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An Inventory of Fish in Streams at Mount Rainier National Park 2001-2003

Natural Resource Technical Report NPS/NCCN/NRTR—2013/717

ON THE COVER
National Park staff conducting a snorkel fish survey in Kotsuck Creek, Mount Rainier National Park, 2002.
Photograph courtesy of Mount Rainier National Park.

An Inventory of Fish in Streams at Mount Rainier National Park 2001-2003

Natural Resource Technical Report NPS/NCCN/NRTR—2013/717

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National Park Service
North Coast and Cascades Network Inventory and Monitoring Program
Mount Rainier National Park
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Executive Summary

The glacial system on Mount Rainier is the largest single mountain system in the contiguous 48 states, consisting of 26 major glaciers covering 35 square miles and creating most of 470 mapped rivers and streams that occur within the park. Streams and rivers within Mount Rainier National Park (MORA) have been altered very little by humans and represent outstanding examples of pristine aquatic ecosystems of North America (Gregory et al. 1991), with the exception of the effects of dams located outside of the park. Glacially influenced and nonglacial drainages originate on the slopes of Mount Rainier. Streamside forests represent old-growth and mature forests that were established before European settlement. In addition, one of the last remnants of rain forests in the Cascade Range occurs in the park. Management of these aquatic resources requires a systematic inventory of the streams and rivers and long-term monitoring to establish an ecological database. One of the least known but regionally most important components of these ecosystems are fish communities. The present status of native fish populations in the park was not well understood due to construction of dams outside the park, previous stocking activities, and a general lack of knowledge as to patterns of fish occurrence within the park. Hatchery stocks of rainbow (*Oncorhynchus mykiss*), westslope cutthroat (*O. clarkii lewisi*), and eastern brook trout (*Salvelinus fontinalis*) were extensively stocked throughout park streams from the early part of the century until the mid-1970s.

Fish surveys conducted from the early part of the century through the 1980s were focused on fish stocking. In the early 1990s park staff began to document the presence of fish species within park streams (Samora, unpublished data), but efforts were not well funded. By 1999 funding was secured to survey streams for salmonid species of concern (Samora and Feola 2000, Samora and Marks 2000). Limnological surveys conducted throughout the park since 1988 have included documentation of fish in park lakes; therefore lake fish surveys were not included in this inventory. However, some lake outlet streams were included in this inventory to better understand past fish stocking effects.

Our primary goal was to meet the National Park Service Inventory and Monitoring program goal to better assess the current status of fish species in the parks and to document, to the 90% verification level, species found in these parks. This report summarizes our efforts to document the presence and general distribution of fish species in streams throughout the park. The inventory was conducted during June through October 2001; May to October 2002; with lake outlet surveys conducted in 2003. One-hundred forty eight surveys were completed on 138 stream segments using electroshocking or snorkeling methods. The inventories spanned eight watersheds, covering over 26,000 linear meters (16.1 miles) of stream. The West Fork watershed was not surveyed during this inventory because previous surveys (Samora and Marks 2000) had focused on this drainage. Elevation of stream sites ranged from 518 m to 1,707 m (1,700 to 5,600 ft). Fish were observed in streams with gradients ranging from 1 to 35%, but most fish were documented in streams with gradients <10%. Species presence, survey method, and meters surveyed are summarized in Table 1 and Figure 1.

Table 1. Summary of fish species by watershed and survey method.

Watershed	Number of Surveys	Meters Surveyed	Snorkel	Shock	Snorkel & Shock	Fish Species Observed
Carbon	17	1,910	10	7	1	ONCL, TRSP, SACO, SAFO, UNSA, COCO, SAXX, COXX,
Cowlitz	20	4,220	6	14	1	ONCL, ONMY, SAFO, SAXX, TRSP, UNSA
Huckleberry	8	7,160	3	5	0	ONCL,ONMY, TRSP, COCO, UNSA, SAFO
Mowich	10	1,020	4	6	1	ONCL, COXX, SAFO, TRSP, UNSA
Nisqually	37	4,820	12	25	1	ONCL, SAFO, UNSA, COCO, COXX
Ohanapecosh	28	3,158	13	15	0	ONCL, TRSP, SAXX,
Puyallup	1	100	1	0	0	none
White	27	3,908	7	20	0	ONMY, TRSP, ONTS, SACO, SAFO, UNSA, COCO, COXX
Totals	148	2,6296	56	92	4	

COXX= *Cottus spp.* (sculpin species). COCO = *Cottus confusus* (shorthead sculpin). ONCL=*Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO= *Salvelinus confluentus* (bull trout). SAFO= *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout).

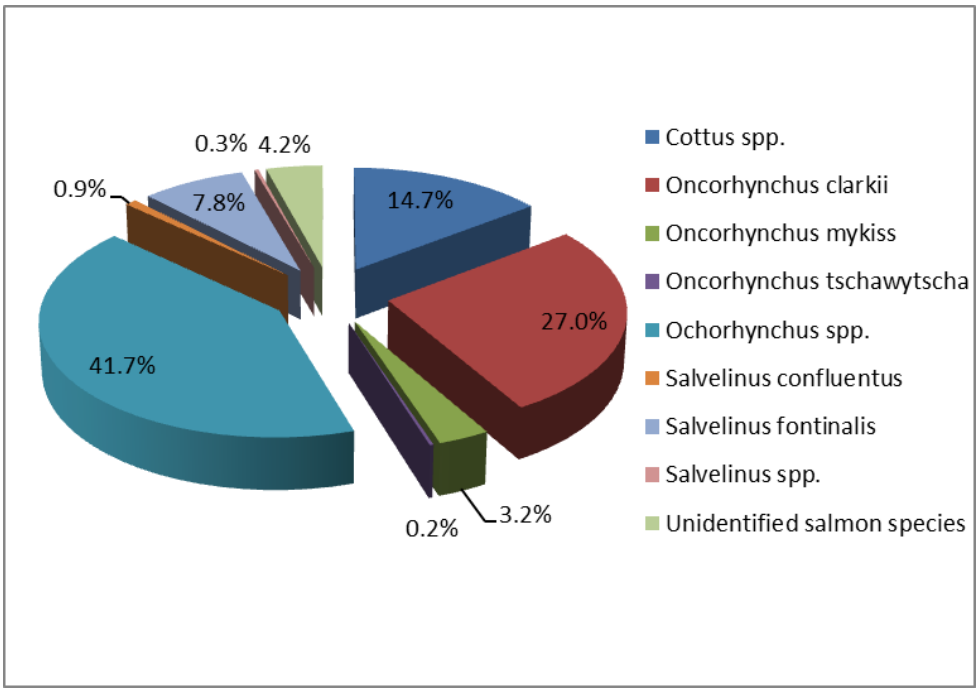

Figure 1. Species documented during inventory (shown as percentages). *Cottus spp.* (sculpin species), *Oncorhynchus clarkii* (cutthroat) including all subspecies, *Oncorhynchus mykiss* (rainbow trout), *Oncorhynchus tshawytscha* (Chinook salmon), *Salvelinus confluentus* (bull trout), *Salvelinus fontinalis* (eastern brook trout), Salvelinus spp. (unidentified char), unidentified salmonid species (trout).

Salmonid spp. are dominant in park streams (>85%). The only non-salmonid fish documented were *Cottus spp*. (sculpins). Trout (*Oncorhynchus spp.*) were the most commonly observed species (n=1207) found in 55 stream segments.[1] Of the trout that could be identified, cutthroat trout were the most abundant species observed (n=453) for fish >100 mm in size, and were documented in 47 stream segments. Rainbow trout >100 mm in size (n=54) were documented in 7 stream segments. DNA analysis and identification through morphometric characteristics confirmed native coastal cutthroat trout presence in 16 streams within four watersheds.

Chinook salmon (*O. tshawytscha*) were documented in the White River inside the park (n=4). Although not included in the inventory sites, coho salmon (*O. kisutch*) were observed at the park boundary on Silver Creek and in the Carbon River. Sockeye/kokanee (*O. nerka*) salmon were observed spawning in a tributary to the Nisqually River.

The predominant char observed was the introduced eastern brook trout (n = 131), found in 14 stream segments and all but two watersheds. Bull trout (*S. confluentus*) were observed in only seven stream segments during this inventory (n=15). *Cottus spp.* were observed in 11 stream segments (n=246). Of all stream segments sampled, 27 had no fish.

Salmonid species observed were mostly in the 50 to 350-mm size classes. Most cutthroat trout ranged in size from 100 mm to 250mm. Most rainbow trout observed were in the 100 to 200 mm size classes. Most unidentified trout (TRSP) ranged in size from <50 to 100 mm. A few individual fish, larger than 100 mm, could not be reliably identified to species during snorkel surveys. Bull trout ranged in size from young-of-the-year (<50 mm) to 300 mm. Eastern brook trout ranged in size from <50 to 350 mm. Sculpin species length ranged from < 50 to 150 mm in size.

DNA analysis confirmed native coastal cutthroat trout presence in 16 streams in the Carbon, Nisqually, Ohanapecosh, and Cowlitz watersheds. Introduced cutthroat trout, including west slope and Yellowstone cutthroat, were present in the Ohanapecosh watershed. Sculpins were present in 11 streams in the Nisqually, Huckleberry, White and Carbon watersheds. Bull trout were found in streams also occupied by cutthroat trout and possibly rainbow trout, *Cottus* sp., and eastern brook trout. Hybridization with eastern brook trout may be occurring however, additional genetic analysis is needed to confirm this. DNA analysis also confirmed that native char samples submitted in this study were bull trout. This suggests that Dolly Varden (*S. malma*) does not occur in MORA which is consistent with reports from studies conducted just outside of the park boundaries in the Upper Puyallup watershed. However, additional studies are needed to determine the species (bull trout or Dolly Varden) and genetic stock of native char that occur within the park. Additional genetic analyses are also needed to determine species, subspecies, and hybrids of trout in park streams.

With taxonomic assistance from the Washington Division of Fish and Wildlife staff, shorthead sculpins (*C. confusus)* were identified from specimens collected from the Carbon, Nisqually, and Huckleberry watersheds.

[1]Fish under 100 mm could not be reliably distinguished between cutthroat and rainbow trout. All trout under 100 mm were documented as TRSP.

Fish habitat data were also collected during this inventory to aid in future fish and stream related studies (see Appendix C). A summary of select habitat parameters (Figure 2) is presented, but complete analyses of these data are beyond the scope of this report. The dominant habitat surveyed was turbulent fast water such as falls, cascades, rapids, riffles and chutes (41%). Non-turbulent fast water such as sheets and runs were the next frequent dominant habitat (27%), followed by scour pools such as eddies, trenches, mid-channel pools, lateral pools, and plunge pools (22%). Most fish were documented in turbulent fast water (n=272), followed by scour pools (n=171) and non-turbulent fast water (n=166). Most fish were also documented in riparian categories that indicate shrubs and trees as the dominant streamside vegetation. Approximately 79% of fish were observed in streams where overstory vegetation exceeded 40%. Most fish were observed in stream gradients below 8%.

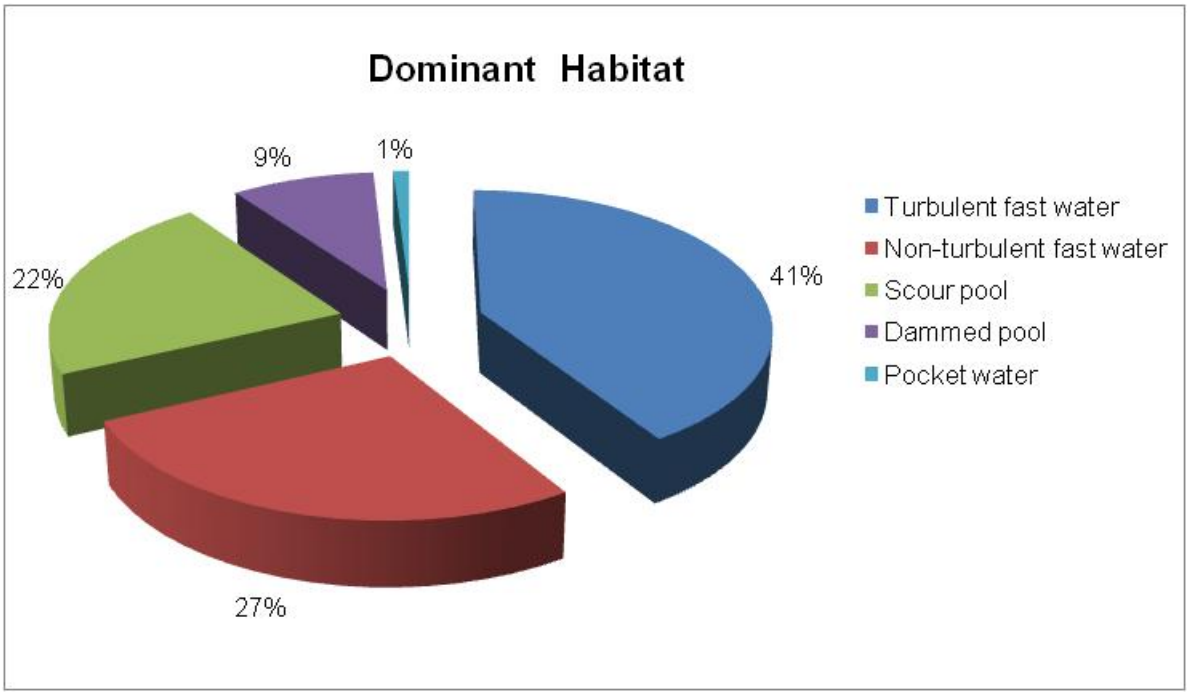

Figure 2. Percent of dominant habitat at survey locations.

Seventeen voucher specimens were collected during this inventory and included cutthroat trout and sculpins. Voucher specimens were accessioned into the park natural history collections. The *NPSpecies* lists for park fish was updated and certified.

Acknowledgments

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Introduction

Background and History

In view of the regional focus on threatened fish stocks and potential for fish to integrate aquatic ecological responses, an inventory of fish communities and habitat status is the first priority for biological monitoring of stream ecosystems. Development and maintenance of park facilities have continued to alter fish communities and habitat. Inventories of streams for fish presence are needed to determine where species of concern occur within the park and to develop appropriate management strategies for their protection. Native cutthroat and rainbow trout stock, unaffected by hatchery strains, may exist in some portions of the park and protection measures are needed for their continued survival. Endangered and threatened species such as bull trout and Chinook salmon occur within the park, but little is known about their distribution.

Sixteen species potentially occur within MORA (see Table 2). The species list was developed based on park historic records (Kitchin1935; May 1966a, 1966b, 1967; Mount Rainier National Park 1965, NPS 1964), and local expertise based on species that occur outside of the park in these streams. Prior to this inventory, six species (32%) had been verified with only four vouchers collected and cutthroat trout subspecies were unknown. Native salmonids include rainbow or steelhead trout (*Oncorhynchus mykiss*), coastal cutthroat trout (*O. clarkii clarkii*), and Dolly Varden (*Salvelinus malma*) and/or bull trout (*S. confluentus*), coho salmon (*O. kisutch),* and Chinook salmon (*O. tshawytscha*). Five species of salmonids are listed as special status species (bull trout, Chinook, coho, cutthroat, and steelhead). Whitefish (*Prosopium williamsoni*) and several species of sculpins (*Cottus spp.*) also occur within the park. The hatchery strains of rainbow, west slope (*O. clarkii lewisi*) and Yellowstone (*O. clarkii bouvieri*) cutthroat trout, and eastern brook trout (*S. fontinalis*) were widely stocked throughout the park and may have hybridized or replaced some native stocks within their historic ranges.

Table 2. Fish species that potentially occur in Mount Rainier National Park and their conservation status as of 2003.

Common Name	Scientific Name	Species Codes	Native / Introduced	Federal Status	State Status
Coastal cutthroat trout	*Oncorhynchus clarkii*	ONCL	Native	None	Game
West slope cutthroat trout	*Oncorhynchus clarkii lewisi*	ONCL	Introduced	None	Game
Yellowstone cutthroat trout	*Oncorhynchus clarkii bouvieri*	ONCL	Introduced	None	None
Rainbow trout	*Oncorhynchus mykiss*	ONMY	Native and Introduced Stock	Steelhead threatened	State Listed or Candidate Species; Game
Steelhead	*Oncorhynchus mykiss*	ONMY	Native	Threatened; Game	Candidate
Unidentified trout	*Oncorhynchus* species	TRSP			
Bull trout	*Salvelinus confluentus*	SACO	Native	Threatened	Threatened
Brook trout	*Salvelinus fontinalis*	SAFO	Introduced	None	none
Coho salmon	*Oncorhynchus kisutch*	ONKI	Native	Species of Concern	Food Fish
Chinook salmon	*Oncorhynchus tshawytscha*	ONTS	Native	Threatened	Threatened
Sockeye	*Oncorhynchus nerka*	ONNE	Unknown	None	Candidate Species; Food Fish
Kokanee	*Oncorhynchus nerka*	ONNE	Introduced	None	Game
Unknown salmonid	*Unknown salmonid*	UNSA			
Mountain whitefish	*Prosopium williamsoni*	PRWI	Native	None	None
Shorthead sculpin	*Cottus confusus*	COCO	Native		
Riffle sculpin	*Cottus gulosus*	COGU	Unknown	None	None
Prickly sculpin	*Cottus asper*	COAS	Introduced	None	None
Torrent sculpin	*Cottus rhotheus*	CORH	Introduced	None	None
Coast range sculpin	*Cottus aleuticus*	COAL	Unknown	None	None
Reticulate sculpin	*Cottus perplexus*	COPE	Unknown	None	None
Speckled dace	*Rhinichthys osculus (Girard)*	RHXX	Native	None	None

Bull trout (*S. confluentus*) historically was found in most major river systems in the Pacific Northwest, including streams within the park. Before 1978, Dolly Varden (*S. malma*) was grouped into anadromous and interior forms. Cavender (1978) redescribed the interior form as a separate species, *S. confluentus*, commonly known as the bull trout. Bull trout is listed as threatened under the federal Endangered and Threatened Species Act. Dolly Varden is protected as well due to the similarity of appearance to bull trout. Schmoe (1925) and May (1966b) listed Dolly Varden as the only native char occurring in the park.

Coastal cutthroat trout historically occurred in all lower Columbia River and Puget Sound tributaries including those within the park. However, native stocks of both sea-run and resident cutthroat trout are in serious decline in some parts of our region. Many populations are considered depressed; some populations may be extinct.

Chinook salmon historically spawned in the White, West Fork, and Mowich rivers and tributaries (Schmoe 1925). Chinook salmon fry have been observed in the White River in the park. The White River early-run Chinook salmon population is genetically the most distinctive stock in central and south Puget Sound. It is the last existing early returning "spring" Chinook salmon population in southern Puget Sound. Most natural spawning occurs in the mainstem of the White River upstream of Mud Mountain Dam, and in major tributaries such as the Clearwater River, Greenwater River, Huckleberry Creek, Boise Creek, and potentially the West Fork White River" (NMFS 2007b).[2]

Most of the early fish related studies in the park focused on recreational fish management. Schmoe (1925) described game species that occurred in the park including Chinook and coho salmon, steelhead, and coastal cutthroat trout. Fish stocking and related field work were conducted from 1934 to 1964 (Kitchin 1935, Pike 1937, Garlick 1949, Morton 1958a, 1958b, Wallis 1959, Wallis and Morton 1958, U.S. Department of the Interior 1960, May 1966a, 1966b, 1967, MORA unpublished fish stocking records 1920-1972).

In a Fish Management Plan for the park, May (1966b) described fish species thought to be present in park streams and lakes. Buttery (1983) conducted creel census surveys throughout the park. Non-native and hatchery stock were intentionally and extensively released into park lakes and streams beginning in the early part of the 20th century. Official stocking of lakes and streams began about 1918, although private, informal stockings were made prior to this time. All of the larger park streams were repeatedly stocked with native and non-native species. Stocking was halted after 1972 consistent with new NPS management policies.

Construction of the Electron Dam on the Puyallup-Mowich drainage, and Alder and LaGrande Dams on the Nisqually River have blocked anadromous passage to these rivers and their upstream tributaries within the park. Mud Mountain Dam on the White River also blocks fish passage, but anadromous and migratory salmonids, (Chinook, coho, steelhead, bull trout) are transported around the dam, thereby allowing access to the upper White River, West Fork of the White River, and Huckleberry Creek basins. Salmon migration in the Cowlitz and Ohanapecosh rivers are blocked by dams at Riffe Lake and Mayfield Lake; however, coho salmon are transported around the dams. The Carbon River is the only major drainage without man-made dams blocking fish passage. Steelhead and coho salmon are found in the upper Carbon River.

Fish stocking continues on lands located outside of the park. Hatchery reared cutthroat trout stock and species continue to be stocked in Huckleberry Creek outside of the park. The non-native kokanee salmon (*O. nerka*) is stocked in the Nisqually watershed (Alder Lake) and have been observed spawning in streams inside the park. Other streams adjacent to the park are also stocked, mostly with salmonid species and have the potential to enter park streams. Non-native species of sculpins (*Cottus spp*.) have been introduced into the park in the past and are likely present in park streams today.

More recent observations of fish in a limited number of streams have been documented since 1989 (Wildman 1989 unpublished MORA data, Samora 1993 unpublished MORA data, Samora

[2]Fish are trucked around the dam every year.

1996, Samora and Feola 2000, Samora and Marks 2000). Non-native fish have also been documented in at least 29 lakes (Samora unpublished MORA data).

Objectives

The primary focus of this project was to provide a basic inventory of all fish species found within MORA streams and to determine general native and non-native fish species distribution within the park. Similar inventories were conducted in other North Coast and Cascades Network parks as part of the National Park Service nationwide Vertebrate and Vascular Plant Inventory effort. Some additional sites were inventoried in MORA during 2001-2003, using the same protocols, in association with surveys conducted to meet requirements of the National Environmental Policy Act, and these data are also included in this report.

Study Area

Mount Rainier National Park is located in the central Cascade Range of western Washington, and is within the NPS North Coast and Cascades Network (NCCN) (Figures 3 and 4). Mount Rainier National Park encompasses 235,625 acres or 368 square miles. The park is surrounded mostly by U.S. Forest Service lands (87%), with 33% of these lands designated as Wilderness (Figures 4 and 5). Thirteen percent of lands surrounding the park are held in private ownership. Within the park, 97% of the lands are designated as the Mount Rainier Wilderness (228,480 acres) (Figure 5). The topography of the park is rugged and precipitous, consisting mainly of peaks and valleys. The park has been delineated into nine watersheds that include Ohanapecosh, Huckleberry, and the more glacially influenced Nisqually, Puyallup, Mowich, Carbon, West Fork, White, and Muddy Fork rivers (Figure 6). All but two park rivers empty into Puget Sound near Tacoma, Washington. The Muddy Fork and Ohanapecosh rivers are the exception, flowing into the Cowlitz River outside the park, which drains into the Columbia River and on to the Pacific Ocean. Each major river occupies a deep canyon whose floor is 305 to 915 m (1,000 to 3,000 ft) below the adjacent divides.

Valley floor gradients are steep and increase markedly upstream. Mount Rainier's summit towers 2743 to 3353 m (9000 to 11,000 ft) above valley floors only three to six miles away. The glacial system on Mount Rainier is the largest single montane glacial system in the contiguous 48 states consisting of 26 major glaciers covering 35 square miles. Approximately 470 mapped rivers and streams, 382 mapped lakes and ponds, over 3000 acres of other wetland types, numerous waterfalls, and mineral springs occur within the park boundary. With few exceptions, the headwaters of most park streams are located within the park boundary.

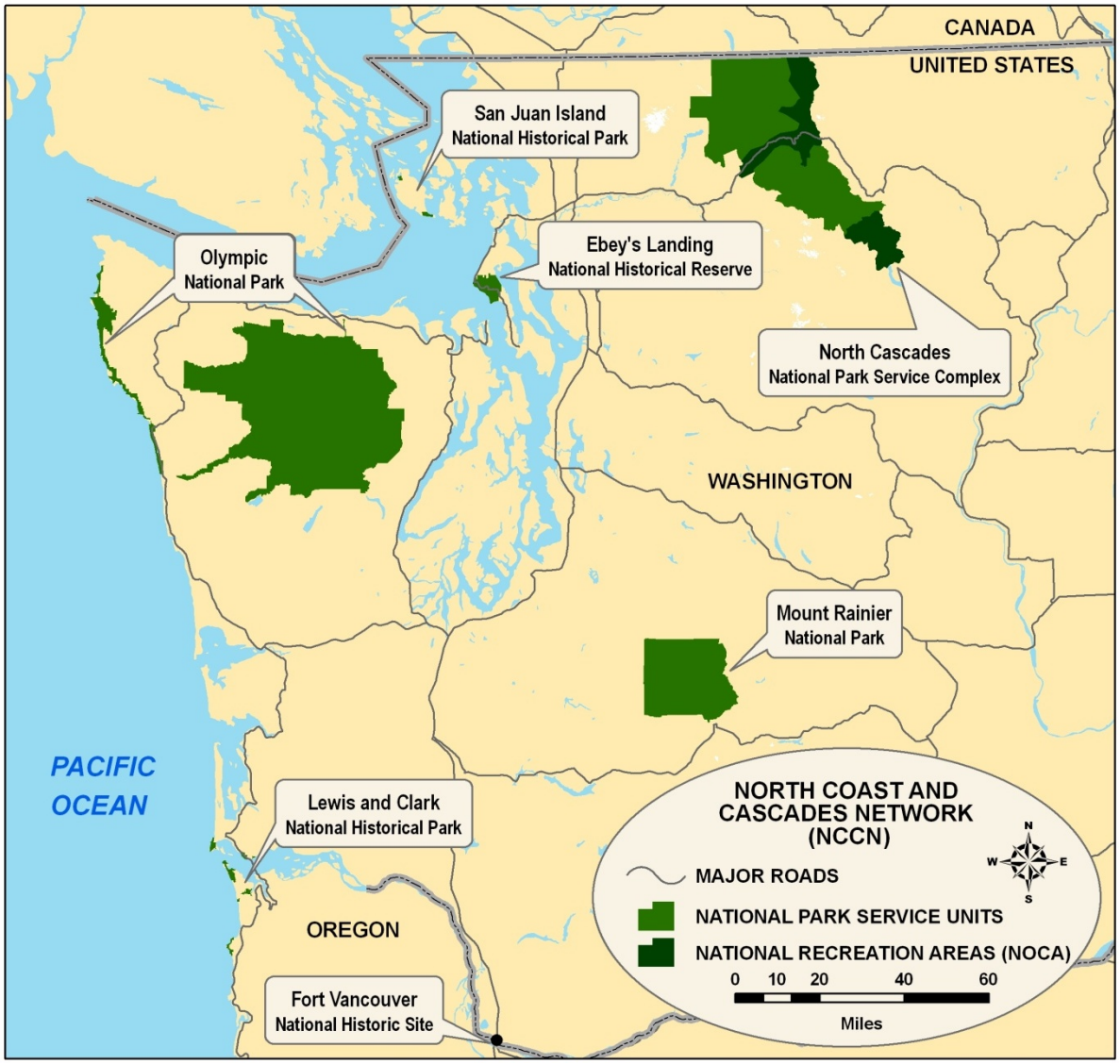


Figure 3. North Coast and Cascades Network.

Figure 4. Mount Rainier National Park.

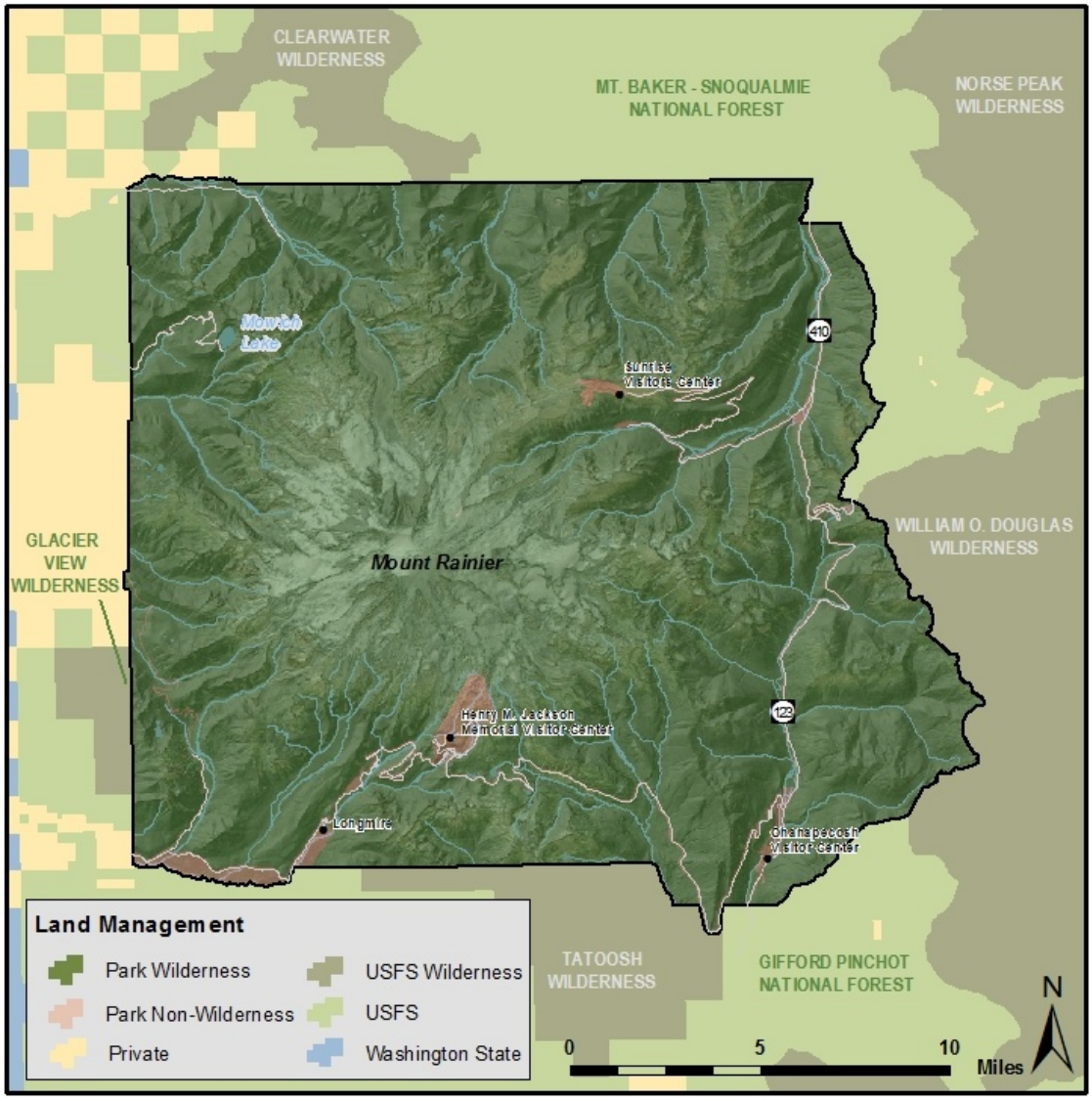


Figure 5. Land use surrounding Mount Rainier National Park.

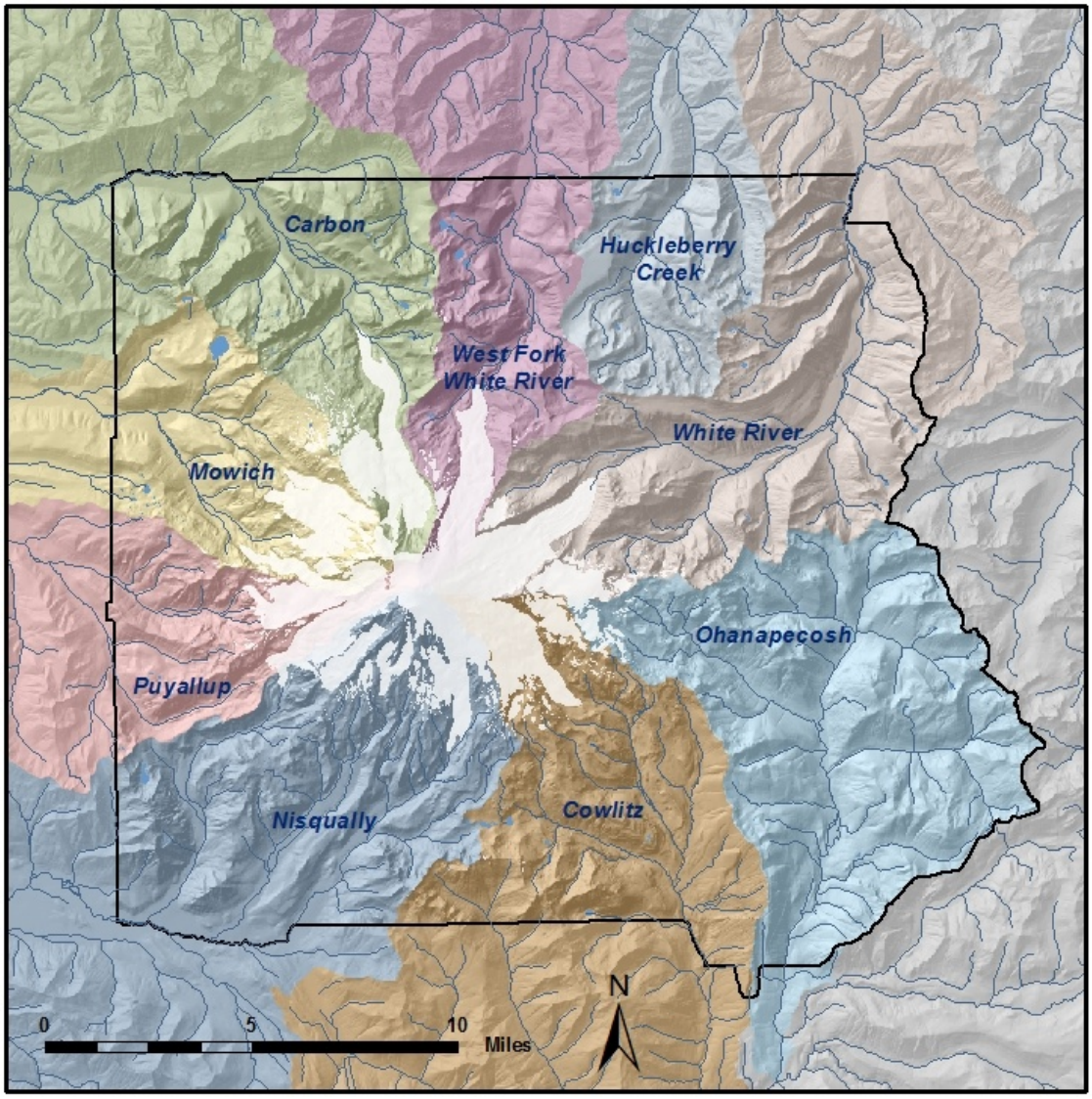


Figure 6. Major rivers and watersheds around Mount Rainier National Park.

Park ecoregions can be classified into four general categories: Lower Forest, mid-elevation forests, Subalpine, and Alpine. Vegetation is diverse, reflecting the varied climatic and environmental conditions encountered across the park's 3871 m (12,700 ft) elevation gradient (Figure 7). Approximately 58% of the park is covered by low and mid-elevation forests. Low elevation forests are distributed from the park's boundary at 518 to about 823m (1219 to 2700 ft) elevation and are dominated by western hemlock, Douglas fir, and western red cedar. Mid-elevation forests extend upward to 1219 to 1829 m (4000 to 6000 ft) elevation and contain Pacific silver fir, Alaska yellow cedar, western white pine, and noble fir. Above 1373 m (4500 ft), trees become less dense as the forest transitions into subalpine parkland. Forest ages range from young stands (less than 100 years old) found on moraines left by receding glaciers or in floodplains, to old-growth stands 1000 or more years old in the upland areas. Almost all (94%) of the survey sites were located in the forested areas of the park. The subalpine parkland covers approximately 23% of the park; vegetation in this zone is a mosaic of tree clumps and

herbaceous meadows extending from 1524 to about 2134 m (5000 to 7000 ft) elevation. The alpine zone extends from treeline to the mountain's summit. Approximately 50% of the zone is covered by permanent snow and ice and the remainder by alpine vegetation.

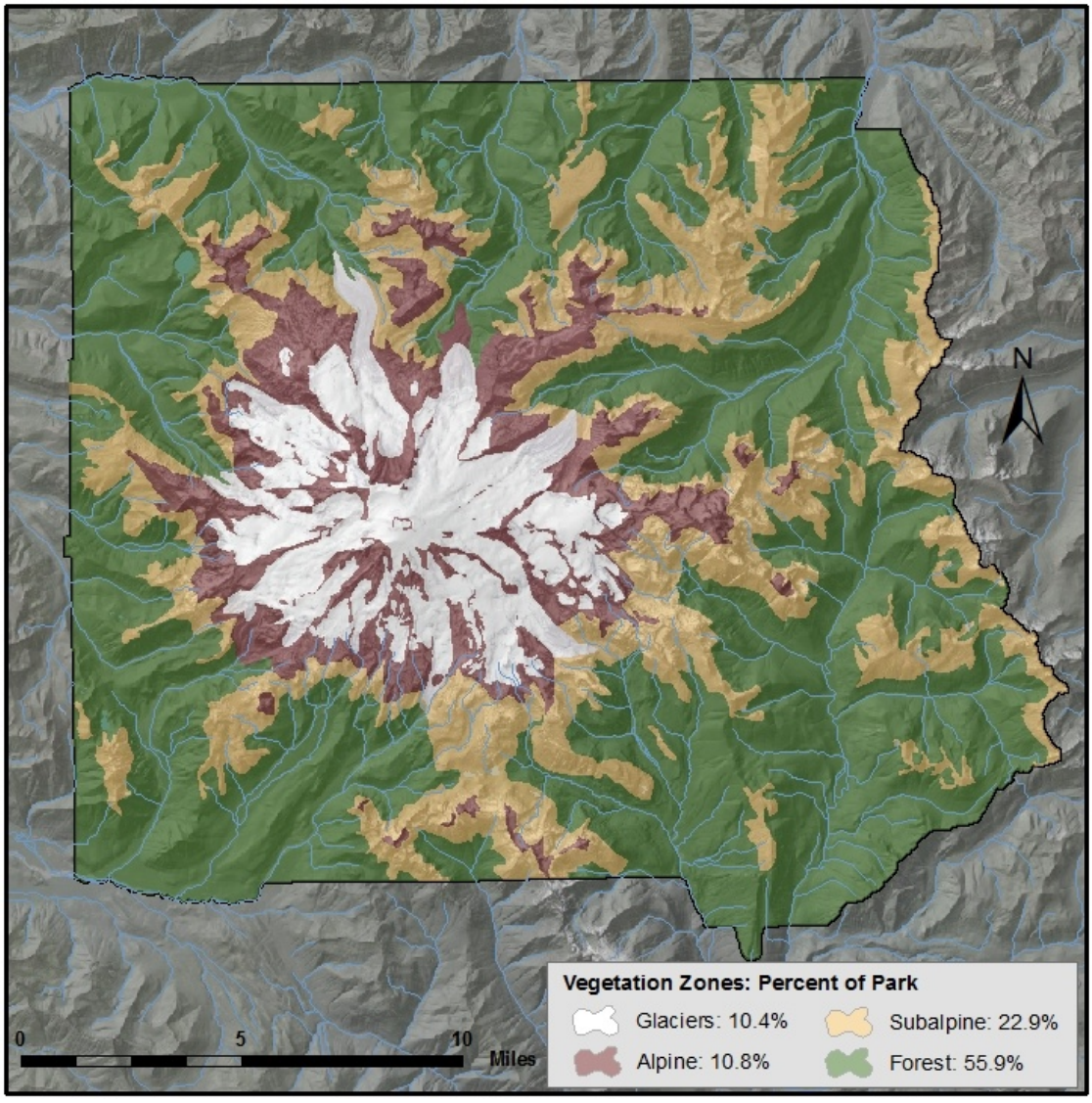


Figure 7. General ecoregions (vegetation zones) of Mount Rainier National Park.

Geology

The Pleistocene glacial geology of the park has been interpreted by Crandell and Miller (1964). Surficial geology has been mapped by Fiske et al. (1964). Crandell (1969) mapped bedrock geology within the park (Figure 8).

Mount Rainier is among the highest and topographically most impressive of the world's volcanoes. The broad cone spreads out on top of the Cascades. The volcano rises about 7000 feet above its foundation, and stands as the highest peak in the Cascade Range at an altitude of 14,410 feet.

Bedrock geology of the park is made up of mostly andesite (19%), granodiorite (25%), sandstone breccia (41%), diorite (6%), and surficial deposits (8%). Glacial, glacial-outwash, and alluvial landforms are common. Complex interbeddings of alluvial and lahar deposits are found along the lower valleys. Glacial outburst floods have cut away existing river terraces on Tahoma Creek, Nisqually River, and the West Fork of the White. Surficial deposits of glacial origin include a wide variety of drift materials. Surficial geology of major rivers includes alluvial deposits interbedded mudlfows and alluvium.

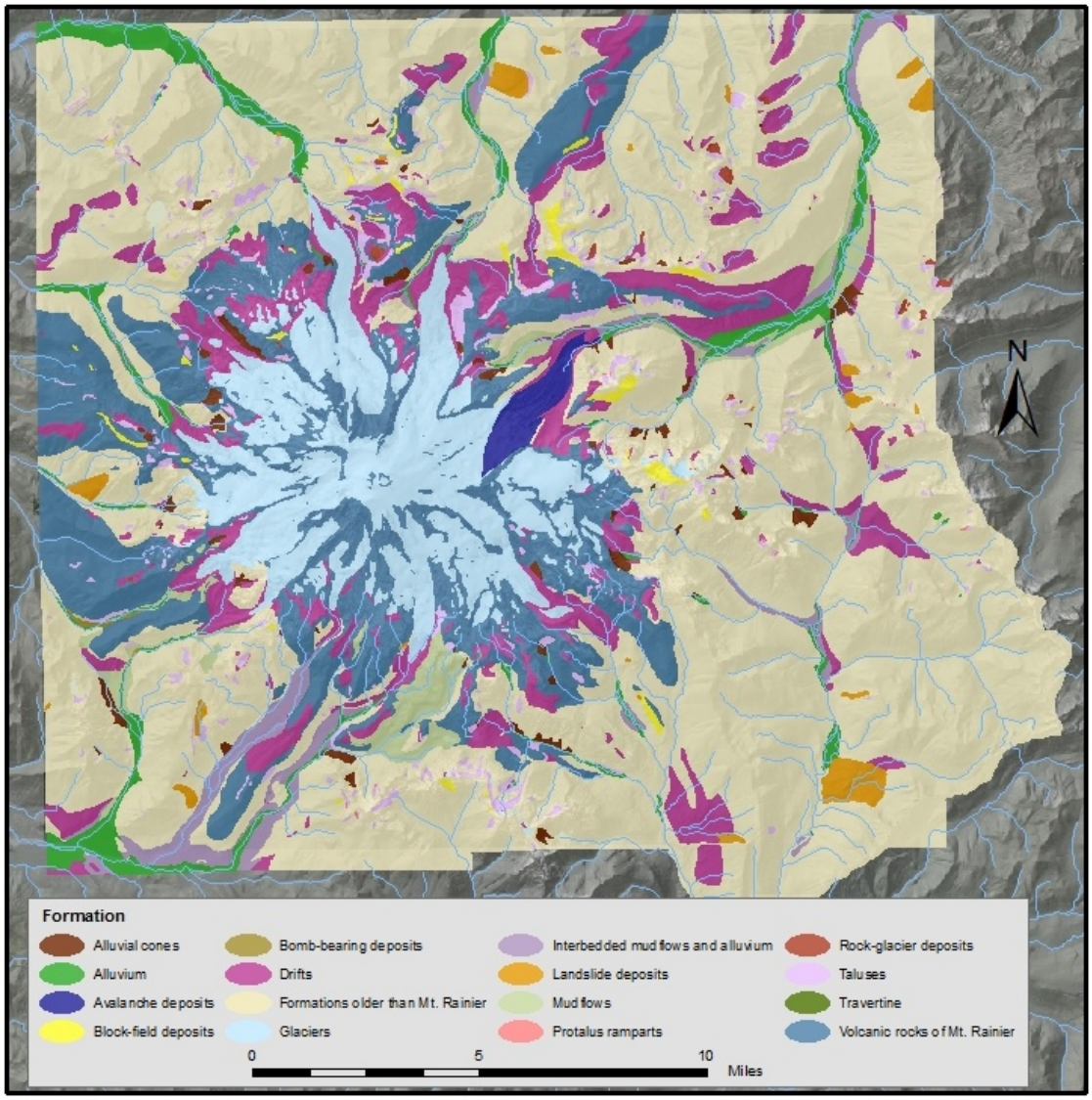


Figure 8. Surficial geology of the study area.

Geologic processes such as earthquakes, landslides, snow avalanches, floods, and volcanic eruptions are important disturbance events in MORA. Most of the large lahars that have occurred on the mountain have been the result of volcanic activity. In recent time, smaller mudflows resulting from glacier outburst floods or debris flows, have periodically but significantly altered some of the major river valleys in the park.

There are 26 named glaciers in the park and numerous snowfields. The Emmons Glacier has the largest area (4.3 square miles) and Carbon Glacier has the lowest terminus altitude (3600 feet) of all glaciers in the conterminous 48 states. Glacial runoff has significant effects on park waters, particularly effecting flow, temperature, and sediment regimes in downstream areas. Glacial outburst floods and small debris flows affect stream hydrology and stream amphibian habitat within the park.

Soils

The soils of the park have not been described in published literature. Franklin (1966) recognized the podzolic nature of many soil profiles and described numerous buried soil horizons resulting from successive volcanic ash deposits. Data from similar soils in the northern Washington Cascade Range indicate that such soils fit all but one criterion for classification into the Spodosol order (Singer and Ugolini 1974). The accumulations of surface organic horizons, development of iron pans, and particle movement from eluvial to illuvial horizons are typical features of soil profiles (Franklin 1966, Hobson 1976).

Colluvial soils are the dominant soil group in the Park. Hobson (1976) describes these as unstable soils, rapidly drained, and consisted of coarse, unconsolidated, mixed parent material. They are found on slopes at all elevations, but especially the steeper slopes and south-facing aspects. Tephra soils are very common in the forests. Colluvial soils intergrade with tephra soils as well (Franklin, et al. 1988).

Climate

The Cascade Range acts as a major barrier that intercepts much of the moisture from storms off of the Pacific Ocean, creating a large gradient in precipitation between the wet western slopes and dry eastern slopes of the range. Mount Rainier has a temperate, maritime climate. A high pressure region over the north Pacific Ocean shifts southward during fall and winter, and warm, moist air moves from a southwesterly direction into the Cascade Range. Condensation of this cooling air as it rises along the mountain slopes results in a rainy season during late fall and winter and generally continues until March or April. These wet seasons end when high pressure again develops over the region, and July and August are usually comparatively dry.

Several elevational and climate zones exist around the park; however, the southeast side of the park is generally the driest, and the northwest side of the park is the wettest sector (especially during spring and summer months). Annual precipitation is heavy, ranging from about 60 inches (152 cm) at lowest elevations to over 100 inches (254 cm) in the subalpine (Figure 9). Over 90% of the precipitation falls between November and April. Much of the winter precipitation is snow that accumulates into snowpacks 20 to 26 feet (6 to 8 meters) deep at higher elevations (Figure 10). Average annual snowfall at high elevations such as at Paradise, on the south side of the park, ranges from about 50 feet to 93 feet (15 to 28 meters). Average annual snowfall at Sunrise, located at 6400 feet on the east side locations, is slightly less with an average range of snowfall of about 40-75 feet (12 to 23 meters). Winter temperatures are relatively warm (mean January temperatures of about 25 to 30 °F (-3 to -1°C). Summers tend to be cool (mean July temperatures of 50 to 60 °F (10 to 15.5°C) and extended periods of cloudiness are not uncommon. Fog and high winds may be expected any day of the year.

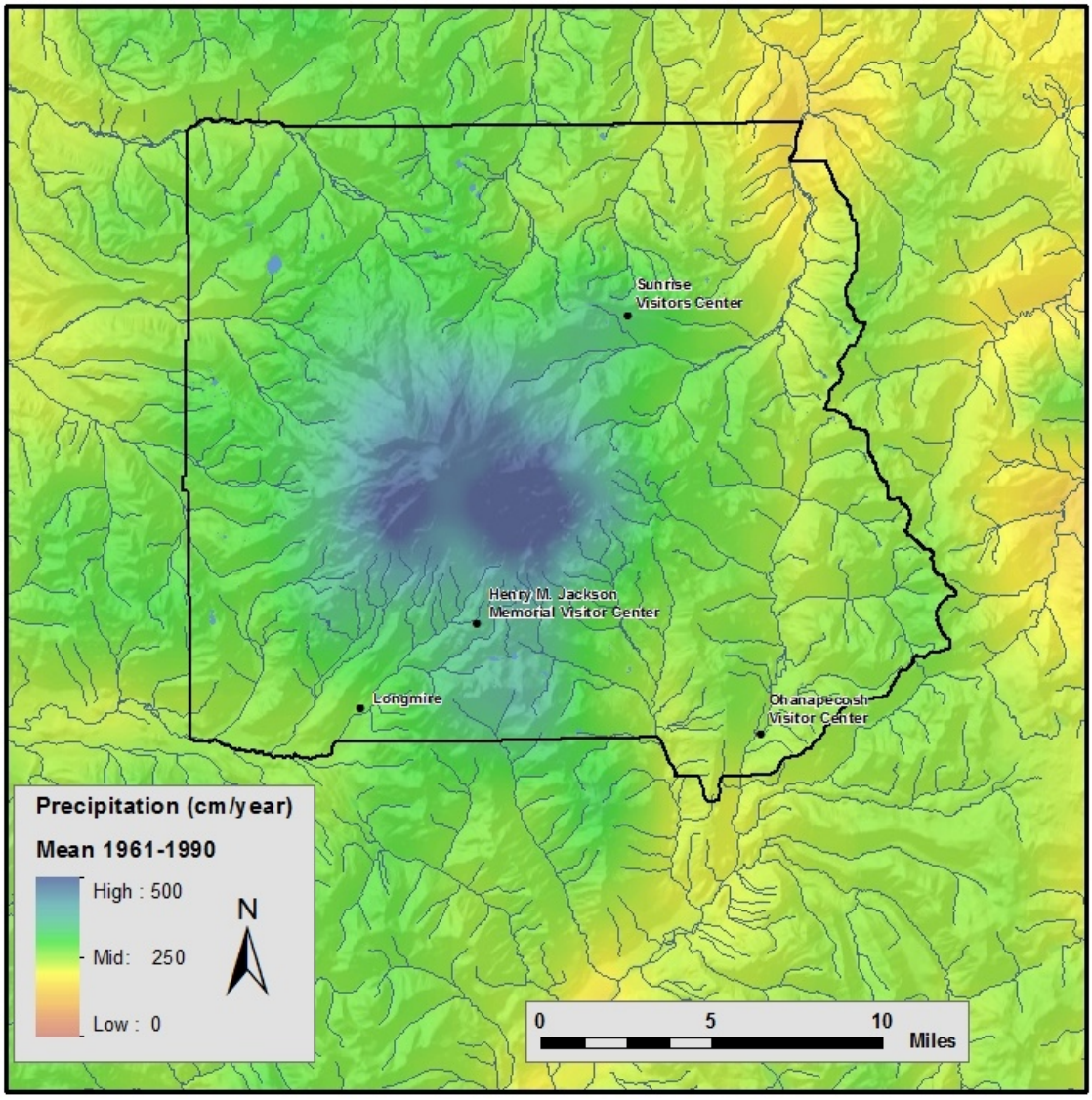


Figure 9. Mean annual precipitation 1961–1990 (Data Source: PRISM; Western Regional Climate Center, Aug. 2006).

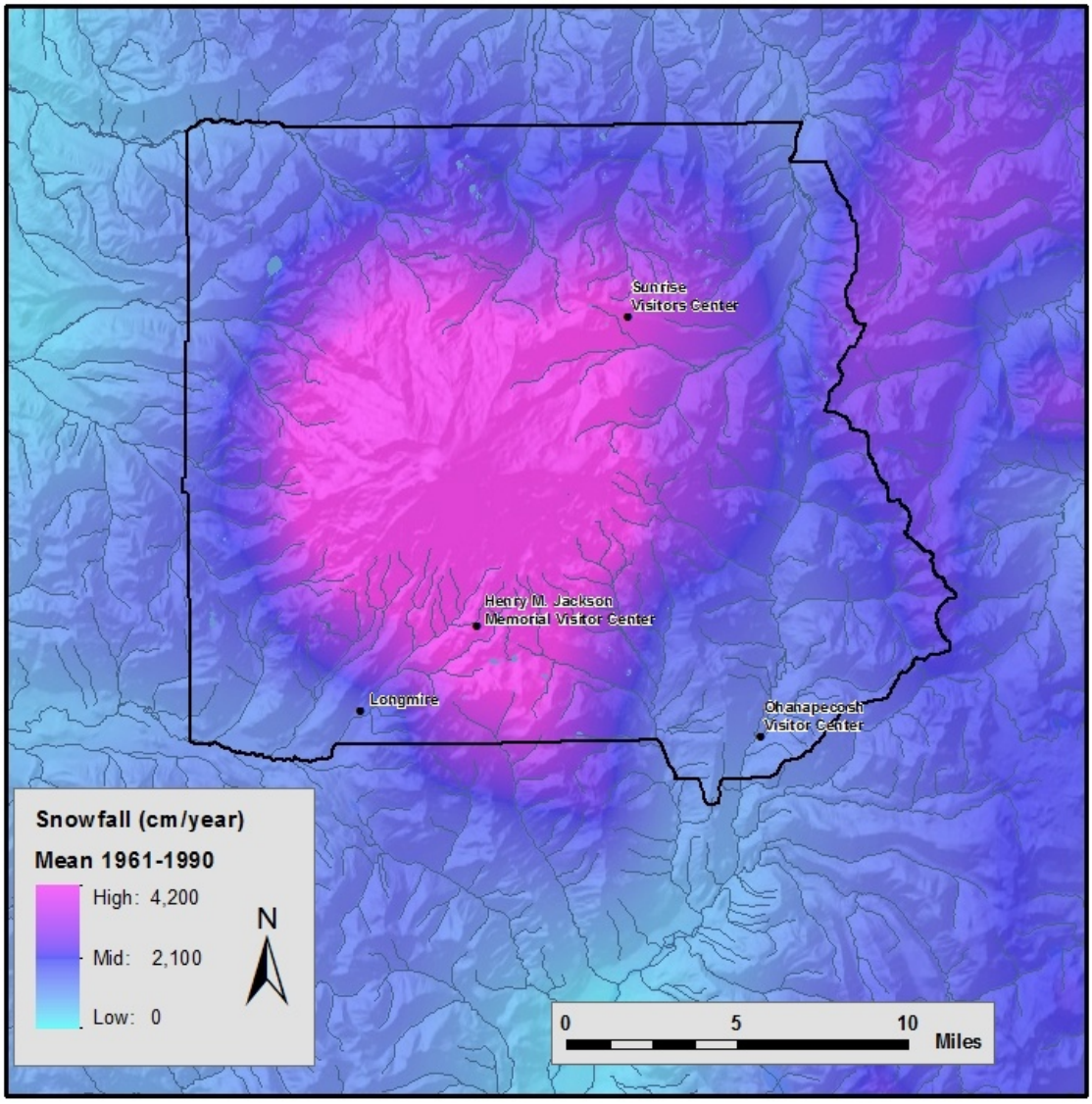


Figure 10. Mean annual snowfall 1961–1990 (Data Source: PRISM; Western Regional Climate Center, Aug. 2006).

Mean annual temperatures in MORA range from less than 35.6 to 46.4°F (2 to 8°C) (Figure 11). Mean July maximum temperatures range from 44.6 to 71.6°F (7.0 to 22.0°C) (Figure 12).

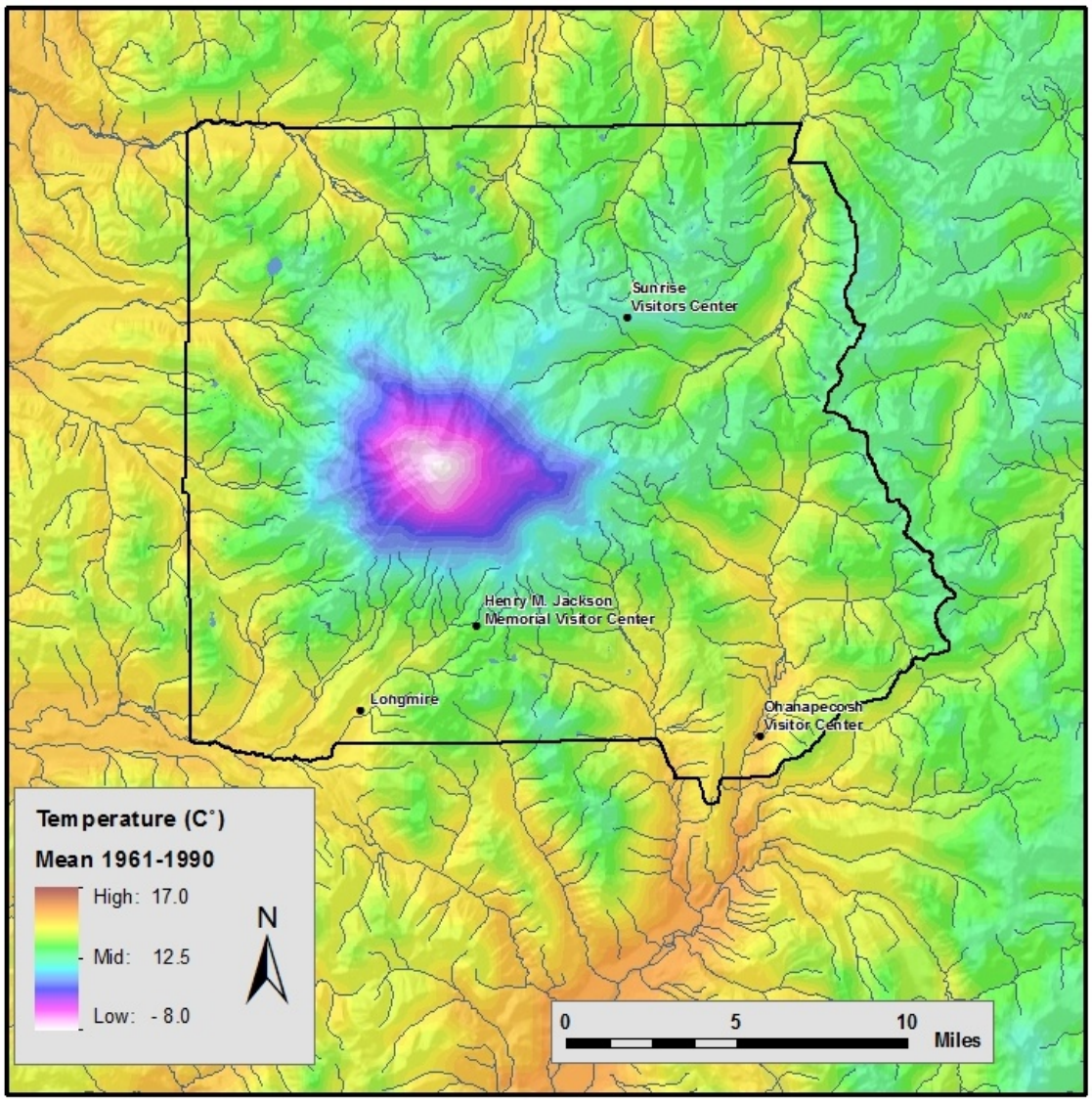


Figure 11. Mean annual temperature 1961–1990 (Data Source: PRISM; Western Regional Climate Center, Aug. 2006).

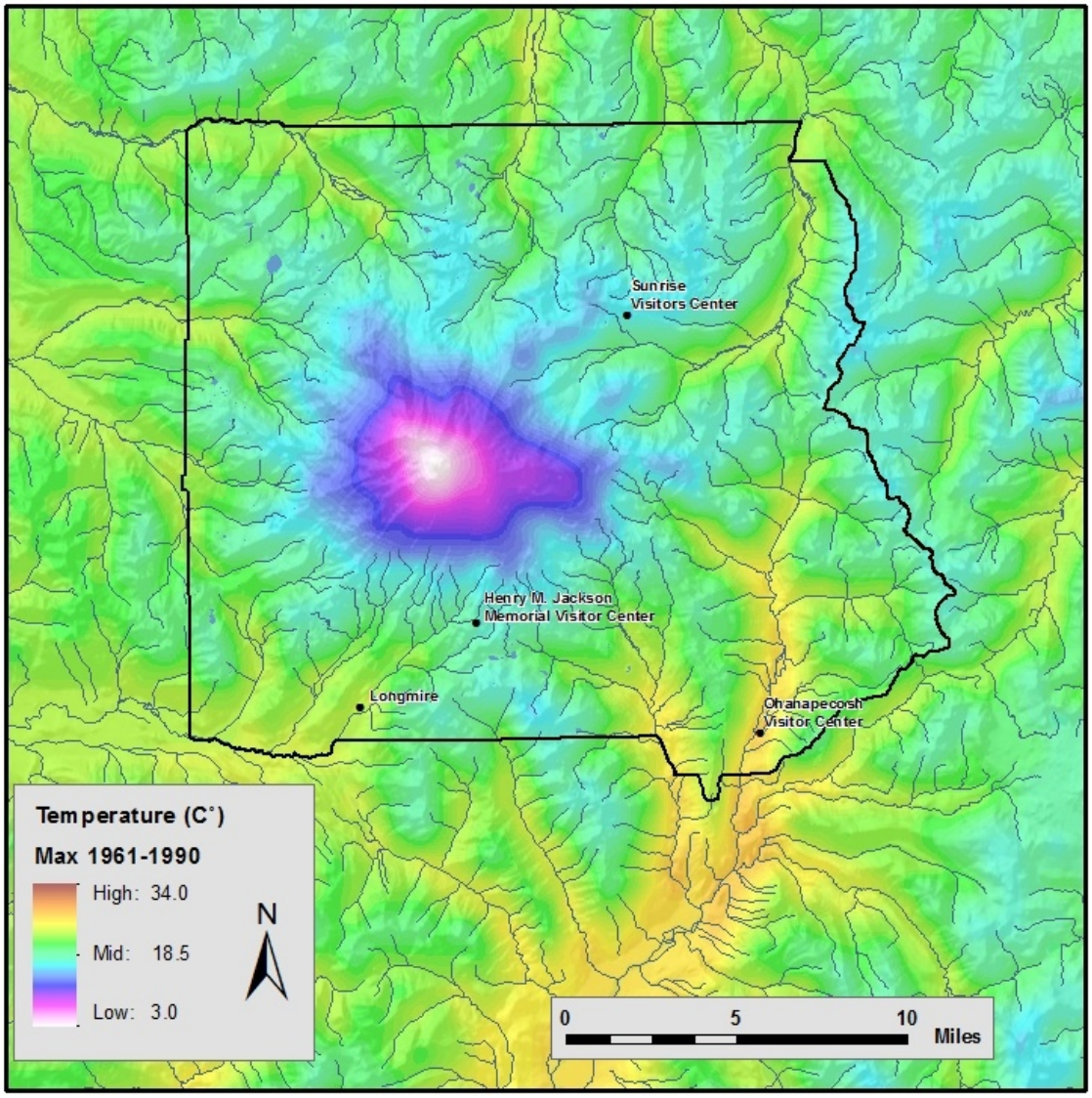


Figure 12. Mean July maximum temperature 1961–1990 (Data Source: PRISM; Western Regional Climate Center, Sept. 2006).

Methods

Stream Segment Selection and Delineation

A total of 148 stream segments were surveyed between 2001–2003 (Figure 13). One hundred eighteen stream segments were randomly selected from a list of accessible park streams with gradients <15%. Thirty additional sites were non-randomly selected (see Appendix B). Twenty of these sites were associated with surveys conducted for park projects that required compliance with the National Environmental Policy Act. Ten sites were lake-outlet streams surveyed to confirm fish presence in park lakes. Stream segments included in this inventory are noted in Table 7 and Appendix B.

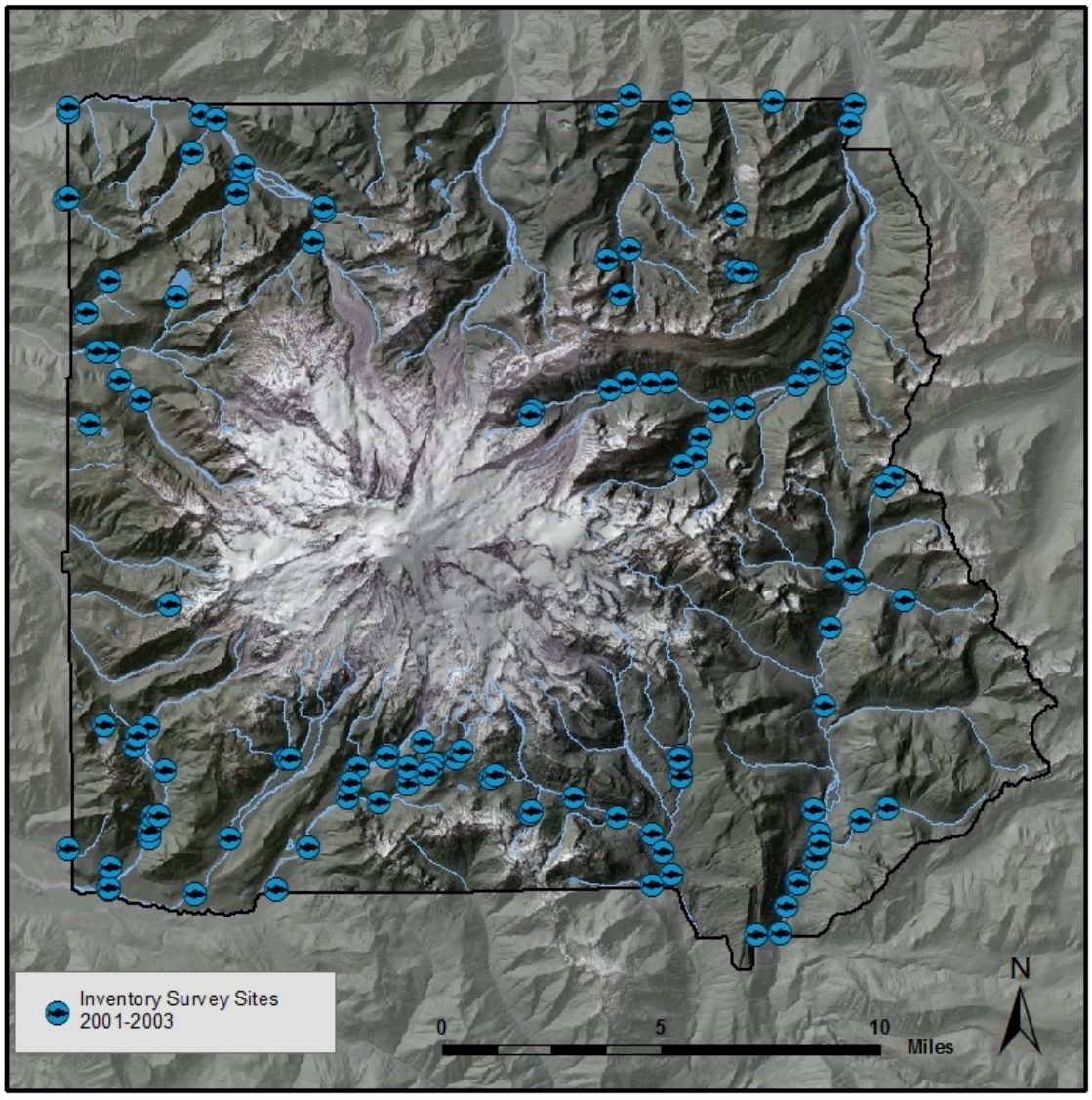


Figure 13. Fish inventory survey sites in Mount Rainier National Park, 2001- 2003.

Distribution of stream segments by watershed, stream order, and elevation are shown in Figures 14 through 16. Thirty six segments selected were in the southwest quadrant of the park; 42 in the

southeast quadrant; 35 in the northeast quadrant; and 24 in the northwest quadrant. Ninety-five percent of all sites selected were first through third order streams. Sixty-three percent of stream segments surveyed were below 1,066 m (3,500 ft) elevation. The length of stream sampled differed depending on the area suitable for surveying. Generally, the survey transect consisted of a 100 meter stream segment.

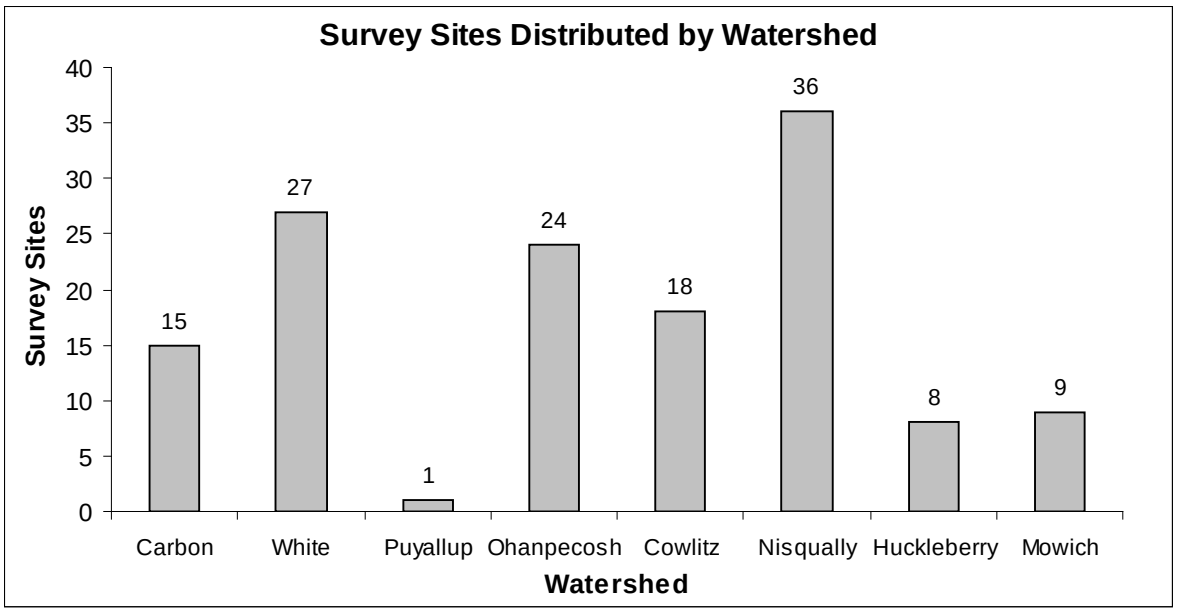


Figure 14. Survey sites distributed by watershed. The West Fork of the White River was the only park watershed not included in this study since it had been surveyed by park staff during 2000.

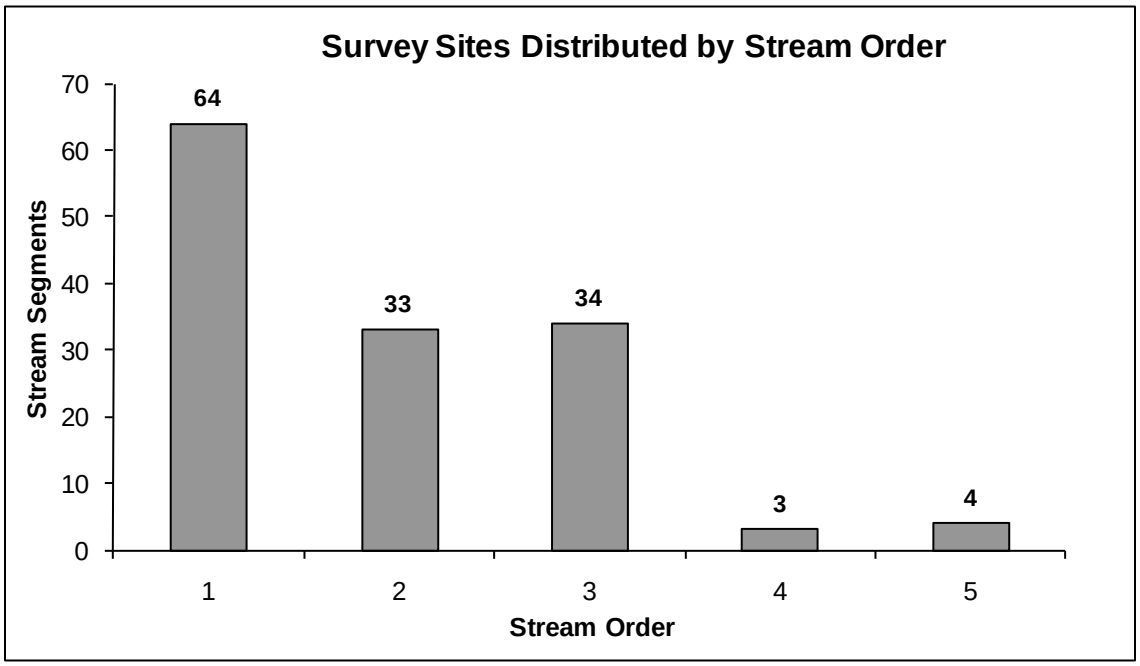


Figure 15. Survey sites distributed by stream order.

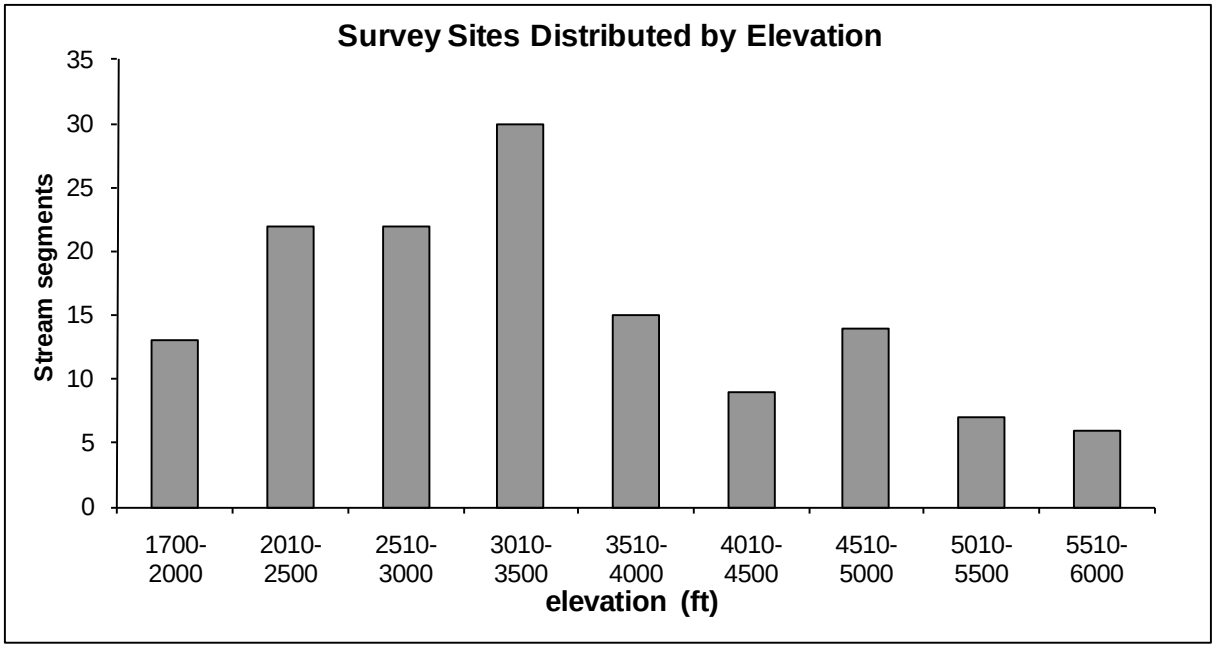


Figure 16. Survey sites distributed by elevation.

Fish Presence

Estimates of fish abundance were made by direct observation by snorkeling (Figure 17 and 18) or electrofishing (Figure 19). Snorkeling was the preferred method where safe, accessible sites existed. Snorkel surveys were conducted according to Thurow (1994), during optimal light conditions, usually between 10:00 am and 4:00 pm with the sun overhead. Generally the snorkeler moved upstream in a zigzag motion to count all fish from bank to bank. All fish encountered were identified to species, if possible, and their size (total length) recorded in 50 mm increments. Night snorkeling was conducted on four streams to detect the presence of native char when they were not detected during daytime surveys. Night snorkeling was conducted, for a few sites, at least one hour after sunset. Block nets were not used for any snorkel surveys.

Figure 17. Mount Rainier National Park staff conducting a snorkel survey in Kotsuck Creek, 2002.

Figure 18. Underwater view during snorkel survey in Kotsuck Creek, 2002.

Electrofishing surveys were conducted from June to late August (outside of the primary spawning season), with Smith-Root Model 12-B (battery-powered) and Model 15-D (gasoline) backpack electrofishers, utilizing a one-pass method. Shocking crews focused on pools and riffles favorable to this survey method. All fish encountered were identified to species and their size (total length) recorded in 50 mm increments. Block nets were not used for any electrofishing surveys. Benthic sampling nets were used to capture fish. Net 1 had a 32x26 cm mouth, was 40 cm long and attached to a 1.75 m long, 3cm diameter wooden pole. Net 2 had a circular mouth 23 cm in diameter, was 25 cm long and attached to a 1.5 m long, 1.5 cm diameter wooden pole. Stunned fish were held in a 5-gallon bucket with fresh stream water to allow the fish to recover from being shocked before being released back into the stream. After several fish were captured, species and measurements were recorded and the fish were released back into the stream. Fish size was measured with a ruler, to the nearest 50 mm.

Adult trout were identified to species where possible; representative samples were photographed. Juvenile salmonids were identified to species using Wydoski and Whitney (1979) and Pollard et al. (1997), or other similar keys. Juvenile characteristics used in identification were recorded when observed. Salmonids were sometimes difficult to document to species. Most cutthroat and rainbow/steelhead trout under 80 mm are indistinguishable while snorkeling, as are other fish of larger sizes that are observed fleetingly. Fish that could be distinguished only as an *Oncorhynchus* trout species were given the code (TRSP). Fish that could be identified only as a salmonid species (including char and possibly mountain whitefish) were identified as UNSA. Fish that could only be identified as char were documented using the code SAXX.

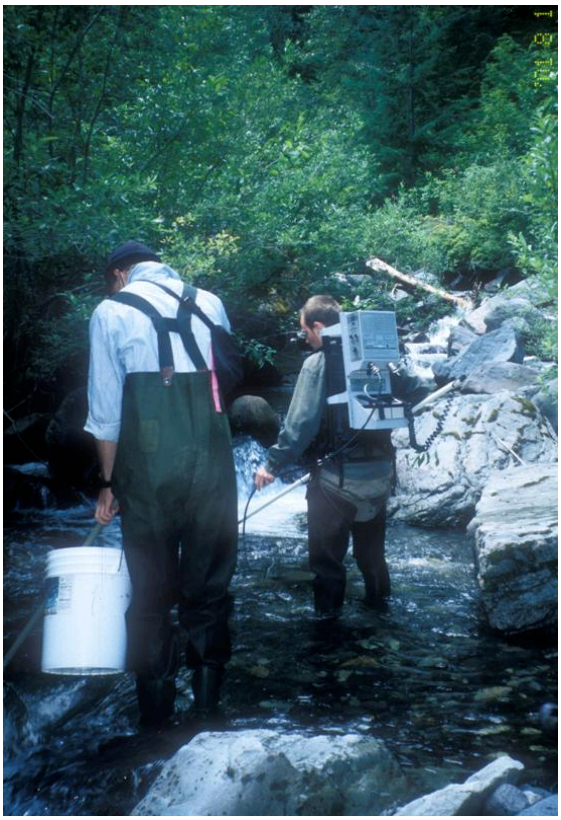


Figure 19. Mount Rainier National Park staff conducting an electrofishing survey in Maple Creek, 2001.

Sculpins were counted, measured, and identified to species, when possible. Representative specimens of sculpins were collected from the Carbon, Huckleberry, White, and Nisqually watersheds, and brought back to the lab to send to Molly Hallock, Washing Department of Fish and Wildlife (WDFW) Nongame Fish Biologist, for taxonomic identification.

Spawning Surveys

A total of 45 spawning surveys were conducted on 21 stream segments during September and October of 2001 and 2002 in the Carbon, Huckleberry, and White watersheds (Table 3). Crews walked along streams and looked for fish, redds, and/or carcasses.

Table 3. Location and dates of 2001–2002 spawning surveys and associated Mount Rainier National Park assigned stream segment numbers and Universal Transverse Mercator (UTM) coordinates (NAD27).

Watershed	Location	Segment Number	UTM	UTM	Date (s)
Carbon	Park boundary north	c00-***	n/a	n/a	9/5/2002
Carbon	Park Boundary south	c00-***	n/a	n/a	9/2/2002
Carbon	Spunkwash	c00-00a	n/a	n/a	9/24/2002, 10/3/2002
Carbon	June Creek	c03-00a	582440	5204985	9/18/2002
Carbon	Falls Creek	c05-00a	n/a	n/a	9/24/2002
Carbon	Ranger Creek	c06-00a	587446	5204876	10/18/2001, 10/4/2001, 9/11/2002, 9/18/2002, 9/24/2002, 10/3/2002
Carbon	Chenuis	c07-00a	588056	5204748	9/11/2002, 9/24/2002, 10/3/2002
Carbon	Ipsut Creek	c08-00a	589009	52093017	10/4/2001, 10/18/2001, 9/11/2002, 9/18/2002, 9/24/2002,10/3/2002
Carbon	Unnamed Chenuis trib.	none	588056	5204748	9/11/2002, 9/18/2002, 10/3/2002
Carbon	Unnamed trib. across from Chenuis	none	588025	5204565	9/18/2002
White	Crystal Creek	c10-00a	611357	5197926	10/7/2002
White	Unnamed	f05-00a	598153	5203773	9/17/2002
White	Van Horn	f06-00a	597487	5203056	9/16/2002
Huckleberry	Huckleberry Creek	h00-00b	598153	5203733	9/27/2001, 9/13/2002, 9/19/2002, 9/25/2002
White	Silver Springs[1]	w00-***	611821	5205828	10/17/2001, 10/25/2001, 9/4/2002
White	Unnamed	w00-***	611443	5205335	10/23/2002
White	Unnamed	w04-00a	611180	5204273	9/23/2002
White	Sunrise	w06-00a	611182	5202735	9/16/2002
White	Deadwood	w12-00a	610917	5196674	09/25/2002, 10/7/2002
White	Klickitat Creek	w13-00a	610586	5195784	10/25/2001, 9/10/2002, 9/23/2002, 10/15/2002
White	Fryingpan	w17-00a	606474	5193780	10/23/2002

[1]The outflow from Silver Springs, located along SR 410 in the USFS Silver Springs Campground along the White River, 600m north of the Park boundary, was visited to search for coho and Chinook during both years.

Genetic Analysis of Native Char

Fin clips were removed from native char captured during electrofishing for genetic analysis. Samples were initially sent to the WDFW. The caudal, dorsal, or adipose fin was cut, with the clip placed in a DNA preservative solution provided by WDFW. Clips were assigned both MORA and WDFW identification numbers and shipped to WDFW for differentiation between bull trout and Dolly Varden. Due to problems with completing genetic analysis at the WDFW lab, we secured additional funding in 2006 to analyze these samples as well as to collect additional samples from park streams. DNA analysis was completed by the U.S. Fish and Wildlife Service, Abernathy Fish Laboratory (DeHaan et al. 2008).

Cutthroat Trout Fin Clips

We also collected caudal fin clips from trout populations in the Ohanapecosh watershed, one sample from the Nisqually River, and one from Taos Creek in the Cowlitz watershed. These samples were sent to the Western Fisheries Research Center, US Geological Survey (USGS) for genetic analysis. Clips were preserved in DNA solution and sent to USGS to for further identification of hybrids and cutthroat trout subspecies.

Minnow Traps

In 2002, minnow traps were placed at five sites to survey for sculpins (Figure 20, Table 4). Traps were baited with salmon eggs and canned cat food, wrapped in plastic bags or foil, punched with holes, and placed inside minnow traps. Traps were set overnight and placed in the Ohanapecosh, White, Carbon, and Nisqually watersheds.

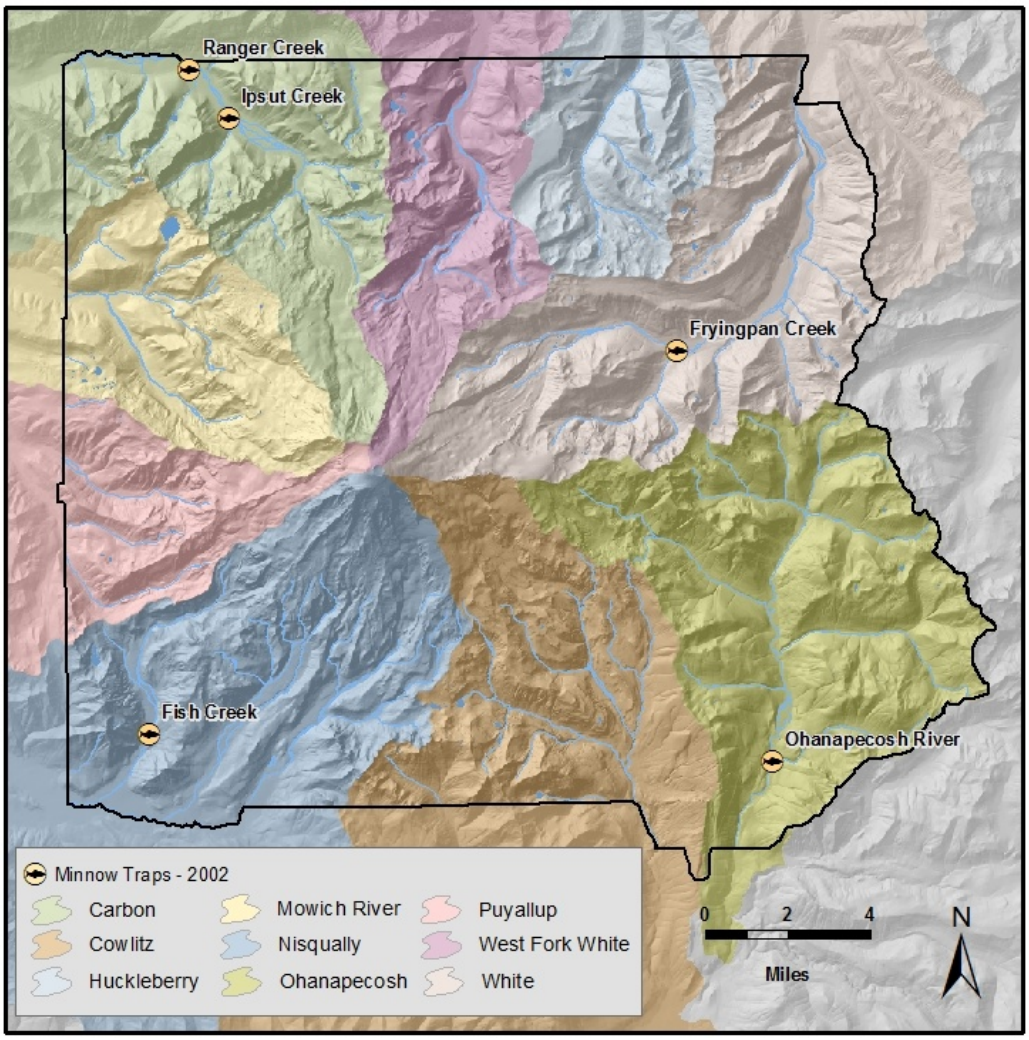


Figure 20. Location of minnow trap sites and watersheds in Mount Rainier National Park.

Table 4. Location of minnow traps in 2002, associated Universal Transverse Mercator (UTM) coordinates (NAD27), dates and times of installation and removal, number of traps and total number of hours placed on site.

Stream - Watershed	Location	UTM E UTM N	Start Date	Start Time	End Date	End Time	# Traps	Total Hours
Fish Creek - Nisqually	above West Side Road	583937 5181018	10/1/2002	17:00	10/3/2002	16:30	8	380
Ranger Creek - Carbon	Below road	587438 5204810	9/24/2002	13:50	9/24/2002	15:50	4	8
Ipsut Creek - Carbon	Above Road in Clearwater	588493 5203278	9/24/2002	13:00	9/24/2002	15:00	4	8
Ohanapecosh - Ohanapecosh R.	Near Laughingwater Creek	609827 5177540	9/25/2002	13:00	9/30/2002	13:00	4	120
Fryingpan Creek - White River	Above bridge	605672 5193504	9/25/2002	12:00	9/26/2002	15:00	4	108

Habitat and Reach Characterization

A series of 15 measurements were obtained along each sample transect for 72 stream segments surveyed to characterize stream hydrology and physical habitat. Most of these data were collected for use in developing future monitoring programs and a thorough analysis of stream habitat is beyond the scope of this inventory. A description of stream habitat measurements collected is presented in the database and datasheet explanations in Appendix A.

Stream gradient was measured over each 20-m interval using a handheld clinometer measured from the lower to the upper transect. Stream order was determined following methods outlined by Strahler (1952). Elevation was obtained from park GIS coverages. Habitat type, wetted width, water depth, substrate, instream cover, number of large woody debris (LWD), number of pools, cumulative length and width of undercut banks[3], presence of side channels, riparian conditions, and percent of overstory vegetation were documented at 20 m intervals along the transect.

Habitat types were classified as (1) turbulent fast water (falls, cascades, rapids, riffles, chutes), (2) non-turbulent fast water (sheets and runs), (3) scour pool (eddies, trenches, mid-channel pools, lateral pools, plunge pools) and, (4) dammed pool (debris, beaver, landslide, backwater, abandoned/side channel) and pocket water (boulder garden). Water depth was measured at ¼, ½, and ¾ intervals across the wetted width in meters (surveyor faced upstream and moved from left to right and measured the maximum depth along the transect in meters).

Riparian conditions were classified into five categories to classify the dominant streamside vegetation: Soil-rock (>50% dominant bank material is soil, rock, bridge materials, road materials, culverts); Forbs; Grass; Shrubs; and Trees. Substrate was visually estimated and classified into dominant/subdominant categories (Table 5).

Table 5. Categories for classification of substrate.

Substrate	Particle Size Description
Silt/Clay	0.001–0.062 mm (0.000039–0.004 in)
Sand	0.062–2.0 mm (0.004–0.079 in)
Fine gravel	2–32 mm (0.08–1.3 in)
Coarse gravel	32– 64mm (1.3– 2.5in)
Pebble	2–64 mm (0.08–2.5 in)*
Cobble	64–128 mm (2.5–5 in)
Rubble	128–256 mm (5–10 in)
Boulder	256–1,024mm (10–40in)
Large boulders	>1,024 mm (40–160 in)
Bedrock	

*When crews were unable to obtain a full substrate measurement, substrate codes were collapsed and dominant substrate fine gravels and course gravels were included into a general "pebble" category.

[3]For example, if the two undercuts in a hypothetical survey unit measured 1.5m x 0.8m and 0.6m x 0.9m, crews recorded 2.1m x 1.7m. For non-rectangular undercuts crews found an average length and width and used those in the cumulative totals.

Instream cover was classified into four categories:

1. 10–30 cm (3.94–11.81 inches), median diameter; wood contributes little to stream habitat complexity, mostly small single pieces.
2. Wood provides cover and some complex habitat; has combinations of single pieces and small accumulations.
3. Wood present with medium (30–50 cm, median diameter [3.94–16.89 inches]) and large (>50 cm [19.69 inches]) pieces providing accumulations and debris jams, with good cover and complex habitat within the low flow channel.
4. Wood present as large single pieces, accumulations, and jams that provide good cover and complex habitat at all discharge levels.

Database

Snorkel and electrofishing survey data were entered into a Microsoft Access database created by Darin Swinney, MORA GIS Specialist. See Appendix A for database structure. Spawning data was entered into a Microsoft Excel spreadsheet. Digital and spatial data archived in the park and NCCN inventory data files. Photographs (slides) are archived in the park Natural Resource slide collection.

Voucher Specimens

In order to verify and document species presence, sculpins were collected from several streams. Cutthroat trout were also collected to add to the existing park voucher specimen collection. In addition, fin clips were collected for genetic analysis of native char and cutthroat subspecies. Details of specimen collections are described in the Results section of this report and in Appendix D.

Results

One hundred forty eight stream sites in 8 watersheds, covering over 26,000 linear meters were inventoried for fish in 2001–2003. A summary of fish presence by park watershed is presented in Table 6. Ten stream segments were surveyed more than once. Snorkel methods were used for 38% of the stream sites. Sixty-two percent of the stream sites were surveyed by electrofishing. Spawning surveys were conducted in 21 stream segments in three watersheds from 2001-2002.

Total fish documented is presented in Figure 21. Trout (*Oncorhynchus spp*.) were the most commonly observed species (n=700), found in 55 stream segments. Of trout more than 100 m in size, cutthroat trout were the most abundant species observed (n=453 in 47 stream segments), compared to rainbow trout over 100 mm in size (n=56 in 7 stream segments). The introduced eastern brook trout, found in 14 stream segments, was the predominant char documented in this inventory (n=130). Native char were observed in only seven stream segments during this inventory (n=15). Sculpin spp. were observed in 11 stream segments (n=209). Of all of the stream segments sampled, 27 had no fish. Salmonid species that could not be identified to species were documented as UNSA.

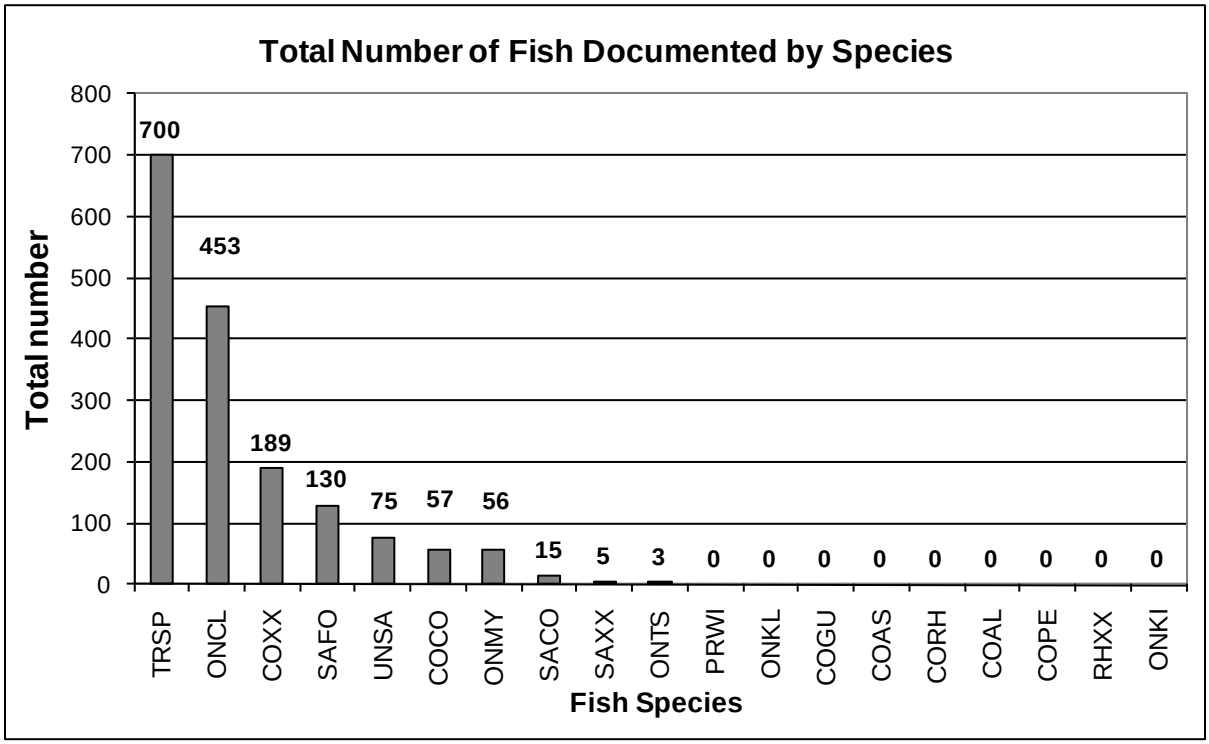


Figure 21. Total number of fish documented by species. COXX = *Cottus sp*. (sculpin species). COCO = *Cottus confusus* (shorthead sculpin). COAS = *Cottus asper* (prickly sculpin). COAL = *Cottus aleuticus* (coastrange sculpin). COPE = *Cottus perplexus* (reticulate sculpin). COGU = *Cottus gulosus* (riffle sculpin). CORH = *Cottus rhotheus* (torrent sculpin). RHXX = Dace species. ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). PRWI = *Prosopium williamsoni* (mountain whitefish). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout).

Table 6. Sample effort for stream fish inventory showing percentage (%) of each species detected by park defined watershed (n = the total number of fish documented in watershed).

Watershed	Carbon n=129	White n=157	Ohanapecosh n=495	Cowlitz n=220	Nisqually n=340	Mowich n=78	Huckleberry n=264
Surveys	**17**	**27**	**28**	**20**	**37**	**10**	**8**
Locations	**15**	**27**	**24**	**18**	**36**	**9**	**8**
	%	**%**	**%**	**%**	**%**	**%**	**%**
Species *							
Sites with no Fish	11	2.48	2.56	7.2	9.09	16.13	4.0
COCO	3.44	1.24			12.3		1.45
COXX	28.27	47.2			13.6	22.5	
ONCL	22.7	8.7	28.3	8.4	30.7	8.6	43.2
ONMY		2.48		15.18			5.8
ONTS		1.86					
SACO	4.13	5.59					
SAFO	24.14	.62		24.5	1.6	23.6	2.9
SAXX	1.38		.2	0.8			
TRSP	2.06	24.8	68.8	35.4	30.7	22.5	31.6
UNSA	2.76	4.97		8.4	1.9	6.45	10.9

* COXX = *Cottus sp.* (sculpin species). COCO = *Cottus confusus* (shorthead sculpin). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout)]. SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout).

Figure 22 summarizes the size class for each species. Most cutthroat trout ranged in size from 100 mm to 250 mm. Most rainbow trout observed were in the 100 to 200 mm size classes. Most of the unidentified trout (TRSP) ranged in size from <50 – 100mm but a number of individuals observed while snorkeling that were >100 mm could not be reliably identified to species. Native char ranged in size from young of the year (<50 mm) to 300 mm. The introduced eastern brook trout ranged in size from <50 to 350 mm. Sculpin species were from <50 mm to 150 mm in size.

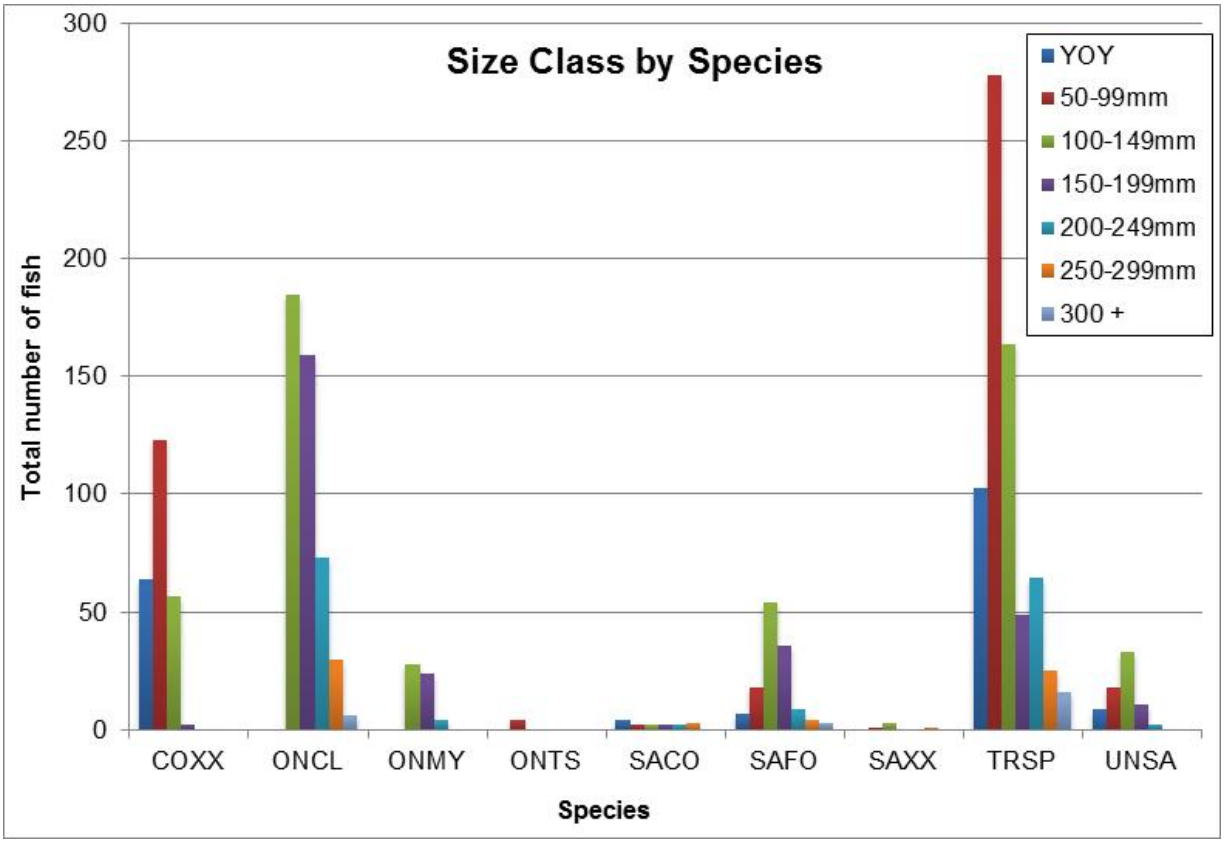


Figure 22. Comparison of fish species by size. COXX = *Cottus sp.* (sculpin species). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout).

Species diversity and composition is presented in Figure 23. More than one species was documented in 31stream segments (excluding fish that we were not identifiable to species such as UNSA, TRSP, COXX). Of the 31 stream segments, 2 species were documented at 23 sites; 3 species at six sites; and 4 species at two sites.

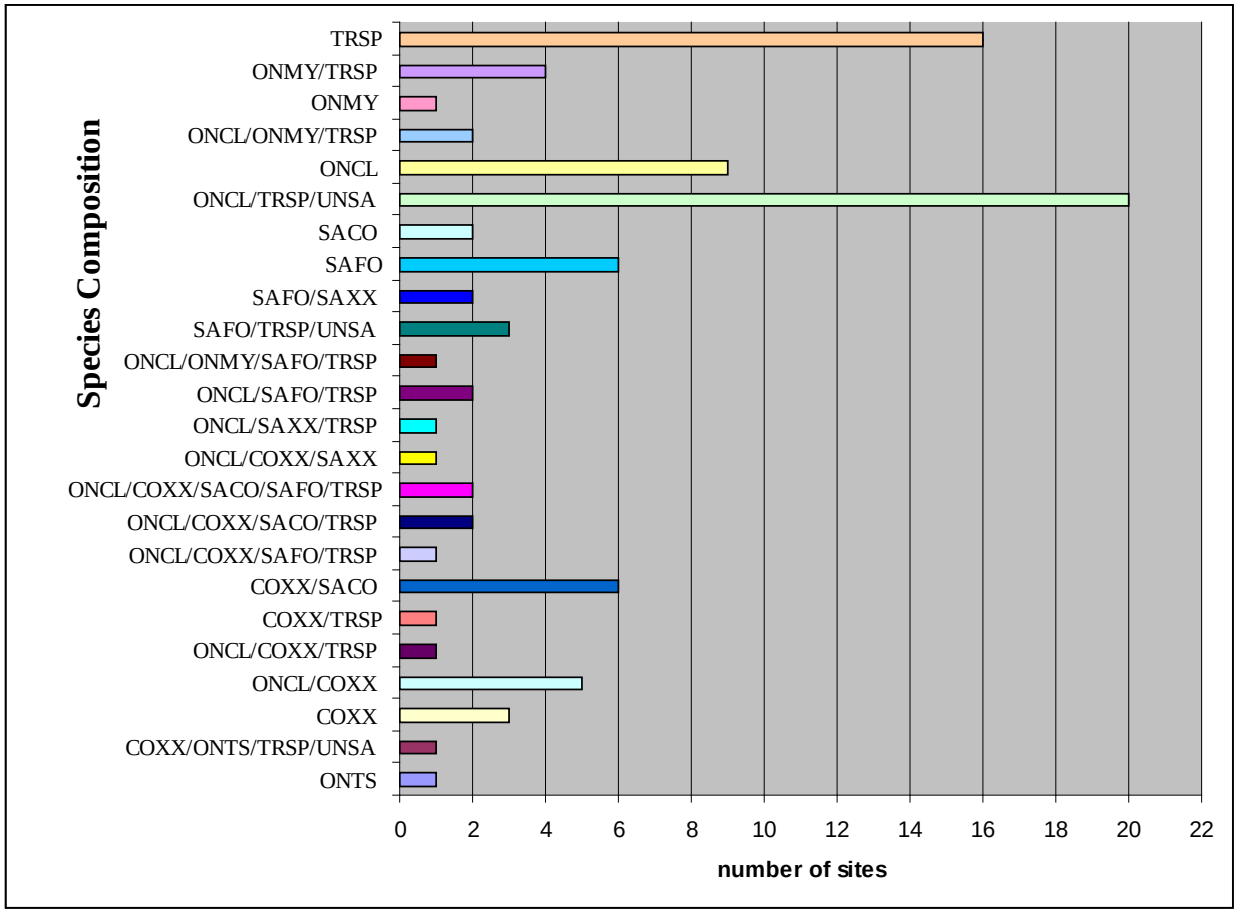


Figure 23. Species diversity and composition for all streams surveyed. COXX = *Cottus sp.* (sculpin species). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout).

Summarized survey results for individual stream segments are provided in Table 7. Species maps are presented in Figures 24–30. Complete fish survey results are provided in Appendix C.

Table 7. 2001–2003 Stream survey methods, dates, meters surveyed and species observed by stream segment and watershed.

Watershed	Survey Date	Site Name	Segment#	Fish Species Observed	Survey Method	Meters Surveyed
Carbon	7/24/2001	Spunkwash Creek	c11-00a	NONE	shock	100
Carbon	7/25/2001	Ipsut Creek (120 m below waterfall)	c08-00a	ONCL,TRSP, SACO, SAFO,	snorkel	120
Carbon	7/25/2001	Ipsut Creek (above confluence with Carbon)	c08-00a	ONCL, COCO, COXX	shock	100
Carbon	7/26/2001	Tolmie Creek	c01-00c	SAFO	shock	100
Carbon	7/26/2001	Tolmie Creek	c01-00c	SAFO, UNSA	snorkel	100
Carbon	8/7/2001	Ipsut Creek (200 feet above falls)	c08-00a	SAFO, SAXX	snorkel	100
Carbon	8/7/2001	Ipsut Creek (100 feet above falls)	c08-00a	SAFO	snorkel	100
Carbon	6/4/2002	June Creek	c03-00a	NONE	snorkel	60
Carbon	6/4/2002	Falls Creek	c05-00a	NONE	snorkel	50
Carbon	6/4/2002	Ranger Creek	c06-00a	NONE	snorkel	50
Carbon	7/14/2002	Spunkwash Creek	c11-00a	NONE	shock	100
Carbon	7/17/2002	Unnamed	c12-00a	ONCL, SACO	shock	350
Carbon	7/17/2002	Cataract Creek	c13-00a	NONE	snorkel	100
Carbon	7/18/2002	June Creek-night snorkel	c03-00a	ONCL, COXX, SAFO	snorkel	60
Carbon	7/18/2002	Ranger Creek	c06-00a	ONCL, COXX, SAXX	snorkel	50
Carbon	7/18/2002	Unnamed: across from Chenuis	NONE	ONCL,SACO, SAFO,COXX	shock	120
Carbon	7/1/2003*	Green Lake outlet/ Ranger Creek	c06-00a	UNSA, ONCL, TRSP	shock	250
Cowlitz	6/20/2001	Nickel Creek (footbridge + 100ft)	z09-00a	ONCL	shock	100
Cowlitz	6/20/2001	Nickel Creek (footbridge +200ft)	z09-00a	UNSA	shock	100
Cowlitz	6/21/2001	Sunbeam Creek (outfall – 200ft)	z08-06c	SAFO, SAXX	snorkel	100
Cowlitz	6/21/2001	Sunbeam Creek (outfall – 100 ft)	z08-06c	SAFO	snorkel	100
Cowlitz	6/28/2001	Unnamed: Cowlitz tributary	z06-00a	ONMY, TRSP	shock	100
Cowlitz	6/29/2001	Unnamed -	z08-05a	NONE	shock	220
Cowlitz	8/1/2001	Stevens Creek	z08-00a	ONMY, ONCL, SAFO, UNSA	snorkel	540

COXX= *Cottus spp*. (sculpin species). COCO = *Cottus confusus* (shorthead sculpin). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout). Lake outlet surveys were completed in 2003.

Table 7. 2001–2003 Stream survey methods, dates, meters surveyed and species observed by stream segment and watershed (continued).

Watershed	Survey Date	Site Name	Segment#	Fish Species Observed	Survey Method	Meters Surveyed
Cowlitz	8/2/2001	Maple Creek	z08-01a	ONMY, TRSP	shock	420
Cowlitz	8/6/2001	Nickel Creek	z09-00d	ONMY	shock	280
Cowlitz	8/8/2001	Twin Falls Creek	z09-02a	ONMY, TRSP	shock	400
Cowlitz	8/8/2001	Unnamed -trib to Nickel Ck	z09-04a	TRSP	shock	450
Cowlitz	8/9/2001	Stevens Creek	z08-00b	SAFO	shock	100
Cowlitz	7/9/2002	Steven's Creek	z08-00a	ONCL	shock	280
Cowlitz	8/7/2002	Taos Creek	z05-00b	ONCL, TRSP	shock	100
Cowlitz	6/26/2003	Sunbeam Creek	z08-06c	UNSA	shock	200
Cowlitz	7/17/2003	Unicorn Creek	z08-04b	UNSA	shock	150
Cowlitz	7/17/2003	Unicorn Creek	z08-04b	UNSA, ONCL	snorkel	150
Cowlitz	7/31/2003	Unnamed (Cliff Lake outlet)	N/A	NONE		50
Huckleberry	8/20/2003	Lower Palisades	h02-00h	UNSA, SAFO, TRSP	snorkel	220
Huckleberry	7/22/2001	Unnamed	h16-00a	NONE	shock	60
Huckleberry	7/23/2001	Unnamed	h16-01a	NONE	shock	100
Huckleberry	7/24/2001	Unnamed	h12-00a	NONE	shock	60
Huckleberry	8/14/2001	Huckleberry Creek	h00-00b	TRSP, COCO, ONCL	snorkel	360
Huckleberry	8/14/2001	Huckleberry Creek	h00-00c	TRSP, COCO, COXX	snorkel	900
Huckleberry	8/15/2001	Huckleberry Creek	h00-00d	ONCL, TRSP	snorkel	350
Huckleberry	8/15/2001	Huckleberry Creek	h00-00e	ONCL, TRSP	snorkel	490
Huckleberry	8/15/2001	Ada Creek	h04-00c	COCO, COXX	shock	80
Huckleberry	8/16/2001	Huckleberry Creek	h00-00f	ONMY, TRSP	snorkel	400
Huckleberry	8/16/2001	Huckleberry Creek	h00-00g	ONMY, TRSP	snorkel	430
Huckleberry	8/22/2001	Huckleberry Creek	h00-00i	ONMY, TRSP	snorkel	1620
Huckleberry	8/22/2001	Huckleberry Creek	h00-00j	ONMY, TRSP	snorkel	870
Huckleberry	8/22/2001	Huckleberry Creek	h00-00k	NONE	snorkel	590
Huckleberry	8/24/2003	Eleanor Creek	h01-00b	UNSA, ONMY	shock	800
Huckleberry	8/26/2003	Unnamed	h12-00a	UNSA, SAFO	shock	50
Mowich	7/17/2001	Crater Creek	m05-01b	NONE	snorkel	100
Mowich	7/18/2001	Meadow Creek	m02-***	SAFO	shock and snorkel	100
Mowich	7/30/2002	Unnamed: Mowich River trib	m07-00a	ONCL, UNSA, TRSP	shock	100
Mowich	7/31/2002	Mowich River side channel	m00-00l	NONE	shock	100
Mowich	7/31/2002	Unnamed: trib to Mowich	m04-00a	TRSP	shock	100
Mowich	7/31/2002	Unnamed	m04-00a	TRSP, COXX	shock	200

Table 7. 2001–2003 Stream survey methods, dates, meters surveyed and species observed by stream segment and watershed (continued).

Watershed	Survey Date	Site Name	Segment#	Fish Species Observed	Survey Method	Meters Surveyed
Mowich	8/12/2002	Meadow Creek	m02-00c	SAFO	shock	100
Mowich	8/4/2003	Crater Creek	m05-01b	COXX	snorkel	160
Mowich	8/27/2003	Unnamed	m01-**	UNSA, SAFO	shock	60
Nisqually	7/2/2001	Unnamed: trib. to Nisqually	n03-01a	ONCL, COCO, COXX, TRSP	shock	100
Nisqually	7/2/2001	Unnamed	n03-03a	TRSP, ONCL, COCO	shock	100
Nisqually	7/2/2001	Unnamed	n03-04a	ONCL, TRSP, COCO	shock	100
Nisqually	7/2/2001	Fish Creek	n03-05a	ONCL, TRSP, SAFO	snorkel	100
Nisqually	7/3/2001	Paradise River (Carter Falls -100)	n13-00b	ONCL, TRSP, SAFO	snorkel	60
Nisqually	7/3/2001	Paradise River (Carter Falls -200)	n13-00b	ONCL, TRSP, UNSA	snorkel	100
Nisqually	7/9/2001	Unnamed: Nisqually trib.	n11-00a	TRSP	shock	100
Nisqually	7/9/2001	Unnamed: Nisqually trib.	n12-00a	TRSP, COCO	shock	100
Nisqually	7/11/2001	Unnamed	n03-08a	ONCL, COCO, TRSP	shock	60
Nisqually	7/19/2001	Paradise River 300 ft. above Narada	n13-00c	NONE	snorkel	100
Nisqually	7/19/2001	Paradise River 100 ft. above Narada	n13-00c	NONE	snorkel	100
Nisqually	7/23/2001	Paradise River Meadows + 100	n13-00c	NONE	snorkel	100
Nisqually	7/23/2001	Paradise River Meadows + 300	n13-00c	NONE	snorkel	100
Nisqually	8/5/2001	Pyramid Creek	n05-01a	ONCL, TRSP	shock	100
Nisqually	8/6/2001	Paradise River below Narada	n13-00c	ONCL, TRSP	snorkel	100
Nisqually	8/8/2001	Tenas Creek	n02-00b	NONE	shock	100
Nisqually	9/20/2001	Paradise River	n13-00a	ONCL, SAFO	shock and snorkel	1100
Nisqually	6/10/2002	Van Trump Creek	n14-00a	NONE	snorkel	100
Nisqually	6/25/2002	Unnamed:-Longmire CG	n10-00a	NONE	shock	100
Nisqually	7/1/2002	Tahoma side channel: Westside road	n03-00g	NONE	shock	100
Nisqually	7/1/2002	Unnamed	n03-07a	ONCL, TRSP	shock	100
Nisqually	7/10/2002	Tahoma Creek side channel	n03-00a	COXX	shock	100
Nisqually	7/10/2002	Unnamed	n03-00a	ONCL,TRSP, COXX	shock	200

Table 7. 2001–2003 Stream survey methods, dates, meters surveyed and species observed by stream segment and watershed (continued).

Watershed	Survey Date	Site Name	Segment#	Fish Species Observed	Survey Method	Meters Surveyed
Nisqually	7/11/2002	Unnamed	n03-02a	ONCL, COXX, TRSP	shock	200
Nisqually	8/8/2002	Pyramid Creek	n05-01d	ONCL,TRSP	shock	100
Nisqually	8/8/2002	Devil's Dream Creek	n05-04b	ONCL, TRSP	shock	100
Nisqually	8/8/2002	Fischer's Hornpipe Creek	n05-06a	NONE	shock	100
Nisqually	8/20/2002	Paradise River	n13-00c	TRSP, SACO	snorkel	100
Nisqually	8/20/2002	Unnamed	n15-00a	NONE	shock	100
Nisqually	8/20/2002	Unnamed	n15-00a	ONCL	shock	100
Nisqually	8/22/2002	Van Trump Creek	n14-00a	NONE	shock	100
Nisqually	8/22/2002	Dead Horse Creek	n17-00a	NONE	shock	100
Nisqually	10/2/2002	Tahoma Creek	n03-00b	ONCL, TRSP, COCO	shock	200
Nisqually	10/2/2002	Kautz Creek	n05-00a	ONCL, TRSP	shock	200
Nisqually	7/9/2003	Unnamed – Lake George outlet	N/A	COXX	shock	100
Ohanapecosh	6/18/2001	Unnamed	o02-00a	NONE	shock	100
Ohanapecosh	6/18/2001	Unnamed	o03-01a	TRSP	shock	100
Ohanapecosh	6/19/2001	Ohanapecosh River	o00-00c	ONCL, ONMY	snorkel	100
Ohanapecosh	6/19/2001	Laughingwater Creek	o07-00a	ONCL, TRSP, UNSA	snorkel	100
Ohanapecosh	6/20/2001	Unnamed	o15-00a	NONE	snorkel	100
Ohanapecosh	6/20/2001	Kotsuck Creek	o16-05a	ONMY, TRSP	snorkel	100
Ohanapecosh	6/21/2001	Unnamed	o00-***	NONE	shock	100
Ohanapecosh	6/21/2001	Unnamed	o03-00b	TRSP	shock	100
Ohanapecosh	6/29/2001	Laughingwater Creek	o07-00a	TRSP	snorkel	100
Ohanapecosh	7/10/2001	Unnamed	o06-00a	NONE	shock	100
Ohanapecosh	7/10/2001	Falls Creek	o09-00a	NONE	shock	158
Ohanapecosh	7/10/2001	Unnamed	o29-00a	TRSP	shock	100
Ohanapecosh	7/11/2001	Ohanapecosh River	o00-***	ONCL, TRSP	snorkel	150
Ohanapecosh	7/25/2001	Ohanapecosh River	o00-00c	ONCL, TRSP	snorkel	50
Ohanapecosh	8/29/2001	Laughing Water Creek- night survey	o07-00a	ONCL, ONMY	snorkel	100
Ohanapecosh	8/30/2001	Chinook ck- Tipsoo Lk. outlet	o16-00h	NONE	shock	80
Ohanapecosh	9/5/2001	Kotsuck Creek	o16-05a	NONE	snorkel	100
Ohanapecosh	9/5/2001	Kotsuck Ck- night dive	o16-05a	ONCL, TRSP	snorkel	100
Ohanapecosh	9/6/2001	Chinook Ck- Stafford Falls	o16-00d	TRSP	snorkel	30
Ohanapecosh	9/10/2001	Ohanapecosh River	o00-00g	ONCL, TRSP, SAXX	snorkel	200
Ohanapecosh	7/2/2002	Boundary Creek	o16-06a	NONE	shock	100

Table 7. 2001–2003 Stream survey methods, dates, meters surveyed and species observed by stream segment and watershed (continued).

Watershed	Survey Date	Site Name	Segment#	Fish Species Observed	Survey Method	Meters Surveyed
Ohanapecosh	7/2/2002	Unnamed	o16-16a	NONE	shock	60
Ohanapecosh	8/6/2002	Unnamed - Ohanapecosh CG tributary	o29-00a	ONCL,TRSP	shock	280
Ohanapecosh	8/15/2002	Chinook Creek (between hwy 410)	o16-00h	NONE	shock	100
Ohanapecosh	8/15/2002	Tipsoo Lake Outlet	o16-00h	NONE	shock	100
Ohanapecosh	8/21/2002	Laughingwater Creek	o07-00b	ONCL, TRSP	shock	300
Ohanapecosh	8/21/2002	Laughingwater Creek (above falls)	o07-00c	NONE	shock	100
Ohanapecosh	7/11/2001	Ohanapecosh River	00-00f	ONCL, TRSP	snorkel	50
Puyallup	7/10/2001	St. Andrew's Creek	p03-00e	NONE	snorkel	100
White	6/28/2001	Deadwood Creek at confluence	w12-00a	TRSP	shock	100
White	6/26/2001	Klickitat	w13-00a	NONE	snorkel	700
White	6/28/2001	Deadwood Creek + 100m	w12-00a	TRSP	shock	100
White	7/2/2001	Outlet Tom Lake	w06-02e	NONE	shock	185
White	7/2/2001	Unnamed	w06-02g	NONE	shock	100
White	7/2/2001	Outlet Harry Lake	w06-02i	NONE	shock	62
White	7/3/2001	Unnamed	w18-00a	TRSP, ONCL	shock	180
White	7/3/2001	Unnamed	w19-00a	TRSP	shock	100
White	7/9/2001	Unnamed - Inter Fork White trib.	w21-01a	NONE	shock	100
White	7/18/2001	Unnamed	w17-01a	TRSP	shock	100
White	7/18/2001	Wright Creek	w17-02a	SACO	snorkel	100
White	7/18/2001	Unnamed	w17-03a	TRSP	shock	100
White	7/19/2001	Buck Creek	w01-00b	NONE	shock	100
White	7/30/2001	Shaw Creek	w15-00a	TRSP, SACO, COXX, ONCL	shock	300
White	7/31/2001	Unnamed	w11-00a	ONCL, SACO, COXX	shock	100
White	8/28/2001	Fryingpan Creek	w17-00a	SACO, COCO	shock	100
White	9/25/2001	Inter Fork White	w21-00a	NONE	shock	200
White	5/22/2002	White River: Chinook survey	w00-***	TRSP	shock	50
White	5/22/2002	Unnamed -trib to White River	w04-00a	ONTS	shock	30
White	8/5/2002	Unnamed	w14-00a	ONCL,COXX, TRSP	snorkel	100
White	8/5/2002	Unnamed - trib to White River	w14-00a	COXX	snorkel	100

Table 7. 2001–2003 Stream survey methods, dates, meters surveyed and species observed by stream segment and watershed (continued).

Watershed	Survey Date	Site Name	Segment#	Fish Species Observed	Survey Method	Meters Surveyed
White	8/26/2002	Unnamed -trib to Inter Fork	w21-04b	NONE	shock	100
White	8/26/2002	Unnamed -trib to Inter Fork	w21-06a	NONE	shock	100
White	8/27/2002	Klickitat Creek	w13-00a	TRSP, ONCL, UNSA	snorkel	200
White	8/27/2002	Littorals Outlet	w16-00a	SAFO	shock	100
White	8/28/2002	Klickitat Creek	w13-00a	UNSA	snorkel	400
White	6/20/2001	Klickitat Creek	w13-00a	ONMY, ONXX	snorkel	100

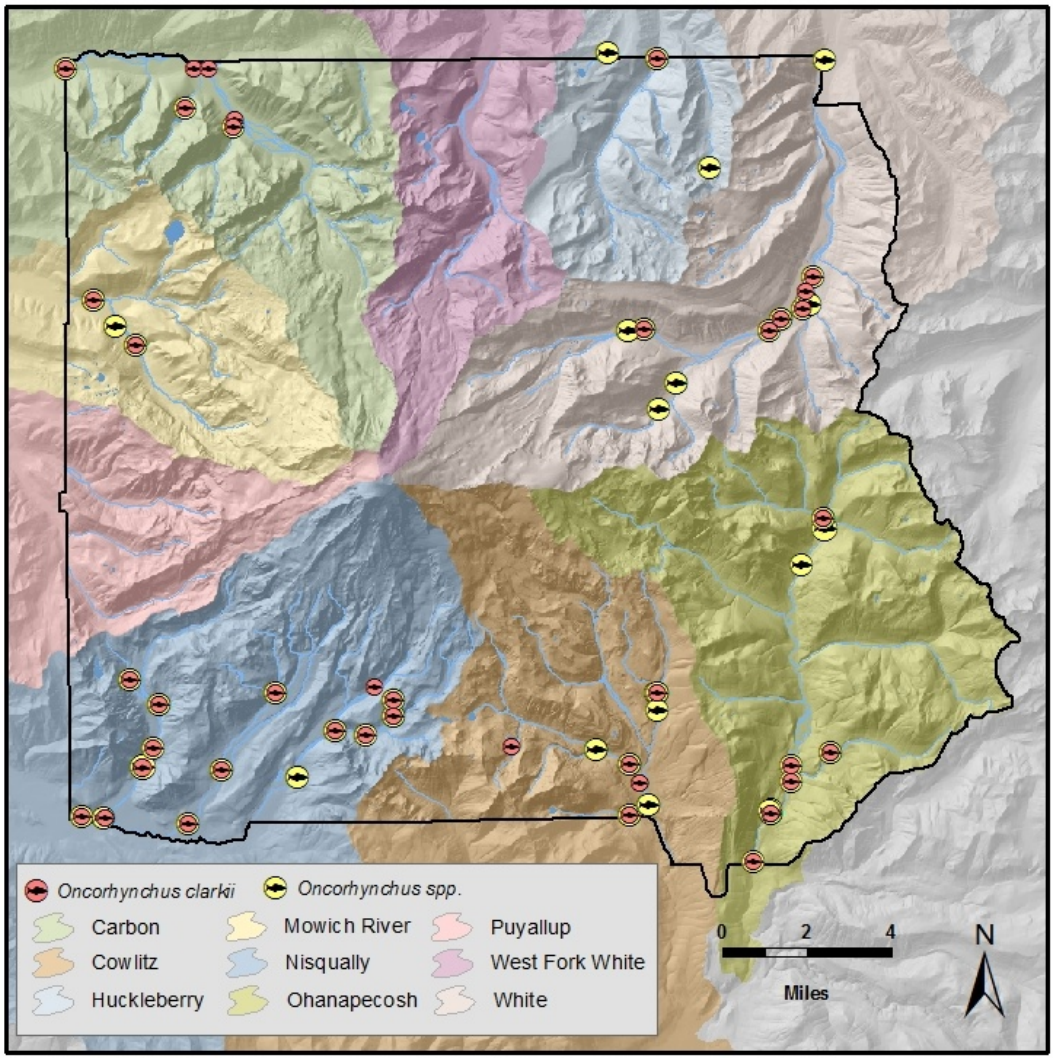


Figure 24. Cutthroat trout (*Oncorhynchus clarkii*) and trout (*Oncorhynchus sp*.) species locations and watersheds in Mount Rainier National Park.

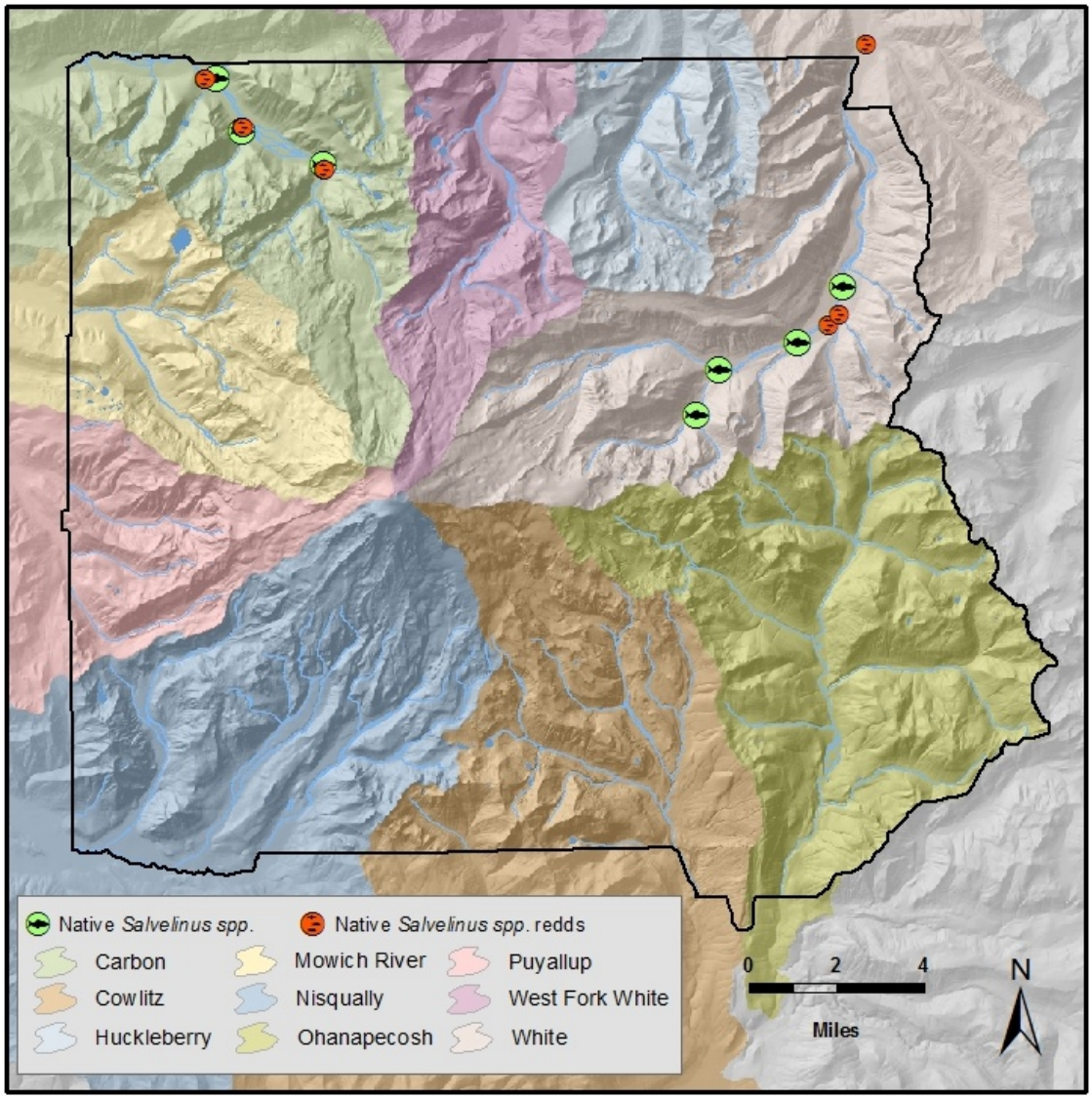


Figure 25. Native char species locations and watersheds in Mount Rainier National Park.

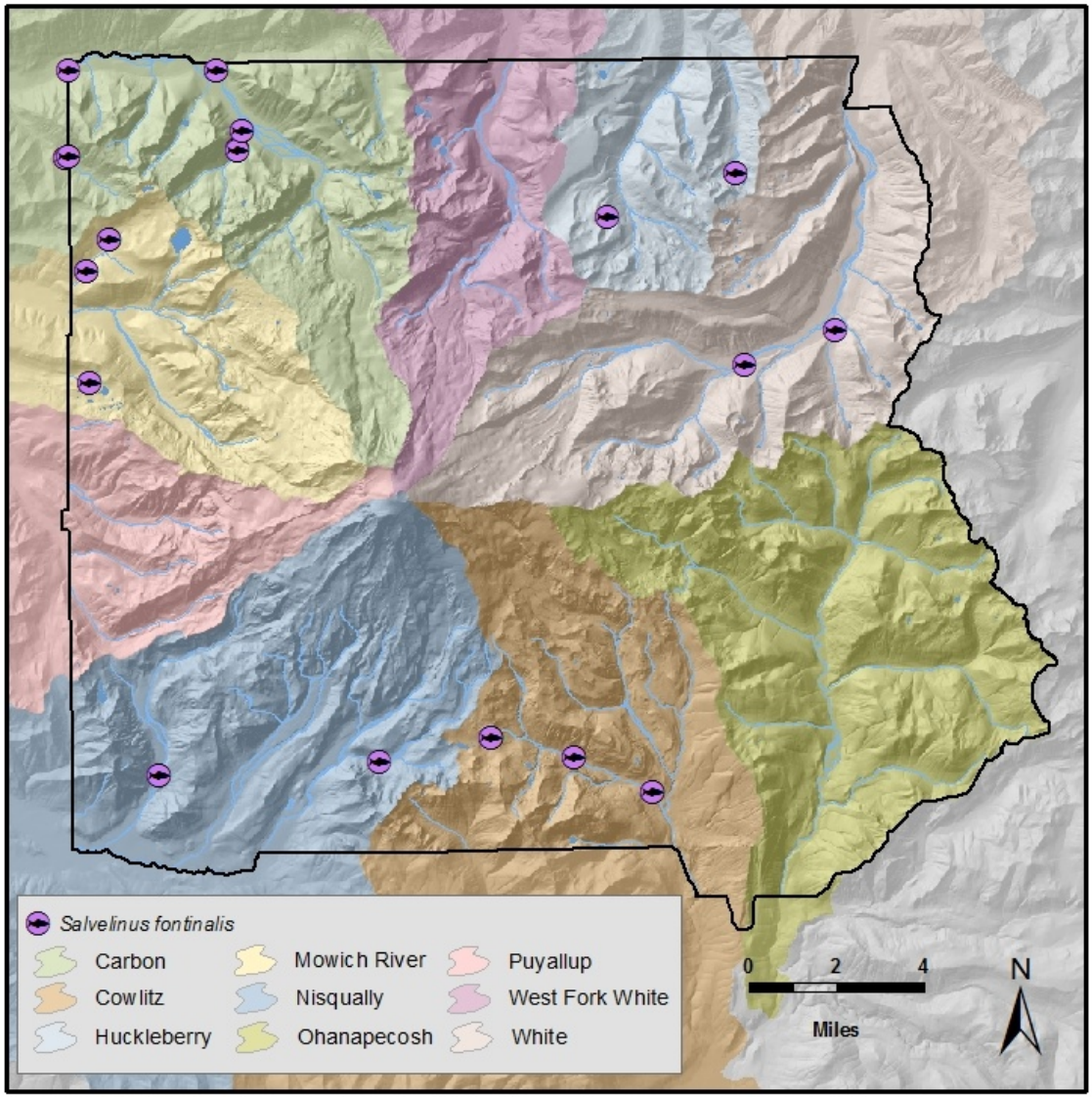


Figure 26. Eastern brook trout (*Salvelinus fontinalis*) species locations and watersheds in Mount Rainier National Park.

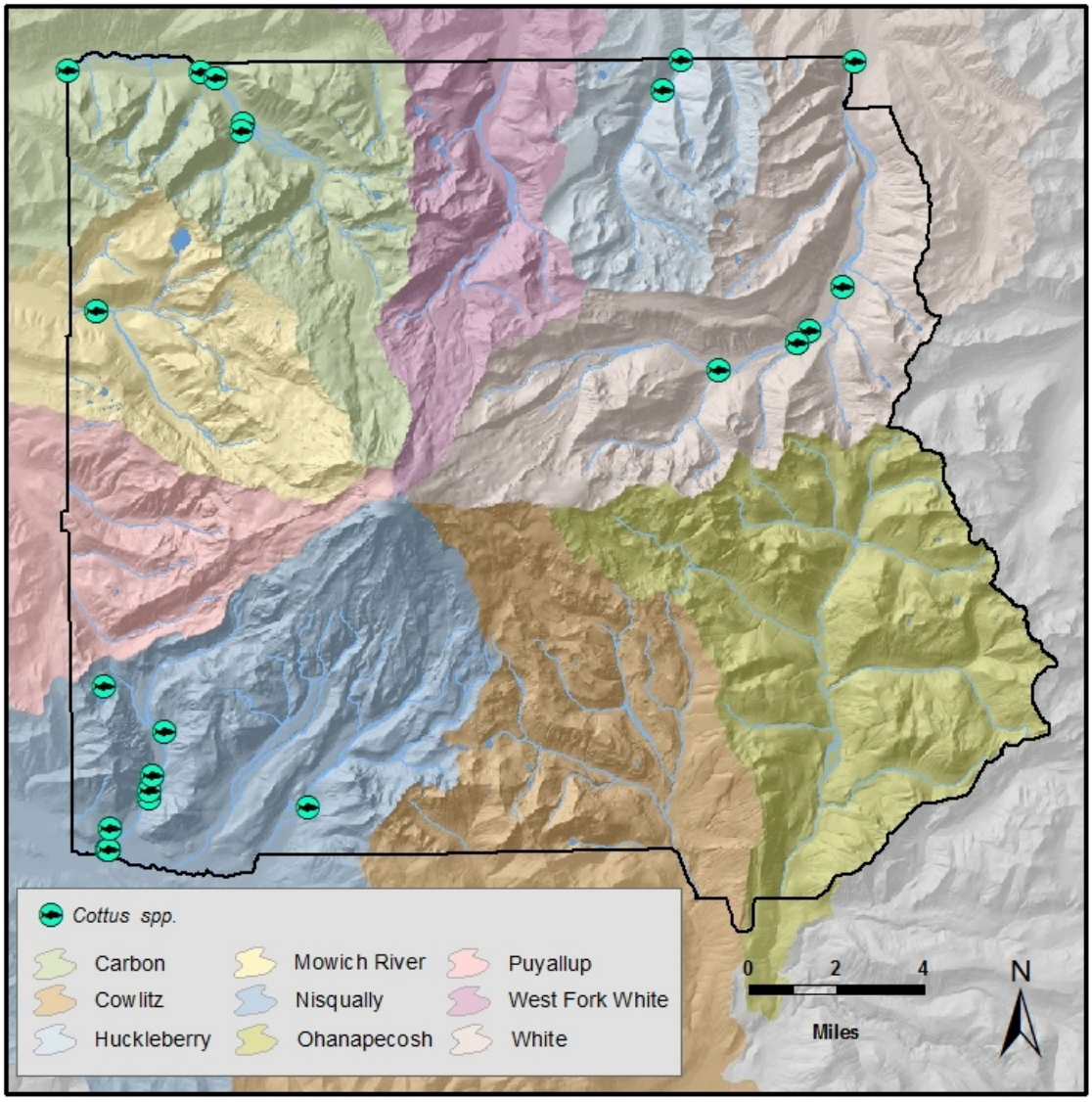


Figure 27. Sculpin species (*Cottus sp*.) locations and watersheds in Mount Rainier National Park.

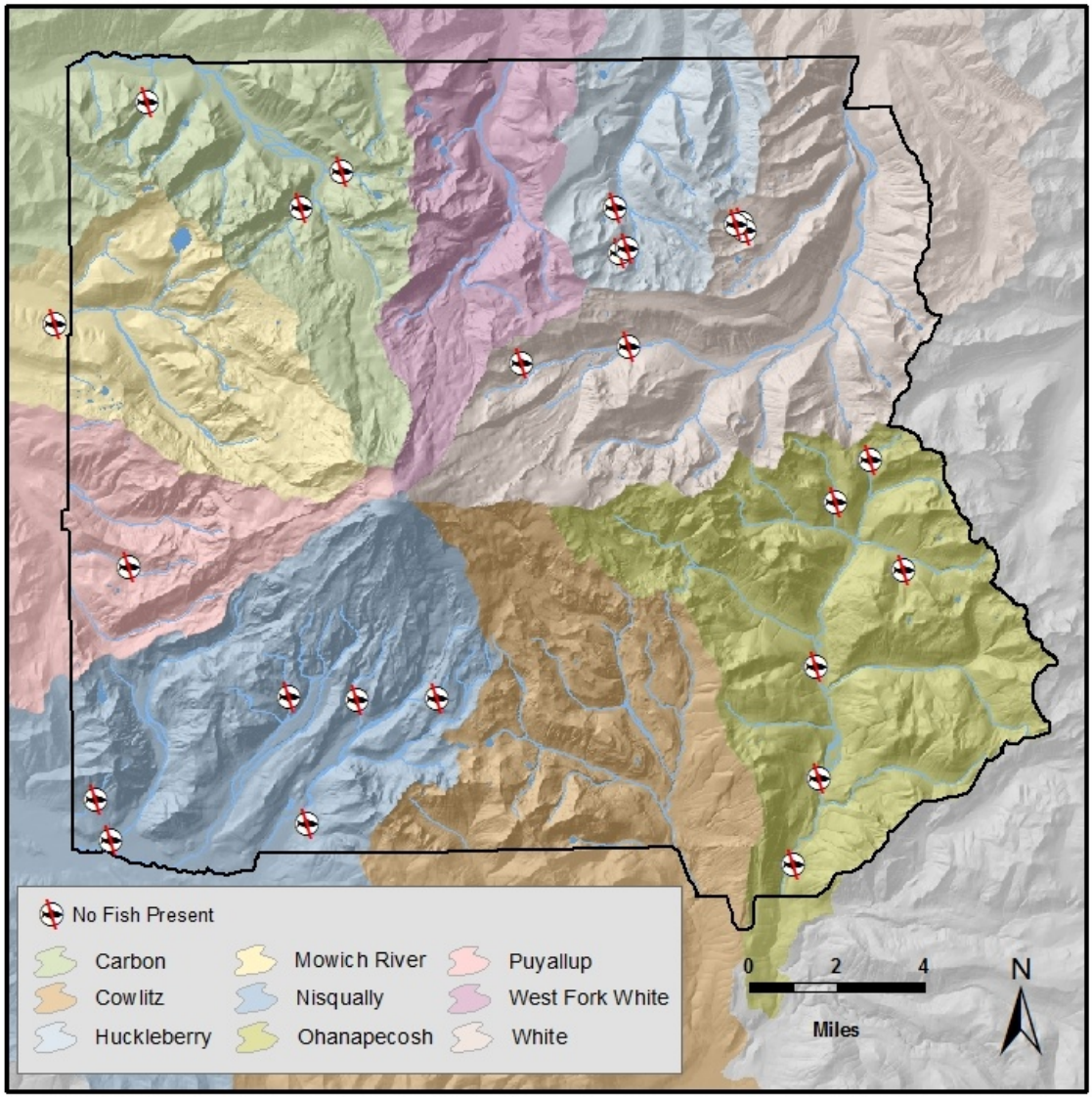


Figure 28. Stream segments where no fish were observed during inventory, and watersheds in Mount Rainier National Park.

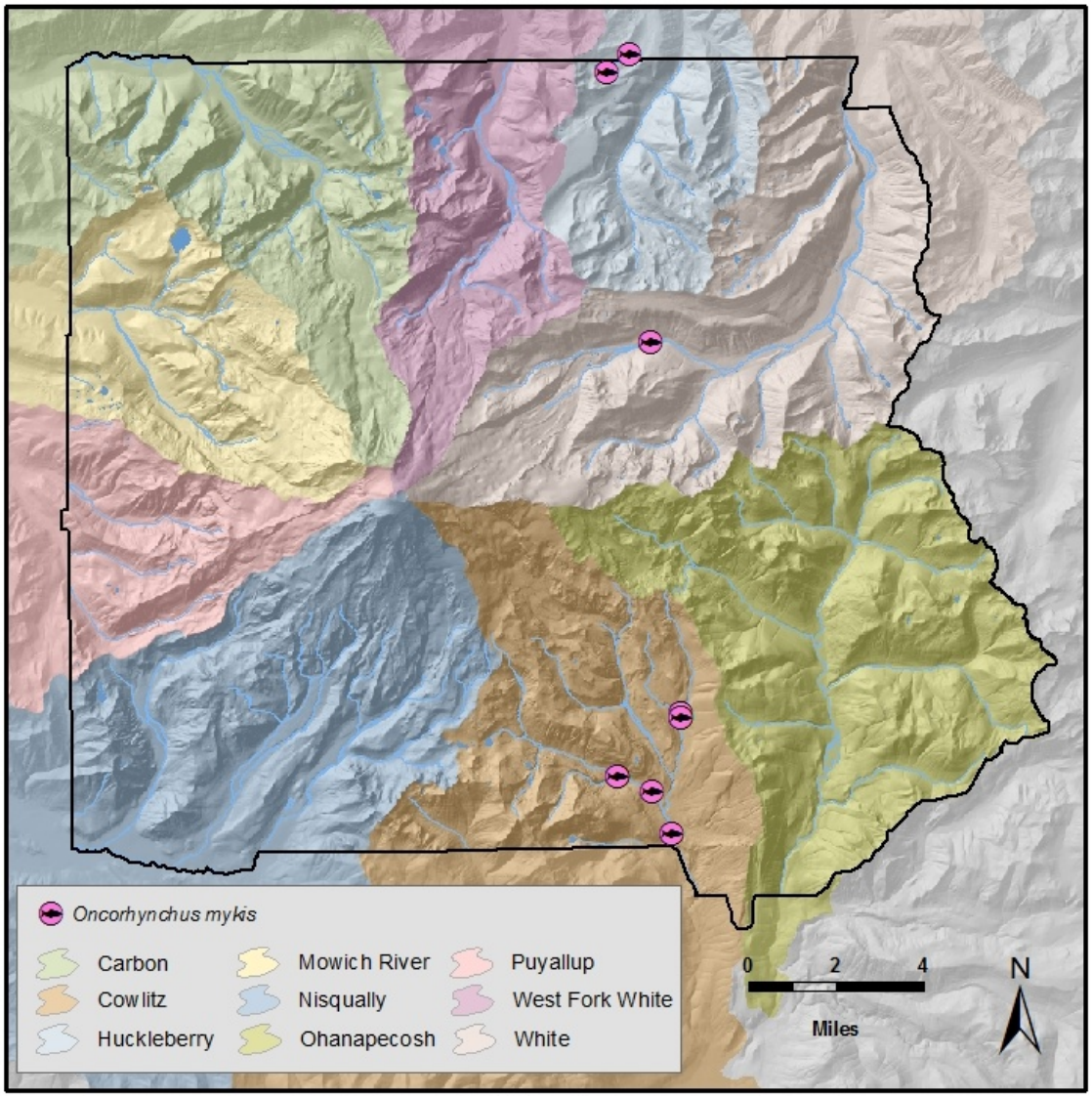


Figure 29. Rainbow trout (*Oncorhynchus mykiss*) species locations and watersheds in Mount Rainier National Park.

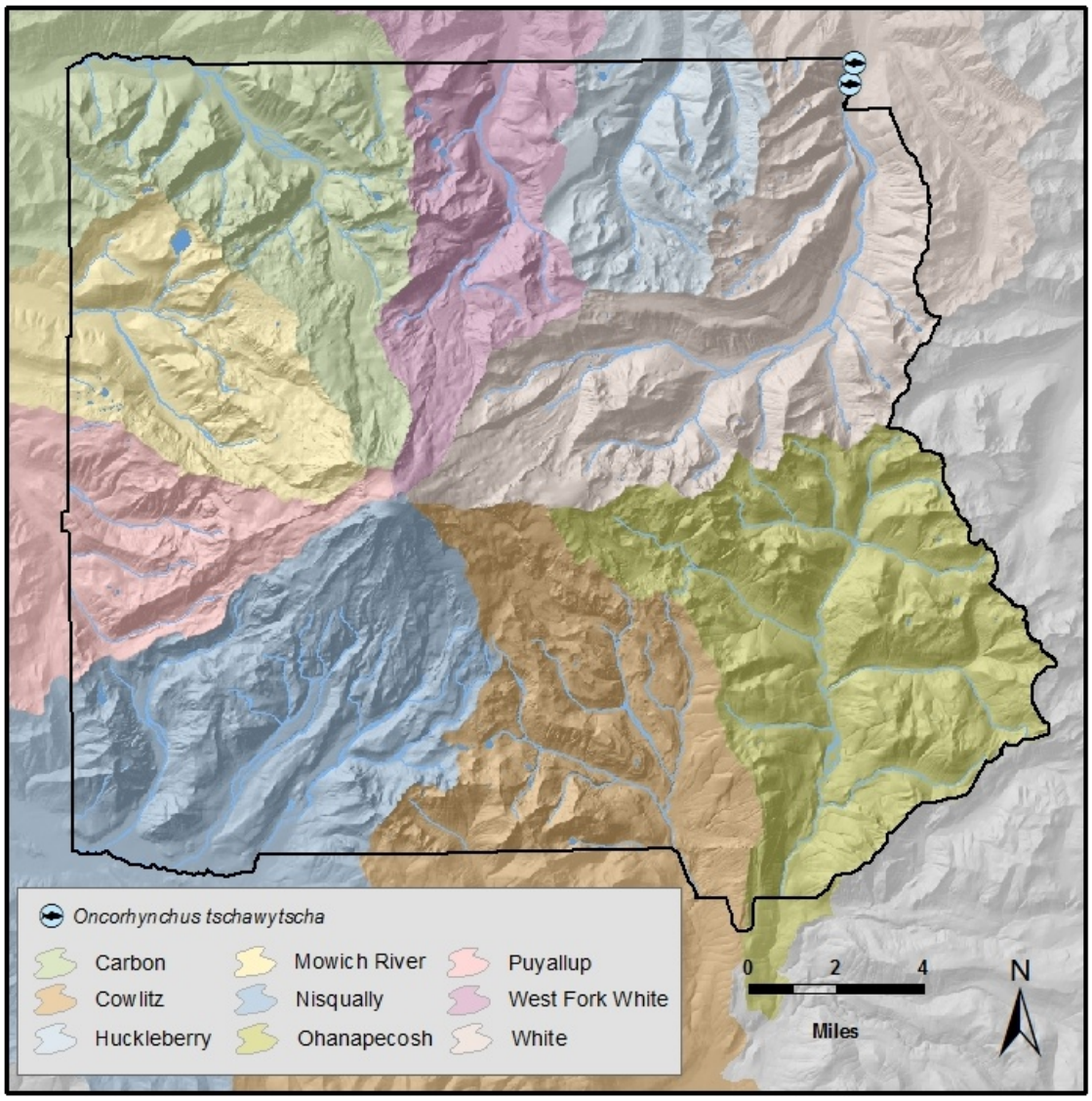


Figure 30. Chinook salmon (*Oncorhynchus tshawytscha*) species locations and watersheds in Mount Rainer National Park.

Minnow Traps

Minnow traps proved to be ineffective for surveying stream fish. Only five small cutthroat trout were captured in over 624 cumulative hours of survey effort.

Native Char

All native char fin clips collected were identified as bull trout through DNA analysis (Table 8, Figure 31). No Dolly Varden were documented in this inventory. Bull trout and/or their redds were observed in the Carbon drainage in Ipsut and Ranger Creeks; and in the White River drainage in Klickitat, Fryingpan, Shaw, and Wright Creeks, in the outflow from Silver Springs, and in an unnamed stream (Figure 25).

Table 8. Bull trout fin clip DNA results including date collected, species identified, total lengths, site name, Mount Rainier National Park assigned stream segment number, assigned GIS number, and watershed. WDFW ID# references the identification label made by the Washington Division of Fish and Wildlife.

MORA ID #	WDFW ID #	Date Collected	Species	Total Length (mm)	Site Name	Seg #	GIS #	Watershed
IP1	01JA 1	18-Sep-01	bull trout	151	Ipsut Creek	c08-00a	2332	Carbon
IP2	01JA 2	18-Sep-01	bull trout	184	Ipsut Creek	c08-00a	2332	Carbon
IP3	01JA 3	18-Sep-01	bull trout	220	Ipsut Creek	c08-00a	2332	Carbon
IP4	01JA 4	18-Sep-01	bull trout	300	Ipsut Creek	c08-00a	2332	Carbon
IP5	01JA 5	18-Sep-01	bull trout	150	Ipsut Creek	c08-00a	2332	Carbon
IP6	01JA 6	18-Sep-01	bull trout	230	Ipsut Creek	c08-00a	2332	Carbon
IP7	01JA 7	18-Sep-01	brook trout	270	Ipsut Creek	c08-00a	2332	Carbon
B1SH	01JA 8	30-Jul-01	bull trout	200–249	Shaw Creek	w15-00a	3658	White
B2SH	01JA 9	30-Jul-01	bull trout	<50	Shaw Creek	w15-00a	3658	White
B3SH	01JA 10	30-Jul-01	bull trout	250–299	Shaw Creek	w15-00a	3658	White
B4	01JA11	31-Jul-01	bull trout	100–149	Unnamed	w11-00a	3105	White

Figure 31. Bull trout captured in Shaw Creek, 2001.

Sculpins

Sculpins were found in the Carbon, Cowlitz, Huckleberry, Nisqually, and White watersheds, in numerous streams (Figure 27). Electrofishing proved the best method of capture so some detections may have been missed in streams where snorkeling only was conducted. Most sculpins were not identified to species and were recorded as COXX. Some sculpins were collected and sent to the WDFW to assist in identification. Shorthead sculpins (COCO) were identified from specimens collected from Ipsut Creek (Carbon watershed); unnamed tributary to Tahoma Creek (Nisqually watershed) and the Nisqually River; as well as in Huckleberry Creek and Ada Creek, in the Huckleberry drainage. Sculpin identification was verified by Molly Hallock, WDFW Nongame Fish Biologist.

Cutthroat Trout

Cutthroat trout locations are shown in Figure 24. Table 9 presents the results of DNA analysis for 43 individuals collected in three separate park watersheds. Most samples were taken from the Ohanapecosh watershed where trout hybrids and at least two cutthroat trout subspecies were thought to be present. DNA results revealed that three subspecies of cutthroat trout are present within the park as well as cutthroat/rainbow trout hybrids. Fin clip samples taken from these trout were analyzed with species-specific molecular markers by Carl Ostberg, Western Fisheries Research Center, US Geological Survey (Ostberg and Rodriguez 2002). DNA analysis indicated a pure strain of coastal cutthroat trout from the mainstem Ohanapecosh River below Silver Falls, and in Taos Creek in the Cowlitz drainage. westslope cutthroat trout and westslope x rainbow trout hybrids were documented in the upper Ohanapecosh drainage (Kotsuck, Chinook, and Deer Creek) and in the Nisqually drainage between Longmire and Paradise.

Table 9. Results from DNA trout analysis including watershed, stream site name, and species.

	Watershed	Site Name	Species Designation *
1	Ohanapecosh	Kotsuck Creek	WCT
2	Ohanapecosh	Kotsuck Creek	WCT
3	Ohanapecosh	Kotsuck Creek	RBTxWCT
4	Ohanapecosh	Kotsuck Creek	WCT
5	Ohanapecosh	Kotsuck Creek	WCT
6	Ohanapecosh	Kotsuck Creek	WCT
7	Ohanapecosh	Kotsuck Creek	WCT
8	Ohanapecosh	Kotsuck Creek	WCT
9	Ohanapecosh	Kotsuck Creek	WCT
10	Ohanapecosh	Kotsuck Creek	WCT
11	Ohanapecosh	Chinook Creek	WCT
12	Ohanapecosh	Chinook Creek	RBTxWCT
13	Ohanapecosh	Chinook Creek	RBTxWCT
14	Ohanapecosh	Chinook Creek	WCT
15	Ohanapecosh	Chinook Creek	RBTxWCT
16	Ohanapecosh	Chinook Creek	RBTxWCT
17	Ohanapecosh	Chinook Creek	WCT
18	Ohanapecosh	Chinook Creek	WCT
19	Ohanapecosh	Chinook Creek	WCT
20	Ohanapecosh	Chinook Creek	WCT
21	Ohanapecosh	Deer Creek	WCT
22	Ohanapecosh	Deer Creek	WCT
23	Ohanapecosh	Deer Creek	RBTxWCT (F1 hybrid)
24	Ohanapecosh	Deer Creek	WCT
25	Ohanapecosh	Deer Creek	WCT
26	Ohanapecosh	Deer Creek	WCT
27	Ohanapecosh	Deer Creek	RBTxWCT
28	Ohanapecosh	Deer Creek	WCT
29	Ohanapecosh	Deer Creek	RBTxWCT
30	Ohanapecosh	Deer Creek	WCT
31	Ohanapecosh	Ohanapecosh River	CCT
32	Ohanapecosh	Ohanapecosh River	CCT
33	Ohanapecosh	Ohanapecosh River	CCT
34	Ohanapecosh	Ohanapecosh River	CCT
35	Ohanapecosh	Ohanapecosh River	CCT
36	Ohanapecosh	Ohanapecosh River	CCT
37	Ohanapecosh	Ohanapecosh River	CCT
38	Ohanapecosh	Ohanapecosh River	CCT
39	Ohanapecosh	Ohanapecosh River	CCT
40	Ohanapecosh	Ohanapecosh River	CCT
41	Cowlitz	Taos Creek	CCT
42	Nisqually	Unnamed- below Glacier Bridge, confl. with n15-00	RBTxWCT
43	Ohanapecosh	Laughingwater Creek (above falls)	YCT

* WCT = westslope cutthroat trout. CCT = coastal cutthroat trout. RBT = rainbow trout. YCT = Yellowstone cutthroat trout

Spawning Surveys

Spawning surveys are summarized in Table 10. In 2001, nine spawning surveys were conducted in Huckleberry Creek, Ipsut and Ranger Creeks in the Carbon watershed, Klickitat Creek, the Silver Springs outflow, and the White River in the White River watershed. Neither fish nor redds were observed in Huckleberry Creek during spawning surveys.

Bull trout (n=5) and their redds (n=3) were observed in Ipsut Creek, and bull trout redds (n=4) were seen in Ranger Creek. The Ipsut Creek redds appear to have been scoured out when the Carbon River partially jumped its banks between October 4 and 18, 2001 and poured down the lower portion of Ipsut's channel. The Ranger Creek redds were unaffected by this event.

No spawning activity was observed in the White River mainstem, but bull trout redds (n=6) were observed in Klickitat Creek which was surveyed by the Puyallup Tribe on September 18, 2001. On October 25, 2001 park staff confirmed that bull trout redds were present. The park crew also observed one unmarked redd, larger than the known bull trout redds. Based on its size, it could have been created by an anadromous bull trout or coho salmon. However, neither carcasses nor adult fish were observed.

The Silver Springs outflow, located only 600 m from the northeast park boundary, and a tributary to the White River, had also been surveyed by another agency several times before our park crew arrived (flags did not indicate which agency had surveyed the area). A bull trout redd and two Chinook salmon redds had been flagged on September 18. Coho salmon redds had been flagged on October 9 (n=22) and October 24 (n=11). Park staff observed two unflagged coho salmon redds on October 25, along with 23 coho salmon, 19 coho salmon carcasses, and all the previously flagged redds.

In 2002, the fish crew conducted 34 redd surveys on a total of 21 streams. Of the 21 streams, 12 were revisited on a weekly basis to identify the onset of spawning. A total of 12 redds (bull trout) were observed in 2002: seven in the White and five in the Carbon watersheds.

Timing of spawning differs from drainage to drainage. For example, bull trout spawning in the White River drainage occurred in mid-September while no spawning was observed in the Carbon River until late September, early October.

Table 10. Spawning survey results by watershed, location, Mount Rainier National Park assigned stream segment number, and date. ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). ONKI = *Oncorhynchus kisutch*. SACO = *Salvelinus confluentus* (bull trout).

Watershed	Location	Segment Number	Date	Observed
Carbon	Park boundary north	c00-***	9/5/2002	None
Carbon	Park Boundary south	c00-***	9/2/2002	None
Carbon	Spunkwash	C11-00a	9/24/2002, 10/3/2002	2 SACO redds
Carbon	June Creek	c03-00a	9/18/2002	None
Carbon	Falls Creek	c05-00a	9/24/2002	None
Carbon	Ranger Creek	c06-00a	10/4/2001, 10/18/2001	4 SACO redds
Carbon	Ranger Creek	c06-00a	9/11/2002, 9/18/2002	None
Carbon	Ranger Creek	c06-00a	9/24/2002, 10/3/2002	2 SACO redds
Carbon	Chenuis	c07-00a	9/11/2002, 9/24/2002, 10/3/2002	None
Carbon	Ipsut Creek	c08-00a	10/4/2001	3 SACO redds
Carbon	Ipsut Creek	c08-00a	10/18/2001,9/11/2002, 9/18/2002, 9/24/2002	None
Carbon	Ipsut Creek	c08-00a	10/3/2002	1 SACO redd
Carbon	Unnamed Chenuis trib.	none	9/11/2002, 9/18/2002, 10/3/2002	None
Carbon	Unnamed trib. across from Chenuis	none	9/18/2002	None
White	Crystal Creek	c10-00a	10/7/2002	None
White	Unnamed	f05-00a	9/17/2002	None
White	Van Horn	f06-00a	9/16/2002	None
Huckleberry	Huckleberry Creek	h00-00b	9/27/2001, 9/13/2002, 9/19/2002, 9/25/2002	None
White	Silver Springs (outside park)	w00-***	10/17/2001, 10/25/2001	1 SACO redd, 2 ONTS redds, 35 ONKI redds
White	Silver Springs (outside park)	w00-***	9/4/2002	None
White	Unnamed	w00-***	10/23/2002	None
White	Unnamed	w04-00a	9/23/2002	None
White	Sunrise	w06-00a	9/16/2002	None
White	Deadwood	w12-00a	09/25/2002, 10/7/2002	2 probable SACO redds
White	Klickitat Creek	w13-00a	10/25/2001	6 SACO redds
White	Klickitat Creek	w13-00a	9/10/2002,9/23/2002	None
White	Klickitat Creek	w13-00a	10/15/2002	5 SACO redds
White	Fryingpan	w17-00a	10/23/2002	None

Fish Presence in Lake Outlets

Lake outlets were surveyed to verify the extent of fish access to park lakes. Table 11 summarizes fish presence in lake outlets.

Table 11. Fish presence in selected lake outlets by Mount Rainier National Park assigned stream segment number, site name, species identified in the lake outlet, and species present within each lake.

Stream Segment Number	Name	Species* present in lake outlets	Species* Present in lake
z08-04b	Snow Lake outlet (Unicorn Creek)	SAFO	SAFO
NONE	Lake George outlet	UNSA, COXX	COXX
p03-***	St. Andrews Lake outlet (St. Andrews Creek)	ONCL	none
z08-06c	Lake Louise outlet (Sunbeam Creek)	SAFO	SAFO
c06-00a	Green Lake outlet (Ranger Creek)	TRSP	ONCL
m05-01b	Mowich Lake outlet (Crater Creek)	COXX	COXX, ONNE
h02-00h	Lower Palisades Lake outlet	SAFO, UNSA, TRSP	SAFO
h01-00b	Lake Eleanor outlet	ONSP	ONMY
m01-***	Golden Lakes (LM 16) outlet (Rushingwater Creek)	SAFO	Unknown
h12-00a	Lh18 outlet	SAFO	SAFO

* COXX= *Cottus sp.* (sculpin species). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONNE = *Oncorhynchus nerka* (sockeye, kokanee salmon). SAFO = *Salvelinus fontinalis* (eastern brook trout). TRSP = unidentified trout. UNSA = unidentified salmonid (trout).

Specimen Collection

In order to verify and document species presence, sculpins were collected from several streams. Cutthroat trout were also collected to add to the existing park voucher specimen collection (Table 12).

Table 12. Specimen collections placed in Park museum and associated catalog and accession numbers, number of animals, location of collection, staff who collected specimen, and collection date.

Sci. Name	Catalog #	Accession #	Quantity	Locality	Collector	Coll. Date
Cottus asper	MORA 14804	MORA-377	7	Lake George	NPS Aquatic field staff	15-Jul-02
Cottus asper	MORA 14805	MORA-377	6	Lake George	NPS Aquatic field staff	16-Jul-02
Cottus confusus	MORA 14802	MORA-377	1	Unnamed Carbon River tributary	B Hasebe	18-Jun-02
Cottus confusus	MORA 14803	MORA-377	1	Unnamed Carbon River tributary	B Hasebe	18-Jun-02
Cottus confusus	MORA 14807	MORA-377	1	Unnamed Mowich River trib (m04-00a)	H Moran	31-Jul-02
Cottus confusus	MORA 14808	MORA-377	1	Unnamed Mowich River trib (m04-00a)	H Moran	31-Jul-02
Cottus confusus	MORA 14811	MORA-377	4	Tahoma Creek (n03-00a)	B Hasebe	10-Feb-02
Cottus confusus	MORA 14814	MORA-377	1	Fryingpan Creek	Fish Crew 2001	28-Aug-01
Cottus confusus	MORA 14815	MORA-377	3	c08-00a	Fish Crew 2001	25-Jul-01
Cottus confusus	MORA 14816	MORA-377	2	h04-00c	Fish Crew 2001	15-Aug-01
Cottus confusus	MORA 14817	MORA-377	1	h00-00c	Fish Crew 2001	14-Aug-01
Cottus confusus	MORA 14818	MORA-377	2	n03-01a	Fish Crew 2001	2-Jul-01
Cottus confusus	MORA 14819	MORA-377	1	n03-03a	Fish Crew 2001	2-Jul-01
Cottus confusus	MORA 14820	MORA-377	3	n03-04a	Fish Crew 2001	2-Jul-01
Cottus confusus	MORA 14821	MORA-377	3	n12-00a	Fish Crew 2001	9-Jul-01
Cottus confusus			1	n03-08a	Fish Crew 2001	11-Jul-01
Oncorhynchus clarkii	MORA 14806	MORA-377	1	Kotsuck Creek	B Hasebe	23-May-02
Oncorhynchus clarkii	MORA 14809	MORA-377	1	Confluence of Kotsuck and Chinook Creeks	B Hasebe	23-May-02
Oncorhynchus clarkii	MORA 14810	MORA-377	1	Tahoma Creek (n03-00a)	B Hasebe	10-Feb-02

Habitat

Dominant instream habitat was documented for 72 stream segments and is presented in Appendix C and in Figure 32 for sites where fish were observed. Turbulent fast water such as falls, cascades, rapids, riffles, and chutes was the dominant habitat documented in this inventory (41%). Sheets and runs were the next frequent dominant habitat (27%), followed by scour pools such as eddies, trenches, mid-channel pools, lateral pools, and plunge pools (22%) (Appendix C, Figure C-1).

Most first order streams were dominated by non-turbulent fast water such as sheets and runs, followed by turbulent fast water (Appendix C, Figure C-2). Second order streams were dominated by turbulent fast water and scour pools. Third order streams were dominated by turbulent fast water. Few fourth order streams were included in this inventory and these were mostly fast turbulent waters. One fifth order stream was included in this inventory and was dominated by non-turbulent fast waters.

Most fish were documented in turbulent fast water (n=272), followed by scour pools (n=171), and non-turbulent fast water (n=166) (Figure 32).

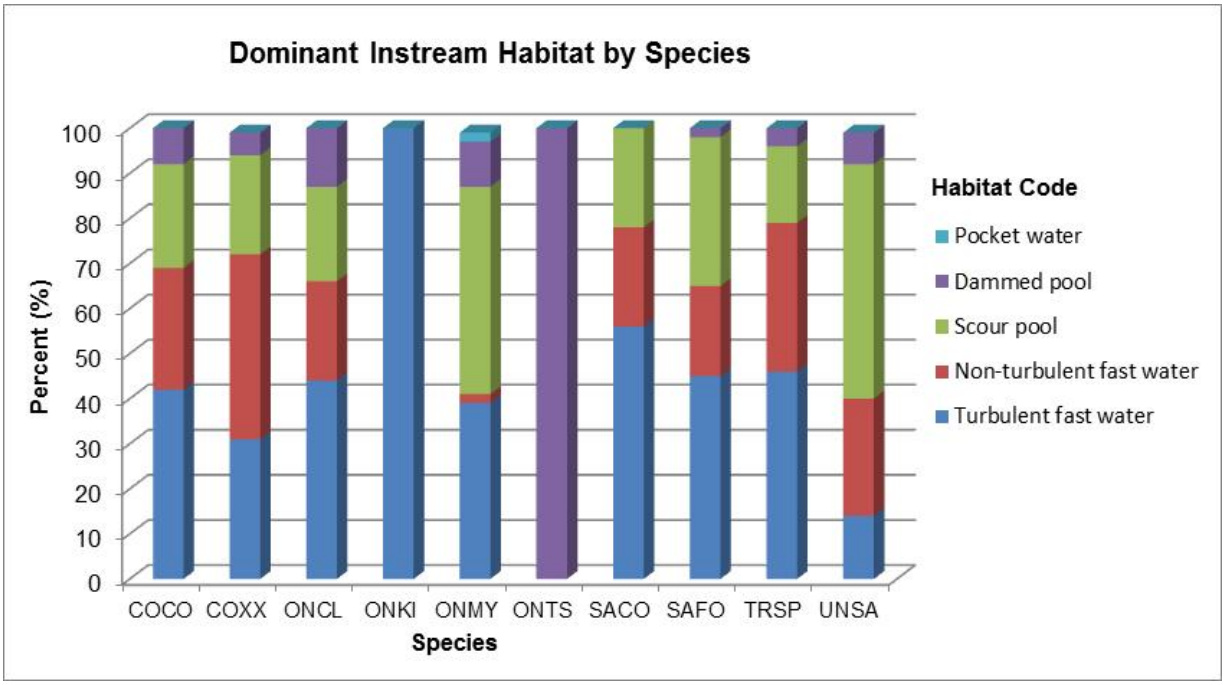
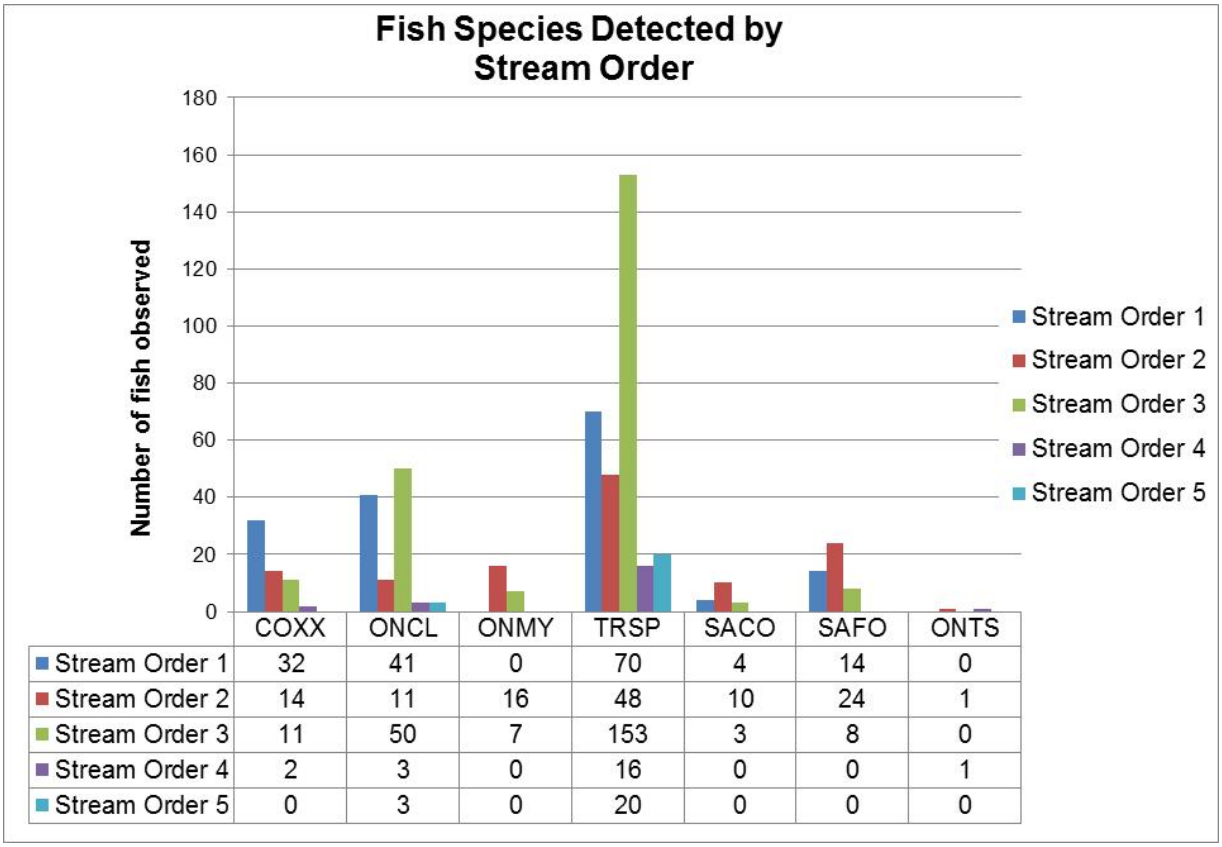


Figure 32.Comparison of dominant habitat with presence of fish. COXX = *Cottus sp.* (sculpin species). COCO = *Cottus confusus* (shorthead sculpin). ONCL=*Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout).

Fish species detected by stream order is presented in Figures 33 for sculpins COXX), trout species (ONCL, ONMY, TRSP), native char (SACO), eastern brook trout (SAFO), and Chinook salmon (ONTS). Sculpin were detected in first, second, third and fourth order streams with most found in first order streams (54%). Most unidentified trout (TRSP) ranging in size from <50 to 100 mm. were detected in third order streams (50%). Cutthroat trout were found in first, second, third, fourth and fifth order streams with most cutthroat detected in first (38%) and third (46%) order streams. Most Rainbow trout were detected in second order streams (70%). Native char were detected in first, second and third order streams with most (59%) found in second order streams. Eastern brook trout were detected in first, second and third order streams with most being detected in second order streams (52%). Chinook salmon were detected in first and fourth order streams.



	COXX	ONCL	ONMY	TRSP	SACO	SAFO	ONTS
Stream Order 1	32	41	0	70	4	14	0
Stream Order 2	14	11	16	48	10	24	1
Stream Order 3	11	50	7	153	3	8	0
Stream Order 4	2	3	0	16	0	0	1
Stream Order 5	0	3	0	20	0	0	0

Figure 33.Fish species detected by stream order. COXX = *Cottus sp*. (sculpin species ONCL=*Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). TRSP = unidentified trout.

Riparian habitat conditions for the survey sites are noted in Figure 34. Most fish were documented in the 4 and 5 category indicating shrubs and trees, respectively, as the dominant streamside vegetation. Percent overstory is presented in Figure 35. Approximately 79% of fish were observed in streams where overstory exceeded 40%. Stream gradients by species and frequency of occurrence are presented in Figure 36. Most fish were observed in stream gradients below 8%.

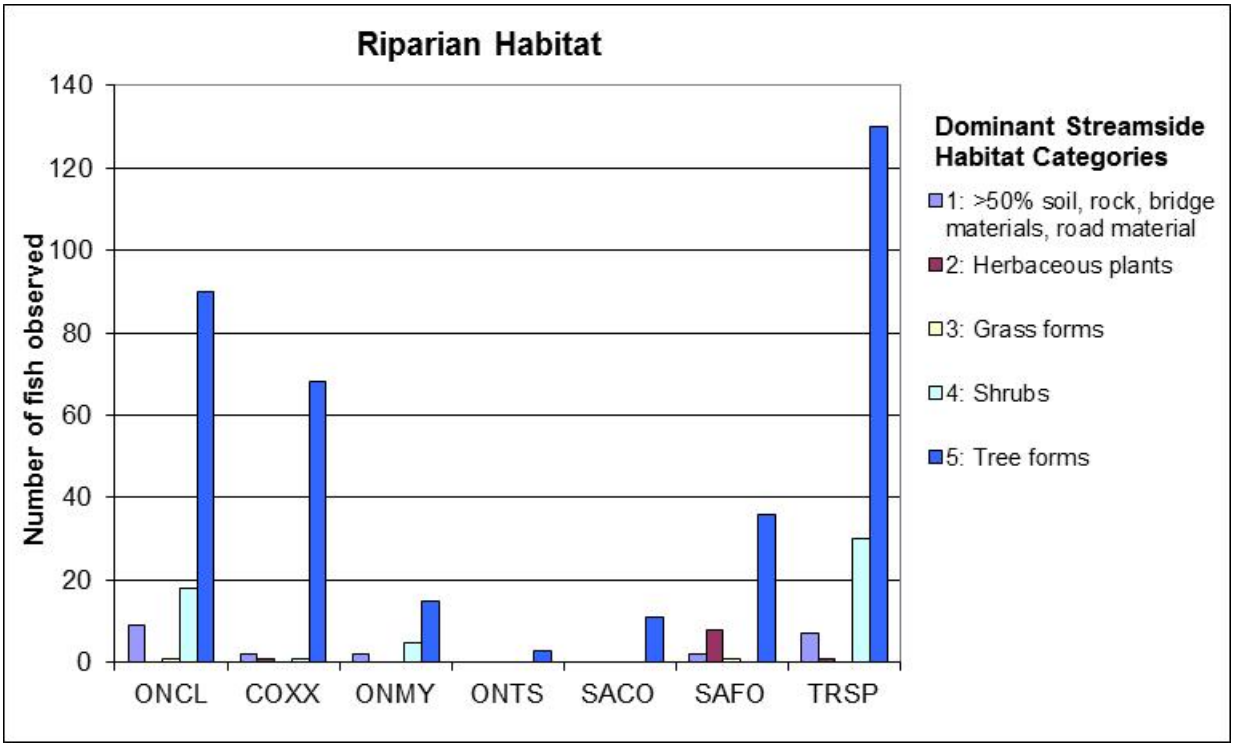


Figure 34. Species occurrence by riparian habitat categories. COXX = *Cottus sp.* (sculpin species). CL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis (*eastern brook trout). TRSP = unidentified trout.

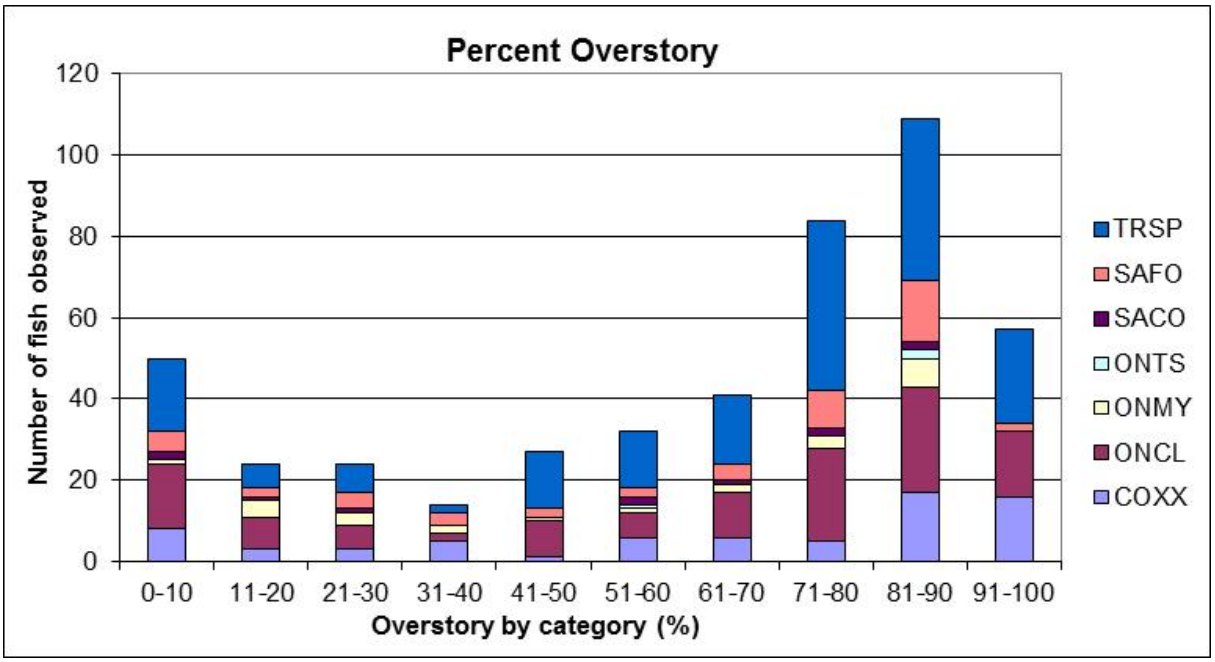


Figure 35. Species occurrence by percent overstory vegetation for stream segments with fish present. COXX= *Cottus sp.* (sculpin species). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout. TRSP = unidentified trout.

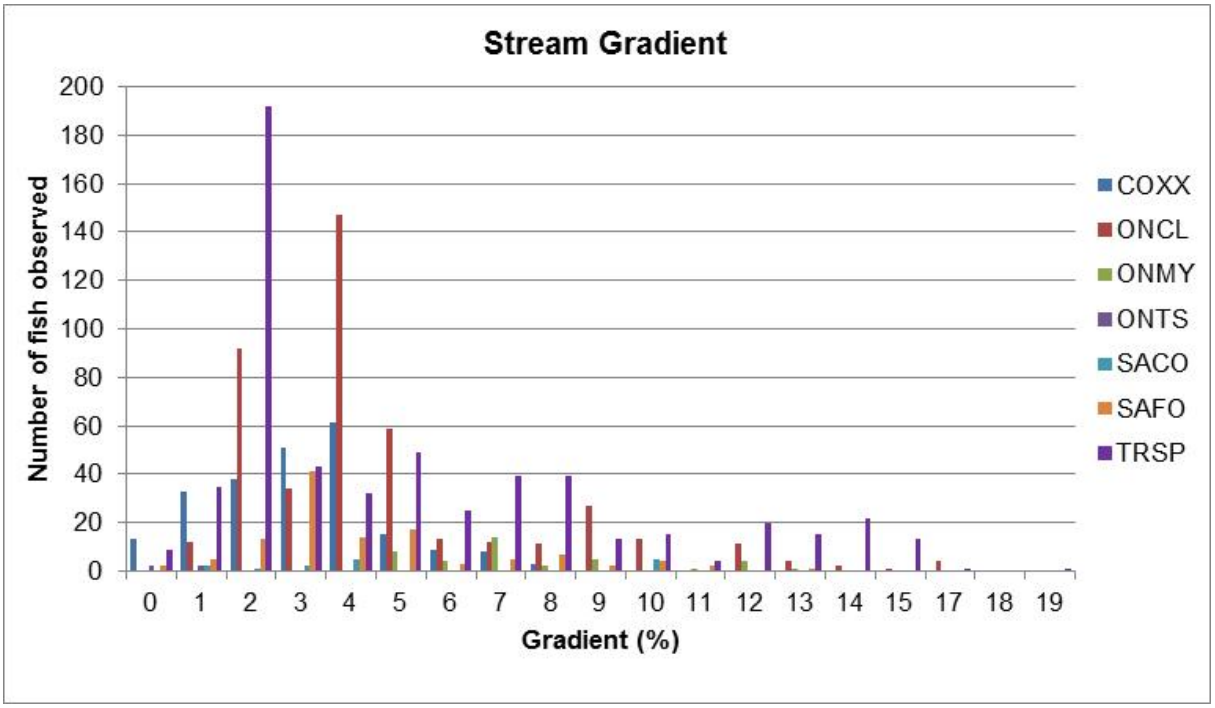


Figure 36. Species occurrence by stream gradient. COXX= *Cottus sp.* (sculpin species). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout.

Discussion

General Comments

Many survey sites had high water flows in mid-summer making access to these sites difficult. The best flow conditions began in late June to early July for most park streams during the survey years; however, timing of peak stream flow varied based on winter precipitation amounts and spring temperatures which dictate rates of snowmelt. Surveying glacial streams presents significant challenges. Glacial streams are often clear during winter and early spring conditions outside of heavy precipitation events. However, for safety reasons and ease of access, most surveys were conducted during the snow-free seasons when stream conditions are much less suitable for detection of fish, and especially anadromous fish in mainstem glacial rivers. The only Chinook salmon documented during the inventory was during the spring of 2002 where an opportunistic survey was conducted. Additional surveys should be conducted in the winter/spring, when glacial systems are relatively clear, to further document the presence of Chinook and coho salmon, steelhead, bull trout, and mountain whitefish.

Specific fish species are discussed below.

Trout

Trout observed in this inventory were generally small. Rainbow trout that could be accurately identified (length >100 mm) ranged in size from 100 mm (3.94 inches) to 249 mm (9.80 inches). Cutthroat trout ranged in size from 100 mm to over 300 mm (11.81 inches).

A significant number of fish observed in this inventory were identified as TRSP (n=700), trout that could not be identified to species. Fifty four percent of these were less than 50 mm (1.97 inches) length; 79% were less than 150 mm (5.90 inches). Coastal cutthroat and rainbow/steelhead trout are very similar in appearance, and were difficult to identify to species when young and when observed while snorkeling (Figures 37-40). While the namesake deep orange slash marks on the ventral side of the lower jaw and throat are also good indicators of a cutthroat trout, some lack jaw slashes, and some rainbow possess them to varying degrees. Coastal cutthroat and rainbow/steelhead trout cannot be consistently differentiated on the basis of body coloration or spotting patterns. Hybrids between the two can be quite common (Gresswell 1988, Young 1995).

In addition to size, it was not always possible to differentiate coastal cutthroat trout from west slope or intermountain stock. Snorkelers thought that coastal cutthroat trout have significantly more spotting all over the body while west slope cutthroat trout have significantly fewer spots anterior to the anal fin, particularly below the lateral line. Snorkelers documented that ‘intermountain’ types tended to have a blue-gray background, while the native coastal cutthroat trout tended to be silver-gray or sometimes bronze, although field staff believed that spotting was a better indicator than background color. However, DNA analysis contradicted the initial field identification of both cutthroat and rainbow trout at several sample sites and proved that it is often difficult to differentiate between cutthroat trout subspecies without genetic verification. DNA analysis verified that coastal cutthroat trout were present below falls in the Ohanapecosh River. Westslope and rainbow/westslope trout hybrids were present in tributaries to the Ohanapecosh River including Kotsuck, Deer, and Chinook Creeks. One sample collected in Laughingwater Creek, also a tributary of the Ohanapecosh River but above waterfalls, was

verified as a Yellowstone cutthroat trout. One sample collected from the Nisqually River below Glacier Bridge was verified as a hybrid rainbow x westslope. One sample collected from Taos Creek in the Cowlitz watershed was verified as a coastal cutthroat trout. Westslope or intermountain cutthroat trout were widely stocked in park streams from 1915 to 1964. However, we could find no park records noting stocking of coastal cutthroat trout which are native to park streams and rivers.

Figure 37. West slope or rainbow x west slope cutthroat trout hybrid from Chinook Creek, Mount Rainier National Park, 2002.

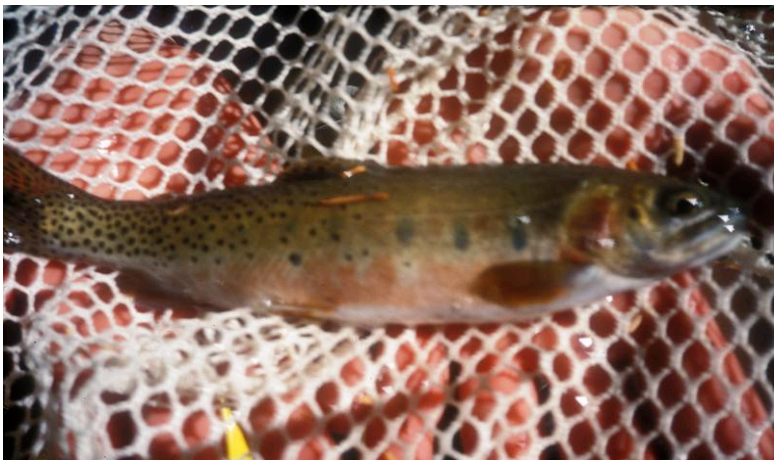


Figure 38. West slope or rainbow x west slope cutthroat trout hybrid from Chinook Creek, Mount Rainier National Park, 2002.

Figure 39. West slope or rainbow x west slope cutthroat from Kotsuck Creek, Mount Rainier National Park, 2002.

Figure 40. Fish identified as a rainbow/cutthroat hybrid by field crews, Huckleberry Creek, Mount Rainier National Park, 2001.

Fish Stocking

Three of the four major subspecies (coastal, westslope, Lahontan, and Yellowstone cutthroat trout), described by Behnke (1992, 1997) occur in the park. The coastal subspecies occurs in the coastal rainforests of North America and east to the Cascade Range crest. Behnke reports that the interior subspecies natural populations have not successfully penetrated the coastal mountains and generally remain in the northern river basins of the western Rocky Mountains. However, parkwide stocking of these interior subspecies (Montana Black spotted, also known as westslope or intermountain; Yellowstone) occurred as early as 1931 in the Ohanapecosh River, 1933 in Chinook Creek, and 1942 in Deer Creek.

Gresswell (1988) and Young (1995) report that hatchery rainbow trout readily hybridize with intermountain cutthroat trout (*O. clarkii lewisi)*, often to the extreme detriment of intermountain cutthroat trout. Some authors have suggested that coastal cutthroat trout have experienced the least amount of hybridization with introduced species (reviewed in Pauley et al. 1989; Trotter

1989; Trotter et al. 1993). DNA analysis conducted as part of this inventory did not document any coastal cutthroat trout hybridization; however, a separate study conducted in 2006 documented coastal cutthroat trout hybrids with westslope or Yellowstone cutthroat trout and cutthroat rainbow trout hybrids in several park streams (Samora et al., in prep).

Stocking of lakes and streams with cutthroat trout was extensive in the park; however, in reviewing park fish stocking records it appears that most, if not all cutthroat trout stocking was with west slope and other intermountain stocks. The earliest stocking records for park streams note that cutthroat trout were introduced as early as 1915 (Chenuis Creek), and rainbow trout in 1926 (Nickel Creek). Before the late 1950s, hatchery production of coastal cutthroat trout in Washington State consisted of nonanadromous forms (Johnson et al. 1999). Westslope cutthroat trout, the first nonanadromous salmonid cultured in Washington, were released into lakes and streams in eastern and western Washington as early as 1895 (Crawford 1979). In the early years of the park, state and county fish wardens were welcomed into the park to plant fish. In the late 1920's, 500,000 Montana black spotted trout (intermountain cutthroat) from Yellowstone National Park were planted in park lakes and streams. In 1928, through a cooperative agreement with the Bureau of Fisheries, an extensive stocking program was initiated throughout the park (NPS 1932).

Results of this inventory suggest that rainbow trout are present in lower numbers than cutthroat trout (5% rainbow trout as compared to 36% cutthroat trout). Park stocking records suggest that cutthroat trout were the predominant trout planted in park streams. From 1915-1953, 1,983,961 cutthroat trout (including 1,667,364 Montana Black Spotted trout) were planted in park streams. From 1922-1958, only 319,039 rainbow trout were planted. Analysis of recent DNA results documented only six of 40 streams surveyed were pure rainbow trout as compared to 26 streams with pure coastal cutthroat trout (Samora et al., in prep). This same study documented approximately 30% of all fish collected as cutthroat/rainbow trout hybrids.

Cutthroat Trout

As noted above, cutthroat trout was the predominant trout species documented in this inventory. Through DNA analysis from samples collected in this inventory we have verified that coastal cutthroat trout inhabit streams in the Ohanapecosh River along with westslope cutthroat and cutthroat/rainbow trout hybrids (Figure 41). Since this inventory was conducted we have verified that coastal cutthroat trout inhabit all park watersheds with the exception of the Cowlitz (Samora et al., in prep). Among these watersheds, only the White River was found to be free of trout hybrids and coastal cutthroat trout were the only subspecies documented in streams in this drainage.

Figure 41. Coastal cutthroat trout (identified through DNA analysis) from Ohanapecosh River, Mount Rainier National Park, 2002.

Large woody debris and in-stream structures play an important role in providing valuable habitat for coastal cutthroat trout. In freshwater, adult cutthroat trout typically reside in large pools while the young reside in riffles, most commonly in upper tributaries of small rivers. Coastal cutthroat trout utilize a wide variety of habitat types during their complex life cycle. They spawn in small tributary streams, and utilize slow flowing backwater areas, low velocity pools, and side channels for rearing of young. Good forest canopy cover, in-stream woody debris, and abundant supplies of insects are crucial for young cutthroat trout survival.

Coastal cutthroat trout streams in the park are part of the Puget Sound Evolutionary Significant Units (ESU) of the Puyallup and Nisqually Rivers and the Southwest Washington/Columbia River ESU for the Cowlitz/Ohanapecosh Rivers. Johnson et al. (1999) reported that there are genetic distinctions between populations from the upper Nisqually River (with strong glacial influences) and other southern Puget Sound populations. On April 5, 1999, the National Marine Fisheries Service (NMFS) determined that listing was not warranted for the Puget Sound ESU but proposed it was for the Southwest Washington/Columbia River ESU (NMFS and USFWS 1999). However, the NMFS stated that reviewing the status of coastal cutthroat trout was difficult because they are one of the most biologically diverse and least-studied groups of West Coast salmonids.

Coastal cutthroat trout express a wide diversity of life-history attributes. This diversity includes several migratory pathways: they may migrate to estuaries and other marine environments (anadromous or sea run forms); they may remain in fresh water (freshwater forms) as river/lake migrants or in upper headwater tributaries as nonmigrants; or they may follow migratory pathways that combine these behaviors. Genetic and environmental influences on these migratory pathways and life-history attributes are poorly understood. The biological review team (BRT) felt strongly that life-history forms in each ESU represent diverse genetic and phenotypic resources important to its evolutionary ecology, and the BRT unanimously concluded that each ESU include all of these life-history forms. Team members concurred that loss of any individual life-history form could increase risk to the ESU as a whole. Furthermore, although a majority of

BRT members concluded that the Puget Sound ESU was not in danger of extinction, a minority felt that they were.

In 1999, the BRT unanimously concluded that the Southwestern Washington/Columbia River ESU was likely to become endangered in the foreseeable future and proposed listing the ESU as threatened. However, in 2002, the USFWS (the agency now responsible for management of coastal cutthroat trout) re-evaluated this proposed rule and found that the change in forest management regulations, the latest information indicating relatively healthy-sized total populations in a large portion of the ESU, and the improved understanding of the ability of freshwater forms to produce anadromous progeny, led them to conclude that this DPS (distinct population segment) did not meet the definition of a threatened species (in danger of becoming endangered in the foreseeable future) at this time (USFWS 2002a). In April, 2009, the U.S Ninth Circuit Court of Appeals ruled that the USFWS did not give Columbia River and southwestern Washington populations of the coastal cutthroat trout thorough consideration when it denied the trout protection under the Endangered Species Act. Although in March 2009, the USFWS reopened the public comment period on the proposal to list the coastal cutthroat trout as a threatened species, they ultimately withdrew the proposed rule in 2010. The Fish and Wildlife Service continues to monitor the conditions of the coastal cutthroat trout in southwest Washington and the Columbia River and to encourage federal and state agencies to address the conservation needs of the coastal cutthroat trout. Park managers should continue to collect additional biological information, monitor the status of coastal cutthroat trout, and continue to mitigate impacts to habitat from park operations.

Rainbow Trout/Steelhead

Rainbow trout and steelhead are the same species with different life history strategies. They have habitat needs similar to cutthroat trout and hatch in gravel-bottomed, fast-flowing, well oxygenated streams. Rainbow trout remain in freshwater while steelhead migrate to the ocean. Adult steelhead develop a much more pointed head, become more silvery in color and typically grow much larger than rainbow trout that remain in fresh water. However, steelhead are often difficult to distinguish from resident rainbow trout because they may remain in freshwater streams from 1 to 7 years, and steelhead that originate in high-elevation streams with cold temperatures and lower productivity require more time to reach a size when they become smolts (up to 2 years) (Wydoski and Whitney 2003).

Only 56 fish were identified as rainbow trout by field crews, although undoubtedly more rainbow exist in park streams but were too small in size to be positively identified by visual observation. As noted previously, rainbow trout readily hybridize with cutthroat trout which increases difficulty in identification to species while snorkeling. Rainbow trout were field identified in the White, Cowlitz, and Huckleberry watersheds. DNA results showed samples submitted from the Ohanapecosh River and one from the Nisqually River were rainbow/west slope cutthroat trout hybrids.

Steelhead may also be present in the park in the Carbon River watershed where there are no dams that block fish passage. Steelhead may also be present in the White River, West Fork and Mowich watersheds where fish are transported around the Puget Sound Power and Light Company diversion dam at river mile (RM) 24.3, and the Mud Mountain dam at RM 29.6. These steelhead are part of the Puget Sound DPS which was listed as threatened in May 2007 (NMFS

2007a). Spawning surveys conducted during the fall have not been extensive, but no steelhead redds have been documented to date, although the Muckleshoot Tribe has reported steelhead redds in the Carbon River inside the park, in past years. The WDFW (1993) reports steelhead spawning in both the Carbon and White River watersheds in early March to mid-June. The native steelhead stock in both systems is sustained by wild production. Steelhead may mature in the ocean or freshwater, based on the state of sexual maturity at the time of river entry and duration of spawning migration. WDFW (1993) identified the Carbon and White River steelhead as winter-run where they enter freshwater between November and April and spawn shortly thereafter.

Future studies involving cutthroat trout should further explore the geographic extent of cutthroat trout hybridization throughout the park including hybridization with rainbow/steelhead trout. Native stocks of rainbow trout were not differentiated from hatchery stock in this inventory but should be studied in the future. Park management activities should strive to protect instream wood and riparian cover in order to ensure protection of native coastal cutthroat and rainbow trout /steelhead. Additional surveys should be conducted during winter and spring to verify the presence of steelhead.

Char

Two out of the three species of char that potentially occur in the park were documented in this inventory and include bull trout and eastern brook trout. Although Schmoe (1925) and May (1966b) listed Dolly Varden as the only native char occurring in the park, DNA analysis conducted for this inventory and a subsequent study (DeHaan et al. 2008) documented only bull trout presence in the park. This is consistent with Baker et al. (2003) who found that migratory char collected in the lower White and Puyallup Rivers were in fact bull trout; however, these authors suggested that populations of Dolly Varden might be present in the headwaters of these rivers. Sampling in this inventory focused on multiple headwater reaches within the Puyallup River system yet we documented no Dolly Varden, suggesting that they may not occur within the headwaters.

Bull Trout

Bull trout have narrower habitat requirements than most other salmonids and exhibit a number of life history strategies. Most bull trout are highly migratory, spawning in tributary streams where juvenile fish usually rear from 1 to 4 years before migrating to either a larger river (fluvial), lake (adfluvial), or ocean (anadromous) where they spend their adult life; typically returning to the natal tributary stream to spawn. Resident bull trout may complete their entire life cycle in the tributary streams where they spawn and rear. Resident and migratory forms of bull trout may be found together, and it is generally believed that the life history form of individuals is more a product of the environment than of any specific genetic combination.

Bull trout use migratory corridors to move from spawning and rearing habitats and between foraging and over-wintering habitats. Bull trout are often found where groundwater infiltrates into streams or in the coldest part of streams and rivers at the headwaters, near glacier termini. Like cutthroat trout, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools (USFWS 2002b).

Bull trout spawn in the fall and incubate and develop over the winter and spring when they are subject to high mortality rates from disturbance including fine sediment deposition, channel incisions, and scouring from high flow events. Alterations of stream channels significantly affect survival of bull trout embryos and juveniles. Timing of spawning differs from drainage to drainage in the park. Bull trout spawning in the White River drainage occurred in mid-September while no spawning during this time was observed in the Carbon River. However, bull trout and their redds were observed in the Carbon watershed in early and mid-October.

Bull trout occurring in the park are part of the Coastal Puget Sound DPS and as noted previously, listed as threatened.

Future studies involving bull trout should further explore their geographic extent within the park. In addition, park management activities should strive to protect instream wood and riparian cover, eliminate management actions that disturb sediments during egg and alevin development which is over 200 days, and in order to ensure protection of critical bull trout habitat, minimize the use of shoreline protection structures in bull trout habitat. As with trout and other species, additional surveys should be conducted during winter and spring to further verify the spatial extent of bull trout presence in the park. In addition, strategies are needed to obtain population estimates of bull trout within the park. A long-term monitoring plan is needed to ensure the protection of bull trout populations which often occur in areas where shoreline protection structures (levees, barbs, dikes) are used to protect adjacent park developed areas, and are subject to an increasing amount of disturbance.

One of the purposes of this inventory was to document bull trout presence and distribution. However, the inventory was limited in the information it provided on bull trout distribution because we were not aware, at that time, how bull trout use streams within the park. Since this inventory was conducted, park staff have conducted studies and collaborated with the U.S. Fish and Wildlife Service to gain a better understanding of fish use of park waters (DeHaan et al 2008). Native bull trout utilize different habitat types dependent upon conditions. During spring and early summer months, low numbers of adult and sub-adult bull trout were observed and captured in the clear tributaries and confluence with turbid water areas. When the crew returned to re-sample sites at lower water levels with higher water temperatures, bull trout were not captured in clear streams. We hypothesize that bull trout leave clear streams as water levels lower and temperatures increase. Later in the season, bull trout were found using waters near the mixing of clear and turbid confluences and along the margins of main channels and side channels of glacial streams. We hypothesize that bull trout prefer the lower water temperatures in these main glacial rivers, and glacial till provides more cover than in clear tributaries. In late August and early September, as water temperatures begin to drop, juvenile and sub-adult bull trout move back into the clear tributaries, followed by spawning adults in September and October.

Other topics of study include comparison of bull trout size to age class, assessing temperature dependence on bull trout movement, and monitoring bull trout population abundance.

Eastern Brook Trout

Brook trout were the other char documented in this inventory and, as noted previously, are introduced and have been extensively stocked in streams and lakes throughout the park. Brook trout are of concern in bull trout habitat because they can hybridize. Brook trout were

documented with bull trout in several Carbon River watershed streams including Chenuis, Ranger, June, and Ipsut Creeks. However, no brook trout hybridization was found in this inventory or in a subsequent study (DeHaan et al, 2008.).

Brook trout were also documented in several lake outlets and in streams in all watersheds with the exception of the Ohanapecosh. Brook trout were documented at only one site (littorals pond outlet) in the White River watershed.

Additional surveys should be conducted to determine the population distribution and abundance of brook trout in the park, to determine the extent of hybridization with bull trout, and to assess whether fish removal of this introduced species is warranted.

Salmon

On October 11, 1996, Congress passed the Sustainable Fisheries Act (Public Law 104-297) which amended the habitat provisions of the Magnuson Act. The re-named Magnuson-Stevens Act (Act) calls for direct action to stop or reverse the continued loss of fish habitats. Congress has mandated the identification of habitats essential to managed species and measures to conserve and enhance this habitat. The Act requires cooperation among the National Marine Fisheries Service (NMFS), the Fishery Management Councils, and Federal agencies to protect, conserve, and enhance "essential fish habitat" (EFH). Congress defined essential fish habitat for federally managed fish species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (Pacific Fish Council 1999). The Pacific Fishery Management Council manages the fisheries for coho, Chinook, and Puget Sound pink salmon and has defined EFH for these three species. Salmon EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California. Salmon EFH excludes areas upstream of longstanding naturally impassible barriers (i.e. natural waterfalls in existence for several hundred years), but includes aquatic areas above all artificial barriers except specifically named impassible dams. The EFH does include areas above the Mud Mountain Dam. Park rivers and streams are included in the habitat associated with Chinook, coho, and pink salmon.

Chinook Salmon

Chinook salmon are the least abundant and largest of the salmon species in our region. The only Chinook salmon found in the park were less than 100 mm in size and observed in early spring in the White River (Figure 42). These fish are part of the Puget Sound White River spring Chinook stocks and the WDFW et al. (1996) report that adults return to freshwater from May to mid-September and spawn in the upper White River watershed. These fish spawn in the larger rivers and major tributaries including Huckleberry Creek and West Fork of the White River from early September through mid-October. Chinook salmon prefer higher velocity waters and larger gravel than other salmon species due to their large size. The White River spring Chinook salmon are one of the more threatened salmon stocks in the region.

As with steelhead, Chinook salmon adults are trapped at the diversion dam near Buckley Washington, and trucked upstream of Mud Mountain Dam where they are released in the White River (WDOE 1998). Fry are thought to emerge from their redds from late February through March (Smith and Wampler 1995). After a short rearing period of three to eight weeks in still water and shallow river margins, spring Chinook salmon typically migrate downstream to rear in

broad, low-gradient channels where they are protected by vegetative cover (Chapman 1981, Wunderlich 1982, Smith and Wampler 1995). However, because emergence from a redd appears to occur over a time period of several weeks, the use of shallow river margins occurs over a broad time period as well. Studies by Dunston (1955) found that Chinook salmon juveniles from the White River migrate as yearlings or sub-yearlings. Most spring Chinook salmon return as three or four-year-old adults, but some return as two, five, or six-year-olds.

Figure 42. Left: Chinook salmon captured on the White River at the north Park boundary, Mount Rainier National Park, spring 2002. Right: Capture location of Chinook salmon.

A description of the history of the White River spring Chinook is provided by WDOE (1998):

> *In the 1940s, the number of White River spring chinook arriving to the Buckley trap averaged 2,953 annually (Washington Department of Fish and Wildlife et al., 1996). The population levels fell in the late 1940s and continued to falter for the next several decades. By the 1980s, the number of returning adults was as low as 6 (Figure 3). In 1977, adults were captured at the Buckley trap to develop a hatchery program which is still in existence today. Adults were transported to Hupp Springs Hatchery near Purdy, Washington, where there is cool, high quality water to maintain the fish. Fish produced from this program were released into Minter Creek. Returning adults have been used to maintain the program.*
>
> *A saltwater captive brood program was also founded in the late 1970s as a second component to the White River spring chinook-rebuilding program. At first the saltwater net pen program was near Manchester, but later moved to Squaxin Island. A small number of chinook yearlings were transferred each year from Hupp Springs to the net pens and kept in the pens until they matured as adults. Upon maturity, adults were transported back to Hupp Springs to be included in the spawning population.*
>
> *Although experimental, this contributed greatly to egg production and facilitated the expansion of the program to include production at White River Hatchery (a third component) near Buckley, as well as rearing and release of juveniles into the upper White River watershed to re-seed the natural environment. Several acclimation ponds have been constructed and operated by the Forest Service and Puyallup Indian Tribe to imprint hatchery spring chinook to the upper White River watershed and facilitate their return as naturally spawning adults.*

Currently, no additional fish are being transferred to the saltwater net pens. The anadromous programs at White River Hatchery and Hupp Springs Hatchery are still operating, and every year, several hundred thousand-chinook juveniles are planted in the upper White River. The number of returning adults has had a strong but variable increasing trend in the 1990s. In 1996, the number of returning adults included 628 natural spawners and in 1997 there were 402 natural spawners.

The White River spring chinook salmon recovery plan (Washington Department of Fish and Wildlife et al., 1996) includes initial and long-term goals for the chinook recovery. They are as follows (pages 3-4):

> *"The initial goal of this recovery plan is to restore White River spring chinook to the White River watershed This goal will be achieved when the interim escapement goal of 1,000 unmarked spawners per year is met in three out of the four consecutive years with the normal level of incidental sport, commercial and tribal harvest.*
>
> *The long-term goal of this recovery plan is to restore the native population of White River spring chinook stock in the White River watershed to healthy, productive condition. To achieve this goal, escapements should equal or surpass the escapement goal in three out of four consecutive years. The escapement goal should reflect the watershed carrying capacity and should be met with a full complement of directed and incidental harvest in sport, commercial, and tribal fisheries. "*

In addition to the White River spring Chinook salmon, Puyallup fall Chinook salmon may also be present in the park (WDFW 2003). The WDFW reports that Puyallup River fall Chinook salmon adults spawn in the mainstem Puyallup River from approximately RM 10.4 upstream to the anadromous barrier at Puget Sound Energy's Electron diversion facility (RM 41.7). Sexually mature fish begin arriving back at the river mouth in late July and continue to enter the river until mid-October. The upstream migration peaks in late August to mid-September. Spawning begins in early September, peaks in early October, and is generally complete by November. Fall Chinook salmon spawning habitat is available in the Carbon River from its mouth up into Mt. Rainier National Park (WDFW and Western Washington Treaty Indian Tribes 2003).

The WDFW reports that most naturally produced Puyallup River Chinook salmon migrate to salt water as zero age smolts after spending only a few months in freshwater. Out-migration timing was not currently well defined, but a study initiated in 2000 by the Puyallup Tribe to determine juvenile production levels and migration timing, has indicated that the peak out-migration occurs in mid-May. Chinook out-migrants at the peak were 80-90 mm in size. After a few weeks of estuarine acclimation, most juveniles begin moving to nearshore feeding grounds in Puget Sound and the Pacific Ocean.

Coho Salmon

No coho salmon were documented in this inventory. However, coho salmon have been documented in the White and Carbon Rivers and tributaries (Mount Rainier National Park, unpublished data 2005-2008). Recent repairs made to a culvert located immediately outside of the park boundary restored fish passage in the Carbon River and tributaries where we have observed a large number of coho salmon in this area during the past several years.

Puget Sound coho salmon typically begin their freshwater spawning migration in the late summer and fall, spawn by mid-winter, then die. Depending on temperature, eggs incubate in redds for 1.5 to 4 months before hatching as alevins. Following yolk sac absorption, alevins emerge from the gravel as young juveniles or fry and begin actively feeding, remain in streams for up to 15 months, and then migrate to the ocean as smolts in the spring. Coho salmon typically spend two growing seasons in the ocean before returning to their natal stream to spawn as 3 year-olds.

Coho salmon generally spawn in tributary streams with lower velocity and smaller gravel than mainstem rivers where Chinook salmon spawn. Most coho salmon fry stay in the stream for over a year feeding on aquatic insects, zooplankton, and small fish. Overstory vegetation, cool stream temperatures, and high dissolved oxygen levels are important for fry survival. Mortality can be especially high during freshwater life stages in areas where siltation can alter spawning beds and smother eggs.

Sockeye/Kokanee

With the exception of certain river-type and sea-type populations, the vast majority of sockeye salmon spawn in or near lakes, where the juveniles rear for 1 to 3 years prior to migrating to sea. For this reason, the major distribution and abundance of large sockeye salmon stocks are closely related to the location of rivers that have accessible lakes in their watersheds for juvenile rearing. Females spawn in 3 to 5 redds over a couple of days. Hatching usually occurs after 6 to 9 weeks. Most sockeye salmon fry then rear in lakes where they feed on aquatic insects and plankton. Most sockeye salmon stay at sea for two years, returning to spawn in their fourth year, but some may be five or six years old when they spawn.

Non-anadromous sockeye are known as kokanee. Kokanee have been extensively stocked in Alder Lake outside of the park, and in Mowich Lake, inside of the park. Taxonomically, kokanee and sockeye salmon do not differ, however kokanee are often genetically distinct from sockeye salmon in a given region due to isolation and mutation (Gustafson et al. 1997).

No sockeye salmon were observed in the inventory sample sites, however sockeye/kokanee were observed spawning in Berry Creek, a tributary to the Nisqually River, in 2002 (Figure 43). These fish were likely from those stocked at Alder Lake, outside of the park.

Figure 43. Kokanee spawning in Berry Creek, October, 2002.

One sockeye salmon was also observed in Fryingpan Creek in 2005, one of the few that were transported around the Mud Mountain Dam to access the Upper White River watershed (Figure 44).

Figure 44. Sockeye salmon observed in Fryingpan Creek, 2005.

Other Salmon Species

Pink salmon (*Oncorhynchus gorbuscha*) are the most plentiful and smallest of the salmon species in our region. They have a two-year life span within their natural range (Pacific Fishery Management Council 1999). Upon emergence, pink salmon fry migrate quickly to sea and grow rapidly as they make extensive feeding migrations. Maturing fish return to freshwater to spawn after only 18 months. Generally pink salmon spawn closer to tidewater than the other Pacific

salmon species (50km or 31 miles) but some migrate as much as 500km (311 miles) upstream. Pink salmon have been observed in increasing numbers in the park since 2006. Park records do not indicate that pink salmon were historically present in the park. Pink salmon observed within the park, as with other anadromous fish, have been trucked around the Puget Sound and Mud Mountain Dam to access the upper White River watershed.

Chum salmon have not been documented in the park, and park records do not indicate that they were historically present. Chum salmon generally spawn in coastal areas and would not likely be present in the park.

Future studies involving salmon should further explore their geographic extent within the park. Park management activities should strive to protect instream wood and riparian cover, and minimize the use of shoreline protection structures in salmon habitat. As with other species, additional surveys should be conducted during winter and spring to further verify the spatial extent of salmon presence in the park. In addition, strategies are needed to obtain population estimates of salmon within the park. A long-term monitoring plan is needed to ensure the protection of salmon populations where they occur near developed areas where shoreline protection structures (levees, barbs, dikes) are used.

Sculpins

Mongillor and Hallock (1998) report that sculpin are one of the most difficult freshwater fish to identify. Consequently, most sculpin documented in this inventory were recorded as COXX. All sculpin have rather large heads that taper to a narrow caudal peduncle and are drab or mottled in coloration. They are also similar in size and seldom exceed 75 mm (3 in). To complicate matters, freshwater sculpin have some history of hybridization (Wydoski and Whitney 1979). Several species are very similar to one another.

Sculpin were found in the Carbon, Cowlitz, Huckleberry, Nisqually, and White River watersheds, in numerous streams. Electrofishing proved the best method of capture. All sculpin specimens collected from park streams were identified as shorthead sculpins by Molly Hallock, WDFW Nongame Fish Biologist. Shorthead sculpins were identified from specimens collected from Ipsut Creek (Carbon watershed); an unnamed tributary to Tahoma Creek (Nisqually watershed) and the Nisqually River; as well as in Huckleberry Creek and Ada Creek, in the Huckleberry drainage.

Shorthead sculpins inhabit cold, swift riffle reaches of streams, and most sculpins documented in this inventory were found in fast flowing turbulent or non-turbulent waters; but some shorthead sculpins were also documented in scour pools and backwater channels. Shorthead sculpin are often found in open water, away from cover or shelter and prefer rubble or gravel substrate. Spawning occurs in the spring (Wydoski and Whitney 2003). The shorthead sculpin lifespan is 4 to 6 years. Although Wydoski and Whitney (2003) report that shorthead sculpin grow to a length of about 4 inches (102 mm), fish documented in this inventory ranged in size from less than 50 mm (about 2 inches) to just under 150 mm (5.9 inches). Some unidentified sculpin were as long as 199 mm (almost 8 inches), suggesting they may be a different sculpin species. Six other sculpin species have the potential to occur in the park; however, only the prickly sculpin (*Cottus asper*) was documented in the park where it was introduced in Lake George.

Additional surveys should be conducted to verify sculpin species present in the park.

Mountain Whitefish

No mountain whitefish were identified in this inventory. However, mountain whitefish have been documented in the Carbon River in the park (Wildman 1989). In streams, juvenile and adult mountain whitefish are found primarily in pools and riffles in summer, and in large pools or slow moving runs in winter. Spawning generally occurs in late October and early November in gravel of stream riffles and on gravel shoals along lake shores. Newly hatched fry are found in backwater stream shallows for a few weeks after hatching in the early spring (Scott and Crossman 1973). Adult mountain whitefish feed primarily on immature forms of bottom dwelling aquatic insects, including mayflies, caddisflies, stoneflies, and midges (Wydoski and Whitney 1979).

Targeted surveys, especially in mainstem rivers during winter and spring, should be conducted to further verify the presence or absence of mountain whitefish throughout the park.

Summary

The Mount Rainier National Park stream fish inventory, conducted as part of the North Coast and Cascades Network Vertebrate and Vascular Plants Inventory, have provided a unique opportunity to learn more about fish presence and distribution throughout the park. Although MORA was established over 100 years ago, little was known about the current status of fish in the park. The intensity of past fish stocking efforts was thought to have resulted in the decimation of native fish populations. The abundance of coastal cutthroat trout, and the presence of native char and salmon species observed in this inventory suggests that some native fish populations have survived. However, the continued presence of non-native species and hatchery stock, as well as the presence of dams, has undoubtedly affected native fish populations. Native stocks of rainbow trout were not differentiated from hatchery stock in this inventory, but should be studied in the future. The presence of introduced cutthroat trout and potential hybridization and speciation of native char are areas where additional studies are needed.

This inventory did not provide an opportunity to assess population status, or species abundance. However, it did provide us with information to verify the presence of over 90% of the species that are likely to occur within the park. This inventory was the first thorough inventory conducted in the park to determine fish presence and distribution. Additional surveys should focus on distinguishing native trout stock from introduced trout; assessing the distribution and abundance of species of concern such as bull trout, Chinook salmon, steelhead, and coastal cutthroat trout; and assessing the status and health of native fish populations. Data collected during this inventory can serve as baseline information for developing a long-term monitoring program for stream fish as part of the overall effort to assess the ecological health of park aquatic ecosystems.

Perhaps one of the most valuable uses of this inventory information is its application to decision-making for park managers. An increasing number of park development projects are directly and indirectly altering natural stream habitat conditions as park managers attempt to adapt to climate change, such as responding to increased flood events. Several projects can affect natural stream processes, including the hyporheic zone where surface water and groundwater interactions occur. The hyporheic zone has a strong influence on stream ecology, stream biogeochemical cycling, and stream-water temperature. Projects that may be detrimental to stream ecology include the installation and repair of shoreline protection structures; removal, disturbance or alteration of wood and substrate from streams and rivers; dredging, that increases the potential for siltation; and removal of riparian vegetation. These types of projects directly affect the survival of several native fish species. Information contained in this report is available to managers for making informed decisions about the direct, indirect, and cumulative effects park management actions may have on native fish species and their habitat.

Distribution of fish species documented in MORA as of the publication date of this report is presented in Table 13. This list includes species documented prior to this inventory (mountain whitefish, steelhead) and post inventory (coho, kokanee/sockeye, and pink salmon). Species identified in this inventory are noted with an “*.”

Table 13. Confirmed fish species for Mount Rainier National Park and their conservation status as of the publication date.

Common Name	Scientific Name	Fish Species Codes	Native/ Introduced	Federal Status	State Status
*Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*	ONCL	Native	Species of Concern	Game
*West slope cutthroat trout	*Oncorhynchus clarkii lewisi*	ONCL	Introduced	None	Game
*Yellowstone cutthroat trout	*Oncorhynchus clarkii bouvieri*	ONCL	Introduced	None	None
*Rainbow trout	*Oncorhynchus mykiss*	ONMY	Native and Introduced Stock	Steelhead threatened	State Listed or Candidate Species; Game
*Trout hybrids	*Oncorhynchus sp.*	Various	Result of introduced stock	None	None
Steelhead	*Oncorhynchus mykiss*	ONMY	Native	Threatened	Candidate
*Bull trout	*Salvelinus confluentus/*	SACO	Native	Threatened	Threatened
*Brook trout	*Salvelinus fontinalis*	SAFO	Introduced	none	none
*Coho salmon	*Oncorhynchus kisutch*	ONKI	Native	Species of Concern	Food Fish
*Chinook salmon	*Oncorhynchus tshawytscha*	ONTS	Native	Threatened	Threatened
*Sockeye salmon	*Oncorhynchus nerka*	ONNE	Recent migrant	None	Candidate Species; Food Fish
*Kokanee	*Oncorhynchus nerka*	ONNE	Introduced	None	Game
*Pink salmon	*Oncorhynchus gorbuscha*	ONGO	Recent migrant	EFH species	EFH species, Game
Mountain whitefish	*Prosopium williamsoni*	PRWI	Native	None	None
*Prickly sculpin	*Cottus asper*	COAS	Introduced	None	None
*Shorthead sculpin	*Cottus confusus*	COCO	Native	None	None

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Appendix A. Data Management: Database Structure, Datasheet Dictionary, and Datasheets

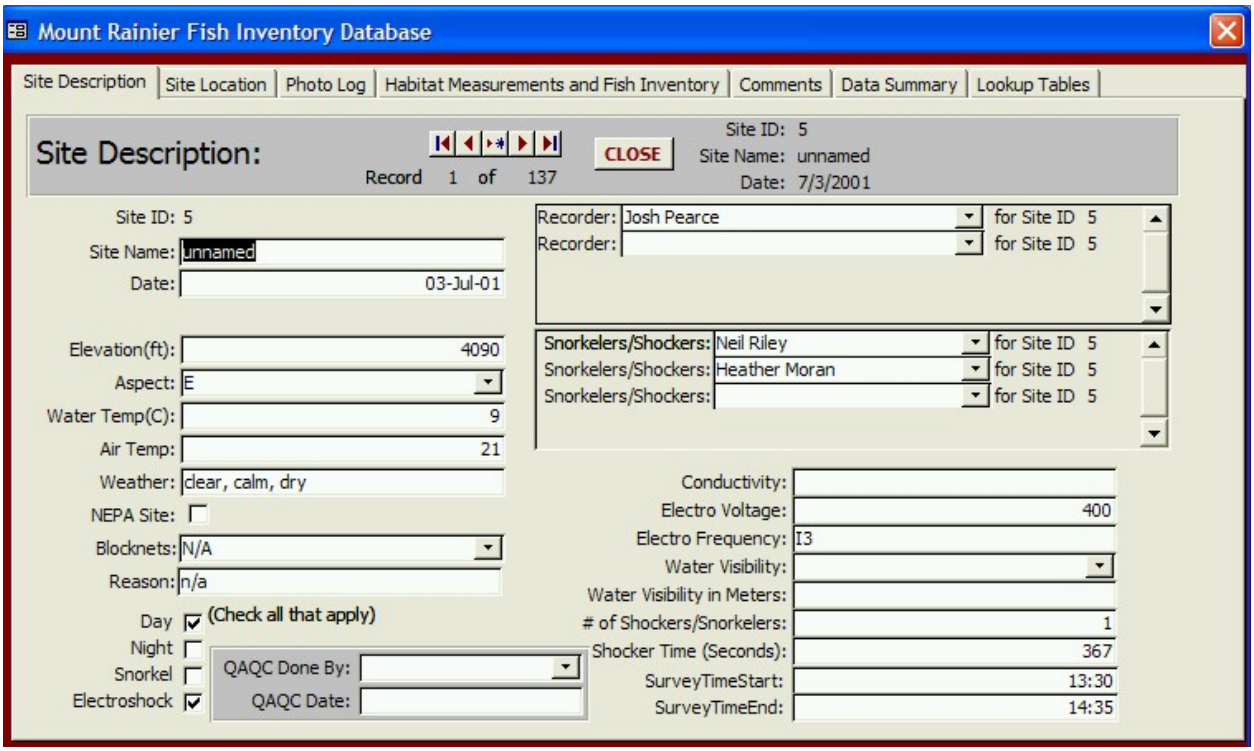

Figure A-1. Site Description data entry form with sample data.

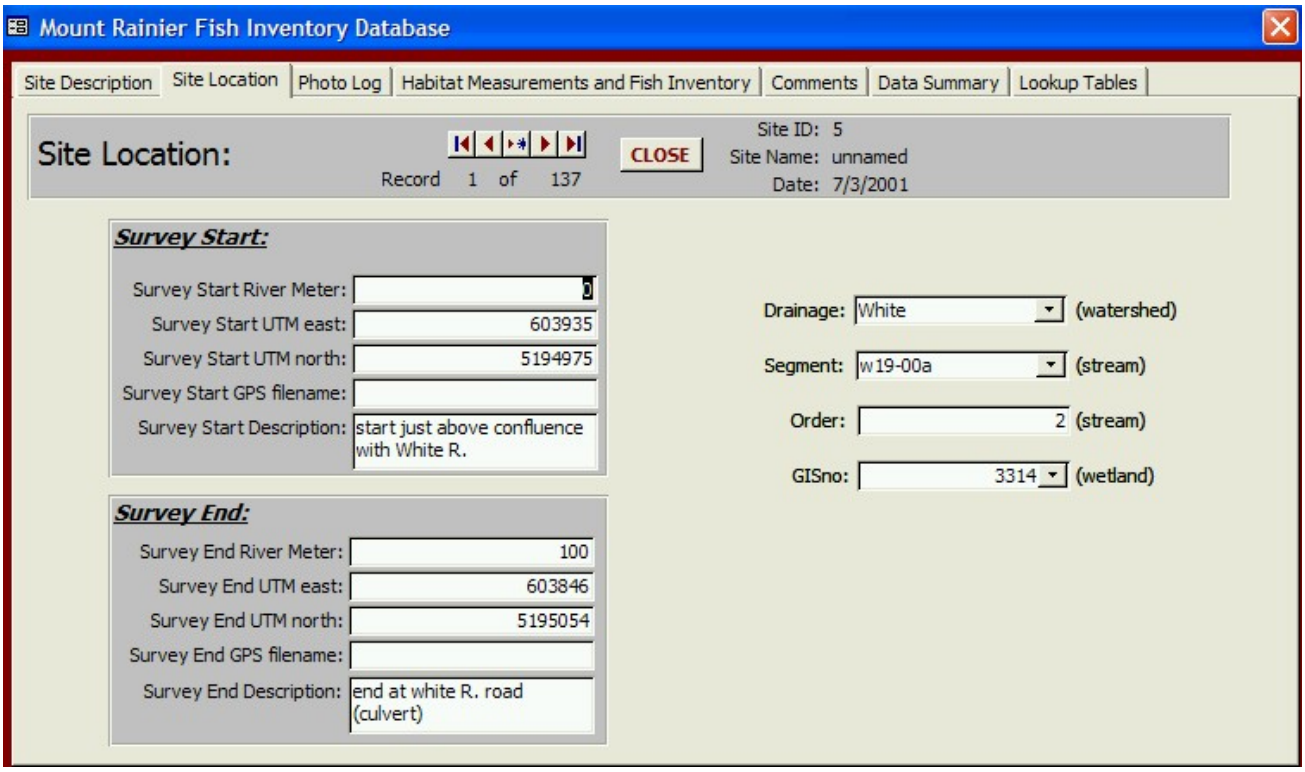

Figure A-2. Site Location data entry form with sample data.

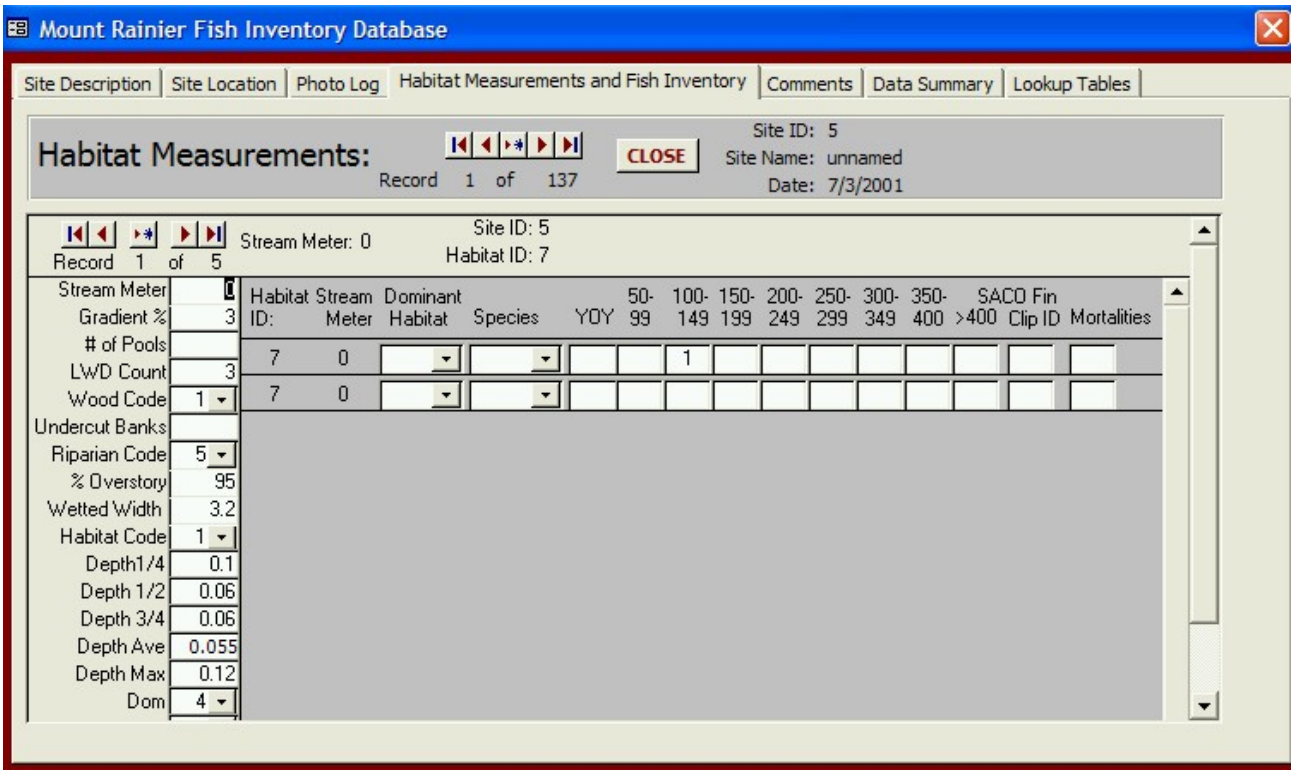

Figure A-3. Habitat measurements and fish inventory data entry form with sample data.

Habitat ID:	Stream Meter	Dominant Habitat	Species	YOY	50-99	100-149	150-199	200-249	250-299	300-349	350-400	>400	SACO Fin Clip ID	Mortalities
7	20		ONMY			1								
9	40		ONMY			1								
10	60		ONMY			3								
11	60		ONMY			3								
7	0					1								
10	40					1								
12	100		ONMY		1	3								1
13	0													
20	100		ONMY	3	5	4	3							
22	100		ONMY		3	1								
23	0	1	ONMY		2	2								
23	0	1	TRSP		1									
24	20	1	ONMY		4	3								
24	20	1	ONCL			1								
24	20	1	TRSP		1									
25	40	1	ONMY		1	2								
25	40	1	TRSP		1									
26	60	1	ONMY		4	4								
26	60	1	ONCL					1						
27	80	1	ONMY		1	1		1						
27	80	1	TRSP		1									
29	20	2	ONMY		5	7		6						
30	20	2	ONMY		2	4		7						
30	20	2	TRSP			1								
30	20	2	ONCL			2								
31	40	2	ONMY		1	5		1						
31	40	2	ONCL					1						
32	60	2	ONMY		4	5		6		2				
32	60	2	TRSP			1		1						
33	80	2	ONMY		6	4		1			1			
39	0	1	TRSP					1						
40	20													
41	40		TRSP		1			1						
43	80	1	TRSP					3						
44	0	1	ONMY		3	2								
45	20	1	ONMY		4	8								1
46	40	1	ONMY		4	5								

Figure A-4. Habitat measurements and fish inventory data entry form with sample data, extended .

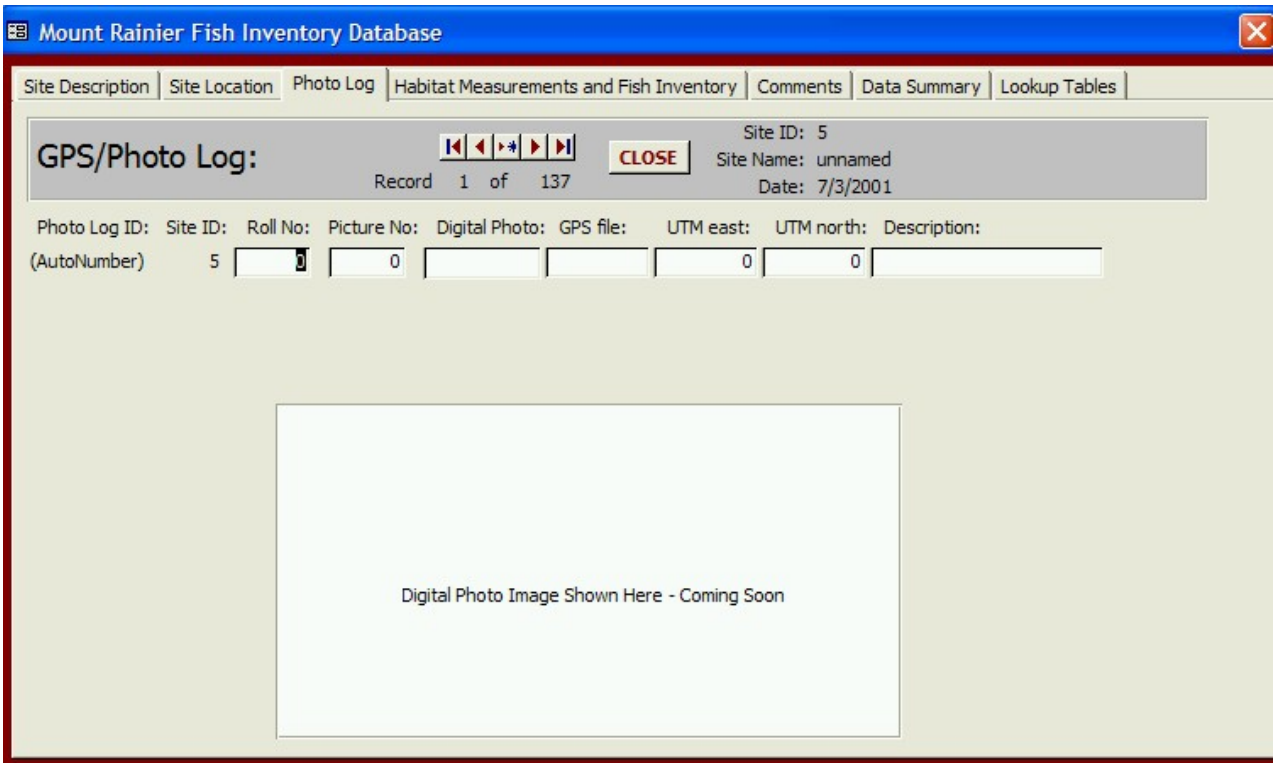

Figure A-5. GPS/Photo log data entry form with sample data.

Figure A-6. Comments entry form with sample data.

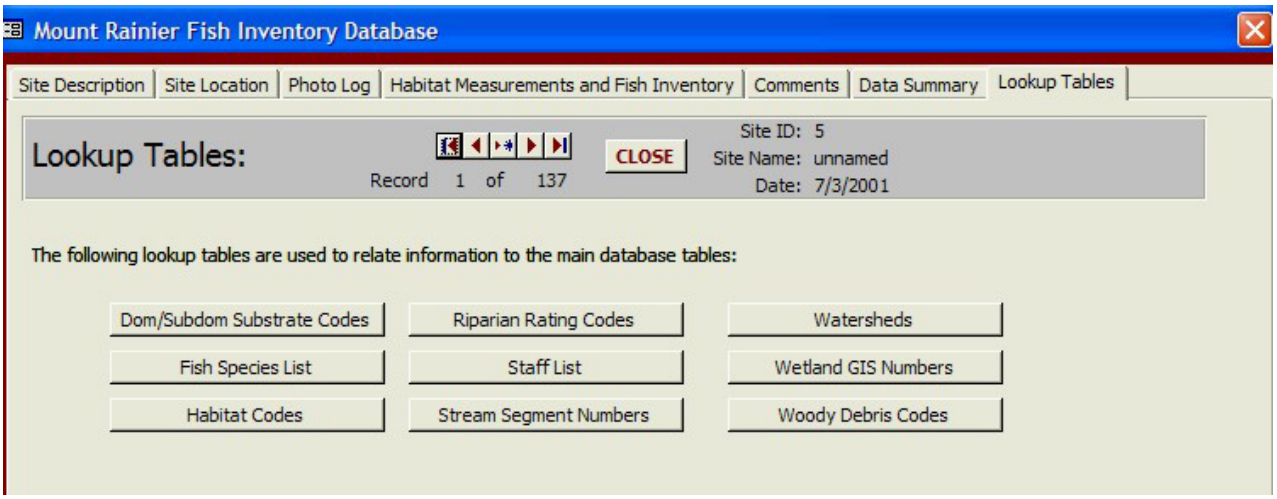

Figure A-7. Lookup tables selection form.

tbl_DomCodesLUT	
DomCodes	**DomDescription**
1	Silt/Clay 0. 001 - 0.062 mm
2	Sand 0.062 – 2.0 mm
3	Fine gravel 2 - 32 mm 0. 08 – 1.3 inches
4	Coarse gravel 32 - 64mm 1. 3 - 2.5inches
5	Pebble 2 - 64 mm 0. 08 – 2.5 inches
6	Cobble 64 – 128 mm 2.5 – 5 inches
7	Rubble 128-256 mm 5 - 10 inches
8	Boulder 256-1,024mm 10 - 40inches
9	Large boulders >1,024 mm 40-160 inches
10	Bedrock

Figure A-8. Lookup table for dominant (substrate) codes form with sample values codes and descriptions.

tbl_RiparianRatingCodeLUT	
RiparianRatingCode	**RiparianDescription**
1	>50% dominant bank material is soil, rock, bridge materials, road materials, culverts.
2	Forbs (herbaceous plants) are the dominant streamside vegetation
3	Grass forms are the dominant streamside vegetation
4	Shrubs are the dominant streamside vegetation.
5	Tree forms are the dominant streamside vegetation.

Figure A-9. Lookup table for riparian (cover) rating codes form with sample values codes and descriptions.

tbl_WatershedsLUT			
WatershedsID	NAME	ACRES	HECTARES
1	Carbon	26320.3	10651.5
9	Cowlitz	28040.1	11347.5
3	Huckleberry	13672.6	5533.14
5	Mowich	19151.7	7750.46
8	Nisqually	35802.6	14488.8
7	Ohanapecosh	41715.5	16881.8
6	Puyallup	13634.8	5517.84
4	West Fork	17821.4	7212.11
2	White	38961.5	15767.2

Figure A-10. Lookup table for watersheds.

tbl_FishSpeciesLUT		
FishSpeciesID	FishSpeciesCodes	FishSpeciesCommon
1	ONCL	Cutthroat trout
2	ONMY	Rainbow trout
3	TRSP	Unidentified trout
4	ONKI	Coho salmon
5	UNSA	Unknown salmonid
6	SACO	Bulltrout
7	SAFO	Brook trout
8	SAXX	Unidentified char
9	PRWI	Mountain whitefish
10	COXX	Unidentified sculpin
11	COGU	Riffle sculpin
12	COAS	Prickly sculpin
13	CORH	Torrent sculpin
14	COCO	Shorthead sculpin
15	COAL	Coastrange sculpin
16	COPE	Reticulate sculpin
17	RHXX	Unidentified dace
18	BUBO	Boreal (Western) Toad
19	DIXX	Cope’s or Pacific giant Salamander
20	PLLA	Larch Mtn. Salamander
21	PLVA	Van Dyke’s salamander
22	ASTR	Tailed frog tadpole
23	ONTS	Chinook Salmon
24	RACA	Cascade Frog
25	NONE	No fish present
26	ONNE	Sockeye

Figure A-11. Species lookup table.

tbl_HabitatCodesLUT	
HabitatCode	**HabitatDescription**
1	Turbulent Fast Water such as falls, cascades, rapids, riffles and chutes.
2	Non-turbulent fast water such as sheets and runs.
3	Scour Pool such as eddies, trenches, mid-channel pools, lateral pools and plunge pools.
4	Dammed Pool such as debris, beaver, landslide, backwater and abandoned / side channel.
5	Pocket water i.e. Boulder garden.

Figure A-12. Habitat codes lookup table.

tbl_WoodCodesLUT	
WoodCodes	**WoodDescription**
1	Wood contributes little to stream habitat complexity, mostly small (10-30 cm, median diameter) single pieces.
2	Wood has combinations of single pieces and small accumulations, providing cover and some complex habitat.
3	Wood present with medium (30-50 cm, median diameter) and large (>50 cm, median diameter) pieces providing accumulations and debris jams, with good cover and complex habitat within the low flow channel.
4	Wood present as large single pieces, accumulations, and jams that provide good cover and complex habitat at all discharge levels.

Figure A-13. Wood codes lookup table.

MORA FISH HABITAT DATASHEET

Pg __1__ of _____
G:\Aquatics\Fish\Fish protocol & forms\snorkel protocol forms
Data entered (date/by): _____
Last Modified: 11 / 2001
QA/QC (date/by): _____

Site Name/Description:_____
Date (dd/mm/yy):_____
Drainage:_____
Segment No._____
Gisno. _____
Recorders:_____

Elevation: _____ ft. gps / topo / alt (circle one)
Aspect: _____
Water temp: _____(°C) Air Temp: _____ (°C)
Start survey at river mile/GPS point:_____
End survey at river mile/GPS point:_____
NEPA Compliance Site: Yes / No

GPS/Photo Log

Roll #	Picture #	GPS FILE	Easting	Northing	Description

Habitat Measurements

Stream Meter (every 20 m)							
Gradient (%)							
# of Pools w/in the 20m interval							
AT EVERY 20 M TRANSECT DO THE FOLLOWING:							
Habitat Code							
Est. Wetted Channel Width (m)							
Depth (m) (1/4)							
Depth (m) (1/2)							
Depth (m) (3/4)							
Avg Depth (m) (1/4, ½, ¾) ÷ 4							
Max Depth (m)							
Dom Substrate							
Subdom Substrate							
LWD Count							
Woody Debris Code							
Undercut Banks (length x width) (m)							
Est. % Overstory							
Side Channel (yes / no)							
Riparian Rating Code							
GPS File (for barriers/falls if present)							

HABITAT CODES

1 Turbulent Fast Water such as falls, cascades, rapids, riffles and chutes.
2 Non-turbulent fast water such as sheets and runs
3 Scour Pool such as eddies, trenches, mid-channel pools, lateral pools and plunge pools
4 Dammed Pool such as debris, beaver, landslide, backwater and abandoned / side channel
5 Pocket water ie. Boulder garden

RIPARIAN RATING CODE

5 Tree forms are the dominant streamside vegetation
4 Shrubs are the dominant streamside vegetation
3 Grass forms are the dominant streamside vegetation
2 Forbs (herbaceous plants) are the dominant streamside vegetation
1 >50% dominant bank material is soil, rock, bridge materials, road materials, culverts

WOOD CODES

1 Wood contributes little to stream habitat complexity, mostly small (10-30 cm, median diameter) single pieces.
2 Wood has combinations of single pieces and small accumulations, providing cover and some complex habitat.
3 Wood present with medium (30-50 cm, median diameter) and large (>50 cm, median diameter) pieces providing accumulations and debris jams, with good cover and complex habitat within the low flow channel (during reduced stream discharge in mid-late summer and early fall, the low flow channel is generally equivalent to the active channel).
4 Wood present as large single pieces, accumulations, and jams that provide good cover and complex habitat at all discharge levels.

DOM/SUBDOM SUBSTRATE CODES:

1 Silt/Clay	0 . 001 - 0.062 mm		5 Pebble	2 - 64 mm	0. 08 – 2 . 5 inches	8 boulder	256-1,024mm 10 - 40inches
2 Sand	0 . 062 – 2 . 0 mm		6 Cobble	64 – 128 mm	2 . 5 – 5 inches	9 Large boulders	>1,024 mm 40-160 inches
3 Fine gravel	2 - 32 mm	0 . 08 – 1 . 3 inches	7 Rubble	128-256 mm	5 - 10 inches	10 Bedrock	
4 Coarse gravel	32 - 64mm	1. 3 - 2 . 5inches					

Figure A-14. Data sheet page 1.

MORA FISH INVENTORY DATASHEET

G:\Aquatics\Fish\Fish protocol & forms\snorkel protocol forms
Last Modified: Spring 2001

Pg __2__ of _____
Data entered (date/by): _____
QA/QC (date/by): _____

Site Name/Description:_____
Date (dd/mm/yy):_____
Drainage:_____
GIS#:_____Segment #: _____

Water temp: _____(°C) Air Temp: _____(°C)
Weather:_____

NEPA Compliance Site: Yes / No
Blocknets: N/A YES NO Reason:_____

Survey: Day / Night Snorkel Electroshock (circle all that apply)
Snorkelers/Shockers:_____
Recorders:_____
Conductivity: _____
Electroshocker voltage/frequency: _____
Water Visibility: Poor / Fair / Good / Very Good / Excellent
Approx. visibility measured in meters: _____
Start survey at river mile/GPS point:_____
End survey at river mile/GPS point:_____
Survey effort (# of shockers/snorkelers):____Time(seconds):_____

Time of survey - Start:_____ End:_____

Stream Meter (20 m increments)	Dominant Habitat unit (w/i 20m)	Species	YOY (<50mm)	50-99 mm	100– 49 mm	150–199 mm	200-249 mm	250-299 mm	300-349 mm	350-400 mm	>400mm	SACO FIN CLIP ID #	# of mortalities

Data Summary:

Fish Species	Total # of each species

Comments:

Genetic fin clip all SACO and assign a sample number to each on the Fin clip log AND on this form! Also measure total length (snout to tip of tail) of all SACO.

SPECIES CODES:

ONCL – Cutthroat trout
ONMY – Rainbow trout
TRSP - Unidentified trout
ONKL – Coho salmon
UNSA – Unknown salmonid

SACO - Bulltrout
SAFO – Brook trout
SAXX – Unidentified char
PRWI – Mountain whitefish

COXX – Unidentified sculpin
COGU – Riffle sculpin
COAS – Prickly sculpin
CORH – Torrent sculpin

COCO – Shorthead sculpin
COAL – Coastrange sculpin
COPE – Reticulate sculpin
RHXX – Unidentified dace

BUBO – Boreal (Western) Toad
DIXX – Cope's or Pacific giant salamander (collect specimen !)
PLLA – Larch Mtn. Salamander
PLVA– Van Dyke's salamander

Attached Map is pg _____of _____

Figure A-15. Data sheet page 2.

Appendix B. Survey Site Locations and Environmental Attributes

Table B-1. All Survey Site Locations. Segment # is the assigned GIS stream segment code. Stream Order was obtained from the park GIS (method described by Strahler 1952). UTM E and UTM N are the Universal Transverse Mercator points (NAD 1927, Zone 10) at the starting point of the survey. A description of the starting point of the survey is described for most sites.

Site Name	Sample Date	Drainage	Segment Number	Stream Order	Elevation (feet)	Survey Start Point UTM E	Survey Start Point UTM N
June Creek	04-Jun-02	Carbon	c03-00a	1	1750	582557	5204961
June Creek	18-Jul-02	Carbon	c03-00a	1	1750	582557	5176423
Falls Creek	04-Jun-02	Carbon	c05-00a	2	1980	582557	5205115
Ranger Creek	18-Jul-02	Carbon	c06-00a	1	2080	587440	5204873
Ranger Creek	04-Jun-02	Carbon	c06-00a	1	2080	587440	5204877
Unnamed: across from Chenuis	18-Jul-02	Carbon	c06-02a	1	2160	587987	5204695
Ipsut Creek	25-Jul-01	Carbon	c08-00a	2	2380	588971	5202990
Ipsut Creek (120m below waterfall)	25-Jul-01	Carbon	c08-00a	2	2380	588939	5202719
Ipsut Creek	07-Aug-01	Carbon	c08-00a	2	2780	588771	5202054
Ipsut Creek (200 feet above waterfall)	07-Aug-01	Carbon	c08-00a	2	2800	588758	5202004
Spunkwash Creek	14-Jul-01	Carbon	c11-00a	2	2840	591915	5201439
Spunkwash Creek	17-Jul-02	Carbon	c11-00a	2	2880	591961	5201363
Unnamed	17-Jul-02	Carbon	c12-00a	1	2880	591893	5201501
Cataract Creek	17-Jul-02	Carbon	c13-00a	2	3150	591548	5200207
Lake Outlet Green Lake / Ranger Creek	01-Jul-03	Carbon	c06-00a	1	3194	587089	5203482
Tolmie Creek	26-Jul-01	Carbon	c01-00c	2	3260	582433	5201748
Tolmie Creek	26-Jul-01	Carbon	c01-00c	2	3280	582519	5201795
Unnamed: Cowlitz tributary	28-Jun-01	Cowlitz	z06-00a	3	2280	604718	5176893
Steven's Creek	09-Jul-02	Cowlitz	z08-00a	3	2340	604367	5177741
Taos Creek	07-Aug-02	Cowlitz	z05-00b	3	2460	604013	5176505
Stevens Creek	01-Aug-01	Cowlitz	z08-00a	3	2600	604004	5178435

Site Name	Sample Date	Drainage	Segment Number	Stream Order	Elevation (feet)	Survey Start Point UTM E	Survey Start Point UTM N
Maple Creek	02-Aug-01	Cowlitz	z08-01a	2	2680	602710	5179018
Stevens Creek	09-Aug-01	Cowlitz	z08-00b	3	3100	601087	5179721
Nickel Creek	20-Jun-01	Cowlitz	z09-00a	3	3340	605077	5180509
Nickel Creek	20-Jun-01	Cowlitz	z09-00a	3	3360	605078	5180508
Nickel Creek	06-Aug-01	Cowlitz	z09-00c	3	3400	605024	5181157
Twin Falls Creek	08-Aug-01	Cowlitz	z09-02a	2	3400	605024	5181174
Unnamed -tributary to Nickel Ck	08-Aug-01	Cowlitz	z09-04a	1	3400	605019	5181166
Nickel Creek	06-Aug-01	Cowlitz	z09-00d	3	3480	605051	5181309
Unnamed	29-Jun-01	Cowlitz	z08-05a	1	4480	599535	5179230
Lake Outlet Louise Lake / Sunbeam Creek	26-Jun-03	Cowlitz	z08-06c	2	4596	598251	5180582
Sunbeam Creek	21-Jun-01	Cowlitz	z08-06c	2	4600	598063	5180446
Sunbeam Creek	21-Jun-01	Cowlitz	z08-06c	2	4640	598064	5180470
Lake outlet Snow Lake / Unicorn Creek	02-Jul-03	Cowlitz	z08-04b	1	4678	599521	5179122
Lake outlet Snow Lake / Unicorn Creek	17-Jul-03	Cowlitz	z08-04b	1	4678	599521	5179122
Lake outlet Cliff Lake	31-Jul-03	Cowlitz			5221		
Huckleberry Creek	14, 15, 16, 22-Aug-01	Huckleberry	h00-00b to h00-00j	4	3170	605067	5205329
Ada Creek	15-Aug-01	Huckleberry	h04-00c	1	3300	604361	5204237
Unnamed	24-Jul-01	Huckleberry	h12-00a	1	4350	603163	5199939
Lake outlet Eleanor Lake (Eleanor Creek)	24-Aug-03	Huckleberry	h01-00b	2	4983	602355	5204872
Lake outlet Lower Pallisades Lake	20-Aug-03	Huckleberry	h02-00h	1	5463	607039	5201187
Lake outlet lh18	26-Aug-03	Huckleberry	h12-00a	1	5532	602322	5199558
Unnamed	22-Jul-01	Huckleberry	h16-00a	2	5600	602871	5198310
Unnamed	23-Jul-01	Huckleberry	h16-01a	2	5640	602808	5198262
Unnamed	31-Jul-02	Mowich	m04-00a	1	2500	583622	5196156

Site Name	Sample Date	Drainage	Segment Number	Stream Order	Elevation (feet)	Survey Start Point UTM E	Survey Start Point UTM N
Mowich River side Channel	31-Jul-02	Mowich	m00-00l	2	2520	584051	5196142
Unnamed: trib to Mowich	31-Jul-02	Mowich	m04-00a	1	2780	584432	5195124
Unnamed: Mowich River trib	30-Jul-02	Mowich	m07-00a	1	3070	585183	5194397
Meadow Creek	18-Jul-01	Mowich	m02-***	2	3400	583192	5197597
Meadow Creek	18-Jul-01	Mowich	m02-***	2	3400	583292	5197597
Meadow Creek	12-Aug-02	Mowich	m02-00c	1	3470	584039	5198751
Lake outlet Golden Lakes (lm16) / Rushingwater creek	27-Aug-03	Mowich	m01-***	1	4228	583305	5193490
Lake outlet Mowich Lake / Crater Creek	04-Aug-03	Mowich	m05-01b	1	4927		
Crater Creek	17-Jul-01	Mowich	m05-01b	1	4929	586559	5198150
Tahoma Creek	02-Oct-02	Nisqually	n03-00b	3	2000	584018	5176419
Unnamed: trib to Nisqually	02-Jul-01	Nisqually	n03-01a	1	2020	584107	5177171
Kautz Creek	02-Oct-02	Nisqually	n05-00a	3	2100	587194	5176184
Unnamed	10-Jul-02	Nisqually	n03-00a	1	2175	584065	5176389
Tahoma Creek side channel	10-Jul-02	Nisqually	n03-00a	3	2280	583961	5176423
Unnamed	02-Jul-01	Nisqually	n03-03a	1	2320	585531	5178553
Unnamed	02-Jul-01	Nisqually	n03-04a	1	2320	585665	5179107
Unnamed	11-Jul-02	Nisqually	n03-02a	1	2400	585559	5178270
Fish Creek	02-Jul-01	Nisqually	n03-05a	2	2420	585868	5179077
Pyramid Creek	05-Aug-01	Nisqually	n05-01a	3	2740	588452	5178227
Tenas Creek	08-Aug-01	Nisqually	n02-00b	1	2780	582553	5177855
Unnamed	11-Jul-01	Nisqually	n03-08a	1	2800	586106	5180745
Unnamed: Nisqually trib.	09-Jul-01	Nisqually	n11-00a	1	2860	591333	5177937
Unnamed: Nisqually trib.	09-Jul-01	Nisqually	n12-00a	1	2860	591333	5177937
Unnamed	01-Jul-02	Nisqually	n03-07a	1	2920	585112	5182005
Unnamed	01-Jul-02	Nisqually	n03-07a	1	2920	584977	5181652
Tahoma side channel: Westside road	01-Jul-02	Nisqually	n03-00g	3	3120	585457	5182374

Site Name	Sample Date	Drainage	Segment Number	Stream Order	Elevation (feet)	Survey Start Point UTM E	Survey Start Point UTM N
Paradise River (Carter Falls -200)	03-Jul-01	Nisqually	n13-00b	3	3180	592775	5179746
Unnamed:-Longmire CG	25-Jun-02	Nisqually	n10-00a	1	3300	590193	5176387
Van Trump Creek	10-Jun-02	Nisqually	n14-00a	3	3300	592894	5180327
Van Trump Creek	22-Aug-02	Nisqually	n14-00a	3	3400	593164	5180883
Pyramid Creek	08-Aug-02	Nisqually	n05-01d	3	3600	590552	5181178
Devil's Dream Creek	08-Aug-02	Nisqually	n05-04b	1	3600	590552	5181178
Paradise River (Carter Falls -100)	03-Jul-01	Nisqually	n13-00b	3	3600	593984	5179564
Fischer's Hornpipe Creek	08-Aug-02	Nisqually	n05-06a	2	3646	590712	5181193
Unnamed	20-Aug-02	Nisqually	n15-00a	1	3760	594254	5181241
Unnamed	20-Aug-02	Nisqually	n15-00a	1	3760	594280	5181380
Paradise River: below Narada Falls	06-Aug-01	Nisqually	n13-00c	3	3900	595000	5180256
Paradise River: below Narada Falls	06-Aug-01	Nisqually	n13-00c	3	3940	594997	5180870
Lake outlet Lake George	09-Jul-03	Nisqually			4291	583863	5182394
Paradise River	20-Aug-02	Nisqually	n13-00c	3	4500	595733	5180625
Paradise River (above Narada Falls +100)	19-Jul-01	Nisqually	n13-00c	3	4555	595856	5180845
Paradise River (above Narada Falls +300)	19-Jul-01	Nisqually	n13-00c	3	4570	595974	5181001
Paradise River	20-Aug-02	Nisqually	n13-00c	3	4600	595876	5180816
Paradise River (Meadows +100)	23-Jul-01	Nisqually	n13-00c	3	4770	596796	5181169
Paradise River (Meadows +300)	23-Jul-01	Nisqually	n13-00c	3	4800	597025	5181453
Dead Horse Creek	22-Aug-02	Nisqually	n17-00a	1	5240	595571	5181816
Ohanapecosh River	11-Jul-01	Ohanapecosh	o00-***	5	1700	608729	5174747
Unnamed	18-Jun-01	Ohanapecosh	o03-01a	1	1760	609330	5176703
Ohanapecosh River	25-Jul-01	Ohanapecosh	o00-00c	5	1840	609329	5176640
Ohanapecosh River	19-Jun-01	Ohanapecosh	o00-00c	5	1840	610136	5177985
Unnamed	18-Jun-01	Ohanapecosh	o02-00a	1	1840	608913	5175745
Unnamed	18-Jun-01	Ohanapecosh	o03-00b	1	1840	609353	5176730

Site Name	Sample Date	Drainage	Segment Number	Stream Order	Elevation (feet)	Survey Start Point UTM E	Survey Start Point UTM N
Ohanapecosh River	10-Sep-01	Ohanapecosh	o00-00g	5	1900	610129	5178399
Unnamed -Ohanapecosh CG tributary	06-Aug-02	Ohanapecosh	o29-00a	1	1930	609368	5176565
Unnamed- loop C Ohanapecosh campground	10-Jul-01	Ohanapecosh	o29-00a	1	2000	609368	5176565
Unnamed	21-Jun-01	Ohanapecosh	o03-00b	1	2040	609329	5176702
Unnamed	10-Jul-01	Ohanapecosh	o06-00a	1	2050	609991	5177525
Laughingwater Creek- night dive	29-Aug-01	Ohanapecosh	o07-00a	3	1990	610150	5178010
Laughingwater Creek	19-Jun-01	Ohanapecosh	o07-00a	3	2075	610130	5177987
Falls Creek	10-Jul-01	Ohanapecosh	o09-00a	1	2310	609936	5179326
Laughingwater Creek	29-Jun-01	Ohanapecosh	o07-00a	3	2350	610139	5178004
Unnamed	20-Jun-01	Ohanapecosh	o15-00a	2	2350	610318	5183134
Chinook Ck- Stafford Falls	06-Sep-01	Ohanapecosh	o16-00d	4	2700	610564	5186031
Kotsuck Ck- night dive	05-Sep-01	Ohanapecosh	o16-05a	3	2840	611347	5187811
Kotsuck Creek	05-Sep-01	Ohanapecosh	o16-05a	3	2840	611347	5187811
Laughingwater Creek	21-Aug-02	Ohanapecosh	o07-00b	3	2880	611624	5178897
Kotsuck Creek	20-Jun-01	Ohanapecosh	o16-05a	3	2900	611452	5187624
Unnamed	21-Jun-01	Ohanapecosh	o00-***	0	3160	607833	5174714
Boundary Creek	02-Jul-02	Ohanapecosh	o16-06a	2	3240	610689	5188138
Laughingwater Creek (above falls)	21-Aug-02	Ohanapecosh	o07-00c	3	3520	612625	5179364
Unnamed	02-Jul-02	Ohanapecosh	o16-16a	2	3600	613233	5187032
Chinook Creek (between hwy 410)	15-Aug-02	Ohanapecosh	o16-00h	1	4910	612555	5191197
Tipsoo Lake outlet	15-Aug-02	Ohanapecosh	o16-00h	1	5240	612888	5191529
Chinook ck- Tipsoo Lk. outlet	30-Aug-01	Ohanapecosh	o16-00h	1	5276	612892	5191515
St. Andrew's Creek	10-Jul-01	Puyallup	p03-00e	1	5310	586278	5186820
White River: Chinook survey	22-May-02	White	w00-***	4	2645	611445	5205277
Unnamed -tributary to White River	22-May-02	White	w04-00a	2	2700	611234	5204531
Deadwood Creek	28-Jun-01	White	w12-00a	2	2940	610748	5196071
Deadwood Creek	28-Jun-01	White	w12-00a	2	3000	610858	5195994

Site Name	Sample Date	Drainage	Segment Number	Stream Order	Elevation (feet)	Survey Start Point UTM E	Survey Start Point UTM N
Unnamed	05-Aug-02	White	w14-00a	1	3050	610594	5196166
Unnamed -tributary to White River	05-Aug-02	White	w14-00a	1	3280	609769	5195423
Unnamed - tributary to White River	05-Aug-02	White	w14-00a	1	3320	610705	5196462
Klickitat Creek	27-Aug-02	White	w13-00a	2	3370	610586	5195798
Klickitat Creek	26-Jun-01	White	w13-00a	2	3410	610704	5195393
Klickitat Creek	28-Aug-02	White	w13-00a	2	3440	610723	5195614
Shaw Creek	30-Jul-01	White	w15-00a	2	3500	609305	5194954
Unnamed- near Deadwood Ck	31-Jul-01	White	w11-00a	1	3600	610984	5197033
Littorals outlet	27-Aug-02	White	w16-00a	1	3670	607395	5194127
Unnamed	18-Jul-01	White	w17-01a	1	3800	605797	5192980
Fryingpan Creek	28-Aug-01	White	w17-00a	3	3920	606423	5193974
Wright Creek	18-Jul-01	White	w17-02a	2	3920	605604	5192304
Unnamed	03-Jul-01	White	w18-00a	1	4000	604573	5195055
Unnamed	18-Jul-01	White	w17-03a	1	4020	605103	5192006
Unnamed	03-Jul-01	White	w19-00a	2	4090	603935	5194975
Inter Fork White	25-Sep-01	White	w21-00a	3	4330	603080	5195043
Unnamed -Inter Fork White trib.	09-Jul-01	White	w21-01a	1	4400	602447	5194768
Buck Creek	19-Jul-01	White	w01-00b	1	4900	608445	5205377
Outlet Harry Lake	02-Jul-01	White	w06-02i	1	5460	607324	5199072
Unnamed -tributary to Inter Fork	26-Aug-02	White	w21-04b	1	5500	599641	5194022
Outlet Tom Lake	02-Jul-01	White	w06-02e	1	5550	607464	5199099
Unnamed -tributary to Inter Fork	26-Aug-02	White	w21-06a	1	5600	599506	5193841
Unnamed: stream from Hidden Lake	02-Jul-01	White	w06-02g	1	5620	607097	5199137

Table B-2. Non-randomly selected sites surveyed.

Site Name	GIS Segment Number
Lake outlet Cliff Lake	N/A
Lake outlet Lake George	N/A
June Creek-night snorkel	c03-00a
Lake outlet Green Lake / Ranger Creek	c06-00a
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b
Lake outlet Lower Pallisades Lake	h02-00h
Lake outlet lh18	h12-00a
Lake outlet Golden Lakes lm16 / Rushingwater creek	m01-***
Lake outlet Mowich Lake / Crater Creek	m05-01b
Unnamed	n03-07a
Unnamed:-Longmire CG	n10-00a
Paradise River	n13-00c
Van Trump Creek	n14-00a
Unnamed	n15-00a
Dead Horse Creek	n17-00a
Laughingwater Creek	o07-00a
Falls Creek	o09-00a
Chinook Creek (between hwy 410)	o16-00h
Tipsoo Lake outlet	o16-00h
Unnamed -Ohanapecosh CG tributary	o29-00a
Outlet Tom Lake	w06-02e
Outlet Harry Lake	w06-02i
Klickitat Creek	w13-00a
Littorals outlet	w16-00a
Unnamed -trib to Inter Fork	w21-04b
Unnamed -trib to Inter Fork	w21-06a
Steven's Creek	z08-00a
Lake outlet Snow Lake / Unicorn Creek	z08-04b
Lake outlet Louise Lake / Sunbeam Creek	z08-06c

Appendix C. Dominant Habitat and Individual Fish Observed or Captured by Stream Segment

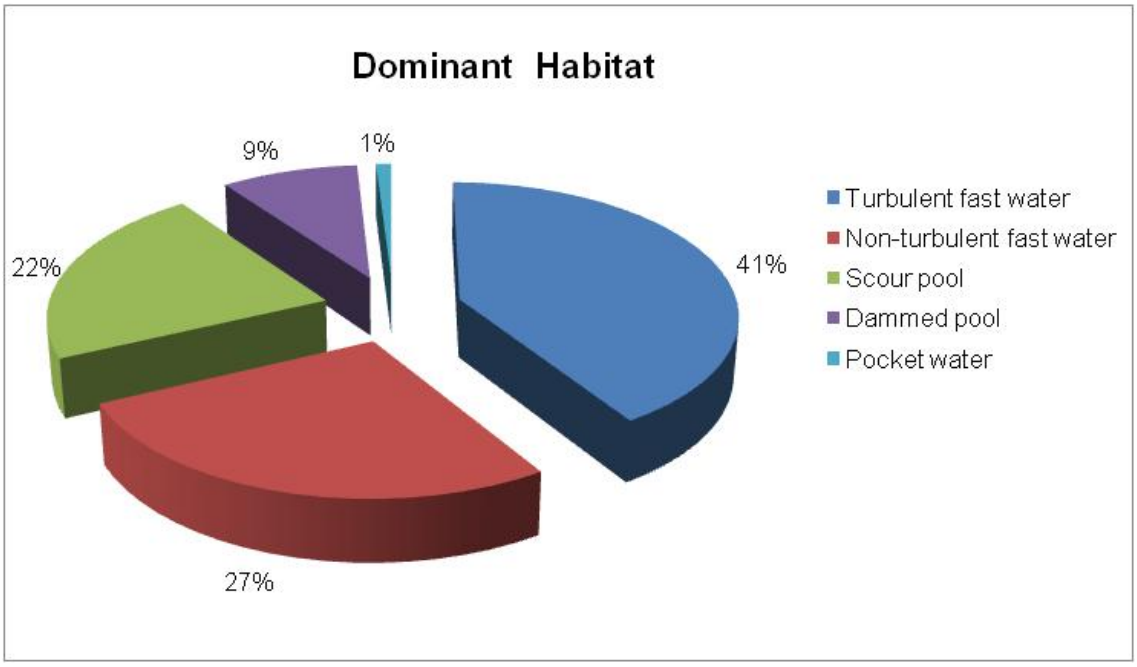

Figure C-1. Percent of dominant habitat at survey locations.

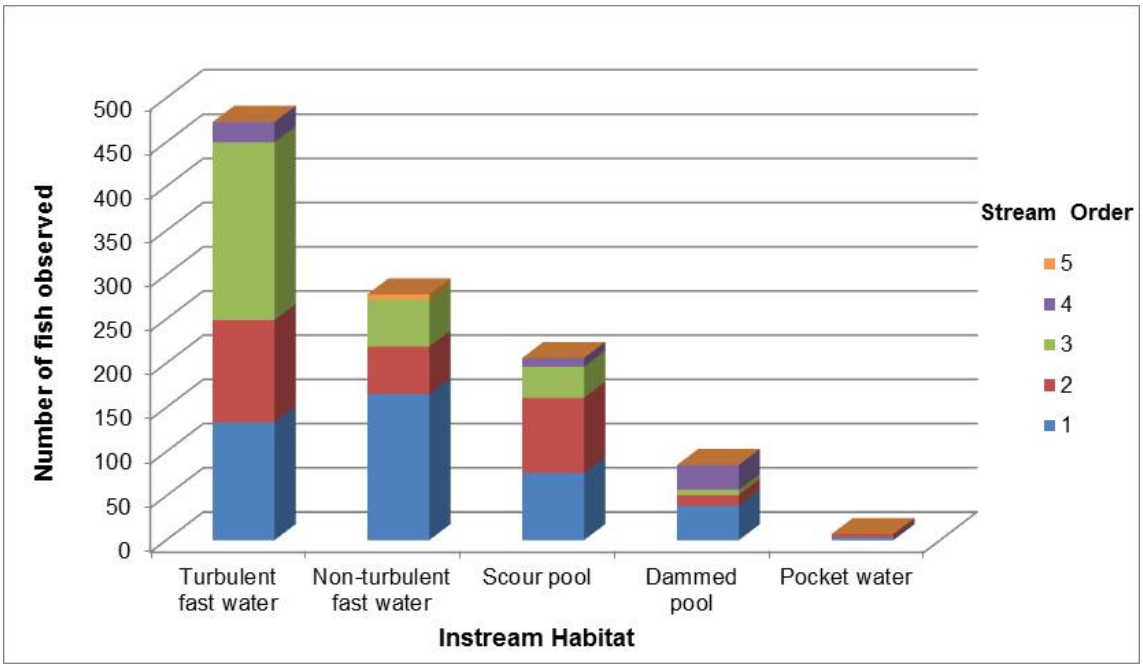

Figure C-2. Comparison of dominant habitat with stream order at survey locations.

Table C-1. Dominant habitat and individual fish observed by stream segment. Categories: 1 = Turbulent Fast Water such as falls, cascades, rapids, riffles and chutes; 2 = Non-turbulent fast water such as sheets and runs; 3 = Scour Pool such as eddies, trenches, mid-channel pools, lateral pools and plunge pools; 4 = Dammed Pool such as debris, beaver, landslide, backwater and abandoned / side channel; 5 = Pocket water i.e. Boulder garden). Species codes: COXX = *Cottus sp*. (sculpin species). COCO = *Cottus confusus* (shorthead sculpin). ONCL = *Oncorhynchus clarkii* (cutthroat) including all subspecies. ONMY = *Oncorhynchus mykiss* (rainbow trout). ONTS = *Oncorhynchus tshawytscha* (Chinook salmon). SACO = *Salvelinus confluentus* (bull trout). SAFO = *Salvelinus fontinalis* (eastern brook trout). SAXX = unidentified char. TRSP = unidentified trout. UNSA = unidentified salmonid (trout). Blank fields= non-detections.

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Lake outlet Lake George		09-Jul-2003	COXX	3	Nisqually
Tolmie Creek	c01-00c	26-Jul-2001	UNSA	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001		3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	1	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
Tolmie Creek	c01-00c	26-Jul-2001	SAFO	3	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002		1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	ONCL	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	COXX	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	ONCL	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	ONCL	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	TRSP	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	ONCL	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	ONCL	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	COXX	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	SAFO	1	Carbon
June Creek-night snorkel	c03-00a	18-Jul-2002	ONCL	1	Carbon
Ranger Creek	c06-00a	18-Jul-2002	ONCL	1	Carbon
Ranger Creek	c06-00a	04-Jun-2002		4	Carbon
Ranger Creek	c06-00a	18-Jul-2002	COXX	1	Carbon
Ranger Creek	c06-00a	18-Jul-2002	SAXX	1	Carbon
Lake outlet Green Lake / Ranger Creek	c06-00a	01-Jul-2003	TRSP	1	Carbon
Lake outlet Green Lake / Ranger Creek	c06-00a	01-Jul-2003	ONCL	1	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	SAFO	2	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	COXX	2	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	ONCL	2	Carbon

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	COXX	2	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	COXX	2	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	SACO	2	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	COXX	4	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	SAFO	4	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002		4	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	UNSA	1	Carbon
Unnamed: across from Chenuis	c06-02a	18-Jul-2002	SAFO	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	ONCL	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	UNSA	3	Carbon
Ipsut Creek	c08-00a	07-Aug-2001		2	Carbon
Ipsut Creek (above falls +200)	c08-00a	07-Aug-2001		1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	SAFO	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001		3	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	SAFO	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	ONCL	1	Carbon
Ipsut Creek	c08-00a	25-Jul-2001	COCO	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	TRSP	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	ONCL	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	COCO	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	SACO	3	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	ONCL	3	Carbon
Ipsut Creek (above falls +200)	c08-00a	07-Aug-2001		4	Carbon
Ipsut Creek (above falls +200)	c08-00a	07-Aug-2001	SAFO	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	SACO	1	Carbon
Ipsut Creek	c08-00a	25-Jul-2001	COXX	1	Carbon
Ipsut Creek (above falls +200)	c08-00a	07-Aug-2001	SAFO	1	Carbon
Ipsut Creek	c08-00a	07-Aug-2001		3	Carbon
Ipsut Creek	c08-00a	07-Aug-2001	SAFO	1	Carbon
Ipsut Creek (120m below waterfall)	c08-00a	25-Jul-2001	ONCL	1	Carbon
Ipsut Creek	c08-00a	25-Jul-2001	COXX	2	Carbon
Ipsut Creek	c08-00a	25-Jul-2001	ONCL	1	Carbon
Ipsut Creek	c08-00a	25-Jul-2001	COXX	1	Carbon
Ipsut Creek	c08-00a	25-Jul-2001	ONCL	1	Carbon
Ipsut Creek	c08-00a	25-Jul-2001	COXX	1	Carbon
Ipsut Creek	c08-00a	07-Aug-2001	SAFO	1	Carbon
Ipsut Creek	c08-00a	07-Aug-2001		2	Carbon
Ipsut Creek (above falls +200)	c08-00a	07-Aug-2001	SAXX	2	Carbon
Ipsut Creek (above falls +200)	c08-00a	07-Aug-2001		1	Carbon

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Ipsut Creek	c08-00a	25-Jul-2001	COXX	1	Carbon
Spunkwash Creek	c11-00a	14-Jul-2001		1	Carbon
Spunkwash Creek	c11-00a	14-Jul-2001		1	Carbon
Spunkwash Creek	c11-00a	14-Jul-2001		3	Carbon
Spunkwash Creek	c11-00a	14-Jul-2001		1	Carbon
Spunkwash Creek	c11-00a	14-Jul-2001		3	Carbon
Unnamed	c12-00a	17-Jul-2002	SACO	2	Carbon
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001		4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001		1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	COCO	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	TRSP	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	TRSP	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	TRSP	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	TRSP	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	3	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	TRSP	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001		1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001		1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	4	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Huckleberry Creek	h00-00b	14-Aug-2001	ONCL	1	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	TRSP	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	ONMY	3	Huckleberry

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Eleanor Creek	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	TRSP	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	ONMY	3	Huckleberry
Lake outlet Eleanor Lake (Eleanor Creek)	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Eleanor Creek	h01-00b	24-Aug-2003	UNSA	3	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003	UNSA	4	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003	SAFO	2	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003	SAFO	1	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003	SAFO	2	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003	UNSA	2	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003		4	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003	TRSP	2	Huckleberry
Lake outlet Lower Pallisades Lake	h02-00h	20-Aug-2003	TRSP	2	Huckleberry
Ada Creek	h04-00c	15-Aug-2001	COCO	1	Huckleberry
Ada Creek	h04-00c	15-Aug-2001	COCO	2	Huckleberry
Lake outlet lh18	h12-00a	26-Aug-2003	UNSA	2	Huckleberry
Lake outlet lh18	h12-00a	26-Aug-2003	UNSA	2	Huckleberry
Lake outlet lh18	h12-00a	26-Aug-2003	SAFO	2	Huckleberry
Lake outlet lh18	h12-00a	26-Aug-2003	SAFO	2	Huckleberry
Lake outlet Golden Lakes lm16 / Rushingwater creek	m01-***	27-Aug-2003	UNSA	2	Mowich
Lake outlet Golden Lakes lm16 / Rushingwater creek	m01-***	27-Aug-2003	SAFO	3	Mowich
Lake outlet Golden Lakes lm16 / Rushingwater creek	m01-***	27-Aug-2003	SAFO	2	Mowich
Lake outlet Golden Lakes lm16 / Rushingwater creek	m01-***	27-Aug-2003	UNSA	2	Mowich
Lake outlet Golden Lakes lm16 / Rushingwater creek	m01-***	27-Aug-2003	SAFO	3	Mowich
Meadow Creek	m02-***	18-Jul-2001	SAFO	2	Mowich
Meadow Creek	m02-***	18-Jul-2001		3	Mowich
Meadow Creek	m02-***	18-Jul-2001		3	Mowich
Meadow Creek	m02-***	18-Jul-2001		2	Mowich
Meadow Creek	m02-***	18-Jul-2001	SAFO	3	Mowich
Meadow Creek	m02-***	18-Jul-2001		3	Mowich

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Meadow Creek	m02-***	18-Jul-2001			Mowich
Meadow Creek	m02-***	18-Jul-2001	SAFO	3	Mowich
Meadow Creek	m02-***	18-Jul-2001		3	Mowich
Meadow Creek	m02-***	18-Jul-2001	SAFO	2	Mowich
Meadow Creek	m02-***	18-Jul-2001		2	Mowich
Meadow Creek	m02-00c	12-Aug-2002	SAFO	1	Mowich
Meadow Creek	m02-00c	12-Aug-2002	SAFO	1	Mowich
Meadow Creek	m02-00c	12-Aug-2002	SAFO	2	Mowich
Meadow Creek	m02-00c	12-Aug-2002	SAFO	1	Mowich
Unnamed: trib to Mowich	m04-00a	31-Jul-2002	TRSP	2	Mowich
Unnamed	m04-00a	31-Jul-2002	COXX	2	Mowich
Unnamed	m04-00a	31-Jul-2002	COXX	2	Mowich
Unnamed	m04-00a	31-Jul-2002	COXX	2	Mowich
Unnamed	m04-00a	31-Jul-2002	TRSP	2	Mowich
Unnamed: trib to Mowich	m04-00a	31-Jul-2002	TRSP	2	Mowich
Unnamed	m04-00a	31-Jul-2002	TRSP	1	Mowich
Unnamed	m04-00a	31-Jul-2002		2	Mowich
Unnamed	m04-00a	31-Jul-2002	COXX	2	Mowich
Unnamed	m04-00a	31-Jul-2002	TRSP	2	Mowich
Unnamed	m04-00a	31-Jul-2002		2	Mowich
Unnamed	m04-00a	31-Jul-2002	TRSP	2	Mowich
Unnamed	m04-00a	31-Jul-2002	COXX	2	Mowich
Unnamed	m04-00a	31-Jul-2002	COXX	2	Mowich
Unnamed	m04-00a	31-Jul-2002	ONCL	2	Mowich
Unnamed	m04-00a	31-Jul-2002		2	Mowich
Unnamed	m04-00a	31-Jul-2002	TRSP	2	Mowich
Unnamed	m04-00a	31-Jul-2002	COXX	2	Mowich
Lake outlet Mowich Lake/Crater Creek	m05-01b	04-Aug-2003	COXX	3	Mowich
Lake outlet Mowich Lake/Crater Creek	m05-01b	04-Aug-2003	COXX	1	Mowich
Crater Creek	m05-01b	17-Jul-2001		4	Mowich
Crater Creek	m05-01b	17-Jul-2001		2	Mowich
Lake outlet Mowich Lake/Crater Creek	m05-01b	04-Aug-2003	COXX	3	Mowich
Crater Creek	m05-01b	17-Jul-2001		4	Mowich
Crater Creek	m05-01b	17-Jul-2001		3	Mowich
Crater Creek	m05-01b	17-Jul-2001		4	Mowich
Unnamed: Mowich River trib	m07-00a	30-Jul-2002	ONCL	2	Mowich
Unnamed: Mowich River trib	m07-00a	30-Jul-2002	ONCL	2	Mowich
Unnamed: Mowich River trib	m07-00a	30-Jul-2002	TRSP	2	Mowich
Unnamed: Mowich River trib	m07-00a	30-Jul-2002	UNSA	4	Mowich

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Unnamed: Mowich River trib	m07-00a	30-Jul-2002	ONCL	4	Mowich
Unnamed: Mowich River trib	m07-00a	30-Jul-2002	TRSP	2	Mowich
Tenas Creek	n02-00b	08-Aug-2001		3	Nisqually
Tenas Creek	n02-00b	08-Aug-2001		3	Nisqually
Tenas Creek	n02-00b	08-Aug-2001		2	Nisqually
Tenas Creek	n02-00b	08-Aug-2001		2	Nisqually
Tenas Creek	n02-00b	08-Aug-2001		2	Nisqually
Tenas Creek	n02-00b	08-Aug-2001		3	Nisqually
Unnamed	n03-00a	10-Jul-2002	COXX	2	Nisqually
Unnamed	n03-00a	10-Jul-2002	TRSP	2	Nisqually
Unnamed	n03-00a	10-Jul-2002	COXX	2	Nisqually
Unnamed	n03-00a	10-Jul-2002	COXX	2	Nisqually
Unnamed	n03-00a	10-Jul-2002	COXX	1	Nisqually
Unnamed	n03-00a	10-Jul-2002	TRSP	1	Nisqually
Tahoma Creek side channel	n03-00a	10-Jul-2002	COXX	3	Nisqually
Tahoma Creek side channel	n03-00a	10-Jul-2002	COXX	3	Nisqually
Tahoma Creek side channel	n03-00a	10-Jul-2002	COXX	3	Nisqually
Unnamed	n03-00a	10-Jul-2002	UNSA	1	Nisqually
Unnamed	n03-00a	10-Jul-2002	TRSP	2	Nisqually
Unnamed	n03-00a	10-Jul-2002	TRSP	4	Nisqually
Unnamed	n03-00a	10-Jul-2002	ONCL	4	Nisqually
Unnamed	n03-00a	10-Jul-2002	TRSP	4	Nisqually
Unnamed	n03-00a	10-Jul-2002	COXX	4	Nisqually
Unnamed	n03-00a	10-Jul-2002	TRSP	2	Nisqually
Unnamed	n03-00a	10-Jul-2002		2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002		2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	COCO	1	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	TRSP	2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	COCO	2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	ONCL	2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	COCO	1	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	ONCL	2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	COCO	1	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	TRSP	1	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	ONCL	1	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	ONCL	2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	COCO	2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	TRSP	2	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	ONCL	3	Nisqually

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Tahoma Creek	n03-00b	02-Oct-2002	COCO	3	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	COCO	1	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	ONCL	1	Nisqually
Tahoma Creek	n03-00b	02-Oct-2002	COCO	1	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	TRSP	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	COXX	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	ONCL	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	COCO	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	ONCL	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	COCO	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	ONCL	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	ONCL	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	COXX	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	COXX	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	TRSP	2	Nisqually
Unnamed: trib to Nisqually	n03-01a	02-Jul-2001	TRSP	2	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	2	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	COXX	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	4	Nisqually
Unnamed	n03-02a	11-Jul-2002	COXX	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	2	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	2	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	COXX	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	COXX	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	3	Nisqually
Unnamed	n03-02a	11-Jul-2002	TRSP	2	Nisqually
Unnamed	n03-02a	11-Jul-2002	ONCL	4	Nisqually
Unnamed	n03-03a	02-Jul-2001	ONCL	3	Nisqually

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Unnamed	n03-03a	02-Jul-2001	ONCL	2	Nisqually
Unnamed	n03-03a	02-Jul-2001	COCO	3	Nisqually
Unnamed	n03-03a	02-Jul-2001	TRSP	3	Nisqually
Unnamed	n03-03a	02-Jul-2001	TRSP	2	Nisqually
Unnamed	n03-03a	02-Jul-2001	ONCL	2	Nisqually
Unnamed	n03-03a	02-Jul-2001	COCO	2	Nisqually
Unnamed	n03-03a	02-Jul-2001	ONCL	2	Nisqually
Unnamed	n03-03a	02-Jul-2001	TRSP	2	Nisqually
Unnamed	n03-03a	02-Jul-2001	COCO	3	Nisqually
Unnamed	n03-03a	02-Jul-2001	TRSP	3	Nisqually
Unnamed	n03-04a	02-Jul-2001		3	Nisqually
Unnamed	n03-04a	02-Jul-2001	ONCL	3	Nisqually
Unnamed	n03-04a	02-Jul-2001	TRSP	3	Nisqually
Unnamed	n03-04a	02-Jul-2001	COCO	3	Nisqually
Unnamed	n03-04a	02-Jul-2001	TRSP	3	Nisqually
Unnamed	n03-04a	02-Jul-2001	COCO	3	Nisqually
Unnamed	n03-04a	02-Jul-2001		3	Nisqually
Unnamed	n03-04a	02-Jul-2001	ONCL	4	Nisqually
Fish Creek	n03-05a	02-Jul-2001	SAFO	1	Nisqually
Fish Creek	n03-05a	02-Jul-2001	TRSP	2	Nisqually
Fish Creek	n03-05a	02-Jul-2001		1	Nisqually
Fish Creek	n03-05a	02-Jul-2001	ONCL	1	Nisqually
Fish Creek	n03-05a	02-Jul-2001	SAFO	3	Nisqually
Fish Creek	n03-05a	02-Jul-2001	SAFO	1	Nisqually
Unnamed	n03-07a	01-Jul-2002	ONCL	2	Nisqually
Unnamed	n03-07a	01-Jul-2002	TRSP	3	Nisqually
Unnamed	n03-07a	01-Jul-2002	TRSP	1	Nisqually
Unnamed	n03-07a	01-Jul-2002	ONCL	2	Nisqually
Unnamed	n03-07a	01-Jul-2002	ONCL	3	Nisqually
Unnamed	n03-08a	11-Jul-2001	TRSP	3	Nisqually
Unnamed	n03-08a	11-Jul-2001	ONCL	2	Nisqually
Unnamed	n03-08a	11-Jul-2001	TRSP	2	Nisqually
Unnamed	n03-08a	11-Jul-2001	TRSP	1	Nisqually
Unnamed	n03-08a	11-Jul-2001	COCO	1	Nisqually
Unnamed	n03-08a	11-Jul-2001	ONCL	3	Nisqually
Unnamed	n03-08a	11-Jul-2001	COCO	3	Nisqually
Kautz Creek	n05-00a	02-Oct-2002	ONCL	1	Nisqually
Kautz Creek	n05-00a	02-Oct-2002	ONCL	1	Nisqually
Kautz Creek	n05-00a	02-Oct-2002	ONCL	1	Nisqually

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Kautz Creek	n05-00a	02-Oct-2002	TRSP	1	Nisqually
Pyramid Creek	n05-01a	05-Aug-2001	TRSP	1	Nisqually
Pyramid Creek	n05-01a	05-Aug-2001	ONCL	1	Nisqually
Pyramid Creek	n05-01a	05-Aug-2001	ONCL	1	Nisqually
Pyramid Creek	n05-01a	05-Aug-2001	TRSP	1	Nisqually
Pyramid Creek	n05-01a	05-Aug-2001	TRSP	3	Nisqually
Pyramid Creek	n05-01a	05-Aug-2001	TRSP	1	Nisqually
Pyramid Creek	n05-01d	08-Aug-2002	TRSP	1	Nisqually
Pyramid Creek	n05-01d	08-Aug-2002	ONCL	1	Nisqually
Devil's Dream Creek	n05-04b	08-Aug-2002	TRSP	1	Nisqually
Devil's Dream Creek	n05-04b	08-Aug-2002	ONCL	1	Nisqually
Devil's Dream Creek	n05-04b	08-Aug-2002	TRSP	3	Nisqually
Unnamed: Nisqually trib.	n11-00a	09-Jul-2001		4	Nisqually
Unnamed: Nisqually trib.	n11-00a	09-Jul-2001	TRSP	4	Nisqually
Unnamed: Nisqually trib.	n11-00a	09-Jul-2001		4	Nisqually
Unnamed: Nisqually trib.	n11-00a	09-Jul-2001		4	Nisqually
Unnamed: Nisqually trib.	n11-00a	09-Jul-2001		4	Nisqually
Unnamed: Nisqually trib.	n11-00a	09-Jul-2001		4	Nisqually
Unnamed: Nisqually trib.	n12-00a	09-Jul-2001	TRSP	4	Nisqually
Unnamed: Nisqually trib.	n12-00a	09-Jul-2001	TRSP	4	Nisqually
Unnamed: Nisqually trib.	n12-00a	09-Jul-2001	COCO	4	Nisqually
Unnamed: Nisqually trib.	n12-00a	09-Jul-2001		4	Nisqually
Unnamed: Nisqually trib.	n12-00a	09-Jul-2001	COCO	4	Nisqually
Unnamed: Nisqually trib.	n12-00a	09-Jul-2001		4	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	SAFO	1	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	ONCL	1	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	ONCL	1	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	TRSP	1	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	SAFO	1	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	ONCL	1	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	TRSP	1	Nisqually
Paradise River (Carter Falls -200)	n13-00b	03-Jul-2001	ONCL	1	Nisqually
Paradise River (Carter Falls -100)	n13-00b	03-Jul-2001	TRSP	1	Nisqually
Paradise River (Carter Falls -200)	n13-00b	03-Jul-2001	TRSP	1	Nisqually
Paradise River (Carter Falls -200)	n13-00b	03-Jul-2001	TRSP	1	Nisqually
Paradise River (Carter Falls -200)	n13-00b	03-Jul-2001	TRSP	1	Nisqually
Paradise River (Carter Falls -200)	n13-00b	03-Jul-2001	TRSP	2	Nisqually
Paradise River (Carter Falls -200)	n13-00b	03-Jul-2001	ONCL	1	Nisqually
Paradise River (Carter Falls -200)	n13-00b	03-Jul-2001	ONCL	1	Nisqually

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	3	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	TRSP	3	Nisqually
Paradise River (Meadows +100)	n13-00c	23-Jul-2001		1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	3	Nisqually
Paradise River (Meadows +300)	n13-00c	23-Jul-2001		2	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	UNSA	3	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001		1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	TRSP	1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	2	Nisqually
Paradise River (Meadows +300)	n13-00c	23-Jul-2001		1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	3	Nisqually
Paradise River (Meadows +300)	n13-00c	23-Jul-2001		2	Nisqually
Paradise River (Meadows +300)	n13-00c	23-Jul-2001		2	Nisqually
Paradise River (Meadows +300)	n13-00c	23-Jul-2001		2	Nisqually
Paradise River (Meadows +100)	n13-00c	23-Jul-2001		3	Nisqually
Paradise River (above Narada Falls +100)	n13-00c	19-Jul-2001		1	Nisqually
Paradise River (Meadows +100)	n13-00c	23-Jul-2001		1	Nisqually
Paradise River (Meadows +100)	n13-00c	23-Jul-2001		1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	3	Nisqually
Paradise River (Meadows +100)	n13-00c	23-Jul-2001		2	Nisqually
Paradise River (above Narada Falls +100)	n13-00c	19-Jul-2001		1	Nisqually
Paradise River (above Narada Falls +100)	n13-00c	19-Jul-2001		2	Nisqually
Paradise River (above Narada Falls +100)	n13-00c	19-Jul-2001		1	Nisqually
Paradise River (above Narada Falls +100)	n13-00c	19-Jul-2001		1	Nisqually
Paradise River (Meadows +100)	n13-00c	23-Jul-2001		1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	TRSP	1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001		1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	TRSP	1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	ONCL	1	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	TRSP	3	Nisqually
Paradise River: below Narada Falls	n13-00c	06-Aug-2001	UNSA	3	Nisqually
Unnamed	n15-00a	20-Aug-2002	ONCL	1	Nisqually
Ohanapecosh River	o00-***	11-Jul-2001			
Ohanapecosh River	o00-***	11-Jul-2001	TRSP		
Ohanapecosh River	o00-***	11-Jul-2001			
Ohanapecosh River	o00-***	11-Jul-2001	ONCL		

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Ohanapecosh River	o00-***	11-Jul-2001	ONCL		
Ohanapecosh River	o00-***	11-Jul-2001			
Ohanapecosh River	o00-***	11-Jul-2001	TRSP		
Ohanapecosh River	o00-***	11-Jul-2001	ONCL		
Ohanapecosh River	o00-00c	19-Jun-2001	TRSP	2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001	TRSP	2	Ohanapecosh
Ohanapecosh River	o00-00c	25-Jul-2001	TRSP	2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001	ONCL	2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001		2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001		2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001	TRSP	2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001	ONCL	2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001	TRSP	2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001		2	Ohanapecosh
Ohanapecosh River	o00-00c	19-Jun-2001	TRSP	2	Ohanapecosh
Ohanapecosh River	o00-00g	10-Sep-2001	SAXX		Ohanapecosh
Ohanapecosh River	o00-00g	10-Sep-2001	TRSP		Ohanapecosh
Ohanapecosh River	o00-00g	10-Sep-2001	ONCL		Ohanapecosh
Unnamed	o03-00b	21-Jun-2001	TRSP	1	Ohanapecosh
Unnamed	o03-00b	21-Jun-2001	TRSP	1	Ohanapecosh
Unnamed	o03-00b	18-Jun-2001	TRSP		Ohanapecosh
Unnamed	o03-00b	21-Jun-2001	TRSP	1	Ohanapecosh
Unnamed	o03-00b	21-Jun-2001	TRSP	1	Ohanapecosh
Unnamed	o03-00b	21-Jun-2001		1	Ohanapecosh
Unnamed	o03-00b	21-Jun-2001	TRSP	3	Ohanapecosh
Unnamed	o03-01a	18-Jun-2001	TRSP		Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001	ONCL	1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	TRSP	1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001		1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	ONCL	1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	TRSP	1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	ONCL	1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	TRSP	1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001		1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001	TRSP	1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	TRSP	1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	TRSP	1	Ohanapecosh
Laughingwater Creek- night dive	o07-00a	29-Aug-2001	ONCL	1	Ohanapecosh
Laughingwater Creek	o07-00a	29-Jun-2001	TRSP	3	Ohanapecosh

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Laughingwater Creek	o07-00a	19-Jun-2001		1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001	TRSP	1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001	TRSP	1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001		1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001	TRSP	1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001	ONCL	1	Ohanapecosh
Laughingwater Creek	o07-00a	19-Jun-2001	TRSP	1	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	TRSP	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	TRSP	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	4	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	1	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	TRSP	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	TRSP	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	1	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	2	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	3	Ohanapecosh
Laughingwater Creek	o07-00b	21-Aug-2002	ONCL	2	Ohanapecosh
Chinook Ck- Stafford Falls	o16-00d	06-Sep-2001	TRSP		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	ASTR		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	ONCL		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	TRSP		Ohanapecosh
Kotsuck Creek	o16-05a	05-Sep-2001	TRSP	1	Ohanapecosh
Kotsuck Creek	o16-05a	05-Sep-2001	ONCL	1	Ohanapecosh
Kotsuck Creek	o16-05a	05-Sep-2001	ONCL	1	Ohanapecosh
Kotsuck Creek	o16-05a	05-Sep-2001	ONCL	1	Ohanapecosh
Kotsuck Creek	o16-05a	05-Sep-2001	ONCL	1	Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	ONCL		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	TRSP		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	ONCL		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001			Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	TRSP		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	TRSP		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	ONCL		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	TRSP		Ohanapecosh
Kotsuck Ck- night dive	o16-05a	05-Sep-2001	ASTR		Ohanapecosh

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Kotsuck Creek	o16-05a	20-Jun-2001		1	Ohanapecosh
Kotsuck Creek	o16-05a	20-Jun-2001	TRSP	1	Ohanapecosh
Kotsuck Creek	o16-05a	20-Jun-2001	TRSP	1	Ohanapecosh
Kotsuck Creek	o16-05a	20-Jun-2001	TRSP	1	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	3	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	3	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	3	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	ONCL	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	3	Ohanapecosh
Unnamed -Ohanapecosh CG tributary	o29-00a	06-Aug-2002	TRSP	2	Ohanapecosh
Unnamed- loop c Ohana campground	o29-00a	10-Jul-2001	TRSP	2	Ohanapecosh
Unnamed- loop c Ohana campground	o29-00a	10-Jul-2001	TRSP	2	Ohanapecosh
Unnamed- loop c Ohana campground	o29-00a	10-Jul-2001	TRSP	2	Ohanapecosh
Unnamed- loop c Ohana campground	o29-00a	10-Jul-2001	TRSP	1	Ohanapecosh
Unnamed- loop c Ohana campground	o29-00a	10-Jul-2001	TRSP	3	Ohanapecosh
St. Andrew's Creek	p03-00e	10-Jul-2001		2	Puyallup
St. Andrew's Creek	p03-00e	10-Jul-2001		2	Puyallup
St. Andrew's Creek	p03-00e	10-Jul-2001		1	Puyallup
St. Andrew's Creek	p03-00e	10-Jul-2001		1	Puyallup
St. Andrew's Creek	p03-00e	10-Jul-2001		1	Puyallup
White River: Chinook survey	w00-***	22-May-2002	ONTS	4	White
White River: Chinook survey	w00-***	22-May-2002	TRSP	4	White
White River: Chinook survey	w00-***	22-May-2002	COXX	4	White
White River: Chinook survey	w00-***	22-May-2002	UNSA	4	White
White River: Chinook survey	w00-***	22-May-2002	TRSP	4	White

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Unnamed -trib to White River- Chinook survey	w04-00a	22-May-2002	ONTS	4	White
Unnamed -trib to White River- Chinook survey	w04-00a	22-May-2002	ONTS	4	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	SACO	1	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	TRSP	1	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	COXX	1	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	COXX	1	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	COXX	1	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	COXX	1	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	COXX	3	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	ONCL	3	White
Unnamed- near Deadwood Ck	w11-00a	31-Jul-2001	SACO	3	White
Deadwood Creek	w12-00a	28-Jun-2001	TRSP	1	White
Deadwood Creek	w12-00a	28-Jun-2001	TRSP	1	White
Deadwood Creek	w12-00a	28-Jun-2001	TRSP	1	White
Deadwood Creek	w12-00a	28-Jun-2001		1	White
Deadwood Creek	w12-00a	28-Jun-2001	TRSP	1	White
Deadwood Creek	w12-00a	28-Jun-2001	TRSP	1	White
Klickitat Creek	w13-00a	27-Aug-2002	ONCL	2	White
Klickitat Creek	w13-00a	27-Aug-2002	TRSP	2	White
Klickitat Creek	w13-00a	27-Aug-2002	UNSA	3	White
Klickitat Creek	w13-00a	28-Aug-2002	UNSA	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	ONCL	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	UNSA	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	TRSP	1	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	COXX	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	TRSP	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	ONCL	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	COXX	1	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	UNSA	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	TRSP	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	TRSP	2	White
Unnamed - trib to White River	w14-00a	05-Aug-2002	ONCL	2	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	1	White
Shaw Creek	w15-00a	30-Jul-2001	ONCL	1	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	2	White
Shaw Creek	w15-00a	30-Jul-2001	SACO	2	White
Shaw Creek	w15-00a	30-Jul-2001	SACO	2	White

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Shaw Creek	w15-00a	30-Jul-2001	COXX	2	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	1	White
Shaw Creek	w15-00a	30-Jul-2001	ONCL	1	White
Shaw Creek	w15-00a	30-Jul-2001	TRSP	2	White
Shaw Creek	w15-00a	30-Jul-2001	ONCL	2	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	1	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	2	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	2	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	2	White
Shaw Creek	w15-00a	30-Jul-2001	COXX	2	White
Shaw Creek	w15-00a	30-Jul-2001	SACO	1	White
Littorals outlet	w16-00a	27-Aug-2002	SAFO	3	White
Fryingpan Creek	w17-00a	28-Aug-2001	COCO	1	White
Fryingpan Creek	w17-00a	28-Aug-2001	COCO	2	White
Fryingpan Creek	w17-00a	28-Aug-2001	SACO	1	White
Unnamed	w17-01a	18-Jul-2001	TRSP	3	White
Unnamed	w17-01a	18-Jul-2001	TRSP	3	White
Unnamed	w17-01a	18-Jul-2001	TRSP	2	White
Wright Creek	w17-02a	18-Jul-2001	SACO	1	White
Unnamed	w17-03a	18-Jul-2001	TRSP	1	White
Unnamed	w18-00a	03-Jul-2001	TRSP	2	White
Unnamed	w18-00a	03-Jul-2001		2	White
Unnamed	w18-00a	03-Jul-2001	TRSP	1	White
Unnamed	w18-00a	03-Jul-2001	ONCL	2	White
Unnamed	w18-00a	03-Jul-2001	ONCL	1	White
Unnamed	w18-00a	03-Jul-2001	TRSP	1	White
Unnamed	w18-00a	03-Jul-2001	TRSP	1	White
Unnamed	w18-00a	03-Jul-2001	TRSP	1	White
Unnamed	w18-00a	03-Jul-2001		1	White
Unnamed	w18-00a	03-Jul-2001	ONCL	1	White
Unnamed	w19-00a	03-Jul-2001	TRSP	1	White
Unnamed	w19-00a	03-Jul-2001	TRSP	1	White
Unnamed	w19-00a	03-Jul-2001	ONMY	1	White
Unnamed	w19-00a	03-Jul-2001	TRSP	1	White
Unnamed	w19-00a	03-Jul-2001	TRSP	1	White
Unnamed	w19-00a	03-Jul-2001	TRSP	1	White
Unnamed	w19-00a	03-Jul-2001	ONMY	1	White
Unnamed -Inter Fork White trib.	w21-01a	09-Jul-2001		1	White
Taos Creek	z05-00b	07-Aug-2002	TRSP	4	Cowlitz

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Taos Creek	z05-00b	07-Aug-2002	ONCL	1	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	ONCL	4	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	ONCL	3	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	TRSP	2	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	TRSP	2	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	ONCL	1	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	ONCL	1	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	TRSP	1	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	ONCL	4	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	TRSP	3	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	TRSP	3	Cowlitz
Taos Creek	z05-00b	07-Aug-2002	ONCL	1	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001		2	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001	TRSP	2	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001		2	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001	TRSP	2	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001	TRSP	2	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001		2	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001	TRSP	3	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001	ONMY	3	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001	ONMY	1	Cowlitz
Unnamed: Cowlitz tributary	z06-00a	28-Jun-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	SAFO	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	ONMY	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001		1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	SAFO	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	UNSA	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	ONCL	3	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	SAFO	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	UNSA	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	SAFO	1	Cowlitz

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Stevens Creek	z08-00a	01-Aug-2001	ONCL	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	UNSA	1	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	3	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	SAFO	3	Cowlitz
Stevens Creek	z08-00a	09-Jul-2002	ONCL	1	Cowlitz
Stevens Creek	z08-00a	09-Jul-2002	ONCL	1	Cowlitz
Stevens Creek	z08-00a	09-Jul-2002	ONCL	1	Cowlitz
Stevens Creek	z08-00a	09-Jul-2002	ONCL	3	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	UNSA	3	Cowlitz
Stevens Creek	z08-00a	01-Aug-2001	TRSP	1	Cowlitz
Stevens Creek	z08-00b	09-Aug-2001	SAFO	1	Cowlitz
Stevens Creek	z08-00b	09-Aug-2001	SAFO	2	Cowlitz
Stevens Creek	z08-00b	09-Aug-2001		1	Cowlitz
Stevens Creek	z08-00b	09-Aug-2001	SAFO	1	Cowlitz
Maple Creek	z08-01a	02-Aug-2001		3	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	3	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	3	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	2	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	1	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	3	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	1	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	2	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	5	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	1	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	5	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ASTR	5	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	5	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	5	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	1	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	2	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	ONMY	1	Cowlitz
Maple Creek	z08-01a	02-Aug-2001	TRSP	3	Cowlitz
Lake outlet Snow Lake / Unicorn Creek	z08-04b	17-Jul-2003	UNSA	1	Cowlitz
Lake outlet Snow Lake / Unicorn Creek	z08-04b	17-Jul-2003	UNSA	2	Cowlitz
Lake outlet Snow Lake / Unicorn Creek	z08-04b	17-Jul-2003		1	Cowlitz
Lake outlet Snow Lake / Unicorn Creek	z08-04b	17-Jul-2003	ONCL	3	Cowlitz
Lake outlet Snow Lake / Unicorn Creek	z08-04b	17-Jul-2003	UNSA	3	Cowlitz
Lake outlet Snow Lake / Unicorn Creek	z08-04b	17-Jul-2003	ONCL	1	Cowlitz
Lake outlet Snow Lake / Unicorn Creek	z08-04b	17-Jul-2003		3	Cowlitz

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	2	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001		1	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	1	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAXX	1	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	1	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001		1	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	1	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	2	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	2	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001		2	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	3	Cowlitz
Sunbeam Creek	z08-06c	21-Jun-2001	SAFO	1	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		1	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		1	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		1	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		1	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		1	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001	TRSP	1	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		2	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		3	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		2	Cowlitz
Nickel Creek	z09-00a	20-Jun-2001		2	Cowlitz
Nickel Creek	z09-00c	06-Aug-2001	ONMY	1	Cowlitz
Nickel Creek	z09-00c	06-Aug-2001	ONMY	1	Cowlitz
Nickel Creek	z09-00c	06-Aug-2001	TRSP	1	Cowlitz
Nickel Creek	z09-00c	06-Aug-2001	ONCL	1	Cowlitz
Nickel Creek	z09-00c	06-Aug-2001	ONCL	1	Cowlitz
Nickel Creek	z09-00d	06-Aug-2001	ONMY	1	Cowlitz
Nickel Creek	z09-00d	06-Aug-2001	ONMY	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	ONMY	3	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	TRSP	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	TRSP	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	TRSP	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	ONMY	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	ONMY	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001		1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	TRSP	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	ONMY	1	Cowlitz
Twin Falls Creek	z09-02a	08-Aug-2001	TRSP	1	Cowlitz

Site Name	Segment Number	Date	Species	Habitat Code	Drainage
Twin Falls Creek	z09-02a	08-Aug-2001	ONMY	1	Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP		Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP	1	Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP	1	Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP	1	Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP	1	Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP		Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP		Cowlitz
Unnamed - trib to Nickel Ck	z09-04a	08-Aug-2001	TRSP		Cowlitz

Appendix D. Voucher Specimens

Table D-1. Voucher specimen classification, catalog and accession numbers, number of specimens, description of project, collector and collection date.

Class 1	Class 2	Class 3	Class 4	Sci. Name	Catalog #	Accession #	Quantity	Descrip.	Collector	Collection Date
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus asper*	MORA 14804	MORA-377	7	Gillnet capture	NPS Aquatic field staff	15-Jul-02
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus asper*	MORA 14805	MORA-377	6	Gillnet capture	NPS Aquatic field staff	16-Jul-02
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14802	MORA-377	1	MORA Fish Inventory 2001-2003	B Hasebe	18-Jun-02
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14803	MORA-377	1	MORA Fish Inventory 2001-2004	B Hasebe	18-Jun-02
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14807	MORA-377	1	MORA Fish Inventory 2001-2005	H Moran	31-Jul-02
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14808	MORA-377	1	MORA Fish Inventory 2001-2006	H Moran	31-Jul-02
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14811	MORA-377	4	MORA Fish Inventory 2001-2009	B Hasebe	10-Feb-02
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14814	MORA-377	1	MORA Fish Inventory 2001-2010	Fish Crew 2001	28-Aug-01
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14815	MORA-377	3	MORA Fish Inventory 2001-2011	Fish Crew 2001	25-Jul-01
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14816	MORA-377	2	MORA Fish Inventory 2001-2012	Fish Crew 2001	15-Aug-01
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14817	MORA-377	1	MORA Fish Inventory 2001-2013	Fish Crew 2001	14-Aug-01

Class 1	Class 2	Class 3	Class 4	Sci. Name	Catalog #	Accession #	Quantity	Descrip.	Collector	Collection Date
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14818	MORA-377	2	MORA Fish Inventory 2001-2014	Fish Crew 2001	2-Jul-01
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14819	MORA-377	1	MORA Fish Inventory 2001-2015	Fish Crew 2001	2-Jul-01
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14820	MORA-377	3	MORA Fish Inventory 2001-2016	Fish Crew 2001	2-Jul-01
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*	MORA 14821	MORA-377	3	MORA Fish Inventory 2001-2017	Fish Crew 2001	9-Jul-01
BIOLOGY	Animalia	Osteichthys	Cottidae	*Cottus confusus*			1	MORA Fish Inventory 2001-2018	Fish Crew 2001	11-Jul-01
BIOLOGY	Animalia	Osteichthys	Salmonidae	*Oncorhynchus clarkii*	MORA 14806	MORA-377	1	MORA Fish Inventory 2001-2004	B Hasebe	23-May-02
BIOLOGY	Animalia	Osteichthys	Salmonidae	*Oncorhynchus clarkii*	MORA 14809	MORA-377	1	MORA Fish Inventory 2001-2007	B Hasebe	23-May-02
BIOLOGY	Animalia	Osteichthys	Salmonidae	*Oncorhynchus clarkii*	MORA 14810	MORA-377	1	MORA Fish Inventory 2001-2008	B Hasebe	10-Feb-02

Table D-2. Voucher Specimen collection location details, person who identified the specimen, location of collection, water body, elevation, and associated Universal Transverse Mercator (UTM) coordinates (NAD27).

Sci. Name	Catalog #	Collection Date	Ident. By	Ident Date	Locality	Park	County	State	Wtrbdy/Dr	UTM E	UTM N	Elevation ft
Cottus asper	MORA 14804	15-Jul-02	M Hollock	30-Oct-02	Lake George	MORA	Pierce	WA	Lake George	583782	5182434	4,292
Cottus asper	MORA 14805	16-Jul-02	M Hollock	30-Oct-02	Lake George	MORA	Pierce	WA	Lake George	583782	5182434	4,292
Cottus confusus	MORA 14802	18-Jun-02	M Hollock	30-Oct-02	Unnamed Carbon River tributary	MORA	Pierce	WA	Carbon River	587973	5204652	2,200
Cottus confusus	MORA 14803	18-Jun-02	M Hollock	30-Oct-02	Unnamed Carbon River tributary	MORA	Pierce	WA	Carbon River	587973	5204652	2,200
Cottus confusus	MORA 14807	31-Jul-02	M Hollock	30-Oct-02	Unnamed Mowich River trib (m04-00a)	MORA	Pierce	WA	Mowich	583622	5186150	2,700
Cottus confusus	MORA 14808	31-Jul-02	M Hollock	30-Oct-02	Unnamed Mowich River trib (m04-00a)	MORA	Pierce	WA	Mowich	583622	5196150	2,700
Cottus confusus	MORA 14811	10-Feb-02	M Hollock	30-Oct-02	Tahoma Creek (n03-00a)	MORA	Pierce	WA	Nisqually	584503	5176919	2,120
Cottus confusus	MORA 14814	28-Aug-01	M Hollock	30-Oct-02	Fryingpan Creek	MORA	Pierce	WA	White River	605954	5193828	3,600
Cottus confusus	MORA 14815	25-Jul-01	C. Ellings	1-Sep-01	c08-00a	MORA	Pierce	WA	Upper Carbon	588971	5202990	2,380
Cottus confusus	MORA 14816	15-Aug-01	C. Ellings	1-Sep-01	h04-00c	MORA	Pierce	WA	Huckleberry	604361	5204237	3,300
Cottus confusus	MORA 14817	14-Aug-01	C. Ellings	1-Sep-01	h00-00c	MORA	Pierce	WA	Huckleberry	604577	5204498	3,200
Cottus confusus	MORA 14818	2-Jul-01	C. Ellings	1-Sep-01	n03-01a	MORA	Pierce	WA	Nisqually	583149	5176440	2,020

Sci. Name	Catalog #	Collection Date	Ident. By	Ident Date	Locality	Park	County	State	Wtrbdy/Dr	UTM E	UTM N	Elevation ft
Cottus confusus	MORA 14819	2-Jul-01	C. Ellings	1-Sep-01	n03-03a	MORA	Pierce	WA	Nisqually	585508	5178339	2,320
Cottus confusus	MORA 14820	2-Jul-01	C. Ellings	1-Sep-01	n03-04a	MORA	Pierce	WA	Nisqually	585508	5178339	2,320
Cottus confusus	MORA 14821	9-Jul-01	C. Ellings	1-Sep-01	n12-00a	MORA	Pierce	WA	Nisqually	591333	5177937	2,860
Cottus confusus		11-Jul-01	C. Ellings	1-Sep-01	n03-08a	MORA	Pierce	WA	Nisqually	586106	5180745	2,800
Oncorhynchus clarkii	MORA 14806	23-May-02	B Hasebe	23-May-02	Kotsuck Creek	MORA	Lewis	WA	Ohanapecosh	611447	5187607	
Oncorhynchus clarkii	MORA 14809	23-May-02	B Hasebe	23-May-02	Confluence of Kotsuck and Chinook Creeks	MORA	Lewis	WA	Ohanapecosh	611468	5187613	
Oncorhynchus clarkii	MORA 14810	10-Feb-02	B Hasebe	10-Feb-02	Tahoma Creek (n03-00a)	MORA	Pierce	WA	Nisqually	584503	5176919	2,120

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NPS 105/120292, April 2013

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