENESS** **LOWER ELWHA** **UPPER ELWHA**

STOCK DEFINITION AND ORIGIN

In the Strait of Juan de Fuca, four stocks of bull trout/Dolly Varden have been tentatively identified: Upper Dungeness River, Dungeness/Gray Wolf, Lower Elwha River, and Upper Elwha River. The stocks are considered separate based on the geographic distribution of their spawning populations. One 660 mm char was observed about one mile above Highway 101 in the anadromous zone in the late 1980s by a WDFW biologist during a snorkel survey to identify steelhead parr habitat (Hal Beecher, WDFW, personal communication). Two presence/absence day time snorkel surveys were conducted by WDFW biologists in the resident fish zone at RM 6.0 and above the water diversion structure at RM 7.0 in October 1996. A 100-meter section was surveyed at each location. No bull trout/Dolly Varden were observed, although rainbow trout of various sizes were seen at both locations. WDFW biologists believe that the one reported bull trout/Dolly Varden in Morse Creek was probably a stray from the Elwha or Dungeness rivers and that no distinct stock exists in Morse Creek .

Run timing and spawning timing are unknown at this time.

Using the Haas (1988) bull trout/Dolly Varden species differentiation formula, both bull trout and Dolly Varden have been identified in the Dungeness and upper Elwha rivers. See individual stock reports for more specific information.

STOCK STATUS

The status of the Dungeness/Gray Wolf, Lower Elwha and Upper Elwha stocks is Unknown. The Dungeness is tentatively considered Healthy.

Plans for the summer of 1997 are to collect more population data and samples for genetic analysis in the Dungeness River.

Information for the Lower Elwha stock includes incidental trap counts and angler reports.

STRAIT OF JUAN DE FUCA -- DUNGENESS/GRAY WOLF
BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Dungeness River have been identified as a distinct stock based on their geographic distribution. Anadromous, fluvial and resident life history forms may be present.

Spawn timing and locations are unknown.

Dungeness/Gray Wolf bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

Anecdotal angler reports and results of electrofishing sampling are available. Anglers report that historically bull trout/Dolly Varden were very common and widespread from the lower to the upper watershed. They report that they are still widespread, but greatly reduced in numbers (Mongillo 1992).

Six bull trout/Dolly Varden were captured incidental to electrofishing for steelhead in June, 1994 by WDFW biologists. Two were taken at RM 16 in the Dungeness River, and four were taken at RM 1 in the Gray Wolf River. Haas (1988) bull trout/Dolly Varden species differentiation formula measurements were made on all fish by three biologists. The two fish from RM 16 were calculated to be bull trout by one biologist and as one bull trout and one Dolly Varden by the other two biologists. All biologists agreed that the four fish from the Gray Wolf were three bull trout and one Dolly Varden.

In 1996 five char collected from the lower Dungeness River were identified as bull trout by using the linear discriminant function of Haas and McPhail (1991). The char ranged in length from 28 to 62 centimeters. They were collected by WDFW personnel at Dungeness Hatchery while spawning hatchery coho salmon in the fall of 1996 (Thom H. Johnson, WDFW, personal communication).

FACTORS AFFECTING PRODUCTION

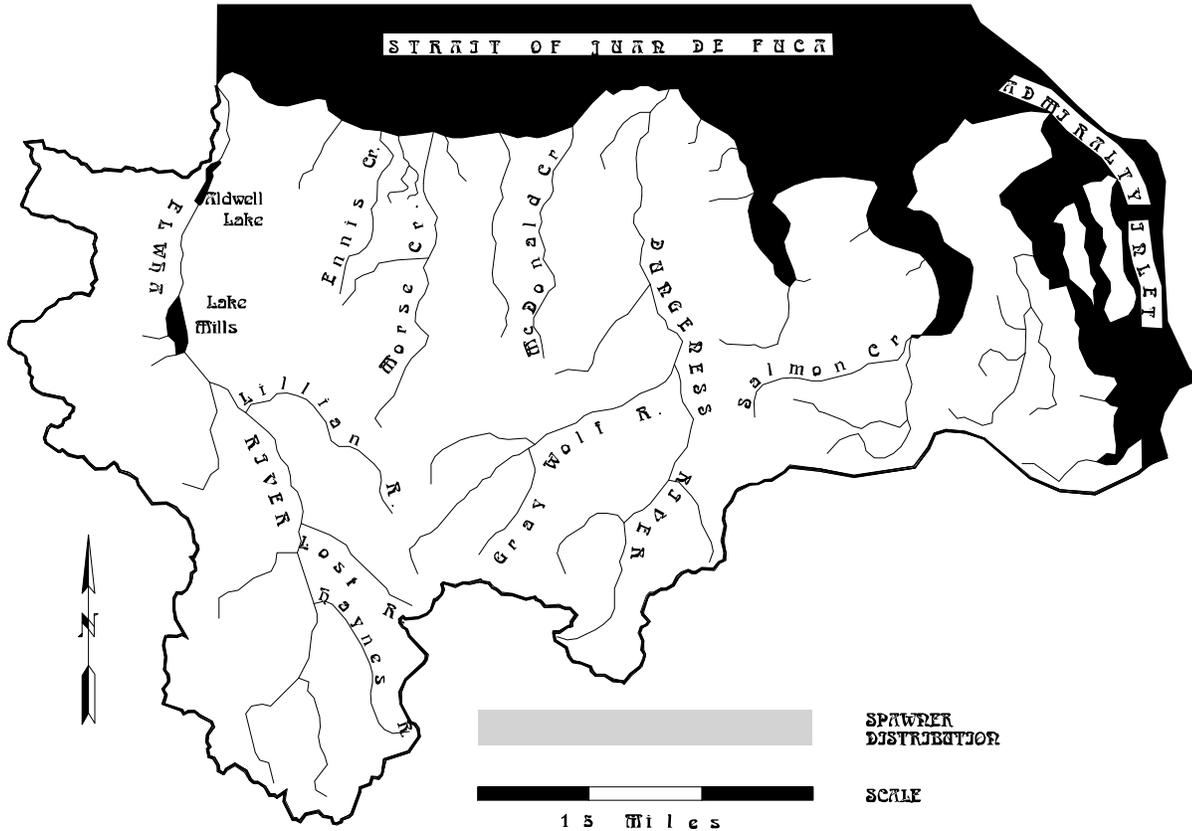
Habitat--The Dungeness watershed is located in a rain shadow and receives little annual precipitation (less than 20 inches per year). A significant portion of the water

STOCK DEFINITION PROFILE for Dungeness/Gray Wolf Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



<u>TIMING</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	<u>DISTINCT?</u>
													Unknown
Spawn timing is unknown for this stock.													

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Dungeness/Gray Wolf Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

flow in the Dungeness River is provided by melting snow and varies from year to year. As a result, the amount of water available for fish production is somewhat limited compared to neighboring watersheds.

The Dungeness River has been affected by human activities including removal of riparian vegetation for urban and agricultural development, logging in the upper watershed, flood control, water withdrawals for irrigation and pollution of the river and estuary by urban and agricultural run-off. Impacts from irrigation withdrawals occur between river miles 6.8 and 11.0 during the critical low-flow period between August and October. Erosion resulting from agriculture, urban development and forest practices has caused extensive gravel aggradation and channel braiding in the river. These factors reduce the water depth, increase water temperature and velocity, and destabilize the river bedload. Fine sediments smother eggs in spawning habitat, and low water flows create barriers to migrating adult fish. Flood control dikes confine the river during high water events, exacerbating bedload instability and subjecting rearing fish to extreme conditions.

Harvest Management--The Dungeness River is closed to fishing for bull trout/Dolly Varden. The Olympic National Park has catch-and-release regulations for bull trout/Dolly Varden in all park waters. Incidental hooking mortality is thought to be low.

Hatchery--Hatchery-origin coho are released into the Dungeness annually. Interactions between them and wild bull trout/Dolly Varden have not been examined.

STRAIT OF JUAN DE FUCA -- UPPER DUNGENESS

DOLLY VARDEN

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 (N =49) indicated that all fish in the sample were Dolly Varden.

STOCK DEFINITION AND ORIGIN

Dolly Varden in the Dungeness River above the falls at Gold Creek (RM 18.8) have been identified as a distinct stock based on their geographic distribution.

Resident and fluvial life history forms are present.

Spawn timing and locations are unknown.

Upper Dungeness Dolly Varden are native and are maintained by wild production.

STOCK STATUS

Stock status is tentatively considered Healthy based upon the number, distribution and age composition of Dolly Varden seen in a survey conducted by WDFW biologists in the upper mainstem Dungeness in August, 1996. Data quality is excellent.

Four sections, selected at random, were electrofished. The first section at approximately RM 28.4 yielded 41 bull trout/Dolly Varden ranging in size from 35 mm to 220 mm. Densities were 0.77 fish per meter and 0.11 fish per square meter. The second section was at approximately RM 29. Twenty-one /Dolly Varden were sampled. Sizes ranged from 30 mm to 170 mm, and densities were 0.51 fish/m and 0.08 fish/m². The third section was approximately 200 meters below the second section. Twenty-five Dolly Varden were sampled. Sizes ranged from 35 mm to 190 mm, and densities were 1.09 fish/m and 0.16 fish/m². The fourth section was at approximately RM 26. Forty Dolly Varden were sampled ranging in size from 50 mm to 205 mm at densities of 0.87 fish/m and 0.11 fish/m². The total sample was 127, and total densities were 0.78 fish/m and 0.108 fish/m².

Most of the four plus miles surveyed were also hook-and-line sampled. Fifty-six Dolly Varden were caught and released in 7.42 hours for an average of 7.5 fish per hour.

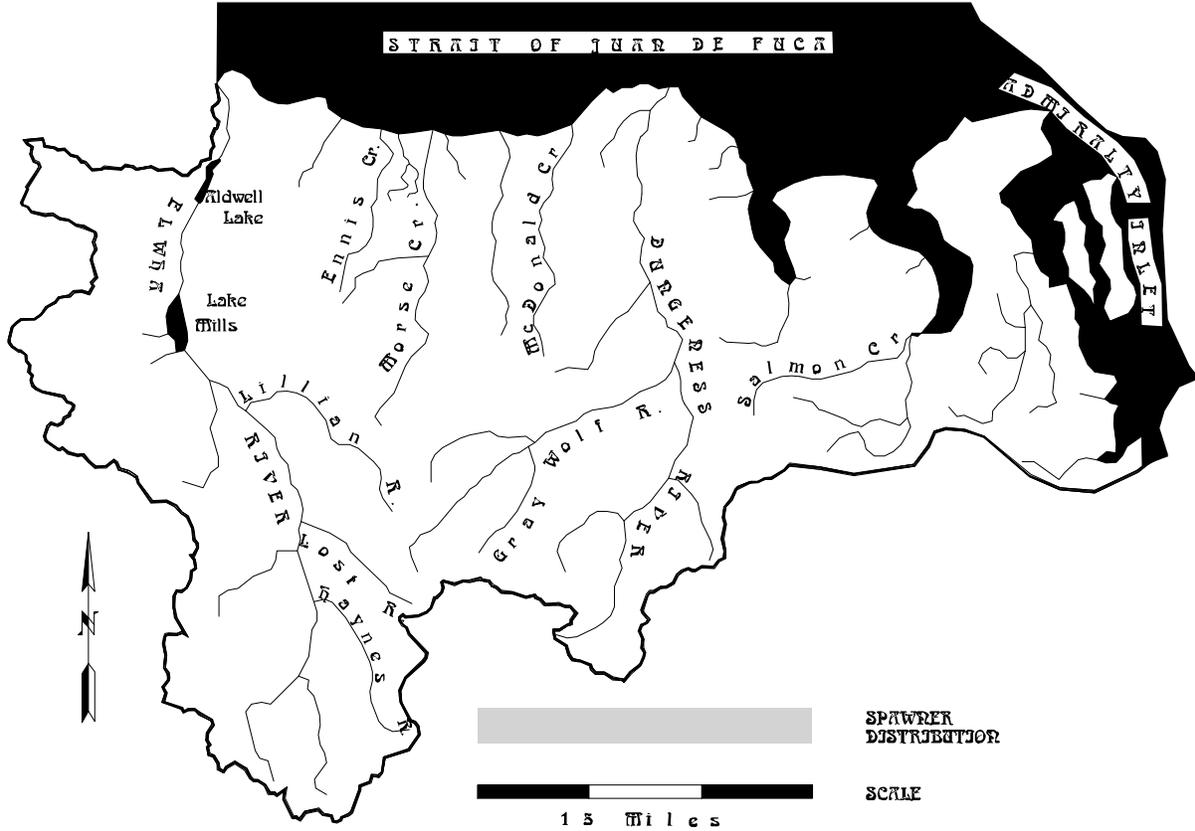
Nineteen scale samples were taken from fish sampled for age analysis. In this sample, fish in their second year ranged from 80 mm to 175 mm in length; those in their third year ranged from 155 mm to 205 mm, and the single fish in its fourth year was 220 mm

STOCK DEFINITION PROFILE for Upper Dungeness Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? -

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? -

STOCK STATUS PROFILE FOR Upper Dungeness Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	FW PROD No./m ²			
--------------	----------------------------	--	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96 0.11
97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Healthy

Screening Criteria

long. Examination of these fish for sexual maturity indicated that they reached sexual maturity at two to three years of age at a size of 155 mm to 180 mm. Seven native char were collected using electrofishing and hook and line and preserved for Haas (1988) bull trout/Dolly Varden species differentiation formula measurements and maturity determination. All seven fish measured as Dolly Varden. Four were mature females, one a mature male, one immature male and one immature female. The Haas formula measurements ranged from -1.57 to -3.60. Two fish were taken from RM 24 (above anadromous blocks) while electrofishing on November 4, 1994. Both fish measured as “strongly” Dolly Varden (-2.33 and - 2.88).

FACTORS AFFECTING PRODUCTION

Habitat--Freshwater habitat is basically pristine. All of the sampled area in the upper river is in the Buckhorn Wilderness in the Olympic National Forest. The headwaters are in the Olympic National Park.

Harvest Management--The Olympic National Park has catch-and-release regulations on bull trout and Dolly Varden in all park waters. There may be some mortality resulting from hook and release while fishing for other species.

Hatchery--No hatchery-origin salmonids have been released into the upper Dungeness.

STRAIT OF JUAN DE FUCA -- LOWER ELWHA **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the lower Elwha River (below the hydropower dams) have been identified as a distinct stock based on their geographic distribution. Anglers have reported hooking bull trout/Dolly Varden in the lower river over the years. The population in the lower river is thought to be anadromous.

Spawn timing and locations are unknown.

Lower Elwha bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

Two types of data are available: angler reports and hatchery rack returns. The Lower Elwha Tribe reports that they occasionally see a few bull trout/Dolly Varden in tribal fisheries over the years (Mike McHenry, Lower Elwha Fisheries, personal communication). Bull trout/Dolly Varden are rarely seen the tribe's hatchery trap with coho. One or two bull trout/Dolly Varden 300 mm to 380 mm long have been seen each year in the WDFW chinook rearing channel since 1983 (Greg Travers, WDFW, personal communication).

FACTORS AFFECTING PRODUCTION

Habitat--Two dams on the Elwha River not only block access of anadromous fish to the upper watershed but also significantly limit gravel recruitment, which is necessary for spawning, to the lower watershed.

Harvest Management--The lower Elwha River is closed to fishing for bull trout/Dolly Varden. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

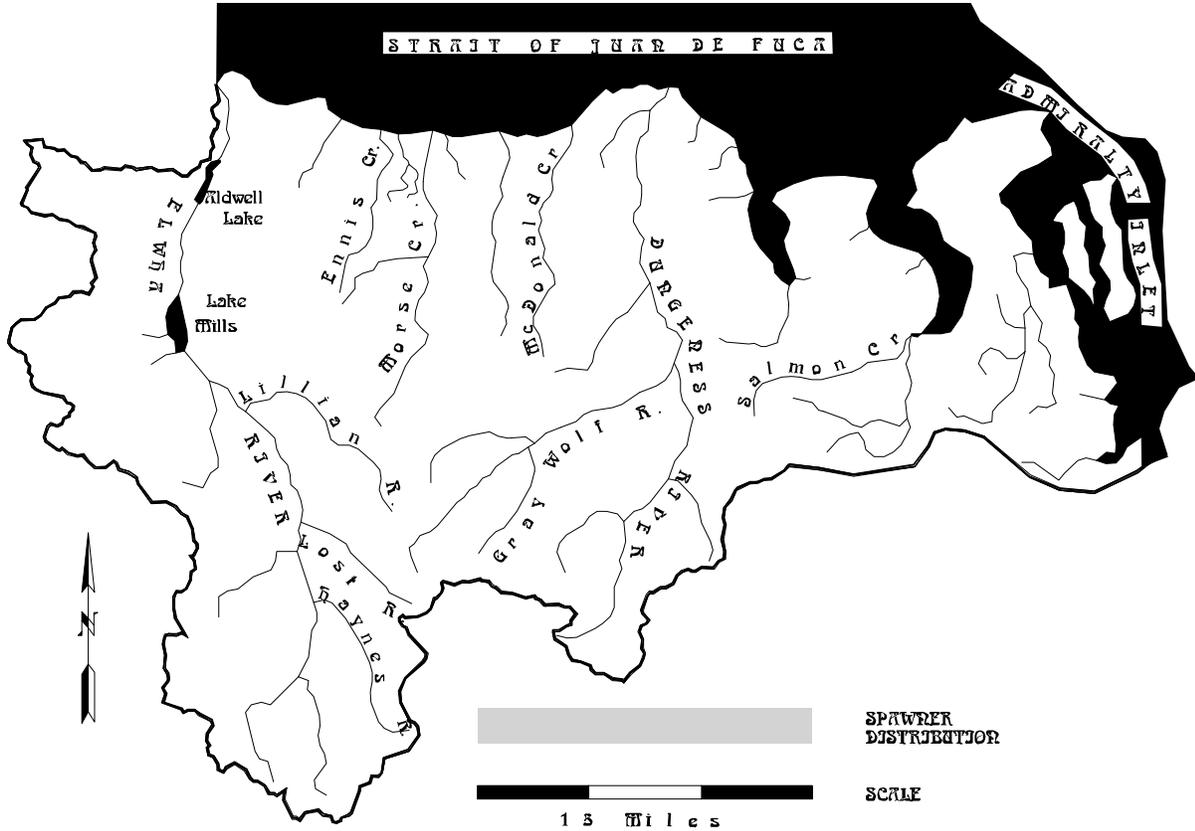
Hatchery--Hatchery-origin chinook and coho are released annually into the lower Elwha River. Interactions between lower Elwha bull trout/Dolly Varden and hatchery-origin salmonids have not been examined.

STOCK DEFINITION PROFILE for Lower Elwha Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Lower Elwha Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

STRAIT OF JUAN DE FUCA -- UPPER ELWHA BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in the upper Elwha watershed in 1997 (N = 58) indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

Bull trout in the upper Elwha River (above the hydropower dams) have been identified as a distinct stock based on their geographic distribution. Anglers have reported hooking native char in both reservoirs and in the river between the reservoirs as well as in the river above the upper reservoir. We believe that fluvial, adfluvial and resident life history forms of bull trout are present in the upper Elwha.

Spawn timing and locations are unknown.

Upper Elwha bull trout are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

Limited electrofishing, hook and line sampling and creel census data are available. The Olympic National Park staff carried out electrofishing and hook and line sampling. They collected four fish between river miles 27 and 35 on the upper Elwha (11 miles above Lake Mills) in May 1992. The Haas (1988) bull trout/Dolly Varden species differentiation formula measurements showed all four to be bull trout. Six fish were collected in the same stretch of river in 1993. Five were measured as bull trout, one as Dolly Varden. In September 1995, three fish were taken at RM 39. All measured as bull trout (Meyer 1995) and were subsequently confirmed as bull trout by genetic analysis (Leary and Allendorf 1996).

WDFW conducted a creel census on the Elwha River in and between both reservoirs in 1981 and 1982. Bull trout were reportedly caught in low numbers at that time (Collins 1983). No species determination was made at that time.

FACTORS AFFECTING PRODUCTION

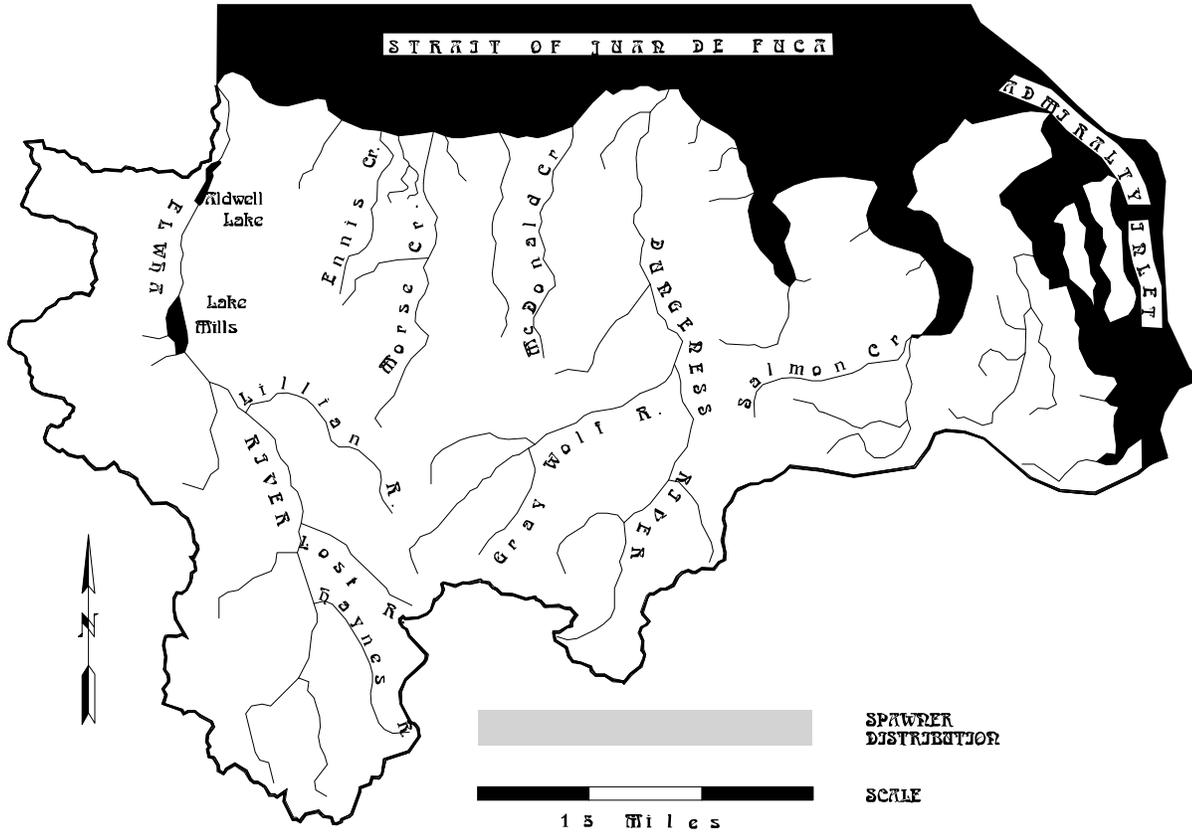
Habitat--Most of the upper Elwha River above the dams is within the Olympic National Park boundaries (with the exception of the lower two miles just above Lake Aldwell).

STOCK DEFINITION PROFILE for Upper Elwha Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Spawn timing is unknown for this stock.

DISTINCT?

Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Upper Elwha Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

The Park provides steep-gradient habitat in excellent condition and well-suited for bull trout.

Harvest Management--The upper Elwha River is closed to fishing for bull trout/Dolly Varden. The Olympic National Park has catch-and-release regulations for bull trout/Dolly Varden in all Park waters. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

Hatchery--Introduced brook trout have been reported in creel checks in the upper Elwha. We do not know if hybridization has occurred between them and bull trout/Dolly Varden. If it has, we would have concerns about the genetic integrity of the stock. Other interactions between brook trout and bull trout/Dolly Varden also have not been examined.

QUILLAYUTE -- SOL DUC DOLLY VARDEN

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1997 (N = 50) indicated that all of the fish in the sample were Dolly Varden.

STOCK DEFINITION AND ORIGIN

Dolly Varden in the Sol Duc River have been identified as a distinct stock based on their geographic distribution. Dolly Varden have been documented only above Sol Duc Falls (RM 65.5). Anglers fishing the lower Sol Duc and the rest of the Quillayute system report no native char in the anadromous zone. The population above the falls is a resident population.

Spawn timing and locations are unknown.

Sol Duc Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

There are no historic reports of native char being caught on hook and line gear in the Sol Duc River.

Olympic National Park (ONP) staff sampled three fish collected by a sport angler in the upper Sol Duc River one-half mile above the Sol Duc Falls (RM 65.5) in September 1994. Two were mature females four to six inches in length. All three fish scored as Dolly Varden (-4.07, -4.08 and -4.78) using the Haas (1988) method for distinguishing bull trout from Dolly Varden. ONP staff also electrofished the river above the falls in September, 1994 and August, 1995. In 1994, electrofishing took place one-half mile above the falls. Eighteen fish were collected and were determined to be Dolly Varden (Brenkman 1995) based on Cavender's (1978) criteria. The Haas method was not used.. Thirty-one Dolly Varden were collected from three electrofishing sites one-eighth mile to two miles above the falls in 1995. The data are presented in the Stock Status Profile. Data quality is fair.

FACTORS AFFECTING PRODUCTION

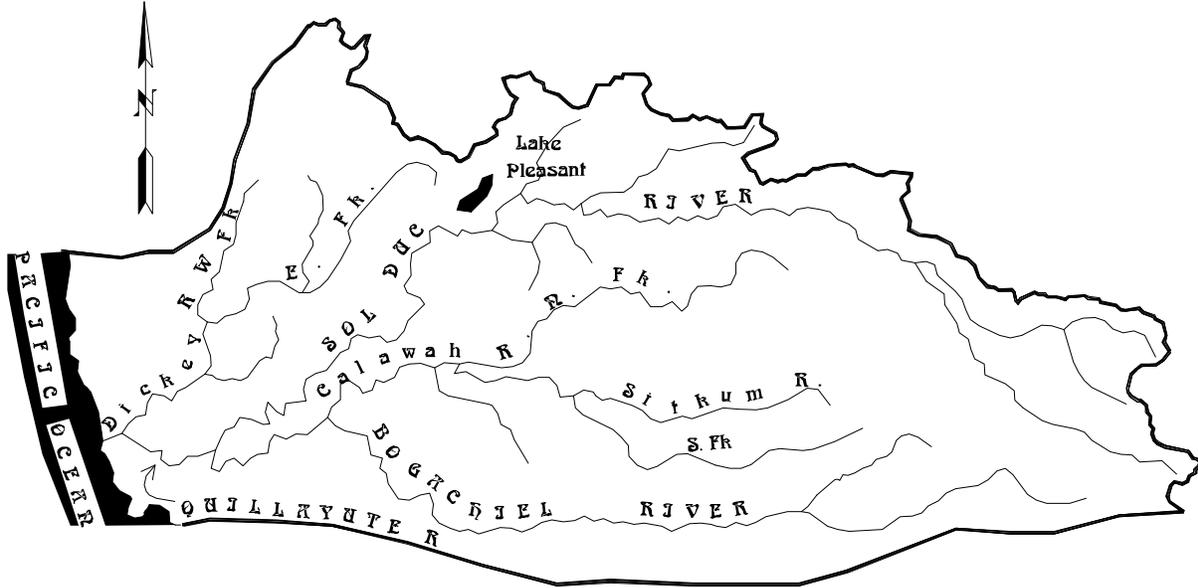
Habitat--The upper Sol Duc River above the falls is within the ONP boundaries. It is steep-gradient habitat in excellent condition and well-suited for bull trout/Dolly Varden.

STOCK DEFINITION PROFILE for Sol Duc Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Sol Duc Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Total	FW PROD Fish/Hr		
-----------------	------------------	--------------------	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

18	15
31	62

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 Sol Duc River has been closed to fishing for bull trout and Dolly Varden since 1994. The ONP has catch-and-release regulations for bull trout and Dolly Varden in all park waters. There may be some mortality from hook and release in fisheries targeting other species.

Hatchery--There is no release of hatchery-origin salmonids in the Sol Duc River within Olympic National Park boundaries. Consequently, we know of no interactions between wild Sol Duc Dolly Varden and hatchery salmonids.

HOH -- HOH BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of samples collected in 1998 (N = 73 in the mainstem Hoh and N = 45 in the South Fork) indicated that all fish both samples were bull trout.

STOCK DEFINITION AND ORIGIN

Bull trout in the Hoh River have been identified as a distinct stock based on their geographic distribution. They have been caught in the anadromous zone for many years and have been observed during snorkel surveys in recent years. We believe that there are resident and anadromous life history forms in the Hoh River.

Spawn timing and locations are unknown.

Hoh bull trout are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

No quantitative harvest data are available for this stock. However, there are many reports of native char being caught on hook and line gear historically (Mongillo 1993). Olympic National Park (ONP) staff snorkeled a 1.8-mile section of the mainstem Hoh River from 1.4 miles above Lewis Meadow to the Olympus Ranger Station in October, 1994. A total of nine native char adults were observed. ONP staff have also observed native char during snorkel surveys of an eleven-mile long section of the South Fork Hoh from just below Slate Creek to the confluence with the mainstem Hoh in October 1994 and 1995. A total of 41 adults were observed in 1994 and 31 in 1995. Data quality is good.

The Hoh River may have the largest population of bull trout on the Washington Coast (Mongillo 1993). Interviews with angler and WDFW employees suggest that the Hoh River population was greatly reduced from 1982 to 1992. The reasons for this decline are unknown, however, Mongillo (1992) reported that local anglers believed overfishing contributed to the decline. He also suggested that increased logging during that time period may cause future habitat problems.

FACTORS AFFECTING PRODUCTION

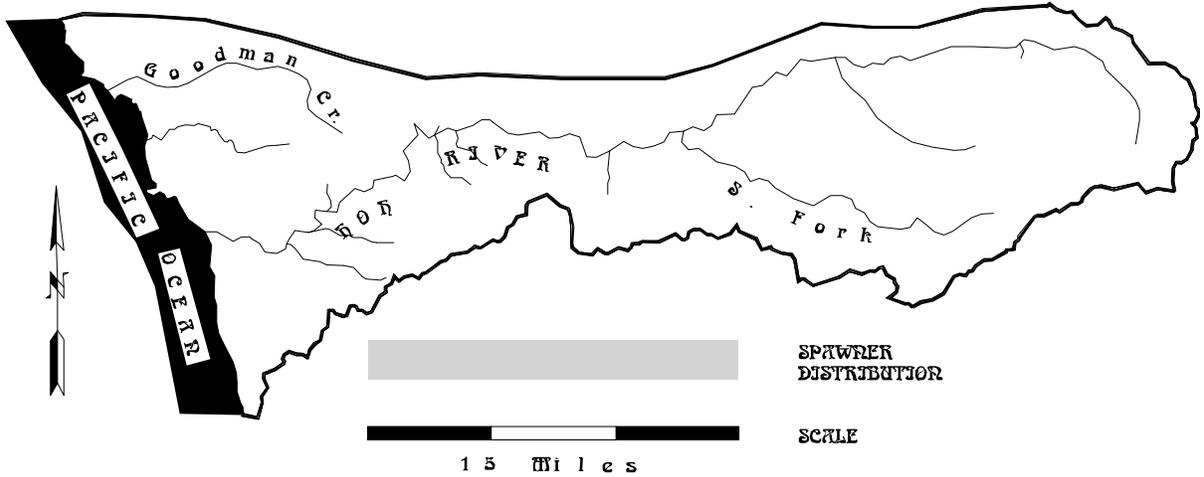
Habitat--The Hoh River drainage has been heavily logged and because of its steepness, which results in slope instability, high silt loads have reduced water quality.

STOCK DEFINITION PROFILE for Hoh Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Hoh Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	FW PROD Adult Count	FW PROD Adult Count		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93				
94	9	41		
95		31		
96				
97				

Column 1: Mainstem Hoh snorkel survey.
 Column 2: South Fork Hoh snorkel survey.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

In the mainstem and several tributaries, loss of riparian vegetation raises summer low-flow water temperatures above those considered optimum for salmonids. Lack of large woody debris in the watershed can result in loss of deep pools which provide holding and hiding cover for fish. The upper mainstem and South Fork are within the Olympic National Park where the habitat is in excellent condition.

The lower South Fork Hoh River drainage has been degraded by logging on steep slopes which has led to bank erosion, some scouring of the South Fork, and loss of large woody debris.

Harvest Management--The Hoh River is closed to fishing for native char. The Olympic National Park has catch-and-release regulations for native char in all park waters. There may be some mortality from hook and release in fisheries targeting other species.

Hatchery--Interactions with hatchery-origin salmonids have not been examined.

QUEETS -- QUEETS BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Queets River have been identified as a distinct stock based on their geographic distribution. They have been caught in the anadromous zone indicating that the anadromous life history form may be present. Resident and fluvial forms may also be present. Both bull trout and Dolly Varden have been identified using the Haas (1988) bull trout/Dolly Varden species differentiation formula.

The Olympic National Park (ONP) biologists collected tissue samples from 20 fish from the mainstem Queets for genetic analysis in September 1995. Twelve fish were taken in the one-mile reach below Hee Haw Creek (RM 44.4) six were taken in the one-mile reach above Hee Haw Creek and two were collected in the mainstem at the confluence of Tshletshy Creek. Haas formula measurements were made on all samples. Six of the 12 fish collected below Hee Haw Creek were bull trout, and one of the six fish collected above Hee Haw Creek was a bull trout. Genetic analysis indicates that all 20 fish were bull trout. Scales and otoliths are yet to be analyzed (Brenkman 1996).

Spawn timing and locations are unknown.

Queets bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Healthy.

Several types of data are available for Queets bull trout/Dolly Varden. Overall data quality is good.

Data collected while seining for salmon from 1977 through 1991 show a consistent catch rate for bull trout/Dolly Varden from 1982 through 1991. There are 16 years of seining data by the Quinault Indian Nation and some data from the former Washington Department of Fisheries which also show consistent capture of bull trout/Dolly Varden. The seining was targeted on migrating anadromous smolts. The data are presented in the Stock Status Profile. Fish per day calculations were used to standardize the seining effort.

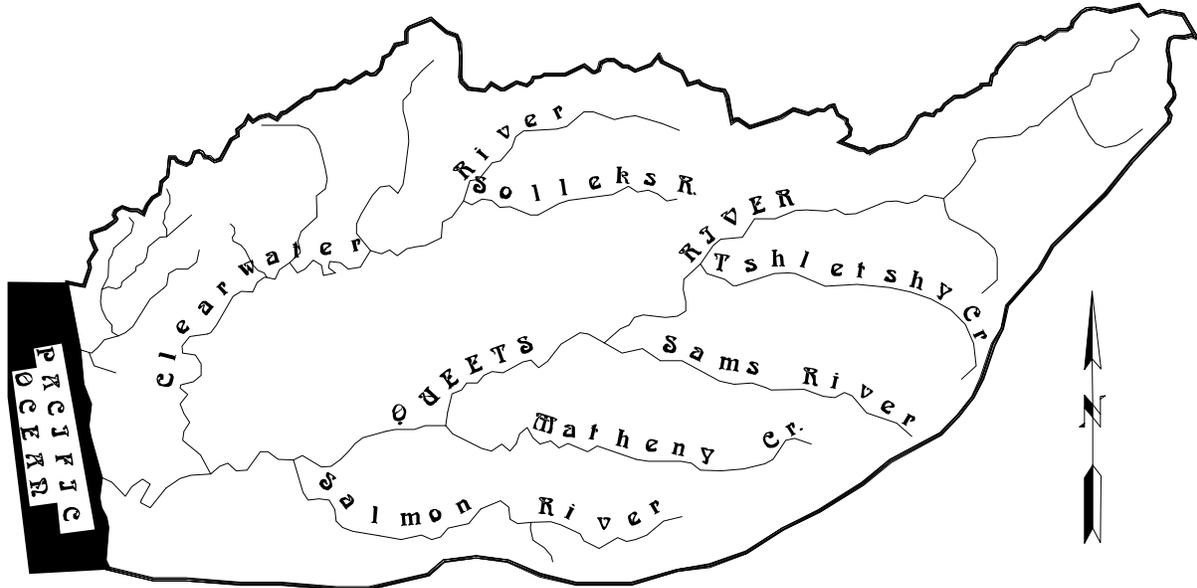
Olympic National Park (ONP) staff also hook-and-line sampled the mainstem Queets River above Hee Haw Creek fishing primarily the deeper pools from September 11-13, 1995. They caught 29 bull trout/Dolly Varden in 17.33 hours of fishing for a catch per effort of 1.67 fish per hour. The fish ranged in size from 150 mm to 610 mm.

STOCK DEFINITION PROFILE for Queets Bull Trout/Dolly Varden

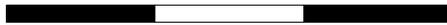
SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



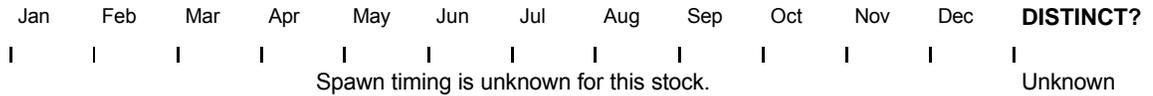
SPAWNER DISTRIBUTION



SCALE

15 Miles

TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Queets Bull Trout/Dolly Varden

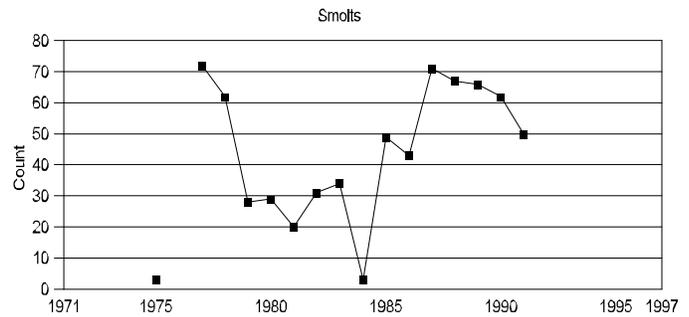
STOCK ASSESSMENT

DATA QUALITY -----> Good

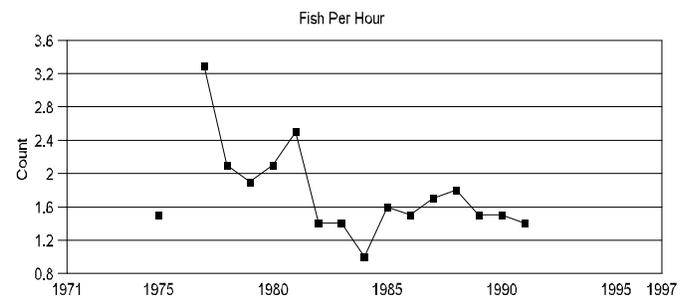
Return Years	JUVENILE Smolts	FW PROD Fish/Day		
--------------	-----------------	------------------	--	--

73		
74		
75	3	1.5
76		
77	72	3.3
78	62	2.1
79	28	1.9
80	29	2.1
81	20	2.5
82	31	1.4
83	34	1.4
84	3	1.0
85	49	1.6
86	43	1.5
87	71	1.7
88	67	1.8
89	66	1.5
90	62	1.5
91	50	1.4
92		
93		
94		
95		
96		
97		

Juvenile



Freshwater Production



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

WDFW biologists electrofished and hook-and-line sampled the mainstem Queets between Hee Hee Creek (RM 41.7) and one-half mile above Saghalie Creek (RM 47.5) in October, 1991. Twenty-nine fish were females, 34 males, and three were unknown. All but four fish were determined to be mature with three ripe females and 28 ripe males. Haas formula measurements were made on 66 fish. The sample consisted of 26 bull trout females, 34 bull trout males, three Dolly Varden females, no Dolly Varden males and three fish which could not be unambiguously classified. The mature males ranged in length from about 380 mm to 648 mm while the mature females were between 457 mm and 686 mm long.

FACTORS AFFECTING PRODUCTION

Habitat--The majority of the Queets mainstem is in the Olympic National Park and remains in near-pristine condition. Water quality is affected by natural glacial melt and logging activities near tributaries outside of the ONP. Overall, the Queets River above the confluence with the Clearwater River is in excellent condition.

Harvest Management--The Queets River has been closed to fishing for bull trout/Dolly Varden since 1994 except that there is a four-fish daily limit for bull trout/Dolly Varden in tribal waters. The ONP has catch-and-release regulations for bull trout/Dolly Varden in all park waters. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

Hatchery--Interactions between wild Queets bull trout/Dolly Varden and hatchery-origin salmonids have not been examined.

QUINAULT -- QUINAULT BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Quinault River have been identified as a distinct stock based on their geographic distribution. They have been caught in the anadromous zone of the river, in Quinault Lake, and in the upper river. Consequently, we assume that the anadromous, adfluvial, fluvial and resident life history forms are present in the Quinault basin.

Spawn timing and locations are unknown.

Quinault bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence.

Snorkel survey, electrofishing, and hook-and-line sampling data are available for bull trout/Dolly Varden from the Quinault River. Overall, data quality is good.

Snorkel data were collected by Olympic National Park (ONP) staff and Olympic National Forest staff in 1994 and 1995. Surveys were conducted in the East Fork in June and July in 1994 and in August 1995 from the Graves Creek campground downstream to the North Shore Quinault Bridge. One survey was conducted in the North Fork and mainstem in September of 1995 from Wolf Bar in the North Fork to the ONP boundary in the mainstem. Large adults and fish less than 12 inches long were observed.

Electrofishing and hook-and-line sampling were conducted by ONP staff from about one-quarter mile below the Enchanted Valley Ranger Station (RM 63.5) to about two miles above the mouth of the upper East Fork Quinault in September, 1995. The crew electroshocked and fished the mainstem and tributaries from one-quarter mile below to about two miles above the ranger station. This area of the East Fork is above an anadromous barrier. Twenty-two bull trout/Dolly Varden were taken for genetic analysis. Haas (1988) bull trout/Dolly Varden species differentiation formula measurements were taken on all samples. Results were not available at this writing.

FACTORS AFFECTING PRODUCTION

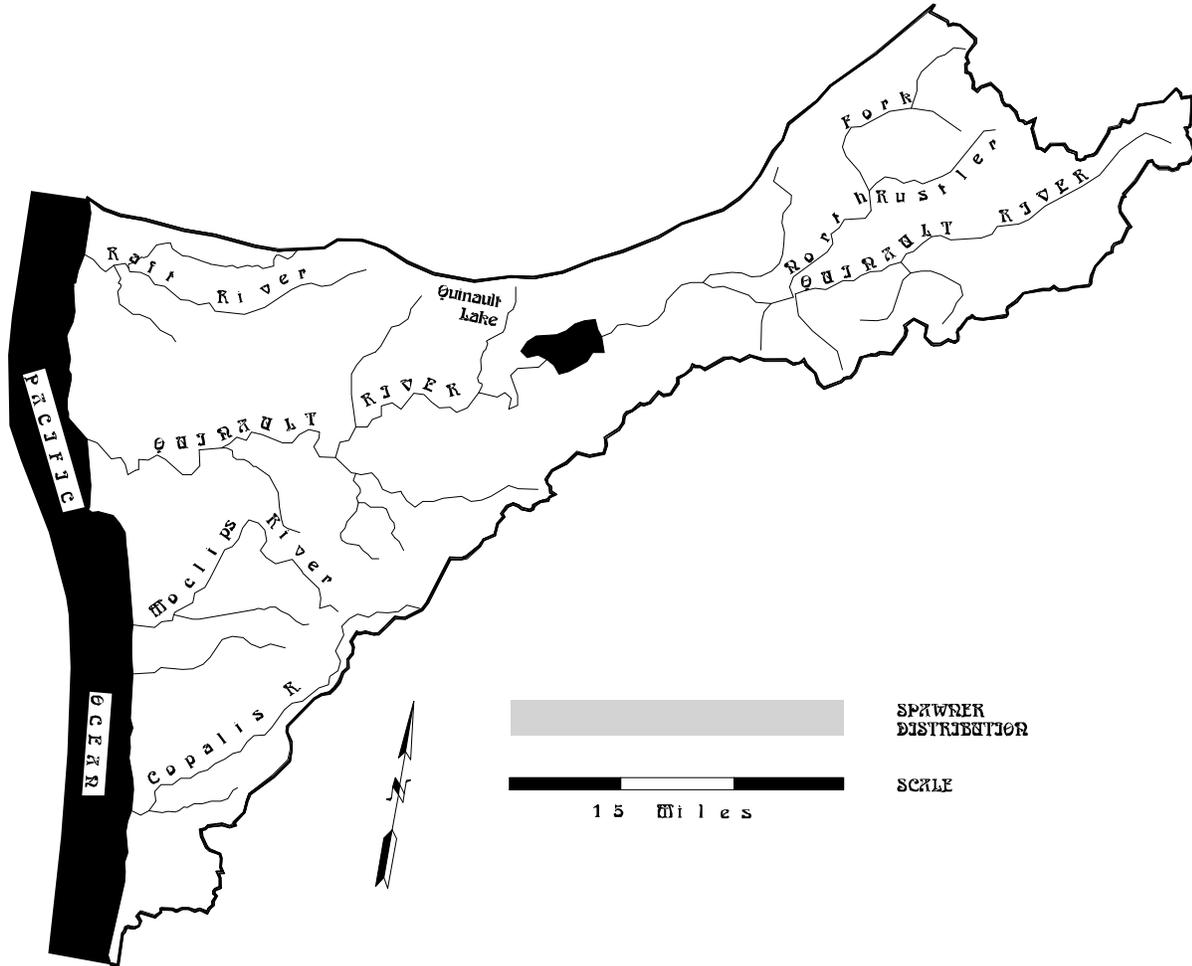
Habitat--Freshwater habitat has been degraded by logging activities outside the national park boundaries. The upper river, above Lake Quinault, flows through a short

STOCK DEFINITION PROFILE for Quinault Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown
Spawn timing is unknown for this stock.												

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Quinault Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	FW PROD Snorkel	FW PROD Snorkel		
-----------------	--------------------	--------------------	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

21
49 38

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

section of U.S. Forest Service land, but the majority of the upper watershed is in the Olympic National Park and remains in near-pristine condition.

Harvest Management--The Quinault River has been closed to fishing for bull trout/Dolly Varden since 1994 except that there is a four-fish daily limit for bull trout/Dolly Varden in tribal waters. The ONP has catch-and-release regulations for bull trout/Dolly Varden in all park waters. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

Hatchery--Hatchery-origin chinook, chum, coho and steelhead are released into the Quinault River annually. Interactions between them and wild bull trout/Dolly Varden have not been examined.

MOCLIPS/COPALIS -- MOCLIPS BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Moclips River have been identified as a distinct stock based on their geographic distribution. They have been caught by anglers in the anadromous zone (Bill Freymond, WDFW, personal communication). We do not know if there is a resident component in the population.

Spawn timing and locations are unknown.

Moclips bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence. The only information on this stock is anecdotal accounts from sport fishers and WDFW employees (Mongillo 1993).

FACTORS AFFECTING PRODUCTION

Habitat--Freshwater habitat has been degraded by logging activities.

Harvest Management--The Moclips River is closed to fishing for bull trout/Dolly Varden. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

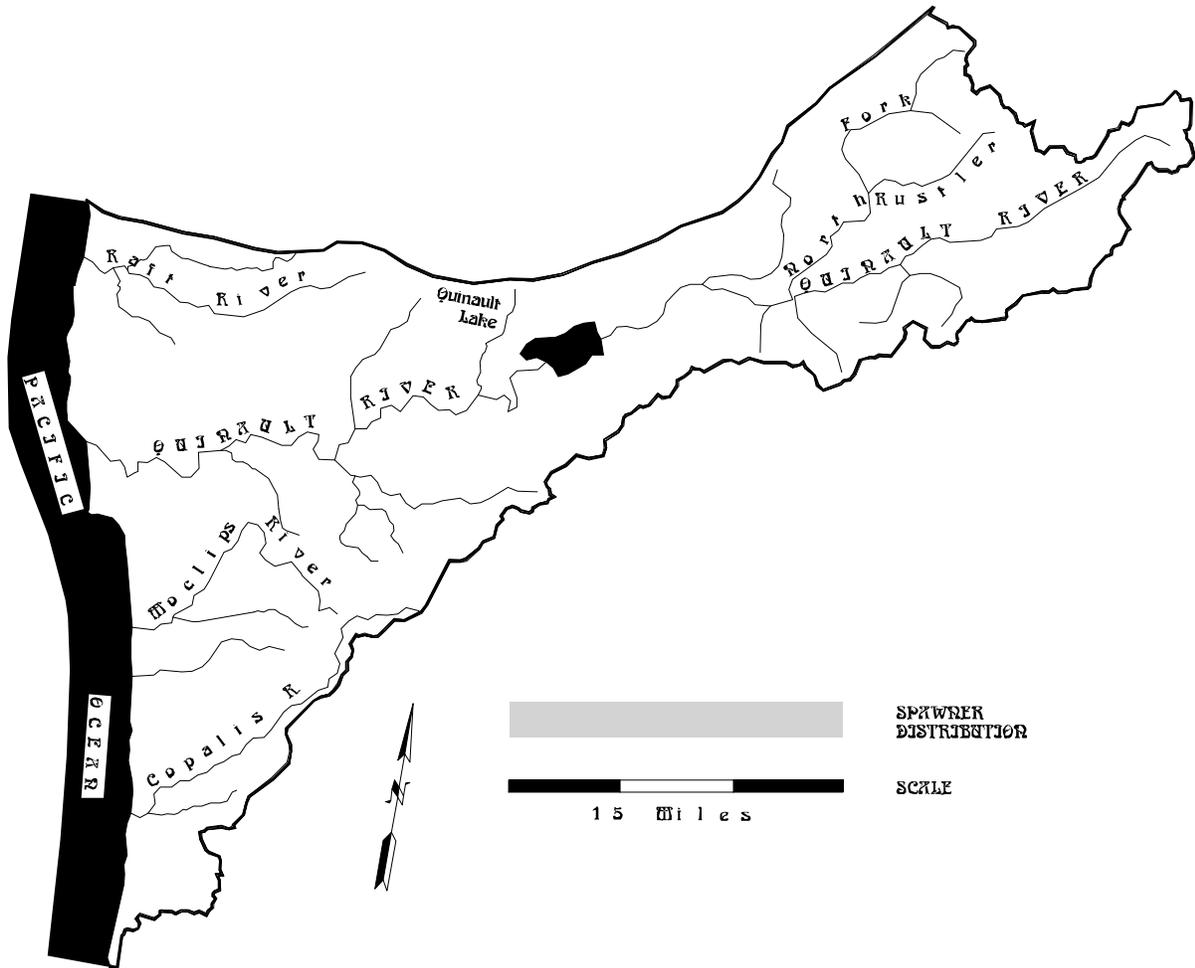
Hatchery--Interactions with other hatchery-origin salmonids released into the Moclips River have not been examined.

STOCK DEFINITION PROFILE for Moclips Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Moclips Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

MOCLIPS/COPALIS -- COPALIS BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Copalis River have been identified as a distinct stock based on their geographic distribution. They have been caught by anglers in the anadromous zone (Bill Freymond, WDFW, personal communication). We do not know if there is a resident component of the population.

Spawn timing and locations are unknown.

Copalis bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence. The only information for this stock is anecdotal accounts from sport fishers and WDFW employees.

FACTORS AFFECTING PRODUCTION

Habitat--Freshwater habitat has been degraded by logging activities.

Harvest Management--Copalis River is closed to fishing for bull trout/Dolly Varden. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

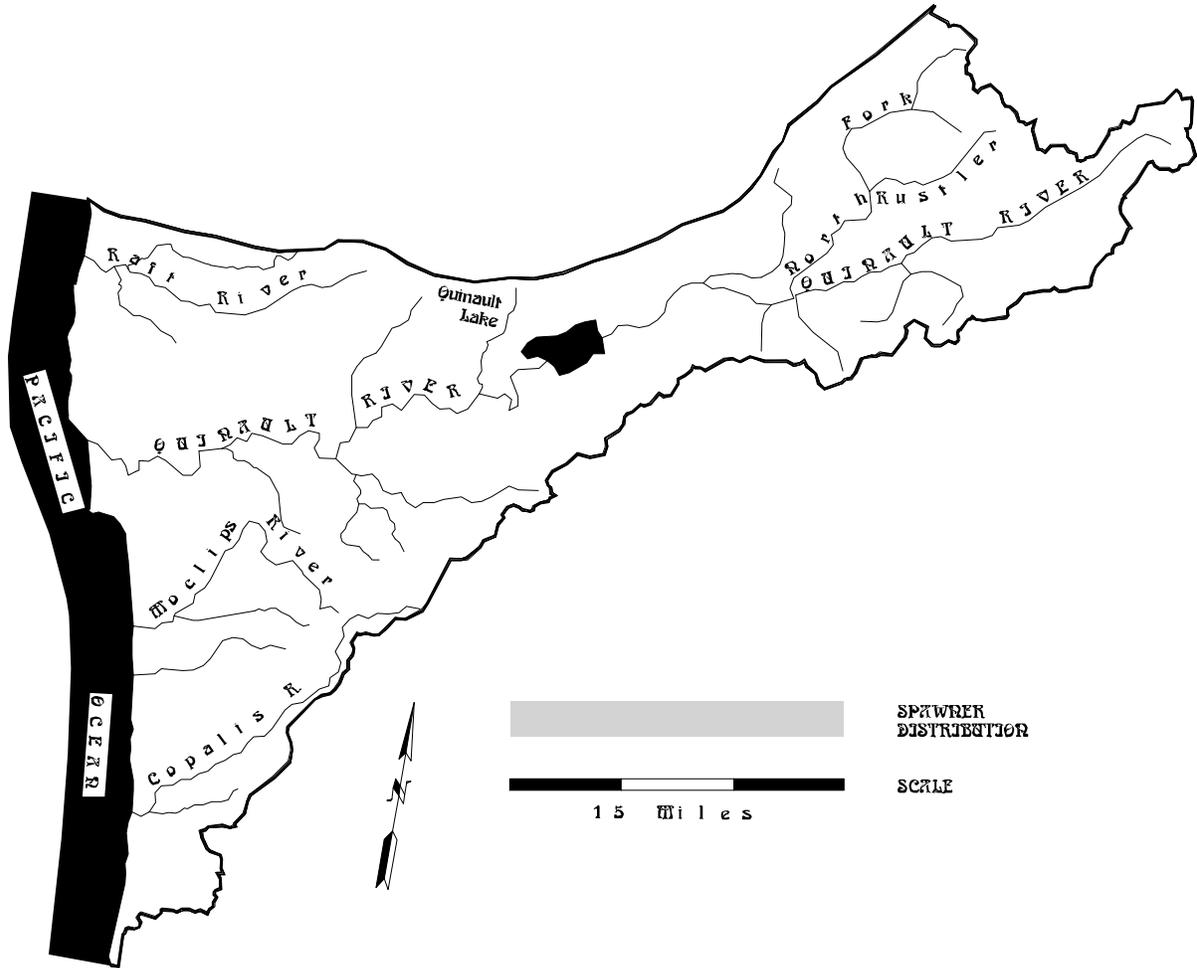
Hatchery--Interactions between wild Copalis bull trout/Dolly Varden and hatchery-origin salmonids have not been examined.

STOCK DEFINITION PROFILE for Copalis Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Copalis Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

GRAYS HARBOR -- CHEHALIS/GRAYS HARBOR **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the Chehalis River/Grays Harbor system have been identified as a distinct stock based on their geographic distribution. Bull trout/Dolly Varden have been caught in the anadromous zone in the spring and fall. Most reported are 457 mm or larger.

Spawn timing and locations are unknown.

Chehalis/Grays Harbor bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The stock status is Unknown. There is insufficient information to assign stock status with confidence. The only information on this stock is anecdotal accounts from sport fishers (Mongillo 1993).

FACTORS AFFECTING PRODUCTION

Habitat--Water quality in the Chehalis River is impacted by pulp mills in the lower river which produce effluents that vary from lethal to benign over a period as short as one day. Logging, agriculture and grazing in the Chehalis basin degrade habitat by removing riparian vegetation, increasing silt loads and decreasing large woody debris. The basin has a relatively low gradient which is not ideal for bull trout/Dolly Varden. The Chehalis and Columbia rivers probably represent the southern end of the range of anadromous char on the west coast.

Harvest Management--The Chehalis River is closed to fishing for bull trout/Dolly Varden. There may be some mortality from hook and release of bull trout/Dolly Varden in fisheries targeting other species.

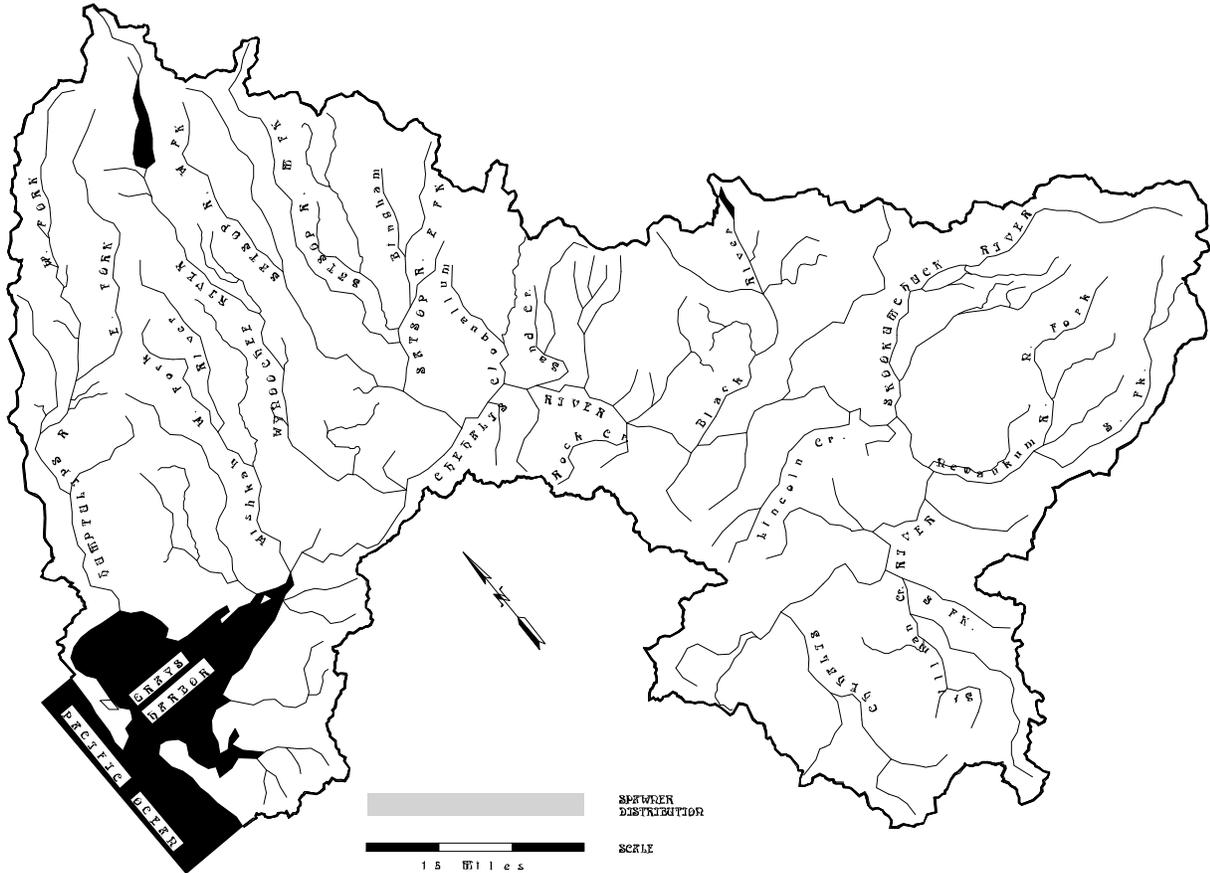
Hatchery--Hatchery-origin chinook, coho and steelhead are released into the Chehalis basin, however interactions between them and wild bull trout/Dolly Varden have not been examined.

STOCK DEFINITION PROFILE for Chehalis/Grays Harbor Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Chehalis/Grays Harbor Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

LEWIS- LEWIS BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 from the Swift Reservoir (N = 22) indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

Bull trout in the Lewis River have been identified as a distinct stock based on their geographic distribution. Currently only small populations of bull trout have been found in the Merwin, Yale and Swift reservoirs above Merwin Dam. We believe that prior to dam construction the Lewis River also contained anadromous and fluvial bull trout. The bull trout populations studied to date have been found to be adfluvial. Some genetic sampling has been done for species identification, but we do not know if this stock is genetically distinct.

Currently there is no upstream passage of fish among the three dams. Some fish move downstream when water is spilled over the dams.

Bull trout in the Merwin reservoir are thought to be present as a result of water spilled over Yale Dam and are not believed to spawn in Merwin Reservoir. Adult bull trout are seen concentrated at the base of Yale Dam in the fall each year. We believe these fish reared in Yale Reservoir and attempt to return to it to spawn. In 1995 surveys were done to document the number of adults staging at the base of the dam.

Cougar Creek is the only known spawning location for bull trout/Dolly Varden in Yale Reservoir. Spawning usually occurs from September through October. (PacifiCorp 1996).

Radio tagging of adult bull trout staging at the top end of Swift Reservoir was done in the spring of 1990, 1991 and 1994 has shown that spawning occurs only in Rush Creek and Pink Creek. A total of 46 adult bull trout were monitored for movement, habitat preferences, and spawn timing. Spawning occurred from late August through mid-September. This research was done cooperatively by the U. S. Forest Service, PacifiCorp, and WDFW.

Lewis River bull trout are native and are maintained by wild production.

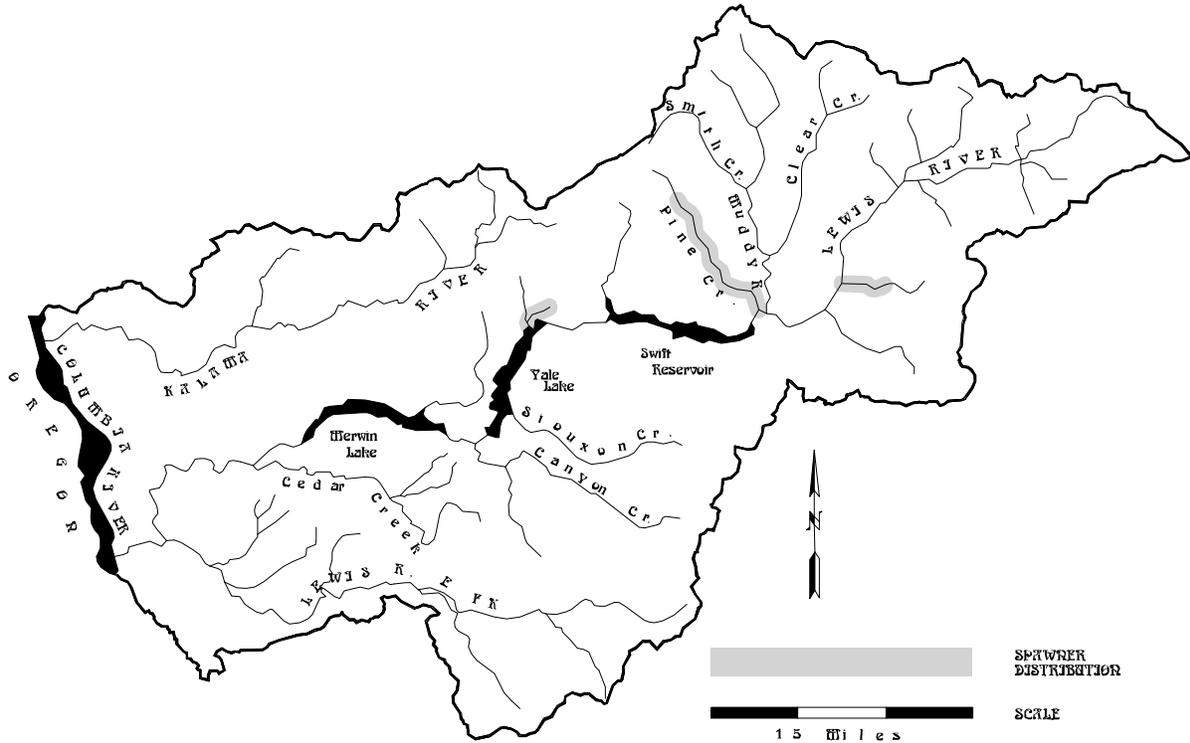
STOCK STATUS

Stock status is Depressed due to chronically low abundance. Spawner surveys in Cougar Creek since 1988 show an average peak count of 22.5 (range seven to 37 fish).

STOCK DEFINITION PROFILE for Lewis Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Lewis Bull Trout

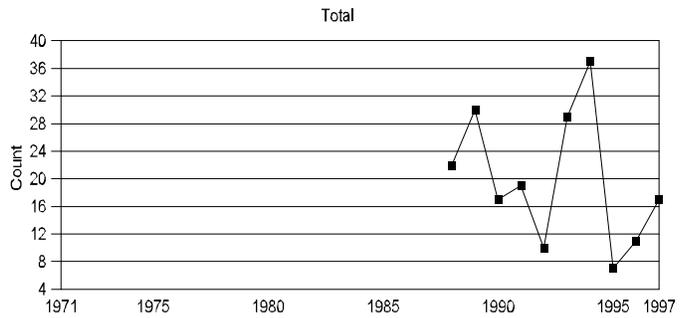
STOCK ASSESSMENT

DATA QUALITY -----> Good

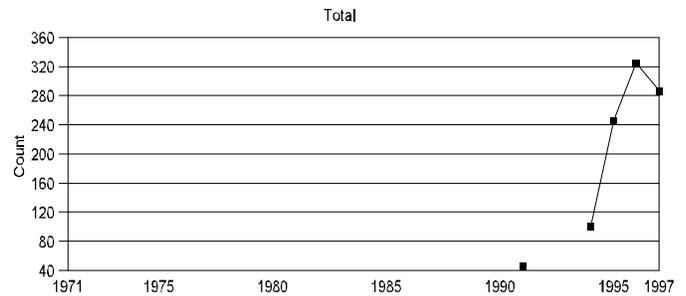
Return Years	FW PROD Total	FW PROD Total		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88	22			
89	30			
90	17			
91	19	46		
92	10			
93	29			
94	37	101		
95	7	246		
96	11	325		
97	17	287		

Column 1: Cougar Cr adult counts
 Column 2: Swift Reservoir adult counts

Freshwater Production



Freshwater Production



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Depressed

Screening Criteria

Chronically low

The lowest and highest counts during the survey period occurred in 1995 and 1994, respectively. Data quality is good. In addition to the radio-tagging study, work has been done to estimate the number of bull troutly Varden leaving Swift Reservoir during the spawning run in the fall. These number are felt to be rough by the biologists who collected them, but adequate to represent trends in abundance. In 1991, a spawning population of 46 adults was estimated. In 1994 through 1997 estimates with 95% confidence intervals (C.I.) of numbers of spawning ascending in mainstem NF Lewis River above Swift Reservoir and entering Rush and Pine Creeks were:

<u>Year</u>	<u>Estimated Spawners</u>	<u>95% C.I.</u>
1994	101	85-118
1995	246	193-326
1996	325	173-782
1997	287	235-361

The biologists from the Forest Service, PacifiCorp and WDFW believe the bull trout population in the Lewis River has been slowly rebuilding since 1990 when monitoring began. Currently, there are no procedures for developing escapement goals, so we do not know if the system is fully seeded.

FACTORS AFFECTING PRODUCTION

Habitat--The North Fork Lewis River contains three mainstem power dams which restrict movement of bull trout in the watershed. The eruption of Mt. St. Helens in 1980 devastated streams such as Pine Creek. Pine Creek is slowly recovering with clean gravels and revegetated streambanks. Activities such as logging, road building, and development are also occurring above Merwin Dam. Rush Creek is a high-gradient stream.

Harvest Management--Fishing for native char has been closed in the Lewis River since 1992. Some hooking mortality from catch and release may occur in fisheries targeting other fisheries. A resident coho sport fishery takes place in Merwin Reservoir, with low numbers of kokanee also being caught. There is a popular kokanee fishery in Yale Reservoir. Incidental catch of bull trout in both reservoirs is thought to be low. A very popular sport fishery for hatchery rainbow trout takes place in Swift Reservoir. The river above Swift is a no-bait area up to the lower falls, (the upper limit of adfluvial bull trout). Incidental catch of bull trout/Dolly Varden is thought to be much higher above Swift Dam than below. The WDFW Enforcement Program has been very active in protecting bull trout/Dolly Varden in the reservoirs and tributaries.

Hatchery--Three hatcheries are located on the North Fork Lewis River, two below Merwin Dam and one on the north shore of Merwin Reservoir. Hatchery coho salmon fingerlings are planted annually in Merwin Reservoir as part of a mitigation program. Hatchery fingerling rainbow trout are planted annually into Swift Reservoir. The Lewis River above Swift Reservoir is not planted with hatchery fish. Kokanee were introduced into the upper reservoirs in the 1950s and now spawn in tributaries of Merwin and Yale reservoirs. Interactions between hatchery-origin salmonids and bull trout/Dolly Varden have not been examined. Brook trout were stocked in upper Lewis watershed. We do not know what effect brook trout may be having on bull trout/Dolly Varden.

WHITE SALMON-- WHITE SALMON BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in the White Salmon River have been identified as a distinct stock based on their geographic distribution. Reported sightings of bull trout/Dolly Varden in the White Salmon River are rare. Two sightings have been reported above Condit Dam, both by WDFW biologists. One fish (273 mm long) was captured in a gill net set in the spring of 1986 in Northwestern Reservoir. The other (about 305 mm long) was checked in the opening day creel census in April 1989. Two sightings have been reported by sport anglers below Condit Dam in the last several years.

Bull trout/Dolly Varden seen below Condit Dam are not believed to reproduce in the White Salmon River. Electroshocking in the lower river has not turned up any juvenile bull trout/Dolly Varden. WDFW fish biologists believe the adult bull trout/Dolly Varden caught in the White Salmon River are "dip-ins" from the Hood River in Oregon. The Hood River contains a small population of bull trout/Dolly Varden which are monitored with an adult trap at the lower end of the river by the Oregon Department of Fish and Wildlife. Other systems in which bull trout/Dolly Varden have been seen are the Wind and Little White Salmon rivers (Drano Lake). Neither of these systems is believed to support reproducing populations of bull trout.

Spawn timing and locations are unknown.

White Salmon bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

Stock status is Unknown. There is insufficient information to make an assessment.

Presence-absence surveys have been conducted by U. S. Forest Service staff in the upper watershed above Trout Lake for the last several years without locating any bull trout/Dolly Varden. Gill net sets and creel censuses have been carried out in Northwestern Reservoir to monitor the trout fishery for many years without reporting bull trout/Dolly Varden catch. Some creel and fish survey work has been done on the mainstem White Salmon River and tributaries above Northwestern Reservoir without locating any bull trout/Dolly Varden.

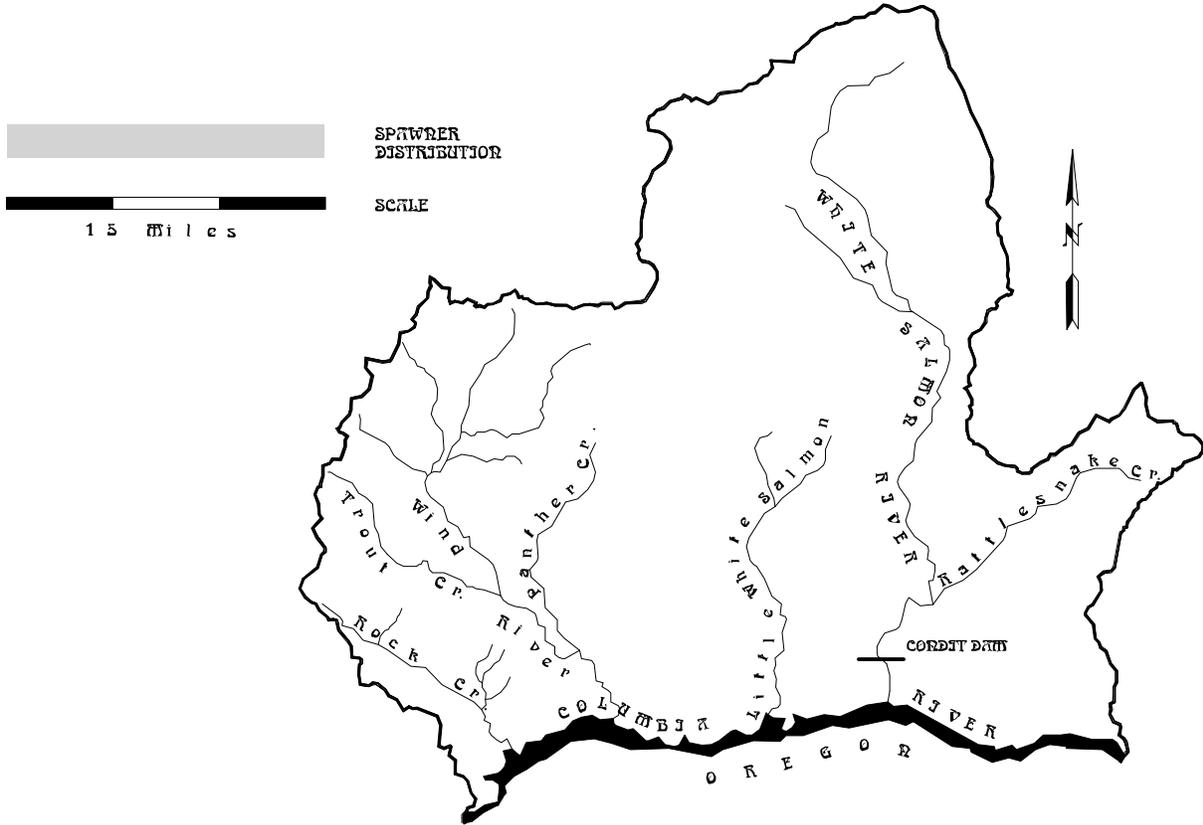
FACTORS AFFECTING PRODUCTION

Habitat--The White Salmon River contains potential bull trout/Dolly Varden spawning habitat in the upper reaches above Trout Lake. Spawning water temperature is a

STOCK DEFINITION PROFILE for White Salmon Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for White Salmon Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

critical limiting factor. Many upper river tributaries such as Trout Lake Creek contain suitable spawning gravels, but the water is too warm for bull trout/Dolly Varden spawning. Consequently only a small fluvial population could be supported. Bull trout/Dolly Varden which migrate below the falls at RM 16 would probably not be able to ascend the falls and would not find suitable spawning habitat. Condit Dam has been a barrier to fish trying to ascend the White Salmon River from the Columbia River throughout most of this century. Both this dam and the Columbia River dams have changed bull trout/Dolly Varden movements and habitat. They block both adult and juvenile passage, and they kill fish going through the spillways and turbines. They slow and warm the water behind them which changes plant and fish communities in the rivers and makes much of the river system unsuitable for bull trout/Dolly Varden.

Harvest Management--Fishing for bull trout/Dolly Varden has been closed in the White Salmon river since 1992.

Hatchery--There are no hatcheries in the White Salmon drainage. Hatchery-origin spring chinook and coho are released into the White Salmon River below Condit Dam, so interactions with wild bull trout/Dolly Varden stock are unlikely. Hatchery rainbow trout fingerlings are released into Northwestern Reservoir annually and may serve as food for bull trout/Dolly Varden. In general, interactions between hatchery salmonids and bull trout/Dolly Varden have not been examined.

KLICKITAT- KLICKITAT BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Klickitat bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. Very little is known about the wild bull trout/Dolly Varden stock in the Klickitat River other than they are known to occur there. Bull trout/Dolly Varden have been observed in the mainstem above the West Fork and in Trappers Creek (a tributary of the West Fork) during snorkel and electrofishing surveys in 1990 and 1995 (Bill Sharp, Yakama Indian Nation, personal communication). We do not know if the bull trout/Dolly Varden that inhabit the Klickitat River drainage are strictly fluvial with resident forms occurring in the headwaters or if the anadromous form is present as well. There are no barriers that prevent migration of bull trout/Dolly Varden from the Columbia River.

Genetic characteristics of bull trout/Dolly Varden in the Klickitat drainage have not been examined. At the present time, there is insufficient information on bull trout/Dolly Varden distribution, abundance, life history forms and migration barriers within the Klickitat drainage to warrant subdividing the population into more than one stock.

Spawn timing and location, age at maturity, sex ratio and fecundity, timing of fry emergence and survival rates are unknown.

Klickitat bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The status of the stock is Unknown. There are insufficient data to make an assessment. However, it appears that there are very few bull trout/Dolly Varden in the lower to mid-Klickitat River drainage. As expected, bull trout/Dolly Varden appear to be more abundant in the upper drainage where habitat conditions are more favorable for native char than in the lower drainage. Four bull trout/Dolly Varden up to 10 inches in length were observed during snorkel surveys in the upper mainstem (RM 64, above the West Fork), and 23 bull trout/Dolly Varden (three to seven inches in length) were observed during electrofishing surveys in Trappers Creek. Additional surveys need to be conducted in this upper drainage to determine the distribution and abundance of bull trout/Dolly Varden.

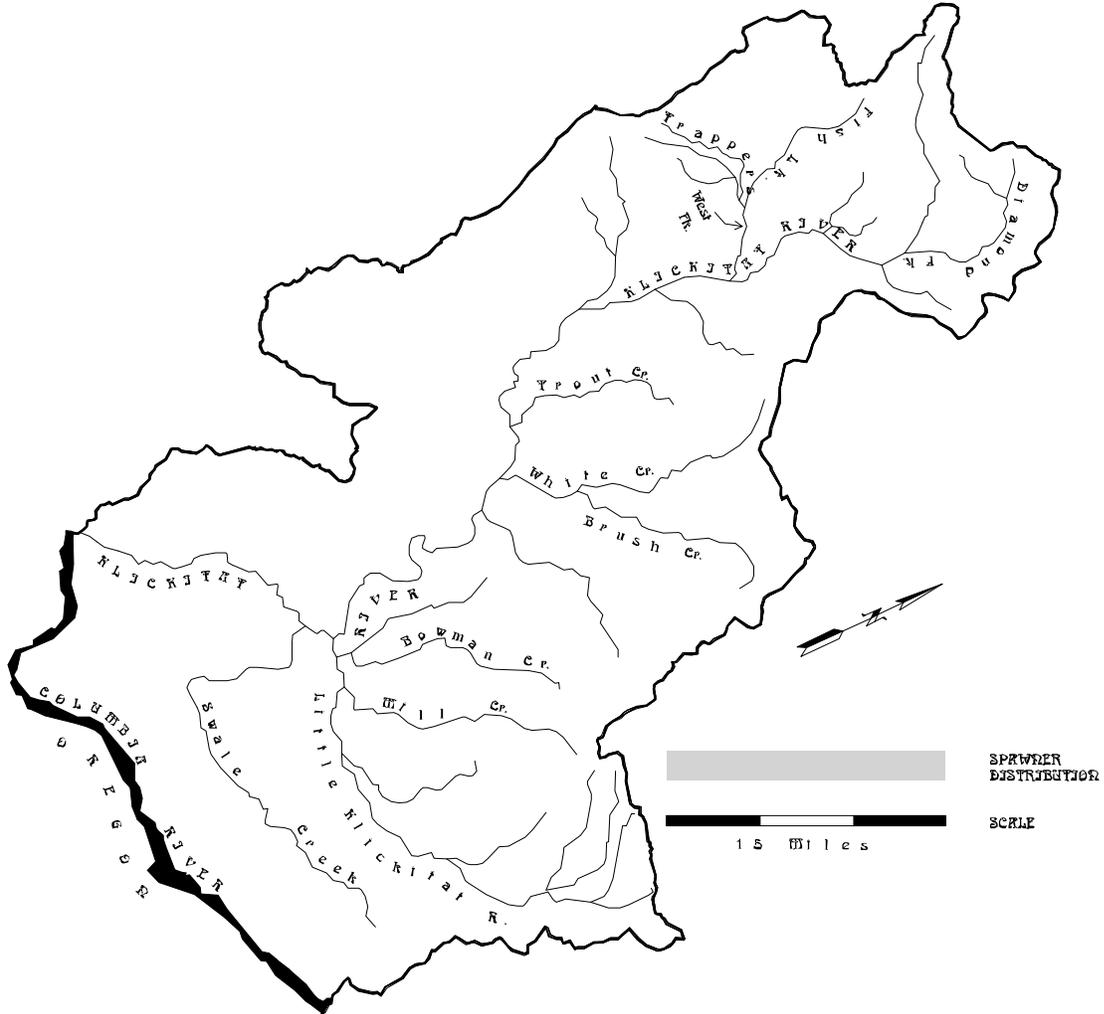
FACTORS AFFECTING PRODUCTION

Habitat--The principal factors limiting bull trout/Dolly Varden production within the Klickitat drainage are as follows. Warm water temperatures due to natural low flows

STOCK DEFINITION PROFILE for Klickitat Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Klickitat Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

are a concern for adult bull trout/Dolly Varden that may spawn in the mainstem or in the lower reaches of tributaries as well as for juveniles that rear in the area. Irrigation water withdrawals from the Little Klickitat River and other lower river tributaries exacerbate natural low river flows and warm water temperatures. Riprap along the banks of the lower river eliminates riparian vegetation and also contributes to higher water temperatures. Turbid water conditions and sedimentation during peak discharge periods from natural sources as well as grazing, logging and roads impair fish health and impede fish growth and development. Human development within the floodplain and in riparian areas (particularly in the Little Klickitat drainage) reduces bank protection and overhead cover, elevates water temperatures and increases sediment loads in the river. Most areas of the upper drainage where development has not occurred appear to be in excellent condition.

Harvest Management--General trout fishing seasons have remained the same in the Klickitat River drainage for about ten years. Historically in the Klickitat River bull trout/Dolly Varden were included as part of the two-trout catch limit, and the minimum size limit was 12 inches. The fishing season was from June 1 to November 30. In the Little Klickitat River regulations were more liberal, with an eight-trout catch limit (five trout in 1994) and no minimum length (June 1 to Oct. 31 season). Fishing was prohibited in the upper Klickitat River and its tributaries within the boundaries of the Yakama Indian Reservation. Beginning in 1992, fishing for bull trout/Dolly Varden was prohibited in the Klickitat drainage.

With the exception of one 432 mm bull trout/Dolly Varden caught in 1991 downstream from the Little Klickitat River (David Lind, Yakama Indian Nation, personal communication) there are no records or references to the catch of bull trout/Dolly Varden. WDFW catch records dating back to 1983 do not show any bull trout/Dolly Varden kept or released. Data prior to 1983 are not available.

Although angling impacts and harvest are not known, they may have been significant prior to the implementation of restrictive fishing regulations in the early 1980s.

Hatchery--Hatchery rainbow trout have been stocked in the Little Klickitat River and tributaries at least since the late 1960s (hatchery stocking records are not readily available before this date). Non-native brown trout were also stocked in the Little Klickitat River in 1984 and 1985. It is difficult to tell what impacts stocking may have had on bull trout/Dolly Varden without historical distribution and abundance of bull trout/Dolly Varden in the drainage. We do not know if bull trout/Dolly Varden even existed in the Little Klickitat River.

Currently, bull trout/Dolly Varden appear to be more abundant in the upper tributaries of the Klickitat drainage, thus current stocking practices probably have negligible impacts on them. Hatchery impacts on bull trout/Dolly Varden are usually manifested in the form

of competition for food and space, predation of juvenile bull trout/Dolly Varden and increased angler harvest rates of trout (including the increased incidental catch of bull trout/Dolly Varden). We do not know what the impacts of stocking hatchery salmon and steelhead in the mainstem Klickitat River on bull trout/Dolly Varden have been. Generally, in drainages colonized by anadromous salmon and steelhead, bull trout/Dolly Varden have successfully co-existed by occupying a different ecological niche. However, negative interactions (predation) can occur when hatchery fish (anadromous or otherwise) are stocked near bull trout/Dolly Varden spawning and rearing areas.

OVERVIEW -- WALLA WALLA BULL TROUT/DOLLY VARDEN STOCKS

TOUCHET MILL CREEK

STOCK DEFINITION AND ORIGIN

The Walla Walla River originates in the western portion of the Blue Mountains of Oregon east of Milton-Freewater and north of Tollgate. The lower half lies in Washington and drains into the Columbia River a few miles upstream of the Washington/Oregon border.

Of the nine principal tributaries of the Walla Walla River in Washington, only two are known to contain bull trout. These are Mill Creek and the upper Touchet River basin.

The Blue Mountains of Washington are a relatively small but geologically old, low-elevation mountain range running from west to east in Walla Walla, Columbia, Garfield, and Asotin Counties. Ancient lava flows exuded from south to north, creating the basalt base of the Columbia Plateau. As the prehistoric Lake Missoula floods flowed west and southwest, alluvial materials were deposited over the Columbia Plateau up to the base of the Blue Mountains in southeast Washington. This probably accounts for much of the large amounts of gravel and soil present in the lower reaches of the Walla Walla, Touchet, and Tucannon rivers. Many of the higher-elevation tributaries containing bull trout are predominately basalt laden and do not exhibit the normally encountered diversity of gravels found in other drainages in the Cascades. Despite the low elevation of the Blue Mountains, the drainage gradients are steep and unstable from an erosion potential standpoint. The headwaters of tributaries with bull trout/Dolly Varden populations in Washington's Blue Mountains are all located in fairly close to one another, often separated by one mountain ridge. Southeast Washington represents some of the earliest records of pioneer settlement. Resulting agricultural conversion and heavy use of the area's water, soil, and timber resources rapidly degraded riparian and in-stream habitats. Most of the lower reaches of drainages in the southeast part of the state are characterized by over-appropriated water withdrawals, siltation, and seasonal high water temperatures and are marginal for optimum salmonid use.

Mill Creek headwaters begin in Washington on the Umatilla National Forest, enter Oregon near the City of Walla Walla water intake and then re-enter Washington some miles downstream. This upper portion has long been the municipal watershed for the city of Walla Walla and has therefore afforded protection for remnant bull trout populations. The population consists of resident and fluvial fish that are isolated from their historic distribution by the watershed and downstream irrigation diversions.

Adfluvial and even anadromous bull trout were likely present prior to the arrival of pioneers and probably moved freely throughout the Walla Walla and Touchet systems.

The Touchet River basin is comprised of the North Fork, and Wolf Forks, Robinson Fork of the Wolf Fork and the South Fork. Bull trout/Dolly Varden have been confirmed only in the North and Wolf forks of the Touchet River but may also be present in small numbers in the South and Robinson forks. Fluvial and resident life history forms are present, with the former probably moving throughout the upper sub-basins.

WALLA WALLA - TOUCHET BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Touchet bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. The stock includes fish in the North Fork Touchet, the Wolf Fork, Robinson Fork and the South Fork Touchet. The Wolf Fork is a tributary of the North Fork, and the Robinson Fork is a tributary of the Wolf Fork. Spawn-timing information and fish-size measurements from surveys conducted by the Forest Service in 1994 and 1995 suggest that both resident and fluvial life history forms are present. Spawn timing is from late August through early October.

The fluvial life history form is thought to move freely among these three streams. Movement between the Touchet and Walla Walla systems may have occurred prior to non-Indian settlement and development in the mid- to late 1800s. The resident life history form in each fork may be isolated.

Recent surveys indicate adults spawning in the Wolf Fork are smaller and spawn earlier than those in Mill Creek and the Tucannon River. Wolf Fork bull trout/Dolly Varden represent the stronghold of the Touchet River basin bull trout/Dolly Varden populations. Spawning occurs in the upper 3.4 miles. Bull trout/Dolly Varden spawning has not been confirmed in Robinson Fork.

Bull trout/Dolly Varden are likely present in the South Fork Touchet but are unconfirmed. If still present, remaining bull trout/Dolly Varden are probably isolated from others in the basin by poor habitat conditions in the lower reaches.

Touchet bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

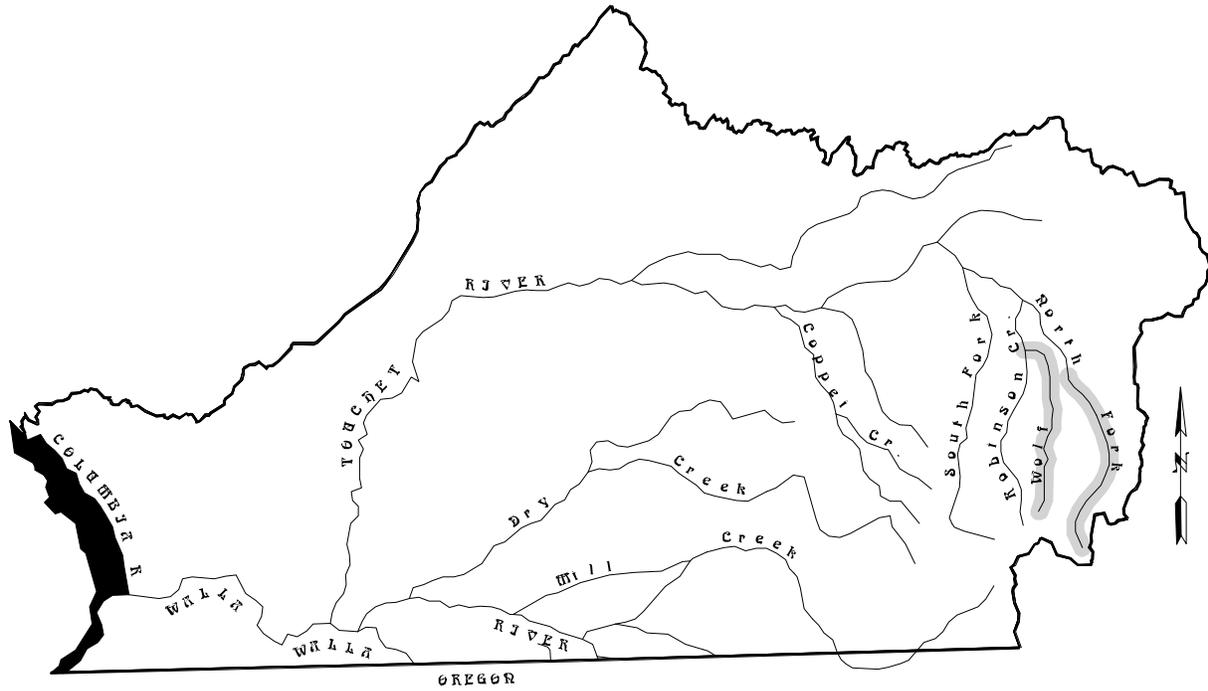
The status of Touchet bull trout/Dolly Varden is Unknown, but may be Depressed based on chronically low numbers of adults, juvenile densities, and declining numbers of redds. Information on the stock is limited. The quantitative data for this stock are from spawner surveys conducted by Forest Service personnel in 1994 and 1995 over three index/survey areas in the North Fork and from juvenile density surveys conducted in 1991 and redd counts made from 1990 by WDFW personnel in the Wolf Fork. Data quality is fair for the North Fork surveys and good for the Wolf Fork surveys. No information is available from the Robinson Fork.

Bull trout/Dolly Varden in the South Fork Walla Walla (Oregon) may interact with Touchet fish, and the status of each population may affect the other. Redd counts in

STOCK DEFINITION PROFILE for Touchet Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning									█				Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Touchet Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Redds	ESCAPE Redds	ESCAPE Redds	FW PROD No/100m ²
--------------	---------------	--------------	--------------	------------------------------

73
74
75
76
77
78
79
80
81
82
83
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86
87
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91
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93
94
95
96
97

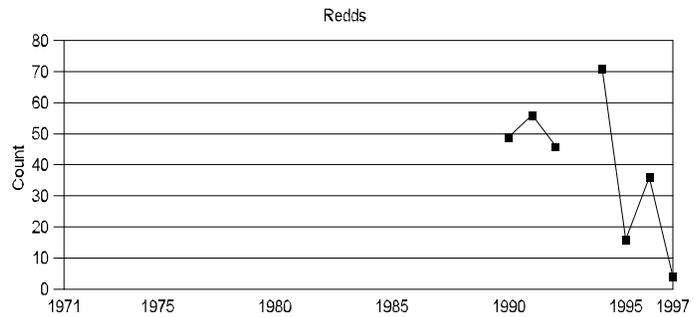
49
56
46
71
16
36
4

13
11
23
30

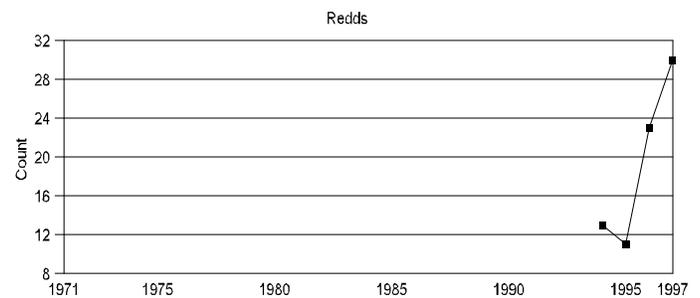
15
11
28
37

9.2

Escapement



Escapement



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

the SF Walla Walla from 1993 through 1996 have been stable (1993--103; 1994--143; 1995--114; 1996--177), and the population has been characterized as being at low risk of extinction (Buchanan, Hanson and Hooton 1997). No redds were seen in the North Fork Wall from 1994 through 1996, and the status of this population has been described as being at high risk of extinction (Buchanan, Hanson and Hooton 1997).

FACTORS AFFECTING PRODUCTION

Habitat--North Fork in-stream habitat has been degraded by logging activities and related road construction, agricultural activities, livestock grazing and development. The streambed in the upper North Fork is composed primarily of angular basalt, suffering from size compaction and sedimentation from logging the highly erodible steep slopes characteristic of most drainages in the Blue Mountains.

A small ski area within the Umatilla National Forest has also contributed significant amounts of sediment to the North Fork in the past, and there are plans for future expansion. Also, a large resort complex has been proposed for the basin along the North Fork above the Wolf Fork. The resort would include a golf course and both lodge and condominium developments. This level of development could further degrade stream habitat.

The Wolf Fork sub-basin is still in good condition, but further removal of timber on private land in the upper reaches will likely reduce bull trout/Dolly Varden numbers substantially as a result of increased siltation. Additional road construction, over-use by livestock, recreational residence construction, and resulting riparian vegetation reduction would increase water temperatures above those conducive to bull trout/Dolly Varden. The Robinson Fork suffers from siltation and marginal water temperatures. Habitat quality is poor due to past logging and agricultural practices.

The South Fork Touchet watershed has been severely degraded due to logging, grazing with resulting siltation, and high water temperatures.

Harvest Management--The North Fork Touchet, Wolf Fork and Robinson Fork are closed to the harvest of bull trout/Dolly Varden.

Hatchery--Hatchery-origin adult and juvenile steelhead are present in the North Fork Touchet. Introduced brown trout are also present in low densities above the town of Dayton and are found in the lower reaches of the North and Wolf forks. Subsequent releases have been moved downstream of Dayton. Brown trout have likely displaced some bull trout/Dolly Varden presence in the lower North Fork system.

Interactions with steelhead were examined in the Wolf Fork in 1992 by WDFW (Martin et al. 1992). The study showed that some competition between juvenile bull trout and

juvenile steelhead may be occurring for rearing habitat based on small habitat preference shifts where the two species overlapped. Small numbers of brown trout have been documented in the Wolf Fork. They probably originated from hatchery releases followed by natural reproduction in the North Fork Touchet River. Brown trout are a concern because of their predatory nature and because they can compete with bull trout/Dolly Varden for food and space. Releases of rainbow and brown trout were made in the Wolf Fork sporadically until 1990 but ended at that time.

WALLA WALLA - MILL CREEK BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 (N= 40) indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

Mill Creek bull trout have been identified as a distinct stock based on their geographical distribution. Both resident and fluvial life history forms are present in the upper reaches, but the latter are more typical of the adfluvial form based on their larger size. Spawning occurs from early September through October.

This stock has been geographically isolated due to over-appropriation of water rights, numerous irrigation diversions, removal of riparian vegetation, and resulting high water temperatures in lower Mill Creek and the Walla Walla River. The potential for significant numbers of adfluvial bull native char using the Walla Walla, Touchet, and Columbia rivers is low. The majority of bull trout in Mill Creek are confined to the City of Walla Walla Watershed inside the Umatilla National Forest in Washington and Oregon. All spawning occurs in the municipal watershed or National Forest. Spawn timing is from early September through October.

Mill Creek bull trout are native and are maintained by wild production.

STOCK STATUS

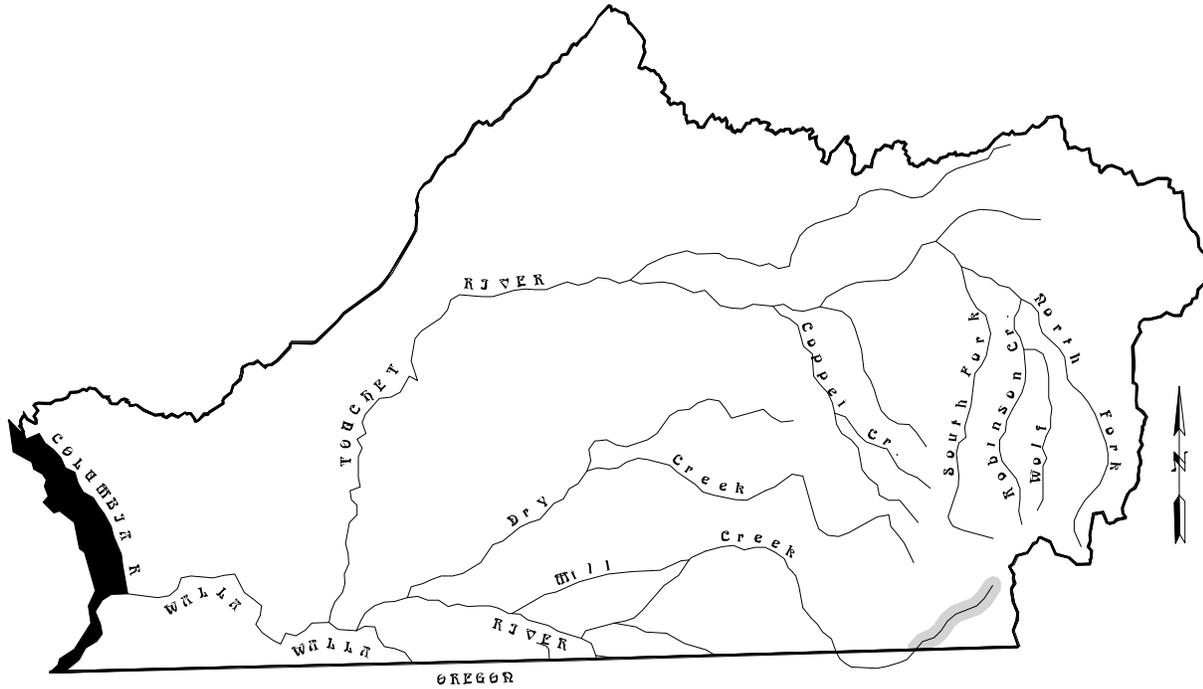
The status of Mill Creek bull trout is Healthy. This determination was based on high densities of juveniles, strong representation of year classes, stable distribution of age groups, and strong, consistent spawning over the four-year survey period. WDFW and Forest Service personnel conducted spawner surveys and redd counts in Mill Creek during 1990, 1991, 1992, 1994, and 1995. Juvenile densities (fish per 100 m²) were estimated during the earlier surveys. An estimate of the population in the survey area was made from foot survey and electrofishing data originally collected by WDFW. The Forest Service has assumed the duty of annual spawner surveys. Data quality is considered good.

The Oregon Department of Fish and Wildlife has described the status of Mill Creek bull trout as being of "special concern" because of an apparent decrease in the number of redds counted from 1994 to 1997 on National Forest land in Oregon and Washington (1994--191; 1995--165; 1996--134; 1997--118) (Buchanan, Hanson and Hooton 1997).

STOCK DEFINITION PROFILE for Mill Creek Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



<u>TIMING</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	<u>DISTINCT?</u>
Spawning													Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

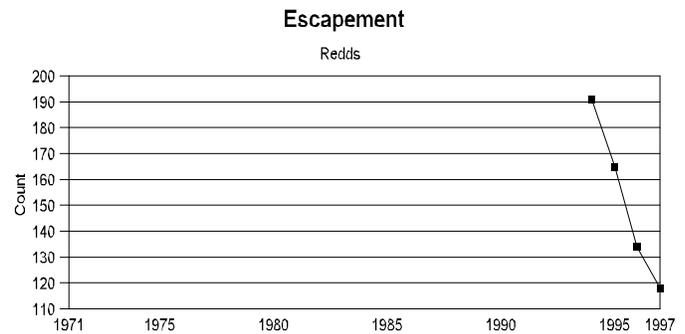
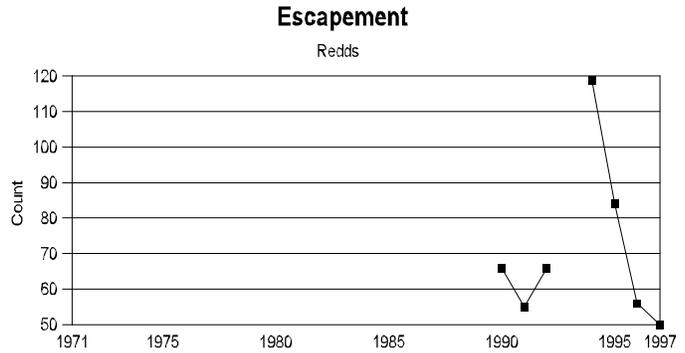
STOCK STATUS PROFILE for Mill Creek Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	ESCAPE Redds	ESCAPE Redds	FW PROD No/100m ²	RUNSIZE Total
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90	66			
91	55		14.0	
92	66		13.4	3,925
93				
94	119	191		
95	84	165		
96	56	134		
97	50	118		

Column 1: Index area redd counts.
Column 2: Total redd counts.



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

FACTORS AFFECTING PRODUCTION

Habitat--The upper section of Mill Creek (within city of Walla Walla Watershed and Umatilla National Forest) is pristine. The middle section (from city watershed diversion to the city of Walla Walla) has been degraded due to road and homesite construction. Loss of riparian habitat with resultant lack of large woody debris and increased water temperatures limits water quality for bull trout. Also, logging and agriculture below the watershed introduce sediment into the system that may degrade the habitat quality. The lower section (from the city to the mouth) has been severely degraded and is unfit for bull trout due to high water temperatures and siltation. The lower Walla Walla basin has been subjected to massive gravel removal operations over the years and is also subject to the effects of urbanization and over 100 years of agricultural use. Severe flooding in the winter of 1996 caused significant bedload movement in Mill Creek. In-stream work with heavy equipment to repair flood damage on private land in the summer of 1996 may have interrupted migration or killed fish (Buchanan, Hanson and Hooton 1997).

Harvest Management--In addition to WDFW regulation closure, bull trout are further protected because the city of Walla Walla restricts access to the watershed.

Hatchery--The middle and lower sections of Mill Creek receive annual releases of rainbow trout. No hatchery-origin salmonids have been observed in upper Mill Creek. Interactions between hatchery-origin fish and bull trout have not been examined.

TUCANNON -- UPPER TUCANNON BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 (N = 81) indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

The Tucannon River originates in the Wenaha-Tucannon Wilderness of the Umatilla National Forest in the central Blue Mountains of Washington and enters the Snake River upstream of the Palouse River mouth. The bull trout in the upper Tucannon River (above RM 34) and its tributaries (Cummings, Panjab, Sheep, and Bear creeks) and Pataha Creek are likely a distinct stock. Most major tributaries have resident and fluvial life history forms. Adfluvial fish are also present in the mainstem upper Tucannon as documented with one radio-tagged fish monitored in 1993. Within a few days, it traveled from above the Tucannon hatchery to the Starbuck area where the signal was lost. It appears to have been heading for the Snake River.

Cummings Creek is the most downstream of the upper Tucannon tributaries containing bull trout. Stream surveys in 1991 documented bull trout presence approximately six miles upstream of the mouth. Based on size, adfluvial, fluvial, and resident forms are believed to be present. Spawning areas have not been identified.

Panjab Creek is the next sub-basin containing bull trout. Surveys by the U. S. Forest Service in 1995 have documented spawning in the lower reach. Visual observations suggest that resident and fluvial life history forms are present.

Sheep Creek is a short-run, steep tributary of about 2.5 miles and is located between Panjab and Bear Creeks. A culvert outfall located approximately one-half mile above its mouth restricts upstream movement and access for bull trout. Forest Service personnel documented bull trout presence (juveniles only) in their 1992 survey. Because no adults have been observed, life history information is lacking.

Bear Creek is one of the uppermost sub-basins of the upper Tucannon containing bull trout and drains from north to south. Bull trout presence has been documented through surveys conducted by Forest Service personnel from early September to early November in 1994 and 1995 covering the lower half-mile. Visual observations indicate resident, fluvial, and adfluvial life history forms are present.

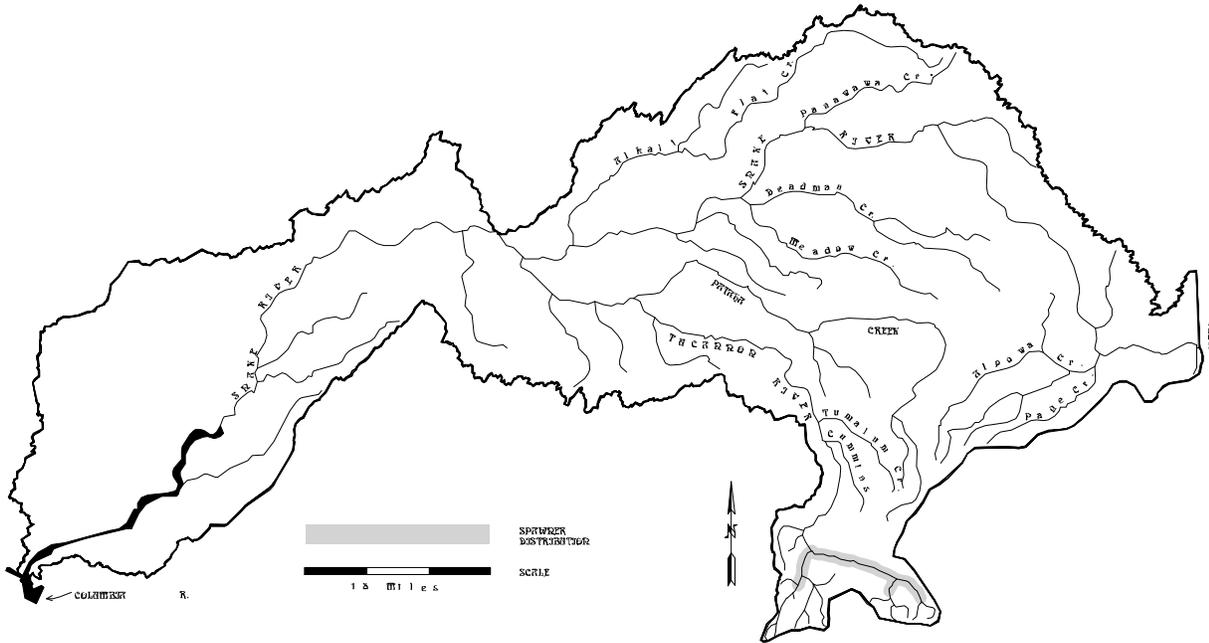
U.S. Forest Service employees have indicated that resident life history forms of bull trout are still present in the headwaters of Pataha Creek.

Upper Tucannon bull trout are native and are maintained by wild production.

STOCK DEFINITION PROFILE for Upper Tucannon Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning									█				Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Upper Tucannon Bull Trout

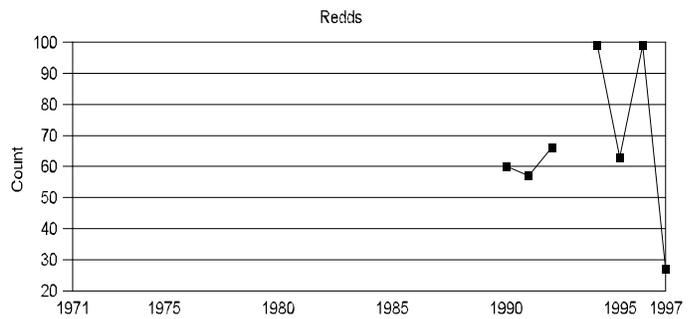
STOCK ASSESSMENT

DATA QUALITY -----> Good

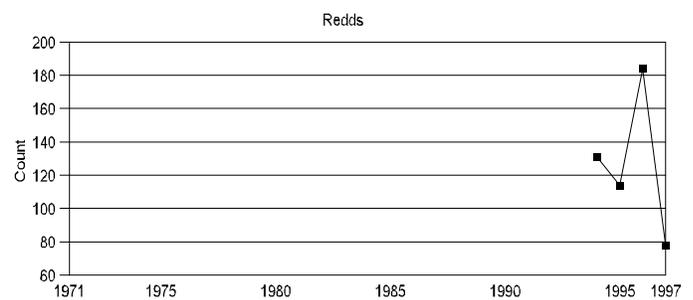
Return Years	ESCAPE Redds	ESCAPE Redds	FW PROD No/100m2	RUNSIZE Total
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90	60		5.6	4,853
91	57			
92	66			
93				
94	99	131		
95	63	114		
96	99	184		
97	27	78		

Column 1: Index area redd counts.
Column 2: Total redd counts.

Escapement



Escapement



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

STOCK STATUS

The status of bull trout/Dolly Varden in the upper Tucannon River is Healthy based on spawning ground surveys and juvenile density studies. WDFW and Forest Service personnel began counting redds in the upper Tucannon in 1990. Juvenile and adult densities and total population size (juveniles and adults) were estimated in 1991 and 1992. Data quality is considered good and represents the most reliable bull trout/Dolly Varden information in southeast Washington.

FACTORS AFFECTING PRODUCTION

Habitat--The upper Tucannon River basin (RM 34 to RM 53) lies within intermixed WDFW and U.S. Forest Service lands. The substrate of the Tucannon differs from that of many of the drainages in the Blue Mountains and consists of round cobble (similar to that in the Touchet, Walla Walla, and Grande Ronde Rivers) as opposed to the angular basalt-laden tributary waters.

Upper Tucannon basin land uses are primarily recreation and logging. Some grazing is allowed on Forest Service lands. The Tucannon headwaters are located in the Wenaha Wilderness which affords good habitat protection. Outside the Wenaha Wilderness, timber harvest, and recreation have degraded habitat in some areas of intense management and use. Bull trout rear in the entire reach, but spawning occurs primarily in the upper ten to twelve miles. Identification of the upper Tucannon as critical habitat for Endangered Species Act-listed spring chinook will likely strengthen habitat protection in the future.

WDFW and federal agencies have taken actions to improve riparian habitat in the upper Tucannon basin. Additionally, campgrounds have been closed to reduce human effects on fish habitat.

The impacts of the late winter 1996 floods in southeast Washington are unknown. Considerable erosion and channel changes occurred in all major drainage basins in the area. However large amounts of woody debris entered the channel as a result of the flood, and have been instrumental in pool development since the flood. Both of these developments should be beneficial to bull trout. Riparian habitat in the upper Tucannon remains in good condition.

Bear Creek habitat is in good condition and is likely to remain so as it originates in the Wenaha Tucannon Wilderness.

Sheep Creek habitat also remains in good condition as does that of Panjab Creek.

Cummings Creek habitat has been impacted by logging and grazing. Its condition should be classed as fair. The 1996 flood may have been beneficial to Cummings Creek by flushing accumulated sediments and creating many new large pools with the introduction of new large woody debris.

Lower Pataha Creek, from Columbia Center to the mouth, is subject to high summer water temperatures, turbidity, erosion, siltation, and otherwise poor water quality due to agricultural use and grazing, and the presence of State Highway 12. Past logging-related road construction up the creek bottom, timber removal, and grazing were likely the primary factors in the decline of this stock. The road has since been closed.

Harvest Management--Harvest of bull trout is allowed in the upper Tucannon from 400 feet above the hatchery intake upstream to Panjab Creek from June 1 through October 31. A two-fish per day bag limit with a minimum size limit of 20 inches is in effect. All tributaries and the main river where bull trout spawn are closed to the harvest of bull native char.

Hatchery--There is some potential for interaction between wild bull trout and hatchery-origin spring chinook and steelhead adults and juveniles, but this potential has been greatly diminished due to low numbers of adult chinook spawners. Martin et al. (1992) and Underwood et al. (1995) have investigated interactions among bull trout, steelhead, and spring chinook in the Tucannon basin. In general, they found no negative interactions between sympatric bull trout and hatchery-origin spring chinook and steelhead because bull trout were using different microhabitats than those used by the other species.

ASOTIN CREEK-- ASOTIN CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Asotin Creek originates in the eastern portion of Washington's Blue Mountains and drains east to its entry into the Snake River upstream of Clarkston at Asotin on the Washington/ Idaho border. This stock is considered distinct based on its geographic distribution. Primary tributaries consist of Pintler, George, Charley, South Fork Asotin, North Fork Asotin, Lick, Middle Branch North Fork Asotin, and South Fork of North Fork Asotin creeks. WDFW and U.S. Forest Service surveys have found bull trout/Dolly Varden only in Charley Creek, the North Fork, the Middle Branch, and the South Fork of North Fork Asotin Creek. Visual assessment indicates resident and fluvial life history forms are present. Movement of fluvial fish between branches of the North Fork probably occurs. Adfluvial bull trout/Dolly Varden were likely present prior to European settlement of the lower Asotin Creek valley and the resulting water diversions and withdrawals. There is a remote possibility that they may still be present. Bull trout/Dolly Varden were probably present historically in the headwaters of Pintler, George, and Lick creeks, and the South Fork of Asotin Creek, and movement among these sub-basins also likely occurred.

Charley Creek is located one mile downstream from the mouth of the North Fork Asotin Creek. Charley Creek bull trout/Dolly Varden have been confirmed to be present and are isolated from others in the basin due to physical and temperature barriers. They were likely contiguous with other fluvial and even adfluvial forms and probably freely intermixed prior to the creation of human-caused obstacles. The resident forms may be distinct in the sub-basin. Both large and very small bull trout/Dolly Varden have been seen in the headwaters.

North Fork Asotin Creek bull trout/Dolly Varden were historically distributed throughout that drainage. Up to the mid-1970s, they were found in the headwaters near the Clearwater Guard Station and also in Cougar Creek. Spawning surveys were performed by WDFW in 1990, 1991 and 1992 in the lower four miles. Fish were observed, but no spawning was confirmed. The U.S. Forest Service recommends that the upper six miles be surveyed. Electrofishing has produced fish in the 150 mm to 250 mm range, indicative of the resident life history form.

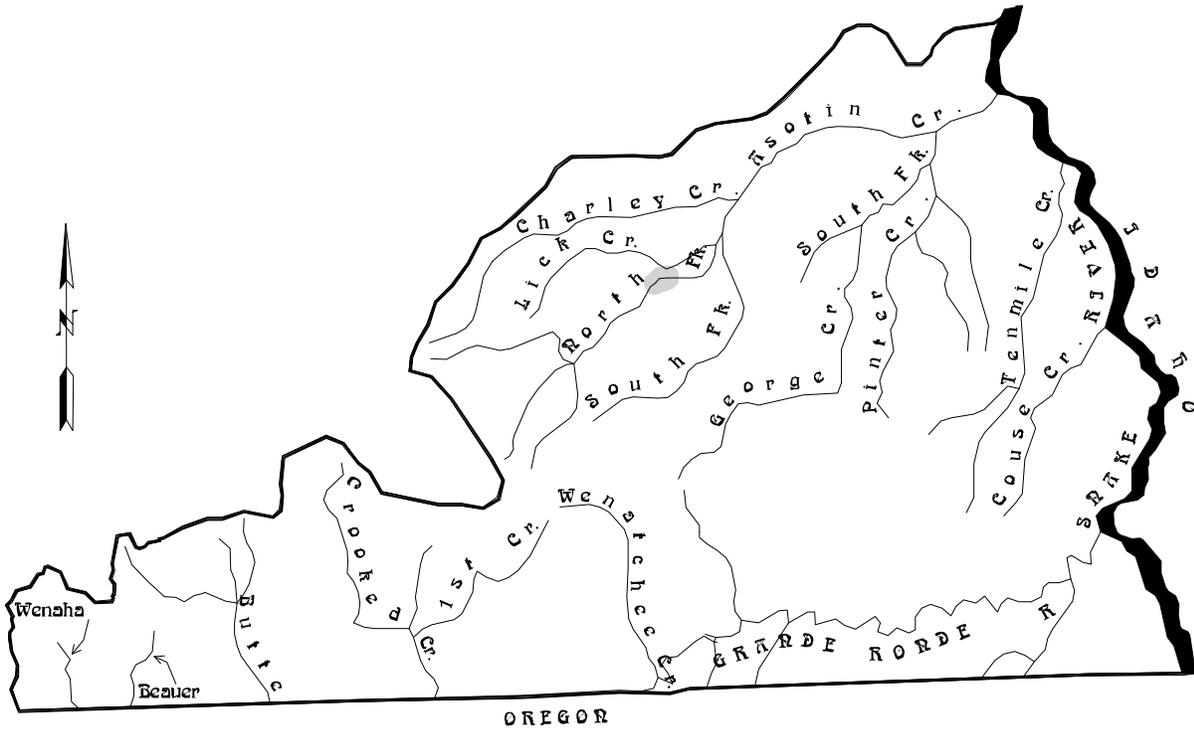
The Middle Branch North Fork Asotin Creek was surveyed by Forest Service personnel in August, 1993. Observed fish were likely the resident life history form and were found in the lower 2.5 miles.

The lower 1.5 miles of the South Fork of the North Fork of Asotin Creek was also surveyed by the Forest Service in July 1993. Observed fish were similar in size to

STOCK DEFINITION PROFILE for Asotin Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



**SPAWNER
DISTRIBUTION**



SCALE

15 Miles

TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning													Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Asotin Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Poor

Return Years	ESCAPE Redds	FW PROD No/100m ²		
--------------	--------------	------------------------------	--	--

73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90	0			
91	0	0.4		
92	0			
93				
94				
95				
96	3			
97	0			

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

those found in the Middle Branch and are thought to be resident forms. Bull trout/Dolly Varden movement among the tributaries of the North Fork likely occurs.

Spawn timing is unknown.

Asotin Creek bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The status of bull trout/Dolly Varden Asotin Creek stock is Unknown but may be Critical based upon very low abundance. Trend data are needed to establish stock status. WDFW initiated bull trout/Dolly Varden presence/absence surveys and spawner surveys beginning in 1990 which were subsequently assumed by U.S. Forest Service personnel in 1996. Of the basins in southeast Washington containing bull trout/Dolly Varden, Asotin Creek is probably the one with the most problems and may have the highest potential for extirpation.

Forest Service personnel surveyed 16 miles of Charley Creek in July 1993 and counted only six bull trout/Dolly Varden. For the purpose of designating stock status, the quality of this information is considered poor. No spawning surveys have been conducted, and no other quantitative data are available. WDFW personnel found no bull trout/Dolly Varden in a 1994 survey.

A survey of juvenile density (fish per 100 m²) was conducted in the North Fork by WDFW in 1991, and spawner surveys were done in 1990 and 1992. Data quality from these surveys is considered good.

The only quantitative data are for the Middle Branch from the 1993 Forest Service snorkel surveys in which eight bull trout/Dolly Varden were documented. Data quality from this survey is considered poor. No spawner surveys have been conducted.

The only quantitative data available for the South Fork of the North Fork Asotin Creek are from the 1993 Forest Service survey where seven bull trout/Dolly Varden were observed. The quality of this information is considered poor. No spawner surveys have been undertaken.

FACTORS AFFECTING PRODUCTION

Habitat--Habitat degradation throughout the basin resulting from timber removal, road construction, and livestock grazing has jeopardized bull trout/Dolly Varden in the upper reaches and has been further compounded downstream with agriculture-related activities, road construction, riparian zone destruction, and water withdrawals. The

lower tributaries and all of the mainstem Asotin Creek exhibit siltation problems and high summer stream temperatures.

The upper portion of Charley Creek lies primarily in the Umatilla National Forest and remains in good condition. The lower reach has been severely degraded due to livestock grazing and also from the construction of a small recreational fishing impoundment and dam in the early 1960s, which blocked upstream movement of bull trout/Dolly Varden. The upper ends of the three North Fork tributaries are in relatively good condition, but floods in 1964 and 1968 and loss of large woody debris reduced pool numbers from 15 to 30 pools per mile to nine pools per mile. These areas represent the best available habitat within this basin for bull trout/Dolly Varden but are still subject to high summer water temperatures which may be the most important limiting factor. The effects of the 1996 floods have not been assessed. Damage may have occurred in some areas, especially in the mainstem Asotin Creek where high water temperatures, lack of riparian vegetation, siltation, and irrigation withdrawals have been long-standing problems for fish welfare. The upper tributaries may have benefitted from the flood if large woody debris entered the channel and created more large pool habitat. High water temperatures will remain a problem for bull trout/Dolly Varden in this basin until riparian habitat can be improved.

Joint efforts are underway among the Natural Resource Conservation Service, private landowners and WDFW to restore in-stream and riparian habitat in the lower reaches, but late winter floods in 1996 and 1997 may have undone much, if not all, work done to date.

Harvest Management--Asotin Creek and its tributaries are closed to the harvest of bull trout/Dolly Varden. Regulations and difficult access to the tributaries provide good protection for bull trout/Dolly Varden from anglers are fishing for other species.

Hatchery--Rainbow trout releases into the mainstem Asotin Creek have been confined to the lower portion of the stream. No trout have been released into Charley Creek since the mid-1960s. In the North Fork, interactions with hatchery-origin adult steelhead have been observed in the creek. Some hatchery-origin rainbow trout may enter the North Fork from the mainstem Asotin Creek. The lower five miles of the North Fork were heavily planted with hatchery rainbows through 1990. Decreasing numbers were planted from 1991 to 1994 and, releases were discontinued in 1995 due to bull trout/Dolly Varden and other wild fish concerns. No hatchery-origin salmonids have been observed in either the Middle Branch or the South Fork of the North Fork.

GRANDE RONDE -- WENAHA BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden are found Crooked Creek, Butte Creek, and the North Fork Wenaha River which all originate in the Blue Mountains of Washington and drain south to the Wenaha River, a tributary of the Grande Ronde River which enters the Snake River upstream from the town of Asotin. The stock is considered distinct based on its geographic distribution. Crooked Creek, Butte Creek and the North Fork Wenaha are all believed to contain resident, fluvial, and adfluvial life history forms of bull trout/Dolly Varden. Resident fish are probably isolated in each sub-basin, while fluvial and adfluvial forms likely move freely throughout the basin.

According to U. S. Forest Service personnel, bull trout/Dolly Varden are present in good numbers in upper Crooked Creek. Forest Service summer surveys in 1993 and 1994 found large and small bull trout/Dolly Varden in First, Second, and Third creeks, tributaries of Crooked Creek. Third Creek has not been systematically surveyed. All life history forms may be present in Crooked Creek, given observed fish sizes. The Forest Service fish biologist with the Pomeroy Ranger District on the Umatilla National Forest believes the tributary populations are resident fish, and those in the mainstem Crooked Creek are fluvial. Adfluvial forms may enter from the Wenaha and Grande Ronde rivers.

Butte Creek lies between the North Fork Wenaha River and Crooked Creek. Forest Service personnel surveyed Butte Creek in the summer of 1995 and found good numbers of bull trout/Dolly Varden. Most of the fish were in the upper mainstem and in the West Fork up to the falls (about 0.5 mile). No bull trout/Dolly Varden were found in the East Fork or above the falls in the West Fork. Butte Creek bull trout/Dolly Varden are thought to be resident and fluvial fish. The larger fish in the Forest Service survey measured 457 mm to 508 mm.

The North Fork Wenaha River is located between Mill Creek to the west and Butte Creek to the east. Forest Service personnel surveyed the lower 1.5 miles in the late summer of 1994. They reported that resident and fluvial life history forms were abundant. The upper reach has not been surveyed.

The Oregon Department of Fish and Wildlife collected fin clip samples from juvenile bull trout/Dolly Varden in Butte Creek in the summer of 1995 for DNA analysis. Results were not available at the time this report was written.

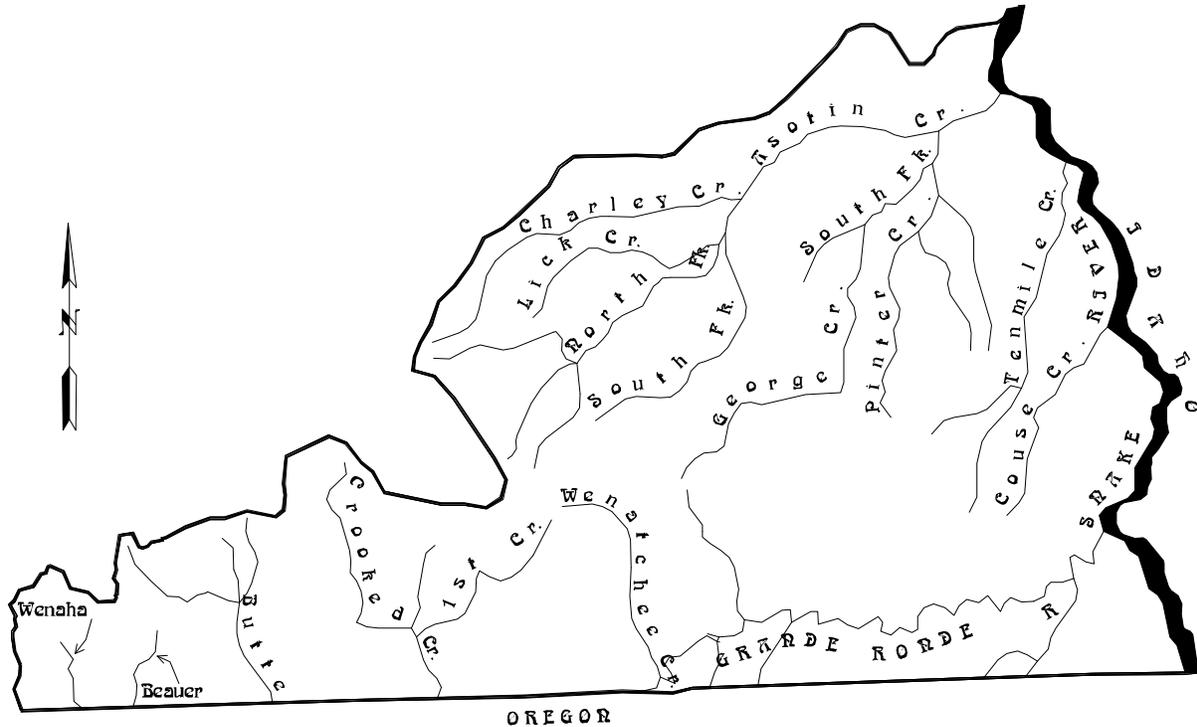
Spawn timing is unknown.

STOCK DEFINITION PROFILE for Wenaha Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Wenaha Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Wenaha bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

Stock status is Unknown but may be Healthy due to the remote location of the three drainages. All originate within the Wenaha-Tucannon Wilderness. The only quantitative data available for this stock are from Forest Service surveys conducted during 1993, 1994, and 1995. Data quality is considered poor. The Oregon Department of Fish and Wildlife has described Wenaha bull trout/Dolly Varden in Oregon as being at low risk of extinction because most of the watershed is located within the Wenaha Tucannon Wilderness.

FACTORS AFFECTING PRODUCTION

Habitat--The habitat in the three sub-basin tributaries is considered good to excellent with the exception of the lower 2.5 miles of Crooked Creek. No bull trout/Dolly Varden have been found in this reach. This may be due in part to its open north-south exposure and resulting high temperature. High temperature is likely seasonal but needs further investigation.

High summer water temperatures in the mainstem Grande Ronde preclude year-round residence. Fish probably ascend into the tributaries when the temperatures rise.

Harvest Management--All three tributaries are closed to the harvest of bull trout/Dolly Varden. Incidental catches by back country recreationists fishing for resident rainbow trout in the summer and fall occur periodically.

Hatchery--Adult hatchery-origin steelhead may be present in each of the sub-basins, but this is unlikely. Interactions between them and wild bull trout/Dolly Varden have not been examined.

OVERVIEW -- YAKIMA BASIN STOCKS

**YAKIMA
AHTANUM CREEK
NACHES
RIMROCK LAKE
BUMPING LAKE
NORTH FORK TEANAWAY
CLE ELUM/WAPTUS LAKES
KACHESS LAKE
KEECHELUS LAKE**

STOCK DEFINITION AND OVERVIEW

In the past, wild bull trout/Dolly Varden occurred throughout the Yakima River subbasin, but they are now fractured into isolated stocks. Although bull trout/Dolly Varden were probably never as abundant as other salmonids in the Yakima basin, they were certainly more abundant and more widely distributed than they are today. Currently, nine bull trout/Dolly Varden stocks have been identified in the basin. Distinct stocks are present in the Yakima River, Ahtanum Creek, Naches River, Rimrock Lake, Bumping Lake, North Fork Teanaway River, Cle Elum/Waptus Lakes, Kachess Lake, and Keechelus Lake. All nine bull trout/Dolly Varden stocks in the Yakima basin are native fish sustained by wild production, as there are no hatchery bull trout/Dolly Varden stocks in Washington state.

There is no information to indicate whether these are genetically distinct stocks. The stocks are treated separately due to geographical, physical and thermal isolation of the spawning populations. More or fewer stocks may be identified after additional data are collected and comprehensive genetic information is available.

Three bull trout/Dolly Varden life history forms are present in the Yakima basin: adfluvial, fluvial and resident. Adfluvial stocks occur in Rimrock, Bumping, Kachess, Keechelus and Cle Elum/Waptus lakes. There is a fluvial stock in the mainstem Yakima River, and a resident stock in Ahtanum Creek. Fluvial/resident forms occur in the Naches River drainage and in the North Fork Teanaway drainage. It is possible that anadromous forms also occurred in the Yakima basin in the past. Run timing of the Keechelus Lake stock and the spawning population in the SF Tieton River (part of the Rimrock Lake stock) is distinct. Run timing for other Yakima stocks is not distinct from other Washington state bull trout/Dolly Varden or is unknown.

STOCK STATUS

Of the nine stocks identified one is Healthy, one is Depressed, six are Critical and one is Unknown. Additional data are needed to determine the status of the unknown stock.

YAKIMA -- YAKIMA BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Yakima bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. Bull trout/Dolly Varden were thought to be extirpated in the lower Yakima River many years ago, probably before the 1950s. However, during electrofishing surveys in June 1997, WDFW biologists caught and released one 278 mm bull trout near Benton City. Although fluvial bull trout/Dolly Varden are present in the mainstem of the upper Yakima River, they are infrequently encountered. Currently, most bull trout/Dolly Varden that inhabit the upper Yakima River are probably fish that outmigrate from upper river tributaries and juvenile or sub-adult fish which are flushed out of upper river reservoirs during irrigation water releases. Fluvial bull trout/Dolly Varden grow and mature in the mainstem and then migrate during the late summer into upper tributaries to spawn.

There are a few references (mostly old catch records) that indicate the presence of bull trout/Dolly Varden in Yakima River tributaries including Satus Creek, Cowiche Creek, Coleman Creek and the Cle Elum River. Some of these records date back to the 1930s. The fish caught in Cowiche and Satus creeks were probably strays or misidentified brook trout (old catch records indicate only one bull trout/Dolly Varden was captured in each of these streams). We do not know if bull trout/Dolly Varden still occur in Coleman Creek or in the Cle Elum River below Cle Elum Lake Dam or if they are isolated resident stocks. In all streams where bull trout/Dolly Varden are noted in the historical catch records relatively few fish were recorded compared to other gamefish. Whether this is a reflection of historically low population abundance is difficult to tell. In May 1996 one 545 mm bull trout was illegally caught in Easton Lake (a 238-acre reservoir of the upper Yakima River). There are a few anecdotal reports of anglers catching bull trout as well. We do not know if these fish are representative of an isolated adfluvial population inhabiting the lake or of the Yakima River fluvial stock.

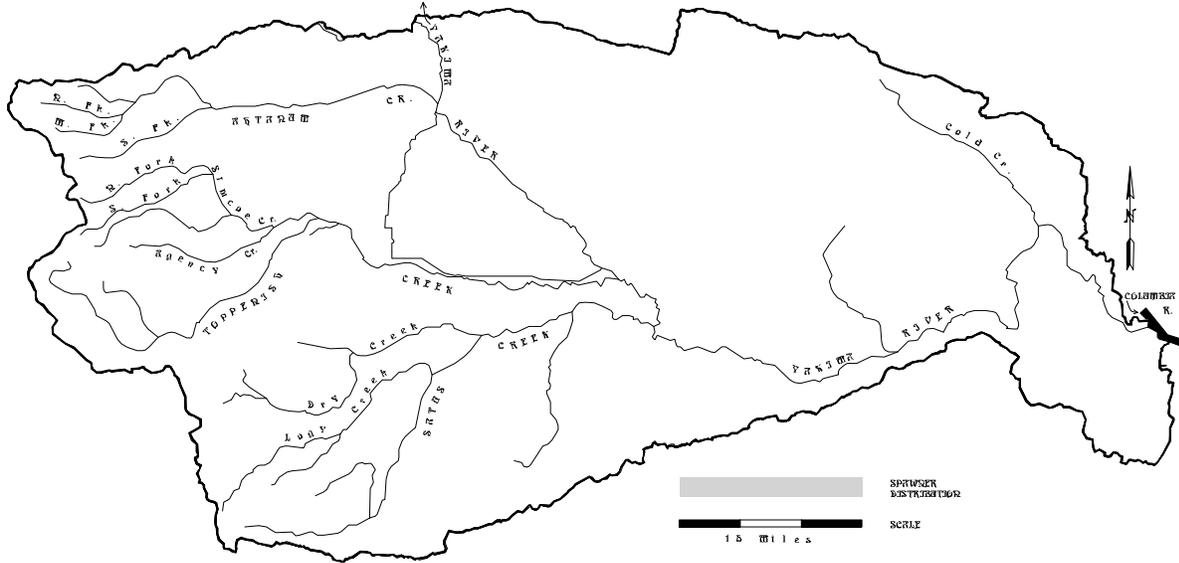
Until information is collected to determine otherwise, all bull trout/Dolly Varden in the upper Yakima River mainstem will be considered as one stock with a fluvial life history pattern. An exception is the North Fork Teanaway River, which is considered a separate isolated resident stock (see North Fork Teanaway stock report). For now, the Yakima fluvial stock is assumed to be composed of fish that inhabit the mainstem between Roza Dam and the upper reservoir dams (i.e., Cle Elum, Kachess and Keechelus dams). Although the genetic characteristics of the stock have not been determined, bull trout/Dolly Varden in the mainstem of the Yakima River are considered distinct from other Yakima subbasin stocks based on physical, geographical and thermal isolating factors (dams, warm water temperatures, irrigation diversions, etc.).

STOCK DEFINITION PROFILE for Yakima Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning					Spawn timing is unknown for this stock.								Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Yakima Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	FW PROD Index Total			
--------------	---------------------	--	--	--

73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	
88	
89	
90	0
91	0
92	2
93	0
94	1
95	1
96	0
97	0

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Critical

Screening Criteria
Chronically low

We do not know where and when spawning occurs. As with other stocks in the Yakima subbasin, spawning probably occurs in September. The few fish that have been caught in recent years range in size from 305 mm to 559 mm. There is no information on age at maturity or any other biological characteristics (e.g., sex ratio, fecundity, etc.).

Yakima bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

The status of the stock is Critical based on chronically low numbers of fish encountered in index areas. The stock is likely suffering from a long-term negative trend and decreases in stock fitness. Only a few bull trout/Dolly Varden have been found after eight years of intensive field monitoring of trout populations in the mainstem of the upper Yakima River (field monitoring began in 1990). Standardized electrofishing surveys conducted annually during September and October in five 4.5 kilometer sections (index areas) of the river have turned up only four bull trout/Dolly Varden (three near Cle Elum and one near Ellensburg). Index areas are located from Cle Elum to Roza Dam. Data quality is excellent. In 1993, a single bull trout/Dolly Varden was captured in a trap in Swauk Creek 200 meters above its mouth. The fish was migrating upstream, apparently out of the Yakima River. There are no index areas in the Yakima River above Easton Lake. More field investigations are needed in this area.

FACTORS AFFECTING PRODUCTION

Habitat--Dams without fish passage capability that were built during the early 1900s to create the large irrigation storage reservoirs in the upper Yakima River drainage fragmented and isolated bull trout/Dolly Varden populations. The dams prevented annual migrations to upper spawning tributaries. The few remaining spawning areas below the dams were affected by unscreened irrigation diversions and low-water conditions in tributary streams created by periodic natural drought conditions and irrigation water withdrawals. These conditions prevented upstream migration and caused stranding of fish in pools or irrigation canals which increased mortality of adult and juvenile bull trout/Dolly Varden. Currently, irrigation diversions are screened to prevent fish from becoming stranded in canals or in agricultural fields, but migration barriers due to low-water conditions are still a concern.

Development in or along the floodplain/shorelines and diking continue to reduce shoreline cover and to increase water temperatures and sediment loads. Grazing, non-point agricultural runoff and irrigation returns with high sediment loads degrade water quality, cover spawning and rearing gravels with sediment, impair fish health and impede fish growth. Timber harvests near or in riparian corridors in the upper watershed combined with excessive road densities contribute greatly to increased water temperatures, sediment loads and poor water quality in all downstream areas.

Harvest Management--Restrictive fishing regulations for bull trout/Dolly Varden began in 1986 with a one-fish catch limit and an eight-inch minimum size limit in streams. Additionally, fishing for bull trout/Dolly Varden was prohibited from August 15 to September 30 to protect spawning fish. Beginning in 1992 fishing for bull trout/Dolly Varden was prohibited in the Yakima River drainage. Since 1990 the use of bait and barbed treble hooks has been prohibited in the upper Yakima River (from Roza Dam to Keechelus Dam), thereby reducing the mortality rate of released bull trout. Beginning in 1998 this fishing regulation will apply to other upper Yakima River tributaries as well, including the Cle Elum River, Kachess River, Naneum Creek, Swauk Creek, Teanaway River and Umtanum Creek.

Very little historical harvest information exists for bull trout/Dolly Varden in the Yakima River. They have been observed during creel checks but probably have been targeted by few anglers due to their lower abundance and because they were not as highly regarded as other gamefish.

Although angling impacts and harvest are not entirely known, they may not have been as significant in the mainstem as in upper tributary areas. It is likely that bull trout/Dolly Varden were so severely affected by upriver dams which blocked passage to spawning areas and by low flow conditions and irrigation diversions that the population crashed in the early 1900s. Although angling and harvest probably had some effect, compared to dams and diversions, it was probably minor.

Hatchery--Hatchery rainbow trout (fry/fingerlings and catchable-size trout) and steelhead have been heavily stocked into the upper and lower Yakima River since the early 1930s. Exotic fish species such as brown trout and brook trout were stocked less frequently into sloughs, beaver ponds and tributaries. In the early 1930's bass, catfish and crappie were stocked in the lower river (Tri-Cities area). It is not known what effect this stocking had on bull trout/Dolly Varden, but it is likely that they were negatively impacted. Impacts to bull trout/Dolly Varden probably included competition for food and space, predation on bull trout/Dolly Varden juveniles, increased angler harvest rates, and hooking mortality associated with the incidental catch-and-release of bull trout/Dolly Varden. Potential bull trout/Dolly Varden hybridization with brook trout is also a concern.

With the exception of steelhead smolts stocked into a few tributary streams, the stocking programs were eliminated in the mainstem Yakima River in the early 1980s and in most tributaries by the early 1990s to avoid potential impacts to native fish species, including bull trout/Dolly Varden.

Currently, there are plans to supplement depressed spring chinook salmon populations in the Yakima River subbasin. A hatchery facility will be constructed at Cle Elum with several acclimation ponds in the upper basin. Biologists responsible for managing the

facility believe that stocking spring chinook in the basin will not impact bull trout/Dolly Varden stocks.

Historically, bull trout/Dolly Varden probably benefitted from the presence of anadromous salmonids such as spring chinook. The downstream drift of eggs released from spawning salmon provided food for bull trout/Dolly Varden and other resident fishes, but more importantly the presence of decaying salmon carcasses greatly benefited juvenile salmon and resident fishes by nutrient recycling. Generally, in drainages colonized by natural anadromous salmon and steelhead the bull trout/Dolly Varden have successfully co-existed by occupying a slightly different ecological niche.

However, in many areas where bull trout/Dolly Varden currently exist, habitat conditions have deteriorated and natural predator/prey balances have been upset. Bull trout/Dolly Varden populations are at or near critically low levels in many areas of the basin. Concern exists over stocking large numbers of hatchery fish into an environment already unfavorable for bull trout/Dolly Varden production. Great care should be taken to avoid actions that will push bull trout/Dolly Varden to extinction.

YAKIMA -- AHTANUM CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Ahtanum Creek bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. Bull trout/Dolly Varden in Ahtanum Creek, a tributary of the Yakima River, originated from native fluvial/resident life history forms that occurred throughout the Yakima River subbasin. Ahtanum Creek bull trout/Dolly Varden are now isolated from fish in the lower Yakima River due to thermal barriers and total dewatering of lower Ahtanum Creek below RM 19.7 at Wapato Irrigation Diversion by irrigation water withdrawals.

Although bull trout/Dolly Varden are present in the mainstem Ahtanum Creek (above RM 19.7) they are probably more abundant in the upper portion of the drainage, particularly in the North, Middle and South forks where habitat conditions are more favorable. Until information is collected to determine otherwise, bull trout/Dolly Varden isolated in the Ahtanum Creek drainage will be considered as one stock with a resident life history pattern.

Information on bull trout/Dolly Varden spawning location and timing is available for the North and Middle Fork. Bull trout/Dolly Varden also occur in Shellneck Creek, a small tributary of the upper North Fork. The few bull trout/Dolly Varden redds observed in this small creek are included in the redd count for the North Fork. It is likely that bull trout spawning in the South Fork as well, but redd counts have not been conducted there yet. Spawning occurs in September. The majority of adult spawners range from 200 mm to 356 mm in total length. The age at maturity, sex ratio, fecundity, timing of fry emergence, and survival rates are all unknown.

STOCK STATUS

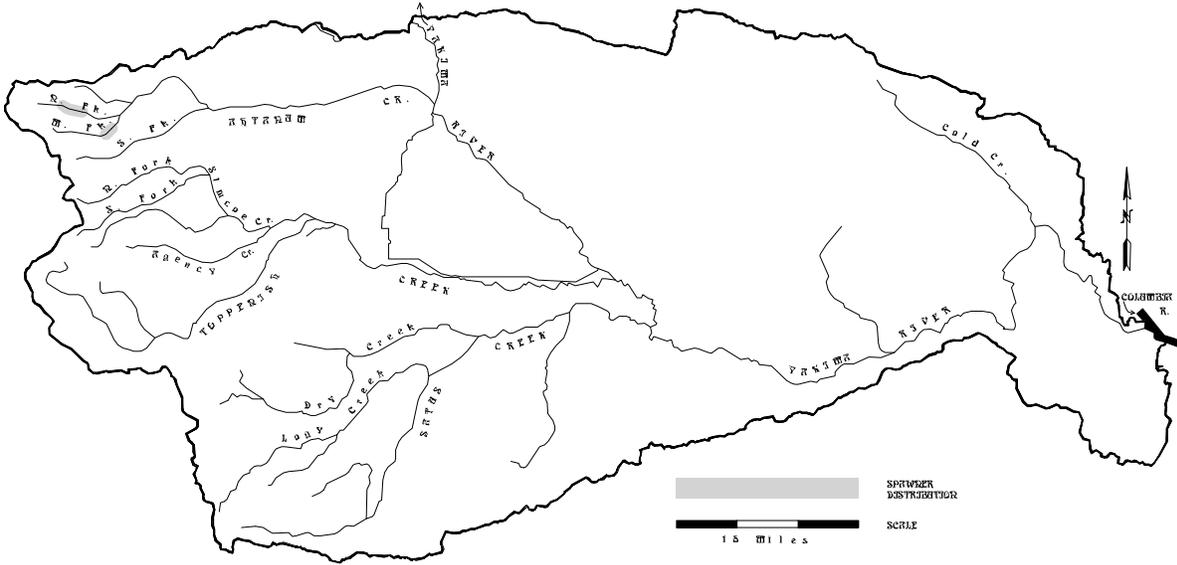
Stock status is Critical, based on chronically low spawning escapement (redd counts) in the North and Middle forks. Although additional investigations are needed to determine if bull trout/Dolly Varden spawn in the South Fork and in the mainstem, preliminary field observations and electrofishing surveys indicate extremely low population size throughout the Ahtanum drainage. Data quality is good.

It is estimated that the redd counts in the North Fork represent 75% of the spawning population for that stream. When viewed on a larger scale, it is roughly estimated that the redd counts in the North Fork represent 25% to 35% of the spawning population for the entire Ahtanum drainage. The low redd counts are not indicative of the available spawning habitat.

STOCK DEFINITION PROFILE for Ahtanum Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning									█				Unknown

BIOLOGICAL CHARACTERISTICS

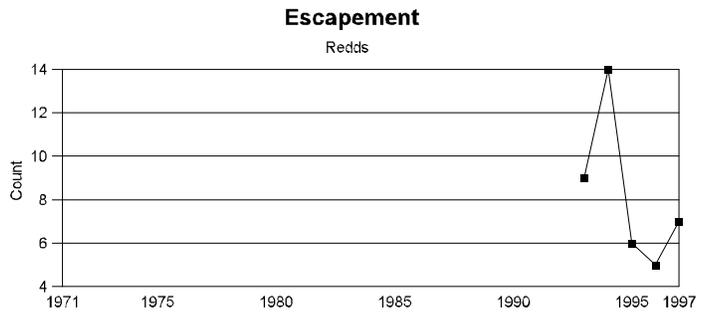
DISTINCT? - Unknown

STOCK STATUS PROFILE for Ahtanum Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	ESCAPE Redds	ESCAPE Redds		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93	9			
94	14			
95	6			
96	5	1		
97	7	1		



Column 1: NF Ahtanum Creek redd counts.
 Column 2: MF Ahtanum Creek redd counts.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Critical

Screening Criteria
Chronically low

FACTORS AFFECTING PRODUCTION

Habitat--Agricultural irrigation from mid- to low elevations causes total dewatering of the mainstem below RM 19.7 during the summer and fall. In Ahtanum Creek poor water quality, excessive sediment loading, and high water temperatures caused by overgrazing, intensive agricultural use along shorelines, development along the shoreline and in the floodplain, excessive timber harvests in the upper basin, and excessive road densities affect bull trout/Dolly Varden production. These conditions destroy bull trout/Dolly Varden habitat in the spawning areas by reducing overhead cover, increasing the amount of sediment covering spawning gravels and by creating stressful conditions (elevated water temperatures) for spawning and rearing fish. In the upper forested portion of the drainage (North, Middle and South forks) some shoreline development occurs, but sedimentation and reduced vegetative cover from cattle grazing, logging and associated road networks in close proximity to riparian areas are the primary concerns. Direct impacts by cattle trampling redds occurs on Department of Natural Resources lands in the North and Middle Forks. Excessive off-road vehicle use within riparian corridors occurs in some areas. In the North Fork Ahtanum Creek, an unscreened irrigation diversion still exists at the John-Cox Ditch and may strand bull trout/Dolly Varden adults and juveniles. This diversion is scheduled for a new screen in 1998. Fortunately, other major irrigation diversions have been screened. Although land-use practices are degrading habitat at an alarming rate, good bull trout/Dolly Varden habitat still exists in the upper portions of the Ahtanum drainage.

Harvest Management--Restrictive fishing regulations for bull trout/Dolly Varden began in 1986 with a one-fish catch limit and an eight-inch minimum size limit in streams. Additionally, fishing for bull trout/Dolly Varden was prohibited from August 15 to September 30 to protect spawning fish. In 1992 fishing for bull trout/Dolly Varden in the Ahtanum Creek drainage was prohibited. Beginning in 1998 there is a total fishing season closure on sections of North Fork Antanum Creek and Shellneck Creek to protect spawning and early-rearing bull trout.

Very little historical harvest information exists for bull trout/Dolly Varden. They have been observed during creel checks, but probably have been targeted by few anglers, since they are not a highly regarded game fish. Although angling impacts and harvest are not known, they may have been significant, especially during the 1960s, 1970s and early 1980s when catchable-size rainbow trout were stocked in the Ahtanum Creek mainstem and tributaries. Stocking probably occurred before 1960 as well, but these earlier records are not readily available. Hatchery rainbow trout stocking increased angling effort and harvest which probably increased the incidental catch of bull trout/Dolly Varden. Despite restrictive fishing regulations for bull trout/Dolly Varden, the continued use of bait in the Ahtanum Creek drainage by anglers fishing for rainbow and cutthroat trout increases the hooking mortality of incidentally caught and released bull trout/Dolly Varden. The combination of hatchery-stocked rainbow, large catch limits, the

use of bait and easy public access to the mainstem and tributary streams generated high angling pressure that probably had negative impacts on the wild bull trout/Dolly Varden stock. However, beginning in 1998 the use of bait and barbed treble hooks is prohibited in the North and Middle Forks of Antanum Creek, thereby reducing the mortality rate of released bull trout.

Hatchery--Catchable-size hatchery rainbow trout were stocked annually into the North and South Forks of Ahtanum Creek (above RM 19.7) throughout the 1960s, 1970s and early 1980s. It is not known what affect this stocking had on bull trout/Dolly Varden, but it is likely that they were negatively impacted. Impacts to bull trout/Dolly Varden probably included competition for food and space, predation on juvenile bull trout/Dolly Varden by rainbow trout, and increased harvest by anglers (including the increased incidental catch of bull trout/Dolly Varden). The rainbow trout stocking program was eliminated in the Ahtanum creek tributaries in the early 1980s to avoid potential impacts to native fish species, including bull trout/Dolly Varden.

In 1995 the Yakama Indian Nation began stocking hatchery coho into bull trout/Dolly Varden streams within the Ahtanum Creek drainage in an effort to reestablish self-sustaining populations (coho have been extinct in the Yakima basin for many years). It is not known what impacts, if any, coho will have on bull trout/Dolly Varden. Coho juveniles are known to be more aggressive than other anadromous or resident species, and there is the potential of competing with or preying on bull trout/Dolly Varden fry. Generally, in drainages colonized by anadromous salmon and steelhead the bull trout/Dolly Varden have successfully co-existed by occupying a different ecological niche. However, negative interactions can occur when hatchery fish (anadromous or otherwise) are stocked near bull trout/Dolly Varden spawning and rearing areas.

YAKIMA -- NACHES BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Naches bull trout/Dolly Varden have been identified as distinct based on their geographic distribution. Wild bull trout/Dolly Varden in the Naches River, a tributary of the Yakima River, originated from native fluvial/resident forms. Although few bull trout/Dolly Varden have been encountered in the mainstem Yakima River, they continue to persist in the Naches River drainage where habitat conditions are more favorable.

Until information is collected to determine otherwise, bull trout/Dolly Varden in the Naches River drainage will be considered as one stock with two primary life history forms, fluvial and resident. The larger fluvial fish inhabit mainstem rivers and spawn in the mainstem or in small tributaries. The smaller resident bull trout/Dolly Varden inhabit small headwater tributaries throughout their life cycle. There is probably some degree of overlap and genetic exchange between the two life history forms within the Naches drainage. For now, the Naches stock is assumed to be composed of fish that inhabit the Tieton River (below Rimrock Lake/Tieton Dam), Rattlesnake Creek, American River, Little Naches River, the Bumping River (below Bumping Lake Dam), and small tributaries of these larger streams. Small tributary streams currently inhabited by bull trout/Dolly Varden include Dog, Hindoo, Little Wildcat and North Fork Rattlesnake creeks (Rattlesnake Creek drainage), Crow Creek (Little Naches River drainage), Kettle, Timber and Union creeks (American River drainage). It is said that bull trout/Dolly Varden were present in Cowiche Creek (Naches River drainage) and Oak Creek (Tieton River drainage) in the early 1970s, but recent electrofishing surveys have not confirmed their presence. U.S. Forest Service staff recently reported capturing a single 100 mm to 125 mm bull trout/Dolly Varden in Milk Creek, a small tributary of the Naches River.

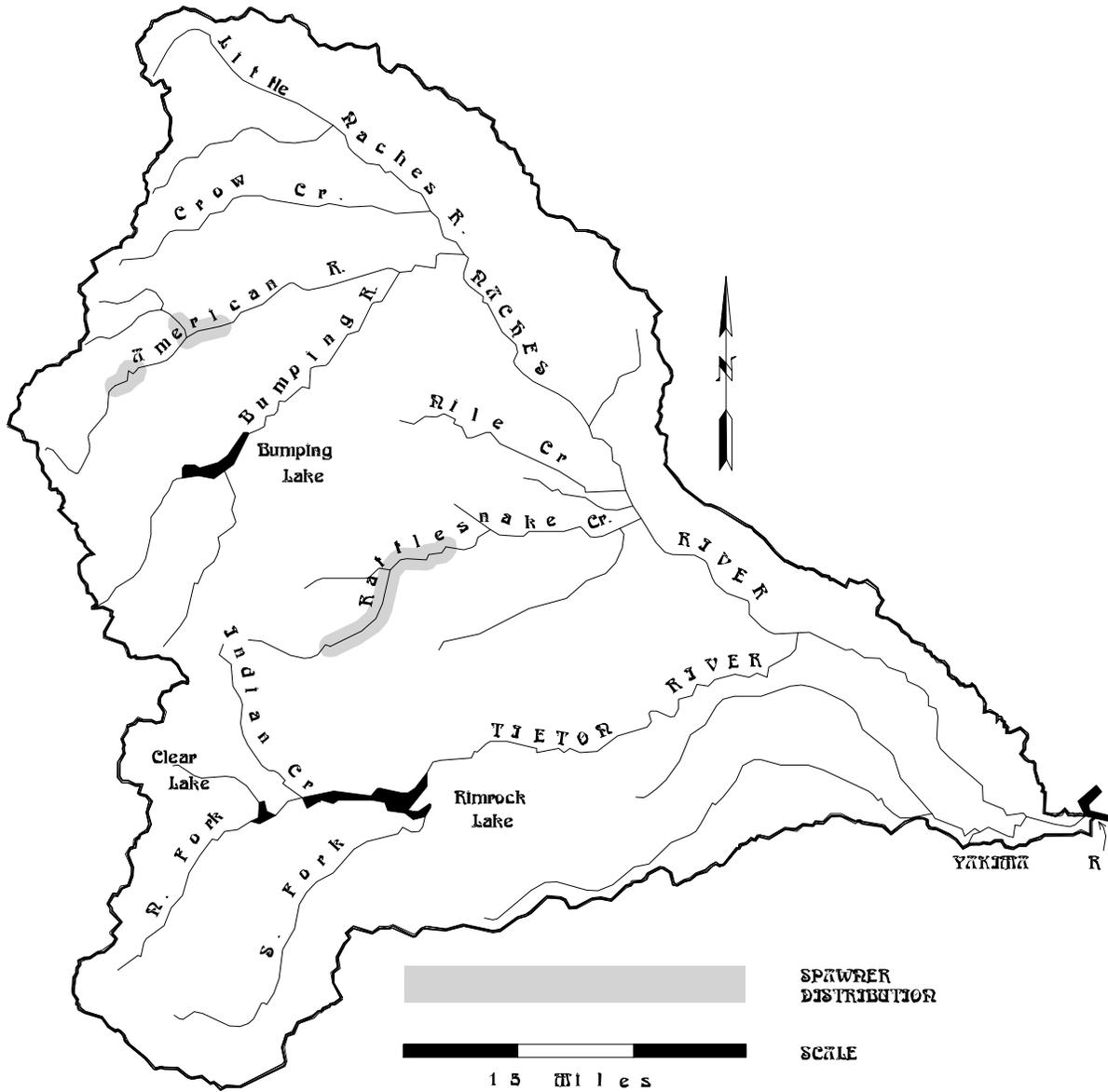
We do not know if the bull trout/Dolly Varden that inhabit the streams listed above are members of individual stocks or if they are all part of the same parent stock. It is certainly possible that some degree of genetic exchange occurs among them (there are no barriers separating any of the streams). With the exception of dams that block bull trout/Dolly Varden passage on the upper Bumping and upper Tieton rivers, bull trout/Dolly Varden are able to migrate freely within the system. Although the genetic characteristics of the stock have not been determined, bull trout/Dolly Varden in the Naches River drainage are considered distinct based on physical, geographical and thermal isolating factors.

Limited information on bull trout/Dolly Varden spawning location and spawn timing is available for Rattlesnake Creek and the American River, but no information is available

STOCK DEFINITION PROFILE for Naches Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

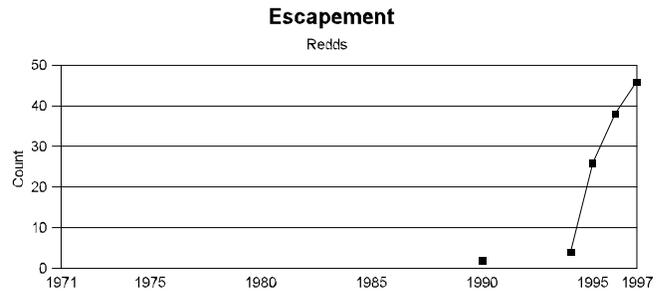
DISTINCT? - Unknown

STOCK STATUS PROFILE for Naches Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	ESCAPE Redds	ESCAPE Redds		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90	2			
91				
92				
93				
94	4			
95	26			
96	38	25		
97	46	24		



Column 1: Rattlesnake Creek redd counts.
 Column 2: American River redd counts.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Critical

Screening Criteria
Chronically low

for other areas of the Naches River drainage. Most adult spawning probably occurs in September. Spawners may range in size from 200 mm to 457 mm in Rattlesnake Creek, but fish longer than 500 mm have been observed spawning in the American River. The age at maturity, sex ratio, fecundity, timing of fry emergence, and survival rates are all unknown.

STOCK STATUS

Stock status is critical, based on chronically low spawning escapement (redd counts). However, the trend reflects increasing numbers of redds. Columns one and two of the Stock Assessment section of the Stock Status Profile show index area redd counts for Rattlesnake Creek and the American River, respectively. Within the Rattlesnake drainage, the few redds found in Dog, Hindoo and Little Wildcat creeks are included in the Rattlesnake total. The 1990 and 1994 redd counts were incomplete and should not be used as an indicator of trend. Data quality is good.

These streams should not be viewed as the only spawning area bull trout/Dolly Varden use in this large drainage. It is estimated that the redd counts represent 60% to 80% of the total spawning population for the entire Naches drainage (excluding reservoirs). The low redd counts in the American River and in Rattlesnake Creek are not indicative of the available spawning habitat.

In the last two years WDFW has been working cooperatively with the U.S. Forest Service on identifying index areas and conducting redd counts.

FACTORS AFFECTING PRODUCTION

Habitat--Dams lacking fish passage capability that were built during the early 1900s (Tieton and Bumping dams) to create large irrigation storage reservoirs in the upper Naches drainage prevented annual migrations to some upper spawning tributaries. Fortunately, sufficient spawning habitat was available in other areas of the Naches drainage. In the past, unscreened or inadequate screening on irrigation diversions in the Naches drainage stranded bull trout/Dolly Varden and other species in irrigation canals. When this stranding occurs, fish cannot return to mainstem rivers and perish shortly after entering irrigation canals or when the canals are dewatered. Until recently, the irrigation diversion at Selah/Naches contributed to high fish mortality rates in the Naches. Thanks to funds that were made available through the Northwest Power Planning Council's Fish and Wildlife Program, old screens have been replaced with new ones. Recent improvements in screen design and more stringent screening requirements have eliminated or substantially reduced fish stranding and passage problems. The last major diversion to be upgraded was the Yakima/Tieton Diversion; a new screen is now in place.

Other important habitat limiting factors contributing to decreased bull trout/Dolly Varden production include high sediment loads and turbid water conditions following (heavy rain or rapid snow-melt events or high and turbid water conditions during irrigation water releases from Rimrock Lake). Such conditions scour redds and deposit sediment on spawning gravels. Shoreline/floodplain development and diking, especially on the mainstem Naches, reduces shoreline cover and increases water temperature. Logging and road construction/maintenance activities create high sediment loads during spring runoff and rain events. They also reduce overhead cover and increase water temperature when logging occurs near streams. Road development in the Rattlesnake drainage, especially Cowpuncher Ridge Road contributes high sediment loads. Off-road vehicle (ORV) use in some areas of the Little Naches and Rattlesnake Creek is a problem (e.g., ORV's crossing or driving in the stream bed). Gold dredging in the late summer, especially in the Little Naches, is also a concern. Dredging may disrupt migration and spawning of bull trout/Dolly Varden during the late summer. An irrigation diversion in the lower Rattlesnake Creek may create a low-water barrier to bull trout/Dolly Varden migration during the late summer. Irrigation water withdrawals increase and exacerbate low flow conditions. Irrigation return flows and non-point runoff from agriculture in the lower Naches River increase sediment loading and decrease water quality.

Although all of the factors mentioned above contribute to decreased bull trout/Dolly Varden production some excellent habitat conditions are still present in the Naches drainage (e.g., American River, Rattlesnake Creek). Although development continues to expand and bull trout/Dolly Varden habitat continues to shrink, bull trout/Dolly Varden persist in areas where streams penetrate into unroaded wilderness areas, or where large riparian buffers exist or where development has not occurred.

Harvest Management--Restrictive fishing regulations for bull trout/Dolly Varden began in 1986 with a one-fish catch limit and an eight-inch minimum size limit in streams. Additionally, fishing for bull trout/Dolly Varden was prohibited from August 15 to September 30 to protect spawning fish. Catch-and-release regulations were implemented in 1990 on Rattlesnake Creek, and in 1992 fishing for bull trout/Dolly Varden was prohibited in the Naches River drainage. Beginning in 1998 there is a total fishing season closure on a section of Union Creek to protect spawning and early-rearing bull trout.

Although bull trout/Dolly Varden appear in catch records dating back to the 1930s, few fish were harvested relative to the catch of other species. Bull trout/Dolly Varden were probably targeted by few anglers due to their lower abundance and because they were not as highly regarded as other gamefish. Historical catch information was based on random creel checks of anglers during the fishing season. The census procedures were not standardized and were often not conducted during consecutive years (there are many years with no data). This type of catch information is useful only for showing the

presence of bull trout/Dolly Varden in a particular stream and possibly their relative abundance compared to other species.

Although angling impacts and harvest are not entirely known, they may have been significant, at least from the 1960s to the early 1990s, when catchable-size rainbow trout were stocked in the Naches drainage. Stocking probably occurred before 1960 as well, but these earlier records are not readily available. Stocking hatchery rainbow trout into bull trout/Dolly Varden streams increased angling use and harvest which probably increased the incidental catch of bull trout/Dolly Varden. Despite restrictive fishing regulations for bull trout/Dolly Varden, the continued use of bait in the Naches drainage by anglers fishing for rainbow trout increases the hooking mortality of incidentally caught and released bull trout/Dolly Varden. The combination of hatchery-stocked rainbow trout, large catch limits, the use of bait and easy public access to the mainstem and tributary streams generated high angling pressure that probably had negative impacts on the wild bull trout/Dolly Varden stock. However, beginning in 1998 the use of bait and barbed treble hooks is prohibited in the Naches, Little Naches, Bumping and American rivers (including the Ranier Fork) and in Cowiche Creek, thereby reducing the mortality rate of released bull trout.

Hatchery--Catchable-size hatchery rainbow trout were stocked annually into the Naches River drainage for at least the past 30 years. We do not know what effect this stocking had on bull trout/Dolly Varden, but it is likely that they were negatively impacted. Impacts to bull trout/Dolly Varden probably included competition for food and space, predation on bull trout/Dolly Varden juveniles, and increased angler harvest rates, including increased incidental catch of bull trout/Dolly Varden. The rainbow trout stocking program was eliminated in the Naches River and other large tributaries (except the Tieton River) in the early 1990s to avoid potential impacts to native fish species, including bull trout/Dolly Varden.

Non-native brook trout were historically planted in the Naches River drainage, and now there are self-sustaining populations in a few areas. Potential bull trout/Dolly Varden hybridization with brook trout, particularly in the American River, is a concern.

In 1995 the Yakama Indian Nation began stocking hatchery coho into various bull trout/Dolly Varden streams within the Naches River drainage in an effort to reestablish self-sustaining populations (coho have been extinct in the Yakima basin for many years). It is not known what impacts, if any, coho will have on bull trout/Dolly Varden. Coho juveniles are known to be more aggressive than other anadromous or resident species, and there is the potential of competing with or preying on bull trout/Dolly Varden fry. Generally, in drainages colonized by anadromous salmon and steelhead the bull trout/Dolly Varden have successfully co-existed by occupying a different niche. However, negative interactions can occur when hatchery fish (anadromous or otherwise) are stocked near bull trout/Dolly Varden spawning and rearing areas.

YAKIMA -- RIMROCK LAKE BULL TROUT

In the 1998 inventory, this stock was identified as a bull trout/Dolly Varden stock. Subsequent genetic analysis of samples collected in the South Fork Tieton and Indian Creek 1996 (N = 123) and in the South Fork Tieton in 1998 (N = 21) indicated that all of the fish in the samples were bull trout.

STOCK DEFINITION AND ORIGIN

Rimrock Lake bull trout have been identified as a distinct stock based on their geographic distribution. They originated from native fluvial/resident life history forms that occurred in the Tieton River, a tributary of the Naches River. Rimrock Lake bull trout are considered distinct based on their physical and geographical isolation of spawning adults above Tieton Dam. After construction of the dam in 1925, the resulting isolated population exhibited an adfluvial life history.

There are a few references (mostly old catch records) that indicate the presence of bull trout in other parts of the Rimrock Lake drainage including Clear Lake and Dog Lake. Historical catch information shows only one bull trout was caught in Dog Lake. This was likely a misidentified eastern brook trout. At Clear Lake, bull trout were recorded in the catch of anglers throughout the 1950s, but few have been caught since then. Some of these records date back to the 1930s. However, in 1993 U.S. Forest Service staff reported capturing one 75 mm to 100 mm bull trout from a minnow trap in Clear Lake, and in 1996 biologists from Central Washington University observed an adult bull trout in the upper North Fork Tieton River (a tributary of Clear Lake) (Paul James, Central Washington University, personal communication).

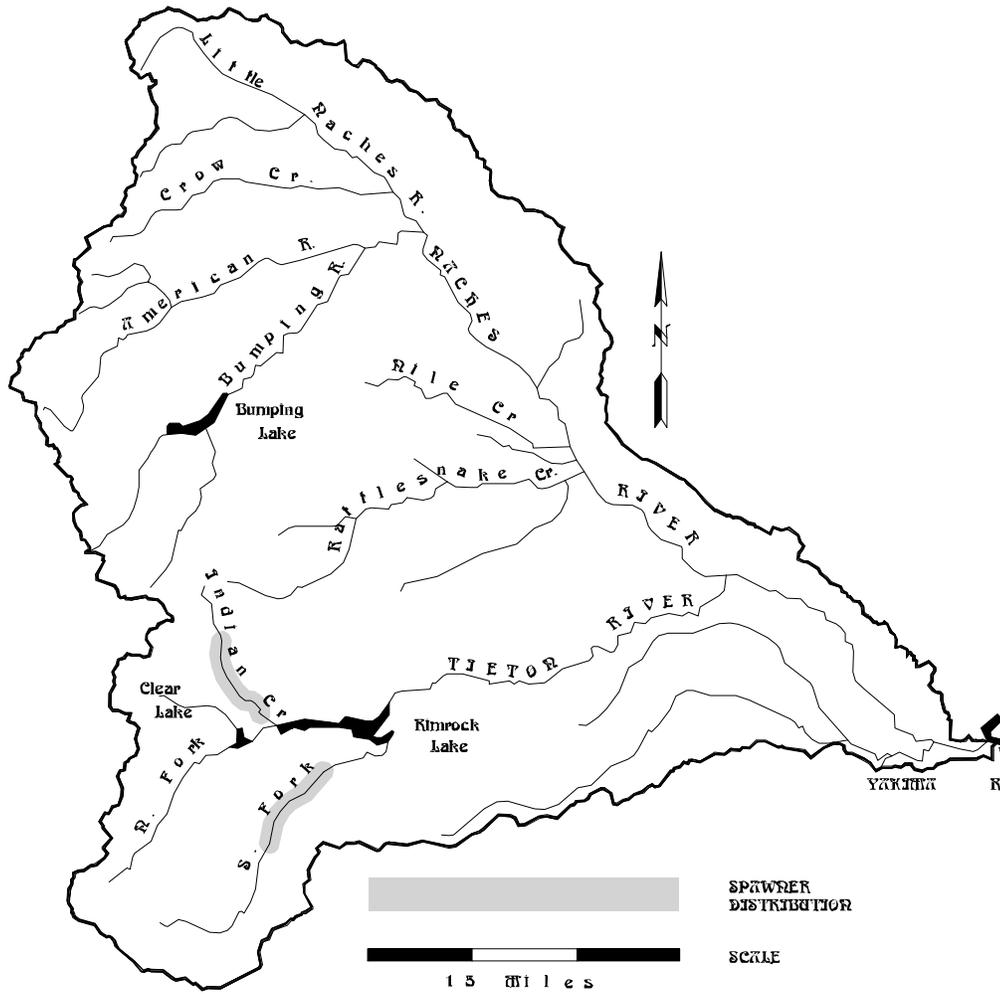
Adult spawning occurs in two drainages of Rimrock Lake, Indian Creek and the South Fork Tieton River. Bull trout also spawn in Bear Creek, a tributary of the South Fork Tieton (redds observed in Bear Creek are included in the redd count for the South Fork). Juvenile bull trout have been observed in several other South Fork Tieton tributaries including Short and Dirty Creek, Grey Creek, Spruce Creek and Corral Creek. Although bull trout are present in the North Fork Tieton River below Clear Lake Dam, spawning activity has not been observed there. Spawning occurs from late August to early October although bull trout begin to stage in the South Fork Tieton as early as July.

The majority of adult spawners range from 457 mm to 610 mm in total length. However, fish from 200 mm to 800 mm have been observed during spawning surveys and trap monitoring. The age at maturity is unknown, but first time spawners are probably 5+ years. Sex ratio and fecundity are unknown.

STOCK DEFINITION PROFILE for Rimrock Lake Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Adfluvial Riv Entry													
Spawning								█					Yes
								█					No

Adfluvial river entry for Indian Creek is mid-August to mid-September. Adfluvial river entry is Distinct for South Fork Tieton, not Indian Creek. Spawn timing is the same for both.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Rimrock Lake Bull Trout

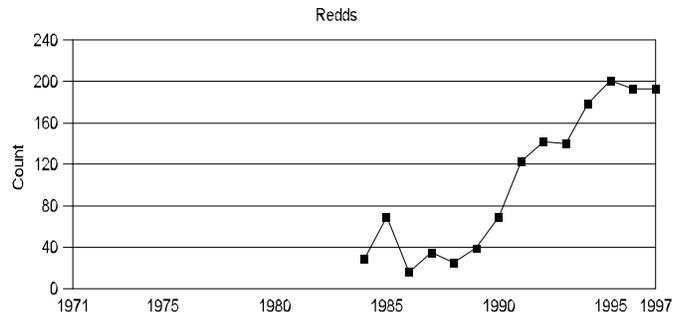
STOCK ASSESSMENT

DATA QUALITY -----> Excellent

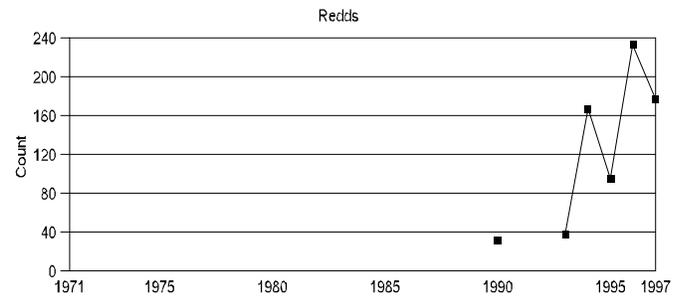
Return Years	ESCAPE Redds	ESCAPE Redds		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84	29			
85	69			
86	16			
87	35			
88	25			
89	39			
90	69	32		
91	123			
92	142			
93	140	38		
94	179	167		
95	201	95		
96	193	233		
97	193	177		

Column 1: Indian Creek counts.
 Column 2: South Fork Tieton River counts.

Escapement



Escapement



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

Although the timing of fry emergence has not been specifically determined, it probably occurs in March as reported in the literature for other populations. Survival rates are unknown. Rearing juveniles probably spend several years in tributary streams before migrating to Rimrock Lake.

STOCK STATUS

The status of the stock is Healthy based on increasing trends in spawning escapement (redd counts). Columns one and two of the Stock Assessment section of the Stock Status Profile show redd counts for Indian Creek and the South Fork Tieton River, respectively. The counts in Indian Creek in 1984 through 1987 and in the South Fork Tieton in 1990 were incomplete and should not be used as indicators of trends. Otherwise, data quality is excellent. In Indian Creek, redd counts have increased from a low of 25 redds in 1988 to over 200 in 1995. Redd counts began in 1990 in the South Fork Tieton River and although they have fluctuated more than those in Indian Creek, there is a definite upward trend in the number of redds.

It is estimated that the redd counts in the Rimrock Lake drainage represent more than 98% of the total spawning population. The redd counts are not indicative of the available spawning habitat.

Since 1995 WDFW has been working cooperatively with the U.S. Bureau of Reclamation and Central Washington University on monitoring and research of the Rimrock Lake bull trout stock. Based upon initial indications of run timing and tagging work, it appears that the Indian Creek and South Fork Tieton fish may be two distinct spawning populations. Ongoing data collection on the population dynamics and life history attributes of these two stocks will be valuable for addressing stock identification issues and management plans in the future.

FACTORS AFFECTING PRODUCTION

Habitat--In the South Fork Tieton River, cattle grazing and jeep/off-road vehicle use destroy riparian vegetation and erode stream banks increasing sediment loads in spawning areas. Cattle also cause direct impacts by trampling redds on U.S. Forest Service lands in the South Fork Tieton. In Indian Creek, low flows during the spawning period may limit spawner access in some areas and high winter/spring runoff shifts the stream bedload and controls channel complexity. Although these conditions may ultimately affect bull trout production in Indian Creek, at least for now it appears that the fish have adapted well enough to increase their population abundance (annual redd counts have increased every year since 1988). Favorable habitat conditions including clean cold spring water with good overhead cover and in-stream woody debris are primary elements that have enabled increased production in Indian Creek. We do not

know what effect large irrigation water releases from Rimrock Lake during the summer/fall may have on the stock.

Harvest Management--Restrictive fishing regulations for native char began in 1984 with a one-fish catch limit and 20-inch minimum size limit for fish caught in the lake and six inches for fish caught in tributary streams. In 1986 the minimum length was increased to eight inches in streams, and fishing for native char in lakes and streams was closed from August 15 to September 30 to protect spawning fish. Beginning in 1992 fishing for bull trout was prohibited in the Rimrock Lake drainage. In addition, there have been total fishing season closures on Indian Creek and a section of the South Fork Tieton River since 1990 and 1995, respectively to protect spawning and rearing bull trout. Beginning in 1998 a section of Bear Creek (a tributary to the South Fork) is included in the total fishing season closure. It appears that increases in escapement over the past eight years have been a direct result of restrictive fishing regulations.

Although bull trout appear in the catch records dating back to the 1930s, few fish were harvested relative to other species. Bull trout were probably targeted by few anglers due to their lower abundance and because they were not as highly regarded as other gamefish. Historical catch information was based on random creel checks of anglers during the fishing season. The census procedures were not standardized and were often not conducted during consecutive years (there are many years with no data). This type of catch information is useful only for showing the presence of bull trout in a particular lake or stream and possibly their relative abundance compared to that of other species.

Although angling impacts and harvest are not entirely known, they may have been significant in some areas of the drainage. The South Fork and North Fork Tieton rivers have been stocked with catchable-size rainbow trout at least since the early 1960's. Stocking probably occurred before 1960 as well, but these earlier records are not readily available. Stocking hatchery rainbow trout into native char streams increased angling use and harvest which probably increased the incidental catch of native char. Despite restrictive fishing regulations for native char, the continued use of bait in these rivers by anglers fishing for hatchery rainbow trout increases the hooking mortality of incidentally caught and released bull native char. The combination of stocked hatchery rainbow, large catch limits, the use of bait and easy public access to these rivers generated high angling pressure that probably had negative impacts to the wild bull trout stock.

Poaching has been a problem in some areas, particularly in the South Fork Tieton River. The combination of easy public access to the spawning grounds and the early migration of adult spawners into the river during the high summer recreational-use period compounds the problem. However, a recent fishing season closure on the spawning grounds, posting bull trout information signs in the area, and increased enforcement patrols are reducing the incidence of poaching.

Hatchery--Catchable-size hatchery rainbow trout were stocked annually into the South Fork and North Fork Tieton rivers for at least the past 30 years. We do not know what effect this stocking had on bull trout, but it is likely that they were negatively impacted. Impacts to bull trout probably included in the form of competition for food and space, predation on juveniles, and increased angler harvest rates of spawning adults. The rainbow trout stocking program in these streams was eliminated in the early 1990's to avoid potential impacts to native fish species in spawning and rearing areas. Although rainbow trout fry are stocked into Rimrock Lake to provide increased angling opportunity, it does not appear that this stocking program is impacting bull trout. Rainbows have not been observed moving into bull trout spawning areas (thus species interactions appear to be nil) and although bull trout are occasionally caught in the lake by anglers fishing for kokanee or rainbows, they are infrequently encountered. During most of the year bull trout reside in the reservoir and are not subjected to the intense angling pressure that can occur when they are concentrated in the spawning areas of streams.

Non-native brook trout were stocked in the Rimrock Lake drainage in the past, but stocking was eliminated due to concerns over hybridization with bull trout. However, naturally-reproducing brook trout populations still persist in some areas of the drainage. Although a few brook trout have been observed in Indian Creek, and one bull/brook hybrid was captured in October, 1994 in a trap at the mouth of Indian Creek (hybridization was confirmed through genetic analysis), widespread hybridization does not appear to have occurred in the drainage.

YAKIMA -- BUMPING LAKE BULL TROUT

In the 1998 inventory, this stock was identified as a bull trout/Dolly Varden stock. Subsequent genetic analysis of samples collected from Deep Creek in 1997 (N = 49) indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

Bumping Lake bull trout have been identified as a distinct stock based on their geographic distribution. They may have originated from a native adfluvial life history form even before the construction of a dam on the Bumping River, a tributary of the Naches River. Fluvial/resident forms may have been present as well since they currently inhabit streams in the drainage below Bumping Lake Dam. Regardless, construction of the dam in 1910 enlarged the natural lake and relegated the bull trout stock to an adfluvial life history. Bumping Lake bull trout are considered distinct based on physical and geographical isolation of spawning adults above Bumping Lake Dam.

Deep Creek appears to be the only tributary of Bumping Lake where bull trout spawn. Spawning occurs from late August to mid-September.

The majority of adult spawners range from 457 mm to 610 mm in total length, although larger fish have been observed during spawning surveys. The age at maturity is unknown, but first time spawners are probably 5+ years. Sex ratio and fecundity are also unknown.

Although the timing of fry emergence has not been specifically determined, it probably occurs in March. Survival rates are unknown. Rearing juveniles probably spend several years in Deep Creek before migrating to Bumping Lake.

STOCK STATUS

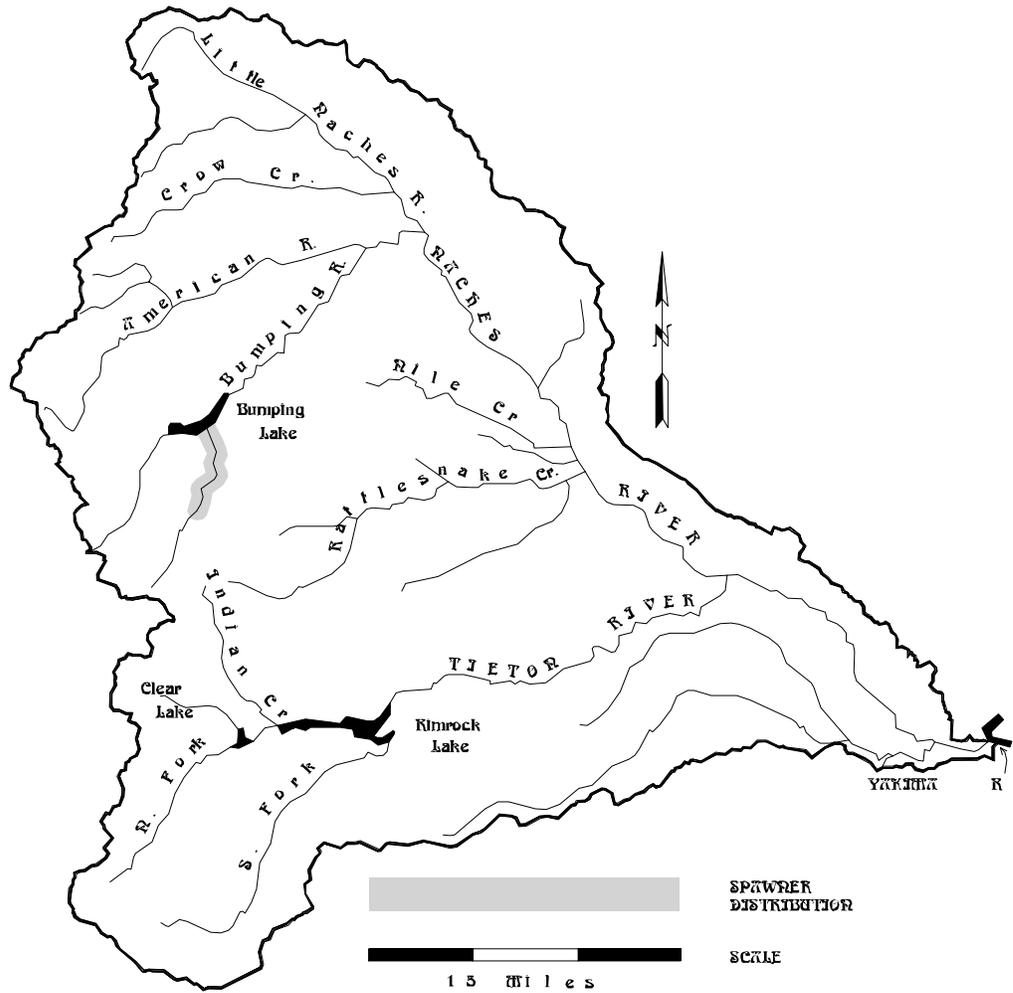
The status of the stock is Depressed based on short-term severe declines in spawning escapement (redd counts) in 1993, 1994 and 1996. Redd counts conducted in 1989 and 1990 were incomplete and should not be used as an indicator of trend. Otherwise, data quality is excellent. The severe declines in redd counts (1993, 1994, 1996) appear to be related to local drought conditions during the spawning period which caused sections of the stream to dry up, thus prohibiting access by migrating adults. Weak year-class strength may also be a factor.

In 1997 WDFW began working with the U.S. Bureau of Reclamation and Central Washington University on monitoring and research of the Bumping Lake bull trout stock. Trapping/tagging studies of adult spawners migrating into Deep Creek will increase our knowledge of population dynamics and life history attributes.

STOCK DEFINITION PROFILE for Bumping Lake Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

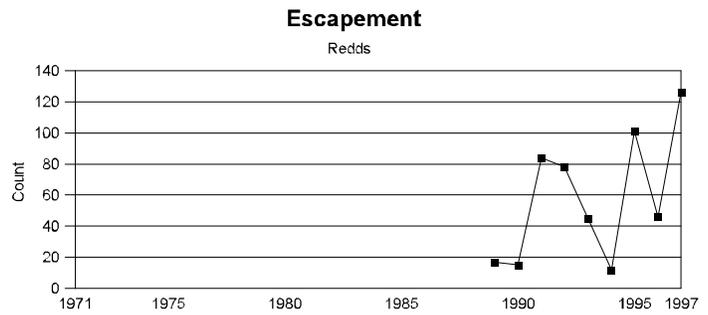
STOCK STATUS PROFILE for Bumping Lake Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds			
--------------	--------------	--	--	--

73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	
88	
89	17
90	15
91	84
92	78
93	45
94	12
95	101
96	46
97	126



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

It is estimated that the redd counts in the Bumping Lake drainage represent more than 98% of the total spawning population. The redd counts are not indicative of the available spawning habitat.

FACTORS AFFECTING PRODUCTION

Habitat--The principal factors limiting bull trout production within the Bumping Lake drainage are caused by low flows during the spawning period which limits access to spawning areas and strands rearing juveniles in dry channel beds. It is not known what effect large irrigation water releases from Bumping Lake may have on the stock. Habitat quality is very good in the lake and in the spawning areas. Habitat conditions include clean, cold spring water with excellent overhead cover and in-stream woody debris.

In 1950 Bumping Lake was treated with rotenone to kill squawfish and suckers. This also killed a variety of other fish species, including bull trout. Obviously bull trout were able to recolonize the lake in subsequent years, but it was probably a slow rebuilding process.

Harvest Management--Restrictive fishing regulations for native char began in 1984 with a one-fish catch limit and 20-inch minimum size limit for fish caught in the lake and six inches for fish caught in tributary streams. In 1986 the minimum size limit was increased to eight inches in streams, and fishing for native char in lakes and streams was closed from August 15 to September 30 to protect spawning fish. Beginning in 1992 fishing for native char was prohibited in the Bumping Lake drainage. In addition, there has been a total fishing season closure in a section of Deep Creek since 1995 to protect spawning and rearing bull trout.

Although bull trout appear in the catch records dating back to the 1940's, few fish were harvested relative to the catch of other species. Bull trout were probably targeted by few anglers due to their lower abundance and because they were not as highly regarded as other gamefish. Historical catch information was based on random creel checks of anglers during the fishing season. The census procedures were not standardized and were often not conducted during consecutive years (there are many years with no data). This type of catch information is useful only for showing the presence of bull trout in a particular lake or stream and possibly their relative abundance compared to other species.

Although angling impacts and harvest are not known, they may have been significant in some areas of the drainage, particularly in Deep Creek. Large adfluvial spawning bull trout were easily harvested from this spawning tributary prior to the implementation of restrictive fishing regulations in the mid-1980s. Poaching has also been a problem in Deep Creek. Easy public access to the spawning grounds of bull trout compounds the problem. However, a recent fishing season closure on the spawning grounds, posting

bull trout information signs in the area and increased enforcement patrols are reducing the incidence of poaching.

Hatchery--Hatchery rainbow trout have been stocked into Bumping Lake for at least the past 25 years. Although catchable-size rainbows are no longer stocked in the lake, rainbow fry continue to be stocked. This stocking program is intended to increase angling opportunity and trout catch rates. It does not appear that stocking rainbow trout fry is negatively impacting bull trout as is often the case when catchable-size hatchery rainbows are stocked into native char streams (e.g., negative impacts to native char include competition for food and space, predation on juveniles by rainbow and increased harvest of spawning adults). Rainbows have not been observed moving into bull trout spawning areas (thus species interactions appear to be nil) and although bull trout are occasionally caught in the lake by anglers fishing for kokanee or rainbows, they are infrequently encountered.

Non-native brook trout were stocked in the Bumping Lake drainage in the past, but stocking was eliminated due to concerns over hybridization with bull trout. Although naturally-reproducing brook trout populations still persist in some areas of the drainage, they do not appear to be causing negative impacts to the bull trout stock (hybridization has not been observed). This may be due to the low number of brook trout that occur in bull trout spawning areas.

YAKIMA -- NORTH FORK TEANAWAY BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

North Fork Teanaway bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. Very little is known about the bull trout/Dolly Varden stock in the North Fork Teanaway River, a tributary of the Teanaway and upper Yakima rivers. However, bull trout/Dolly Varden appear to be more abundant in the North Fork than in other upper Yakima River tributaries. Although the genetic characteristics of the stock have not been determined, this fluvial/resident stock is considered distinct based on the geographic distribution. Isolating factors in the lower Teanaway River including low flows and dewatering caused by irrigation diversions may preclude adult spawning migrations from the Yakima River during some years. Although the habitat appears to be suitable for bull trout/Dolly Varden in the West and Middle forks, no bull trout/Dolly Varden have been found in these streams. Bull trout/Dolly Varden have been observed only in the North Fork Teanaway and small tributary streams (i.e., Jungle, Jack, and DeRoux creeks). Most adult spawning probably occurs in September. Mature fish may range in size from 225 mm to 530 mm. The age at maturity, sex ratio and fecundity, timing of fry emergence and survival rates are all unknown.

North Fork Teanaway bull trout/Dolly Varden are native and are maintained by wild production.

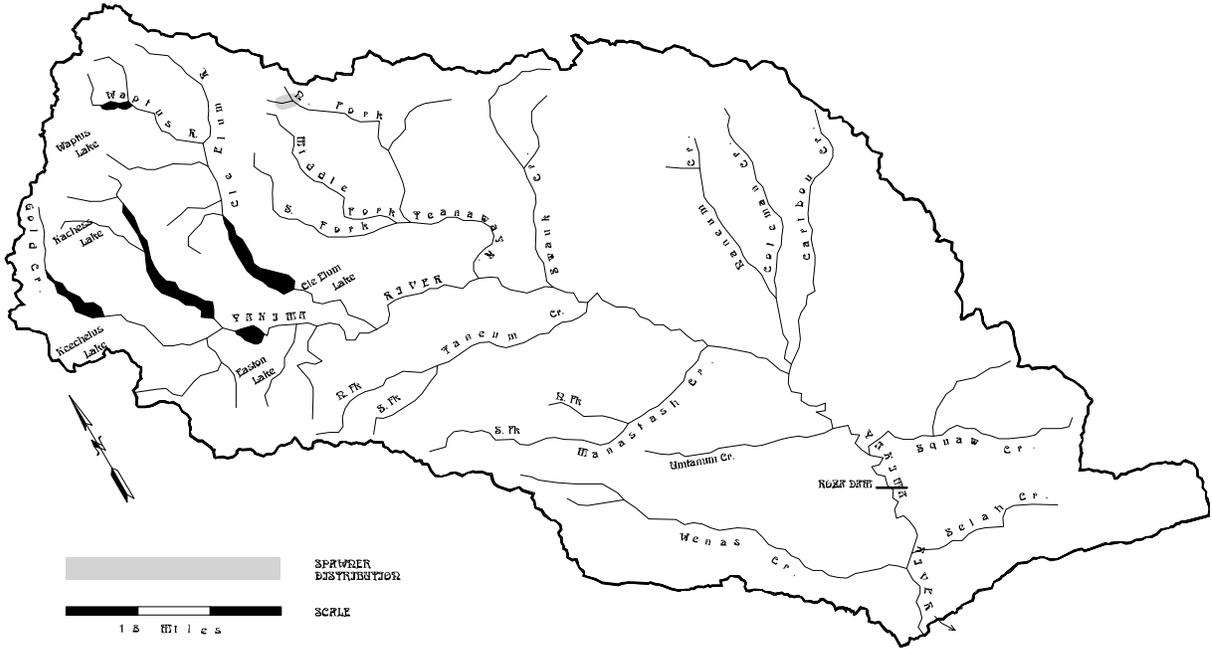
STOCK STATUS

The status of the stock is Critical based on chronically low numbers of fish observed in index areas, traps and low redd counts. WDFW staff collected bull trout/Dolly Varden information from traps during 1991 to 1994 and Index Count information with electrofishing equipment from 1990 to 1996. Spawning surveys began in 1996. Data quality is good. Only two redds were observed in DeRoux Creek (a small tributary of the North Fork). Most fish observed in index and trap counts ranged in size from 100 mm to 254 mm in total length. Index counts were based on electrofishing surveys conducted from July through in September in three 100-meter sections. Index-trap monitoring occurred during April/May at one site. The trap was operated in 1995 and 1996. Population estimates for the entire North Fork indicated a total of 54 bull trout in 1994 and a total of 10 bull trout in 1997. These estimates were based on snorkel surveys and include all size or age classes, juvenile through adult (mainstem North Fork only).

STOCK DEFINITION PROFILE for North Fork Teanaway Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
								█				Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for North Fork Teanaway Bull Trout/Dolly Varden

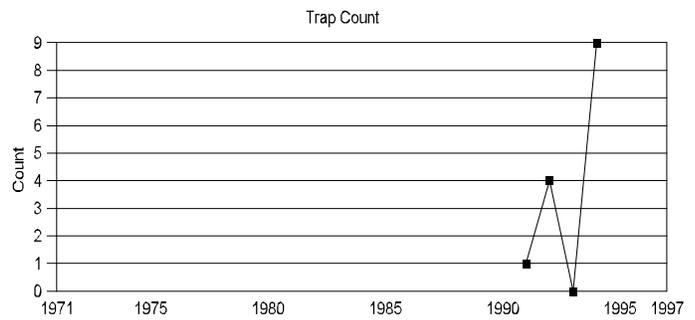
STOCK ASSESSMENT

DATA QUALITY -----> Good

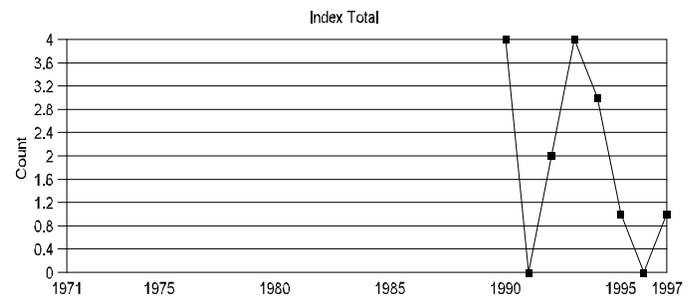
Return Years	ESCAPE Trap count	FW PROD Index Total	ESCAPE Redds	FW PROD Pop. est.
--------------	-------------------	---------------------	--------------	-------------------

73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90		4		
91	1	0		
92	4	2		
93	0	4		
94	9	3		54
95		1		
96		0	2	
97		1	0	10

Escapement



Freshwater Production



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Critical

Screening Criteria

Chronically low

FACTORS AFFECTING PRODUCTION

Habitat--In the past, unscreened irrigation diversions were a major problem in the Teanaway drainage because they created conditions that stranded bull trout/Dolly Varden and other species in irrigation canals. When this occurs fish cannot return to mainstem rivers and perish shortly after entering the canals or when the canals are dewatered. Although irrigation diversions are now screened in the North Fork Teanaway, some of the screens are inefficient at bypassing juvenile fish due to inadequate mesh size and poor approach velocities. However, there are plans to correct these deficiencies and upgrade the screens to current screening standards in the near future. Low water flows also affect the Teanaway River. Irrigation diversions create extreme low flows or dry channels, particularly in the lower river. Such conditions impede or prevent fish migration within the system. Timber harvests in or near riparian corridors in the upper watershed combined with excessive road densities contribute greatly to increased water temperatures, sediment loads and poor water quality in all downstream areas. Increased sediment loading smothers eggs or retards their development in the redds, reduces juvenile growth and elevates water temperatures causing stressful conditions for coldwater fish such as bull trout/Dolly Varden.

Harvest Management--Restrictive fishing regulations for bull trout/Dolly Varden began in 1986 with a one-fish catch limit and an eight-inch minimum size limit in streams. Additionally, fishing for bull trout/Dolly Varden was prohibited from August 15 to September 30 to protect spawning fish. In 1992 fishing for bull trout/Dolly Varden was prohibited in the Teanaway drainage.

Very little catch information exists for the Teanaway drainage, and few of the random creel checks conducted in the area identified bull trout/Dolly Varden in the catch. Hatchery rainbow trout were the predominant species recorded from angler creel checks. Although angling impacts and harvest are not known, they may have been significant, especially during the mid 1970s to early 1990s when catchable-size rainbow trout were stocked in the North Fork Teanaway River. Hatchery rainbow trout stocking increased angling opportunity and harvest which probably increased the incidental catch of bull trout/Dolly Varden. Despite restrictive fishing regulations for bull trout/Dolly Varden, the continued use of bait in the Teanaway drainage by anglers fishing for rainbow trout probably increases the hooking mortality of incidentally caught and released bull trout/Dolly Varden. However, beginning in 1998 the use of bait and barbed treble hooks were prohibited in the North Fork and in DeRoux Creek, thereby reducing the mortality rate of released bull trout.

Hatchery--Rainbow trout have been periodically stocked in the North Fork Teanaway since the early 1930s. For the most part, rainbow trout fry were stocked until the mid-1970s, then stocking was switched to catchable-size rainbow. It is not known what effect this stocking had on bull trout/Dolly Varden, but it is likely that they were negatively

impacted. Impacts to bull trout/Dolly Varden probably included competition for food and space, predation on juvenile bull trout/Dolly Varden by rainbow, and increased harvest rates of trout by anglers (including the increased incidental catch of bull trout/Dolly Varden). The rainbow trout stocking program was eliminated in the Teanaway tributaries in the early 1990s to avoid potential impacts to native fish species, including bull trout/Dolly Varden.

Currently, there are plans to supplement spring chinook populations in the Yakima River subbasin. Hatchery facilities will be built and an acclimation pond for spring chinook will be constructed in the North Fork Teanaway River. Biologists responsible for managing the facility believe that spring chinook will not impact the local bull trout/Dolly Varden stock because the acclimation facility will be constructed downstream of bull trout/Dolly Varden headwater areas. Furthermore, it is assumed that returning spring chinook adults and their progeny will not encroach into bull trout/Dolly Varden areas and that temporal and spatial segregation will occur, even though bull trout/Dolly Varden have been captured in traps near the acclimation site.

Historically, bull trout/Dolly Varden and chinook salmon occurred together in many areas of the basin. Bull trout/Dolly Varden probably benefited from the presence of anadromous salmonids such as spring chinook. The downstream drift of eggs released from spawning salmon provided food for bull trout/Dolly Varden and other resident fishes, but more importantly the presence of decaying salmon carcasses greatly benefitted juvenile salmon and resident fishes by recycling nutrients. Generally, in drainages colonized by wild anadromous salmon and steelhead, bull trout/Dolly Varden have successfully co-existed by occupying a slightly different ecological niche.

However, in many areas where bull trout/Dolly Varden exist, habitat conditions have deteriorated, and natural predator/prey balances have been upset. Bull trout/Dolly Varden populations are at or near critically low levels in many areas of the basin. Concern exists over acclimating or stocking large numbers of hatchery fish into bull trout/Dolly Varden streams that are already being impacted by unfavorable habitat conditions. Great care should be taken to avoid actions that will push bull trout/Dolly Varden to extinction.

YAKIMA -- CLE ELUM/WAPTUS LAKES BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Cle Elum Lake/Waptus Lakes bull trout/Dolly Varden are considered distinct based on their physical and geographical isolation above Cle Elum Lake Dam. They may have originated from a native adfluvial life history form even before the construction of a dam on the Cle Elum River, a tributary of the upper Yakima River. Fluvial forms may have been present in the area as well, although currently very few are encountered in the mainstem Yakima River below the Cle Elum drainage. Regardless, construction of the dam in 1931 enlarged the natural lake and relegated the bull trout/Dolly Varden stock to an adfluvial life history.

Old catch records indicate that bull trout/Dolly Varden were present in Waptus Lake (which lies in the headwaters of the Cle Elum drainage) in the 1940s and early 1950s, but no catch data have been collected since then. WDFW biologists only recently confirmed the presence of bull trout in Waptus Lake by capturing a single 190 mm fish from a gill net in 1996 and a 470 mm fish by hook and line in 1997. Surveys to identify spawning locations have been unsuccessful so far. It is not known what relationship, if any, there is between bull trout/Dolly Varden inhabiting Waptus and Cle Elum lakes. A falls located on the lower Waptus River between Waptus and Cle Elum Lakes may serve as an effective barrier to bull trout/Dolly Varden migration between the two systems. Until additional investigations can be conducted to address the question, Cle Elum and Waptus lakes will be considered together.

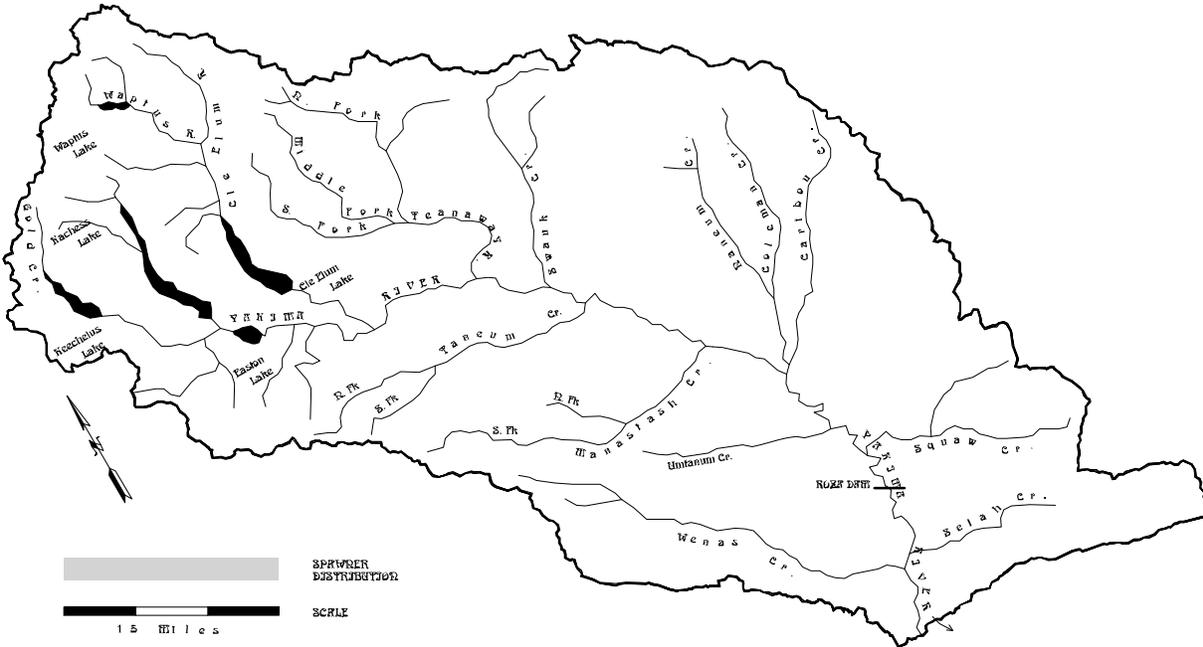
The genetic characteristics of the Cle Elum/Waptus lakes stock have not been determined. No information is available on their relative abundance, or about where and when they spawn. Other stock attributes need to be determined as well, such as age and size structure, sex ratio and fecundity, fry emergence time and survival rates. All we can confirm at this time is that bull trout/Dolly Varden are currently present in Cle Elum Lake. This statement is based on 17 fish that were captured in traps set in the lake during 1990 to 1993 by the National Marine Fisheries Service while conducting studies on the feasibility of reestablishing sockeye salmon in the Yakima basin. Bull trout/Dolly Varden ranged in size from 150 mm to 400 mm. In 1996, biologists from Central Washington University (Paul James, Central Washington University, personal communication) observed several adult bull trout/Dolly Varden in the upper Cle Elum River in late August. These fish appeared to be migrating upstream, presumably to spawn.

STOCK DEFINITION PROFILE for Cle Elum/Wapatus Lks Bull Trout/Dolly Varden

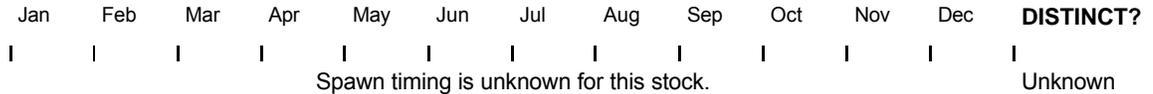
SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Cle Elum/Waptus Lakes Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

STOCK STATUS

Stock status is Unknown. Currently, little information is available to determine the status of the bull trout/Dolly Varden stock in the Cle Elum/Waptus drainage. However, based on recent WDFW surveys there appear to be very low numbers of bull trout/Dolly Varden in the drainage. Status may be Critical.

FACTORS AFFECTING PRODUCTION

Habitat--Habitat factors affecting bull trout/Dolly Varden production within the Cle Elum Lake drainage are not well understood primarily because there is no quantitative information on the bull trout/Dolly Varden stock or on the habitat characteristics in the drainage. However, it is likely that many of the same limiting factors prevalent in other nearby reservoirs where adfluvial bull trout/Dolly Varden stocks exist also affect the Cle Elum drainage since many of the same type of activities occur there (e.g., logging, road construction, irrigation water releases, poaching, natural variations in flows, etc.). Although poor land-use and land-management practices occur in the Cle Elum drainage, in-stream and riparian habitat quality is generally good to excellent in the tributaries, and there is cold, clean water in the lake and in the streams, particularly in the upper portions of the Cle Elum drainage and in the Alpine Lakes Wilderness around Waptus Lake.

The major limiting habitat factor in the Waptus drainage seems to be low stream flows in the upper Waptus River during the late summer migration period. The lake is located in a wilderness area and is not subjected to human development activities. Tributaries of Waptus Lake, especially the upper Waptus River have excellent water quality, in-stream woody debris, pools and backwater rearing areas for bull trout/Dolly Varden.

Harvest Management--Restrictive fishing regulations for bull trout/Dolly Varden began in 1986 with a one-fish catch limit and a 20-inch minimum size limit for fish caught in the lake and eight inches for fish caught in streams. In addition fishing for bull trout/Dolly Varden was prohibited in lakes and streams from August 15 to September 30 to protect spawning fish. Beginning in 1992 fishing for bull trout/Dolly Varden was prohibited in the Cle Elum/Waptus drainage.

There is very little historical harvest information for bull trout/Dolly Varden in the Cle Elum/Waptus drainage. One fish was harvested from Cle Elum Lake in 1981 and a few dozen fish harvested from Waptus Lake during the 1940s and 1950s.

Hatchery--Rainbow trout and kokanee have been the primary species stocked into Cle Elum Lake since the early 1930s. Cutthroat trout and rainbow trout have been stocked in higher-elevation lakes of the drainage as well. Kokanee probably have had a positive impact on bull trout/Dolly Varden because they have served as an important food source. Natural reproduction of kokanee may occur in some tributary streams, but is

probably limited. Other than providing food for adult bull trout/Dolly Varden, rainbow and kokanee releases have probably had no impact on bull trout/Dolly Varden in Cle Elum Lake.

Non-native brook trout were stocked in the upper Cle Elum/Waptus drainage in the past, but stocking was eliminated due to concerns over potential hybridization with bull trout/Dolly Varden. Unfortunately, naturally-reproducing brook trout are now prevalent in the upper Cle Elum River, Fish Lake, Cooper Lake and Waptus Lake. This is a very great concern in Waptus Lake because brook trout appear to be abundant in the lake and are probably spawning in tributaries that would be suitable for bull trout/Dolly Varden. Preliminary fisheries surveys in the Waptus lake drainage in summer, 1995 indicate a healthy naturally-reproducing population of brook trout. It is quite possible that bull trout/Dolly Varden are in danger of being extirpated in the Waptus Lake area due to competition and hybridization with brook trout.

Two other exotic predatory species that occur in the drainage are brown trout and lake trout. Brown trout were discovered in Cooper Lake (upper Cle Elum/Cooper River drainage) in 1987. Apparently this species was illegally introduced, probably in the late 1970s. Fisheries surveys conducted in Cooper Lake in 1995 confirmed a wide range of sizes of brown trout, suggesting that natural reproduction is occurring. In 1996, brown trout were discovered in the lower Waptus River by WDFW biologists. We hope that brown trout do not continue to invade other parts of the Cle Elum drainage to compete with or prey on bull trout/Dolly Varden.

Lake trout are present in Cle Elum Lake and although these fish are naturally reproducing in the lake, they do not appear to be very abundant, as evidenced by catch data. However, few anglers have targeted lake trout, thus, it is difficult to estimate their abundance based on current catch data. The species certainly has the potential to compete with or prey on bull trout/Dolly Varden. Lake trout were probably stocked into Cle Elum Lake before 1933.

YAKIMA -- KACHESS LAKE BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of samples collected in Mineral Creek (N = 51) and Box Canyon Creek (N = 6) in 1998 indicated that all of the fish in the samples were bull trout.

STOCK DEFINITION AND ORIGIN

Kachess Lake bull trout have been identified as a distinct stock based on their geographic distribution. They may have originated from a native adfluvial life history form even before the construction of a dam on the Kachess River, a tributary of the upper Yakima River. Fluvial forms may have been present in the area as well, although currently very few are encountered in the mainstem Yakima River below the Kachess drainage. Regardless, construction of the dam in 1905 enlarged the natural lake and relegated the bull trout stock to an adfluvial life history. Although the genetic characteristics of the stock have not been determined, Kachess Lake bull trout are considered distinct based on the physical and geographical isolation of spawning adults above Kachess Lake Dam.

Adult spawning occurs primarily in Box Canyon Creek but may also occur in the upper Kachess River and in Mineral Creek when adequate flows are available. Although bull trout have been observed in the latter two streams, there are no data to confirm spawning activity. Additional investigation is needed. Spawning occurs from early September to mid-October in Box Canyon Creek, although some bull trout can be observed holding in the deeper pools in late August.

The majority of adult spawners range from 457 mm to 610 mm in total length, although larger fish have been observed during spawning surveys. Very little information is available on the age composition of the spawning population as only a few fish have been aged. Most spawning adults are probably at least five or six years old with some twice that age. The sex ratio and fecundity are unknown.

Although the timing of fry emergence has not been determined, it probably occurs in March. Survival rates are unknown. Rearing juveniles probably spend several years in Box Canyon Creek before migrating to Kachess Lake.

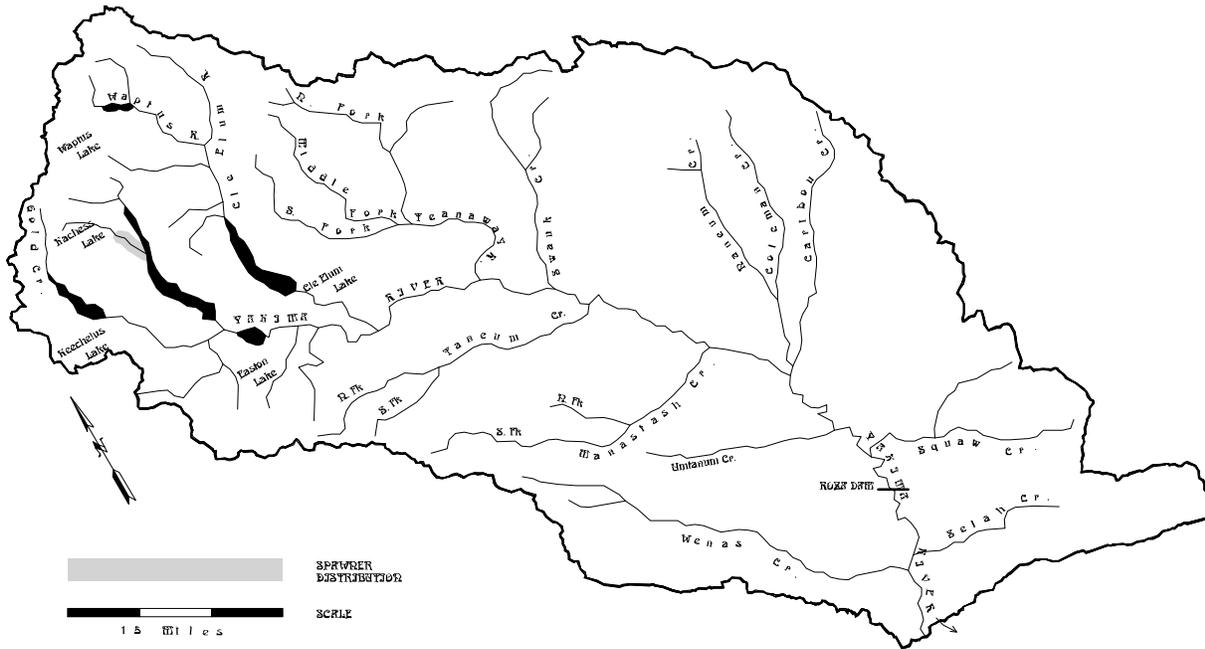
STOCK STATUS

The status of the stock is Critical based on chronically low spawning escapement (redd counts) since 1984. Data quality is excellent. The extremely low population size may have affected the genetic variability of the stock thus decreasing its overall fitness. The highest redd count in Box Canyon Creek was eleven in 1994. There have been fewer

STOCK DEFINITION PROFILE for Kachess Lake Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

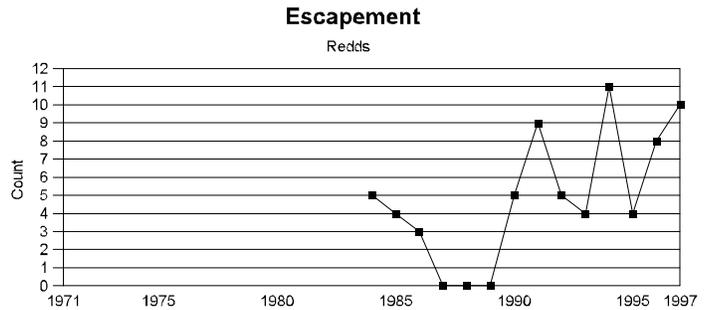
STOCK STATUS PROFILE for Kachess Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds			
--------------	--------------	--	--	--

73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	5
85	4
86	3
87	0
88	0
89	0
90	5
91	9
92	5
93	4
94	11
95	4
96	8
97	10



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Critical

Screening Criteria
Chronically low

than a half-dozen redds in any given year for ten of the last fourteen years (the entire period for which data are available). The Kachess Lake stock is very near extirpation. It is estimated that the redd counts in the Kachess Lake drainage represent more than 98% of the total spawning population. The redds counts are not indicative of the available spawning habitat.

FACTORS AFFECTING PRODUCTION

Habitat--During the spawning period the water level in the reservoir is lowered below the confluence of Box Canyon Creek which causes extremely shallow and dispersed attraction flows that inhibit bull trout spawner migrations. In the lower portion of Box Canyon Creek the proximity of undeveloped campsites along the creek has led to the destruction of riparian vegetation in some areas. Otherwise habitat conditions for bull trout are good in Box Canyon Creek. In the Kachess River a combination of low stream flows and low reservoir levels due to downstream irrigation demands cause dewatering conditions that inhibit bull trout spawning migrations. General logging practices and road construction/maintenance activities increase sediment loads in spawning areas.

Harvest Management--Restrictive fishing regulations for native char began in 1984 with a one-fish catch limit and 20-inch minimum size limit for fish caught in the lake and six inches for fish caught in streams. In 1986 the minimum size limit was increased to eight inches in streams, and fishing for native char was closed in lakes and streams from August 15 to September 30 to protect spawning fish. In 1987 fishing for native char was prohibited in Kachess Lake. In addition, there has been a total fishing season closure on sections of Box Canyon Creek, the Kachess River and Mineral Creek since 1990 to protect spawning and early-rearing bull trout.

Very little historical harvest information exists for bull trout in Kachess Lake or in the tributaries. Bull trout have been observed during creel checks but were probably targeted by few anglers due to their lower abundance and because they were not as highly regarded as other gamefish.

Although angling impacts and harvest are not known, they may have been significant in some areas of the drainage, particularly in the spawning tributaries. Large adfluvial bull trout were easily harvested from spawning areas prior to the implementation of restrictive fishing regulations in the mid-1980s. Poaching has been a problem in Box Canyon Creek. Easy public access to bull trout spawning grounds compounds the problem. We hope that by posting bull trout information signs in the area and by increasing enforcement patrols, the incidence of poaching will decrease. Although bull trout are occasionally caught in the lake by anglers fishing for other gamefish, bull trout are infrequently encountered.

Hatchery--Non-native brook trout were stocked in Kachess Lake in the early 1930s but have not been stocked since. It does not appear that brook trout have established themselves in Kachess Lake, thus hybridization has not been a concern. Lake trout are said to have been stocked into Kachess Lake before 1933, but the introduction was probably unsuccessful. There are no data that confirm the presence of lake trout. Rainbow trout and kokanee were the primary species stocked in the lake for a period of about 50 years. Kokanee probably have had a positive impact on bull trout/Dolly Varden because they have served as an important food source. Natural reproduction of kokanee may occur in some tributary streams, but is probably limited. Cutthroat trout were stocked into Kachess Lake throughout the 1980s. Currently, only cutthroat and kokanee are stocked. Other than providing food for adult bull trout, stocking has probably had no impacts.

YAKIMA -- KEECHELUS LAKE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Keechelus Lake bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. They may have originated from a native adfluvial life history form even before the construction of a dam on the Yakima River in 1914. Construction of the dam turned the former natural lake into a large irrigation storage reservoir. Although the genetic characteristics of the stock have not been determined, Keechelus Lake bull trout/Dolly Varden are considered distinct based on the physical and geographical isolation of adfluvial spawning adults above Keechelus Lake Dam. Although they are infrequently encountered, fluvial bull trout/Dolly Varden are found in the Yakima River drainage below the dam (see Yakima stock report).

Adult spawning occurs in Gold Creek from early September to mid-October. Most fish probably enter the creek in early August and hold in the deeper pools, but some fish may enter as much as a month or two earlier. Anecdotal accounts suggest that bull trout/Dolly Varden were present in Rocky Run Creek in the early 1980s, but there have been no recent surveys to confirm their presence.

The majority of adult spawners range from 457 mm to 610 mm in total length, although fish as small as 200 mm have been observed on redds. Limited information indicates the age composition of the spawning population is four to 10+ years of age with a sex ratio of 1:1 and fecundity of several thousand eggs per adult female.

Although the timing of fry emergence has not been determined, it is likely occurs in March. Survival rates are unknown. Rearing juveniles probably spend several years in Gold Creek before migrating to Keechelus Lake.

STOCK STATUS

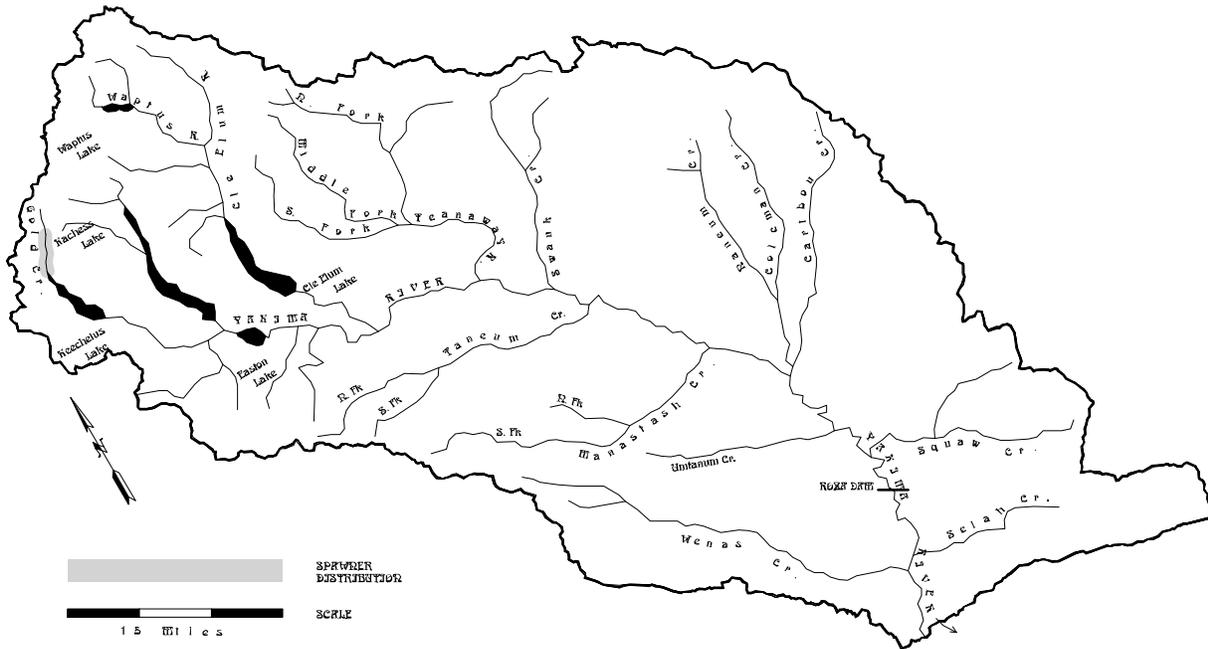
The status of the stock is Critical based on chronically low spawning escapement (redd counts) since 1984. Data quality is excellent. The low population size may have reduced the genetic variability of the stock thus decreasing its overall fitness. Annual redd counts have fluctuated from two to 51 redds since 1984 (the entire period for which data are available). A dramatic increase in the redd counts occurred in 1996 (51 redds) and 1997 (31 redds).

It is estimated that the redd counts in the Keechelus Lake drainage represent more than 98% of the total spawning population. The redd counts are not indicative of the available spawning habitat.

STOCK DEFINITION PROFILE for Keechelus Lake Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Adfluvial Riv Entry								█					Yes
Adfluvial Spawning								█	█	█			Yes

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

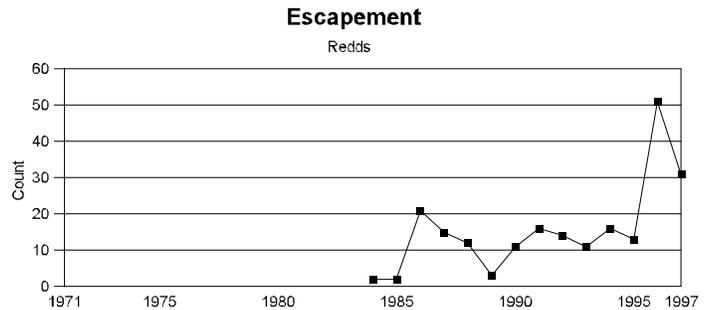
STOCK STATUS PROFILE for Keechelus Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds			
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73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	2
85	2
86	21
87	15
88	12
89	3
90	11
91	16
92	14
93	11
94	16
95	13
96	51
97	31



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Critical

Screening Criteria

Chronically low

FACTORS AFFECTING PRODUCTION

Habitat--Physical habitat destruction due to development activities and logging practices have altered the floodplain in the lower section of Gold Creek. This has reduced overhead and riparian cover, elevated stream temperatures, created unstable channel conditions, and increased sediment loads. All of these effects create stressful conditions for spawning and rearing bull trout/Dolly Varden. For example, sediment covers redds and smothers developing eggs, unstable channels create blocks to fish passage, elevated temperatures and sediment loading stress fish and reduce growth and natural productivity. Low stream flows or subterranean flow conditions (dry channels) in the creek block upstream migration of adult spawners and strand adults and juveniles. These conditions are exacerbated by development activities. Studies conducted by the University of Washington in Gold Creek indicate a high mortality rate of adult spawners (approximately 63%) due to stranding caused by low stream flows and dry stream channels (Craig and Wissmar 1993). We do not know what effect large irrigation water releases from Keechelus Lake may have on the stock. Good to excellent habitat conditions still exist in upper Gold Creek where it penetrates into the Alpine Lakes Wilderness.

Harvest Management--Restrictive fishing regulations for bull trout/Dolly Varden began in 1984 with a one-fish catch limit and a 20-inch minimum size limit for fish caught in the lake and six inches for fish caught in streams. In 1986 the minimum size limit was increased to eight inches in streams and fishing for bull trout/Dolly Varden in lakes and streams was closed from August 15 to September 30 to protect spawning fish. In 1987 fishing for bull trout/Dolly Varden was prohibited in Keechelus Lake. In addition, there has been a total fishing season closure on Gold Creek since 1990 to protect spawning and early rearing bull trout/Dolly Varden.

Although anglers have caught bull trout/Dolly Varden in Keechelus Lake and in the tributaries, no historical harvest information is available. Bull trout/Dolly Varden were probably targeted by few anglers due to their low abundance and because they were not as highly regarded as other gamefish.

Although angling impacts and harvest are not known, they may have been significant in some areas of the drainage, particularly in Gold Creek. Large adfluvial spawning bull trout/Dolly Varden were easily harvested from this spawning tributary prior to the implementation of restrictive fishing regulations in the mid-1980s. Poaching has also been a problem in Gold Creek. Easy public access to bull trout/Dolly Varden spawning grounds compounds the problem. We hope that by posting bull trout/Dolly Varden information signs in the area and by increasing enforcement patrols the incidence of poaching will decrease. Although bull trout/Dolly Varden are occasionally caught in the lake by anglers fishing for kokanee, bull trout/Dolly Varden are infrequently encountered.

Hatchery--Non-native brook trout were stocked in the Keechelus Lake drainage in the past, but stocking was eliminated due to concerns over hybridization with bull trout/Dolly Varden. Although brook trout still persist in some areas of the drainage, they are seldom seen in bull trout/Dolly Varden spawning areas, and hybridization has not been observed. Lake trout are said to have been stocked into Keechelus Lake before 1933, but the introduction was probably unsuccessful. There are no data that confirm the presence of lake trout.

Kokanee and rainbow trout were stocked into Keechelus Lake throughout the 1930s and 1940s, but the lake is seldom stocked anymore because the kokanee population is now self-sustaining. Kokanee probably have had a positive impact on bull trout/Dolly Varden because they have served as an important food source. Other than providing food for adult bull trout/Dolly Varden, stocking has probably had no impacts.

OVERVIEW -- WENATCHEE BULL TROUT/DOLLY VARDEN

**INGALLS CREEK
ICICLE CREEK
CHIWAUKUM CREEK
CHIWAWA
CHIKAMIN CREEK
ROCK CREEK
PHELPS CREEK
NASON CREEK
LITTLE WENATCHEE
WHITE (WENATCHEE)
PANTHER CREEK**

STOCK DEFINITION AND ORIGIN

Currently ten bull trout/Dolly Varden stocks have been identified in the Wenatchee River watershed. They are the Icicle, Ingalls, Chiwaukum, Chikamin, Rock, Phelps, Nason, and Panther creeks stocks and the Little Wenatchee, Chiwawa and White rivers stocks. A population in the Napecqua River is thought to be extinct. Adfluvial, fluvial and resident life forms are present.

The bull trout/Dolly Varden in the Wenatchee River watershed are native. No hatchery introduction of bull trout/Dolly Varden has occurred.

Bull trout/Dolly Varden spawn and alevins rear in cold, headwater reaches where annual heat budgets are too cold for steelhead and chinook salmon. The stocks spawn in thermal isolation, because water temperature between spawning sites is too warm.

STOCK STATUS

Four of the ten bull trout/Dolly Varden stocks have been classified as Healthy with the remaining six listed as Unknown based on the trend of available abundance data.

Nearly all suitable spawning habitat is currently used by bull trout/Dolly Varden and present spawning distribution is nearly the same as the distribution prior to European settlement. This habitat is naturally limited because adequately cold water is limited and found in high gradient, headwater reaches where access and flow are limited.

Habitat quantity ebbs and flows with climate, precipitation, and forestation changes. The worst scenario is a warming, drying climate where the forest is removed (e.g., wildfire, disease/parasite, logging, etc.).

WENATCHEE -- INGALLS CREEK BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

Ingalls Creek bull trout have been identified as a distinct stock based on their geographic distribution. This native stock spawns in isolation in Ingalls Creek; the precise reach and timing are unknown. Fluvial fish are known to exist, but more information is needed to determine the presence/absence of resident fish.

Recent snorkeling surveys (USFWS) found fluvial fish judging by their size (457 mm total length). Smaller fish were found upstream, but it is not known if these were resident fish or juvenile fluvial fish. We expect the resident life history form to be present because fish have access to the coldest headwaters, where resident fish would normally be found.

STOCK STATUS

Stock status is Unknown. Data quality is good but limited to presence/absence data. Abundance assessment over time is lacking.

FACTORS AFFECTING PRODUCTION

Habitat--Cold water is plentiful and accessible up to Turnpike Creek. Moreover, the bull trout zone (spawning and fry rearing) is located within the Alpine Lakes Wilderness and remains unspoiled by human activities. Downstream in parent Peshastin Creek, the situation is different with urban and agricultural encroachment; the presence of Blewett Pass Highway with bridges, revetments, and some channelization; and dewatering from irrigation withdrawal. Some rearing habitat for fluvial fish is lost, but migration is unaffected because bull trout pass upstream in spring runoff and pass downstream after the irrigation season. Some fluvial fish may rear in the Columbia River, where hydroelectric development has degraded the habitat.

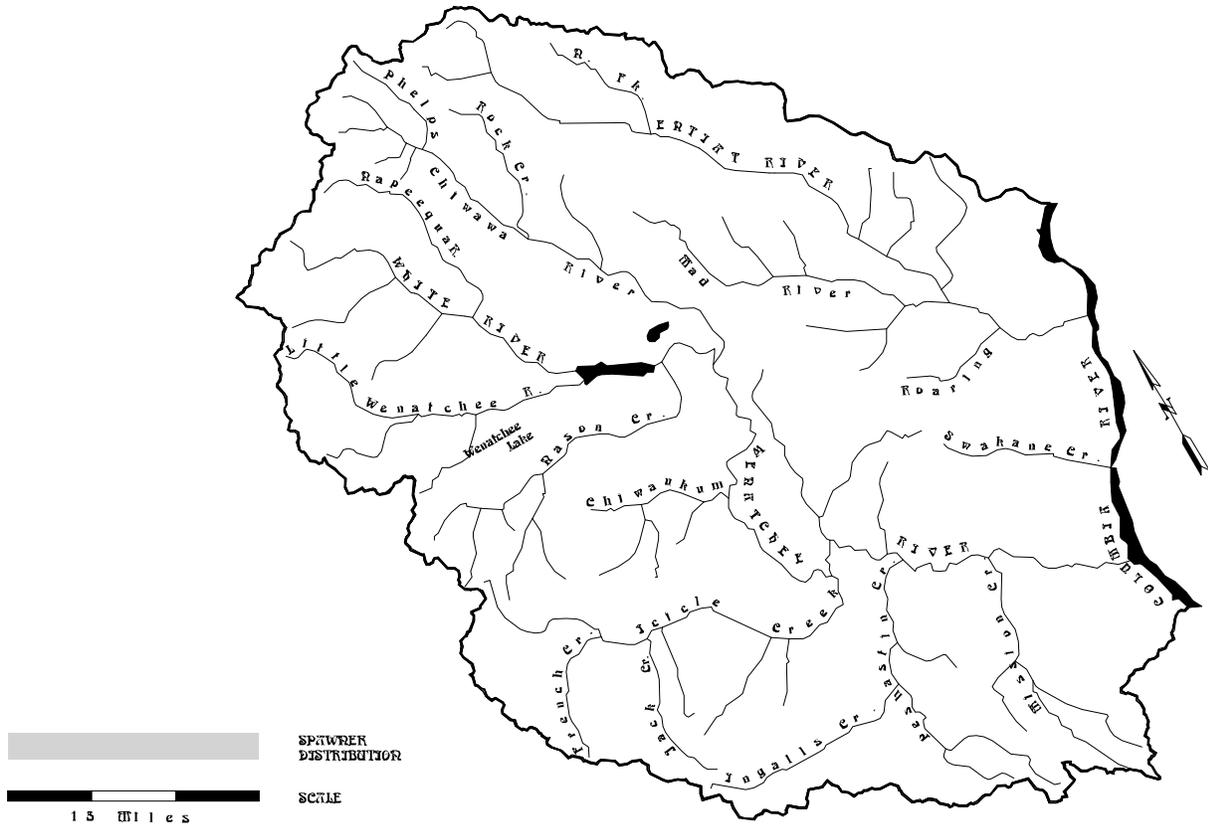
Harvest Management--In Ingalls Creek historically there was a small fishery for fluvial bull trout. Today bull trout are protected from harvest in Ingalls Creek. Some losses may occur when anglers using bait catch and release bull trout incidentally to fishing for other species. Poaching of conspicuous fluvial spawners is expected (and confirmed in 1990 with a single example), given that people are aware of this stock. Hooking mortality and illegal harvest of bull trout are expected to decline significantly in the Wenatchee and Columbia rivers as a result of the closure of the recreational steelhead

STOCK DEFINITION PROFILE for Ingalls Creek Bull Trout

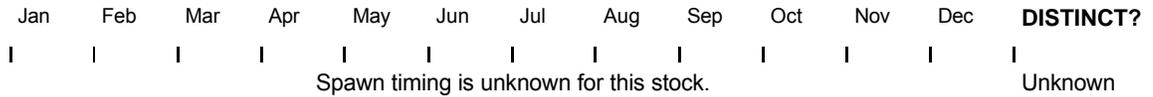
SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Ingalls Creek Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Rainbow trout and cutthroat trout have been released into the headwaters lake of Ingalls Creek (Ingalls Lake). Steelhead and rainbows have been released into Peshastin Creek. These releases were discontinued in the late 1980s. They are not thought to have had lasting effects on bull trout in this drainage.

Species Interactions--Anadromous species use Ingalls Creek up to RM 4.7. Rainbow trout are stocked in Ingalls Lake, the source of Ingalls Creek, and have spread downstream throughout the creek. Rainbow trout prefer warmer water than bull trout and successfully replace them when temperature favors them. But considering the large amount of cold water in Ingalls Creek, based on river miles accessible to bull trout over 3,000 feet in elevation, the risk of rainbow trout replacing bull trout is low in the foreseeable future.

WENATCHEE -- ICICLE CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This is a native and distinct stock isolated geographically from other stocks by water temperature and by the U.S. Fish and Wildlife Service dam at Leavenworth National Fish Hatchery (RM 2.8). Resident fish are found above the dam, but spawning distribution and timing are unknown. Fluvial fish return to the base of the dam and must be recruits from the resident fish above the dam, since fluvial fish, with rare exceptions, are blocked from reaching headwater spawning habitat.

STOCK STATUS

Stock status is Unknown. Snorkel surveys were conducted by the U.S. Fish and Wildlife Service in 1994 in Icicle Creek (RM 4.0 to 21.8) and two tributaries, Trout (RM 0.0 to 1.1) and Jack (RM 0.0 to 0.6) creeks. A total of three juvenile bull trout/Dolly Varden were observed. The salmonid biomass was predominately rainbow trout, which is expected in the river below the barrier falls at RM 24.0. Data quality is excellent, but surveys proved to be downstream of the spawning and initial rearing habitat for bull trout/Dolly Varden.

The most likely headwater reach (Leland Creek to Trapper Creek) was surveyed by WDFW in 1997. Rainbow trout predominated. Brook trout were common, and some cutthroat trout were found in Trapper Creek and Icicle Creek above Trapper Creek, but no bull trout/Dolly Varden were captured. Data quality is excellent, but it now appears that resident bull trout/Dolly Varden spawning is not located in Icicle Creek itself but rather in tributary streams. Upper French and Leland Creeks are likely sites.

FACTORS AFFECTING PRODUCTION

Habitat--Icicle Creek is a fourth-order stream that is 31.8 miles long and drains a basin of 211 square miles containing 14 glaciers and 102 lakes. The spawning habitat of bull trout/Dolly Varden is on U.S. Forest Service land within the Alpine Lakes Wilderness. State and private property amounting to 13% of the basin is concentrated in the lower basin. Minimum flow at RM 24.0 (falls) is 23 cfs. The gradient between French and Trapper creeks, the reach most likely for bull trout/Dolly Varden spawning, is 1.2%, and elevation ranges from 2,875 to 3,3360 feet.

Upper Icicle Creek, where bull trout/Dolly Varden spawn, is unaltered by human activity. The middle and lower sections are roaded, and several irrigation withdrawals are made, some of which may not be screened. The Leavenworth National Fish Hatchery dam,

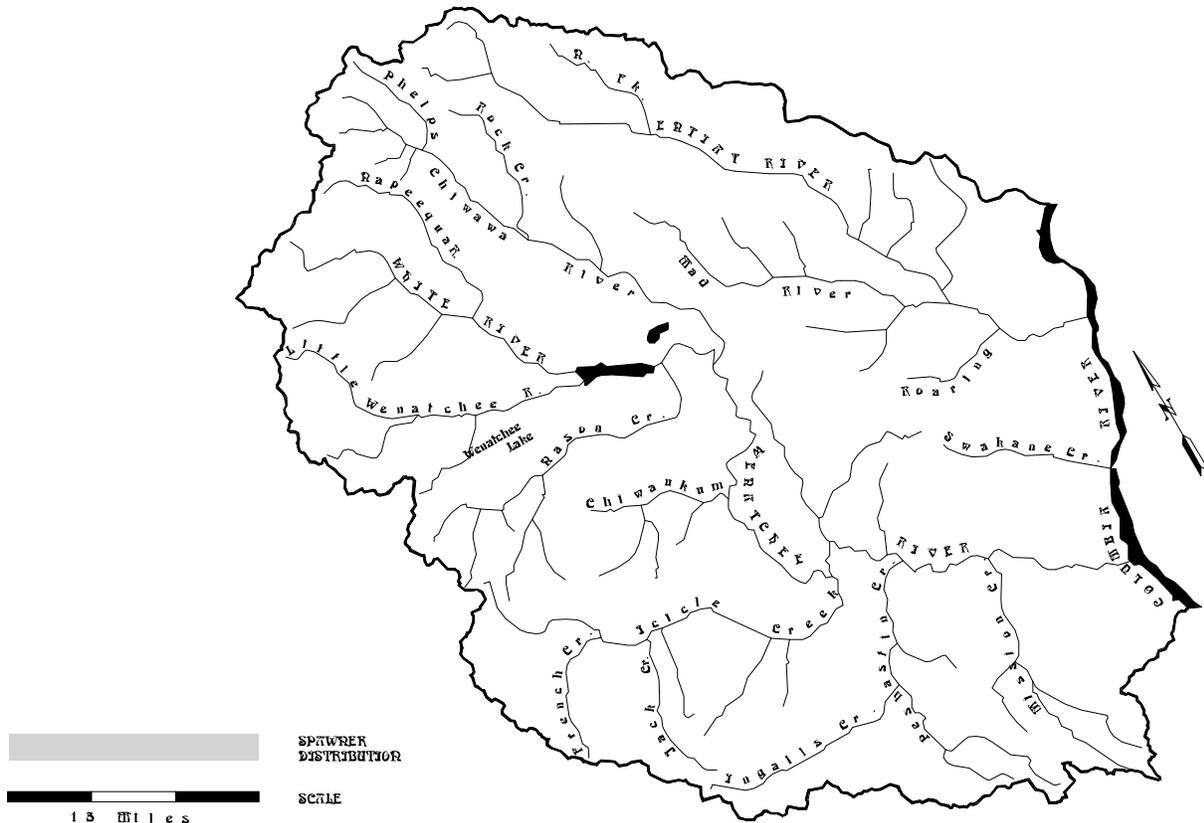
built in 1939-1940, blocks upstream passage of anadromous species and migratory bull trout/Dolly Varden.

STOCK DEFINITION PROFILE for Icicle Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Icicle Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
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- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Cold water may be limited in this basin above RM 9.0 where bull trout/Dolly Varden are likely to spawn because the basin elevation is relatively low, glaciers are absent, and there are many lakes. Conversely, the Stuart Range has high elevation and contains 14 glaciers, but the streams which drain the glaciers are too steep for fish and enter Icicle Creek below the bull trout/Dolly Varden zone.

Harvest Management--Fluvial fish neither successfully spawn below the hatchery dam nor pass it, so harvest is irrelevant. Historically, there was no bull trout/Dolly Varden fishery in upper Icicle Creek. Bull trout/Dolly Varden are now protected from harvest in Icicle Creek. Catches now and in the past are incidental to catches mostly of rainbow trout. Most spawning probably takes place above the reach from Rock Island Bridge to Leland Creek, which is regulated by selective fishery rules (bait is not allowed) for other species. Above this reach, fish are subjected to higher hooking mortality inherent in using bait, but angling intensity is minimized by the ten-mile hike and dense streamside cover.

Hatchery--Leland Creek was stocked with rainbow trout fry annually from 1937 to 1940. If these fish were successfully established above the falls in the absence of native rainbow trout, they may have replaced bull trout/Dolly Varden upstream to the area where colder temperature favors bull trout/Dolly Varden.

A single brook trout introduction was made in 1956 into upper Icicle Creek, but it is unclear if these fish were released above or below the falls. U.S. Fish and Wildlife Service snorkel surveyors found three brook trout below the falls. A WDFW hook-and-line survey in the headwaters of Icicle Creek (from Leland Creek to Trapper Creek) showed that brook trout are widely distributed above the falls and likely threaten bull trout/Dolly varden in this sub-basin.

Species Interactions--Prior to 1939-1940, when upstream migration was blocked by installation of the hatchery dam, anadromous fish and migratory bull trout/Dolly Varden had access up to an impassible falls at RM 24.0. The ubiquitous resident steelhead trout is the prevalent salmonid below and above the falls. Of grave concern is the presence of brook trout, whose similarities in habitat preference and biology allow them to hybridize with bull trout/Dolly Varden, and eventually to eliminate them. More information is needed to determine if bull trout/Dolly Varden are isolated from brook trout in Icicle Creek.

WENATCHEE -- CHIWAUKUM CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Although spawn timing and location are unknown, Chiwaukum Creek bull trout/Dolly Varden have been identified as a distinct stock based on their geographical distribution. Anecdotal accounts tell of fishing on concentrations of large pre-spawners, which suggests that the fluvial life history form is present. Most migratory bull trout/Dolly Varden probably rear in the Wenatchee River, but some may move upstream into Lake Wenatchee. Chiwaukum Creek has sufficiently cold water to support resident bull trout/Dolly Varden if barriers do not block access to cold upstream reaches. Anadromous fish and possibly fluvial bull trout/Dolly Varden are blocked by the falls at RM 4.3.

Chiwaukum Creek bull trout/Dolly Varden are native and are maintained by wild production.

STOCK STATUS

Stock status is Unknown. Presence\absence data are based on anecdotal angler input. Quantitative information is limited to a single electrofishing survey in 1990 and a hook-and-line survey in 1997. The bull trout/Dolly Varden collected in 1990 were heavily vermiculated and may have been brook trout. No bull trout/Dolly Varden were found in 1997 from Foolhen Creek to the South Fork. Data quality is good, but reaches which may support bull trout/Dolly Varden have not been surveyed. More surveys are needed to determine if bull trout/Dolly Varden still reside in this creek.

FACTORS AFFECTING PRODUCTION

Habitat--This creek is a third-order stream that measures 11.5 miles in length. The basin contains one glacier and 16 lakes and covers an area of 50 square miles. The presumed upper spawning limit is the falls at RM 4.3 where the elevation is 2,680 feet. The gradient between RM 3.3 and 4.3 is 4.0%. Minimum flow is 23 cfs. The creek, particularly the spawning habitat, lies mostly on U.S. Forest Service property, but a portion of the lower stream is on Washington Department of Natural Resources land.

The basin is isolated and pristine. The cold water originates from high-altitude ridges and meltwater from one glacier. The creek is a high-gradient, boulder stream that seems ideal for bull trout/Dolly Varden except for possible restricted access.

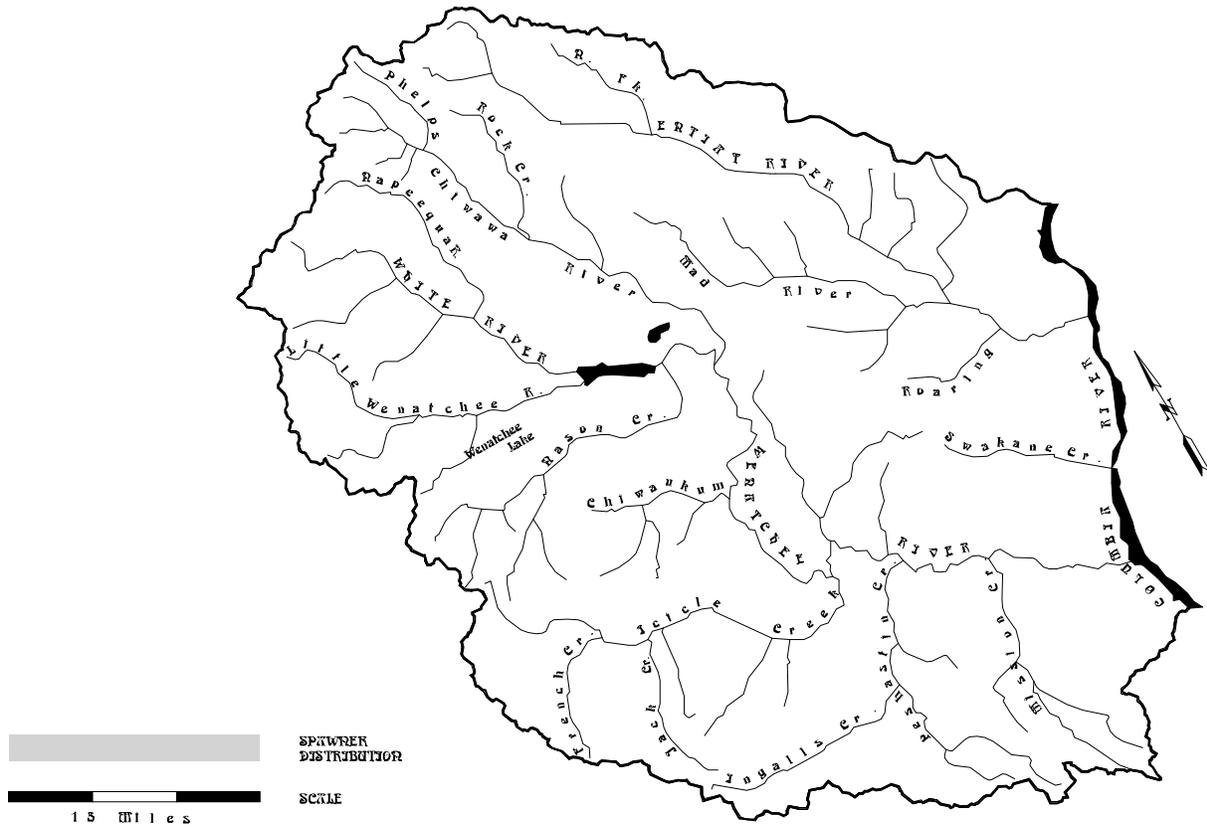
The Columbia River's productivity for fluvial bull trout/Dolly Varden has been reduced by hydroelectric development. Dams kill some migrants and block migration of others.

STOCK DEFINITION PROFILE for Chiwaukum Creek Bull Trout/Dolly Varden

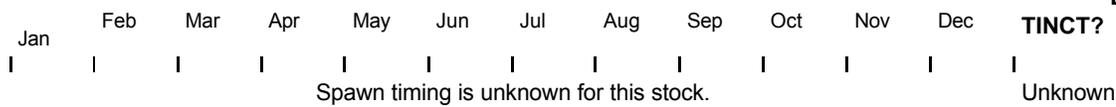
SPAWNER DISTRIBUTION

DISTINCT? - Yes

Spawner distribution is distinct for this stock, but specific spawning locations are unknown.



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Chiwaukum Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
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- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Harvest Management--In the past, when bull trout/Dolly Varden harvest was permitted, a few local anglers fished for them. Currently, fishing for trout remains open but under selective fishery regulations (bait is not permitted). Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline significantly in the Wenatchee and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--In 1899 a salmon hatchery was constructed on lower Chiwaukum Creek, but closed only five years later in part because of cold water and heavy snow. It is unclear what effect, if any, the presence and operation of the hatchery had on bull trout/Dolly Varden.

Many native rainbow and cutthroat trout fry from Chiwaukum Hatchery (resurrected by the Washington Department of Game in the 1930s) were stocked into wild populations of rainbow and bull trout/Dolly Varden in Chiwaukum Creek in the 1930s and 1940s. Since introductions of hatchery-origin rainbow trout did not increase distributions of native rainbow trout, interactions with bull trout/Dolly Varden are not considered harmful or lasting. Apparently populations of cutthroat trout were established from hatchery releases, but cutthroat and bull trout/Dolly Varden are ecologically compatible.

Species Interactions--Rainbow trout and chinook salmon are found in the lower portion of Chiwaukum Creek, and will invade upstream if the water temperature warms. This risk is relatively high because cold water is scarce below the falls. We do not know whether bull trout/Dolly Varden are obstructed by the falls and denied access to the cold water above the falls that would protect them from downstream invaders. Brook trout may be found above the falls and, if so, pose a grave risk to bull trout/Dolly Varden.

WENATCHEE -- CHIWAWA BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This native stock of fluvial fish is considered distinct based on the geographic distribution of its spawning grounds. Spawn timing is typical of Columbia River bull trout/Dolly Varden, from mid-September through mid-October. Rearing may occur in the Chiwawa, Wenatchee, and Columbia rivers. Some fish may rear in Lake Wenatchee. Spawning areas in the Chiwawa River begin at Phelps Creek (RM 30.2) and end at the falls at RM 33.1. These areas are contiguous with those from lower Buck Creek to the falls impasse. There is minor spawning in lower Alpine and James Creeks.

STOCK STATUS

Stock status is Unknown. Based on the limited survey this stock may be Healthy. Trend data are needed to better assess the stock status.

Redds were counted (single surveys) in 1989 and 1990 in Buck and Alpine creeks and the Chiwawa River. The counts in 1990 may be low due to high flows. Isolation and excellence habitat may be the major factors in monitoring a healthy stock in this drainage. Downriver hooking mortality and illegal harvest are the only obvious factors affecting this stock. Data quality is fair.

FACTORS AFFECTING PRODUCTION

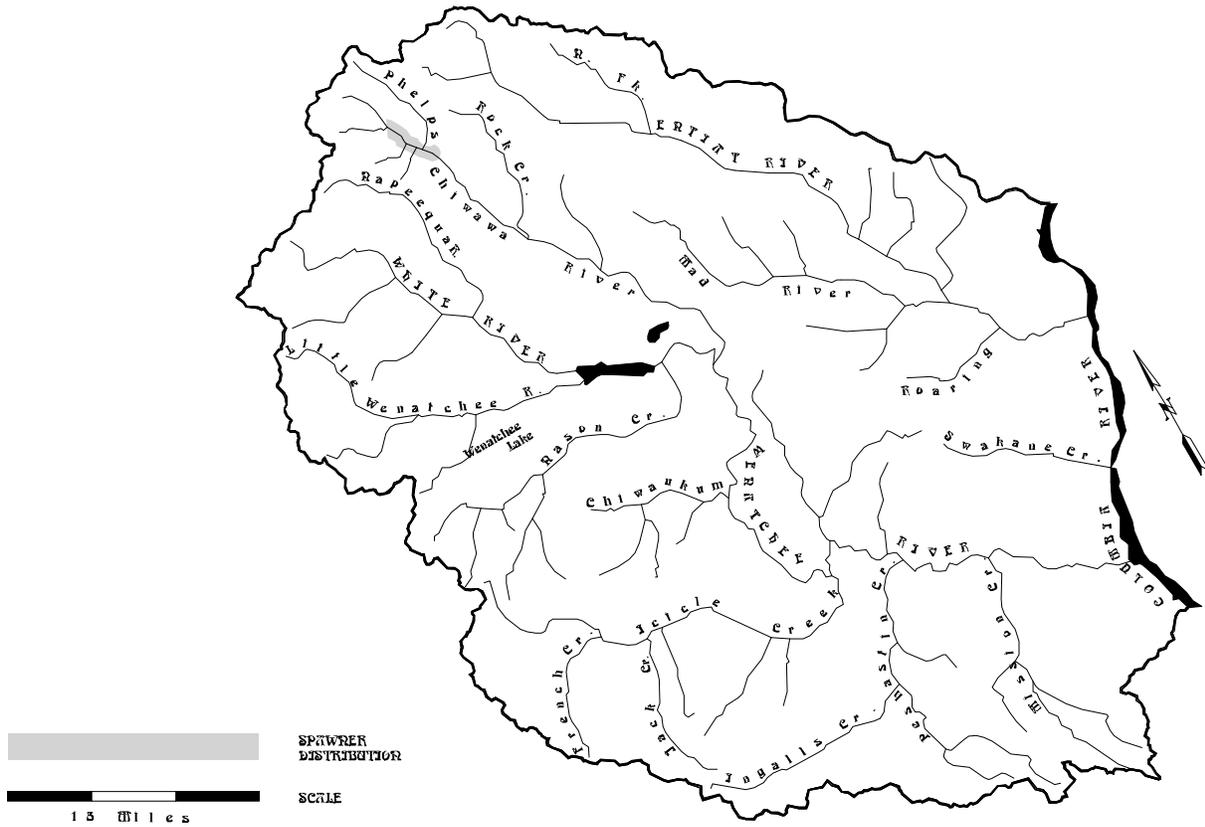
Habitat--The Chiwawa River is a fourth-order stream that is 36.0 miles long and drains a basin measuring 182 square miles and containing five glaciers and six lakes. At RM 30.5 minimum flow is 20 cfs. The gradient between Phelps Creek and the falls is 3.3%, and elevation ranges from 2,780 to 3,280 feet. Except for a small private holding at Trinity, the upper river lies on U.S. Forest Service land in the Glacier Peak Wilderness.

Trinity marks the end of the Chiwawa Valley Road (U.S. Forest Service Road 6200), beyond which the habitat is isolated and pristine. The cold river water temperature is ideal for bull trout/Dolly Varden. Glacial meltwater from Phelps Creek chills the upper Chiwawa River below Trinity.

STOCK DEFINITION PROFILE for Chiwawa Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Chiwawa Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Redds	ESCAPE Redds	ESCAPE Redds	
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89	21	16	3	
90	8	1	0	
91				
92				
93				
94				
95				
96				
97				

Columns 1: Buck Creek count.
 Column 2:: Alpine Creek count
 Column 3: Counts from the Chiwawa River.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Harvest Management--Road access ends at Trinity. A trail runs above the river in many places, but access is mostly difficult. Bull trout/Dolly Varden are protected from harvest, but bait is allowed in fisheries targeting other species downriver to Rock Creek where selective regulations (no bait allowed) are in force. Hooking mortality and illegal harvest probably are insignificant in the Chiwawa River above Trinity. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline significantly in the Wenatchee and Columbia rivers as a result of the closure of the recreational steelhead fishery. This closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Rainbow trout fry produced from Chiwaukum Hatchery were released to the headwaters of the Chiwawa River in 1944 and 1948, but the water was too cold and they did not survive.

For many years catchable-size rainbow trout were released into the Chiwawa River below Trinity in the summer. Resulting fisheries increased harvest on all migratory stocks of bull trout/Dolly Varden within the basin. The program was discontinued in 1990.

Species Interactions--The water in the Chiwawa River is so cold that the upper boundary of rainbow trout distribution is more than nine miles downriver from bull trout/Dolly Varden spawning and early rearing areas, offering maximum buffering from climatic warming and invasion by rainbow trout.

WENATCHEE -- CHIKAMIN CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Chikamin Creek bull trout/Dolly Varden are a native, distinct stock of fluvial fish that is geographically isolated from other Chiwawa River stocks. They spawn from U.S. Forest Service Road 6200 to slightly past the forks (the upper boundary of the redd count index reach) from mid-September through mid-October. The high elevation and resulting cold water at the upper end of their distribution suggests that the resident life history form may also be present.

Chikamin, Phelps and Rock creeks are the major spawning reaches for Chiwawa River bull trout/Dolly Varden. Some spawning also occurs in the mainstem Chiwawa River above Phelps Creek and in James, Alpine and Buck creeks.

The high number of bull trout/Dolly Varden passing the salmon weir on the lower Chiwawa River indicates that substantial rearing occurs outside the Chiwawa River basin, i.e., in the Wenatchee and Columbia rivers and, perhaps, in Lake Wenatchee.

STOCK STATUS

Stock status is Healthy. Redd count monitoring started in 1989. Redds are surveyed over the 4.6 miles (RM 0.8-5.4) from Marble Creek to the forks. Counts are complete except for 1990, when flooding reduced access and visibility. Data quality is excellent. Counts are highly variable across years, but the trend is stable.

FACTORS AFFECTING PRODUCTION

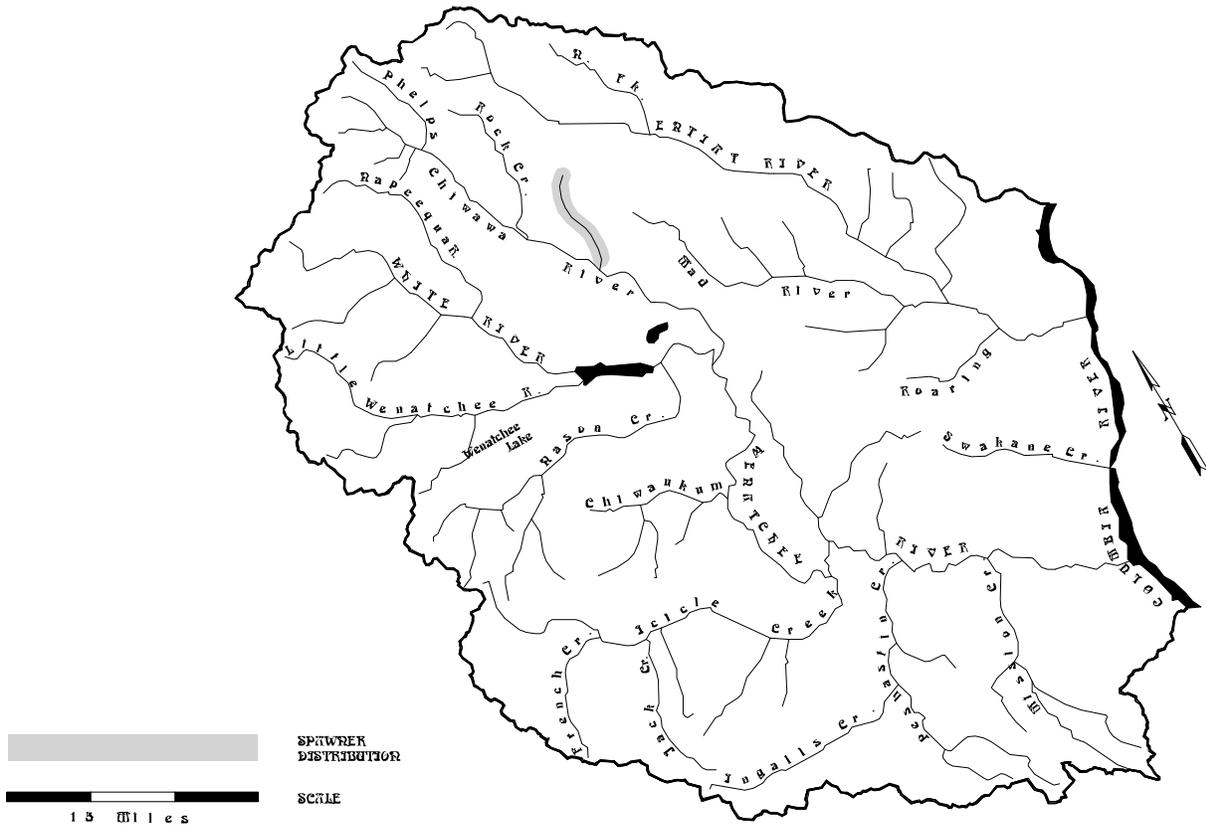
Habitat--Chikamin Creek is a third-order stream that is 7.4 miles long and drains a basin of 21 square miles. Spawning occurs from RM 0.5 to RM 5.5, where the gradient is 4.6%, and elevation varies from 2,410 to 3,760 feet. Minimum flow is 7 cfs. The lower mile is on private land; the remainder, including almost all of the bull trout/Dolly Varden spawning reach, is on U.S. Forest Service land.

The Chikamin Creek basin is nearly roadless and essentially pristine. The gradient near the valley floor is moderate and contains most of the spawning gravels and large woody debris. Gradient increases upstream as the stream enters a steep canyon,

STOCK DEFINITION PROFILE for Chikamin Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												No

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

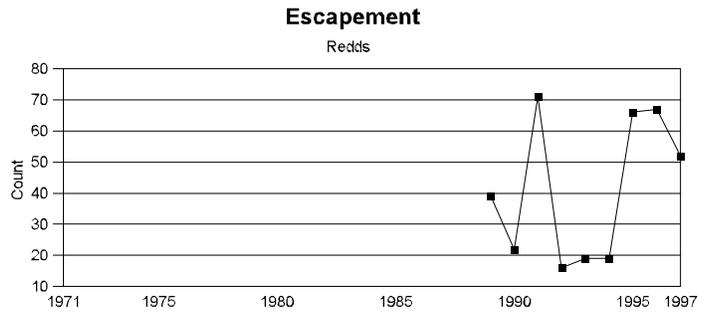
DISTINCT? - Unknown

STOCK STATUS PROFILE for Chikamin Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds			
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89	39			
90	22			
91	71			
92	16			
93	19			
94	19			
95	66			
96	67			
97	52			



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

where gravel is found in small patches and cover is composed of boulders and overhanging brush.

The capacity of the Columbia River to rear fluvial bull trout/Dolly Varden has been diminished from the environmental and ecological changes resulting from the impoundment of a free-flowing river. Dams may kill or block some migrating bull trout/Dolly Varden.

Harvest Management--In-stream fishing-related mortality such as hooking mortality and poaching is considered insignificant because the taking of bull trout/Dolly Varden is illegal, and access is difficult. Hooking mortality and illegal harvest probably are insignificant in the Chiwawa River above Trinity. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline significantly in the Wenatchee and Columbia rivers as a result of the closure of the recreational steelhead fishery. This closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Rainbow trout and cutthroat trout fry were released on top of native rainbow and bull trout/Dolly Varden populations several times in the 1930s and 1940s. Resulting interactions are not considered negative because the rainbow trout distribution has not expanded, and established cutthroat trout and bull trout/Dolly Varden are ecologically compatible.

Species Interactions--Wild rainbow trout are found in the Chiwawa River and lower Chikamin Creek and will invade upstream if water temperatures warm. The most elevated reach of distribution is high (cold) enough to offer moderate resistance to warming.

WENATCHEE -- ROCK CREEK BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

This is a native stock of fluvial fish that is geographically isolated during spawning. Spawning occurs from U.S. Forest Service Road 6200 to the barrier falls (RM 5.8). Spawning timing is from mid-September through mid-October. It is possible that some fish rear in Lake Wenatchee, but most probably rear in the Chiwawa, Wenatchee, or Columbia rivers.

STOCK STATUS

Stock status is Healthy. Redd counts commenced in 1989. The entire spawning reach (4.9 miles- from Forest Service Road 6200 to the falls) is examined. Counts are complete except for 1990, when flooding impaired access and visibility. Data quality is excellent .

Spawning escapements are variable, but the trend is stable over the seven-year monitoring period. Escapements into Rock Creek are much higher than in any other stream in the mid-Columbia region.

FACTORS AFFECTING PRODUCTION

Habitat--Rock Creek is a third-order stream that is 11.7 miles long. The basin area is 21 square miles. The spawning area is from RM 0.6 to RM 5.3, where the gradient is 4.9%, and elevations range from 2,500 to 3,720 feet. Minimum low flow is 11 cfs. The entire basin is on U.S. Forest Service land, and the upper basin is in the Glacier Peak Wilderness.

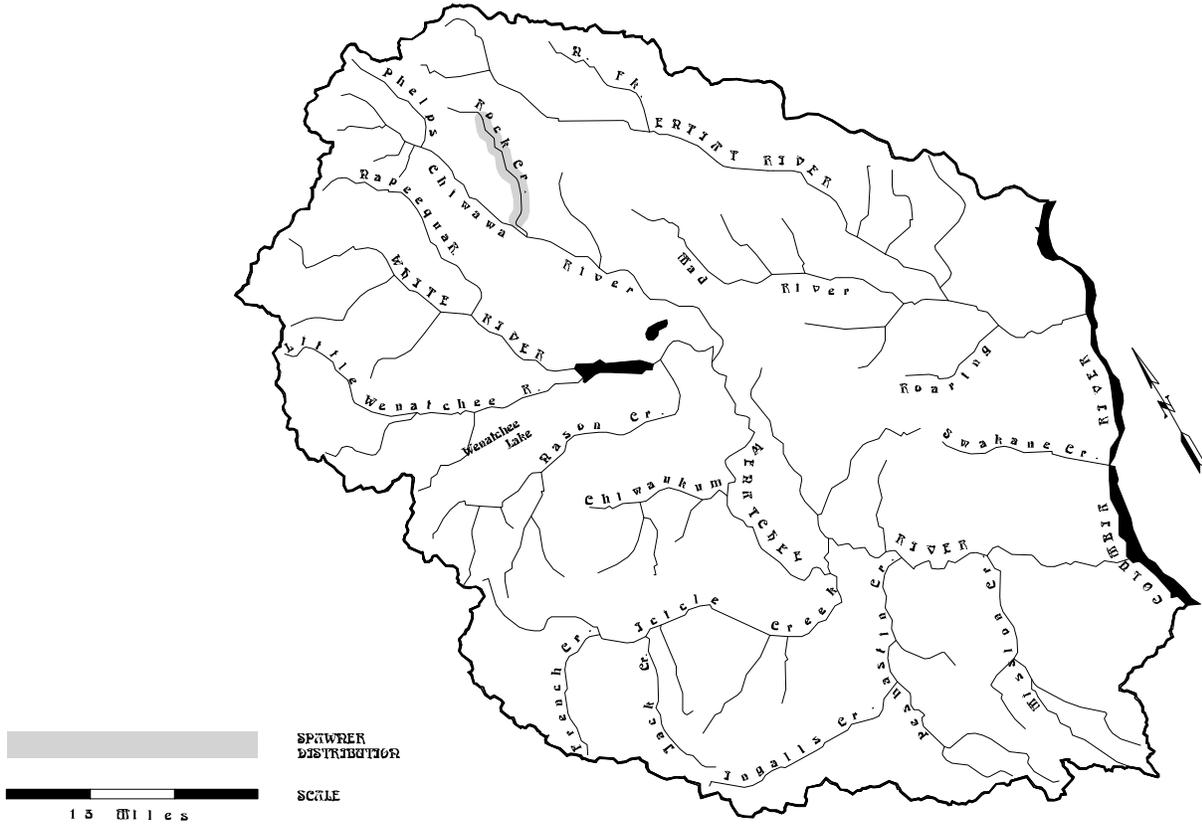
Roading is limited to the lower mile of western part of the basin, where some timber harvesting once occurred, and an old mine shaft remains. Campgrounds are denuded of vegetation at a few points near the mouth. But habitat alterations by human activities have been minor and are confined to the lower basin. Habitat for bull trout/Dolly Varden remains essentially pristine.

Anadromous species use the lower mile of stream, where low gradient causes gravel deposition and active meandering across the floodplain. Above this reach, the stream

STOCK DEFINITION PROFILE for Rock Creek Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



<u>TIMING</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning										█			No

BIOLOGICAL CHARACTERISTICS

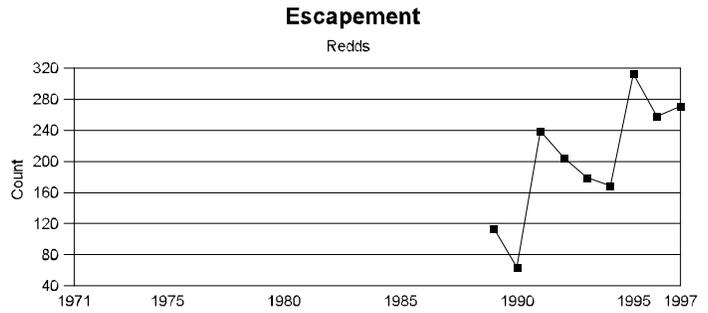
DISTINCT? - Unknown

STOCK STATUS PROFILE for Rock Creek Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds			
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89	114			
90	64			
91	239			
92	205			
93	179			
94	169			
95	313			
96	258			
97	271			



The 1990 survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

climbs into a steep, narrow, forested canyon, where it becomes torrential and cover consists of boulders and turbulence. Spawning gravel is limited and scattered. Large woody debris and pools are scarce. The U.S. Forest Service has proposed a habitat rehabilitation project that would improve habitat diversity (add pools and large woody debris) and stabilize streambanks of erodible, barren soils, though sedimentation is not a key limiting factor now.

Downriver, migrant bull trout find the Columbia River less productive due to hydroelectric development and encounter migration problems that are lethal to some fish.

Harvest Management--Fishing pressure is concentrated at the campgrounds near the mouth of Phelps Creek. Hatchery-origin catchable-size rainbow trout were planted here for many years, and intense fisheries developed. This program was abandoned after 1990. Bull trout are now protected from harvest. Hooking mortality from the use of bait in trout fisheries is probably insignificant because most bull trout move upstream into less accessible reaches, where angling effort is low. The level of poaching of fluvial spawners is unknown, but local anglers long have been knowledgeable about the presence of bull trout in the Chiwawa River basin, and upper Rock Creek is served by trail. Hooking mortality and illegal harvest probably are insignificant in the Chiwawa River above Trinity. Hooking mortality and illegal harvest of bull trout are expected to decline significantly in the Wenatchee and Columbia rivers as a result of the closure of the recreational steelhead fishery. This closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--From 1933 to 1948 cutthroat trout fry and rainbow trout fry were stocked seven and eight times, respectively. Rainbow trout stocking has not expanded the original distribution of rainbow trout because the water in Rock Creek is too cold for them. Though cutthroat trout have become established, they are ecologically compatible with bull trout.

Species Interactions--Chinook salmon and rainbow trout reside in lower Rock Creek, and the latter will invade upstream bull trout habitat if water temperature rises over the long term. Full invasion does not appear imminent considering the 5.8 river miles of habitat. However, the southern exposure, absence of glaciers, and relatively low elevation of Rock Creek mean that the lower basin may be sensitive to warming.

WENATCHEE -- PHELPS CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This native stock is considered distinct based on its geographic distribution. Spawning is confined to Phelps Creek from U.S. Forest Service Road 6200 (RM 0.3) to the falls impasse near Box Creek (RM 2.1). Spawning occurs from mid-September through mid-October. The size of spawners indicates that the stock is fluvial. Fluvial fish may rear in the Chiwawa, Wenatchee, or Columbia rivers. Some migrant fish may rear in Lake Wenatchee.

STOCK STATUS

Stock status is Healthy. Trend data are based on redd counts which began in 1989. Redds are surveyed over the 1.9 miles from the Forest Service road to Box Creek. Counts are complete in this reach except for 1990, when flooding impaired access and visibility. Data quality is excellent. Trends have been stable with high annual variability.

FACTORS AFFECTING PRODUCTION

Habitat--Phelps Creek is 8.0 miles long. It is a third-order stream draining a basin area of 16 square miles and with a mean elevation of 5,823 feet. Minimum flow of 12 cfs occurs in September. Spawning occurs between RM 0.3 and 2.1, where the gradient is 9.1%, and elevation ranges from 2,820 to 3,620 feet. Spawning habitat is on U.S. Forest Service land, but two private mine holdings are located upstream.

Roading is limited to the lower basin. Hard rock mining occurred at Trinity (lower Phelps Creek) and upstream near Chipmunk Creek with limited or no impact. Habitat is functionally unaltered as far as is known. Water temperature is ideal for bull trout/Dolly Varden.

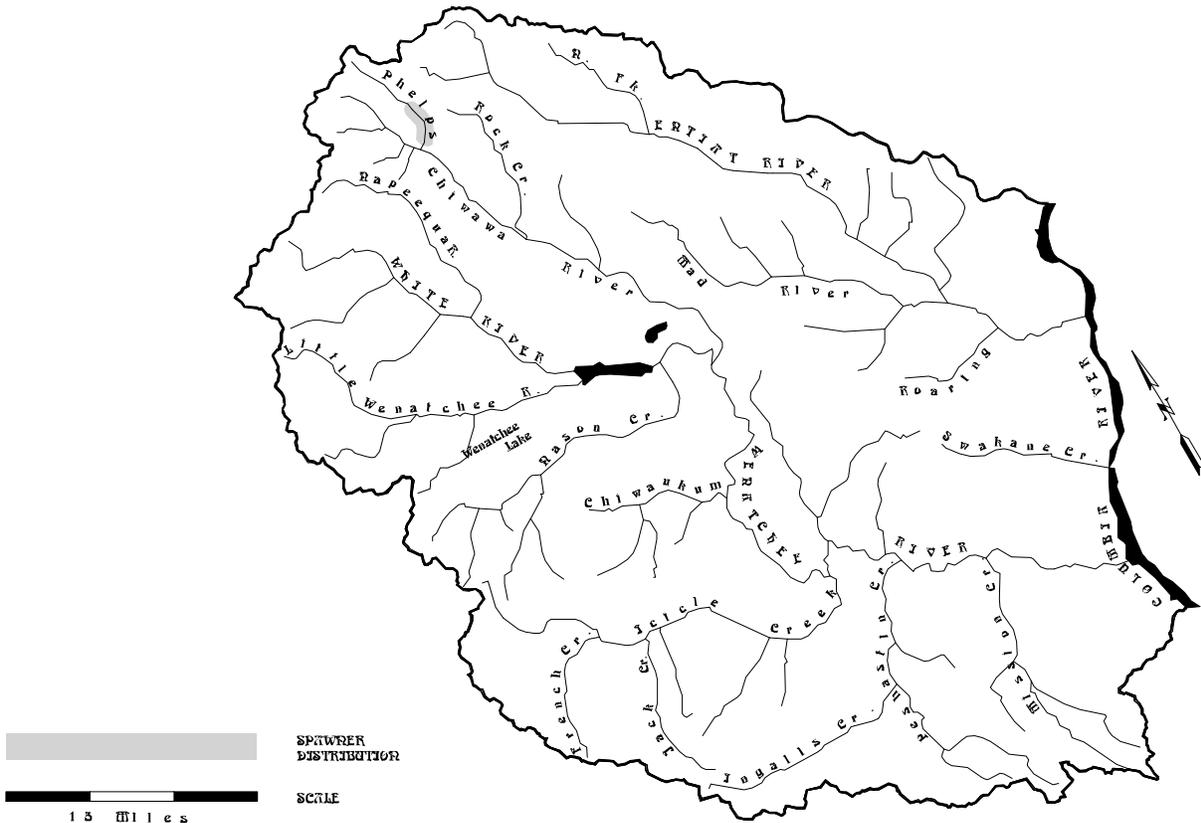
Hydroelectric development reduces the capacity for rearing fluvial bull trout in the Columbia River. Dams kill or obstruct some migrants.

Harvest Management--A campground near the mouth of Phelps Creek intensifies angling there. Upstream, the topography is steep, and there is no trail. Bull trout are protected from harvest in Phelps Creek. Hooking mortality and illegal harvest probably are insignificant in Phelps Creek itself and in the Chiwawa River above Trinity. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline significantly in the Wenatchee and Columbia rivers as a result of the closure of the recreational steelhead fishery. This closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

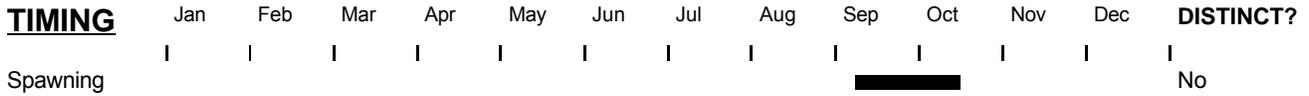
STOCK DEFINITION PROFILE for Phelps Creek Bull Trout

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING



BIOLOGICAL CHARACTERISTICS

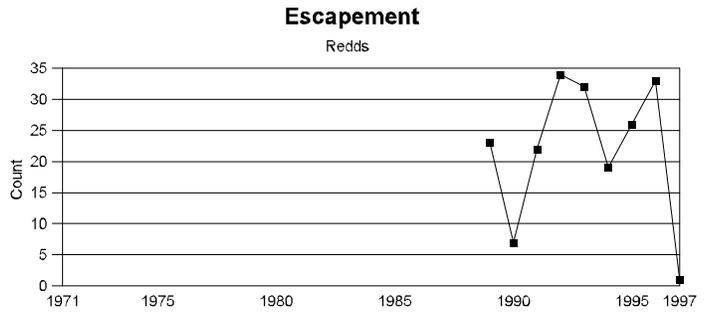
DISTINCT? - Unknown

STOCK STATUS PROFILE for Phelps Creek Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds			
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89	23			
90	7			
91	22			
92	34			
93	32			
94	19			
95	26			
96	33			
97	1			



The 1990 and 1997 surveys were incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

Hatchery -- Between 1933 and 1943 rainbow trout fry were released into Phelps Creek five times and cutthroat trout fry three times. Potential adverse effects on bull trout/Dolly Varden from rainbow trout have not occurred because the water in Phelps Creek is too cold for rainbow trout to colonize. Introduced westslope cutthroat trout colonized the creek, but they are ecologically compatible with bull trout/Dolly Varden.

Species Interactions--The upper limit of rainbow trout distribution in the Chiwawa River occurs at RM 21.5, 8.9 miles below the mouth of Phelps Creek. High elevation and glacial meltwater produce low water temperature that resists invasion of rainbow trout into Phelps Creek and the upper Chiwawa River.

WENATCHEE -- NASON CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This native stock is considered distinct due to geographic isolation of its spawning grounds. Spawning is confirmed in lower Mill Creek. Nason Creek from Gaynor Falls to Mill Creek may also be an important spawning reach. Spawn timing is unknown. Nason Creek enters the Wenatchee River at the outlet of Lake Wenatchee, and bull trout/Dolly Varden parr migrating from Nason Creek may rear in either environment, becoming adfluvial (Lake Wenatchee) or fluvial (Wenatchee River) fish. Resident fish are undoubtedly absent from this basin because the water is not cold enough for them.

STOCK STATUS

Stock status is Unknown. Anecdotal accounts refer to a localized fishery for bull trout/Dolly Varden between Whitepine and Berne. Electrofishing sampling in 1989 yielded a 508 mm fluvial/adfluvial fish in lower Mill Creek.

The Nason Creek basin was surveyed extensively (six surveys in mainstem Nason Creek, four in Mill Creek, one in Smith Brook Creek, one in Lanham Creek, and three in Whitepine Creek) in 1989 to define the distribution of bull trout/Dolly Varden. All bull trout/Dolly Varden were found in Mill Creek, but the reach from the falls to Mill Creek should be surveyed more thoroughly. Redd counts were made in 1989 and 1990, but high flows hampered the 1990 count. Data quality is excellent for presence/absence sampling but poor for redd counts.

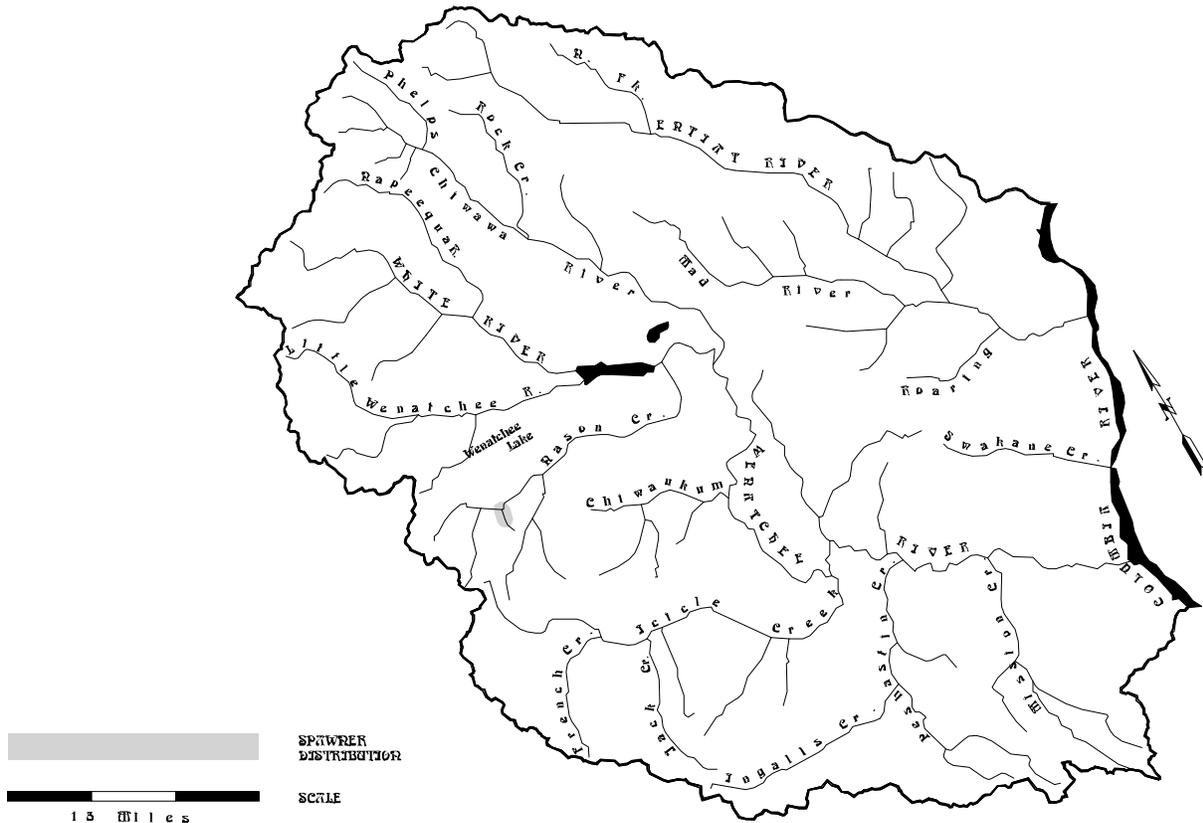
FACTORS AFFECTING PRODUCTION

Habitat--Nason Creek is a third-order stream measuring 26.5 miles in length and draining a basin of 108 square miles. The basin is the lowest-elevation portion of the Cascade Mountains and receives less precipitation than higher areas to the north and south. The lower elevation and open topography cause early snow melt and low flow with elevated temperatures in July and August. The gradient between Whitepine and Mill Creeks is 1.8%, and elevation ranges from 2,310 to 2,790 feet. Unlike most bull trout/Dolly Varden spawning habitat in the eastern Cascades, which is generally found on U.S. Forest Service land, portions of Nason Creek are privately owned. Bull trout/Dolly Varden habitat in Nason Creek lies within a major transportation corridor containing U.S. Highway 2 and a Burlington Northern railroad line. In places, railroad riprap extends into the channel. Much of the railroad right-of-way has been repeatedly burned by fires set by locomotives. Nevertheless, past abuses to the habitat have healed over time.

STOCK DEFINITION PROFILE for Nason Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

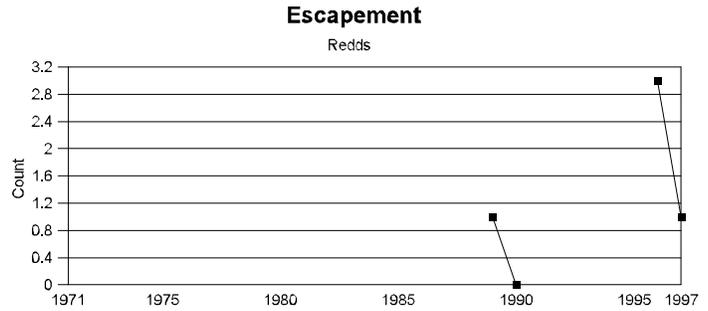
DISTINCT? - Unknown

STOCK STATUS PROFILE for Nason Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Poor

Return Years	ESCAPE Redds			
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89	1			
90	0			
91				
92				
93				
94				
95				
96	3			
97	1			



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

In fact, because of its high-quality habitat, the U.S. Fish and Wildlife Service selected lower Nason Creek as a site for holding translocated steelhead and chinook salmon from the Columbia River between 1939 and 1944.

Lower Mill Creek seems to be the primary spawning area for this stock. This part of the stream is small and flat with a substrate of sands and gravels in contrast to the typically larger, more torrential streams with boulder bottoms.

Harvest Management--Nason Creek and its tributaries are closed to bull trout/Dolly Varden harvesting. Most of Nason Creek is managed under selective fishery regulations (no bait is allowed) for other species, but use of bait is permitted in Mill Creek. This regulation and ultra-easy access may reduce bull trout/Dolly Varden abundance. The potential for poaching of pre-spawners below Gaynor Falls and spawners in Mill Creek is high, given the historical awareness of bull trout/Dolly Varden presence and easy access to the creek. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline significantly in Lake Wenatchee and Columbia River as a result of the closure of the recreational steelhead fishery. This closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Upper Nason Creek was stocked from 1933 until 1990, when the last catchable-size rainbow trout were released. Rainbow and cutthroat trout were the most common species stocked. Kokanee and eastern brook trout were stocked occasionally. Rainbow fry releases were replaced by catchable rainbows in 1950. Most fish were released below the falls. Rainbow trout were released into Mill Creek in 1934 and 1948, but they are not found there today because the water is too cold. Cutthroat trout were released into Mill and Smith Brook creeks, and self-sustaining populations exist in both creeks today. Brook trout were released below the falls and in Whitepine Creek, but these introductions were unsuccessful.

Though multiple species have been stocked over several decades, only cutthroat trout have been established above the falls. Cutthroat trout do not adversely affect bull trout/Dolly Varden.

Species Interactions--Gaynor Falls (RM 16.8) seems to block rainbow trout and anadromous species but not migratory bull trout/Dolly Varden. This apparent impasse may actually be thermal rather than physical, since bull trout/Dolly Varden are not obstructed. Because cold water habitat above the falls is limited, and rainbow trout may replace bull trout/Dolly Varden given the thermal opportunity, this stock is at risk of extinction if the falls proves passable and the climate warms. If Gaynor Falls is and remains a barrier to rainbow trout but not to bull trout/Dolly Varden, then climate warming poses little threat.

WENATCHEE -- LITTLE WENATCHEE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Little Wenatchee bull trout/Dolly Varden have been tentatively identified as a distinct stock based on their geographic distribution. Anecdotal accounts indicated a popular bull trout/Dolly Varden fishery for native adfluvial fish just below the barrier falls (RM 7.8) in the past. Spawning occurs immediately below the falls, isolating this stock from others. Spawn timing is unknown.

STOCK STATUS

Stock status is Unknown. Trend data are needed to establish the stock status. No bull trout/Dolly Varden have been reported (seven electrofishing surveys were conducted in three tributaries in 1989) above the falls by WDFW personnel. Only juveniles have been found below the falls. A snorkel survey in August, 1989 located no bull trout/Dolly Varden in a two-mile reach from the falls to Hidden Creek. Bull trout/Dolly Varden were not observed in a 1997 WDFW hook-and-line survey conducted from the falls to 0.4 miles below Hidden Creek. Spawners have not been observed since 1984, though surveys are not routine. This stock may be extinct; more information is required. Data quality is good, but data are limited.

FACTORS AFFECTING PRODUCTION

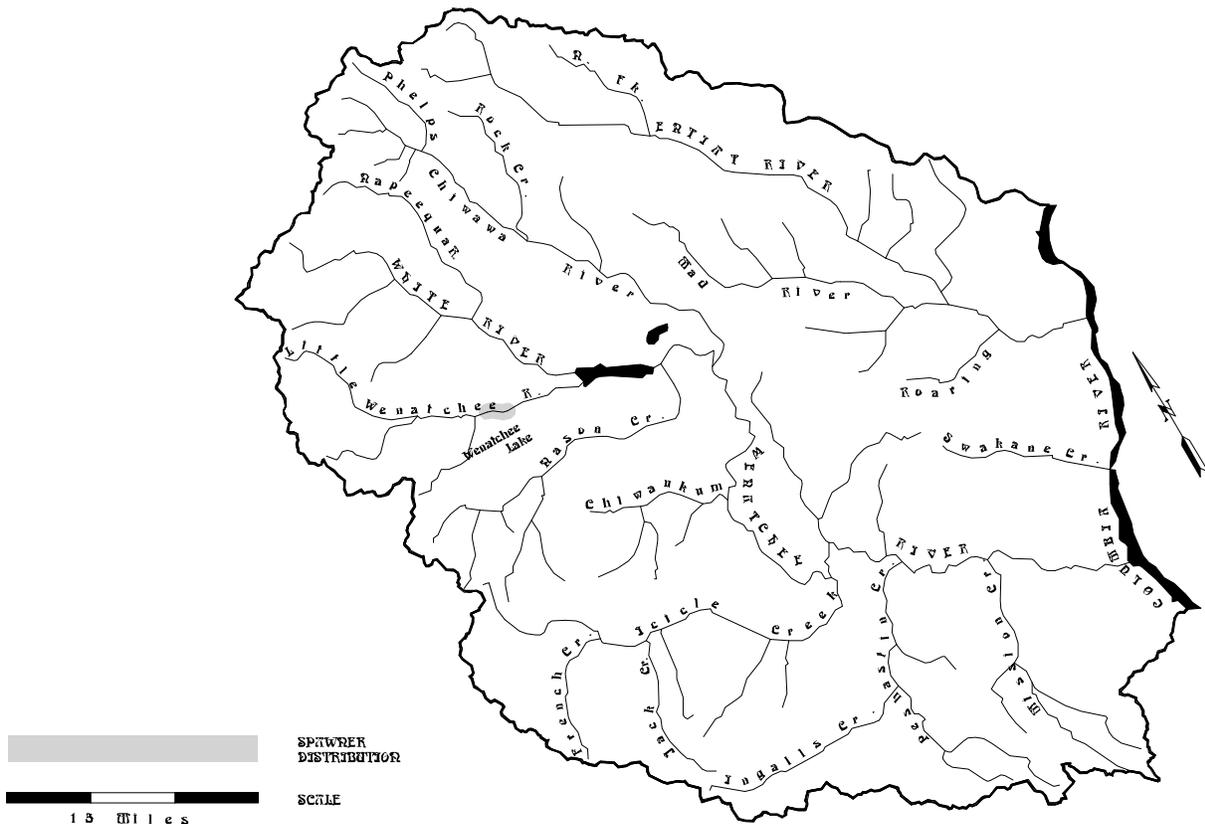
Habitat--The Little Wenatchee River is a third-order river that is 22.7 miles long and drains a basin of 100 square miles. This basin and the Nason Creek basin drain the lowest-elevation portion of the Cascade Mountains within the Wenatchee River drainage. The elevation at the upstream limit of distribution (the falls) is low (2,040 feet). Precipitation is less, and snow melts earlier than in higher-elevation basins, resulting in lower minimum flows and higher stream temperatures during July and August. The basin contains 13 lakes (which tend to have relatively warm water) but no glaciers to cool the water. Water temperature is marginally high for bull trout/Dolly Varden. Minimum flow at the mouth is 60 cfs. The gradient between the mouth and the falls is 0.4%. Spawning habitat is on U.S. Forest Service land; only the flats near Lake Wenatchee are privately owned. Human activity has been minor, and habitat for bull trout/Dolly Varden remains essentially pristine. The area below the falls has limited organic cover and undercut banks. The gradient between RM 7.4 and RM 7.8 (the falls) is 3.3%.

Harvest Management--Bull trout/Dolly Varden are protected from harvest in the Little Wenatchee, and selective fishery regulations (bait is not allowed) for other species are in place from just above the falls downstream to the mouth. Local anglers, aware

STOCK DEFINITION PROFILE for Little Wenatchee Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Little Wenatchee Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	FW PROD Snorkel			
--------------	-----------------	--	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

0

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

of the bull trout/Dolly Varden spawners below the falls and with easy access from Riverside Campground, may have overharvested them. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline significantly in the Wenatchee and Columbia rivers as a result of the closure of the recreational steelhead fishery. This closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--The Little Wenatchee River has a long history of fish stocking. Cutthroat and rainbow trout fry, especially the latter, were stocked annually from 1933 until 1949. Though both species became established above the falls, effects on bull trout/Dolly Varden were not deleterious. Cutthroat trout and bull trout/Dolly Varden are ecologically compatible.

After 1949, catchable-size rainbow trout plants became the rule until 1996, when the program ceased. The catchable program resulted in intense fisheries that undoubtedly increased harvest of bull trout/Dolly Varden, especially during the many years when bait was allowed, and harvesting bull trout/Dolly Varden was legal. Negative effects on bull trout/Dolly Varden may have resulted from high stocking densities of rainbow trout catchables released just above the falls.

Brook trout were stocked in 1949 and again in 1957. They are now abundant above and below the falls and undoubtedly will eliminate bull trout/Dolly Varden if they have not already done so.

Species Interactions--Historically, this stock probably ebbed and flowed into and out of extinction naturally in concert with climatic warming and cooling. When the climate warmed and the falls blocked access to coldwater upstream, the river offered no suitable habitat and bull trout/Dolly Varden probably disappeared, replaced by rainbow trout, mountain whitefish, and chinook and sockeye salmon. In cooler periods water temperature favored bull trout/Dolly Varden, and strays from nearby stocks probably recolonized the water. Currently the climate does not favor bull trout/Dolly Varden. Brook trout are abundant below the falls and will eventually extirpate bull trout/Dolly Varden if they have not already done so.

WENATCHEE -- WHITE (WENATCHEE) BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This is a native stock of adfluvial (Lake Wenatchee) and perhaps fluvial fish (White River) that is geographically isolated from other species when spawning. The elevation at White River falls (RM 14.3), the upper end of bull trout/Dolly Varden distribution, is too low (2,160 feet) to support the resident life history form, which requires colder water. Spawning occurs from the Napeequa River to the falls from mid-September through mid-October.

STOCK STATUS

Stock status is Unknown. In 1984 four redds were observed on a single survey from Grasshopper Meadows to the base of the falls. Every year some spawning occurs just below Panther Creek on the west side of the island at Grasshopper Meadows. The turbidity of the water in the river is so great from glacial flour that counting redds is impractical. Data quality is poor.

FACTORS AFFECTING PRODUCTION

Habitat--The White River is a fourth-order stream that is 26.7 miles long and drains 150 square miles. The basin contains 13 glaciers. At RM 6.4 mean basin elevation is 4,590 feet, and minimum flow in September is 34 cfs versus 83 cfs in January. The gradient from the Napeequa River confluence to the falls is 1.4%, and elevation ranges from 1,935 to 2,160 feet. Ninety-seven percent of the White River is located on U.S. Forest Service land, of which 61% is in wilderness. About six percent of the basin has been logged.

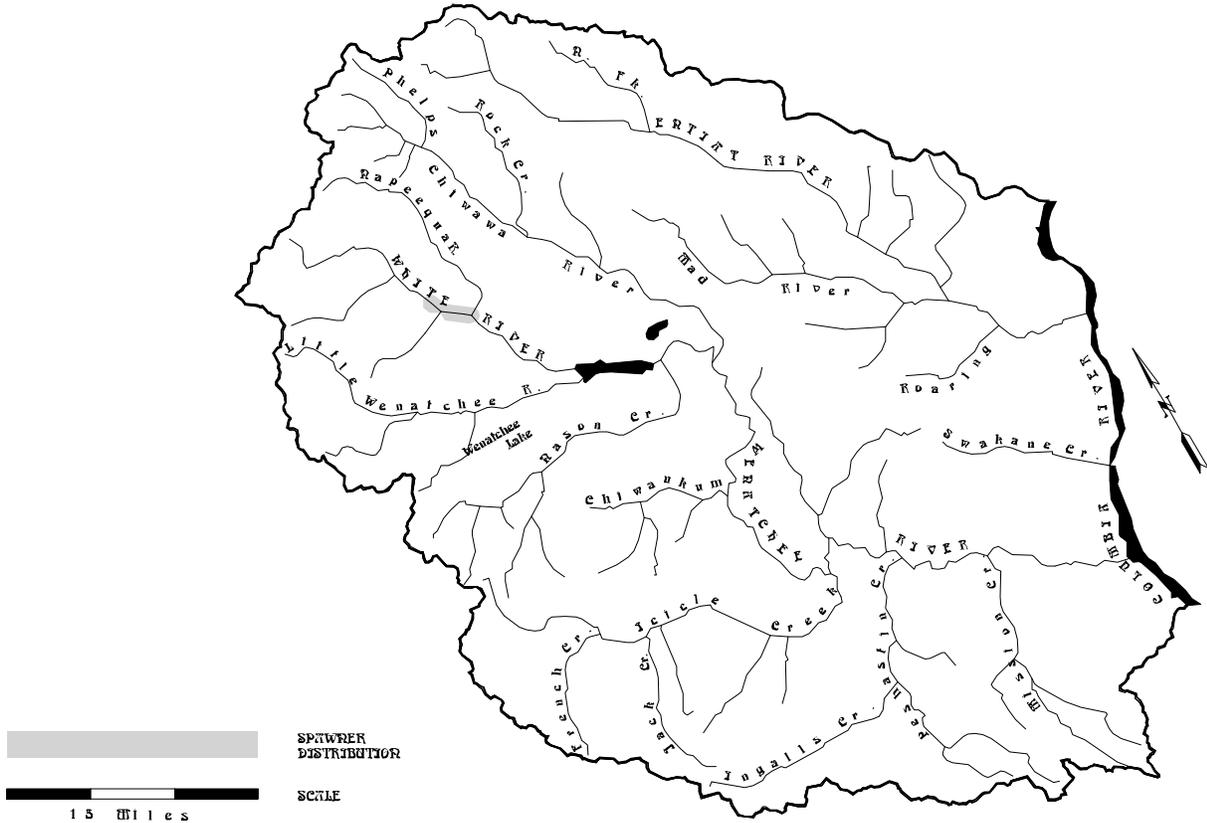
Alterations resulting from human activity have been minor, and habitat for bull trout/Dolly Varden remains essentially pristine. Water temperature is lower than might be expected for a given elevation because the river originates as glacial meltwater, but elevation at the falls is low enough that water temperature is marginally warm for bull trout/Dolly Varden. On August 7, 1989 the White River was 15.6° C at the falls, which is too warm for bull trout/Dolly Varden spawning and early rearing.

Harvest Management--Bull trout/Dolly Varden are protected from harvest, and selective fishery regulations (bait is not allowed) for other species are in force in the White River. Though access to the river is good, its size, turbidity and swiftness discourage fishing. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline significantly downriver in Lake Wenatchee as a result of the closure of the recreational steelhead fishery. This closure is associated with the listing of upper

STOCK DEFINITION PROFILE for White (Wenatchee) Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Fluvial Spawning									█				No
Adfluvial Spawning									█				No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for White (Wenatchee) Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Poor

Return Years	ESCAPE Redds			
--------------	--------------	--	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

4

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--The White River has a long history of fish stocking dating back to 1933. Rainbow trout and cutthroat trout fry were stocked most frequently but occasional releases of kokanee and steelhead fry also occurred until 1965. Brook trout were released a few times into sloughs and beaver ponds and undoubtedly some gained access to the White River. Though brook trout are not common in the White River, a few have been discovered in Canyon Creek, where they have not been stocked. Introduced species have not changed the distribution of native salmonids below the falls and, therefore, have not significantly affected bull trout/Dolly Varden.

A more significant threat to bull trout/Dolly Varden occurred from 1965 until 1990, when releases of catchable-size rainbow trout created substantial fisheries that increased harvest of bull trout/Dolly Varden. In 1990, fish stocking ceased.

Species Interactions--Rainbow trout and chinook and sockeye salmon are abundant in the White River below the falls and may be replacing bull trout/Dolly Varden there now because they have a thermal advantage.

WENATCHEE -- PANTHER CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Panther Creek bull trout/Dolly Varden are native and are considered a distinct stock based on the geographic distribution of their spawning grounds. Spawning occurs in Panther Creek from the mouth to the barrier falls at RM 0.7 from early September through mid-October. The stock consists of adfluvial (Lake Wenatchee) and perhaps fluvial (White River) life history forms. The falls at RM 0.7 blocks bull trout/Dolly Varden migration into upstream reaches where temperatures are cold enough for the resident life history form.

STOCK STATUS

Stock status is Healthy. Trend data are based on redd counts which began in 1983. The entire spawning reach is surveyed. Counts before 1987 were incomplete. Since 1988, counts have been complete except for 1990, when flooding precluded some surveys. The trend is stable despite high annual variation. Data quality is excellent.

FACTORS AFFECTING PRODUCTION

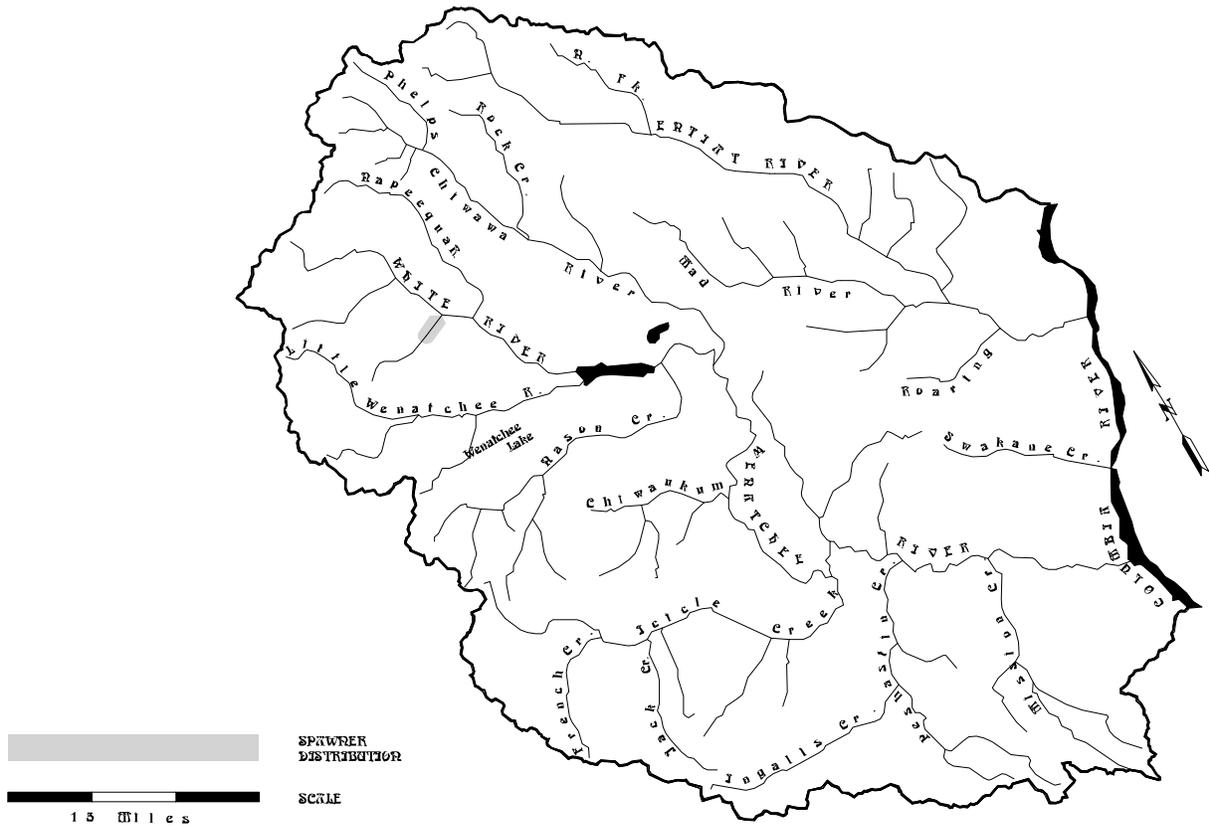
Habitat--The habitat is unaffected by human activity and, with the exception of warm water temperature, is prime for bull trout/Dolly Varden. The initial 0.4 mile is of moderate gradient, and gravel and cobbles are relatively abundant. Runs and riffles far outnumber pools. Bull trout/Dolly Varden spawn heavily in this reach, especially in the upper section. Upstream, the gradient steepens, and the creek climbs one plunge pool after another among huge boulders. The overall gradient is 5.1%, and elevation ranges from 2,010 to 2,200 feet. Gravel is patchy and spawning is less dense. Though the basin is heavily forested, riparian vegetation is poorly developed, and large woody debris is almost absent. Nearly the entire basin is located on U.S. Forest Service land in the Glacier Peak Wilderness.

Harvest Management--Panther Creek is closed to all fishing. Poaching of spawners has occurred in the past, but seems to have declined after the recent total fishing closure. Hooking mortality and illegal harvest of bull trout/Dolly Varden in Lake Wenatchee are expected to decline significantly as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the federal Endangered Species Act in August, 1997.

STOCK DEFINITION PROFILE for Panther Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



<u>TIMING</u>	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning									█				No

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

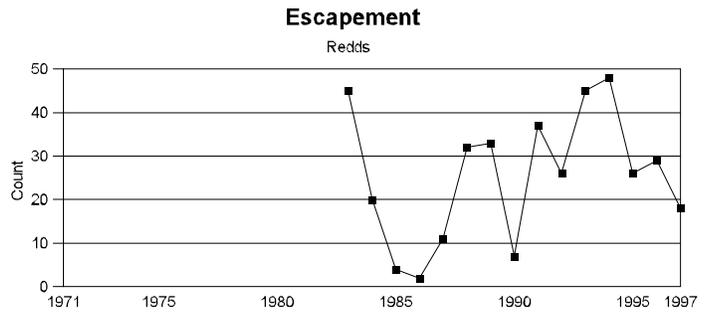
STOCK STATUS PROFILE for Panther Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds			
--------------	--------------	--	--	--

73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	45
84	20
85	4
86	2
87	11
88	32
89	33
90	7
91	37
92	26
93	45
94	48
95	26
96	29
97	18



The 1990 survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

Hatchery--Rainbow trout fry were released four times into Panther Creek between 1937 and 1946. A very low number of rainbow trout are found today, and they probably are native rainbow trout recruited from the White River rather than descendants from hatchery-origin fish. Consequently, we believe that hatchery-origin plants have had no effect on bull trout/Dolly Varden in Panther Creek.

Species Interactions--A small population of rainbow trout is found in Panther Creek, and chinook salmon occasionally spawn in lower Panther Creek. Rainbow trout may eventually dominate bull trout/Dolly Varden in Panther Creek because the water temperature is relatively warm due to low elevation, and the falls prevents bull trout/Dolly Varden from reaching cold water upstream. This creek likely is at the threshold of a rainbow trout takeover, though the outcome may not be manifested for many years.

OVERVIEW -- ENTIAT BULL TROUT/DOLLY VARDEN

ENTIAT MAD RIVER

STOCK DEFINITION AND ORIGIN

Currently two bull trout/Dolly Varden stocks have been identified in the Entiat River Watershed. They are the Entiat River and Mad River stocks. The two stocks are isolated from one another because the water temperature between them is too warm for bull trout/Dolly Varden.

The bull trout/Dolly Varden in the Entiat River watershed are native. No hatchery introductions of bull trout/Dolly Varden have occurred.

STOCK STATUS

The Entiat River bull trout/Dolly Varden stock has been classified as Unknown while the Mad River stock has been classified as Healthy based on the trend of available abundance data.

Suitable spawning habitat is currently used by bull trout/Dolly Varden, and present spawning distribution is the same as the distribution prior to European settlement. Habitat is naturally limited because adequately cold water is limited and found in high gradient, headwater reaches where access and flow are limited.

Habitat quantity ebbs and flows with climate, precipitation, forestation changes. The worse scenario is a warming, drying climate where the forest is removed (e.g., wildfire, disease/parasite, logging, etc.).

ENTIAT -- ENTIAT BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Whether spawners below Entiat Falls (RM 29.2) in 1994 constitute a stock or are strays from other Columbia River tributaries that elected to spawn when confronted with the falls is unknown. Straying could result from Columbia River dams blocking migration of fish to upriver natal streams. Further, that rainbow trout and chinook salmon are abundant in the Entiat River up to Entiat Falls, casts doubt on the thermal suitability of the habitat for bull trout/Dolly Varden. Nevertheless, a distinct stock that is geographically and thermally isolated is assumed. Only fluvial fish are present. The barrier falls precludes distribution to water cold enough to support the resident life history form. The lower spawning boundary is not precisely known, but it undoubtedly occurs within one mile of the Entiat Falls. Spawn timing is from mid-September through mid-October.

STOCK STATUS

Stock status is Unknown. Redd counts are limited to 1994 and 1995 and one location (the gaging station pool below the falls). Presence/absence data are based on seven standing crop surveys conducted throughout the river below Entiat Falls in 1984 and six snorkel surveys in 1987 by the USFWS. A total of seven juvenile bull trout/Dolly Varden were counted in these surveys, but the origin (Mad River versus Entiat River) of these fish is unknown. Data quality is poor for population size trend information, but good for presence/absence data.

FACTORS AFFECTING PRODUCTION

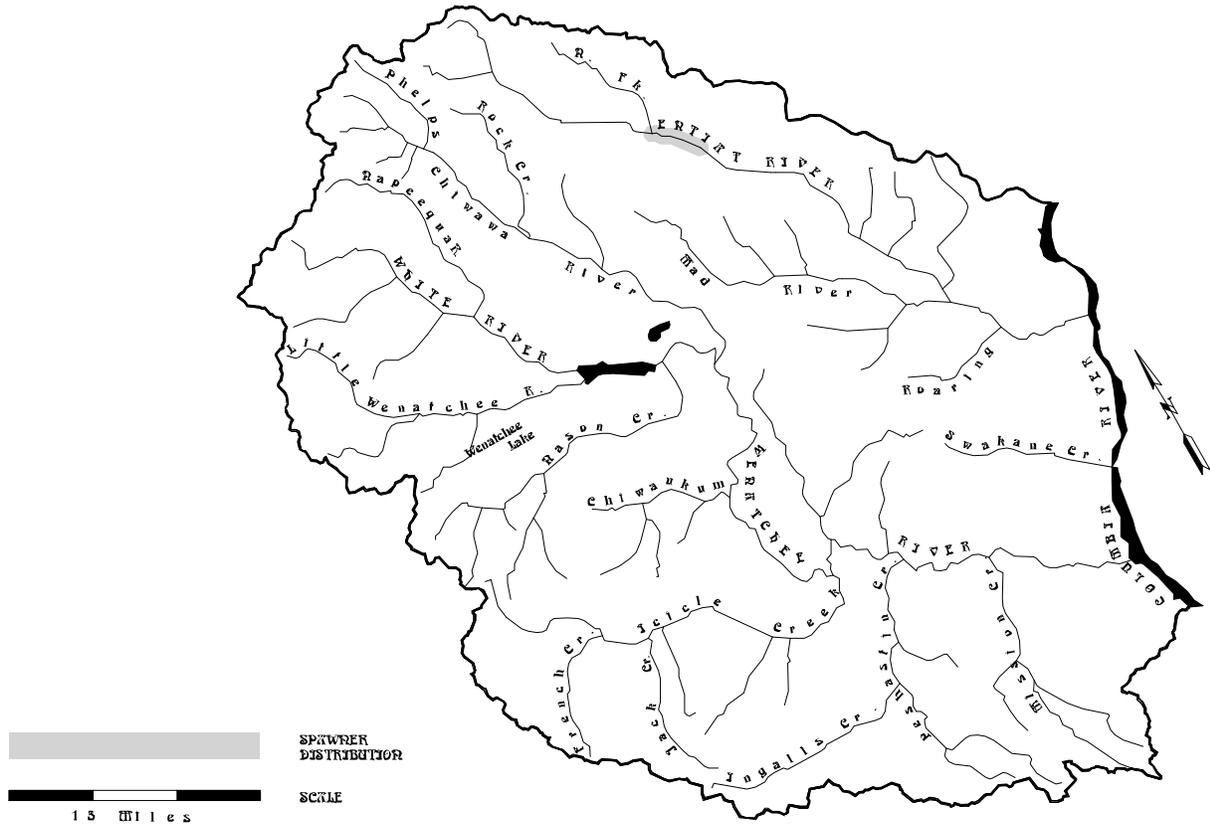
Habitat--The Entiat River is 53.4 miles long and is a fourth-order river. At RM 18.1 the basin area is 203 square miles, and basin elevation is 5,230 feet. From RM 28.2 to Entiat Falls (RM 29.2), the presumed spawning reach, the gradient is 2.5%, and elevations range from 2,510 to 2,640 feet. Minimum flow at RM 30.5 is 63 cfs. The breeding and initial rearing zone of bull trout/Dolly Varden is on U.S. Forest Service land, but most of the middle and lower river courses through private property.

The watershed in the vicinity of the bull trout/Dolly Varden zone is little altered by human activity, owing to its mountainous nature. Some water withdrawal for irrigation occurs in the lower river, but the depletion rate is less than 10%. The watershed is naturally vulnerable to wildfire, and 62% of the basin has been scorched by catastrophic fires in 1970, 1976, and 1988. In the lower basin, the absence of ground-stabilizing vegetation after the fires caused major erosion and flooding following heavy rain.

STOCK DEFINITION PROFILE for Entiat Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Entiat Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Poor

Return Years	ESCAPE Redds			
--------------	--------------	--	--	--

73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	
88	
89	
90	
91	
92	
93	
94	3
95	3
96	0
97	0

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Below RM 15.0, the gradient drops below 0.3%, the basin acts as a catchment for materials originating upstream, and the river meanders as a riffle on its broadest floodplain. Above RM 15.0 to the falls, the gradient increases (2.3% average), pools appear, and cobbles and boulders dominate the substrate. Large woody debris is rare throughout the river course.

The low elevation and presence of rainbow trout and chinook salmon suggest that water temperature may be too warm for bull trout/Dolly Varden spawning and initial rearing. Conversely, the Entiat River drains high-elevation, deeply-incised topography containing 11 glaciers, which may counter the warming effects of low elevation. However, on August 29, 1989 the maximum temperature at the falls was 14° C, only marginally cold enough for bull trout/Dolly Varden at that time of year (maximum annual water temperature occurs in late July or early August).

The Columbia River's conversion from river to reservoir has decreased its capacity to rear bull trout/Dolly Varden, and dams kill some downstream migrants and impede upstream migration.

Harvest Management--The Entiat River is closed to the taking of bull trout/Dolly Varden. Hooking mortality and illegal harvest may become significant in the summer trout fishery. Hooking mortality and illegal harvest of bull trout/Dolly Varden in the Entiat and Columbia rivers are expected to decline significantly as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the federal Endangered Species Act in August, 1997.

Hatchery--Annual fish stocking began in 1933 and continued unabated until 1996, when trout stocking stopped. Brook trout and rainbow, cutthroat, and steelhead trout were commonly stocked in the 1930s and 1940s, after which catchable-sized rainbows and steelhead became the rule. Heavy stocking densities and intense fisheries in bull trout/Dolly Varden breeding habitat undoubtedly resulted in overharvesting and perhaps in negative interactions between native fish and hatchery-origin fish.

Brook trout are established above the falls. It is unclear whether the 12 parr observed in a two-mile snorkel survey below the falls on August 29, 1989 were produced above or below the falls. Their presence poses grave hybridization risks for bull trout/Dolly Varden.

Species Interactions--The isolation that bull trout/Dolly Varden require during spawning and initial rearing is being lost, since rainbow trout and chinook salmon are found in good numbers to the base of the falls. Blocked from cold water sources above the falls, bull trout/Dolly Varden are being replaced by trout and salmon with higher temperature preferences.

ENTIAT -- MAD RIVER BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Mad River bull trout/Dolly Varden are native and have been identified as a distinct stock based on geographic and thermal isolation of spawning and initial juvenile rearing areas. Fluvial fish spawn between Young Creek (RM 11.2) and Jimmy Creek (RM 18.9). Occasionally, fluvial fish may spawn in Tillicum Creek. Resident fish may exist in the Mad River above Jimmy Creek and in Cougar and Tillicum creeks. A bull trout/Dolly Varden has been reported in Mad Lake, but this apparently is not an adfluvial fish but a resident fish that migrated into the lake. Spawn timing is from mid-September through mid-October.

STOCK STATUS

Status is Healthy. Redds have been enumerated annually between Young Creek (RM 11.2) and Jimmy Creek (RM 18.9) since 1989. The annual variation in redd counts is high, but the trend is stable. Data quality is good.

FACTORS AFFECTING PRODUCTION

Habitat--The Mad River is a third-order stream that is 24.5 miles long. The basin area is 94 square miles. The basin has no glaciers and originates from Mad Lake (5,800 feet elevation). Known spawning occurs from RM 11.2 to 18.9, where the gradient is 4.1%, and elevation ranges from 2,900 to 4,560 feet. Minimum flow is 17 cfs at the river mouth. All of the Mad River is on U.S. Forest Service land.

Habitat diversity is low; riffles and large rock predominate. Spawning gravel and large woody debris are limited. The watershed is naturally vulnerable to wildfire and was scorched in the 1880s. It had returned to pristine condition until the 1994 Tye Fire. Though the Tye Fire was generally of low burn intensity along the Mad River, fire suppression tree cutting, done in an attempt to prevent the fire from escaping to the south side of the Mad River, may have compromised existing large woody debris and future recruitment.

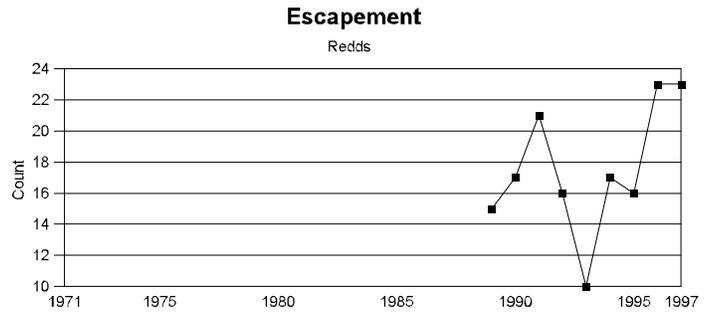
Harvest Management--The Mad River is closed to all fishing from the mouth to Jimmy Creek, but some illegal fishing persists. Hooking mortality and illegal harvest of bull trout/Dolly Varden in the Entiat and Columbia rivers are expected to decline significantly as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the federal Endangered Species Act in August, 1997.

STOCK STATUS PROFILE for Mad River Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	ESCAPE Redds			
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89	15			
90	17			
91	21			
92	16			
93	10			
94	17			
95	16			
96	23			
97	23			



AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Healthy

Screening Criteria

Hatchery--Cutthroat and rainbow trout fry were stocked first in 1934 and annually thereafter until 1990, when stocking ceased. Small fry up to subcatchable-size were planted until 1964, when the catchable-sized rainbow trout program commenced. The resulting fishery was popular and increased the harvest of migrant bull trout/Dolly Varden. Because catchable trout were released far below the spawning and initial rearing zones, harvest and negative interactions with bull trout/Dolly Varden were minimized.

Tillicum Creek was stocked with brook trout in 1973. Apparently this introduction failed, as no brook trout are found there today.

Species Interactions--Low water temperature now favors bull trout/Dolly Varden over rainbow trout in the vicinity of Cougar Creek, and most spawning occurs upstream of this point. Invasion of rainbow trout could occur if water temperature warms over the long-term, but a minimum of five miles of suitable bull trout/Dolly Varden spawning habitat offers more thermal buffering than found in most streams. On the other hand, the upper river may be vulnerable to warming because Mad Lake, the origin of Mad River has high exposure to sunlight.

OVERVIEW -- METHOW RIVER BULL TROUT/DOLLY VARDEN

**GOLD CREEK
BEAVER CREEK
TWISP
EAST FORK BUTTERMILK CREEK
WEST FORK BUTTERMILK CREEK
REYNOLDS CREEK
LAKE CREEK
WOLF CREEK
GOAT CREEK**

**EARLY WINTERS CREEK
CEDAR CREEK
LOST RIVER
MONUMENT CREEK
COUGAR LAKE
FIRST HIDDEN LAKE
MIDDLE HIDDEN LAKE
WEST FORK METHOW**

STOCK DEFINITION AND ORIGIN

Currently 17 bull trout/Dolly Varden stocks have been identified in the Methow River watershed. They are the Gold Creek, Beaver Creek, Twisp River, East Fork Buttermilk Creek, West Fork Buttermilk Creek, Reynolds Creek, Lake Creek, Wolf Creek, Goat Creek, Early Winters Creek, Cedar Creek, Lost River, Monument Creek, Cougar Lake, First Hidden Lake, Middle Hidden Lake, and the West Fork Methow River stocks. Adfluvial, fluvial and resident life history forms are present.

The bull trout/Dolly Varden in the Methow River watershed are native. No hatchery introduction of bull trout/Dolly Varden has occurred.

Bull trout/Dolly Varden spawn, and alevins rear in cold, headwater reaches where annual heat budgets are less than 1600° C, the upper limit of steelhead and chinook salmon distribution. The stocks spawn in thermal isolation, because water temperature is too warm downstream between spawning sites.

Adfluvial, fluvial and resident forms are present. In addition to genetics, the environment plays a role in determining life form. The resident form is found in the coldest reaches or above passage barriers. Below such barriers in warmer, richer water resident emigrants likely transform into the fluvial form, which are forced to spawn in unsuitable habitat below barriers. Some resident fish enter Cougar Lake and First and Middle Hidden Lakes and become adfluvial fish.

STOCK STATUS

The status of bull trout/Dolly Varden stocks in the Methow River watershed has been classified as Unknown with the exception of the Lost River stock which has been classified as Healthy based on the trend of available abundance data. The stock in the

South Fork of Beaver Creek was extirpated by brook trout introgression. This also probably occurred in Eightmile Creek.

Nearly all suitable spawning habitat is currently used by bull trout/Dolly Varden and present spawning distribution is nearly the same as the distribution prior to European settlement. This habitat is naturally limited (less than 5% of the subbasin total) because adequately cold water is limited and found in high gradient, headwater reaches where access and flow are limited.

Habitat quantity ebbs and flows with climate, precipitation, forestation changes. The worst scenario is a warming, drying climate where the forest is removed (e.g., wildfire, disease/parasite, logging, etc.).

METHOW -- GOLD CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

The existence of a stock in the Gold Creek basin is speculative in that no adults or young-of-the-year fry have been found. The assumption of a stock is based on the collection of three parr, which may be emigrants from a distant basin. Only juvenile fish have been sampled to date, making it impossible to identify their life history form. Because barrier falls bar access to the coldest water where the resident life history form is usually found, we assume that bull trout/Dolly Varden in this basin are the fluvial. Spawning would occur within 0.5 mile of the falls on Foggy Dew and Crater Creeks. Spawn timing is unknown.

STOCK STATUS

Stock status is Unknown but may be Critical or Extinct. Six standing crop estimates were made in likely bull trout/Dolly Varden reaches during 1987 and 1988. Test fishing efforts using hook and line were conducted once in 1975 and six times in 1990. Only three bull trout/Dolly Varden have ever been captured. Red surveys were initiated in Crater Creek in 1996. Very low numbers of redds have been observed. Data quality is good for presence/absence and redd survey data but poor for test fish data.

FACTORS AFFECTING PRODUCTION

Habitat--The base of the falls on Crater Creek (3,800 feet elevation) and Foggy Dew Creek (3,840 feet elevation) are the most likely areas for bull trout/Dolly Varden in the Gold Creek basin. Both of these streams are second-order streams that are less than ten miles long with base flows under 5 cfs. All but lower Gold Creek is in the Okanogan National Forest.

Gold Creek may be too warm for bull trout/Dolly Varden. Impassable falls preclude them from accessing colder water reaches above the falls. Aside from the warm water, habitat is not a factor in the status of bull trout/Dolly Varden, as it remains pristine in the headwaters of Foggy Dew and Crater creeks, both of which are boulder-filled torrential streams limited in gravel and large woody debris.

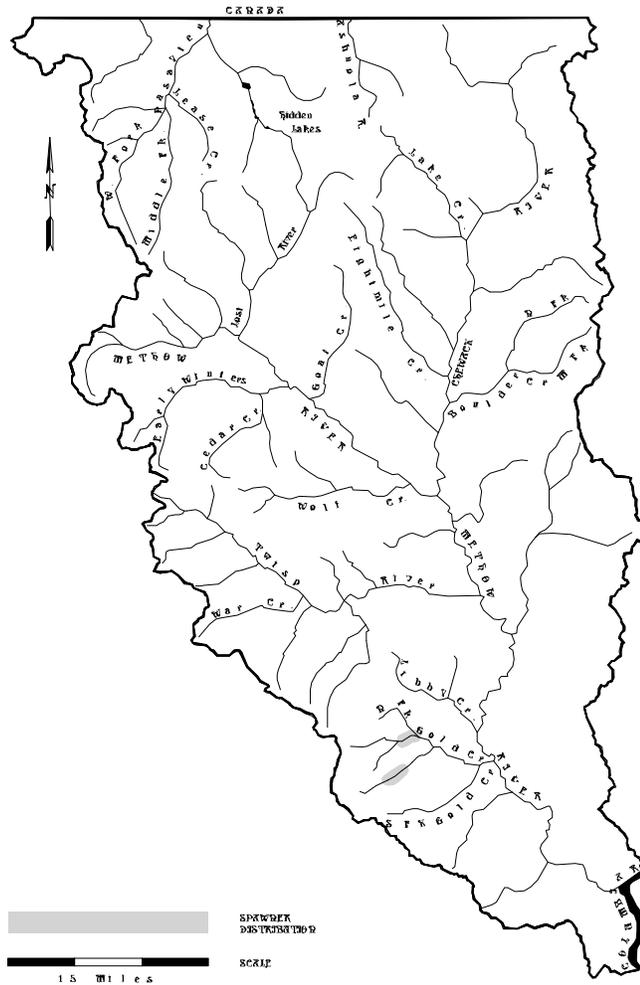
Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstructing migration of some fluvial fish.

Harvest Management--Fishing effort is low in the bull trout/Dolly Varden zones (where hiking is required) but moderate in the lower basin (below Foggy Dew Creek), where selective fishing regulations protect bull trout/Dolly Varden. Hooking mortality and

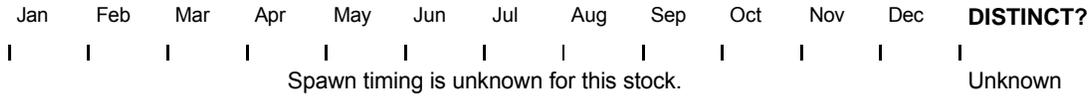
STOCK DEFINITION PROFILE for Gold Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Gold Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD No./100m ²	FW PROD Fish/Hr	ESCAPE Redds	
73				
74				
75		1		
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87	.5			
88				
89				
90				
91				
92				
93				
94				
95				
96			2	
97			1	

The 1996 redd survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

illegal harvest of bull trout/Dolly Varden in the Methow and Columbia rivers are expected to decline significantly as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the federal Endangered Species Act in August, 1997.

Hatchery--Rainbow trout fry releases in Gold, Crater, and Foggy Dew creeks started in the 1940s. In the 1950s, catchable-size rainbow trout stocking sustained trout fisheries in lower Gold Creek, and incidental catch of bull trout/Dolly Varden rose. Heavy rainbow trout stocking rates may have negatively affected bull trout/Dolly Varden parr. The catchable rainbow program was discontinued in the mid-1970s and likely had no lasting effects on bull trout/Dolly Varden because hatchery-origin fish were released below the bull trout/Dolly Varden zones into native rainbow trout populations that were probably already replacing bull trout/Dolly Varden naturally.

Rainbow trout became established in Crater Creek from an introduction made into Crater Lake. Recruits from this population, protected from bull trout/Dolly Varden by the falls, may have put added pressure on bull trout/Dolly Varden in Crater Creek. Only cutthroat trout (released in 1917 in Cooney Lake, the source of Foggy Dew Creek) are found above Foggy Dew Falls, and they have no effect on the status of bull trout/Dolly Varden in that stream.

Species Interactions--Thermal conditions in this basin are marginal for bull trout/Dolly Varden and favor rainbow trout, which predominate in coldest water accessible to bull trout/Dolly Varden. Bull trout/Dolly Varden may now be extinct in Gold Creek, the natural result of habitat favoring rainbows. Bull trout/Dolly Varden are sustainable in this basin under present thermal conditions only if they are established above the falls where rainbow trout are not found.

METHOW -- BEAVER CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Historically, distinct stocks of native bull trout/Dolly Varden were found in the South Fork of Beaver Creek and Blue Buck Creek. The stock in the South Fork is now extinct, and the one in Blue Buck Creek is nearly so. Distinct stocks probably existed in the Middle Fork and Lightning creeks as well, though this is speculation based on available habitat. Stocks were spatially separated in headwater reaches and probably consisted of both fluvial and resident life history forms. Distribution of the Blue Buck stock is centered between RM 1.5 (elevation 4,600 feet) and RM 2.0 (elevation 4,800 feet). Spawn timing is unknown.

STOCK STATUS

Stock status is Unknown, however the limited information indicates the stock may be Critical. More information is needed to confirm the status of this stock.

Excellent-quality standing-crop estimates were conducted in the late 1980s (Ken Williams, WDFW, personal communication) in the Middle Fork (two sites) and South Fork (two sites) of Beaver Creek and in lower Beaver Creek, but no bull trout/Dolly Varden were found. Upper Beaver and Lightning creeks have not been surveyed.

The Blue Buck Creek population, probably the last remaining bull trout/Dolly Varden population in this basin, was discovered in the early 1990s with electrofishing gear. Low abundance and limited distribution prompted discontinuation of the use of this potentially lethal gear. Test fishing with hook/line verified bull trout/Dolly Varden presence, that their numbers and range are very limited, and that introgression with brook trout is occurring. Data quality in Blue Buck Creek is fair; only presence/absence data are available.

An interview with a local angler whose familiarity with the fishes of the South Fork of Beaver Creek dates back to the 1940s revealed that bull trout/Dolly Varden were common to upper reaches of this stream. Only brook trout are present today.

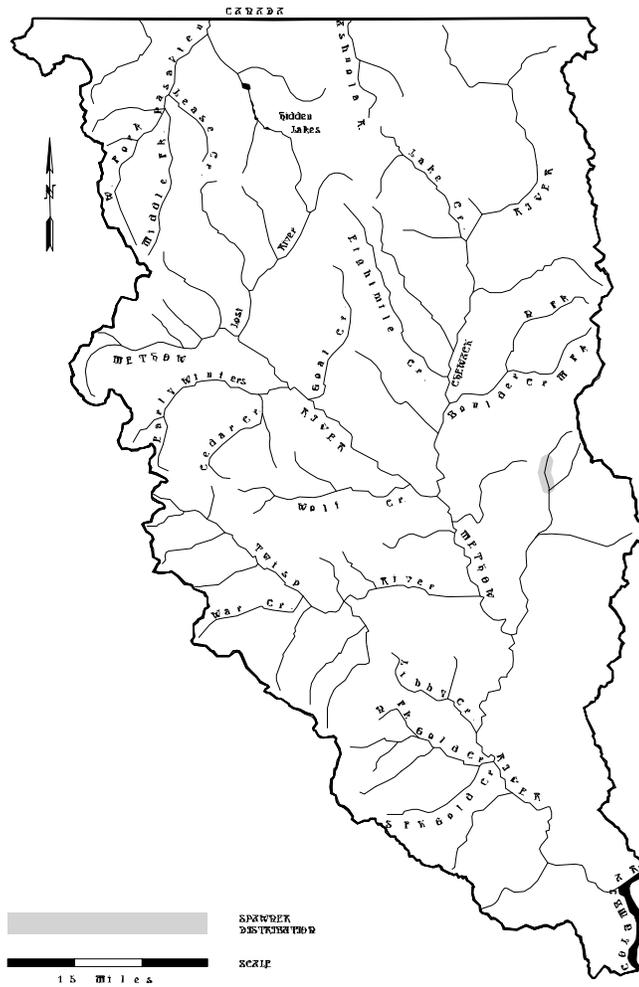
FACTORS AFFECTING PRODUCTION

Habitat--Blue Buck Creek is located on the eastern flank of the Methow basin and is exposed from the south and west. Suitably cold water in south/west-facing streams is found at much higher elevations and gradients and lower stream order than in north/east-facing streams.

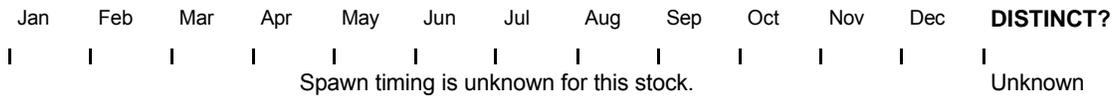
STOCK DEFINITION PROFILE for Beaver Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Beaver Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Accordingly, in Blue Buck Creek bull trout/Dolly Varden are distributed at 4,600 to 4,800 feet elevation in a very small second-order stream where the gradient is 7.8%. The upper half of the Beaver Creek basin is on U.S. Forest Service land; the lower half is on private farm land.

Timber harvesting and road building have severely sedimented and deforested the Blue Buck Creek basin. During late summer the entire flow in lower Beaver Creek is used for irrigation, but migratory bull trout/Dolly Varden still may have access to headwater reaches during spring runoff if they can pass numerous beaver dams.

Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstructing migration of fluvial fish.

Harvest Management--Roads associated with timber harvesting have made Blue Buck Creek highly accessible to anglers during the summer, but there appears to be little fishing interest. Poaching is minimized by road closure (locked-gate) at the peak of spawning. Bull trout/Dolly Varden harvesting is prohibited. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Brook trout were stocked in Beaver Lake (source of the South Fork Beaver Creek) in 1933. Brook trout were released directly into Beaver Creek in 1948, 1955, and 1958, though the precise location of the releases is unknown. The early extirpation of South Fork bull trout/Dolly Varden was due to directed releases of brook trout into that stream. The late invasion of Blue Buck Creek is a function of distance from spreading brook trout released in other parts of the basin, movement through the rainbow trout zone at lower elevation, and movement upstream through a high-gradient gorge.

Catchable-size rainbow trout from Winthrop National Fish Hatchery were released into Beaver Creek in the 1950s and 1960s. Though new fisheries harvested some parr and adult bull trout/Dolly Varden, the net effect was benign because stockings and fisheries were far below the breeding and initial rearing habitat of bull trout/Dolly Varden.

A single stocking of cutthroat trout was made from horseback in upper Beaver Creek (above Blue Buck Creek) and in Blue Buck Creek in 1963, but it is unclear whether self-sustaining populations were established. The point is academic, since cutthroat and bull trout/Dolly Varden are ecologically compatible.

Species Interactions--Introduced brook trout are widespread in the Beaver Creek basin. They have replaced bull trout/Dolly Varden in the South Fork and they are now in the process of extirpating them in Blue Buck Creek.

METHOW -- TWISP BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Twisp River bull trout/Dolly Varden are native and distinct from other stocks due to their geographic distribution. The size of spawners noted during redd counting indicates that the fluvial life history form is present in the Twisp River, and the resident form is present in lower North Creek. Spawning occurs in the mainstem between North Creek (a few resident fish spawn in lower North Creek) to the falls from early September through mid-October.

STOCK STATUS

Stock status is Unknown. A standing crop estimate made at RM 27.1 in 1987 showed good numbers of juvenile bull trout/Dolly Varden. Redd counts prior to 1995 were conducted too early in the year and were confined to the upper breeding zone. The redd count in 1995 was the third largest for Methow basin streams. More escapement data are needed to more accurately assess status, but the only unnatural limiting factor seems to be fishing mortality. Data quality is excellent (standing crop estimate and 1995 redd count) but poor for redd count data prior to 1995, when counts were incomplete.

FACTORS AFFECTING PRODUCTION

Habitat--This fourth-order river is 28.2 miles long and drains a basin of 247 square miles. The spawning area is from RM 26.1 to RM 28.0, has a gradient of 5.7%, and elevation ranges from 3,450 to 4,020 feet. Minimum flow is 66 cfs above RM 4.0, where 62 cfs are withdrawn for irrigation. All but the lower 13 miles of river are within the Okanogan National Forest.

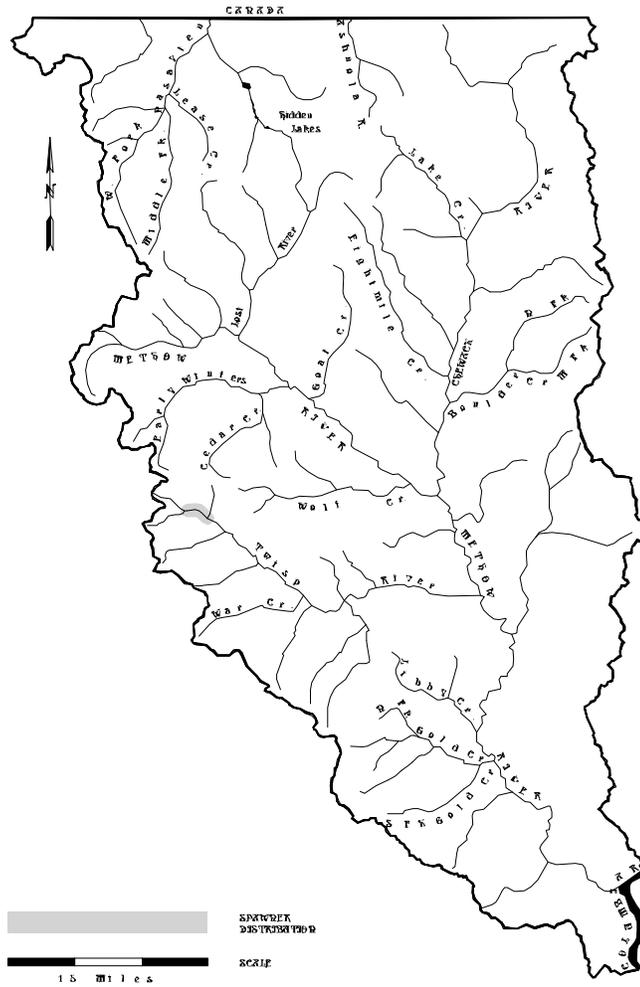
The habitat is pristine. Summer flow is sustained by glaciers, and water temperatures may actually decline during drought, since the percentage of glacier meltwater increases then. The glaciers are key in maintaining cold water in the event of increasing air temperatures. The gradient is high, and riffles outnumber pools. Boulders and turbulence are the predominant cover type. Gravel and large woody debris are naturally limiting.

Columbia River productivity has declined from the impoundment of a free-flowing river, and the dams kill and obstruct some migrants.

STOCK DEFINITION PROFILE for Twisp Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

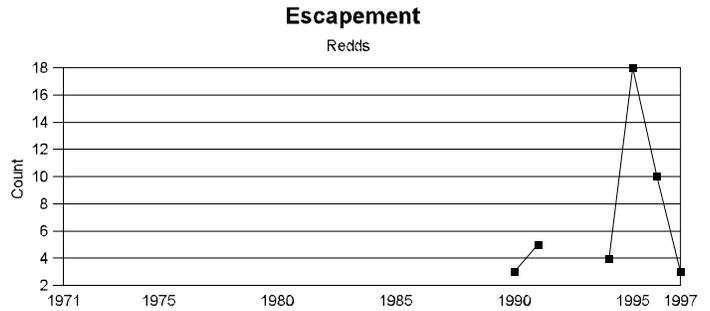
DISTINCT? - Unknown

STOCK STATUS PROFILE for Twisp Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	ESCAPE Redds	ESCAPE Redds	FW PROD No./100m ²	
73				
74				
75				
76				
77				
78				
79				
80				
81				
82			5.9	
83				
84				
85				
86				
87			5.9	
88				
89				
90	3			
91	5			
92				
93				
94	4			
95	18	3		
96	10			
97	3			



The 1990, 1991, 1994 and 1996 redd surveys were incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Harvest Management--Bull trout/Dolly Varden are protected from harvest, but bait fishing remains legal, and some hooking mortality and illegal harvest of bull trout/Dolly Varden occur. Hooking mortality and illegal harvest of bull trout/Dolly Varden downriver in the Methow and Columbia rivers are expected to decline as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Brook trout were stocked in the 1950s in beaver ponds and sloughs adjacent to the Twisp River, but none are seen today.

Rainbow trout fry and catchable-size fish have a long history of releases dating back to the 1930s, yet the effect on bull trout/Dolly Varden has not been significant because the releases have not expanded the distribution of hatchery-origin fish over native fish and the releases, and fisheries, occur well below bull trout/Dolly Varden spawning and rearing areas.

The Twisp River road terminates in a campground near the center of the spawning area. During the 1970s and 1980s catchable-size residual steelhead from Wells Hatchery were stocked each summer drawing a fair number of bait anglers. Bull trout/Dolly Varden harvest, however, was minimized due to the torrential, brushy character of the river. Fishing pressure and harvest rates declined upon termination of hatchery catchable releases in the 1990s.

A few cutthroat trout are found below the falls in the bull trout/Dolly Varden zone. Above the falls they are extremely abundant and originated from alpine lake stocking. They are ecologically compatible with bull trout/Dolly Varden.

Species Interactions--Rainbow trout abut the bull trout/Dolly Varden population at North Creek, leaving about two miles of prime spawning and fry-rearing habitat, an intermediate amount relative to habitat available to other populations. The barrier falls prevent full distribution of bull trout/Dolly Varden into cold-water reaches which would provide the greatest protection from invasion by rainbow trout if climate warming should occur.

METHOW -- EAST FORK BUTTERMILK CREEK **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

This stock is native and distinct, separated geographically and thermally from other bull trout/Dolly Varden populations. The stock contains fluvial and resident life history forms. Spawning is limited to the area about 0.5 mile of the falls (RM 3.2) and occurs from early September to mid-October.

STOCK STATUS

Stock status is Unknown. Though abundance per unit area suggests a Healthy status, low total population size due to limited habitat may decrease fitness (due to possible reduced genetic variability), and a more conservative status may be appropriate.

Data are limited to a standing crop estimate at RM 2.7 and a redd survey in 1995. The redd survey was complete in terms of reach coverage, but only a single survey in early October was conducted. Data quality is excellent.

FACTORS AFFECTING PRODUCTION

Habitat--The East Fork is a third-order stream that is 9.2 miles long. Basin area is 17 square miles. The gradient is 10%, minimum flow is 6.7 cfs, and elevation ranges from 3,600 to 4,000 feet. The East Fork is a torrential stream with large, clean boulders and limited gravel and large woody debris. The entire basin is on U.S. Forest Service land, and the headwaters are in the Sawtooth Wilderness.

Habitat in bull trout/Dolly Varden spawning and initial rearing areas remains in pristine condition, despite recent timber harvesting on the east flank of the basin. Two road crossings occur, one above and below the bull trout/Dolly Varden zone.

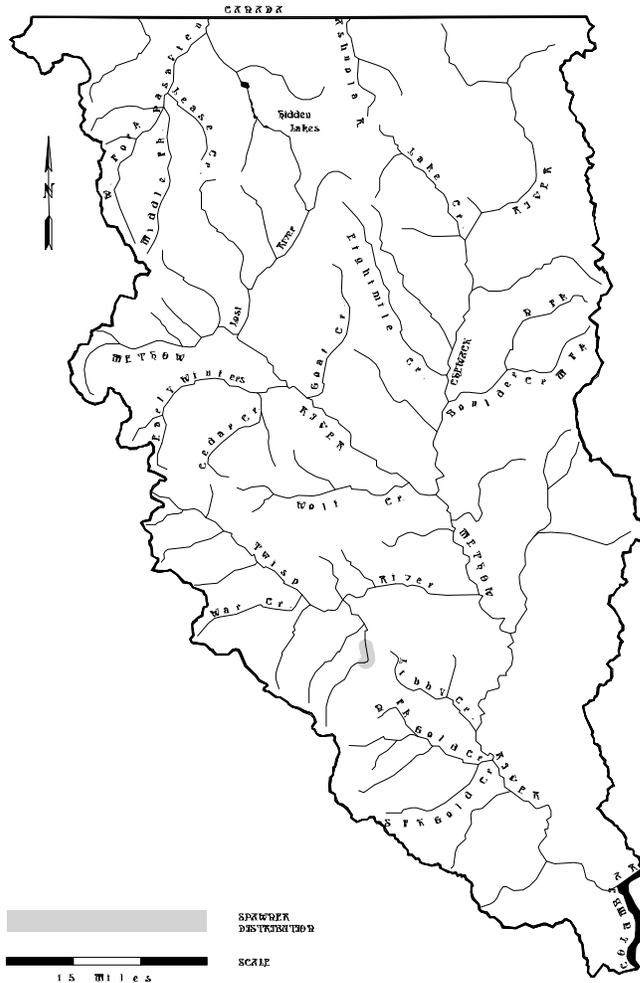
Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstructing of fluvial fish.

Harvest Management--Bull trout/Dolly Varden in the East Fork are moderately accessible in terms of road distance, but the steep, rugged topography is a deterrent to anglers. Poaching of fluvial spawners probably is low because anglers do not seem to be aware of bull trout/Dolly Varden here. Hooking mortality and illegal harvest of bull trout/Dolly Varden downriver in the Methow and Columbia rivers are expected to decline as a result of the closure of the recreational steelhead fishery. The closure is

STOCK DEFINITION PROFILE for EF Buttermilk Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for EF Buttermilk Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	FW PROD No./100m ²	ESCAPE Redds		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89	13.1			
90				
91				
92				
93				
94				
95		4		
96		0		
97		0		

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

associated with the listing of steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Rainbow trout releases in 1948 (fry) and 1962 (catchable-size) are the only recorded plants in the East Fork, but cutthroat trout were undoubtedly were stocked above the falls. Interactions between hatchery-origin salmonids and bull trout/Dolly Varden in East Fork Buttermilk Creek are insignificant.

Species Interactions--Cutthroat trout and bull trout/Dolly Varden co-exist about 0.5 mile below the falls before rainbow trout appear. Slight warming would give rainbow trout a thermal advantage, and they could replace cutthroat and bull trout/Dolly Varden.

METHOW -- WEST FORK BUTTERMILK CREEK **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

This stock is native and distinct, separated geographically and thermally from other bull trout/Dolly Varden/Dolly Varden stocks. The stock is composed of fluvial and resident life history forms. Fluvial fish are separated from resident fish by a logjam impasse at RM 1.8. Spawning by resident fish ranges upstream to RM 3.8. The time of spawning is unknown.

STOCK STATUS

Stock status is Unknown but may be Depressed.

A standing crop estimate was made at RM 0.0 in 1988. Three hook and line surveys were conducted in 1983 and 1990. Data quality is fair. The results indicated that fish density was lower than would be expected based on available habitat.

FACTORS AFFECTING PRODUCTION

Habitat--This third-order stream is 9.6 miles long and drains an area of 17 square miles. The gradient is 5.0%, and elevation ranges from 3,600 to 4,100 feet. Minimum flow is 4 to 10 cfs. Habitat is pristine. Recent timber harvesting high above the west bank has caused no problems. The West Fork is a torrential stream with large, clean boulders and limited gravel and large woody debris. The entire basin is on U.S. Forest Service land, and the headwaters are in the Sawtooth Wilderness.

Because fluvial spawners cannot migrate above the logjam, upstream habitat may be underseeded above the falls.

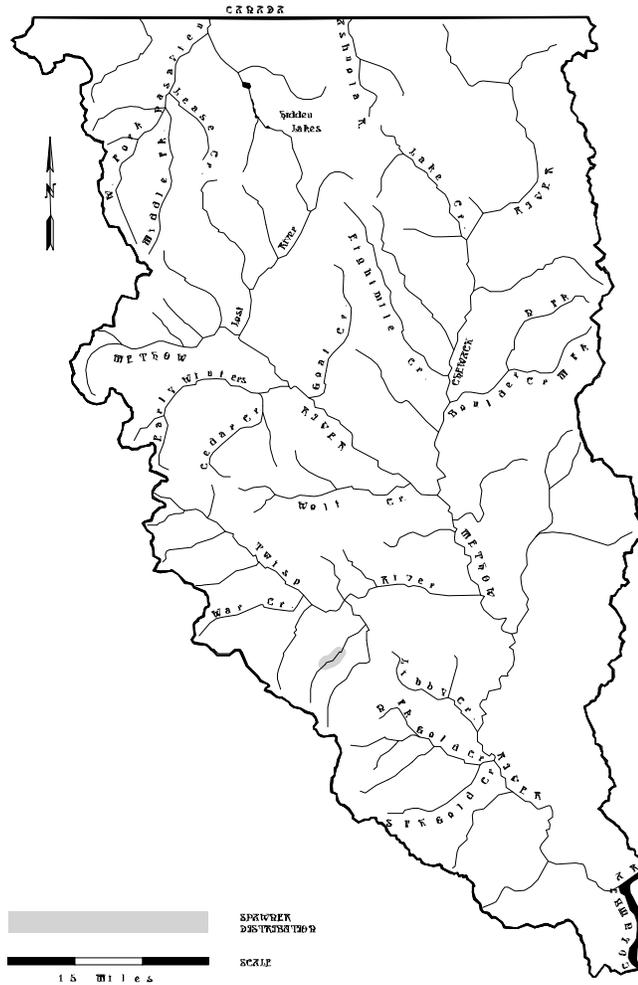
Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstructing migration of fluvial fish.

Harvest Management--A well-used trail commences in the bull trout/Dolly Varden zone and follows the creek upstream. Downstream, easy access results from a road crossing. There is evidence of fishing in the West Fork and, though harvesting bull trout/Dolly Varden is prohibited, hooking mortality by anglers fishing with bait for cutthroat or rainbow trout could be significant. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is

STOCK DEFINITION PROFILE for WF Buttermilk Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawn timing is unknown for this stock.												Unknown

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for WF Buttermilk Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Fish/Hr			
-----------------	--------------------	--	--	--

73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	1.5
84	
85	
86	
87	
88	
89	3.7
90	
91	
92	
93	
94	
95	
96	
97	

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

associated with the listing of the upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--The only recorded releases of hatchery-origin fish in Buttermilk Creek occurred with the release of rainbow trout fry in 1948 (fry) and catchable-size rainbows in 1962. The effect of these releases on bull trout/Dolly Varden is unknown.

Species Interactions--The interface between bull trout/Dolly Varden and rainbow trout occurs at the falls, which suggests that the falls is a barrier to fish. As long as the falls (formed by a logjam) holds, rainbow trout will not be able to invade upstream bull trout/Dolly Varden populations. This probably explains why the bull trout/Dolly Varden are more widely distributed in the West Fork than in the East Fork. Elevations and temperature are similar in the two streams, and if the logjam should disappear, rainbow trout are sure to invade upstream, forcing bull trout/Dolly Varden into higher elevation, colder areas.

METHOW -- REYNOLDS CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This bull trout/Dolly Varden stock is both native and distinct, owing to geographic isolation of spawning grounds. Spawning is confined to the area between the falls (RM 0.7) and Forest Service Road 4430 (RM 0.2). Spawning occurs from mid-September through mid-October. The size of spawners noted during redd counting surveys confirms that the stock is fluvial. A barrier falls excludes the population from the coldest water, where the resident life history would otherwise be found.

STOCK STATUS

Stock status is Unknown but may be Critical. Trend data are based on single redd counts made in 1990 and 1995. The 1990 count was conducted too early, whereas the 1995 count was made at the proper time. The presence of bull trout/Dolly Varden is well established from sampling by electrofishing (two surveys) and hook and line (three surveys). Only one redd has been seen in two years of surveys. Data quality is fair.

FACTORS AFFECTING PRODUCTION

Habitat--This second-order stream is 6.0 miles long and drains an area of 8.3 square miles. The spawning area lies between RM 0.2 and RM 0.7 (the falls), has a gradient of 12.0%, and elevation ranges from 2,860 to 3,240 feet. Minimum flow is 1.5 cfs. The entire basin is on U.S. Forest Service land, and the headwaters are within the Sawtooth Wilderness.

The habitat is essentially pristine except for Forest Service Road 4430 which crosses the creek. The road culvert is passable because fluvial bull have been seen above it along with marked steelhead smolts released below it. A tremendous falls at RM 0.7 confines bull trout/Dolly Varden to the short reach below. This stream is a torrential-boulder stream with limited gravel, little large woody debris, mostly riffles and few pools. Ordinarily, bull trout/Dolly Varden would not be found at this low elevation (3,000 ft.) because the water would be too warm. The water is inordinately cold for this elevation from short-run glacial snowmelt off Reynolds Peak. Water temperatures may actually decline during the hottest, driest summers, since the percentage of glacier meltwater increases at that time.

Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstruction migration of fluvial fish.

STOCK STATUS PROFILE for Reynolds Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Redds			
--------------	--------------	--	--	--

73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	
88	
89	
90	1
91	
92	
93	
94	
95	0
96	
97	

The 1990 and 1995 redd surveys were incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Harvest Management--Bull trout/Dolly Varden are protected from harvest in Reynolds Creek. Rainbow trout are open to harvest, and bait is allowed. Some incidental hooking mortality occurs with bait-caught bull trout/Dolly Varden, but fishing effort is so low that this is probably insignificant. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Steelhead residual smolts were released into Reynolds Creek below the road once in the mid-1980s, but only a few moved upstream through the culvert to bull trout/Dolly Varden habitat, and no adverse interactions were observed. There is no record of fish releases above the falls.

Species Interactions--A few rainbow trout are found with bull trout/Dolly Varden up to the barrier falls. This suggests that the tenuous balance between the two species is at the threshold of a rainbow trout takeover if the water warms only slightly over the long-term.

METHOW -- LAKE CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This adfluvial stock of native bull trout/Dolly Varden spawns in isolation in Lake Creek from Black Lake to Three Prong Creek. Spawning occurs later than with other stocks, from late September to late October. A few fluvial fish have been found below Black Lake in Lake Creek and the Chewuch River, and since Lake Creek supports the only known bull trout/Dolly Varden population in the Chewuch basin, these fish probably are of Lake Creek origin.

STOCK STATUS

Stock status is Unknown but may be Healthy. Black Lake was sampled by gill net in 1972. The initial redd count was made in 1995. The 22-redd total was second highest for Methow basin populations. Data are limited, but data quality is excellent.

FACTORS AFFECTING PRODUCTION

Habitat--Lake Creek is a third-order stream that drains a basin of 54 square miles. Minimum flow is 11 to 17 cfs. The spawning habitat lies between RM 8.1 and RM 9.7 at elevations ranging from 3,982 feet to 4,250 feet and a gradient of 3.2%.

The habitat is uninfluenced by human activity, and its location in the U.S. Forest Service Pasayten Wilderness should minimize perturbations by humans. Aspect is southern, so water temperature is relatively warm. Yet at elevations exceeding 4,000 feet, the water is sufficiently cold to support bull trout/Dolly Varden. Spawning gravel is reasonably abundant. A combination of large woody debris and boulders provides excellent cover for rearing juveniles.

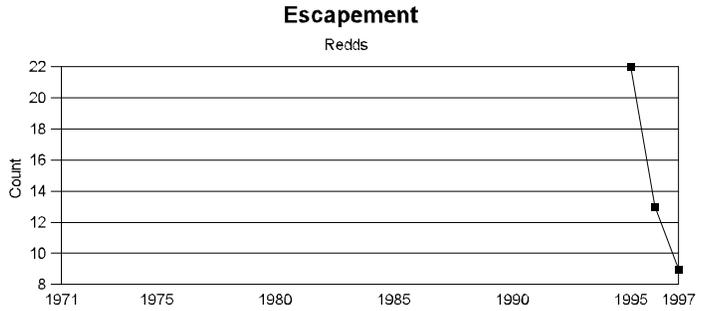
Harvest Management--Though reaching Black Lake requires a five-mile hike, the trail is not difficult and conveys heavy traffic to many other destinations in the Pasayten Wilderness. The result is that fishing intensity in Black Lake is moderate. This is mitigated somewhat by the lake's size and depth. Bait-based hooking mortality and illegal harvest may be significant even though harvesting bull trout/Dolly Varden is not permitted. Bait is prohibited in Lake Creek above the wilderness boundary, about 1.5 miles below Black Lake. Poaching of spawners is limited because spawning is late, spread out across the spawning area, of short duration, and occurs in brushy reaches not easily reached by anglers. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated

STOCK STATUS PROFILE for Lake Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds	FW PROD Fish/Hr		
72		1.5		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93				
94				
95	22			
96	13			
97	9			



The 1996 redd survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Rainbow trout releases in Black Lake ceased many years ago, and effects are considered insignificant because rainbow trout are indigenous, themselves affecting bull trout/Dolly Varden as much or more than their hatchery-origin counterparts. The cutthroat trout in upper Lake Creek are recruits from naturalized populations in alpine lakes that were originally stocked with cutthroat trout. Cutthroat trout and bull trout/Dolly Varden are ecologically compatible.

Species Interactions--Rainbow trout dominate the biomass of salmonids in Lake Creek below Black Lake and share Black Lake with bull trout/Dolly Varden. But from Black Lake to Three Prong Creek bull trout/Dolly Varden dominate because cold water favors them. Above Three Prong Creek only cutthroat trout are found, due to a barrier falls that marks the upstream limit of bull trout/Dolly Varden distribution.

METHOW -- WOLF CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This stock is native and distinct owing to reproductive isolation from other bull trout/Dolly Varden stocks. The stock is thought to have resident and fluvial components. Resident bull trout/Dolly Varden have been confirmed from female size-at-maturity data. Fluvial fish have not been observed because redd surveys have not been conducted yet, but they surely exist. Spawning occurs from the North Fork of Wolf Creek to a point unknown below the South Fork of Wolf Creek. Spawn timing is early September through mid-October.

STOCK STATUS

Stock status is Unknown. No unnatural limiting factors affect this stock; so its status may be Healthy.

Four standing-crop surveys have been made, but only the one at RM 7.2 in 1990 was conducted fully in the bull trout/Dolly Varden zone. Redd counts are available. Data quality is excellent for presence/absence data but poor for trend data.

FACTORS AFFECTING PRODUCTION

Habitat--This third-order stream is 14.0 miles long and drains a basin of 38 square miles. Minimum flow at RM 4.2 is 8.0 cfs. Spawning starts at RM 7.2, but it stops at some unknown point below the East Fork falls at RM 10.3. The gradient from RM 5.9 to RM 8.0 is 5.1%, and elevation ranges from a low of 3,060 to 3,620 feet, though the elevation of the upper distribution is unknown.

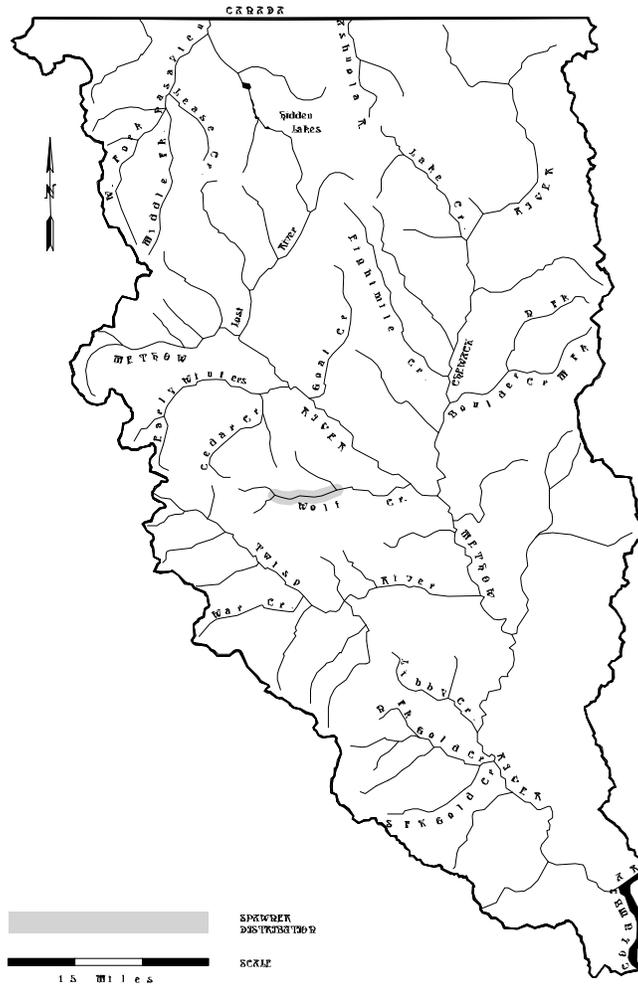
In the bull trout/Dolly Varden zone habitat remains unaltered. In the rainbow trout zone at RM 4.2 a sizeable volume of flow is diverted into Patterson Lake, and some fluvial parr migrants are lost. Some smaller diversions downstream combine with a permeable delta to dry the stream channel by late summer, though it is possible that the stream might dry up naturally. This has little bearing on migration, since bull trout/Dolly Varden enter and leave before and after the dry period.

Most spawning gravel is deposited in the lower 0.5 mile of the bull trout/Dolly Varden zone from torrential flow upstream. Cover consists mainly of boulders, turbulence, and overhanging riparian vegetation. Large woody debris is limited because spring flooding tends to remove it. Riffles outnumber pools in this torrential stream.

STOCK DEFINITION PROFILE for Wolf Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Wolf Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Poor

Return Years	FW PROD No./100m ²	ESCAPE Redds		
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90	7.7			
91				
92				
93				
94				
95				
96		7		
97		3		

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

A major fire burned much of the headwater of Wolf Creek in the mid-1980s, but there have been no discernable effects as determined by the 1990 surveys, which revealed large standing crops of salmonids and a clean substrate.

The capacity of the Columbia River for rearing fluvial bull trout/Dolly Varden has been diminished by hydroelectric development, and dams kill and obstruct some migrants.

Harvest Management--Wolf Creek is closed to the taking of bull trout/Dolly Varden. It is too isolated to receive significant angling effort and to suffer significant angling-related mortality (hooking mortality, illegal harvest, or poaching spawners). Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Cutthroat trout were established above the falls from four horseback releases in the early 1960s. Bull trout/Dolly Varden were probably unaffected because of the ecological compatibility of the two species. Hatchery-origin rainbow trout fry were introduced several times from 1939 to 1953 into lower Wolf Creek well below the bull trout/Dolly Varden zone into an existing native rainbow trout stock. Effects were likely insignificant because the rainbow trout distribution did not increase, and releases occurred far below the bull trout/Dolly Varden zone.

Species Interactions--The rainbow/bull trout/Dolly Varden interface occurs at North Fork Wolf Creek at RM 5.9. Bull trout/Dolly Varden are present at RM 7.2 but not at the falls at the South Fork Wolf Creek (RM 10.3). The precise upstream limit of distribution is unknown, but the amount of suitable habitat is at least average. Invasion by rainbow trout is unlikely because the water draining into Wolf Creek from northslope tributaries is cold.

METHOW -- GOAT CREEK BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 (N = 50) indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

This native stock is considered distinct based on its thermal and geographical isolation from other bull trout stocks. The stock has resident and fluvial life history components. Spawning occurs from early September through mid-October from about RM 9.0 to RM 10.8.

Resident fish are verified through size-at-maturity of females. Fluvial fish are assumed present because there is no natural barrier to isolate this population. A fish that was too large to be a resident fish was observed just below a culvert at RM 6.8 (a possible barrier) in 1995.

STOCK STATUS

Stock status is Unknown but may be Depressed.

Electrofishing, chemical sampling, and test fishing with hook/line have all shown the presence of bull trout, but only test fishing from RM 10.0 to RM 11.5 in 1990 was conducted fully in the bull trout zone. Redd counting began in 1995. Data quality is fair for presence/absence data and excellent but limited for redd counts.

Counts indicate that abundance is lower than expected based on available habitat.

FACTORS AFFECTING PRODUCTION

Habitat--This third-order stream is 12.5 miles long and drains an area of 36 square miles. Minimum flow is 3 to 5 cfs. The gradient is 6.7%. Elevation ranges from 4,680 to 5,320 feet. Exposure is south and west, which means that water cold enough for bull trout is not encountered until the elevation is high. The upper end of their distribution is so high in elevation that the stream becomes a second-order stream too small for bull trout. Except where Goat Creek enters private holdings on the Methow Valley floor, the stream is in the Okanogan National Forest.

Cattle grazing in the valley increases sedimentation. Timber harvesting has reduced riparian shading in upper Goat Creek. There is a good mix of pools and riffles and boulders, gravel, and large woody debris. The culvert at RM 6.8 may obstruct fluvial fish from reaching spawning habitat.

STOCK STATUS PROFILE for Goat Creek Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	FW PROD Fish/Hr	ESCAPE Index Total	ESCAPE Redds	
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90	1.5			
91				
92				
93				
94				
95		0	0	
96				
97				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

For fluvial fish, the productivity of the Columbia River has probably been reduced from its alteration from a free-flowing river to a reservoir, and dams kill some migrants and obstruct migration of others.

Harvest Management--Regulations forbid the taking of native char, but cutthroat and rainbow trout attract anglers, resulting in hooking mortality (bait is allowed) and illegal harvest. The bull trout is not accessible by established trail, though a low-use road terminates within 0.5 mile of the creek. Judging by streamside evidence, angling pressure is low. Fluvial fish are vulnerable to fishing in the pool below the culvert if it blocks or delays fish passage. Hooking mortality and illegal harvest of bull trout are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Westslope cutthroat are the only salmonid released into upper Goat Creek, and resulting interactions with bull trout are not considered negative.

Species Interactions--Bull trout and cutthroat co-exist above RM 9.0. Below this point rainbow trout predominate and can replace bull trout if the climate warms moderately.

METHOW -- EARLY WINTERS CREEK BULL TROUT

In the 1998 inventory, this stock was called a bull trout/Dolly Varden stock. Subsequent genetic analysis of a sample collected in 1998 (N = 50) indicated that all of the fish in the sample were bull trout.

STOCK DEFINITION AND ORIGIN

The Early Winters Creek stock of native bull trout is distinct based on its geographic and thermal isolation from other stocks. Resident bull trout occupy the creek above Early Winters Creek Falls at RM 7.9. The presence of fluvial fish is based on anecdotal information. Fluvial fish, which may be resident emigrants, are found below the falls. Resident fish in Early Winters Creek spawn from RM 7.9 to RM 14.5. The fluvial component of the stock spawns from the falls to about one mile downstream. Spawn timing is from early September to mid-October.

STOCK STATUS

Stock status is Unknown, although the status of the resident form may be Healthy. Standing crop estimates are available at three sites on Early Winters Creek. Data quality is excellent for presence/absence data, but trend data (redd counts) are not available. Resident bull trout are widely distributed and abundant. Determining status of fluvial bull trout is confounded by recruitment of resident bull trout below the falls. Therefore we do not know if the juvenile bull trout surveyed at RM 5.0 (see Stock Status Profile) are the progeny of resident or fluvial spawners.

FACTORS AFFECTING PRODUCTION

Habitat--This fourth-order stream is 15.7 miles long and drains an area of 79 square miles. The basin contains seven glaciers and four lakes. Minimum low flow in the summer is 24 cfs (below the irrigation diversion of 23 cfs) versus 29 cfs low flow in the winter. The gradient and elevation in the resident life history form zone are 4.1% and 3,380 to 4,800 feet versus 3.5% and 3,195 to 3,380 feet in the fluvial life history zone. This a very cold stream. As much as 44% of the flow in a hot, dry summer may be glacier melt.

The habitat is both pristine and abundant above the falls. The fluvial form reach is thermally limited. Except for Highway 20, which follows the creek from mouth to headwater, the watershed has been altered little, especially in the bull trout zone. There is good a mix between pools and riffles, and gravel is plentiful. The substrate is diverse, with large boulders the predominant cover in torrential zones and large woody debris in low-gradient reaches.

STOCK STATUS PROFILE for Early Winters Bull Trout

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	FW PROD No./100m ²	FW PROD No./100m ²	FW PROD No./100m ²	ESCAPE Redds
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86	1.5			
87				
88				
89		6.1	6.9	
90				
91				
92				
93				
94				
95				
96				9
97				0

Column 1: Sampled at RM 5.0.

Column 2: Sampled at RM 8.8.

Column 3: Sampled at RM 12.3; 1996 and 1997 redd surveys incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstructing migration of fluvial fish.

Harvest Management--Though thousands of people traveling Highway 20 pass within yards of this stream annually, imposing talus slopes and dense riparian vegetation discourage fishing in the upper Early Winters Creek (above the falls) except at Lone Fir Campground. Judging from well-worn trails, more angling intensity is directed at the stream immediately below the falls because of easy access and the concentration of large fish. The stream is closed to the taking of bull trout, but some hooking mortality occurs when bait is used. Also, the incidence of illegal harvest though misidentification of bull trout is likely higher here because spontaneous use from visual stimulation while traveling the highway increases the number of casual, uninformed anglers. Hooking mortality and illegal harvest of bull trout are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--Rainbow trout fry were released frequently into native rainbow populations below the falls starting in the 1930s. Starting in 1952 and continuing for about twenty years, catchable-size rainbow trout from Winthrop National Fish Hatchery were released each summer to provide stream fishing in the upper Methow Valley. Releases were made below the bull trout zone and caused no additional interaction problems beyond those with native rainbow trout. The resulting fishery harvested some passing migratory bull trout, but the effect was probably low, because the fishery was localized and fluvial fish passed through the area during high flows when angling pressure was low and ineffective.

Above the falls, cutthroat trout were stocked in Cutthroat Lake, but details are undocumented. This self-sustaining population then expanded downstream into Early Winters Creek via Cutthroat Creek, where bull trout predation limits their abundance. Cutthroat trout have not adversely affected bull trout.

Species Interactions--The resident form is protected from downstream invaders by the falls and is the most secure population in the Methow basin. The fluvial form has limited cold water to shield it from rainbow trout invaders and is highly vulnerable to slight climatic warming. A few rainbow trout already have reached the falls on Early Winter Creek and threaten fluvial fish if those fish, indeed, originate below the falls and not above it.

METHOW -- CEDAR CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

The Cedar Creek stock of native, fluvial bull trout/Dolly Varden is distinct based on its geographic and thermal isolation from other species. They spawn immediately below Cedar Creek Falls (RM 2.4) to about 0.5 miles downstream. Spawn time is unknown.

STOCK STATUS

Stock status is Unknown. One standing crop estimate in bull trout/Dolly Varden habitat is available. The quality of the standing crop data is excellent but limited. The standing crop information verifies the presence of bull trout/Dolly Varden but is insufficient to determine status. Trend data (redd counts) are not available.

FACTORS AFFECTING PRODUCTION

Habitat--This third-order stream is 9.4 miles long, and drains a basin of 31 square miles. The gradient is 10.2%, and elevation ranges from 3,240 to 3,510 feet. Minimum flow is 14 cfs. All of the basin is on the Okanogan National Forest.

Cedar Creek is a high-gradient torrential stream with a substrate dominated by cobbles and boulders that is gravel- and large woody debris-limited. The channel stairsteps from one plunge pool to another. The low-elevation falls limits the amount of cold water habitat available to bull trout/Dolly Varden.

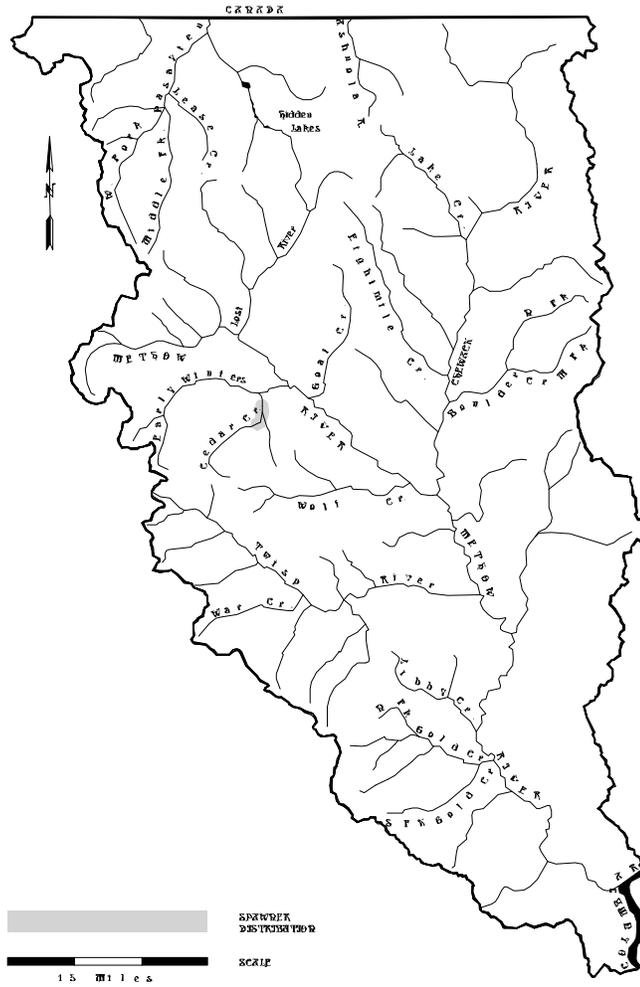
Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstructing migration of fluvial fish.

Harvest Management--Thousands of people traveling the North Cascades Highway pass within a short distance of this stream annually. An old roadbed offers relatively easy access to lower Cedar Creek, and though the stream is closed to the taking of bull trout/Dolly Varden, fishing intensity is enough to cause significant losses to hooking mortality (bait is legal) and illegal harvest. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

STOCK DEFINITION PROFILE for Cedar Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Cedar Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	FW PROD No./100m ²	ESCAPE Redds		
--------------	-------------------------------	--------------	--	--

73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87	3.9			
88				
89				
90				
91				
92				
93				
94				
95				
96		2		
97				

The 1996 red survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Hatchery--Rainbow trout fry were released into wild populations of rainbow trout in 1939 and 1944 in lower Cedar Creek. Cutthroat trout were native below the falls and were stocked above the falls in the 1960s. Hatchery-origin fish have had no significant effect on bull trout/Dolly Varden in Cedar Creek.

Species Interactions--Cutthroat trout and bull trout/Dolly Varden co-inhabit Cedar Creek below the falls. Water cold enough to protect bull trout/Dolly Varden from invading rainbow trout is very limited because Cedar Creek Falls bar them from moving upstream to colder water. Accordingly, this stock is highly vulnerable to slight climatic warming that would swing thermal advantage to rainbow trout.

METHOW -- LOST RIVER BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This stock is native and distinct, owing to its geographic isolation, though some gene flow may occur with the adfluvial stock in Cougar Lake when Lost River resident fish enter Cougar Lake or Cougar Lake adfluvial fish move into the Lost River. Female size-at-maturity has shown Lost River stock to be composed of resident fish. Fluvial spawners are blocked by a barrier falls at RM 9.6. Lost River bull trout/Dolly Varden spawn from about a mile above Drake Creek to Cougar Lake. Spawn time is unknown.

STOCK STATUS

Stock status is Healthy. The healthy status is based on high abundance, i.e., 1,092 (210 fish per mile) catchable-size bull trout/Dolly Varden.

Data quality is excellent. A standing crop estimate of resident bull trout/Dolly Varden from Drake and Diamond creeks (RM 11.7 to RM 16.9) was made in 1993. Since then, the entire reach has been test-fished annually in the first week of September by hook and line. Redd counting for fluvial spawners from Eureka Creek to Monument Creek started in 1994 and continued in 1995.

FACTORS AFFECTING PRODUCTION

Habitat--This third-order river is 22.5 miles long and originates from Cougar Lake. The basin area is 146 square miles. Spawning occurs between RM 11.7 and RM 20.3, but population density is highest between RM 12.8 and RM 15.5, where the gradient is 2.0% and elevations range between 3,640 and 3,930 feet.

Minimum flow is 43 cfs just below Eureka Creek but is less above Drake Creek. Lost River was named for the fact that it is "lost" to the substrate at various points above Monument Creek.

The extent and number of dry reaches depends on snowpack and summer precipitation. In 1994, an exceptionally dry year, four dry reaches totaling about 67% of the stream channel were observed in early September.

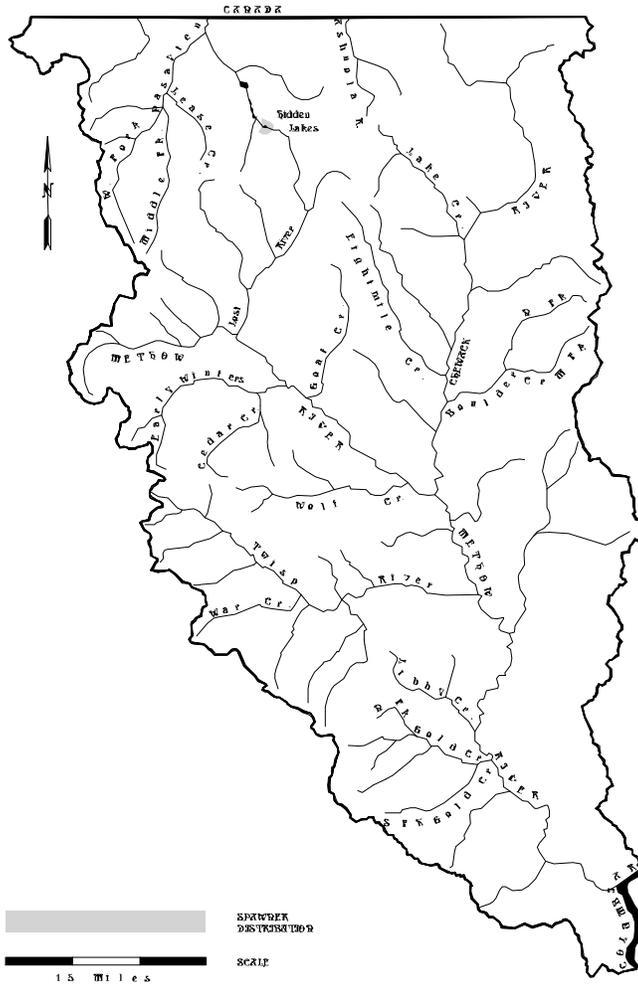
All bull trout/Dolly Varden populations in the Lost River are located within the Pasayten Wilderness, and their habitat has not been altered by human activities.

STOCK DEFINITION PROFILE for Lost River Bull Trout/Dolly Varden

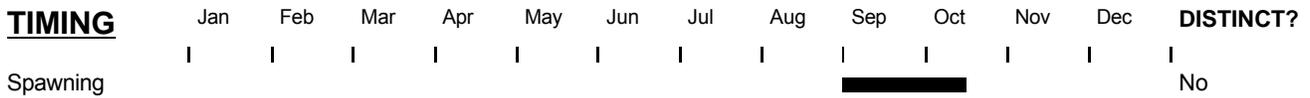
SPAWNER

DISTINCT? - Yes

DISTRIBUTION



TIMING



BIOLOGICAL CHARACTERISTICS

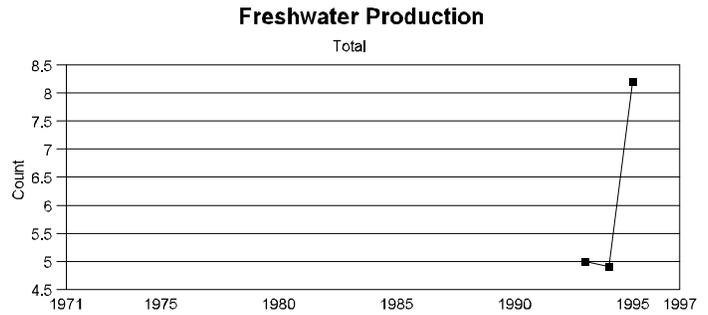
DISTINCT? - Unknown

STOCK STATUS PROFILE for Lost River Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	FW PROD Total	FW PROD Total	ESCAPE Redds	
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93	5.0	1,092		
94	4.9			
95	8.2			
96			5	
97			0	



The 1995 survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Healthy

Screening Criteria

The gradient from Cougar Lake to a point due east of Rampart Lake is low. Cover in this reach is large woody debris, which is scarce except for a few large logjams. Gravel is profuse. Below this reach almost to Drake Creek the river roars down a steep gorge. A few long pools and runs are present, but whitewater riffles are the rule. Boulders and turbulence provide cover; large woody debris is nearly absent. Fair amounts of gravel are widely scattered.

Harvest Management--Lost River above Drake Creek is open to bull trout/Dolly Varden harvest. Fishery rules include a bait prohibition and a 14-inch minimum size limit intended to permit most females to spawn at least once. Angling is minimized by the seven rugged, trailless miles required to reach the lower end of this reach. The canyon reach is accessible only in late summer when flow recedes enough for fording. Almost no fishing occurs in this reach. Some fishing occurs below Cougar Lake, in the vicinity of the horsecamp around Diamond Creek, and in the area just above the mouth of Drake Creek.

Hatchery--Rainbow trout were introduced into Cougar Lake in the 1930s. Rainbows are probably native to Cougar Lake and the Lost River above the falls. Their presence could be devastating to bull trout/Dolly Varden if the climate warms. At this time rainbow trout dominate bull trout/Dolly Varden in the warm outflow just below Cougar Lake whereas bull trout/Dolly Varden dominate downriver of Diamond Creek. Cutthroat trout are sparsely scattered throughout the Lost River above Drake Creek from naturalized plants made in Diamond Creek and Cougar Lake. Bull trout/Dolly Varden and cutthroat trout are ecologically compatible.

Species Interactions--Below the falls the Lost River is too warm for bull trout/Dolly Varden, and rainbow trout predominate. A few rainbows co-exist with bull trout/Dolly Varden between Drake and Diamond creeks, but they probably are downstream emigrants. Cougar Lake's warming effect tips the thermal advantage to rainbows, and they outnumber bull trout/Dolly Varden and cutthroats in the reach just below the lake. By late summer in all but the wettest years, this warm outflow disappears into the substrate above Diamond Creek. The cold water of Diamond Creek gives the advantage back to bull trout/Dolly Varden. The widespread presence of rainbow trout assures that they will prevail if warming favors them.

METHOW -- MONUMENT CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This native stock is distinct because it is isolated geographically from other stocks. Some fluvial fish are found in lower Monument Creek and may genetically link this stock with the Lost River stock if some of the fluvial fish are recruits from the Lost River stock (above the falls). The fluvial fish may also be recruits from the Monument Creek stock. Fluvial fish spawning is limited to the Monument Creek delta. Resident fish in Monument Creek spawn from the delta to some undetermined point at least 1.0 mile above the mouth. Spawn time is from early September through mid-October.

STOCK STATUS

Stock status is Unknown, although resident fish may be Healthy, and fluvial fish may be Depressed. Redd counting for fluvial spawners from Eureka Creek to Monument Creek started in 1994 and continued in 1995. Only one count was made each year because of the difficulty of making the count. Only seven fluvial fish redds have been counted in two years. Hook and line sampling in 1994 showed good abundance of resident bull trout/Dolly Varden. Data quality is fair.

The healthy status of resident fish is based on their abundance and the absence of unnatural limiting factors. Some hooking and illegal harvest of migratory bull trout/Dolly Varden occurs, and abundance is low, but their continued existence is assured by recruits from resident populations in Monument Creek and the Lost River above the falls.

FACTORS AFFECTING PRODUCTION

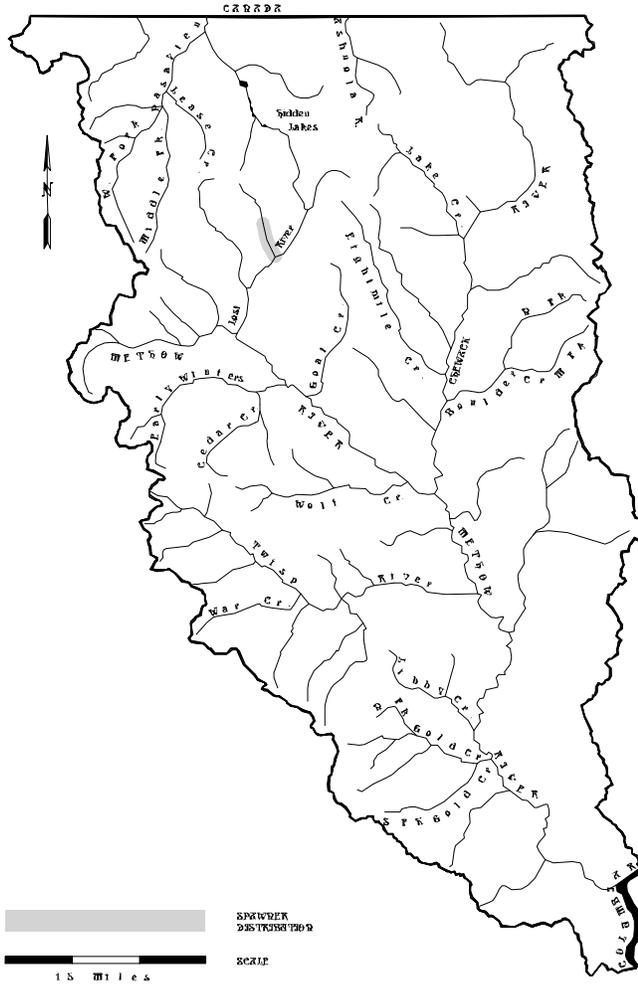
Habitat--This second-order stream is 7.9 miles long and drains an area of 17 square miles. Minimum flow is less than 5 cfs. Spawning is from RM 0.0 to an undetermined point above RM 1.0. The gradient to RM 1.0 is 9.8%, and elevation ranges from 2,950 to at least 3,500 feet.

All of this basin is within the Pasayten Wilderness, and habitat has not been altered by human activity. Low elevation and the southern exposure of the middle to lower channel are warming factors, whereas the short run from high-elevation ice fields and the deeply incised canyon counteract warming. The net result is that fluvial fish are highly vulnerable to climatic warming. The vulnerability of resident fish depends on the elevation of their upstream distribution. Monument Creek is a torrential stream of stairstepping plunge pools. The majority of cover is from boulders and turbulence.

STOCK DEFINITION PROFILE for Monument Creek Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

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

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Monument Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	ESCAPE Redds			
--------------	--------------	--	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

2
0

The 1994 survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Gravel and large woody debris are scarce. Riparian vegetation is lacking in the lower basin.

Hydroelectric development of the Columbia River has greatly altered the environment, reducing rearing capacity for and obstructing migration of some fluvial fish.

Harvest Management--Harvest of bull trout/Dolly Varden in Monument Creek is prohibited. Bait is allowed in other fisheries, but angling pressure is almost non-existent because of inordinately difficult access. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

Hatchery--No hatchery-origin salmonids have been introduced into Monument Creek.

Species Interactions--The Lost River up to Monument Creek is too warm for bull trout/Dolly Varden, and rainbow trout predominate. Cold water from Monument Creek gives bull trout/Dolly Varden a thermal advantage, and they are the most abundant salmonid there. Rainbow trout are invading lower Monument Creek, suggesting that temperatures are now marginal for fluvial fish.

METHOW -- COUGAR LAKE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in Cougar Lake are native and considered distinct because they are usually isolated from the population in First Hidden Lake. The stock is composed primarily of the adfluvial life history form, but some resident fish from the Lost River may enter Cougar Lake and spawn with Cougar Lake fish in the outlet. Two-way or even three-way stock mixing may take place when First and Middle Hidden Lakes are connected during extraordinary spring flooding. Spawning is confined to the outlet, but spawn timing is unknown.

STOCK STATUS

Stock status is Unknown. Overnight sampling with a gillnet (50-foot, variable mesh) was conducted in 1972. Data quality is fair.

FACTORS AFFECTING PRODUCTION

Habitat--Cougar Lake is the second lake below Middle Hidden Lake, the source of the Lost River. The elevation is 4,260 feet, and the surface area is 21 acres. The lake is uniformly shallow, with a maximum summer depth of 15 feet. Surface temperature is colder and less variable than in the Hidden Lakes, and the lake probably does not stratify during the summer. The pH in Cougar Lake is neutral versus distinctly basic for the Hidden Lakes. The annual frequency with which First Hidden Lake overflows in spring runoff and spills into Cougar Lake is unknown. In the summer, fall and winter, subsurface flow from Ptarmigan Creek and First Hidden lake emerges from the substrate about a mile above the lake. Bull trout/Dolly Varden do not use the inlet stream for spawning for lack of gravel. Compared to the Hidden Lakes, the water level in Cougar Lake is stable.

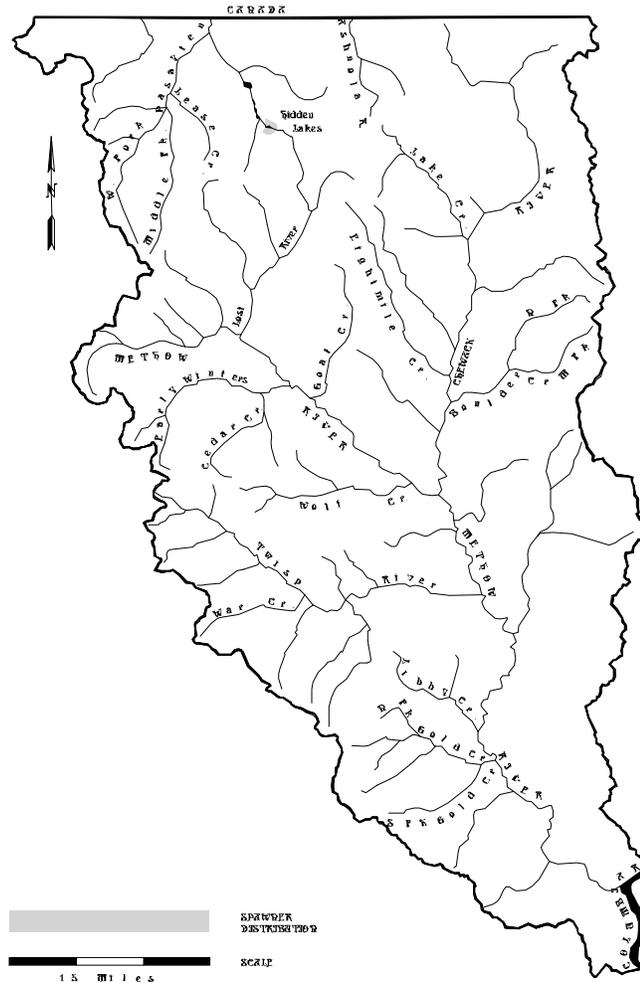
Cougar Lake is in pristine condition today, and its location in the U. S. Forest Service Pasayten Wilderness should guard against human-caused habitat degradation in the future.

Harvest Management--Cougar and the Hidden lakes are popular destination sites for backpack/horseback users, but the 14-mile trek and the short season limit visits. Fishing is light, and bull trout/Dolly Varden catch is low compared to that of rainbow and cutthroat trout.

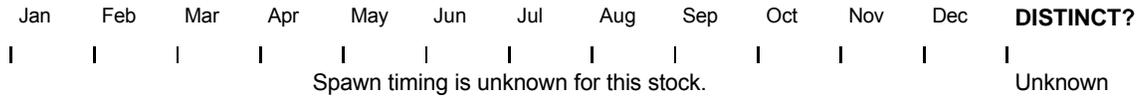
STOCK DEFINITION PROFILE for Cougar Lake Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING



BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for Cougar Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Fish/Hr			
--------------	-----------------	--	--	--

72 0.26
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Taking bull trout/Dolly Varden is illegal. Some bait-related hooking mortality and illegal harvest occurs, but the effect is minor.

Hatchery--Rainbow trout may be native to the Lost River basin, but releases of this species date back to the 1930s. Introductions of rainbow and cutthroat trout fry in 1975 have not resulted in negative interactions yet, though climate warming may allow threats from rainbow trout in the future.

Species Interactions--Rainbow trout and bull trout/Dolly Varden co-exist in Cougar Lake, though temperature in the outlet spawning area appears to favor rainbows which predominate in the outlet creek. Perhaps the massive debris dam that clogs the outlet provides a cover dynamic that permits bull trout/Dolly Varden to co-exist with rainbows rather than be excluded. How changing climate might affect these interactions is unclear, however, it is prudent to assume that warming would favor rainbow trout.

METHOW -- FIRST HIDDEN LAKE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Bull trout/Dolly Varden in First Hidden Lake are usually isolated from those Cougar and Middle Hidden lakes, though gene flow with bull trout/Dolly Varden from Cougar and Middle Hidden Lakes may occur following unusually high water levels in First Hidden Lake. The stock is primarily the adfluvial life history form, but some resident fish may reside in lower Ptarmigan Creek and recruit into First Hidden Lake during spring runoff. Spawning may occur in the lake, as the Ptarmigan Creek delta dries well before the spawning begins. It seems unlikely that adfluvial fish move into the stream in high water and remain there until they spawn. Between the creek disappearing into the alluvium above the lake and the barrier falls upstream, bull trout/Dolly Varden are confined to about 0.3 miles. Spawn timing is unknown.

STOCK STATUS

Stock status is Unknown but may be Healthy. Quantitative data are based on sampling with single gillnets (50 foot, variable mesh) fished overnight in 1972, 1977, and 1994. Catch rates seem to reflect fair but stable abundance. Data quality is good.

FACTORS AFFECTING PRODUCTION

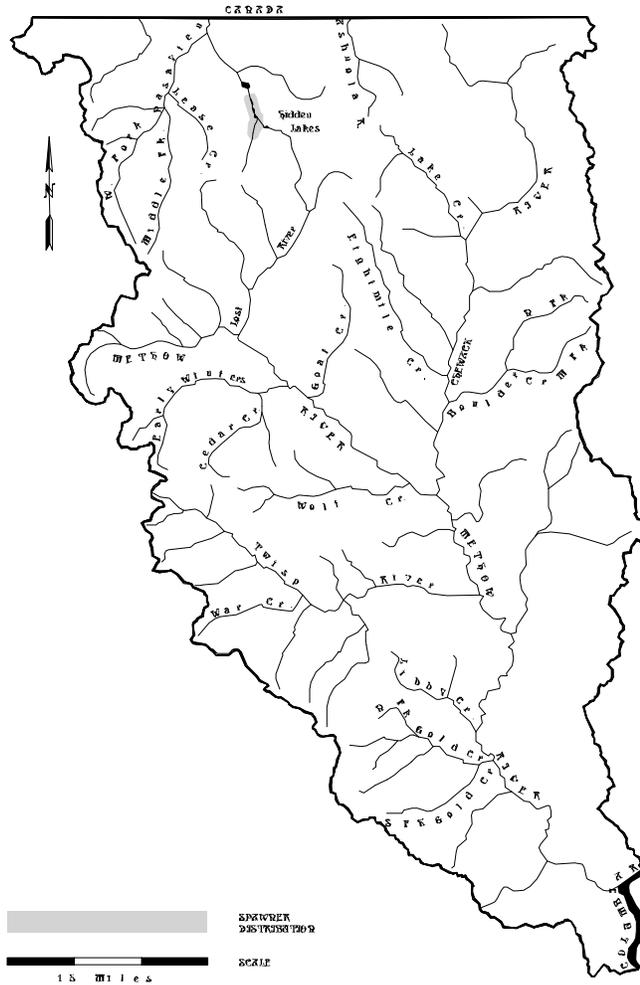
Habitat--First Hidden Lake is the next lake upstream from Cougar Lake but below Middle Hidden Lake, the source of the Lost River. Ptarmigan and Stub Creeks drain into First Hidden Lake. In high water the lake has two equal-sized sections, the southernmost of which usually dries each summer, killing any fish contained in it. The perennial portion is about 19 surface acres in late summer and 4,303 feet in elevation. The annual frequency with which First Hidden Lake overfills and spills into Cougar Lake and receives overflow from Middle Hidden Lake is unknown, but the latter occurs less frequently.

The water is slightly basic (pH 7.5). On September 4, 1972 the high temperature was 12.8° C. The lake temperature is more variable than in Cougar Lake, and First Hidden Lake probably stratifies in the summer. Maximum depth varies within and between seasons. In late summer of 1972, a year of unusually high discharge, maximum depth was measured at 25 feet. The lake's substrate is so porous that lake levels decline up to twenty feet by late summer. This porosity and water movement (incoming and outgoing subsurface flow) combined with gravel oxygenates water in the gravel sufficiently to enable lake spawning.

STOCK DEFINITION PROFILE for First Hidden Lake Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION

DISTINCT? - Yes



TIMING

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
												Unknown

Spawn timing is unknown for this stock.

BIOLOGICAL CHARACTERISTICS

DISTINCT? - Unknown

STOCK STATUS PROFILE for First Hidden Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Good

Return Years	FW PROD Fish/Hr			
72	0.12			
73				
74				
75				
76				
77	0.78			
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93				
94	0.26			
95				
96				
97				

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

A barrier falls about 0.3 mile above the start of perennial flow in lower Ptarmigan Creek limits bull trout/Dolly Varden production there. This second-order stream is 4.8 miles long. The gradient is 14.5%, and elevation ranges from 4,290 to 4,520 feet.

The Lost River lakes have not been altered by human activities, and their location in the Pasayten Wilderness should protect them from future human-caused habitat degradation.

Harvest Management--Cougar Lake and the Hidden lakes are popular destination sites for backpack/horseback users, but the 14-mile trek and the short season limit visits. Fishing is light, and bull trout/Dolly Varden catch is low compared to that of rainbow and cutthroat trout. Taking bull trout/Dolly Varden is illegal. Some bait-related hooking mortality and illegal harvest occurs, but the effect is minor.

Hatchery--Rainbow trout may be native to the Lost River basin, but multiple stockings of this species date back to the 1930s. Introductions of rainbow and cutthroat trout fry in 1975 have not resulted in negative interactions yet, though climate warming may permit threats from rainbow trout in the future. Brook trout were planted in First and Middle Hidden Lakes in 1972, but there is no evidence of them today.

Species Interaction--Rainbow trout and bull trout/Dolly Varden co-exist in all three lakes but not in Ptarmigan Creek, where bull trout/Dolly Varden live with cutthroat trout in water too cold for rainbow trout. Because of the unusual adfluvial life histories for both species (i.e., lake spawning), bull trout/Dolly Varden and rainbows co-exist rather than rainbow trout excluding bull trout/Dolly Varden as expected in the fluvial environment. Responses of this interaction to changing climate are unclear.

METHOW -- MIDDLE HIDDEN LAKE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Native bull trout/Dolly Varden in Middle Hidden Lake are usually isolated from those First Hidden Lake, consequently Middle Hidden Lake fish are considered geographically distinct stock. Some gene flow with bull trout/Dolly Varden from First Hidden Lake and even Cougar Lake may occur when water levels are high. The stock is adfuvial. Spawning occurs in the lake, as conditions are unsuitable in Gunbarrel Creek, the lake's only tributary. Spawn timing is unknown.

STOCK STATUS

Stock status is Unknown. Quantitative data are based on sampling with single gill nets (50 foot, variable mesh) fished overnight in 1972 and 1977. Catch rates seem to reflect fair but stable abundance. Data quality is fair.

FACTORS AFFECTING PRODUCTION

Habitat--Middle Hidden Lake is the source of the Lost River. Inflow from Gunbarrel Creek sustains the lake. The annual frequency of overflowing and spilling into First Hidden Lake is unknown, but probably happens less often than First Hidden Lake overflows into Cougar Lake, because inflow into First Hidden Lake is much greater than into Middle Hidden Lake.

The water in Middle Hidden Lake is slightly basic (pH 7.5). On September 4, 1972 the high temperature was 13° C. The water temperature in the lake is more variable than that in Cougar Lake, and Middle Hidden Lake probably stratifies in the summer. Maximum depth varies within and between seasons. In late summer of 1972, a year of unusually high discharge, maximum depth was at least 30 feet. The lake's substrate is less porous than that in First Hidden Lake, and water level fluctuates much less (six to eight feet in August), improving productivity somewhat, though on September 4, 1972 a Secchi disk was visible at maximum depth. Subsurface inflow or outflow in suitably-sized gravel attracts spawning bull trout/Dolly Varden.

The Lost River lakes have not been altered by human activity, and their isolated location in the Pasayten Wilderness should protect against future human-caused perturbations.

STOCK STATUS PROFILE for Middle Hidden Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Fair

Return Years	FW PROD Fish/Hr			
--------------	-----------------	--	--	--

72	0.14
73	
74	
75	
76	
77	0.13
78	
79	
80	
81	
82	
83	
84	
85	
86	
87	
88	
89	
90	
91	
92	
93	
94	
95	
96	
97	

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Harvest Management--Cougar Lake and the Hidden lakes are popular destination sites for backpacker and horseback users, but the 14-mile trek and the short season limit visits. Fishing is light, and bull trout/Dolly Varden catch is low compared to that of rainbow and cutthroat trout. Taking bull trout/Dolly Varden in Middle Hidden Lake is illegal. Some bait-related hooking mortality and illegal harvest occurs, but the effect is minor.

Hatchery--Rainbow trout may be native to the Lost River basin, but multiple stockings of this species date back to the 1930s. Introductions of rainbow and cutthroat trout (1975) fry have not resulted in negative interactions with bull trout/ Dolly Varden yet, though climate warming may provide the opportunity for threats from rainbow trout in the future. Brook trout were released into First and Middle Hidden Lakes in 1972, but there is no evidence of them today.

Species Interactions--Rainbow trout and bull trout/Dolly Varden in Middle Hidden Lake both exhibit an unusual adfluvial life history feature (lake spawning). As a result they co-exist in Middle Hidden Lake rather than excluding one another as expected in the fluvial environment. The response of this interaction to changing climate is unclear.

METHOW -- WEST FORK METHOW BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

This fluvial stock is both native and distinct, isolated thermally and geographically from other bull trout/Dolly Varden populations. Spawning occurs in the mainstem from Trout Creek (a few spawn in lower Trout Creek) to the falls from early September through mid-October.

Size-at-maturity of females confirms that the population consists of the fluvial life history form. A barrier falls limits the potential distribution of the population into the coldest water, where the resident form would likely occur.

STOCK STATUS

Stock status is Unknown but may be Healthy. A standing crop estimate was made at RM 9.7 in 1989. An initial redd count was made in 1995, and the 27 redds amounted to the largest count in the Methow basin. Data quality is excellent but limited.

FACTORS AFFECTING PRODUCTION

Habitat--This third-order river is 13.8 miles long and drains an area of 83 square miles. Minimum flow at RM 1.8 is 39 cfs. Spawning occurs between RM 4.9 and RM 10.1, in a gradient of 3.4%, and elevations ranging from 2,950 to 3,880 feet. All but a small portion of the lower river is within the Okanogan National Forest.

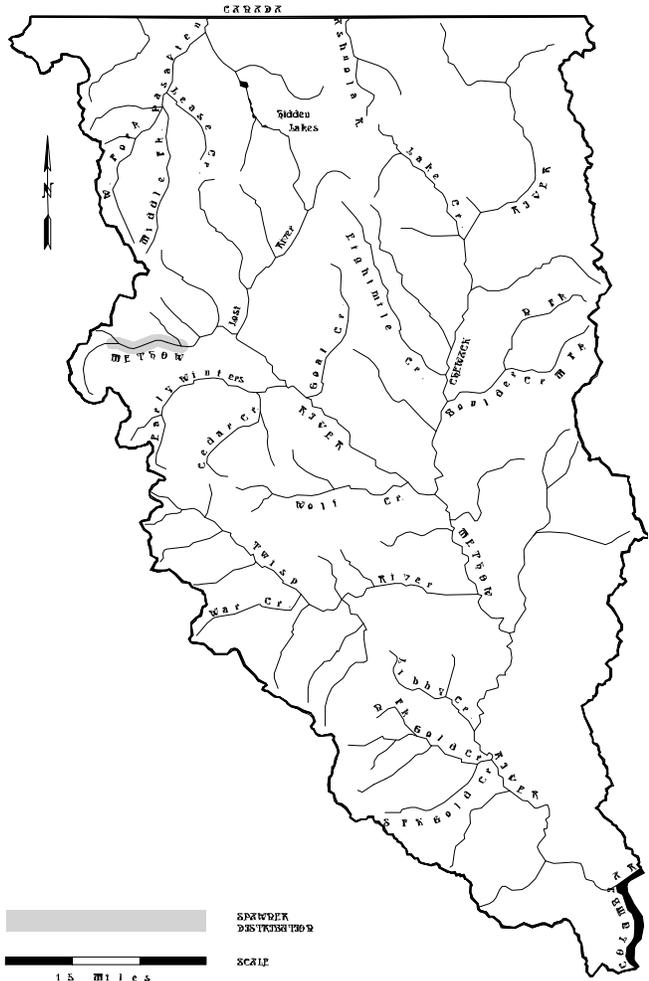
The habitat is isolated and in pristine condition. Tributary streams drain north-facing slopes and five glaciers, so water temperature is extraordinarily cold. Riffles and boulders predominate. Spawning gravel and large woody debris are scarce.

Impoundment of the Columbia River has lowered its productivity for rearing fluvial bull trout/Dolly Varden, and dams kill and obstruct some migrants.

Harvest Management--West Fork Methow bull trout/Dolly Varden are protected from harvest. Angling effort for other species is very low because of the isolation and the brushy, torrential nature of the stream. Bait-related hooking mortality, illegal harvest, and poaching of fluvial spawners is insignificant. Hooking mortality and illegal harvest of bull trout/Dolly Varden are expected to decline downriver in the Methow and Columbia rivers as a result of the closure of the recreational steelhead fishery. The closure is associated with the listing of upper Columbia steelhead as threatened under the Endangered Species Act in August, 1997.

STOCK DEFINITION PROFILE for West Fork Methow Bull Trout/Dolly Varden

SPAWNER DISTRIBUTION
DISTINCT? - Yes



TIMING

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	DISTINCT?
Spawning									[Thick Black Bar]				No

BIOLOGICAL CHARACTERISTICS
DISTINCT? - Unknown

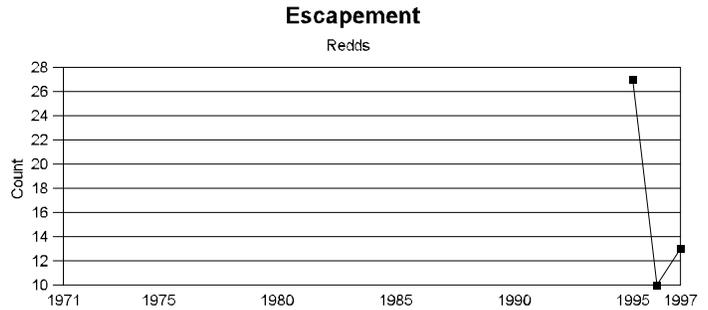
STOCK STATUS PROFILE for West Fork Methow Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> Excellent

Return Years	ESCAPE Redds	FW PROD No./100m ²		
--------------	--------------	-------------------------------	--	--

73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89		9		
90				
91				
92				
93				
94				
95	27			
96	10			
97	13			



The 1997 redd survey was incomplete.

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

Hatchery--All hatchery-origin rainbow trout and steelhead releases were made well below the breeding and initial rearing zone of bull trout/Dolly Varden and have had no discernable effect on them. Occasionally cutthroat trout have been released into the bull trout/Dolly Varden breeding zone and above the falls, where they abound, but this program has had no negative consequences because these species are ecologically compatible.

Species Interaction--Rainbow trout and bull trout/Dolly Varden interface at Trout Creek. The bull trout/Dolly Varden zone extends from Trout Creek to the barrier falls, a distance of 5.1 miles, a great length compared to other streams, making it a stronghold for bull trout/Dolly Varden in the Methow basin. Only the stock in Early Winters Creek above the falls is more secure.

OVERVIEW -- UPPER COLUMBIA
BULL TROUT/DOLLY VARDEN STOCKS

FRANKLIN D. ROOSEVELT LAKE
PEND OREILLE
SOUTH SALMO
GRANITE CREEK

STOCK DEFINITION AND ORIGIN

Limited information exists for bull trout/Dolly Varden within Washington in the Upper Columbia River system. Based on the information available, stocks have been identified as occurring in the Franklin D. Roosevelt Lake, Pend Oreille, South Salmo and Granite Creek drainages. Bull trout/Dolly Varden have been observed in Cedar Creek (north of Cedar Lake, Stevens Co.). While bull trout/Dolly Varden have been observed in the Canadian portion of Cedar Creek, none have been observed in Washington. Recent sampling conducted by the U.S. Forest Service in the East Fork Cedar Creek found only brook trout. Habitat in the Washington portion of Cedar Creek is not suitable for bull trout/Dolly Varden due to extensive agricultural and logging activities. Based on the available information a Cedar Creek stock has not been designated in Washington.

The bull trout/Dolly Varden in the Upper Columbia River system are native. No hatchery introduction of bull trout/Dolly Varden has occurred.

STOCK STATUS

Currently no trend data exist for the bull trout/Dolly Varden stock in the upper Columbia River system in Washington. Until trend data are obtained for these stocks they are assigned a status designation of Unknown.

UPPER COLUMBIA -- FRANKLIN D. ROOSEVELT LAKE **BULL TROUT/DOLLY VARDEN**

STOCK DEFINITION AND ORIGIN

Franklin D. Roosevelt (FDR) Lake was formed by construction of the Grande Coulee Dam on the Columbia River in the early 1940s. The upper reaches of FDR Lake lie just south of Onion Creek, a small tributary near Northport, Washington. From there to the Canadian border the Columbia River is free-flowing. FDR Lake is 83,000 surface acres at normal pool elevation.

Two bull trout/Dolly Varden were observed in FDR Lake near the mouth of Onion Creek in 1991. One bull trout/Dolly Varden was captured and released near the mouth of Boulder Creek in the Kettle River drainage in 1991. Other bull trout/Dolly Varden have been captured in the lake near Hawk, Hunters and Sherman creeks. The largest of these fish was 280 mm long, and the smallest was 152 mm long. The scattered locations of bull trout/Dolly Varden sightings suggest that these fish may be straying from Canadian waters.

No spawning activity has been observed in any tributaries of the lake.

STOCK STATUS

The status of FDR Lake bull trout/Dolly Varden is Unknown. Trend information is not available to assess status.

FACTORS AFFECTING PRODUCTION

Habitat--Most of the tributaries of FDR Lake lie in private or U.S. Forest Service land. Habitat is either not suitable for spawning or is inaccessible to bull trout/Dolly Varden. All tributaries have been degraded by agricultural or logging activities with the result that sediment levels are high, water temperature is too high for bull trout/Dolly Varden spawning, and habitat complexity has been lost. Some tributaries are not accessible because waterfalls prevent upstream migration.

Harvest Management--FDR Lake has been closed to the taking of bull trout/Dolly Varden since 1992. FDR Lake is open year-round for other gamefish.

Hatchery--Brook trout, rainbow trout, walleye, burbot, smallmouth bass, lake whitefish, yellow perch and common carp have all been introduced into the system and are well established in FDR Lake. Interactions with bull trout/Dolly Varden have not been examined.

STOCK STATUS PROFILE for FDR Lake Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

UPPER COLUMBIA -- PEND OREILLE BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

The Pend Oreille River originates at the outflow of Lake Pend Oreille in Idaho. It flows into Washington just east of the town of Newport. The river then flows north and enters Canada approximately fourteen miles north of Metaline Falls and ultimately enters the Columbia River at Waneta, British Columbia. Pend Oreille bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. Bull trout/Dolly Varden have been identified in or near several small tributaries in Washington including Slate, Sullivan, Mill, LeClerc, Cedar and Winchester creeks. No more than one to three fish have been seen in each stream.

Little is known about the genetics or life history of these fish. Brook trout were sampled for genetic analysis in 1995. No evidence of ongoing hybridization with bull trout/Dolly Varden was found. We believe that hybridization between introduced brook trout and bull trout/Dolly Varden occurred earlier when bull trout/Dolly Varden were more numerous. Hybridization is now considered unlikely because bull trout/Dolly Varden numbers are very low.

No spawning bull trout/Dolly Varden have been documented, and only about one dozen fish have been seen. These fish are known to be native since no bull trout/Dolly Varden have been stocked in Washington or Idaho.

STOCK STATUS

Stock status is Unknown. Although spawning escapement or relative abundance information is not available, the extremely small numbers of bull trout detected in the system are cause for concern.

FACTORS AFFECTING PRODUCTION

Habitat--All of the Pend Oreille tributaries lie either on the Colville National Forest or on private, intensively-managed timber lands. Five hydroelectric dams, all lacking fish passage facilities, are located on the Pend Oreille River. Habitat degradation as well as the hydroelectric dams and past hybridization with brook trout have combined to all but eliminate bull trout/Dolly Varden in this drainage.

Harvest Management--Before 1992 bull trout/Dolly Varden angling was controlled by standard statewide seasons and limits for trout, except in the mainstem Pend Oreille River where the fishing was open year-round. Since 1992 fishing for bull trout/Dolly Varden in the Pend Oreille drainage has been closed.

STOCK STATUS PROFILE for Pend Oreille Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
--------------	---------	--	--	--

- 73
- 74
- 75
- 76
- 77
- 78
- 79
- 80
- 81
- 82
- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

Hatchery--Introduced brook trout populations were established by the early to mid-1940s. However, an brook trout broodstock station was in operation in the 1920s in Stevens County. The station was operated by the federal government and then, presumably, by the counties in NE Washington until 1933. Stocking brook trout in waters connected to the Pend Oreille River was stopped in 1994. Rainbow and cutthroat trout stocking in lakes connected to the Pend Oreille system continues as an integral part of the resident trout fishery program. Interactions between these hatchery-origin trout and bull trout/Dolly Varden/Dolly Varden have not been examined.

UPPER COLUMBIA -- SOUTH SALMO BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

The South Salmo River originates in the northeast corner of Pend Oreille County, Washington in the Salmo-Priest Wilderness. It flows northwest for about five miles where it enters British Columbia. It is a tributary of the Salmo River in Canada, which flows into the Pend Oreille River in Canada. South Salmo bull trout/Dolly Varden have been identified as a distinct stock based on their geographic distribution. Bull trout/Dolly Varden were captured in the South Salmo River within the Salmo-Priest Wilderness in the mid-1970s by U.S. Forest Service personnel. Electrofishing efforts by WDFW and the Forest Service in 1994 found no bull trout/Dolly Varden even though sampling was done in the same stream areas as in the 1970s. Verbal communication with Canadian biologists indicates that bull trout/Dolly Varden inhabit the mainstem Salmo River in British Columbia.

Spawn timing is unknown.

STOCK STATUS

Stock status is Unknown. Spawning escapement or other relative abundance information is not available.

FACTORS AFFECTING PRODUCTION

Habitat--The South Salmo in Washington lies entirely within the Salmo-Priest Wilderness. Habitat is pristine, and water temperatures are cold enough for bull trout/Dolly Varden spawning.

Harvest Management--Prior to 1992 bull trout/Dolly Varden were considered a part of the trout catch limit in Washington. Since 1992 the South Salmo has been closed to fishing for bull trout/Dolly Varden.

Hatchery--There have been no releases of hatchery-origin trout or other char species in the South Salmo River.

STOCK STATUS PROFILE for South Salmo Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
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97				

- 73
- 74
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- 79
- 80
- 81
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- 83
- 84
- 85
- 86
- 87
- 88
- 89
- 90
- 91
- 92
- 93
- 94
- 95
- 96
- 97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin
Native

Production Type
Wild

Stock Distinction
Distribution

Stock Status
Unknown

Screening Criteria

UPPER COLUMBIA -- GRANITE CREEK BULL TROUT/DOLLY VARDEN

STOCK DEFINITION AND ORIGIN

Granite Creek is a tributary of Priest Lake, Idaho. Approximately 10 miles of the creek are located in Washington State. Spawning bull trout/Dolly Varden were observed by U. S. Forest Service habitat survey contractors in the early 1990s. Spawning also occurs downstream of the Idaho portion of the stream. Spawning occurs from early October through November.

This stock is an adfluvial stock which enters Granite Creek from Priest Lake. During recent electrofishing efforts, resident bull trout/Dolly Varden were observed in the Idaho portion of the stream. This indicates there may be both adfluvial and resident life history components.

STOCK STATUS

Stock status is Unknown but may be Depressed due to low numbers of observed fish. Additional information is needed to determine stock status. Spawning escapement or other relative abundance information is not available.

FACTORS AFFECTING PRODUCTION

Habitat--Granite Creek in Washington is fairly pristine in spite of its proximity to a major Forest Service road. It is a low-productivity stream and may support only spawning and early rearing of bull trout/Dolly Varden fry.

Harvest Management--Granite Creek in Washington has been closed to fishing since 1984. The Idaho portion of the stream was closed to fishing in 1978. In 1992 the creek was reopened to fishing but remained closed to harvesting bull trout/Dolly Varden.

Hatchery--Brook trout were probably introduced in the early 1920s, but none have been stocked in recent decades. The brook trout population is now self-sustaining, and is now the dominant species in Granite Creek. Competition, rather than hybridization, with brook trout is thought to be the major threat to bull trout/Dolly Varden in this stream. The adfluvial bull trout/Dolly Varden may be too large to spawn with brook trout which are about eight inches long in Granite Creek.

STOCK STATUS PROFILE for Granite Creek Bull Trout/Dolly Varden

STOCK ASSESSMENT

DATA QUALITY -----> No Data

Return Years	NO DATA			
-----------------	---------	--	--	--

73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97

AVERAGE RUNSIZE DISTRIBUTION

Data not available.

STOCK SUMMARY

Stock Origin

Native

Production Type

Wild

Stock Distinction

Distribution

Stock Status

Unknown

Screening Criteria

LITERATURE CITED

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GLOSSARY

ADFLUVIAL -- A life history type in which spawning and early rearing occur in streams, but most growth and maturation occur in lakes or reservoirs.

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 enzymes and other proteins) are separated in an electric field.

ENDANGERED SPECIES ACT (ESA) -- A 1973 Act of Congress that mandated that endangered and threatened species of fish, wildlife, and plants be protected and restored.

ESCAPEMENT -- Those fish that have survived all fisheries and will make up a spawning population.

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 with major growth and maturation 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 inherited 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 starch-gel electrophoresis and histochemical staining using tissue extracts; (3) characterize each population by aggregating the individual genetic profiles and computing allele frequency distributions; and (4) conduct statistical tests using the allele counts characterizing each population to identify significantly different populations.

GENOME -- The total genetic composition of an individual. The complete genetic information possessed by an organism.

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.

INLET -- The point where a stream flows into 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.

OUTLET -- The point where a stream flows out of a lake.

PRODUCTION TYPE -- The method of spawning and rearing that produced the fish that constitute a stock.

REDD -- A salmonid 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) occurs 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.

SASSI -- Salmon and Steelhead Stock Inventory.

SMOLT -- A juvenile anadromous salmonid which is undergoing physiological 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 (Strahler method) -- A system for describing streams and their tributaries such that first-order streams are headwater streams, second-order streams are formed by the confluence of two first-order streams, third-order streams are formed by the confluence of two second-order streams, and so on.

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 -- This description is applied to stocks where 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. Forest Service.

WDF -- Washington Department of Fisheries.

WDG -- Washington Department of Game. Became 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).