NORTH FORK CALAWAH

LARGE WOODY DEBRIS PROJECT

Pacific Ranger District

Olympic National Forest

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WATERSHED OVERVIEW

The North Fork Calawah River is one of three large tributaries, along with the South Fork Calawah and Sitkum Rivers, forming the Calawah River watershed. The Calawah River is one of four major river systems comprising the Quillayute basin. The North Fork Calawah watershed has 220 miles of perennial streams. Originating in the Olympic Mountains and flowing westerly for approx. 21 miles to its confluence with the South Fork Calawah River, the North Fork Calawah watershed is over 30,000 acres, ranging in elevation from 280 feet to 3,500 feet. Timber production is the main activity in the watershed, with only one occupied residence. Major land owners and managers in the watershed are the U.S. Forest Service, Washington Department of Natural Resources and several large industrial timber companies.

Fisheries: Anadromous salmonids are found in 26.7 miles of stream (Fig. 1). The mainstem North Fork Calawah provides 17.3 miles (65%) of the anadromous fish habitat and supports substantial populations of Chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *O. kitsutch*, and steelhead trout, *O. mykiss.* Small populations of sockeye salmon, *O. nerka* , and chum salmon, *O. keta*, are believed to be present, though information is limited. In addition resident and anadromous cutthroat trout, *Oncorhynchus clarkii* , mountain whitefish, *Prosopium williamsoni*, sculpin, *cottid spp*, and Pacific lamprey, *Entrosphenus tridentatus* are present in the North Fork Calawah drainage. All fish production is "wild" and all fish species are considered native.

However a hatchery on the Bogachiel River produces large numbers of winter steelhead and some straying into the North Fork Calawah is suspected.

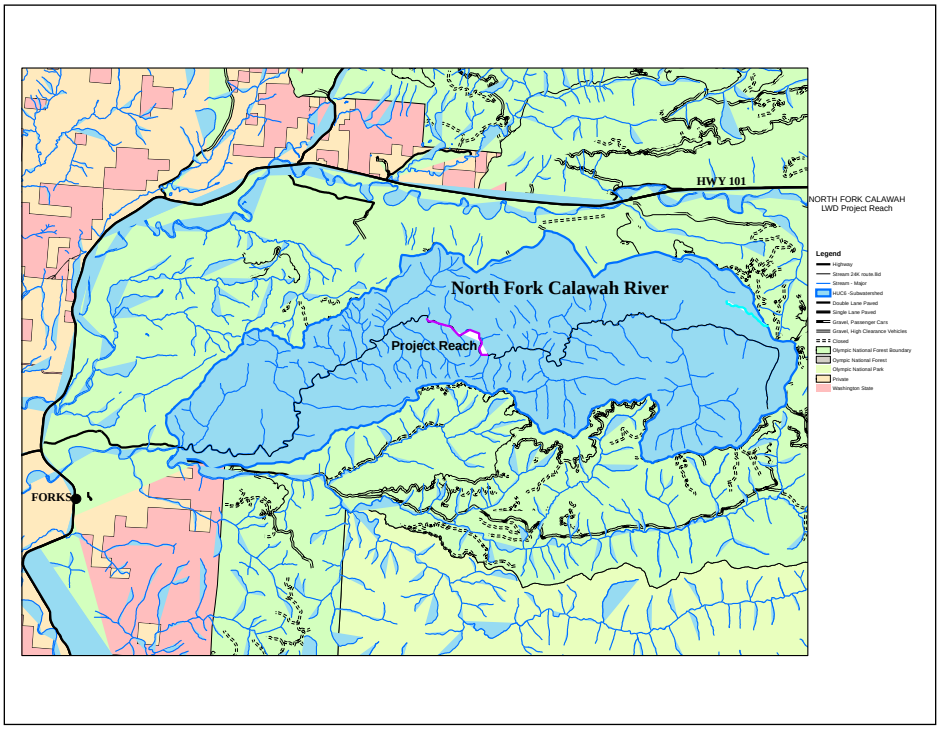

Figure 1. Large woody debris project location.

Management of the fisheries in the Calawah River watershed is the responsibility of the Quileute Tribe and Washington Department of Fish and Wildlife (WDF&W). Most of the fisheries management centers on salmon and steelhead runs. In general, the North Fork Calawah is closed to tribal gillnet and sport fisheries, though salmon and steelhead produced in the North Fork contribute to these fisheries in other portions of the Quillayute system. Salmonid stock assessments conducted by the WDF&W et al (2002) and Huntington et al (1994), for the Calawah River watershed as a whole (Table 1), classified fall Chinook, fall coho and winter steelhead stocks as "healthy". It may be assumed that this is representative of stocks in the North Fork Calawah River. According to the SASSI report, where adequate information was available for assessment, stocks within the Calawah drainage were rated as **Healthy**. Healthy is described as, "A stock of fish experiencing production levels consistent with its available habitat and within the natural variation in survival for the stock." The report goes on to state, "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 mean that managers have no concerns about its production status." A lack of information on summer steelhead, led to an unknown stock status determination.

Table 1. Stock Status - Calawah River

Species	**Race**	**Production**	**Stock Origin**	**Stock Status SASSI**	**Stock Status Huntington**
Chinook	Fall	Natural	Native	Healthy	Healthy
	Summer	Natural	Native	Unknown	
Coho	Fall	Natural	Native	Healthy	Healthy
Steelhead	Winter	Natural	Native	Healthy	Healthy
	Summer	Natural	Unresolved	Unknown	

The Pacific Ranger District has worked with the Quileute tribe since 1994 in monitoring adult coho, Chinook and winter steelhead spawning escapement. Based on information collected from past years we know that the mainstem from RM 8.6 – 10.7, is probably the upper limit of fall Chinook spawning as well as any significant fall coho spawning. Adult winter run steelhead are found to the upper limits of anadromous fish penetration but in lesser numbers than within the established indice areas. Tributary spawning in the North Fork Calawah is mainly limited to tributaries in the middle and lower watershed. Tributaries with significant salmon and steelhead production are Western Cool Creek, Devils Creek and 0183A, and 0184. The larger tributaries in the upper mainstem, such as Albion Creek and Pistol Creek offer limited anadromous fish spawning habitat.

Geology / Hydrology: The natural hydrologic regime of the North Fork Calawah River is one of the most unusual in Washington State. The North Fork Calawah watershed straddles the boundary between the peripheral rocks of the coastal portions of the Olympic Peninsula and the core rocks of the Olympic Mountain; this boundary is the

Calawah fault. Many deep seated failures are associated with the Calawah fault zone. Glaciers have played a significant part in shaping the North Fork Calawah River. Approximately 12,000 years ago the continental ice sheet thrust three fingers of ice through low passes in the Sol Duc valley into the North Fork Calawah watershed. The mainstem North Fork Calawah received large volumes of melt water and outwash, which filled the valley with several hundred feet of unconsolidated gravels and sand. Depending on seasonal precipitation, almost every July, August and September portions of the mainstem go dry, from approximately RM 9 to RM 16. The highly permeable outwash deposits create a huge underground reservoir capable of transporting 30 – 60 cfs down the valley. The drying reach is natural and precedes timber harvesting and road building. Quileute tribal legend refers to the North Fork Calawah drying reach as "the door to the underworld."

Disturbance History: Logging of the lower watershed began in the 1920's. In 1951 a large fire, known as the "Forks Fire," burned across most of the watershed from east to west. The fire burned hot and fast killing most trees. Salvage logging followed the fire and by the mid-1950's most of the burned area was logged and roaded. In the 1960's the Forest Service started building roads and commenced patchwork clearcutting in the upper watershed drainages that had escaped the Forks fire. Since 1990's, under direction of the Northwest Forest Plan, clearcut logging of old growth has ceased on Federal lands and the emphasis has been placed on restoration of aquatic and terrestrial habitats. Private timber companies are currently clearcut harvesting trees that have regenerated since the Forks Fire.

Past Restoration Projects: Restoration efforts in the NF Calawah drainage have been focused exclusively on federal lands. In 1986 and 1987 instream structures were placed in the mainstem North Fork from @RM 10 to 12.5. The structures were built with the intention of scouring out deep pools which would remain watered as the mainstem dried up, hopefully providing summer rearing habitat for juvenile salmonids.

In 1991, LWD structures were placed in the stream channel between RM's 16.5 - 17.0. The project was aimed at taking LWD that had been pushed out of the active channel during a recent large flood event, and position the LWD to provide some hydrologic control, create gravel bars, form pools and protect eroding toe slopes

In 1993 riparian silvicultural treatments were initiated between RM 8.5 - 10.5, the goal being to re-establish a conifer component in riparian areas dominated by hardwood vegetation, which would provide future woody debris recruitment to the stream channel. Silvicultural treatments have involved alder girdling and falling in order to release suppressed conifers, as well as creating small openings for interplanting conifer seedlings, mainly Sitka spruce.

In 1993 several impassable debris jams in Albion Creek, a North Fork Calawah tributary, were modified with the intent of allowing adult and juvenile fish passage upstream. Two jams were partially modified with the use of explosives. Monitoring of both modifications indicates that the upper jam is still impassable to fish.

In 1998 and 1999 instream and riparian restoration projects were conducted in two smaller tributaries, identified as 0184 and 0183A. The 2 tributaries are mainly utilized by fall coho, cutthroat trout and in some years by winter steelhead. The tributaries are

located in the middle NF Calawah and provide summer refuge within the drying section of the mainstem. In 2005 and 2006 culverts on both tributaries were removed to improve fish passage. On tributary 0184 the culvert was replaced with a bridge. On tributary 0183A the culvert was removed and a road crossing structure was not installed. The channel was restored to a more natural condition using stream simulation design criteria (Fig. 2).

Figure 2. Stream channel in tributary 0183A after culvert removal.

PROJECT OVERVIEW

In 2001, the Pacific Ranger District Fisheries biologist decided to initiate instream restoration in the mainstem North Fork Calawah River. It was decided to apply a "reach" scale perspective in defining the scope of the project. Based on information generated for the North Fork Calawah Watershed Analysis (USDA 1997) on fish distribution, disturbance history and fluvial processes, the segment of the North Fork between RM 8.6 and RM 10.2 was selected for restoration (Fig. 3).

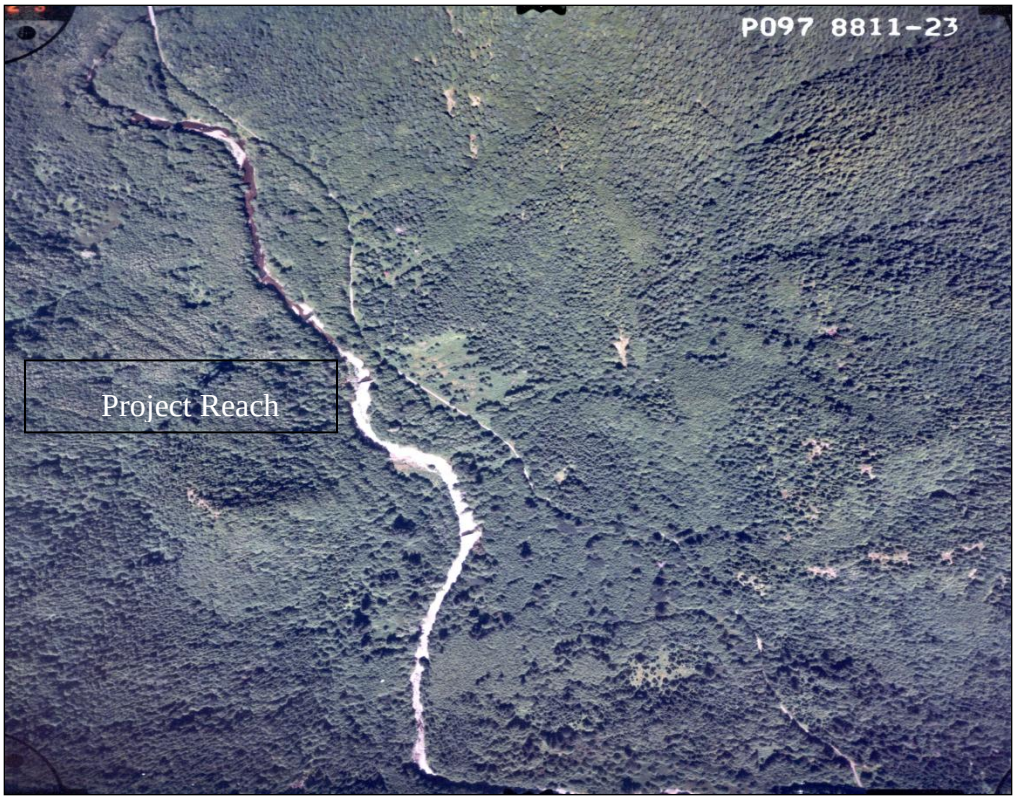

Figure 3. Aerial view of project reach, NF Calawah River.

The project goal was to improve and restore channel complexity and aquatic habitat, and improve spawning habitat for Chinook and coho. The large woody debris (LWD) structures would be designed and constructed to alter flow hydraulics at flows greater than base flow. The structures would be placed along the channel margins to direct or concentrate stream flow, causing channel bed scour and forming pools. The placement of LWD structures would also indirectly moderate lateral channel migration rates by dissipating flow energy. At flows greater than base flow discharge, the large woody complexes would create low-velocity or low-energy areas, providing temporary refuges for fish and depositional areas for fine sediments. Additionally, the marginal or lateral scour pools created by the LWD complexes would be designed to generate spawning habitat for fish, primarily fall Chinook and fall coho, along the exit slopes and margins of the pools. The increase in the availability of suitable spawning habitat would protect against catastrophic loss of eggs in the gravel from channel disturbances during storm events, by distributing redds rather than concentrating them in several locations.

Project Reach Description: In the project area the river valley is primarily confined by and incised into a series of multiple terraces of varying heights. The stream is able to meander (generally unrestricted) across a wide valley bottom that has a well-developed vegetated floodplain and lower terraces situated 2-3 m above the channel bottom. At several sections along the stream, the channel has migrated to the sides of the valley whose slopes consist of high glacio-fluvial terrace deposits, bedrock, or road fill from US Forest Service roads (Fig. 4). Although bank erosion is an important geomorphic process in the project area, the removal of wood from the channel from past management activities has caused an increase in flow energy, which in turn probably has increased the

rates of bank erosion and lateral channel migration. In the project reach the channel gradient varies between 0.05 to 2.0 percent and is primarily a pool-riffle morphology. The project is entirely within the portion of the mainstem that experiences seasonal drying.

Figure 4. Right bank erosion against valley wall and road fill.

Project Planning and Design: A core team consisting of the Forest Fluvial Geo-morphologist, District Fisheries Biologist and District Restoration Technician was formed to plan and implement the project. Several stream walks were conducted to identify priority restoration segments within the planning area, incorporating our knowledge of fish distribution and fluvial processes. Once the segments were selected, and under the direction of the Forest Fluvial Geo-morphologist, we surveyed the stream channel to identify the lower terraces, floodplains, bank full elevations, and channel gradients. The Forest Fluvial Geo-morphologist then created a plane view of the channel from the survey data with more exact locations for LWD placement (Fig. 5).

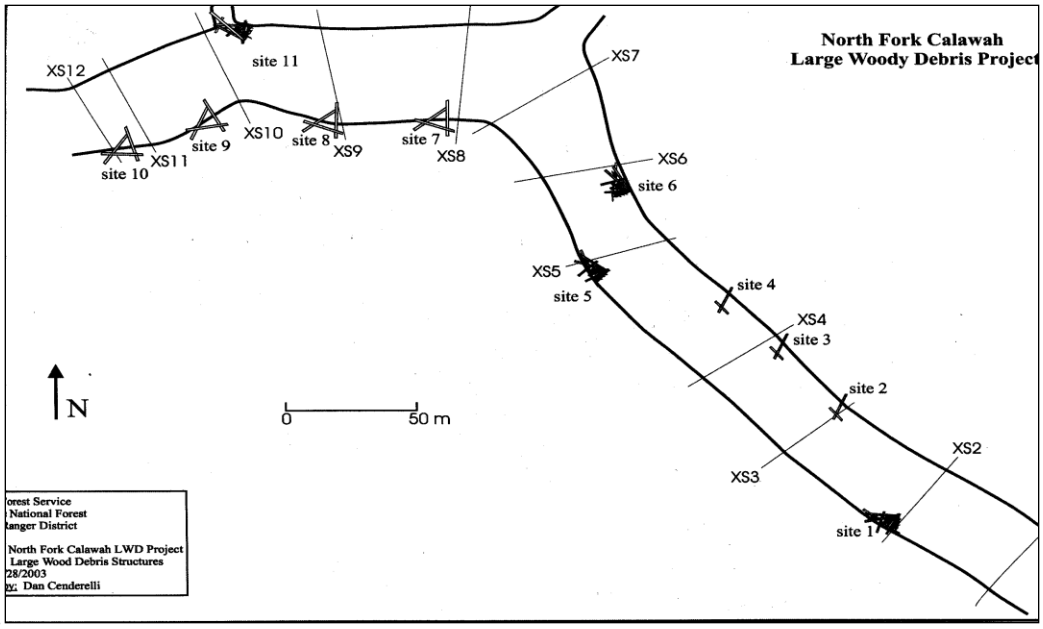

Figure 5. Plane view with LWD sites.

The next phase consisted of acquiring the woody debris necessary to construct the log structures. While it would have been desirable to collect large diameter trees with rootwads attached, the constraints imposed by the removal of "old growth" trees under the Northwest Forest Plan and Endangered Species Act, the logistics of removing and transporting large trees and a limited budget made it unrealistic if we wanted to proceed with the project. The team concluded that we could design and construct effective, stable log jams using large and small diameter logs that did not have the rootwads attached. From a variety of sources, mainly campground hazard tree removals, right-of-way road clearings, and timber trespass, we collected several hundred logs, ranging in size from 14 – 44 inches in diameter. In general the log lengths were limited to the maximum lengths carried on log trucks, averaging 40 feet to 50 feet. All logs were inventoried and numbered by diameter and length. The Forest Fluvial Geo-morphologist then designed a template for each log structure to be constructed. Details included specific log diameters and lengths, the angle of log placement, the depth of excavation into the streambed, bank full elevations, etc. (Fig. 6).

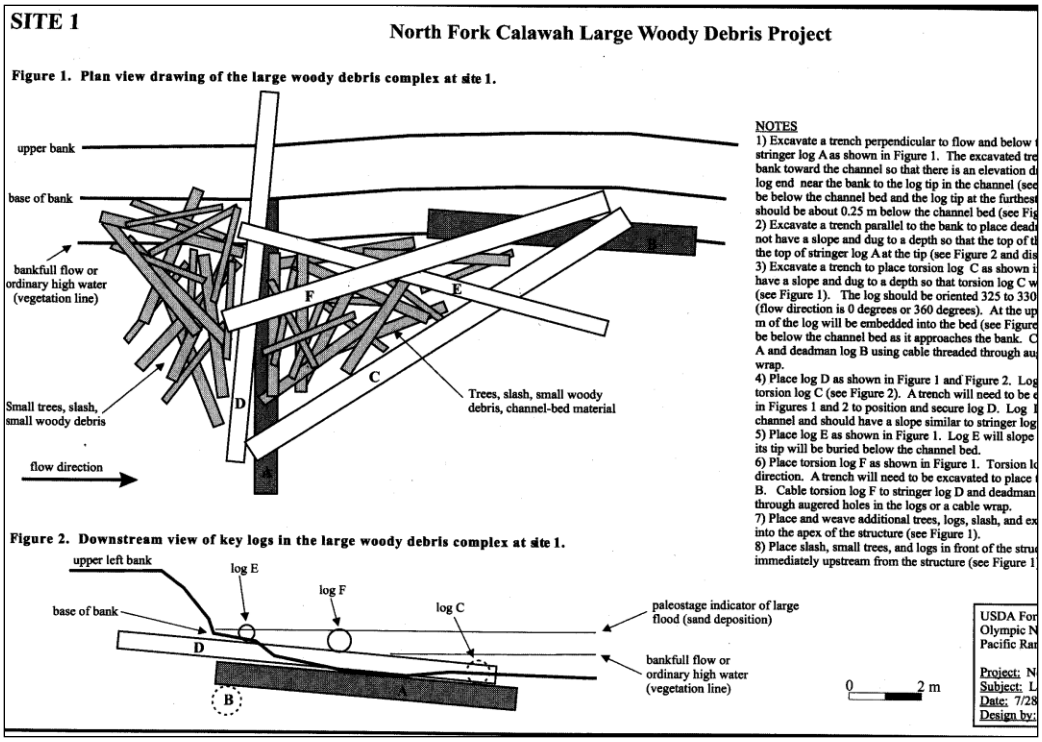

Figure 6. Log jam design typical.

Every structure was assigned a specific color. Using the individual templates, the District Restoration technician identified the structural logs with the appropriate letter (A, B, C etc,) and the color specific to that structure. The instream sites were then staked, numbered and identified with the appropriate color.

Project Implementation: Instream work began in August 2003. Construction was facilitated by working in a dry channel. Logs were transported to several staging areas near the work site using a self-loading log truck (Fig. 7). An excavator with a bucket and "thumb" was used to do the majority of the log jam construction (Fig. 8).

Figure 7. Self loading log truck.

Figure 8. Excavator with "thumb."

Figures 9A and 9B

Streambed excavation for footer logs was well below scout depth. Structural logs were cabled together, using ½" steel cable and 4" staples (Figures 9A and 9B). Alders from the nearby riparian area were pushed over with there rootwads intact and incorporated in the log jam construction. A critical part of log jam construction was backfilling the basic

structures. Excavated streambed gravels and numerous smaller diameter logs were used to seal spaces which would provide stability to the structure (Figures 9C - 9F).

Figures 9C – 9F

In addition to the engineered, anchored LWD structures, a number of individual logs were placed in smaller clusters along the stream margins (Figures 10A and B). These small clusters utilized existing trees and streambank features to provide stability. None of these logs were cabled, and it was anticipated that they could in the future become mobile.

Figures 10A and B. Small clusters of woody debris.

Project Results: A total of 400 – 500 pieces of woody debris were placed within the project reach from 2003 - 2005. A summary of structure types is as follows: **11** engineered logs jams; an additional **4** log jams with no cabling; **8** individual diagonal logs referred to as "bar buddies"; **3** small in-channel structures with upstream facing rootwads; **15** clusters of multiple, un-cabled logs, using existing streambank vegetation for stability.

To date, of the 11 engineered log jams constructed, only one was lost during a record setting storm event in October 2003. All other structures appear to be intact and functioning. Cross sections within the project reach have not yet been re-surveyed to document the channel response to the woody debris placement. Monitoring of the streams response to the LWD placement has relied mostly on visual and photo documentation. Chinook and coho redds have been observed during annual spawning surveys in gravels deposited as a result of woody debris placement. Several structures that were constructed to reduce bank erosion and control lateral migration appear to be successful (Figures 11, 12 and 13). Some structures have started to trap woody debris (Fig. 14).

Figure 11. Bar formed after construction is now growing vegetation.

Figure 12. Several naturally fallen alders were supplemented with additional wood to increase stability. Notice gravel deposition in foreground and along right bank.

Figure 13. Site 14 looking downstream, shows fine and coarse sediment deposition.

Figure 14. Diagonal log "bar buddy" collecting debris, forming upstream bar.

This structure was created to divert flow and create and maintain a secondary channel. Pink flagging along the right bank indicates location of fall coho redds. Surveys are conducted by the Quileute tribe on an annual basis.

Figure 15. Mid channel structure with root wad.

This structure at Site #14, immediately after construction (2004) and during a near record storm event in November 2006 (Figures 16 and 17).

Figures 16. Site # 14 after construction during summer drying period.

Figure 17. Site #14 during recent near record storm event.

Project Funding, Costs and Partnerships: Three sources of funding were used to pay for the project: direct Forest Service funding; funds secured under the Title II portion of the "Payments to Counties Act" of 2000; and partnership contributions. The Pacific Coast Salmon Coalition, a citizen based salmon restoration group, comprised of local area residents, was our main partner. An approximate break down of funding contributions is: Title II - $27,500; Pacific Coast Salmon Coalition, $20, 000; Forest Service funds, $75,000.

CITATIONS

Huntington , C., W. Nehlsen, J. Bowers. 1994. Healthy native stocks of anadromous salmonids in the Pacific Northwest and California. Oregon Trout. Portland.

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Washington Department of Fish and Wildlife (WDFW) and Western Washington Treaty Tribes (WWTT). 2004. 2002 Washington State Salmon and Steelhead Stock Inventory. Olympia, WA.