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BULL TROUT ASSESSMENTS IN THE COLUMBIA RIVER GORGE

FY-2000 Annual Report

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Bull Trout Population Assessment in the Columbia River Gorge

FY-2000 Annual Report

by

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February 2001

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Abstract

We summarized existing knowledge regarding the known distribution of bull trout (*Salvelinus confluentus)* across four sub-basins in the Columbia River Gorge in Washington. The Wind River, Little White Salmon River, White Salmon River, and the Klickitat River sub-basins were analyzed. Cold water is essential to the survival, spawning, and rearing of bull trout. We analyzed existing temperature data, installed Onset temperature loggers in the areas of the four sub-basins where data was not available, and determined that mean daily water temperatures were <15^{o}C and appropriate for spawning and rearing of bull trout.

We snorkel surveyed more than 74 km (46.25 mi.) of rivers and streams in the four sub-basins (13.8 km at night and 60.2 km during the day) and found that night snorkeling was superior to day snorkeling for locating bull trout. Surveys incorporated the Draft Interim Protocol for Determining Bull Trout Presence (Peterson et al. In Press). However, due to access and safety issues, we were unable to randomly select sample sites nor use block nets as recommended. Additionally, we also implemented the Bull Trout/Dolly Varden sampling methodology described in Bonar et al. (1997).

No bull trout were found in the Wind River, Little White Salmon, or White Salmon River sub-basins. We found bull trout in the West Fork Klickitat drainage of the Klickitat River Sub-basin. Bull trout averaged 6.7 fish/100m^2 in Trappers Creek, 2.6 fish/100m^2 on Clearwater Creek, and 0.4 fish/100m^2 in Little Muddy Creek. Bull trout was the only species of salmonid encountered in Trappers Creek and dominated in Clearwater Creek. Little Muddy Creek was the only creek where bull trout and introduced brook trout occurred together.

We found bull trout only at night and typically in low flow regimes. A single fish, believed to be a bull trout x brook trout hybrid, was observed in the Little Muddy Creek. Additional surveys are needed in the West Fork Klickitat and mainstem Klickitat to determine the distribution of bull trout throughout the drainage and to determine the extent of hybridization with brook trout.

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Introduction

Populations of bull trout (*Salvelinus confluentus*), a native species of char, previously ranged over much of the western states and western Canada. Bull trout were widely distributed in Washington, Oregon, Montana, Idaho, Nevada, and California, and in British Columbia, the Yukon Territory, and Alberta in Canada (Buchanan, et al. 1997). Bull trout numbers have been impacted by habitat degradation, passage barriers, harvest pressure, and interactions with introduced species. Many bull trout populations are declining or have disappeared. Past and current efforts to assess, protect, and restore existing bull trout populations have been limited by a lack of basic information on ecology, life history and genetics of bull trout (Rieman and McIntyre 1993; Kostow 1995; Rieman and McIntyre 1995; Buchanan et al. 1997; Spruell and Allendorf 1997: Dunham and Rieman 1999).

In 1989, the American Fisheries Society (AFS) classified bull trout as a species "of special concern" because of destruction of habitat, hybridization, predation, and competition from non-native species (Williams et al. 1989). In 1995, the Northwest Power Planning Council (Northwest Power Planning Council 1994, 1995) in their Columbia River Basin Fish and Wildlife Program recognized the special needs of bull trout stating "...studies and evaluations should be undertaken and completed quickly and on-the-ground projects identified and implemented as soon as possible to address the needs of this species" (Amendment 10.5A). Amendment 10.5A.6 calls for the Washington Department of Fish and Wildlife (WDFW) and the Yakama Nation (YN) to cooperate in studies to document bull trout life histories and factors that limit bull trout. The need for protection of salmonid species has long been understood and the Washington Fish and Wildlife Commission in 1997 adopted the Wild Salmonid Policy (WSP) "to protect, restore and enhance the productivity, production, and diversity of wild salmonids and their ecosystems..."(Washington Department of Fish and Wildlife 1997).

The U. S. Fish and Wildlife Service (USFWS) determined on June 10, 1998 (United States Fish and Wildlife Service 1998) that the Columbia and Klamath rivers contained distinct population segments of bull trout that should be listed as "threatened" under the Endangered Species Act (ESA). The Columbia River population segment is estimated to have occupied about 60% of the Columbia River Basin and now occupies 45% of the estimated historical range (Quigley and Arbelbide 1997). The USFWS, in their 1998 listing, recognized distinct bull trout subpopulations in the White Salmon and Klickitat rivers in Washington's Columbia Gorge watersheds. The USFWS is obliged to develop a recovery plan for these subpopulations.

The need for protection of bull trout and other salmonid species in Washington State is noted in the 1999 Draft Statewide Strategy To Recover Salmon -- Extinction Is Not An Option (State of Washington Governor's Salmon Recovery Office 1999). The statewide goal is "To restore salmon, steelhead and trout populations to healthy, harvestable levels and improve those habitats on which the fish rely." This is also reflected in the current State Agencies' Action Plan for the

Statewide Strategy to Recover Salmon (State of Washington Governor's Salmon Recovery Office 2000).

Bull trout appear to have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993; Bellerud et al. 1997; Baxter et al.1999). Channel stability, substrate composition, overhead cover (large woody debris, undercut banks, etc.), and low water temperatures are some important habitat variables that influence bull trout abundance and distribution (Buchanan et al. 1997). Bull trout are stenothermal and tolerate a narrow range of cold temperatures to rear and reproduce (Buchanan and Gregory 1997). Bull trout prefer water temperatures below about 9° C. Rieman and Chandler (1999) report that bull trout were observed more frequently at summer mean water temperatures of about 6-9° C with summer maximums less than 13-14° C. Temperatures in excess of 15° C are thought to limit bull trout distribution (Reiman and McIntyre 1993).

Bull trout have four life-history patterns: resident, fluvial, adfluvial and anadromous. Resident bull trout are thought to confine their migrations to and within their natal stream. Fluvial populations generally migrate between smaller streams used for spawning and early juvenile rearing and larger rivers used for adult rearing. Adfluvial populations generally migrate between smaller streams used for spawning and juvenile rearing, and lakes or reservoirs used for adult foraging. Adult adfluvial bull trout may weigh more than 10 kg. In addition, some populations of bull trout are anadromous, where access to the estuary and marine environment remains available. There is a report of bull trout traversing the fish ladder at Bonneville Dam in March 1947 (United States War Department 1947).

The Washington Department of Fish and Wildlife completed a Salmonid Stock Inventory (SaSI) on Bull Trout and Dolly Varden in 1998 (Washington Department of Fish and Wildlife 1998). The best-studied population of bull trout in southern Washington exists in the Lewis River Drainage. These bull trout are adfluvial and have been monitored since 1988. They occur in Yale Reservoir, Swift Reservoir and Merwin Lake. Trout in Yale Reservoir, spawn in Cougar Creek, while those from Swift Reservoir, stage at the top end of the reservoir, move up the Lewis River, and spawn in Pine and Rush creeks. Bull trout in Merwin Lake are thought to be present as a result of water spilled over Yale Dam and are not believed to spawn in Merwin Lake.

Limited information exists on bull trout in the Columbia Gorge, Washington (Wind, Little White Salmon, White Salmon, and Klickitat sub-basins). The SaSI report (Washington Department of Fish and Wildlife, 1998) evaluated existing information on native char in Washington and provided no information on bull trout in the Wind and Little White Salmon sub-basins and listed as "unknown" the stock status in the White Salmon and Klickitat sub-basins. Sub-basin summaries (Columbia Basin Fish and Wildlife Authority. 2000) report sightings of bull trout in all four sub-basins, including their confluences with the Columbia River. A population of bull trout has been reported in Trappers Creek and in the upper mainstem of the Klickitat Sub-basin. A few bull trout have also been observed: in the Wind River below Shipherd Falls, in Drano Lake at the mouth of the Little White Salmon River, in Northwestern Lake above Condit Dam in the White Salmon River, at the mouth of the Klickitat River, and in the mainstem Klickitat River

(Columbia Basin Fish and Wildlife Authority 2000: Wind, Little White Salmon, and Klickitat sub-basin Summaries; United States Forest Service 1998 Upper White Salmon River Watershed Analysis). Bull trout observed in the Wind River and at the mouth of the Little White Salmon River are believed to be adfluvial and part of a population utilizing Bonneville Pool.

There has been insufficient information available to make an accurate assessment of bull trout in the Columbia Gorge. Hydroelectric dams, such as Bonneville and Condit, and naturally occurring waterfalls in some drainages, have isolated bull trout populations and prevented genetic exchange among populations. This leads to increased risk of extinction of these populations from genetic isolation and random cataclysmic events (Rieman and McIntyre 1993). Other limiting factors including habitat degradation, over-harvest, and exotic species introductions have also contributed to the decline of bull trout populations. Spruell and Allendorf (1997) advocate that maintaining the genetic diversity of bull trout will require continued existence of many distinct populations. Condit Dam is scheduled for removal in 2006, opening 16 miles of the White Salmon River for possible recolonization by adfluvial bull trout. It is important, therefore, to conduct studies to understand and assess bull trout populations in the Columbia Gorge.

Peterson et al. (In Press) have developed a draft interim protocol for determining bull trout presence. Bonar et al. (1997) developed a sampling methodology for distribution and abundance of Bull trout. We incorporated both approaches into our analysis.

The importance of bull trout as a threatened species has lead to the drafting of a Bull Trout Recovery Plan for the Lower Columbia River. This plan is being developed by a task force headed by the USFWS with the participation of WDFW, PacifiCorp, and the USFS.

The purpose of this study is to provide critical information to determine the status of bull trout populations in the Wind, Little White Salmon, White Salmon, and Klickitat River sub-basins and to develop and implement management plans for these populations. These studies directly address amendments 10.5A and 10.5A.6 of the Columbia River Basin Fish and Wildlife Program by providing scientific information that will help protect and restore weak stocks of native bull trout in Washington's section of the Columbia Gorge. The WDFW and YIN cooperatively conducted this work. We have cooperated with similar efforts in Oregon and Washington.

Description of Project Area

The locations of the Wind, Little White Salmon, and White Salmon sub-basins are presented in Figure 1.

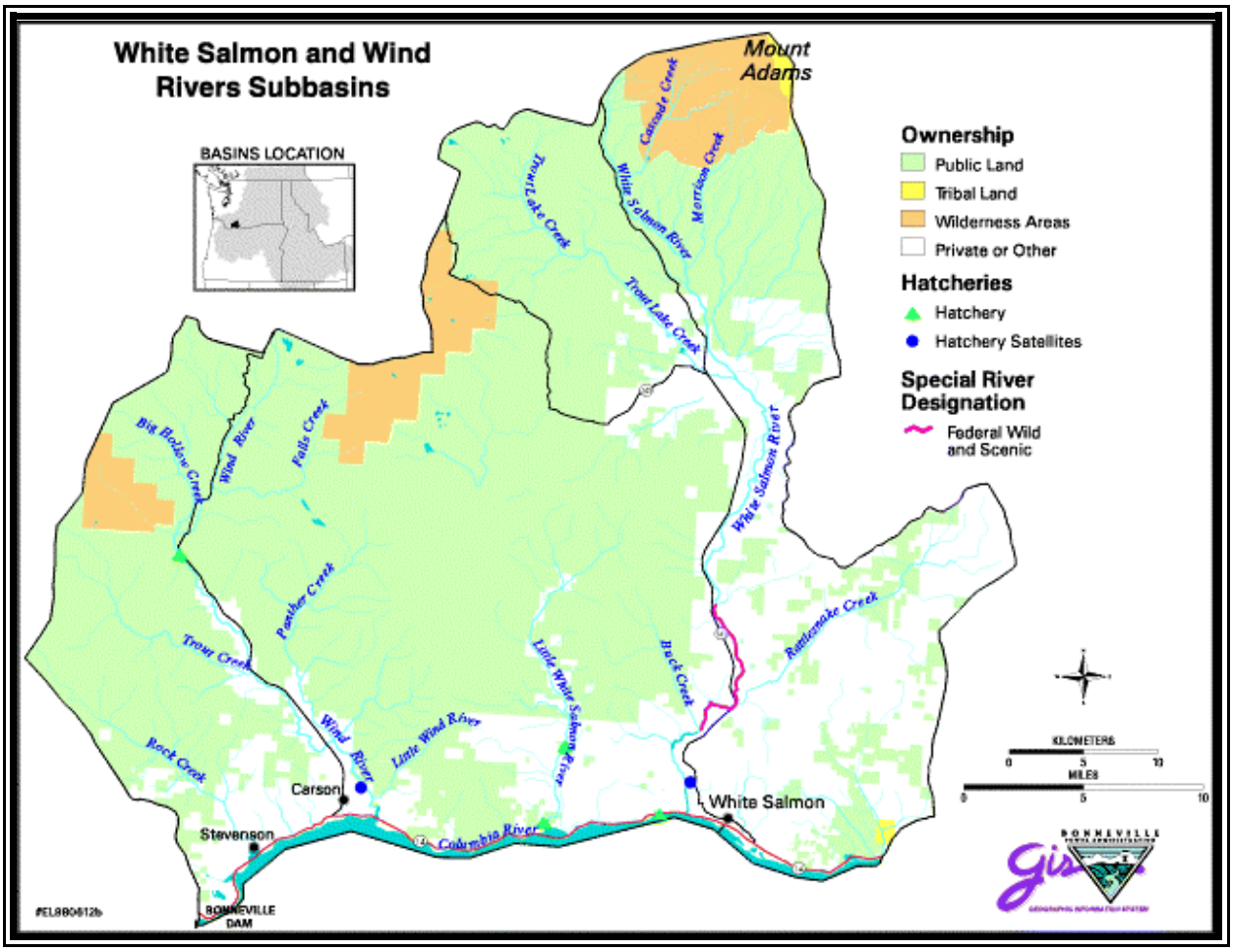

Figure 1. Location of the Wind, Little White Salmon, and White Salmon Sub-basins.

Wind River Sub-basin

The Wind River originates in McClellan Meadows in the western Cascades on the Gifford Pinchot National Forest and enters Bonneville Reservoir at river mile (RM) 154.5 near Carson, Washington. The Wind River drains approximately 225 square miles of Skamania County over a distance of approximately 31 miles. Principle tributaries to the Wind River include Little Wind River, Bear, Panther, Trout, Trapper, Dry, Nineteenmile, Falls, and Paradise creeks. The largest tributary, Panther Creek, enters at RM 4.3 and drains 18% of the Wind River Sub-basin. Trout Creek, which drains 15% of the Sub-basin, enters at RM 10.8 (Figure 2).

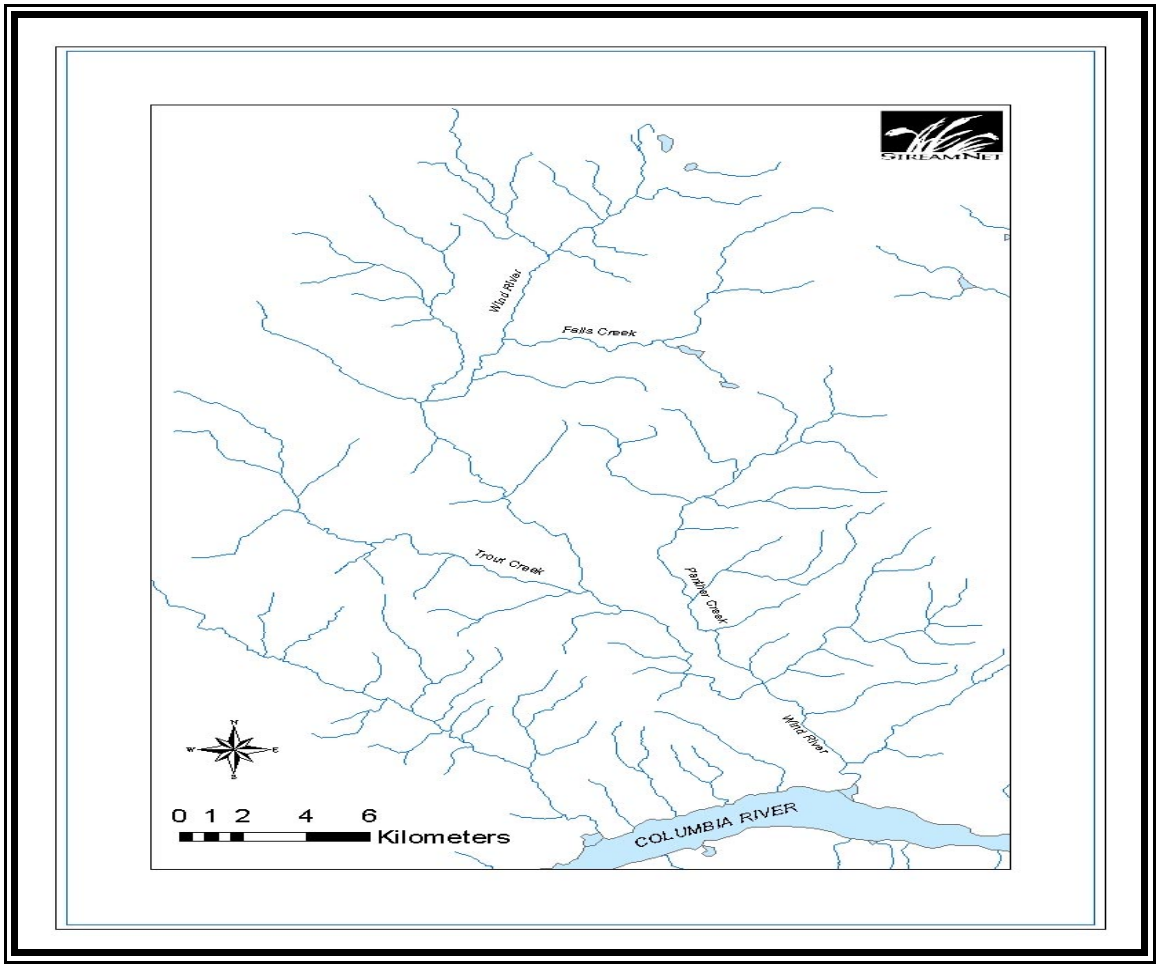

Figure 2. Wind River Sub-basin.

Topography varies within the watershed. It is steep in the northwest and lower southeast, flatter in the northeast (McClellan Meadows area), and forms a series of benches in Trout Creek Flats and in the middle portions of the Wind River Valley. Elevations range from 80 feet to 3,900 feet. The mainstem of the Wind River drops 3,820 feet in 30.5 miles for an average gradient of 2.3%. Shipherd Falls, located at RM 2.0, is a series of four falls ranging from 8 to 12 feet that were a barrier to all anadromous salmonids, except steelhead, until the construction of a fish ladder in 1956. Stream flows in the watershed range from summer low flows to peak flows in the winter. Some streams are dry portions of the year (ephemeral).

Little White Salmon River Sub-basin

The Little White Salmon River originates in the Gifford Pinchot National Forest west of Monte Cristo Peak and enters Drano Lake near Cook, Washington. Drano Lake, a backwater created by impoundment of the Columbia River, enters Bonneville Reservoir at RM 162. The Little White Salmon River drains 135 square miles of Skamania and Klickitat counties over a distance of approximately 19 miles. Principle tributaries to the Little White Salmon River include Lost (north and south), Lava, Moss, Beetle, Lusk, Homes, Berry, Cabbage, and Rock creeks.

The topography in the watershed ranges from gentle slopes formed by lava flows and volcanic cones to steep rugged landforms. Elevations range from 80 feet to 5,300 feet. The mainstem of the Little White Salmon River drops 3,520 feet in 19 miles for an average gradient of 3.5%. Anadromous fish passage is blocked by a series of waterfalls located 2 miles upstream from the river's confluence with the Bonneville Reservoir. Stream flows in the watershed range from summer low flows to peak flows in the winter. Some streams only flow during high flow events and are dry the remainder of the year (ephemeral streams).

White Salmon River Sub-basin

The White Salmon River originates on the south side of Mt. Adams and enters the Bonneville Reservoir at RM 168.3 (Figure 3). The White Salmon River drains 391 square miles of Skamania, Klickitat, and Yakima counties over a distance of approximately 49 miles. The river is fed by the White Salmon and Avalanche glaciers, which lie above 7,000 feet on Mt. Adams.

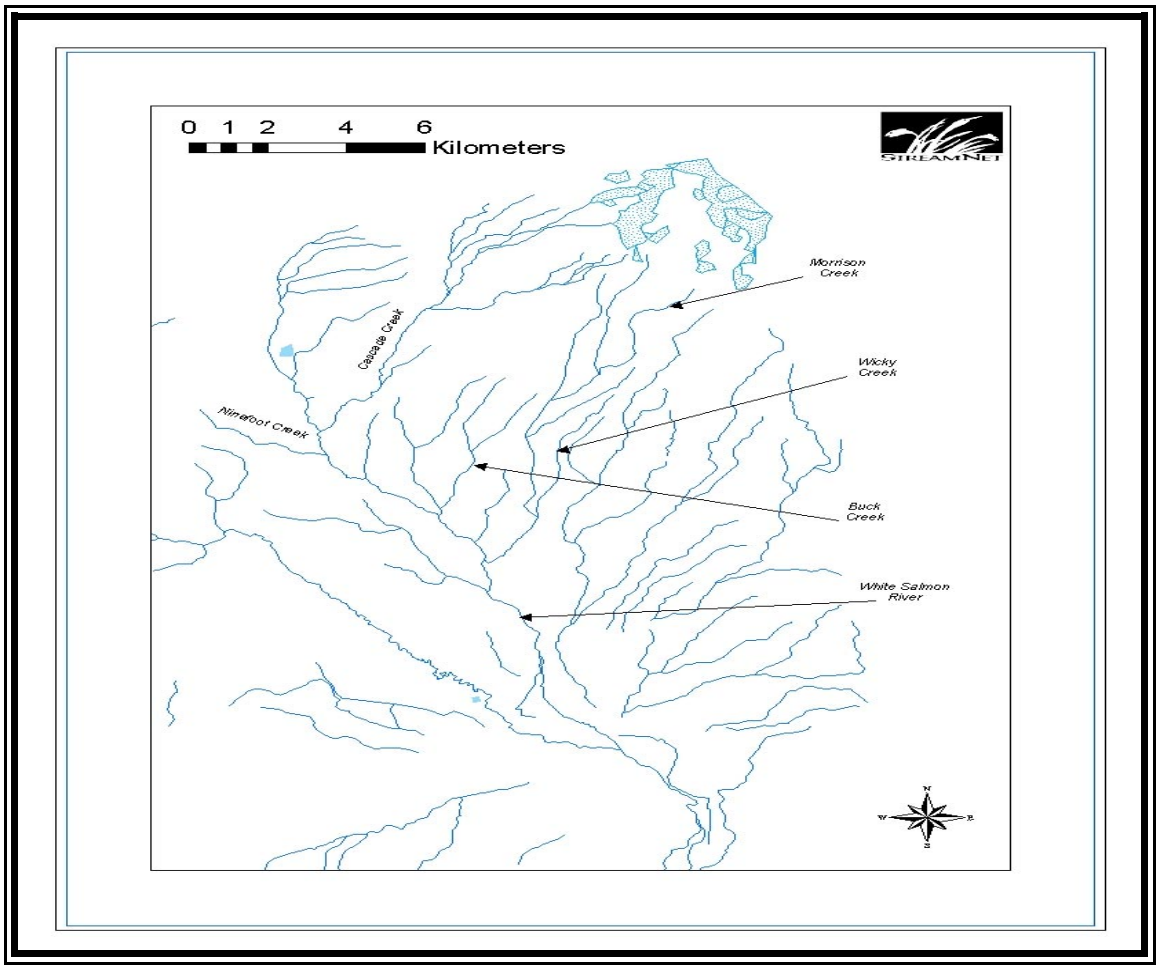

Figure 3. White Salmon River Sub-basin.

The upper White Salmon River watershed extends from the headwaters on Mt. Adams to the White Salmon River confluence with Trout Lake Creek near the town of Trout Lake. The mainstem of the White Salmon River in this upper reach is approximately 23 miles long. Principle tributaries to the upper White Salmon River are Cascade, Salt, Wicky, Morrison, Buck, Gotchen, Hole-in-the-Ground, Green Canyon, Ninefoot, and Cait creeks. With the exception of Ninefoot Creek and Green Canyon Creek, which enter the White Salmon River from the west, all of the major tributaries to the upper White Salmon drain the south slopes of Mt. Adams and

enter the mainstem from the northeast. Glacial melt sustains relatively high summer and spring flows, notably in Cascade Creek and the mainstem White Salmon River. Glacial melt causes turbidity, especially in Cascade Creek and the mainstem White Salmon River below the confluence with Cascade Creek.

The lower White Salmon River drainage extends 26 miles from the confluence with Trout Lake Creek to where the river enters Bonneville Reservoir. Condit Dam, located at RM 3.3, creates Northwestern Lake. Principle tributaries in this lower reach are Spring Creek that enters from the west at RM 6.6 and Rattlesnake Creek that enters from the east near Husum at RM 7.5. Condit Dam blocks anadromous fish passage.

Topography ranges from the steep flanks of Mt. Adams to gentle slopes near Trout Lake. The elevation of the drainage ranges from the peak of Mt. Adams at 12,276 feet to its mouth at the Columbia River at about 100 feet above sea level.

Klickitat River Sub-basin

The Klickitat River Sub-basin is located on the east slope of the Cascade Range and drains 1,350 square miles in Klickitat and Yakima counties (Figure 4). The Klickitat River is one of the longest undammed rivers in the northwest, flowing about 95 miles south from its source to where it enters the Columbia River at RM 180.4. Principle tributaries to the mainstem Klickitat are Swale Creek, Little Klickitat River, Outlet Creek, Big Muddy Creek, West Fork Klickitat River (with the fourth order tributaries: Little Muddy, Trappers, Clearwater, and Crawford Creeks; and Fish Lake Stream; (Figure 5)), McCreedy Creek, Piscoe Creek, and Diamond Fork Creek. Mt. Adams has a distinct influence on both water quantity and water quality in the Klickitat River. The Klickitat, Wilson and Rusk glaciers on the east flank of Mt. Adams contribute water and volcanic debris. Volcanic rock, weathering to clay, and glacial action combine to deliver a large volume of fine sediment to the river system through Big Muddy Creek and Little Muddy Creek (which flows into the West Fork Klickitat). The suspended sediment in these streams during the summer causes turbidity in the mainstem Klickitat River from the West Fork to the Columbia River 63 miles downstream.

The topography in the watershed ranges from the rugged flanks of Mt. Adams and deep canyons to flat lands and gentle slopes south of the mountain. Elevations range from 12,276 feet at the summit of Mt. Adams to about 74 feet where the Klickitat River enters the Columbia at RM 180.4. Extensive basalt strata dominate the geology of the watershed. The erosion-resistant nature of some of these strata has resulted in the creation of deep (700 to 1500 feet), steep-walled canyons and has severely restricted alluvial floodplain development over most of the watershed. In some areas, local variations in erosion resistance of these flows have resulted in the formation of cascades and waterfalls along the mainstem and in many of the tributaries. Castile Falls on the mainstem (RM 64.0 to 64.5) is a series of 11 falls having a total elevation drop of approximately 80 feet.

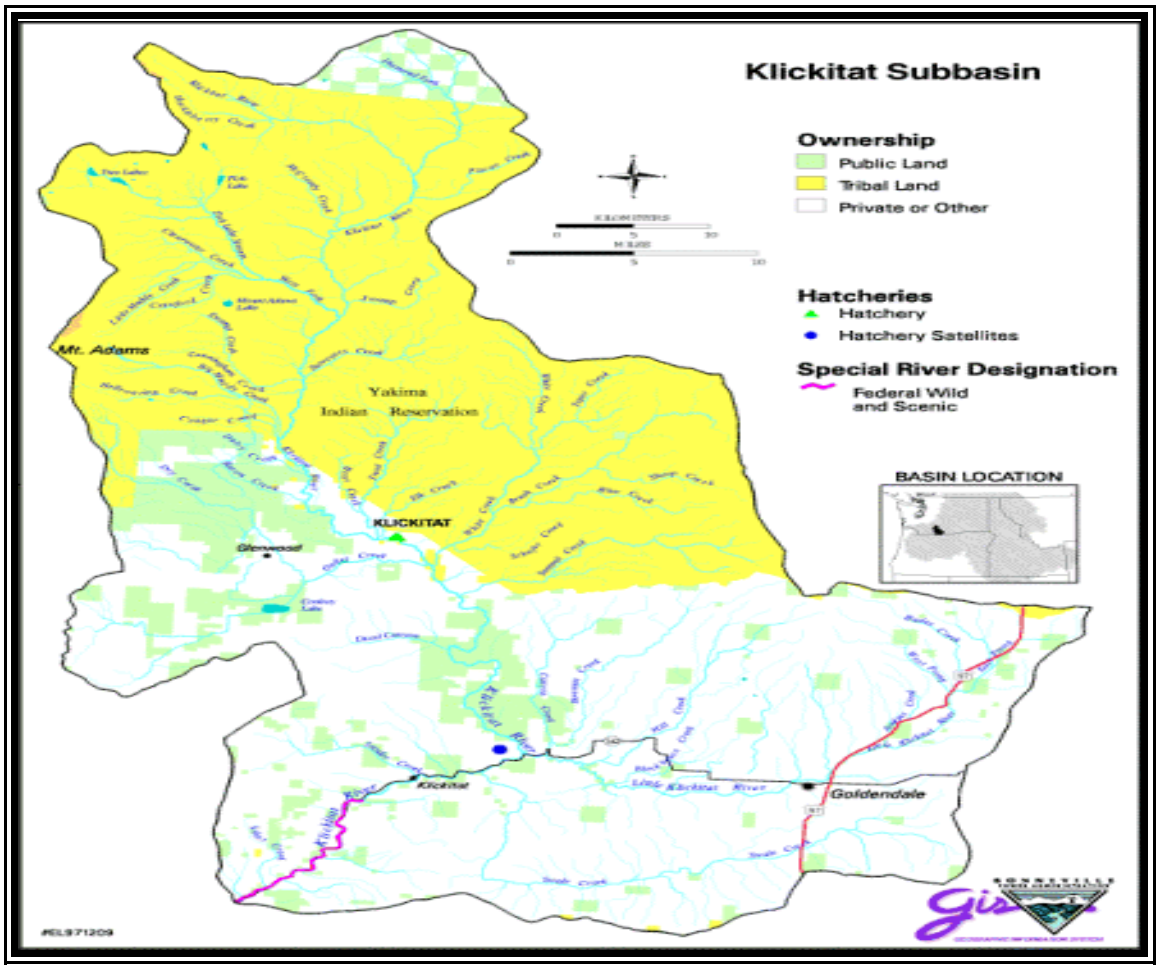

Figure 4. Klickitat River Sub-basin.

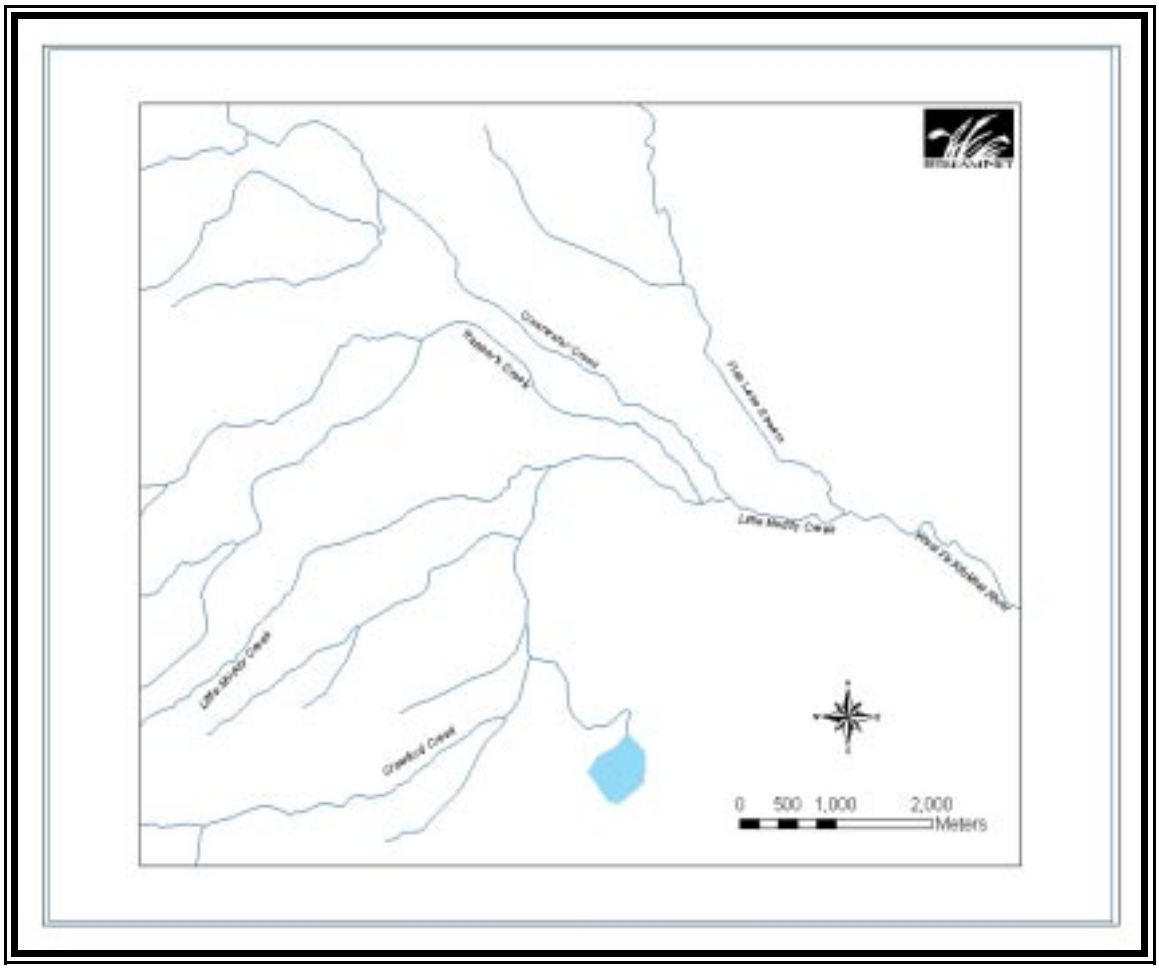

Figure 5. West Fork Klickitat drainage.

Methods and Materials

Bull trout require the coldest waters for rearing and spawning of any salmonid (Rieman and Chandler 1999; Baxter and McPhail 1999; Buchanan and Gregory 1997). Rieman and Chandler (1999) report observing bull trout more frequently at summer mean temperatures of about 6-9° C with summer maximums less than about 13-14° C. We researched existing temperature data provided by the U.S. Geologic Survey Columbia River Lab, U. S. Forest Service, and the Underwood Conservation District and focused our assessment efforts on streams with known cold-water temperature profiles (below 15° C) and below 9° C where available. We stratified our sampling effort by concentrating on cold-water locations. We installed 14 Onset Optic StowAway (WTA08) temperature loggers in prospective areas where temperature information was lacking. Three were placed in the Wind River watershed, two in the Little White Salmon, six in the White Salmon, and two in the Klickitat drainage. Additionally, one was placed in the headwaters of Rock Creek, a small Skamania County creek that enters the Columbia River at Stevenson.

Peterson et al. (In Press) developed a draft interim protocol for determining bull trout presence. The protocol is based on work done on river systems primarily in Idaho. A finalized protocol will be presented to the American Fisheries Society for acceptance as the standard for determining presence/absence of bull trout. The protocol develops probabilities of detection estimates for juvenile migratory and resident bull trout using three sampling methods: day snorkeling, night snorkeling, and backpack electrofishing (3 passes). It provides habitat-specific estimated mean sampling efficiencies for each methodology and concludes that night snorkeling is the most efficient survey technique for determining if bull trout are present. Important habitat variables to consider are: water temperature, channel width, gradient, amount of large woody debris, and visibility. The protocol recommends a given number of samples required to detect bull trout (<200 mm TL) with 80% and 95% probabilities of detection in 50-m and 100-m long sampling units. The protocol also calls for use of block nets at the upper and lower unit boundaries to prevent movement of fish from one unit to the next.

"Using the beta-binomial, the probability ($_{Pc}$) of capturing at least one individual (detection) is estimated as:

$$P_c = 1 - \left[\frac{\Gamma(i+1)\Gamma(a+x)\Gamma(a+b)\Gamma(i+b-x)}{\Gamma(x+1)\Gamma(I-x+1)\Gamma(a+b+i)\Gamma(a)\Gamma(b)} \right],$$

where a and b are the beta shape parameters and x is the number of individuals captured (0 in this case). The beta-binomial shape parameters are estimated using the mean sampling efficiency estimate (q) and the dispersion parameter (γ) from a beta-binomial regression as $a = q/\gamma$ and $b = (1 - q)/\gamma$". (Peterson et al. In Press).

Potential problems with the draft interim protocol survey methodology were recognized prior to conducting actual field surveys. Concerns and procedures were discussed in a series of meetings and phone calls between WDFW, USFS, and USFWS. Cooperatively, we conducted an on-site evaluation of the protocol on different stream reaches within the Gifford Pinchot National Forest. The interim protocol was also the focus of a round table discussion at the Salvelinus confluentus Curiosity Society (SCCS) annual meeting in mid-August. There was consensus that the approaches developed for low gradient Idaho rivers were not working well in the western Cascades. There were difficulties with access issues, randomizing survey reaches, multiple pass electroshocking and the use of block nets. One of the protocol authors was present at the SCCS meeting and recognized these difficulties and indicated that revisions in the protocol would be forthcoming for the next survey year. We provided our written concerns with the protocol methodology to the AFS protocol review team. Future revisions and refinements will be incorporated into our FY2001 sampling regime where feasible.

Additionally, we also implemented the Bull Trout/Dolly Varden sampling protocol described in Bonar et al. (1997). This consists of identifying a "patch" (a stream reach or group of streams, that contains suitable spawning or initial rearing habitat and is separated from other patches by barriers to migration). Sampling sites should then be randomly chosen from the suitable habitat patches to maximize the chance of encountering bull trout. Bonar et al. (1997) assumed a minimum sampling efficiency of 25%. They calculated the number of 100-m stream sections to survey for a 95% chance of detecting bull trout to be:

$$n = \frac{-\ln \beta}{(0.25)m\varepsilon} = -\frac{\ln \beta}{m\varepsilon}$$

where ε = density of bull trout encountered (e.g., Sampling efficiency X mean density m) and 1-β = the desired power (0.95).

They report that at water temps over 9° C, twenty randomly selected stream sections of preferred habitat in a patch are necessary to have a 95% chance of sighting bull trout when they are at an actual density (m) of 0.60 fish/100 m in preferred habitat of the stream, assuming a minimum sample efficiency of 25%.

The draft interim protocol for determining bull trout presence (Peterson et al., In Press) and Bonar et al. (1997) was incorporated into FY2000 sampling where possible, particularly in the Wind and Little White Salmon watersheds. However, we found it difficult to utilize aspects of the protocol. The protocol is based upon a beta-binomial probability distribution of detecting fish presence. However, the probability distribution requires that survey locations be chosen randomly. Due to access and safety issues (deep canyons, extensive log jams, etc.) this was not always possible, therefore our sample locations were not chosen randomly. Most creeks and stream reaches that we sampled were in remote areas and were not easily accessible. We could only sample where access was available, even though this entailed a 4.8 km hike to reach some sample areas. Therefore, it became necessary to sample 100-m sections along accessible stream

reaches. We often surveyed adjoining 100-m stream intervals up to three kilometers total length.

Early in our sampling we concentrated on diurnal snorkeling due to safety concerns. We became convinced of the superiority of night snorkeling by conducting a nocturnal and diurnal comparison on a 100-m section of Trappers Creek (a creek known to contain bull trout). The 100-m section was snorkeled very carefully during the day using a flashlight to check beneath overhangs and in dark recesses. Cobble and soft substrate areas were also searched. No bull trout were seen during the day, while 24 bull trout were seen over this same 100-m section during the night. Most data presented in this report are derived from nocturnal snorkel surveys, although we snorkeled a greater linear distance during the day.

Survey sections were laid out during the day by measuring along or within the stream. Each 100-m section was marked with surveyor's tape. The following habitat data were collected at the beginning and end of each 100-m section: percent overhead cover; wetted width; depth at 1/4, 1/2, and 3/4 distance across wetted width; maximum depth; and size of cobble. The amount of large woody debris (LWD) was quantified in each 100-m section and a gradient was measured, where possible, over a 50-m length of stream. LWD was defined as wood in the stream that measured at least 3 m in length and 10 cm in diameter. Water temperatures were taken with a hand-held thermometer at the beginning of the first 100-m section when snorkeling commenced. A Suunto PM-5/360 PC Clinometer was used for determining the gradient. The gradient, expressed as a percent, was determined by averaging several 50-m readings taken along the stream. In some instances, we were unable to take gradient readings over a 50-m segment or were only able to sight over one or two segments because the creek was obscured by foliage or by sinuosity. In most cases, the gradient determined represents an underestimate of the actual gradient because we were not able to obtain actual measurements where gradients were high due to impaired visibility.

O. S. Systems dry suits and small compact PC Lite underwater flashlights were used for the snorkel surveys. These lights were more functional than larger bulky flashlights, which were difficult to handle in fast water. Red Cyalume OmniGlow light sticks were attached to each individual's snorkel during night surveys to allow safety monitoring of each snorkeler.

Some survey reaches required considerable hiking. Our exit trail out from the survey area was marked with cyalumes before nightfall. We worked upstream when snorkeling, using 1 to 4 snorkelers, depending on the width of the stream. One person walked along the creek monitoring snorkeler safety and recording fish counts relayed by snorkelers. All salmonids were counted. Rainbow trout/steelhead (*Oncorhynchus mykiss*), chinook salmon (*Oncorhynchus tshawytscha*), brook trout (*Salvelinus frontinalis*), and bull trout were seen during the surveys. The size of each fish was estimated as over or under 150 mm total length (TL). It is difficult to distinguish juvenile rainbow trout from steelhead. We, therefore, grouped them together as *O. mykiss*, "rainbow/steelhead", or rainbow trout in the text.

Electroshocking was used where there was insufficient depth for snorkeling. We used protocols approved by the National Marine Fisheries Service (NMFS) and Smith Root to limit the

potential trauma of shocking. A battery powered Smith-Root (Model 12-B) backpack electroshocker supplied by YIN personnel was used in Trappers Creek, McCreedy Creek, and Piscoe Creek in the Klickitat Sub-basin. A Smith-Root (Model 15-D) generator powered the backpack electroshocker, which was used in Ninefoot Creek and in the mainstem of the White Salmon.

Tissue samples for DNA analysis were obtained from fish collected in Trappers Creek and Clearwater Creek in the West Fork Klickitat. Fin clips (≈ 4 x 4-mm) were taken from the anal and/or caudal fins. Fourteen specimens were sampled in Trappers Creek, nine by electroshocking and five by using a small aquarium net. Bull trout were easily netted at night using a 12.5 x 15 cm aquarium net with the handle bent to facilitate capturing the fish. Captured fish were placed in a dilute solution of methyl tricane sulfonate (MS22) until the fish lost equilibrium. When docile, fork lengths were taken, scales removed, and tissue samples were removed with surgical scissors. Tissue samples were immediately placed in ethanol. Fifteen specimens were netted at night in Clearwater Creek. Scales were also collected from all Clearwater Creek samples and the second sample from Trappers Creek. DNA tissue samples were shipped to the WDFW Genetics Laboratory (DNA) in Olympia, Washington for analysis, and scale cards were sent to John Sneva in Olympia for aging.

Angling was used to sample lower Bird Creek in the Klickitat Sub-basin in an area where bull trout had been reported. Angling efforts were minimal. We also investigated using a minnow trap baited with salmon eggs to capture bull trout in Little Muddy Creek.

Results and Discussion

Temperature profiles obtained by the 14 Onset Optic StowAway Temp loggers are presented in Appendix A. A summary of mean daily high and low temperatures and the number of days temperatures exceeded 9° C (48.2° F) and 15° C (59.0° F) is presented in Table 1. All areas, other than Rock Creek, had mean daily water temperatures below 15° C. Maximum daily water temperatures ranged as high as 23° C while minimum daily water temperatures ranged near 0° C.

Table 1. Maximum and minimum mean daily temperatures, number of days greater than 9° C, and number of days greater than 15° C during summer, 2000.

Location	Maximum daily temp. (°C)	Minimum daily temp. (°C)	Days = 9° C	Days = 15° C
Rock Creek	15.71	6.55	101	11
Wind River Sub-basin				
Upper Wind River	14.22	1.97	83	0
Upper Trout Creek	6.15	4.58	0	0
Upper Panther Creek	5.74	4.73	0	0
Little White Salmon Sub-basin				
Lava Creek	26.4	4.89	69	0
Moss Creek	5.22	4.26	0	0
White Salmon Sub-basin				
Upper White Salmon	8.47	2.12	0	0
Ninefoot Creek	10.39	0.33	13	0
Morrison Creek	10.16	-0.04	7	0
Wicky Creek	7.59	3.52	0	0
Upper Cascade Creek	9.94	2.32	12	0
Lower Cascade Creek	10.46	2.93	17	0
Klickitat Sub-basin				
Bird Creek	12.81	-0.30	20	0
Hellroaring Creek	8.17	1.63	69	0

The length of the night survey reaches ranged from 200 m on Trappers Creek and Moss Creek to 1300 m on Trout Creek and Lava Creek. A summary of the distance surveyed in the four sub-basins is presented in Table 2. Day snorkel surveys covering more than a mile in length were also conducted on a few creeks and rivers. Data obtained from habitat and snorkel surveys are presented under the appropriate creek or river (see Appendix B). Fish densities for each sample site are presented in Table 3.

Table 2. Sites and Distances Surveyed.

Sub-Basin & Site	Night Snorkel (m)	Day Snorkel (m)	Total Distance for Sub-basin
Wind River			
Panther Creek	0	5,120	
Trout Creek	1,300	0	
Wind River	1,200	35,200[1]	
Total Distance	2,500	40,320	42,820
Little White Salmon River			
Lava Creek	1,300	0	
Moss Creek	200	0	
Little White Salmon River	0	3,100	
Total Distance	1,500	3,100	4,600
White Salmon River			
Husum to Northwestern Lake	4,200	4,200	
Morrison Creek (Below 8031)	0	2,400[2]	
Morrison Creek (Horse Camp)	350	0	
Cascade Creek (Lower Site)	300	0	
Cascade Creek (Upper Site)	400	0	
Ninefoot Creek	0	3,200[2]	
White Salmon River	0	6,700[2]	
White Salmon River (Lower Site)	400	0	
White Salmon River (Upper Site)	400	0	
Total Distance	6,050	16,500	22,550
Klickitat River			
Bird Creek	500	0	
Dry Creek	200	0	
Cunningham Creek	400	0	
Trappers Creek	200	100	
Clearwater Creek (Lower)	341	0	
Clearwater Creek (Upper)	200	0	
Little Muddy Creek	400	0	
Fish Lake Stream	815	15	
McCreedy Creek	337	200	
Diamond Fork Creek	400	0	
Total Distance	3,793	315	4,108
Grand Total Distance Surveyed	13,843	60,235	74,078

[1] Survey done as part of steelhead survey.
[2] Joint surveys with USFS.

Table 3. Salmonid densities in sampled streams per 100 m2 of stream. Rainbow trout, brook trout, bull trout, other salmonids, and total salmonid are expressed.

Sites	Rainbow	Brook	Bull	Other	Total
Wind River					
Trout Creek	1.30	1.70	0.00	0.00	3.00
Wind River-Upper	1.50	1.20	0.00	0.00	2.70
Wind River-Oldman	8.20	0.00	0.00	0.00	8.20
Little White Salmon River					
Lava Creek	0.24	0.13	0.00	0.00	0.36
Little White Salmon River	0.30	0.00	0.00	0.00	0.30
White Salmon River					
Upper White Salmon R-High Site	2.20	0.00	0.00	0.00	2.20
Upper White Salmon R-Low Site	3.00	0.00	0.00	0.00	3.00
Cascade Creek-High Site	1.40	0.00	0.00	0.00	1.40
Cascade Creek-Low Site	0.70	0.00	0.00	0.00	0.70
Klickitat River					
Trappers Creek	0.00	0.00	6.70	0.00	6.70
Clearwater Creek	0.10	<0.10	2.60	0.00	2.70
Little Muddy Creek	0.30	0.10	0.40	0.00	0.80
Fish Lake Stream-Mid Site	1.20	1.20	0.00	0.00	2.40
Fish Lake Stream-Low Site	1.10	0.60	0.00	0.00	1.70
McCreedy Creek	2.90	1.50	0.00	0.20[1]	4.60
Diamond Fork Stream	3.90	0.40	0.00	12.60[2]	16.90
Bird Creek-above S4000 Bridge	0.70	5.30	0.00	0.00	6.00
Bird Creek-below S4000 Bridge	1.80	3.60	0.00	0.00	5.40
Dry Creek	0.40	4.60	0.00	0.00	5.00
Cunningham Creek	0.60	0.00	0.00	0.00	0.60

[1] Three juvenile chinook, 3 unknown salmonids.
[2] We observed 453 juvenile chinook, nearly all <150 mm.

Rock Creek (Skamania County)

Rock Creek possesses intact, seemingly suitable bull trout habitat, although it is outside of our study area. Rock Creek's bull trout potential and temperature profile were unknown. A data logger was placed in the headwaters of Rock Creek July 10, 2000 and removed November 1, 2000. Rock Creek had the highest overall temperatures of any creek sampled. Mean water temperatures exceeded 15° C during early August (Appendix A4). The temperature gradually declined to near 6.5° C by the end of the survey period. The maximum temperature recorded was approximately 17.5° C and the minimum was 6° C. We did not snorkel this creek.

Wind River Sub-basin

Panther Creek and Trout Creek are the two primary cold-water tributaries that enter the Wind River. Data loggers were placed in Panther Creek, Trout Creek, and the mainstem Wind River June 20 - July 7, 2000 to document the temperature regimes of these cold-water habitats. Snorkel and habitat surveys were conducted in the Wind River Sub-basin from July 20 through August 31, 2000. We snorkeled 42,820 m in the sub-basin: 2,500 m at night and 40,320 m during the day (Table 2).

Panther Creek

Panther Creek is a significant cold-water tributary of the Wind River, which passes through a steep canyon before reaching the 6513 Road. A data logger was placed in Panther Creek on July 7, 2000 and removed November 1, 2000. It was placed approximately 200 m above the falls on Panther Creek, where Forest Road 65 makes a sharp bend. The water temperature in Panther Creek was constant during the nearly four month sampling period (Appendix A2). Mean daily temperature averaged 4.7-5.7° C. The maximum temperature recorded was slightly more than 6.0° C while the minimum was 4.6° C.

We day-snorkeled approximately 5.1 km of Panther Creek downstream from the falls to the 6513 road. It took two days (July 20 and 26) and 10 hrs of actual snorkel time to complete this survey. Water temperatures taken during the snorkel survey were several degrees higher than the mean daily temperature recorded with the data logger. Temperatures ranged from 7.2-8.9° C during the survey. Water clarity was excellent for observing fish (≈ >10 m visibility). Panther Creek averaged more than 10 m wetted width, and ranged from large pools to plunging waterfalls over rock ledges and log jams a few meters in height. We saw no bull trout during the survey but did see 170 salmonids: 165 rainbow trout, one adult wild steelhead, one unidentified fry (≈ 30 mm), and three unidentified salmonids.

Trout Creek

We surveyed more than 1300 m of the creek from the 3300 Road to the origins of Trout Creek. The creek, during low summer flows, begins near the 419 Road quarry. There is a large beaver pond draining into the west side of Trout Creek near the quarry. A data logger was placed in Trout Creek near the 42 Road on June 20, 2000 and retrieved November 14, 2000 (Appendix A3). The creek is directly affected by groundwater from springs originating in nearby lava beds. Water temperatures during the sample period averaged 5-6° C. The maximum temperature recorded was 6.7 ° C, while the minimum was 4.3° C.

Habitat data was collected on August 22, 2000. The creek was night snorkeled from the 3300 Road to the 42 Road (a distance of more than 700 m) on August 22, 2000 (Appendix B1). The remainder of Trout Creek (600 m above the 42 Road) was snorkeled at night on August 29, 2000 (Appendix B2). The creek over the entire 1300 m distance averaged 6.0 m wetted width, 72.7%

overhead canopy cover, 2.8 pieces of LWD, and had a gradient of 1.84%. Water temperatures taken during the day with a hand-held thermometer were 6.1-7.2° C. A temperature of 4.5° C was recorded at night, near the beaver pond.

We observed no bull trout in Trout Creek during the night snorkel, however, 224 salmonids were observed: 99 rainbow trout (34 <150 mm and 65 >150 mm) and 125 brook trout (53 <150 mm and 72 >150 mm). In addition, twelve brook trout were seen in the beaver pond (9 <150 mm and 3 >150 mm). Rainbow trout averaged 1.3 fish/100 m^2, brook trout averaged 1.7 fish/100 m^2 and total salmonids averaged 3.0 fish/100 m^2 of river (Table 3).

Wind River

We placed a temperature data logger in the Wind River near the confluence of Oldman Creek at RM 26.8 on July 7, 2000 and retrieved it on November 10, 2000. Average water temperatures during the sample period ranged from a high of 14° C in early August to a low of 2° C in early November (Appendix A1). The maximum temperature recorded was 16° C and the minimum was slightly below 2° C. We surveyed two reaches on the Wind River mainstem: one immediately below the falls near RM 28.0 and the other 1.9 km downstream near the confluence of Oldman Creek at RM 26.8.

On August 30, 2000, we surveyed a 500-m section on the mainstem (Upper Site) immediately below the falls and an additional 100-m in nearby Pete's Gulch, a tributary that enters the mainstem from the east (Appendix B3). The canyon was steep near the falls and in Pete's Gulch. Bedrock dominated the substrate. Pools in this area were separated by bedrock chutes. The falls on the Wind River was 9 m high and the river below the falls averaged 3.8 m wetted width and 73% overhead cover. There was virtually no LWD in the mainstem or in Pete's Gulch, where we surveyed. The water temperature in the mainstem ranged between 10.6 and 12.3° C during the day. Pete's Gulch had a wetted width of 2.6 m and 37% overhead cover.

We saw no bull trout during the night snorkel in the Wind River at the Upper Site or in Pete's Gulch. We did see 49 salmonids in the mainstem at night: 27 rainbow trout (5 <150 mm and 22 >150 mm) and 22 brook trout (3 <150 mm and 19 >150 mm). Salmonid density in the 500-m section of the mainstem averaged 2.7 fish/100m^2. Rainbow trout density averaged 1.5 fish/100 m^2 and brook trout averaged 1.2 fish/100m^2. Two brook trout over 150 mm were seen in Pete's Gulch. Their density averaged 0.8 fish/100 m^2.

The Lower Site on the upper Wind River was surveyed August 31, 2000 (Appendix B4). The river here was wider than at the Upper Site and pools were separated by very shallow glides and riffles. The 600 meters surveyed in this area were difficult to snorkel because of the shallow water, which necessitated "crawling" upstream. The Lower Site averaged 6.4 m wetted width, 25% overhead cover, and had a gradient of 2.27%. There was no LWD in this area. The water temperature ranged from 11.7-12.2° C during the day and was (10.6° C) at night during the survey. We saw no bull trout during the night survey. Unlike the survey at the Upper Site, we

saw no brook trout at this location. A total of 300 rainbow trout was observed in the 600 meters surveyed (225 <150 mm and 75 >150 mm). Average rainbow density was 8.2 fish/100 m^2.

We also participated in diurnal steelhead snorkels in the Wind River that were conducted August 18-19, 2000 and September 27-29, 2000. The surveys covered from Falls Creek to the mouth of the Wind River, a distance of 35.2 km (22 mi.). Various salmonid species were noted during the surveys, but no bull trout were seen.

Four smolt traps have been operated in the Wind River Sub-basin. Traps in the Little Wind River, Trout Creek, and Panther Creek have been monitored since 1995, while the trap at Government Bridge has been checked since 1998. No bull trout have ever been observed in these traps.

We night snorkeled twelve 100-m segments in the Upper Wind system and an additional thirteen 100-m segments in the Trout Creek drainage, for a total of twenty five 100-m segments. We also day snorkeled ≈ 5.1 km of Panther Creek. We chose primarily clear, cold streams.

Bonar et al. (1997) developed a methodology that provides a 95% chance that bull trout will be detected if they are at an actual density of 0.60 fish/100 m. They suggest that night snorkeling twenty 100-m long patches will be sufficient to provide a 95% chance of detecting bull trout at this density. We exceeded their recommended number of patches by 25%.

Applying the interim draft protocol (Peterson et al, In Press), we had a 90% probability of detecting bull trout via night snorkeling in Trout Creek and the upper Wind River drainages. We also conducted a daytime census (100% coverage) of ≈ 5.1 km of upper Panther Creek. This corresponds to an 82% probability of detecting bull trout via day snorkeling for the entire Panther Creek drainage under Peterson et al. Combining both day and night snorkels and all locations yields a 98% probability of detection of bull trout for the entire Wind River Sub-basin under the interim protocol.

Little White Salmon Sub-basin

Lava and Moss creeks, two cold-water tributaries created from groundwater flowing from the Big Lava Bed, enter the Little White Salmon River from the west near the town of Willard. Temperature loggers were placed in these creeks on July 10, 2000. Snorkel and habitat surveys were conducted in the Little White Salmon Sub-basin September 5 through November 9, 2000. We snorkeled a total of 4,600 m in the sub-basin: 1,500 m at night and 3,100 m during the day (Table 2).

Lava Creek

Lava Creek enters the Little White Salmon River at RM 6.3, approximately 150 m above the Tibbets Road Bridge at Willard. The data logger in Lava Creek was placed approximately 0.5 mi. above the 6800 Road. The creek was at high flow when the logger was placed on July 10, 2000 and the temperature was 5.3° C. Unfortunately, the upper reaches of Lava Creek dried up shortly after the data logger was put in place. Initially, water temperatures averaged around 5° C. The data logger was apparently out of the water before late July (Appendix A6).

We surveyed the lower 1300 m of Lava Creek from the confluence at the Little White Salmon River on September 5, 2000. Lava Creek was night snorkeled September 5-6, 2000 (Appendix B5). The creek averaged 10.7 m wetted width, 40% overhead cover, approximately 1 piece of LWD, and had a gradient of 2.30%. Water temperatures ranged from 6.1-6.7° C during the day and was 5.6° C during the night snorkel.

We saw no bull trout during our night snorkels. We observed 49 salmonids: 32 rainbow trout (12 <150 mm and 20 >150 mm) and 17 brook trout (4 <150 mm and 13 >150 mm). Rainbow trout density averaged 0.24 fish/100 m^2, brook trout averaged 0.13 fish/100 m^2, and total fish averaged 0.37 fish/100 m^2.

Little White Salmon River

We surveyed the mainstem of the Little White Salmon River on September 20-21, 2000 (Appendix B6). The survey extended from the confluence of Moss Creek at RM 8.0 (adjacent to the County Road Bridge) downstream to the Tibbets Road Bridge at RM 6.1, a distance of nearly 3.1 km. The gradient along the river is relatively flat throughout most of its length, except between 2.45 km and 2.85 km below Moss Creek. A steep canyon with high gradient exists along this 400 m of river. We were unable to get accurate gradient readings in this area, therefore, the reported average gradient of 1.09% is an underestimate. This reach averaged 13.7 m wetted width, 44.3% overhead cover, and 1.75 pieces of LWD.

The mainstem Little White Salmon River was day snorkeled from Moss Creek down to the Tibbets Road Bridge on September 28, 2000. We saw no bull trout or brook trout during the snorkel survey and 117 rainbow trout (18 <150 mm and 99 >150 mm). Most rainbows were seen from 1400 m below the Moss Creek confluence to the Tibbets Road Bridge at Willard. Mean rainbow density averaged 0.3 fish/100 m^2.

Moss Creek

Moss Creek enters the Little White Salmon River just below Big Cedar Campground at RM 8.0. Moss Creek begins primarily as a series of ponds, approximately 0.75 miles west of the Little White Salmon River. The ponds are spring fed and exceedingly clear. We estimated visibilities in excess of 30 m. The creek is cold, of low gradient, and is packed with LWD making surveying difficult. A data logger was placed in Moss Creek about 300 m below the ponds on July 10, 2000 and removed November 9, 2000 (Appendix A5). Water temperatures averaged 4-5^{o}C.

Moss Creek contributes considerable cold water to the Little White Salmon River. For instance, we measured water temperatures on September 20, 2000 in the Little White Salmon River just above the confluence of Moss Creek and 30 m below the confluence. The temperature on the mainstem above Moss Creek was 13.9^{o}C. The temperature was 6.1^{o}C 30 m below the confluence. Moss Creek contributed cold water to the mainstem and decreased the temperature by 7.8^{o}C. Moss Creek is virtually impenetrable to snorkelers due to the great amount of blow down and woody debris in this stream. From a previous snorkel effort conducted in 1999 by USFS and USFWS personnel, we chose to concentrate our efforts in the area of ponds where bull trout were most likely to be found.

The Moss Creek ponds were night snorkeled on November 9, 2000 (Appendix B7). The water temperature was 4.4^{o}C. The night snorkel covered 200 m of the main pond and a branch that extends on the north side of the drainage. No bull or rainbow trout were seen during the night snorkel. Five brook trout were seen.

We concentrated our efforts in those areas of the Little White Salmon Sub-basin that had the greatest potential to harbor bull trout based on existing temperature records. Using Peterson et al. (In Press), we had a 73% nocturnal probability (Lava Ck.) and a 69% diurnal probability (Little White Salmon) of detecting bull trout. Combining both methods exceeded a 92% probability of detection of bull trout for the entire drainage.

Because water temperatures in this system were < 9^{o}C, we had to modify Bonar et al. (1997) to account for a lower threshold (0.15 fish/100m) of detection. The lower detection level required thirty three100-m patches to be surveyed. We night snorkeled 15 100-m patches and day snorkeled 31 patches for a total of 46. This was 139% of the total required by Bonar et al.

White Salmon River Sub-basin

Two bull trout recoveries were reported by WDFW biologists in the White Salmon River Sub-basin above Condit Dam (Washington Department of Fish and Wildlife 1998). A 273 mm bull trout was captured in a gill net set in the spring of 1986 in Northwestern Lake. A second fish, about 305 mm, was checked in the opening day creel census at Northwestern Lake in April 1989.

In addition, sport anglers downstream from Condit Dam have reported two sightings in the recent years.

The White Salmon River drains into the head of Northwestern Lake at RM 5.5. Condit Dam, located at RM 3.3, creates Northwestern Lake. Two tributaries enter the White Salmon River, in the lower portion of the sub-basin, near Northwestern Lake: Spring Creek enters from the west at RM 6.6 and Rattlesnake Creek enters from the east near Husum at RM 7.5. We did not survey Spring Creek but did a walking survey along Rattlesnake Creek.

We concentrated our surveys in the upper reaches of the White Salmon River where there are colder water temperatures. We snorkel-surveyed and placed data loggers in the mainstem White Salmon River and the following tributaries in the upper sub-basin: Cascade Creek, Morrison Creek, and Ninefoot Creek. We snorkeled 22,550 m in the sub-basin: 6,050 m at night and 16,500 m during the day (Table 2). USFS personnel conducted approximately 6,700 m of the day surveys during joint surveys of the White Salmon. A temperature logger was also placed in Wicky Creek, but snorkel and habitat surveys were not conducted. Buck Creek, a small tributary, was hiked and deemed insufficient to support bull trout. We did not place a temperature logger in Buck Creek.

Glacial melt sustains relatively high spring, summer and fall flows, especially in Cascade Creek and the mainstem White Salmon River. This causes significant turbidity in Cascade Creek and the mainstem below the confluence.

White Salmon River Sub-basin -- Lower Region

White Salmon River (Husum to Northwestern Lake)

We participated with the Columbia River Gorge National Scenic Area (CRGNSA), USFS and USFWS personnel with day and night snorkels in the White Salmon River on August 21, 2000. Seven snorkelers surveyed from the Husum Bridge to the headwaters of Northwestern Lake, a distance of 3.6 km. One pass was made during the day with an additional pass at night. We saw no bull trout during either snorkel survey; however, we did see many large trophy rainbow trout (350-600 mm TL).

Rattlesnake Creek

Rattlesnake creek drains a large valley to the east of Husum. We hiked along the creek at several locations on October 10, 2000. Flow was low and the water temperature was 17.8^{o} C. Headwater streams were dry. The creek formed a series of intermittent, isolated, warm pools. We did not find any habitat that we considered suitable for bull trout and thus, did not conduct habitat or snorkel surveys for bull trout.

White Salmon River Sub-basin -- Upper Region

Buck Creek

We hiked Buck Creek on June 28, 2000 and July 19, 2000 (with USFS and USFWS personnel) and determined that Buck Creek was too small to snorkel. The wetted width was estimated at less than 2 m. The temperature on June 28, 2000 was 8.3° C.

Wicky Creek

A data logger was placed in Wicky Creek near the 8040 Road on June 21, 2000 and retrieved November 9, 2000 (Appendix A10). Water temperatures of 6.7° C was taken with a hand-held thermometer on June 28, 2000 and 2.8° C on November 9, 2000. Average water temperatures recorded by the data logger during the sample period ranged from a high of 7.5° C in early August to a low of 3.5° C on November 9. The maximum temperature recorded was 8.7° C and the minimum was slightly less than 3.5° C.

Wicky Creek is considered too small to support bull trout. We therefore did not conduct habitat and snorkel surveys on Wicky Creek.

Morrison Creek

We placed a data logger in Morrison Creek near the Morrison Creek Horse Camp on June 28, 2000, and retrieved it November 9, 2000 (Appendix A9). Snow covered the ground and ice was forming in the creek when the data logger was removed in November. The water temperature recorded with a hand-held thermometer was 0° C. Average water temperatures recorded by the data logger during the sample period ranged from a high of 10° C in early August and mid-September to a low of 0° C. The maximum temperature recorded was 14° C.

We worked cooperatively with USFS on July 25, 2000 surveying the lower part of Morrison Creek from the confluence on the White Salmon River at RM 32.5 to the 8031 Road. The distance was approximately 2.4 km. There are two significant barrier falls (each ≈ 3 m high) just above the confluence with the White Salmon River. This day snorkel revealed no bull trout, or any other fish in Morrison Creek. We were surprised by the lack of insect larvae, amphibians, and fish in this portion of Morrison Creek. The creek seemed "devoid of life."

Later, during the course of this study, we became convinced of the superiority of night snorkeling. We revisited this creek, scheduling an additional night snorkel of 350m of Morrison Creek, near the Morrison Creek Horse Camp, on October 11, 2000 (Appendix B8). The habitat was surveyed during the day and the creek was snorkeled at night. Morrison Creek averaged 3.0 m wetted width, 52% overhead cover, and 8.9 pieces of LWD. The water temperature taken during the day on October 11, 2000 was 5.6° C. No bull trout or other fish were seen during the night snorkel and insect life was minimal.

Cascade Creek

Cascade Creek enters the White Salmon River at RM 36.9, just below the 8031 Bridge. The creek, known for large amounts of glacial flour, is usually turbid until late fall and winter when the White Salmon and Avalanche glaciers freeze.

Data loggers were placed at two locations in Cascade Creek on June 26, 2000 and were removed October 24, 2000. One logger was placed approximately 5 km and the other 4 km above the confluence with the White Salmon. The water temperature taken with a hand-held thermometer was 10.6° C when the data loggers were placed in the creek and 5.0° C when they were retrieved. Mean daily water temperatures recorded at the upper location ranged from a high of 10° C in late July and mid-September to a low near 2° C when the recorder was retrieved in late October (Appendix A11). The maximum temperature recorded at the upper location was 14.3° C and the minimum was near 1.0° C. Water temperatures were slightly higher at the lower data logger (Appendix A12). Average water temperatures recorded at the lower location ranged from a high of 10.5 ° C in mid-September to a low of 3° C in late October. The maximum temperature recorded at the lower spot was 14.5° C and the minimum was 2.0° C.

We conducted two night snorkel surveys in Cascade Creek. The Lower Site covered 300 m from the confluence with the White Salmon River to the bridge on the 8031 Road (Appendix B9). The Upper Site was 400 m in length and was approximately 4 km above the confluence (Appendix B10). This site was at the location of the lower data logger). Snorkel surveys were not attempted until the glaciers froze and visibility improved in late fall.

The Lower Site was night snorkeled October 11, 2000. Cascade Creek in this area averaged 7.5 m wetted width, 61.3% overhead cover, 6.6 pieces of LWD, and had a gradient of 3.38%. No bull trout were seen. We saw 15 rainbow trout (10 <150 mm and 5> 150 mm) that averaged 0.7 fish/100 m^2.

The Upper Site was night snorkeled October 26, 2000. USFS personnel assisted with the survey. The water temperature during the survey ranged from 5.0-5.6° C. Cascade Creek in this area averaged 5.7 m wetted width, 60.0% overhead cover, 8.25 pieces of LWD, and had a gradient of 2.75%. No bull trout or brook trout were seen. We saw 31 rainbow trout (22 <150 mm and 9> 150 mm) averaging 1.4 fish/100 m^2.

Upper White Salmon River (above Cascade Creek confluence)

A data logger was placed in the upper White Salmon River off the 531 Road on June 21, 2000 and retrieved November 9, 2000 (Appendix A7). Average water temperatures recorded by the data logger ranged from a high of 8.5° C in mid-September to a low of 2.0° C on November 9. The maximum temperature recorded in the mainstem was 10.0 ° C and the minimum was slightly below 2.0° C. The water temperature taken with a hand-held thermometer during the habitat

survey and night snorkel October 10, 2000 was 5.6° C. The hand-held thermometer read 1.7° C during snow-covered conditions November 9, 2000.

We collaborated with the USFS in diurnal snorkel surveys of the upper White Salmon River above the confluence of Cascade Creek. Approximately 6.7 km of river were snorkeled upstream during five days from August 1 through August 11, 2000. A total of 219 rainbow trout were seen day snorkeling in the mainstem. Eight additional rainbows were collected by electroshocking a small-unnamed tributary that entered the White Salmon River from the east. No bull trout or brook trout were seen during the surveys.

Because of concern over the accuracy of day snorkeling, we re-snorkeled at night; two different reaches on the upper White Salmon River above the Cascade Creek confluence. The Lower Site was approximately 2.4 km above the bridge on Forest Road 8031 while the Upper Site was off Road 531 (near the data logger), approximately 4.8 km above the bridge.

We surveyed 400 meters at the Lower Site on October 9, 2000 (Appendix B11). The White Salmon River at the Lower Site averaged 7.2 m wetted width, 66% overhead cover, and had a gradient of 3.05%. LWD was extremely high, averaging 32 pieces per 100-m section. The water temperature taken during the day was 5.9° C. We saw no bull or brook trout during the night snorkel. Ninety rainbow trout were observed (52 <150 mm and 38 > 150 mm) and averaged 3.0 fish/100 m^2.

We surveyed 400 meters at the Upper Site on October 10, 2000 (Appendix B12). The Upper Site averaged 7.3 m wetted width, 28% overhead cover, 2.51% gradient, and 8.25 pieces of LWD/100m at this site. Twenty-five pieces of LWD were in one 100-m section. The remaining three 100-m sections totaled 8 pieces of LWD. We saw no bull trout or brook trout during the night snorkel. A total of 62 rainbow trout (40 <150 mm and 22 > 150 mm) were observed and averaged 2.2 fish/100 m^2 of river and 46.5 m^2 /fish.

Ninefoot Creek

Ninefoot Creek enters the White Salmon River from the west at RM 36.2. A data logger was placed in the creek, approximately 2.6 km (1.6 road miles) above Forest Road 23, on July 19, 2000 and retrieved on November 14, 2000 (Appendix A8). Average water temperatures recorded by the data logger ranged from a high of 10.5° C in early August to a low of 0.5° C in early November. The maximum temperature recorded was 11.5° C and the minimum was slightly below 0° C.

We collaborated with the USFS in day snorkel surveys and electroshocking of 4.6 km during July and August 2000. Two hundred nineteen rainbow trout were seen during the snorkel surveys and electroshocking. This was the same amount of rainbow seen in snorkeling 6.7 km of the mainstem White Salmon. The water temperature on August 8, 2000 was 9.5° C.

Klickitat River Sub-basin

The 1998 Salmonid Stock Inventory (Appendix Bull Trout/Dolly Varden) reports that little is known about bull trout in the Klickitat River other than that they are known to occur there (Washington Department of Fish Wildlife 1998). Bull trout have been reported 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 Nation, personal communication). Four bull trout up to ≈ 254 mm in length were reported during snorkel surveys in the mainstem Klickitat (RM 64, above the West Fork) and 23 bull trout (≈ 76 to 178 mm in length) were observed during electroshocking surveys in Trappers Creek. In the early 1990's, an ≈ 360 mm bull trout was angled near the town of Klickitat. Recent evidence indicates that bull trout also frequent the Columbia River at the mouth of the Klickitat River. In 1998, tribal pikeminnow gillnetters reported capturing two bull trout at the mouth of the Klickitat. In May 2000, an anecdotal bull trout recovery and release at this area was reported to the Pikeminnow Sport-Reward Registration Station.

Principle tributaries that are of interest and have cold water are: Bird Creek, Hellroaring Creek, Big Muddy Creek, West Fork Klickitat River (Little Muddy Creek and Fish Lake Stream) Trappers Creek, Clearwater Creek, Crawford Creek, McCreedy Creek, Piscoe Creek, and Diamond Fork Creek. The Rusk Glacier on Mt. Adams contributes a large volume of fine sediment to the Klickitat River through Big Muddy Creek (RM 53.8) and West Fork Klickitat (RM 63.1). Little Muddy Creek, which receives glacial flour from the Wilson Glacier, joins Fish Lake Stream to become the West Fork Klickitat. This suspended sediment during the summer causes turbidity in the mainstem Klickitat River from the West Fork to the Columbia River 63 miles downstream.

We conducted snorkel surveys in the following tributaries in the Klickitat River Sub-basin: Bird Creek, Dry Creek, Clearwater Creek, Trappers Creek, Little Muddy Creek, Fish Lake Stream, Cunningham Creek, McCreedy Creek, and Diamond Fork Creek. We also checked the West Fork Klickitat at night immediately above the falls near the confluence with Fish Lake Stream. We snorkeled a total of 4,108 m in this sub-basin: 3,793 m at night and 315 m during the day (Table 2). In addition, we electroshocked Trappers Creek, Clearwater Creek, McCreedy Creek and Piscoe Creek. Data loggers were placed in the upper portion of Bird Creek and in Hellroaring Creek on July 11, 2000 and retrieved October 24, 2000.

All work in the Klickitat River Sub-basin (except that done in lower Bird Creek and Dry Creek) was done on the Yakama Indian Reservation. Fisheries staff from the Yakama Nation assisted us on the reservation.

Hellroaring Creek

Hellroaring Creek passes near Bench Lake in Track D on the Yakama Indian Reservation and enters Big Muddy Creek. The creek was not surveyed or snorkeled due to extreme gradients.

We did obtain temperature data from the data logger (Appendix A14). Average water temperatures ranged from a high of 8.2° C in mid-September to a low of 1.7° C in late October. The maximum temperature recorded was nearly 12° C and the minimum was 0.5° C. Daily maximum and minimum temperatures varied by as much as 7° C from mid-July through mid-August.

Bird Creek & Dry Creek

We had reports that bull trout were present in Bird Creek, near Glenwood. We angled the creek on September 7, 2000 and caught 2 brook trout. Bird Creek at this location was turbid with glacial melt that presumably was contributed through irrigation diversions from Big Muddy and Hellroaring creeks. We also day snorkeled a portion of Bird Creek at the junction of the K3000 and K4000 roads. The water at this location was above the influence of glacial input and was clear enough to snorkel. Rainbow and brook trout were seen at this site during this day snorkel. No bull trout were seen.

A temperature logger was placed in the upper reaches of Bird Creek on July 11, 2000 and retrieved October 24, 2000 (Appendix A13). The data logger was located in Tract D, approximately 30 m above the crossing of the 285 Road. Average water temperatures ranged from a high of 12.7° C in mid-September to a low of 0° C in late October. The maximum temperature recorded was approximately 23° C and the minimum was slightly below 0° C. A maximum temperature spike in mid-September was nearly 7° C above other maximum temperatures.

The lower reaches of Bird Creek (near Glenwood) were surveyed October 10, 2000 (Appendices B13 and B14). Dry Creek enters Bird Creek just above the culvert on Road S4000. A total of 500 m of Bird Creek was night snorkeled: 300 m below the confluence of Dry Creek and 200 m above. In addition, 200 m of Dry Creek were night snorkeled above the confluence with Bird Creek (Appendix B15).

Bird Creek, downstream from the confluence with Dry Creek, averaged 7.1 m wetted width, 47.5% overhead cover, 14.3 pieces of LWD/100 m, and had a gradient of 1.00%. The water temperature was 5.0° C. We saw no bull trout during the night snorkel. A total of 116 salmonids were observed during the survey: 38 rainbow trout (6 <150 mm and 32 >150 mm) and 78 brook trout (37 <150 mm and 41 >150 mm). Rainbow trout density averaged 1.75 fish/100 m^2, 78 brook trout averaged 3.59 fish/100 m^2 and total salmonids averaged 5.34 fish/100 m^2.

Bird Creek, upstream from the confluence with Dry Creek, averaged 4.67 m wetted width, 81.7% overhead cover, 6 pieces of LWD/100 m, and had a water temperature of 4.4° C. Fifty-four salmonids were seen during the night snorkel: 6 rainbow trout (0 <150 mm and 6 >150 mm) and 48 brook trout (24 <150 mm and 24 >150 mm). Rainbow trout averaged 0.7 fish/100 m^2, brook trout averaged 5.3 fish/100 m^2 and total salmonids averaged 6.0 fish/m^2.

Dry Creek above the confluence with Bird Creek averaged 6.13 m wetted width, 23.3% overhead cover, 19.5 pieces of LWD/100 m, and had a water temperature of 5.6° C (42° F). Fifty-nine salmonids were seen during the night snorkel: 5 rainbow trout (1 <150 mm and 4 >150 mm) and 54 brook trout (25 <150 mm and 29 >150 mm). Rainbow trout density averaged 0.4 fish/100 m^2, brook trout averaged 4.6 fish/100 m^2 and total salmonids averaged 5.0 fish/m^2.

Cunningham Creek

Cunningham Creek enters the Klickitat River from the west at RM 58.1. The creek was surveyed 400 m downstream from the culvert on Road 255 (Appendix B16). The habitat survey was completed October 3, 2000 and the night snorkel was conducted October 18, 2000. Water temperature was 6.1-6.7° C. Cunningham Creek had two waterfalls that were ≈ 4-6 m in height. The creek averaged 5.64 m wetted width, 61.0% overhead cover, 2.8 pieces of LWD/100 m, and had a gradient of at least 3.07%. We were not able to get a gradient reading over the falls and therefore our value of 3.0% is an underestimate.

We saw no bull trout or brook trout in Cunningham Creek during the night snorkel, but did see 12 rainbow trout (6 <150 mm, 6 >150 mm) in the two lowest 100-m sections. Six were small young-of-the-year (YOY) trout. It was unusual to find YOY rainbow between the two waterfalls, while finding no fish above. Rainbow density averaged 0.6 fish/100 m^2.

Trappers Creek

Trappers Creek enters Little Muddy Creek 250 m above the Clearwater Creek confluence. Most maps based upon the USGS topographic map incorrectly show Trappers Creek entering Clearwater Creek. Figure 5 correctly indicates its confluence.

Trappers Creek has historical bull trout records and was electroshocked September 11, 2000 with YIN personnel. The water temperature was 6.6° C. We electroshocked nine bull trout and obtained fin tissue samples for DNA analysis. We observed a general darkness in pigmentation of electroshocked fish. The bull trout ranged from 95 mm to 157 mm and were returned to Trappers Creek after the tissue samples were taken. Five additional bull trout were captured at night on October 4, 2000 to obtain additional tissue samples for DNA analysis and scales for age determination. Fish were caught using a small aquarium net.

We conducted an experiment on September 26, 2000 to determine the accuracy of day versus night snorkeling. Night snorkels have been reported in the literature to be superior for observing bull trout (Thurow 1994; Bonneau et al. 1995; Thurow and Schill 1996). We day and night snorkeled the same 100-m section of the creek on the same day. We searched carefully with flashlights during the day, specifically checking overhanging vegetation and rock crevasses. We found no bull trout. This section of creek averaged 5.3 m wetted width, 75% overhead cover, and 11 pieces of LWD/100 m. We found 24 bull trout in this section during the nocturnal

survey. Bull trout were settled stationary on the substrate and were easily approached and captured at night.

Night snorkels proved far superior to day snorkeling. In other areas, where bull trout were not present, we saw approximately four times the number of fish at night relative to day snorkeling.

We night snorkeled an additional 100 m of Trappers Creek on September 26, 2000 and saw 27 bull trout in this lower reach (Appendix B17). There were 51 total bull trout (38 <150 mm and 13 >150mm) in 200 m of Trappers Creek. Average density was 6.7 fish/100 m^2. No other salmonids were seen in Trappers Creek.

Clearwater Creek

Clearwater Creek is a tributary that enters Little Muddy Creek 1.3 km. above Fish Lake Stream. The Clearwater is located 250 m below the confluence of Trappers Creek and the Little Muddy. We suspected there might be bull trout in Clearwater Creek because of its communication with Trappers Creek through Little Muddy Creek. We electroshocked Clearwater Creek on September 11, 2000, near a bridge that crosses the creek approximately 0.8 km. above the confluence with the Little Muddy. We also electroshocked Clearwater Creek where the 271 Road crosses the creek several kilometers upstream. No bull trout or other salmonids were captured by electroshocking at either site. This seemed odd, as the habitat appeared suitable for salmonids.

We followed Clearwater Creek upstream from the confluence with the Little Muddy to the bridge and discovered four significant waterfalls. Two waterfalls are definite barriers to fish passage and possibly all four could be impassible. A total of 200 m of Clearwater Creek near the bridge (Upper Site) was snorkeled at night on September 27, 2000 (Appendix B18). The water temperature was 4.4^o C and the creek averaged 10.6 m wetted width, 67.5 % overhead cover, and 38.5 pieces of LWD/ 100 m. The habitat seemed ideal for bull trout. Presumably, the waterfalls prevented passage of bull trout from Trappers Creek, Little Muddy Creek and the lower Clearwater into this upper area.

The lower part of Clearwater Creek was night snorkeled on October 3, 2000 from the confluence with the Little Muddy to the first waterfall, a distance of 341 m (Appendix B19). Clearwater Creek at this Lower Site averaged 10.25 m wetted width, 32.50% overhead cover, 19.3 pieces of LWD/100 m, and had a gradient of 1.00%. The water temperature during our snorkel was 6.1^o C. Bull trout were common in the lower section of Clearwater Creek, almost to the exclusion of other salmonids. We saw 94 bull trout (45 <150 mm and 49 >150 mm), 3 rainbow trout (2 <150 mm and 1 >150 mm), and 1 brook trout (<150 mm) during the night snorkel. Bull trout density averaged 2.6 fish/100 m^2, rainbow trout averaged 0.1 fish/m^2, brook trout averaged less than 0.1 fish/m^2 and total salmonids averaged 2.7 fish/100 m^2.

We returned to Clearwater Creek at the confluence with Little Muddy Creek on October 4, 2000 to collect bull trout for DNA tissue and scale samples. We easily netted fifteen specimens (≈ 90 to 205 mm) at night using the small aquarium net.

We also successfully trapped bull trout in Clearwater Creek using a minnow trap baited with moribund salmon eggs from the Klickitat Hatchery. The trap was placed in the creek during the day on October 17, 2000 and checked in the early evening, after dark. A snorkel observation revealed two bull trout in the trap and several others busily trying to get to the salmon eggs. The minnow trap was left in Clearwater Creek overnight. We returned on October 18 in the late afternoon and found no bull trout present in the trap. If left over an extended period, bull trout can find their way out of an unattended trap. However, this technique may prove valuable in high turbidity streams where fish cannot be directly observed. Bull trout appear to prefer locations with minimal flows. Minnow traps placed in low flow areas of high turbidity streams, behind rootwads etc., may prove successful in capturing bull trout, where other means of documenting bull trout fail.

Little Muddy Creek

The Little Muddy Creek is clouded with glacial melt during most of the year. It usually has poor visibility and snorkeling for bull trout is not possible until alpine glaciers freeze in the fall. Freezing temperatures in mid-October decreased turbidity allowing us to night snorkel Little Muddy Creek from the Clearwater Creek confluence upstream 400 m on October 17, 2000 (Appendix B20). Trappers Creek enters Little Muddy Creek 250 m above the Clearwater Creek confluence.

Little Muddy Creek averaged 7.8 m wetted width, 28.0% overhead cover, 9.75 pieces of LWD/100 m, had a gradient of 3.57%, and a temperature of 6.1° C. We found 24 salmonids in Little Muddy Creek: 11 bull trout (8 <150 mm and 3 > 150 mm), 9 rainbow (5 <150 mm and 4 > 150 mm), and 4 brook trout (4 <150 mm). Bull trout density averaged 0.4 fish/100 m^2. They were found in sheltered areas behind logs and rootwads with low flows. Rainbow trout density averaged 0.3 fish/100 m^2 and brook trout averaged 0.1 fish/100. Total salmonid density averaged 0.8 fish/100 m^2.

We also set three minnow traps in Little Muddy Creek on October 17, 2000 and caught no bull trout or other salmonids. We could not find sufficiently sheltered areas of low flow to position our minnow traps to capture bull trout.

Little Muddy Creek is the only creek where we saw moderate numbers of brook trout and bull trout together. Bull trout x brook trout hybrids have been well documented and concern for the impact of hybridization on bull trout has been expressed (Markle, 1992). Markle (1992) noted that hybrids had light spotting on the dorsal fin, brook trout had black markings, and bull trout had no markings on the dorsal. We did spot checks of a few protected areas in the Little Muddy

Creek below our 400 m survey section. We observed one char that had obvious light spotting on the dorsal fin and we believe that this fish was a bull trout x brook trout hybrid.

Fish Lake Stream

Fish Lake Stream merges with Little Muddy Creek at RM 4.9 to form the West Fork of the Klickitat. Historical records of bull trout in Fish Lake Stream have been reported (Bill Sharp, Yakama Nation, personal communication). We night snorkeled 400 m of the stream (Upper Site) approximately 3.2 km above Potato Hill Road on September 27, 2000 (Appendix B21). High water velocity made it difficult to snorkel the thalweg of the stream. Fish Lake Stream at this site averaged 16.5 m wetted width, 21.0% overhead cover, 2.8 pieces of LWD/100-m, had a gradient of 1.6% and a water temperature of 6.1° C. We saw no bull trout during this survey. Rainbow trout and brook trout were common. Unfortunately, specific fish counts from this night snorkel were misplaced and are not reported.

Fish Lake Stream was night snorkeled a second time at two different sites on November 8, 2000 (Appendices B22 and B23). We surveyed 300 meters at a Mid Site (approximately 2.7 km above Potato Hill Road) and 100 meters at the Lower Site (just above the Potato Hill Road Bridge). The Lower Site started approximately 150 m above the confluence with Little Muddy Creek. Conditions were cold, snow covered the ground, and the water temperature was 2.8° C.

Fish Lake Stream at the Mid Site averaged 11. 5 m wetted width, 25.0% overhead cover, 1 pieces of LWD/100 m, and had a gradient of 3.0%. We saw no bull trout. We did see 83 salmonids during this night snorkel: 41 rainbow trout (26 <150 mm and 15>150 mm) and 42 brook trout (19 <150 mm and 23 >150 mm). Rainbow trout density averaged 1.2 fish/100 m^2, brook trout averaged 1.2 fish/m^2 and total salmonids averaged 2.4 fish/100 m^2.

The Lower Site averaged 15.9 m wetted width, and had 32.5% overhead cover and no LWD. We saw no bull trout, however, 27 salmonids were seen: 18 rainbow trout (6 <150 mm and 12 >150 mm) and 9 brook trout (5 <150 mm and 4 >150 mm). Rainbow trout density averaged 1.1 fish/100 m^2, brook trout averaged 0.6 fish/m^2 and total salmonids averaged 1.7 fish/100 m^2.

We also compared day and night snorkeling in Fish Lake Stream near the confluence with the Little Muddy on October 4, 2000. A single rainbow trout was seen during a short ≈15 m day snorkel while more than 20 rainbows and brook trout were seen at night in the same area.

McCreedy Creek

McCreedy Creek joins the mainstem Klickitat River above Castile Falls at RM 70.7. A single bull trout was reported in McCreedy Creek just below the culvert on the 255 Road (Bill Sharp, Yakama Nation, personal communication).

McCreedy Creek was day snorkeled and electroshocked below the culvert on September 11, 2000. We electroshocked 2 rainbow trout and saw only 3 rainbow trout during the day snorkel.

We night snorkeled a total of 337 m September 25, 2000 (Appendix B24). The distance from the confluence of McCreedy Creek and the Klickitat River to the culvert was 281 m and the distance above the culvert was 56 m. McCreedy Creek averaged 7.6 m wetted width, 23.33% overhead cover, 5 pieces of LWD/100 m, and had a gradient of 1.00% and water temperature of 5.3° C. We saw no bull trout during the night snorkel but did see 126 salmonids: 79 rainbow trout (53 <150 mm and 26 >150 mm), 41 brook trout (32 <150 mm and 9 >150 mm), 3 juvenile chinook, and 3 unknown salmonids. Rainbow trout density averaged 2.9 fish/100 m^2, brook trout averaged 1.5 fish/100 m^2 and total salmonids seen during this night snorkel averaged 4.6 fish/100 m^2.

Piscoe Creek

Piscoe Creek is a small creek that enters the mainstem Klickitat River from the east at RM 75.1. Approximately 200 m of the creek was electroshocked adjacent to the 80 Road on October 19, 2000. Twenty rainbow trout (55-186 mm) and 7 brook trout (73-146 mm) were captured by electroshocking. No bull trout were seen.

Diamond Fork Creek

Diamond Fork Creek enters the mainstem Klickitat River from the east at RM 76.8. We night snorkeled 400 m of the creek on October 18, 2000 at a site 6.7 km above the 255 Road (Appendix B25). Diamond Fork Creek averaged 8.66 m wetted width, 3% overhead cover, 4.75 pieces of LWD/100 m, and had a gradient of 2.36%. The water temperature varied from a high of 6.7° C during the day to 4.4° C at night.

We were surprised by the high number of juvenile chinook salmon in the creek. We observed 423 chinook (nearly all <150 mm) in the 400 m section. These fish were planted earlier in the year (Bill Sharp, Yakama Nation, personal communication). In addition to the chinook, we saw 131 rainbow trout (77 <150 mm and 54 >150 mm) and 12 brook trout (8 <150 mm and 4 >150 mm). No bull trout were seen. Rainbow trout density averaged 3.9 fish/100 m^2, while brook trout averaged 0.4 fish/m^2. Chinook juveniles averaged 12.6 fish/100 m^2. Total salmonids seen during this night snorkel averaged 16.8 fish/100 m^2.

Conclusions

This bull trout assessment in the Columbia River Gorge covered four large sub-basins. We focused our effort in these sub-basins by first reviewing existing temperature records to locate areas with cold water that might support bull trout. We placed 14 Onset Optic StowAway Temp data loggers in streams where temperature data was lacking and confirmed that these streams were cold enough to support bull trout. We stratified our choice of survey sites to those containing these cold waters <15° C. Survey location was also based on accessibility and safety concerns.

We attempted, where possible, to conform to the 2000 draft Interim Protocol for Determining Bull Trout Presence (Peterson et al., In Press) and meet the sampling methodology of Bonar et al. (1997) in our surveys for bull trout. These protocols were developed for the Idaho and Montana intermountain west and are based on the randomization of sample sites. In the western Cascades gradients are higher and access is more limited. During the course of this study we concluded that it was impossible to randomly select stream reaches to survey because of accessibility and safety concerns. We could only sample those reaches we could safely access, even though this entailed hiking as much as 4.8 km. We felt that block nets were not needed because bull trout were not disturbed by the presence of snorkelers. Block nets were too difficult to safely transport, install, and maintain. We met all other recommendations of Peterson et al. (In Press).

We snorkel surveyed more than 74 km of creeks and rivers during the 2000 bull trout population assessment in the Columbia River Gorge. We conclude, after snorkeling more than 13.8 km at night and 60.2 km during the day, that night snorkeling is far superior to day snorkeling for detecting bull trout and other salmonids. In the White Salmon River, during the day, we saw 219 fish in 6.7 km reach. At night, we saw 152 fish, snorkeling in only two 400 m segments of that same reach. Additionally, we saw no bull trout in a 100m stretch of Trappers Creek during the day but did see 24 bull trout at night. In day snorkels, we did not just miss detecting a percentage of the available bull trout, but all of them. Decisions based on day snorkels alone would have incorrectly assumed bull trout were not present. Therefore, we recommend that night snorkeling be utilized to assess bull trout populations.

We successfully trapped bull trout in a conventional minnow trap, using moribund salmon eggs as bait. We observed fish in the trap at night; however, they had escaped by the time we rechecked the trap, late the following afternoon. Provided the trap is checked regularly; we believe this could be a promising technique to document the presence of bull trout in slow moving turbid waters, where poor visibility precludes snorkeling.

The following are our conclusions for the four sub-basins surveyed during this assessment:

Wind River Sub-basin

No bull trout have ever been observed above Shipherd Falls (RM 2.0) in the Wind River. We surveyed 42.8 km in the sub-basin (2.5 km at night and 40.3 km during the day) and found no bull trout. Bull trout have never been observed in the four smolt traps operating in the Wind River (three since 1995; one since 1998) nor seen in the Shepherd Falls trap, or in any fish surveys of any kind. Based on this work, we conclude that bull trout are not present in this sub-basin above Shipherd Falls and recommend that no further surveys for bull trout be conducted in the Wind River Sub-basin.

Little White Salmon River Sub-basin

Bull trout have been observed and captured in Drano Lake in this sub-basin but never above a barrier at the Little White Salmon National Fish Hatchery. Presumably, this barrier and a subsequent impassible falls prevent their movement upstream. We snorkeled 4.6 km in this sub-basin (1.5 km at night and 3.1 km during the day) and did not observe bull trout. Based this research, we conclude that bull trout are not present in Lava Creek or in the Mainstem Little White Salmon above the barrier at the hatchery. Due to extensive amounts of woody debris and equipment failure, more extensive surveys are needed in Moss Creek to confirm bull trout absence in this sub-basin. We recommend additional night snorkel surveys in Moss Creek during 2001.

White Salmon River Sub-basin

Bull trout have been reported from Northwestern Lake in the lower reaches of this sub-basin. We snorkel surveyed 22.6 km in this sub-basin (6.1 km at night and 16.5 km during the day) and found no bull trout. We conducted a scouting of Rattlesnake Creek. Water temperatures were too high (17.8^{o}C) and flow was too low to support bull trout. The creek had dried up completely in its upper reaches and formed a series of falls into warm disconnected pools in its canyon area. It does not appear to be bull trout habitat.

Condit Dam, presently an impassible barrier to fish, is scheduled to be removed in 2006. The habitat evaluations conducted in conjunction with our search for bull trout should allow us to predict what areas may be potentially re-colonized by adfluvial bull trout and other species moving into the sub-basin once Condit Dam is removed.

Additional areas of cold-water habitat need to be surveyed in the sub-basin. The White Salmon River is entrenched in a steep canyon for most of its middle reaches making access restricted. It is supplied by cold groundwater seeping from the canyon walls and bottom. These canyon areas and Spring Creek (also of groundwater origin) should be investigated as possible bull trout

habitat. We recommend that these areas and Northwestern Lake be surveyed in 2001 before finalizing conclusions about the presence or absence of bull trout in this sub-basin.

Klickitat River Sub-basin

Bull trout have previously been reported from the mouth of the Klickitat River, in the mainstem Klickitat near Leidl Bridge and Castile Falls, McCreedy Creek, and in Trappers and Clearwater creeks of the West Fork Klickitat drainage. We snorkel surveyed 4.1 km in this sub-basin (3.8 km at night and 0.3 km during the day) and found bull trout present in Trappers Creek, Clearwater Creek, Little Muddy Creek and in the West Fork Klickitat drainage.

We anticipated seeing bull trout in Fish Lake Stream, a stream that joins Little Muddy Creek to become the West Fork Klickitat River. This was not the case, even though we night surveyed three different segments of this stream. Large numbers of brook trout in Fish Lake Stream may compete with bull trout and prevent their establishment.

Additional snorkel surveys are needed in several creeks and sections of the mainstem Klickitat that we were not able to sample during 2000. We propose to expand our snorkel survey coverage of the West Fork Klickitat drainage to more precisely determine the extent of the bull trout population in Trappers Creek, Clearwater Creek, Little Muddy Creek, and the West Fork Klickitat River. During the course of this study we located four waterfalls on Clearwater Creek. We surveyed to the base of the first waterfall and found bull trout. The second waterfall presents a vertical face of approximately 6 meters. We do not anticipate any bull trout above this barrier. Above these falls the habitat appears ideal in terms of temperature, flow and LWD. These falls appear to be a barrier to fish passage and limit fish production in the Clearwater Basin. Trappers Creek also has a series of cascades near its confluence with the Little Muddy, but the gradients are apparently not too steep to hinder fish migration. Falls may be barriers to bull trout movement and reduce potential genetic diversity.

Little Muddy Creek contributes significant amounts of glacial till to the system during the summer precluding snorkel surveys in Little Muddy Creek and the West Fork Klickitat River during this time. We expect to concentrate our efforts in these glacial areas in the fall when temperatures drop and streams become clear.

We also snorkeled Cunningham Creek, another creek with a series of impassible falls, and found no bull trout. We conducted a series of three snorkels in Fish Lake Stream and found no bull trout but higher than average flows. Typically, we would find bull trout holding on the substrate in areas of minimal flow. Passage barriers at Castile Falls and high flows may prove to be limiting factors for bull trout in the Klickitat Sib-basin

Additional tributaries and sections above Castile Falls on the mainstem will be surveyed in 2001. We will continue investigation of Fish Lake Stream. We plan to PIT tag bull trout in the

Trappers Creek and Clearwater drainages to map their movements and document age and growth. We plan to explore the continued use of minnow traps in sampling bull trout in Little Muddy Creek and other creeks affected by glacial melt during the summer.

Bull Trout Characteristics

During 2000, we assisted in bull trout surveys in Rush and Pine creeks of the Lewis River System. This is the only area where we have seen bull trout during daytime. The population is adfluvial and consists of large individuals (71-84 cm) that reside in Swift Reservoir and use Rush and Pine creeks to spawn and rear. Populations we observed in the Klickitat Sub-basin are very different and consisted of smaller individuals, 9-21 cm in size, who were only active at night. We typically saw these fish at night residing on the substrate in low flow areas. Fish would not panic at our approach and would hover unmoving over the substrate. They were so docile; we could easily position a small aquarium net over them for capture. We do not feel block net are necessary, as fish do not flee up or downstream at a snorkeler's approach. We saw no bull trout during daytime in the Klickitat Sub-basin.

It has been well documented that bull trout occur in areas of low water temperatures (Rieman and McIntyre 1993; Buchanan and Gregory 1997; Rieman and Chandler, 1999). Although we investigated water temperature in many drainages (Table 1.); we did not install temperature recorders in Trappers, Little Muddy or Clearwater Creeks where bull trout were present. The Yakama Nation has a series of data temperature data from the West Fork Klickitat, at a site 5.6 km below Clearwater Creek (where the 255 Bridge crosses the river). Mean average 1997 and 1998 daily water temperature did not exceed 10^{o} C (Bill Sharp, personal communication). Temperatures at this downstream site may slightly exceed those at Trappers, Clearwater and Little Muddy creeks where bull trout were observed. We will install temperature data loggers in 2001 in areas where we observed bull trout.

Bull trout appear to prefer lower flow regimes. We saw them in low flow areas of Trappers Creek, Clearwater Creek and behind logs and rootwads in the Little Muddy. We did not see them in Fish Lake Stream, the only tributary in the West Fork drainage where we did not see bull trout. Flows in Fish Lake Stream are higher than those of the other tributaries. Bull trout appear to have a lower tolerance to high flows than rainbow or brook trout. This does not appear to be true for Rush and Pine creek populations in the Lewis River, which can contend with high flows.

Where we did find bull trout, they were often the most common species present. In Clearwater Creek, clearly, they were the dominant species (94 bull trout, 3 rainbow and 1 brook trout). In Trappers Creek, they were the only fish species present.

Observed fish densities per 100 m^2 of river are presented in Table 3. There was considerable overlap in density for all species. Densities ranged from 0.1 fish/100 m^2 in marginal bedrock habitats of Lava Creek and the high flow, high turbidity, low LWD of the Little Muddy; to 6.7

fish/100 m^2 in the low gradient, high LWD, of the upper Wind and Clearwater Creek. The Diamond Fork of the Klickitat had the highest overall density, but this was due to a hatchery plant of chinook fry.

Brook trout were found at higher altitude and in colder waters. In the past brook trout had been planted in ponds and streams by WDFW and YN. We found brook and bull trout coexisting in the Little Muddy and in Clearwater Creek. This raises concern as brook trout have the potential to hybridize with bull trout. We believe we did observe a bull trout x brook trout hybrid in the Little Muddy. DNA samples will indicate bull trout x brook trout hybrids. Brook trout plants in potential bull trout waters have been terminated.

As might be expected, fish appeared to be holding in areas where LWD was present and breaks in the flow pattern existed. Overall, we could not find a statistically significant correlation between the number of pieces of LWD in a hundred meter segment and the number of fish in that segment, although statistically significant correlations did occur in some sample reaches.

Bull trout appeared in the greatest density in Trappers Creek, but this may be due to its narrow stream channel. We found large numbers of bull trout in Lower Clearwater Creek, below the falls, a much wider stream. Flow and turbidity were much greater in the Little Muddy, which might explain the lower bull trout density and fish density in general. The Little Muddy also had reduced densities for rainbow and for brook trout in comparison to other streams. Where bull trout were present they were by far the dominant species. Generally, all salmonid densities varied with habitat, being reduced in areas of bedrock and little cover and increased in areas of pools and high incidence of pieces of LWD.

Next season, we will complete surveys on Moss Creek in the Little White Salmon Sub-basin and investigate Northwestern Lake, Spring Creek and the canyon area of the White Salmon River for bull trout presence. We will focus efforts to determine numbers and age structure of bull trout populations in those creeks where bull trout were found through PIT tag mark recapture estimates. We will continue to collect DNA samples for genetic analysis and attempt to identify limiting factors for bull trout production.

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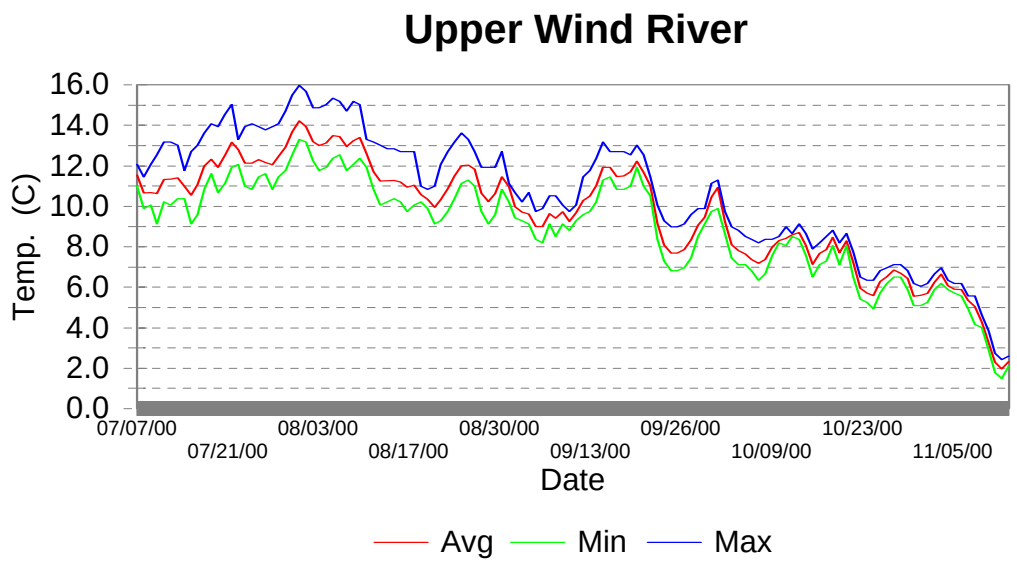
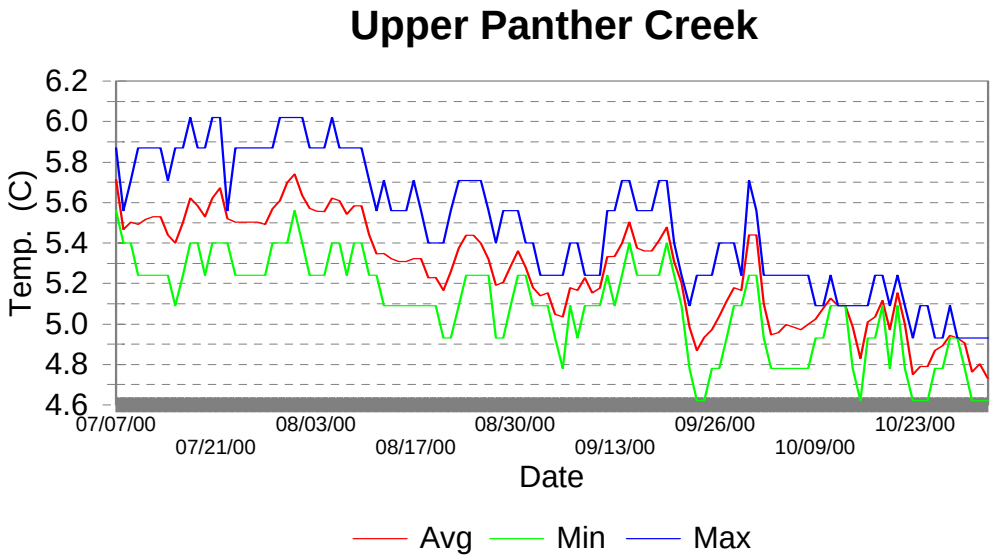
Appendix A

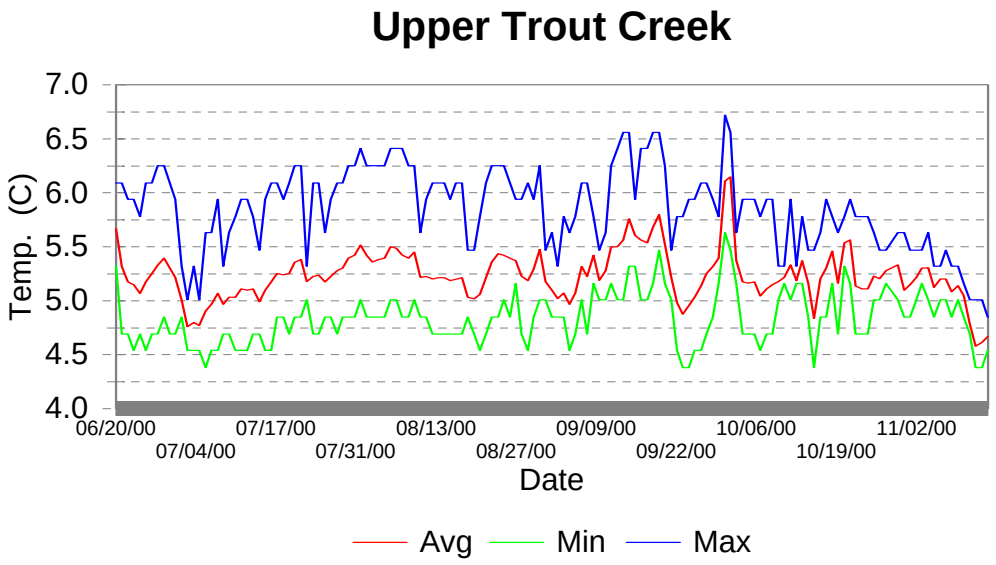
Mean Daily, Minimum and Maximum Temperatures Figures



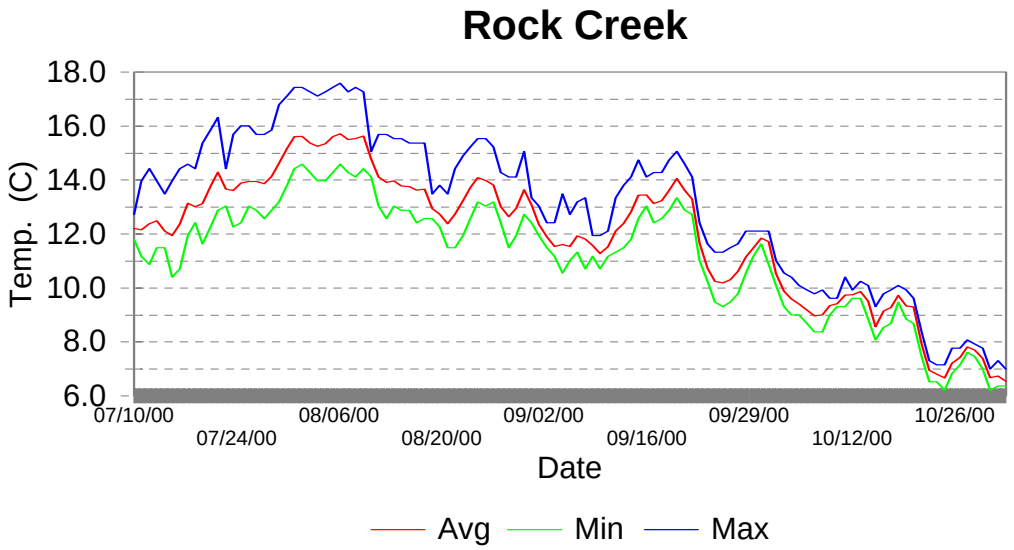
Appendix A Figure 1. Mean daily, minimum and maximum temperatures for the Upper Wind River, Summer-Fall 2000.



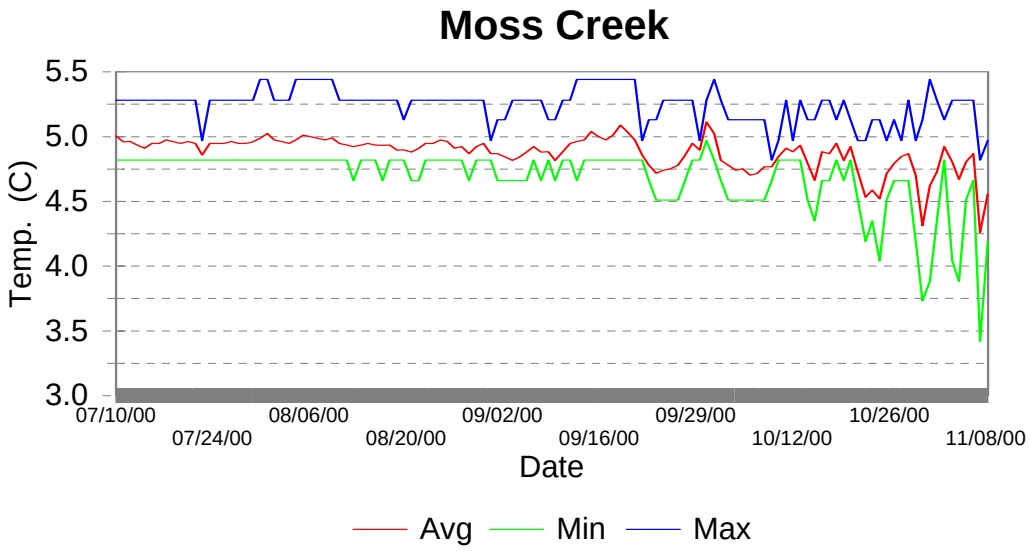
Appendix A Figure 2. Mean daily, minimum and maximum temperatures for Upper Panther Creek, Summer-Fall 2000.



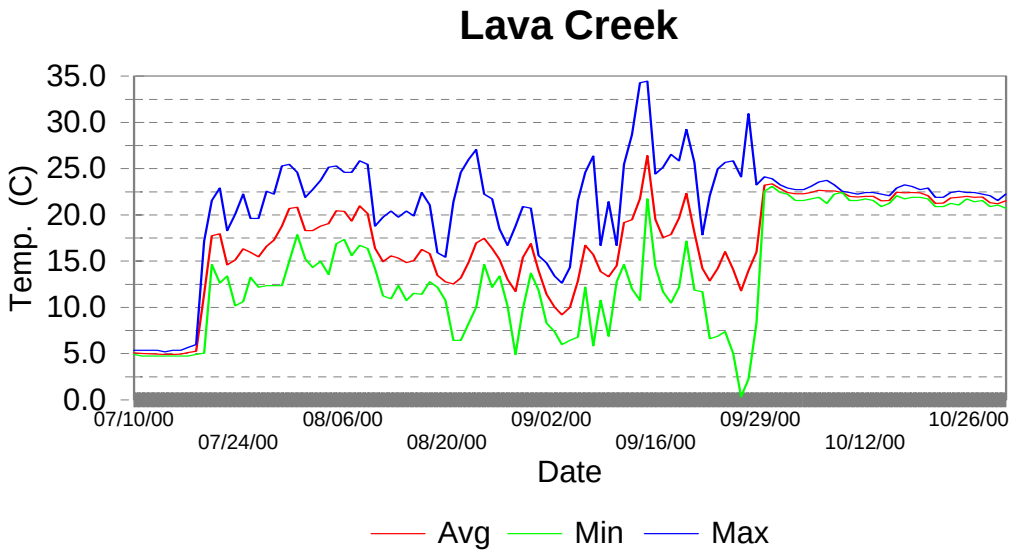
Appendix A Figure 3. Mean daily, minimum and maximum temperatures for Upper Trout Creek, Summer-Fall 2000.



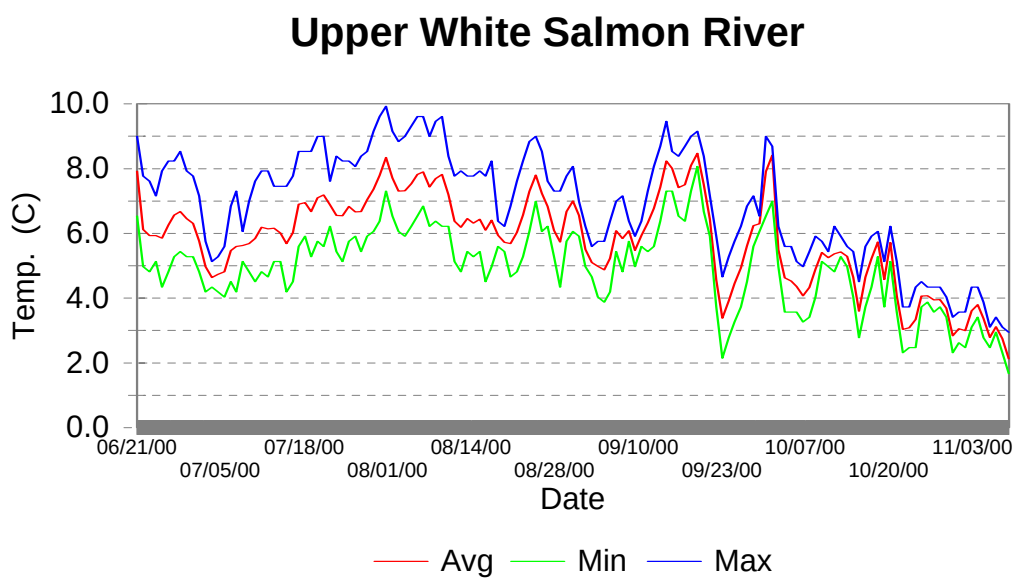
Appendix A Figure 4. Mean daily, minimum and maximum temperatures for Rock Creek, Summer-Fall 2000.



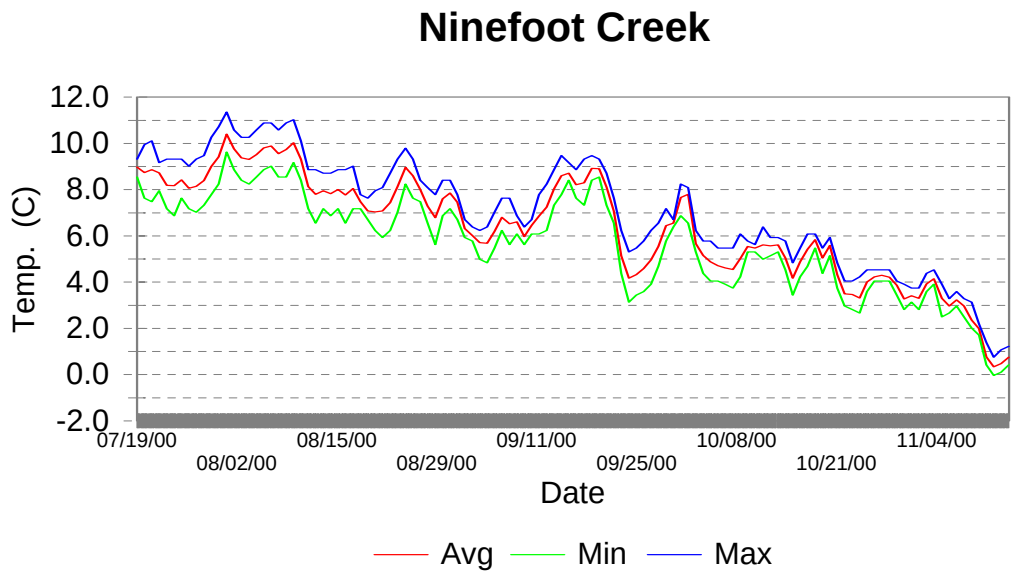
Appendix A Figure 5. Mean daily, minimum and maximum temperatures for Moss Creek, Summer-Fall 2000.



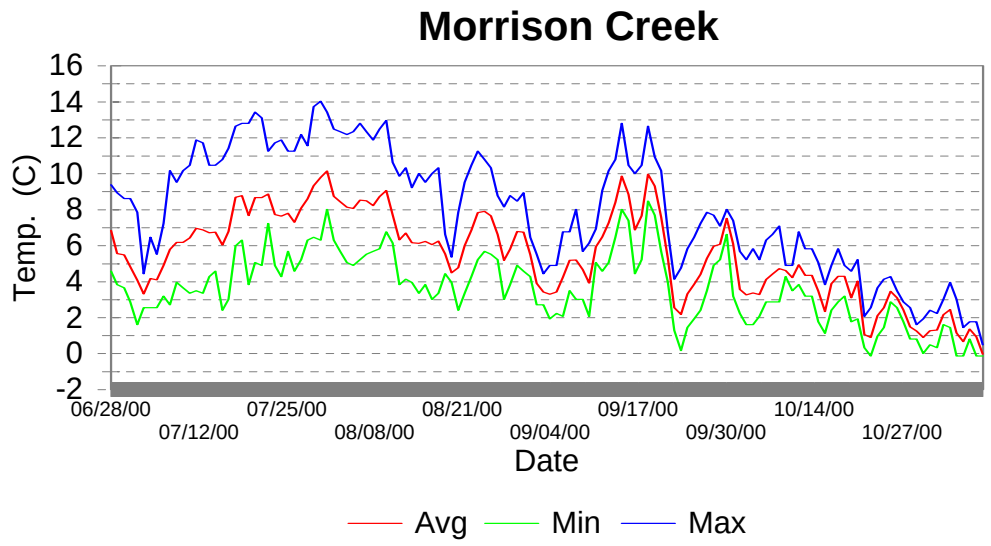
Appendix A Figure 6. Mean daily, minimum and maximum temperatures for Lava Creek, Summer-Fall 2000.



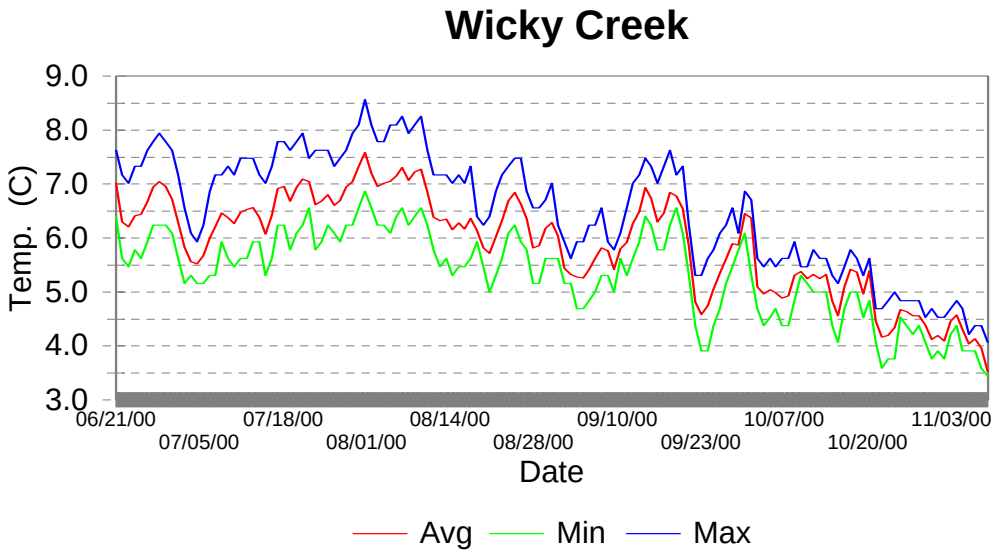
Appendix A Figure 7. Mean daily, minimum and maximum temperatures for the upper White Salmon River; Summer-Fall 2000.



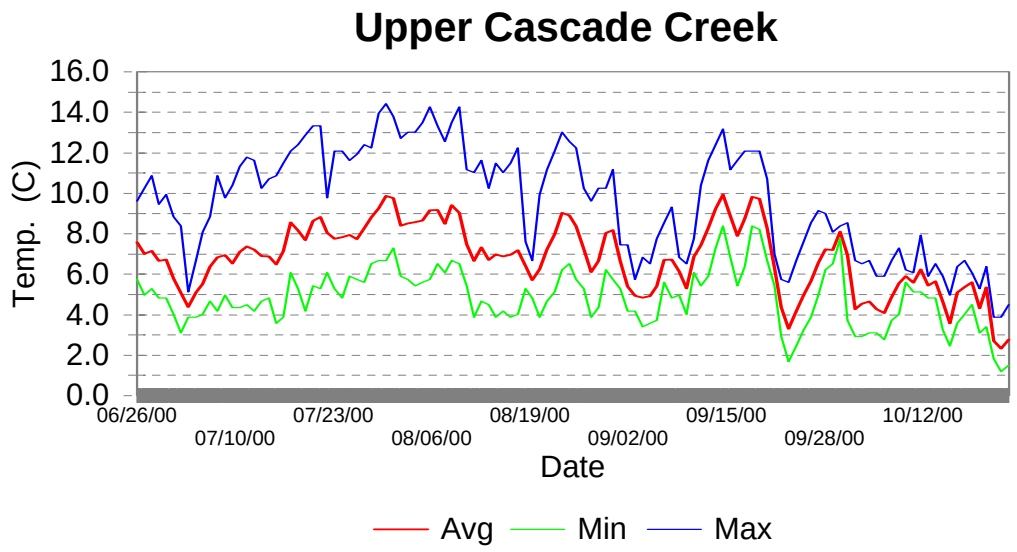
Appendix A Figure 8. Mean daily, minimum and maximum temperatures for the Ninefoot Creek, Summer-Fall 2000.



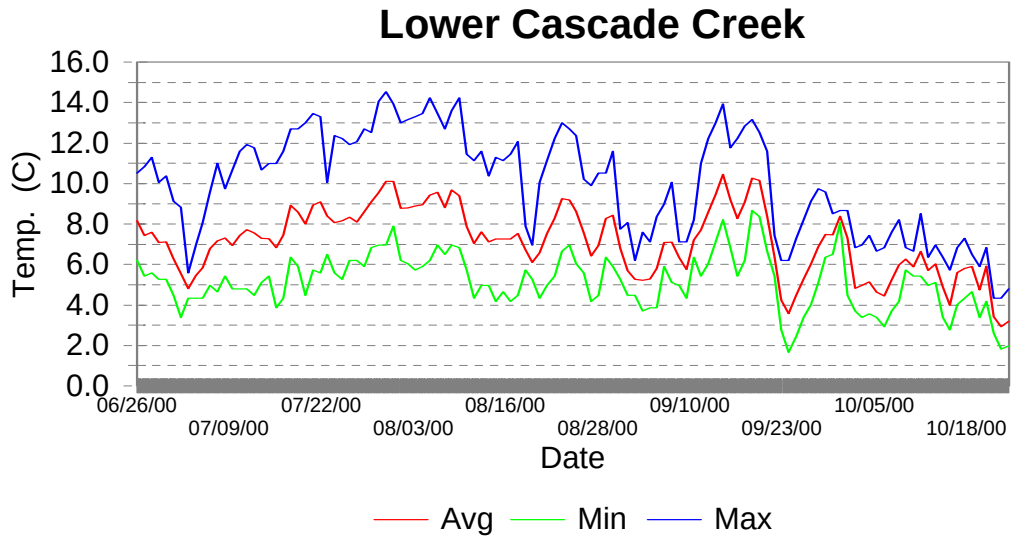
Appendix A Figure 9. Mean daily, minimum and maximum temperatures for Morrison Creek, Summer-Fall 2000.



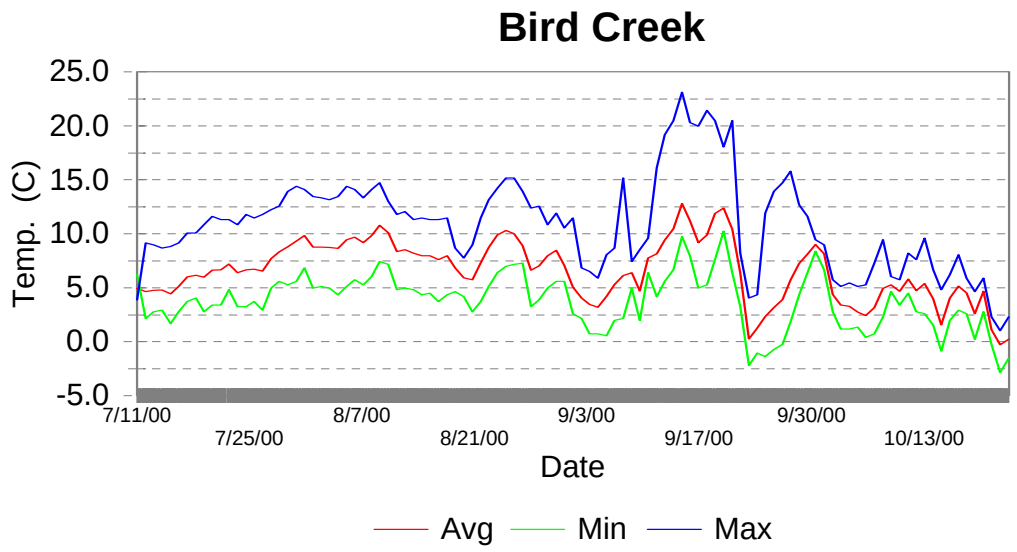
Appendix A Figure 10. Mean daily, minimum and maximum temperatures for Wicky Creek, Summer-Fall 2000.



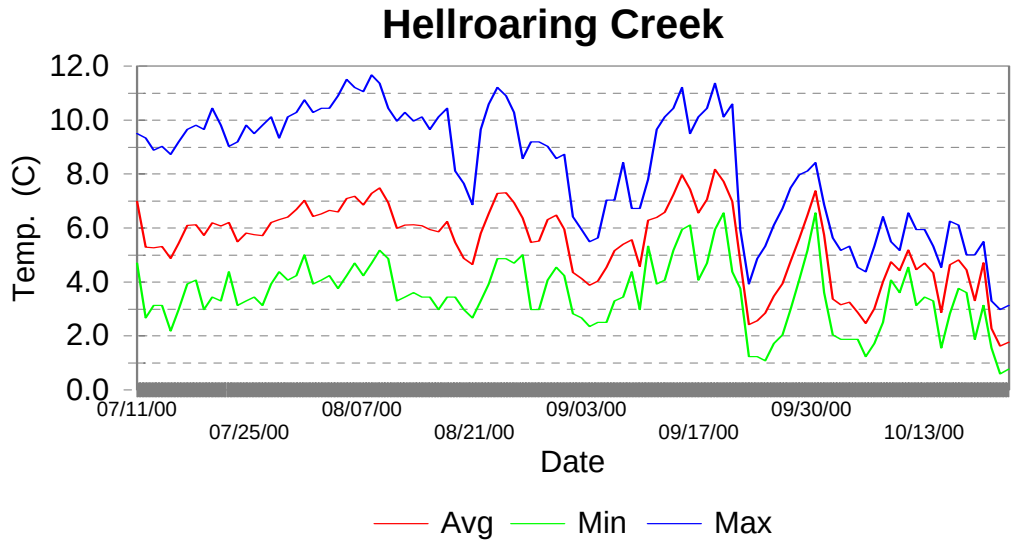
Appendix A Figure 11. Mean daily, minimum and maximum temperatures for Upper Cascade Creek, Summer-Fall 2000.



Appendix A Figure 12. Mean daily, minimum and maximum temperatures for Lower Cascade Creek, Summer-Fall 2000.



Appendix A Figure 13. Mean daily, minimum and maximum temperatures for Bird Creek, Summer-Fall 2000.



Appendix A Figure 14. Mean daily, minimum and maximum temperatures for Hellroaring Creek, Summer-Fall 2000.

Appendix B

Habitat Data and Fish Observation Tables

Appendix B Table 1. Trout Creek (Lower Site habitat data and fish observations during summer-fall, 2000.

Site Name		Upper Trout Creek 33 Rd. to 42 Rd.			**Snorkelers**	JB, RHM, BMM	
Date		August 22, 2000			**Gradient**		2.00%
River Name		Wind					
Stream Name		Trout Creek			**Temp. F**	Snorkel	45.0
WRIA		29					
County		Skamania					
GPS	**North**	45°	50'	36.4"	**Day/Night**	N	
	West	122°	01'	55.3"			

Transects per hundred meters

	Start	T1	T2	T3	T4	T5	T6	T7	T8
Cover %	90%	70%	25%	85%	50%	40%	15%	90%	
Cobble (cm)	15	14	9	13	8	5	7	5	
Wetted Width (m)	10.7	4.8	2.8	4.4	5.7	5.5	5.8	9.2	
Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Water Depth 1/4 (m)	1.06	0.56	0.15	0.12	0.17	0.44	0.19	0.21	
Water Depth 1/2 (m)	1.02	0.62	0.30	0.35	0.58	0.27	0.19	0.34	
Water Depth 3/4 (m)	0.49	0.35	0.17	0.18	0.33	0.23	0.09	0.36	
Mean Depth (m)	0.64	0.38	0.16	0.16	0.27	0.24	0.12	0.23	
Max. Depth (m)	1.06	0.63	0.45	0.35	0.68	0.53	0.20	0.37	
LWD		0	1	0	3	1	3	3	
Section Area (m^2)		773	378	358	503	560	563	748	44
Fish		16	1	4	5	2	1	0	0
Mykiss <150 mm		18	6	1	3	6	7	1	0
Mykiss >150 mm									
Total Mykiss		34	7	5	8	8	8	1.000	0
Fish/100 meters2		4.401	1.854	1.399	1.592	1.429	1.422	0.134	0.000
Meters2/fish		22.7	53.9	71.5	62.8	70.0	70.3	747.5	0.0
Brook Trout <150 mm		0	0	2	6	3	4	2	2
Brook Trout >150 mm		4	0	2	0	7	2	1	3
Total Brook Trout		4	0	4	6	10	6	3	5
Fish/100 meters2		0.518	0.000	1.119	1.194	1.786	1.067	0.401	11.442
Meters2/fish		193.1	0.0	89.4	0.0	56.0	93.8	249.2	8.7
Bull Trout <150 mm		0	0	0	0	0	0	0	0
Bull Trout >150 mm		0	0	0	0	0	0	0	0
Total Bull Trout		0	0	0	0	0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All fish	38	7	9	14	18	14	4	5	
Fish/100 meters2	4.919	1.854	2.517	2.786	3.214	2.489	0.535	11.442	
Meters2/fish	5.1	0.0	9.9	0.0	31.1	40.2	186.9	8.7	

Summary: Brook trout and rainbow/steelhead are present.

Comments: T8 represents a 7.5 meter stream segment completing a survey between the 33 and 42 roads.

Appendix B Table 2. Trout Creek (Upper Site) habitat data and fish observations during summer-fall 2000.

Site Name		Trout Creek to Start at Springs			**Snorkelers**		JB, RHM, BMM		
Date		August 29, 2000			**Gradient**				1.67%
River Name		Wind							
Stream Name		Trot Creek to Start			**Temp. F**		Habitat		44.0
							Snorkel		43.0
WRIA		29							
County		Skamania							
GPS	**North**	45°	51'	1.1"	**Day/Night**		N		
	West	122°	02'	6.8"					

		Transects per hundred meters							
	Start	T1	T2	T3	T4	T5	T6	T7	
Cover %	40%	100%	100%	95%	95%	98%	100%	70%	
Cobble (cm)	10	23	8	19	25	10	36		
Wetted Width (m)	6.2	4.7	5.7	6.1	7.3	5.4	6.2	0.27	
Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Water Depth 1/4 (m)	0.08	0.25	0.00	0.21	0.18	0.08	0.13		
Water Depth 1/2 (m)	0.14	0.22	0.00	0.19	0.04	0.18	0.15		
Water Depth 3/4 (m)	0.09	0.07	0.09	0.13	0.12	0.19	0.019		
Mean Depth (m)	0.08	0.14	0.02	0.13	0.08	0.11	0.07		
Max. Depth (m)	0.14	0.40	0.32	0.34	0.18	0.21	0.25	0.22	
LWD		4	11	5	2	0	4	0	
		Island							
Section Area (m^2)		545	520	590	670	635	580	133	
Fish									
Mykiss <150 mm		0	1	0	3	1	0		
Mykiss >150 mm		3	11	4	1	1	3		
Total Mykiss		0	12	4	4	2	3	0	
Fish/100 meters2		0.550	2.310	0.679	0.597	0.315	0.517	0.000	
Meters2/fish		181.7	43.3	147.4	167.5	317.5	193.3	0.0	
									Beaver
Brook Trout <150 mm		7	9	9	4	3	2	0	9
Brook Trout >150 mm		10	18	14	5	5	1	0	3
Total Brook Trout		17	27	23	9	8	3	0	
Fish/100 meters2		3.119	5.197	3.902	1.343	1.260	0.517	0.000	
Meters2/fish		32.1	19.2	25.6	74.4	79.4	193.3	0.0	
Bull Trout <150 mm		0	0	0	0	0	0	0	
Bull Trout >150 mm		0	0	0	0	0	0	0	
Total Bull Trout		0	0	0	0	0	0	0	
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Meters2/fish		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
All fish		20	39	27	13	10	6	0	
Fish/100 meters2		3.670	7.507	4.580	1.940	1.575	1.034	0.000	
Meters2/fish		1.6	0.5	0.9	5.7	63.5	96.7	0.0	

Summary: Brook trout and rainbow/steelhead are present.

Comments: T7 represents a 41 meter stream segment completing the survey to the origin of Trout Cr. We also snorkeled a beaver pond disconnected from Trout Ck. that contained brook trout.

Appendix B Table 3. Upper Wind River (Upper Site) habitat data and fish observations during summer-fall 2000.

Site Name		Upper Wind to falls			**Snorkelers**		JB, RHM, BMM
Date		August 30,2000			**Gradient**		22% at falls
River Name		Wind					
Stream Name		Upper Wind			**Temp. F**		
WRIA		29					
County		Skamania					
GPS	**North**	45°	58'	26.9"	**Day/Night**		N
	West	121°	54'	11.1"			

	Transects per hundred meters						
	T4	T3	T2	T1	Start	T5	Pete's Gulch
Cover %	80%	90%	95%	50%	50%	50%	25%
Cobble (cm)	B	B	B	B	B	B	16
Wetted Width (m)	4.6	3.1	5.5	2.8	2.8	2.8	2.4
Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.09	0.07	0.51	0.26	0.15	0.09	0.23
Water Depth 1/2 (m)	0.04	0.41	0.24	0.36	0.02	0.16	0.23
Water Depth 3/4 (m)	0.27	0.25	0.30	0.15	0.10	0.02	0.20
Mean Depth (m)	0.10	0.18	0.26	0.19	0.07	0.07	0.17
Max. Depth (m)	0.30	0.44	0.57	0.45	0.24	0.20	0.32
LWD	0	0	0	0	1	0	0
Type	R	P	P	P	R		
Section Area (m^2)		385	430	415	280	280	260
Fish							
Mykiss <150 mm		0	0	0	5	0	0
Mykiss >150 mm		0	0	7	15	0	0
Total Mykiss		0	0	7	20	0	0
Fish/100 meters2		0.000	0.000	1.687	7.143	0.00	0.000
Meters2/fish		0.0	0.0	59.3	14.0	0.0	0.0
Brook Trout <150 mm		2	1	0	0	0	0
Brook Trout >150 mm		7	4	4	4	0	2
Total Brook Trout		9	5	4	4	0	2
Fish/100 meters2		2.338	1.163	0.964	1.429	0.000	0.769
Meters2/fish		42.8	86.0	0.0	70.0	0.0	130.0
Bull Trout <150 mm		0	0	0	0	0	0
Bull Trout >150 mm		0	0	0	0	0	0
Total Bull Trout		0	0	0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0	0.0	0.0
All fish		9	5	11	24	0	2
Fish/100 meters2		2.338	1.163	2.651	8.571	0.000	0.769
Meters2/fish		42.8	86.0	37.7	11.7	0.0	130.0

Summary: Brook trout and rainbow/steelhead are present.

Comments: Pete's Gulch is a tributary of the Wind River.

Appendix B Table 4. Upper Wind River (Lower Site) habitat data and fish observations during summer-fall 2000.

Site Name		Eind/Oldman			**Snorkelers**	JB, RHM, BMM	
Date		August 31, 2000			**Gradient**	2.27%	
River Name		Wind/Oldman					
Stream Name		Upper Wind			**Temp. F**	Habitat Snorkel	53.0, 54.0 51.0
WRIA		29					
County		Skamania					
GPS	**North**	45°	57'	43.8"	**Day/Night**	N	
	West	121°	54'	49.0"			

	Transects per hundred meters						
	Start	T1	T2	T3	T4	T5	T6
Cover %	0%	50%	0%	40%	5%	0%	80%
Cobble (cm)	10	25	7	12	64	29	14
Wetted Width (m)	9.4	5.4	6.8	6.0	5.5	4.4	7.4
Margin	0.0	0.00	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.12	0.08	0.11	0.27	0.28	0.09	0.21
Water Depth 1/2 (m)	0.12	0.11	0.20	0.32	0.12	0.00	0.00
Water Depth 3/4 (m)	0.04	0.21	0.26	0.27	0.00	0.10	0.00
Mean Depth (m)	0.07	0.10	0.14	0.22	0.10	0.05	0.05
Max. Depth (m)	0.24	0.41	0.26	0.35	0.28	0.32	0.38
LWD		0	0	0	0	0	0
Type	G	R	R	P	R	P	P, R
Section Area (m^2)		740	610	640	575	495	590
Fish							
Mykiss <150 mm		39	50	51	28	27	30
Mykiss >150 mm		14	13	10	8	17	13
Total Mykiss		53	63	61	36	44	43
Fish/100 meters2		7.162	10.328	9.531	6.261	8.889	7.288
Meters2/fish		14.0	9.7	10.5	16.0	11.3	13.7
Brook Trout <150 mm		0	0	0	0	0	0
Brook Trout >150 mm		0	0	0	0	0	0
Total Brook Trout		0	0	0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000
Meters2/fish		0	0	0	0	0	0
Bull Trout <150 mm		0	0	0	0	0	0
Bull Trout >150 mm		0	0	0	0	0	0
Total Bull Trout		0	0	0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0	0.0	0.0
All fish		53	63	61	36	44	43
Fish/100 meters2		7.162	10.328	9.531	6.261	8.889	7.288
Meters2/fish		14.0	9.7	10.5	16.0	11.3	13.7

Summary: Rainbow/steelhead are present.

Comments: The “Upper Wind” section of Wind River one half mile above this section contains brook trout, while this section does not. There does not seem to be an obvious barrier to brook trout passage.

Appendix B Table 5. Lava Creek survey site, habitat data and fish observation during summer-fall, 2000.

Site Name		Lava Creek lower			**Snorkelers**	JB, RHM, BMM	
Date		September 5, 2000			**Gradient**		2.30%
River Name		Little White Salmon					
Stream Name		Lava Creek lower			**Temp. F**	Habitat Snorkel	43.0, 44.0 42.0
WRIA		29					
County		Skamania					
GPS	**North**	45°	46'	52.4"	**Day/Night**	N	
	West	121°	37'	41.5"			

Transects per hundred meters

	Start	T1	T2	T3	T4	T5	T6	T7	T8	T9	T9	T10	T11
Cover %	15%	30%	85%	3%	80%	50%	90%	60%	30%		20%	60%	20%
Cobble (cm)	B	13	B	31	B	B	B	B	B		B	16	B
Wetted Width (m)	14.3	15.0	7.2	10.0	15.4	16.6	8.0	10.0	12.4	8.5		6.0	13.0
Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.35	0.27	0.28	0.12	0.25	0.22	0.10	0.28	0.31	0.12	0.21	0.16	0.13
Water Depth 1/2 (m)	0.10	0.08	0.16	0.15	0.39	0.08	0.65	0.19	0.39	0.22	0.08	0.30	0.32
Water Depth 3/4 (m)	0.22	0.28	0.50	0.26	0.11	0.30	0.21	0.19	0.07	0.00	0.09	0.15	0.50
Mean Depth (m)	0.17	0.16	0.24	0.13	0.19	0.15	0.24	0.17	0.19	0.09		0.15	0.24
Max. Depth (m)	0.39	0.29	0.61	0.42	0.43	0.35	0.65	0.4	0.5	0.24	0.27	0.30	0.50
LWD		0	1	1	0	3	2	0	0	1			
Section Area (m^2)	G	R,G	P	R	G	R	R	G	G	R		G	P
Fish													
Mykiss <150 mm		9	2	0	0	0	0	0	0	1		0	0
Mykiss >150 mm		3	16	0	0	0	0	0	0	1		0	0
Total Mykiss		12	18	0	0	0	0	0.000	0	2		0	0
Fish/100 meters2		0.819	1.622	0.000	0.000	0.000	0.000	0.000	0.00	1.191		0.000	0.000
Meters2/fish		122.1	61.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Brook Trout <150 mm		2	0	0	0	2	0	0	0	0		0	0
Brook Trout >150 mm		0	0	0	7	2	0	2	0	0		0	0
Total Brook Trout		2	0	0	7	4	0	2	0	0		0	0
Fish/100 meters2		0.137	0.000	0.000	0.551	0.250	0.000	0.222	0.000	0.000		0.000	0.000
Meters2/fish		732.5	0.000	0.000	181.4	400.0	0.000	450.0	0.000	0.000		0	0
Bull Trout <150 mm		0	0	0	0	0	0	0	0	0		0	0
Bull Trout >150 mm		0	0	0	0	0	0	0	0	0		0	0
Total Bull Trout		0	0	0	0	0	0	0	0	0		0	0
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
All fish		14	18	0	7	4	0	2	0	2		0	0
Fish/100 meters2		0.956	1.622	0.000	0.551	0.250	0.000	0.222	0.000	0.191		0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0	400.0	0.0	450.0	0.0	522.5		0.0	0.0

Summary: Brook trout and rainbow/steelhead are present.

Comments:

Appendix B Table 6. Little White Salmon River survey site, habitat data and fish observations during summer-fall 2000.

Site Name		Little White Salmon Moss to lower bridge			**Snorkelers**	JB, RHM, BMM
Date		September 20 & 21, 2000			**Gradient**	1.09%
River Name		Little White Salmon				
Stream Name		Little White Salmon			**Temp. F**	57.0 above Moss Ck., 42.0
WRIA		29				at Moss Ck, 43.0 below
County		Skamania				confluence
GPS	**North**	45°	50'	36.4"	**Day/Night**	Canyon with high falls and
	West	122°	01'	55.3"		high gradient T25-29

Transects per hundred meters

	Start	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
Cover %	64%	50%	25%	50%	40%	95%	100%	70%	45%	80%	50%	9% 0	40%	20%	95%
Cobble (cm)	9	4	4	9	6	6	5	9	9	6	5	4	6	8	7
Wetted Width (m)	8.4	15.6	17.0	18.0	13.0	12.0	16.0	17.9	9.6	18.8	10.5	19.6	23.0	8.2	15.0
Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.87	0.54	0.54	0.35	0.05	0.41	0.23	0.26	0.50	0.35	0.48	0.09	0.14	0.14	0.38
Water Depth 1/2 (m)	0.42	0.32	0.50	0.40	0.09	0.49	0.30	0.32	0.64	0.24	1.04	0.14	0.07	0.74	0.28
Water Depth 3/4 (m)	0.39	0.18	0.11	0.07	0.99	0.19	0.29	0.15	0.49	0.02	0.10	0.26	0.13	0.36	0.32
Mean Depth (m)	0.42	0.26	0.29	0.21	0.28	0.27	0.21	0.18	0.41	0.15	0.00	0.00	0.00	0.00	0.00
Max. Depth (m)	0.87	0.60	0.58	0.42	>1.00	0.49	0.37	0.32	0.65	0.35	>1.00	0.26	0.74	1.14	0.57
LWD		0	2	0	1	1	4	4	4	3	0	0	2	2	5
Type	P	G	G	G	G	G	G	G	G	GP	P	G	P	P	G
Section Area (m^2)		1200	1630	1750	1550	1250	1400	1695	1375	1420	1465	1505	2130	1560	1160
Fish															
Mykiss <150 mm		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mykiss >150 mm		0	0	0	2	1	0	1	0	0	0	0	0	0	10
Total Mykiss		0	0	0	2	1	0	1	0	0	0	0	0	0	10
Fish/100 meters2		0.000	0.000	0.000	0.129	0.080	0.000	0.059	0.00	0.000	0.000	0.000	0.000	0.000	0.862
Meters2/fish		0.0	0.0	0.0	775.0	1250.0	0.0	1695.0	0.0	0.0	0.0	0.0	0.0	0.0	116.0
Brook Trout <150 mm		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brook Trout >150 mm		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Brook Trout		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bull Trout <150 mm		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bull Trout >150 mm		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Bull Trout		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All fish		0	0	0	2	1	0	1	0	0	0	0	0	0	10
Fish/100 meters2		0.000	0.000	0.000	0.129	0.080	0.000	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.862
Meters2/fish		0.0	0.0	0.0	775.0	1250.0	0.0	1695.0	0.0	0.0	0.0	0.0	0.0	0.0	116.0

Summary: Rainbow/steelhead are present.

Comments: We day snorkeled 3 km from Moss Ck. to the Willard Rd. bridge. There was a steep canyon in section T24-29 making some habitat data unavailable.

Appendix B Table 6. Little White Salmon River survey site, habitat data and fish observations during summer-fall 2000 (continued)

T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	730
95%	60%	0%	35%	0%	20%	85%	10%	60%	3%	10%	65%	20%	20%	45%	0%	25%
7	5	8	5	8	6	5	6	7	3B	B	B	B	B	B	B	
15.0	19.4	7.6	16.0	12.0	12.0	9.4	17.2	13.0	17.4	9.0	6.8	8.5	9.5	13.2	13.5	20.0
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.38	0.39	0.39	0.35	0.34	0.30	0.73	0.19	0.23	0.12							0.30
0.28	0.40	0.54	0.20	0.49	0.27	0.42	0.34	0.16	0.21							0.17
0.32	0.65	0.57	0.11	0.36	0.19	0.25	0.14	0.68	0.15							0.36
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.57	0.68	0.64	0.38	0.54	0.43	0.74	0.14	0.74								0.54
5	2	5	1	3			2	2	3	3	0	0	0	0	0	0
G	G	G	R	G	R		G	R,P	R	R	P	P	P	R	R	R
1160	1720	1350	1180	1400	1200	1070	1330	1510	1520	1320	790	765	900	1135	1335	1675
0	0	0	0	0	0	0	0	0	0	0	3	5	5	2	3	0
10	4	11	0	0	2	0	0	0	2	15	9	12	10	9	11	0
10	4	11	0	0	2	0	0	0	2	15	12	17	15	11	14	0
0.862	0.233	0.815	0.000	0.000	0.167	0.000	0.000	0.000	0.132	1.136	1.519	2.222	1.667	0.969	1.049	0.000
116.0	430.0	122.7	0.0	0.0	600.0	0.0	0.0	0.0	760.0	88.0	65.8	45.0	60.0	103.2	95.4	0.0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	4	11	0	0	2	0	0	0	2	15	12.1.	17	15	11	14	0
0.862	0.233	0.815	0.00	0.000	0.167	0.000	0.000	0.000	0.132	1.136	519	2.222	1.667	0.969	1.049	0.000
116.0	430.0	122.7	0.0	0.0	600.0	0.0	0.0	0.0	760.0	88.0	65.8	45.0	60.0	103.2	95.4	0.0

Appendix B Table 7. Moss Creek survey site, habitat data and fish observations during summer-fall 2000.

Site Name		Moss Creek (pond)			**Snorkelers**	JB, RHM	
Date		November 9, 2000			**Gradient**	Not taken	
River Name		Little White Salmon River					
Stream Name		Moss Creek			**Temp. F**	Snorkel	40.0
WRIA		29					
County		Skamania					
GPS	**North**	45°	47'	47.5"	**Day/Night**	N	
	West	121°	39'	00.3"			

GPS taken at bridge about 300 m below pond

	Transects per hundred meters		
	Start	T1	T2
Cover %			
Cobble (cm)			
Wetted Width (m)	Pond	Pond	Rt Pond
Margin	0.00	0.00	0.00
Water Depth 1/4 (m)	Pond	Pond	Rt Pond
Water Depth 1/2 (m)	Pond	Pond	Rt Pond
Water Depth 3/4 (m)	Pond	Pond	Rt Pond
Mean Depth (m)	0.00	0.00	0.00
Max. Depth (m)	Pond	Pond	Rt Pond
LWD	Pond	Pond	Rt Pond
Section Area (m^2)	Pond	Pond	Rt Pond unknown
Fish			
Mykiss <150 mm		0	0
Mykiss >150 mm		0	0
Total Mykiss		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0
Brook Trout <150 mm		0	1
Brook Trout >150 mm		0	4
Total Brook Trout		0	5
Fish/100 meters2		0.000	area unknown
Meters2/fish		0.0	area unknown
Bull Trout <150 mm		0	0
Bull Trout >150 mm		0	0
Total Bull Trout		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0
All fish		0	5
Fish/100 meters2		0.000	area unknown
Meters2/fish		0.0	area unknown

Summary: Brook trout only are present

Comments: We day and night snorkeled the pond area. Fish were only seen at night. There are tremendous amounts of wood debris. We are unable to determine pond widths.

Appendix B Table 8. Morrison Creek survey site, habitat data and fish observations during summer-fall 2000.

Site Name		Morrison Creek			**Snorkelers**	JB, RHM, BMM	
Date		October 11, 2000			**Gradient**		6.50% ???
River Name		White Salmon River					
Stream Name		Morrison Creek			**Temp. F**	Habitat	42.0
WRIA		29					
County							
GPS	**North**	46°	07'	30.1"	**Day/Night**	N	
	West	121°	31'	12.6"			

	Transects per hundred meters				
	Start	T1	T2	T3	T5
Cover %	30%	40%	0%	95%	95%
Cobble (cm)	4	6	sand	3	3
Wetted Width (m)	2.7	2.8	3.8	2.4	3.2
Margin	0.00	0.00	0.00	0.03	0.00
Water Depth 1/4 (m)	0.09	0.10	0.36	0.07	0.10
Water Depth 1/2 (m)	0.06	0.19	0.04	0.04	0.09
Water Depth 3/4 (m)	0.04	0.17	0.03	0.13	0.00
Mean Depth (m)	0.05	0.12	0.11	0.06	0.05
Max. Depth (m)	0.15	0.2	0.44	0.15	0.13
LWD		18	11	2	2
Type	R	R	P	R	R
Section Area (m^2)		275	330	310	280
Fish					
Mykiss <150 mm		0	0	0	0
Mykiss >150 mm		0	0	0	0
Total Mykiss		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Brook Trout <150 mm		0	0	0	0
Brook Trout >150 mm		0	0	0	0
Total Brook Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Bull Trout <150 mm		0	0	0	0
Bull Trout >150 mm		0	0	0	0
Total Bull Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
All fish		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0

Summary: No fish or other aquatic life are present.

Comments: The habitat appeared desirable, but there was minimal aquatic life. There seemed to be large amounts of volcanic ash/sand in the stream.

Appendix B Table 9. Cascade Creek (Lower Site) habitat data and fish observations during summer-fall 2000.

Site Name		Cascade Ck (confluence with White Salmon)			**Snorkelers**	JB, RHM, BMM	
Date		October 11, 2000			**Gradient**		3.38%
River Name		White Salmon River					
Stream Name		White Salmon River			**Temp. F**	Habitat	43.0
						Snorkel	41.0
WRIA		29					
County		Yakima					
GPS	**North**	46°	06'	14.9"	**Day/Night**	N	
	West	121°	36'	29.0"			

	Transects per hundred meters			
	Start	T1	T2	T3
Cover %	90%	70%	15%	70%
Cobble (cm)	26	20	28	35
Wetted Width (m)	6.4	6.8	8.0	8.8
Margin	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.28	0.06	0.24	0.37
Water Depth 1/2 (m)	0.24	0.20	0.15	0.39
Water Depth 3/4 (m)	0.09	0.23	0.02	0.32
Mean Depth (m)	0.15	0.12	0.10	0.27
Max. Depth (m)	0.47	0.32	0.50	0.42
LWD		7	5	8
Type	R	R	R	R
Section Area (m^2)		660	740	840
Fish				
Mykiss <150 mm		4	3	3
Mykiss >150 mm		1	2	2
Total Mykiss		5	5	5
Fish/100 meters2		0.758	0.676	0.595
Meters2/fish		132.0	148.0	168.0
Brook Trout <150 mm		0	0	0
Brook Trout >150 mm		0	0	0
Total Brook Trout		0	0	0
Fish/100 meters2		0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0
Bull Trout <150 mm		0	0	0
Bull Trout >150 mm		0	0	0
Total Bull Trout		0	0	0
Fish/100 meters2		0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0
All fish		5	5	5
Fish/100 meters2		0.758	0.676	0.595
Meters2/fish		132.0	148.0	168.0

Summary: Rainbow/steelhead are present.

Comments: Cascade Ck. has high glacial input. Late season snorkels are required as the glacier freezes visibility improves.

Appendix B Table 10. Cascade Creek (Upper Site) habitat data and fish observations during summer-fall 2000.

Site Name		Cascade (2 miles up at lower data logger			**Snorkelers**		
Date		October 26, 2000			**Gradient**		2.75%
River Name		White Salmon River					
Stream Name		Cascade Creek			**Temp. F**	Habitat Snorkel	41.0 42.0
WRIA		29					
County		Skamania					
GPS	**North**	46°	08'	3.3"	**Day/Night**	N	
	West	121°	35'	7.8"			

	Transects per hundred meters				
	Start	T1	T2	T3	T4
Cover %	40%	20%	80%	60%	100%
Cobble (cm)	4	4	8	4	5
Wetted Width (m)	8.8	7.0	6.0	3.9	2.8
Margin	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.22	0.25	0.10	0.28	0.19
Water Depth 1/2 (m)	0.13	0.31	0.50	0.57	0.55
Water Depth 3/4 (m)	0.20	0.16	0.43	0.50	0.46
Mean Depth (m)	0.14	0.18	0.26	0.34	0.30
Max. Depth (m)	0.29	0.32	0.58	0.59	0.64
LWD		9	10	5	9
Type		G	G	R	G
Section Area (m^2)		790	650	495	335
Fish					
Mykiss <150 mm		5	8	2	7
Mykiss >150 mm		2	4	1	2
Total Mykiss		7	12	3	9
Fish/100 meters2		0.886	1.846	0.606	2.687
Meters2/fish		112.9	54.2	165.0	37.2
Brook Trout <150 mm		0	0	0	0
Brook Trout >150 mm		0	0	0	0
Total Brook Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Bull Trout <150 mm		0	0	0	0
Bull Trout >150 mm		0	0	0	0
Total Bull Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
All fish		7	12	3	9
Fish/100 meters2		0.886	1.846	0.606	2.687
Meters2/fish		112.9	54.2	165.0	37.2

Summary: Rainbow/steelhead are present.

Comments: Cascade Ck has high glacial input. Late season snorkels are required as the glacier freezes visibility improves.

Appendix B Table 11. Upper White Salmon River (lower site) habitat data and fish observations during summer-fall 2000.

Site Name		Lower White Salmon River			**Snorkelers**	JB, RHM, BMM	
Date		October 9, 2000			**Gradient**		3.05%
River Name		White Salmon					
Stream Name		White Salmon			**Temp. F**	Habitat	42.5
WRIA		29					
County		Skamania					
GPS	**North**	46°	4'	32.1"	**Day/Night**	N	
	West	121°	37'	25.6"			

	Transects per hundred meters				
	Start	T1	T2	T3	T4
Cover %	0%	60%	70%	100%	100%
Cobble (cm)	7	6	9	3	5
Wetted Width (m)	5.2	8.4	6.7	8.4	7.5
Margin	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.37	0.72	0.31	0.30	0.16
Water Depth 1/2 (m)	0.41	0.15	0.14	0.42	0.29
Water Depth 3/4 (m)	0.14	0.32	0.22	0.44	0.29
Mean Depth (m)	0.23	0.30	0.17	0.29	0.19
Max. Depth (m)	0.41	0.80	0.55	0.61	0.65
LWD		64	43	11	10
Section Area (m^2)		680	755	755	795
Fish					
Mykiss <150 mm		17	16	15	4
Mykiss >150 mm		15	11	4	8
Total Mykiss		32	27	19	12
Fish/100 meters2		4.706	3.576	2.517	1.509
Meters2/fish		21.3	28.0	39.7	66.3
Brook Trout <150 mm		0	0	0	0
Brook Trout >150 mm		0	0	0	0
Total Brook Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Bull Trout <150 mm		0	0	0	0
Bull Trout >150 mm		0	0	0	0
Total Bull Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
All fish		32	27	19	12
Fish/100 meters2		0.047	0.036	0.025	0.015
Meters2/fish		21.3	28.0	39.7	66.3

Summary: Rainbow/steelhead are present.

Comments: High flows, difficult to snorkel upstream. We correlated fish presence with incidence of large woody debris. There was a near significant correlation (r=0.92, r2=0.86, p=0.07)

Appendix B Table 12. Upper White Salmon River (upper site) habitat data and fish observations during summer-fall 2000.

Site Name		Upper White Salmon (data logger site)			**Snorkelers**	JB, RHM, BMM	
Date		October 10, 2000			**Gradient**		2.51%
River Name		White Salmon					
Stream Name		White Salmon			**Temp. F**	Habitat Snorkel	42.0 42.0
WRIA		29					
County		Skamania					
GPS	**North**	46°	09'	18.2"	**Day/Night**	N	
	West	121°	37'	35.6"			

	Transects per hundred meters				
	Start	T1	T2	T3	T4
Cover %	20%	40%	60%	20%	0%
Cobble (cm)	7	11	11	10	9
Wetted Width (m)	9.0	7.4	4.8	8.8	6.6
Margin	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.05	0.15	0.45	0.11	0.00
Water Depth 1/2 (m)	0.29	0.28	0.28	0.29	0.15
Water Depth 3/4 (m)	0.46	0.26	0.10	0.10	0.16
Mean Depth (m)	0.20	0.17	0.21	0.13	0.08
Max. Depth (m)	0.66	0.33	0.48	0.36	0.30
LWD		25	2	2	4
Type	P	G	G	P	R
Section Area (m^2)		820	610	680	770
Fish					
Mykiss <150 mm		18	10	4	8
Mykiss >150 mm		7	7	2	6
Total Mykiss		25	17	6	14
Fish/100 meters2		3.049	2.787	0.882	1.818
Meters2/fish		32.8	35.9	113.3	55.0
Brook Trout <150 mm		0	0	0	0
Brook Trout >150 mm		0	0	0	0
Total Brook Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Bull Trout <150 mm		0	0	0	0
Bull Trout >150 mm		0	0	0	0
Total Bull Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
All fish		25	17	6	14
Fish/100 meters2		0.030	0.028	0.009	0.018
Meters2/fish		32.8	35.9	113.3	55.0

Summary: Rainbow/steelhead are present.

Comments: High flows, difficult to snorkel upstream.

Appendix B Table 13. Big Bird Creek survey site below Dry Creek confluence, habitat data and fish observations during summer-fall 2000.

Site Name		Bird Creek below Dry Creek confluence			**Snorkelers**	JB, RHM, BMM, CA	
Date		October 25, 2000			**Gradient**		1.00%
River Name		Klickitat River					
Stream Name		Bird Creek			**Temp. F**	Habitat	41.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	3'	35.4"	**Day/Night**	N	
	West	121°	18'	21.3"			

	Transects per hundred meters			
	Start	T1	T2	T3
Cover %	50%	40%	55%	45%
Cobble (cm)	1 & sand	8	6	5
Wetted Width (m)	7.4	10.0	5.0	6.0
Margin	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.23	0.19	0.24	0.11
Water Depth 1/2 (m)	0.00	0.13	0.28	0.09
Water Depth 3/4 (m)	0.25	0.19	0.25	0.19
Mean Depth (m)	0.12	0.13	0.19	0.10
Max. Depth (m)	0.36	0.30	0.32	0.19
LWD		23	18	2
Type	G	G	G	R
Section Area (m^2)		870	750	550
Fish				
Mykiss <150 mm		3	0	3
Mykiss >150 mm		14	13	5
Total Mykiss		17	13	8
Fish/100 meters2		1.954	1.733	1.455
Meters2/fish		51.2	57.7	68.8
Brook Trout <150 mm		9	12	16
Brook Trout >150 mm		18	12	11
Total Brook Trout		27	24	27
Fish/100 meters2		3.103	3.200	4.909
Meters2/fish		32.3	31.3	20.4
Bull Trout <150 mm		0	0	0
Bull Trout >150 mm		0	0	0
Total Bull Trout		0	0	0
Fish/100 meters2		0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0
All fish		44	37	35
Fish/100 meters2		5.057	4.933	6.364
Meters2/fish		19.8	20.3	15.7

Summary: Brook trout and rainbow/steelhead are present.

Comments:

Appendix B Table 14. Bird Creek survey site above Dry Creek confluence, habitat data and fish observations during summer-fall 2000.

Site Name		Bird Creek above Dry Creek confluence			**Snorkelers**	BMM, CA	
Date		October 25, 2000			**Gradient**	Not taken	
River Name		Klickitat River					
Stream Name		Bird Creek			**Temp. F**	Habitat	40.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	03'	35.4"	**Day/Night**	N	
	West	121°	18'	21.3"			

	Transects per hundred meters		
	Start	T1	T2
Cover %	45%	100%	100%
Cobble (cm)	5	1	Bedrock
Wetted Width (m)	6	4	4
Margin	0.00	0.00	0.00
Water Depth 1/4 (m)	0.11	0.35	0.33
Water Depth 1/2 (m)	0.09	0.00	0.11
Water Depth 3/4 (m)	0.19	0.05	0.00
Mean Depth (m)	0.10	0.10	0.11
Max. Depth (m)	0.19	0.35	0.33
LWD		6	6
Type	R	P	R
Section Area (m^2)		500	400
Fish			
Mykiss <150 mm		0	0
Mykiss >150 mm		3	3
Total Mykiss		3	3
Fish/100 meters2		0.600	0.750
Meters2/fish		166.7	133.3
		0.2	0.1
Brook Trout <150 mm		16	8
Brook Trout >150 mm		18	6
Total Brook Trout		34	14
Fish/100 meters2		6.800	3.500
Meters2/fish		14.7	28.6
Bull Trout <150 mm		0	0
Bull Trout >150 mm		0	0
Total Bull Trout		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0
All fish		37	17
Fish/100 meters2		7.400	4.250
Meters2/fish		13.5	23.5

Summary: Brook trout and rainbow/steelhead are present.

Comments:

Appendix B Table 15. Dry Creek survey site above Bird Creek vonfluence, habitat data and fish observations during summer-fall 2000.

Site Name		Dry Creek above Bird Creek confluence			**Snorkelers**	JBB, RMP	
Date		October 25, 2000			**Gradient**	Not taken	
River Name		Klickitat					
Stream Name		Bird Creek			**Temp. F**	Habitat	42
WRIA		30					
County		Yakima					
GPS	**North**	46°	3'	35.4"	**Day/Night**	N	
	West	121°	18'	21.3"			

	Transects per hundred meters		
	Start	T1	T2
Cover %	60%	5%	5%
Cobble (cm)	9	6	14
Wetted Width (m)	7.2	5.2	6.0
Margin	0.00	0.00	0.00
Water Depth 1/4 (m)	0.20	0.01	0.21
Water Depth 1/2 (m)	0.10	0.17	0.19
Water Depth 3/4 (m)	0.05	0.26	0.19
Mean Depth (m)	0.09	0.11	0.15
Max. Depth (m)	0.29	0.27	0.23
LWD		15	24
Type	R	R/G	R
Section Area (m^2)		620	560
Fish			
Mykiss <150 mm		1	0
Mykiss >150 mm		3	1
Total Mykiss		4	1
Fish/100 meters2		0.645	0.179
Meters2/fish		155.0	560.0
Brook Trout <150 mm		5	20
Brook Trout >150 mm		9	20
Total Brook Trout		14	40
Fish/100 meters2		2.258	7.143
Meters2/fish		44.3	14.0
Bull Trout <150 mm		0	0
Bull Trout >150 mm		0	0
Total Bull Trout		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0
All fish		18	41
Fish/100 meters2		2.903	7.321
Meters2/fish		34.4	13.7

Summary: Bull trout and rainbow/steelhead are present.

Comments:

Appendix B Table 16. Cunningham Creek survey site, habitat data and fish observations during summer-fall 2000.

Site Name		Cunningham Creek			**Snorkelers**	JB, RHM, BMM	
Date		October 3, 2000			**Gradient**		3.07%
River Name		Klickitat					
Stream Name		Cunningham Creek			**Temp. F**	Habitat Snorkel	43.0 44.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	10'	56.4"	**Day/Night**	N	
	West	121°	17'	10.4"			

	Transects per hundred meters				
	Start	T1	T2	T3	T4
Cover %	35%	80%	80%	50%	60%
Cobble (cm)	4	7	Bedrock	17	8
Wetted Width (m)	8.3	4.1	3.2	6.6	6.0
Margin	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.70	0.26	0.09	0.21	0.45
Water Depth 1/2 (m)	0.56	0.25	0.30	0.35	0.27
Water Depth 3/4 (m)	>1.00	0.15	0.10	0.39	0.51
Mean Depth (m)	0.32	0.017	0.12	0.24	0.31
Max. Depth (m)	>1.00	0.27	0.41	0.39	0.51
LWD		1	4	5	1
Type	P	R	R	R	
Section Area (m^2)		620	365	490	630
Fish					
Mykiss <150 mm		0	0	1	5
Mykiss >150 mm		0	0	4	2
Total Mykiss		0	0	5	7
Fish/100 meters2		0.000	0.000	1.020	1.111
Meters2/fish		0.0	0.0	98.0	60.0
Brook Trout <150 mm		0	0	0	0
Brook Trout >150 mm		0	0	0	0
Total Brook Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Bull Trout <150 mm		0	0	0	0
Bull Trout >150 mm		0	0	0	0
Total Bull Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
All fish		0	0	5	7
Fish/100 meters2		0.000	0.000	1.020	1.111
Meters2/fish		0.0	0.0	98.0	90.0

Summary: Rainbow/steelhead are present.

Comments: Cunningham Ck. has high falls in section T3. Juvenile YOY rainbow/steelhead were present in this reach.

Appendix B Table 17. Trapper Creek survey site, habitat data and fish observations during summer-fall 2000.

Site Name		Trappers Creek			**Snorkelers**	JB, RHM, BMM
Date		September 26, 2000			**Gradient**	Not taken
River Name		Klickitat				
Stream Name		Trappers Creek			**Temp. F**	
WRIA		30				
County		Yakima				
GPS	**North**	46°	16'	52.9"	**Day/Night**	N
	West	121°	20'	27.8"		

	Transects per hundred meters			
	below bridge			above bridge
	Start	T1	T2	T3
Cover %	80%			70%
Cobble (cm)	2			Bedrock
Wetted Width (m)	6.0	5.7	4.8	4.5
Margin	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.19	0.20		0.24
Water Depth 1/2 (m)	0.05	0.18		0.05
Water Depth 3/4 (m)	0.11	0.10		0.12
Mean Depth (m)	0.09	0.12	0.00	0.10
Max. Depth (m)	0.25			0.35
LWD		10		12
Type		R	R	R
Section Area (m^2)		300		465
Fish				
Mykiss <150 mm		1		1
Mykiss >150 mm		0		0
Total Mykiss		1		1
Fish/100 meters2		0.333		0.215
Meters2/fish		300.0		465.0
Brook Trout <150 mm		0		0
Brook Trout >150 mm		0		0
Total Brook Trout		0		0
Fish/100 meters2		0.000		0.000
Meters2/fish		0.0		0.0
Bull Trout <150 mm		22		16
Bull Trout >150 mm		5		8
Total Bull Trout		27		24
Fish/100 meters2		9.000		5.161
Meters2/fish		0.0		0.0
All fish		28		25
Fish/100 meters2		9.333		5.376
Meters2/fish		10.7		18.6

Summary: 51 bull trout were present in 200 m of stream.

Comments: Only bull trout were present.

Appendix B Table 18. Clearwater Creek (upper site) habitat data and fish observations during summer-fall 2000.

Site Name		Clearwater Creek at bridge			**Snorkelers**	JB, RHM, BMM, IH	
Date		September 27, 2000			**Gradient**	Not taken	
River Name		Klickitat River					
Stream Name		Clearwater Creek			**Temp. F**	Habitat	40.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	16'	51.3"	**Day/Night**	N	
	West	121°	20'	05.7"			

	Transects per hundred meters			
	bridge			
	Start	T1	T2	T2
Cover %	0%	45%		90%
Cobble (cm)	8	6		5
Wetted Width (m)	6.4	10.6	6.6	8.2
Margin	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.14	0.21		0.42
Water Depth 1/2 (m)	0.43	0.25		0.00
Water Depth 3/4 (m)	0.26	0.41		0.17
Mean Depth (m)	0.21	0.22	0.00	0.15
Max. Depth (m)	0.50	0.42		0.50
LWD	0	27	50	
Type	R			G
Section Area (m^2)		850		1270

At 200 m, removing island leaves wetted width at 14.8 m

Fish			0
Mykiss <150 mm		0	0
Mykiss >150 mm		0	
Total Mykiss		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0
Brook Trout <150 mm		0	0
Brook Trout >150 mm		0	0
Total Brook Trout		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0
Bull Trout <150 mm		0	0
Bull Trout >150 mm		0	0
Total Bull Trout		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0
All fish		0	0
Fish/100 meters2		0.000	0.000
Meters2/fish		0.0	0.0

Summary: No fish were present.

Comments: Clearwater Ck. has four water falls beginning 343 m from confluence with the Little Muddy. Two of the four falls are impassible to fish. Otherwise, the habitat appears ideal for salmonids with much LWD, pools and cold temperatures.

Appendix B Table 19. Clearwater Creek (lower site) habitat data and fish observations during summer-fall 2000.

Site Name		Clearwater Creek at mouth			**Snorkelers**	JB, RHM, BMM	
Date		September 27, 2000			**Gradient**	100%	
River Name		Klickitat					
Stream Name		Clearwater Creek			**Temp. F**	Habitat Snorkel	42.0 43.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	16'	32.7"	**Day/Night**	N	
	West	121°	19'	41.0"			

	Transects per hundred meters				
	Start	T1	T2	T3	T4
Cover %	10%	30%	70%	20%	
Cobble (cm)	large cbl.	14	deep	deep	
Wetted Width (m)	9.5	12.7	7.2	11.6	
Margin	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.28	0.15	0.32		
Water Depth 1/2 (m)	0.87	0.23	0.65		
Water Depth 3/4 (m)	0.72	0.35	0.69		
Mean Depth (m)	0.47	0.18	0.42	0.00	0.00
Max. Depth (m)	0.95	0.38	0.69		
LWD		12	27	19	

Total length 341.3 m. Could not get readings at bottom of falls.

Type	P	R, G	P	R	
Section Area (m^2)		1110	995	940	237.8
Fish					
Mykiss <150 mm		1	1	0	0
Mykiss >150 mm		0	0	1	0
Total Mykiss		1	1	1	0
Fish/100 meters2		0.090	0.101	0.106	0.000
Meters2/fish		1110.0	995.0	940.0	0.0
Brook Trout <150 mm		0	0	1	0
Brook Trout >150 mm		0	0	0	0
Total Brook Trout		0	0	1	0
Fish/100 meters2		0.000	0.000	0.106	0.000
Meters2/fish		0.0	0.0	940.0	0.0
Bull Trout <150 mm		27	9	6	3
Bull Trout >150 mm		23	18	6	2
Total Bull Trout		50	27	12	5
Fish/100 meters2		4.505	2.714	1.277	2.103
Meters2/fish		22.2	36.9	78.3	47.6
All fish		51	28	14	5
Fish/100 meters2		4.595	2.814	1.489	2.103
Meters2/fish		21.8	35.5	67.1	47.6

Summary: 94 bull trout, 1 brook trout and 3 rainbow/steelhead were present.

Comments: Clearwater Ck. has four water falls beginning 343 m from confluence with the Little Muddy. Two of the four falls are impassible to fish. These fish were found downstream of the first falls. The falls appear to be a barrier to fish passage.

Appendix B Table 20. Little Muddy Creek survey site, habitat data and fish observations during summer-fall 2000.

Site Name		Little Muddy Creek			**Snorkelers**	JB, RHM, BMM	
Date		October 17, 2000			**Gradient**	3.57%	
River Name		Klickitat					
Stream Name		Little Muddy Creek, Clearwater Creek			**Temp. F**	Habitat	43.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	16'	32.7"	**Day/Night**	N	
	West	121°	19'	41.0"			

(At confluence of Little Muddy Ck and Clearwater Ck.)

	Transects per hundred meters				
	Start	T1	T2	T3	T4
Cover %	50%	25%	30%	15%	20%
Cobble (cm)	8	9	7	12	8
Wetted Width (m)		10.4	5.5	10.3	5.0
Margin	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.03	0.13	0.13	0.26	0.30
Water Depth 1/2 (m)	0.02	0.37	0.34	0.08	0.32
Water Depth 3/4 (m)	0.12	0.25	0.51	0	0.27
Mean Depth (m)	0.04	0.19	0.25	0.09	0.22
Max. Depth (m)	0.4	0.38	0.59	0.31	0.34
LWD		10	11	9	9
Type	R	R	R	R	R
Section Area (m^2)		520	795	790	765
		Trappers Ck enters @ 250 m mark			
Fish					
Mykiss <150 mm		1	0	2	2
Mykiss >150 mm		0	0	1	3
Total Mykiss		1	0	3	5
Fish/100 meters2		0.192	0.000	0.380	0.654
Meters2/fish		520.0	0.0	263.3	153.0
Brook Trout <150 mm		0	1	1	2
Brook Trout >150 mm		0	0	0	0
Total Brook Trout		0	1	1	2
Fish/100 meters2		0.000	0.126	0.127	0.261
Meters2/fish		0.0	795.0	790.0	382.5
Bull Trout <150 mm		4	1	1	2
Bull Trout >150 mm		1	1	0	1
Total Bull Trout		5	2	1	3
Fish/100 meters2		0.962	0.252	0.127	0.392
Meters2/fish		0.0	0.0	0.0	0.0
All fish		6	3	5	10
Fish/100 meters2		1.154	0.377	0.633	1.307
Meters2/fish		86.7	265.0	158.0	76.5

Summary: 11 bull trout, 4 brook trout and 9 rainbow/steelhead were present.

Comments: the Little Muddy has high glacial input. Late season snorkels are needed, when the Wilson Glacier freezes up reducing input of till and improving visibility.

Appendix B Table 21. Fish lake Stream (upper site) habitat data and fish observations during summer-fall 2000.

Site Name		Fish Lake Stream			**Snorkelers**	JB, RHM, BMM	
Date		September 27, 2000			**Gradient**	1.58%	
River Name		Klickitat					
Stream Name		Fish Lake Stream			**Temp. F**	Habitat	43.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	17'	31.9"	**Day/Night**	N	
	West	121°	20'	3.4"			

	Transects per hundred meters				
	Start	T1	T2	T3	T4
Cover %	5%	25%	10%	50%	15%
Cobble (cm)	5	Rocks	9	6	7
Wetted Width (m)	19.4	14.2	16.0	16.0	16.8
Margin	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.18	0.46	0.47	0.42	0.22
Water Depth 1/2 (m)	0.36	0.54	0.43	0.39	0.62
Water Depth 3/4 (m)	0.41	0.40	0.46	0.10	0.18
Mean Depth (m)	0.24	0.35	0.34	0.23	0.26
Max. Depth (m)	0.55	0.54	0.60	0.45	0.62
LWD		3	3	3	2
Section Area (m^2)		1680	1510	1600	1640
Fish			data misplaced		
Mykiss <150 mm					
Mykiss >150 mm					
Total Mykiss		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Brook Trout <150 mm			data misplaced		
Brook Trout >150 mm					
Total Brook Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
Bull Trout <150 mm			data misplaced		
Bull Trout >150 mm					
Total Bull Trout		0	0	0	0
Fish/100 meters2		0.000	0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0	0.0
All fish					
Fish/100 meters2					
Meters2/fish		0.0	0.0	0.0	0.0

Summary: Brook trout and rainbow/steelhead are present, no bull trout were seen.

Comments: Data on fish counts misplaced. This is not reflected in counts.

Appendix B Table 22. Fish Lake Stream (mid site) habitat data and fish observations during summer-fall 2000.

Site Name		Upper Fish Lake Stream			**Snorkelers**	JB, RHM, IH, GS	
Date		November 8, 2000			**Gradient**	3.00%	
River Name		Klickitat					
Stream Name		Fish Lake Stream			**Temp. F**	Snorkel	37.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	17'	13.9"	**Day/Night**	N	
	West	121°	19'	46.2"			

	Transects per hundred meters			
	Start	T1	T2	T3
Cover %	20%	15%	30%	35%
Cobble (cm)	4	deep	deep	deep
Wetted Width (m)	12.8	12.8	9.5	10.9
Margin	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.79	deep	deep	deep
Water Depth 1/2 (m)	0.70	deep	deep	deep
Water Depth 3/4 (m)	0.39	deep	deep	deep
Mean Depth (m)	0.47	0.00	0.00	0.00
Max. Depth (m)	>1.00	deep	deep	deep
LWD		1	2	1
Type	G	R	R	R
Section Area (m^2)		1270	1105	1020
Fish				
Mykiss <150 mm		6	13	7
Mykiss >150 mm		4	5	6
Total Mykiss		10	18	13
Fish/100 meters2		0.787	1.629	1.275
Meters2/fish		127.0	61.4	78.5
Brook Trout <150 mm		2	10	7
Brook Trout >150 mm		9	6	8
Total Brook Trout		11	16	15
Fish/100 meters2		0.866	1.448	1.471
Meters2/fish		115.5	69.1	68.0
Bull Trout <150 mm		0	0	0
Bull Trout >150 mm		0	0	0
Total Bull Trout		0	0	0
Fish/100 meters2		0.000	0.000	0.000
Meters2/fish		0.0	0.0	0.0
All fish		21	34	28
Fish/100 meters2		1.654	3.077	2.745
Meters2/fish		60.5	32.5	36.4

Summary: Brook trout and rainbow/steelhead are present.

Comments:

Appendix B Table 23. Fish Lake Stream (lower site) habitat data and fish observations during summer-fall 2000.

Site Name		Lower Fish Lake Stream			**Snorkelers**	JB, RHM, IH, GS	
Date		November 8, 2000			**Gradient**	Not taken	
River Name		Klickitat					
Stream Name		Fish Lake Stream			**Temp. F**	Snorkel	37.0
WRIA		30					
County		Yakima					
GPS	**North**	46°	16'	31.3"	**Day/Night**	N	
	West	121°	18'	53.0"			

	Transects per hundred meters	
	Start	T1
Cover %	45%	20%
Cobble (cm)	11	deep
Wetted Width (m)	16.4	15.4
Margin	0.00	0.00
Water Depth 1/4 (m)	0.45	0.11
Water Depth 1/2 (m)	0.47	0.54
Water Depth 3/4 (m)	0.34	0.87
Mean Depth (m)	0.32	0.38
Max. Depth (m)	0.47	>1.00
LWD		0
Type	R	R
Section Area (m^2)		1590
Fish		
Mykiss <150 mm		6
Mykiss >150 mm		12
Total Mykiss		18
Fish/100 meters2		1.132
Meters2/fish		88.3
Brook Trout <150 mm		5
Brook Trout >150 mm		4
Total Brook Trout		9
Fish/100 meters2		0.566
Meters2/fish		176.7
Bull Trout <150 mm		0
Bull Trout >150 mm		0
Total Bull Trout		0
Fish/100 meters2		0.000
Meters2/fish		0.0
All fish		27
Fish/100 meters2		1.698
Meters2/fish		58.9

Summary: Brook trout and rainbow/steelhead are present.

Comments: This is an area where bull trout were previously reported by YIN biologists. We snorkeled a 400 m and 300 m section above this area and day and night snorkeled Fish Lake Stream's confluence with the West Fork and saw no bull trout.

Appendix B Table 24. McCreedy Creek habitat data and fish observations during summer-fall 2000.

Site Name		McCreedy Creek			**Snorkelers**			JB, RHM, BMM	
Date		September 25, 2000			**Gradient**			1.00%	
River Name		Klickitat							
Stream Name		McCreedy Creek			**Temp. F**			Habitat	41.5
WRIA		30							
County					**Day/Night**			N	
	Confluence				**Culvert**				
GPS	**North**	46°	19'	18.9"	**North**	46°	19'	36.3"	
	West	121°	15'	14.6"	**West**	121°	15'	14.6"	

Transects per hundred meters

	Start	T1	T2	T3	T4	T5	T6
Cover %	5%	0%	5%	0%	40%	90%	
Cobble (cm)	7	4	13		8		
Wetted Width (m)	6.8	9	9	8.3	6.3	6.3	
Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Depth 1/4 (m)	0.24	0.18	0.05 >1		0.3		
Water Depth 1/2 (m)	0.13	0.41	0.23 >1		0.38		
Water Depth 3/4 (m)	0.06	0.69	0.21 >1		0.24		
Mean Depth (m)	0.11	0.32	0.12	0.00	0.23	0.00	0.00
Max. Depth (m)	0.39	0.83	0.23 >1		0.5		
LWD	0	2	11		2		
Type	R	P/R	R	P	R		
Section Area (m^2)		790	900	865			
Total Area (m^2)				2555			176.4

	mouth to culvert	culvert to logjam	
Fish			
Mykiss <150 mm	51	2	
Mykiss >150 mm	23	3	
Total Mykiss	74	5	
Fish/100 meters2	2.896	2.834	
Meters2/fish	34.5	35.3	
Brook Trout <150 mm	32		
Brook Trout >150 mm	8	1	
Total Brook Trout	40	1	0
Fish/100 meters2	1.566	0.567	
Meters2/fish	63.9	176.4	
Bull Trout <150 mm			
Bull Trout >150 mm			
Total Bull Trout	0	0	
Fish/100 meters2	0.000	0.000	
Meters2/fish	0.0	0.0	
All fish	120	6	
Fish/100 meters2	4.697	3.401	
Meters2/fish	21.3	29.4	

Summary: Brook trout, juvenile chinook and rainbow/steelhead were present.

Comments: The night snorkel was completed prior to the habitat analysis. 100 m segments were combined reflecting areas above and below the 255 Road culvert.

Appendix B Table 25. Diamond Fork Creek habitat data and fish observations during summer-fall 2000.

Site Name		Diamond Fork Creek			**Snorkelers**	JB, RHM, BMM	
Date		October 18, 2000			**Gradient**	2.36%	
River Name		Klickitat					
Stream Name		Diamond Fork Creek			**Temp. F**	Habitat	44.0
						Snorkel	42.0 @ 1900, 40.0 @ 2130
WRIA		30					
County		Yakima					
GPS	**North**	46°	25'	30.7"	**Day/Night**	N	
	West	121°	9'	27.2"			

	Transects per hundred meters					
	Start	T1	T2	T3	T4	
Cover %	0%	0%	0%	15%	0%	
Cobble (cm)	13	30	13	10	14	
Wetted Width (m)	11.4	11.3	6.0	6.6	8.0	
Margin	0.00	0.00	0.00	0.00	0.00	
Water Depth 1/4 (m)	0.30	0.12	0.52	0.35	0.23	
Water Depth 1/2 (m)	0.21	0.20	0.60	0.31	0.05	
Water Depth 3/4 (m)	0.14	0.15	0.44	0.16	0.13	
Mean Depth (m)	0.16	0.12	0.39	0.21	0.10	
Max. Depth (m)	0.36	0.20	0.55	0.44	0.28	
LWD		4	10	1	4	
Type	G	R	P	R	P	
Section Area (m^2)		1135	865	630	730	
Fish						
Mykiss <150 mm		35	20	14	8	
Mykiss >150 mm		14	19	15	6	total
Total Mykiss		49	39	29	14	131
Fish/100 meters2		4.317	4.509	4.603	1.918	
Meters2/fish		23.2	22.2	21.7	52.1	
Brook Trout <150 mm		1	7	0	0	
Brook Trout >150 mm		1	3	0	0	total
Total Brook Trout		2	10	0	0	12
Fish/100 meters2		0.176	1.156	0.000	0.000	
Meters2/fish		567.5	86.5	0.0	0.0	
Bull Trout <150 mm		0	0	0	0	
Bull Trout >150 mm		0	0	0	0	
Total Bull Trout		0	0	0	0	
Fish/100 meters2		0.000	0.000	0.000	0.000	
Meters2/fish		0.0	0.0	0.0	0.0	
All fish		51	49	29	14	
Fish/100 meters2		4.493	5.665	4.603	1.918	
Meters2/fish		22.3	17.7	0.0	0.0	
Chinook <150m		44	128	105	141	
Chinook >150m		1	3	1	0	total
Total chinook		45	131	106	141	586
All Fish		96	180	135	155	

Summary: Rainbow/steelhead, brook trout and juvenile chinook are present.

Comments: There was a plant of hatchery chinook salmon this summer reflected.