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Wind River Watershed Restoration

2000-2001 Annual Report

February 2003

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Table of Contents

Executive Summary

This report focuses on work conducted in 2000 and 2001 by the U.S. Geological Survey's Columbia River Research Laboratory (USGS-CRRL) as part of the Wind River Watershed Restoration Project. The project started in the early 1990s, and has been funded through the Bonneville Power Administration (BPA) since 1998. The project is a comprehensive effort involving public and private entities seeking to restore water quality and fishery resources in the Wind River subbasin through cooperative actions. Project elements include coordination, watershed assessment, restoration, monitoring, and education. In addition to USGS-CRRL, other BPA-funded entities involved with implementing project components are the Underwood Conservation District (UCD), USDA Forest Service (USFS), and Washington Department of Fish and Wildlife (WDFW).

To describe the activities and accomplishments of the USGS-CRRL portion of the project, we partitioned the 2000-2001 annual report into two pieces: Report A and Report B. In Report A, we provide information on flow, temperature, and habitat conditions in the Wind River subbasin. Personnel from CRRL monitored flows at 12 sites in 2000 and 17 sites in 2001. Flow measurements were generally taken every two weeks during June through October, which allowed tracking of the descending limb of the hydrograph in late spring, through the base low flow period in summer, and the start of the ascending limb of the hydrograph in fall. We maintained a large array of water-temperature sites in the Wind River subbasin, including data from 25 thermographs in 2000 and 27 thermographs in 2001. We completed stream reach surveys on 14.0 km in 2000 and 6.1 km in 2001. Our focus for these reach surveys has been on the upper Trout Creek and upper Wind River watersheds, though some reach surveys have occurred in the Panther Creek watershed. Data generated by these reach surveys include stream width, stream gradient, large woody debris frequency, pool frequency, canopy shade, and riparian vegetation. Data on flow, temperature, and stream reaches have been collected by USGS-CRRL personnel since 1996. Where appropriate, we have compared the data collected in 2000-2001 to those data available from our earlier work.

In Report B, we present data resulting from our extensive fish sampling efforts in the Wind River watershed. We found a total of four fish species in our sampling areas in 2000-2001: steelhead/rainbow trout (hereafter referred to as steelhead), shorthead sculpin, brook trout, and chinook salmon. Juvenile steelhead were present in all areas sampled. Shorthead sculpin, brook trout, and chinook salmon were much more limited in their distribution than steelhead. Although chinook salmon are not endemic to the Wind River above Shipherd Falls (rkm 4.0), we found juvenile chinook salmon throughout the mainstem Wind River and in some tributaries. Presence of juvenile chinook salmon indicate that escaped hatchery adult chinook, most likely resulting from release as smolts from Carson National Fish Hatchery (rkm 28), have some degree of spawning success.

We conducted population surveys by electrofishing in 2000 and 2001. In 2000, we sampled seven stream sections, including four 500-m sections in the upper Wind watershed (Trapper Creek, Dry Creek, Paradise Creek, mainstem Wind River above Paradise Creek), a 500-m section on Crater Creek in the Trout Creek watershed, and two 100-m sections of mainstem Trout Creek. We conducted population-electrofishing surveys in 10 stream sections during 2001, including one 500-m section of Dry Creek in the upper Wind River watershed, six 500-m sections in the Trout Creek watershed (upper mainstem Trout Creek, Crater Creek, Compass Creek, E. Fork Trout Creek, upper Layout Creek, and Planting Creek), a 1000-m section of lower Layout Creek in the Trout Creek watershed, and two 100-m sections of mainstem Trout Creek. These survey sites were an extension of an existing matrix of comparative surveys that we have annually conducted since 1996.

During 2000 and 2001, we deployed PIT tags in juvenile steelhead 80-mm or greater. Steelhead parr were PIT tagged at smolt traps run by WDFW and through our instream-electrofishing efforts. In 2000, we deployed 764 PIT tags at the smolt traps and 697 steelhead parr from electrofishing surveys at 10 locations in the Trout Creek and upper Wind River watersheds. In 2001, we deployed 335 PIT tags at the smolt traps and 823 steelhead parr from electrofishing surveys at 19 locations in Trout Creek, Panther Creek and the upper Wind River watersheds. Of the fish tagged instream during 2000, 19 (2.7%) were detected as they passed Bonneville Dam with a median date of passage at Bonneville of 29 May 2001. During spring 2001, a portion of the steelhead that we PIT tagged at smolt traps and instream during 2000 outmigrated as smolts. Of 764 fish tagged at the smolt traps during 2000, 63

(8.2%) were detected as they passed Bonneville Dam with a median date of passage at Bonneville of 11 May 2001. Information from PIT tagging efforts are helping us understand the life history diversity of steelhead within the Wind River subbasin.

We conducted extensive fish surveys by snorkeling in 2000 and 2001. During 2000, we snorkel sampled 13,800 m in the mainstem Wind River (rkm 30.0 – 43.8), 6,100 m in tributaries to the mainstem Wind River, 1,500 m in tributaries to Trout Creek, and five 100-m index sites in mainstem Trout Creek. During 2001, our primary effort was in Trout Creek, where we snorkel-sampled 14,400 m of the mainstem and 500 m of Crater Creek. We also snorkel sampled 700 m of middle Dry Creek, a tributary to the upper Wind River. In a cooperative effort, personnel from U.S. Forest Service snorkel-sampled 4,600 m of mainstem Wind River in 2001, following USGS sampling protocol. Age-1 or older steelhead decreased between 2000 and 2001 in the upper mainstem Wind River, which mimicked the low age-0 steelhead population found in 2000.

We estimated total populations of salmonids in the portions of the upper Wind River watershed (222 km^2) and in the Trout Creek watershed (67 km^2) that were accessible to anadromous fish. In the upper Wind River in 2000, we estimated that there were 6,686 age-0 and 6,914 age-1 or older juvenile steelhead. Brook trout (0.2%) and juvenile chinook (10%) accounted for less than 11 percent of the total salmonid population estimate in the upper Wind River. In the Trout Creek watershed in 2001, we estimated that there were 19,693 age-0 and 7,321 age-1 or older juvenile steelhead. Brook trout accounted for 19 percent of the total salmonid population estimate in this watershed. These estimates represent the first attempt ever to generate an estimate for the standing population of salmonids in these watersheds.

As an in-kind cooperative effort, the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center provided complete disease profiles for wild fish collected throughout the Wind River system. No viral disease agents and no Whirling Disease have found in salmonids in the Wind River watershed during 1996-2001. Bacterial Kidney Disease has been found in steelhead and brook trout in the upper Trout Creek watershed and in chinook salmon in the upper Wind River watershed. Bacterial Coldwater Disease has been found in steelhead in Trout Creek. A number of parasitic disease agents were found in salmonids in the Wind River watershed. Steelhead were infected, some heavily, with the ciliated protozoan *Heteropolaria* (formerly *Epistylis*) throughout the basin. Brook trout were found to have *Heteropolaria* in the upper reach of mainstem Trout Creek and Compass Creek. In general, the wild salmonids in the Wind River system have a low incidence of disease.

The variability of anadromous fish production was clearly evident in the Wind River watershed during 2000 and 2001. Age-0 steelhead population was low in 2000, but rebounded in 2001. These data correspond to concurrent monitoring of adults, smolts, and parr at traps by WDFW. Steelhead parr outmigration was down in 2001, which corresponded with low age-0 population in 2000 and with low adult-returns for brood years 1998-2000. Adult steelhead returns were up for the 2001 brood year, which corresponds with the high age-0 populations that we observed during 2001. Populations of age-1 or older steelhead held steady relative to our estimates in 1996-1999, but appear to be depressed relative to estimates resulting from much less extensive sampling efforts conducted in 1984 –1988.

Report A: Flow, Temperature, and Habitat Conditions in the Wind River Watershed

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List of Tables

List of Figures

List of Appendix Tables

List of Appendix Figures

Introduction

Sampling efforts and results covered by this report include reach-scale habitat surveys (hereafter referred to as "reach surveys"), stream temperature, and streamflow that we have gathered on a regular basis at key sites within the Wind River subbasin in southwest Washington. This report covers a portion of the work completed under Tasks 2a and 2b of Objective 2 as stated in the Statement of Work (SOW) submitted in January 2000 by the U.S. Geological Survey's Columbia River Research Laboratory (USGS-CRRL). This report presents data we have collected from 1996 through fall of 2001.

We used results from habitat surveying, temperature profiling, and flow monitoring to characterize physical habitat conditions and their variation among and within streams of the subbasin. Habitat characterization in concert with our report on fish population, condition, and survival will allow us to assess rearing conditions for steelhead within the subbasin. These data should aid ongoing Ecological Diagnosis and Treatment modeling efforts, which will help prioritize sites in need of restoration and help judge the success or failure of ongoing restoration activities.

Study Area

The Wind River watershed covers 582 km^2 and supports a fifth-order stream system with the largest tributary watersheds of Trout (88 km^2) and Panther (107 km^2) creeks supporting third-order systems (Figure 1). Elevations range from 25 m at the mouth of the Wind River at the watershed's southern edge to 1,190 m at ridge tops near its northern edge. The watershed is exposed to a temperate marine climate with most of the average annual precipitation of 280 cm occurring between November and April. Precipitation in the winter is largely delivered as rain in the lower elevations of the watershed and as snow in the higher elevations.

Methods

Reach Survey

Our reach surveys generally started at the mouth of a stream (exceptions being where a stream starts on private land or where a stream is too large to effectively survey by our methods) and continued upstream until a fish barrier was reached or we deemed the stream unsuited for anadromous fish. We walked the stream channel and performed a series of measurements at 20-m intervals. At each interval, we measured stream width, took a densitometer reading, and measured stream gradient to the next interval using an Abney level. Within each 20-m interval, we counted large woody debris (LWD; length $\geq$ 1.0 m, diameter $\geq$ 0.3 m), boulders (diameter $\geq$ 0.5 m), and number of pools. For each pool, we measured maximum depth and estimated percent cover. We estimated percent spawning area and percent canopy closure within each 20-m interval. Data on pool depth and cover, spawning area, and canopy closure have not been analyzed at the time of this writing and are not included in this report. We classified LWD as conifer or hardwood and tallied pieces into four size classes by length (L) and diameter (D) (L > 5 m with D = 0.3-0.6 m; L > 5 m with D > 0.6 m; L 1-5 m, with D = 0.3-0.6 m; and L 1-5 m with D > 0.6 m).

Every 100 m, we formed a transect where we characterized riparian vegetation and channel confinement. At these transects, we described vegetation found within the riparian area and measured distance to terraces and hillslopes. Riparian transect data have not been analyzed at the time of this writing and are not included in this report.

Temperature

Personnel from CRRL maintained a network of 9 to 27 thermographs throughout the Wind River subbasin from 1997 through October 2001 (Table 1). Not all thermograph sites were maintained for the entire period. The location of fish sampling efforts determined thermograph placement during any one year. All thermograph units deployed and maintained by CRRL personnel were Optic StowAway thermograph devices from Onset Computer Corporation (OCC). Prior to deployment, the units were tested at our lab for accuracy and adequacy of response time to change in temperature as per instructions from OCC's operating manual.

Thermographs were left in the stream all year and were set to record temperature every two hours. Temperature data were downloaded twice a year (spring and fall). Downloads occurred in the field with use of an OCC optic shuttle to minimize time out of water and missed readings. We calculated the daily mean temperature as the mean of the twelve daily readings. We took the daily minimum and maximum temperatures from the minimum and maximum reading of the twelve daily readings. We maintained 25 thermographs throughout summer 2000 and 27 thermographs throughout summer 2001.

Underwood Conservation District (UCD) personnel maintained seven thermographs throughout the Wind River subbasin from mid June to early October during 1999-2001 (Table 2). The units deployed by UCD were OCC Hobo thermographs. These units were set to take 20 readings per day. Personnel from CRRL derived daily maximum, minimum, and mean temperatures from these 20 readings.

Flow

Personnel from CRRL have established 22 flow-monitoring sites in the Wind River subbasin. Flows were taken with a Marsh-McBirney flow meter following the protocol of Gallagher and Stevenson (1999). During 2000 we monitored flows at 12 sites; during 2001 we monitored flows at 17 sites (Table 3). Sites were visited about every two weeks from early June – October. The location of fish sampling efforts determined selection of flow-monitoring sites sampled during any one year (Table 3).

Results

Reach Survey

Personnel from CRRL completed reach surveys on 5.9 km of stream in 1996, 2.8 km in 1998, 21.6 km in 1999, 14.0 km in 2000, and 6.1 km in 2001 (Table 4). Our focus has been on the upper Trout Creek and upper Wind River watersheds, though some reach surveys have occurred in the Panther Creek watershed. Data generated by these reach surveys include stream width, stream gradient, counts of LWD, pools, and boulders, estimates of canopy closure, and riparian vegetation composition. These data allow comparison of geomorphic habitat conditions within and between streams.

Several stream sections had relatively high amounts of LWD (Table 4). Those streams with at least 6 pieces of LWD per 100 m that measure > 5 m in length and > 0.6 m in diameter include East Fork Trout Creek, Paradise Creek, reach 1 of Layout Creek, reach 5 of Dry Creek, and reach 2 of Trapper Creek (Appendix Figures 1, 2, and 3; Table 4). Reach 2 of Eightmile Creek has high densities of LWD (25.4 conifer pieces/100 m), however this is largely because of several large logjams at the base of landslide areas that resulted in an uneven distribution of LWD (Appendix Figure 3). The high density of LWD in reach 1 of Layout Creek is the result of LWD placement as part of a restoration project implemented by the Forest Service in 1996.

Temperature

The Wind River Restoration Project has a database of stream temperatures dating from December 1996. Our thermal coverage for the period 1997-2001 is for the Trout and Panther Creek watersheds with coverage expanded to the upper Wind River watershed during 2000-2001. We have year-round thermograph coverage, but we have limited our analyses to summer temperatures in this report.

A 16°C limit has been set by the Washington Department of Ecology as an indicator of stream health (Washington Department of Ecology, November 18 1997, Chapter 173-201A, Water Quality Standards for the Surface Waters of the State of Washington). During 1997-2001 we recorded water temperatures that met or exceeded 16°C at 25 sites in the Wind River subbasin (Table 5). There are six sites (Trout Creek at the 33 Road bridge, Crater Creek, Compass Creek, Trout Creek at the 43 Road bridge, upper Eightmile Creek, and lower Eightmile Creek) for which we have complete data for each summer during July-September 1997-2001; at each of these five sites the highest maximum temperature occurred in 1998 (Table 5). The highest maximum water temperature reading we have recorded was 23.2°C in Trout Creek just above Hemlock Lake (LTRO, Rkm 6.0) in 1998. During 2000 and 2001 we had thermograph sites operating at LTRO, below Hemlock Lake (HEML, Rkm 4.9), and at the mouth of Trout

Creek (BTRT, Rkm 0.2). During summer of 2000 and 2001, the HEML site was warmer than the LTRO site 1.1 km upstream, and we assume it was warmer in 1998 as well. The HEML location regularly met or exceeded 20°C: 6 days in 1999, 16 days in 2000, and 22 days in 2001. The BTRT location met or exceeded 20°C: 0 days in 1999, 11 days in 2000, and 20 days in 2001. The Trout Creek watershed has more severe high water-temperature events than the upper Wind River or Panther Creek watersheds.

The portion of the Wind River below the mouth of Trapper Creek frequently experiences temperatures that exceed 16°C. During summer 2001 we recorded 22 days that met or exceeded 16°C at the Wind River below the mouth of Trapper Creek (UWIN, Rkm 30.0), 40 days that met or exceeded 16°C at the Stabler site (MWIN, Rkm 18.5), and 38 days that met or exceeded 16°C at the Lower Wind site 2 (BWIN, Rkm 1.5) (Table 5, Figure 2). No thermograph site in the mainstem Wind River exceeded 20°C in 1999-2000.

Our two thermographs in mainstem Panther Creek did not record a temperature that met or exceeded 16°C during 1999-2001 (Table 5). Our thermograph site in lower Eightmile Creek regularly met or exceeded 16°C, with 31 days equal to or exceeding 16°C in 2000 and 37 days in 2001. No thermograph site in Panther Creek or its tributaries exceeded 20°C in 1999-2001 (Table 5).

The locations that experienced the lowest maximum summer temperatures in 2001 were upper Trout Creek and upper Panther Creek with maximum readings of 7.8 and 10.2°C. The lower mine reach site (LMIN, Rkm 36.5) in the mainstem Wind River had cooler temperatures than sites above or below it in 2000 and 2001 (e.g., August 2000 maximum temperatures: LMIN 12.7°C, site above 16.5°C, site below 14.9°C) (Table 5; Figures 2 and 3; Appendix Tables 2 and 3).

Investigating rate of temperature change between our thermograph sites helped us identify areas prone to warming. The mainstem Wind River warmed little in the 16 km between just below Falls Creek (WIBF, Rkm 34.5) and Stabler (MWIN Rkm 18.5) (Figure 3). The rate of change of mean temperature during August between UWIN at Rkm 30.0 and MWIN at Rkm 18.5 during 2000 and 2001 was 0 and –0.1°C/km throughout the 11.5 km section (Figure 4). Some warming did occur between MWIN and the mouth of the Wind River (BWIN Rkm 1.5), but the rate of warming is low: less than

0.5°C/km throughout the 10 km section for 1999, 2000, and 2001 (Figure 4). Temperatures in the lower 7 km of the mainstem Wind River are likely moderated by Panther Creek (Figure 3). The highest rate of warming that we recorded on the mainstem Wind River occurred during 2001 between LMIN at Rkm 36.5 and WIBF at Rkm 34.5 (Figure 4), but we believe that the thermograph at LMIN may be located where groundwater input is occurring. The LMIN site is at the lower end of a long alluvial reach and just above a bedrock section of streambed that may force cool hyporheic flow to the surface (Baxter et al. 1999, Stanford and Ward 1993).

In addition to minimum and maximum temperature and rate of warming, we investigated diel temperature range. The greatest diel temperature range in the mainstem Wind River on the year's hottest day occurred at the MWIN site at Rkm 18.5 in 2000 and 2001 (Figure 5). Mean temperature for the year's hottest day at the BWIN site at Rkm 1.5 was slightly higher than UWIN at Rkm 30.0 and MWIN, however, the diel range at BWIN was less than the diel range at the upstream sites of UWIN and MWIN in 2000 and 2001 (mean diel range in °C for the years hottest day: UWIN 3.3, MWIN 5.6, BWIN 2.5) (Figure 5).

Mainstem Trout Creek warmed considerably between the 33 Road Bridge (MS33, Rkm 14.4) and 3.4 km downstream at the 43 Road Bridge (MS43, Rkm 11.0) (Figure 6 and 7). Trout Creek continued to warm between MS43 and our site below Hemlock Dam (HEML, Rkm 4.9). A similar pattern of warming was observed for all summers, 1998-2001 (Figures 7 and 8). The rate of warming (°C/km) of mean August temperature during 1998-2001 was 1.3, 1.1, 1.3, and 1.8°C/km from MS33 to the site at the upper old growth channel (UOLG, Rkm 12.2) (Figure 8). The highest rate of warming that we have recorded on Trout Creek was between UOLG and LOLG at Rkm 11.6 at 2.5°C/km mean August 2000 temperature (Figure 8). During August 2001 the rate of warming between UOLG and LOLG was lower than the sections MS33 to UOLG and LOLG to MS43 (Figure 8). A consistently high rate of warming occurred from LTRO to HEML. The HEML site had the highest temperature reading on Trout Creek in all years monitored (1999-2001). During 1999, 2000, and 2001, the water appears to have slightly cooled or remained stable between HEML at Rkm 4.9 and the BTRT site 4.7 km downstream (Table 5; Figure 6 and 7; Appendix Tables 1, 2, 3).

The Trout Creek sites UPOG, MS43, and LTRO not only reach high temperatures, they also experience a large diel range (Figure 9). The MS43 site experienced the largest diel fluctuations (mean diel range 5.9^{o}C on the years hottest day for 1997 to 2001). Although LTRO at Rkm 6.0 has warmer maximum temperatures than MS43 at Rkm 11.0 the diel range narrowed at LTRO (Figure 9) concurrent with Trout Creek passing from an area of high solar exposure to a shaded canyon reach. The HEML site at Rkm 4.9 had the warmest mean temperatures in Trout Creek but had a diel range smaller than the upstream sites UOLG, LOLG, MS43, and LTRO (Figure 9). Maximum temperatures and diel range declined slightly between HEML and BTRT at Rkm 0.2.

In contrast to Trout Creek, the mainstem of Panther Creek warms little in the 8 km between the upper (UPAN, Rkm 12) and lower (LPAN, Rkm 4) thermographs. In 1999 maximum temperature at the upper site was 9.3^{o}C while the lower Panther site was 13.5^{o}C (Table 5), and similar results were found in 2000 and 2001. Eightmile Creek warms considerably between the upper (UEIG, Rkm 0.8) and lower (LEIG, Rkm 0.2) thermograph sites. In 1999 lower Eightmile Creek (LEIG) had 32 days with temperature $\geq$ 16^{o}C with a maximum temperature of 17.8^{o}C while upper Eightmile Creek (UEIG) had no days $\geq$ 16^{o}C with a maximum temperature of 14.9^{o}C. Similar results were found in 2000 and 2001. The UEIG site is within a shaded reach, while the LEIG site is within a highly exposed reach. The LEIG site is in an area that experienced a debris flow in February 1996, which removed much of the riparian vegetation.

Flow

The Pacific Northwest experienced a drought in 2001. Flow measurements taken by CRRL personnel in the Wind River subbasin reflect an earlier drop to base flow conditions with slight change in base flow from previous years (Figures 10 - 16). Base flow was lower in the Wind River below Trapper Creek during 2001 than in 2000 (Figure 10). Most of our flow sites are on small tributaries (< 2 cfs at base flow) and it is possible that our measurements are not sensitive enough to pick up the small differences at such low-flow levels.

Upper Trout Creek consistently had the most stable flow from early July to late September, with a surface flow reduction of less than 75% during the years that we have complete flow data for Trout Creek (1996, 1998, 1999, and 2001). All other streams showed a surface flow reduction of over 90% from early July to late September. Upper Trout Creek is fed by a series of large springs that originate in a lava flow at the head of the drainage and that maintain more stable summer flows than other streams in the basin. Dry Creek has lost all surface flow in its lower reach by early September during the three years we have monitored it (1999, 2000, and 2001). Residual pools in Dry Creek were completely lost before surface flow resumed. Juvenile salmonids had been present in some of these pools. During 1999, Martha Creek lost all surface flow at our flow site by early September. Residual pools contained juvenile steelhead in Martha Creek in 1999, but pools were maintained through the summer. Both Dry and Martha creeks maintained surface flow upstream of the areas that became dry. Martha Creek had surface flow approximately 400 m above our flow site; it is unknown how far below the flow site the lack of surface flow continued because the stream flows onto private land that was not surveyed. Surface flow in Dry Creek resumed about 2,000 m above our flow site. Flow measurements taken on mainstem Trout Creek on 10 October 2001 were lower at the site above Hemlock Lake (4.8 cfs) than the site 43 Bridge site 5 Rkm upstream (6.5 cfs).

Discussion

Reach surveys provide data on geomorphic characteristics and overall stream-habitat conditions that allow comparison within and between streams. We have found the highest densities of KEY pieces of LWD (> 5 m in length and > 0.6 m in diameter) in East Fork Trout Creek, Paradise Creek, reach 5 of Dry Creek, and reach 2 of Trapper Creek. These streams flow through areas of old-growth forest where recruitment of the largest pieces of LWD occurs. Reach 1 of Trapper Creek also flows through old-growth forest, but has little wood in this reach, possibly as a result of stream clean-out (pers. comm. Brian Bair, U.S. Forest Service). The two reaches of Trapper Creek will provide an interesting comparison for future data analysis. Falls Creek also flows through a portion of old-growth forest but has low densities of KEY pieces of LWD (1.9 pieces/100 m) (Figure 4). The lack of wood in Falls Creek is probably due to its high gradient

(4.8%) and potentially high peak flows that may flush wood through its largely bedrock canyon. The lower four reaches of Dry Creek flow through an area where much timber was harvested in the 1930's and 1940's, these areas are now considered late-successional stands and they have not yet reached historic levels of LWD recruitment. Some of the riparian area along Dry Creek has grown to be dominated by hardwood species. Reach 3 of Dry Creek and Big Hollow Creek, a tributary of Dry Creek, have the highest densities of hardwood LWD (7.4 and 9.6 pieces/100 m) we have encountered in the Wind River subbasin (Table 4, Appendix Figure 1). Paired with fish data and corresponding unit-scale habitat information, reach surveys provide an indication of which streams show healthy reach-scale habitat conditions, such as high levels of LWD. These healthy reaches can serve as index sites for restoration efforts on other reaches.

The Forest Service has completed several stream-habitat restoration projects in the Wind River subbasin during the past 6 years. During summer 2001, the Forest Service completed a restoration project on Dry Creek in which they added much LWD. The Dry Creek project was completed after our reach survey. Reach 1 of Layout Creek has a high density of LWD (6.0 KEY pieces/100 m) as a result of habitat restoration by the Forest Service in 1996. Our fish and habitat sampling efforts, and those of others involved in the Wind River Restoration Project, will help track effects and success or failure of these restoration efforts.

Our approach to reach survey data and the relationships therein is conceptually similar to the hierarchical (microhabitat and mesohabitat) approach to fish-habitat relationships advocated by Rabeni and Sowa (1995). Future sampling and analyses should begin to provide clues on the habitat conditions most productive for steelhead in the Wind River subbasin.

Water temperature in the Wind River subbasin has been a major focus of CRRL personnel. The Trout Creek watershed is of particular concern as temperatures often exceed the preferred range for steelhead of 10-13^{o}C (Bell 1986). We have recorded temperatures in the lower portion of Trout Creek near the lethal level for steelhead of 23.9^{o}C (Bell 1986). The 8.4 km section of Trout Creek from the MS33 site to the LTRO site has been heavily logged in the past. Warming along the sections MS33 to UOLG and LOLG to MS43 is most likely due to solar exposure in a largely unshaded area. The old growth channel section of Trout Creek is well shaded and has seen restoration efforts by the Forest Service including an increase in flow directed through the channel. Input of warm tributaries between MS33 and MS43 likely contributes to warming in this section but these tributaries generally have very low flow (< 2 cfs) during the period of maximum temperatures. Our thermograph network will document changes in stream temperature as restoration projects and reforestation occur in the MS33 to MS43 section of Trout Creek. At present this area of Trout Creek is subject to a large diel temperature range that could be stressful to fish. The lack of warming between HEML at Rkm 4.9 and BTRT at Rkm 0.2 may be a result of groundwater that enters the creek in the bedrock canyon section above the mouth, but this has not been verified.

There is a springtime downstream migration of parr in Trout Creek (Rawding 1999), which may rear in the lower portion of the creek. The Wind River and Panther Creek also have a downstream parr migration during the spring. Thermal conditions appear more favorable to fish in the lower reaches of the Wind River and Panther Creek than in Trout Creek. Small changes in the temperature regime of a stream can affect fish life history, physiology, and behavior. Life stages from developing embryos to spawning adults can be affected (Spence et al. 1996; Beacham and Murray 1990; Hotlby 1988; Monan et al. 1975).

Eightmile Creek experienced a large increase in temperature between our upper and lower thermograph sites in all years monitored (Table 5). In 1996 a landslide originated out of a tributary gully and scoured the lower 500 m of the stream. The debris flow removed much of the riparian vegetation and left the stream open to direct solar heating. Our thermographs will track changes in water temperature as the riparian area along lower Eightmile Creek recovers from the debris flow event.

The sites with the lowest maximum water temperatures in the Wind River subbasin are upper Trout Creek and upper Panther Creek (Tables 4 and 5). In contrast to Trout Creek, which warmed greatly between our upper and lower thermograph sites (UTRO at Rkm 15.2 and BTRO at Rkm 0.2), Panther Creek stayed cool between our upper and lower thermograph sites (UPAN at Rkm 12.0 and LPAN at Rkm 4.0). Maximum temperature in August of 2001 was 7.8^{o}C at UTRO and 22.9^{o}C at BTRO: 9.9^{o}C at UPAN and 15.4^{o}C at LPAN. Panther Creek may help to moderate temperatures in the lower Wind River during the period when adult summer steelhead enter and hold in the lower river.

Higher flows during the early and mid-summer period in 1999 may have helped to moderate water temperatures. Maximum water temperatures in 1999 were lower than 1997, 1998, and 2000 at most locations. We saw higher water temperatures at many sites in 2001, possibly as a result of low-flow conditions. An exception to the higher water temperatures in summer 2001 was at the LMIN site at Rkm 36.5 on the mainstem Wind River. Mean water temperature during August at the LMIN site was lower and the diel range much less in 2001 than in 2000 (Figures 2, 3, and 5). The cooler temperatures at LMIN during the lower flow of 2001 (Figure 10) may be the result of hyporheic input cooling the surface water at that site. It is possible that the low flow conditions in 2001 resulted in a higher proportion of hyporheic flow that may have been forced to the surface by the bedrock present at LMIN. In late August 2001, a sharp but brief rise in water temperature occurred at the LMIN site (Figure 2). Correspondingly, a sharp but brief decline in water temperature occurred at other sites on the Wind River. Heavy rain that occurred at that time may have caused a drop in temperature of the surface water while increasing the proportion of surface to hyporheic flow, lessening the cooling impact of hyporheic flow at the LMIN site. We hope to further investigate the interaction of surface and hyporheic flow with flow data and an additional thermograph just downstream of the LMIN site. During summer 2002, CRRL personnel will deploy a thermograph in the bedrock area just downstream of the LMIN site as a comparison site where water will likely have mixed.

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Table 1. Locations of thermographs in the Wind River subbasin maintained by U.S. Geological Survey's Columbia River Research Laboratory, 1996-2001. Sites are listed from upstream to downstream within a watershed. Coordinates were obtained from a hand-held Global Positioning System using North American Datum 1927. The word "present" indicates that the thermograph was recording data as of October 2001.

Watershed Subwatershed Subdrainage	Coordinates North	 West	Elevation (ft)	Distance upstream from mouth (km)	Date start (mm/yy)	Date end (mm/yy)
Trout Creek						
Trout Cr. – upper	45º 50.798'	122º 01.962'	1,920	15.2	12/96	10/98
					6/01	present
Crater Cr.	45º 50.769'	122º 01.997'	1,920	0.1	12/96	10/99
					6/00[a]	present
Trout Cr. – 33 bridge	45º 50.727'	122º 01.987'	1,900	14.4	12/96[b]	present
Compass Cr.	45º 50.427'	122º 02.051'	1,900	0.2	12/96	present
East Fork Trout Cr.	RNO[c]		1,860	0.2	5/99	present
Trout Cr. – upper OG[d]	45º 49.867'	122º 01.428'	1,835	12.2	11/97	6/00
					7/00	present
Upper Layout Cr.	RNO		1,930	2.9	5/99	present
Layout Cr.	45º 49.776'	122º 01.525'	1,830	0.1	11/97[e]	10/99
					8/00	present
Trout Cr. – lower OG	45º 49.656'	122º 01.278'	1,810	11.6	11/97[f]	present
Trout Cr. – 43 bridge	45º 49.320'	122º 00.894'	1,805	11.0	08/97[g]	present
Planting Cr.	45º 48.972'	121º 59.436'	1,730	0.2	05/97[g]	10/99
					06/01	present
Trout Cr. – above Hemlock	RNO[b]		1,120	6.0	11/98[g,h,i]	present
Trout Cr. – below Hemlock	45º 48.126'	121º 55.810'	1,080	4.9	10/98	present
Upper Martha Cr.	RNO		1,130	1.8	5/99	present
Martha Cr.	45º 47.737'	121º 55.342'	1,080	1.0	10/97[g,j]	present

Continued.

Table 1. Continued.

Watershed Subwatershed Subdrainage	Coordinates North	 West	Elevation (ft)	Distance upstream from mouth (km)	Date start (mm/yy)	Date end (mm/yy)
Upper Wind River						
Wind R. – ab. Paradise Cr.	45º 57.047'	121º 55.815'	1,560	40.9	7/00	present
Paradise Cr.	45º 57.149'	121º 56.400'	1,550	1.0	10/98[g]	present
Wind R – lower mining	45º 54.793'	121º 56.926'	1,360	36.5	7/00	present
Falls Cr.	45º 54.486'	121º 56.844'	1,340	0.1	7/00	present
Ninemile Cr.	45º 53.651'	121º 56.752'	1,300	0.2	6/00	present
Dry Cr. – 1	45º 54.127'	121º 57.874'	1,190	1.5	5/99[g]	6/00
Dry Cr. – 2	RNO		1.250	3.3	6/00	present
Trapper Cr.	45º 53.431'	122º 00.593'	1,360	1.5	10/98	present
Wind R. – bl Trapper Cr.	45º 52.501'	121º 58.629'	1,090	30.0	10/98[g,k]	present
Panther Creek						
Panther Cr. – upper	45º 50.573'	121º 51.567'	1,070	12.0	10/98	present
Eightmile Cr. – upper	RNO		1,090	0.6	07/97	present
Eightmile Cr. – lower	45º 50.393'	121º 52.069'	1,030	0.2	07/97[g]	present
Cedar Cr.	45º 48.176'	121º 51.404'	940	1.2	05/97	12/99
Panther Cr. – lower 1	RNO		730	4.0	07/97	09/97
Panther Cr. – lower 2	RNO		730	4.0	11/98	present

[a] No data from 10/4/99-6/15/00 because of thermograph loss.
[b] No data from 10/7/98-6/17/99 because of thermograph failure.
[c] RNO = Reading not obtainable.
[d] OG = Restored old-growth channel.
[e] No data from 10/4/99-7/28/00 because of thermograph loss.
[f] No data from 4/22/98-10/19/98 because of thermograph failure.
[g] Exposed to air during low water in September-October 1999.
[h] Data for 11/96-5/97 are available from the US Forest Service.
[i] No data from 10/18/99-6/16/00 because of thermograph failure.
[j] No data from 2/7/99-6/17/99 because of thermograph failure.
[k] No data from 2/1/99-8/13/99 because of thermograph failure.

Table 2. Locations of thermographs deployed and maintained by Underwood Conservation District within the Wind River subbasin during summer 1999, 2000, and 2001. Sites are listed from upstream to downstream within a subbasin. No GPS readings are available at the time of writing.

Watershed Subwatershed Subdrainage	Elevation (ft)	Distance upstream from mouth (km)	Date start (mm/yy)	Date end (mm/yy)
Upper Wind River				
Wind R. – blw. Falls Cr.	1,250	33.5	6/99	10/99
			6/00	11/00
			6/01	11/01
Trapper Cr. at mouth	1,015	0.3	6/99	10/99
			6/00	11/00
			6/01	11/01
Middle Wind River				
Wind R. – at Stabler Bridge	890	18.5	6/99	10/99
			6/00	11/00
			6/01	11/01
Trout Creek				
Trout Cr. – blw. Martha Cr.	865	0.2	6/99	10/99
			6/00	11/00
			6/01	11/01
Lower Wind River				
Bear Cr.	317	2.4	6/99	10/99
			6/00	11/00
			6/01	11/01
Little Wind River	85	0.2	6/99	10/99
			6/00	11/00
			6/01	11/01
Lower Wind River	80	1.5	6/99	10/99
			6/00	11/00
			6/01	11/01

Table 3. Flow measurement locations within the Wind River subbasin, 1996-2001. Coordinates are from a hand-held Global Positioning System (GPS) using North American Datum 1927. Sites are listed from upstream to downstream within a subbasin.

Watershed Subwatershed	GPS reading North	GPS reading West	Elevation (ft)	Distance upstream of mouth (km)	Year sampled[a] 1996	1997	1998	1999	2000	2001
Upper Wind River[b]										
Wind R. – ab. Paradise Cr.	45º 57.047'	121º 55.815'	1,560	40.6	No	No	No	No	Yes	Yes
Paradise Cr.	45º 56.951'	121º 56.957'	1,550	0.5	No	No	Yes	Yes	Yes	Yes
Falls Cr.	45º 54.534'	121º 56.772'	1,340	0.1	No	No	No	No	Yes	Yes
Ninemile Cr.	45º 53.651'	121º 56.752'	1,300	0.2	No	No	No	No	Yes	Yes
Dry Cr. – upper	RNO		1,190	1.5	No	No	No	Yes	Yes	Yes
Dry Cr. – lower	45º 54.127'	121º 57.874'	1,120	0.1	No	No	No	Yes	Yes	Yes
Trapper Cr.	45º 52.761'	121º 58.849'	1,120	0.1	No	No	Yes	Yes	Yes	Yes
Wind R. – bl. Trapper Cr.	45º 52.581'	121º 58.682'	1,090	30.3	No	No	No	No	Yes	Yes
Trout Creek[d]										
Trout Cr. – upper	45º 50.794'	122º 01.961'	1,920	15.2	Yes	Yes	Yes	Yes	Yes	Yes
Crater Cr.	45º 50.779'	122º 01.036'	1,920	0.1	Yes	Yes	Yes	Yes	Yes	Yes
Compass Cr.	45º 50.427'	122º 02.051'	1,900	0.2	No	No	No	No	No	Yes
East Fork Trout Cr.	RNO		1,860	0.2	No	No	No	No	No	Yes
Layout Cr. – upper	RNO		1,940	2.5	No	No	Yes	Yes	No	Yes
Layout Cr. – lower	45º 49.776'	122º 01.525'	1,830	0.1	No	No	No	Yes	Yes	Yes
MS43 Bridge	45º 49.434'	122º 00.978'	1,805	11.3	No	No	No	No	Yes	Yes
Planting Cr.	45º 48.972'	121º 59.436'	1,730	0.1	No	Yes	Yes	No	No	Yes
Trout Cr. – lower	RNO		1,120	6.0	No	No	No	No	No	Yes
Martha Cr.	45º 47.767'	121º 55.255'	1,070	1.0	No	Yes	Yes	Yes	No	No
Panther Creek										
Mouse Cr.	RNO		1,080	0.1	Yes	No	No	No	No	No
Eightmile Cr. – lower	45º 50.393'	121º 52.069'	1,020	0.1	No	Yes	Yes	No	No	No
Cedar Cr.	45º 48.176'	121º 51.404'	940	1.2	Yes	Yes	No	No	No	No
Panther Cr. – lower	RNO		1,010	4.0	Yes	No	No	No	No	No

[a] Flows generally taken at regular intervals of time from June through October.
[b] In addition, a flow reading was taken on the mainstem Wind River above Paradise Cr. and below Trapper Cr. on 10/6/99.
[c] RNO = Reading not obtainable by GPS because of topography of basin.
[d] Trout Cr. 2000 flows were measured only once on 10/13/00.

Table 4. Reach survey data for streams within the Wind River subbasin, 1996-2001. Sites are listed from upstream to downstream within a subbasin. -- denotes no data available.

Watershed Subwatershed Subdrainage	Rosgen (1994) channel type	Accessible length (m)	Surveyed length (m) Start –End	Surveyed length (m) Length	Mean width (m)	Survey date (mm/yy)	Number per 100 m in reach length[a] Pools	Boulders	CLW	HLW	KEY	Stream gradient (%)
Wind River												
Upper Wind River (above PARA)	B	4800	40000-44800	4800	8.3	07/00	3.1	92.8	5.6	1.1	3.8	3.2
Paradise Cr.[b]	B	3900	0-3900	3900	7.0	07/99	3.5	52.7	15.2	3.5	6.2	2.4[c]
Falls Cr.	A,B	2700	0-2700	2700	8.1	07/00	3.7	93.4	3.4	0.2	1.9	4.8
Nine Mile Cr.	A,B	3700	0-3700	3700	4.7	06/00	4.7	62.7	4.5	1.9	3.0	3.4
Dry Cr.		7500	0-7500	7500		06/99						
Reach 1[b]	C		0-1200	1200	11.0	06/99	1.9	4.0	5.1	1.9	1.0	0.8[c]
Reach 2[b]	B		1200-2500	1300	8.9	06/99	2.7	--	2.4	0.2	1.1	2.4[c]
Reach 3[b]	C		2500-5900	3400	11.6	06/99	2.4	--	3.4	7.4	2.0	1.2[c]
Reach 4[b]	B		5900-6120	220	8.5	06/99	2.7	5.0	5.0	6.4	3.2	2.6[c]
Reach 5[b]	B,A		6120-7500	1380	7.3	06/99	4.3	15.0	16.0	3.1	7.1	2.0[c]
Big Hollow Cr.[b,d]		3000[e]	0-1000	1000								
Survey1	B		0-500	500	6.2	06/98	3.4	35.0	16.8	9.6	5.8	2.1
Survey 2	B		0-1000	1000	6.9	06/99	3.9	35.0	9.0	5.7	3.3	
Trapper Cr.[b]		6000[e]	0-4300	4300								
Reach 1	B,A,,D		0-2800	2800	9.9	07/00	3.0	--	1.0	2.0	1.8	2.7
Reach 2	B,A,,D		2800-4300	1500	6.9	08/99	4.7	115.7	16.7	1.7	6.8	4.0

Continued.

Table 4. Continued.

Watershed Subwatershed Subdrainage	Rosgen (1994) channel type	Accessible length (m)	Surveyed length (m) Start – End	Surveyed length (m) Length	Mean width (m)	Survey date (mm/yy)	Number per 100 m in reach length[a] Pools	Boulders	CLW	HLW	KEY	Stream gradient (%)
Trout Creek		13897										
Reach 1	B		0-2897	2897		06/95						
Reach 2 [c]	B,C		2897-3771	874		06/95	1.2					3.0
Reach 3 [c]	B,C		3771-4382	669		06/95	0.6					2.0
Reach 4 [c]	B		4382-5727	1392		06/95	1.1					4.0
Reach 5 [c]	B,C		5727-10319	4592		06/95	1.4					2.0
Reach 6 [c]	C,F		10319-13897	3678		06/95	1.5					1.0
Upper Trout (above Crater Cr.)[b,e]	C,B,A	2500 [e]	13897-14897	1000	5.8	06/96	3.6	8.0	16.2	0.2	4.9	2.2
Crater Cr [b]	C,B	3000 [e]	0-2600	2600	4.7	07/99	5.2	32.0	16.1	2.1	4.9	3.4
Compass Cr .[b,e]		3600										
Reach 1, Survey 1	B		0-500	500	4.2	06/96	5.4	0.0	14.2	0.6	1.2	1.5
Reach 1, Survey 2	B		0-1400	1400	4.4	07/01	3.6	2.5	3.6	0.7	1.6	1.7
Reach 2	B		1400-3400	2000	4.2	07/01	2.0	38.5	4.9	0.5	2.1	3.7
East Fork Trout Cr. [b,e]		3500 [e]										
Survey 1	B		0-540	540	4.7	07/96	4.3	7.0	31.6	0.0	1.6	1.0
Survey 2	B		0-1000	1000	4.2	07/01	4.2	2.6	17.1	1.3	6.7	0.7
Layout Cr		4500 [e]	0-4000	4000								
Reach 1[b,e]	C,B		0-2840	2840	6.4	07/99	3.4	0.0	19.3	1.5	6.0	1.8
Reach 2 [b]	B		2840-4000	1160	4.3	07/99	4.1	4.0	9.8	1.6	3.7	3.1
North Fork Layout Cr. [b,e]	B	800	0-800	800	4.1	07/99	4.0	23.0	8.1	3.3	1.4	4.0
Planting Cr. [b,e]		2000 [e]										
Survey 1	B		0-1000	1000	4.3	06/96	5.4	147.0	13.9	1.8	1.5	3.7
Survey 2	B		0-1680	1680	4.2	07/01	4.4	108.8	3.2	0.7	0.8	4.4
Martha Cr.[b]	B,A	3352	1052-3352	2300	3.6	07/98	4.2	43.0	6.4	4.1	1.9	2.6

Continued.

Table 4. Continued.

Watershed Subwatershed Subdrainage	Rosgen (1994) channel type	Accessible length (m)	Surveyed length (m) Start – End	Surveyed length (m) Length	Mean width (m)	Survey date (mm/yy)	Number per 100 m in reach length[a] Pools	Boulders	CLW	HLW	KEY	Stream gradient (%)
Panther Creek												
Mouse Cr[b].	B	2500 [e]	0-800	800	4.6	06/96	7.8	288.0	16.8	0.5	0.5	6.9
Eightmile Cr.[b]	B	3500 [e]	0-1080	1080								
Reach 1[e]	B		0-580	580	4.2	06/96	4.5	297.0	13.4	2.8	1.2	3.6
Reach 2[e]	B		580-1080	500	4.3	06/96	3.8	113.0	25.4	0.8	1.2	2.7
Cedar Cr.[b,e]	B	2000 [e]	1000-2000	1000	4.6	07/96	3.9	173.0	10.9	3.6	0.6	3.4

[a] CLW = Conifer large woody debris ≥1 m length and ≥ 0.3 m diameter; HLW = Hardwood large woody debris ≥ 1 m length and ≥ 0.3 m diameter; KEY = "Key pieces" Conifer and Hardwood large woody debris ≥ 5 m length and ≥ 0.6 m diameter.
[b] Data from USGS habitat survey.
[c] Data from USFS habitat survey.
[d] During winter 98/99 Big Hollow Cr. shifted into a new channel just above it's confluence with Bourbon Cr. As of this date, Big Hollow and Bourbon flow into Dry Cr. separately. The 500 m of Big Hollow surveyed in 1998 is now Bourbon Cr.
[e] Assessed from USGS 1:24,000 quad maps.

Table 5. Annual number of days when maximum water temperature exceeded 16°C and 20°C and the maximum water temperature recorded at sites in the Wind River subbasin, 1997-2001. Data are from Onset Corporation's StowAway thermographs, which recorded temperature every two hours. Sites are listed from upstream to downstream within a subbasin.

Watershed / Subwatershed / Subdrainage	No. days >=16 °C					No. days >=20 °C					Maximum (°C)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Trout Creek															
Trout Cr. – upper	0	0	--- [a]	---	0	0	0	---	---	0	8.3	8.5	---	---	7.8
Crater Cr. Site 1	23	44	15	---	---	0	1	0	---	---	18.3	20.0	17.4	---	---
Crater Cr. Site 2[b]	---	---	---	22	11	---	---	---	0	0	---	---	---	18.4	17.8
Trout Cr. – 33 bridge	0	0	0	0	0	0	0	0	0	0	10.1	10.7	9.0	10.6	8.9
Compass Cr.	0	5	0	0	0	0	0	0	0	0	14.9	16.3	14.0	14.9	14.8
East Fork Trout Cr.	---	---	42	34	37	---	---	0	0	0	---	---	19.0	19.2	19.9
Trout Cr. – upper OG[c]	---	0	0	0	0	---	0	0	0	0	---	15.9	13.5	14.4	15.2
Upper Layout Cr.	---	---	0	0	0	---	---	0	0	0	---	---	14.0	14.6	15.4
Layout Cr. Site 1	---	56	23	---	---	---	0	0	---	---	---	19.6	17.4	---	---
Layout Cr. Site 2[d]	---	---	---	---	31	---	---	---	---	0	---	---	---	---	18.5
Trout Cr. – lower OG	---	---	1	0	0	---	---	0	0	0	---	---	16.1	15.8	15.9
Trout Cr. – 43 bridge	13	37	0	9	17	0	0	0	0	0	17.8	18.6	15.7	16.7	17.6
Planting Cr.	16	33	---	---	6	0	0	---	---	0	18.7	19.2	---	---	17.3
Trout Cr. – ab. Hemlock	---	74	---	48	56	---	23	---	11	9	---	23.2	---	21.3	21.8
Trout Cr. – blw. Hemlock	---	---	44	65	69	---	---	6	16	22	---	---	20.3	22.6	22.8
Upper Martha Cr.	---	---	22	11	11	---	---	0	0	0	---	---	17.0	16.7	17.3
Martha Cr.	---	62	45	45	62	---	5	0	0	0	---	21.2	18.7	19.8	19.7
Trout Cr. – at mouth[e]	---	---	37	55	75	---	---	0	11	20	---	---	18.7	21.0	22.9

Continued.

Table 5. Continued.

Watershed Subwatershed Subdrainage	No. days >=16 °C					No. days >=20 °C					Maximum (°C)				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
Upper Wind River															
Wind R. – ab. Paradise Cr.	---	---	---	3	---	---	---	---	0	---	---	---	---	16.8	---
Paradise Cr.	---	---	---	0	0	---	---	---	0	0	---	---	---	15.7	15.7
Wind R. – Lower Mine Reach	---	---	---	0	0	---	---	---	0	0	---	---	---	12.7	12.9
Wind R. – blw. Falls Cr.	---	---	0	0	6	---	---	0	0	0	---	---	14.1	15.6	17.1
Falls Cr.	---	---	---	0	1	---	---	---	0	0	---	---	---	14.3	16.3
Ninemile Cr.	---	---	---	0	0	---	---	---	0	0	---	---	---	13.7	14.6
Dry Cr.	---	---	---	0	1	---	---	---	0	0	---	---	---	15.2	16.1
Trapper Cr.	---	---	0	0	0	---	---	0	0	0	---	---	13.8	14.5	15.2
Trapper Cr. lower[e]	---	---	0	0	4	---	---	0	0	0	---	---	14.5	15.6	16.0
Wind R. – blw. Trapper Cr.	---	---	---	1	22	---	---	---	0	0	---	---	---	16.3	19.9
Middle Wind River															
Wind R. – at Stabler Bridge[e]	---	---	6	19	40	---	---	0	0	0	---	---	16.4	17.5	18.3
Panther Creek															
Panther Cr. – upper	---	---	0	0	0	---	---	0	0	0	---	---	9.3	9.3	10.2
Eightmile Cr. – upper	0	4	0	0	0	0	0	0	0	0	15.3	16.1	14.9	15.3	14.7
Eightmile Cr. – lower[f]	29	39	32	31	37	0	0	0	0	0	18.4	18.6	18.7	18.4	18.1
Cedar Cr.	0	10	0	---	---	0	0	0	---	---	15.8	16.9	15.6	---	---
Panther Cr. – lower	---	---	0	0	0	---	---	0	0	0	---	---	13.5	14.3	15.7
Lower Wind River															
Bear Cr.[e]	---	---	25	20	31	---	---	0	0	0	---	---	16.8	17.9	17.5
Little Wind River[e]	---	---	---	51	58	---	---	---	0	0	---	---	---	19.4	19.0
LowerWindRiver site 1[e]	---	---	---	18	44	---	---	---	0	0	---	---	---	17.5	19.4
Lower Wind River site 2[e]	---	---	---	17	38	---	---	---	0	0	---	---	---	17.1	17.9

[a] --- = Thermograph not in place or not operating properly during period of maximum temperatures.
[b] Thermograph was lost during winter 99/00, new site is about 25 m downstream, 30 m upstream of mouth.
[c] OG = Restored old-growth channel..
[d] Thermograph was lost during winter 99/00, new site is about 30 m downstream, 100 m upstream of mouth.
[e] Thermographs deployed and maintained by Underwood Conservation District from mid June to early October.
[f] No data for September 1999, thermograph was out of water.

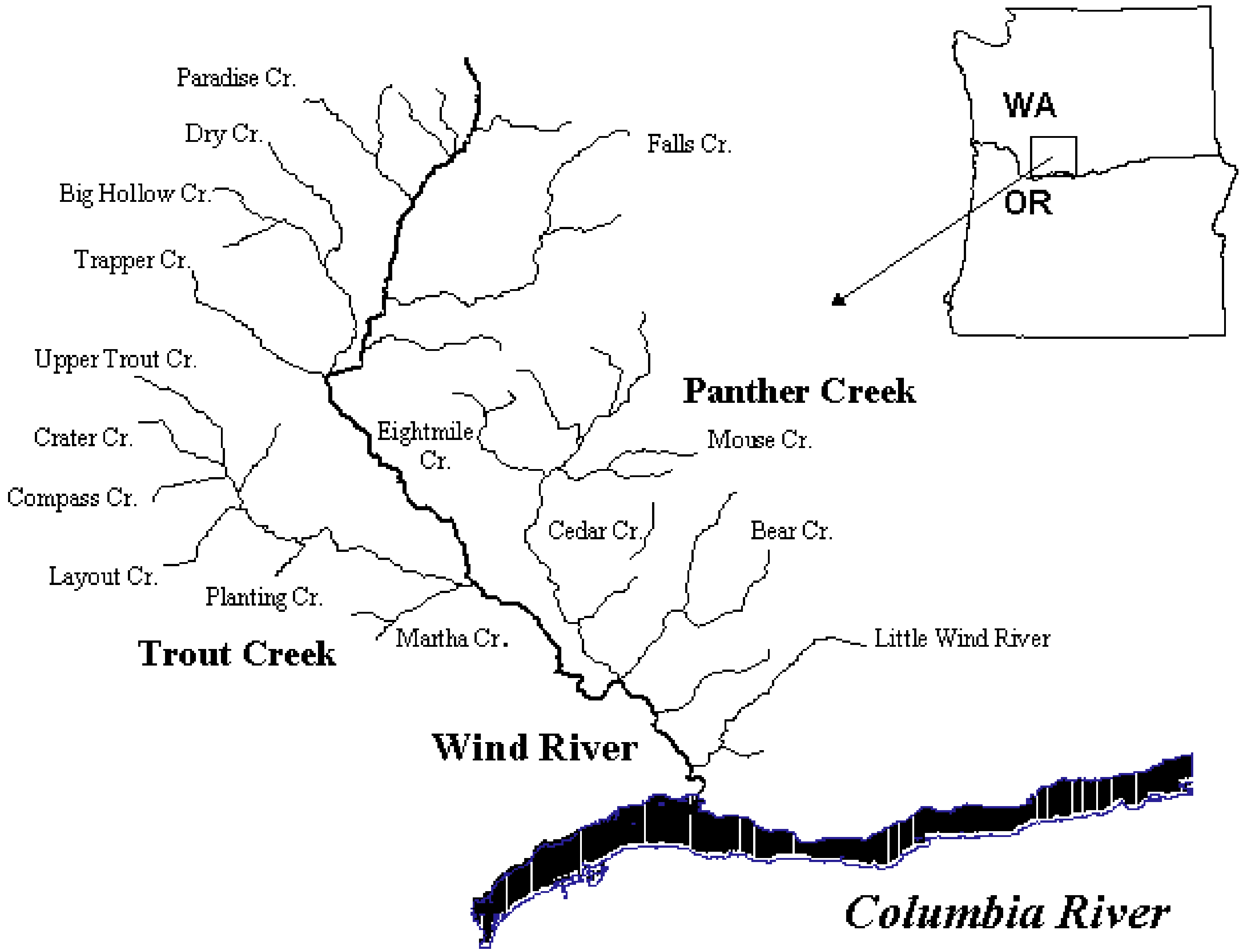


Figure 1. Wind River subbasin.

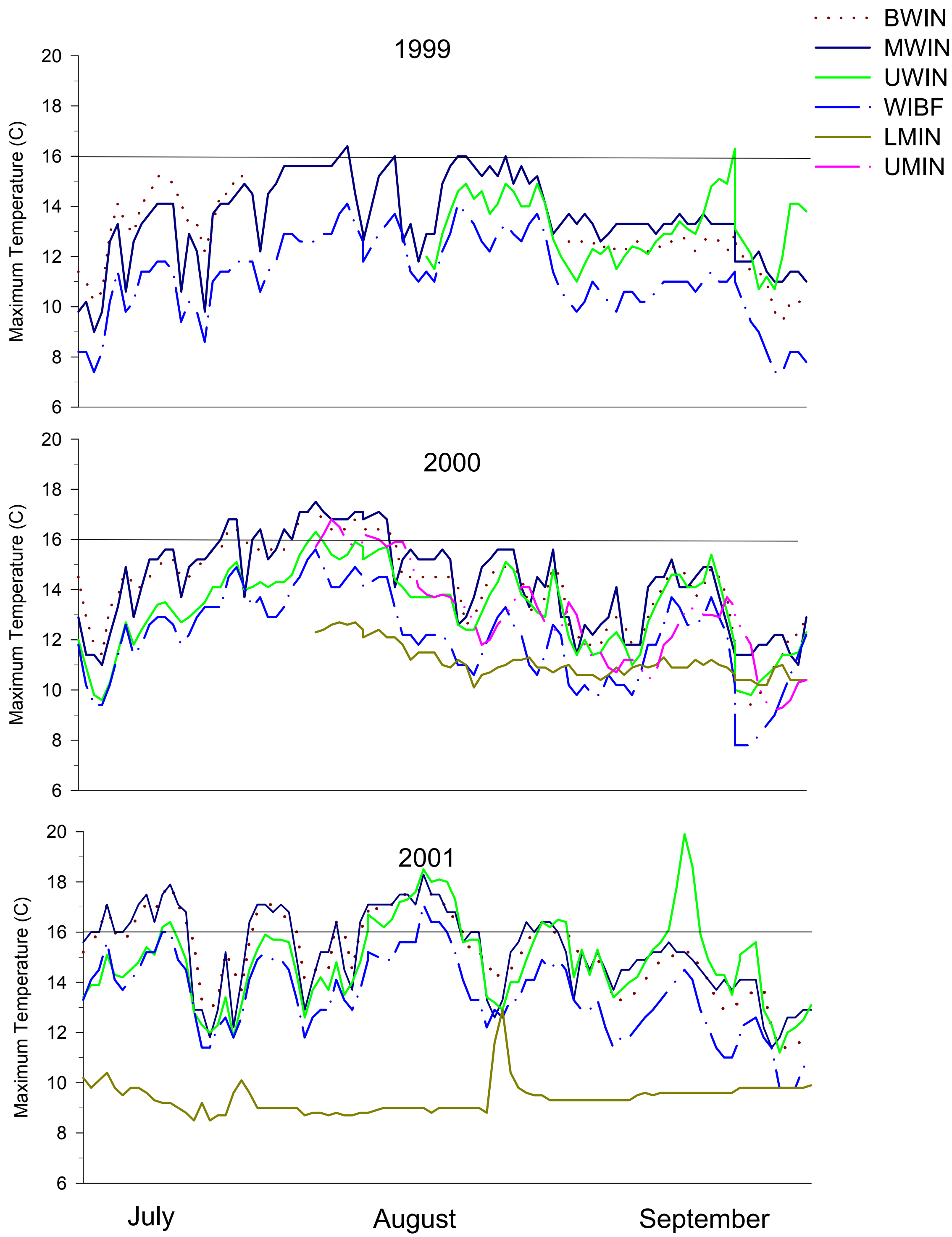


Figure 2. Daily maximum temperature at six sites in the mainstem Wind River for 1 July to 1 Oct. 2000 and 2001. Sites from downstream to upstream are, lower Wind at Rkm 1.5 (BWIN), Stabler Bridge at Rkm 18.5 (MWIN), 3065 Rd. Bridge at Rkm 30.0 (UWIN), downstream of Falls Creek at Rkm 33.5 (WIBF), lower mine reach at Rkm 36.5 (LMIN), and upper mine reach at Rkm 40.9 (UMIN). The line at 16°C marks the maximum surface water temperature standard set by the Washington Department of Ecology (Chapter 173-201A, Nov. 18 1997, Water Quality Standards for the Surface Waters of the State of Washington).

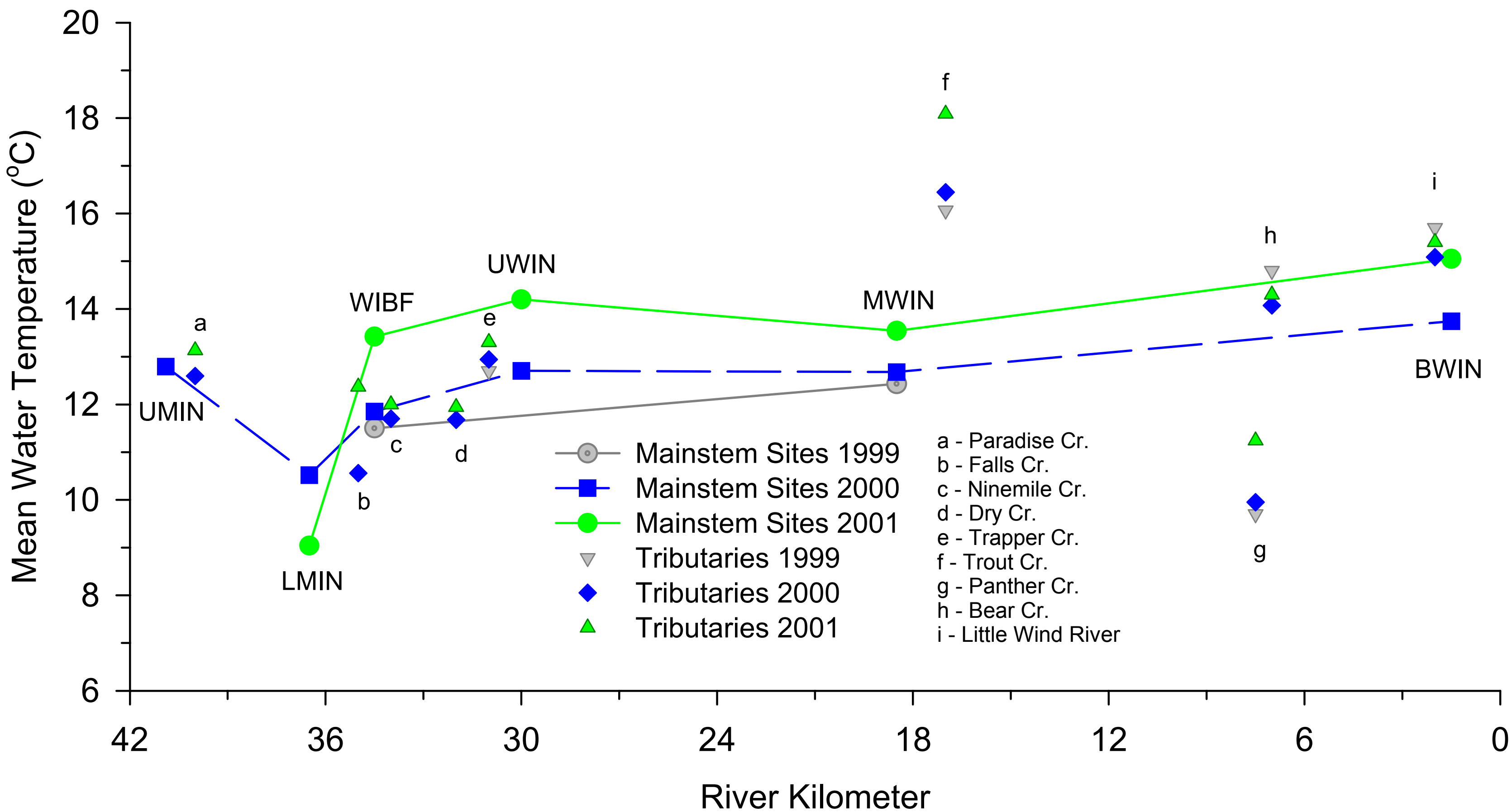


Figure 3. Mean water temperature during August 1999, 2000, and 2001 in mainstem Wind River and its tributaries. Sites, from left to right, are shown from upstream to downstream. River kilometer zero is the mouth of the Wind River. Mainstem sites are, upper mine reach at Rkm 40.9 (UMIN), lower mine reach at Rkm 36.5 (LMIN), below Falls Creek at Rkm 33.5 (WIBF), 3065 Rd. Bridge at Rkm 30.0 (UWIN), Stabler Bridge at Rkm 18.5 (MWIN), and the mouth of the Wind River at Rkm 1.5 (BWIN).

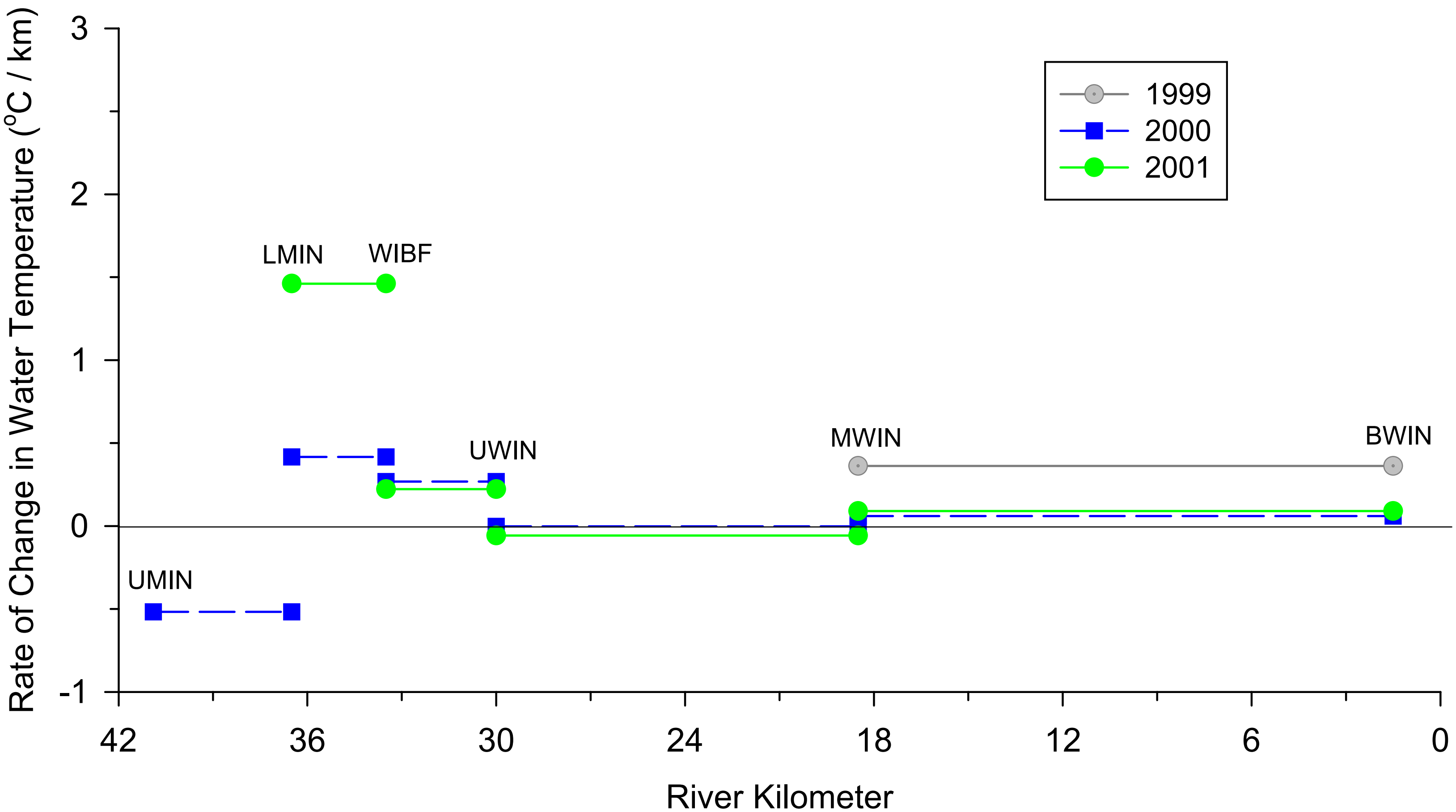


Figure 4. Rate of change (°C/km) of mean temperature for sections of the Wind River during August 1999, 2000, and 2001. River kilometer zero is the mouth of the Wind River. Sites are, upper mine reach at Rkm 40.9 (UMIN), lower mine reach at Rkm 36.5 (LMIN), below Falls Creek at Rkm 33.5 (WIBF), 3065 Rd. Bridge at Rkm 30.0 (UWIN), Stabler Bridge at Rkm 18.5 (MWIN), and the mouth of the Wind at Rkm 1.5 (BWIN).

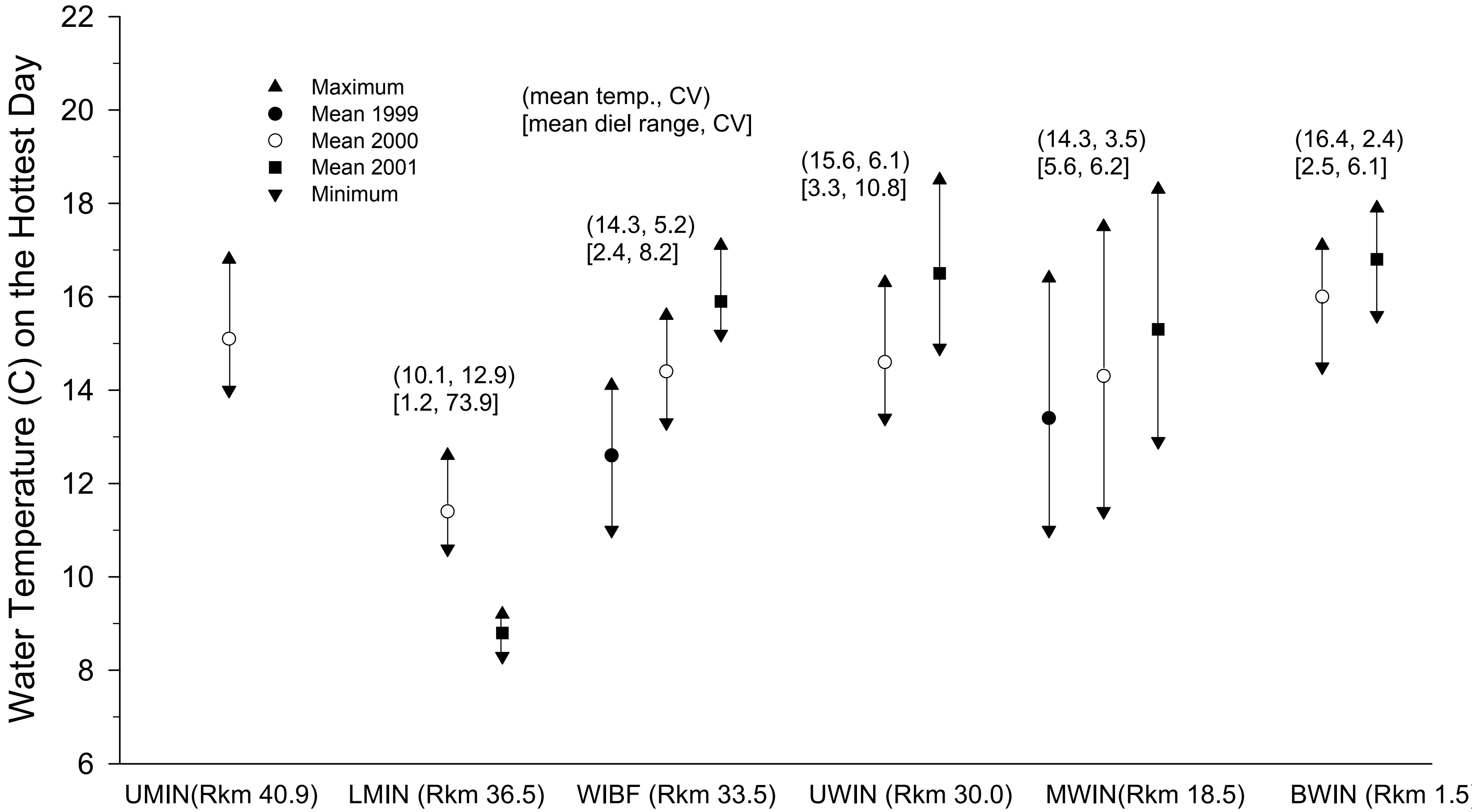


Figure 5. Mean and diel water temperature range for the year's hottest day at five sites in mainstem Wind River. Sites are, upper mine reach at Rkm 40.9 (UMIN), lower mine reach at Rkm 36.5 (LMIN), below Falls Creek at Rkm 33.5 (WIBF), 3065 Rd. Bridge at Rkm 30.0 (UWIN), Stabler Bridge at Rkm 18.5 (MWIN), lower Wind at Rkm 1.5 (BWIN). Dates chosen had the warmest single day water temperature at the WIBF site with the years 1999 (August 4), 2000 (July 31), and 2001 (August 13).

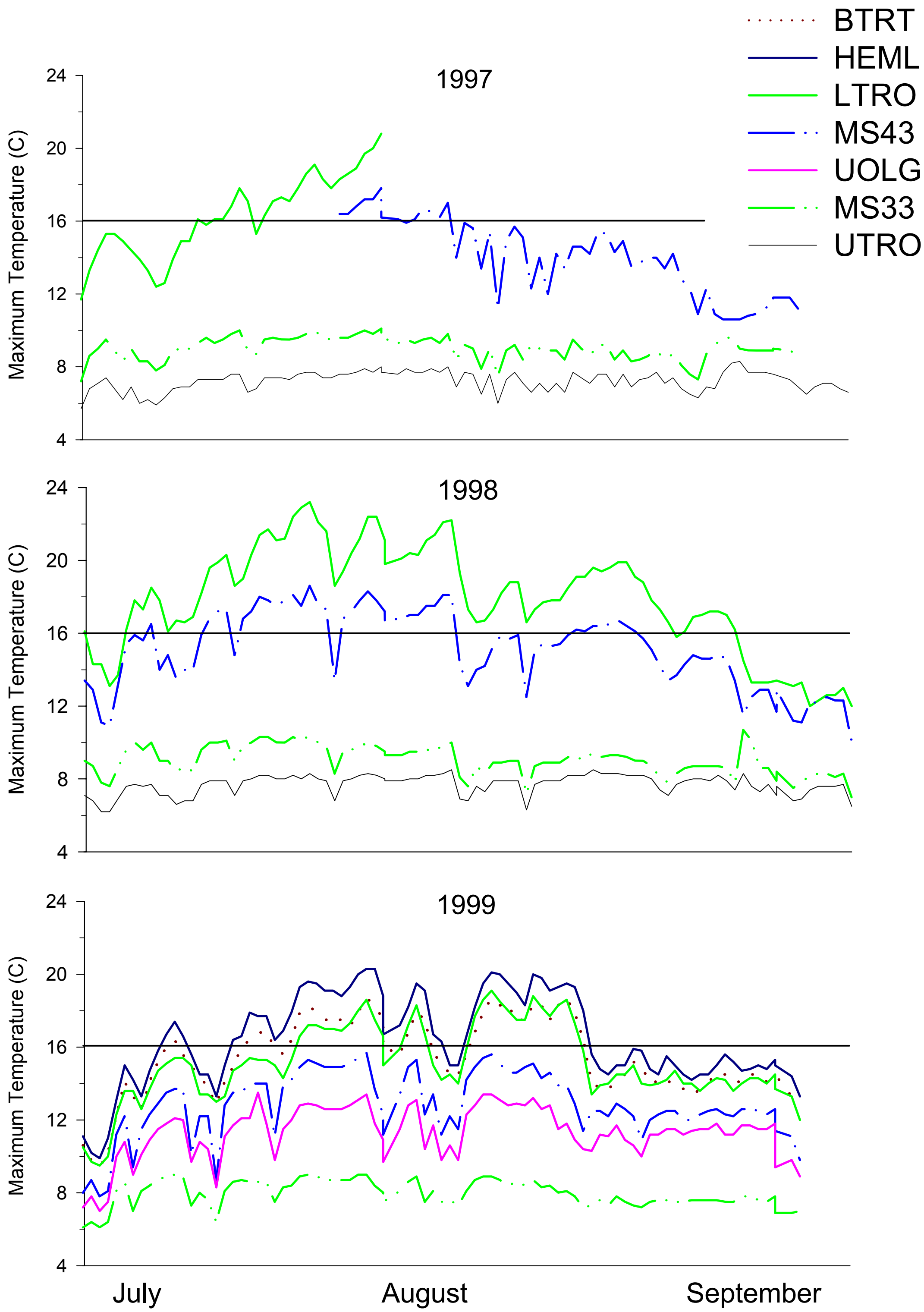


Figure 6. Daily maximum temperatures at seven sites in mainstem Trout Creek for July 1 to Oct 1 1997-2001. Sites from downstream to upstream are, the mouth of Trout Cr. at Rkm 0.2 (BTRT), below Hemlock Dam at Rkm 4.9 (HEML), lower Trout Cr. at Rkm 6.0 (LTRO), 43 Bridge at Rkm 11.0 (MS43), upper old-growth channel at Rkm 12.2 (UOLG), 33 Bridge at Rkm 14.4 (MS33), and upper Trout Cr. at Rkm 15.2 (UTRO). The line at 16^{o}C marks the maximum surface water temperature standard set by the Washington Department of Ecology (Chapter 173-201A, Nov. 18 1997, Water Quality Standards for the Surface Waters of the State of Washington).

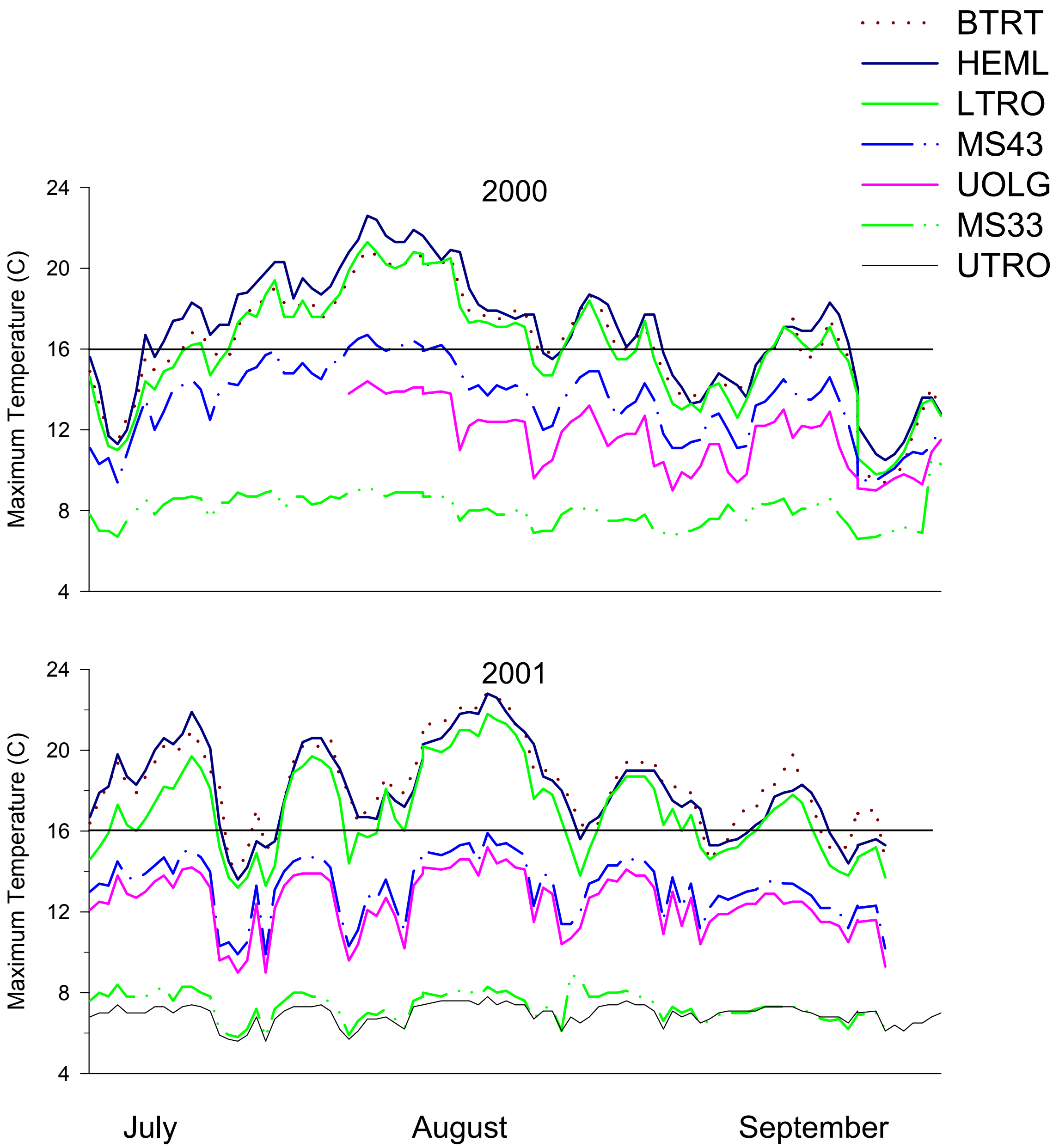


Figure 6. Continued.

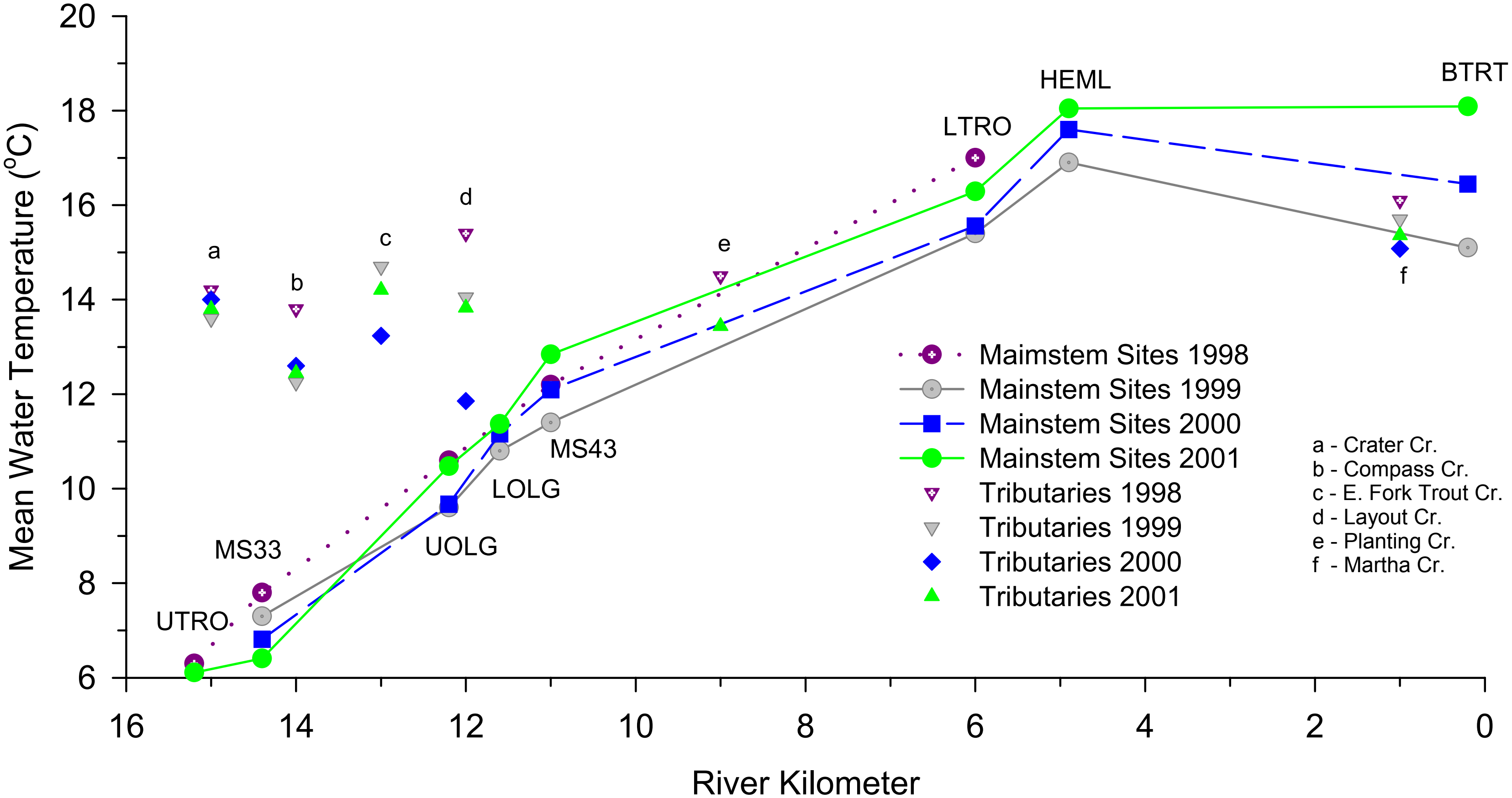


Figure 7. Mean water temperature during August 1998, 1999, 2000, and 2001 in mainstem Trout Creek and its tributaries. Sites, from left to right, are shown from upstream to downstream. River kilometer zero is the mouth of Trout Creek. Mainstem sites are, upper Trout Cr. at Rkm 15.2 (UTRO), 33 Rd. Bridge at Rkm 14.4 (MS33), upper old-growth channel at Rkm 12.2 (UOLG), lower old-growth channel at Rkm 11.6 (LOLG), 43 Rd. Bridge at Rkm 11.0 (MS43), above Hemlock Lake at Rkm 6.0 (LTRO), below Hemlock Dam at Rkm 4.9 (HEML), and the mouth of Trout Creek at Rkm 0.2 (BTRO).

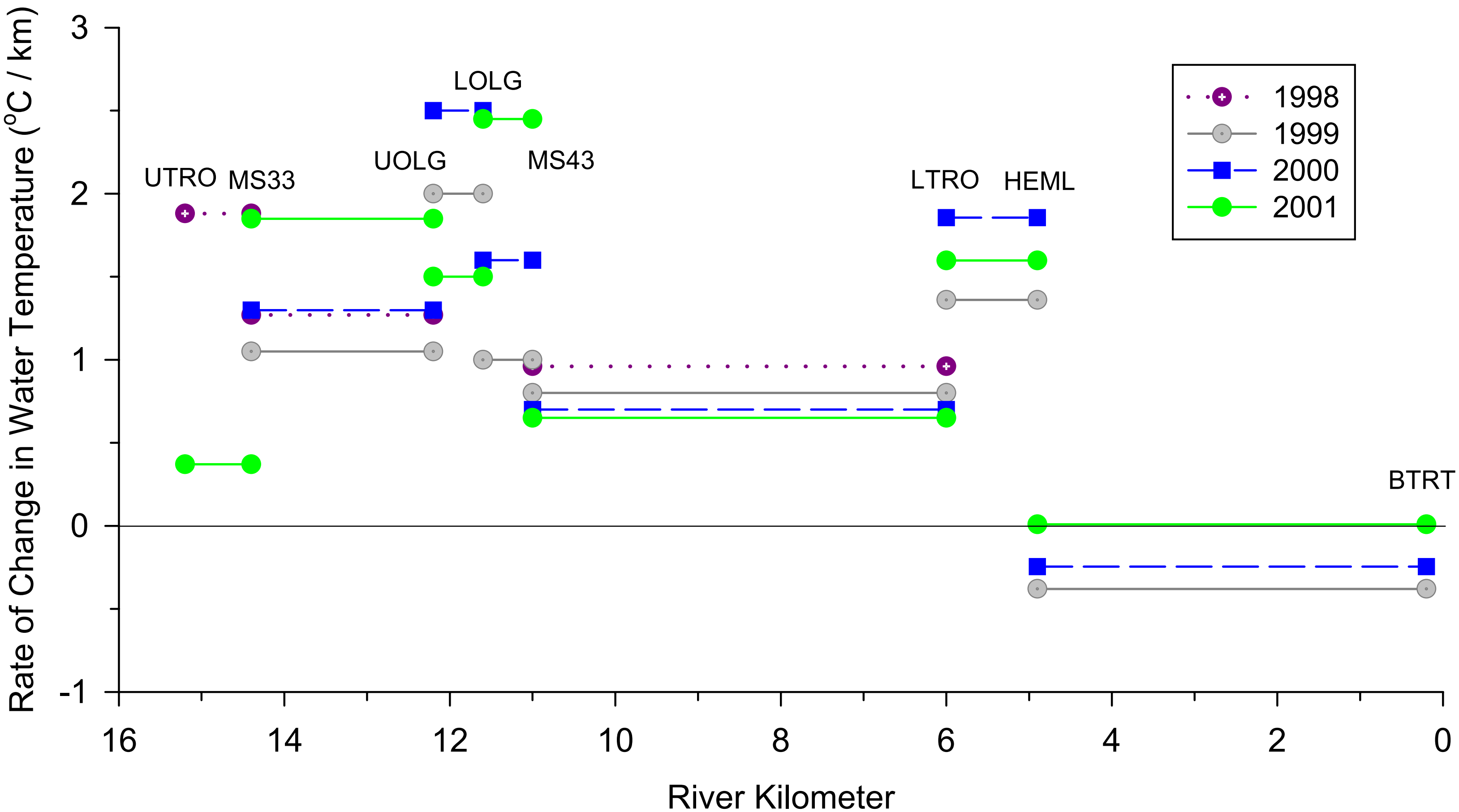


Figure 8. Rate of change (°C/km) of mean temperature for sections of Trout Creek during August 1998-2001. River kilometer (Rkm) zero is the mouth of Trout Creek. Thermograph locations at the ends of each section are shown from upstream to downstream. Sites are, upper Trout Cr. at Rkm 15.2 (UTRO), 33 Rd. Bridge at Rkm 14.4 (MS33), upper old-growth channel at Rkm 12.2 (UOLG), lower old-growth channel at Rkm 11.6 (LOLG), 43 Rd. Bridge at Rkm 11.0 (MS43), lower Trout at Rkm 6.0 (LTRO), below Hemlock Dam at Rkm 4.9 (HEML), and the mouth of Trout Cr. at Rkm 0.2 (MTRO).

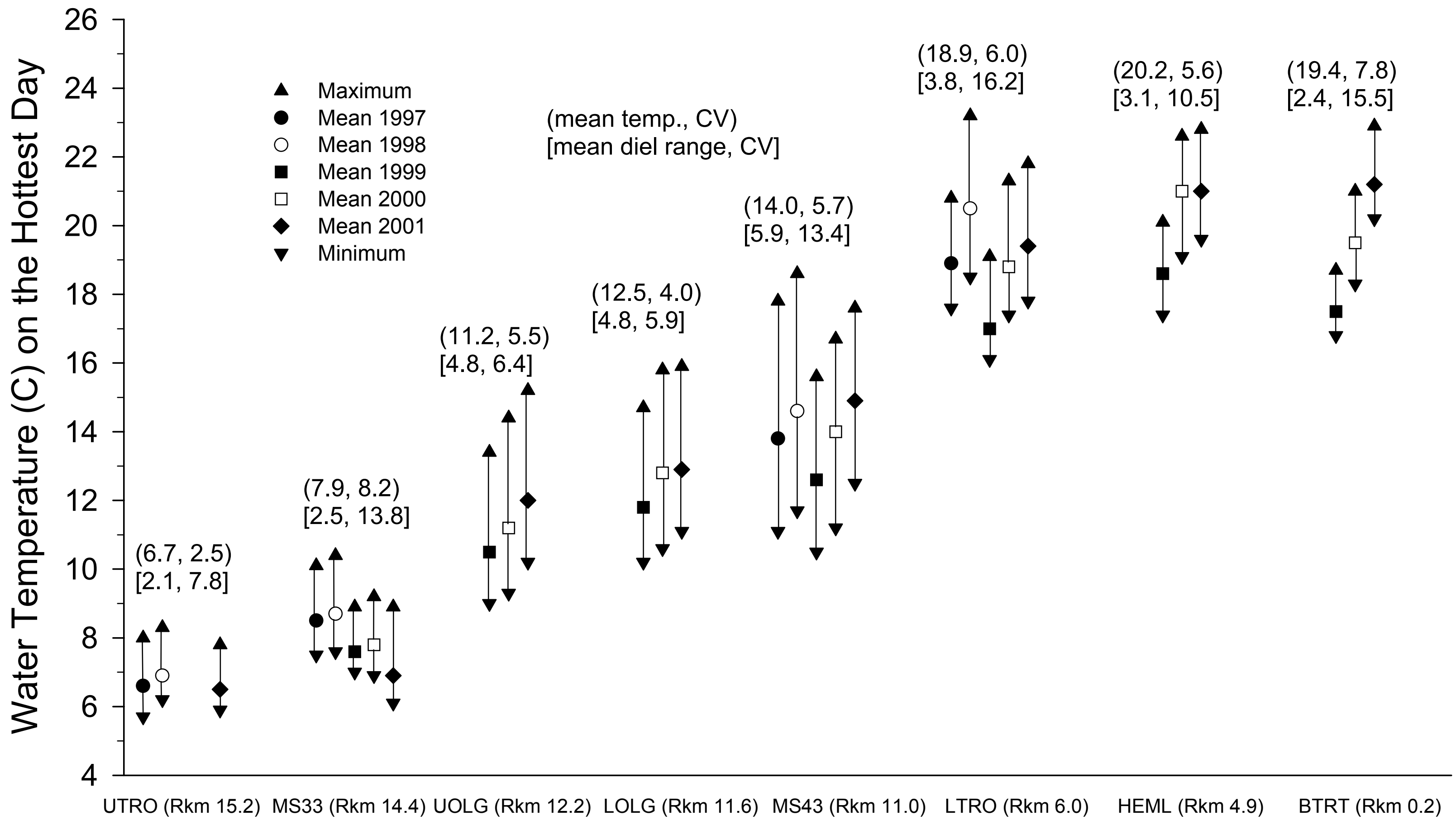
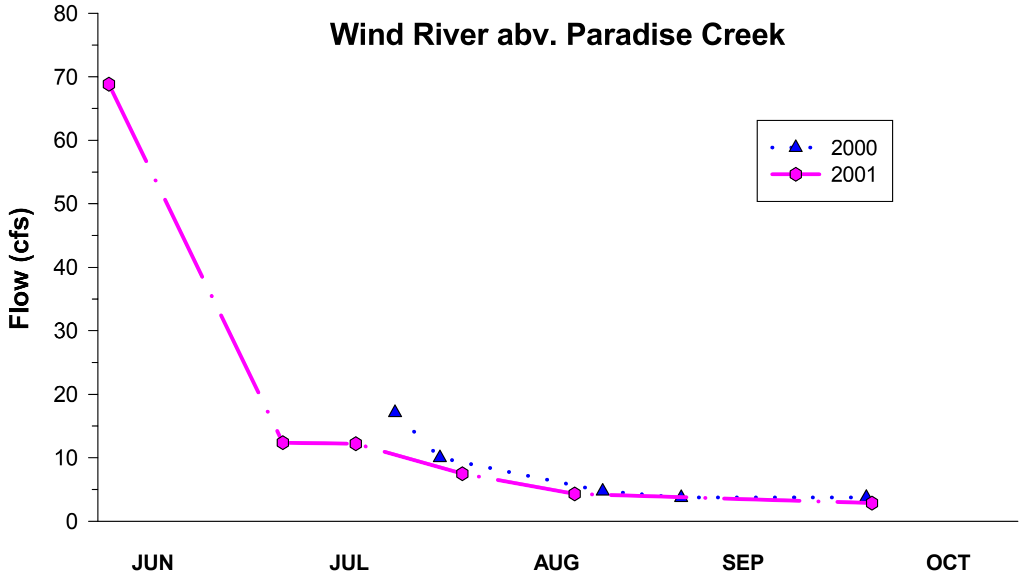


Figure 9. Mean and diel water temperature range for the year's hottest day at eight sites in mainstem Trout Creek. Sites from left to right are ordered in an upstream to downstream direction. Sites are, upper Trout Cr. at Rkm 15.2 (UTRO); 33 Rd. Bridge at Rkm 14.4 (MS33); upper old-growth channel at Rkm 12.2 (UOLG), lower old-growth channel at Rkm 11.6 (LOLG), 43 Rd. Bridge at Rkm 11.0 (MS43); lower Trout Creek at Rkm 6.0 (LTRO); below Hemlock Dam at Rkm 4.9 (HEML), and the mouth of Trout Cr. at Rkm 0.2 (BTRT). Dates chosen had the warmest single day water temperature at the MS43 site within the years 1997 (August 6), 1998 (July 28), 1999 (August 19), 2000 (July 31), and 2001 (August 13).



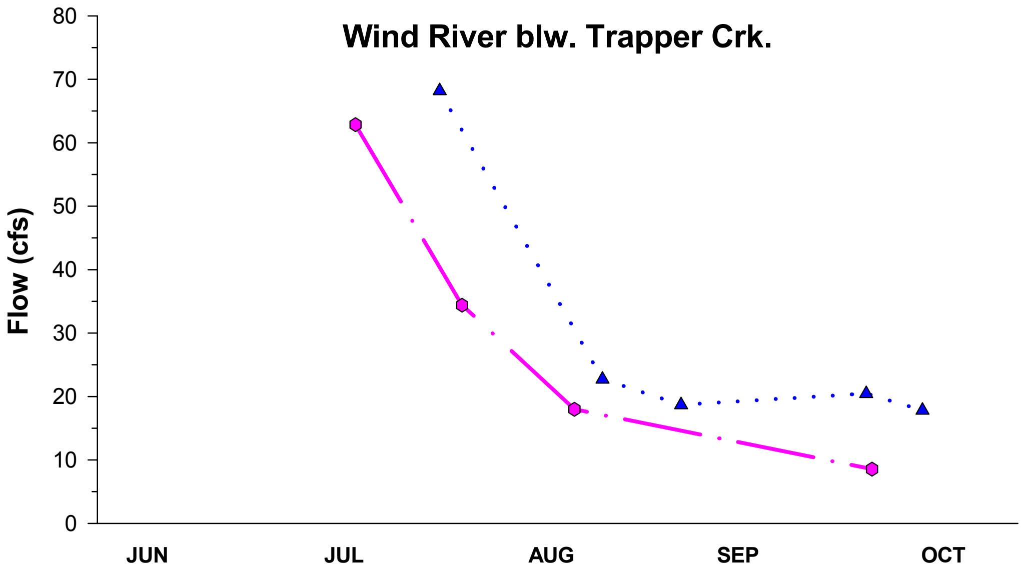


Figure 10. Flow for two sites on the Wind River, 2000-2001. For locations of measurement sites, see Table 3 of this report.

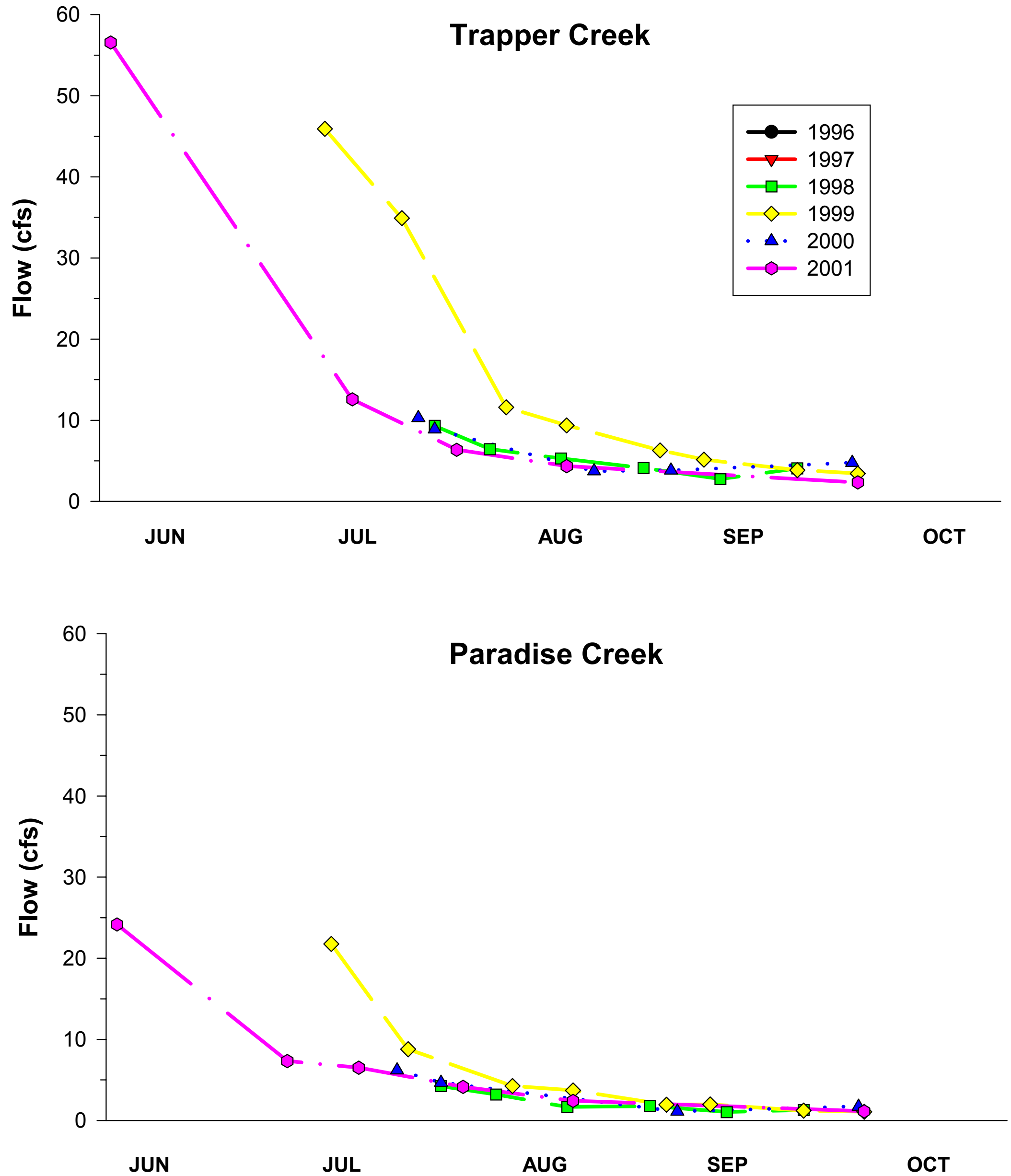
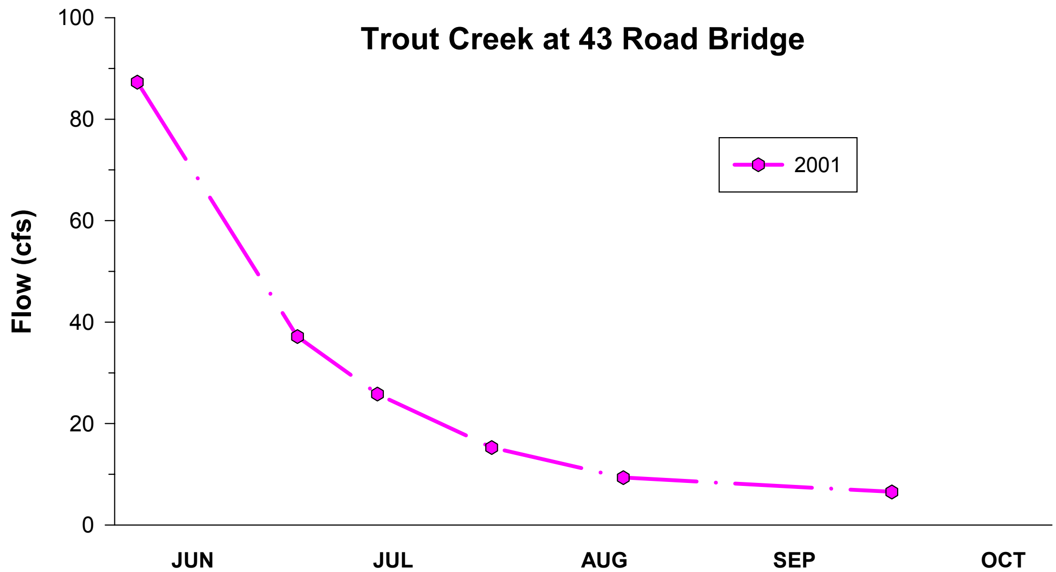


Figure 11. Flow for Trapper and Paradise creeks in the upper Wind River watershed, 1998-2001. For locations of measurement sites, see Table 3 of this report.



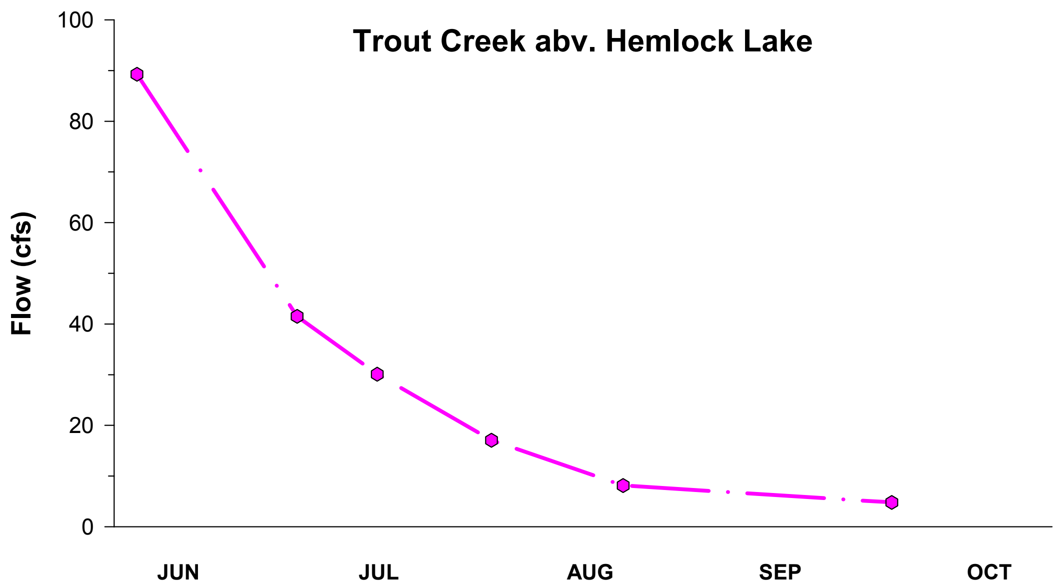


Figure 12. Flow for two sites on Trout Creek in 2001. For locations of measurement sites, see Table 3 of this report.

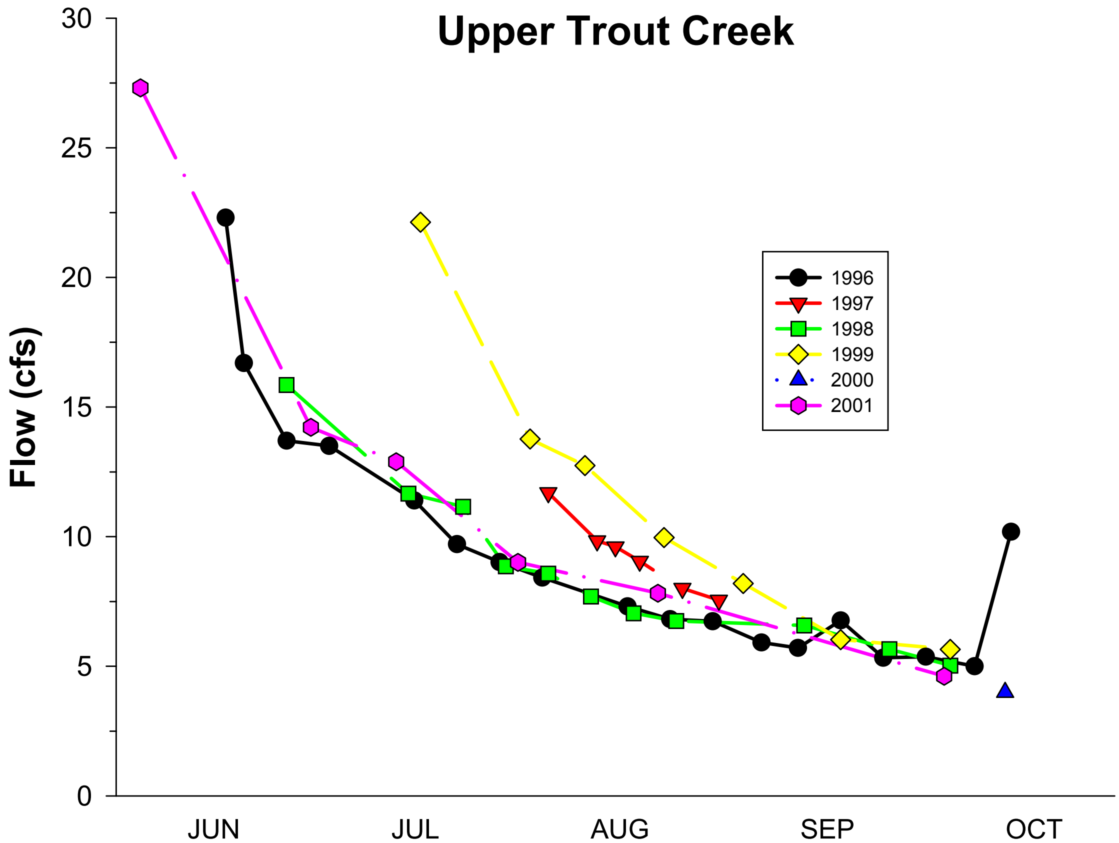


Figure 13. Flow for upper Trout Creek, 1996-2001. For location of measurement site, see Table 3 of this report.

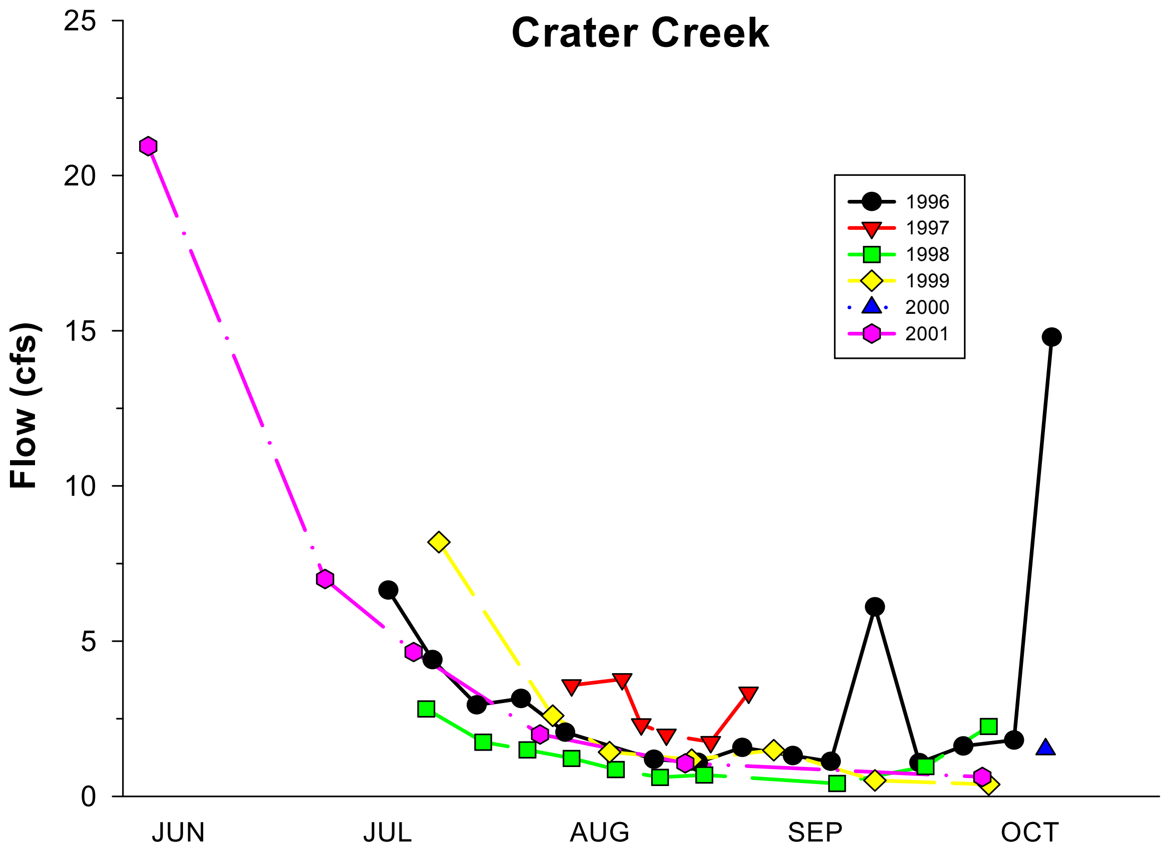


Figure 14. Flow for Crater Creek in the Trout Creek watershed, 1996-2001. For location of measurement site, see Table 3 of this report.

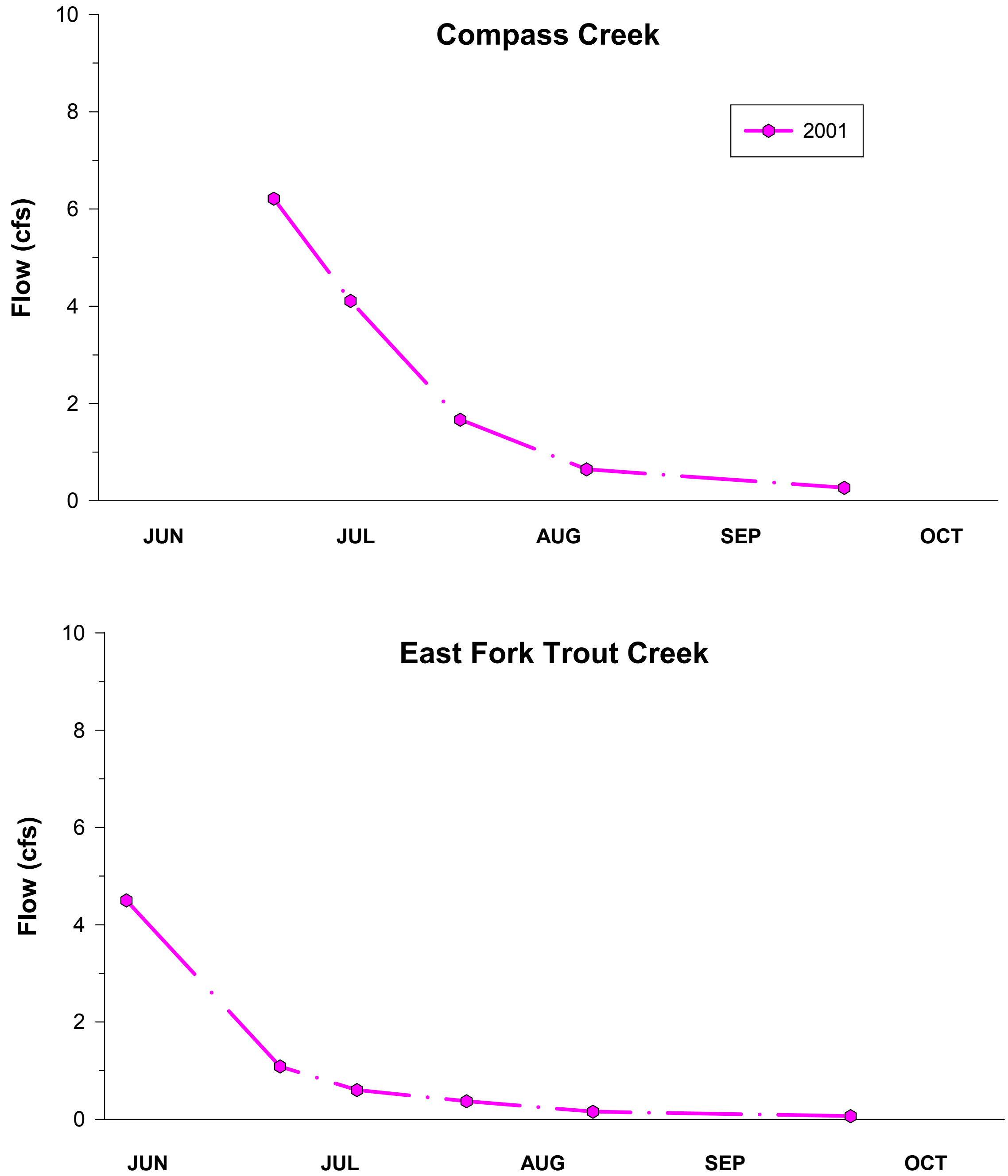
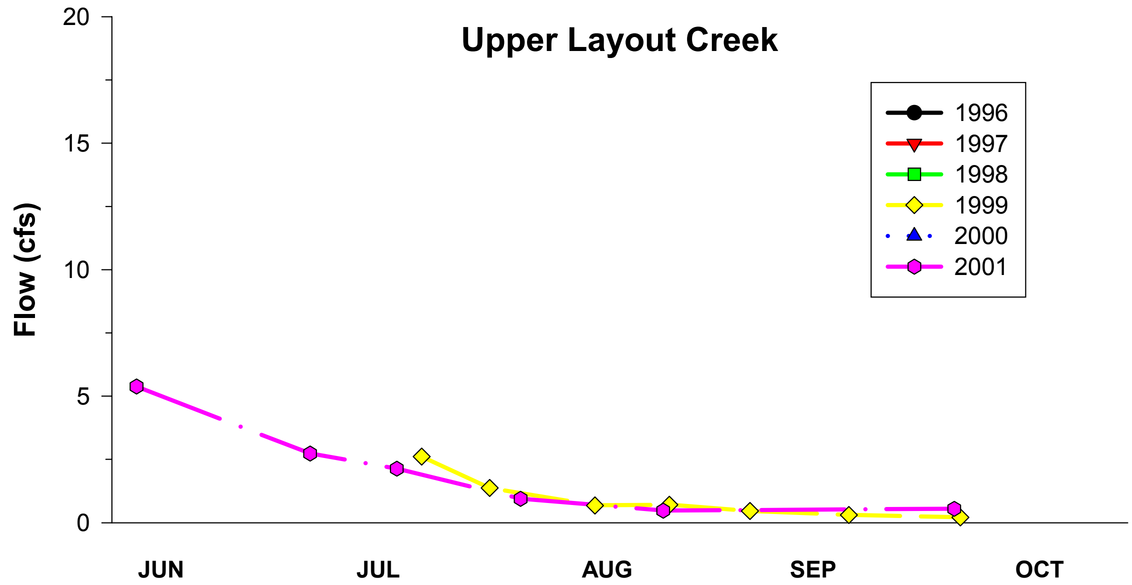


Figure 15. Flow for Compass and East Fork Trout creeks in the Trout Creek watershed, 2001. For locations of measurement sites, see Table 3 of this report.



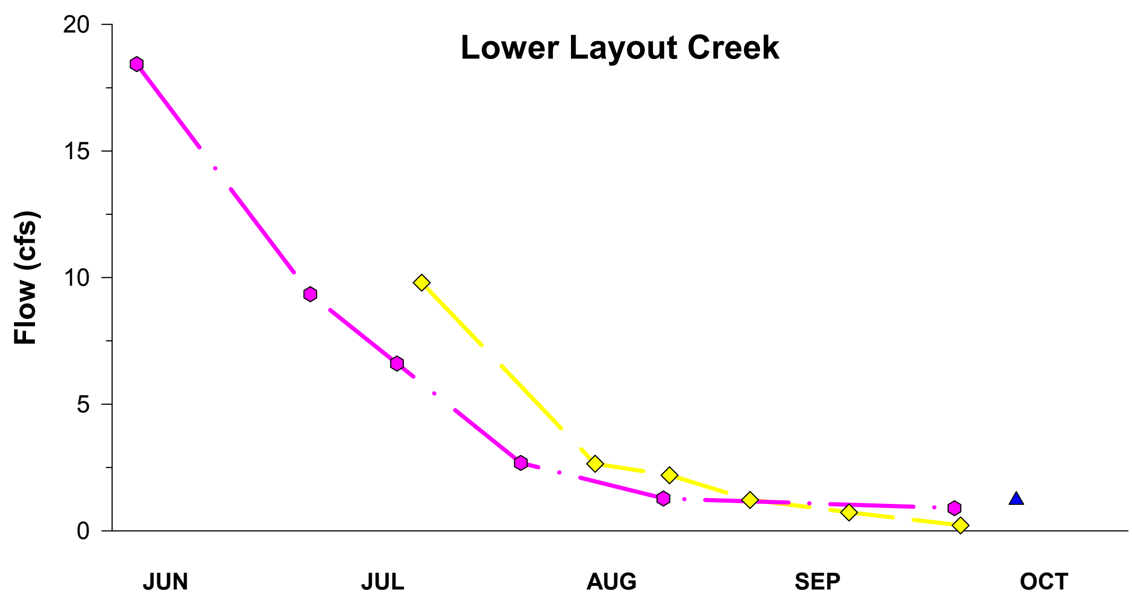


Figure 16. Flow for upper and lower Layout Creek in the Trout Creek watershed, 1999-2001. For locations of measurement sites, see Table 3 of this report.

Appendix Table 1. Mean, minimum, and maximum water temperature recorded at sites within the Wind River subbasin during summer 1999. Data are from Onset Corporation's StowAway Thermographs, which recorded water temperature every two hours. Sites are listed from upstream to downstream within a subbasin.

Watershed / Subwatershed / Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Trout Creek									
Crater Cr.	5.3	11.1	6.8	9.9	14.1	11.1	15.3	17.4	13.5
Trout Cr. – 33 bridge	4.7	6.2	4.4	6.8	7.3	6.2	9.0	9.0	7.8
Compass Cr	5.8	10.9	8.0	9.5	12.5	10.5	13.1	14.0	12.0
East Fork Trout Cr.	8.4	10.9	5.2	13.6	14.7	10.1	18.7	19.0	12.7
Trout Cr. – upper OG[a]	5.2	7.5	4.9	8.5	9.6	8.2	13.5	13.4	11.8
Upper Layout Cr.	6.1	8.7	6.4	8.8	10.8	9.8	12.9	14.0	12.6
Layout Cr.	6.4	11.2	8.1	11.0	13.9	11.9	16.4	17.4	14.8
Trout Cr. – lower OG	5.4	8.5	5.5	9.5	10.8	9.2	16.1	14.7	12.5
Trout Cr. – 43 bridge	5.5	8.4	5.2	9.5	11.4	9.6	15.3	15.7	12.9
Trout Cr. – abv. Hemlock	7.1	11.9	6.6	12.6	15.4	11.8	17.2	19.1	15.0
Trout Cr. – blw. Hemlock	8.2	13.0	8.3	13.6	16.9	13.2	19.6	20.3	15.9
Upper Martha Cr.	9.0	12.8	9.5	12.6	14.7	12.5	16.2	17.0	15.1
Lower Martha Cr	8.8	12.9	7.3	13.5	15.7	11.8	18.7	18.4	17.4
Trout Cr. – at mouth[b]	8.2	12.9	7.8	13.3	16.1	12.4	18.3	18.7	15.2

Continued.

Appendix Table 1. Continued.

Watershed Subwatershed Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Upper Wind River									
Wind R. – blw. Falls Cr.[b]	5.8	9.4	5.4	9.4	11.7	9.3	12.9	14.1	11.4
Trapper Cr.	6.2	10.7	8.0	9.6	12.2	10.5	13.0	13.8	11.9
Trapper Cr. at mouth[b]	6.2	11.0	8.2	9.7	12.8	10.9	13.7	14.5	12.2
Middle Wind River									
Wind R. – at Stabler Bridge[b]	7.0	9.8	6.6	10.8	12.5	10.7	15.6	16.4	13.7
Panther Creek									
Panther Cr. – upper	5.7	6.2	5.0	7.1	7.2	6.6	9.1	9.0	8.1
Eightmile Cr. – upper	10.1	12.9	9.9	12.4	13.9	12.0	14.6	14.9	13.0
Eightmile Cr. – lower	10.0	11.8	---[c]	13.4	14.8	---	17.3	18.7	---
Cedar Creek	9.1	11.5	8.5	12.1	13.2	11.1	15.6	15.6	12.9
Panther Cr. – lower 2	6.7	7.8	5.3	9.5	9.7	8.3	13.5	13.4	11.0
Lower Wind River									
Bear Cr.[b]	9.0	12.6	8.2	12.8	14.6	12.2	16.8	16.8	14.5
Little Wind River[b]	10.2	12.9	8.6	14.2	15.8	12.8	18.3	18.3	15.6

[a] OG = Restored old-growth channel.
[b] Thermographs deployed and maintained by Underwood Conservation District
[c] --- = Thermograph not in place or not operating properly during period of maximum temperatures.

Appendix Table 2. Mean, minimum, and maximum water temperature recorded at sites within the Wind River subbasin during summer 2000. Data are from Onset Corporation's StowAway Thermographs, which recorded water temperature every two hours. Sites are listed from upstream to downstream within a subbasin.

Watershed Subwatershed Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Trout Creek									
Crater Cr.	7.9	10.1	6.9	13.0	13.9	11.1	18.4	17.9	14.6
Trout Cr. – 33 bridge	5.5	5.2	4.4	7.2	6.8	6.6	9.2	8.9	10.6
Compass Cr	7.8	10.4	8.4	11.2	12.5	10.7	14.6	14.9	12.9
East Fork Trout Cr.	9.2	8.6	4.8	13.9	13.2	10.7	19.2	18.1	15.7
Trout Cr. – upper OG [a]	8.5	6.5	5.1	10.9	9.7	8.7	14.4	14.1	13.0
Upper Layout Cr.	7.2	8.3	6.3	9.8	11.0	9.7	14.5	14.6	13.5
Layout Cr.	10.8	9.8	9.1	12.4	11.6	10.5	14.6	14.5	12.2
Trout Cr. – lower OG	7.7	7.9	6.1	10.9	11.2	10.0	15.8	15.4	14.0
Trout Cr. – 43 bridge	7.0	7.7	5.6	11.2	12.1	10.3	16.7	16.4	14.6
Trout Cr. – ab. Hemlock	9.3	11.5	7.0	14.5	15.6	12.5	21.3	20.8	17.1
Trout Cr. – blw. Hemlock	9.7	13.9	7.3	15.9	17.6	13.4	22.6	22.4	18.3
Upper Martha Cr.	9.3	11.8	9.6	12.6	14.1	12.4	16.7	16.7	15.4
Lower Martha Cr	9.1	11.2	8.1	13.4	15.1	12.7	19.8	19.3	16.5
Trout Cr. – at mouth[b]	9.8	12.6	7.4	15.2	16.4	13.0	21.0	20.6	17.5

Continued.

Appendix Table 2. Continued.

Watershed / Subwatershed / Subdrainage	Minimum (°C) July	Minimum (°C) Aug.	Minimum (°C) Sept.	Mean (°C) July	Mean (°C) Aug.	Mean (°C) Sept.	Maximum (°C) July	Maximum (°C) Aug.	Maximum (°C) Sept.
Upper Wind River									
Wind R. – ab. Paradise Cr.	---[c]	9.8	7.5	---	12.8	10.7	---	16.5	13.7
Paradise Cr.	9.2	10.7	9.0	11.9	12.6	11.0	15.7	15.4	12.9
Wind R. – Lower Mine Reach	9.8	9.5	9.5	11.1	10.5	10.3	12.6	12.7	11.9
Wind R. – blw. Falls Cr .[b]	7.8	8.6	6.2	11.5	11.8	10.1	15.6	14.9	13.7
Falls Cr	---	7.0	4.5	---	10.6	8.9	---	14.3	12.9
Nine Mile Cr.	9.0	10.3	8.7	11.2	12.0	10.7	13.7	13.7	12.3
Dry Cr.	8.2	9.7	8.0	10.7	11.7	10.6	15.2	15.2	13.9
Trapper Cr.	8.2	10.5	8.6	11.2	12.4	10.7	14.5	14.5	12.8
Trapper Cr. at mouth [b]	8.2	10.6	8.6	11.7	12.9	11.1	15.6	15.6	13.3
Wind R. – blw. Trapper Cr.	8.3	9.6	6.7	11.8	12.7	11.1	16.3	15.9	15.4
Middle Wind River									
Wind R. – at Stabler Bridge [b]	8.2	9.0	7.0	12.1	12.7	11.0	17.5	17.1	15.2
Panther Creek									
Panther Cr. – upper	5.9	5.7	4.8	7.3	7.1	6.6	9.3	9.0	8.4
Eightmile Cr. – upper	10.8	12.1	9.9	12.8	13.5	11.9	15.3	15.3	13.3
Eightmile Cr. – lower	10.7	11.2	8.9	13.6	14.0	12.2	18.4	18.4	15.1
Panther Cr. – lower 2	7.2	7.0	5.1	9.9	9.9	8.6	14.3	14.0	12.4
Lower Wind River									
Bear Cr.[b]	10.2	11.4	8.6	13.4	14.1	12.3	17.9	17.5	15.6
Little Wind River [b]	11.0	11.8	8.6	14.6	15.1	13.1	19.4	19.0	17.5
Lower Wind River site 1 [b]	9.8	10.6	7.8	13.6	13.8	11.6	17.5	16.8	14.9
Lower Wind River site 2 [b]	9.8	10.6	7.8	13.6	13.7	11.6	17.1	16.8	14.9

[a] OG = Restored old-growth channel.

[b] Thermographs deployed and maintained by Underwood Conservation District from 14 June through 1 October, 2000.

[c] --- = Thermograph not in place or not operating properly during period of maximum temperatures.

Appendix Table 3. Mean, minimum, and maximum water temperature recorded at sites within the Wind River subbasin during summer 2001. Data are from Onset Corporation's StowAway Thermographs, which recorded water temperature every two hours. Sites are listed from upstream to downstream within a subbasin.

Watershed Subwatershed Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Trout Creek									
Trout Cr. – upper	5.0	5.0	4.7	5.8	6.1	5.9	7.4	7.8	7.3
Crater Cr.	9.0	10.4	8.1	12.5	13.9	12.0	16.0	17.8	15.1
Trout Cr. – 33 bridge	4.8	4.8	4.1	6.3	6.4	5.8	8.4	8.9	7.3
Compass Cr	8.6	10.1	9.0	11.1	12.4	11.4	13.4	14.8	13.1
East Fork Trout Cr.	10.3	10.6	6.4	14.0	14.2	11.2	18.7	19.9	15.2
Trout Cr. – upper OG [a]	7.1	7.4	6.1	9.8	10.5	9.2	14.2	15.2	13.0
Upper Layout Cr.	7.5	8.3	7.8	9.8	11.2	10.5	13.4	15.4	13.7
Layout Cr.	8.9	10.3	8.9	12.5	13.8	12.4	17.0	18.5	15.6
Trout Cr. – lower OG	8.0	8.3	6.9	10.6	11.4	10.1	15.0	15.9	13.7
Trout Cr. – 43 bridge	8.1	8.6	6.9	11.5	12.8	11.1	16.4	17.6	14.8
Planting Cr.	9.6	9.9	7.8	12.2	13.4	11.6	15.4	17.3	14.9
Trout Cr. – ab. Hemlock	11.2	12.1	8.6	14.9	16.3	13.4	19.7	21.8	17.8
Trout Cr. – blw. Hemlock	11.9	13.1	10.7	16.1	18.0	14.9	21.9	22.8	18.3
Upper Martha Cr.	10.3	11.5	10.3	12.9	14.3	13.1	15.7	17.3	15.4
Lower Martha Cr	10.2	11.5	9.4	13.8	15.4	13.6	18.4	19.7	16.8
Trout Cr. – blw. Martha Cr [b]	12.6	13.7	6.6	16.7	18.1	13.8	21.0	22.9	19.8

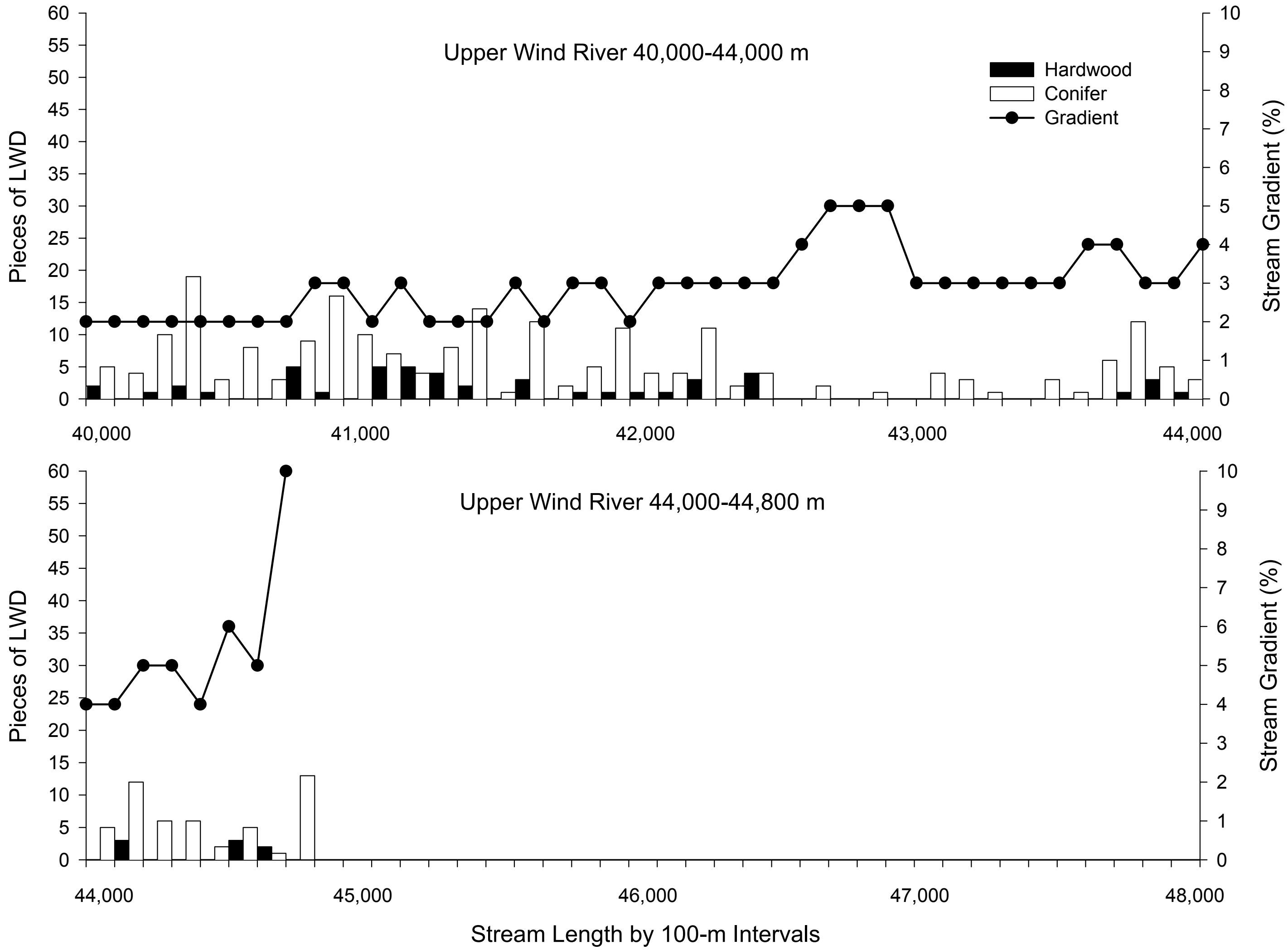
Continued.

Appendix Table 3. Continued.

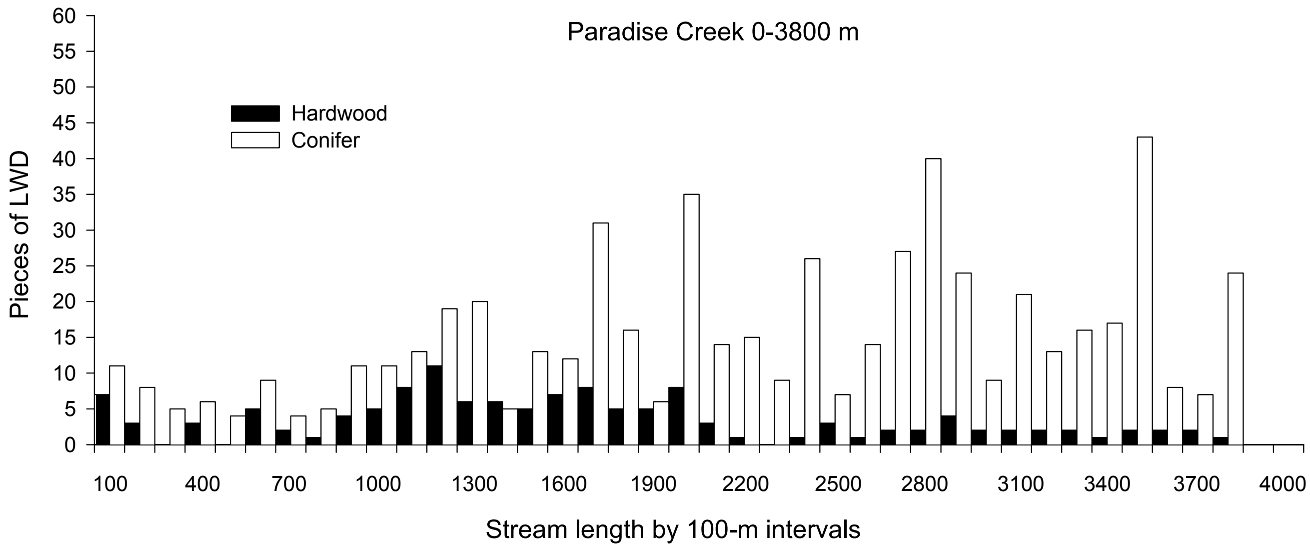
Watershed Subwatershed Subdrainage	Minimum (°C)			Mean (°C)			Maximum (°C)		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Upper Wind River									
Paradise Cr.	10.4	11.2	10.3	12.6	13.1	12.0	15.7	15.7	13.8
Wind R. – Lower Mine Reach	8.2	8.4	9.2	8.8	9.0	9.5	10.4	12.9	9.8
Wind R. – blw. Falls Cr .[b]	9.8	10.2	8.2	12.5	13.4	11.5	16.0	17.1	14.5
Falls Cr	8.9	8.9	6.2	11.6	12.4	10.1	14.9	16.3	13.3
Nine Mile Cr.	9.2	10.3	9.3	11.1	12.0	11.3	12.9	13.7	14.6
Dry Cr.	8.8	9.6	9.1	11.1	11.9	11.3	14.8	16.1	14.1
Trapper Cr.	9.7	10.8	9.7	11.9	12.8	11.8	14.2	15.2	13.5
Trapper Cr. at mouth [b]	9.8	11.0	9.8	12.3	13.3	12.1	15.2	16.0	14.1
Wind R. – blw. Trapper Cr.	10.0	10.9	8.8	12.7	14.2	12.6	16.4	18.5	19.9
Middle Wind River									
Wind R. – at Stabler Bridge [b]	9.0	9.8	8.2	12.9	13.5	12.0	17.9	18.3	15.6
Panther Creek									
Panther Cr. – upper	6.5	6.5	5.7	7.7	7.8	7.1	10.2	9.9	8.7
Eightmile Cr. – upper	11.0	12.1	10.8	12.8	13.5	12.5	14.4	14.7	13.6
Eightmile Cr. – lower	11.1	11.8	10.0	13.6	14.3	12.8	17.3	18.1	16.5
Panther Cr. – lower	8.1	8.4	6.5	11.0	11.2	9.8	15.7	15.4	13.0
Lower Wind River									
Bear Cr.[b]	11.0	11.8	9.8	13.5	14.5	13.2	16.8	17.5	16.0
Little Wind River [b]	11.8	12.6	9.8	14.6	15.8	14.1	17.9	19.0	17.5
Lower Wind River site 1 [b]	11.8	12.6	9.4	14.6	15.2	12.9	17.9	19.4	15.6
Lower Wind River site 2 [b]	11.8	12.6	9.4	14.6	15.0	12.9	17.9	17.9	15.6

[a] OG = Restored old-growth channel.

[b] Thermographs deployed and maintained by Underwood Conservation District from 14 June through 11 October, 2001.



Appendix Figure 1. Reach survey data for the upper Wind River and tributaries. Shown are counts of hardwood and conifer large woody debris (LWD; length ≥ 1.0 m and diameter ≥ 0.3 m) and stream gradient (%) for 100-m intervals. Stream gradient data are not available for Paradise, Dry, and Big Hollow creeks.



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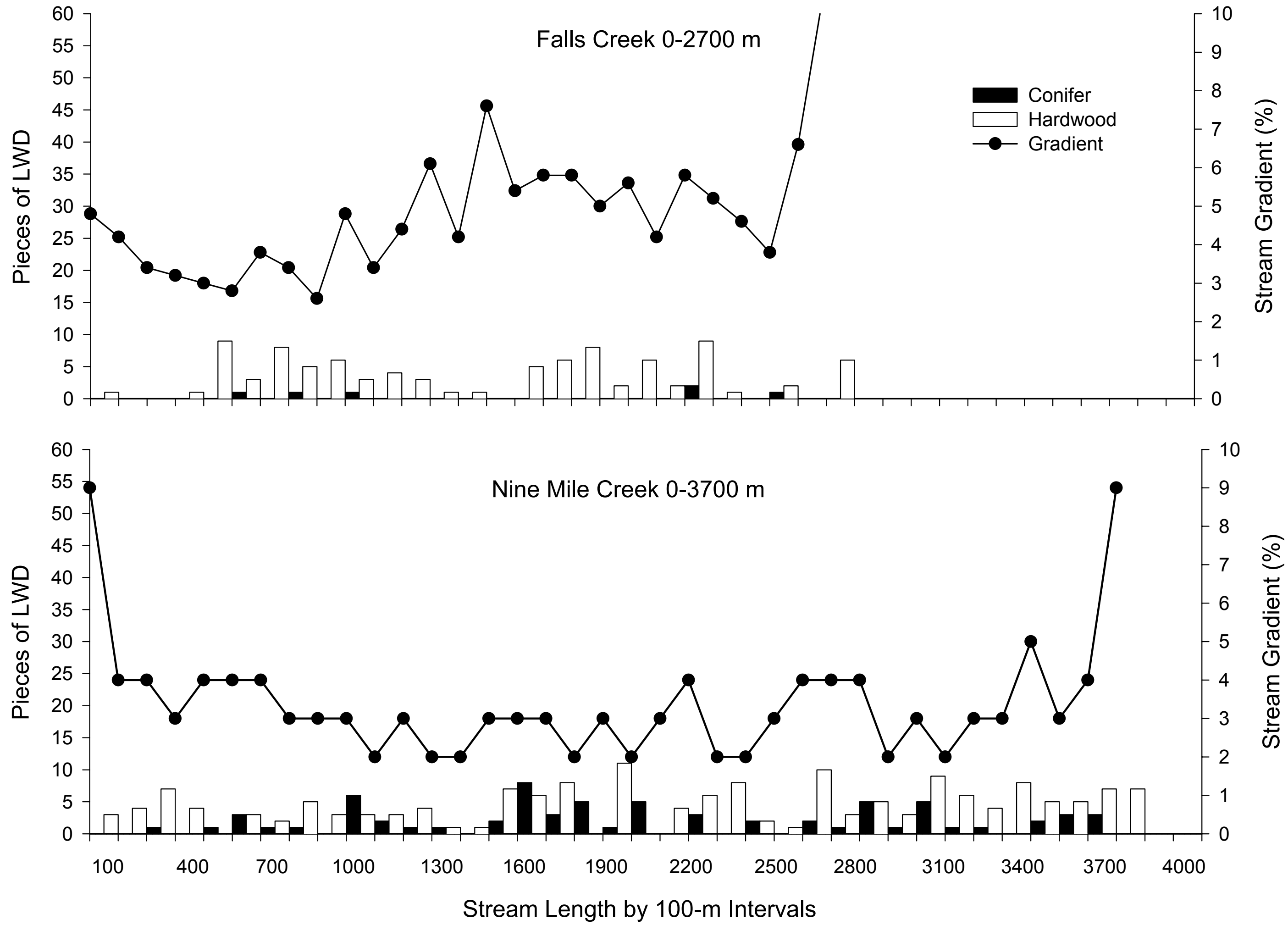

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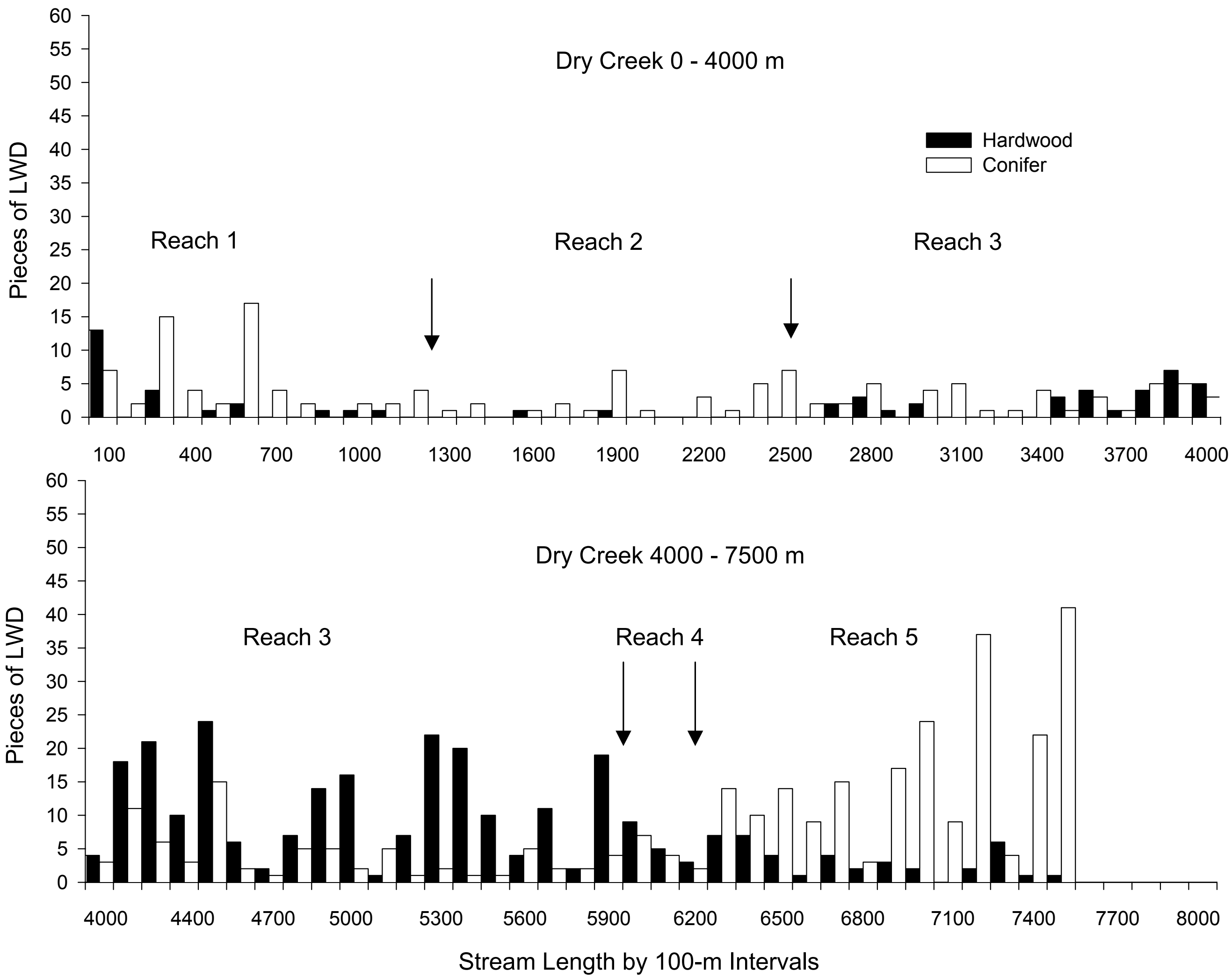

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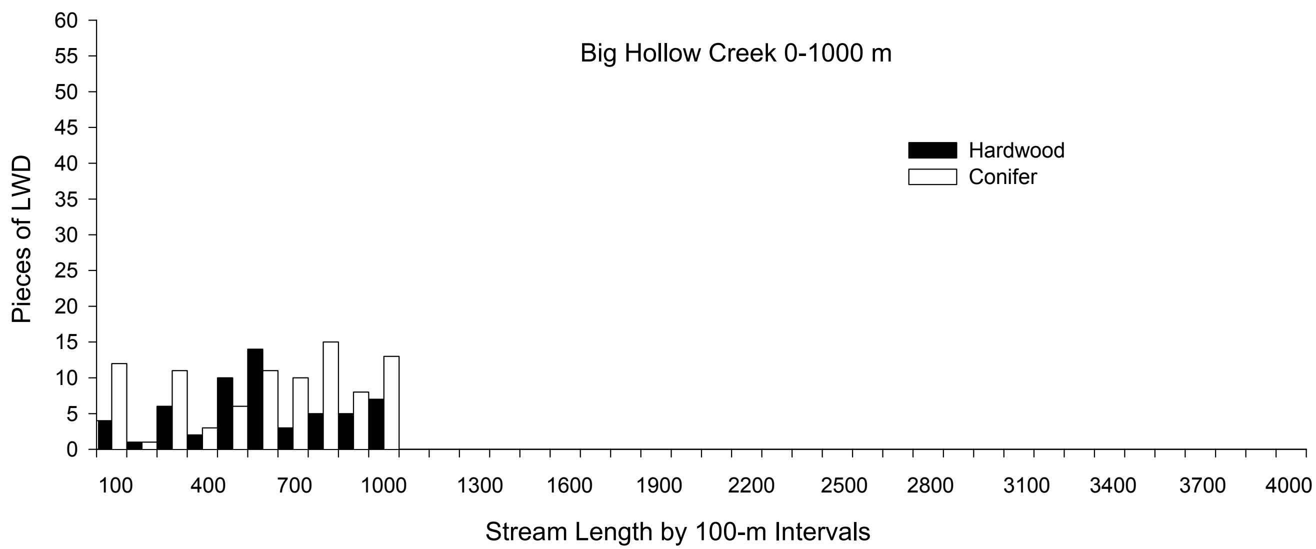

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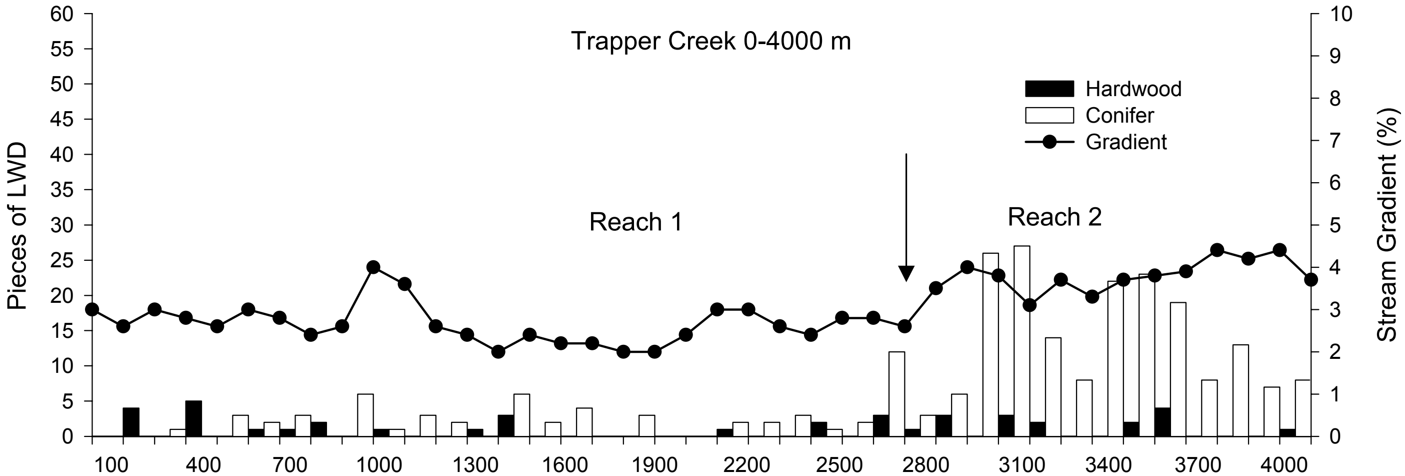

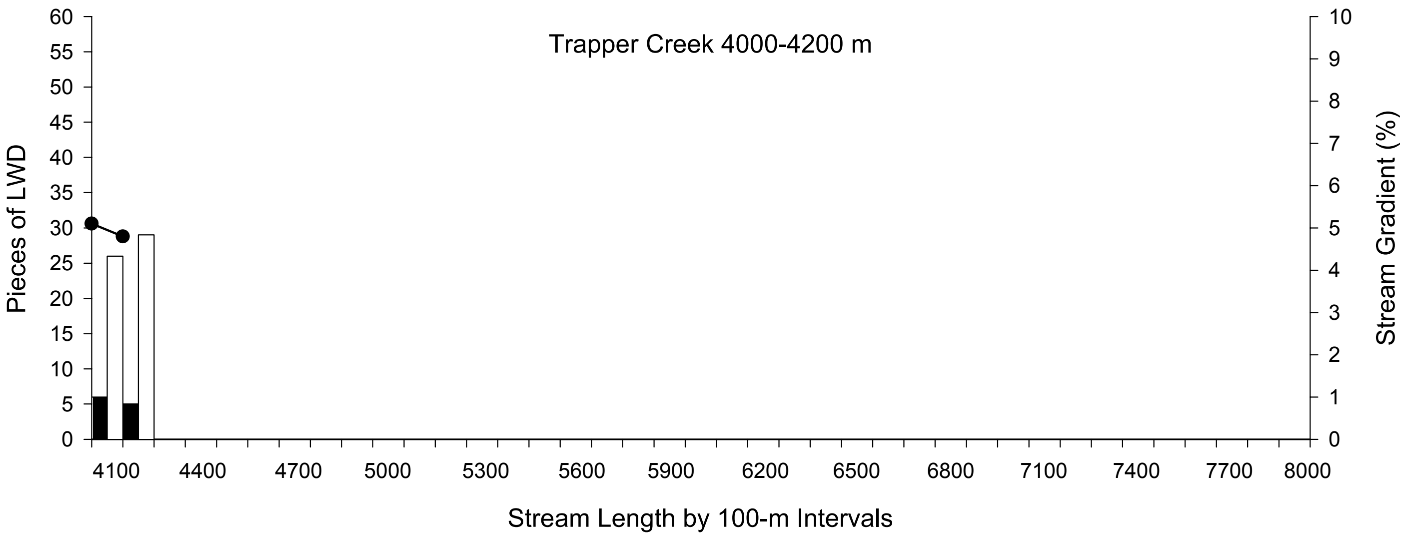

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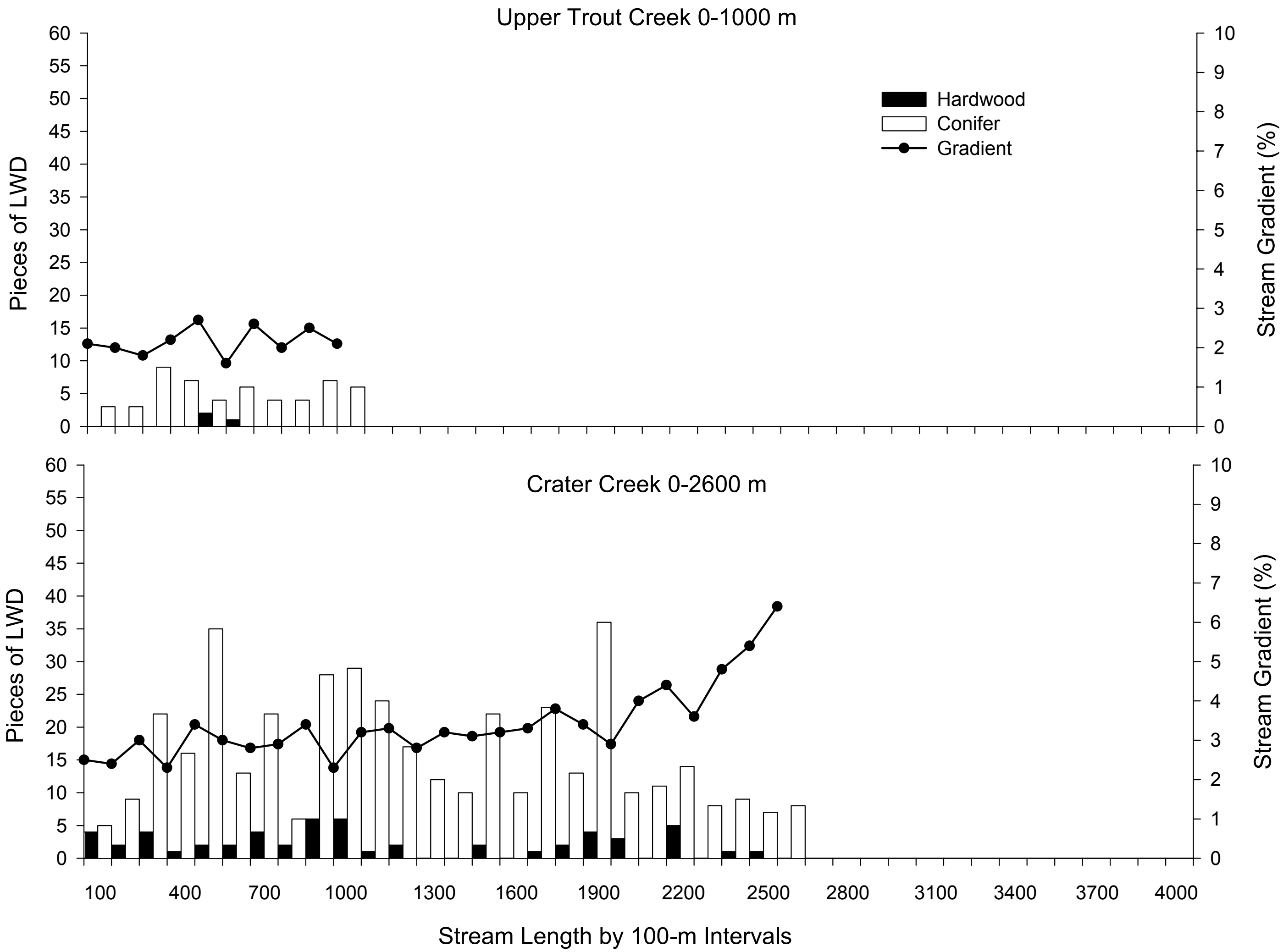
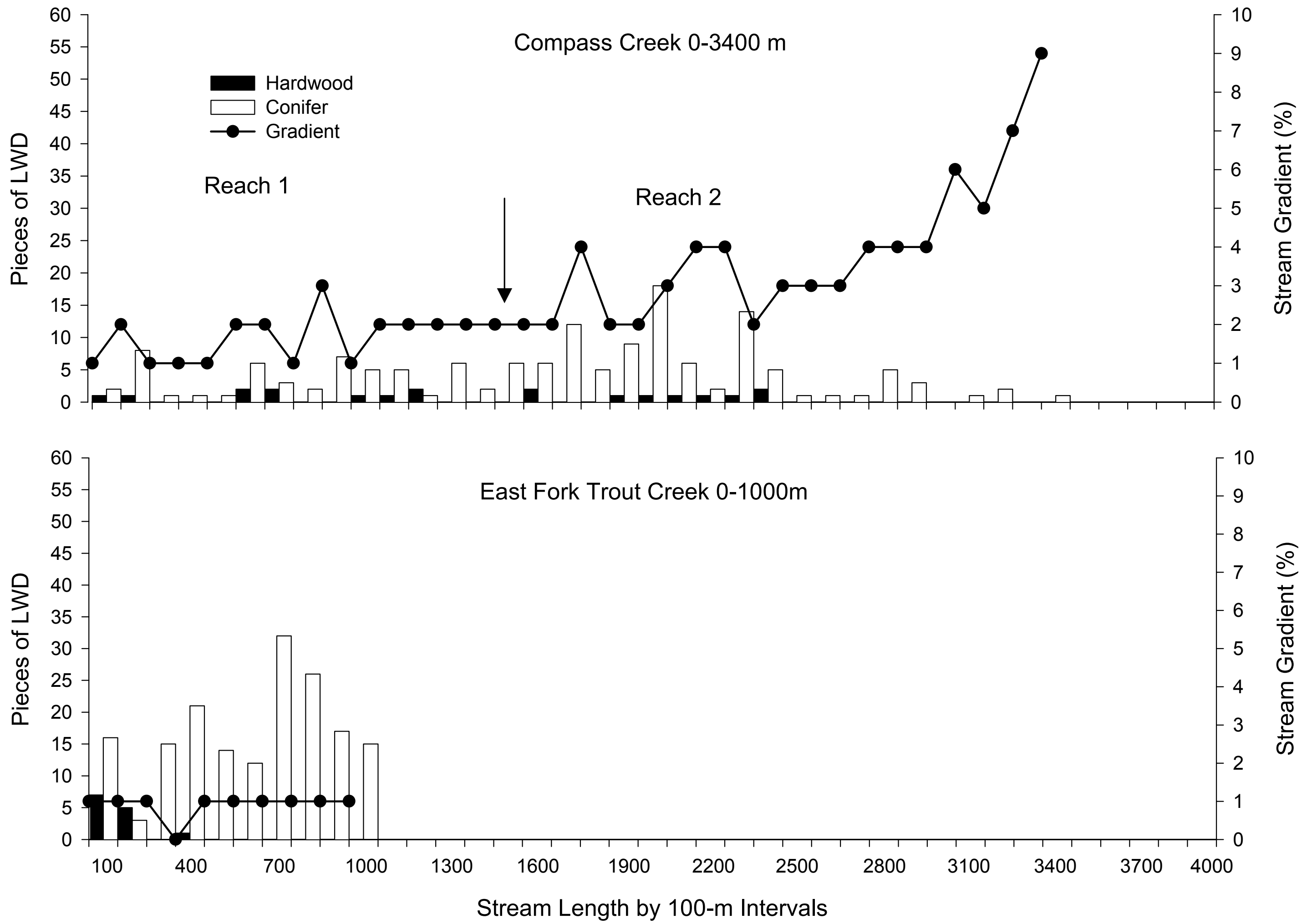


Appendix Figure 2. Reach survey data for tributaries of Trout Creek. Shown are counts of hardwood and conifer large woody debris (LWD; length ≥ 1.0 m and diameter ≥ 0.3 m) and stream gradient (%) for 100-m intervals.



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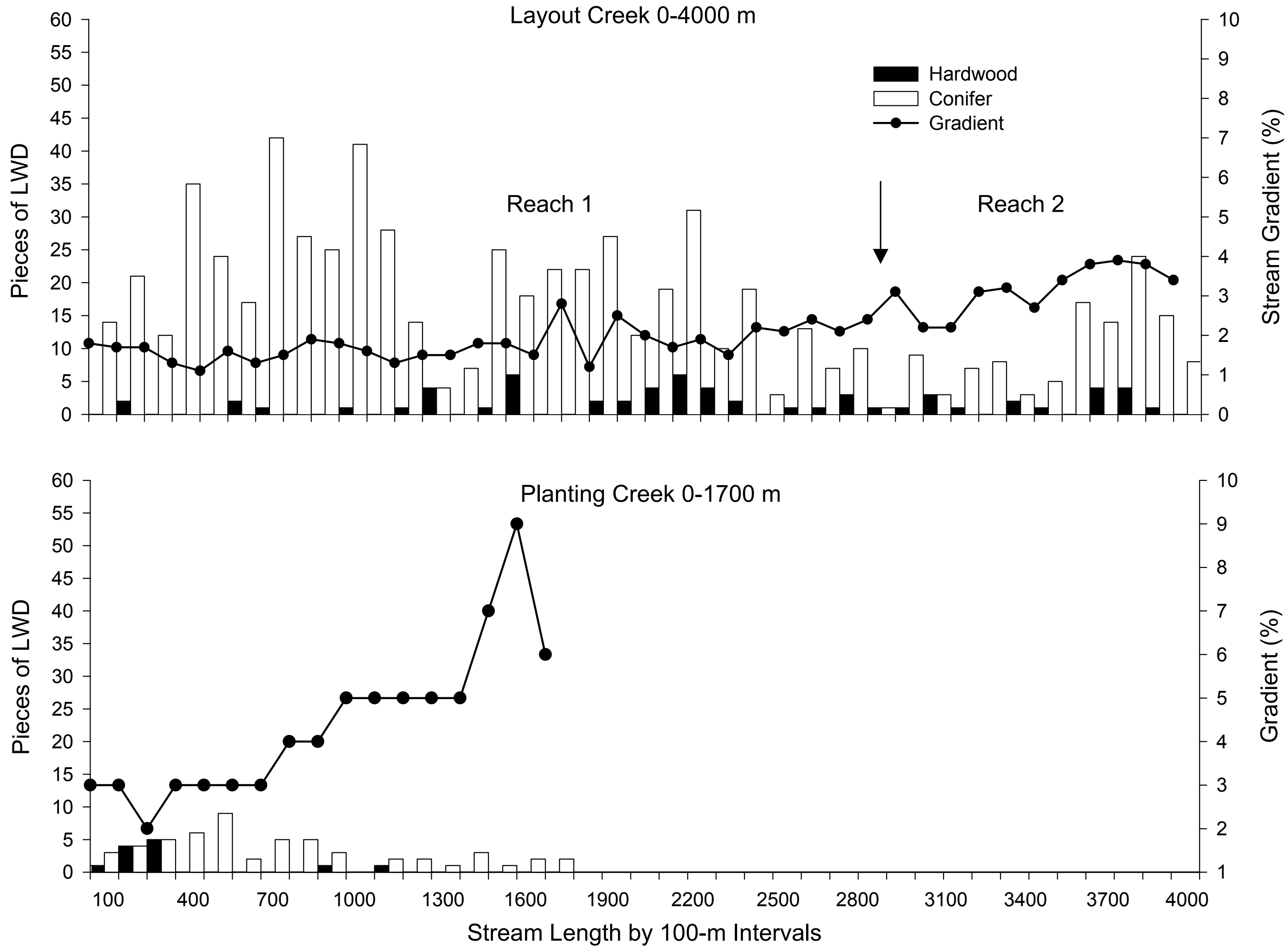

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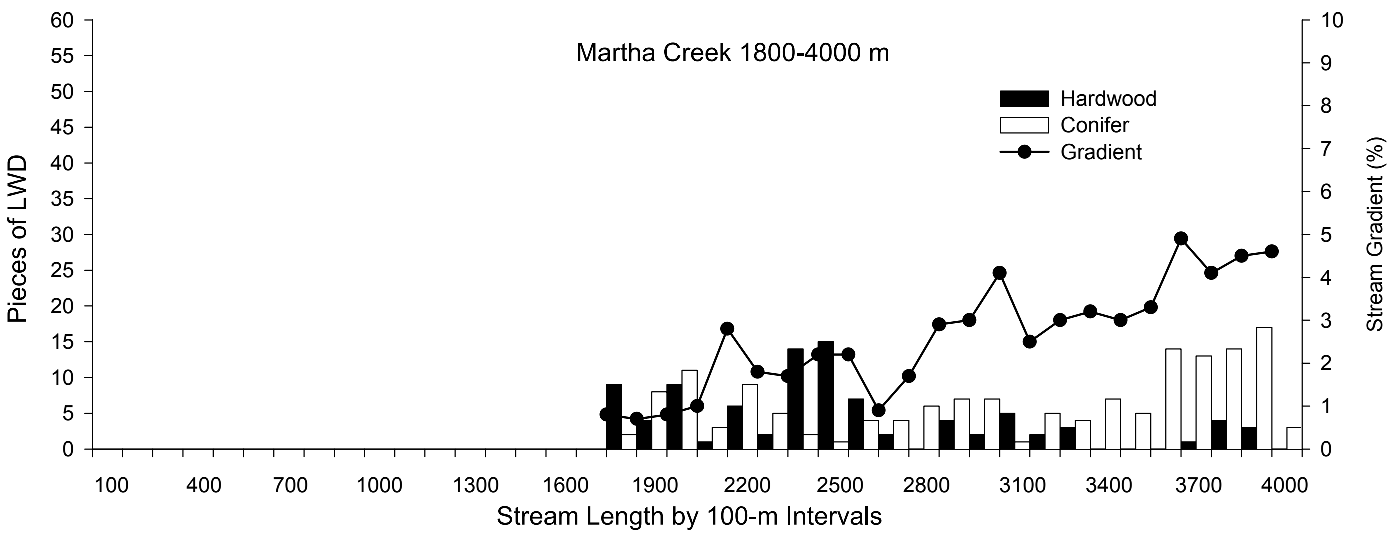
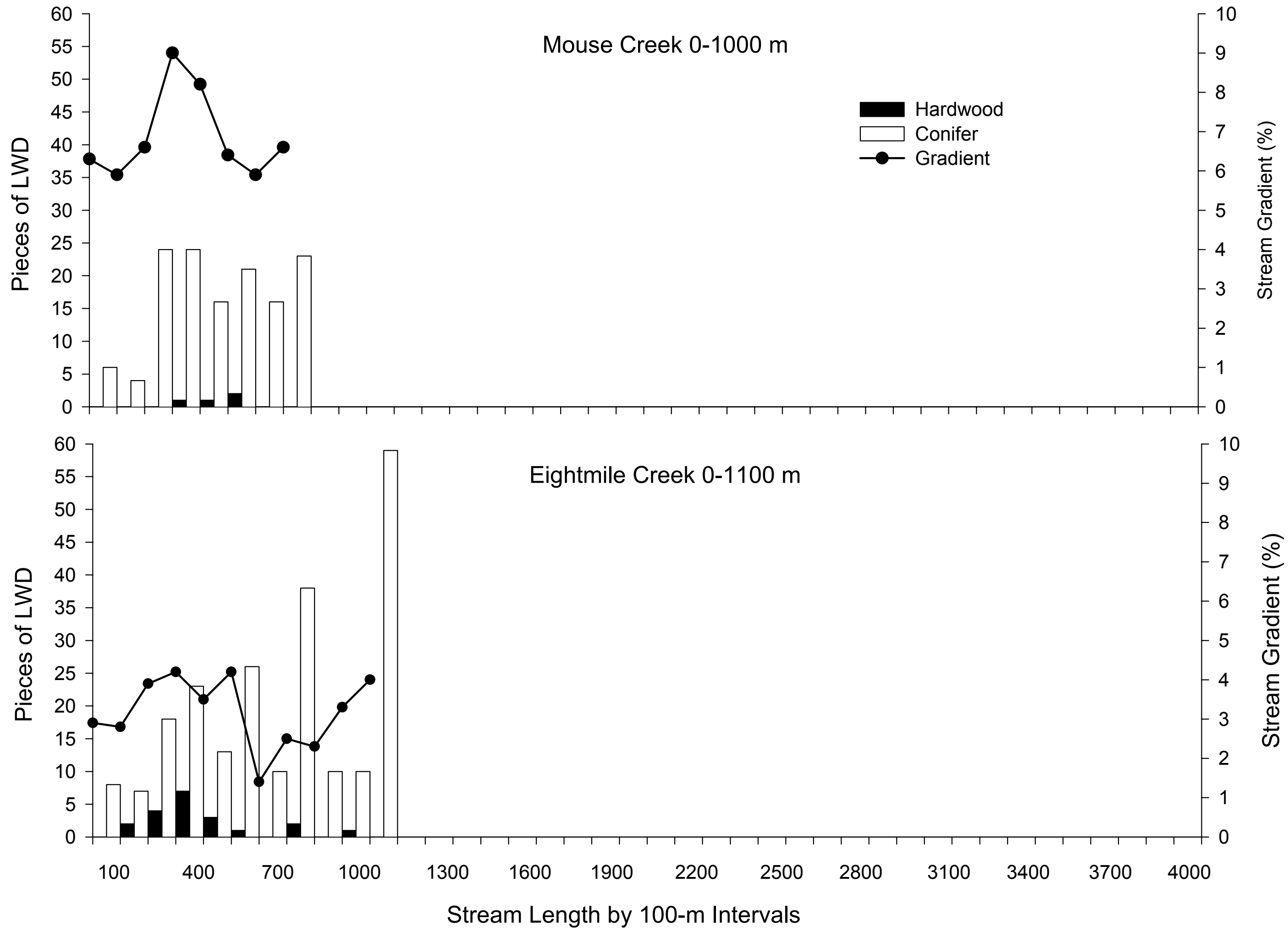
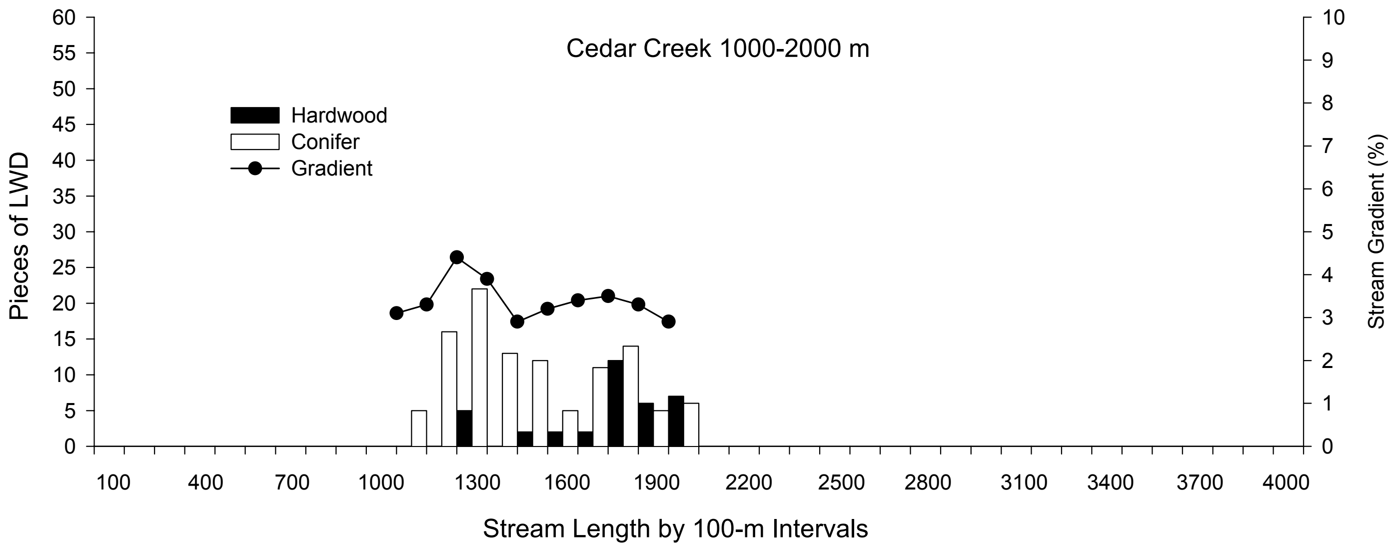


Appendix Figure 2. Continued.



Appendix Figure 3. Reach survey data for tributaries of Panther Creek. Shown are counts of hardwood and conifer large woody debris (LWD; length $\geq$ 1.0 m and diameter $\geq$ 0.3 m) and stream gradient (%) for 100-m intervals.



Appendix Figure 3. Continued.

Report B: Juvenile Steelhead and Other Fish Rearing in the Wind River Watershed

Wind River Watershed Project

2000-2001 Annual Report

February 2003

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Table of Contents

List of Tables

List of Figures

List of Appendix Tables

Introduction

Sampling efforts and results covered by this report are the result of efforts by personnel from U.S. Geological Survey's Columbia River Research Laboratory (USGS-CRRL). This report covers work completed on tasks that were delineated in the FY2001 Statement of Work submitted to Bonneville Power Administration in April 2001 (Contract year: April 2001 through 31 March 2002). In this report, we present our findings on fish assemblages and populations of juvenile salmonids based on data collected through December 2001.

Personnel from USGS-CRRL conducted field sampling in 2000 and 2001 to derive population estimates for steelhead/rainbow trout *Oncorhynchus mykiss*, brook trout *Salvelinus fontinalis*, and chinook salmon *O. tshawytscha* in streams of the Wind River subbasin. We have rotated sampling efforts between years, with the focus in 2000 on streams in the Trout Creek watershed, and with the focus in 2001 on streams in the upper Wind River watershed. We maintained a number of index sample sites throughout these two watersheds that were sampled every year.

During 2000 and 2001, we expanded our effort to tag juvenile steelhead with Passive Integrated Transponder (PIT) tags. We began PIT tagging Wind River steelhead in 1999. Because these PIT tag mark individual fish, they allow exploration of growth, survival, and life history traits.

Study Area

The Wind River subbasin covers 582 km^2 and supports a fifth-order stream system with the largest tributary watersheds being Trout Creek (88 km^2) and Panther Creek (107 km^2), which support third-order stream-systems (Figure 1). This report covers work that we did in the Trout Creek watershed above river kilometer 3.0 (67 km^2) and in the upper portion of the Wind River watershed above river kilometer 30.0 (222 km^2). Elevations in the Wind River subbasin range from 25-m at the mouth of the Wind River at the watershed's southern edge to 1,190-m at ridge tops near its northern edge. The watershed is exposed to a temperate marine climate with most of the average annual precipitation of 280-cm occurring between November and April. Precipitation in the winter is largely delivered as rain in the lower elevations of the watershed and as snow in the higher elevations.

Methods

We determined fish assemblage and density estimates by electrofishing and snorkeling. Electrofishing allowed us to handle fish to measure length and weight, to inspect for disease, and to tag fish. Snorkeling allowed us to rapidly sample long sections of stream and causes minimal impact on fish. Snorkeling also allowed us to sample stream sections too large for effective electrofishing. We have begun preliminary work on combining electrofishing and snorkeling data to achieve population estimates for watersheds.

Electrofishing

For all population-electrofishing sections, we first conducted a habitat-unit survey. We divided habitat units into strata (e.g., pools, glides, riffles, and side channels) and we shocked a systematic sample of units. Habitat units chosen for electrofishing were blocked off with nets to insure no immigration or emigration of fish. We used a backpack electrofisher to conduct two or more passes under the removal-depletion methodology (Zippin 1956; Bohlin et al. 1982; White et al. 1982). The field guides of Connolly (1996) were used to determine the number of passes necessary to insure that a controlled level of precision in the population estimate (CV < 25% for age-0 steelhead and CV < 12.5% for age-1 or older juvenile steelhead) was achieved within each sampling unit for each salmonid species (steelhead/rainbow trout, brook trout, chinook salmon) and age group (age-0 and age-1 or older). These methods were chosen to minimize the number of units sampled and the number of passes per unit. This approach lessens the chance that individual fish will be exposed to the effects of electrofishing while insuring a high degree of precision in our estimates.

In Crater Creek in 2000, we limited our electroshocking to pools. To determine population and biomass estimates over the total length of our sample section, we performed linear regression on values for pools against values for the total section from the years 1996, 1997, 1998, 1999, and 2001. Because all regressions were significant at the $\propto = 0.10$ level, and 16 of 18 were significant at the $\propto = 0.05$ level, and because all r^2 values were 0.7 or higher (Appendix Tables 1 and 2), we had confidence that this method was appropriate.

During 2000 and 2001, we electrofished two 100-m sections in mainstem Trout Creek. All habitat units within the sections were sampled. We have attempted to sample these 100-m sections annually since 1996. The upper section was sampled in 1984 by Washington Department of Fish and Wildlife (Crawford et. al. 1985). Annual sampling of these sections allows us to index fish abundance through time.

Fish captured by electrofishing were anesthetized with the lightest possible dose of MS-222 before handling. All fish captured were measured for fork length to the nearest mm, weighed to the nearest 0.01 g, and inspected for external signs of disease. When possible, fish that died during sampling were sent to U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center (USFWS-LCRFHC) for disease analysis (see below). In order to track movements, growth, and survival of juvenile steelhead trout, we PIT tagged juvenile steelhead that were 80-mm fork length or greater (see below). After work up, fish were held in fresh ambient-temperature stream water and released to their point of capture after regaining equilibrium.

All PIT tagging followed the procedures and guidelines outlined by Columbia Basin Fish and Wildlife Authority (1999). The PIT tags we used during 2000 and 2001 were 134.2 kHz and 12-mm in length. Because PIT tags have an effective life of over 10 years (Prentice et al. 1990), steelhead implanted with PIT tags provide the opportunity for recapture and data collection throughout their lifespan. We recaptured tagged fish by electrofishing in streams, capture at smolt traps, and by trapping as returning adults. PIT-tagged fish were also interrogated by automated detectors in the juvenile-bypass facilities at Bonneville Dam on the Columbia River. We submitted all PIT-tag and recapture data to the PTAGIS database administered by Pacific States Marine Fisheries Commission (PSMFC).

Snorkeling

Our snorkel surveys followed the methodology of Hankin and Reeves (1988), utilizing a stratified systematic survey technique to sample and estimate fish populations. We performed a habitat-unit survey from downstream to upstream and snorkeled every other pool, every third glide, every fourth riffle, and every fifth side channel. The start number for each unit type was randomly determined prior to the survey. Generally, one snorkeler was in the water for each unit. Riffles and side channels longer than 20-m were generally subsampled. Snorkelers counted all salmonids seen and broke them into age classes (age-0, age-1 or older, and adult). We collected snorkeler calibration data following the guidelines of Dolloff et al. (1993). Some snorkeler calibration data are presented in this report.

We snorkeled five 100-m sections of Trout Creek in which all habitat units within were snorkeled. The 100-m sections were between the upper end of Hemlock Lake (rkm 3) and the Forest Road 43 Bridge (rkm 11). Four of these sections have been snorkeled each year beginning in 1998; a fifth section was added in 1999. These sections serve as an index of salmonid numbers between years and between sites in this 8-km section of Trout Creek.

Population Estimates for Watersheds

We used estimates from snorkeling and electrofishing data from 18 stream sections to derive a population estimate for 2000 for the entire upper Wind River watershed accessible to anadromous salmonids. We used estimates from snorkeling and electrofishing data from 16 stream sections to derive a population estimate for 2001 for the entire Trout Creek watershed accessible to anadromous salmonids. Where we limited our sampling to pools only, we used the ratio of pools: riffles: glides from near-by stream sections or from stream sections that were geomorphically similar to extrapolate estimates for riffles and glides. For unsampled sections between two sections with population estimates, we averaged the numbers of fish per meter from the upper and lower sections. For unsampled sites that did not have an estimate above and below, we used the number of fish per meter from the closest geomorphically similar upstream or downstream section that had an estimate. The length (meters) of the section multiplied by the number of fish per meter provided the population estimate for the unsampled sections. In sections known to go dry, the estimate was assumed to be zero. We then combined our estimates and extrapolations to derive a basin estimate.

Fish Health

Fish provided to the USFWS-LCRFHC (Susan Gutenberger, Project Leader) were given a rigorous lab inspection for disease. Diseases screened at the Center by testing or microscopic observations included bacterial (bacterial kidney disease, coldwater disease, columnaris, emphysematous putrefactive disease, furunculosis, enteric redmouth), viral (infectious pancreatic necrosis, infectious hematopoietic necrosis, viral hemorrhagic septicemia), and parasitic (whirling disease, *Certomyxa*, digenetic trematodes, *Myxobous kisutchi*, *Myxidium minteri*, *Hexamita*, *Gyrodactulus*, *Scyphidia*, *Heteropolaria*) agents. The budgeting for this effort was 100% supported by in-kind contributions from the USFWS.

Results

We found a total of four fish species in our sampling areas in 2000-2001 (Table 1): steelhead/rainbow trout (hereafter referred to as steelhead), shorthead sculpin *Cottus confusus*, brook trout, and chinook salmon (Table 2). Juvenile steelhead were present in all areas sampled. Shorthead sculpin, brook trout, and chinook salmon were much more limited in their distribution than steelhead (Table 2).

We found sculpin throughout mainstem Wind River, Panther Creek, and their tributaries, but only in the lower portion of Trout Creek. We did not determine the exact extent of sculpin distribution in Trout Creek. We have encountered sculpin at the head of Hemlock Lake (rkm 2.8), but we have never encountered one in mainstem Trout Creek or its tributaries upstream of the Pacific Crest Trail Bridge (rkm 6.0).

Brook trout were found in both the Trout Creek and upper Wind River watersheds. We found brook trout to be prevalent in the mainstem and tributaries of Trout Creek above Planting Creek (rkm 9.0), but at low densities in the portion of Trout

Creek between Hemlock Lake and Planting Creek (rkm 2.9-9.0). We have observed brook trout, at low densities, in the mainstem and tributaries of the Wind River above rkm (30.0). Brook trout were introduced to the Wind River subbasin by the 1930s and stocked as late as 1979 (Lucas and Nawa 1985; USFS 1996).

We found juvenile chinook salmon throughout the mainstem Wind River and in some tributaries. Chinook salmon are not endemic to the Wind River above Shipherd Falls (rkm 4.0). Carson National Fish Hatchery was constructed in 1937 (Smith 1995), at rkm 28.0, and began producing strictly spring chinook in 1952. In 1956, Shipherd Falls was laddered to allow adult chinook access to the hatchery. Each year, a portion of these chinook adults do not enter the hatchery, but stay in the river and attempt to spawn. During 2000, we found juvenile chinook in the mainstem Wind River up to rkm 42.5. We also found juvenile chinook in the upper Wind River tributaries: Paradise Creek, Falls Creek, and Trapper Creek. We have not found juvenile chinook in Trout Creek, Panther Creek, or their tributaries during our sampling from 1996 to present. Presence of juvenile chinook salmon indicate that escaped hatchery adults have some degree of spawning success.

Electrofishing, Year 2000

We conducted population surveys by electrofishing in seven stream sections during 2000, including four 500-m sections in the upper Wind watershed (Trapper Creek, Dry Creek, Paradise Creek, mainstem Wind River above Paradise Creek), a 500-m section on Crater Creek in the Trout Creek watershed, and two 100-m sections of mainstem Trout Creek (MSA and MSB; Table 1). These survey sites were an extension of an existing matrix of comparative surveys conducted in 1984 (Crawford et al. 1985), in 1985-1988 (USFS, unpublished data), and in 1996-1999 (Connolly 2001).

<u>Juvenile Steelhead, 2000</u>

During 2000, age-0 steelhead populations (fish/m) were very low in all sections surveyed except Dry Creek (Figure 1; Appendix Tables 3 and 4). The sample sections on Crater Creek, Trout Creek MSA, and Paradise Creek had age-0 steelhead populations of 1.64, 1.25, and 1.50 fish/m in the 1980s, populations of 0.34, 0.56, and 0.47 fish/m in the

1990s, and populations of 0.02, 0.02, and 0.03 fish/m in 2000. Age-0 steelhead populations in Dry Creek were 0.93 fish/m in the 1980s sample and 1.13 fish/m in 2000. Dry Creek had the highest age-0 steelhead density of any of our sample sections. In most sections, age-0 steelhead densities in 2000 were much lower than those reported in Connolly (2001) for 1984-1988 and 1996-1999.

During 2000, age-1 or older steelhead populations (no./m) were generally lower than those reported for 1984-88 and similar to values for 1996-99. Crater Creek, Trout Creek MSA, and Paradise Creek sampling sections had age-1 or older steelhead populations of 0.42, 1.29, and 0.49 fish/m from the 1980s data, 0.30, 0.29, and 0.25 fish/m from the 1990s data, and 0.37, 0.22, and 0.41 fish/m in 2000. Age-1 or older steelhead population in Dry Creek was 0.31 fish/m in a sample from the 1980s, but was 0.45 fish/m in 2000. Biomass (g/m) of both age-0 and age-1 or older steelhead was higher in Dry Creek than in any other sample site in 2000 (Figure 1).

Brook Trout and Juvenile Chinook, 2000

Brook trout were present in Crater Creek, Trout Creek MSA, and Trout Creek MSB during 2000 (Appendix Tables 5 and 6). In 2000, we found only age-1 or older brook trout in Trout Creek MSB. Brook trout constituted about a third of the salmonid biomass in Crater Creek and Trout Creek MSA in 2000 (Figure 2). We found no brook trout in Paradise Creek or mainstem Wind River above Paradise Creek in 2000, though we have found isolated individuals in the past (Connolly 2001).

We found age-0 chinook salmon in our Trapper Creek, Paradise Creek, and mainstem Wind River above Paradise Creek electrofishing sites in 2000. Populations and biomass were generally low (Appendix Tables 7 and 8). At our site in mainstem Wind River above Paradise Creek, the population and biomass of age-0 chinook in pools were greater than those of age-0 steelhead during 2000 (age-0 chinook: 0.27 fish/m, 1.74 g/m; age-0 steelhead: 0.03 fish/m, 0.09 g/m). An adult trap at Hemlock Dam on Trout Creek ensures that no adult chinook use Trout Creek above the dam.

Electrofishing, Year 2001

We conducted population-electrofishing surveys in 10 stream sections during 2001, including one 500-m section of Dry Creek in the upper Wind River watershed, six 500-m sections in the Trout Creek watershed (upper mainstem Trout Creek, Crater Creek, Compass Creek, E. Fork Trout Creek, upper Layout Creek, and Planting Creek), a 1000-m section of lower Layout Creek in the Trout Creek watershed, and two 100-m sections of mainstem Trout Creek (Trout Creek MSA and MSB; Table 1; Appendix Tables 9-14). As in 2000, these sites were an extension of the matrix of previous samples.

Juvenile Steelhead, 2001

In 2001, age-0 steelhead populations increased (Figures 1 and 3; Appendix Tables 9 and 10). We electrofished three sites in the Trout Creek watershed in both 2000 and 2001: Crater Creek, Trout Creek MSA, and Trout Creek MSB. Each showed an increase in age-0 steelhead population (fish/m) from 2000 to 2001 of greater than 85 percent (Appendix Tables 3 and 4). Age-0 steelhead population in Dry Creek was lower in 2001 than in 2000; however, because we sampled Dry Creek in early summer 2001 (12 July), it was likely that the steelhead fry had not emerged, or were not yet susceptible to our gear. Despite higher populations of age-0 steelhead in 2001, age-0 steelhead populations in Planting Creek and Compass Creek were lower than mean values found by Connolly (2001) for the 1990s and lower than mean values for the 1980s reported in Connolly (2001).

Age-1 or older steelhead populations were similar between 2000 and 2001 in Crater Creek, Trout Creek MSA, and Trout Creek MSB. Age-1 or older steelhead populations in Dry Creek more than doubled from 2000 to 2001 from 0.45 to 0.93 fish/m (Figures 1 and 3). Crater Creek, Trout Creek MSA, and Layout Creek had age-1 or older steelhead populations of 0.42, 1.29, and 0.10 fish/m from the 1980s data, 0.30, 0.30, and 0.14 fish/m from the 1990s data, and 0.24, 0.21, and 0.05 fish/m in 2001. Age-1 or older steelhead number per meter in 2001 were lower than the mean number per meter reported by Connolly (2001) for both the 1980s and 1990s periods at all sites except Dry and Compass creeks.

Brook Trout and Juvenile Chinook, 2001

Brook trout densities and biomass increased from 2000 to 2001 in Crater Creek, Trout Creek MSA, and Trout Creek MSB (Figure 4). Age-1 or older brook trout populations in Crater Creek, Trout Creek MSA, and Trout Creek MSB were 0.10, 0.06, and 0.01 fish/m in 2000 and 0.14, 0.15, and 0.02 fish/m in 2001 (Figures 1 and 3; Appendix Tables 5, 6, 11, and 12). Brook trout biomass was higher at these three sites in 2001 than 2000. Brook trout biomass, as a percentage of total salmonid biomass, showed an increasing trend at these three sites from the mid-1990s to 2001 (Figure 5). The increase in brook trout biomass at these sites coincided with a decreasing trend in steelhead biomass (Figure 6). Brook trout populations and biomass in Compass Creek, East Fork Trout Creek, and Layout Creek in 2001 were higher than mean values reported by Connolly (2001) for the 1990s.

PIT Tagging

During 2000 and 2001, we deployed PIT tags in juvenile steelhead 80-mm or greater. Steelhead parr were PIT tagged at smolt traps run by WDFW and through our instream-electrofishing efforts. Steelhead captured during 2000 were scanned for 400-kHz tags, which we deployed in 1999, and steelhead captured during 2001 were scanned for 134.2-kHz tags, which we deployed during 2000. We submitted all PIT-tag data to PSMFC's PTAGIS database.

To study the downstream migration of steelhead parr within the Wind River subbasin (Rawding 2001), we PIT tagged parr at three smolt traps during 2000 and 2001: Trout Creek, Panther Creek and mainstem Wind River above Carson National Fish Hatchery. In 2000, we deployed 764 PIT tags at the smolt traps, and in 2001, we deployed 335 PIT tags at the smolt traps (Table 3). We PIT tagged steelhead parr at the smolt traps from late May through late June.

During 2000 and 2001, we PIT tagged steelhead parr during instream-electrofishing efforts. During 2000, we PIT tagged 697 steelhead parr from electrofishing surveys at 10 locations in the Trout Creek and upper Wind River watersheds. During 2001, we PIT tagged 823 steelhead parr from electrofishing surveys at 19 locations in Trout Creek, Panther Creek and the upper Wind River watersheds

(Table 4). The higher number of steelhead tagged during 2001 resulted from increased effort, and does not necessarily reflect higher densities or capture rates.

During spring 2001, a portion of the steelhead that we PIT tagged at smolt traps and instream during 2000 outmigrated as smolts. Of 764 fish tagged at the smolt traps during 2000, 63 (8.2%) were detected as they passed Bonneville Dam. Median date of passage at Bonneville was 11 May 2001 for steelhead tagged at smolt traps during 2000. Of 697 fish tagged instream during 2000, 19 (2.7%) were detected as they passed Bonneville Dam. Median date of passage at Bonneville was 29 May 2001 for steelhead tagged instream during 2000 (Figure 7). In addition to interrogations at Bonneville Dam, we have information on recaptures of PIT-tagged steelhead through electrofishing surveys and at the smolt traps; these data have not been summarized at the time of this writing.

Snorkeling

Juvenile Steelhead, Year 2000

During 2000, we snorkel sampled 13,800 m in the mainstem Wind River (rkm 30.0 – 43.8), 6,100 m in tributaries to the mainstem Wind River, 1,500 m in tributaries to Trout Creek, and five 100-m index sites in mainstem Trout Creek (Appendix Table 15). Overall, populations of age-0 steelhead were low. The highest population of age-0 steelhead was in lower Falls Creek with 0.50 fish/m (Figure 8; Appendix Table 16). Age-0 steelhead numbers were very low in Crater Creek at 0.03 fish/m, and extremely low in the mainstem Wind River between Trapper and Falls creeks at 0.004 fish/m. Population of age-1 or older steelhead was highest in middle Dry Creek at 0.41 fish/m. The mainstem Wind River had moderate numbers of age-1 or older steelhead from Falls Creek to above Paradise Creek (rkm 35.4 - 43.8; Figure 8). Population of age-1 or older steelhead was low in Crater Creek at 0.10 fish/m. Crater Creek, and much of the upper Trout Creek watershed has seen few steelhead spawners in recent years (pers comm., Brian Bair, USFS).

Brook Trout and Juvenile Chinook, Year 2000

Brook trout were present at low levels in the mainstem Wind River and Falls Creek. Density of age-0 brook trout in Crater Creek was higher than age-0 steelhead at 0.06 and 0.03 fish/m (Appendix Tables 16 and 17). Juvenile chinook salmon were present in the mainstem Wind River from rkm 30.0 to about rkm 42.0, in both upper and lower Falls Creek, and in our lower Trapper Creek snorkel-sample (Appendix Table 18). Chinook numbers were generally low; however, the age-0 chinook population in pools was greater than the age-0 steelhead population in pools in the upper-mine reach of mainstem Wind River (0.07 and 0.04 fish/m) and in the Trapper Creek to Falls Creek section of maistem Wind River (0.007 and 0.004 fish/m). Juvenile chinook population was highest in lower Falls Creek at 0.20 fish/m.

Juvenile Steelhead, Year 2001

During 2001, our main effort was in Trout Creek, where we snorkel-sampled 14,400 m of the mainstem and 500 m of Crater Creek. We also snorkel sampled 700 m of middle Dry Creek, a tributary to the upper Wind River (Table 1). Personnel from U.S. Forest Service snorkel-sampled 4,600 m of mainstem Wind River, following USGS sampling protocol. We saw no age-0 steelhead on middle Dry Creek (Figure 9); however, we sampled early in the summer (12 July) and the fry had most likely not emerged. Age-1 or older steelhead decreased slightly in the middle section of Dry Creek from 2000 to 2001 (Figure 10). In the mine reach of the Wind River (MINE, rkm 36.0 - 40.0), age-0 steelhead numbers were higher in 2001 than in 2000, at 0.45 and 0.16 fish/m (Figure 11). Age-1 or older steelhead decreased between 2000 and 2001 in the mine reach of the Wind River (MINE) from 0.36 to 0.20 fish/m. This decrease was not surprising given the low age-0 steelhead population during 2000.

In mainstem Trout Creek, age-0 steelhead populations ranged from 0.04 to 0.90 fish/m between reaches (Figure 9; Appendix Table 19). Over the entire stream length that we sampled in Trout Creek, age-0 steelhead population was 0.40 fish/m. Age-1 or older steelhead population in mainstem Trout Creek was highest in Reach 4 (rkm 4.5-7.4) at 0.60 fish/m. Over the entire stream length that we sampled in Trout Creek, age-1 steelhead population was 0.32 fish/m.

Brook Trout and Juvenile Chinook, Year 2001

During 2001, we found brook trout present throughout mainstem Trout Creek (rkm 2.9 – 14.3), but at relatively low numbers (age-0 = 0.006 fish/m, age-1 or older = 0.02 fish/m). The upper portion of mainstem Trout Creek that we snorkel sampled (rkm 11.9 – 14.3) had the highest population of brook trout with age-0 and age-1 or older fish at 0.02 and 0.05 fish/m. Populations of age-0 and age-1 or older brook trout in our snorkel-sample section of Crater Creek were each 0.03 fish/m (Appendix Table 20). In the mine reach of mainstem Wind River, age-0 and age-1 chinook populations were 0.04 and 0.03 fish/m (Appendix Table 21). The age-0 chinook population in the mine-reach of the Wind River (rkm 36.0 –40.0) decreased from 0.10 fish/m in 2000; the age-1 chinook population increased from 0.02 fish/m in 2000 (Figure 12). We will continue to monitor distribution and populations of brook trout and chinook in upcoming years.

Juvenile Steelhead, Trout Creek 100-m Sites, 1998-2001

We have five 100-m index-snorkel sites along the length of mainstem Trout Creek. We have sampled four of these sites since 1998, the fifth site was added in 1999. Steelhead populations at these sites have shown much variation between sites and between years (Figure 12). Population of age-1or older steelhead has been highest at the site at rkm 7.0 in each of the three years that it has been sampled. Population of age-1 or older steelhead at the rkm 7.0 site was nearly 2.0 fish/m in 2001, yet in 2000 the population of age-0 steelhead at this site was less than 0.25 fish/m.

Population Estimates for Watersheds

We estimated total populations of salmonids in the upper Wind River and Trout Creek watersheds with relatively simple methods (Appendix Tables 22-31). During 2000, in the upper Wind River, we estimated a greater number of age-1 or older steelhead than age-0 steelhead (Table 5). During 2001, in Trout Creek, we estimated the population of age-0 steelhead to be three times that of age-1 or older steelhead (Table 6). In the upper Wind watershed, chinook and brook trout are introduced species. During 2000, these introduced fish made up 11 percent of our total salmonid estimate for the upper Wind River. Brook trout were introduced to the Trout Creek watershed and have maintained populations despite the cessation of stocking. During 2001, brook trout made up 19 percent of the total salmonid estimate for the Trout Creek watershed. Readers are cautioned in comparing the estimates we have generated as they are from different watersheds and different years. More complex, and potentially more accurate, methods of deriving these watershed-population estimates based on habitat variation and snorkeler calibration are being developed.

Fish Health

No viral disease agents were found in salmonids in the Wind River watershed during 1996-2001. Bacterial Kidney Disease *Renibacterium salmoninarum* was found in steelhead and brook trout in the upper Trout Creek watershed and in chinook salmon in the upper Wind River watershed (Tables 7-9). Bacterial Coldwater Disease was found in steelhead in the Trout Creek. A number of parasitic disease agents were found in salmonids in the Wind River watershed (Tables 10-13). Steelhead were infected, some heavily, with the ciliated protozoan *Heteropolaria* (formerly *Epistylis*) throughout the basin. Brook trout were found to have *Heteropolaria* in the upper reach of mainstem Trout Creek and Compass Creek. No salmonids infected with *Heteropolaria* have been found in the upper Wind River watershed. No Whirling Disease *Myxobolus cerebralis* has been found in the Wind River watershed as of this writing.

Snorkel Calibration

We have calibrated snorkelers who have worked for us using methods described by Dolloff et al. (1993). To date we have calibrated snorkelers in pool habitat only. Results to date are shown in Table 13. Our overall calibration ratios, in pool habitat, are 1.3 for age-0 steelhead and 1.1 for age-1 or older steelhead. We will continue to calibrate snorkelers and plan to use calibrations to adjust watershed-population estimates.

Discussion

The variability of anadromous fish production was clearly evident in the Wind River watershed during 2000 and 2001. Age-0 steelhead population was low in 2000, but rebounded in 2001. These data correspond to concurrent monitoring of adults and smolts by WDFW. Steelhead parr outmigration at the smolt traps was down in 2001 (pers comm. Charlie Cochran, WDFW), which corresponded with low age-0 population in 2000 and with low adult-returns for brood years 1998-2000. Adult steelhead returns were up for the 2001 brood year, which corresponds with the higher age-0 populations that we observed during 2001. Populations of age-1 or older steelhead are holding steady relative to their numbers during 1996-1999, but continue to be depressed relative to their numbers in 1984 –1988 (see Connolly 2001). The exception to these trends was Dry Creek, which has shown an increase in *O. mykiss* numbers, but we suspect densities in Dry Creek are more influenced by resident rainbow trout that most of the areas we sampled.

Introduction of exotic fish in the Wind River subbasin had a potentially negative effect on steelhead production. The stocking of brook trout within the watershed has established naturally reproducing populations in a number of locations, particularly in the upper Trout Creek watershed. The increased percentage of brook trout biomass in areas in the upper Trout Creek watershed corresponds to a decrease in steelhead biomass. During 2000, density of age-0 brook trout was higher than density of age-0 steelhead in some areas in the upper Trout Creek watershed, and during 2001, we found a higher density of age-1 or older brook trout than age-1 or older steelhead in Crater Creek. Behnke (1992) listed introduced brook trout as a reason for decline of some native cutthroat trout populations. Levin et al. (2002) suggested that brook trout limited survival of wild juvenile chinook in pristine habitat. In a laboratory setting, Magoulick and Wilzbach (1998) found brook trout to dominate rainbow trout. The recent period of depressed steelhead production could give brook trout a competitive advantage during future years, which may limit the desired response of steelhead to habitat restoration.

The laddering of Shipherd Falls at rkm 4.0 allowed adult chinook salmon, and other species, to enter the upper portion of the Wind River watershed. Juvenile chinook populations in the upper Wind River were relatively low in 2001, but they were in higher in 2000 and the fish were much more widely distributed (up to rkm 42.5). The extent of juvenile chinook distribution is most likely related to water levels during the preceding fall when adult chinook spawn. During 1999, a relatively high water year, adult spring chinook were probably able to make it far up the river for spawning in August-September. During 2000, adult steelhead returns were poor, and age-0 chinook population exceeded age-0 steelhead population in the upper Wind River (Figure 1; Appendix Tables 1 and 5). Although steelhead and chinook often coexist with no apparent impact (Everest and Chapman 1972; McMichael and Pearsons 1998) because they tend to use different reaches and habitats (Roper and Scarnecchia 1994), they did not co-evolve in the Wind River and their interactions with steelhead in the Wind River are potentially negative. One possibility is that the location of the hatchery artificially promotes potential interactions. Returning adult chinook that do not enter the hatchery tend to hold and spawn close to or above the hatchery, which is on an area important for steelhead spawning and rearing.

Other non-native species have been sighted in the Wind River (e.g., sockeye salmon, coho salmon, and brown trout). None appear to be at problematic levels, and little, if any, successful spawning has occurred during our study years (1996-present).

Life history of steelhead is generally considered plastic and can express many site-specific life-history traits (Behnke 1992; Peven et al. 1994). Our PIT-tagging efforts in 2000, and subsequent interrogations at Bonneville Dam in 2001, showed encouraging results for deciphering steelhead life histories within the Wind River watershed. The Bonneville Dam interrogation data from 2001 suggested earlier smolt-migration timing for parr that migrate from headwater habitat to mainstem areas within the Wind River before smolting than for parr that remain in headwater areas until they smolt. A higher percentage of parr tagged at smolt traps than parr tagged in headwater areas were detected at Bonneville Dam in the subsequent year. This could indicate that the parr that migrate and rear in mainstem habitat smolt at an earlier age than those that remain in headwater habitat. It could also indicate that parr rearing in mainstem areas have better survival than those remaining in natal areas for longer periods. Recapture data from smolt traps and electrofishing should continue to contribute to our understanding of steelhead life histories within the Wind River.

The protozoan *Heteropolaria* continued to be prevalent in the subbasin, particularly in the headwaters area of Trout Creek watershed. *Heteropolaria* was first detected by Connolly in 1996 (Connolly 1997), and has been found in every year since. The potential parasite was present in other areas of the Wind River subbasin, but not to the same extent. In the Trout Creek watershed, this parasite seems to affect steelhead to a greater degree than brook trout in the same areas. Additional investigation of this parasite and the effect it has on juvenile steelhead is warranted.

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Table 1. Surveys conducted by the USGS-CRRL using snorkeling or the removal method with electrofishing within the Wind River subbasin. Sites are listed from upstream to downstream within a watershed relative to the mainstem.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of reach (km)	Year electrofished[a] (Yes/No)						Year snorkeled[a] (Yes/No)					
			1996	1997	1998	1999	2000	2001	1996	1997	1998	1999	2000	2001
Upper Wind														
Wind R. – ab. Paradise Cr.	40.0	3.8	N	N	N	N	Y	N	N	N	N	N	Y	N
Paradise Cr. – lower[b]	0 (at mouth)	0.5	N	N	Y	Y	Y	N	N	N	Y	N	N	N
Paradise Cr. – middle	1.3	0.8	N	N	N	N	N	N	N	N	N	N	Y	N
Paradise Cr. – upper	2.6	0.7	N	N	N	N	N	N	N	N	N	N	Y	N
Wind R – mining reach	36.0	4.2	N	N	N	N	N	N	N	N	N	N	Y	Y[c]
Wind R – Falls-mine	35.4	0.6	N	N	N	N	N	N	N	N	N	N	Y	Y
Falls Cr. – lower	0 (at mouth)	0.8	N	N	N	N	N	N	N	N	N	N	Y	N
Falls Cr. – upper	1.6	0.5	N	N	N	N	N	N	N	N	N	N	Y	N
Ninemile Cr.	1.5	0.8	N	N	N	N	N	N	N	N	N	N	Y	N
Dry Cr. – lower	3.4	0.5	N	N	N	N	Y	Y	N	N	N	N	N	N
Dry Cr. – middle	4.5	0.7	N	N	N	N	N	N	N	N	N	N	Y	Y
Dry Cr. – upper	5.9	0.6	N	N	N	N	N	N	N	N	N	N	Y	N
Big Hollow Cr.[b]	0 (at mouth)	0.5	N	N	Y	N	N	N	N	N	N	N	N	N
Trapper Cr. – lower	0 (at mouth)	1.0	N	N	N	N	N	N	N	N	Y	N	Y	N
Trapper Cr. – middle1	2.9	0.6	N	N	N	N	Y	N	N	N	N	N	N	N
Trapper Cr. – middle2	3.7	0.8	N	N	N	N	N	N	N	N	N	N	Y	N
Trapper Cr. – upper	4.8	0.6	N	N	N	N	N	N	N	N	N	N	Y	N
Wind R – (Trapper-Falls Cr.)	30.0	5.4	N	N	N	N	N	N	N	N	N	N	Y	N

Table 1. Continued.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of reach (km)	Year electrofished[a] (Yes/No) 1996	1997	1998	1999	2000	2001	Year snorkeled[a] (Yes/No) 1996	1997	1998	1999	2000	2001
Trout Creek														
Trout Cr. – upper	0 (at mouth)	0.5	Y	Y	N	N	N	Y	N	N	N	N	N	N
Crater Cr. – middle	0.5	0.5	N	N	N	N	N	N	N	N	N	N	N	Y
Crater Cr. [b]	0 (at mouth)	0.5	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	N
Trout Cr. – Reach 6[d]	11.9	2.3	N	N	N	N	N	N	N	N	N	Y	N	Y
Trout Cr. – MSA [b]	14.0	0.1	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N
Trout Cr. – Reach 5[d]	7.4	3.5	N	N	N	N	N	N	N	N	N	N	N	Y
Compass Cr. [b]	0 (at mouth)	0.5	Y	N	N	N	N	Y	N	N	N	N	N	N
East Fork Trout Cr.	0 (at mouth)	0.4	Y	N	N	N	N	Y	N	N	N	N	N	N
Layout Cr. – upper	2.3	0.5	N	N	N	N	N	Y	N	N	N	N	N	N
Layout Cr.	0 (at mouth)	1.0	Y	N	N	Y	N	Y	N	N	N	N	Y	N
Trout Cr. – MSB	11.0	0.1	Y	N	Y	N	Y	Y	N	N	N	N	Y	Y
Planting Cr. [b]	0 (at mouth)	0.5	Y	Y	N	N	N	Y	N	N	N	N	N	N
Trout Cr. – at Planting Cr.	9.0	0.1	N	N	N	N	N	N	N	N	Y	Y	Y	Y
Trout Cr. – Reach 4[d]	4.5	2.8	N	N	N	N	N	N	N	N	N	N	N	Y
Trout Cr. – Canyon	7.0	0.1	N	N	N	N	N	N	N	N	N	Y	Y	Y
Trout Cr. – PCT Bridge	5.0	0.1	N	N	N	N	N	N	N	N	Y	Y	Y	Y
Trout Cr. – Reach 3[d]	3.9	0.6	N	N	N	N	N	N	N	N	N	N	N	Y
Trout Cr. – Reach 2[d]	2.9	1.0	N	N	N	N	N	N	N	N	N	N	N	Y
Trout Cr. – bl. Smolt Trap	3.0	0.1	N	N	N	N	N	N	N	N	Y	Y	Y	Y
Trout Cr. – All Reaches	2.9	15.2	N	N	N	N	N	N	N	N	N	N	N	Y
Martha Cr. [b]	0.9	0.4	N	Y	Y	N	N	N	N	N	Y	N	N	N

Table 1. Continued.

Watershed Subwatershed Subdrainage	Start point distance from mouth (km)	Length of reach (km)	Year electrofished[a] (Yes/No) 1996	1997	1998	1999	2000	2001	Year snorkeled[a] (Yes/No) 1996	1997	1998	1999	2000	2001
Panther Creek														
Mouse Cr. [b]	0 (at mouth)	0.5	Y	N	N	N	N	N	N	N	N	N	N	N
Eightmile Cr. – upper	0.7	0.5	Y	N	Y	N	N	N	N	N	N	N	N	N
Eightmile Cr. – lower	0 (at mouth)	0.6	Y	Y	Y	N	N	N	N	N	N	N	N	N
Cedar Cr.	1.0	0.6	Y	N	N	N	N	N	N	N	N	N	N	N

[a] Electrofishing sampling conducted during August through mid-October except for Dry Creek in 2001. Results from 1996, 1997, and 1998 were reported in Connolly (1997), Connolly et al. (1997), and Connolly (1999), respectively.
[b] Locations sampled in 1984 by Crawford et al. (1985).
[c] Snorkel survey was conducted by the U.S. Forst Service.
[d] Reaches were determined by the U. S. Forest Service, 1995 Level II Stream Survey Trout Creek Stream Narrative by P. Cochran.

Table 2. Assemblages of fish species observed in streams of the Wind River subbasin during electrofishing and snorkeling surveys, 1996-2001. Watersheds and streams are listed in an upstream to downstream pattern. P = present, A = absent.

Watershed / Subwatershed / Stream	Stream code	Steelhead/ rainbow trout	Brook trout[a]	Chinook salmon[a]	Shorthead sculpin
Upper Wind River					
Wind R – ab. Para. Cr.	UMIN	P	P	P	P
Paradise Cr. – lower[b]	PARA	P	P	P	P
Paradise Cr. – middle	MPAR	P	A	A	A
Paradise Cr. – upper	UPAR	P	A	A	A
Wind R – mine reach	MINE	P	P	P	P
Falls Cr. – lower	LFAL	P	P	P	A
Falls Cr. – upper	UFAL	P	P	P	A
Ninemile Cr.	NINE	P	A	A	A
Dry Cr. – lower	DRYC	P	A	A	P
Dry Cr. – middle	MDRY	P	A	A	P
Dry Cr. – upper	UDRY	P	A	A	P
Big Hollow Cr.b	BIGH	P	A	A	P
Trapper Cr. – lower	LTRA	P	A	P	P
Trapper Cr. – middle1	TRAP	P	P	P	P
Trapper Cr. – midlle2	MTRA	P	A	A	P
Trapper Cr. – upper	UTRA	P	A	A	P
Wind R. – (Trapper – Falls)	UWTF	P	A	P	P
Panther Creek					
Mouse Cr.[b]	MOUS	P	A	A	A
Eightmile Cr. – upper	UEIG	P	A	A	P
Eightmile Cr. – lower	LEIG	P	A	A	P
Cedar Cr.	CEDA	P	A	A	P

Table 2. Continued

Watershed Subwatershed Stream	Stream code	Steelhead/ rainbow trout	Brook trout[a]	Chinook salmon[a]	Shorthead sculpin
Trout Creek					
Trout Cr. – upper	UTRO	P	P	A	A
Trout Cr. – Reach 7[c]	MTR7	P	P	A	A
Crater Cr. – middle	MCRA	P	P	A	A
Crater Cr.[b]	CRAT	P	P	A	A
Trout Cr. – Reach 6[c]	MTR6	P	P	A	A
Trout Cr. – MSA[b]	MS33	P	P	A	A
Compass Cr.[b]	COMP	P	P	A	A
East Fork Trout Cr.	EFTR	P	P	A	A
Layout Cr. – upper	ULAY	P	P	A	A
Layout Cr.	LAYO	P	P	A	A
Trout Cr. – MSB	MS43	P	P	A	A
Trout Cr. – Reach 5[c]	MTR5	P	P	A	A
Planting Cr.[b]	PLAN	P	P	A	A
Trout Cr. – at Planting Cr	MTPL	P	P	A	A
Trout Cr. – Reach 4[c]	MTR4	P	P	A	A
Trout Cr. – Canyon	TCAN	P	P	A	P
Trout Cr. – PCT Bridge	PCTB	P	P	A	A
Trout Cr. – Reach 3[c]	MTR3	P	P	A	A
Trout Cr. – Reach 2[c]	MTR2	P	P	A	A
Trout Cr. – Smolt Trap	LTRT	P	P	A	P
Martha Creek[b]	MART	P	A	A	A

[a] These species are considered nonnative to the Wind River subbasin above Shipherd Falls.
[b] Locations sampled in 1984 by Crawford et al (1985) as well as by USGS-CRRL during 1996-2001.
[c] Reaches were defined by P. Cochran (1995) who used the U.S. Forest Service Level II Stream Survey method.

Table 3. Number of steelhead/rainbow trout parr PIT tagged at each of three smolt traps within the Wind River subbasin during May and June 2000- 2001. Readings are from a hand-held Global Positioning System (GPS) using North American Datum 1927.

Smolt Trap	GPS Reading		Number of 134.2 kHz PIT Tags deployed	
	North	West	2000	2001
Upper Wind[a]	45º 52.501'	121º 58.629'	547	290
Trout Creek[a]	45º 48.241'	121º 56.330'	125	19
Panther Creek[a]	RNO[b]		92	26
Total			**764**	**335**

[a] Steelhead parr 80 mm or longer were tagged three days a week through the period listed.
[b] RNO = Reading not obtainable by GPS because of basin topography

Table 4. Total number of juvenile steelhead/rainbow trout parr that were captured by electrofishing and PIT tagged in the Wind River subbasin 1999-2001. Watersheds and streams are listed in an upstream to downstream pattern within a watershed.

Watershed Stream reach or section		**Number of 400 kHz** PIT tags deployed **1999**	**Number of 134.2 kHz** PIT tags deployed **2000**	**Number of 134.2 kHz** PIT tags deployed **2001**
Upper Wind River				
Wind River - above Paradise Cr.		59	36	15
Paradise Creek		68	85	17
Wind River – mining reach		0	61	36
Dry Creek – lower		44	115	142
Trapper Creek – middle		0	101	30
	Subtotal	**171**	**398**	**240**
Trout Creek				
Trout Creek – upper		0	0	14
Crater Creek- lower		27	24	49
Trout Creek mainstem – A (33 bridge)		18	26	18
Compass Creek – lower		0	0	71
East Fork Trout Creek – lower		0	0	7
Layout Creek – upper		0	0	127
Layout Creek – lower		69	89	35
Trout Creek mainstem – B (43 bridge)		0	46	116
Planting Creek – lower		0	0	90
Martha Creek		0	114	0
	Subtotal	**114**	**299**	**528**
Wind River				
Wind River – canyon		0	0	12
	Subtotal	**0**	**0**	**12**
Panther Creek				
Eightmile Creek – upper		0	0	23
Eightmile Creek – lower		0	0	20
	Subtotal	**0**	**0**	**43**
Total		**285**	**697**	**823**

[a] Fish tagged were limited to steelhead parr 80 mm or longer.

Table 5. Preliminary population estimates, based on snorkeling and electrofishing data, for steelhead/rainbow trout, brook trout, and chinook salmon in the upper Wind watershed, above rkm 30.0, in 2000.

	Population estimate	
Species	Age-0	Age-1 or older
Steelhead/rainbow trout	6,686	6,914
Brook trout	25	12
Chinook salmon	1,369	138

Table 6. Preliminary population estimates, based on snorkeling and electrofishing data for steelhead/rainbow trout and brook trout in the Trout Creek watershed, above rkm 3.0, in 2001. No chinook salmon were found in the Trout Creek watershed.

	Population estimate	
Species	Age-0	Age-1 or older
Steelhead/rainbow trout	19,693	7,321
Brook trout	3,864	1,181

Table 7. Detected bacterial and viral disease agents in wild juvenile steelhead/rainbow trout from three focus watersheds in the Wind River subbasin, 1996-2000. Results are from laboratory examinations by the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center (LCRFHC; Underwood, WA). YES = detected; S = suspected; nd = not detected. Streams not listed did not have fish analyzed by LCRFHC.

Watershed Stream or reach	Number of fish examined by LCRFHC	Disease agent[a]							
		IHNV	IPNV	VHS	RS	BCD	AS	YR	CD
Upper Wind River									
Paradise Creek	14	nd	nd	nd	YES	nd	nd	nd	nd
Wind River (mining reach)	12	nd	nd	nd	YES	nd	nd	nd	nd
Ninemile Creek	4	nd	nd	nd	nd	nd	nd	nd	nd
Dry Creek	2	nd	nd	nd	nd	nd	nd	nd	nd
Big Hollow Creek	8	nd	nd	nd	nd	nd	nd	nd	nd
Trapper Creek	9	nd	nd	nd	YES	nd	nd	nd	nd
Trout Creek									
Trout Creek - upper	7	nd	nd	nd	S	YES	nd	nd	nd
Crater Creek	9	nd	nd	nd	S	nd	nd	nd	nd
Trout Creek - A (33 bridge)	16	nd	nd	nd	S	nd	nd	nd	nd
Compass Creek	4	nd	nd	nd	nd	nd	nd	nd	nd
Layout Creek	18	nd	nd	nd	nd	nd	nd	nd	nd
Trout Creek - B (43 bridge)	6	nd	nd	nd	nd	nd	nd	nd	nd
Planting Creek	2	nd	nd	nd	nd	YES	nd	nd	nd
Martha Creek	3	nd	nd	nd	nd	nd	nd	nd	nd
Panther Creek									
Eightmile Creek	13	nd	nd	nd	nd	nd	nd	nd	nd
Cedar Creek	5	nd	nd	nd	nd	nd	nd	nd	nd
Panther Creek (trap)	1	nd	nd	nd	S	nd	nd	nd	nd

[a] Viral: IHNV = Infectious Hematopoietic Necrosis Virus, IPNV = Infectious Pancreatic Necrosis Virus, VHS = Viral Hemorrhagic Septicemia Virus; Bacterial: RS = *Renibacterium salmoninarum* (Bacterial Kidney Disease), BCD = *Flavobacterium psychrophilum* (Bacterial Coldwater Disease), AS = *Aeromonas salmonicida* (Furunculosis), YR = *Yersinia ruckeri* (Enteric Redmouth), CD = *Flavobacterium columnaris* (Columnaris).

Table 8. Detected bacterial and viral disease agents in wild brook trout from the Trout Creek watershed in the Wind River subbasin, 1996-2000. Results are from laboratory examinations by the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center (LCRFHC; Underwood, WA). YES = detected; S = suspected; nd = not detected. Streams not listed did not have fish analyzed by LCRFHC.

Watershed Stream or reach	Number of fish examined by LCRFHC	Disease agent[a]							
		IHNV	IPNV	VHS	RS	BCD	AS	YR	CD
Trout Creek									
Trout Creek - upper	10	nd	nd	nd	S	nd	nd	nd	nd
Crater Creek	16	nd	nd	nd	S	nd	nd	nd	nd
Trout Creek - A (33 bridge)	20	nd	nd	nd	S	nd	nd	nd	nd
Compass Creek	2	nd	nd	nd	nd	nd	nd	nd	nd
East Fork Trout Creek	5	nd	nd	nd	nd	nd	nd	nd	nd
Layout Creek	66	nd	nd	nd	YES	nd	nd	nd	nd
Trout Creek - B (43 bridge)	4	nd	nd	nd	S	nd	nd	nd	nd

[a] Viral: IHNV = Infectious Hematopoietic Necrosis Virus, IPNV = Infectious Pancreatic Necrosis Virus, VHS = Viral Hemorrhagic Septicemia Virus; Bacterial: RS = *Renibacterium salmoninarum* (Bacterial Kidney Disease), BCD = *Flavobacterium psychrophilum* (Bacterial Coldwater Disease), AS = *Aeromonas salmonicida* (Furunculosis), YR = *Yersinia ruckeri* (Enteric Redmouth), CD = *Flavobacterium columnaris* (Columnaris).

Table 9. Detected bacterial and viral disease agents in wild juvenile spring chinook in the upper Wind River watershed, 2000-2001. Results are from laboratory examinations by the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center (LCRFHC; Underwood, WA). YES = detected; S = suspected; nd = not detected. Streams not listed did not have fish analyzed by LCRFHC.

Watershed Stream or reach	Number of fish examined by LCRFHC	Disease agent[a]							
		IHNV	IPNV	VHS	RS	BCD	AS	YR	CD
Upper Wind River									
Paradise Creek	2	nd	nd	nd	YES	nd	nd	nd	nd
Wind River (mining reach)	105	nd	nd	nd	YES	nd	nd	nd	nd
Trapper Creek	1	nd	nd	nd	nd	nd	nd	nd	nd

[a] Viral: IHNV = Infectious Hematopoietic Necrosis Virus, IPNV = Infectious Pancreatic Necrosis Virus, VHS = Viral Hemorrhagic Septicemia Virus; Bacterial: RS = *Renibacterium salmoninarum* (Bacterial Kidney Disease), BCD = *Flavobacterium psychrophilum* (Bacterial Coldwater Disease), AS = *Aeromonas salmonicida* (Furunculosis), YR = *Yersinia ruckeri* (Enteric Redmouth), CD = *Flavobacterium columnaris* (Columnaris).

Table 10. Detected parasitic disease agents in wild juvenile steelhead from three focus watersheds in the Wind River subbasin, 1996-2000. Results are from laboratory examinations by the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center (LCRFHC; Underwood, WA) unless noted with an "*", which indicates the disease factor was identified by USGS personnel in the field. YES = detected; S = suspected; nd = not detected. Streams not listed did not have fish analyzed by LCRFHC.

Watershed	Number of	Disease agent[a]									
Stream or reach	fish examined by LCRFHC	WD	CS	MK	MM	HEX	GYR	TRE	SCY	EPI	CO
Upper Wind River											
Paradise Creek	14	nd	nd	nd	nd	nd	nd	nd	YES	YES*	nd
Wind River (mining reach)	12	nd	nd	nd	nd	YES	YES	nd	YES	YES*	nd
Ninemile Creek	4	nd	nd	nd	nd	nd	YES	YES	nd	YES	nd
Dry Creek	2	nd	nd	nd	nd	nd	nd	nd	nd	YES	nd
Big Hollow Creek	8	nd	nd	nd	nd	nd	nd	nd	YES	YES	nd
Trapper Creek	9	nd	nd	nd	nd	nd	nd	nd	nd	YES	nd
Trout Creek											
Trout Creek - upper	7	nd	nd	nd	nd	nd	nd	YES	YES	YES	nd
Crater Creek	9	nd	nd	nd	YES	nd	YES	nd	YES	YES	nd
Trout Creek - A (33 bridge)	16	nd	nd	nd	nd	nd	YES	nd	nd	YES	YES
Compass Creek	4	nd	nd	nd	YES	YES	YES	nd	nd	YES	nd
Layout Creek	18	nd	nd	nd	nd	nd	nd	nd	YES	YES	nd
Trout Creek - B (43 bridge)	6	nd	nd	nd	nd	nd	nd	nd	nd	YES	nd
Planting Creek	2	nd	nd	nd	nd	nd	nd	nd	nd	YES	nd
Martha Creek	3	nd	nd	nd	nd	nd	YES	nd	nd	YES*	nd
Panther Creek											
Eightmile Creek	13	nd	nd	YES	nd	nd	nd	YES	YES	YES	nd
Cedar Creek	5	nd	nd	nd	nd	nd	YES	YES	nd	nd	nd

[a] Parasites: WD = *Myxobolus cerebralis* (Whirling Disease), CS = *Ceratomyxa Shasta* (Salmonid Ceratomyxosis), MK = *Myxobolus kisutchi,* MM = *Myxidium minteri*, HEX = *Hexamita*, GYR = *Gyrodactylus*, TRE = digenetic trematodes, SCY = *Scyphidia*, EPI = *Epistylis* (newer name: *Heteropolaria*), CO = *Costia*.

Table 11. Detected parasitic disease agents in wild brook trout from the Trout Creek watershed in the Wind River subbasin, 1996-2000. Results are from laboratory examinations by the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center (LCRFHC; Underwood, WA) unless noted with an "*", which indicates the disease factor was identified by USGS personnel in the field. YES = detected; S = suspected; nd = not detected. Streams not listed did not have fish analyzed by LCRFHC.

Watershed Stream or reach	Number of fish examined by LCRFHC	Disease agent[a]									
		WD	CS	MK	MM	HEX	GYR	TRE	SCY	EPI	CO
Trout Creek											
Trout Creek - upper	10	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Crater Creek	16	nd	nd	nd	YES	nd	nd	nd	YES	nd	nd
Trout Creek - A (33 bridge)	20	nd	nd	nd	nd	nd	nd	nd	nd	YES	nd
Compass Creek	2	nd	nd	nd	nd	nd	nd	nd	nd	YES	nd
East Fork Trout Creek	5	nd	nd	nd	nd	nd	nd	nd	YES	nd	nd
Layout Creek	66	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Trout Creek - B (43 bridge)	4	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

[a] Parasites: WD = *Myxobolus cerebralis* (Whirling Disease), CS = *Ceratomyxa Shasta* (Salmonid Ceratomyxosis), MK = *Myxobolus kisutchi,* MM = *Myxidium minteri*, HEX = *Hexamita*, GYR = *Gyrodactylus*, TRE = digenetic trematodes, SCY = *Scyphidia*, EPI = *Epistylis* (newer name: *Heteropolaria*), CO = *Costia*.

Table 12. Detected parasitic disease agents in wild juvenile spring chinook from the upper Wind River watershed, 2000-2001. Results are from laboratory examinations by the U.S. Fish and Wildlife Service's Lower Columbia River Fish Health Center (LCRFHC; Underwood, WA) unless noted with an "*", which indicates the disease factor was identified by USGS personnel in the field. YES = detected; S = suspected; nd = not detected. Streams not listed did not have fish analyzed by LCRFHC.

Watershed Stream or reach	Number of fish examined by LCRFHC	Disease agent[a]									
		WD	CS	MK	MM	HEX	GYR	TRE	SCY	EPI	CO
Upper Wind River											
Paradise Creek	2	nd	nd	nd	nd	YES	nd	nd	nd	nd	nd
Wind River (mining reach)	105	nd	nd	nd	nd	YES	nd	nd	nd	nd	nd
Trapper Creek	1	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

[a] Parasites: WD = *Myxobolus cerebralis* (Whirling Disease), CS = *Ceratomyxa Shasta* (Salmonid Ceratomyxosis), MK = *Myxobolus kisutchi,* MM = *Myxidium minteri*, HEX = *Hexamita*, GYR = *Gyrodactylus*, TRE = digenetic trematodes, SCY = *Scyphidia*, EPI = *Epistylis* (newer name: *Heteropolaria*), CO = *Costia*.

Table 13. Snorkeler calibration for juvenile steelhead/rainbow (STH/RBT) trout in tributaries of the Wind River from 1998-2001.

Age-0 STH/RBT				Age-1 or older STH/RBT			
Snorkeler number	Caibration units	Ratio of electroshocking/snorkeling	Correlation (r)	Snorkeler number	Caibration units	Ratio of electroshocking/snorkeling	Correlation (r)
1	4	2.3443	0.9684	1	4	1.4722	0.7854
2	6	1.0395	0.8560	2	7	0.9091	0.9646
3	3	0.5000	1.0000	3	7	1.0364	0.8612
4	8	1.1980	0.9848	4	8	1.6512	0.8820
5	5	3.0000	-0.6951	5	5	1.8571	0.9531
6	7	1.0862	0.3537	6	7	0.7609	0.7184
7	9	1.5076	0.6680	7	9	0.4211	0.2968
11	6	0.9091	0.6357	11	6	1.0874	0.6030
All Snorkelers	48	1.3177	0.7960	**All Snorkelers**	52	1.0907	0.7672

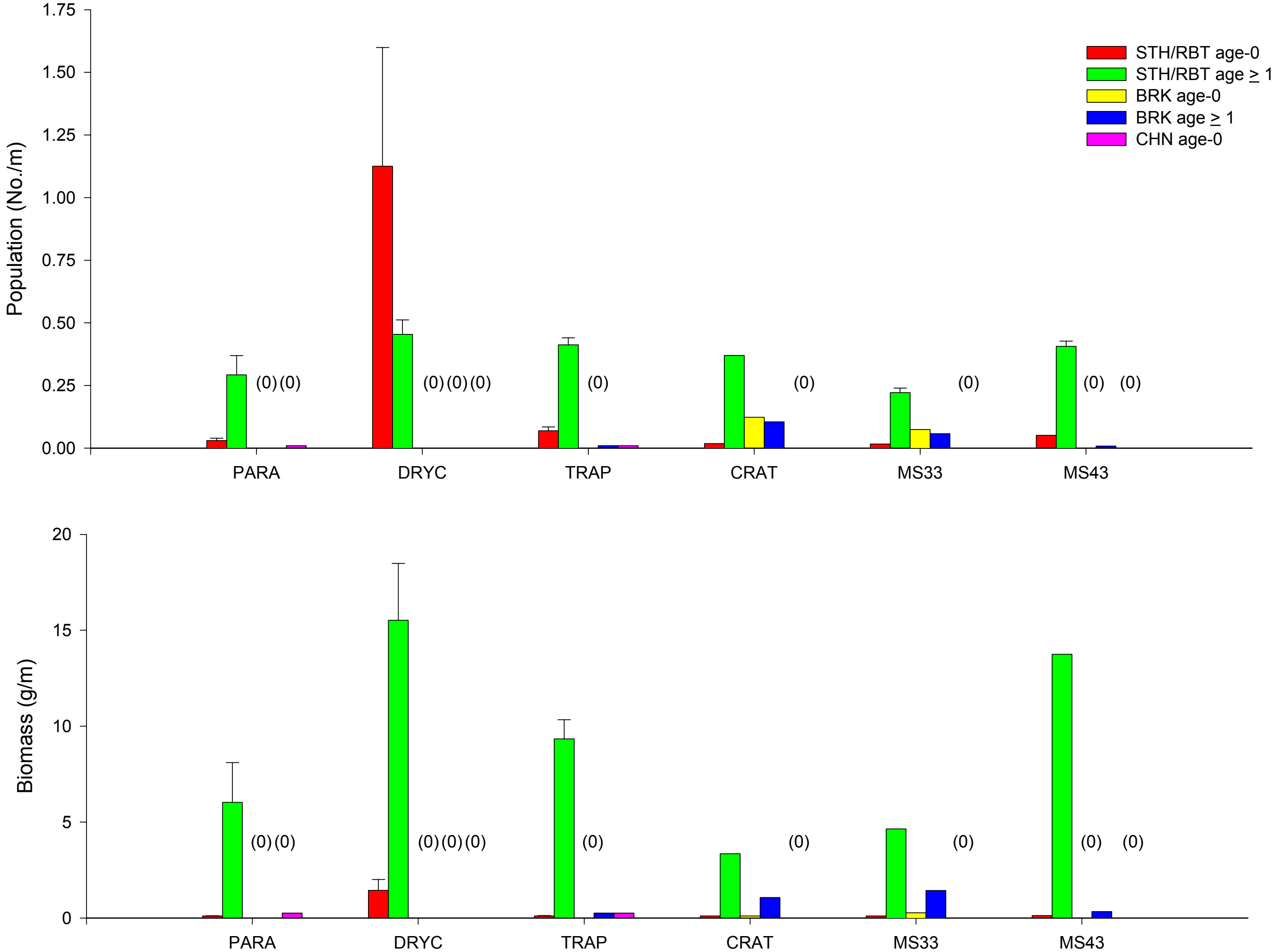


Figure 1. Electrofishing population and biomass estimates (with 1 SE bars) of age-0 and age-1 or older salmonids in stream sections in the Wind River watershed, 2000. Stream codes, read from left to right, go upstream to downstream. Stream codes are: UMIN = Wind River above Paradise Cr., PARA = Paradise Cr., DRYC = Dry Cr., TRAP, = Trapper Cr., CRAT, = Crater Cr., MS33 = Trout Cr below Forest Road 33, MS43 = Trout Cr. below Forest Road 43. Estimates for CRAT were extrapolated from pools only data (see text) and no estimate of error was calculated.

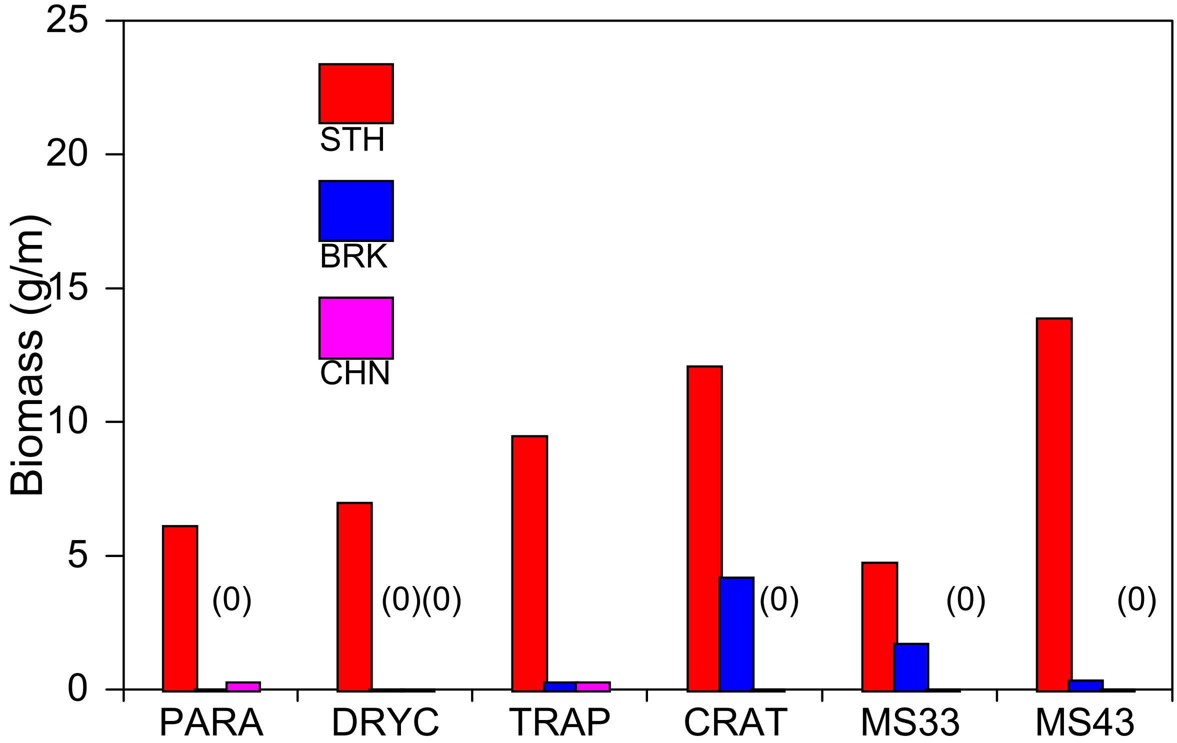


Figure 2. Estimated biomass of all age classes of steelhead (STH), brook trout (BRK), and chinook salmon (CHN) by electrofishing, in selected tributaries of the Wind River subbasin, summer 2000. Stream codes, read from left to right, go upstream to downstream. Stream codes are: PARA = Paradise Cr., DRYC = Dry Cr., TRAP, = Trapper Cr., CRAT, = Crater Cr., MS33 = Trout Cr below Forest Road 33, MS43 = Trout Cr. below Forest Road 43. Estimates for CRAT were extrapolated from pools only data (see text).

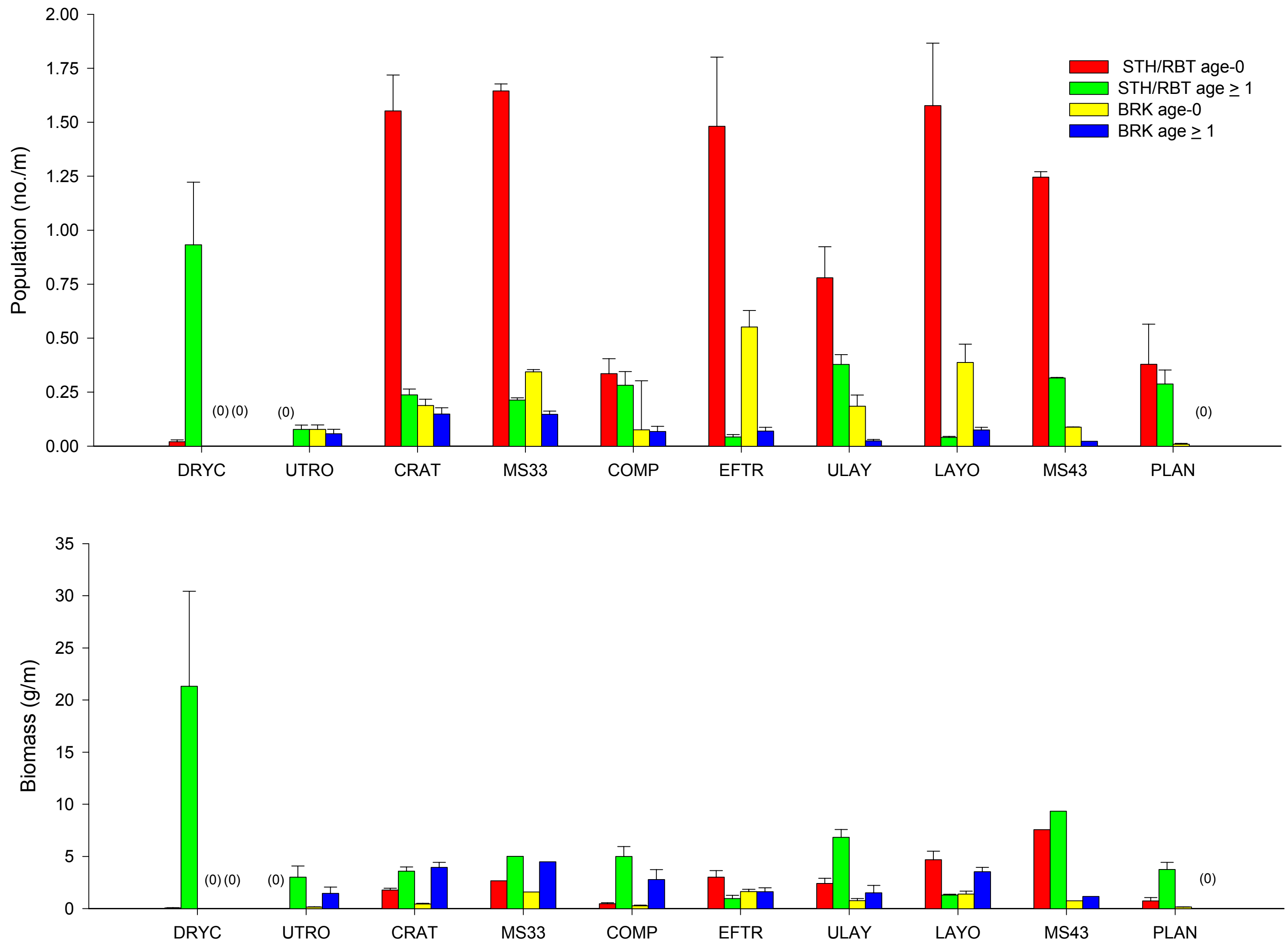


Figure 3. Electrofishing population and biomass estimates (with 1 SE bars) of age-0 and age-1 or older salmonids in stream sections in the Wind River watershed, 2001. Stream codes, read from left to right, go upstream to downstream. Stream codes are: DRY = Dry Cr., UTRO = Trout Cr. above Crater Cr., CRAT = Crater Cr., MS33 = Trout Cr below Forest Road 33, COMP = Compass Cr., EFTR = East Fork Trout Cr., ULAY = Upper Layout Cr., LAYO = Lower Layout Cr., MS43 = Trout Cr. below Forest Road 43, PLAN = Planting Cr. Dry Cr. was sampled early in the year (12 July), before many age-0 fish had emerged or were large enough to be susceptible to our gear.

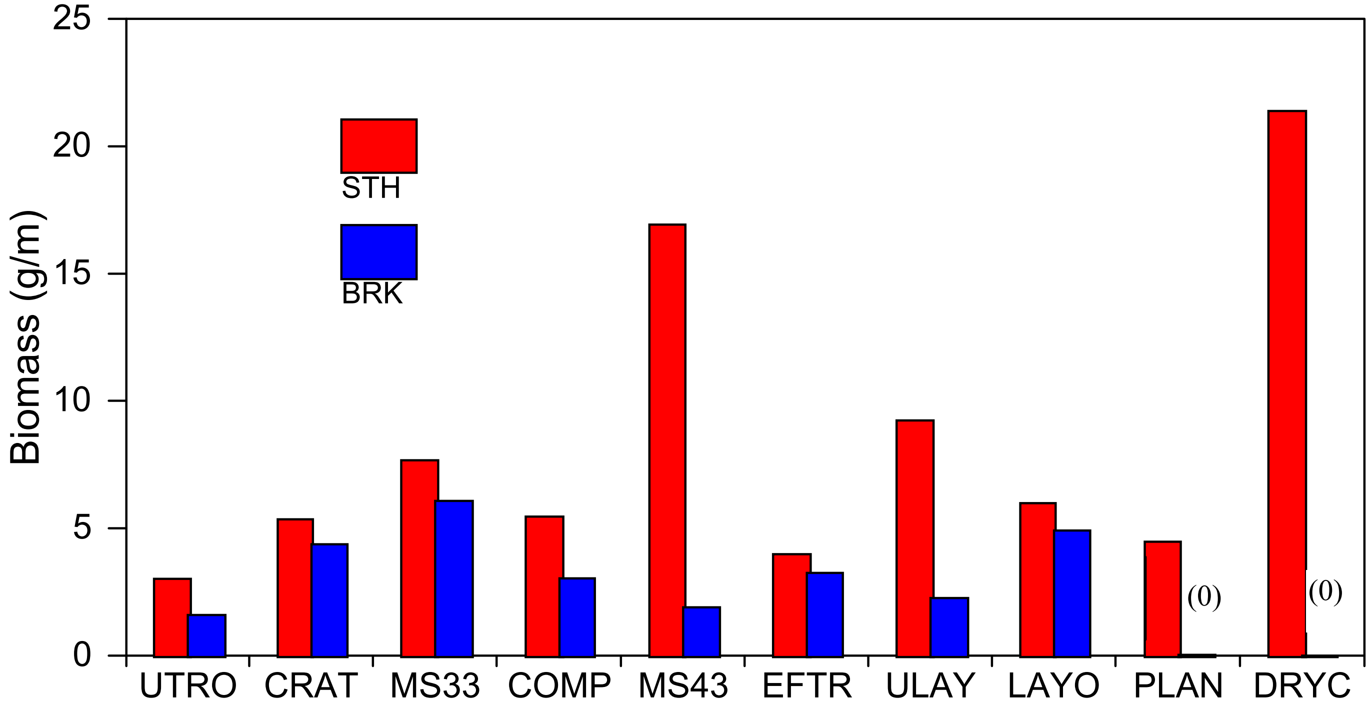


Figure 4. Estimates of biomass of all age classes of steelhead (STH) and brook trout (BRK) by electrofishing, in selected tributaries of the Wind River subbasin, summer 2001. Stream codes, read from left to right, go upstream to downstream. Stream codes are: UTRO = Trout Cr. above Crater Cr., CRAT = Crater Cr., MS33 = Trout Cr below Forest Road 33, COMP = Compass Cr., EFTR = East Fork Trout Cr., ULAY = Upper Layout Cr., LAYO = Lower Layout Cr., MS43 = Trout Cr. below Forest Road 43, PLAN = Planting Cr., DRY = Dry Cr. Dry Cr. was sampled early in the year (July 12), before many age-0 fish had emerged or were large enough to be susceptible to our gear.

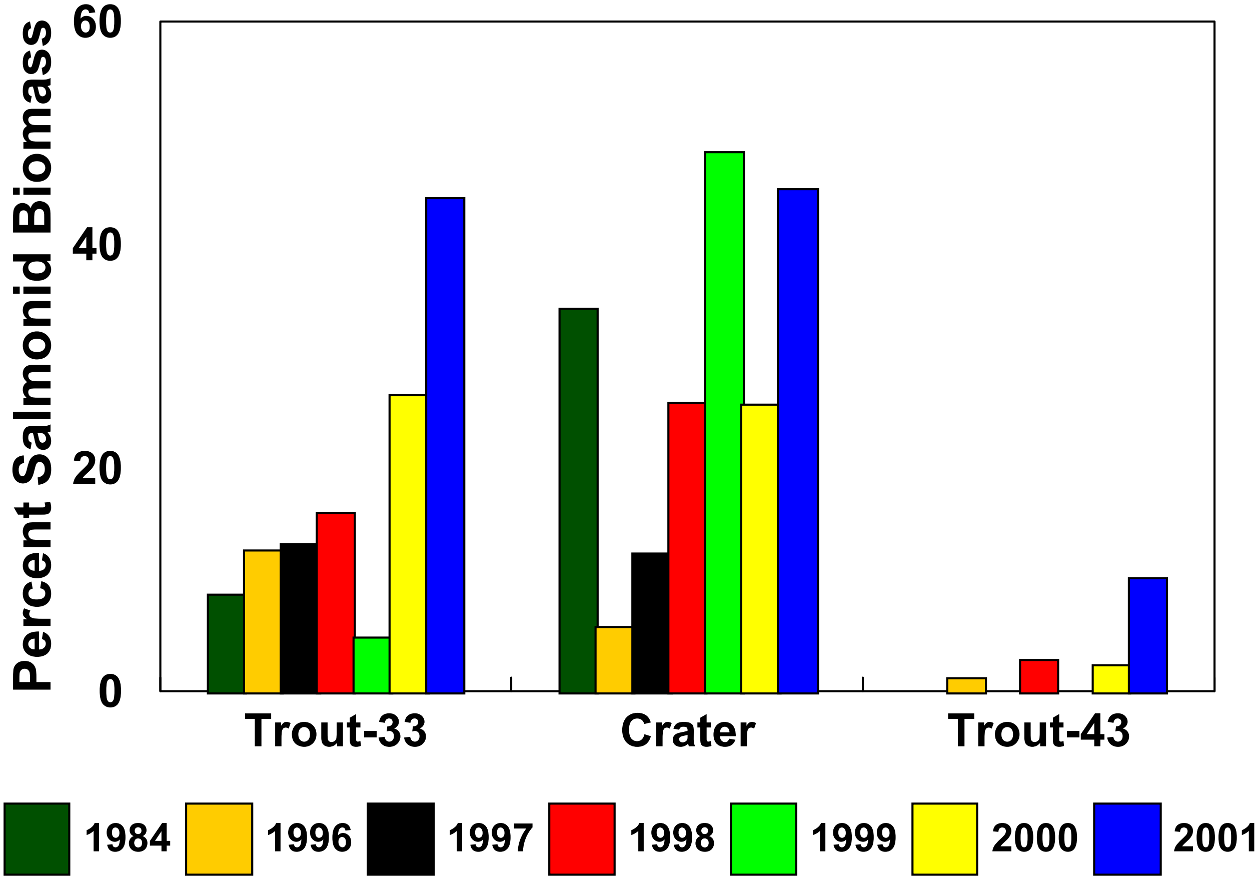


Figure 5. Annual estimates of the percent of total salmonid biomass that is brook trout in three stream reaches of Trout Creek watershed, 1984, 1996 –2001. The 1984 estimates are revised from Crawford et al. (1985; see Connolly 2001). Pools only were sampled in Crater Cr. in 2000, so the estimate was extrapolated from pool data only (see text). MS43 was not sampled in 1984, 1997, and 1999.

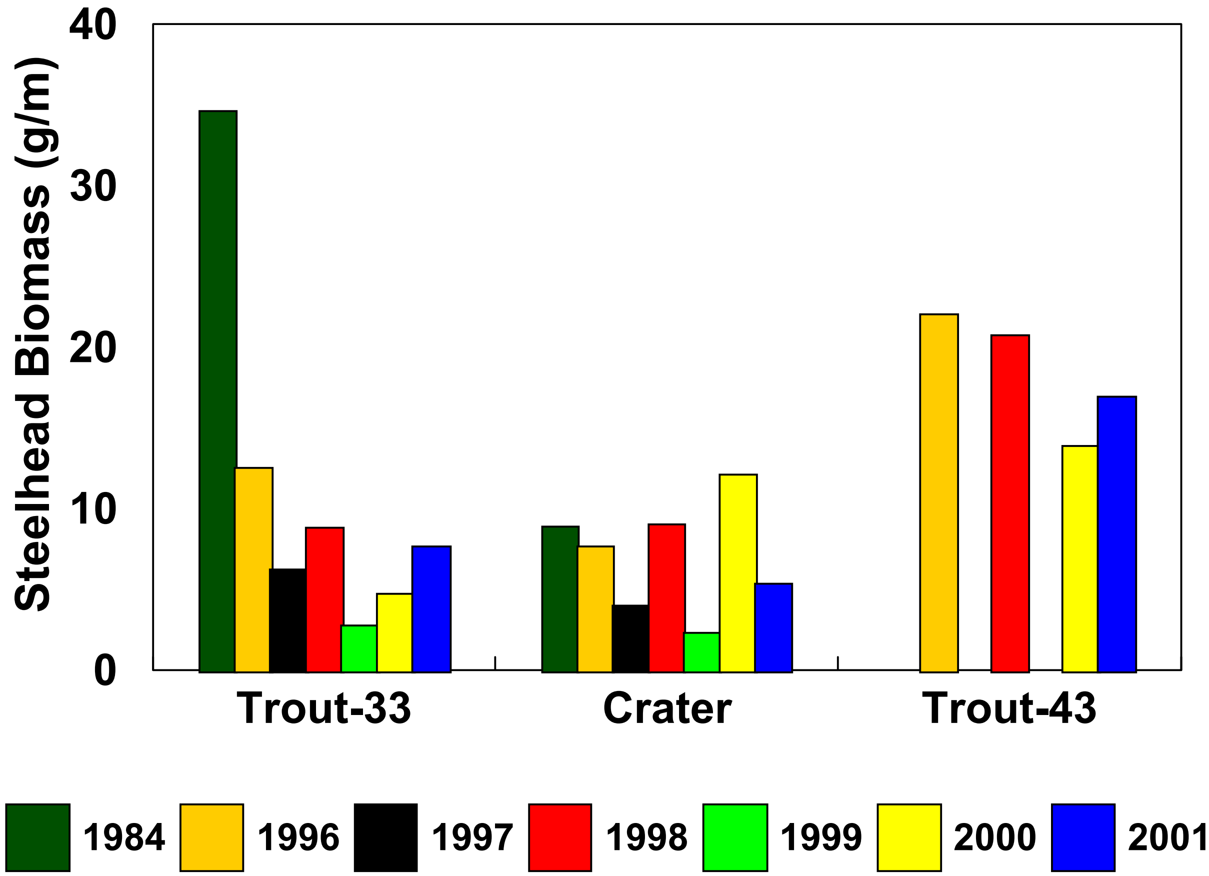


Figure 6. Annual estimates of total juvenile steelhead/rainbow trout biomass in three stream sections in Trout Creek watershed, 1984, 1996-2001. The 1984 estimates are revised from Crawford et al. (1985; see Connolly 2001). Pools only were sampled in Crater Creek. in 2000, so the estimate was extrapolated from pool data only (see text). MS43 was not sampled in 1984, 1997, and 1999.

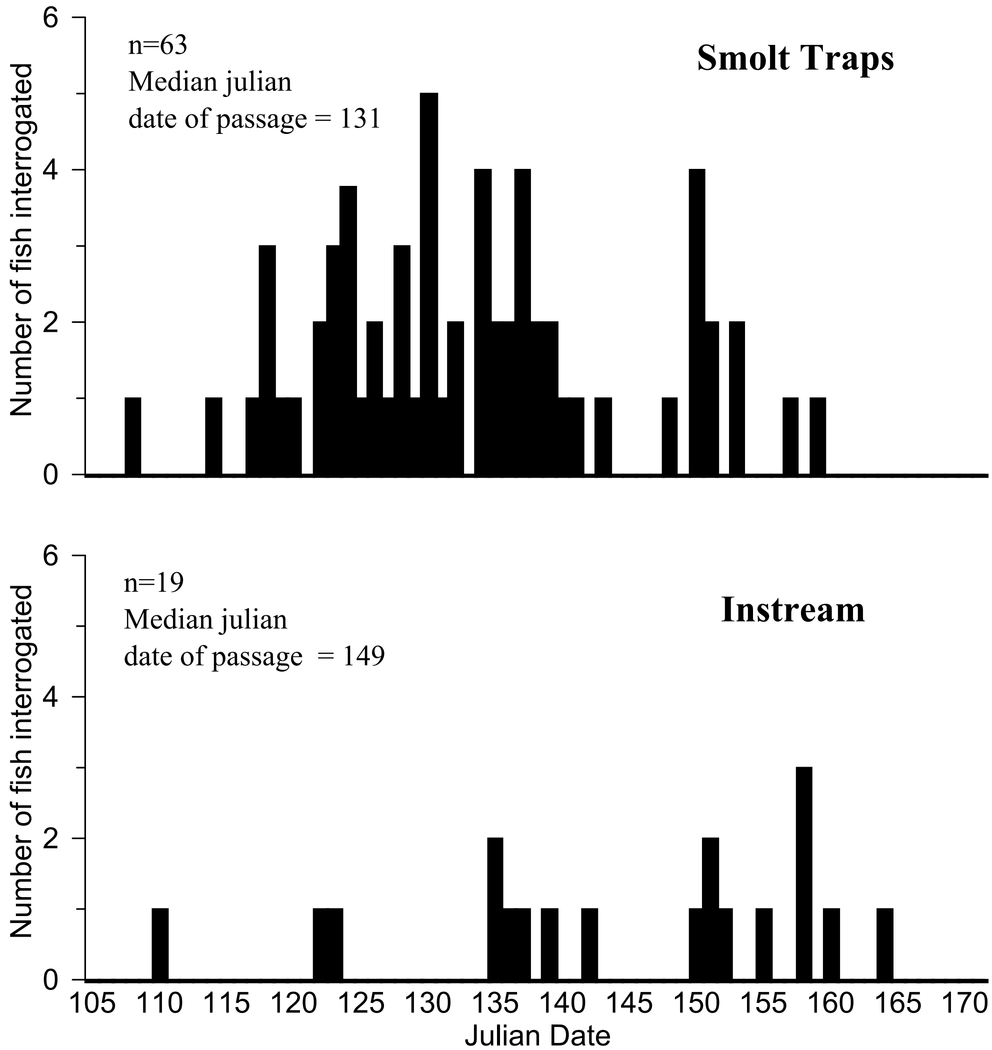


Figure 7. Timing of smolt passage at Bonneville Dam, spring 2001, of steelhead parr PIT-tagged at smolt traps and instream during 2000. Steelhead parr were tagged at smolt traps 17 May 2000 – 28 June 2000, and instream by electrofishing surveys, during 2000. Julian date 105 = April 15, Julian date 135 = May 15, Julian date 160 = June 9.

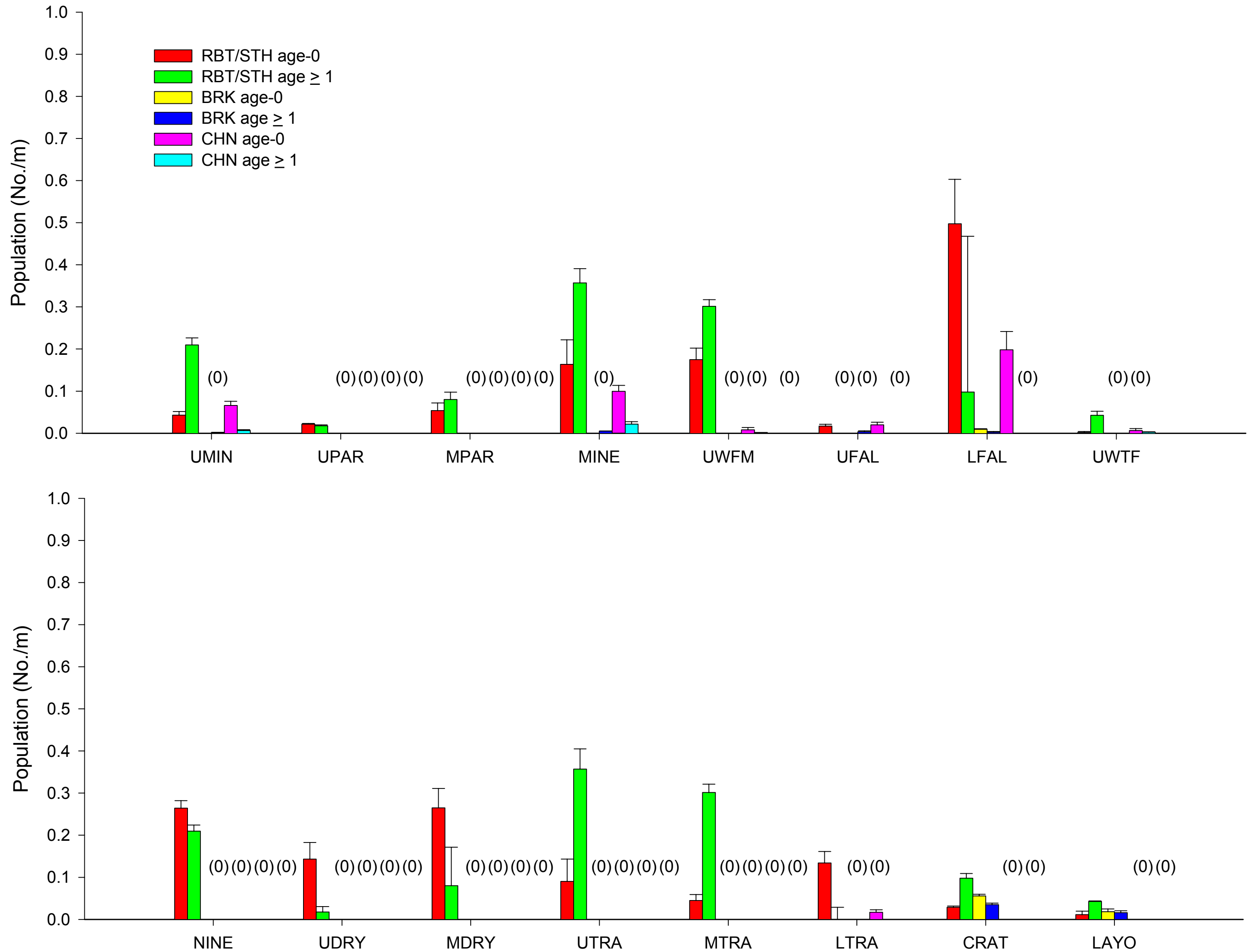


Figure 8. Population estimates (+ 1 SE bars), by expanded direct snorkeler counts, of age-0 and age-1 or older salmonids in stream sections of the Wind River watershed, 2000. Sections codes, read from left to right, go upstream to downstream. For section codes see Appendix Tables 16 – 18. Only pool units were snorkeled on UPAR, UFAL, NINE, CRAT, and LAYO. Data for UFAL and LAYO were gathered under poor conditions and should be considered presence/absence only.

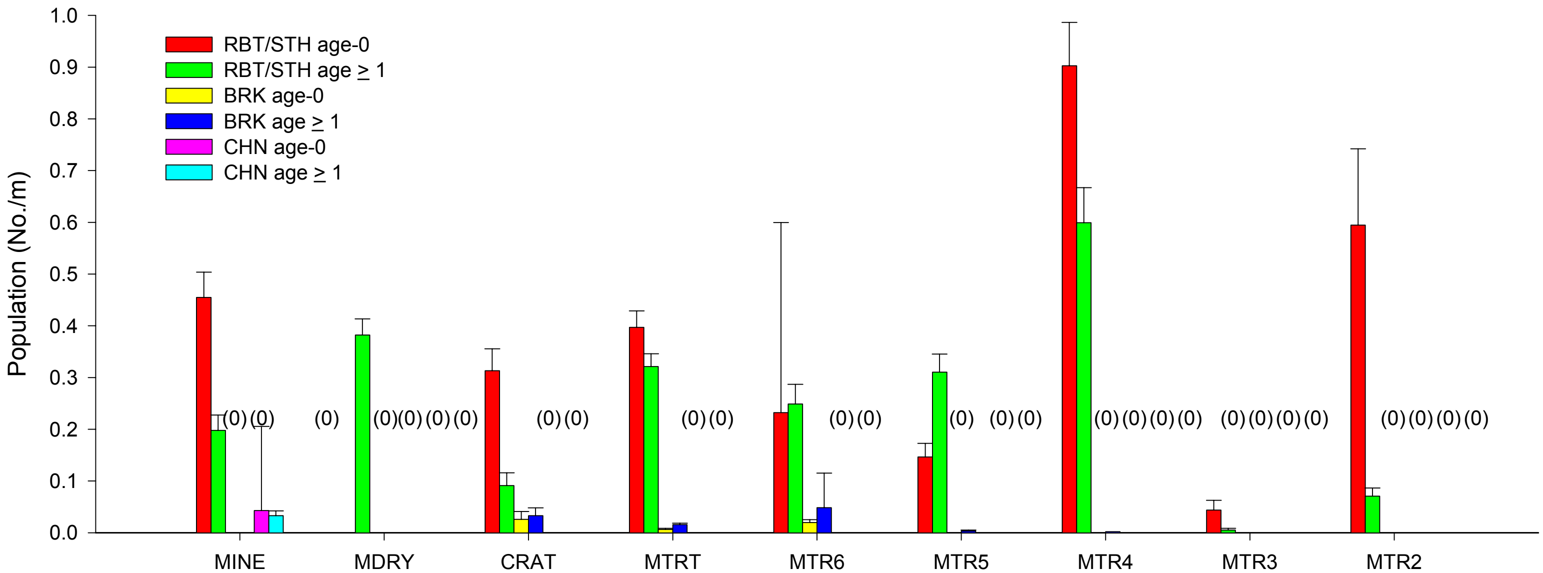


Figure 9. Population estimates (+ 1 SE bars), by expanded direct-snorkeler counts, of age-0 and age-1 or older salmonids in stream sections in the Wind River watershed, 2001. Section codes, read from left to right, go upstream to downstream. Section codes are: MINE = Wind R. rkm 36.0 – 40.0, MDRY = Dry Cr. rkm 3.7 –4.5, CRAT =Crater Cr. rkm 0.0 – 0.5, MTRT = Trout Cr. rkm 2.9 – 14.3, MTR6 = Trout Cr. rkm 11.9 – 14.2, MTR5 = Trout Cr. rkm 7.4 – 11.9, MTR4 = Trout Cr. rkm 4.5 – 7.4, MTR3 = Trout Cr. rkm 3.9 –4.5, MTR2 = Trout Cr. rkm 2.9 – 3.9. Only pool units were snorkeled on CRAT (see text for explanation of extrapolation to estimate). MDRY was done early in the year (12 July), before many age-0 STH/RBT had emerged.

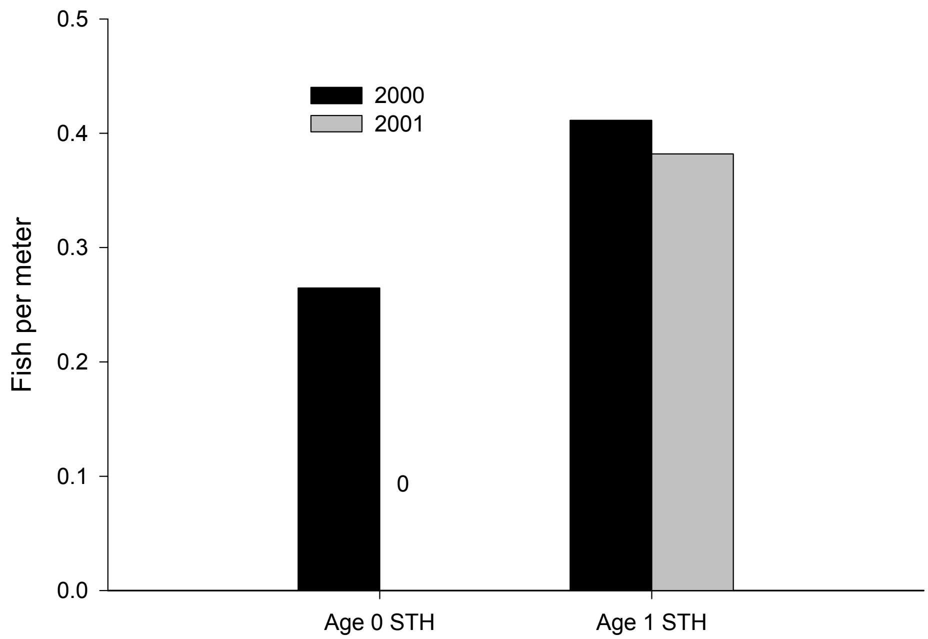


Figure 10. Fish-per-meter by expanded direct-snorkeler counts of two age classes of steelhead (STH) in middle Dry Cr. (rkm 4.5 – 5.2), 2000 and 2001. The 2001 survey was done early in the year (12 July), prior to emergence of age-0 fish, whereas the 2000 survey was conducted later (27 September).

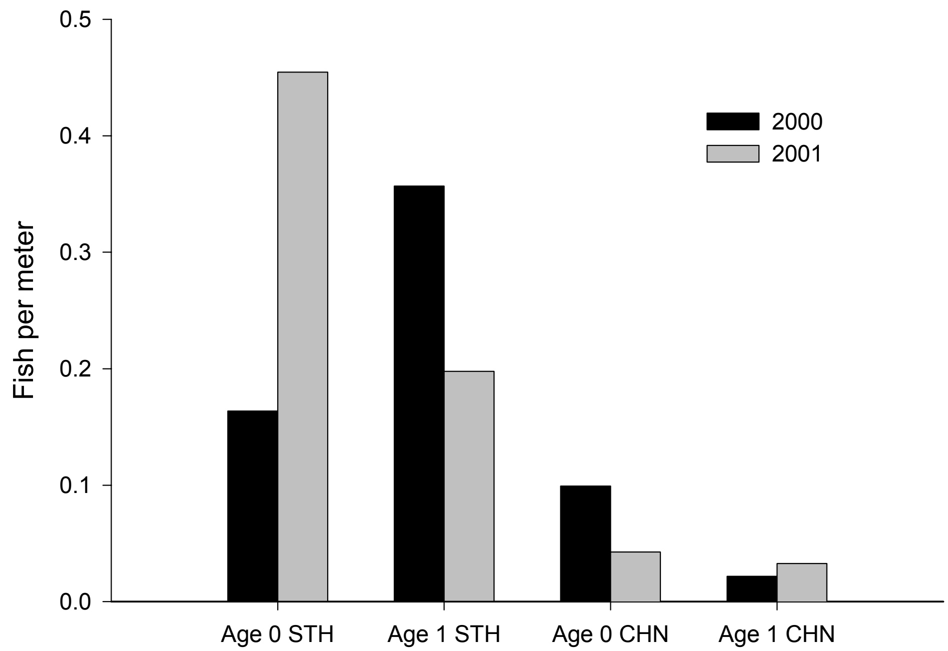
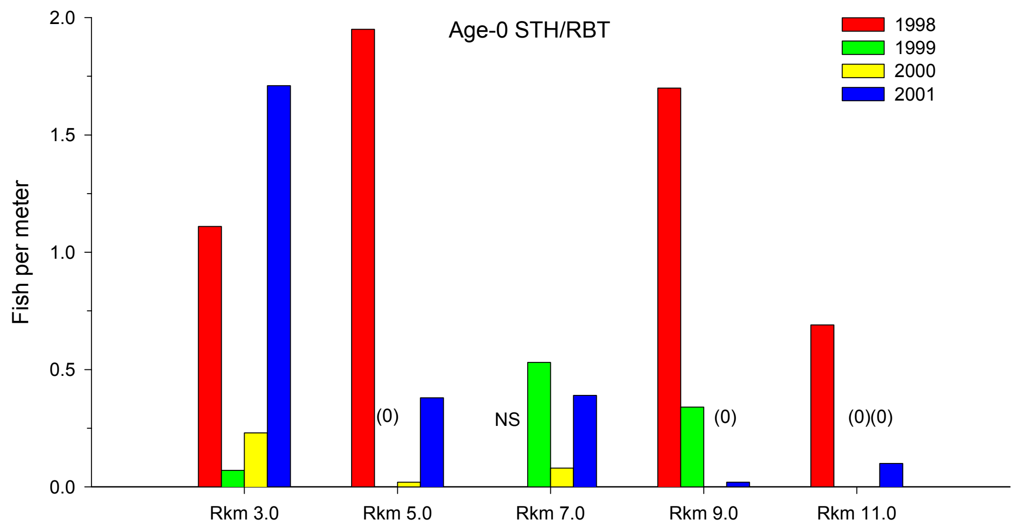


Figure 11. Fish-per-meter by expanded direct-snorkeler counts of two age classes of juvenile steelhead (STH) and chinook salmon (CHN) in the mine reach of the Wind River (rkm 35.4 – 40.0), 2000 and 2001.



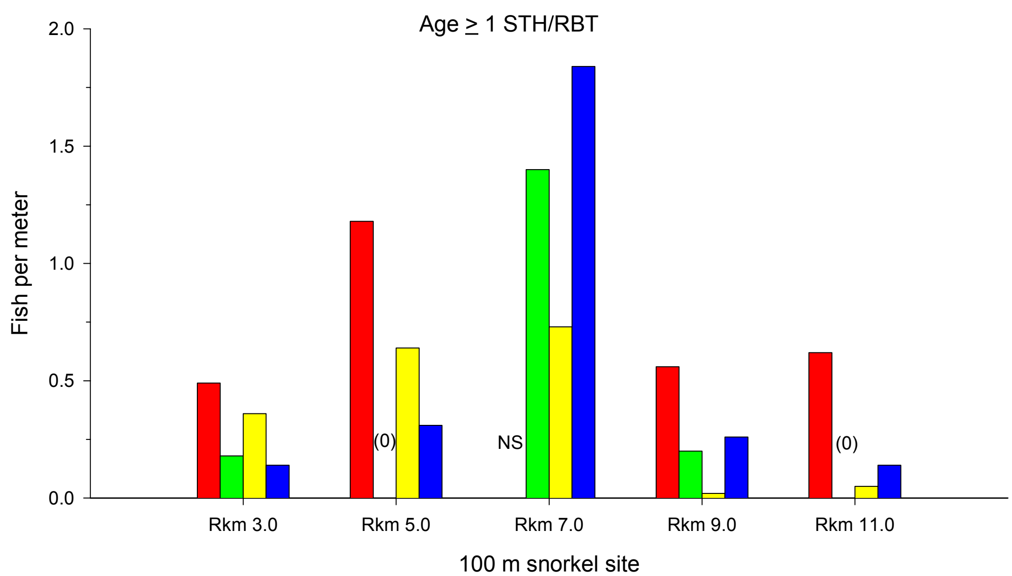


Figure 12. Fish-per-meter for two age classes of steelhead (STH)/rainbow trout (RBT), by direct-snorkeler count, in five 100-m sections of mainstem Trout Creek, 1998 – 2001. Sites read from left to right go downstream to upstream. The most downstream site is located just above the head of Hemlock Lake; the most upstream site is located just below Forest Road 43 bridge.

Appendix Table 1. Linear regression results for measures of age-0 steelhead (STH) and age-0 brook trout (BRK) in pools within an electrofishing-sample section against age-0 steelhead and age-0 brook trout throughout the entire sample section.

	r^2 (p-value)					
Species	n/m	n/m^2	n/m^3	g/m	g/m^2	g/m^3
STH	0.9983(<0.0001)	0.9517(0.0046)	0.9700(0.0022)	0.9974(<0.0001)	0.9992(<0.0001)	0.9801(0.0012)
BRK	0.9685(0.0024)	0.9649(0.0028)	0.9031(0.0132)	0.9697(0.0023)	0.9668(0.0026)	0.9008(0.0137)

Appendix Table 2. Linear regression results for measures of age-1 or older steelhead (STH) and age-1 or older brook trout (BRK) in pools within an electrofishing-sample section against age-1 or older steelhead and age-1 or older brook trout throughout the entire sample section.

	r^2 (p-value)					
Species	n/m	n/m^2	n/m^3	g/m	g/m^2	g/m^3
STH	0.7150(0.0711)	0.7258(0.0668)	0.7994(0.0407)	0.9461(0.0054)	0.9624(0.0031)	0.9891(0.0005)
BRK	0.9102(0.0118)	0.9203(0.0098)	0.8267(0.0324)	0.9125(0.0113)	0.8784(0.0187)	0.8564(0.0242)

Appendix Table 3. Estimates of populations from electrofishing surveys for two age classes of juvenile steelhead (STH)/rainbow trout (RBT) in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometers Start	End	Age-0 STH/RBT Total	SE[a]	CV[b]	no./m	no./m²	no./m³	Age-1 or older STH/RBT Total	SE	CV	no./m	no./m²	no./m³
Upper Wind River															
Wind R.-upper mine[c]	UMIN	41.0	41.5	2	0.0	0.0	0.0319	0.0056	0.0130	42	0.0	0.0	0.6709	0.1183	0.2735
Paradise Cr.	PARA	0.0	0.5	17	4.2	25.5	0.0305	0.0064	0.0277	158	41.7	26.4	0.2922	0.0611	0.2648
Dry Cr.	DRYC	3.4	3.9	635	267.3	42.1	1.1251	0.1151	0.3944	256	32.9	12.8	0.4539	0.0464	0.1591
Trapper Cr.	TRAP	2.9	3.5	38	8.4	22.5	0.0689	0.0110	0.0395	225	15.0	6.7	0.4125	0.0658	0.2367
Trout Creek															
Trout Cr.-MSA	MS33	14.0	14.1	2	0.0	0.0	0.0164	0.0020	0.0082	27	2.2	8.0	0.2215	0.0286	0.1110
Crater Cr.[d]	CRAT	0.0	0.5	10			0.0182	0.0034	0.0791	199			0.3702	0.0768	0.3191
Trout Cr.-MSB	MS43	11.0	11.1	6	0.0	0.0	0.0508	0.0052	0.0126	48	2.6	5.0	0.4064	0.0414	0.1010

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Estimate is for pools only.
[d] Data are extrapolated from pool data to total section length (see text).

Appendix Table 4. Estimates of biomass (g) from electrofishing surveys for two age classes of juvenile steelhead (STH)/rainbow trout (RBT) in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometers Start	River kilometers End	Age-0 STH/RBT Biomass	SE[a]	CV[b]	g/m	g/m^2	g/m^3	Age-1 or older STH/RBT Biomass	SE	CV	g/m	g/m^2	g/m^3
Upper Wind River															
Wind R.- upper mine[c]	UMIN	41.0	41.5	6	0.0	0.0	0.0942	0.0166	0.0384	1238	0.0	0.0	19.7827	3.4874	8.0654
Paradise Cr.	PARA	0.0	0.5	38	9.0	23.7	0.0703	0.0147	0.0638	3256	1124.6	34.5	6.0233	1.2598	5.4548
Dry Cr.	DRYC	3.4	3.9	814	319.6	39.3	1.4410	0.1474	0.5051	8765	1673.2	19.1	15.5244	1.5881	5.4421
Trapper Cr.	TRAP	2.9	3.5	50	13.5	26.9	0.0921	0.0147	0.0529	5081	546.1	10.7	9.3349	1.4892	5.3563
Trout Creek															
Trout Cr.-MSA	MS33	14.0	14.1	11	0.0	0.0	0.0911	0.0113	0.0457	566	0.0	0.0	4.6389	0.5776	2.3256
Crater Cr.[d,e]	CRAT	0.0	0.5	16			0.0298	0.0036	0.0184	6469			12.0532	3.3466	10.8762
Trout Cr.-MSB	MS43	11.0	11.1	14	0.0	0.0	0.1224	0.0125	0.0304	1623	0.0	0.0	13.7463	1.4013	3.4151

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Estimate is for pools only.
[d] Data are extrapolated from pool data to total section length (see text).
[e] Only one age-0 STH was captured and weight was not taken. Weight was derived from length weight relationship from 1999 data.

Appendix Table 5. Estimates of populations from electrofishing surveys for two age classes of brook trout in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometers Start	River kilometers End	Age-0 brook trout Total	SE[a]	CV[b]	no./m	no./m^2	no./m^3	Age-1 or older brook trout Total	SE	CV	no./m	no./m^2	no./m^3
Upper Wind River															
Wind R.-upper mine[c]	UMIN	41.0	41.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Paradise Cr.	PARA	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.	DRYC	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.	TRAP	2.9	3.5	0	0.0	0.0	0.0000	0.0000	0.0000	1	0.0	0.0	0.0018	0.0003	0.0011
Trout Creek															
Trout Cr.-MSA	MS33	14.0	14.1	9	0.0	0.0	0.0738	0.0092	0.0370	7	0.0	0.0	0.0574	0.0072	0.0288
Crater Cr.[d]	CRAT	0.0	0.5	66			0.1234	0.0283	0.1310	56			0.1049	0.0236	0.0987
Trout Cr.-MSB	MS43	11.0	11.1	0	0.0	0.0	0.0000	0.0000	0.0000	1	0.0	0.0	0.0085	0.0019	0.0021

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Estimate is for pools only.
[d] Data are extrapolated from pool data to total section length (see text).

Appendix Table 6. Estimates of biomass (g) from electrofishing surveys for two age classes of brook trout in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem streams.

Subwatershed		River Kilometers		Age-0 brook trout						Age-1 or older brook trout					
Stream	Code	Start	End	Biomass	SE[a]	CV[b]	g/m	g/m^2	g/m^3	Biomass	SE	CV	g/m	g/m^2	g/m^3
Upper Wind River															
Wind R.-upper mine[c]	UMIN	41.0	41.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Paradise Cr.	PARA	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.	DRYC	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.	TRAP	2.9	3.5	0	0.0	0.0	0.0000	0.0000	0.0000	11	0.0	0.0	0.0193	0.0031	0.0111
Trout Creek															
Trout Cr.-MSA	MS33	14.0	14.1	33	0.0	0.0	0.2719	0.0339	0.1363	175	0.0	0.0	1.4345	0.1786	0.7191
Crater Cr.[d]	CRAT	0.0	0.5	115			0.2146	0.0569	0.1970	2128			3.9646	1.0668	3.9100
Trout Cr.-MSB	MS43	11.0	11.1	0	0.0	0.0	0.0000	0.0000	0.0000	39	0.0	0.0	0.3282	0.0335	0.0815

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/biomass)*100.
[c] Estimate is for pools only.
[d] Data are extrapolated from pool data to total section length (see text).

Appendix Table 7. Estimates of populations from electrofishing surveys for two age classes of juvenile chinook salmon in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed		River Kilometers		Age-0 chinook						Age-1 or older chinook					
Stream	Code	Start	End	Total	SE[a]	CV[b]	no./m	no./m^2	no./m^3	Total	SE	CV	no./m	no./m^2	no./m^3
Upper Wind River															
Wind R.-upper mine[c]	UMIN	41.0	41.5	17	1.0	6.1	0.2716	0.0479	0.1107	1	0.0	0.0	0.1757	0.0310	0.0716
Paradise Cr.	PARA	0.0	0.5	2	0.0	0.0	0.0037	0.0008	0.0034	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.	DRYC	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.	TRAP	2.9	3.5	1	0.0	0.0	0.0018	0.0003	0.0011	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Trout Cr.-MSA	MS33	14.0	14.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Crater Cr.[d]	CRAT	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Cr.-MSB	MS43	11.0	11.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Estimate is for pools only.
[d] Data are extrapolated from pool data to total section length (see text).

Appendix Table 8. Estimates of biomass (g) from electrofishing for two age classes of juvenile chinook salmon in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed		River Kilometers		Age-0 chinook						Age-1 or older chinook					
Stream	Code	Start	End	Biomass	SE[a]	CV[b]	g/m	g/m²	g/m³	Biomass	SE	CV	g/m	g/m²	g/m³
Upper Wind River															
Wind R.-upper mine[c]	UMIN	41.0	41.5	109	6.8	6.2	1.7441	0.3075	0.7111	11	0.0	0.0	0.1757	0.0310	0.0716
Paradise Cr.	PARA	0.0	0.5	12	0.0	0.0	0.0226	0.0047	0.0205	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.	DRYC	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.	TRAP	2.9	3.5	6	0.0	0.0	0.0105	0.0017	0.0060	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Trout Cr.-MSA	MS33	14.0	14.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Crater Cr.[d]	CRAT	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Cr.-MSB	MS43	11.0	11.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/biomass)*100.
[c] Estimate is for pools only.
[d] Data are extrapolated from pool data to total section length (see text).

Appendix Table 9. Estimates of populations from electrofishing surveys for two age classes of juvenile steelhead (STH)/rainbow trout (RBT) in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed		River kilometer		Age-0 STH/RBT						Age-1 or older STH/RBT					
Stream	Code	Start	End	Total	SE[a]	CV[b]	no./m	no./m^2	no./m^3	Total	SE	CV	no./m	no./m^2	no./m^3
Upper Wind River															
Dry Cr.[c]	DRYC	3.4	3.9	11	4.6	41.7	0.0201	0.0018	0.0060	512	159.2	31.1	0.9324	0.0830	0.2781
Trout Creek															
Trout Cr.-upper	UTRO	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	53	14.2	26.7	0.0769	0.0161	0.0748
Trout Cr.-MSA	MS33	14.0	14.1	201	3.4	2.0	1.6448	0.2103	1.2109	26	1.2	5.0	0.2128	0.0272	0.1566
Crater Cr.	CRAT	0.0	0.5	796	84.9	10.7	1.5524	0.3200	1.0322	121	14.2	11.7	0.2367	0.0488	0.1574
Compass Cr.	COMP	0.0	0.5	187	38.4	20.6	0.3358	0.1054	0.4117	157	35.2	22.5	0.2815	0.0884	0.3451
East Fork Trout Cr.	EFTR	0.0	0.5	778	168.3	21.6	1.4814	0.3951	2.0817	22	5.6	25.5	0.0419	0.0112	0.0589
Layout Cr.-upper	ULAY	2.3	2.8	423	77.8	18.4	0.7796	0.1859	0.7741	205	23.1	11.3	0.3778	0.0901	0.3751
Layout Cr.-lower	LAYO	0.0	1.0	1732	318.2	18.4	1.5766	0.2745	0.6268	50	5.5	11.0	0.0451	0.0079	0.0179
Trout Cr.-MSB	MS43	11.0	11.1	170	4.1	2.0	1.2454	0.1287	0.5751	43	0.5	1.0	0.3150	0.0325	0.1455
Planting Cr.	PLAN	0.0	0.5	196	96.6	49.2	0.3784	0.1357	0.8572	149	33.6	22.5	0.2877	0.1032	0.6516

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Sample was early in the year (12 July), prior to emergence of many age-0 STH.

Appendix Table 10. Estimates of biomass (g) from electrofishing surveys for two age classes of juvenile steelhead (STH)/rainbow trout (RBT) in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed		River kilometer		Age-0 STH/RBT						Age-1 or older STH/RBT					
Stream	Code	Start	End	Biomass	SE[a]	CV[b]	g/m	g/m^2	g/m^3	Biomass	SE	CV	g/m	g/m^2	g/m^3
Upper Wind River															
Dry Cr.[c]	DRYC	3.4	3.9	34	13.3	38.8	0.0626	0.0056	0.0187	11696	5010.0	42.8	21.3194	1.8979	6.3590
Trout Creek															
Trout Cr.-upper	UTRO	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	2078	733.8	35.3	3.0138	0.6293	2.9310
Trout Cr.-MSA	MS33	14.0	14.1	325	0.0	0.0	2.6560	0.3396	1.9553	613	0.0	0.0	5.0130	0.6410	3.6905
Crater Cr.	CRAT	0.0	0.5	905	95.0	10.5	1.7637	0.3636	1.1727	1841	207.1	11.3	3.5896	0.7400	2.3867
Compass Cr.	COMP	0.0	0.5	257	46.1	17.9	0.4625	0.1452	0.5670	2778	523.8	18.9	4.9957	1.5681	6.1242
East Fork Trout Cr.	EFTR	0.0	0.5	1582	329.3	20.8	3.0123	0.8035	4.2327	507	154.5	30.5	0.9644	0.2572	1.3552
Layout Cr.-upper	ULAY	2.3	2.8	1307	271.2	20.8	2.4088	0.5742	2.3917	3707	406.8	11.0	6.8327	1.6289	6.7843
Layout Cr.-lower	LAYO	0.0	1.0	5143	903.9	17.6	4.6821	0.8153	1.8614	1426	88.9	6.2	1.2985	0.2261	0.5163
Trout Cr.-MSB	MS43	11.0	11.1	1033	0.0	0.0	7.5706	0.7822	3.4957	1276	0.0	0.0	9.3461	0.9656	4.3155
Planting Cr.	PLAN	0.0	0.5	378	163.0	43.1	0.7288	0.2615	1.6510	1946	356.7	18.3	3.7491	1.3449	8.4931

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Sample was early in the year (12 July), prior to emergence of many age-0 STH.

Appendix Table 11. Estimates of populations from electrofishing surveys for two age classes of brook trout in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometer		Age-0 brook trout						Age-1 or older brook trout					
		Start	End	Total	SE[a]	CV[b]	no./m	no./m^2	no./m^3	Total	SE	CV	no./m	no./m^2	no./m^3
Upper Wind River															
Dry Cr.	DRYC	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Trout Cr.-upper	UTRO	0.0	0.5	53	14.6	27.5	0.0769	0.0161	0.0748	39	14.9	38.2	0.0566	0.0118	0.0550
Trout Cr.--MSA	MS33	14.0	14.1	42	1.3	3.0	0.3437	0.0439	0.2530	18	1.8	10.0	0.1473	0.0188	0.1084
Crater Cr.	CRAT	0.0	0.5	96	15.0	15.5	0.1880	0.0387	0.1250	76	14.8	19.5	0.1482	0.0305	0.0985
Compass Cr.	COMP	0.0	0.5	42	12.6	30.2	0.0752	0.0236	0.0922	37	13.4	35.8	0.0673	0.0211	0.0825
East Fork Trout Cr.	EFTR	0.0	0.5	290	40.4	13.9	0.5515	0.1471	0.7749	37	8.9	24.2	0.0696	0.0186	0.0978
Layout Cr.--upper	ULAY	2.3	2.8	100	28.3	28.3	0.1843	0.0439	0.1830	13	3.6	27.4	0.0240	0.0057	0.0238
Layout Cr.--lower	LAYO	0.0	0.1	425	93.8	22.1	0.3870	0.0674	0.1539	82	13.5	16.5	0.0744	0.0130	0.0296
Trout Cr.--MSB	MS43	11.0	11.1	12	0.1	1.0	0.0879	0.0091	0.0406	3	0.0	0.0	0.0220	0.0023	0.0101
Planting Cr.	PLAN	0.0	0.5	4	2.0	46.4	0.0083	0.0030	0.0189	0	0.0	0.0	0.0000	0.0000	0.0000

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.

Appendix Table 12. Estimates of biomass (g) from electrofishing surveys for two age classes of brook trout in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed		River kilometer		Age-0 brook trout						Age-1 or older brook trout					
Stream	Code	Start	End	Biomass	SE[a]	CV[b]	g/m	g/m^2	g/m^3	Biomass	SE	CV	g/m	g/m^2	g/m^3
Upper Wind River															
Dry Cr.	DRY1	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Trout Cr.-upper	UTRO	0.0	0.5	96	25.1	26.0	0.1397	0.0292	0.1359	1002	409.9	40.9	1.4531	0.3034	1.4131
Trout Cr.-MSA	MS33	14.0	14.1	193	0.0	0.0	1.5871	0.2029	1.1684	548	0.0	0.0	4.4835	0.5733	3.3006
Crater Cr.	CRAT	0.0	0.5	221	36.9	16.7	0.4318	0.0890	0.2871	2025	244.3	12.1	3.9477	0.8139	2.6248
Compass Cr.	COMP	0.0	0.5	140	43.8	31.3	0.2517	0.0790	0.3086	1548	527.3	34.1	2.7844	0.8740	3.4134
East Fork Trout Cr.	EFTR	0.0	0.5	855	109.6	12.8	1.6277	0.4342	2.2872	847	201.7	23.8	1.6123	0.4301	2.2656
Layout Cr.- upper	ULAY	2.3	2.8	415	108.1	26.0	0.7647	0.1823	0.7593	816	385.1	47.2	1.5040	0.3585	1.4933
Layout Cr.-lower	LAYO	0.0	0.5	1521	316.0	20.8	1.3848	0.2411	0.5505	3876	461.1	11.9	3.5288	0.6144	1.4029
Trout Cr.-MSB	MS43	11.0	11.1	101	0.0	0.0	0.7368	0.0761	0.3402	159	0.0	0.0	1.1635	0.1202	0.5373
Planting Cr.	PLAN	0.0	0.5	15	7.2	47.7	0.0289	0.0104	0.0654	0	0.0	0.0	0.0000	0.0000	0.0000

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/biomass)*100.

Appendix Table 13. Estimates of populations from electrofishing surveys for two age classes of juvenile chinook salmon in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometer Start	River kilometer End	Age-0 chinook Total	SE[a]	CV[b]	no./m	no./m²	no./m³	Age-1 or older chinook Total	SE	CV	no./m	no./m²	no./m³
Upper Wind River															
Dry Cr.	DRYC	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Trout Cr.-upper	UTRO	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Cr.-MSA	MS33	14.0	14.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Crater Cr.	CRAT	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Compass Cr.	COMP	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
East Fork Trout Cr.	EFTR	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Layout Cr.-upper	ULAY	2.3	2.8	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Layout Cr.-lower	LAYO	0.0	1.0	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Cr.-MSB	MS43	11.1	11.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Planting Cr.	PLAN	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.

Appendix Table 14. Estimates of biomass (g) from electrofishing surveys for two age classes of juvenile chinook salmon in two subwatersheds of the Wind River Subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed		River kilometer		Age-0 chinook						Age-1 or older chinook					
Stream	Code	Start	End	Biomass	SE[a]	CV[b]	g/m	g/m^2	g/m^3	Biomass	SE	CV	g/m	g/m^2	g/m^3
Upper Wind River															
Dry Cr.	DRYC	3.4	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Trout Cr.-upper	UTRO	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Cr.-MSA	MS33	14.0	14.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Crater Cr.	CRAT	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Compass Cr.	COMP	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
East Fork Trout Cr.	EFTR	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Layout Cr.-upper	ULAY	2.3	2.8	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Layout Cr.-lower	LAYO	0.0	1.0	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Cr.-MSB	MS43	11.0	11.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Planting Cr.	PLAN	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/biomass)*100.

Appendix Table 15. Number of habitat units snorkeled in Upper Wind River and tributaries, 1998-2001.

Subbasin Stream	Year	Type of survey[a]	Stream length	Number of units covered by snorkeler number												All Snorkelers
				1	2	3	4	5	6	7	8	9	10	11	12	
Upper Wind River																
Wind River-UMIN	2000	A	4852		18	33	27									78
Wind River-MINE	2000	A	7058		24	24	18									66
Wind River-MINE	2001	A	7732								44	22				66
Wind River-UWTF	2000	A	5964		18	15	18									51
Paradise Cr.	1998	A	1387	4	4											8
Paradise Cr.-upper	2000	A	993		6	2	6									14
Paradise Cr.-middle	2000	A	930			9	6									15
Falls Cr.-upper	2000	A	645			3	3									6
Falls Cr.-lower	2000	A	925		6	6	6									18
Ninemile Cr.	2000	A	966			6	9									15
Dry Cr.-upper	2000	A	947		6	9	6									21
Dry Cr.-middle	2000	A	1024		6	3	6									15
Dry Cr.-middle	2001	A	1277		3	3		2			3					11
Trapper Cr.-upper	2000	A	578		6	6	6									18
Trapper Cr.-middle	2000	A	756		10		12									22
Trapper Cr.-lower	2000	A	1319		6	6	3									15

Continued.

Appendix Table 15. Continued.

Subbasin Stream	Year	Type of survey[a]	Stream length	Number of units covered by snorkeler number 1	2	3	4	5	6	7	8	9	10	11	12	All Snorkelers
Trout Creek																
Trout Cr-MS33	1998	C	100	1	5											6
Trout Cr-MS43	1999	A	4083	15	15											30
Trout Cr- MS43	1999	C	100	2	4											6
Trout Cr-MS43	2000	C	100		5											5
Trout Cr-MS43	2001	C	100					3		2						5
Trout Cr-CANY	1999	C	100	5	4											9
Trout Cr-CANY	2000	C	100		3	3	3									9
Trout Cr-CANY	2001	C	100		3								6			9
Trout Cr-PLAN	1999	C	100	3	3											6
Trout Cr-PLAN	2000	C	100			3	1									4
Trout Cr-PLAN	2001	C	100		2									3		5
Trout Cr-PCT	1999	C	100	5	5											10
Trout Cr-PCT	2000	C	100		3	3	3									9
Trout Cr-PCT	2001	C	100		5									5		10
Trout Cr-LTRT	1999	C	100	2	1											3
Trout Cr-LTRT	2000	C	100		5											5
Trout Cr-LTRT	2001	C	100			6										6
Trout Cr.	2001	A	13830		21	37		76	8	76			32	30		280
Crater Cr.	2000	B	547		11	3	5									19
Crater Cr.-middle	2001	B	711						3	3			3			9
Layout Cr.	2000	B	881		3	5										8

[a] A = Stratified systematic survey (all HU types represented); B = Pool only (100% or 50% sampled); C = 100 m sections (all units sampled)

Appendix Table 16. Expanded direct snorkeler counts of two age classes of juvenile steelhead (STH)/rainbow trout (RBT) in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed		River kilometer		Age-0 STH/RBT						Age-1 or older STH/RBT					
Stream	Code	Start	End	Total	SE[a]	CV[b]	no./m	no./m^2	no./m^3	Total	SE	CV	no./m	no./m^2	no./m^3
Upper Wind River															
Wind R.-upper mine	UMIN	40.0	43.8	183	36.5	20.0	0.0428	0.0067	0.0236	896	71.4	8.0	0.2097	0.0329	0.1158
Wind R.-mine	MINE	36.0	40.0	703	249.7	35.5	0.1637	0.0188	0.0677	1531	145.8	9.5	0.3568	0.4089	0.1477
Wind R. -Falls-mine	UWFM	35.4	36.0	105	16.2	15.5	0.1748	0.0267	0.0560	181	9.5	5.2	0.3013	0.0460	0.0971
Wind R.-Trapper-Falls	UWTF	30.0	35.4	23	11.6	50.9	0.0040	0.0003	0.0007	242	53.4	22.0	0.0424	0.0037	0.0075
Paradise Cr.-upper[c]	UPAR	2.6	3.3	19	1.7	8.5	0.0212	0.0056	0.0261	16	2.0	12.2	0.0176	0.0047	0.0218
Paradise Cr.-middle	MPAR	1.3	2.1	46	16.0	34.2	0.0535	0.0124	0.0557	70	15.1	21.6	0.0800	0.0185	0.0832
Falls Cr.-upper[c]	UFAL	1.6	2.1	9	2.3	24.9	0.0167	0.0026	0.0054	0	0.0	0.0	0.0000	0.0000	0.0000
Falls Cr.-lower	LFAL	0.0	0.8	432	91.8	21.2	0.4972	0.0758	0.2157	85	32.2	37.8	0.0978	0.0149	0.0424
Ninemile Cr.[c]	NINE	1.5	2.3	247	16.6	6.7	0.2641	0.0883	0.2896	151	13.1	8.7	0.1612	0.0539	0.1768
Dry Cr.-upper	UDRY	5.9	6.5	114	31.4	27.5	0.1433	0.0217	0.0547	86	10.1	11.8	0.1082	0.0164	0.0413
Dry Cr.-middle	MDRY	4.5	5.2	221	38.6	17.4	0.2646	0.0446	0.1480	344	76.3	22.2	0.4113	0.0692	0.2301
Trapper Cr.-upper	UTRA	4.8	5.4	48	28.3	58.8	0.0901	0.0182	0.0643	148	25.7	17.4	0.2766	0.0559	0.1973
Trapper Cr.-middle	MTRA	3.7	4.5	32	10.0	31.5	0.0448	0.0081	0.0272	118	14.0	11.9	0.1663	0.0299	0.1009
Trapper Cr.-lower	LTRA	2.9	3.5	143	29.3	20.5	0.1339	0.0176	0.0611	135	30.9	22.9	0.1258	0.0165	0.0574
Trout Creek															
Crater Cr.[c]	CRAT	0.0	0.5	15	1.6	10.0	0.0288	0.0076	0.0262	56	6.1	10.8	0.1050	0.0276	0.0956
Layout Cr. [c]	LAYO	0.0	1.0	10	7.1	70.7	0.0114	0.0021	0.0053	14	8.4	60.0	0.0159	0.0030	0.0074

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Estimate is for pools only.

Appendix Table 17. Expanded direct snorkeler counts of two age classes of brook trout in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometer		Age-0 brook trout						Age-1 or older brook trout					
		Start	End	Total	SE[a]	CV[b]	no./m	no./m²	no./m³	Total	SE	CV	no./m	no./m²	no./m³
Upper Wind River															
Wind R.-upper mine[c]	UMIN	40.0	43.8	0	0.0	0.0	0.0000	0.0000	0.0000	2	1.0	60.6	0.0004	0.0001	0.0002
Wind R.-mine	MINE	36.0	40.0	0	0.0	0.0	0.0000	0.0000	0.0000	2	1.4	70.1	0.0005	0.0001	0.0002
Wind R. -Falls-mine	UWFM	35.4	36.0	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Wind R.-Trapper-Falls	UWTF	30.0	35.4	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Paradise Cr.-upper	UPAR	2.6	3.3	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Paradise Cr.-middle	MPAR	1.3	2.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Falls Cr.-upper[c]	UFAL	1.6	2.1	0	0.0	0.0	0.0000	0.0000	0.0000	2	1.2	67.4	0.0033	0.0005	0.0011
Falls Cr.-lower	LFAL	0.0	0.8	8	1.4	17.7	0.0092	0.0014	0.0040	2	1.4	70.7	0.0023	0.0004	0.0010
Ninemile Cr.	NINE	1.5	2.3	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.-upper	UDRY	5.9	6.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.-middle	MDRY	4.5	5.2	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.-upper	UTRA	4.8	5.4	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.-middle	MTRA	3.7	4.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.-lower	LTRA	2.9	3.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Crater Cr.[c]	CRAT	0.0	0.5	30	2.1	7.1	0.0556	0.0146	0.0506	19	2.0	10.8	0.0350	0.0092	0.0319
Layout Cr. [c]	LAYO	0.0	1.0	16	5.7	35.4	0.0182	0.0034	0.0085	14	4.0	28.3	0.0159	0.0030	0.0074

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Estimate is for pools only.

Appendix Table 18. Expanded direct snorkeler counts of two age classes of juvenile chinook salmon in two subwatersheds of the Wind River subbasin, summer 2000. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometer		Age-0 chinook						Age-1 or older chinook					
		Start	End	Total	SE[a]	CV[b]	no./m	no./m^2	no./m^3	Total	SE	CV	no./m	no./m^2	no./m^3
Upper Wind River															
Wind R.-upper mine[c]	UMIN	40.0	43.8	282	40.8	14.5	0.0660	0.0104	0.0364	28	7.6	27.2	0.0065	0.0010	0.0036
Wind R.-mine	MINE	36.0	40.0	425	61.8	14.5	0.0992	0.0114	0.0411	93	24.8	26.7	0.0216	0.0025	0.0089
Wind R. -Falls-mine	UWFM	35.4	36.0	5	3.5	75.6	0.0078	0.0012	0.0025	1	0.0	0.0	0.0017	0.0003	0.0005
Wind R.-Trapper-Falls	UWTF	30.0	35.4	37	25.0	67.1	0.0065	0.0006	0.0012	13	6.2	47.4	0.0023	0.0002	0.0004
Paradise Cr.-upper	UPAR	2.6	3.3	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Paradise Cr.-middle	MPAR	1.3	2.1	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Falls Cr.-upper[c]	UFAL	1.6	2.1	11	3.3	30.2	0.0200	0.0031	0.0065	0	0.0	0.0	0.0000	0.0000	0.0000
Falls Cr.-lower	LFAL	0.0	0.8	172	37.8	22.0	0.1978	0.0302	0.0858	0	0.0	0.0	0.0000	0.0000	0.0000
Ninemile Cr.	NINE	1.5	2.3	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.-upper	UDRY	5.9	6.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.-middle	MDRY	4.5	5.2	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.-upper	UTRA	4.8	5.4	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.-middle	MTRA	3.7	4.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trapper Cr.-lower	LTRA	2.9	3.5	18	6.4	35.4	0.0168	0.0022	0.0077	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Crater Cr.[c]	CRAT	0.0	0.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Layout Cr. [c]	LAYO	0.0	1.0	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000

[a] SE = standard error.
[b] CV = coefficient of variation = (SE/total fish)*100.
[c] Estimate is for pools only.

Appendix Table 19. Expanded direct snorkeler counts of two age classes of juvenile steelhead (STH)/rainbow trout (RBT) in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometer[a] Start	River kilometer[a] End	Age-0 STH/RBT Total	SE[b]	CV[c]	no./m	no./m²	no./m³	Age-1 or older STH/RBT Total	SE	CV	no./m	no./m²	no./m³
Upper Wind River															
Wind R.-mine[d]	MINE	36.0	40.0	2172	234.4	10.8	0.4546	0.0379	0.1404	944	141.6	15.0	0.1976	0.0165	0.0611
Dry Cr.-middle[e]	MDRY	4.5	5.2	0	0.0	0.0	0.0000	0.0000	0.0000	316	25.9	8.2	0.3820	0.0407	0.1429
Trout Creek															
Reach 2[f]	MTR2	2.9	3.9	628	155.6	24.8	0.5945	0.0477	0.1266	74	16.9	22.7	0.0704	0.0056	0.0150
Reach 3[f]	MTR3	3.9	4.5	29	12.5	43.4	0.0436	0.0038	0.0094	3	2.1	63.2	0.0051	0.0004	0.0011
Reach 4[f]	MTR4	4.5	7.4	2615	243.5	9.3	0.9024	0.0908	0.2011	1736	195.9	11.3	0.5991	0.0603	0.1335
Reach 5[f]	MTR5	7.4	11.9	538	96.2	17.9	0.1465	0.0141	0.0423	1140	129.1	11.3	0.3102	0.0298	0.0896
Reach 6[f]	MTR6	11.9	14.2	880	139.1	15.8	0.2322	0.0289	0.0876	941	143.5	15.2	0.2486	0.0310	0.0938
All Reaches	MTRT	2.9	14.3	4836	390.5	8.1	0.3966	0.0400	0.1080	3916	300.6	7.7	0.3211	0.0324	0.0875
Crater Cr.[g]	CRAT	0.5	1.0	172	23.2	13.5	0.3131	0.0796	0.2962	50	13.7	27.4	0.0910	0.0232	0.0861

[a] River kilometers taken from River Mile Index, Hydrology Subcommittee Columbi Basin Inter-Agency Committee, March 1967.
[b] SE = standard error.
[c] CV = coefficient of variation = (SE/total fish)*100.
[d] Snorkel survey conducted by the United States Forest Service.
[e] Survey completed early in summer.
[f] Reaches as determined by Cochran (1995).
[g] Estimate is for pools only.

Appendix Table 20. Expanded direct snorkeler counts of two age classes of brook trout in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometer[a] Start	River kilometer[a] End	Age-0 brook trout Total	SE[b]	CV[c]	no./m	no./m²	no./m³	Age-1 or older brook trout Total	SE	CV	no./m	no./m²	no./m³
Upper Wind River															
Wind R.-mine[d]	MINE	35.4	40.0	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Dry Cr.-middle[e]	MDRY	4.5	5.2	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Reach 2[f]	MTR2	2.9	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Reach 3[f]	MTR3	3.9	4.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Reach 4[f]	MTR4	4.5	7.4	0	0.0	0.0	0.0000	0.0000	0.0000	2	1.4	69.8	0.0007	0.0001	0.0002
Reach 5[f]	MTR5	7.4	11.9	0	0.0	0.0	0.0000	0.0000	0.0000	11	6.9	59.9	0.0031	0.0003	0.0009
Reach 6[f]	MTR6	11.9	14.2	74	19.9	26.7	0.0197	0.0024	0.0074	183	25.3	13.8	0.0483	0.0060	0.0182
All Reaches	MTRT	2.9	14.3	74	20.8	27.8	0.0061	0.0006	0.0017	192	30.1	15.7	0.0157	0.0016	0.0043
Crater Cr.[g]	CRAT	0.5	1.0	14	8.4	60.2	0.0255	0.0065	0.0241	18	8.2	45.6	0.0328	0.0083	0.0310

[a] River kilometers taken from River Mile Index, Hydrology Subcommittee Columbia Basin Inter-Agency Committee, March 1967.
[b] SE = standard error.
[c] CV = coefficient of variation = (SE/total fish)*100.
[d] Snorkel survey conducted by the United States Forest Service.
[e] Survey completed early in summer
[f] Reaches as determined by Cochran (1995).
[g] Estimate is for pools only.

Appendix Table 21. Expanded direct snorkeler counts of two age classes of juvenile chinook salmon in two subwatersheds of the Wind River subbasin, summer 2001. Sites are listed from upstream to downstream within a subwatershed relative to the mainstem stream.

Subwatershed Stream	Code	River kilometer[a]		Age-0 chinook						Age-1 or older chinook					
		Start	End	Total	SE[b]	CV[c]	no./m	no./m^2	no./m^3	Total	SE	CV	no./m	no./m^2	no./m^3
Upper Wind River															
Wind R.-mine[d]	MINE	35.4	40.0	204	77.9	38.2	0.0426	0.0036	0.0132	156	44.9	28.8	0.0327	0.0027	0.0101
Dry Cr.-middle[e]	MDRY	4.5	5.2	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Trout Creek															
Reach 2[f]	MTR2	2.9	3.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Reach 3[f]	MTR3	3.9	4.5	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Reach 4[f]	MTR4	4.5	7.4	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Reach 5[f]	MTR5	7.4	11.9	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Reach 6[f]	MTR6	11.9	14.2	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
All Reaches.	MTRT	2.9	14.3	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000
Crater Cr.[g]	CRAT	0.5	1.0	0	0.0	0.0	0.0000	0.0000	0.0000	0	0.0	0.0	0.0000	0.0000	0.0000

[a] River kilometers taken from River Mile Index, Hydrology Subcommittee Columbi Basin Inter-Agency Committee, March 1967
[b] SE = standard error.
[c] CV = coefficient of variation = (SE/total fish)*100.
[d] Snorkel survey conducted by the United States Forest Service.
[e] survey completed early in summer
[f] Reaches as determined by Cochran (1995).
[g] Estimate is for pools only.

Appendix Table 22. Population estimates of age-0 steelhead (STH)/rainbow trout (RBT) in the upper Wind River watershed, summer 2000. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
UWIN	1	5,714	Y	SN	23	0.0040	0.0068	0.0022	0.0000	1.0000	0.3201	0.0000					23
UWIN	2	600	Y	SN	105	0.1748	0.1818	0.1747	0.1610	1.0000	0.9607	0.8856					105
UWIN	3	4,292	Y	SN	703	0.1657	0.1138	0.1822	0.1684	1.0000	1.6016	1.4800					703
UWIN	4	4,273	Y	SN	183	0.0428	0.0731	0.0163	0.0807	1.0000	0.2230	1.1034					183
UWIN	5	500	N														21
TRAP	1	1,070	Y	SN	143	0.1339	0.1053	0.0781	0.0828	1.0000	0.7422	0.7866					143
TRAP	1	1,730	N														232
TRAP	2	100	N														7
TRAP	2	544	Y	EF	38	0.0689	0.1491	0.0189	0.0964	1.0000	0.1265	0.6464					38
TRAP	2	175	N														10
TRAP	2	707	Y	SN	32	0.0448	0.0633	0.0270	0.0603	1.0000	0.4266	0.9526					32
TRAP	2	918	N														62
TRAP	2	533	Y	SN	48	0.0901	0.0776	0.0000	0.3451	1.0000	0.0000	4.4484					48
TRAP	2	267	N														24
DRYC	1	1,200	N														0
DRYC	2	1,300	N														0
DRYC	3	800	N														900
DRYC	3	564	Y	EF	635	1.1251	1.6185	0.5455	0.0000	1.0000	0.3370	0.0000					635
DRYC	3	636	N														442
DRYC	3	835	Y	SN	221	0.2646	0.5016	0.0163	0.2558	1.0000	0.0326	0.5100					221
DRYC	3	526	N														107
DRYC	3,4,5	796	Y	SN	114	0.1433	0.2396	0.0127	0.3933	1.0000	0.0530	1.6412					114
DRYC	5	843	N														121

Continued.

Appendix Table 22. Continued.

						No./m				Ratio			Estimates from pools only sampling: Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
NINE	1	1,500	N														0
NINE[b]	1	900	Y	SNP	247	0.2641				1.0000	0.2582	0.4367	247	64	108	0.4652	419
NINE	1	1,300	N														605
FALL	1	870	Y	SN	432	0.4972	0.6491	0.1425	0.7101	1.0000	0.2196	1.0940					432
FALL	1	1,830	N														910
PARA	1	541	Y	EF	17	0.0305	0.0404	0.0261	0.0270	1.0000	0.6465	0.6689					17
PARA	1	759	N														32
PARA	1	875	Y	SN	46	0.0535	0.1340	0.0317	0.0185	1.0000	0.2370	0.1382					46
PARA	1	425	N														17
PARA[b]	1	911	Y	SNP	19	0.0212							19	5	3	0.0287	26
PARA	1	389	N														11
																Total	**6,686**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.
[b] Population estimate was based on the ratio of pools to riffles to glides from paradise, trapper and dry creeks.

Appendix Table 23. Population estimate of age-1 or older steelhead (STH)/rainbow trout (RBT) in the upper Wind River watershed, summer 2000. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
UWIN	1	5,714	Y	SN	242	0.0424	0.0257	0.0602	0.0469	1.0000	2.3382	1.8236					242
UWIN	2	600	Y	SN	181	0.3013	0.1225	0.4018	0.4915	1.0000	3.2788	4.0115					181
UWIN	3	4,292	Y	SN	1,531	0.3568	0.6645	0.0933	0.2669	1.0000	0.1403	0.4017					1,531
UWIN	4	4,273	Y	SN	896	0.2097	0.5083	0.0888	0.1446	1.0000	0.1748	0.2845					896
UWIN	5	500	N														105
TRAP	1	1,070	Y	SN	135	0.1258	0.1704	0.0391	0.2994	1.0000	0.2292	1.7566					135
TRAP	1	1,730	N														218
TRAP	2	100	N														41
TRAP	2	544	Y	EF	225	0.4125	0.7719	0.2830	0.2530	1.0000	0.3666	0.3278					225
TRAP	2	175	N														51
TRAP	2	707	Y	SN	118	0.1663	0.4615	0.0270	0.0345	1.0000	0.0586	0.0747					118
TRAP	2	918	N														203
TRAP	2	533	Y	SN	148	0.2766	0.8621	0.1063	0.1062	1.0000	0.1233	0.1232					148
TRAP	2	267	N														74
DRYC	1	1,200	N														0
DRYC	2	1,300	N														0
DRYC	3	800	N														363
DRYC	3	564	Y	EF	256	0.4539	0.65231	0.2330	0.0000	1.0000	0.3571	0.0000					256
DRYC	3	636	N														275
DRYC	3	835	Y	SN	344	0.4113	0.9270	0.0523	0.0837	1.0000	0.0564	0.0903					344
DRYC	3	526	N														137
DRYC	3,4,5	796	Y	SN	86	0.1082	0.2396	0.0127	0.0787	1.0000	0.0530	0.3282					86
DRYC	5	843	N														91

Continued.

Appendix Table 23. Continued.

Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	No./m All	No./m Pools	No./m Riffles	No./m Glides	Ratio Pools	Ratio Riffles	Ratio Glides	Estimates from pools only sampling: Total Population Pools	Total Population Riffles	Total Population Glides	no./m all	Pop. Estimate
NINE	1	1,500	N														0
NINE[b]	1	900	Y	SNP	151	0.1612				1.0000	0.1923	0.1967	151	29	30	0.2331	210
NINE	1	1,300	N														303
FALL	1	870	Y	SN	85	0.0978	0.2189	0.0230	0.1006	1.0000	0.1050	0.4596					85
FALL	1	1,830	N														179
PARA	1	541	Y	EF	158	0.2922	0.4798	0.1679	0.0541	1.0000	0.3500	0.1127					158
PARA	1	759	N														141
PARA	1	875	Y	SN	70	0.0800	0.2775	0.0099	0.0432	1.0000	0.0357	0.1557					70
PARA	1	425	N														21
PARA	1	911	Y	SNP	16	0.0176							16	1	2	0.0209	19
PARA	1	389	N														8
																Total	**6,914**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.
[b] Population estimate was based on the ratio of pools to riffles to glides from Paradise, Trapper, and Dry creeks.

Appendix Table 24. Population estimate of age-0 brook trout (BRK) in the upper Wind River watershed, summer 2000. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

						No./m				Ratio			Estimates from pools only sampling: Total Population			Estimates from pools only sampling: no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
UWIN	1	5,714	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
UWIN	2	600	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
UWIN	3	4,292	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
UWIN	4	4,273	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
UWIN	5	500	N														0
TRAP	1	1,070	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	1	1,730	N														0
TRAP	2	100	N														0
TRAP	2	544	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	175	N														0
TRAP	2	707	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	918	N														0
TRAP	2	533	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	267	N														0
DRYC	1	1,200	N														0
DRYC	2	1,300	N														0
DRYC	3	800	N														0
DRYC	3	564	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	636	N														0
DRYC	3	835	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	526	N														0
DRYC	3,4,5	796	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	5	843	N														0

Continued.

Appendix Table 24. Continued.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
NINE	1	1,500	N														0
NINE	1	900	Y	SNP	0	0.0000							0	0	0	0.0000	0
NINE	1	1,300	N														0
FALL	1	870	Y	SN	8	0.0092	0.0075	0.0000	0.0000	1.0000	0.0000	0.0000					8
FALL	1	1,830	N														17
PARA	1	541	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
PARA	1	759	N														0
PARA	1	875	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
PARA	1	425	N														0
PARA	1	911	Y	SNP	0	0.0000							0	0	0	0.0000	0
PARA	1	389	N														0
																Total	**25**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.

Appendix Table 25. Population estimate of age-1or older brook trout (BRK) in the upper Wind River watershed, summer 2000. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
UWIN	1	5,714	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
UWIN	2	600	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
UWIN	3	4,292	Y	SN	2	0.0005	0.0012	0.0000	0.0000	1.0000	0.0000	0.0000					2
UWIN	4	4,273	Y	SN	2	0.0004	0.0017	0.0000	0.0000	1.0000	0.0000	0.0000					2
UWIN	5	500	N														0
TRAP	1	1,070	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	1	1,730	N														0
TRAP	2	100	N														0
TRAP	2	544	Y	EF	1	0.0018	0.0088	0.0000	0.0000	1.0000	0.0000	0.0000					1
TRAP	2	175	N														0
TRAP	2	707	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	918	N														0
TRAP	2	533	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	267	N														0
DRYC	1	1,200	N														0
DRYC	2	1,300	N														0
DRYC	3	800	N														0
DRYC	3	564	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	636	N														0
DRYC	3	835	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	526	N														0
DRYC	3,4,5	796	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	5	843	N														0

Continued.

Appendix Table 25. Continued.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
NINE	1	1,500	N														0
NINE	1	900	Y	SNP	0	0.0000							0	0	0	0.0000	0
NINE	1	1,300	N														0
FALL	1	870	Y	SN	2	0.0023	0.0076	0.0000	0.0000	1.0000	0.0000	0.0000					2
FALL	1	1,830	N														4
PARA	1	541	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
PARA	1	759	N														0
PARA	1	875	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
PARA	1	425	N														0
PARA	1	911	Y	SNP	0	0.0000							0	0	0	0.0000	0
PARA	1	389	N														0
																Total	**12**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.

Appendix Table 26. Population estimate of age-0 chinook (CHN) in the upper Wind River watershed, summer 2000. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	No./m				Ratio			Estimates from pools only sampling: Total Population			Estimates from pools only sampling: no./m	Pop. Estimate
						All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	
UWIN	1	5,714	Y	SN	37	0.0065	0.0027	0.0000	0.0391	1.0000	0.0000	14.7625					37
UWIN	2	600	Y	SN	5	0.0078	0.0000	0.0000	0.0424								5
UWIN	3	4,292	Y	SN	425	0.0992	0.2229	0.0024	0.0657	1.0000	0.0107	0.2948					425
UWIN	4	4,273	Y	SN	282	0.0660	0.2010	0.0082	0.0487	1.0000	0.0405	0.2423					282
UWIN	5	500	N														33
TRAP	1	1,070	Y	SN	18	0.0168	0.0451	0.0000	0.0000	1.0000	0.0000	0.0000					18
TRAP	1	1,730	N														29
TRAP	2	100	N														0
TRAP	2	544	Y	EF	1	0.0018	0.0088	0.0000	0.0000	1.0000	0.0000	0.0000					1
TRAP	2	175	N														0
TRAP	2	707	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	918	N														0
TRAP	2	533	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	267	N														0
DRYC	1	1,200	N														0
DRYC	2	1,300	N														0
DRYC	3	800	N														0
DRYC	3	564	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	636	N														0
DRYC	3	835	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	526	N														0
DRYC	3,4,5	796	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	5	843	N														0

Continued.

Appendix Table 26. Continued.

Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	No./m All	No./m Pools	No./m Riffles	No./m Glides	Ratio Pools	Ratio Riffles	Ratio Glides	Estimates from pools only sampling: Total Population Pools	Total Population Riffles	Total Population Glides	no./m all	Pop. Estimate
NINE	1	1,500	N														0
NINE	1	900	Y	SNP	0	0.0000							0	0	0	0.0000	0
NINE	1	1,300	N														0
FALL	1	870	Y	SN	172	0.1978	0.3094	0.0000	0.1775	1.0000	0.0000	0.5737					172
FALL	1	1,830	N														362
PARA	1	541	Y	EF	2	0.0037	0.0101	0.0000	0.0000	1.0000	0.0000	0.0000					2
PARA	1	759	N														3
PARA	1	875	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
PARA	1	425	N														0
PARA	1	911	Y	SNP	0	0.0000							0	0	0	0.0000	0
PARA	1	389	N														0
																Total	**1,369**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.

Appendix Table 27. Population estimate of age-1 or older chinook (CHN) in the upper Wind River watershed, summer 2000. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
UWIN	1	5,714	Y	SN	13	0.0023	0.0015	0.0044	0.0000	1.0000	2.8805	0.0000					13
UWIN	2	600	Y	SN	1	0.0017	0.0040	0.0000	0.0000	1.0000	0.0000	0.0000					1
UWIN	3	4,292	Y	SN	93	0.0216	0.0356	0.0000	0.0657	1.0000	0.0000	1.8463					93
UWIN	4	4,273	Y	SN	28	0.0065	0.0148	0.0000	0.0167	1.0000	0.0000	1.1316					28
UWIN	5	500	N														3
TRAP	1	1,070	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	1	1,730	N														0
TRAP	2	100	N														0
TRAP	2	544	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	175	N														0
TRAP	2	707	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	918	N														0
TRAP	2	533	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
TRAP	2	267	N														0
DRYC	1	1,200	N														0
DRYC	2	1,300	N														0
DRYC	3	800	N														0
DRYC	3	564	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	636	N														0
DRYC	3	835	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	3	526	N														0
DRYC	3,4,5	796	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
DRYC	5	843	N														0

Continued.

Appendix Table 27. Continued.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
NINE	1	1,500	N														0
NINE	1	900	Y	SNP	0	0.0000							0	0	0	0.0000	0
NINE	1	1,300	N														0
FALL	1	870	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
FALL	1	1,830	N														0
PARA	1	541	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
PARA	1	759	N														0
PARA	1	875	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
PARA	1	425	N														0
PARA	1	911	Y	SNP	0	0.0000							0	0	0	0.0000	0
PARA	1	389	N														0
																Total	**138**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.

Appendix Table 28. Population estimate of age-0 steelhead (STH)/rainbow trout (RBT) in the Trout Creek watershed, summer 2001. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling					
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
MSTR	2	1,056	Y	SN	628	0.5945	1.0730	0.2839	0.4048	1.0000	0.2646	0.3772					628
MSTR	3	658	Y	SN	29	0.0436	0.0794	0.0359	0.0000	1.0000	0.4523	0.0000					29
MSTR	4	2,897	Y	SN	2,615	0.9024	1.1948	0.6770	0.7521	1.0000	0.5667	0.6295					2,615
MSTR	5	3,674	Y	SN	538	0.1465	0.1930	0.0891	0.1573	1.0000	0.4617	0.8149					538
MSTR	6	3,789	Y	SN	880	0.2322	0.4039	0.0268	0.1179	1.0000	0.0664	0.2920					880
PLAN	1	519	Y	EF	196	0.3784	0.4054	0.1297	1.0561	1.0000	0.3199	2.6050					196
PLAN	1	1,481	N														560
LAYO	1	1,099	Y	EF	1,732	1.5766	1.6271	1.4809	1.5529	1.0000	0.9102	0.9544					1,732
LAYO	1	1,201	N														1,415
LAYO	1	543	Y	EF	423	0.7796	1.0402	0.3527	1.0446	1.0000	0.3390	1.0043					423
LAYO	2	1,657	N														1,292
EFTR	1	525	Y	EF	778	1.4814	1.8429	1.0848	0.5634	1.0000	0.5886	0.3057					778
EFTR	1	2,975	N														4,407
COMP	1	556	Y	EF	187	0.3358	0.4849	0.0706	0.2182	1.0000	0.1456	0.4500					187
COMP	1	844	N														283
COMP	2	2,000	N														672
CRAT	1	513	Y	EF	796	1.5524	1.7754	0.8235	2.5539	1.0000	0.4639	1.4385					796
CRAT	1	549	Y	SNP	172	0.3131							172	80	247	0.9093	499
CRAT	1	1,938	N														1,762
UTRT	1	690	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
UTRT	1	1,810	N														0
																Total	**19,693**

Continued.

Appendix Table 29. Population estimate of age-1 or older steelhead (STH)/rainbow trout (RBT) in the Trout Creek watershed, summer 2001. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
MSTR	2	1,056	Y	SN	74	0.0704	0.1135	0.0411	0.0714	1.0000	0.3618	0.6293					74
MSTR	3	658	Y	SN	3	0.0051	0.0140	0.0000	0.0000	1.0000	0.0000	0.0000					3
MSTR	4	2,897	Y	SN	1,736	0.5991	0.6990	0.3669	1.4573	1.0000	0.5249	2.0847					1,736
MSTR	5	3,674	Y	SN	1,140	0.3102	0.4831	0.2315	0.1617	1.0000	0.4791	0.3347					538
MSTR	6	3,789	Y	SN	941	0.2486	0.4507	0.0104	0.1179	1.0000	0.0231	0.2617					941
PLAN	1	519	Y	EF	149	0.2877	0.6126	0.1604	0.3178	1.0000	0.2618	0.5187					149
PLAN	1	1,481	N														426
LAYO	1	1,099	Y	EF	50	0.0451	0.0707	0.0000	0.0118	1.0000	0.0000	0.1665					50
LAYO	1	1,201	N														254
LAYO	1	543	Y	EF	205	0.3778	0.7411	0.0870	0.1975	1.0000	0.1173	0.2530					205
LAYO	2	1,657	N														626
EFTR	1	525	Y	EF	22	0.0419	0.0665	0.0000	0.0000	1.0000	0.0000	0.0000					22
EFTR	1	2,975	N														125
COMP	1	556	Y	EF	157	0.2815	0.4152	0.0707	0.0909	1.0000	0.1700	0.2190					157
COMP	1	844	N														238
COMP	2	2,000	N														563
CRAT	1	513	Y	EF	121	0.2367	0.3659	0.1177	0.0000	1.0000	0.3215	0.0000					121
CRAT	1	549	Y	SNP	50	0.0910							50	16	0	0.1204	66
CRAT	1	1,938	N														233
UTRT	1	690	Y	EF	53	0.0769	0.1082	0.0758	0.0234	1.0000	0.7000	0.2166					53
UTRT	1	1,810	N														139
																Total	**7,321**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.

Appendix Table 30. Population estimate of age-0 brook trout (BRK) in the Trout Creek watershed, summer 2001. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
MSTR	2	1,056	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
MSTR	3	658	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
MSTR	4	2,897	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
MSTR	5	3,674	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
MSTR	6	3,789	Y	SN	74	0.0197	0.0316	0.0000	0.0100	1.0000	0.0000	0.3179					74
PLAN	1	519	Y	EF	4	0.0083	0.0360	0.0000	0.0000	1.0000	0.0000	0.0000					4
PLAN	1	1,481	N														12
LAYO	1	1,099	Y	EF	425	0.3870	0.4797	0.0000	0.1118	1.0000	0.0000	0.2330					425
LAYO	1	1,201	N														343
LAYO	1	543	Y	EF	100	0.1843	0.2500	0.0000	0.2143	1.0000	0.0000	0.8571					100
LAYO	2	1,657	N														305
EFTR	1	525	Y	EF	290	0.5515	0.6828	0.0000	0.4789	1.0000	0.0000	0.7014					525
EFTR	1	2,975	N														1,641
COMP	1	556	Y	EF	42	0.0752	0.1182	0.0000	0.0364	1.0000	0.0000	0.3077					42
COMP	1	844	N														63
COMP	2	2,000	N														150
CRAT	1	513	Y	EF	96	0.1880	0.2464	0.1177	0.1231	1.0000	0.4775	0.4995					96
CRAT	1	549	Y	SNP	14	0.0255							14	7	7	0.0504	28
CRAT	1	1,938	N														98
UTRT	1	690	Y	EF	53	0.0769	0.0260	0.0000	0.0234	1.0000	0.0000	0.9023					53
UTRT	1	1,810	N														139
																Total	**3,864**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.

Appendix Table 31. Population estimate of age-1 or older brook trout (BRK) in the Trout Creek watershed, summer 2001. Sites are listed from downstream to upstream within a subwatershed relative to the mainstem stream.

													Estimates from pools only sampling				
						No./m				Ratio			Total Population			no./m	
Stream code	Reach	Total length	Sampled Y/N	Survey type[a]	Total	All	Pools	Riffles	Glides	Pools	Riffles	Glides	Pools	Riffles	Glides	all	Pop. Estimate
MSTR	2	1,056	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
MSTR	3	658	Y	SN	0	0.0000	0.0000	0.0000	0.0000								0
MSTR	4	2,897	Y	SN	2	0.0007	0.0014	0.0000	0.0000	1.0000	0.0000	0.0000					2
MSTR	5	3,674	Y	SN	11	0.0031	0.0028	0.0067	0.0000	1.0000	2.4163	0.0000					11
MSTR	6	3,789	Y	SN	183	0.0480	0.0860	0.0069	0.0163	1.0000	0.0805	0.1896					183
PLAN	1	519	Y	EF	0	0.0000	0.0000	0.0000	0.0000								0
PLAN	1	1,481	N														0
LAYO	1	1,099	Y	EF	82	0.0744	0.1233	0.0000	0.0000	1.0000	0.0000	0.0000					82
LAYO	1	1,201	N														59
LAYO	1	543	Y	EF	13	0.0240	0.0580	0.0000	0.0000	1.0000	0.0000	0.0000					13
LAYO	2	1,657	N														40
EFTR	1	525	Y	EF	37	0.0696	0.1057	0.0000	0.0282	1.0000	0.0000	0.2664					37
EFTR	1	2,975	N														207
COMP	1	556	Y	EF	37	0.0673	0.1061	0.0000	0.0364	1.0000	0.0000	0.3429					37
COMP	1	844	N														57
COMP	2	2,000	N														135
CRAT	1	513	Y	EF	76	0.1482	0.2500	0.0294	0.0308	1.0000	0.1176	0.1231					76
CRAT	1	549	Y	SNP	18	0.0328							18	2	2	0.0407	22
CRAT	1	1,938	N														79
UTRT	1	690	Y	EF	39	0.0566	0.0346	0.0667	0.0703	1.0000	1.9250	2.0303					39
UTRT	1	1,810	N														102
																Total	**1,181**

[a] EF=multiple pass electrofishing, SN=population snorkel survey, SNP=population snorkel survey on pools only.