



Inventory of Fish Species in the Bogachiel, Dosewallips, and Quinault River Basins, Olympic National Park, Washington

Natural Resource Report NPS/NCCN/NRR—2015/955



ON THE COVER

Top: (left) Federally threatened bull trout captured in Rustler Creek, North Fork Quinault River, Olympic National Park (OLYM) during fish inventory; (right) OLYM fisheries technicians conducting fish inventory via backpack electrofishing in Rustler Creek, North Fork Quinault River, OLYM.

Middle: Upper Bogachiel River where OLYM fisheries crews inventoried 16 tributaries from June to August, 2002.

Lower: (left) Sam Brenkman conducting snorkel survey in Dosewallips River, OLYM; (right) Rainbow trout captured in Big Creek, Quinault River, OLYM during fish inventory.

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Executive Summary

Fish assemblages represent a critical component of biological integrity from both ecosystem and public interest perspectives and are good indicators of ecological health. In Olympic National Park (OLYM), fish populations are of major recreational, aesthetic, and economic importance and contribute to commercial, tribal, and recreational fisheries. Currently, there is little specific information related to presence and spatial distributions of fish species throughout the upper portions of large watersheds in OLYM. This report summarizes a two-summer effort that included the first formal fish surveys in the Bogachiel, Dosewallips, and Quinault River Basins of OLYM. Specific objectives of this study were to: 1) determine fish species composition and relative spatial distribution in tributaries to each basin during summer low-flow conditions; 2) assess the extent of non-native fishes and fish species of concern in the selected basins; and 3) provide baseline information to guide future fish monitoring efforts. Secondary objectives were to determine seasonal trends in relative abundance of adult fishes in the Quinault River and determine the incidence and prevalence of fish pathogens in fish that inhabit the Elwha River Basin.

Single pass electrofishing was conducted in 16 tributaries to the Bogachiel River, 10 tributaries to the Dosewallips River, seven locations along the main stem Dosewallips, and in 19 tributaries in the Quinault Basin. A total of 13 fish species from three different Families (Salmonidae, Cottidae, and Catostomidae) and one Subfamily (Coregoninae) were observed during this study. In the Bogachiel Basin, we observed six native fish species from two different families including coho salmon, rainbow/steelhead trout, coastal cutthroat trout, riffle sculpin, shorthead sculpin, and torrent sculpin. Fifteen of 16 tributaries that were sampled in the Bogachiel Basin contained fish, and sculpins were observed in 81% of the tributaries. In the Dosewallips Basin, only rainbow trout and non-native Eastern brook trout were observed upstream from Dosewallips Falls. We also observed 12 fish species from three Families in the Quinault Basin during the summer of 2003 including: Chinook salmon, coho salmon, sockeye salmon, native char, steelhead trout, coastal cutthroat trout, mountain whitefish, largescale sucker, prickly sculpin, shorthead sculpin, riffle sculpin, and torrent sculpin. From May to September, 2003, snorkel surveys in a five kilometer (km) reference site revealed: low abundances of adult steelhead and adult Chinook; relatively high abundances of mountain whitefish; and the first observation of largescale suckers in Park waters. Preliminary results from tests for fish pathogens in the Elwha River revealed the presence of low levels of Bacterial-Kidney Disease in rainbow trout and brook trout. There was no evidence of bacterial or viral infections in any of more than 100 tested fish.

This fish inventory represents a thorough, yet incomplete, representation of composition and relative distributions of fish species in 45 tributaries of three large river basins in OLYM. The detection of 13 fish species in three river basins was consistent with known distribution patterns for each species. The presence of non-native species was limited to observations of Eastern brook trout in the Dosewallips River, and native char were only observed in the Quinault Basin. Additional spatial and temporal sampling is necessary to document the full species assemblage in each basin. Knowledge of these distributions will be essential in the development of future monitoring efforts to detect trends in species distribution, frequency of occupancy, and species composition in wadeable streams of

OLYM. Information related to species occurrence and spatial distributions also is necessary to understand ecological interactions among species, to address the extent of non-native fish invasions, and to make informed management decisions on fish resources.

Acknowledgments

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Introduction

The National Park Service (NPS) is serving an important mandate from the public and scientific communities to acquire information regarding the status and health of flora and fauna in national parks. Native fish assemblages represent a critical component of biological integrity in park ecosystems, have a high level of public interest, and are good indicators of ecological health. Additionally, fish populations that inhabit OLYM are of major recreational, aesthetic, and economic importance and contribute to commercial, tribal, and recreational fisheries. OLYM also contains some of the last remaining undisturbed habitat throughout the range of numerous species, with the spawning habitats of many species found exclusively within the Park.

Currently, there is little specific information related to presence and spatial distributions of fish species throughout the upper portions of large watersheds in OLYM. Recently, formal surveys for distribution of fish species in OLYM rivers occurred in the Hoh, North Fork Skokomish, and Elwha River Basins (Brenkman 1998, Brenkman and Meyer 1999, Adams et al. 1999). Species occurrence and spatial distributions are necessary to understand ecological interactions among species, to address the extent of non-native fish invasions, and to make informed management decisions on fish and aquatic resources. The lack of scientific information on spatial distributions of fish species poses several challenges for resource managers, particularly related to compliance under the Endangered Species Act, harvest management, and biological diversity issues.

A total of 29 native freshwater fish species have been observed in OLYM rivers, streams, and lakes including: five species of Pacific salmon; rainbow/steelhead trout (*Oncorhynchus mykiss*); coastal cutthroat trout (*O. clarkii clarkii*); bull trout (*Salvelinus confluentus*); Dolly Varden (*S. malma*); longnose sucker (*Catostomus catostomus*); largescale sucker (*Catostomus macrocheilus*); coastrange sculpin (*Cottus aleuticus*); prickly sculpin (*C. asper*); shorthead sculpin (*C. confusus*); riffle sculpin (*C. gulosus*); reticulate sculpin (*C. perplexus*); torrent sculpin (*C. rhotheus*); threespine stickleback (*Gasterosteus aculeatus*); western brook lamprey (*Lampetra richardsoni*); Pacific lamprey (*L. tridentate*); river lamprey (*L. ayresi*); peamouth (*Mylocheilus caurinus*); Olympic mudminnow (*Novumbra hubbsi*); pygmy whitefish (*Prosopium coulteri*); mountain whitefish (*P. williamsoni*); northern pikeminnow (*Ptychocheilus oregonensis*); longnose dace (*Rhinichthys cataractae*); speckled dace (*Rhinichthys osculus*); and redbside shiner (*Richardsonius balteatus*). Additionally, there are six non-native freshwater fish species known to inhabit OLYM waters that include: American shad (*Alosa sapidissima*); largemouth bass (*Micropterus salmoides*); yellow perch (*Perca flavescens*); Eastern brook trout (*S. fontinalis*); yellow bullhead (*Ictalurus nebulosus*); Yellowstone (*O. clarkii bouvieri*) and westslope cutthroat trout (*O. clarkii lewisi*). The presence of the above species is based on published and unpublished studies summarized in OLYM fisheries database and in a voucher collection stored at Park headquarters in Port Angeles.

In this study, we established baseline inventories of fish populations in the Bogachiel, Dosewallips, and Quinault Basins in OLYM. These watersheds were identified as areas of high priority for inventories since no formal fish surveys have ever occurred in portions of the basins located in OLYM. This report summarizes a two-summer inventory effort designed to determine fish species

occurrences and relative distributions in each basin. The primary objectives of this study were to: 1) determine occurrence and relative distribution of fish species in the Bogachiel, Dosewallips, and Quinault River Basins during summer low-flow conditions; 2) describe the extent of non-native fish invasions in the three basins; and 3) provide baseline information that will be used to guide future monitoring efforts. The secondary objectives were to determine seasonal trends in relative abundance of adult fishes in the Quinault River and determine the occurrence of fish pathogens in salmonids and sculpins that inhabit the Elwha River Basin.

Study Area

The inventory of fish species focused on three major watersheds and associated tributaries: the Bogachiel, Dosewallips, and Quinault Basins. The Bogachiel River is located on the western side of the Olympic Mountains in Clallam County (Figure 1). The river ultimately forms the Quillayute River approximately 19 km from the Pacific Ocean. The Bogachiel River has two major tributaries, the Calawah River and the North Fork Bogachiel River. At the confluence with the Calawah, the Bogachiel River drains 287 km², has a mean annual stream discharge of 30 cubic meters per second (cms), and has 540 km of stream in the basin (Phinney and Bucknell 1975, Nelson 1982). Vegetation in the Bogachiel River Basin is primarily western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), western redcedar (*Thuja plicata*), and Douglas fir (*Pseudotsuga menziesii*) and annual precipitation varies from 254 to 356 cm (Nelson 1982). The Bogachiel River is known to contain coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*O. tshawytscha*), steelhead trout, coastal cutthroat trout, lamprey, and unidentified sculpins. However, the distribution of these fish throughout the watershed remains unknown, particularly within the boundaries of OLYM.

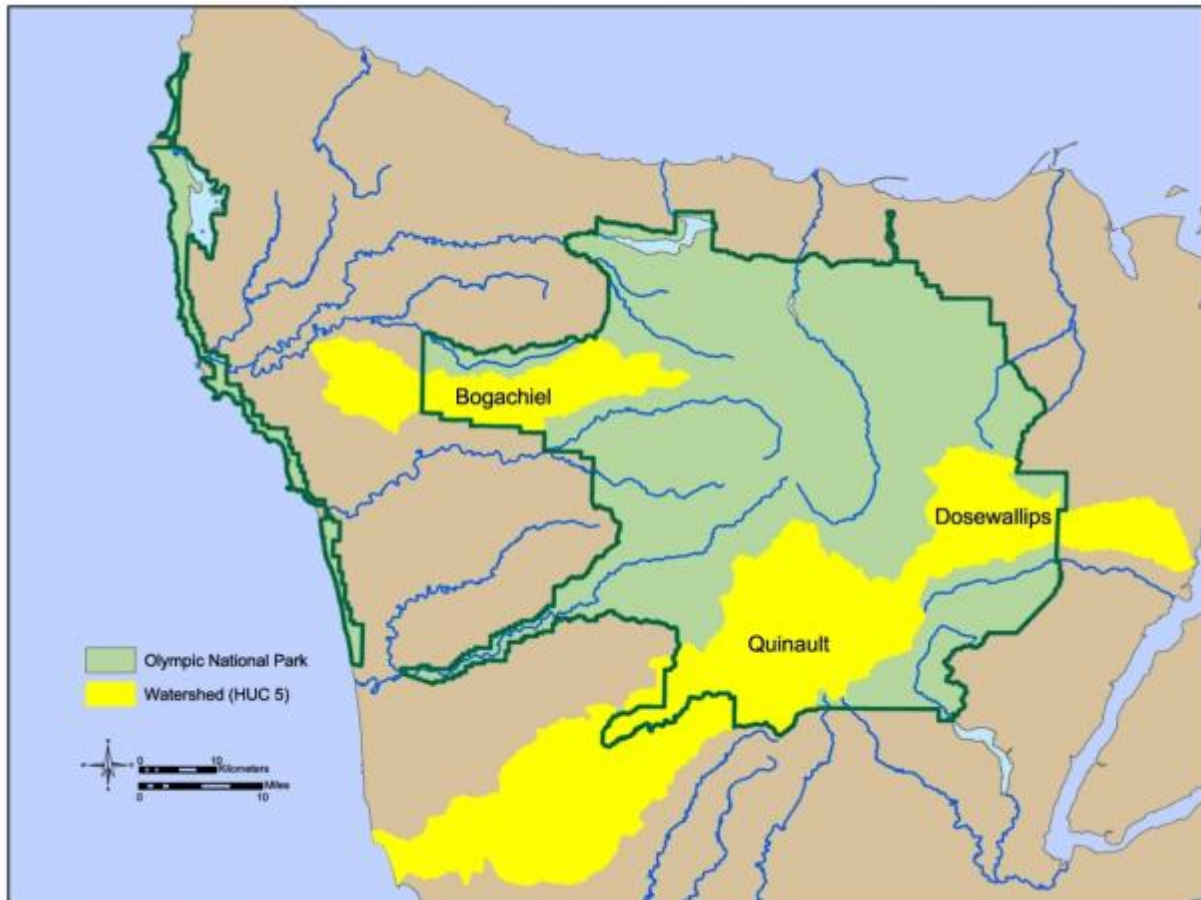


Figure 1. Map of study area in the Bogachiel, Dosewallips, and Quinault River Basins in Olympic National Park, Washington.

The Dosewallips River is located on the eastern side of the Olympic Mountains in Jefferson County and flows east to the Hood Canal. The Dosewallips watershed drains 243 km², has a total of 274 km in tributary length, and has two main tributaries that include the West Fork and Silt Creek (Phinney and Bucknell 1975). Approximately 65% of the watershed occurs within the boundaries of OLYM where vegetation is primarily composed of Douglas fir, western hemlock, and western redcedar (Dosewallips Watershed Analysis Team 1998). Annual precipitation in the Dosewallips River basin varies from 152 cm near the Hood Canal to 305 cm at the headwaters near Mt. Anderson.

The lower Dosewallips River located outside of OLYM contains coho salmon, two populations of chum salmon (*O. keta*) that run in the summer and fall, pink salmon (*O. gorbuscha*), two populations of Chinook salmon that run in the summer and fall, coastal cutthroat trout, summer and winter runs of steelhead trout, and sculpin species. There are no anadromous fish species in the river upstream from Dosewallips Falls (at river kilometer 24.3) where a natural barrier obstructs migration. Little is known about fish distribution within the Dosewallips River basin inside OLYM, although rainbow trout and Eastern brook trout were introduced into high elevation lakes in the upper basin.

The Quinault River has a total stream length of 137 km and drains 1,808 km² from the southwestern corner of the Olympic Mountains in Grays Harbor and Jefferson Counties. The river is formed by the North Fork and East Fork Quinault Rivers. Mean annual river flow at the outlet of Lake Quinault is ~105 cms. Approximately 51% of the Quinault watershed occurs within the boundaries of OLYM, and vegetation is dominated by Sitka spruce, western hemlock, and western redcedar (Quinault River Watershed Analysis Team 1999). The Quinault River basin receives an average annual precipitation of 370 cm.

The Quinault River Basin contains one of the most diverse assemblages of native fishes on the Olympic Peninsula. The river, including areas outside the Park, contains spring/summer/fall Chinook salmon, coho salmon, pink salmon, chum salmon, sockeye salmon (*O. nerka*), winter and summer steelhead, bull trout, Dolly Varden, coastal cutthroat trout, common carp (*Cyprinus carpio*), largescale sucker, Eastern brook trout, and several sculpin species (Quinault River Watershed Analysis Team 1999; Olympic National Park files). To date, the presence and spatial distribution of fishes in the upper Quinault located in OLYM remains unknown.

Methods

Presence and Distribution of Fish Species in Bogachiel, Dosewallips, and Quinault Basins

In summer 2002 and 2003, a total of 45 tributaries and nine sites on main stem rivers were inventoried including 16 tributaries to the Bogachiel, 10 tributaries to the Dosewallips, and 19 tributaries to Quinault (Table 1). Our goal was to conduct fish inventories in all accessible habitat units of the lower portions of named, wadeable tributary streams and confirm species identification in each. To determine the presence and spatial distribution of fish species, single pass electrofishing was conducted in the Bogachiel and Dosewallips Basins from June 17 to August 27, 2002 and in the Quinault Basin from June 30 to September 4, 2003. A two-person team equipped with a Smith-Root model 12A backpack electrofishing unit and dip nets proceeded upstream capturing and identifying fish. We began each survey at the mouth of a tributary and ascended until we encountered a cascade or waterfall greater than 5 m in height or the area became unsafe to survey.

The sampling approach was designed to maximize the number of streams sampled and maximize the area surveyed within each stream. The high initial effort to mobilize equipment into remote areas of OLYM led us to survey all accessible portions of each stream in the vicinity of the established base camp. A more randomized or probabilistic sampling approach would have drastically reduced the number of streams or area of streams that were surveyed during each year based on extensive travel times to randomly selected sites.

We measured the total lengths of up to 30 fish of each species from each stream and released each fish near its point of capture. We estimated the upper capture location for each species by measuring elevation using a Suunto altimeter and estimating linear distance from the creek mouth. Global Positioning System units proved unsuccessful in attaining satellites in this study because of the steep terrain and extensive canopy cover. Upper capture locations were plotted using Geographic Information System ArcView 3.3.

Representative specimens of juvenile salmonids and sculpin species were preserved in 95% ethanol for identification in the laboratory by NPS biologists and subsequent species verification by Katherine Pearson (University of Washington Fish Collection Manager) and Molly Hallock (Washington Department of Fish and Wildlife). Preserved specimens were placed in the OLYM fish collection with corresponding catalog numbers for future use and to provide a permanent taxonomic record (Appendix D). A Section 10(a)(1)(A) permit was obtained from the U.S. Fish and Wildlife Service for any incidental take of federally threatened bull trout. Additionally, all backpack electrofishing occurred in accordance with guidelines written by National Marine Fisheries Service (NMFS) and OLYM. All data collected during this study were archived in OLYM's fisheries database that contains parkwide distributions of fish species.

Table 1. List of streams and distances sampled in the 2002 and 2003 fish inventory of the Bogachiel, Dosewallips, and Quinault River Basins.

Stream Name	Estimated Distance Sampled (m)
Tributaries to Bogachiel River	
Bee	190
Boulevard	200
Camp	300
Cultus	175
Devil Club	295
Fraker	650
Hades	175
Hyak	415
Indian	350
Kloshe	300
Lolo	330
Mosquito	80
Olallie	1500
Sunday	900
Tumwata	750
Warkum	400
Total	7.0 km
Dosewallips River	
Dosewallips River	870
Burdick	125
Butler	100
Deception	60
Hawk	100
Pass	410
Slide	100
Station	110
Sunny Brook	110
Twin Creek (Lower)	100
Twin Creek (Upper)	210
Total	2.3 km
Quinault River	
Big	6019
Bunch	200
Cannings	563
Canoe	1384
Finley	2285
Fire	193
Graves	1690
Higley	563
Howe	1030
Ignar	80
July	241
Kestner	418
Noname	1600
O'Neil	724
Pyrites	2400
Rustler	1690
Slide	418
Success	161
Upper O'Neil	50
Total	22.1 km

Relative Abundance of Adult Fishes in Quinault River

To determine presence and seasonal trends in relative abundance of fish species from the Quinault River (river kilometer 70.8 to 75.6), NPS and USFWS biologists conducted bi-monthly snorkel surveys in the main stem Quinault River from May to September, 2003, at flows of less than 62 cms (as measured at USGS gage below Lake Quinault). A total of four divers proceeded downstream identifying fish species, estimating fish lengths, and counting numbers of each species. Divers positioned themselves near the midline of the wetted channel width and floated through habitat units parallel to one another while remaining as motionless as possible. Two divers counted fish from the midline to the left bank and two divers counted fish from the midline to the right bank.

Inventory of Fish Pathogens in Elwha Basin

In August, 2003, fish were collected from the Elwha Basin and tested for the presence of bacteria, viruses, and external parasites as part of the USFWS Wild Fish Health Survey. We collected rainbow trout, brook trout, and sculpin in sections of the main stem river and tributaries located upstream, downstream, and draining into Lake Mills (Figure 2). Fish were collected from eight sites including four sites downstream from Lake Mills (Griff Creek and Elwha River at river kilometer 17.2, 18.2, and 19.3), two sites draining into Lake Mills (Boulder Creek and Cat Creek), and two sites upstream from Lake Mills (Long Creek, and Elwha River at river kilometer 29.0). At each sample site, fish were euthanized and samples of gill, scales, kidney, and stomach were removed and analyzed at the USFWS Fish Health Center in Olympia, Washington. Specifically, laboratory analysis was conducted to determine presence or non-detection of Infectious Pancreatic Necrosis Virus, Infectious Hematopoietic Necrosis Virus, Viral Hemorrhagic Septicemia, Furunculosis (*Aeromonas salmonicida*), *Hersinia ruckeri*, Bacterial Kidney Disease (*Renibacterium salmoninarum*), *Edwardsiella ictaluri*, and Whirling Disease (*Myxobolus cerebralis*) (personal communication, Sonia Mumford, USFWS, Lacey, WA). Any positive results for Bacterial Kidney Disease were to be later confirmed by polymerase chain reaction analysis. Samples were analyzed by species at each sample site (i.e. not analyzed by individual).

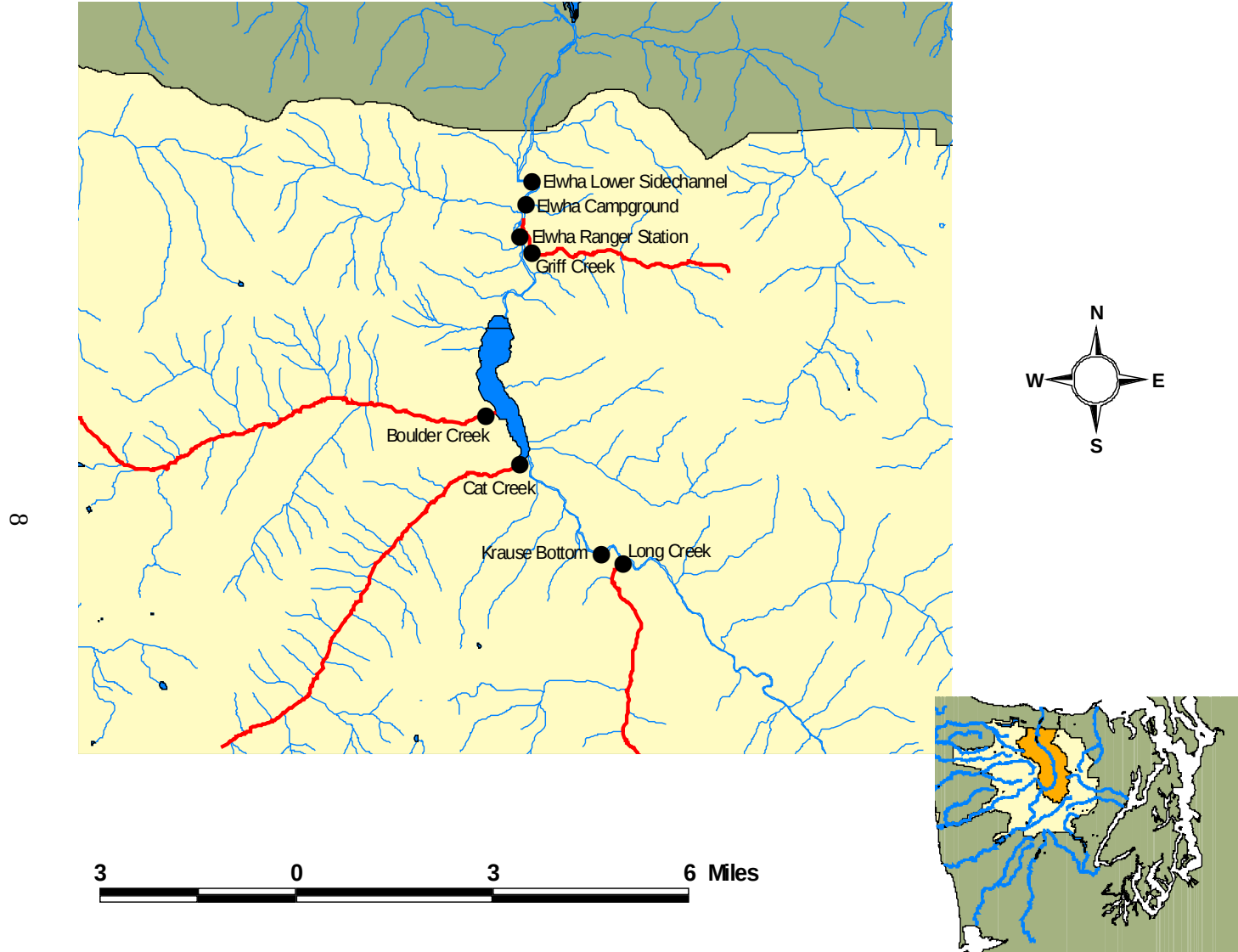


Figure 2. Fish species were collected at eight sample sites (streams sampled in red) to determine presence or non-detection of pathogens. The sample sites are located downstream, adjacent to, and upstream of Lake Mills, Elwha Basin, Olympic National Park.

Results

Bogachiel River Basin

In summer 2002, we sampled a total of 7.0 km in 16 tributaries to the Bogachiel River. A total of 15 of 16 tributaries to the Bogachiel Basin contained fish (Figure 3). We observed six native fish species from two different families (Salmonidae and Cottidae) including coho salmon, rainbow/steelhead trout, cutthroat trout, riffle sculpin, torrent sculpin, and shorthead sculpin (Table 2; Appendix A). Sculpins were the most numerous, detected in 81% of the tributaries, whereas coho salmon and trout were detected in fewer tributaries (Table 2). Total lengths of sculpins throughout the watershed ranged from 30 to 110 mm (Appendix A). Coho salmon fry were captured at lower elevations near tributary confluences and were the most abundant species although they were present in only 56% of tributaries. Rainbow trout and cutthroat trout were captured at higher elevations, at greater distances from tributary confluences, and were less abundant than coho salmon. Cutthroat trout and rainbow trout co-occurred in only three of 16 tributaries, and coho salmon and cutthroat trout co-occurred in six of 16 tributaries in the Bogachiel River. Of all the tributaries, only Warkum Creek and Cultus Creeks did not contain cutthroat trout or rainbow trout. Species richness generally was lower upstream from Bee Creek in Camp, Hyak, and Lolo Creeks in the North Fork Bogachiel River.

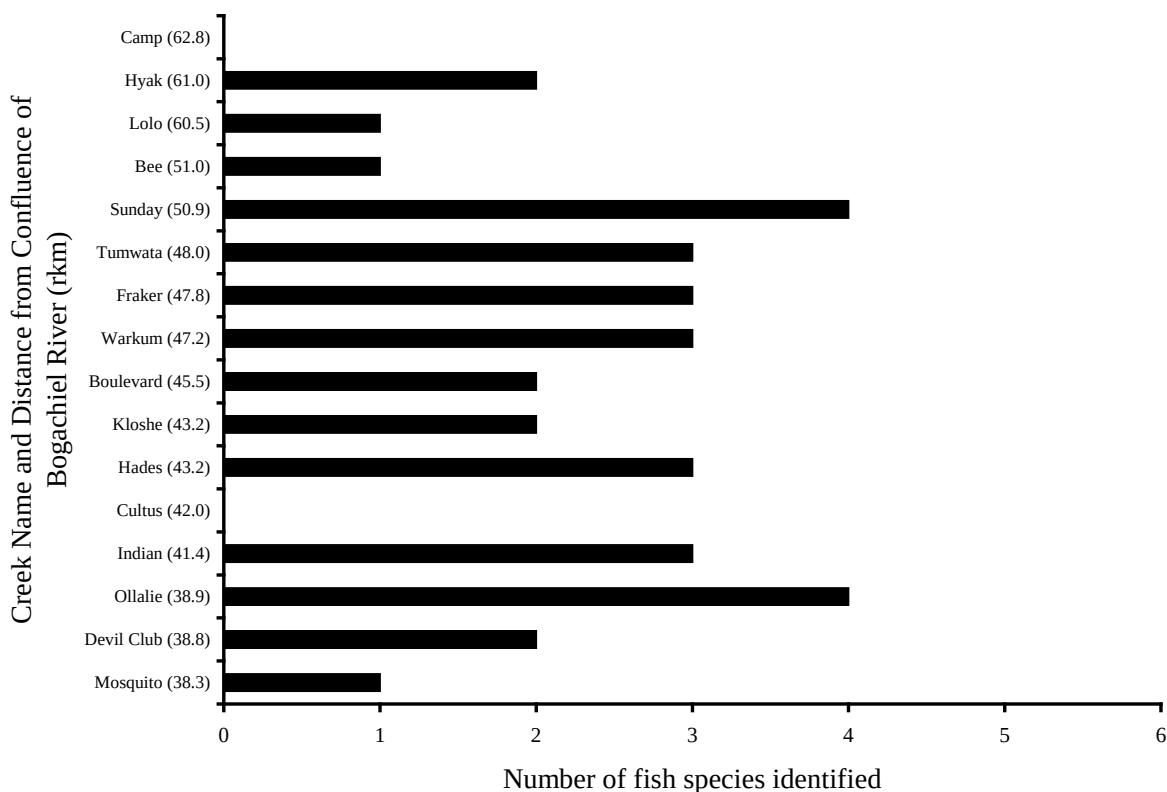


Figure 3. Number of fish species identified in tributaries (in longitudinal order) to the Bogachiel River based on single pass electrofishing from June 17 to August 27, 2002 (river kilometer at confluence with main stem river in parentheses).

Table 2. Fish species observed in tributaries to the Bogachiel River based on electrofishing surveys from June 19 to July 26, 2002 (X=present; O=not detected).

Tributaries to Bogachiel River	Coho salmon	Cutthroat trout	Rainbow/ steelhead trout	Sculpin
Bee	O	X	O	<i>Cottus spp.</i>
Boulevard	X	X	O	<i>Cottus spp.</i>
Camp *	O	O	O	O
Cultus	O	O	O	O
Devil Club	X	X	O	<i>Cottus spp.</i>
Fraker	X	O	X	<i>Cottus gulosus; Cottus spp.</i>
Hades	X	X	O	<i>Cottus rhotheus; Cottus spp.</i>
Hyak	O	O	X	<i>Cottus confusus; Cottus spp.</i>
Indian	O	X	X	<i>Cottus gulosus</i>
Kloshe	X	X	O	<i>Cottus spp.</i>
Lolo	O	O	X	O
Mosquito	O	X	O	<i>Cottus spp.</i>
Olallie	X	X	X	<i>Cottus rhotheus; Cottus spp.</i>
Sunday	X	X	X	<i>Cottus rhotheus; Cottus spp.</i>
Tumwata	X	O	X	<i>Cottus rhotheus; Cottus spp.</i>
Warkum	X	O	O	<i>Cottus gulosus; Cottus rhotheus; Cottus spp.</i>
Percentage of streams with each species	56%	56%	44%	81%

*Unidentified salmonid fry observed

Dosewallips River Basin

In summer 2002, we sampled a total of 2.3 km in 10 tributaries to the Dosewallips River and seven sites along the main stem river and preserved a total of six fish (Table 1). Rainbow trout and Eastern brook trout accounted for 100% of the fish species captured in the Dosewallips Basin, and no sculpins were detected (Table 3; Appendix B). Rainbow trout were observed in 45% of the sites surveyed, and brook trout were only detected in the main stem river. The two species co-occurred in the main stem Dosewallips River at elevations from 760 to 920 m. We observed brook trout up to an elevation of 1,170 m. The range in total lengths of rainbow trout was 25 to 230 mm throughout the sample area (Appendix B). The range in total lengths of brook trout in the main stem river was 86 to 280 mm (Appendix B). Steeper terrain limited sampling distances in the Dosewallips Basin. The mean distance sampled in each tributary of the Dosewallips River Basin (143 m) was 1/3 of the distance of sampled in the Bogachiel (438 meters) and 1/8 of the distance sampled in the Quinault (1,143 m) (Table 1).

Table 3. Fish species observed in the Dosewallips River Basin based on single pass electrofishing surveys conducted from August 12 to 27, 2002 (X=present; O=not detected).

Dosewallips Basin	Rainbow trout	Brook trout
Dosewallips River	X	X
Burdick Creek	X	O
Butler Creek	O	O
Deception Creek	X	O
Hawk Creek	O	O
Pass Creek	X	O
Slide Creek	O	O
Station Creek	O	O
Sunny Brook Creek	X	O
Twin Creek (Lower)	O	O
Twin Creek (Upper)	O	O
Percentage of streams with each fish species	45%	9%

Quinault River Basin

In 2003, we sampled a total of 22.1 km in 19 tributaries to the Quinault River, three sites in the East Fork Quinault River, and one repeated snorkel index reach in the main river. We observed 12 fish species from three Families (Salmonidae, Cottidae, and Catostomidae) and one Subfamily (Coregoninae) in the Quinault Basin during electrofishing and snorkel surveys including: Chinook salmon, coho salmon, sockeye salmon, native char (bull trout/Dolly Varden), rainbow/steelhead trout, cutthroat trout, mountain whitefish, largescale sucker, prickly sculpin, shorthead sculpin, riffle sculpin, and torrent sculpin (Appendix C). Fish were vouchered for positive species identification (Appendix D). We failed to detect fish in only one tributary, Upper O'Neil Creek. Juvenile rainbow/steelhead trout were the most frequently detected species (Table 4). Chinook salmon and sockeye salmon were the least frequently detected species in the Quinault Basin. Species richness in the Quinault Basin was generally greatest in tributaries that were lower in the basin and those that drained into Lake Quinault (Figure 4). Native char were found to inhabit some of the larger creeks (Graves, O'Neil, Rustler Creeks) and main stem river (East and North Fork Quinault Rivers). Largescale sucker, mountain whitefish, and adult steelhead, Chinook, and coho were only detected during snorkel surveys in the main stem Quinault River and were not observed in tributaries. The number of fish by species and their total lengths (mean and range) may be found in Appendix C.

Table 4. Fish species observed in the Quinault River Basin based on single pass electrofishing surveys conducted from June 30 to September 4, 2003 (X=present; O=not detected, rkm=river kilometer).

Tributaries	Coho salmon	Chinook salmon	Sockeye salmon	Cutthroat trout	Bull Trout / Dolly Varden	Rainbow / Steelhead trout	Sculpin
Big Creek	X	X	O	X	O	X	<i>Cottus rhotheus</i> ; <i>C. asper</i> ; <i>C. spp.</i>
Bunch Creek	O	O	O	X	O	X	<i>Cottus spp.</i>
Cannings Creek	X	O	O	X	O	X	<i>Cottus rhotheus</i> , <i>C. confusus</i> ; <i>C. spp.</i>
Canoe Creek	X	O	O	X	O	X	<i>Cottus confusus</i> ; <i>C. spp.</i>
Finley Creek	X	O	O	O	O	X	<i>Cottus confusus</i> ; <i>C. spp.</i>
Fire Creek	O	O	O	O	O	X	O
Graves Creek	X	O	O	O	X	X	<i>Cottus rhotheus</i> , <i>C. gulosus</i> , and <i>C. confusus</i>
Higley Creek	X	X	O	X	O	X	<i>Cottus asper</i> , <i>C. gulosus</i> , <i>C. confusus</i> , <i>C. rhotheus</i> , and <i>C. spp.</i>
Howe Creek	X	O	O	X	O	X	<i>Cottus rhotheus</i>
Ignar Creek	O	O	O	O	O	X	O
July Creek	X	X	X	X	O	X	<i>Cottus rhotheus</i> , <i>C. gulosus</i> , <i>C. confusus</i> , and <i>C. spp.</i>
Kestner Creek	X	O	O	X	O	X	<i>C. gulosus</i> , <i>C. confusus</i> , and <i>C. spp.</i>
Noname Creek	O	O	O	O	O	X	O
O'Neil Creek	O	O	O	O	X	X	O
Pyrites Creek	O	O	O	O	O	X	O
Quinault River (rkm 70.8 to 75.6)							
Rustler Creek	X	O	O	O	X	X	<i>Cottus rhotheus</i> , <i>C. confusus</i> , and <i>C. spp.</i>
Slide Creek	O	O	O	X	O	X	O
Success Creek	O	O	O	O	O	X	O
Upper O'Neil Creek	O	O	O	O	O	O	O
Percentage of streams occupied by each species	53%	16%	5%	47%	16%	95%	58%

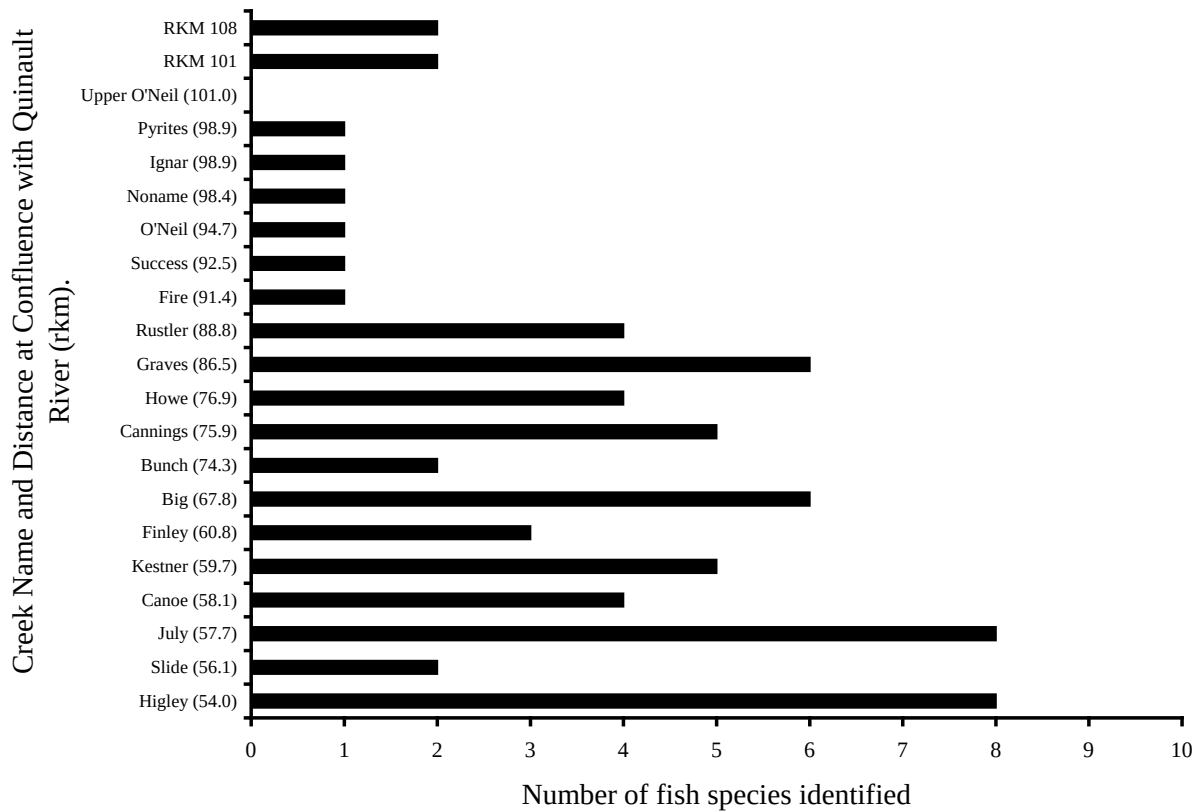


Figure 4. Number of fish species detected in tributaries (in longitudinal order) to the Quinault River (river kilometer at confluence with main stem river in parentheses) and the main stem river at river kilometer 101 and 108 from June 30 to September 4, 2003.

A total of seven fish species were observed during snorkel surveys of the main stem river including: adult mountain whitefish, cutthroat trout, adult native char, adult largescale sucker, adult steelhead trout, adult Chinook salmon, and juvenile coho salmon (Figures 5 and 6). Mountain whitefish were the most frequently observed fish and increased from $24 \text{ fish} \times \text{RKM}^{-1}$ on June 11 to $257 \text{ fish} \times \text{RKM}^{-1}$ on September 15. We observed seven to 10 native char $\times \text{RKM}^{-1}$. Up to 60 cutthroat/rainbow trout $\times \text{RKM}^{-1}$ were observed during the late summer and a total of 23 or 24 largescale suckers during the survey period from late June to late July. We observed low abundances of adult steelhead and adult Chinook salmon on each survey date from May to September (Figure 6).

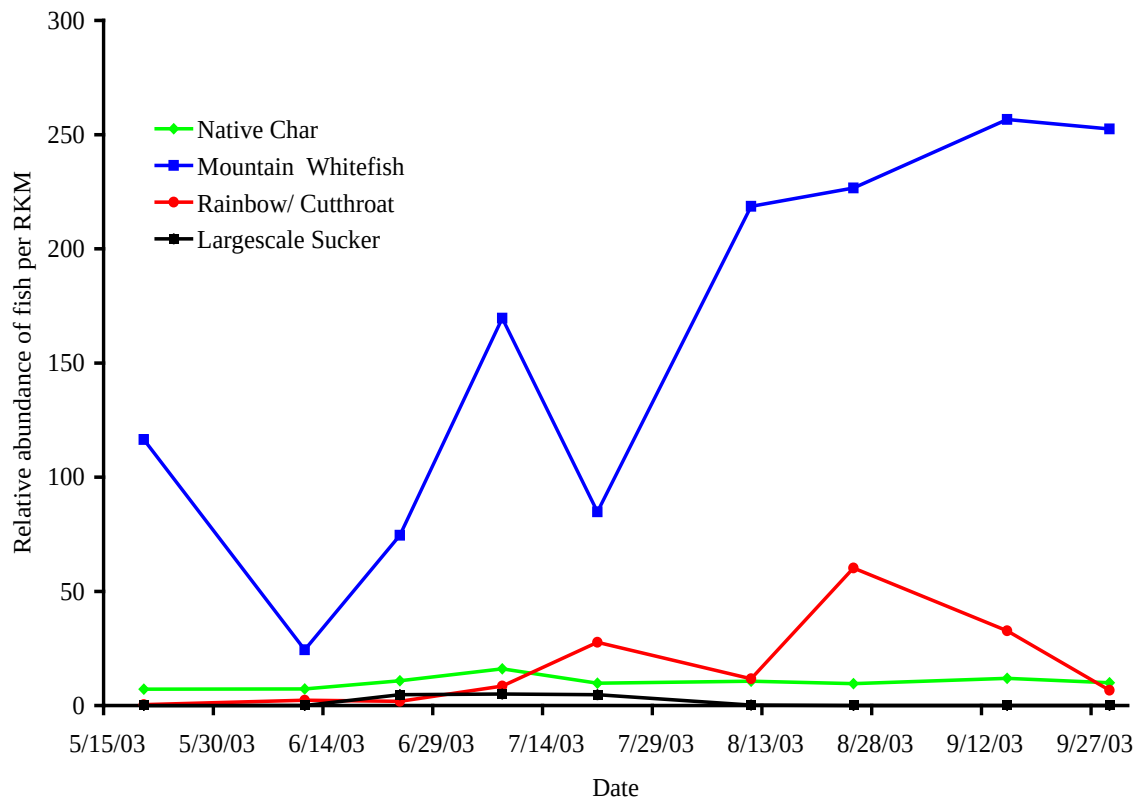


Figure 5. Relative abundance of native char, mountain whitefish, cutthroat/rainbow trout, and largescale sucker from river kilometer 70.8 to 75.6 in the Quinault River based on snorkel surveys conducted from May to September, 2003.

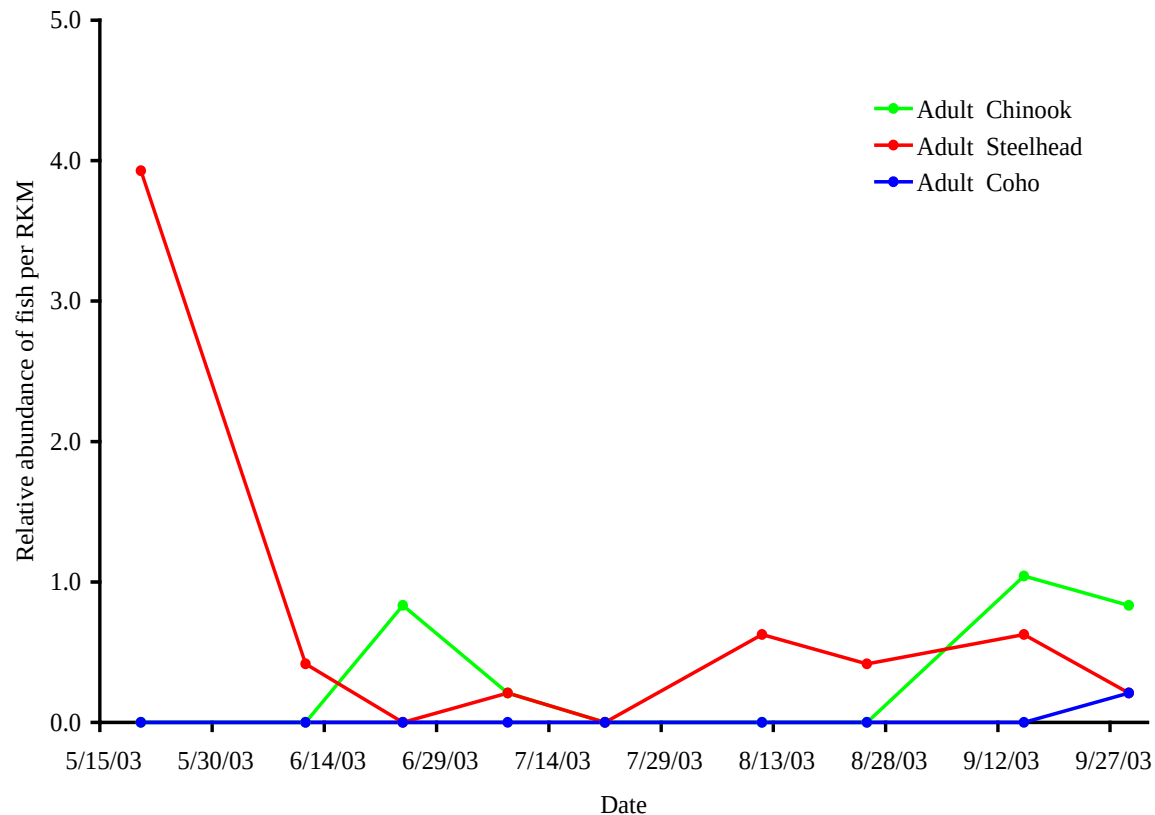


Figure 6. Relative abundance of adult Chinook salmon, adult coho salmon, and adult steelhead trout per river mile (from river kilometer 70.8 to 75.6) in the Quinault River based on snorkel surveys conducted from May to September, 2003.

Fish Pathology in Elwha River Basin

Preliminary results conducted by USFWS biologists revealed a low prevalence of bacterial, parasitic, and viral infestations in rainbow trout, Eastern brook trout, and sculpins in the Elwha River Basin (personal communication, Sonia Mumford, USFWS). Results from laboratory analysis of whirling disease (*Myxobolus cerebralis*) were not available for this report. USFWS biologists reported that groups of rainbow trout and brook trout tested positive for Bacterial-Kidney Disease (*Renibacterium salmoninarum*) and failed to detect bacteria or viruses in any of more than 100 tested fish (Table 5).

Table 5. Results of bacteriology, parasitology, serology, and virology tests of rainbow trout, brook trout, and sculpin spp. collected from seven sites located upstream, at, and downstream of Lake Mills, Elwha Basin (personal communication, Sonia Mumford, U.S. Fish and Wildlife Service Fish Disease Laboratory, Olympia, Washington). Analysis was based on presence or non-detection for each species (e.g. not individual fish) at a given site.

Site	Date	Parasitology			Serology		
		Rainbow	Brook	Sculpin	Rainbow	Brook	Sculpin
Elwha River/Ranger Station	8/4	◊, n=2	X	X	○, n=2	X	X
Elwha River/Above Culvert	8/4	◊, n=30	X	X	●, n=10	X	X
Elwha River/Campground	8/4	◊, n=5	◊, n=5	◊, n=1	●, n=9	●, n=1	X
Boulder Creek	8/5	◊, n=12	X	◊, n=12	●, n=8	X	X
Cat Creek	8/5 - 8/6	◊, n=12	X	◊, n=13	●, n=6	X	X
Krause Bottom	8/6	◊, n=34	X	X	●, n=20	X	X
Long Creek	8/7	◊, n=14	X	X	●, n=7	X	X

Site	Date	Bacteriology			Virology		
		Rainbow	Brook	Sculpin	Rainbow	Brook	Sculpin
Elwha River/Ranger Station	8/4	○, n=1	X	○, n=1	○, n=2	X	X
Elwha River/Above Culvert	8/4	○, n=21	X	X	○, n=23	X	X
Elwha River/Campground	8/4	○, n=2	○, n=2	X	○, n=24	○, n=5	X
Boulder Creek	8/5	○, n=10	X	X	○, n=11	X	X
Cat Creek	8/5 - 8/6	○, n=12	X	X	○, n=11	X	X
Krause Bottom	8/6	○, n=29	X	X	○, n=32	X	X
Long Creek	8/7	○, n=14	○, n=14	X	○, n=14	X	X

●, result positive
○, result negative
◊, result pending
X, not captured/tested

Parasitology target agents: *Myxobolus cerebralis*

Bacteriology target agents: *Aeromonas salmonicida*; *Yersinia ruckeri*

Serology target agents: *Renibacterium salmoninarum*

Virology target agents: Infectious pancreatic necrosis virus; Infectious hematopoietic necrosis virus; Viral hemorrhagic septicemia

Discussion

This fish inventory represents a thorough, yet incomplete, representation of composition and relative distributions of fish species in the three large river basins in OLYM. Results from this study established baseline inventories and relative spatial distributions of fish species in 45 different tributaries to the upper Bogachiel, Dosewallips, and Quinault Basins. The sampling schedule for this study was limited to two 10-week periods that occurred during periods of summer low flows. The detection of 13 different species of fish from three Families during this inventory was consistent with known distribution patterns of each species. We documented 37% of the known freshwater fish species that inhabit the entire Park. No range extensions or additional non-native species were detected when compared to the existing list of fish species known to inhabit OLYM. Information in this study may be used to design an aquatic monitoring plan to detect trends in species distribution, frequency of occupancy, and richness in large rivers and small streams of OLYM. Information related to species occurrence and spatial distributions is also necessary to understand ecological interactions among species, to address the extent of non-native fish invasions, and to make informed management decisions on fish resources.

The failure to detect other fish species known to inhabit OLYM during this study may be attributed to the localized distributions of many species (i.e. endemic mudminnow and many non-natives inhabit the Ozette area only), sampling methods, and the limited temporal sampling effort. Also, limited access in remote terrain precluded sampling in the upper portions of several tributaries that likely contained suitable fish habitat. Additional work during autumn and winter months is necessary to determine the total fish species assemblage and associated spatial distributions of migratory species such as Pacific salmonids and Pacific lamprey. Prior to the establishment of monitoring protocols for small streams, there is a need to develop a more rigorous temporally- and spatially-explicit sampling regime designed to detect more species. Specifically, further inventory work should occur in West Fork Dosewallips Basin, tributaries to the upper North Fork Quinault River, and other unsurveyed basins including the upper portions of the Duckabush, Greywolf, Sol Duc, and Queets Rivers.

We detected non-native Eastern brook trout in the main stem Dosewallips River. Additionally, we captured brook trout in Elwha Basin during the collection of samples in the disease study. Brook trout are native to eastern and northeastern North America. Prior to the establishment of OLYM in 1938 and extending into the early 1970's, brook trout were introduced into many backcountry lakes of the Park. At a minimum, 51 Park lakes are known to contain introduced fish, and probably many more (Olson and Meyer 1994). Eastern brook trout are known to occur in high lakes in the Dungeness, Elwha, Hamma Hamma, Hoh, North Fork Skokomish, Sol Duc, and Quinault drainages in the Park (OLYM files). There are a number of biological concerns related to brook trout including the possibility of hybridization with native Dolly Varden and bull trout. Based on NPS Policy, eradication of exotic species should be considered whenever such species threaten Park resources. In this study, we also detected the presence of young-of-the-year and adult native char in the main stem Quinault, Rustler Creek, Graves Creek, and O'Neil Creek. No native char were detected in the Dosewallips and Bogachiel Basins. Bull trout currently are listed as a threatened species under the

Endangered Species Act. Future studies should address the extent and pathways of brook trout invasion in Park waters with an emphasis on streams that contain native Dolly Varden and bull trout.

Bogachiel Basin

The six fish species that were observed in the Bogachiel Basin were consistent with distribution of fishes found in other coastal Washington rivers. Surveyors failed to detect Chinook salmon, chum salmon, and lamprey, all of which are known to occur in the basin. The lack of detection of these species presumably was the result of limited seasonal sampling effort and an emphasis on tributary streams and not the main stem river. The observations of riffle, torrent, and shorthead sculpins provided the first verification of these species in the Bogachiel Basin of OLYM.

Dosewallips Basin

Rainbow trout and Eastern brook trout were the only fish species detected in the upper Dosewallips River Basin despite extensive electrofishing surveys in 10 tributaries and the main stem river. Generally, there was a lack of suitable fish habitat in the high gradient tributaries that drain into the main stem river, and most fish appeared to be limited to the river. No surveys were conducted in the West Fork Dosewallips River and Silt Creek. Future survey effort should focus on fish inventories in these areas. The non-detection of sculpins in the upper Dosewallips River Basin was unexpected based on their ubiquitous distribution throughout streams and rivers on the Olympic Peninsula at comparable elevations (OLYM Files; Mongillo and Hallock 1997).

We suggest three ideas that may explain the current distributions of fish in the upper Dosewallips River: 1) the formation of Dosewallips Falls occurred prior to the colonization by native fish species typically found in other Peninsula drainages; 2) Eastern brook trout and rainbow trout were planted into high elevation lakes in the basin and subsequently invaded the river; and 3) a population of steelhead trout existed before the formation of Dosewallips Falls, after which time these fish became landlocked and persisted as a resident freshwater population. Recent PCA microsatellite analysis indicates that rainbow trout collected upstream of Dosewallips Falls are genetically distinct from hatchery rainbow trout previously introduced to the Dosewallips Basin and native Pacific Northwest rainbow trout (Small 2003). Fisheries management should focus on the conservation of resident rainbow trout in the upper Dosewallips River through the elimination of harvest on this species. Previous angling regulations allowed the removal of two fish over 8 inches in length.

Quinault Basin

Of the three watersheds sampled in 2002 and 2003, the number of fish species was highest in the Quinault River Basin. However, we failed to detect chum salmon and sockeye salmon in three creeks (Big Creek, Graves Creek, and Bunch Creek) known to contain these species. We suspect that chum and sockeye salmon had already emigrated to the river or lake prior to our sampling during summer. The low numbers of adult steelhead and Chinook observed during snorkel surveys in the river also was surprising as we expected to see higher numbers from July to September. The status of summer run steelhead remains unknown in Park waters.

The upper East Fork Quinault River is one of the few areas where bull trout and Dolly Varden exist in sympatry (Leary and Allendorf 1997). Further investigation into the life history characteristics in

the upper East Fork Quinault River is necessary to determine genetically distinct populations and mechanisms that enable these two species to remain biologically distinct. We also verified four different species of sculpin in the Quinault.

The lower Quinault Basin contains perennial streams that flow under the North Shore Road. In particular, Big Creek, Canoe Creek, and Finley Creek contain a diverse range of habitats including sections of stream that remain dry for part of the year. We observed at least two species of salmonids and multiple age-classes of steelhead trout, cutthroat trout, and sculpins in each of these three tributaries. In general, the extent of roads and culverts make lower Quinault Basin tributaries more vulnerable to habitat degradation than others. These tributaries to the Quinault are critical to the production of anadromous fish, and maintenance of their natural biological, chemical, physical characteristics is essential. Future studies should investigate the effects of culverts on movement, distribution, and life history diversity of migratory fish in the Quinault River.

Although we sampled a total of 19 Quinault River Basin tributaries, we did not sample tributaries in the North Fork Quinault River Basin upstream of Rustler Creek. In order to complete a thorough inventory of the Quinault Basin, several tributaries (Wild Rose, Kimta, Geoduck, and Promise Creeks) need to be sampled in addition to sites in the upper main stem North Fork Quinault River.

Snorkel surveys provided useful information on the relative abundance of migratory fish species in the Quinault and enabled us to detect species or life stages that otherwise would have been difficult to sample using backpack electrofishing techniques. One unique finding was the presence of largescale suckers in the Quinault River. It is likely that largescale suckers inhabit Lake Quinault and portions of the river immediately upstream from the lake. Largescale suckers typically spawn in April and May in shallow water along the edges of pools and occasionally along lake shorelines (Wydoski and Whitney 1979). This is the first observation of this species in Park waters.

Elwha Basin

Results from the laboratory analysis revealed a low prevalence of fish pathogens in Elwha fish. USFWS biologists detected Bacterial-Kidney Disease (BKD) in nearly all groups of salmonids that were sampled upstream from Lake Aldwell. However, further analysis via Polymerase Chain Reaction is necessary to verify the presence of BKD in the Elwha Basin. The disease is characterized by lesions or growths on kidneys and other internal organs of salmonids and may be present in both hatchery and wild salmon (Warren 1991). The presence of BKD may have implications for fish species that re-colonize the Elwha after the scheduled removal of two dams in 2007.

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Appendix A. Summary of the number of fish captured, mean total lengths in (), and range of total lengths in the Bogachiel Basin. All units in mm.

Tributary	<i>Cottus confusus</i>	<i>Cottus gulosus</i>	<i>Cottus rhotheus</i>	<i>Unidentified sculpin</i>	<i>Oncorhynchus clarkii</i>	<i>Oncorhynchus kisutch</i>	<i>Oncorhynchus mykiss</i>
Bee	O	O	O	2 (47) 30-65	8 (78) 27-160	O	O
Boulevard	O	O	O	10 (54) 40-90	2 (95) 90-100	5 (45) 40-50	O
Camp	O	O	O	O	O	O	O
Cultus	O	O	O	O	O	O	O
Devil Club	O	O	O	9 (56) 40-75	9 (102) 80-125	33 (50) 40-72	O
Fraker	O	1 (74)	O	2 (65) 50-80	O	1 (40)	2 (77) 53-100
Hades	O	O	1 (80)	3 (67) 60-70	2 (95) 90-100	1 (60)	O
Hyak	1 (116)	O	O	2 (105) 100-110	O	O	9 (129) 85-170
Indian	O	1 (36)	O	10 (64) 40-70	14 (78) 40-130	O	4 (56) 40-90
Kloshe	O	O	O	3 (72) 50-85	2 (60) 40-80	14 (30) 15-50	O
Lolo	O	O	O	O	O	O	11 (116) 105-165
Mosquito	O	O	O	3 (58) 45-70	7 (113) 100-130	O	O
Olallie	O	O	1 (60)	6 (65) 40-100	17 (111) 45-210	22 (47) 40-70	1 (130)
Sunday	O	O	1 (70)	10 (48) 45-50	2 (130) 80-180	50 (55) 30-80	1 (90)
Tumwata	O	O	1 (40)	4 (64) 30-95	O	4 (35) 30-50	2 (105) 100-110
<i>Warkum</i>	O	2 (78) 70-86	2 (46) 42-59	3 (NA) 30-100	O	30 (45) 30-60	O

O=Fish species not detected.

Appendix B. Summary of the number of fish captured, mean total lengths in (), and range of total lengths in the Dosewallips Basin. All units in mm.

Tributary	<i>Oncorhynchus mykiss</i>	<i>Salvelinus fontinalis</i>
Dosewallips River	18 (80) 25-200	6 (200) 86-280
Burdick	1 (90)	O
Butler	O	O
Deception	1 (230)	O
Hawk	O	O
Pass	12 (125) 80-200	O
Slide	O	O
Station	O	O
Sunny Brook	3 (117) 80-135	O
Twin Creek (Lower)	O	O
Twin Creek (Upper)	O	O

O=Fish species not detected.

Appendix C. Summary of the number of fish captured, mean total lengths (), and range of total lengths in the Quinault Basin. All units in mm.

Stream	<i>Catostomus macrocheilus</i>	<i>Cottus asper</i>	<i>Cottus confusus</i>	<i>Cottus gulosus</i>	<i>Cottus rhotheus</i>	<i>Prosopium williamsoni</i>
Quinault River	*24 adults	O	O	O	O	*1,232 fish
Big	O	1 (83)	O	O	1 (41)	O
Bunch	O	O	O	O	O	O
Cannings	O	O	1 (80)	O	1 (51)	O
Canoe	O	O	5 (54) 29-87	O	O	O
Finley	O	O	4 (70) 22-100	O	O	O
Fire	O	O	O	O	O	O
Graves	O	O	1 (122)	1 (83)	1 (55)	O
Higley	O	1 (87)	1 (58)	2 (60)	1 (45)	O
Howe	O	O	O	O	10 (74) 53-84	O
Ignar	O	O	O	O	O	O
July	O	O	1 (81)	2 (48)	2 (39) 36-42	O
Kestner	O	O	2 (26) 24-28	3 (73) 56-89	O	O
Noname	O	O	O	O	O	O
O'Neil	O	O	O	O	O	0 (0)
Pyrites	O	O	O	O	O	O
Rustler	O	O	4 (61) 27-94	O	2 (55) 58-58	O
Slide	O	O	O	O	30 (97) 54-168	O
Success	O	O	O	O	O	O
Upper O'Neil	O	O	O	O	O	O

*Represent peak counts from snorkel surveys that occurred from May to September, 2003.

O=Fish species not detected.

Appendix C. Summary of the number of fish captured, mean total lengths (), and range of total lengths in the Quinault Basin. All units in mm. (continued).

Stream	<i>Oncorhynchus clarkii</i>	<i>O. kisutch</i>	<i>O. mykiss</i>	<i>O. nerka</i>	<i>O. tshawytscha</i>	<i>Bull Trout / Dolly Varden</i>
Quinault River	*289 fish	*1 adult	*11 adults	O	*5 adults	*77 adults
Big	1 (164)	82 (43) 37-52	20 (139) 95-215	O	1 (61)	O
Bunch	9 (77) 36-181	O	1 (48)	O	O	O
Cannings	10 (109) 97-130	4 (63) 57-67	17 (76) 26-156	O	O	O
Canoe	9 (136) 78-210	18 (63) 44-82	31 (75) 30-119	O	O	O
Finley	O	4 (70) 62-83	64 (103) 45-405	O	O	O
Fire	O	O	4 (43) 39-50	O	O	O
Graves	O	2 (58) 46-69	22 (78) 20-190	O	O	1 (203)
Higley	19 (89) 32-136	19 (53) 30-83	5 (84) 39-110	O	1 (61)	O
Howe	2 (105) 104-106	10 (68) 56-82	16 (116) 40-182	O	O	O
Ignar	O	O	8 (117) 75-182	O	O	O
July	8 (97) 41-117	13 (44) 29-59	7 (57) 42-91	1 (41)	3 (45) 37-54	O
Kestner	19 (98) 51-163	19 (61) 42-77	22 (83) 41-180	O	O	O
Noname	O	O	9 (150) 61-160	O	O	O
O'Neil	O	O	12 (71) 31-106	O	O	2 (106) 44-168
Pyrites	O	O	5 (83) 30-145	O	O	O
Rustler	O	15 (75) 61-92	29 (77) 44-250	O	O	2 (545) 530*-560
Slide	30 (87) 54-168	O	9 (59) 43-107	O	O	O
Success	O	O	8 (137) 78-190	O	O	O
Upper O'Neil	O	O	O	O	O	O

*Represent peak counts from snorkel surveys that occurred from May to September, 2003.

O=Fish species not detected.

Appendix D. List of voucher specimens collected from the Bogachiel, Dosewallips, and Quinault River Basins.

Accession/ Catalog #	Drainage Basin	Creek	Species	Total Length (mm)	Elevation (m)
595-34475	Bogachiel	Bee	<i>Oncorhynchus clarkii</i>	28	75
595-33061	Bogachiel	Bee	<i>Oncorhynchus clarkii</i>	27	85
595-33057	Bogachiel	Fraker	<i>Cottus gulosus</i>	74	550
595-33053	Bogachiel	Fraker	<i>Oncorhynchus mykiss</i>	53	550
595-33058	Bogachiel	Hyak	<i>Cottus confusus</i>	116	175
595-33055	Bogachiel	Indian	<i>Cottus gulosus</i>	36	40
595-33065	Bogachiel	Sunday	<i>Oncorhynchus kisutch</i>	72	25-900
595-33052	Bogachiel	Sunday	<i>Oncorhynchus mykiss</i>	90	475
595-33964	Bogachiel	Warkum	<i>Cottus gulosus</i>	70	275
595-34479	Bogachiel	Warkum	<i>Cottus gulosus</i>	86	275
595-33062	Dosewallips	mainstem*	<i>Oncorhynchus mykiss</i>	96	1625
595-33059	Dosewallips	mainstem**	<i>Oncorhynchus mykiss</i>	122	1625
595-33073	Dosewallips	mainstem	<i>Oncorhynchus mykiss</i>	23	2350
595-34536	Dosewallips	Pass Creek	<i>Oncorhynchus mykiss</i>	103	50
595-33051	Dosewallips	mainstem	<i>Salvelinus fontinalis</i>	176	2480
595-33077	Dosewallips	mainstem	<i>Salvelinus fontinalis</i>	86	2480
595-33056	Dosewallips	mainstem	<i>Salvelinus fontinalis</i>	165	3806
595-33571	Quinault	Big	<i>Oncorhynchus kisutch</i>	34	276
595-33570	Quinault	Big	<i>Oncorhynchus kisutch</i>	33	282
595-33572	Quinault	Big	<i>Cottus asper</i>	76	286
595-33574	Quinault	Bunch	<i>Oncorhynchus mykiss</i>	48	361
595-33578	Quinault	Cannings	<i>Oncorhynchus mykiss</i>	26	381
595-33576	Quinault	Cannings	<i>Oncorhynchus mykiss</i>	34	390
595-33577	Quinault	Cannings	<i>Cottus confusus</i>	80	482
595-33575	Quinault	Cannings	<i>Oncorhynchus mykiss</i>	37	594
595-33579	Quinault	Canoe	<i>Cottus confusus</i>	50	282
595-33580	Quinault	Canoe	<i>Oncorhynchus mykiss</i>	67	282
595-33581	Quinault	Canoe	<i>Cottus confusus</i>	87	301
595-33585	Quinault	Canoe	<i>Oncorhynchus mykiss</i>	50	311
595-33583	Quinault	Canoe	<i>Cottus confusus</i>	73	324
595-33584	Quinault	Canoe	<i>Cottus confusus</i>	29	357
595-34476	Quinault	Canoe	<i>Cottus confusus</i>	31	357
595-33582	Quinault	Canoe	<i>Oncorhynchus mykiss</i>	61	436
595-33586	Quinault	Finley	<i>Cottus confusus</i>	64	387
595-33587	Quinault	Finley	<i>Oncorhynchus mykiss</i>	73	394
595-33588	Quinault	Finley	<i>Cottus confusus</i>	95	407
595-33589	Quinault	Finley	<i>Cottus confusus</i>	22	410
595-33590	Quinault	Finley	<i>Cottus confusus</i>	100	495
595-33591	Quinault	Finley	<i>Oncorhynchus kisutch</i>	83	495
595-33593	Quinault	Graves	<i>Oncorhynchus mykiss</i>	42	589
595-33594	Quinault	Graves	<i>Oncorhynchus mykiss</i>	33	589

* River kilometer 15.8

** River kilometer 15.9

Appendix D. List of voucher specimens collected from the Bogachiel, Dosewallips, and Quinault River Basins (continued).

Accession/ Catalog #	Drainage Basin	Creek	Species	Total Length (mm)	Elevation
595-33595	Quinault	Graves	<i>Cottus gulosus</i>	83	589
595-33596	Quinault	Graves	<i>Oncorhynchus mykiss</i>	39	608
595-33597	Quinault	Graves	<i>Cottus confusus</i>	122	612
595-33598	Quinault	Higley	<i>Oncorhynchus tshawytscha</i>	61	187
595-33599	Quinault	Higley	<i>Cottus asper</i>	87	187
595-33601	Quinault	Higley	<i>Cottus confusus</i>	58	190
595-33602	Quinault	Higley	<i>Oncorhynchus mykiss</i>	39	203
595-33603	Quinault	Higley	<i>Cottus gulosus</i>	45	219
595-33604	Quinault	Higley	<i>Cottus gulosus</i>	75	226
595-33605	Quinault	Howe	<i>Oncorhynchus mykiss</i>	40	403
595-33606	Quinault	Howe	<i>Cottus rhotheus</i>	76	409
595-33607	Quinault	Howe	<i>Oncorhynchus kisutch</i>	75	419
595-33610	Quinault	July	<i>Oncorhynchus mykiss</i>	42	187
595-33609	Quinault	July	<i>Oncorhynchus mykiss</i>	42	187
595-34534	Quinault	July	<i>Oncorhynchus mykiss</i>	56	190
595-33612	Quinault	July	<i>Oncorhynchus mykiss</i> x <i>clarkii</i>	96	190
595-33608	Quinault	July	<i>Oncorhynchus mykiss</i>	43	194
595-33618	Quinault	July	<i>Cottus gulosus</i>	48	200
595-33616	Quinault	July	<i>Cottus confusus</i>	81	203
595-33615	Quinault	July	<i>Cottus gulosus</i>	48	222
595-33619	Quinault	Kestner	<i>Cottus gulosus</i>	51	350
595-33620	Quinault	Kestner	<i>Cottus gulosus</i>	85	350
595-33621	Quinault	Kestner	<i>Oncorhynchus mykiss</i>	53	380
595-33622	Quinault	Kestner	<i>Cottus gulosus</i>	78	390
595-33623	Quinault	Kestner	<i>Oncorhynchus mykiss</i>	62	416
595-33624	Quinault	Kestner	<i>Cottus confusus</i>	28	416
595-34535	Quinault	Kestner	<i>Cottus confusus</i>	24	416
595-33626	Quinault	O'Neil	<i>Oncorhynchus mykiss</i>	31	1227
595-33625	Quinault	O'Neil	<i>Oncorhynchus mykiss</i>	34	1227
595-33627	Quinault	Pyrites	<i>Oncorhynchus mykiss</i>	37	1437
595-33628	Quinault	Pyrites	<i>Oncorhynchus mykiss</i>	30	1473
595-33629	Quinault	Rustler	<i>Cottus rhotheus</i>	52	708
595-33630	Quinault	Rustler	<i>Cottus confusus</i>	94	717
595-33633	Quinault	Rustler	<i>Cottus confusus</i>	56	759
595-33632	Quinault	Rustler	<i>Cottus confusus</i>	66	762
595-33634	Quinault	Rustler	<i>Cottus confusus</i>	27	762
595-33636	Quinault	Slide	<i>Oncorhynchus mykiss</i>	54	205
595-33635	Quinault	Slide	<i>Oncorhynchus mykiss</i>	43	211
595-33637	Quinault	Slide	<i>Oncorhynchus mykiss</i>	70	272
595-33638	Quinault	Slide	<i>Oncorhynchus mykiss</i>	46	290
595-33631	Quinault	Slide	<i>Oncorhynchus mykiss</i>	45	290
595-33592	Quinault	Slide	<i>Oncorhynchus mykiss</i>	45	290

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