B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

# Lake Roosevelt Fisheries Evaluation Program

## Limnological and Fisheries Monitoring

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# Lake Roosevelt Fisheries Evaluation Program

## Limnological and Fisheries Monitoring

## Annual Report
## January 2000 – December 2000

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## Executive Summary

A slightly dryer than normal year yielded flows in Lake Roosevelt that were essentially equal to the past ten year average. Annual mean inflow and outflow were 3,160.3 $m^3$/s and 3,063.4 $m^3$/s respectively. Mean reservoir elevation was 387.2 m above sea level at the Grand Coulee Dam forebay. The forebay elevation was below the mean elevation for a total of 168 days. During the first half of the 2000 forebay elevation changed at a rate of 0.121 m/d and during the last half changed at a rate of 0.208 m/d. The higher rate of elevation change earlier in the year is due to the drawdown to accommodate spring runoff. Mean annual water retention time was 40 days.

Annual mean total dissolved gas was 108%. Total dissolved gas was greatest at upriver locations (110% = US/Canada Border annual mean) and decreased moving toward Grand Coulee Dam (106% = Grand Coulee Dam Forebay annual mean). Total dissolved gas was greatest in May (122% reservoir wide monthly mean). Gas bubble trauma was observed in 16 fish primarily largescale suckers and was low in severity.

Reservoir wide mean temperatures were greatest in August (19.5 °C) and lowest in January (5.5 °C). The Spokane River and Sanpoil River Arms experienced higher temperatures than the mainstem reservoir. Brief stratification was observed at the Sanpoil River shore location in July. Warm water temperatures in the Spokane Arm contributed to low dissolved oxygen concentrations in August (2.6 mg/L at 33 m). However, decomposition of summer algal biomass was likely the main cause of depressed dissolved oxygen concentrations. Otherwise, dissolved oxygen profiles were relatively uniform throughout the water column across other sampling locations.

Annual mean Secchi depth throughout the reservoir was 5.7 m. Nutrient concentrations were generally low, however, annual mean total phosphorus (0.016 mg/L) was in the mesotrophic range. Annual mean total nitrogen was in the meso-oligotrophic range. Total nitrogen to total phosphorus ratios were large (31:1 annual mean) likely indicating phosphorus limitations to phytoplankton.

Phytoplankton density and biovolume were dominated by diatoms (annual mean relative density = 40% and annual mean relative biovolume = 62%) and cryptophytes (annual mean relative density = 27% and annual mean relative biovolume = 24%). Mean diatom biovolume peaked in June (0.220 $mm^3/L$) and cryptophytes peaked in May (0.163 $mm^3/L$). Reservoir wide mean annual phytoplankton chlorophyll *a* was 1.1 $mg/m^3$. Phytoplankton chlorophyll *a* was greater in the Spokane Arm (Porcupine Bay annual mean 4.9 $mg/m^3$). During the spring and summer mean shore phytoplankton chlorophyll *a* (4.6 $mg/m^3$) was greater than the pelagic mean (2.4 $mg/m^3$). Diatom and cryptophyte biomass likely provided zooplankton with fair to good nutrition quality. Phytoplankton measures were positively correlated with reservoir inflow. Phosphorus associated with inflow may be stimulating phytoplankton growth. Carlson's trophic state index places Lake Roosevelt in the meso-oligotrophic range with mean trophic state indices ranging from 22 to 39.

Attached algae were also dominated by diatoms. The relative density and biovolume of attached diatoms were 94% and 85% respectively. Annual mean attached algae density, biovolume, and chlorophyll *a* concentrations were 57,700 $cells/cm^2$, 0.0338 $mm^3/cm^2$, and 14.0 $mg/m^2$ respectively. Attached algae biovolume accumulated at a mean rate of 5.91 $mm^3/m^2 \bullet day$. The observed attached algae communities likely represent an early seral stage because of their attachment substrate (glass slides) and the disturbance regime.

Copepods accounted for 86% of total pelagic zooplankton density; however, 62% of zooplankton biomass was associated with *Daphnia* spp. Mean annual zooplankton density and biomass was 302 $organisms/m^3$ and 1,163 ($\mu g/m^3$) respectively. Zooplankton biomass was greater in the Spokane and Sanpoil arms than the mainstem reservoir. Additionally, zooplankton biomass was generally greater at locations near Grand Coulee Dam and lower at upriver locations. Zooplankton measures were positively correlated with reservoir wide temperatures.

Electrofishing and gill net surveys yielded 1,685 fish representing 21 species from 9 families. Walleye was the most abundant species in electrofishing surveys, representing 30.3% of the fish captured. The catch-per-unit-effort (CPUE) for electrofishing surveys (27.1 fish/hour) was similar to that observed in 1999, but considerably lower than the four years prior. Lake whitefish were the most abundant species in both horizontal gill nets and vertical gill nets. Consistent with electrofishing yield, gill net CPUE (0.29 fish/hour) was similar to the previous year, but lower than the four years prior to 1999. CPUE was higher for horizontal gill nets (0.36 fish/hour) than for vertical gill nets (0.02 fish/hour). Walleye showed the greatest increase in relative abundance and CPUE in both electrofishing and gill net surveys.

The test fishery was performed in January near Spring Canyon and targeted kokanee salmon. Anglers yielded 147 fish from 403 rod hours of effort (CPUE = 0.36 fish/hour). Rainbow trout (n = 101) and kokanee salmon (n = 46) represented the only species captured.

The Two Rivers Trout Derby held in August in the vicinity of the Spokane River confluence produced 425 fish harvested by 60 anglers over a two-day period. Rainbow trout (n = 405) and kokanee salmon (n = 46) were the target species and the only recorded harvest.

Scale analysis was used to determine age for twelve species from four families. Northern pikeminnow represented the only member of the Cyprinidae family and were aged from one to nine. Members of the Salmonidae family included lake whitefish and mountain whitefish aged from one to eight, kokanee salmon from one to three, rainbow trout and brown trout from one to four, and eastern brook trout from one to two years. Three species of the Centrarchidae family were smallmouth bass aged from one to three, largemouth bass from one to five, and black crappie from one to four years. Species representing the Percidae family were walleye aged from one to nine, and yellow perch from one to four years.

Mean condition factors were higher for hatchery origin rainbow trout and kokanee salmon compared to kokanee salmon and rainbow trout of wild origin. Kokanee salmon, both hatchery origin and wild origin, possessed higher condition factors compared to 1999 and the condition factor of hatchery origin rainbow trout was the same as the previous year. All other salmonids showed a decreased condition factor from 1999. Walleye and smallmouth bass were the only non-salmonids that had increased condition factors. All other non-salmonids expressed the lowest condition since 1997.

The most important diet item was Cladocera for rainbow trout and kokanee salmon, while Osteichthyes was the most important diet category of walleye and smallmouth bass. High diet overlaps (>0.70) were observed between brown trout, rainbow trout, kokanee salmon, and lake whitefish, longnose suckers with largescale suckers, and black crappie with yellow perch.

Hatchery origin and wild origin rainbow trout also exhibited high diet overlap (0.86) with the most important food items being Cladocera, followed by Diptera, Trichoptera, and Hemiptera.

Of the 39,188 rainbow trout tagged in 2000, 323 tags were recovered. All of the tags recovered were from diploid rainbow trout, although 9,226 triploid rainbow trout were tagged and released. More tags were recovered from fish released at Seven Bays than fish released at Kettle Falls. Most of the tag recoveries from fish released at Kettle Falls were made downstream of the release location, whereas the majority of the recoveries made from fish released at Seven Bays were made at the release location. Of the 323 tags recovered, 4% were made below Grand Coulee Dam, although concerted tag recovery efforts do not extend below the dam. The time between tagging and capture were similar for fish tagged and released at Kettle Falls and Seven Bays, however Phalon Lake stock rainbow trout released at Kettle Falls had the shortest time between tag and capture. Growth rates in total length were similar for both groups, however growth rates in weight were greatest for fish released at Seven Bays.

Creel surveys estimated 170,930 angler trips were made to Lake Roosevelt during the nine months the surveys were performed. Angler pressure was estimated at 858,068 angler hours and mean trip length was 5.02 hours. The total estimated catch (fish harvested and released) was 319,118 fish, smallmouth bass being the most abundant species captured (n = 121,007). Estimated harvest was 176,188 fish, the majority of which were rainbow trout (n = 117,210). Kokanee salmon harvest (12,129) was the highest since 1995. Rainbow trout was the most frequently targeted species reservoir wide. The estimated economic value of the fishery was $4.66 million.

## Acknowledgments

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## Project History

The construction of Grand Coulee Dam in 1939 permanently blocked waters historically utilized for reproduction and rearing by anadromous fish species. Grand Coulee Dam eliminated steelhead (*Onchorhynchus mykiss*), chinook salmon (*O. tshawytscha*), coho salmon *(O. kisutch)* and sockeye salmon *(O. nerka*) from returning to approximately 1,835 km (1,140 miles) of natal streams and tributaries found in the upper Columbia River drainage in the United States and Canada (Mullan 1984; Mullan et al. 1986).

The Pacific Northwest Electric Power Planning and Conservation Act of 1980 gave the Bonneville Power Administration (BPA), the authority and responsibility to use its legal and financial resources, "to protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries. This is to be done in a manner consistent with the program adopted by the Northwest Power Planning Council (NWPPC), and the purposes of the Act" (NWPPC, 1987).

With the phrase "protect, mitigate and enhance," Congress signaled its intent that the NWPPC's fish and wildlife program should do more than avoid future hydroelectric damage to the basin's fish and wildlife. The program must also counter past damage, work toward rebuilding those fish and wildlife populations that have been harmed by the hydropower system, protect the Columbia Basin's fish and wildlife resources, and mitigate for harm caused by decades of hydroelectric development and operations. By law, this program is limited to measures that deal with impacts created by the development, operation and management of hydroelectric facilities on the Columbia River and its tributaries.

Resident game fish populations have been established in Franklin D. Roosevelt Lake, the reservoir behind Grand Coulee Dam, since the elimination of anadromous fish species. The resident game fish populations are now responsible for attracting a large percentage of the recreational visits to the region. In 2000 approximately 1,415,600 people visited the Lake Roosevelt National Recreational Area (WSDB 2003). Increased use of the reservoir prompted amplified efforts to enhance the Native American subsistence fishery and the resident sport fishery in 1984 with hatchery supplementation of rainbow trout *(O. mykiss)* and kokanee salmon

(*O. nerka*). This was followed by the formation of the Spokane Tribal Lake Roosevelt Monitoring Project (LRMP) in 1988 and later by formation of the Lake Roosevelt Data Collection Project in 1991.

The Lake Roosevelt Data Collection Project began in July 1991 as part of the BPA, Bureau of Reclamation, and U.S. Army Corps of Engineers' System Operation Review process. This process sought to develop an operational scenario for the federal Columbia River hydropower system to maximize the in-reservoir fisheries with minimal impacts to all other stakeholders in the management of the Columbia River.

The Lake Roosevelt Monitoring / Data Collection Program (LRMP) is the result of a merger between the Lake Roosevelt Monitoring Program (BPA No. 8806300) and the Lake Roosevelt Data Collection Project (BPA No. 9404300). These projects were merged in 1996 forming the Lake Roosevelt Monitoring Program (LRMP), which continues the work historically performed under the separate projects.

The LRMP has two main goals. The first is to develop a biological model for Lake Roosevelt that will predict in-reservoir biological responses to a range of water management operational scenarios, and to develop fisheries and reservoir management strategies accordingly. The model will allow identification of lake operations that minimize impacts on lake biota while addressing the needs of other interests (e.g. flood control, hydropower generation, irrigation, and downstream resident and anadromous fisheries). Major components of the model will include: 1) quantification of entrainment and other impacts to phytoplankton, zooplankton and fish caused by reservoir drawdowns and low water retention times; 2) quantification of seasonal distributions, standing crop, and habitat use of fish food organisms (i.e. zooplankton and juvenile fish species) in the reservoir; 3) examination of variations in fish growth and abundance in relation to reservoir operations, prey abundance and predator/prey relationships; and 4) quantification of habitat alterations due to hydro-operations.

The second goal of the LRMP is to evaluate the impacts of hatchery kokanee salmon and rainbow trout on the ecosystem and to determine stocking strategies that maximize angler harvest and return of adult kokanee salmon to egg collection facilities. Major tasks of the hatchery evaluation portion of the project include conducting a year round (9 month) reservoir wide creel survey, sampling the fishery during spring, summer and fall via electro-fishing and gillnet surveys, and collecting information on diet, growth, and age composition of various fish species in Lake Roosevelt.

## Introduction

### Limnology

In 1980, primary production values revealed the trophic status of the reservoir to be mesotrophic to slightly eutrophic (Stober et al. 1981). However, recent data indicate Lake Roosevelt has become more oligotrophic (RAASC 1999; Wierenga et al. 1998; Wilson et al. 1996). Reductions in industrial effluents into the Columbia River, mainly from the British Columbia based Cominco, Ltd. lead-zinc smelter and fertilizer plant, along with the Celgar Pulp Co. mill, have reduced the reservoir's nutrient load (Sheehan and Lamb 1987; Johnson et al. 1988; Kenyon and Glover 1994). Reductions in reservoir nutrient loading are thought to have changed the trophic status, in part, through declines in phytoplankton abundance. Since zooplankton rely on phytoplankton as a food source the reduction in pelagic primary production is of concern.

Long-term monitoring by the LRMP and others have underlined the importance of zooplankton communities in supporting viable populations of resident sport fish within the reservoir (Beckman et al. 1985; Peone et al. 1990; Cichosz et al. 1997; Cichosz et al. 1999). The zooplankton community of Lake Roosevelt forms a critical link between phytoplankton and secondary consumers. In particular, cladoceran zooplankton comprise a substantial portion of the diets of many Lake Roosevelt fishes (Beckman et al. 1985; Cichosz et al. 1999). Monitoring zooplankton populations in Lake Roosevelt assists in determining biomass available to fish, and are necessary for modeling efforts.

### Fishery

Monitoring of the Lake Roosevelt fishery began in July 1988 (Peone et al. 1990). The monitoring program is a cooperative effort between the Spokane Tribe of Indians (STI), Colville Confederated Tribes (CCT), Washington Department of Fish and Wildlife (WDFW), and Eastern Washington University (EWU). Fishery surveys were conducted to collect information on relative abundance, growth and condition, dietary items and overlap focused on inter-and-intra specific competition, identifying predator-prey relationships, and harvest of sport fish.

The Lake Roosevelt fishery has brought in 5.3 to 20.7 million dollars annually to the local economy since artificial production began in the late 1980's (McLellan et al. 2003). Anglers have harvested as many as an estimated 32,353 kokanee salmon and 499,460 rainbow trout annually in Lake Roosevelt since monitoring began (Cichosz et al. 1999). A self-sustaining walleye population is managed in conjunction with the salmonid fishery to maximize sport fishing opportunities. Long-term monitoring of the fishery has allowed managers to adjust regulations to maintain the integrity of the fishery while maximizing harvest.

## Study Objectives 2000

### Limnology

1) Analyze surface hydrology data for Lake Roosevelt.
2) Collect limnological data from Lake Roosevelt including temperature, dissolved oxygen, conductivity, turbidity, pH, redox potentials, and total dissolved gas.
3) Collect primary production data, including speciation, abundance, and chlorophyll *a* for phytoplankton and attached algae from Lake Roosevelt.
4) Collect zooplankton biomass, density, and length data from Lake Roosevelt.
5) Examine interactions between parameters to improve understanding of the reservoir ecosystem within 2000.
6) Maintain complete databases to be used in the development of an ecological model of Lake Roosevelt.

### Fishery

1) Estimate the relative abundance and catch-per-unit-effort of fishes in Lake Roosevelt through electrofishing, gill net, beach seine, and angling surveys to evaluate species population trends.
2) Back calculate length at age of selected fish species collected from Lake Roosevelt to assess annual growth rates by year class.
3) Assess ecological impacts, relative importance of predator/prey relationships, and dietary overlap for the majority of fish species in Lake Roosevelt.

4) Estimate annual angler pressure and harvest, mean size of harvested fish, and conduct comparative assessments through rove-access creel surveys.

5) Compare and contrast historical and current fishery and limnological data to evaluate the reservoir ecosystem stability.

6) Evaluate the performance of hatchery stocks of kokanee salmon and rainbow trout as they contribute to the fishery.

7) Make comparisons of hatchery origin fishes to native wild stocks to identify potential impacts of artificial production.

**Additional objectives (sub-contracted to other agencies)**

1) Evaluation of hatchery kokanee returns to egg collection facilities (EWU) (McLellan et al. 2001).

2) Evaluation of limiting factors for stocked kokanee and rainbow trout in Lake Roosevelt (WDFW) (Baldwin et al. 2002, and Baldwin et al. 2003).

3) Assessment of Lake Roosevelt habitat (CCT).

Previous annual reports for the Lake Roosevelt Data Collection Project include, Shields and Underwood (1996a and b), Cichosz et al. (1997; combined 1996 Annual Report for the Lake Roosevelt Monitoring and Data Collection Programs), Cichosz et al. (1999), Shields et al. (2002), and Spotts et al.(2002). Previous reports for the Lake Roosevelt Monitoring Program include Peone et al. (1990), Griffith and Scholz (1991), Griffith et al. (1995), Griffith and McDowell (1996), Voeller (1996), Underwood et al. (1996a and b), Cichosz et al. (1997; combined 1996 Annual Report for the Lake Roosevelt Monitoring and Data Collection Programs), and McLellan et al. (2003; 1999 Annual Report).

# Methods

## Description of Study Area

Lake Roosevelt is a mainstem Columbia River impoundment formed by the completion of Grand Coulee Dam in 1941 (Figure 1). The reservoir, at a full pool elevation of 393 m (1290 ft) inundates 33,490 hectares (82,691 acres) with a storage capacity of $1.16 \times 10^{10}$ $m^3$ ($9.41 \times 10^{10}$ acre-ft) and a maximum depth of 122 meters (400 ft) (Nigro et al. 1981). Lake Roosevelt is the largest reservoir in Washington, the sixth largest reservoir in the U.S., and one of the largest artificial lakes in the world (Johnson et al. 1991). Grand Coulee Dam is the largest producer of hydropower in the United States and the third largest in the world, generating $462 million in power in 1994 (GCDIC 2002). Grand Coulee Dam is a Bureau of Reclamation storage project operated primarily for power, flood control, and irrigation with secondary operations for recreation, fish, and wildlife.

The Lake Roosevelt watershed drains a wide range of ecological habitat types including the steppe-shrub desert of central Washington, the agricultural/urban areas of the Spokane and Colville River valleys, the ponderosa pine (*Pinus ponderosa*) forests of the inter-mountain plateau, and the western snow pack of the Rocky Mountains (Wilson 1996). Major tributaries to Lake Roosevelt include the Columbia, Spokane, and Kettle Rivers, which contribute an average of 89, 7, and 3 percent of the inflow volumes to the lake respectively (Stober et al. 1981).

Flood control operations at Grand Coulee Dam annually reduce reservoir water elevation by up to 24 m between January and June to create room for peak spring flows. Spring drawdown events decrease the volume of the reservoir by an average of 55 % and its surface area by 45 % annually (Beckman et al. 1985). Full pool elevation (393 m) is usually achieved by early July, coinciding with the Fourth of July weekend (Nigro et al. 1981). More recently, Lake Roosevelt has experienced an August drawdown of three-meters to facilitate anadromous fish migration through the lower Columbia and Snake Rivers.

## Limnology

### Surface Hydrology

Hydrologic data was obtained from the "data at real time" (DART) website maintained by the University of Washington. Their hydrologic data was provided courtesy of the US Army Corps of Engineers (USACOE 2003). Reservoir elevation was converted to volume of water stored ($m^3/s \cdot d$) using a reservoir water storage table (USACOE 1981), and daily water retention time was calculated by reservoir volume divided by outflow.

### Physical and Chemical Characteristics

Water temperature, dissolved oxygen, conductivity, pH, oxidation–reduction (redox) potential, turbidity, total dissolved solids, and total dissolved gas were recorded from pelagic and shore/littoral zones using a Hydrolab Surveyor 4. The Hydrolab was maintained and calibrated as recommend by the manufacturer. When instrument malfunctions or other sampling issues occurred they were noted in the results section of this report.

Lake Roosevelt was sampled throughout 2000 during 18 consecutive rounds (Table 1). Nineteen different locations were sampled (Table 2; Figure 1). Hydrolab data was collected from the surface to a depth of 33 m at 3 m intervals. Additional Hydrolab measurements were taken from 40 m to 90 m at 10 m intervals at Keller Ferry and Spring Canyon to characterize the profundal zones of the lower reservoir. Ten locations were sampled at near-shore and mid-channel sites to compare pelagic and littoral habitats (Table 2).

Euphotic zone depths were estimated using a Kahl Scientific Instruments Model 268WD305 underwater irradiameter. Euphotic zone depths were defined as the portion of the water column extending from the surface to a depth where one percent of ambient surface light penetrates (Horne and Goldman 1994). Water transparency was also measured with a standard 20 cm (diameter) Secchi disk.

Macronutrients and other chemical constituents were determined at ten pelagic and five littoral locations (Table 2). Water samples were collected with an integrated sampling tube from the bottom of the euphotic zone to the surface. Samples were stored in acid washed bottles, and sent to the EPA certified, Spokane Tribal laboratory in Spokane, WA for analysis. Chemical constituents were analyzed using standard methodologies (Table 3) listed in the National Environmental Methods Index or NEMI (EPA and USGS 2003). Some chemical concentrations were at or below reporting limits (the smallest measured concentration of a substance that can be reliably measured by using a given analytical method). In those cases, theoretical concentrations were substituted. These concentrations were determined by dividing the report limit in half (RAASC 1999; USGS 1999).

**Primary Production**

Spatial and temporal trends in primary producers within Lake Roosevelt were investigated by conducting phytoplankton and attached algae studies within the euphotic zone. Phytoplankton density and biovolume samples were collected at ten pelagic and five littoral locations (Table 2).

Phytoplankton samples were collected by pumping water from selected depths within the euphotic zone with an opaque hose. These samples were preserved with Lugol's solution. Phytoplankton samples were processed at Eastern Washington University, Limnology Lab in Cheney, WA. Analysis included speciation, enumeration, and estimation of biovolumes.

Phytoplankton chlorophyll *a* measurements were conducted at twelve pelagic and four littoral locations on Lake Roosevelt (Table 2). Phytoplankton chlorophyll *a* concentrations were determined using a Turner Designs Model 10-AU field fluorometer, which was calibrated monthly to laboratory determined (EWU spectrophotometrically) chlorophyll *a* concentrations. Phytoplankton chlorophyll *a* samples were taken from three depths within the euphotic zone at a given location: 0.5 m below the surface; the mid-point of the euphotic zone; and 0.5 m above the bottom of the euphotic zone.

Trophic status was assessed using Secchi disk depths, chlorophyll *a* concentrations, total phosphorus, and total nitrogen concentrations. The various measures were entered into Carlson's trophic state index (Carlson 1977; Carlson and Simpson 1996). The equations used in the trophic state index (TSI) were as follows:

| | | |
|---|---|---|
| TSI SD | = | 60 - 14.41 ln (Secchi Disk in m) |
| TSI Chl *a* | = | 9.81 ln (Chlorophyll *a* in $mg/m^3$) + 30.6 |
| TSI TP | = | 14.42 ln (Total P in $mg/m^3$) + 4.15 |
| TSI TN | = | 54.45 + 14.43 ln (Total N in mg/L) |
| n | = | number of TSI observations |
| TSI Overall | = | (TSI SD + TSI Chl *a* + TSI TP + TSI TN) / n |

Attached algae colonization rates were monitored on artificial growing substrates beginning in July and continuing until November in embayment/littoral habitats near Gifford, Porcupine Bay, Seven Bays and Spring Canyon (Table 2). Attached algae colonized glass microscope slides anchored at depths of 1.5 m (5 ft) and 4.6 m (15 ft) below the reservoir surface. Slides were collected and frozen following retrieval and sent to Eastern Washington University's, Limnology Lab for speciation, enumeration, biovolume estimation, and chlorophyll *a* concentration determination.

Table 1. Limnology sampling dates and corresponding round numbers on Lake Roosevelt (2000).

| Round | Sampling Dates | Round | Sampling Dates |
|---|---|---|---|
| 1 | Jan. 18-20, & 24 | 10 | Jul. 25-27 |
| 2 | Feb. 14-15 | 11 | Aug. 7-9 |
| 3 | Mar. 20-23 | 12 | Aug. 21-22 |
| 4 | Apr. 17-19, & 27 | 13 | Sep. 11-14 |
| 5 | May 3-5 | 14 | Sep. 25-26 |
| 6 | May 6 & 17 | 15 | Oct. 9-12 |
| 7 | Jun. 5-8 | 16 | Oct. 24-25 |
| 8 | Jun. 19-20 | 17 | Nov. 15-16 |
| 9 | Jul. 5-7 | 18 | Dec. 12, 14, & 20 |

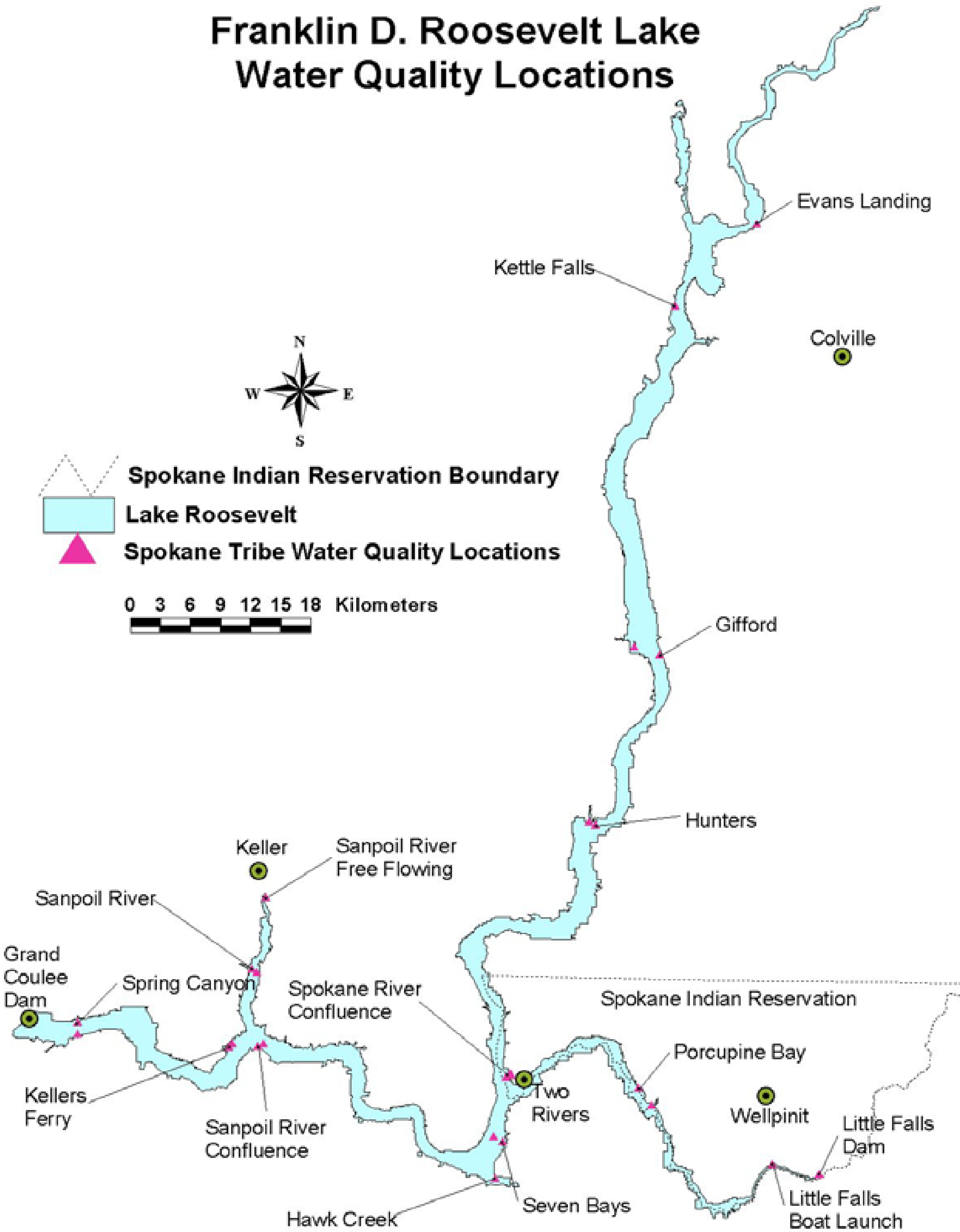


Figure 1. Limnology sampling stations on Lake Roosevelt, WA (2000).

Table 2. Sampling locations on Lake Roosevelt and limnologic parameters sampled (2000).

| Location Name | Location # | River km From Mouth | Hydrolab Profiles | Water Quality | Zooplankton Den. & Biomass | Phytoplankton Den. & Biovol. | Phytoplankton Chlorophyll *a* | Attached Algae Den. & Biovol. | Attached Algae Chlorophyll *a* |
|---|---|---|---|---|---|---|---|---|---|
| **Columbia River** | | | | | | | | | |
| Evan's Landing | 0.0 | 1143 | P | P | P | P | P | | |
| Kettle Falls | 1.0 | 1128 | P & L | P | P | P | P | | |
| <u>Gifford</u> | 2.0 | 1085 | P & L | P & L | P | P & L | P & L | L | L |
| Hunters | 3.0 | 1064 | P & L | P | P | P | P | | |
| Spokane R. Confluence | 5.5 | 1028 | P & L | | P | | P | | |
| <u>Seven Bays</u> | 6.0 | 1024 | P & L | P & L | P | P & L | P | L | L |
| Sanpoil R. Confluence | 8.5 | 992 | P & L | P | P | P | P | | |
| <u>Keller Ferry</u> | 7.0 | 989 | P & L | P | P | P | P | | |
| <u>Spring Canyon</u> | 9.0 | 965 | P & L | P & L | P | P & L | P & L | L | L |
| **Spokane River** | | | | | | | | | |
| Little Falls Above Dam | 5.6 | 47.5 | L | | | | | | |
| Little Falls Raceway | 5.4 | 47.5 | L | | | | | | |
| Little Falls Spillway | 5.3 | 47.5 | L | | | | | | |
| Little Falls Turbine | 5.2 | 47.5 | L | | | | | | |
| Little Falls Boat Launch | 5.1 | 41.8 | L | | | | | | |
| <u>Porcupine Bay</u> | 4.0 | 18.5 | P & L | P & L | P | P & L | P & L | L | L |
| **Sanpoil River** | | | | | | | | | |
| Free Flowing Sanpoil R. | 8.8 | 12.9 | L | | | | | | |
| Sanpoil R. | 8.0 | 3.6 | P & L | P & L | P | P & L | P & L | | |
| **Other** | | | | | | | | | |
| Hawk Creek | 6.5 | 1.2 | L | | | | L | | |

P=pelagic L=littoral <u>Index Station</u>

Table 3. Report limits and methods for selected analytes.

| Analyte | Method[1] | Report Limit |
|---|---|---|
| $NO_3^-$ as N | 300.0 | <0.01 (mg/L) |
| $NO_2^-$ as N | 300.0 | <0.01 & <0.005 (mg/L) |
| $NH_3$ as N | 350.3 | <0.05 (mg/L) |
| Total Kjeldahl Nitrogen | 351.4 | <0.03 (mg/L) |
| Total N | Sum all forms | -- |
| Total P | 200.7 | <0.005 (mg/L) |
| Ortho P | 300.0 | <0.001-<0.01 (mg/L) |
| Alkalinity | 310.1 | <1.0 (mg/L) |
| Silicon | 200.7 | <0.02 (mg/L) |
| Total Suspended Solids | 160.2 | <4.0 & <2.0 (mg/L) |
| Turbidity | 180.1 | <0.5 NTU |
| Hardness as $CaCO_3$ | 200.7 | <0.02 (mg/L) |

[1]All methods from NEMI except for total N.

### Zooplankton

Zooplankton were sampled from eleven pelagic locations throughout 2000 (Table 2). All zooplankton samples collected were obtained using a 20 cm diameter, 80 µm mesh Wisconsin plankton net fitted with a high efficiency sampling collar (Aquatic Resource Incorporated). Three vertical Wisconsin zooplankton tows were taken from a depth of 33 m to the surface. In cases where sampling location depths were less than 33 m, zooplankton tows were taken from 1 m above the bottom to the lake surface.

Assuming 100% filtering efficiency, each 33 m tow filtered approximately 1,036 liters of reservoir water. When tow depth was taken from 1 m off the bottom, the depth was noted and the filtered volume was calculated during zooplankton processing. Zooplankton collected from each tow were rinsed onto a 63 µm mesh screen (to remove excess water) and flash killed for one minute in 95% ethanol to ensure maximum egg retention. Collected organisms were then rinsed into a 60 ml polyethylene sample bottle using 70% ethanol for preservation.

In the laboratory, zooplankton samples were sorted, counted, and identified to species or lowest practical taxa using taxonomic keys by Brooks (1957), Edmondson (1959), Pennak (1989) and Thorp and Covitch (1991). When organism densities were too high to count directly, sub-samples were taken using a Motodo 1.5 liter plankton splitter. High-density zooplankton samples were split until approximately 100 organisms of the most prevalent species remained in the sub-sample. Organism lengths were taken from the first 20 individuals of each species using a Leica MZ-8 dissecting microscope fitted with an optical micrometer. Upon obtaining 20 length measurements by species, all remaining individuals were counted. Organism lengths for Branchiopoda (i.e. *Daphnia* and other cladocera) were taken from the anterior most region of the head to the posterior base of the carapace. Organism lengths for copepod taxa were taken from the anterior most region of the head to the base of the caudal ramus.

Zooplankton length, density, biomass, number of eggs per female and organism sex ratios (where applicable) were calculated for individual tows and the results of replicate tows were combined to derive average values by location and date. The average number of eggs per female was calculated for each tow by counting the total number of eggs by species and dividing this value by the number of females observed for the species. Zooplankton densities were calculated through the incorporation of two equations. First, the volume of water sampled by the plankton net was calculated according to the equation:

$$V = \pi r^2 h$$

Where:

| | | |
|---|---|---|
| V | = | volume of water sampled (liters); |
| $\pi$ | = | pi (3.14); |
| r | = | radius of the sample net (cm); and |
| h | = | depth of the sample (m). |

Second, the number of zooplankton per cubic meter of water sampled was calculated using the equation:

$$D = ((TC \times SF)/V) \times 1000$$

Where:

| | | |
|---|---|---|
| D | = | organism density (#/$m^3$); |
| TC | = | total organisms measured and counted; |
| SF | = | the split fraction of original sample analyzed; and |
| V | = | volume of water sampled (liters). |

Zooplankton biomass was determined for each species using the length to dry weight regressions of Dumont et al. (1975) and Bottrell et al. (1976) as summarized by Downing and Rigler (1984;

Table 4). Dry weight estimates for observed zooplankton species were calculated using the equation:

$$W = e^{a + b \ln(L)}$$

Where:

| | | |
|---|---|---|
| W | = | dry weight estimate (µg) for each species; |
| a | = | the slope intercept constant; |
| b | = | the slope constant of the regression line; and |
| L | = | length measurement (µm) for each individual. |

Table 4. Slope (b) and intercept (ln a) values used to estimate dry weights for 2000 Lake Roosevelt, WA zooplankton samples.

| **Zooplankton Species** | **ln *a*** | ***b*** |
|---|---|---|
| ***Daphnia*** | | |
| *Daphnia galeata mendotae* [a] | 1.5100 | 2.5600 |
| *Daphnia pulex* [a] | 1.5900 | 2.7700 |
| *Daphnia retrocurva* [a] | 1.4322 | 3.1290 |
| *Daphnia rosea* [b] | 1.6380 | 1.8900 |
| *Daphnia thorata* [a] | 1.5100 | 2.5600 |
| Juvenile Daphnia [b] | 2.4500 | 2.6700 |
| **Other Cladocera** | | |
| *Acroperus harpae* [c] | -4.6565 | 0.8500 |
| *Alona quadrangularis* [a] | 2.8713 | 3.0790 |
| *Bosmina longirostris* [a] | 3.2800 | 3.1300 |
| *Ceriodaphnia quadrangula* [a] | 2.5623 | 3.3380 |
| *Ceriodaphnia reticulata* [a] | 2.8300 | 3.1500 |
| *Chydorus sphaericus* [a] | 4.5430 | 3.6360 |
| *Diaphanosoma brachyurum* [a] | 1.6242 | 3.0468 |
| *Ilyocriptus acutifrons* [a] | 5.9913 | 7.942 |
| *Ilyocriptus sordidus* [a] | 5.9913 | 7.942 |
| *Leptodora kindtii* [a] | -0.8220 | 2.6700 |
| *Sida crystallina* [a] | 2.0539 | 2.1890 |
| **Copepoda** | | |
| Calanoid/cyclopoid nauplii [c] | 1.1000 | 1.8900 |
| *Diacyclops bicuspidatus thomasi* [c] | 1.1000 | 2.5900 |
| *Epischura nevadensis* [c] | 0.0077 | 2.3300 |
| Harpacticoid [b] | 2.5265 | 4.4000 |
| *Leptodiaptomus ashlandi* [c] | 0.0077 | 2.3300 |
| *Mesocyclops edax* [c] | 1.1000 | 2.5900 |

References: [a]Downing and Rigler 1984, [b]Bottrell et al. 1976, and [c]Dumont et al. 1975.

Statistical analysis of limnology data included analysis of variance (ANOVA) with significance tests based on F distributions. Analyses of variances were supplemented by pairwise comparisons between means to assess differences between groupings (Kleinhaum et al. 1998). Pairwise comparisons included Fisher's protected least squared difference (Fisher PLSD) and Scheffe multiple comparison (Scheffe). Pairwise comparisons and ANOVA's were computed using Statview 5.0.1. Statistical test assumptions (homogeneity of variance and normal distribution) were verified and data were transformed (natural log) in some cases to better meet assumptions (Kleinhaum et al. 1998). Simple linear regression on selected limnology data was preformed to examine the relationship between a dependent and independent variable. Pearson's correlation was also used to measure the degree of linear relationship between selected limnologic variables. Significance of correlations was determined using a z-test. Correlations between sampling round means are noted and hydrologic data round means were calculated using measurements from either the 14 or 30 day period prior to the sampling round. Standard abbreviations used were: standard deviation (SD), sample size (n), minimum (Min), and maximum (Max).

**Fishery**

**Fisheries Surveys**

Seasonal (spring, summer, and fall) fishery surveys were conducted at ten index locations in the reservoir, which included: Evans Landing, Kettle Falls, Gifford, Hunters, Porcupine Bay, Little Falls Dam, Seven Bays, Sanpoil River, Keller Ferry, and Spring Canyon (Figure 2). Surveys occurred over 24 hour intervals.

Boat electrofishing surveys were performed in littoral areas of Lake Roosevelt and its tributaries. Ten minute transects were surveyed along 0.5 km of shoreline using SR-180 and SR-23 electrofishing boats (Smith Root, Inc., Vancouver, WA; Reynolds 1983, Novotany and Prigel 1974). Voltage was adjusted to produce a pulsating DC current of approximately 5 amperes. A minimum of five transects were sampled at each index location.

Gill net surveys were performed in pelagic zones with benthic set horizontal and vertical gill nets (Hubert 1983). Four gillnets were set at each index station including 2-3 horizontal gillnets, and

1-2 vertical gill nets dependent upon site morphology. Horizontal gill nets were set on the lake bottom, and were 61 m in length and 3.7 m wide. Each horizontal net consisted of four 15.2 m panels with square mesh sizes of 1.3 cm, 2.5 cm, 3.8 cm and 5.1 cm. Vertical gill nets were 3.0 m wide, extended to a maximum depth of 61 m, and had a uniform 5.1 cm square mesh size. Gill nets were set in early afternoon and pulled the next morning.

Fish were identified to species using Wydoski and Whitney (1979). Each fish was measured to the nearest millimeter (mm) total length and weighed to the nearest gram using a spring scale. Sex and origin (hatchery or wild) were determined by field observation of gonads, floy tag, fin clips, and fin deformities when possible. Mean length and weight were calculated for each species collected. Relative abundance and catch-per-unit-effort (CPUE) were calculated seasonally for each gear type (Anderson and Neumann 1996). The heads of hatchery kokanee were removed, placed in individually numbered bags and frozen. Heads were sent to the Fisheries Research Center, at Eastern Washington University's for coded wire tag extraction and analyses.

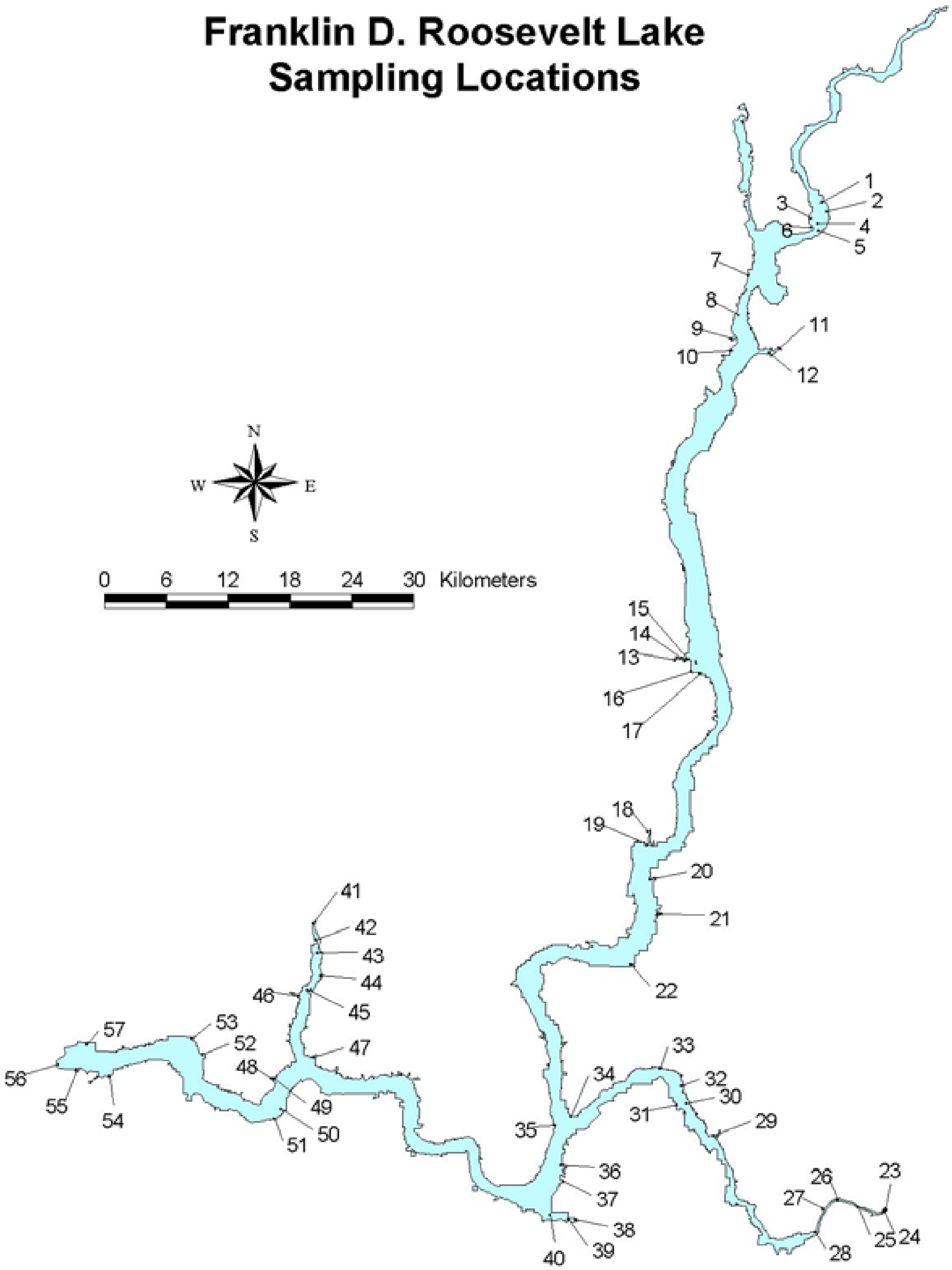


Figure 2. Boat electrofishing and gill net sampling locations on Lake Roosevelt, WA (2000). Refer to Table 5 for sampling location name and gear type used.

Table 5. Fish sampling locations on Lake Roosevelt, WA (2000). EF=Electrofishing, HG=Horizontal Gill Net, VG=Vertical Gill Net.

| Site # | Site Name | Location # | Location Name | Gear Type |
|---|---|---|---|---|
| 1 | Pink Castle Above | 0 | Evans Landing | EF |
| 2 | Pink Castle Below | 0 | Evans Landing | EF |
| 3 | Fisherman's Cove | 0 | Evans Landing | EF/HG |
| 4 | Pump Flats Middle | 0 | Evans Landing | VG |
| 5 | Pump Flats Shore | 0 | Evans Landing | EF/HG |
| 6 | Tom's Korner | 0 | Evans Landing | EF/HG |
| 7 | Nancy Creek | 1 | Kettle Falls | EF |
| 8 | Kettle Falls west shore (across from launch) | 1 | Kettle Falls | VG |
| 9 | Sherman Creek | 1 | Kettle Falls | EF/HG |
| 10 | Game Reserve Cove | 1 | Kettle Falls | EF/HG |
| 11 | Colville Bridge above | 1 | Kettle Falls | EF |
| 12 | Colville Bridge Below | 1 | Kettle Falls | EF/VG |
| 13 | Hall Creek | 2 | Gifford | EF |
| 14 | Hall Creek Inside | 2 | Gifford | HG |
| 15 | Hall Creek Mouth | 2 | Gifford | HG |
| 16 | Stensgar Creek | 2 | Gifford | EF/HG |
| 17 | Lynx Creek | 2 | Gifford | EF/VG |
| 18 | Nez Perce Creek | 3 | Hunters | EF/VG |
| 19 | Nez Perce Creek Mouth | 3 | Hunters | H/G |
| 20 | Hunters Creek | 3 | Hunters | EF/HG |
| 21 | Alder Creek | 3 | Hunters | EF/HG |
| 22 | O-Ra-Pak-En Creek | 3 | Hunters | EF |
| 23 | Little Falls Spillway | 4 | Spokane River Upper | EF |
| 24 | Little Falls Turbines | 4 | Spokane River Upper | EF |
| 25 | Ardell Flats | 4 | Spokane River Upper | EF |
| 26 | Tribal Boat Launch | 4 | Spokane River Upper | EF |
| 27 | Pump Flats | 4 | Spokane River Upper | EF |
| 28 | Walleye Flats | 4 | Spokane River Upper | EF |
| 29 | Blue Creek | 5 | Spokane River Lower | EF/HG |
| 30 | Sand Creek | 5 | Spokane River Lower | EF/HG |
| 31 | Eagle's Nest | 5 | Spokane River Lower | EF/VG |
| 32 | Cematery Flats | 5 | Spokane River Lower | HG |
| 33 | A-Frame | 5 | Spokane River Lower | EF |
| 34 | Confluence East | 6 | Seven Bays | VG |
| 35 | Confluence West | 6 | Seven Bays | HG |
| 36 | Sunday Bay | 6 | Seven Bays | EF/HG |
| 37 | Friday Bay | 6 | Seven Bays | EF |
| 38 | Hawk Creek Upper | 6 | Seven Bays | EF |
| 39 | Hawk Creek Lower | 6 | Seven Bays | EF/HG |
| 40 | Hawk Creek Mouth | 6 | Seven Bays | HG |
| 41 | Sanpoil River Upper | 7 | Sanpoil River | EF |
| 42 | Sanpoil River Lower | 7 | Sanpoil River | EF/HG |
| 43 | Across From Campground | 7 | Sanpoil River | VG |
| 44 | John Tom Creek | 7 | Sanpoil River | EF |
| 45 | Dick Creek | 7 | Sanpoil River | EF/HG |
| 46 | Log Boom | 7 | Sanpoil River | EF/VG |
| 47 | Whitlaw Cove | 8 | Keller Ferry | EF/HG |
| 48 | Moonlight Cove | 8 | Keller Ferry | EF/HG |
| 49 | Moonlight Cove Entrance | 8 | Keller Ferry | VG |
| 50 | Orchard Cove | 8 | Keller Ferry | EF |
| 51 | Lighthouse Cove | 8 | Keller Ferry | EF/HG |
| 52 | Sandy Cove | 9 | Spring Canyon | EF/HG |
| 53 | Kwei Kwei Creek (Goat Ranch) | 9 | Spring Canyon | EF/VG |
| 54 | Spring Canyon Boat Launch | 9 | Spring Canyon | EF |
| 55 | Yacht Club | 9 | Spring Canyon | EF |
| 56 | Cresent Bay | 9 | Spring Canyon | EF/HG |
| 57 | GCD North Shore | 9 | Spring Canyon | HG |

**Age and Growth**

Scales were taken from appropriate locations for each species (Jearld 1983) and placed in coin envelopes. Scales were analyzed by placing them between two microscope slides and magnifying them with a Realist Vantage 5, Model 3315 microfiche reader. Ages were determined by counting the annuli of non-regenerated, uniform scales and distances between the origin of the scale and each annuli and the scale radius were measured for back calculating length at age (Jearld 1983). Each measurement was made under constant magnification to the nearest millimeter.

The direct proportional method was used to back calculate the length of the fish at the formation of each annulus (Devries and Frie 1996). The direct proportional method was used to maintain consistency with the methods used in previous Lake Roosevelt reports. Back-calculations were computed using the formula:

$$L_i = \left( \frac{Si}{S_c} \right) L_c$$

Where:

$L_i$ = back calculated length of fish (mm) when the *i*th increment was formed;
$L_c$ = length of fish (mm) at capture;
$S_c$ = radius of hard part at capture; and
$S_i$ = radius of hard part at the *i*th increment.

A condition factor ($K_{TL}$) was calculated for each fish (Hile 1970, Everhart and Youngs 1981). Condition factor describes how a fish adds weight in relation to incremental changes in length. The relationship is shown by the formula:

$$K_{TL} = \left( \frac{w}{l^3} \right) 10^5$$

Where:

$K_{TL}$ = condition factor;
w = weight of fish (g); and
l = total length of fish (mm).

**Diet**

Fish stomachs were collected opportunistically from kokanee salmon, rainbow trout, eastern brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), lake whitefish (*Coregonus clupeaformis*), mountain whitefish (*Prosopium williamsoni*), walleye, yellow perch, black crappie (*Pomoxis nigromaculatus*), smallmouth bass, bridgelip sucker (*Catostomus columbianus*), longnose sucker (*C. catostomus*), largescale sucker, burbot (*Lota lota*), northern pikeminnow (*Ptychocheilus oregonensis*), and tench (*Tinca tinca*) captured during index sampling. Additional kokanee stomachs were obtained by creel clerks throughout the year and from fish harvested during the test fishery in January. Stomachs were collected by making an incision into the body cavity, cutting the esophagus, and pinching the pyloric sphincter. The esophagus was clamped to keep prey items from being expelled and the stomach was placed in 70% ethanol.

In the laboratory, stomachs were transferred to a 70% ethanol. Contents were identified to Order or Family when possible using Brooks (1957), Edmondson (1966), Borror et al. (1976), Ruttner-Kolisko (1974), Edmonds et al. (1976), Wiggins (1977), Pennak (1978, 1989), and Merritt and Cummins (1984). Food organisms were identified using a Nikon SMZ-1B dissecting microscope equipped with a fiber optics illumination system and 5 mm ocular micrometer.

Prey items were enumerated and weighed by drying sorted stomach contents in an oven at 105° for 24 hours on a stainless steel wire screen. Sub-samples of zooplankton were taken using a petri dish with a molded grid. Eight squares were counted, and counts were extrapolated to represent the entire sample. Contents were weighed on a Sartorius Model H51 analytical balance to the nearest 0.0001 g (Weber 1973, APHA 1995).

Number, dry weight, and frequency of occurrence were calculated for each prey item (Bowen 1996). Relative importance index values were used to compensate for numerical estimate biases that over-emphasize small prey groups consumed in large numbers and weight estimate biases that exaggerate influence of large prey items consumed in small numbers. The relative importance index was calculated using the formula (George and Hadley 1979; Bowen 1996):

$$Ri_a = \frac{100Ai_a}{\sum_{a=1}^{n} Ai_a}$$

Where:

$Ri_a$ = relative importance of food item a;
$Ai_a$ = absolute importance of food item a; and
n = number of different food types.

Relative importance values range from zero to 100% with prey items near zero being relatively less important than those prey items near one hundred percent.

Diet overlap was calculated to determine forage utilization and degree of potential interspecific competition. The overlap index ($Ri_a$) is expressed in the following equation (Morisita 1959; Horn 1966):

$$C_x = \frac{2\sum_{i=1}^{n}\left(P_{xi} x P_{yi}\right)}{\sum_{i=1}^{n} P_{xi}2 + \sum_{i=1}^{n} p_{yi}2}$$

Where:

$C_x$ = overlap coefficient;
n = number of food categories;
$P_{xi}$ = proportion of food category (i) in the diet of species x; and
$P_{yi}$ = proportion of food category (i) in the diet of species y.

Overlap coefficients were computed using $Ri_a$ values in the equation for the variables $P_{xi}$ and $P_{yi}$. Overlap coefficients range from 0 (no overlap) to 1 (complete overlap). Values of less than 0.3 are considered low and values greater than 0.7 indicate high overlap (Peterson and Martin-Robichaud 1982). High diet overlap indices may indicate competition if food items utilized by the species are limited (MacArthur 1968).

**Tagging Studies**

Sub-samples of hatchery reared rainbow trout and kokanee salmon were marked with T-anchor Floy tags as part of a tagging study to evaluate fish performance. The date, location, and fish stock were recored for each tagging event. All fish were measured for total length and 25 of each 1,000 fish were weighed to attain a mean weight. Spokane stock rainbow trout (coastal strain, *O. m. irideus*) were marked and released in April from Kettle Falls and Seven Bays net pens (Table 6). Phalon Lake stock redband rainbow trout (*O. m. gairdneri*), native to Kettle River tributaries, were released in October from net pens at Kettle Falls. Kokanee salmon were released from net pens in June at Kettle Falls (Table 6).

Posters with tag return information were posted at access points throughout the reservoir. Tags were recovered from anglers via creel clerks or were reported by phone or mail. Anglers were asked to provide date of capture, location, species, length and weight when possible. The same information was collected when fish were encountered during scientific fisheries surveys. Data was used to evaluate movement within the reservoir, entrainment, and growth.

Table 6. Number, release location and stock of rainbow trout tagged in Lake Roosevelt, WA (2000).

| Release Location and stock | Tag Date | n |
|---|---|---|
| **Kettle Falls** | | |
| Rainbow trout (Spokane stock) | April | 9,999 |
| Rainbow trout (Phalon Lake stock) | June | 9,995 |
| **Seven Bays** | | |
| Rainbow trout (Spokane stock) | April | 9,968 |
| Rainbow trout (Triploids) | July | 9,226 |
| **Totals** | | **39,188** |

## Creel Survey

A two-stage probability sampling scheme using a roving-access design was used to estimate annual fishing pressure, catch-per-unit-effort (CPUE), and sport fish harvest of each species on Lake Roosevelt (Pollock et al. 1994, Malvestuto 1996). Creel surveys were a cooperative effort of the STI, CCT, and WDFW. The lake was stratified into three sections; upper, middle and lower, with each agency responsible for a section. Creel surveys were conducted at Spokane and Colville tribal campgrounds and National Park Service boat launches for a total of 27 survey locations (Figure 3).

The creel surveys are reported for the time period January 2000 through October 2000. Quarters were split into January through February 2000 (winter), March through May 2000 (spring), June through August 2000 (summer), and September through October 2000 (fall). To reduce costs, creel surveys were not conducted in any section during April (the mid spring month), November (historically a low pressure month), or December.

Schedules were constructed by dividing each month into weekday and weekend/holiday stratum and days were stratified into a.m. (sunrise to 12:00) and p.m. (12:00 to sunset) time periods. Eighteen weekdays and four weekend/holidays were randomly selected to schedule roving progressive pressure counts with half of the surveys conducted during the a.m. and the other half conducted during the p.m. (Pollock et al. 1994). The remaining a.m. or p.m. time slots over the 21 day time period were used to conduct four hour access point surveys. The schedules were developed monthly by randomly selecting day, time (am/pm), and location of access point surveys. Rove surveys were conducted during the opposite time period of the access point surveys. Schedules were randomly constructed and independent by section.

During roving progressive pressure counts, creel clerks recorded the number of boat trailers and shore anglers at access points in their section. Many shoreline anglers do not fish at boat launches. Consequently, locations frequently visited by anglers were added as sites for the rove, but not as access areas to sit at. The creel clerk reached the access points by road. If the clerk was ahead of schedule, they interviewed the shoreline anglers that were close to the road. An interview took less than five minutes, and enabled the clerk to gather important catch and trip length data.

Access point surveys were only conducted at boat launches (Figure 3). During each access point survey, creel clerks interviewed anglers to collect the following information: angler type, hours fished, trip completeness, satisfaction, zip code of residence, target species, and number of fish harvested and released. Harvested fish were identified to species, measured for total length (mm), weighed (g), and examined for floy tags, fin clips, and physical markings such as eroded pectoral and pelvic fins, and stubbed dorsal fins. Physical marks were used to differentiate

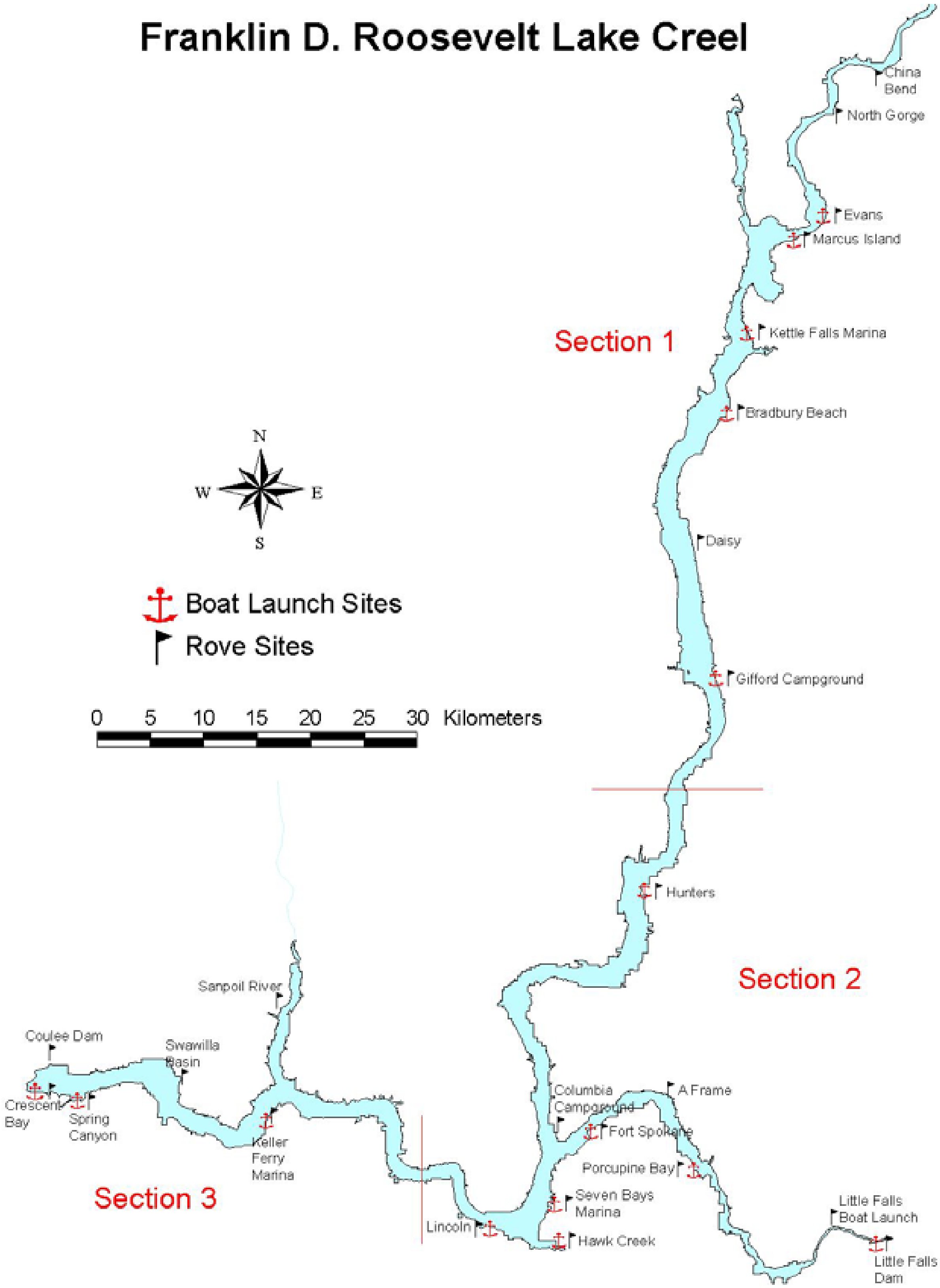


Figure 3. Creel survey locations on Lake Roosevelt, WA (2000).

rainbow trout of net-pen/hatchery origin from wild fish. Scale samples were collected from kokanee, rainbow trout, and walleye. Heads were taken from fin clipped kokanee for coded wire tag analyses. Additionally, non-anglers were interviewed to correct for recreational boaters vs. anglers.

Between 1990 and 1993, air flights (one flight per stratum) were scheduled to coincide with monthly roving pressure counts. The creel clerks recorded the number of boat trailers and shore anglers in their section while concurrently the surveyor in the airplane recorded the number of boats on the water and the number of shore anglers. This information was used to compute a correction factor for the number of boats on the water versus the number of boat trailers at access points. The correction factor for boat trailers versus boats on the water was determined between 1990 and 1993, averaged among years and then applied to 2000. Limitation of funds negated our ability to conduct regularly scheduled air flights. See Cichosz et al. (1999) for flight correction factors.

The number of boats on the reservoir was determined for the stratum weekday/weekend, section and month by completing the following calculation:

$$T_b = (C_{bt})(CF_b)$$

Where:

$T_b$ = number of boats on the water for each stratum per month;

$C_{bt}$ = mean boat trailer count from pressure counts for each stratum per month (total # of boats/ # of days sampled; and

$CF_b$ = boat trailer correction factor for each stratum per month.

The number of boats fishing for the strata weekday/weekend, section and month was calculated by using the formula:

$$B_f = (T_b)(\%B_f)$$

Where:

$B_f$ = number of boats fishing for each stratum per month;

$T_b$ = number of boats on the water for each stratum per month; and

$\%B_f$ = percent of boats fishing for each stratum per month (number is in decimal form).

The adjusted mean number of boat anglers per day for the strata weekday/weekend, section and month was estimated using the formula:

$$X_d = (Ad)(B_f)$$

Where:

$X_d$ = adjusted mean number of anglers per boat per day for each stratum per month;

Ad = mean number of anglers per boat from effort counts for each stratum per month; and

$B_f$ = number of boats fishing for each stratum per month.

The above calculations used to estimate the instantaneous number of boat anglers were estimated separately by section then summed to obtain a full lake estimate.

The number of hours available for fishing (sunrise to sunset) was estimated using the following formula:

$$N_s = (D_s)(H_d)$$

Where:

$N_s$ = number of hours per weekend, weekday per month;

$D_s$ = number of days per month a weekday or weekend; and

$H_d$ = average number of hours per day for each stratum per month.

The number of hours sampled for each stratum per month was estimated using the formula:

$$n = \sum_{i=1}^{D_s} (H_{ci})$$

Where:

$n$ = number of hours sampled for each stratum per month;

$D_s$ = number of days per month within each stratum; and

$H_{ci}$ = mean number of hours creeled per day for each stratum per month.

The number of shore anglers per day for each stratum per month was estimated using the formula:

$$Xd = \sum_{i=1}^{Pd} (Spi)$$

Where:

$X_d$ = mean number of shore anglers per day for each stratum per month from pressure counts;

$P_d$ = Number of days that pressure counts were conducted for each stratum per month; and

$S_{pi}$ = total number of shore anglers counted during pressure counts for each stratum per month.

The mean number of anglers (boat or shore) for each stratum per month was estimated using the formula:

$$X_s = (X_d)(D_s)$$

Where:

$X_s$ = mean number of anglers for each stratum per month;

$X_d$ = mean number of anglers for each stratum per day; and

$D_s$ = number of days per month within the stratum.

The standard deviation of anglers (boat or shore) for each stratum per month was estimated using the formula:

$$S_s = (S_d)(D_s)$$

Where:

$S_s$ = standard deviation of anglers for each stratum per month;

$S_d$ = standard deviation of anglers per day for each stratum per month; and

$D_s$ = number of days per month for each stratum per month.

The mean number of angler hours per angler for each stratum was estimated using the formula:

$$H_a = \left(\frac{T_h}{A_i}\right)$$

Where:

$H_a$ = mean number of angler hours per angler for each stratum per month;

$T_h$ = total hours spent fishing for each stratum per month; and

$A_i$ = total number of anglers interviewed for each stratum per month.

Pressure (hours fished) was estimated for day stratum (week day or weekend/holiday) for boat and shore anglers for each month by section by the formula:

$$PE_s = \left(\frac{N_s}{n}\right)(X_s)(H_a)$$

Where:

$PE_S$ = pressure estimate for each stratum per month;

$N_S$ = number of hours for each stratum per month;

$n$ = number of hours sampled for each stratum per month;

$X_S$ = mean number of anglers for each stratum per month; and

$H_a$ = mean number of angler hours per angler for each stratum per month.

The variance of the pressure (hours fished) estimate for each stratum per month was calculated by:

$$VPE_s = \left(\frac{N_s}{n}\right)S_s^2$$

Where:

$VPE_S$ = variance of pressure estimate for each stratum per month;

$N_S$ = number of hours for each stratum per month;

$n$ = number of hours sampled for each stratum per month; and

$S_S$ = standard deviation of mean number of angler hours for each stratum per month.

Ninety-five percent confidence intervals for each stratum per month were calculated by:

$$C.I. = PE \pm \sqrt{(VPE_s)1.96}$$

| | | | |
|---|---|---|---|
| Where: | C.I. | = | 95% confidence intervals for each stratum per month; |
| | PE | = | pressure estimate for each stratum per month; and |
| | $VPE_S$ | = | variance of the pressure estimate for each stratum per month. |

Monthly angler pressure and 95% C.I. were determined by calculating weekend/weekday and boat/shore anglers per month by section. If data gaps existed in any strata, the annual averages were used to fill the gaps. Annual angler pressure and 95% C.I. estimates were calculated by summing monthly angler pressure estimates and variances, which were used to calculate a 95% C.I. estimate for each section. Each section was then summed to estimate reservoir wide pressure.

Literature by Malvestuto et al. (1978), Fletcher (1988) and, Malvestuto (1996) demonstrated that CPUE values calculated independently from complete and incomplete trip data were not statistically different. Therefore, complete and incomplete angler trips were used to compute CPUE for fish species in each stratum. CPUE was calculated independently for fish captured (kept and released) and fish harvested (kept) for each stratum and month with the formula:

$$CPUE = \left(\frac{F}{T_h}\right)$$

Where:

| | | |
|---|---|---|
| CPUE | = | Catch per unit effort of a particular fish species for each stratum per month; |
| F | = | number of fish captured (harvested) for each stratum per month; and |
| $T_h$ | = | total hours spent fishing for each stratum per month. |

Monthly CPUE of a particular fish species was calculated by dividing the total catch for the entire month (all stratum) by the total angler hours (all stratum) for each section. Annual CPUE values of a particular fish species were calculated by dividing the total catch for the year by the total number of angler hours for the year.

Harvest of fish species was determined for each stratum per month by the formula:

$$\text{Harvest} = \left(H_{cpue}\right)\left(PE_s\right)$$

Where:

| | | |
|---|---|---|
| Harvest | = | harvest of a particular fish species for each stratum per month; |
| $H_{cpue}$ | = | number of particular fish species harvested for each stratum per month; and |
| $PE_S$ | = | pressure (hours fished estimate for each stratum per month). |

Monthly harvest estimates for a particular fish species by stratum were combined to calculate a total monthly harvest estimate by section. Monthly harvest estimates were combined to calculate annual estimates for each fish species by section. Section harvest estimates were added by month to obtain reservoir wide harvest.

Data compiled by the U.S. Fish and Wildlife Service in 1996 determined that the average inland fishery angler spent $25.00 per trip (USFWS 1998). To calculate current dollar amount spent by anglers per trip, the 1996 cost per fishing trip was adjusted for inflation using the consumer price index inflation calculator, which adjusted $25.00 in 1996 to $27.44 in 2000 (USDL 2003).

The adjusted dollar value was multiplied by total number of angler trips in 2000 to provide an estimate of the economic value of the fishery. The number of angler trips per month was determined by dividing the total number of angler hours per month by the average length of a completed fishing trip for the month. Annual angler trips were calculated by summing monthly angler trip values.

# Results

## Limnology

### Surface Hydrology

Water year 2000 was slightly drier than the 30 year mean between 1961 and 1990. Precipitation in water year 2000 was 90% of normal (1961-1990 average) in the Columbia River basin above Grand Coulee Dam. The annual accumulation of precipitation was 64.8 cm (25.5 in) in water year 2000. Monthly precipitation accumulation in water year 2000 was highest 10.3 cm (148% of normal 1961-1990 mean) in November 1999 and lowest in August 2000 at 1.5 cm (0.61 in), which was 36% of normal (1961-1990 mean) in water year 2000 (USACOE 2000).

Slightly lower than average precipitation and subsequent snow pack created inflows and outflows at Lake Roosevelt in 2000 that were nearly equal to the ten-year average (1989-1999). Average annual inflow at Grand Coulee Dam was 99% of the 1989-1990 average. Inflow in 2000 averaged 3,160.3 $m^3/s$ and monthly averages ranged from 2,121.3 $m^3/s$ in October to 4,257.3 $m^3/s$ in May (Table 7). Mean outflow in 2000 was 3,063.4 $m^3/s$, which was 100.1% of the 1989-1999 average (Table 7). Monthly mean outflow ranged from 2,032.0 $m^3/s$ in October to 3,971.3 $m^3/s$ in January (Table 7). Inflows and outflows were generally higher in the spring following the freshet and lower in the fall following the dry summer season (Figure 4).

To accommodate the spring freshet, Lake Roosevelt was drawn down to an elevation (Grand Coulee forebay) of 376.1 m above sea level (ASL) by May 19 and refill followed thereafter (Figure 5). Full pool is designated at 393.2 m ASL (1290 ft ASL) however; the annual mean forebay elevation was 387.2 m ASL (1270.4 ft ASL) in 2000. Mean monthly forebay elevation ranged from 377.9 m ASL in May to 392.0 m ASL in October. The forebay elevation was below the mean elevation a total of 168 days (Table 7). Forebay elevation was below the annual mean from February through May. Daily elevation changed on average 0.208 m/d from January to June and 0.121 m/d from July to December in 2000. Mean daily elevation change was greatest in June 0.344 m/d and least in October 0.083 m/d (Table 7).

Mean water retention time was 39.6 d in 2000. Water retention time was negatively correlated to outflow (r = –0.905). Mean monthly water retention time ranged from 21.4 d in May to 64.7 d in October (Table 7). Water retention in Lake Roosevelt was generally shorter in the spring to accomodate spring runoff and higher in summer and fall hold limited water flows (Figure 5).

Table 7. Monthly and annual hydrologic characteristics at Lake Roosevelt, WA (2000).

| Month | Inflow ($m^3/s$) | Outflow ($m^3/s$) | Spill ($m^3/s$) | Forebay Elevation (m ASL) | Water Retention Time (d) | Storage ($m^3/s{\cdot}d$) | Mean Elevation Change (m/d) | Days Below Mean Elevation |
|---|---|---|---|---|---|---|---|---|
| Jan | 3702.6 | 3971.9 | 0.0 | 386.1 | 27.0 | 105316.9 | 0.178 | 28 |
| Feb | 3140.4 | 3162.3 | 0.0 | 384.3 | 32.9 | 99214.3 | 0.133 | 29 |
| Mar | 2794.3 | 2764.3 | 0.0 | 385.2 | 39.3 | 102167.2 | 0.141 | 31 |
| Apr | 3495.3 | 3931.1 | 3.4 | 382.2 | 25.6 | 92760.7 | 0.208 | 30 |
| May | 4257.4 | 3920.2 | 0.0 | 377.9 | 21.4 | 80198.9 | 0.239 | 31 |
| Jun | 4246.3 | 3001.2 | 1.4 | 386.3 | 36.2 | 106079.1 | 0.344 | 15 |
| Jul | 3542.9 | 3142.9 | 2.6 | 391.4 | 41.0 | 123647.2 | 0.147 | 0 |
| Aug | 3023.4 | 2965.5 | 1.3 | 391.0 | 43.8 | 122214.3 | 0.099 | 0 |
| Sep | 2624.2 | 2279.3 | 2.8 | 391.2 | 56.0 | 123132.0 | 0.109 | 0 |
| Oct | 2121.3 | 2032.0 | 0.3 | 392.0 | 64.7 | 125931.8 | 0.083 | 0 |
| Nov | 2260.0 | 2621.2 | 0.0 | 390.9 | 47.6 | 121981.5 | 0.132 | 0 |
| Dec | 2716.4 | 2961.7 | 0.0 | 387.9 | 39.1 | 111142.0 | 0.160 | 4 |
| **Annual Mean** | **3160.3** | **3063.4** | **1.0** | **387.2** | **39.6** | **109528.9** | **0.164** | **Sum=168** |

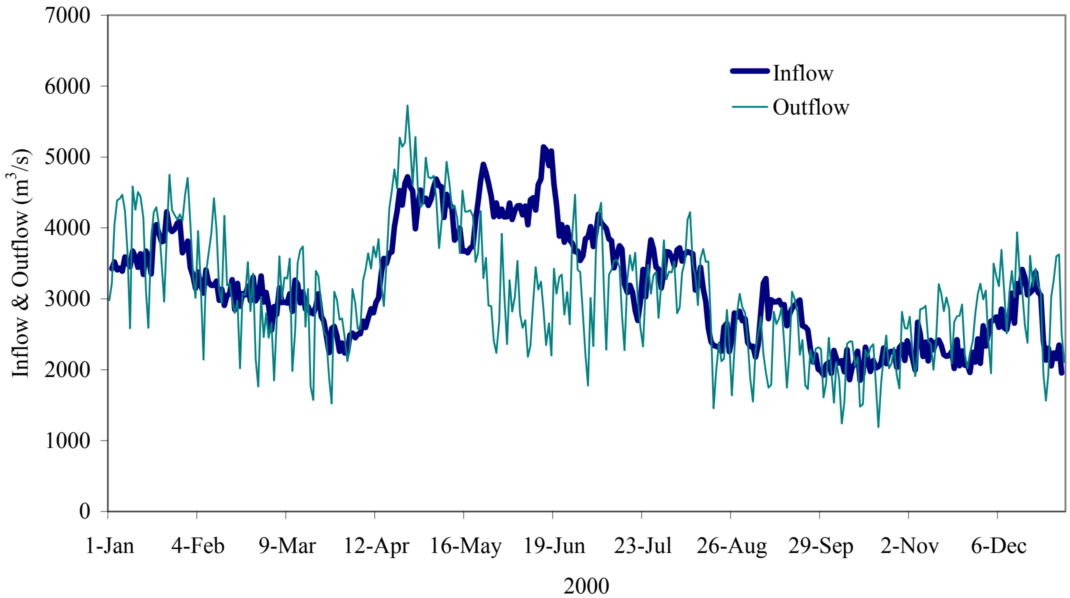


Figure 4. Daily inflow and outflow at Lake Roosevelt, WA (2000).

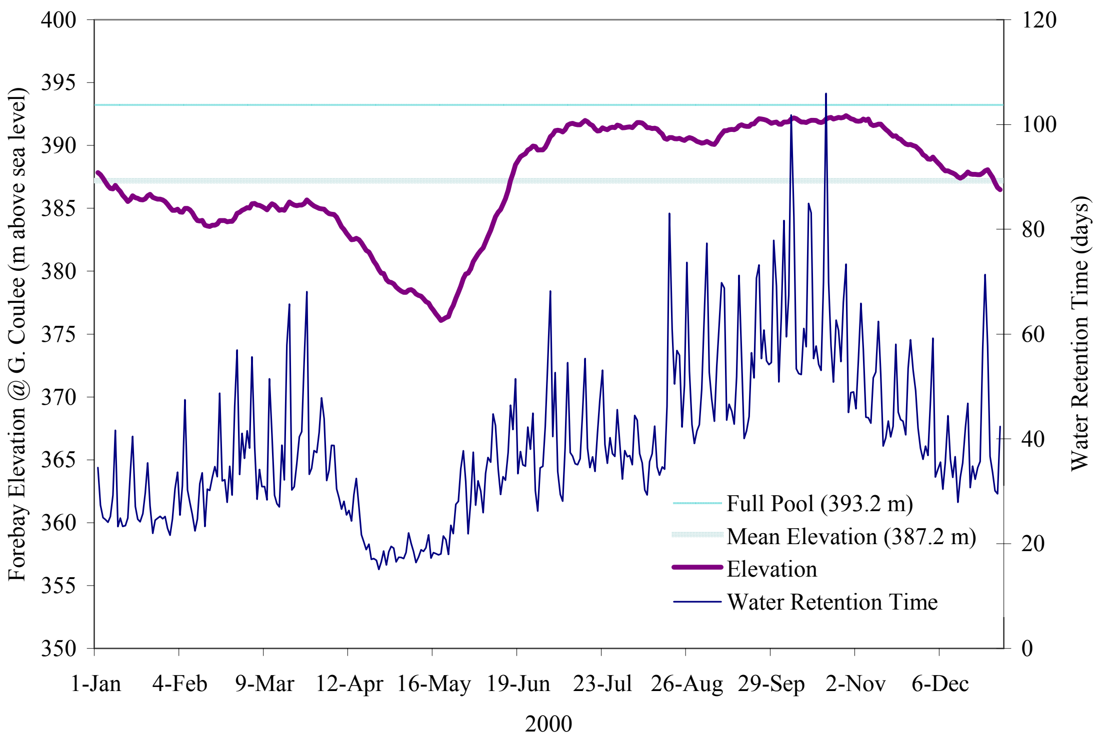


Figure 5. Daily reservoir elevation at Grand Coulee Dam forebay and water retention time in Lake Roosevelt, WA (2000).

**Total Dissolved Gas**

Total dissolved gas (TDG) was measured incrementally during 2000 at various locations on Lake Roosevelt. Total dissolved gas data was unusually low during rounds one, two, and nine. Barometric pressures recorded during rounds one and two were also unusually high (900's mmHg range) and likely the result of improper calibration. When barometric pressure increases the amount of total dissolved gas in water will also increase. Total dissolved gas data from these rounds was not included in the data analysis because of the suspect barometric pressures. Low TDG data during round nine was likely caused by not installing the TDG membrane prior to profiling the water column. For that reason round nine data was also excluded from the analysis.

The annual mean percent TDG at all Columbia River mainstem locations was 107.9% in 2000 (SD = 12.9%; n = 1653). Total dissolved gas generally decreases from upstream to downstream in Lake Roosevelt due to degassing as water travels through the reservoir (Table 8). Annual mean TDG at the US/Canadian border was 109.9% (SD = 9.2%; n = 300), which decreased to 106.3% (SD = 8.4%; n = 342) at Grand Coulee forebay (USACOE 2003). Total dissolved gas concentrations at the US/Canadian border were significantly greater than the Grand Coulee forebay concentrations during 2000 (Fisher's PSLD; p = 0.0033).

Total dissolved gas concentrations varied less at the US/Canadian border and Grand Coulee forebay stations since they are fixed monitors and the LRFEP data includes water column profiles up to 33 m in depth. Total dissolved gas concentrations in other parts of Lake Roosevelt were similar in 2000. In the Spokane Arm annual mean TDG measured 105.2% (SD = 10.0%; n = 286). Annual mean TDG was slightly higher in the Sanpoil River arm at 106.3% but concentrations varied more through the year (SD = 13.0%; n = 230).

Temporally mean TDG was highest (122.3%; SD = 13.6%; n = 93) during sampling in mid May from all sampling locations on Lake Roosevelt. Mean TDG was lowest in mid December at 91.8% (SD = 5.3%; n = 168) across all LRFEP sampling locations. Total dissolved gas was generally highest during the spring (Figure 6). At LRFEP sampling locations only 28% (754/2686) of the 2000 TDG measurements exceeded 110% saturation. Mean TDG by round across all locations was correlated with 30 d mean inflow (r = 0.768, p = 0.0072) and 30 d mean water retention time (r = -0.733, p = -0.0133). Fish sampling conducted by Eastern Washington

University indicated that 16 fish had signs of gas bubble trauma. The gas bubble trauma was ranked low (redness in fins) in severity for all fish and occurred in burbot (n = 2), longnose sucker (n = 1), largescale sucker (n = 11), northern pikeminnow (n = 1), and rainbow trout (n = 1).

Table 8. Total dissolved gas annual means, standard deviation (SD), sample size (n), and ranges from sampling locations on Lake Roosevelt, WA (2000).

| Waterbody | Location | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|---|
| **Columbia R.** | US-Canada Border[1] | 109.9 | 9.2 | 300 | 96.6 | 170.6 |
| | Evan's Landing | 111.9 | 12.3 | 66 | 92.5 | 145.2 |
| | Kettle Falls | 109.7 | 12.5 | 128 | 84.3 | 148.1 |
| | Gifford | 110.8 | 13.0 | 256 | 88.7 | 151.8 |
| | Hunters | 106.8 | 11.6 | 144 | 79.9 | 140.3 |
| | Spokane R. Confluence | 107.8 | 11.0 | 50 | 91.8 | 134.1 |
| | Seven Bays | 108.1 | 13.5 | 222 | 88.4 | 151.0 |
| | Sanpoil R. Confluence | 107.3 | 13.7 | 223 | 83.8 | 148.4 |
| | Keller Ferry | 105.8 | 13.8 | 144 | 83.2 | 138.4 |
| | Spring Canyon | 106.1 | 12.6 | 279 | 82.6 | 149.3 |
| | Grand Coulee Forebay[1] | 106.3 | 8.4 | 342 | 91.1 | 166.2 |
| **Spokane R.** | Little Falls | 99.2 | 7.6 | 41 | 90.1 | 130.7 |
| | Porcupine Bay | 106.2 | 10.0 | 245 | 89.9 | 145.9 |
| **Sanpoil R.** | Free Flowing Sanpoil R. | 94.2 | 4.6 | 13 | 87.1 | 103.0 |
| | Sanpoil River | 107.1 | 13.0 | 217 | 87.4 | 145.8 |
| **Hawk Creek** | Hawk Creek | 108.3 | 12.1 | 113 | 90.0 | 141.6 |

[1] Data from DART website, downloaded 2003.

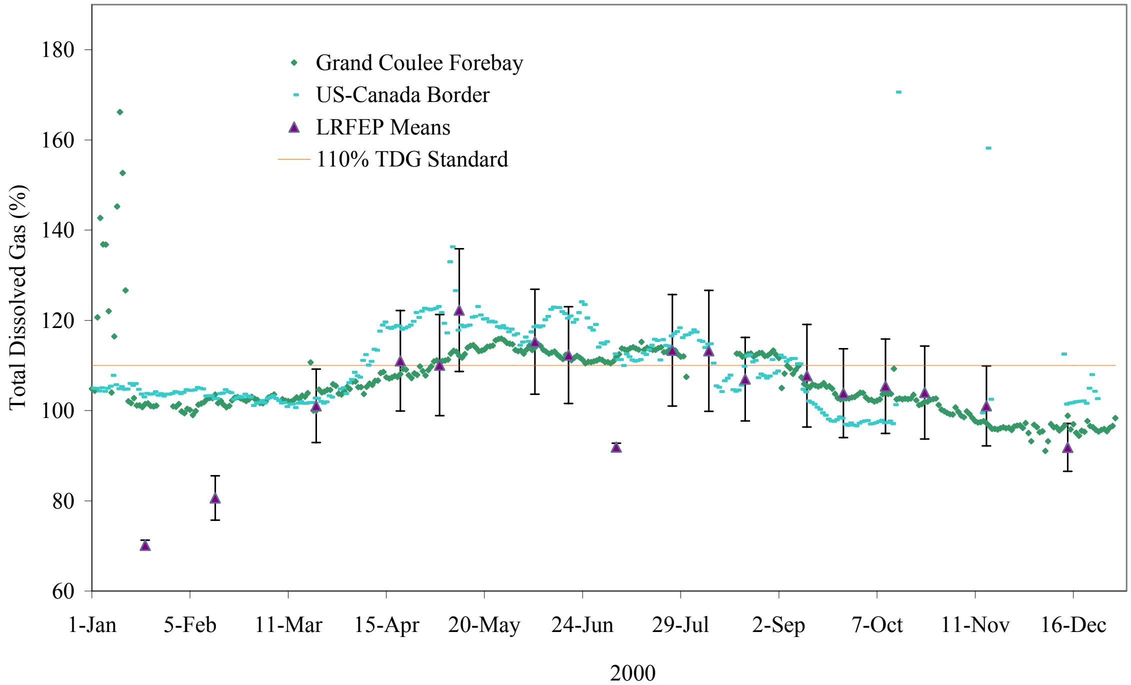


Figure 6. Mean total dissolved gas (± standard deviation) at all LRFEP sampling locations during all rounds compared to the fixed monitoring at the US/Canada border and Grand Coulee Dam Forebay (2000).

**Other Chemical and Physical Characteristics**

Temperature was monitored throughout 2000 at various locations on Lake Roosevelt. Annual temperature means were separated by waterbody and included data from January through October from both pelagic and shore sites at all depths sampled. The annual mean from Columbia River mainstem locations was 11.4 ºC (SD = 5.8 ºC; n = 1853; Table 9). Mean temperatures were significantly greater in both the Sanpoil Arm (12.4 ºC; Table 9; Fisher's PLSD; $p = 0.0122$) and Spokane Arm (13.5ºC; Table 7; Scheffe; $p < 0.0001$). Hawk Creek was slightly warmer than the mainstem but not significantly (11.5 ºC; Fisher's PLSD; $p = 0.8609$; Table 9). Temperatures at mainstem Columbia River locations ranged from 2.9 ºC to 24.1 ºC during January to October. Mean temperatures were lowest early (~3.5 ºC) in the year and peaked in August (~19.5 ºC) throughout the reservoir (Figure 7).

Annual mean temperature at pelagic and shore sites at mainstem locations were similar. From January to mid May, mid June, and July to December (rounds1-6, 8, & 10-18), mean temperatures at pelagic and shore sites at mainstem locations were 10.8 ºC (SD = 5.8 ºC; n = 1322) and 10.5 ºC (SD = 6.2 ºC; n = 529) respectively. Differences between these pelagic and shore temperatures were insignificant (Fisher's PLSD; p = 0.3309). During the May to September period shore temperatures were slightly higher than pelagic temperatures at mainstem sites however, the differences were insignificant, where pelagic and shore temperatures were 14.1 ºC and 14.5 ºC respectively (Fisher's PLSD; p = 0.1260). Comparisons of temperatures between pelagic and shore sites on the Spokane Arm indicated shore temperatures were significantly higher only from June to September (Scheffe; p=0.0013). Spokane Arm shore and pelagic means from June to September were 18.7 ºC (SD = 2.2; n = 56) and 17.3 (SD = 2.7; n = 79) respectively. Mean shore (14.9 ºC; SD = 4.7; n = 158) temperature at Sanpoil River location was also significantly greater than the pelagic mean (14.0 ºC; SD = 4.7; n = 72) during April to September (Scheffe; p = 0.0177).

Temperature profiles were examined across all locations to identify thermal stratification meeting a criterion of ≥ 1 ºC Δ/m at any depth. Discrete temperature points were recorded every three meters. Profiling every three meters may be too coarse to measure thermal stratification in every case. The only location meeting this stratification criterion was the shore site at the Sanpoil River (location 8.0) during round ten (late July; Figure 8). Stratification set up shortly before round nine (early July) and was gone by round eleven (early August). Temperature at the surface was 21.7 ºC and had dropped to 16.6 ºC below the thermocline. The thermocline occupied a depth between 6 and 30 m. The greatest change (1.07 ºC Δ/m) occurred between 9 and 12 m. Other locations where stratification nearly occurred include Spring Canyon, Sanpoil River confluence, Porcupine Bay, and Keller Ferry. Rates of 0.70 to 0.98 ºC Δ/m were observed at those locations between May and August of 2000.

Table 9. Annual (Jan-Oct) mean temperature (ºC), standard deviation (SD), sample size (n) and ranges from pelagic and shore sites at all depths separated into mainstem and reservoir arms of Lake Roosevelt, WA (2000).

| **Waterbody** | **Mean** | **SD** | **n** | **Min** | **Max** |
|---|---|---|---|---|---|
| Columbia R. | 11.4 | 5.8 | 1853 | 2.9 | 24.1 |
| Hawk Creek | 11.5 | 6.0 | 129 | 3.3 | 21.8 |
| Sanpoil R. | 12.4 | 6.1 | 251 | 0.4 | 24.8 |
| Spokane R. | 13.5 | 5.6 | 301 | 3.5 | 23.8 |

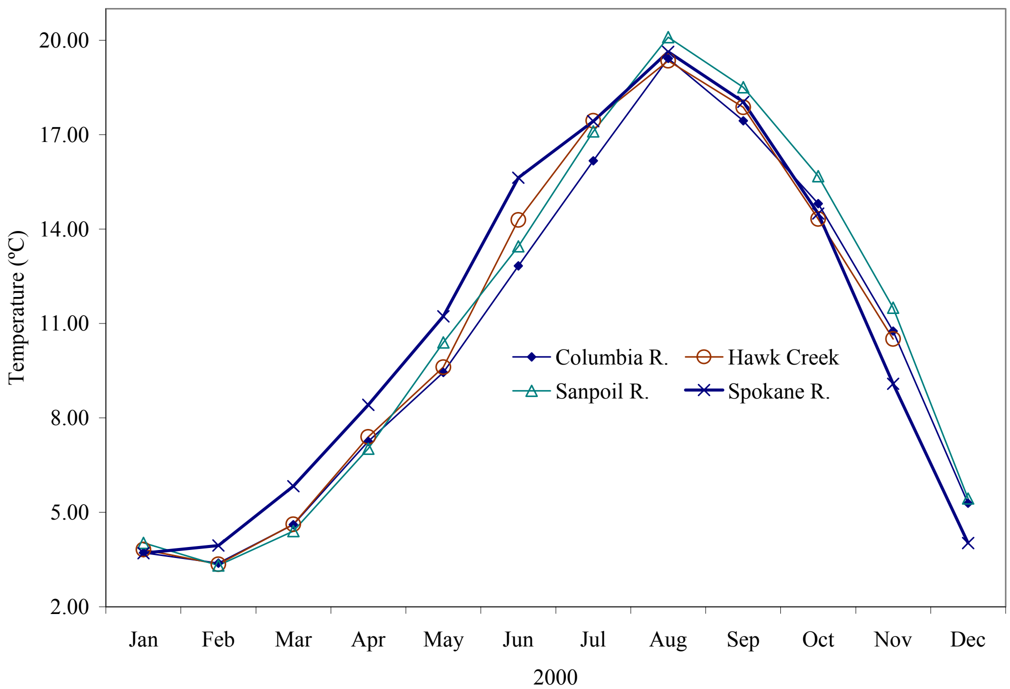


Figure 7. Monthly mean temperatures (ºC) from pelagic and shore sites at all depths according to mainstem and reservoir arms of Lake Roosevelt, WA (2000).

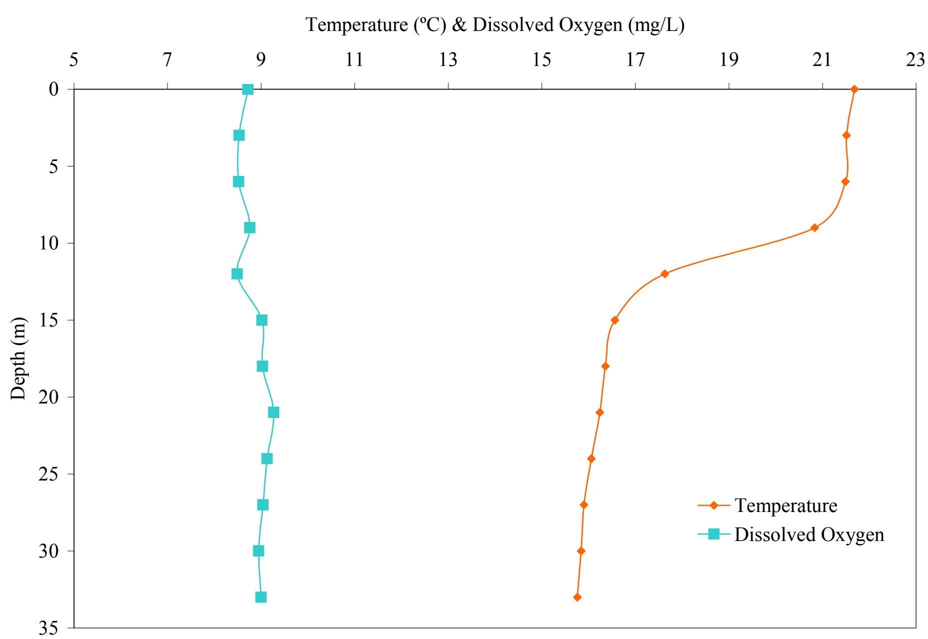


Figure 8. Thermal stratification at the shore site of the Sanpoil River (location 8.0) during round 10 (late July). Includes temperature (ºC) and dissolved oxygen (mg/L) profiles (2000).

Dissolved oxygen was negatively correlated (r = -0.727) with temperature across all locations and times in Lake Roosevelt during 2000. The annual mean dissolved oxygen concentration at Columbia River mainstem sites was 10.3 mg/L (Table 10). Mean dissolved oxygen at mainstem locations was lowest in October at 7.9 mg/L and highest in March at 13.7 mg/L. Observed mainstem dissolved oxygen concentrations were no lower than 6.8 mg/L measured in late September (round 14) at the surface of the pelagic Gifford location.

At Hawk Creek and the Sanpoil Arm, annual mean dissolved oxygen was 10.5 and 10.0 mg/L respectively (Table 10). Monthly mean dissolved oxygen was lowest in September at both Hawk Creek (7.9 mg/L) and in the Sanpoil Arm (7.4 mg/L). The annual mean dissolved oxygen concentrations in the Spokane Arm was 9.2 mg/L. These concentrations were significantly less than concentration at mainstem locations, the Sanpoil Arm and Hawk Creek (Scheffe; $p < 0.0001$). Monthly mean dissolved oxygen concentrations in the Spokane Arm were lowest during August (6.6 mg/L) when temperatures were highest. Mean surface concentrations at Porcupine Bay were 8.9 mg/L in August. At 33 m, mean dissolved oxygen had dropped to 2.6 mg/L at Porcupine Bay in August, decreasing considerably from July (7.1 mg/L at 33 m), then rebounding in September (6.9 mg/L at 33 m; Figure 9).

Table 10. Annual mean, standard deviation (SD), sample size (n) and ranges for dissolved oxygen (mg/L) from pelagic and shore sites at all depths separated into mainstem and reservoir arms of Lake Roosevelt (2000).

| **Waterbody** | **Mean** | **SD** | **n** | **Min** | **Max** |
|---|---|---|---|---|---|
| Columbia R. | 10.3 | 1.9 | 2049 | 6.8 | 16.0 |
| Hawk Creek | 10.5 | 2.2 | 136 | 7.5 | 15.7 |
| Sanpoil R. | 10.0 | 2.0 | 284 | 7.2 | 14.9 |
| Spokane R. | 9.2 | 2.4 | 344 | 1.6 | 14.3 |

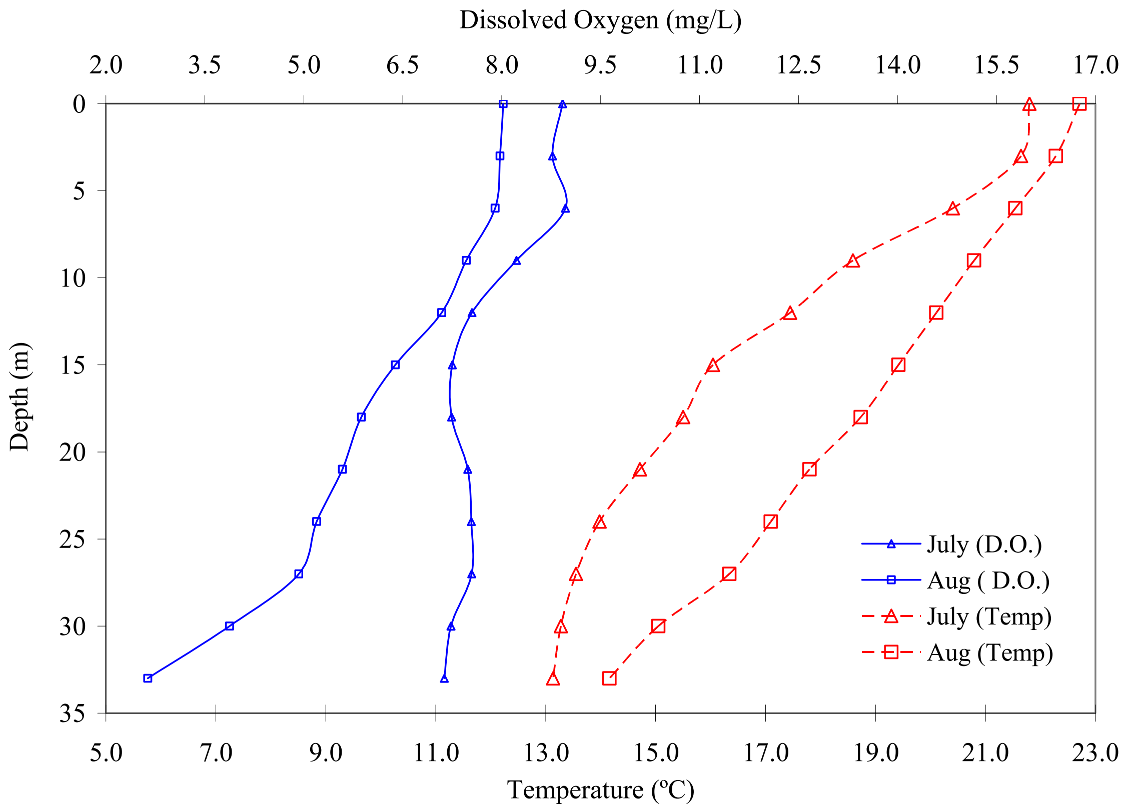


Figure 9. Dissolved oxygen (mg/L) and temperature profiles in July and August at Porcupine Bay on the Spokane Arm (2000).

Mean annual specific conductance was 121.4, 122.1, 121.8, and 139.8 µS/cm at the Columbia River mainstem locations, Hawk Creek, Sanpoil Arm, and Spokane Arm respectively (Table 11). Specific conductance was significantly greater in the Spokane Arm than mainstem locations, Hawk Creek, and the Sanpoil River arm (Scheffe; $p < 0.0001$). Annual variability in specific conductance was also greatest in the Spokane Arm. Specific conductance round means were negatively correlated to the 14 d mean inflows ($r = -0.790$, $p = 0.0013$) and 30 d mean daily elevation change ($r = -0.663$, $p = 0.0167$).

Specific conductance at shore and pelagic sites averaged across the entire year and reservoir were 126.7 and 122.2 µS/cm respectively. The shore mean was significantly greater than the pelagic mean (Scheffe; $p < 0.0001$). Total dissolved solids were positively correlated with specific conductance ($r = 0.99$). The mean annual total dissolved solid (TDS) concentration across all sampling locations was 79.1 mg/L and ranged from 37.0 to 159.0 mg/L (SD = 12.7; n = 2814).

Table 11. Annual mean, standard deviation (SD), sample size (n), and ranges for specific conductance (µS/cm) from pelagic and shore sites at all depths separated into mainstem and reservoir arms of Lake Roosevelt, WA (2000).

| Waterbody | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| Columbia R. | 121.4 | 9.5 | 2049 | 95.0 | 248.0 |
| Hawk Creek | 122.1 | 8.1 | 136 | 110.0 | 140.0 |
| Sanpoil R. | 121.8 | 10.7 | 284 | 88.0 | 197.0 |
| Spokane R. | 139.8 | 48.5 | 344 | 58.0 | 291.0 |

Annual mean hydrogen ion concentration (pH) across all sampling locations during 2000 was 8.4 and ranged from 6.7 to 9.8 (SD =0.513; n = 2814). Reduction oxidation (redox) potential averaged across all locations in 2000 was 265.1 mV and ranged from 68.0 to 452.0 mV (SD = 107.9; n = 2814).

Turbidity measurement averaged across all locations and sampling rounds was 0.9 NTU (SD = 10.5; n = 2697) and ranged from 0.0 to 323.3 NTU. Less than 1.9 % of the turbidity measurements were between 6.1 and 323.3 NTU. Some of the higher turbidity measurements could have resulted from air bubble interference or from the sonde disturbing sediments when near the bottom. Mean annual turbidity from point samples analyzed at the Spokane Tribal Laboratory from all locations were similar (Table 12). These turbidity measurements averaged 1.0 NTU and ranged from 0.1 to 20.0 NTU (SD = 1.8; n = 175). Mean annual total suspended solids (TSS) was 2.5 mg/L and ranged from 1.0 to 13.5 mg/L across all locations (SD = 2.1; n = 175; Table 12). Turbidity round means measured *ex situ* were negatively correlated with temperature round means (r = -0.848, p = 0.0002), and 14 d mean elevation (r = -0.761, p = 0.0027), and 14 d mean water retention times (r = -0.688, p = 0.0114).

Annual mean Secchi disk depth across all sampling locations was 5.7 m (SD =2.7; n = 257). Mean Secchi disk in 2000 at the mainstem Columbia River locations, Hawk Creek, the Spokane Arm, and the Sanpoil Arm were 6.1, 5.0, 6.5, and 5.3 m respectively. Differences between these means were not significant (Fisher's PLSD; p ≥ 0.1262). Differences between pelagic (5.3 m; SD = 2.8; n=76) and shore (5.5 m; SD = 3.2; n = 45) means during the months of May through September were insignificant as well (Fisher's PLSD; p ≥ 0.6422).

Secchi disk depths from round means were positively correlated with 30 d mean elevation ($r = 0.913$, $p < 0.0001$), 14 d mean water retention time ($r = 0.808$, $p = 0.0008$), and photic zone depth ($r = 0.713$, $p = 0.0074$) in 2000. Secchi depths from round means were negatively correlated with 14 d mean inflows ($r = -0.799$, $p = 0.0010$), 14 d mean outflows ($r = -0.728$, $p = 0.0055$), 30 d mean daily elevation change ($r = -0.615$, $p = 0.0314$), and turbidity from round means ($r = -0.572$, $p = 0.0508$).

Annual mean photic zone depth across all mainstem locations was 10.6 m (SD = 3.2; n = 134). Annual mean photic zone depth at Hawk Creek was 10.2 m (SD = 2.6; n = 12). Annual mean photic zone depth at the Sanpoil Arm (10.2 m; SD = 3.7; n = 18; $p = 0.0271$) and Spokane Arm (7.8 m; SD = 3.9; n = 25; $p = 0.0002$) were both significantly less than the mainstem mean (Fisher's PLSD). Annual mean pelagic and shore photic zone depths were 10.4 m (SD = 3.5 m; n = 149) and 9.4 m (SD = 3.2; n = 40) respectively. Mean shore photic zone depth was nearly significantly less than the pelagic mean (Fisher's PLSD; $p = 0.1060$). Mean annual incidental radiation was 46.8 $\mu W/cm^2 \cdot nm$ and ranged from 2.3 to 100.8 $\mu W/cm^2 \cdot nm$ across all locations (SD = 28.7; n = 189).

Table 12. Annual mean, standard deviation (SD), sample size (n), and ranges for chemical characteristics across all locations sampled in Lake Roosevelt, WA (2000).

| Analyte | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| Nitrate as Nitrogen (mg/L) | 0.139 | 0.162 | 175 | 0.009 | 0.842 |
| Nitrite as Nitrogen (mg/L) | 0.003 | 0.000 | 175 | 0.003 | 0.003 |
| Ammonia as Nitrogen (mg/L) | 0.010 | 0.010 | 175 | 0.005 | 0.076 |
| Total Kjeldahl Nitrogen (mg/L) | 0.144 | 0.051 | 148 | 0.039 | 0.338 |
| Total Nitrogen (mg/L) | 0.272 | 0.172 | 175 | 0.113 | 1.023 |
| Total Phosphorus (mg/L) | 0.016 | 0.015 | 175 | 0.003 | 0.107 |
| Ortho-P (µg/L) | 2 | 4 | 175 | 0.5 | 34 |
| Total Nitrogen:Total Phosphorus | 31.3 | 27.9 | 175 | 1.6 | 119.8 |
| Alkalinity (mg/L) | 58.7 | 11.0 | 175 | 33.2 | 98.6 |
| Silicon (mg/L) | 3.1 | 1.4 | 27 | 2.1 | 8.5 |
| Total Suspended Solids (mg/L) | 2.5 | 2.1 | 175 | 1.0 | 13.5 |
| Turbidity (NTU) | 1.0 | 1.8 | 175 | 0.1 | 20.0 |
| Hardness as $CaCO_3$ (mg/L) | 66.0 | 6.9 | 27 | 41.8 | 76.0 |

Mean annual alkalinity was 58.7 mg/L and ranged from 33.2 to 98.6 mg/L across all locations in Lake Roosevelt (Table 12). Hardness from calcium and magnesium averaged 66.0 mg/L from January to March (SD = 6.9; n = 27; Table 12).

Nitrogen was measured in several different forms during 2000 in Lake Roosevelt. The most common inorganic form was $NO_3^-$. Annual mean $NO_3^-$ was 0.139 mg/L and ranged from 0.009 to 0.842 mg/L (Table 12) across all locations. Ammonia was the next most common inorganic form of N with an annual mean of 0.010 mg/L (Table 12). Annual mean $NO_2^-$ estimated at 0.003 mg/L was below the report limit (0.005 mg/L) for all samples, across all locations (Table 12). Organic N as measured by total Kjeldahl nitrogen averaged 0.144 mg/L and ranged from 0.039 to 0.338 mg/L across all locations during 2000 (Table 12). Mean total N was 0.272 mg/L as calculated by adding all forms of N and ranged from 0.113 to 1.023 mg/L in 2000 across all locations (Table 12). Total N from round means were positively correlated with temperature round means ($r = 0.661$, $p = 0.0170$) and 30 d mean water retention time ($r = 0.645$, $p = 0.0215$). Total N from round means were negatively correlated with *ex situ* turbidity round means ($r = -0.685$, $p = 0.0118$).

Phosphorus was also monitored throughout 2000 at different locations on Lake Roosevelt. Orthophosphorus was measured in low concentrations, near or at report limit. Mean annual orthophosphorus was 0.002 mg/L and ranged from 0.001 to 0.034 mg/L (Table 12). Prior to mean testing orthophosphorus data was transformed by the natural logarithm. Annual mean orthophosphorus was significantly higher at Porcupine Bay (0.007 mg/L) than Gifford (0.002 mg/L), Seven Bays (0.002 mg/L), Sanpoil River Confluence (0.001 mg/L), and Spring Canyon (0.001 mg/L; Scheffe; $p \leq 0.0135$). Annual (May-November) mean shore (0.002 mg/L) and pelagic (0.002 mg/L) concentrations were not significantly different (Fisher's PLSD; $p = 0.257$).

Inorganic and organic phosphorus as measured by total phosphorus was 0.016 mg/L during 2000 averaged across all locations (Table 12). Prior to mean testing, total P data was transformed by the natural logarithm. Annual mean total P at Kettle Falls (0.021 mg/L) was significantly greater than concentrations at Gifford (0.012 mg/L) and Spring Canyon (0.010 mg/L; Scheffe; $p \leq 0.0344$). Annual mean total P at Porcupine Bay (0.027 mg/L) was significantly higher than concentrations at Kettle Falls, Hunters (0.013 mg/L), Seven Bays (0.015 mg/L), Sanpoil R.

Confluence (0.014 mg/L), and Spring Canyon (Scheffe; $p \leq 0.0452$). Mean annual (May-November) differences between shore (0.014 mg/L) and pelagic (0.011 mg/L) total P concentrations were insignificant (Fisher's PLSD; $p = 0.9608$).

Total P round means were positively correlated with orthophosphorus round means ($r = 0.807$, $p = 0.0008$), *ex situ* turbidity round means ($r = 0.668$, $p = 0.0156$), and photic zone depth round means ($r = 0.610$, $p = 0.0336$). Total P round means were negatively correlated with Total N round means ($r = -0.726$, $p = 0.0058$), and temperature round means ($r = -0.649$, $p = 0.0203$). Orthophosphorus round means were also positively correlated with turbidity round means ($r = 0.770$, $p = 0.0022$), but negatively correlated with temperature round means ($r = -0.760$, $p = 0.0028$) and total N round means ($r = -0.726$, $p = 0.0058$).

Total N and total P ratios (TN:TP) were calculated to examine potential limiting nutrients to primary producers of Lake Roosevelt. The mean annual (May-November) TN:TP across all sites was 31:1 and ranged from 2:1 to 120:1 (SD = 28:1; n = 175; Table 12). Data was transformed by the natural logarithm before significance testing of means. Mean annual TN:TP at Kettle Falls (19:1) was significantly less than ratios at Gifford (35:1), Porcupine Bay (43:1) and Spring Canyon (37:1; Fisher's PLSD; $p \leq 0.0493$). Porcupine Bay's annual mean TN:TP ratio was also significantly greater than Evan's Landing (31:1) and the Sanpoil R. (23:1; Fisher's PLSD; $p \leq 0.0251$). Differences between annual mean pelagic (44:1) and shore (40:1) ratios were insignificant (Fisher's PLSD; $p = 0.6299$).

**Phytoplankton**

There were 42 different phytoplankton taxa, representing six Classes collected from all pelagic sampling sites during 2000 (January-November, Table 13). Thirty-eight different phytoplankton taxa representing six Classes were observed during 2000 at shore sites across all locations (May-November, Table 14). Of the 38 different shore phytoplankton taxa only five (*Aphanocapsa sp.*, *Closterium sp.*, *Mallomonas pseudocoronata, Quadrigula chodatii,* and *Stephanodiscus sp.*) did not appear in the pelagic phytoplankton samples. In both pelagic and shore sampling total relative density was dominated by the Bacillariophyceae with respective values of 36.9% and 34.4% (Table 13 and Table 14). A total of 155,524 cells were counted and identified from all pelagic sites. A total of 81,490 cells were counted and identified from all shore sites.

*Rhodomonas sp.* (22.5%), *Asterionella formosa* (21.4%), and microplankton (15.6%) had the highest relative densities for all pelagic phytoplankton sampling during 2000. Mean densities of *Rhodomonas sp.*, *Asterionella formosa*, and microplankton across all pelagic sampling locations respectively were 437 cells/ml, 490 cells/ml, and 303 cells/ml. *Rhodomonas sp.* (26.7%), *Asterionella formosa* (20.8%), and *Chlamydomonas sp.* (12.3%) had the highest relative densities for all shore phytoplankton sampling. Mean densities of *Rhodomonas sp.*, *Asterionella formosa*, and *Chlamydomonas sp.* across all shore sampling locations were 622 cells/ml, 736 cells/ml, and 286 cells/ml respectively.

Mean pelagic density of all Classes peaked between May and August of 2000 (Figure 10). The highest monthly mean densities (all pelagic sites) for each Class were as follows: Cryptophyceae 466 cells/ml (July), Microplankton 445 cells/ml (June), Cyanophyceae 438 cells/ml (July), Bacillariophyceae 312 cells/ml (June), Chlorophyceae 260 cells/ml (August), Chrysophyceae 118 cells/ml (May), and Dinophyceae 17 cells/ml (July).

Phytoplankton density round means were negatively correlated with specific conductance round means ($r = -0.839$, $p = 0.0003$), photic zone depth round means ($r = -0.675$, $p = 0.0140$), Secchi depth round means ($r = -0.672$, $p = 0.0145$), and 30 d mean reservoir elevation ($r = -0.672$, $p = 0.0146$). Density round means were positively correlated with 14 d mean inflows ($r = 0.783$, $p = 0.0016$).

Density values were transformed by the natural logarithm prior to mean comparison because of skewed distributions and large standard deviations. Spatially mean pelagic density (all taxa) did not vary significantly between Gifford (167 cells/ml, SD = 221, n = 154), Porcupine Bay (270 cells/ml, SD = 547, n = 109), Seven Bays (184 cells/ml, SD = 269, n = 127), and Spring Canyon (165 cells/ml, SD = 235, n = 127) during January through November (Fisher's PLSD, $p \geq 0.2027$). Mean density between pelagic (216 cells/ml, SD = 364, n = 359) and shore (229 cells/ml, SD = 459, n = 299) sites at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon during May through November were also not significantly different (Fisher's PLSD, $p = 0.8323$).

Relative biovolumes at pelagic and shore sites across all sampling locations were also dominated by Bacillariophyceae with respective values of 62.4% and 63.2% (Table 13 and Table 14).

*Asterionella formosa* (32.6%), *Cryptomonas sp.* (14.1%), and *Rhodomonas sp.* (9.6%) had the greatest total relative biovolumes at all pelagic sites during January to November. *Asterionella formosa*, *Cryptomonas sp.*, and *Rhodomonas sp.* from all pelagic sites during January to November had respective mean biovolumes of 0.257 $mm^3$/L, 0.095 $mm^3$/L, 0.064 $mm^3$/L. *Asterionella formosa* (29.2%), *Tabellaria sp.* (16.1%), and *Cryptomonas sp.* (15.1%) had the greatest total relative biovolume at all shore sites from May to November. *Asterionella formosa*, *Tabellaria sp.*, and *Cryptomonas sp.* from all shore sites during May through November, had respective mean biovolumes of 0.383 $mm^3$/L, 0.484 $mm^3$/L, and 0.130 $mm^3$/L.

Mean monthly biovolume was greatest for all classes from May to July (Figure 11). The greatest pelagic monthly mean biovolume for each class was as follows (January to November): Bacillariophyceae 0.220 $mm^3$/L (June), Cryptophyceae 0.163 $mm^3$/L (May), Dinophyceae 0.149 $mm^3$/L (July), Cyanophyceae 0.065 $mm^3$/L (July), Chlorophyceae 0.044 $mm^3$/L (July), Chrysophyceae 0.039 $mm^3$/L (May), and Microplankton 0.017 $mm^3$/L (June).

Phytoplankton biovolume round means were positively correlated with phytoplankton density round means ($r = 0.947$, $p < 0.0001$), 14 d mean inflow ($r = 0.802$, $p = 0.0009$), and 30 d mean daily elevation change ($r = 0.685$, $p = 0.0118$). Biovolume round means were negatively correlated with specific conductance round means ($r = -0.846$, $p = 0.0002$), photic zone depth round means ($r = -0.755$, $p = 0.0031$), Secchi depth round means ($r = -0.712$, $p = 0.0075$) and 30 d mean elevation ($r = -0.682$, $p = 0.0124$).

Biovolume values were transformed by the natural logarithm prior to mean comparison because of skewed distribution and large standard deviations. Mean pelagic biovolume (all taxa) did not vary significantly between Gifford (0.051 $mm^3$/L, SD = 0.094, n = 154), Porcupine Bay (0.105 $mm^3$/L, SD = 0.296, n = 109), Seven Bays (0.068 $mm^3$/L, SD = 0.140, n = 139) and Spring Canyon (0.062 $mm^3$/L, SD = 0.113, n = 127) from January to November (Fisher's PLSD, $p \geq 0.5051$). Mean biovolume at pelagic (0.081 $mm^3$/L, SD = 0.191, n = 359) and shore (0.084 $mm^3$/L, SD = 0.238, n = 299) sites at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon from May to November were not significantly different (Fisher's PLSD, $p = 0.8890$).

Chlorophyll *a* (chla) was also measured to assess the phytoplankton community. Mean chla determined fluorometrically from all locations and sampling times (January to December) was 1.6 $mg/m^3$ (SD = 3.1, n = 420), while mean chla determined spectrophotometrically from all locations and sampling times (April to December) was 1.0 $mg/m^3$ (SD = 1.1, n = 66). When chla values from different methods were combined the monthly average was greatest in June (4.18 $mg/m^3$, SD = 5.80, n = 59) and lowest in March (0.02 $mg/m^3$, SD = 0.01, n = 36; Figure 12).

Phytoplankton chla round means were positively correlated with phytoplankton biovolume round means (r = 0.937, $p < 0.0001$), phytoplankton density round means (r = 0.841, p = 0.0002), 14 d mean inflow (r = 0.695, p = 0.0101), and 30 d daily elevation change (r = 0.702, p = 0.0090). Chlorophyll *a* round means were negatively correlated to photic zone depth round means (r = -0.710, p = 0.0077), specific conductance round means (r = -0.675, p = 0.0139), Secchi depth round means (r = -0.628, p = 0.0266), and 30 d mean elevation (r = -0.617, p = 0.0307).

Both pelagic and shore monthly means from combined chla data (fluorometer and spectrophotometric) peaked in June with (Gifford, Porcupine Bay, Hawk Creek, Sanpoil R., and Spring Canyon) respective means of 4.6 $mg/m^3$ (SD = 6.2, n = 20) and 7.5 $mg/m^3$ (SD = 7.8, n = 15). These pelagic and shore locations were lowest in March with respective means of 0.029 $mg/m^3$ (SD = 0.023, n = 12) and 0.007 $mg/m^3$ (SD = 0.006, n = 3). Combined mean chla from March to July at shore (4.6 $mg/m^3$, SD = 5.9, n = 51) sites was significantly greater than pelagic (2.4 $mg/m^3$, SD = 3.7, n = 86) sites (Scheffe, p = 0.0227). Combined chla data included only Gifford, Porcupine Bay, Hawk Creek, Sanpoil R., and Spring Canyon locations and was transformed by the natural logarithm prior to mean comparisons.

Mean comparisons across locations were also transformed with the natural logarithm and only February to July and October data were included in the analysis. Combined chlorophyll *a* values at Porcupine Bay (4.85 $mg/m^3$) were significantly greater than Evan's Landing (0.85 $mg/m^3$), Kettle Falls (0.67 $mg/m^3$), Gifford (1.76 $mg/m^3$), Hunters (0.57 $mg/m^3$), Keller Ferry (0.97 $mg/m^3$), Sanpoil R. Confluence (1.42 $mg/m^3$), Spring Canyon (2.11 $mg/m^3$) and the Sanpoil R (1.13 $mg/m^3$; Table 15; Scheffe, $p \leq 0.0497$).

**2001 Phytoplankton Density and Biovolume (Supplemental)**

Phytoplankton from Lake Roosevelt was collected during two (January and March) months in 2001. So rather than put that data in the 2001 annual report, it was included in this report for continuity. Sampling periods included January 23-25 and March 26-27. Sampling locations included Gifford, Seven Bays, Sanpoil R. Confluence, Spring Canyon, Porcupine Bay, and Sanpoil River. A total of 27 taxa from five Classes were identified from all sampling (Table 81). Bacillariophyceae had the greatest total relative density (32.3%) followed by the Cryptophyceae (22.4%). Bacillariophyceae also had greater total relative biovolume (61.6%) again followed by the Cryptophyceae (16.3%). Mean phytoplankton density at all locations in January was 116 cells/ml (SD = 138, n = 111) and 180 cells/ml in March (SD = 286, n = 114). Mean phytoplankton biovolume at all locations in January was 0.0286 $mm^3$/L (SD = 0.0385, n = 111) and 0.0611 $mm^3$/L in March (SD = 0.1588, n = 114).

Table 13. Phytoplankton taxa list, relative density, and relative biovolume from pelagic sites at all locations on Lake Roosevelt, WA (January to November, 2000).

| **Division** | **Class** | *Species* | **% of Total Den.** | **% of Total Biovol.** |
|---|---|---|---|---|
| **Chlorophyta** | | | | |
| | **Chlorophyceae** | | **16.2** | **7.2** |
| | | *Ankistrodesmus falcatus* | 1.5 | 0.0 |
| | | *Carteria sp.* | 0.0 | 0.0 |
| | | *Chlamydomonas sp.* | 13.3 | 6.4 |
| | | *Cosmarium sp.* | 0.0 | 0.0 |
| | | *Eudorina elegans* | 0.6 | 0.3 |
| | | *Mougeotia sp.* | 0.0 | 0.0 |
| | | *Pandorina morum* | 0.1 | 0.1 |
| | | *Pediastrum boryanum* | 0.1 | 0.0 |
| | | *Raciborskiella uroglenoides* | 0.0 | 0.0 |
| | | *Scenedesmus bijuga* | 0.3 | 0.1 |
| | | *Scenedesmus dimorphus* | 0.0 | 0.0 |
| | | *Scenedesmus quadricauda* | 0.1 | 0.0 |
| | | *Schroederia setigera* | 0.1 | 0.0 |
| | | *Staurastrum paradoxum* | 0.0 | 0.1 |
| **Chrysophyta** | | | | |
| | **Bacillariophyceae** | | **36.9** | **62.4** |
| | | *Achnanthes sp.* | 0.2 | 0.1 |
| | | *Amphora sp.* | 0.0 | 0.1 |
| | | *Asterionella formosa* | 21.4 | 32.6 |
| | | *Cocconeis sp.* | 0.0 | 0.1 |
| | | *Cyclotella sp.* | 0.3 | 0.9 |
| | | *Cymbella sp.* | 0.0 | 0.1 |
| | | *Fragilaria crotonensis* | 4.3 | 9.0 |
| | | *Fragilaria sp.* | 0.1 | 0.5 |
| | | *Gomphonema sp.* | 0.0 | 1.4 |
| | | *Melosira distans* | 0.2 | 0.6 |
| | | *Melosira granulata* | 0.0 | 0.0 |
| | | *Melosira herzogii* | 0.1 | 0.1 |
| | | *Melosira italica* | 1.6 | 5.1 |
| | | *Melosira varians* | 0.0 | 0.7 |
| | | *Navicula sp.* | 0.0 | 0.1 |
| | | *Rhizosolenia sp.* | 1.2 | 2.9 |
| | | *Synedra sp.* | 6.6 | 1.1 |
| | | *Tabellaria sp.* | 0.8 | 7.2 |
| **Chrysophyta** | | | | |
| | **Chrysophyceae** | | **2.9** | **3.2** |
| | | *Dinobryon bavaricum* | 0.1 | 0.1 |
| | | *Dinobryon sertularia* | 2.5 | 2.0 |
| | | *Mallomonas sp.* | 0.3 | 1.2 |
| **Cryptophyta** | | | | |
| | **Cryptophyceae** | | **26.5** | **23.7** |
| | | *Cryptomonas sp.* | 4.1 | 14.1 |
| | | *Rhodomonas sp.* | 22.5 | 9.6 |
| **Cyanophyta** | | | | |
| | **Cyanophyceae** | | **1.9** | **0.7** |
| | | *Anabaena sp.* | 0.7 | 0.3 |
| | | *Gloeocapsa sp.* | 0.3 | 0.2 |
| | | *Oscillatoria sp.* | 0.9 | 0.2 |
| **Pyrrhophyta** | | | | |
| | **Dinophyceae** | | **0.0** | **0.3** |
| | | *Ceratium hirundinella* | 0.0 | 0.3 |
| | | **Microplankton** | **15.6** | **2.6** |

Table 14. Phytoplankton taxa list, relative density, and relative biovolume from shore sites at all locations on Lake Roosevelt, WA (May to November, 2000).

| Division | Class | *Species* | % of Total Den. | % of Total Biovol. |
|---|---|---|---|---|
| **Chlorophyta** | | | | |
| | **Chlorophyceae** | | **15.2** | **6.2** |
| | | *Ankistrodesmus falcatus* | 2.0 | 0.0 |
| | | *Chlamydomonas sp.* | 12.3 | 5.5 |
| | | *Closterium sp.* | 0.0 | 0.2 |
| | | *Eudorina elegans* | 0.1 | 0.0 |
| | | *Pediastrum boryanum* | 0.3 | 0.3 |
| | | *Quadrigula chodatii* | 0.1 | 0.0 |
| | | *Scenedesmus bijuga* | 0.1 | 0.0 |
| | | *Scenedesmus dimorphus* | 0.0 | 0.0 |
| | | *Scenedesmus quadricauda* | 0.1 | 0.0 |
| | | *Schroederia setigera* | 0.1 | 0.0 |
| | | *Staurastrum paradoxum* | 0.0 | 0.2 |
| **Chrysophyta** | | | | |
| | **Bacillariophyceae** | | **34.4** | **63.2** |
| | | *Achnanthes sp.* | 0.5 | 0.2 |
| | | *Amphora sp.* | 0.2 | 1.1 |
| | | *Asterionella formosa* | 20.8 | 29.2 |
| | | *Cocconeis sp.* | 0.0 | 0.0 |
| | | *Cyclotella sp.* | 0.4 | 1.0 |
| | | *Fragilaria crotonensis* | 2.5 | 5.4 |
| | | *Fragilaria sp.* | 0.1 | 0.2 |
| | | *Gomphonema sp.* | 0.0 | 0.0 |
| | | *Melosira distans* | 0.1 | 0.4 |
| | | *Melosira italica* | 1.2 | 3.1 |
| | | *Navicula sp.* | 0.4 | 1.6 |
| | | *Rhizosolenia sp.* | 1.7 | 3.9 |
| | | *Stephanodiscus sp.* | 0.0 | 0.2 |
| | | *Synedra sp.* | 5.5 | 0.9 |
| | | *Tabellaria sp.* | 1.1 | 16.1 |
| **Chrysophyta** | | | | |
| | **Chrysophyceae** | | **2.4** | **2.4** |
| | | *Dinobryon bavaricum* | 0.1 | 0.1 |
| | | *Dinobryon sertularia* | 2.0 | 1.4 |
| | | *Mallomonas pseudocoronata* | 0.0 | 0.1 |
| | | *Mallomonas sp.* | 0.2 | 0.9 |
| **Cryptophyta** | | | | |
| | **Cryptophyceae** | | **32.3** | **25.2** |
| | | *Cryptomonas sp.* | 5.5 | 15.1 |
| | | *Rhodomonas sp.* | 26.7 | 10.1 |
| **Cyanophyta** | | | | |
| | **Cyanophyceae** | | **3.5** | **0.7** |
| | | *Anabaena sp.* | 0.1 | 0.0 |
| | | *Aphanocapsa sp.* | 1.3 | 0.0 |
| | | *Gloeocapsa sp.* | 1.1 | 0.2 |
| | | *Oscillatoria sp.* | 1.1 | 0.4 |
| **Pyrrhophyta** | | | | |
| | **Dinophyceae** | | **0.0** | **0.3** |
| | | *Ceratium hirundinella* | 0.0 | 0.4 |
| | | **Microplankton** | **12.2** | **1.9** |

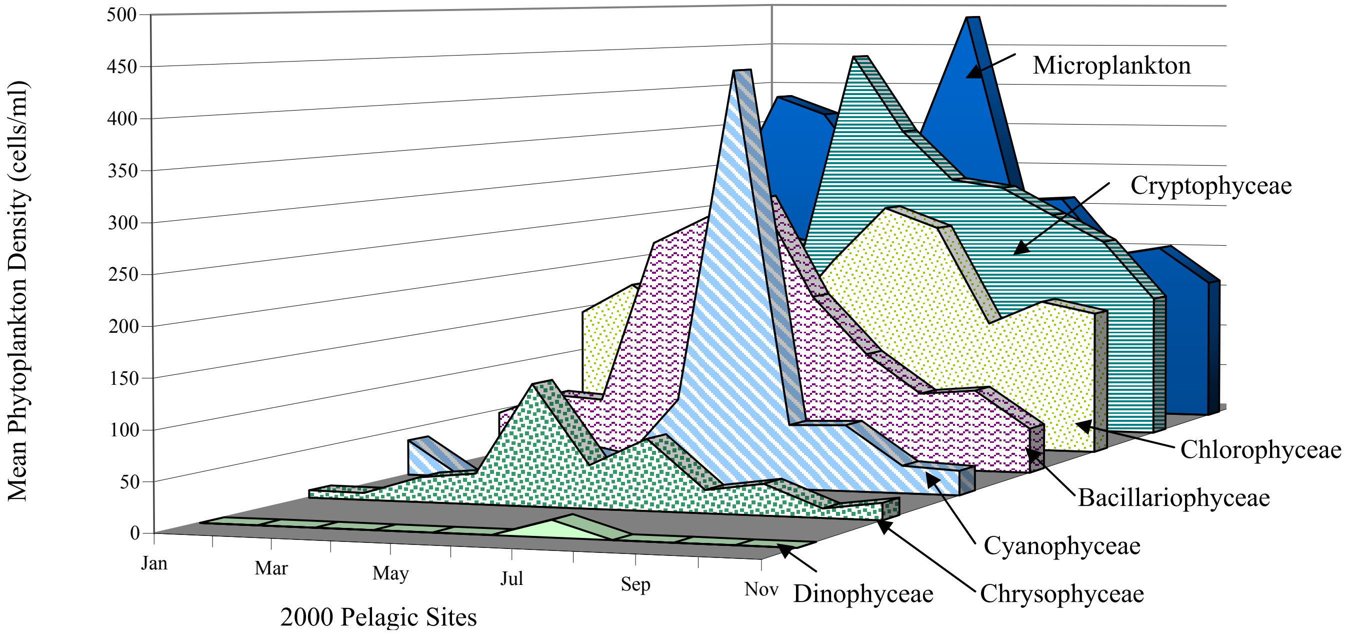


Figure 10. Mean monthly phytoplankton densities at pelagic sites across all locations on Lake Roosevelt, WA (2000).

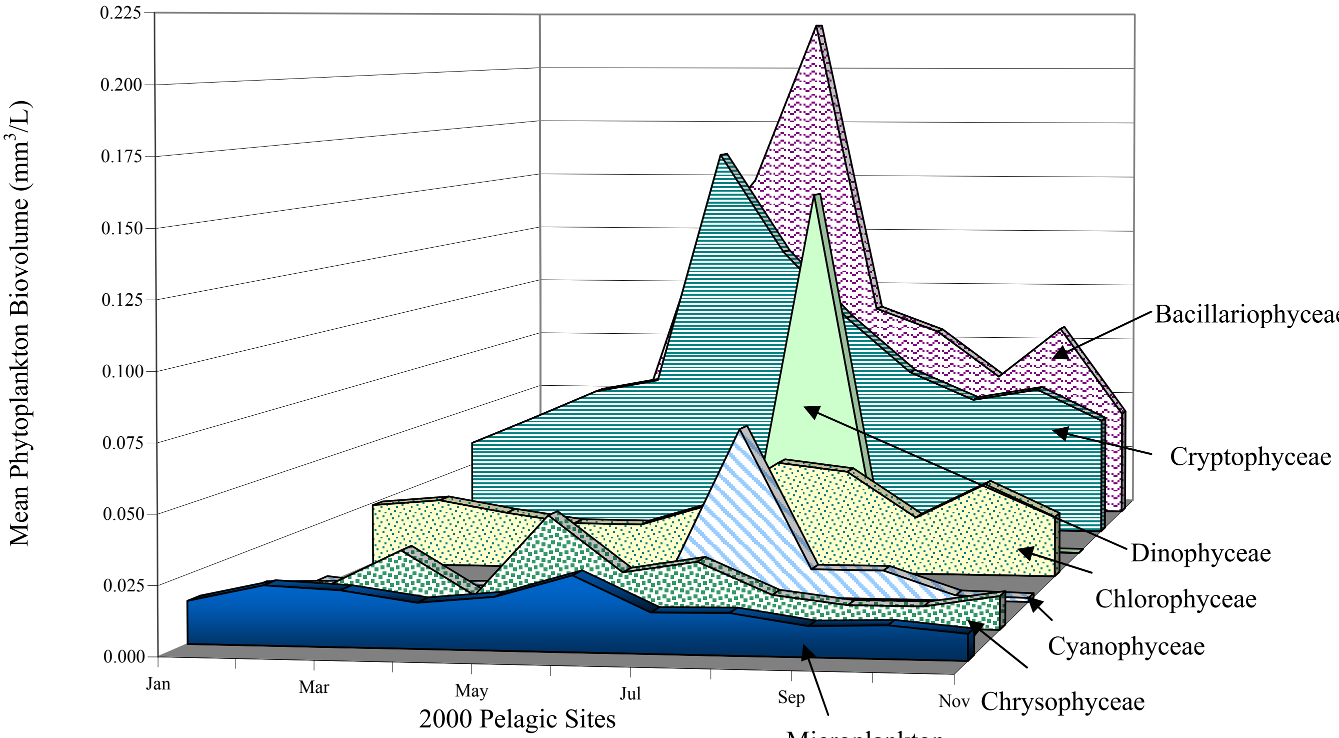


Figure 11. Mean monthly phytoplankton biovolumes at pelagic sites across all locations on Lake Roosevelt, WA (2000).

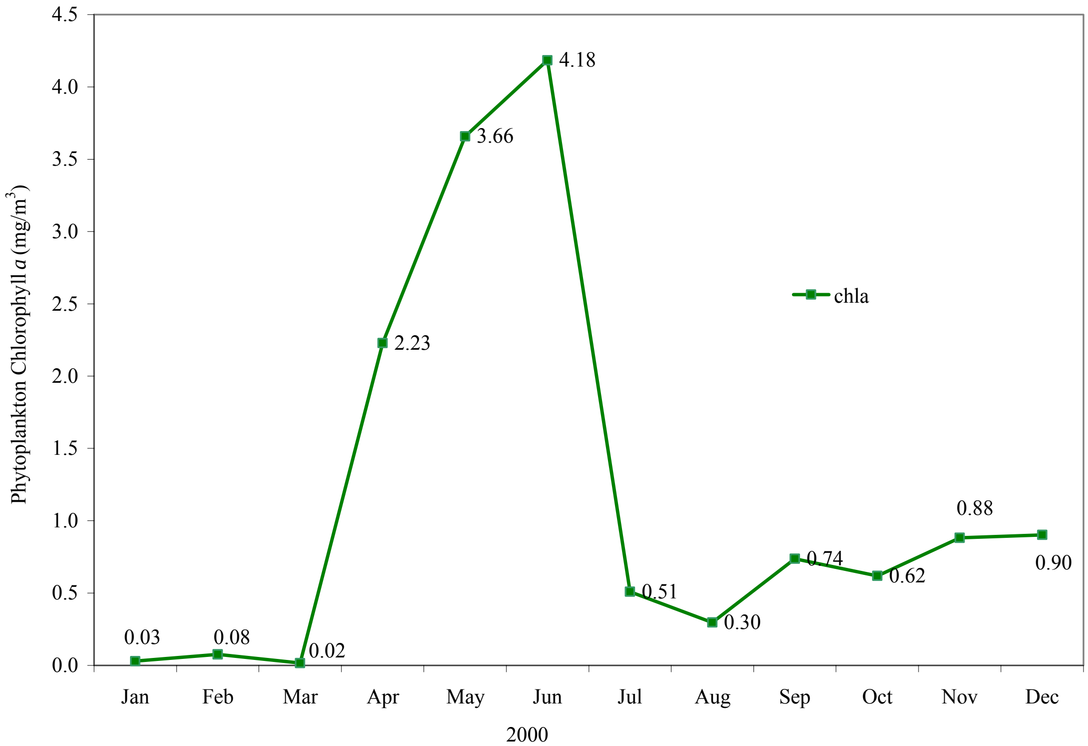


Figure 12. Mean monthly phytoplankton chlorophyll *a* concentrations ($mg/m^3$) from fluorometric and spectrophotometric data across all locations on Lake Roosevelt, WA (2000).

Table 15. Mean phytoplankton chlorophyll *a* concentrations ($mg/m^3$) from fluorometric and spectrophotometric data combined during February to July and October on Lake Roosevelt, WA (2000).

| **Waterbody** | **Location** | **Mean** | **SD** | **n** | **Min** | **Max** |
|---|---|---|---|---|---|---|
| **Columbia R.** | Evan's Landing | 0.85 | 1.25 | 19 | 0.00 | 5.55 |
| | Kettle Falls | 0.67 | 0.58 | 19 | 0.00 | 1.56 |
| | Gifford | 1.76 | 2.58 | 39 | 0.00 | 10.51 |
| | Hunters | 0.57 | 0.57 | 19 | 0.00 | 1.62 |
| | Seven Bays | 1.50 | 1.69 | 29 | 0.00 | 5.18 |
| | Sanpoil R. Confluence | 1.42 | 1.93 | 28 | 0.00 | 6.92 |
| | Keller Ferry | 0.97 | 1.01 | 18 | 0.00 | 2.87 |
| | Spring Canyon | 2.11 | 3.11 | 39 | 0.00 | 14.63 |
| **Spokane R.** | Porcupine Bay | 4.85 | 6.70 | 38 | 0.00 | 24.99 |
| **Sanpoil R.** | Sanpoil River | 1.13 | 1.26 | 28 | 0.00 | 3.39 |
| **Hawk Creek** | Hawk Creek | 4.34 | 5.67 | 19 | 0.00 | 17.85 |

**Trophic Status**

Mean annual TSI values calculated from phytoplankton chlorophyll *a*, Secchi, total nitrogen, and total phosphorus across all locations and sampling times were 22, 37, 34, and 39 respectively (Table 16). Mean chlorophyll *a* TSI was significantly less than all other mean TSI values (Scheffe, $p<0.0001$). Trophic state values were generally higher during spring and early summer largely due to the spring phytoplankton bloom and reduced Secchi depths from increased turbidity.

Annual mean TSI values calculated by phytoplankton chlorophyll *a* were significantly less than values calculated from Secchi, total nitrogen, and total phosphorus (Scheffe, $p<0.0001$). The mean TSI value (chlorophyll, Secchi, TN, TP combined) from shore sites (mean = 34, SD = 16, n = 150) across all reservoir locations, during May to August and October was slightly greater than the pelagic mean (mean = 32, SD = 14, n = 394). However, the difference between the pelagic and shore mean was insignificant (Fisher's PLSD, $p = 0.2415$). Mean TSI (chlorophyll, Secchi, TN, TP combined) at Porcupine Bay (mean = 40, SD = 17, n = 94) during March through August and October was significantly greater than mean TSI at Hunters (mean = 27, SD = 16, n = 45) and Spring Canyon (mean = 30, SD = 15, n = 93, Scheffe, $p \leq 0.0464$).

Table 16. Annual mean, standard deviation (SD), sample size (n), and ranges for trophic state indices from phytoplankton chlorophyll *a*, Secchi, total phosphorus, and total nitrogen in Lake Roosevelt, WA (2000).

| TSI Measure | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| Phytoplankton Chlorophyll *a* | 21.9 | 17.7 | 488 | 0.0 | 62.2 |
| Secchi Depth | 36.9 | 8.5 | 257 | 23.0 | 70.0 |
| Total Nitrogen | 33.8 | 6.8 | 175 | 22.9 | 54.8 |
| Total Phosphorus | 39.2 | 12.3 | 175 | 17.4 | 71.5 |

**Attached Algae**

There were 22 taxa from three Classes of attached algae collected from glass slides during 2000. These slides were incubated at different sampling locations and depths on Lake Roosevelt. Total relative density was dominated by Bacillariophyceae 95.0% followed by Chlorophyceae 5.0% and Cyanophyceae 1.0% (Table 17). *Achnanthes sp*. (71.5%), *Synedra sp*. (8.1%), and *Fragilaria sp*. (5.0%) accounted for approximately 85% of the annual total relative density (Table 17). Additionally, all of these species are diatoms. *Mougeotia sp.* and *Merismopedia sp.*

had the highest relative densities of all Chlorophyceae and Cyanophyceae respectively (Table 17). Bacillariophyceae (85.1%) also had the greatest relative biovolume followed by the Chlorophyceae 14.8% and Cyanophyceae 0.0% (Table 17). *Melosira varians* (36.2%), *Mougeotia sp.* (14.8%), and *Achnanthes sp.* (13.2%) accounted for approximately 64% of the annual total relative biovolume (Table 17).

Mean density over all sampling periods, locations, and species was 57,700 cells/$cm^2$ (SD = 145,258, n = 303; Table 18). Attached algal density was significantly greater at the 1.5 m (68,475 cells/$cm^2$) incubation depth than at 4.6 m (41713 cells/$cm^2$; Scheffe, p = 0.0137; Table 19). Density at Spring Canyon (73,387 cells/$cm^2$) was significantly greater than density at Porcupine Bay (51,870 cells/$cm^2$) and Seven Bays (20,625 cells/$cm^2$; Fisher's PLSD, p = 0.0256; Table 19). Density values were transformed by the natural logarithm prior to mean comparisons.

Mean biovolume over all sampling periods, locations, and species was 0.0338 $mm^3/cm^2$ (SD = 0.0758, n = 303, Table 18). Overall, biomass accumulated at a mean rate of 5.91 $mm^3/m^2$•day. Attached algal biovolume was significantly greater at the 1.5 m (0.0400 $mm^3/cm^2$) incubation depth versus the 4.6 m depth (0.0250 $mm^3/cm^2$; Scheffe, p = 0.0011; Table 20). Similar to the density comparisons, mean biovolume at Spring Canyon (0.0500 $mm^3/cm^2$) was significantly greater than mean biovolume at Porcupine Bay (0.0180 $mm^3/cm^2$) and Seven Bays (0.0160 $mm^3/cm^2$; Scheffe, $p \leq 0.0324$; Table 20). Biovolume values were transformed by the natural logarithm prior to mean comparisons.

Attached algal chlorophyll *a* averaged over all sampling periods and locations, was 14.0 mg/$m^2$ (SD = 12.8, n = 41; Table 21). Differences between mean chlorophyll *a* at 1.5 m (15.6 mg/$m^2$) and 4.6 m (11.5 mg/$m^2$) incubation depths were insignificant (Fisher's PLSD, p = 0.4315). Mean chlorophyll *a* at Spring Canyon (20.2 mg/$m^2$) was significantly greater than chlorophyll *a* at Porcupine Bay (10.8 mg/$m^2$; Scheffe, p = 0.0330; Table 21). Chlorophyll *a* values were transformed by the natural logarithm prior to mean comparisons.

Table 17. Attached algae taxa list, relative density, and relative biovolume from all locations on Lake Roosevelt, WA (2000).

| **Division** | **Class** | *Species* | **% of Total Den.** | **% of Total Biovol.** |
|---|---|---|---|---|
| **Chlorophyta** | | | | |
| | **Chlorophyceae** | | **5.0** | **14.8** |
| | | *Ankistrodesmus falcatus* | 0.0 | 0.0 |
| | | *Closterium sp.* | 0.0 | 0.0 |
| | | *Mougeotia sp.* | 4.9 | 14.8 |
| | | *Scenedesmus dimorphus* | 0.1 | 0.0 |
| **Chrysophyta** | | | | |
| | **Bacillariophyceae** | | **94.0** | **85.1** |
| | | *Achnanthes sp.* | 71.5 | 13.2 |
| | | *Amphipleura sp.* | 0.0 | 0.0 |
| | | *Amphora sp.* | 2.7 | 11.4 |
| | | *Asterionella formosa* | 0.0 | 0.0 |
| | | *Cocconeis sp.* | 0.1 | 0.2 |
| | | *Cyclotella sp.* | 0.0 | 0.1 |
| | | *Cymbella sp.* | 0.0 | 0.1 |
| | | *Fragilaria crotonensis* | 0.4 | 0.6 |
| | | *Fragilaria sp.* | 5.0 | 4.1 |
| | | *Gomphonema sp.* | 1.5 | 5.8 |
| | | *Melosira italica* | 0.0 | 0.1 |
| | | *Melosira varians* | 2.6 | 36.2 |
| | | *Navicula sp.* | 1.3 | 1.3 |
| | | *Pinnularia sp.* | 0.1 | 2.0 |
| | | *Synedra sp.* | 8.1 | 0.9 |
| | | *Tabellaria sp.* | 0.7 | 9.2 |
| **Cyanophyta** | | | | |
| | **Cyanophyceae** | | **1.0** | **0.0** |
| | | *Merismopedia sp.* | 0.9 | 0.0 |
| | | *Oscillatoria sp.* | 0.1 | 0.0 |

Table 18. Mean density, mean density production, mean biovolume, and mean biovolume production from attached algae taken from glass slides incubated at various embayment locations in Lake Roosevelt, WA (2000).

| ***Species*** | **Mean Den. (cells/cm$^2$)** | **Mean Den. Prod. (cells/cm$^2$•day)** | **Mean Biovol. (mm$^3$/ cm$^2$)** | **Mean Biovol. Prod. (mm$^3$/ m$^2$•day)** |
|---|---|---|---|---|
| *Achnanthes sp.* | 347,333 | 5,562 | 0.0377 | 6.05 |
| *Amphipleura sp.* | 1,000 | 20 | 0.0020 | 0.41 |
| *Amphora sp.* | 13,028 | 314 | 0.0324 | 10.09 |
| *Ankistrodesmus falcatus* | 3,000 | 37 | 0.0000 | 0.00 |
| *Asterionella formosa* | 1,000 | 21 | 0.0010 | 0.21 |
| *Closterium sp.* | 1,000 | 13 | 0.0020 | 0.25 |
| *Cocconeis sp.* | 2,167 | 37 | 0.0033 | 0.50 |
| *Cyclotella sp.* | 2,000 | 28 | 0.0023 | 0.31 |
| *Cymbella sp.* | 7,000 | 62 | 0.0120 | 1.06 |
| *Fragilaria crotonensis* | 18,500 | 182 | 0.0163 | 1.55 |
| *Fragilaria sp.* | 41,571 | 986 | 0.0200 | 4.54 |
| *Gomphonema sp.* | 7,371 | 156 | 0.0170 | 3.22 |
| *Melosira italica* | 5,000 | 45 | 0.0070 | 0.63 |
| *Melosira varians* | 15,586 | 170 | 0.1279 | 13.45 |
| *Merismopedia sp.* | 78,500 | 1,325 | 0.0000 | 0.00 |
| *Mougeotia sp.* | 26,719 | 591 | 0.0474 | 11.20 |
| *Navicula sp.* | 7,552 | 102 | 0.0047 | 0.61 |
| *Oscillatoria sp.* | 5,250 | 155 | 0.0013 | 0.11 |
| *Pinnularia sp.* | 1,444 | 22 | 0.0224 | 2.83 |
| *Scenedesmus dimorphus* | 10,000 | 125 | 0.0000 | 0.00 |
| *Synedra sp.* | 39,528 | 950 | 0.0026 | 0.63 |
| *Tabellaria sp.* | 9,000 | 159 | 0.0726 | 13.34 |
| **Overall** | **57,700** | **1,009** | **0.0339** | **5.91** |

Table 19. Annual mean, standard deviation (SD), sample size (n), and ranges of attached algae density (cells/$cm^2$) from different depths and locations on Lake Roosevelt, WA (2000).

| Attached Algal Density | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| 1.5 m | 68,475 | 165,500 | 181 | 0 | 1,300,000 |
| 4.6 m | 41,713 | 107,171 | 122 | 0 | 702,000 |
| Gifford | 48,000 | 104,655 | 76 | 1,000 | 739,000 |
| Porcupine Bay | 51,870 | 141,480 | 92 | 0 | 800,000 |
| Seven Bays | 20,625 | 38,481 | 16 | 0 | 125,000 |
| Spring Canyon | 73,387 | 175,766 | 119 | 0 | 1,300,000 |

Table 20. Annual mean, standard deviation (SD), sample size (n), and ranges of attached algae biovolume ($mm^3/cm^2$) from different depths and locations on Lake Roosevelt, WA (2000).

| Attached Algal Biovolume | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| 1.5 m | 0.0400 | 0.0760 | 181 | 0.0000 | 0.4810 |
| 4.6 m | 0.0250 | 0.0750 | 122 | 0.0000 | 0.6100 |
| Gifford | 0.0310 | 0.0500 | 76 | 0.0000 | 0.2270 |
| Porcupine Bay | 0.0180 | 0.0360 | 92 | 0.0000 | 0.2890 |
| Seven Bays | 0.0160 | 0.0320 | 16 | 0.0010 | 0.1170 |
| Spring Canyon | 0.0500 | 0.1070 | 119 | 0.0000 | 0.6100 |

Table 21. Annual mean, standard deviation (SD), sample size (n), and ranges of attached algal chlorophyll *a* (mg/$m^2$) from different depths and locations on Lake Roosevelt, WA (2000).

| Attached Algae Chla | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| 1.5 m | 15.6 | 14.3 | 25 | 0.6 | 54.2 |
| 4.6 m | 11.5 | 10.0 | 16 | 1.0 | 37.0 |
| Gifford | 10.9 | 4.2 | 9 | 3.1 | 17.6 |
| Porcupine Bay | 10.8 | 12.5 | 14 | 0.6 | 40.3 |
| Seven Bays | 1.0 | -- | 2 | 1.0 | 1.0 |
| Spring Canyon | 20.2 | 14.6 | 16 | 4.2 | 54.2 |
| **Overall** | **14.0** | **12.8** | **41** | **0.6** | **54.2** |

## Zooplankton

Twenty-one different zooplankton taxa were observed in Lake Roosevelt during 2000 (Table 22). Zooplankton were grouped into three major categories for analyses: *Daphnia*, other Cladocera, and Copepoda. Species groupings are listed in Table 4.

Table 22. Zooplankton species found in Lake Roosevelt, WA (2000).

| | |
|---|---|
| **Phylum Arthropoid** | **Phylum Arthropoid** |
| **Sub-class Crustacea** | **Sub-class Copepoda** |
| **Order Branchiopoda** | **Sub-order Calanoida** |
| **Family Bosminidae** | **Family Diaptomidae** |
| *Bosmina longirostris* | *Leptodiaptomus ashlandi* |
| | |
| **Family Chydoridae** | **Family Temoridae** |
| *Acroperus sp.* | *Epischura nevadensis* |
| *Alona quadrangularis* | |
| *Chydorus sphaericus* | **Sub-order Cyclopoida** |
| | **Family Cyclopoidae** |
| **Family Daphniidae** | *Diacyclops bicuspidatus thomasi* |
| *Ceriodaphnia quadrangula* | *Mesocyclops edax* |
| *Ceriodaphnia reticulata* | |
| *Daphnia galeata mendotae* | **Sub-order Harpacticoid** |
| *Daphnia pulex* | **Family Harpacticoidea** |
| *Daphnia retrocurva* | Harpacticoid sp. |
| *Daphnia rosea* | |
| *Daphnia thorata* | |
| | |
| **Family Leptodoriidae** | |
| *Leptodora kindtii* | |
| | |
| **Family Macrothricidae** | |
| *Ilyocriptus acutifrons* | |
| *Ilyocriptus sordidus* | |
| | |
| **Family Sididae** | |
| *Diaphanosoma brachyurum* | |
| *Sida crystallina* | |

**Pelagic Zooplankton Density**

Copepoda were the most abundant zooplankton taxon collected from Lake Roosevelt in 2000, accounting for 86% of the annual total pelagic zooplankton density. High copepod densities were driven primarily by large numbers of nauplii, *Diacyclops bicuspidatus thomasi*, and *Leptodiaptomous ashlandi*, which respectively comprised 56%, 18%, and 11% of the total zooplankton density in Lake Roosevelt in 2000. *Daphnia* spp. were the second most abundant taxon, accounting for 12% of the annual total pelagic zooplankton density. The most common *Daphnia* spp. (*Daphnia pulex*) contributed 10% to the total zooplankton assemblage. Other Cladocera were the least abundant taxon, comprising 2% of the total zooplankton density.

Mean pelagic zooplankton abundance was lowest at the northernmost locations in Lake Roosevelt, and generally increased downriver (Table 23). Greatest densities were found at the Sanpoil River location (695 organisms/$m^3$) while the lowest densities were observed at Kettle Falls (42 organisms/$m^3$; Table 23). The mainstem Columbia River mean (238 ogranisms/$m^3$) was significantly less than both the mean at the Sanpoil Arm (695 organisms/$m^3$) and the Spokane Arm (368 organisms/$m^3$; Scheffe, $p<0.0001$). The Sanpoil Arm mean was also significantly greater than the Spokane Arm mean (Scheffe, $p = 0.0247$).

The greatest abundances of both Copepoda and *Daphnia* were observed in the Sanpoil Arm (2,259 organisms/$m^3$ and 379 organisms/$m^3$ respectively). The lowest copepod, *Daphnia*, and other Cladocera densities were observed at Kettle Falls being 147, 3, and 6 (organisms/$m^3$), respectively (Table 23). Copepods were the most abundant group at all locations, comprising 80-99% of the total zooplankton present at each location (Table 23). *Daphnia* comprised the second most abundant group for all locations, except Evan’s Landing and Kettle Falls where they, comprised 5-16% of the total zooplankton present (Table 23). Other cladocerans were second most abundant group at Evan’s Landing (6%) and Kettle Falls (6%), and the least abundant at all other locations (1-7%; Table 23).

Table 23. Mean pelagic zooplankton density (organisms/m$^3$) and taxonomic group density across locations in Lake Roosevelt, WA (2000). Italicized numbers indicate taxonomic group percentage of grouping abundance at a given location.

| Location | Copepoda | *Daphnia* | Other Cladocera | Overall Zooplankton |
|---|---|---|---|---|
| Evan's Landing | 188 | 6 | 6 | 54 |
| | *91* | *3* | *6* | |
| Kettle Falls | 147 | 3 | 5 | 42 |
| | *92* | *2* | *6* | |
| Gifford | 253 | 37 | 8 | 80 |
| | *83* | *12* | *5* | |
| Hunters | 441 | 67 | 22 | 143 |
| | *80* | *12* | *7* | |
| Spokane R. Confl. | 534 | 1 | 1 | 140 |
| | *99* | *0* | *0* | |
| Seven Bays | 903 | 134 | 19 | 280 |
| | *84* | *12* | *3* | |
| Keller Ferry | 926 | 48 | 7 | 257 |
| | *94* | *5* | *1* | |
| Sanpoil R. Confl. | 1,143 | 169 | 10 | 347 |
| | *86* | *13* | *1* | |
| Spring Canyon | 1,766 | 215 | 8 | 521 |
| | *88* | *11* | *1* | |
| Porcupine Bay | 1,147 | 230 | 19 | 368 |
| | *81* | *16* | *2* | |
| Sanpoil R. | 2,259 | 379 | 14 | 695 |
| | *85* | *14* | *1* | |
| **Mean** | **995** | **142** | **12** | **302** |
| | *86* | *12* | *2* | |

Mean pelagic zooplankton densities in 2000 were low January through April (22-62 organisms/m$^3$; Table 24). May through July exhibited progressively greater pelagic zooplankton densities (355-656 organisms/m$^3$), followed by a steady decline from August through October (568-276 organisms/m$^3$; Table 24). Overall zooplankton abundance increased slightly in November (365 organisms/m$^3$) before decreasing in December (141 organisms/m$^3$; Table 24). Timing of peak pelagic zooplankton abundances varied slightly across taxonomic groups in 2000 (Table 82, Table 84, Table 86, and Table 88). *Daphnia* densities were greatest in August (283 organisms/m$^3$) and lowest in April (4 organisms/m$^3$). The high *Daphnia* density observed in August resulted from high *Daphnia* densities (organisms/m$^3$) observed at Porcupine Bay (610) and Sanpoil River (432; Table 86). Copepoda densities were greatest in July (2,227 organisms/$m^3$) and lowest in January (70 organisms/$m^3$; Table 24). Other Cladocera densities were greatest in August (42 organisms/$m^3$) and lowest in February (0.5 organisms/$m^3$; Table 24). Elevated mean pelagic zooplankton density was typically observed during the summer months when water temperatures were higher. Pelagic zooplankton density round means were positively correlated with temperature round means in Lake Roosevelt in 2000 ($r = 0.895$, $p < 0.0001$).

Table 24. Mean densities (organisms/$m^3$) of *Daphnia*, Other Cladocera, Copepoda, and overall pelagic zooplankton for all locations sampled in Lake Roosevelt, WA (2000).

| **Month** | ***Daphnia*** | **Copepoda** | **Other Cladocera** | **Overall Zooplankton** |
|---|---|---|---|---|
| Jan | 12 | 70 | 1 | 22 |
| Feb | 23 | 103 | 0 | 33 |
| Mar | 13 | 134 | 2 | 39 |
| Apr | 4 | 234 | 0 | 62 |
| May | 142 | 1,205 | 7 | 355 |
| Jun | 73 | 1,437 | 20 | 404 |
| Jul | 257 | 2,227 | 17 | 656 |
| Aug | 283 | 1,816 | 42 | 568 |
| Sep | 216 | 1,124 | 8 | 354 |
| Oct | 143 | 895 | 11 | 276 |
| Nov | 269 | 1,099 | 17 | 365 |
| Dec | 213 | 322 | 2 | 141 |

**Pelagic Zooplankton Biomass**

*Daphnia* accounted for 62% of the zooplankton biomass observed in Lake Roosevelt, compared with 12% of the zooplankton abundance (Table 25). High *Daphnia* biomass was driven primarily by *Daphnia pulex*, which comprised 57% of the total biomass in Lake Roosevelt in 2000 (Table 91). In contrast, copepods contributed 36% of the zooplankton biomass and 86% of the total abundance (Table 25). *Diacyclops bicuspidatus thomasi* and *Leptodiaptomous ashlandi* each accounted for 15% of the total biomass, while nauplii, the most abundant group observed, contributed only 2% to the total biomass (Table 90 and Table 91). Other Cladocera contributed 2% to both the total pelagic zooplankton biomass and abundance (Table 25).

Table 25. Total biomass, percent biomass, total density, and percent density contributed by zooplankton taxonomic group in Lake Roosevelt, WA (2000).

| | Total Biomass (μg) | Percent Biomass | Total Density (organisms) | Percent Density |
|---|---|---|---|---|
| **Copepods** | 4,519,994 | 36 | 2,789,119 | 86 |
| ***Daphnia*** | 7,767,278 | 62 | 399,202 | 12 |
| **Other Cladocera** | 199,787 | 2 | 61,226 | 2 |
| **Total Zooplankton** | **12,487,058** | | **3,249,546** | |

Mean pelagic zooplankton biomass was lowest at the northern most locations in Lake Roosevelt, and typically increased downriver (Table 26). Only the Spokane River Confluence and Keller Ferry locations exhibited large decreases in zooplankton abundance compared with nearby locations (Table 26). Zooplankton was collected at the Spokane River Confluence location January through May only, months that are typically characterized by low abundance and biomass (Table 27; Table 24). Mean pelagic zooplankton biomass was low overall at Keller Ferry due to a proportionally lower abundance of *Daphnia* (5% of zooplankton density) compared with copepods (94% of zooplankton density; Table 23). The greatest mean pelagic zooplankton biomass was observed at the Sanpoil River location (2,903 $\mu g/m^3$) and the lowest at Kettle Falls (32 $\mu g/m^3$). Mainstem Columbia River biomass (771 $\mu g/m^3$) was significantly less than mean biomass in the Spokane Arm (2,051 $\mu g/m^3$) and the Sanpoil Arm (2,903 $\mu g/m^3$; Scheffe, $p < 0.0001$). Zooplankton biomass at the Sanpoil Arm was also significantly greater than mean biomass at the Spokane Arm (Scheffe, $p = 0.0125$)

Mean *Daphnia* biomass was greatest at the Sanpoil River (7,180 $\mu g/m^3$) and Porcupine Bay (5,826 $\mu g/m^3$) but lowest at the Sanpoil River Confluence (2 $\mu g/m^3$; Table 26). Copepoda biomass was greatest at the Sanpoil River location (3,766 $\mu g/m^3$) and least at Evan's Landing (78 $\mu g/m^3$; Table 26). Other Cladocera mean biomass was greatest at the Sanpoil River (99 $\mu g/m^3$) and lowest at Kettle Falls (7 $\mu g/m^3$; Table 26). *Daphnia* exhibited the greatest biomass at all locations, except Evan's Landing, Kettle Falls, Spokane River Confluence and Keller Ferry, comprising 54-74% of the total zooplankton biomass present (Table 26). Copepoda exhibited the greatest biomass at the Spokane River Confluence (98%), Keller Ferry (72%), Kettle Falls

(71%), and Evan's Landing (51%). Copepods were the second most common group at all other locations, comprising 24-41% of the overall biomass (Table 26). Other Cladocera contributed the least biomass at all locations, comprising 20% of the Evan's Landing assemblage, 11% at Kettle Falls, and less than 7% at all other locations (Table 26).

Table 26. Mean pelagic zooplankton biomass (μg/m$^3$) and taxonomic group biomass across locations in Lake Roosevelt, WA (2000). Italicized numbers indicate taxonomic group percentage of biomass at a given location.

| Location | Copepoda | Daphnia | Other Cladocera | Overall Zooplankton |
|---|---|---|---|---|
| Evan's Landing | 78 | 44 | 17 | 40 |
| | *51* | *29* | *20* | |
| Kettle Falls | 86 | 22 | 7 | 32 |
| | *71* | *18* | *11* | |
| Gifford | 198 | 398 | 10 | 161 |
| | *32* | *65* | *3* | |
| Hunters | 658 | 910 | 60 | 438 |
| | *39* | *54* | *7* | |
| Spokane R. Confl. | 360 | 2 | 2 | 95 |
| | *98* | *1* | *1* | |
| Seven Bays | 1,760 | 2,658 | 60 | 1,181 |
| | *39* | *59* | *2* | |
| Keller Ferry | 1,367 | 515 | 9 | 495 |
| | *72* | *27* | *1* | |
| Sanpoil R. Confl. | 2,015 | 3,039 | 14 | 1,325 |
| | *40* | *60* | *1* | |
| Spring Canyon | 2,941 | 4,143 | 29 | 1,862 |
| | *41* | *58* | *1* | |
| Porcupine Bay | 1,912 | 5,826 | 68 | 2,051 |
| | *24* | *74* | *2* | |
| Sanpoil R. | 3,766 | 7,180 | 99 | 2,903 |
| | *34* | *65* | *2* | |
| **Mean** | **1,613** | **2,773** | **39** | **1,163** |
| | *36* | *62* | *2* | |

Pelagic zooplankton biomass was low during the winter and early spring (January through April) in Lake Roosevelt in 2000 (Table 27). Pelagic zooplankton biomass increased sharply in May (942 μg/m$^3$) likely a result of high abundances of *Daphnia* observed in the Sanpoil Arm (17,381 μg/m$^3$; Table 87). Pelagic zooplankton decreased in June (712 μg/m$^3$) rebounded in July (1,939

$\mu g/m^3$; Table 27) and peaked in August (2,694 $\mu g/m^3$) before steadily decreasing into October (1,238 $\mu g/m^3$; Table 27). Pelagic zooplankton biomass (2,230 $\mu g/m^3$) increased again in November, before declining in December (1,274 $\mu g/m^3$; Table 27).

Peak *Daphnia*, Copepoda, and other Cladocera biomass ($\mu g/m^3$) occurred in August with respective valvues of 2,924, 7,052, and 191. *Daphnia* biomass was lowest (55 $\mu g/m^3$) in January. Copedoda and other Cladocera biomass was lowest in April respectively at 27 and 0.5 $\mu g/m^3$ (Table 27). Complete biomass by taxonomic group across location and month is presented in Table 83, Table 85, Table 87, and Table 89. Elevated mean pelagic zooplankton biomass was typically observed during the summer months when water temperatures were higher. Total pelagic zooplankton biomass round means were positively correlated with temperature round means in Lake Roosevelt in 2000 ($r = 0.886$, $p < 0.0001$).

Table 27. Monthly mean biomass ($\mu g/m^3$) of *Daphnia*, Other Cladocera, Copepoda, and total pelagic zooplankton for all locations sampled in Lake Roosevelt, WA (2000).

| Month | Daphnia | Copepoda | Other Cladocera | Overall Zooplankton |
|---|---|---|---|---|
| **Jan** | 55 | 150 | 1 | 54 |
| **Feb** | 193 | 287 | 1 | 126 |
| **Mar** | 139 | 117 | 2 | 68 |
| **Apr** | 151 | 27 | 1 | 47 |
| **May** | 1,391 | 2,198 | 12 | 942 |
| **Jun** | 1,616 | 1,068 | 25 | 712 |
| **Jul** | 2,874 | 4,445 | 62 | 1,939 |
| **Aug** | 2,924 | 7,052 | 191 | 2,694 |
| **Sep** | 2,507 | 4,880 | 45 | 1,949 |
| **Oct** | 2,527 | 2,168 | 28 | 1,238 |
| **Nov** | 2,448 | 6,048 | 27 | 2,230 |
| **Dec** | 918 | 3,957 | 5 | 1,274 |

Beginning in 1991, reservoir mean zooplankton biomass was calculated as an average of *Daphnia* biomass observed at five index stations (Gifford, Porcupine Bay, Seven Bays, Keller Ferry, and Spring Canyon). While additional zooplankton sampling locations have been added since 1995, between-year comparisons of zooplankton biomass are made using average *Daphnia* biomass across the five index locations in order to preserve comparability across years.

*Daphnia* biomass at the five index locations in 2000 initially followed a similar pattern to what has been observed in the past. On average, biomass levels tended to be low January through May and increase during the summer to mid-fall. Zooplankton densities were high during October through to December in 2000 compared the past three years (Table 28). In November and December mean *Daphnia* biomass was at the second and third greatest biomass concentration observed for the Lake Roosevelt index stations in 2000 (Table 28). The annual index station mean in 2000 was between 1998 and 1999 values (Table 28). Recent (1997 – 2000) annual index station mean concentration are lower than all previous years other than 1991 and 1992 (Table 28).

Table 28. Mean *Daphnia* spp. biomass (µg/m$^3$) collected from five index locations in Lake Roosevelt, WA (1991-2000).

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan | 13 | 1,168 | | 55,075 | 2,050 | | 1,435 | 97 | 172 | 33 |
| Feb | | 122 | 518 | 1,350 | 1,985 | | 68 | 29 | 11 | 5 |
| Mar | | 328 | 61 | 1,625 | 347 | 10 | 59 | 16 | 0 | 3 |
| Apr | 23 | 35 | 56 | 2,950 | 158 | 40 | 200 | | 19 | 9 |
| May | 21 | 146 | 2,655 | 475 | 438 | 55 | 58 | 612 | 28 | 131 |
| Jun | 58 | 1,497 | 26,063 | 22,875 | 47,788 | 1,335 | 180 | 1,228 | 414 | 203 |
| Jul | 3,108 | 1,704 | 13,061 | 35,725 | 31,800 | 66,010 | 7,663 | 9,065 | 2,977 | 3,328 |
| Aug | 3,843 | 7,100 | 81,123 | 147,200 | 71,825 | 39,775 | 60,937 | 3,877 | 7,436 | 8,432 |
| Sep | 3,467 | 1,831 | 27,993 | 15,400 | 78,425 | 37,150 | 9,245 | 2,754 | 9,937 | 3,890 |
| Oct | 5,756 | 2,062 | 7,939 | 13,925 | 15,675 | 64,567 | 5,764 | 1,941 | 8,876 | 2,661 |
| Nov | 7,634 | 2,158 | 6,906 | | | 11,600 | | 1,522 | 4,584 | 8,245 |
| Dec | 2,066 | | 9,907 | | | 50,035 | 3,764 | 2,505 | 2,704 | 7,393 |
| **Annual Mean** | **2,599** | **1,650** | **16,026** | **29,660** | **25,049** | **27,058** | **8,125** | **1,464** | **3,741** | **2,901** |

## Zooplankton Length

Of the twenty-one species of zooplankton collected in Lake Roosevelt during 2000, six species had annual mean lengths less than 0.5 mm, seven species had annual mean lengths of 0.5 to 1.0 mm, and eight species had annual mean lengths of 1.0 mm or greater (Table 29). Only one species, *Leptodora kindti*, exceeded 2.0 mm annual mean length (Table 29). Of the total number of zooplankton measured in 2000 (n = 24,074), 53.6% (n = 12,901) were smaller than 0.5 mm, 27.4% (n = 6,605) were 0.5 mm to 1.0 mm in length, 15.8% (n = 3,807) were 1.0 to 2.0 mm in length, and 3.2% (n = 761) were 2.0 mm or greater in length. Copepoda comprised the majority of the < 0.5 mm (90.5%; n = 11,669) and the 0.5 to 1.0 mm (74.9%; n = 4,946) categories. *Daphnia* (53.3%; n = 2,029) and Copepoda (45.4%; n = 1,730) comprised the majority of the 1.0 to 2.0 mm category, and zooplankton greater than 2.0 mm were primarily comprised of *Daphnia* (90.4%; n = 688).

*Daphnia* exhibited the greatest annual mean length (1.34 mm) and Copepoda were the shortest group (0.45 mm; Table 29). Other Cladocera, the group that contains both the smallest zooplankter in Lake Roosevelt (*Chydorus sphaericus*; 0.28 mm) and the largest (*Leptodora kindti*; 3.99 mm), were only slightly larger (0.49 mm; Table 29) than the Copepoda (Table 29). D*aphnia* maintained the greatest mean length throughout the year (Figure 13). Copepoda were the smallest group from January to September, but were only marginally smaller than other Cladocera during all months excluding April and September. Mean length of other Cladocera was much greater for September compared with any other time of the year (Figure 13), while April was characterized by both a decreased mean Copepoda length and an increased mean other Cladocera length. The observed increases in other Cladocera in both April and September were the result of low densities of small-bodied species compared to relatively high numbers of large-bodied species present in the zooplankton assemblage. From October to December, other Cladocera were the smallest group observed in Lake Roosevelt, although differences observed between the copepods and other cladocerans were minimal (Figure 13).

Zooplankton length tended to increase from winter through spring and into the summer in 2000 (Figure 13). Total pelagic zooplankton length round means were positively correlated with temperature round means in Lake Roosevelt in 2000 ($r = 0.909$, $p < 0.0001$).

Table 29. Annual mean lengths, standard deviation (SD), number (n), and range of observed zooplankton lengths in Lake Roosevelt, WA (2000).

| | Mean | SD | n | Observed Range |
|---|---|---|---|---|
| ***Daphnia*** | | | | |
| *Daphnia galeata mendotae* | 1.13 | 0.47 | 821 | 0.42 - 2.78 |
| *Daphnia pulex* | 1.43 | 0.58 | 3,090 | 0.39 - 3.52 |
| *Daphnia retrocurva* | 1.07 | 0.46 | 269 | 0.50 - 2.43 |
| *Daphnia rosea* | 1.84 | -- | 1 | 1.84 |
| *Daphnia thorata* | 1.84 | 0.39 | 12 | 0.89 - 2.48 |
| Juvenile Daphnia | 0.47 | 0.09 | 57 | 0.19 - 0.66 |
| ***Daphnia*** | **1.34** | **0.57** | **4,250** | **0.19 - 3.53** |
| | | | | |
| **Other Cladocera** | | | | |
| *Acroperus* sp. | 0.62 | 0.09 | 4 | 0.52 - 0.74 |
| *Alona quadrangularis* | 0.47 | 0.22 | 76 | 0.20 - 1.40 |
| *Bosmina longirostris* | 0.35 | 0.09 | 1,088 | 0.14 - 0.64 |
| *Ceriodaphnia quadrangula* | 0.59 | 0.22 | 13 | 0.27 - 0.92 |
| *Ceriodaphnia reticulata* | 0.44 | -- | 1 | 0.44 |
| *Chydorus sphaericus* | 0.28 | 0.08 | 124 | 0.15 - 0.56 |
| *Diaphanosoma brachyurum* | 0.95 | 0.32 | 54 | 0.36 - 1.62 |
| *Ilyocryptus acutifrons* | 0.56 | 0.12 | 11 | 0.34 - 0.70 |
| *Ilyocryptus sordidus* | 0.20 | -- | 1 | 0.2 |
| *Leptodora kindtii* | 3.99 | 2.53 | 38 | 0.60 - 10.40 |
| *Sida crystallina* | 1.20 | 0.48 | 29 | 0.64 - 2.13 |
| **Other Cladocera** | **0.49** | **0.74** | **1,439** | **0.14 - 10.40** |
| | | | | |
| **Copepoda** | | | | |
| *Diacyclops bicuspidatus thomasi* | 0.66 | 0.24 | 5,333 | 0.20 - 1.46 |
| *Epischura nevadensis* | 1.00 | 0.65 | 319 | 0.23 - 2.50 |
| *Leptodiaptomus ashlandi* | 0.78 | 0.28 | 3,426 | 0.32 - 2.04 |
| *Mesocyclops edax* | 0.93 | 0.27 | 330 | 0.26 - 1.54 |
| Harpacticoid | 0.44 | 0.14 | 13 | 0.28 - 0.76 |
| Nauplii | 0.16 | 0.06 | 8,964 | 0.08 - 1.98 |
| **Copepoda** | **0.45** | **0.35** | **18,385** | **0.08 - 2.50** |
| | | | | |
| **Total Zooplankton** | **0.61** | **0.55** | **24,074** | **0.08 - 10.40** |

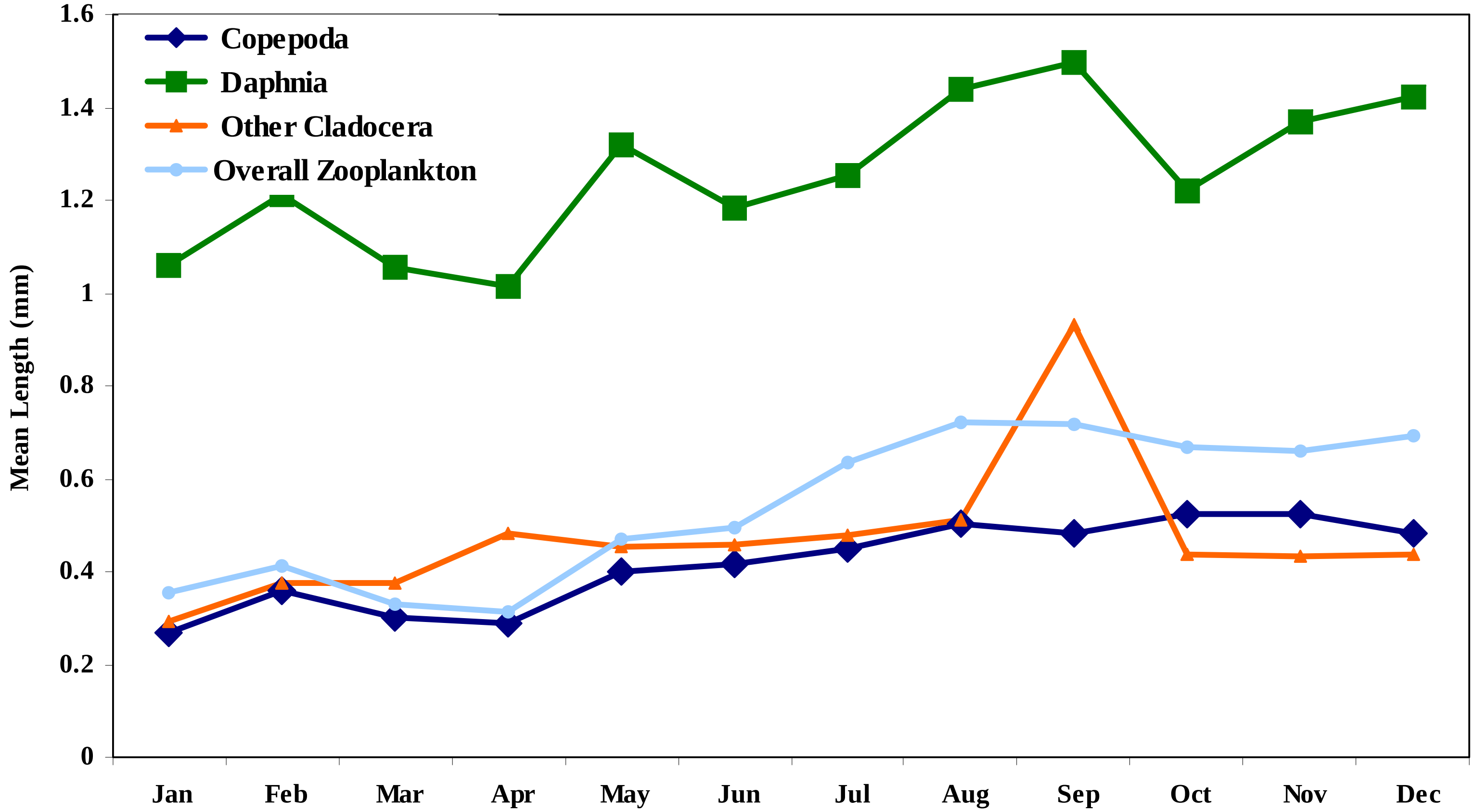


Figure 13. Seasonal variation of zooplankton mean length and mean length by taxonomic group in Lake Roosevelt, WA (2000).

Comparisons amongst locations sampled in 2000 indicated that mean length of pelagic zooplankton was smallest at the Spokane River Confluence (0.31 mm), and greatest at the Sanpoil River location (0.73 mm; Table 30). General trends indicate that mean zooplankton length increased downriver (Table 30; Table 92). Only the Spokane River Confluence and Keller Ferry locations did not follow this trend. The Spokane River Confluence location was sampled January through May only, a period of time when overall zooplankton lengths are low (Figure 13), while the Keller Ferry location was characterized by low densities of small *Daphnia* sp. compared with other downriver locations (Table 92). The Sanpoil and Spokane Arms of the reservoir exhibited the two greatest total mean zooplankton lengths (0.68 mm and 0.73 mm respectively; Table 30). Mean total zooplankton length in Lake Roosevelt has been strongly impacted by *Daphnia* density in the past (McLellan et al. 2003). In 2000, *Daphnia* spp. densities, and *Daphnia pulex* densities in particular, were greatest at the Spokane and Sanpoil Arms, which likely caused the greater zooplankton mean length observed at those locations.

Table 30. Mean zooplankton length from pelagic sampling at each location and reach from Lake Roosevelt, WA (2000).

| **Location** | **Reach** | **Mean Length (mm)** | **Standard Deviation** |
|---|---|---|---|
| Evans Landing | Mainstem - Upper | 0.369 | 0.349 |
| Kettle Falls | Mainstem - Upper | 0.371 | 0.358 |
| Gifford | Mainstem - Upper | 0.515 | 0.453 |
| Hunters | Mainstem - Mid | 0.573 | 0.571 |
| Spokane R. Confluence | Mainstem - Mid | 0.314 | 0.26 |
| Seven Bays | Mainstem - Mid | 0.627 | 0.565 |
| Keller Ferry | Mainstem - Lower | 0.527 | 0.433 |
| Sanpoil R. Confluence | Mainstem - Lower | 0.636 | 0.529 |
| Spring Canyon | Mainstem - Lower | 0.653 | 0.545 |
| | | | |
| Porcupine Bay | Spokane Arm | 0.675 | 0.615 |
| Sanpoil Arm | Sanpoil Arm | 0.729 | 0.62 |

## Fishery

### Fisheries Surveys

Surveys were performed on Lake Roosevelt (2000) to determine species composition and abundance using boat electrofishing, horizontal and vertical gill nets. A total of 1,685 fish representing 21 species from 9 families were collected (Table 31). The most abundant species captured were walleye (28.1%), largescale suckers (15.4%), and rainbow trout (13.8%; Table 32).

Electrofishing surveys consisted of 245 sampling events totalling 41.0 hours of effort. The sampling yielded 1,086 fish representing 19 species from 8 families (Table 33). The overall CPUE for electrofishing was 27.1 fish/hour. Walleye was the most abundant species collected representing 30.3% of the total catch, followed by largescale suckers (22.6%), rainbow trout (19.9%), and smallmouth bass (9.4%). Walleye (8.03 fish/hour), largescale sucker (5.98 fish/hour), and rainbow trout (5.27 fish/hour) had the highest CPUE in boat electrofishing surveys. Electrofishing CPUE during 2000 was highest in the summer followed by fall and spring (Table 33). Walleye had the highest CPUE in the spring and summer, while rainbow trout CPUE was highest in the fall (Table 33).

Gill net surveys in 2000 yielded 599 fish representing 11 species from 7 families. Horizontal gill nets were set on 78 occasions, capturing 587 fish with 1,637.7 hours of effort resulting in a CPUE of 0.36 fish/hour. Lake whitefish (26.7%) were the most abundant species collected in horizontal gill net sampling, followed by walleye (24.2%), burbot (12.8%), and longnose sucker (12.6%; Table 34). Catch composition of horizontal gill nets varied by season with CPUE rates being highest in the spring. In summer and fall, walleye were the most prevalent species captured, and lake whitefish were the species most frequently captured in the spring (Table 34).

Vertical gill nets were set on 21 occasions with a yield of 12 fish in 444.8 hours of effort. Across all sampling occasions, vertical gill net CPUE was 0.02 fish/hour. Lake whitefish (33.3 %) were the most abundant species collected by vertical gill nets followed by kokanee (25.0 %), rainbow trout (16.7 %), and walleye (16.7 %; Table 35). CPUE rates were the highest during the fall (Table 35).

Table 31. Taxa list of fish species collected via gill nets and electrofishing surveys from Lake Roosevelt, WA (2000).

| Family | *Species* | Common Name |
|---|---|---|
| **Acipenseridae** | | |
| | *Acipenser transmontanus* | White sturgeon |
| **Cyprinidae** | | |
| | *Ptychocheilus oregonensis* | Northern pikeminnow |
| | *Richardsonius balteatus* | Redside shiner |
| | *Tinca tinca* | Tench |
| **Catostomidae** | | |
| | *Catostomus catostomus* | Longnose sucker |
| | *Catostomus macrocheilus* | Largescale sucker |
| **Ictaluridae** | | |
| | *Ictalurus nebulosus* | Brown bullhead |
| **Salmonidae** | | |
| | *Coregonus clupeaformis* | Lake whitefish |
| | *Oncorhynchus mykiss* | Rainbow trout |
| | *Oncorhynchus nerka* | Kokanee salmon |
| | *Oncorhynchus tshawytscha* | Chinook salmon |
| | *Prosopium williamsoni* | Mountain whitefish |
| | *Salmo trutta* | Brown trout |
| | *Salvelinus fontinalis* | Eastern brook trout |
| **Gadidae** | | |
| | *Lota lota* | Burbot |
| **Cottidae** | | |
| | *Cottus* spp. | Sculpin |
| **Centrarchidae** | | |
| | *Micropterus dolomieui* | Smallmouth bass |
| | *Micropterus slamoides* | Largemouth bass |
| | *Pomoxis nigromaculatus* | Black crappie |
| **Percidae** | | |
| | *Perca flavescens* | Yellow perch |
| | *Stizostedion viteum* | Walleye |

Table 32. Number, relative abundance, mean total length (± standard deviation), and mean weight (± standard deviation) for fish collected via boat electrofishing and gill nets in Lake Roosevelt, WA (2000).

| Species | n | %RA | Mean TL (mm) | Mean weight (g) |
|---|---|---|---|---|
| White sturgeon | 2 | 0.12 | 706 ±76.37 | 1850.0 ± 494.97 |
| Northern pikeminnow | 16 | 0.95 | 329.75 ±120.32 | 455.25 ± 444.78 |
| Redside shiner | 7 | 0.42 | 92.0 ± 13.9 | 11.43 ± 4.89 |
| Tench | 1 | 0.06 | 348.0 ± 0 | 600.0 ± 0 |
| Longnose sucker | 94 | 5.58 | 338.73 ± 95.99 | 574.91 ± 403.70 |
| Largescale sucker | 259 | 15.37 | 503.10 ± 80.78 | 1308.10 ± 479.37 |
| Brown bullhead | 1 | 0.06 | 238.0 ± 0 | 160.0 ± 0 |
| Lake whitefish | 166 | 9.85 | 447.64 ± 92.65 | 1229.27±875.28 |
| Mountain whitefish | 60 | 3.56 | 437.57±104.54 | 1077.25±594.91 |
| Rainbow trout | 233 | 13.83 | 444.96 ± 95.81 | 395.18 ± 506.06 |
| Kokanee salmon | 56 | 3.32 | 334.07 ±105.12 | 389.55 ± 326.55 |
| Chinook salmon | 1 | 0.06 | 394.0 ± 0 | 370.00 ± 0 |
| Brown trout | 4 | 0.24 | 322.25 ± 115.23 | 450.00 ± 324.04 |
| Eastern brook trout | 5 | 0.30 | 216.40 ± 117.88 | 170.40 ± 215.34 |
| Burbot | 105 | 6.23 | 489.54 ±54.96 | 639.05 ± 271.93 |
| Sculpin | 1 | 0.06 | 65.0 ±0 | N/A |
| Smallmouth bass | 142 | 8.43 | 237.75 ± 61.61 | 226.04 ± 153.04 |
| Largemouth bass | 7 | 0.42 | 270.86 ± 49.39 | 291.57 ± 168.27 |
| Black crappie | 9 | 0.53 | 163.44 ± 50.79 | 64.67 ± 53.81 |
| Yellow perch | 43 | 2.55 | 155.58 ±78.42 | 79.91 ± 102.59 |
| Walleye | 473 | 28.07 | 317.88 ± 93.14 | 353.22 ± 356.50 |
| **Totals** | **1,685** | | **362.40 ± 131.62** | **654.28 ± 630.03** |

Table 33. Number (n), relative abundance (%RA) and catch-per-unit-effort (CPUE; fish/hr) of fish species collected via boat electrofishing of Lake Roosevelt, WA (2000).

| Species | May | | | July | | | October | | | Annual Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | %RA | CPUE | n | %RA | CPUE | n | %RA | CPUE | n | %RA | CPUE | Size Range |
| Northern pikeminnow | 3 | 1.3 | 0.22 | 8 | 1.0 | 0.57 | 1 | 0.4 | 0.16 | 12 | 1.1 | 0.29 | 140-561 |
| Redside shiner | 0 | 0.0 | 0.00 | 0 | 0.0 | 0.00 | 7 | 2.8 | 0.54 | 7 | 0.6 | 0.17 | 68-106 |
| Tench | 0 | 0.0 | 0.00 | 1 | 0.2 | 0.07 | 0 | 0.0 | 0.00 | 1 | 0.1 | 0.02 | 348 |
| Longnose sucker | 5 | 2.2 | 0.36 | 11 | 1.8 | 0.80 | 4 | 1.6 | 0.31 | 20 | 1.8 | 0.49 | 85-519 |
| Largescale sucker | 42 | 18.4 | 3.02 | 136 | 22.3 | 9.89 | 67 | 26.9 | 5.21 | 245 | 22.6 | 5.98 | 95-615 |
| Brown bullhead | 0 | 0.0 | 0.00 | 1 | 0.2 | 0.07 | 0 | 0.0 | 0.00 | 1 | 0.1 | 0.02 | 140-561 |
| Lake whitefish | 4 | 1.8 | 0.29 | 0 | 0.0 | 0.00 | 1 | 0.4 | 0.00 | 5 | 0.5 | 0.12 | 245-430 |
| Mountain whitefish | 1 | 0.4 | 0.07 | 6 | 1.0 | 0.44 | 2 | 0.8 | 0.16 | 14 | 1.3 | 0.34 | 110-445 |
| Rainbow trout | 57 | 25.0 | 4.09 | 89 | 14.6 | 6.47 | 70 | 28.1 | 5.45 | 216 | 19.9 | 5.27 | 85-550 |
| Kokanee salmon | 19 | 8.3 | 1.36 | 12 | 2.0 | 0.87 | 16 | 6.4 | 1.25 | 47 | 4.3 | 1.15 | 90-580 |
| Chinook salmon | 1 | 0.4 | 0.07 | 0 | 0.0 | 0.00 | 0 | 0.0 | 0.00 | 1 | 0.1 | 0.02 | 394 |
| Brown trout | 0 | 0.0 | 0.00 | 1 | 0.2 | 0.07 | 3 | 1.2 | 0.23 | 4 | 0.4 | 0.10 | 162-412 |
| Brook trout | 0 | 0.0 | 0.00 | 2 | 0.0 | 0.15 | 3 | 1.2 | 0.23 | 5 | 0.5 | 0.12 | 111-364 |
| Burbot | 0 | 0.0 | 0.00 | 28 | 1.0 | 2.04 | 2 | 0.8 | 0.16 | 30 | 2.8 | 0.73 | 415-560 |
| Sculpin | 0 | 0.0 | 0.00 | 1 | 0.2 | 0.07 | 0 | 0.0 | 0.00 | 1 | 0.1 | 0.02 | 65 |
| Smallmouth bass | 14 | 6.1 | 1.01 | 78 | 12.8 | 5.67 | 10 | 4.0 | 0.78 | 102 | 9.4 | 2.49 | 62-360 |
| Largemouth bass | 2 | 0.9 | 0.14 | 5 | 0.8 | 0.36 | 0 | 0.0 | 0.00 | 7 | 0.6 | 0.17 | 218-339 |
| Black crappie | 1 | 0.4 | 0.07 | 6 | 1.0 | 0.44 | 2 | 0.8 | 0.16 | 9 | 0.8 | 0.22 | 70-210 |
| Yellow perch | 1 | 0.4 | 0.07 | 15 | 2.5 | 1.09 | 19 | 7.6 | 1.48 | 35 | 3.2 | 1.48 | 50-240 |
| Walleye | 78 | 34.2 | 5.60 | 209 | 34.3 | 15.2 | 42 | 16.9 | 3.27 | 329 | 30.3 | 8.03 | 97-445 |
| **Totals** | **228** | | **16.37** | **609** | | **44.27** | **249** | | **19.46** | **1,086** | | **27.11** | **50-615** |

Table 34 Number (n), percent relative abundance (%RA), and catch-per-unit-effort (CPUE; fish/hr) of fish captured in horizontal gill nets in Lake Roosevelt, WA by sampling event (2000). (Effort = 41.0 hours)

| Species | May | | | July | | | October | | | Annual Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **n** | **%RA** | **CPUE** | **n** | **%RA** | **CPUE** | **n** | **%RA** | **CPUE** | **n** | **%RA** | **CPUE** | **Size Range** |
| White sturgeon | 0 | 0.0 | 0.00 | 1 | 0.5 | 0.00 | 1 | 0.4 | 0.00 | 2 | 0.03 | 0.00 | 652-760 |
| Northern pikeminnow | 1 | 0.8 | 0.00 | 0 | 0.0 | 0.00 | 1 | 0.5 | 0.00 | 4 | 0.7 | 0.00 | 321-375 |
| Longnose sucker | 25 | 20.7 | 0.05 | 27 | 12.3 | 0.05 | 22 | 8.9 | 0.04 | 74 | 12.6 | 0.05 | 133-535 |
| Largescale sucker | 2 | 1.7 | 0.00 | 5 | 2.3 | 0.01 | 7 | 2.8 | 0.01 | 14 | 2.4 | 0.01 | 234-550 |
| Lake whitefish | 49 | 40.5 | 0.10 | 50 | 22.8 | 0.09 | 58 | 23.5 | 0.10 | 157 | 26.7 | 0.10 | 80-601 |
| Mountain whitefish | 0 | 0.0 | 0.00 | 36 | 16.4 | 0.06 | 15 | 6.1 | 0.03 | 51 | 8.7 | 0.03 | 310-573 |
| Rainbow trout | 0 | 0.0 | 0.00 | 13 | 5.9 | 0.02 | 2 | 0.8 | 0.00 | 15 | 2.6 | 0.01 | 260-521 |
| Kokanee | 0 | 0.0 | 0.00 | 3 | 1.4 | 0.01 | 3 | 1.2 | 0.01 | 6 | 1.0 | 0.00 | 245-479 |
| Burbot | 21 | 17.4 | 0.04 | 29 | 13.2 | 0.05 | 25 | 10.1 | 0.04 | 75 | 12.8 | 0.05 | 321-630 |
| Smallmouth bass | 5 | 4.1 | 0.01 | 0 | 0.0 | 0.00 | 34 | 13.8 | 0.06 | 39 | 6.6 | 0.02 | 103-335 |
| Walleye | 18 | 14.9 | 0.04 | 53 | 24.2 | 0.09 | 71 | 28.7 | 0.13 | 142 | 24.2 | 0.09 | 120-636 |
| Yellow perch | 0 | 0.0 | 0.00 | 1 | 0.5 | 0.00 | 7 | 2.8 | 0.01 | 8 | 1.4 | 0.00 | 265-305 |
| **Total** | **121** | | **1.24** | **219** | | **0.38** | **247** | | **0.43** | **587** | | **0.36** | **80-760** |

Table 35. Number (n), percent relative abundance (%RA), catch-per-unit-effort (CPUE; fish/hour), and range of total length (mm) for fish captured via vertical gill nets in Lake Roosevelt, WA (2000). (Effort = 444.8 hours)

| Species | May | | | July | | | October | | | Annual Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **n** | **%RA** | **CPUE** | **n** | **%RA** | **CPUE** | **n** | **%RA** | **CPUE** | **n** | **%RA** | **CPUE** | **Size Range** |
| Rainbow trout | 0 | 0.0 | 0.00 | 0 | 0.0 | 0.00 | 2 | 40.0 | 0.02 | 2 | 16.7 | 0.00 | 350 |
| Kokanee salmon | 3 | 60.0 | 0.02 | 0 | 0.0 | 0.00 | 0 | 0.0 | 0.00 | 3 | 25.0 | 0.01 | 405-441 |
| Smallmouth bass | 0 | 0.0 | 0.00 | 0 | 0.0 | 0.00 | 1 | 20.0 | 0.01 | 1 | 8.3 | 0.00 | 225 |
| Lake whitefish | 2 | 40.0 | 0.01 | 0 | 0.0 | 0.00 | 2 | 40.0 | 0.02 | 4 | 33.3 | 0.01 | 210-263 |
| Walleye | 0 | 0.0 | 0.00 | 2 | 100.0 | 0.01 | 0 | 0.0 | 0.00 | 2 | 16.7 | 0.00 | 320-263 |
| **Total** | **5** | | **0.03** | **2** | | **0.01** | **5** | | **0.05** | **12** | | **0.02** | **210-441** |

Table 36. Number (n), percent relative abundance (%RA), mean length (± standard deviation), and mean weight (± standard deviation) of hatchery and wild kokanee salmon and rainbow trout collected via electrofishing and gill netting in Lake Roosevelt, WA (2000).

| Species | Origin | n | %RA | Mean TL (mm) | Mean wt. (g) |
|---|---|---|---|---|---|
| Kokanee salmon | hatchery | 25 | 46.3 | 275.76±46.77 | 276.63±127.81 |
| | wild | 29 | 53.7 | 387.88±110.88 | 778.0±495.96 |
| **Total** | | **54** | | **335.85±103.33** | **389.84±327.30** |
| Rainbow trout | hatchery | 71 | 30.7 | 294.35±72.77 | 411.98±375.98 |
| | wild | 160 | 69.3 | 324.11±125.88 | 315.13±591.80 |
| **Total** | | **231** | | **314.64±112.43** | **374.04±471.72** |

## Age and Growth

Lengths and weights were used to calculate the condition factor for 20 fish species collected in Lake Roosevelt (Table 37). Walleye and smallmouth bass had condition factors of 0.83 ± 0.21 and 1.39 ± 0.40, respectively. Wild kokanee (1.19 ± 0.39) had a slightly higher condition factor than hatchery kokanee (1.17 ± 0.24), and hatchery rainbow trout (1.13 ± 0.29) had a slightly higher condition factor than wild rainbow trout (0.98 ± 0.24; Table 36).

Scales were used to back-calculate ages of 12 fish species for which lengths and weights were recorded. Ages were back calculated for 7 seven species from the Salmonidae family. Hatchery and wild kokanee salmon were combined and were aged from one to three years (Table 38). Scales from hatchery rainbow trout (n = 132) ranged from one to four years, and wild rainbow trout (n = 21) scales were aged from one to three years (Table 39 and Table 40). Lake whitefish (n = 10) showed ages from one to eight years, as did mountain whitefish (n = 8; Table 41 and Table 42, respectively). Brown trout (n = 4) ranged from one to four years, and eastern brook trout (n = 3) were aged from one to two years (Table 43 and Table 44, respectively). In the Cyprinidae family, scales were taken from northern pikeminnow (n = 11) ranging from one to nine years (Table 45). Three species from the Centrarchidae family were analyzed. Smallmouth bass (n = 53) ranged from one to three years, largemouth bass (n = 6) ranged from one to five years, and black crappie (n = 9) from one to four years (Table 46,Table 47, andTable 48, respectively). In the Percidae family, two species were collected and analyzed. Walleye (n =

354) ranged from one to nine and yellow perch (n = 29) ranged from one to four years (Table 48 and Table 49, respectively).

Table 37. Mean condition factor ($K_{TL}$) (± standard deviation) of fish captured in Lake Roosevelt, WA. (2000)

| Species | n | $K_{TL}$ |
|---|---|---|
| White sturgeon | 2 | 0.52 ± 0.03 |
| Northern pikeminnow | 16 | 0.89 ± 0.17 |
| Redside shiner | 7 | 1.63 ± 1.23 |
| Tench | 1 | 1.42 ± 0.00 |
| Longnose sucker | 94 | 1.25 ± 0.30 |
| Largescale sucker | 259 | 0.98 ± 0.21 |
| Lake whitefish | 166 | 1.24 ± 0.94 |
| Kokanee salmon (hatchery) | 24 | 1.17 ± 0.24 |
| Kokanee salmon (wild) | 9 | 1.19 ± 0.39 |
| Kokanee salmon (total) | 33 | 1.17 ± 0.28 |
| Chinook salmon | 1 | 0.61 ± 0.00 |
| Rainbow trout (hatchery) | 132 | 1.13 ± 0.29 |
| Rainbow trout (wild) | 26 | 0.98 ± 0.24 |
| Rainbow trout (total) | 158 | 1.10 ± 0.28 |
| Mountain whitefish | 60 | 1.07 ± 0.24 |
| Brown trout | 4 | 1.09 ± 0.11 |
| Eastern brook trout | 5 | 0.93 ± 0.14 |
| Brown bullhead | 1 | 1.19 ± 0.00 |
| Burbot | 105 | 0.53 ± 0.14 |
| Smallmouth bass | 142 | 1.39 ± 0.40 |
| Largemouth bass | 7 | 1.33 ± 0.19 |
| Black crappie | 9 | 1.29 ± 0.58 |
| Walleye | 473 | 0.83 ± 0.21 |
| Yellow perch | 43 | 1.22 ± 0.53 |
| **Total** | **1,776** | |

Table 38. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of kokanee salmon collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| **1999** | 7 | 161(36) | | |
| **1998** | 3 | 152(57) | 237(75) | |
| **1997** | 3 | 154(7) | 280(61) | 387(60) |
| **Grand Mean** | **13** | **157(35)** | **258(65)** | **387(60)** |
| **Mean Annual Growth** | | **157(35)** | **106(57)** | **108(51)** |

Table 39. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of hatchery rainbow trout collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| **1999** | 19 | 171(33) | | | |
| **1998** | 65 | 142(37) | 250(50) | | |
| **1997** | 47 | 111(27) | 207(46) | 321(57) | |
| **1996** | 1 | 140 | 257 | 334 | 467 |
| **Grand Mean** | **132** | **135(39)** | **232(46)** | **321(56)** | **467** |
| **Mean Annual Growth** | | **135(39)** | **103(36)** | **113(33)** | **132** |

Table 40. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of wild rainbow trout collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| **1999** | 8 | 105(28) | | |
| **1998** | 12 | 105(38) | 188(56) | |
| **1997** | 1 | 99 | 138 | 217 |
| **Grand Mean** | **21** | **105(33)** | **184(55)** | **217** |
| **Mean Annual Growth** | | **105(33)** | **79(40)** | **81** |

Table 41. Mean annual growth and mean length at age derived from back-calculated total length (mm) (± standard deviation) of lake whitefish collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **1999** | 5 | 64(8) | | | | | | | |
| **1998** | 1 | 117 | 201 | | | | | | |
| **1997** | 1 | 66 | 152 | 230 | | | | | |
| **1996** | 0 | | | | | | | | |
| **1995** | 1 | 85 | 164 | 230 | 344 | | | | |
| **1994** | 0 | | | | | | | | |
| **1993** | 0 | | | | | | | | |
| **1992** | 2 | 69(4) | 113(26) | 143(34) | 200(41) | 254(12) | 296(14) | 342(11) | 415(15) |
| **Grand Mean** | **10** | **73(18)** | **149(40)** | **187(54)** | **248(88)** | **254(12)** | **296(14)** | **342(11)** | **415(15)** |
| **Mean Annual Growth** | | **73(18)** | **76(24)** | **51(25)** | **76(33)** | **54(28)** | **42(2)** | **46(25)** | **73(25)** |

Table 42. Mean annual growth and mean length at age derived from back-calculated total length (mm) (± standard deviation) of mountain whitefish collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **1999** | 3 | 144(10) | | | | | | | |
| **1998** | 2 | 125(7) | 221(21) | | | | | | |
| **1997** | 1 | 79 | 133 | 248 | | | | | |
| **1996** | 0 | | | | | | | | |
| **1995** | 0 | | | | | | | | |
| **1994** | 1 | 86 | 198 | 300 | 333 | 399 | 429 | | |
| **1993** | 0 | | | | | | | | |
| **1992** | 1 | 62 | 89 | 129 | 183 | 226 | 261 | 321 | 385 |
| **Grand Mean** | **8** | **114(34)** | **172(60)** | **226(87)** | **258(106)** | **313(122)** | **345(118)** | **321** | **385** |
| **Mean Annual Growth** | | **114(34)** | **77(38)** | **86(40)** | **187(62)** | **55(16)** | **32(4)** | **59** | **65** |

Table 43. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of brown trout collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| **1999** | 1 | 113 | | | |
| **1998** | 0 | | | | |
| **1997** | 2 | 120(50) | 206(44) | 296(101) | |
| **1996** | 1 | 112 | 200 | 265 | 365 |
| **Grand Mean** | **4** | **116(29)** | **204(31)** | **285(74)** | **365** |
| **Mean Annual Growth** | | **116(29)** | **87(5)** | **81(43)** | **100** |

Table 44. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of eastern brook trout collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | |
|---|---|---|---|
| | | 1 | 2 |
| **1999** | 1 | 96 | |
| **1998** | 2 | 194(31) | 276(44) |
| **Grand Mean** | **3** | **162(58)** | **276(44)** |
| **Mean Annual Growth** | | **162(58)** | **82(29)** |

Table 45. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of northern pikeminnow collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **1999** | 1 | 85 | | | | | | | | |
| **1998** | 3 | 109(10) | 207(6) | | | | | | | |
| **1997** | 2 | 85(31) | 170(2) | 249(26) | | | | | | |
| **1996** | 1 | 99 | 178 | 305 | 364 | | | | | |
| **1995** | 2 | 112(11) | 192(9) | 259(28) | 319(49) | 375(70) | | | | |
| **1994** | 1 | 120 | 235 | 331 | 384 | 460 | 508 | | | |
| **1993** | 0 | | | | | | | | | |
| **1992** | 0 | | | | | | | | | |
| **1991** | 1 | 97 | 149 | 188 | 226 | 278 | 323 | 382 | 408 | 446 |
| **Grand Mean** | **11** | **102(17)** | **191(25)** | **263(48)** | **323(66)** | **372(85)** | **416(131)** | **382** | **408** | **446** |
| **Mean Annual Growth** | | **102(17)** | **87(22)** | **79(30)** | **54(14)** | **60(17)** | **47(2)** | **58** | **26** | **39** |

Table 46. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of smallmouth bass collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| **1999** | 12 | 66(20) | | | | | |
| **1998** | 9 | 93(10) | 176(22) | | | | |
| **1997** | 25 | 80(14) | 153(32) | 217(36) | | | |
| **1996** | 22 | 73(20) | 135(27) | 197(39) | 259(42) | | |
| **1995** | 0 | | | | | | |
| **1994** | 5 | 64(16) | 98(24) | 136(26) | 168(32) | 210(21) | 246(14) |
| **Grand Mean** | **53** | **76(18)** | **145(34)** | **201(43)** | **243(54)** | **210(21)** | **246(14)** |
| **Mean Annual Growth** | | **76(18)** | **67(25)** | **61(21)** | **57(27)** | **41(24)** | **36(14)** |

Table 47. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of largemouth bass collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| **1997** | 1 | 67 | 113 | 223 | | |
| **1996** | 3 | 55(15) | 101(34) | 190(32) | 236(17) | |
| **1995** | 2 | 49(7) | 116(30) | 153(37) | 192(58) | 304(24) |
| **Grand Mean** | **6** | **55(12)** | **108(27)** | **183(38)** | **218(39)** | **304(24)** |
| **Mean Annual Growth** | | **55(12)** | **53(24)** | **75(33)** | **43(21)** | **112(34)** |

Table 48. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of black crappie collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| **1999** | 2 | 58(15) | | | |
| **1998** | 4 | 87(13) | 147(35) | | |
| **1997** | 2 | 80(19) | 124(5) | 179(6) | |
| **1996** | 1 | 122 | 136 | 156 | 168 |
| **Grand Mean** | **9** | **83(22)** | **139(27)** | **171(14)** | **168** |
| **Mean Annual Growth** | | **83(22)** | **49(24)** | **43(22)** | **12** |

Table 49. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of walleye collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| **1999** | 22 | 117(31) | | | | | | | | |
| **1998** | 92 | 140(36) | 294(50) | | | | | | | |
| **1997** | 114 | 126(29) | 220(42) | 305(50) | | | | | | |
| **1996** | 69 | 125(30) | 208(46) | 281(52) | 343(58) | | | | | |
| **1995** | 37 | 124(33) | 190(50) | 245(55) | 298(62) | 350(71) | | | | |
| **1994** | 11 | 119(31) | 200(55) | 288(53) | 344(58) | 396(66) | 440(82) | | | |
| **1993** | 5 | 133(23) | 205(43) | 298(65) | 385(63) | 452(87) | 508(66) | 568(59) | | |
| **1992** | 2 | 142(47) | 208(44) | 240(51) | 290(51) | 329(35) | 358(22) | 405(6) | 462(11) | |
| **1991** | 2 | 118(2) | 176(35) | 270(17) | 316(14) | 351(9) | 387(12) | 411(25) | 466(7) | 494(2) |
| **Grand Mean** | **354** | **129(33)** | **221(51)** | **287(55)** | **330(62)** | **368(75)** | **444(82)** | **497(95)** | **464(8)** | **494(2)** |
| **Mean Annual Growth** | | **129(33)** | **91(37)** | **77(32)** | **60(20)** | **53(25)** | **45(26)** | **49(21)** | **56(19)** | **28(6)** |

Table 50. Mean annual growth and mean length at age derived from back-calculated total lengths (mm) (± standard deviation) of yellow perch collected from Lake Roosevelt, WA (2000).

| Cohort | n | Back-calculated total length at annulus formation | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| **1999** | 20 | 61(9) | | | |
| **1998** | 1 | 41 | 126 | | |
| **1997** | 6 | 49(5) | 141(35) | 186(30) | |
| **1996** | 2 | 37(2) | 75(18) | 136(20) | 178(30) |
| **Grand Mean** | **29** | **56(11)** | **125(41)** | **173(35)** | **178(30)** |
| **Mean Annual Growth** | | **56(11)** | **80(37)** | **49(28)** | **43(50)** |

## Diet

Stomachs of 1075 fish were collected from Lake Roosevelt in 2000, representing 20 species from 8 families (Cyprinidae, Catostomidae, Salmonidae, Gadidae, Cottidae, Centrarchidae, Percidae, Ictaluridae). Contents were examined from the stomachs of the following species: eastern brook trout (n=5; 1 empty), brown trout (n=2; 1 empty), rainbow trout (n=182; 16 empty), chinook salmon (n=1), kokanee salmon (n=70; 9 empty), lake whitefish (n=6; 2 empty), mountain whitefish (n=8; 4 empty), brown bullhead (n=2; 1 empty), longnose sucker (n=19; 5 empty), largescale sucker (n=187; 40 empty), northern pikeminnow (n=12; 4 empty), redside shiner (n=7; 6 empty), black crappie (n=9; 1 empty), largemouth bass (n=9; 2 empty), smallmouth bass (n=70; 20 empty), walleye (n=211; 78 empty), yellow perch (n=31; 13 empty), and burbot (n=29; 14 empty).

Cladocera (32.9 %) had the highest relative importance ($Ri_a$) among identified prey items across all fish species, followed by Diptera (15.0 %) and Osteichthyes (11.7 %; Appendix B). The diet category identified as Other, consisting of detritus, plant seeds, invertebrate eggs, and unidentifiable organic matter, comprised 19.9 % of the relative importance of all species combined (Appendix B). Osteichthyes comprised the highest percent of the diet by dry weight (22.6%), followed by Cladocera (13.2 %; Appendix B). However, Cladocera were consumed in the highest numbers, accounting for 83.8% of the total items consumed (Appendix B).

The four main sport fish species in Lake Roosevelt are kokanee salmon, rainbow trout, walleye, and smallmouth bass. Cladocera ($Ri_a$=90.6 %) was the most important food item in the diet of kokanee salmon followed by Diptera ($Ri_a$=2.58%;Table 51 Cladocera ($Ri_a$=61.7%) and Diptera

($Ri_a$=7.3%) were also the most important food items in the diet of rainbow trout (Table 51). The most important food item of walleye was Osteichthyes ($Ri_a$=52.7%) followed by Diptera ($Ri_a$=20.6%; Table 51). Smallmouth bass also consumed considerable amounts of Osteichthyes (54.6%), and Cladocera (12.0%; Table 51).

High diet overlaps (>0.70) were found between brown trout, rainbow trout, kokanee salmon, and lake whitefish, longnose suckers with largescale suckers, and yellow perch with black crappie (Table 52). The highest diet overlap (0.99) occurred between kokanee salmon and lake whitefish as well as kokanee and brown trout (although this figure may not be completely representative due to the low number of brown trout stomachs (n=1) that were analyzed). Species that did not have a high diet overlap with any other species included: eastern brook trout, chinook salmon, brown bullhead, northern pikeminnow, redside shiner, largemouth bass, walleye, and burbot. Moderate diet overlaps (0.60-0.69) existed between rainbow trout and northern pikeminnow (0.68), and burbot and yellow perch (0.62) (Table 52).

Comparisons made between the diets of hatchery origin rainbow trout and wild rainbow trout identified a high overlap (0.86). Cladocera was the most important food item for both hatchery origin rainbow trout ($Ri_a$=28.7 %) and wild rainbow trout ($Ri_a$=30.2 %). It was also found that hatchery origin and wild rainbow trout diets contained Diptera, Hemiptera, and Trichoptera. Hatchery origin rainbow trout $Ri_a$ values were Diptera at 10.5 %, Hemiptera at 4.8 %, and Trichoptera at 6.4 %. In wild rainbow trout, Diptera had a $Ri_a$ value of 23.3 %, Hemiptera was 3.1 %, and Trichoptera was 3.9 %. The percent by weight, percent by number, frequency of occurrence, and $Ri_a$ for each species is summarized in Appendix B.

Table 51. Relative importance values of prey items in the diet of kokanee salmon, rainbow trout, walleye, and smallmouth bass collected in Lake Roosevelt, WA. (2000).

| Taxa | Kokanee salmon | Rainbow trout | Walleye | Smallmouth bass |
|---|---|---|---|---|
| **Osteichthyes** | | | | |
| Catostomidae | 0.00 | 0.31 | 0.24 | 3.37 |
| Centrarchidae | 0.00 | 0.00 | 0.23 | 0.00 |
| Cottidae | 0.00 | 0.00 | 10.07 | 26.96 |
| Cyprinidae | 0.00 | 0.00 | 0.27 | 0.00 |
| Percidae | 0.00 | 0.00 | 1.67 | 3.22 |
| Salmonidae | 0.00 | 0.16 | 23.96 | 5.32 |
| Unidentified non-salmonidae | 0.00 | 0.00 | 13.31 | 5.96 |
| Unidentified Osteichthyes | 0.00 | 1.23 | 2.94 | 9.76 |
| **Amphipoda** | | | | |
| Gammaridae | 0.00 | 0.31 | 0.22 | 0.00 |
| Unidentified Amphipoda | 0.00 | 0.16 | 0.00 | 0.00 |
| **Arachnoidea** | | | | |
| Unidentified Arachnoidea | 0.50 | 0.78 | 0.00 | 0.00 |
| **Cladocera** | | | | |
| Daphnidae | 89.58 | 45.67 | 3.48 | 0.00 |
| Unidentified Cladocera | 0.51 | 15.03 | 4.42 | 0.00 |
| Unidentified Cladocera/Copepoda | 0.53 | 0.97 | 0.00 | 11.99 |
| **Coleoptera** | | | | |
| Psephenidae | 0.00 | 0.00 | 0.00 | 0.70 |
| **Diptera** | | | | |
| Chironomidae | 0.52 | 0.84 | 1.23 | 0.62 |
| Chironomidae larvae | 1.01 | 2.76 | 2.57 | 0.00 |
| Chironomidae pupae | 1.05 | 3.36 | 16.34 | 4.82 |
| Tabanidae | 0.00 | 0.17 | 0.22 | 0.00 |
| Heleidae | 0.00 | 0.16 | 0.00 | 0.00 |
| Tipulidae | 0.00 | 0.00 | 0.22 | 1.10 |
| **Hemiptera** | | | | |
| Baetidae | 0.00 | 0.00 | 0.22 | 0.00 |
| Ephemerellidae | 0.00 | 0.00 | 0.22 | 0.00 |
| Corixidae | 0.00 | 2.33 | 0.23 | 3.67 |
| Mesoveliidae | 0.00 | 0.16 | 0.00 | 0.00 |
| **Lepidoptera** | | | | |
| Cossidae | 0.00 | 0.16 | 0.00 | 0.00 |
| **Odonata** | | | | |
| Zygoptera | 0.00 | 0.16 | 0.00 | 0.00 |
| Unidentified Anisoptera | 0.00 | 0.16 | 0.00 | 0.00 |
| **Trichoptera** | | | | |
| Brachycentridae | 0.00 | 0.16 | 0.00 | 0.00 |
| Coenagrionidae | 0.00 | 0.31 | 0.00 | 0.00 |
| Glossosomatidae | 0.00 | 0.29 | 0.23 | 0.00 |
| Helicopsychidae | 0.00 | 0.32 | 0.00 | 0.00 |
| Hydropsychidae | 0.00 | 0.00 | 8.15 | 0.00 |
| Limnephilidae | 0.00 | 0.37 | 0.00 | 0.00 |
| Unidentified Trichoptera | 0.00 | 0.00 | 0.47 | 0.00 |
| Leptidostimotidae | 0.00 | 0.16 | 0.00 | 0.00 |
| Leptoceridae | 0.00 | 1.25 | 1.37 | 1.77 |
| Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.63 |
| **Plecoptera** | | | | |
| Chloroperlidae | 0.00 | 0.17 | 0.00 | 0.00 |
| Perlidae | 0.00 | 0.16 | 0.22 | 0.00 |

Table 52 cont.

| Taxa | Kokanee salmon | Rainbow trout | Walleye | Smallmouth bass |
|---|---|---|---|---|
| **Gastropoda** | | | | |
| Lymnaeidae | 0.00 | 0.20 | 0.00 | 0.00 |
| Physidae | 0.00 | 1.14 | 0.00 | 0.00 |
| Planorbidae | 0.00 | 0.48 | 0.00 | 0.00 |
| **Annelida** | | | | |
| Hirudinea | 0.00 | 0.00 | 0.25 | 0.72 |
| Oligochaeta | 0.00 | 0.00 | 0.45 | 5.39 |
| Lumbriculidae | 0.00 | 1.42 | 0.00 | 0.00 |
| Diphyllobothriidae | 5.27 | 0.00 | 0.22 | 0.00 |
| **Nematoda** | | | | |
| Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 2.48 |
| **Lithobiomorpha** | | | | |
| Unidentified Lithobiomopha | 0.00 | 0.00 | 0.47 | 0.00 |
| **Arthropoda** | | | | |
| Unidentified Arthropoda | 1.03 | 3.24 | 1.74 | 2.84 |
| **Terrestrial** | 0.00 | 6.99 | 1.13 | 1.80 |
| **Other** | 0.00 | 8.46 | 3.28 | 6.90 |

Table 52. Diet overlap of various fish species collected in Lake Roosevelt, WA (2000).

| Species | n | Diet Overlap | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Eastern brook trout** | **4** | - | | | | | | | | | | | | | | | | | |
| **Brown trout** | **1** | 0.00 | - | | | | | | | | | | | | | | | | |
| **Rainbow trout** | **166** | 0.08 | 0.73 | - | | | | | | | | | | | | | | | |
| **Chinook salmon** | **1** | 0.09 | 0.00 | 0.14 | - | | | | | | | | | | | | | | |
| **Kokanee salmon** | **61** | 0.01 | 0.99 | 0.78 | 0.01 | - | | | | | | | | | | | | | |
| **Lake whitefish** | **4** | 0.00 | 0.98 | 0.79 | 0.04 | 0.99 | - | | | | | | | | | | | | |
| **Mountain whitefish** | **4** | 0.00 | 0.00 | 0.22 | 0.10 | 0.00 | 0.00 | - | | | | | | | | | | | |
| **Brown bullhead** | **1** | 0.16 | 0.00 | 0.11 | 0.19 | 0.00 | 0.00 | 0.00 | - | | | | | | | | | | |
| **Longnose sucker** | **14** | 0.25 | 0.04 | 0.23 | 0.59 | 0.05 | 0.06 | 0.02 | 0.34 | - | | | | | | | | | |
| **Largescale sucker** | **147** | 0.41 | 0.08 | 0.36 | 0.43 | 0.09 | 0.10 | 0.17 | 0.42 | 0.80 | - | | | | | | | | |
| **Northern pikeminnow** | **8** | 0.37 | 0.38 | 0.68 | 0.08 | 0.41 | 0.42 | 0.29 | 0.32 | 0.22 | 0.46 | - | | | | | | | |
| **Redside shiner** | **1** | 0.16 | 0.00 | 0.05 | 0.00 | 0.01 | 0.00 | 0.00 | 0.42 | 0.10 | 0.14 | 0.43 | - | | | | | | |
| **Black crappie** | **9** | 0.11 | 0.00 | 0.30 | 0.07 | 0.01 | 0.00 | 0.62 | 0.18 | 0.08 | 0.32 | 0.42 | 0.10 | - | | | | | |
| **Largemouth bass** | **5** | 0.20 | 0.00 | 0.08 | 0.51 | 0.00 | 0.00 | 0.10 | 0.06 | 0.09 | 0.13 | 0.07 | 0.00 | 0.10 | - | | | | |
| **Smallmouth bass** | **50** | 0.49 | 0.00 | 0.07 | 0.31 | 0.00 | 0.01 | 0.04 | 0.18 | 0.18 | 0.29 | 0.21 | 0.05 | 0.10 | 0.40 | - | | | |
| **Walleye** | **133** | 0.11 | 0.06 | 0.18 | 0.33 | 0.07 | 0.10 | 0.09 | 0.09 | 0.25 | 0.23 | 0.29 | 0.03 | 0.14 | 0.13 | 0.51 | - | | |
| **Yellow perch** | **31** | 0.27 | 0.14 | 0.49 | 0.21 | 0.15 | 0.15 | 0.63 | 0.10 | 0.16 | 0.45 | 0.54 | 0.03 | 0.82 | 0.24 | 0.35 | 0.25 | - | |
| **Burbot** | **15** | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.37 | 0.21 | 0.26 | 0.11 | 0.00 | 0.00 | 0.13 | 0.58 | 0.62 | 0.16 | - |
| | | **Eastern brook trout** | **Brown trout** | **Rainbow trout** | **Chinook salmon** | **Kokanee salmon** | **Lake whitefish** | **Mountain whitefish** | **Brown bullhead** | **Longnose sucker** | **Largescale sucker** | **Northern pikeminnow** | **Redside shiner** | **Black crappie** | **Largemouth bass** | **Smallmouth bass** | **Walleye** | **Yellow perch** | **Burbot** |

## Tagging Studies

Tags were recovered from 323 fish in Lake Roosevelt during 2000. Most of the tags recovered (n = 240) came from fish released in 2000, followed by 1999 (n = 65) and 1998 (n = 18;Table 53). Recoveries were higher for fish released at Seven Bays (n = 192) than those from Kettle Falls (n = 131). Tags collected from 1998, 1999, and 2000 made up 6, 20, and 74%, respectively, of total tags collected in 2000 (Table 53). Tags recovered in 2000 from fish released in 1998 represented 0.07% of fish tagged and released from Kettle Falls and 0.08% of fish tagged and released from Seven Bays (Table 54). Tags recovered from 1999 rainbow trout releases comprised 0.21% of fish tagged and released from Kettle Falls and 0.24% of fish tagged and released from Seven Bays. Tags recovered from fish released in 2000 included 0.42% of the rainbow trout tagged and released at Kettle Falls, and 0.83% tagged and released at Seven Bays (Table 54).

Tags were recovered from 131 fish that were released from Kettle Falls, consisting of 88 Spokane stock rainbow trout and 43 Phalon Lake stock rainbow trout. A total of 77.9 % of these were recovered downstream of the release site and 4.6% were recovered downstream of Grand Coulee Dam in Rufus Woods Reservoir (Table 54). Twenty-seven of the tags recovered at Kettle Falls (20.6%) were from rainbow trout that were previously tagged and released there (Table 54). Rainbow trout from the Phalon Lake stock were collected throughout Lake Roosevelt, with the highest numbers being collected from Kettle Falls (27.9%). Of the Spokane stock rainbow trout tagged and released at Kettle Falls, the most common recovery location was Seven Bays (27.3%), while only 17.1% were recovered at Kettle Falls. The other 55.7% of fish tagged and released at Kettle Falls were recovered at various locations downstream from the release site (Table 54). No tags were recovered from the 9,621 kokanee salmon tagged and released from Kettle Falls in 1999.

Tags were recovered from 192 fish that were tagged and released at Seven Bays, 62.5% of which were also recovered there. Twenty-five percent of fish tagged and released at Seven Bays were captured downstream from their release site, while 4.7% were captured upstream. Of the fish released from Seven Bays during 2000, 3.7 % were captured below Grand Coulee Dam (Table 54). No tags were recovered from the 9,226 triploids released from Seven Bays in 2000.

The mean (± standard deviation) number of days spent in the reservoir after release across both release locations and both rainbow trout stocks was 232.0 (± 152.9) days. The mean (± standard deviation) time difference between tag date and capture for fish released from Kettle Falls (238.6±161.2) was higher than that of fish released from Seven Bays (227.5±147.2; Table 55).

Growth was evaluated as mean growth per day between the tag date and date of capture for total length (mm/d) and weight (g/d) when possible. The mean growth in total length (± standard deviation) across both release locations for both Spokane and Phalon Lake stocks (n = 323) was 0.71 (± 0.02) mm/d (Table 55). The mean growth in weight (± standard deviation) across both release locations for both stocks was 1.36 (± 0.14) g/d. The mean growth in total length (± standard deviation) was greater for fish (both stocks) released at Kettle Falls (2.55 ± 0.36 mm/d) than for fish released at Seven Bays (1.80 ± 1.02 mm/d; Table 55). Phalon Lake stock released from Kettle Falls had a higher growth rate (0.82 ± 0.54 mm/d and 3.30 ± 2.59 g/d) than the Spokane stock rainbow trout released there (0.76 ± 0.21 mm/d and 2.26 ± 1.09 g/d). Spokane stock rainbow trout (1.80 ± 1.02 mm/d and 0.68 ± 0.73 g/d) released at Seven Bays showed higher growth rates than those released at Kettle Falls (Table 55).

Table 53. Number of fish (n) and percent (%) of rainbow trout tag recoveries in 2000 by release year.

| Year | n | % |
|---|---|---|
| 1998 | 18 | 6 |
| 1999 | 65 | 20 |
| 2000 | 240 | 74 |
| **Total** | **323** | **100** |

Table 54. Number (n) and percent (%) of rainbow trout tag recoveries by release location and tag recovery location in Lake Roosevelt (FDR), WA (2000).

| Tag Recovery Location | Release Location: Kettle Falls, Phalon Lake stock | | Kettle Falls, Spokane stock | | Seven Bays, Spokane stock | | Total | |
|---|---|---|---|---|---|---|---|---|
| | **n** | **%** | **n** | **%** | **n** | **%** | **n** | **%** |
| Evans | 1 | 2 | 0 | 0 | 0 | 0 | 1 | <1 |
| Kettle Falls | 12 | 28 | 15 | 17 | 1 | 1 | 28 | 9 |
| Gifford | 0 | 0 | 2 | 1 | 0 | 0 | 2 | <1 |
| Hunters | 6 | 14 | 8 | 9 | 7 | 4 | 21 | 7 |
| Fort Spokane | 0 | 0 | 1 | 1 | 1 | 1 | 2 | <1 |
| Seven Bays | 4 | 2 | 24 | 27 | 120 | 63 | 148 | 46 |
| Keller Ferry | 2 | 5 | 12 | 14 | 25 | 13 | 39 | 12 |
| Sanpoil River | 1 | 2 | 1 | 1 | 5 | 3 | 7 | 2 |
| Spring Canyon | 5 | 11 | 9 | 10 | 11 | 6 | 25 | 8 |
| Unknown FDR | 11 | 26 | 11 | 13 | 15 | 8 | 40 | 12 |
| Below GCD* | 1 | 2 | 5 | 6 | 7 | 4 | 13 | 4 |
| **Totals** | **43** | | **88** | | **192** | | **323** | |

*GCD= Grand Coulee Dam

Table 55. Mean total length growth (mm/day), mean weight growth (g/day) and mean number of days in the fishery (± standard deviation) between date of tag and date of capture, by release location and stock of recaptured rainbow trout in Lake Roosevelt, WA (2000).

| Location and Stock | Growth (TL) | Growth (wt) | Days in Fishery |
|---|---|---|---|
| Kettle Falls | | | |
| Spokane stock | 0.57 (±0.37) | 0.83 (±1.28) | 265.56 (±179.70) |
| Phalon Lake stock | 0.64 (±0.58) | 0.92 (±2.00) | 183.33 (±94.18) |
| **Kettle Falls Totals** | **0.59 (±0.45)** | **0.86 (±1.54)** | **238.56 (±161.17)** |
| | | | |
| Seven Bays | | | |
| Spokane stock | 0.57 (±0.34) | 1.34 (±1.67) | 227.54 (±147.20) |
| **Grand Totals** | **0.58 (±0.39)** | **1.15 (±1.64)** | **232.01 (±152.87)** |

**Test Fishery**

The annual test fishery was conducted January 10–13, in the vicinity of Spring Canyon. Anglers captured 147 fish during 403 rod hours of effort (Table 56). Rainbow trout (n = 101) and kokanee salmon (n = 46) were the only two species caught, accounting for 68.7% and 31.3% of the catch, respectively (Table 56). The total CPUE was 0.11 fish/rod hour for kokanee salmon and 0.25 fish/rod hour for rainbow trout (Table 56).

Table 56. Number (n), relative abundance (% RA), and catch-per-unit-effort (CPUE in fish/hour) of fish captured during the annual test fishery in Lake Roosevelt, WA (2000). (Effort=403 rod/hours)

| Species | n | % RA | CPUE |
|---|---|---|---|
| Kokanee salmon | 46 | 31.3 | 0.11 |
| Rainbow trout | 101 | 68.7 | 0.25 |
| **Totals** | **147** | **100** | **0.36** |

## Two Rivers Trout Derby

The first Two Rivers Trout Derby was held on Lake Roosevelt August 26 and 27, 2000. A total of 52 teams comprised of two anglers registered for the derby. Only 30 teams recorded a catch. Rainbow trout (n = 405) and kokanee salmon (n = 20) represented the only species harvested. Tags were recovered from 18 rainbow trout.

Rainbow trout mean length was 315.6 mm (± 38.73), and mean weight was 398.3 g (± 175.3; Table 57). Kokanee salmon mean length was 418 mm (± 60.96), and mean weight was 876.6g (± 319.8; Table 57). Mean condition factors ($K_{TL}$) for rainbow trout and kokanee salmon were 1.23 ± 0.11 and 1.15 ±0.11, respectively (Table 57).

Table 57. Number (n), range of total length (TL), mean total length (± standard deviation), range of weight, mean weight (± standard deviation), and condition factor ($K_{TL}$) of kokanee salmon and rainbow trout collected during the Two Rivers Derby, at Lake Roosevelt, WA, 2000.

| Species | n | TL(mm) | Mean TL | Wt.(g) | Mean Wt. | Mean $K_{TL}$ |
|---|---|---|---|---|---|---|
| Kokanee salmon | 20 | 310-520 | 418.0±61.0 | 340.2-1,451.5 | 876.6±319.8 | 1.15±0.11 |
| Rainbow trout | 405 | 242-556 | 315.6±38.7 | 158.8-1,678.3 | 398.3±175.3 | 1.23±0.11 |

## Creel Surveys

Total annual pressure (9 months) was estimated to be 858,068 (± 43,431 C.I.) angler hours (Table 58). The highest estimated angling pressure occurred in Section 3 (499,390 ± 17,951 C.I.), followed by Section 2 (301,264 ± 22,407 C. I.), with the lowest estimated angling pressure in Section 1 (57,414 ± 3,073 C.I.; Table 58 and Figure 3). Calculations for boat and total pressure estimates were summarized in Appendix B.

Estimates from annual mean trip length and angler pressure indicated that 170,930 angler trips were made to Lake Roosevelt during the study period (Table 59). The mean duration of each angler trip was calculated to be 5.02 hours (Table 59). An estimated 10,798 angler trips were made in Section 1, 54,730 in Section 2, and 97,634 in Section 3 (Table 58). Reservoir wide, the greatest number of angler trips was made in August in Section 3 (32,127 angler trips; Table 59).

Across all sections of Lake Roosevelt, ten species of fish were captured by anglers; lake whitefish, rainbow trout, kokanee salmon, chinook salmon, brown trout, eastern brook trout, smallmouth bass, walleye, yellow perch and an unidentified sucker (Table 60). Eastern brook trout and an unidentified sucker were the only two species of fish that were identified as being captured by anglers and not harvested (Table 61). The estimated annual harvest of all species in Lake Roosevelt was 176,188 (± 7,925 C.I.; Table 61) and the total catch was 319,118 (± 14,349 C.I.; Table 60). Rainbow trout (104,164 ± 4,063 C.I.) was the most abundant species harvested, followed by walleye, smallmouth bass and kokanee salmon (Table 61). Overall, smallmouth bass (121,007 ± 4,077 C.I.) was the most abundant species captured, followed by rainbow trout, walleye and kokanee salmon (Table 60).

In Section 1 and Section 2, walleye were the most abundant species captured and harvested, followed by rainbow trout and smallmouth bass (Table 60and Table 61). Kokanee salmon represented the fourth most harvested species in Section 2 and were absent from the creel in Section 1 (Table 61). Rainbow trout were the most abundant species harvested in Section 3, followed by smallmouth bass and kokanee (Table 61). Smallmouth bass were captured the most frequently in Section 3, followed by rainbow trout, walleye and kokanee salmon (Table 60). Eastern brook trout and yellow perch were only caught in Section 2, and brown trout, chinook salmon, kokanee, and walleye were captured in sections 1 and 2, but were not captured in Section 3 (Table 60).

CPUE and HPUE across all species were highest in Section 3, followed by Section 1 and Section 2 (Table 62 and Table 63). CPUE and HPUE followed similar patterns. Walleye had the highest CPUE and HPUE in Section 1 and Section 2, followed by rainbow trout and smallmouth bass (Table 62 and Table 63). In Section 3, rainbow trout had the highest CPUE and HPUE, followed by kokanee salmon and smallmouth bass (Table 62 and Table 63). Monthly harvest and catch for each species were summarized in Appendix B.

A total of 811 fish harvested by anglers were measured for total length and 747 were weighed (Table 64). Overall, rainbow trout (n = 490) averaged 367mm and 617 g.

Rainbow trout were the largest in Section 3 (382 mm and 756 g) and the smallest in Section 2 (358 mm and 539 g). Reservior wide, walleye averaged 367 mm and 469 g. Walleye were largestin Section 1 (372 mm and 480 g) and decreased in size downstream (Table 64). Across all sections, kokanee salmon averaged 400 mm and 778 g and were the largest in Section 3 (423 mm and 871 g; Table 64).

Of the 1,479 anglers that answered the question of a specific target species, 40.7% targeted rainbow trout and 20.3% targeted walleye (Table 65). Of the remaining anglers that answered the question, 35.8 % were not targeting any specific species. Seasonally, rainbow trout were targeted most frequently in the winter (73%), whereas walleye were targeted most frequently in the summer (34.8%; Table 65). In Section 1 and Section 2 walleye were targeted most frequently in the spring and summer, and rainbow trout in the fall and winter (Table 65). In Section 3, rainbow trout were the most sought after fish throughout the year (Table 65). Of anglers that had completed their fishing trip (n = 354), 41% were satisfied (Table 66). Seasonally, anglers were satisfied in the spring (59%) and fall (71%), and unsatisfied in the summer (56%) and winter (79%; Table 66).

The supplementary creel performed in Section 2 indicated that 16,152 angler trips were made during August, September and October (Table 67). The most angler trips over the three months were made in September (8,471; Table 67). Angler pressure was estimated at 105,531 (± 6,275 C.I.) angler hours (Table 67). Mean trip length from the supplemental creel (6.53 hrs) was greater than the annual mean for Section 2 (5.02), which was also the average trip length across all sections during the same three-month period. Rainbow trout were the most frequently targeted, caught and harvested species, followed by walleye (Table 68). Smallmouth bass, yellow perch and kokanee salmon were also caught and harvested in Section 2 during the supplemental creel period (Table 68).

Anglers from a variety of counties utilized each reservoir section. Anglers from 6 counties were interviewed in Section 1, with the majority residing in Stevens (71.1%) and Spokane (24.1%) counties (Table 69). More than half the anglers interviewed in Section 2 came from Spokane County (59.2%), in addition to visitors from Lincoln (14.1%), Stevens (12.0%), and 14 other counties (Table 69). In Section 3, anglers from 17 counties were interviewed, the majority being from Grant (48.7%), Okanogan (18.7%), and Spokane (10.3%) counties (Table 69). Anglers visiting from the west side of Washington state comprised 2.1 % of those interviewed in Section 1, 3.2% of those in Section 2, and 1.3% of those angling in Section 3 (Table 69). Many anglers had traveled great distances to Lake Roosevelt. Out of state anglers utilizing Lake Roosevelt traveled from as far as Hawaii, Missouri, California, Montana, and Idaho (Table 69).

Table 58. Total monthly angler pressure estimates in hours (± 95 % confidence intervals) by creel section on Lake Roosevelt, WA (2000).

| Month | Section 1 | Section 2 | Section 3 | Total |
|---|---|---|---|---|
| January | 122 ± 46 | 3,568 ± 486 | 1,121 ± 422 | 4,811 ± 954 |
| February | 533 ± 128 | 10,377 ± 534 | 8,240 ± 1,359 | 19,150 ± 2,021 |
| March | 568 ± 123 | 10,598 ± 1,600 | 12,801 ± 554 | 23,967 ± 2,277 |
| April | X | X | X | X |
| May | 939 ± 133 | 2,524 ± 582 | 23,663 ± 1,581 | 27,126 ± 2,296 |
| June | 11,881 ± 700 | 45,532 ± 3,099 | 75,118 ± 416 | 132,531 ± 4,215 |
| July | 18,393 ± 1,172 | 93,589 ± 6,343 | 78,334 ± 2,221 | 190,316 ± 9,736 |
| August | 18,638 ± 198 | 102,624 ± 7,277 | 207,151 ± 4,970 | 328,413 ± 12,445 |
| September | 3,985 ± 319 | 17,720 ± 1,328 | 75,911± 4,986 | 97,616 ± 6,633 |
| October | 2,355 ± 254 | 14,732 ± 1,158 | 17,051 ± 1,442 | 34,138 ± 2,854 |
| November | X | X | X | X |
| December | X | X | X | X |
| **Totals** | **57,414 ± 3,073** | **301,264 ± 22,407** | **499,390 ± 17,951** | **858,068 ± 43,431** |

An X denotes that no creel surveys were performed.

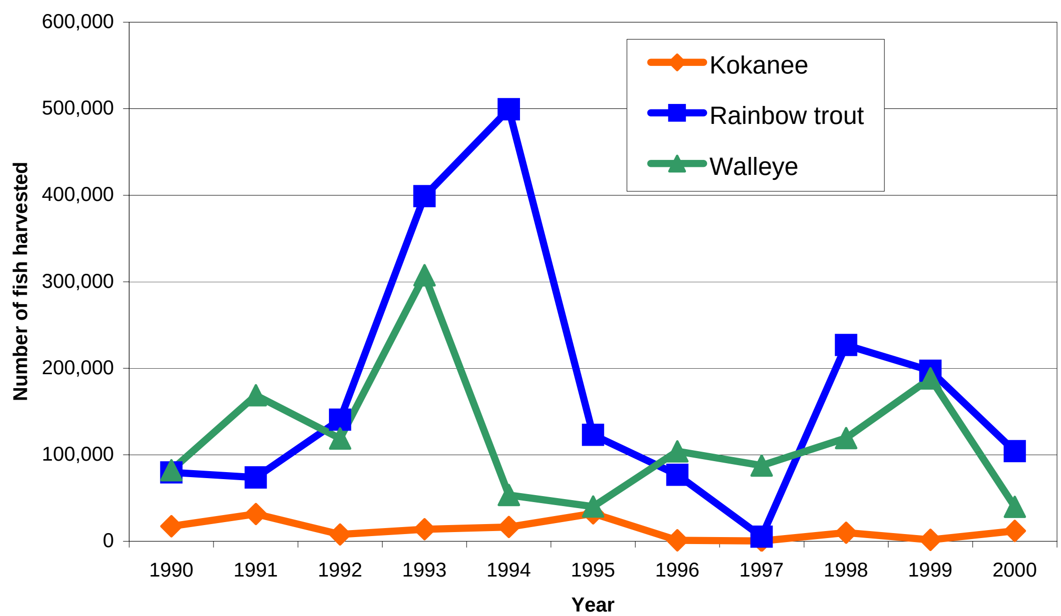


Figure 14. The number of kokanee salmon, rainbow trout, and walleye harvested from Lake Roosevelt, WA (1990-2000).

Table 59. Angler trip estimates by section based on angler hours (pressure estimates) and average trip length (hrs) for Lake Roosevelt, WA (2000).

| **Month** | **Section** | **Mean Trip Length** | **Angler Hours** | **Number Angler Trips** |
|---|---|---|---|---|
| January | 1 | 2.98 | 122 | 41 |
| | 2 | 3.54 | 3,568 | 1,007 |
| | 3 | 3.69 | 1,121 | 304 |
| February | 1 | 2.99 | 533 | 178 |
| | 2 | 4.53 | 10,377 | 2,292 |
| | 3 | 4.31 | 8,240 | 1,912 |
| March | 1 | 2.91 | 568 | 195 |
| | 2 | 5.07 | 10,598 | 2,092 |
| | 3 | 3.50 | 12,801 | 3,657 |
| May | 1 | 4.78 | 939 | 196 |
| | 2 | 3.71 | 2,524 | 680 |
| | 3 | 6.02 | 23,663 | 3,930 |
| June | 1 | 5.49 | 11,881 | 2,163 |
| | 2 | 5.59 | 45,532 | 8,141 |
| | 3 | 7.88 | 75,118 | 9,539 |
| July | 1 | 6.08 | 18,393 | 3,026 |
| | 2 | 6.76 | 93,589 | 13,837 |
| | 3 | 3.61 | 78,334 | 21,692 |
| August | 1 | 4.69 | 18,638 | 3,975 |
| | 2 | 5.14 | 102,624 | 19,951 |
| | 3 | 6.45 | 207,151 | 32,127 |
| September | 1 | 6.74 | 3,985 | 591 |
| | 2 | 4.45 | 17,720 | 3,980 |
| | 3 | 4.90 | 75,911 | 15,948 |
| October | 1 | 5.45 | 2,355 | 432 |
| | 2 | 5.36 | 14,732 | 2,750 |
| | 3 | 2.00 | 17,051 | 8,526 |
| **Grand Total** | | **5.02** | **858,068** | **170,930** |

Table 60. Number of fish captured (n) and estimated number of fish captured (harvested and released) (± 95% confidence intervals) by section for Lake Roosevelt, WA from January through October, 2000 (excluding April).

| Species | n | Section 1 | n | Section 2 | n | Section 3 | n | Total |
|---|---|---|---|---|---|---|---|---|
| Lake whitefish | 1 | 77±5 | 0 | 0±0 | 0 | 0±0 | 1 | 77±5 |
| Rainbow trout | 62 | 2,474±212 | 118 | 26,005±1,905 | 264 | 88,731±2,755 | 444 | 117,210±4,872 |
| Kokanee salmon | 0 | 0±0 | 15 | 4,264±301 | 74 | 12,551±642 | 89 | 16,815±943 |
| Chinook salmon | 0 | 0±0 | 3 | 316±32 | 1 | 7±3 | 4 | 323±35 |
| Brown trout | 0 | 0±0 | 3 | 187±28 | 1 | 35±6 | 4 | 222±34 |
| Brook trout | 0 | 0±0 | 2 | 382±26 | 0 | 0±0 | 2 | 382±26 |
| Smallmouth bass | 3 | 219±4 | 68 | 14,629±1,019 | 50 | 106,159±3,054 | 121 | 121,007±4,077 |
| Walleye | 231 | 15,787±899 | 229 | 46,893±3,433 | 0 | 0±0 | 460 | 62,680±4,332 |
| Yellow perch | 0 | 0±0 | 2 | 343±29 | 0 | 0±0 | 2 | 343±29 |
| Unidentified sucker | 1 | 105±1 | 0 | 0±0 | 0 | 0±0 | 1 | 105±1 |
| **Annual** | **298** | **18,592±1,115** | **440** | **93,019±6,774** | **390** | **207,507±6,460** | **1,128** | **319,118±14,349** |

Table 61. Number of fish harvested (n) and estimated number of fish harvested (± 95 confidence intervals) for Lake Roosevelt, WA from January through October, 2000 (excluding April).

| Species | n | Section 1 | n | Section 2 | n | Section 3 | n | Total |
|---|---|---|---|---|---|---|---|---|
| Lake whitefish | 1 | 77±5 | 0 | 0±0 | 0 | 0±0 | 1 | 77±5 |
| Rainbow trout | 59 | 2,461±208 | 79 | 15,508±1,163 | 244 | 86,195±2,692 | 382 | 104,164±4,063 |
| Kokanee salmon | 0 | 0±0 | 3 | 899±63 | 12 | 11,230±375 | 15 | 12,129±438 |
| Chinook salmon | 0 | 0±0 | 1 | 191±13 | 1 | 7±3 | 2 | 198±16 |
| Brown trout | 0 | 0±0 | 0 | 0±0 | 1 | 35±6 | 1 | 35±6 |
| Brook trout | 0 | 0±0 | 0 | 0±0 | 0 | 0±0 | 0 | 0±0 |
| Smallmouth bass | 3 | 219±4 | 11 | 2,369±164 | 5 | 16,667±473 | 19 | 19,255±641 |
| Walleye | 163 | 11,022±610 | 146 | 28,941±2,120 | 0 | 0±0 | 309 | 39,963±2,730 |
| Yellow perch | 0 | 0±0 | 2 | 343±29 | 0 | 0±0 | 2 | 343±29 |
| **Annual** | **226** | **13,779±825** | **242** | **48,252±3,552** | **263** | **114,157±3,548** | **731** | **176,188±7,925** |

Table 62. Harvest-per-unit-effort (HPUE) by species and section from January through October, 2000 (excluding April) at Lake Roosevelt, WA. HPUE reflects the number of fish kept per angler hour.

| Species | Section 1 | Section 2 | Section 3 | Total |
|---|---|---|---|---|
| Lake whitefish | 0.001 | 0.000 | 0.000 | 0.000 |
| Rainbow trout | 0.067 | 0.054 | 0.265 | 0.117 |
| Kokanee salmon | 0.000 | 0.002 | 0.013 | 0.005 |
| Chinook salmon | 0.000 | 0.001 | 0.001 | 0.001 |
| Brown trout | 0.000 | 0.000 | 0.001 | 0.000 |
| Smallmouth bass | 0.003 | 0.008 | 0.005 | 0.006 |
| Walleye | 0.184 | 0.100 | 0.000 | 0.095 |
| Yellow perch | 0.000 | 0.001 | 0.000 | 0.001 |
| **Annual HPUE** | **0.256** | **0.166** | **0.286** | **0.224** |

Table 63. Catch-per-unit-effort (CPUE) by species and section from January through October, 2000 (excluding April) at Lake Roosevelt, WA. CPUE reflects the number of fish harvested and released per angler hour.

| Species | Section 1 | Section 2 | Section 3 | Total |
|---|---|---|---|---|
| Lake whitefish | 0.001 | 0.000 | 0.000 | 0.000 |
| Rainbow trout | 0.070 | 0.081 | 0.287 | 0.136 |
| Kokanee salmon | 0.000 | 0.010 | 0.080 | 0.027 |
| Chinook salmon | 0.000 | 0.002 | 0.001 | 0.001 |
| Brook trout | 0.000 | 0.001 | 0.000 | 0.001 |
| Brown trout | 0.000 | 0.002 | 0.001 | 0.001 |
| Smallmouth bass | 0.003 | 0.047 | 0.054 | 0.037 |
| Walleye | 0.261 | 0.157 | 0.000 | 0.141 |
| Yellow perch | 0.000 | 0.001 | 0.000 | 0.001 |
| Unidentified sucker | 0.001 | 0.000 | 0.000 | 0.000 |
| **Annual CPUE** | **0.337** | **0.302** | **0.424** | **0.346** |

Table 64. Mean total length (mm) and weight (grams) and standard deviation (SD) of fish captured in each section of Lake Roosevelt, WA (2000).

| Species | n | Mean TL (SD) | n | Mean Wt (SD) |
|---|---|---|---|---|
| **Section 1** | | | | |
| LWF | 1 | 492 | 1 | 1385 |
| RBT | 59 | 363 (66) | 59 | 647 (444) |
| SMB | 3 | 259 (43) | 3 | 457 (318) |
| WE | 162 | 372 (53) | 157 | 480 (314) |
| Total Section 1 | 225 | 369 (58) | 220 | 529 (364) |
| **Section 2** | | | | |
| CHK | 1 | 682 | 1 | 3500 |
| KOK | 3 | 307 (3) | 2 | 270 (28) |
| RBT | 73 | 358 (73) | 56 | 539 (297) |
| SMB | 5 | 280 (28) | 4 | 463 (214) |
| WE | 111 | 360 (60) | 96 | 486 (426) |
| YP | 2 | 260 (42) | 1 | 420 |
| Total Section 2 | 195 | 357 (70) | 160 | 520 (445) |
| **Section 3** | | | | |
| BRN | 1 | 340 | 1 | 600 |
| CHK | 1 | 490 | 1 | 1600 |
| KOK | 12 | 423 (67) | 11 | 871 (367) |
| RBT | 229 | 382 (38) | 224 | 756 (187) |
| Total Section 3 | 243 | 384 (41) | 237 | 765 (206) |
| **Section 2 (suppl.)** | | | | |
| RBT | 129 | 349 (32) | 112 | 359 (140) |
| SMB | 2 | 293 (18) | 2 | 280 (132) |
| WE | 17 | 358 (22) | 16 | 251 (56) |
| Total Section 2 (suppl.) | 148 | 349 (32) | 130 | 345 (137) |
| **Reservoir** | | | | |
| LWF | 1 | 492 | 1 | 1385 |
| RBT | 490 | 367 (50) | 451 | 617 (292) |
| KOK | 15 | 400 (77) | 13 | 778 (408) |
| CHK | 2 | 586 (136) | 2 | 2550 (1344) |
| BRN | 1 | 340 | 1 | 600 |
| SMB | 10 | 276 (31) | 9 | 420 (226) |
| WE | 290 | 367 (55) | 269 | 469 (354) |
| YP | 2 | 260 (42) | 1 | 420 |
| **Grand Total** | **811** | **367 (55)** | **747** | **570 (346)** |

Table 65. Number of anglers interviewed (n) and percent targeting various fish species by quarter and section at Lake Roosevelt, WA (2000).

| Quarter | Section | n | Burbot | Chinook | Kokanee | Rainbow trout | Smallmouth bass | White sturgeon | Walleye | Any |
|---|---|---|---|---|---|---|---|---|---|---|
| Spring | 1 | 20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 |
| | 2 | 27 | 0.0 | 0.0 | 0.0 | 11.1 | 0.0 | 0.0 | 14.8 | 74.1 |
| | 3 | 28 | 0.0 | 0.0 | 0.0 | 92.9 | 0.0 | 0.0 | 0.0 | 7.1 |
| Spring Total | | 75 | 0.0 | 0.0 | 0.0 | 38.7 | 0.0 | 0.0 | 32.0 | 29.3 |
| Summer | 1 | 90 | 0.0 | 0.0 | 0.0 | 17.8 | 0.0 | 10.0 | 72.2 | 0.0 |
| | 2 | 414 | 0.0 | 4.3 | 0.0 | 8.7 | 0.5 | 0.0 | 32.6 | 53.9 |
| | 3 | 38 | 0.0 | 0.0 | 5.3 | 73.7 | 0.0 | 0.0 | 0.0 | 21.1 |
| | 2 (suppl.) | 38 | 0.0 | 0.0 | 0.0 | 18.4 | 0.0 | 0.0 | 5.3 | 76.3 |
| Summer Total | | 580 | 0.0 | 3.1 | 0.3 | 15.0 | 0.3 | 1.6 | 34.8 | 44.8 |
| Fall | 1 | 28 | 0.0 | 0.0 | 0.0 | 60.7 | 0.0 | 0.0 | 39.3 | 0.0 |
| | 2 | 27 | 0.0 | 7.4 | 0.0 | 37.0 | 0.0 | 0.0 | 14.8 | 40.7 |
| | 3 | 6 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2 (suppl.) | 245 | 0.0 | 0.0 | 0.0 | 30.6 | 0.4 | 0.0 | 6.5 | 62.4 |
| Fall Total | | 306 | 0.0 | 0.7 | 0.0 | 35.3 | 0.3 | 0.0 | 10.1 | 53.6 |
| Winter | 1 | 52 | 0.0 | 0.0 | 0.0 | 96.2 | 0.0 | 0.0 | 3.8 | 0.0 |
| | 2 | 199 | 1.0 | 0.0 | 0.0 | 59.8 | 0.0 | 0.0 | 20.6 | 18.6 |
| | 3 | 267 | 0.0 | 0.4 | 4.1 | 78.3 | 0.0 | 0.0 | 0.0 | 17.2 |
| Winter Total | | 518 | 0.4 | 0.2 | 2.1 | 73.0 | 0.0 | 0.0 | 8.3 | 16.0 |
| **Grand Total** | | **1,479** | **0.1** | **1.4** | **0.9** | **40.7** | **0.2** | **0.6** | **20.3** | **35.8** |

Table 66. Number of anglers interviewed (n) and percent of anglers unsatisfied and satisfied with their fishing trip by quarter and section at Lake Roosevelt, WA (2000).

| Quarter | Section | n | % Unsatisfied | % Satisfied |
|---|---|---|---|---|
| Spring | 1 | 20 | 5.00 | 95.00 |
| | 2 | 14 | 78.57 | 21.43 |
| | 3 | 12 | 58.33 | 41.67 |
| Spring Total | | 46 | 41.30 | 58.70 |
| Summer | 1 | 69 | 33.33 | 66.67 |
| | 2 | 65 | 83.08 | 16.92 |
| | 3 | 24 | 50.00 | 50.00 |
| Summer Total | | 158 | 56.33 | 43.67 |
| Fall | 1 | 25 | 16.00 | 84.00 |
| | 2 | 4 | 50.00 | 50.00 |
| | 3 | 2 | 0.00 | 100.00 |
| | 4 | 4 | 100.00 | 0.00 |
| Fall Total | | 35 | 28.57 | 71.43 |
| Winter | 1 | 25 | 92.00 | 8.00 |
| | 2 | 58 | 86.21 | 13.79 |
| | 3 | 32 | 56.25 | 43.75 |
| Winter Total | | 115 | 79.13 | 20.87 |
| **Grand Total** | | **354** | **59.04** | **40.96** |

Table 67. Angler trip estimates for Section 2 based on angler hours (pressure estimates) and average trip length (hrs) during supplemental creel surveys at Lake Roosevelt, WA (August through October, 2000).

| Month | Mean Trip Length | Angler Hrs | Number of Angler Trips |
|---|---|---|---|
| August | 6.67 | 34,959 | 5,239 |
| September | 6.23 | 52,801 | 8,471 |
| October | 6.69 | 17,771 | 2,655 |
| **Totals** | **6.53** | **105,531** | **16,152** |

Table 68. Number of fish harvested and caught, harvest-per-unit-effort (HPUE; fish harvested per angler hour), catch-per-unit-effort (CPUE ; fish harvested and released per angler hour), and estimated total harvest and catch (± standard deviation)for all species caught by anglers at Lake Roosevelt, WA (August-October, 2000).

| **Species** | Section 2 (suppl.) Harvest | | | Section 2 (suppl.) Catch | | |
|---|---|---|---|---|---|---|
| | **n** | **HPUE** | **Harvest** | **n** | **CPUE** | **Catch** |
| Lake whitefish | 0 | 0.000 | 0±0 | 0 | 0.000 | 0±0 |
| Rainbow trout | 182 | 0.113 | 9,181±565 | 186 | 0.115 | 9,296±572 |
| Kokanee salmon | 1 | 0.001 | 29±2 | 1 | 0.001 | 29±21 |
| Chinook salmon | 0 | 0.000 | 0±0 | 0 | 0.000 | 0±0 |
| Brown trout | 0 | 0.000 | 0±0 | 0 | 0.000 | 0±0 |
| Brook trout | 0 | | 0±0 | 0 | 0.000 | 0±0 |
| Smallmouth bass | 2 | 0.001 | 320±15 | 8 | 0.005 | 492±26 |
| Walleye | 21 | 0.001 | 2,304±121 | 26 | 0.016 | 2,447±131 |
| Yellow perch | 1 | 0.001 | 68±4 | 1 | 0.001 | 68±4 |
| Unidentified sucker | 0 | | 0±0 | 0 | 0.000 | 0±0 |
| **Grand Totals** | **207** | **0.128** | **11,900±707** | **222** | **0.137** | **12,332±735** |

Table 69. Origin of residence (States italicized), number, and percent of anglers interviewed in each section of Lake Roosevelt, WA (2000).

| **County or *State*** | **No. of anglers interviewed** | **Percent** | **County or *State*** | **No. of anglers interviewed** | **Percent** |
|---|---|---|---|---|---|
| | **Upper (1)** | | | **Lower (3)** | |
| Benton | 2 | 1.07 | Adams | 9 | 2.90 |
| Grant | 1 | 0.53 | Benton | 2 | 0.65 |
| King | 4 | 2.14 | *California* | 1 | 0.32 |
| Lincoln | 2 | 1.07 | Chelan | 3 | 0.97 |
| Spokane | 45 | 24.06 | Ferry | 28 | 9.03 |
| Stevens | 133 | 71.12 | Grant | 151 | 48.71 |
| **Total** | **187** | | *Hawaii* | 1 | 0.32 |
| | | | *Idaho* | 1 | 0.32 |
| | **Middle (2)** | | King | 2 | 0.65 |
| Adams | 6 | 0.96 | Kittitas | 4 | 1.29 |
| Benton | 13 | 2.09 | Lincoln | 8 | 2.58 |
| Columbia | 2 | 0.32 | Okanogan | 58 | 18.71 |
| *Hawaii* | 3 | 0.48 | Pend Orielle | 2 | 0.65 |
| *Idaho* | 3 | 0.48 | Pierce | 2 | 0.65 |
| King | 16 | 2.57 | Spokane | 32 | 10.32 |
| Kittitas | 2 | 0.32 | Whitman | 2 | 0.65 |
| Klickitat | 5 | 0.80 | Yakima | 4 | 1.29 |
| Lincoln | 88 | 14.13 | **Total** | **310** | |
| *Missouri* | 1 | 0.16 | | | |
| *Montana* | 5 | 0.80 | | | |
| Okanogan | 7 | 1.12 | | | |
| Pend Orielle | 3 | 0.48 | | | |
| Pierce | 1 | 0.16 | | | |
| Snohomish | 3 | 0.48 | | | |
| Spokane | 369 | 59.23 | | | |
| Stevens | 75 | 12.04 | | | |
| Whitman | 11 | 1.77 | | | |
| Yakima | 10 | 1.61 | | | |
| **Total** | **623** | | | | |

# Discussion
## Limnology

Water flows were nearly equal to the ten year average even though precipitation was slightly below normal. This contributed to water retention times that were slightly greater than 32 days, the 1999 average (McLellan et al. 2003). The higher water retention times and inflows resulted in lower mean total dissolved gas during 2000. Only 28% of TDG measurements from all LRFEP sampling locations were above 110% TDG compared to 70% of 1999 LRFEP measurements (McLellan et al. 2003). Total dissolved gas likely had minimal effects on biota in the reservoir since TDG concentrations were below 110% for most of the year. The Washington State and Spokane Tribal water quality standard requires that TDG not exceed 110% in Lake Roosevelt (EPA 2003, WDOE 2003). Gas bubble trauma was observed in 16 fish and most affected were largescale suckers. The higher incidence of gas bubble trauma in largescale sucker is thought to be a result of spawning behavior. Largescale suckers spawn in the spring in shallow waters and are potentially exposed to higher TDG concentrations (A. Scholz Pers. Comm.). Some fish that naturally occupy greater depths are able to avoid the negative effects of TDG (Weitkamp 2000).

Shore locations were expected to be warmer than pelagic locations overall. However, this was not observed. Significant lateral temperature variations in Lake Roosevelt were observed sporadically at given locations, such as in the Spokane River and the Sanpoil River during the spring and summer months. Since the shore areas are shallow and contain less water volume they likely warm and cool more quickly than open waters. Warming in the littoral areas may become more pronounced during the spring and summer. The greatest thermal variations may also occur where wind mixing is minimal and in coves that are protected from reservoir currents and winds. This phenomenon of warm littoral areas may be similar to thermal bars that develop in large lakes (Horne and Goldman 1994, Wetzel 2001). These lateral temperature variations in Lake Roosevelt are much less stable and on a much smaller scale than true thermal bars because they are more readily mixed.

The pattern of thermal stratification is likely similar to the observed lateral temperature variations. Since water retention times are relatively short in Lake Roosevelt strong thermal stratification has not been observed. Stratification is weak and likely turned over easily with wind mixing and/or internal currents. Stratification meeting a 1 °C Δ / m in the thermocline was only observed once at the Sanpoil River shore site, however, it was only present for about one month (rounds 9-11). Stratification by our criteria may have occurred at Spring Canyon, Sanpoil R Confluence, Porcupine Bay, and Keller Ferry but was not documented. A temperature change of 1 °C per meter might be obscured in some cases by the current methodology since temperature measurements are only taken every three meter. Such a case might be where the temperature change over 1 meter is 1 °C or slightly greater but the change over the other 2 meter is small and a mean < 1 is created.

Dissolved oxygen at the Sanpoil River shore site during thermal stratification showed little variation from top to bottom indicating oxygen consumption was similar from top to bottom and minimal. However, dissolved oxygen was considerably lower at Porcupine Bay in August (2.6 mg/L @ 33 m). This was likely the result of dissolved oxygen consumption by microbes following the senesences of phytoplankton. Phytoplankton chlorophyll *a* at Porcupine Bay had dropped from a mean of 18.5 mg/m$^3$ during late June (round 8) to 0.5 mg/m$^3$ in early July (round 9). Biological oxygen demand commonly increases following the senescence of phytoplankton which can result in hypoxic conditions (Wetzel 2001). Washington state and Spokane Tribe water quality standards in the Spokane Arm of Lake Roosevelt require dissolved oxygen to be ≥ 8.0 mg/L (2003 EPA, 2003 WDOE). Lasee (1995) suggests that fish require a minimum of 5 mg/L dissolved oxygen in water for respiration.

In backwater reaches of the Tualatin River (Northwestern Oregon) low dissolved oxygen concentrations are frequently observed following senescence of phytoplankton (Rounds 2002). A combination of factors contribute to the low dissolved oxygen concentrations in the Tualatin River, including low stream flow, plentiful nutrients, warm water, and abundant light energy. These factors are likely important at Porcupine Bay as well. However, dissolved oxygen concentrations rebounded quickly at Porcupine Bay. By mid-September (round 13) dissolved oxygen was 6.59 mg/L. The rapid increase in dissolved oxygen was also due, in part, to the decreasing water temperatures, observed reservoir in the fall (August 19.0 °C to September 17.7 °C).

Mean Grand Coulee forebay elevation was positively correlated with Secchi depth. Mean elevation was lowest in the May so the reservoir could absorb the spring runoff. Secchi depth was negatively correlated with inflow and the elevation change rate, which is also related to spring runoff. Turbidity often increases with higher flows that have more energy for particle transport, and as elevation changes, wave action can create mass wasting of sediments. Wave action from wind was positively correlated with turbidity in an Oklahoma Reservoir (Lake Carl Blackwell; Howick and Wilhm 1985). Additionally, the annual drawdown does not allow vegetation to establish and stabilize the shoreline. Near shore areas frequently appear considerably more turbid than the main channel of the reservoir. Major landslides have been documented in Lake Roosevelt and mass wasting has occurred at a higher rate since the impoundment of the Columbia River by Grand Coulee dam (Jones et al. 1961). However, no significant differences were detected between pelagic and shore turbidity as measured by Secchi depth, turbidity, and photic zone depth.

Increased turbidity in littoral areas could, potentially increase nutrients available to primary producers, given that light penetration did not become limiting. Plant limiting nutrients are often associated with soil particles and can become available to primary producers once in the water (Horne and Goldman 1994). Phytoplankton density, biovolume, and chlorophyll *a* were all negatively correlated with Secchi depth and photic zone depth. This suggests that light is not limiting phytoplankton growth. Similar relationships were observed between measures of water clarity and phytoplankton in previous years on Lake Roosevelt (Shields et al 2002, McLellan et al. 2003). Phytoplankton chlorophyll *a* and Secchi depth were inversely related (Pearson correlations -0.63 to -0.86 respectively) during sampling in 1994 and 1995 in Lake Roosevelt (Wilson et al. 1996).

Phytoplankton were more likely limited by phosphorus. Mean total nitrogen (0.272 mg/L) from all sampling events and locations was comparable to other oligo-mesotrophic lakes (0.250-0.600 mg/L; Wetzel 2001). Mean total phosphorus (0.016 mg/L) actually placed Lake Roosevelt into the mesotrophic range (0.010-0.030 mg/L) compared with other lakes (Wetzel 2001). Overall, total nitrogen to total phosphorus ratios (31:1) indicate that phosphorus is likely the limiting nutrient to phytoplankton. Nitrogen to phosphorus ratios > 23:1 can create strong phosphorus limitation for phytoplankton (Wetzel 2001). Horne and Goldman (1994) suggest that phosphorus limitation begins at a ratio of 10:1 (N:P). Total nitrogen to total phosphorus ratios > 20:1 were reported in 1994 and 1995 from Lake Roosevelt (Wilson et al. 1996). McLellan et al. (2003) also reported likely phosphorus limitation with mean total nitrogen and total phosphorus ratios of 40:1 from 1999 Lake Roosevelt sampling. Strong phosphorus limitation was reported at the Rocky Reach Reservoir (Mid-Columbia River) during water year 2000 where the mean dissolved inorganic nitrogen to orthophosphorus ratio was 61:1 (CCPUD 2001).

The nutrient limitation by phosphorus not only reduces the standing crop of phytoplankton but can also alter the composition of algal assemblages. When nitrogen and phosphorus ratios are >29:1 cyanobacteria tend to be rare because they are poor phosphorus competitors (Smith 1983, Carpenter 1989). Cyanobacteria are able to fix atmospheric nitrogen and can have a competitive edge when nitrogen concentrations are low (Olden 2000). Diatoms (37% pelagic relative abundance) were the dominant phytoplankter followed by unicellular flagellates (26% pelagic relative abundance) and green algae (16% pelagic relative abundance) in Lake Roosevelt during 2000. Diatoms dominated relative density during 1994-1995 at 85% and in 1999 at 37% in Lake Roosevelt (Wilson et al. 1996, McLellan et al. 2003). The large differences in planktonic diatom relative density between Wilson et al. (1996) and McLellan et al. (2003) are unexplained. However, Wilson et al. (1996) did not observe any cryptophytes while McLellan et al. (2003) reported a mean relative density of 25%. Downstream in the Rocky Reach Reservoir cryptophytes comprised 22% of the relative biovolume during water year 2000 compared to 24% in the current study (CCPUD 2001).

Cryptophytes provide herbivorous zooplankton with average to high quality nutrition (Olden 2000, CCPUD 2001, Talling 2003). While diatoms provide average quality nutrition to zooplankton (Olden 2000). Since zooplankton can feed selectively they can influence phytoplankton community structure and succession (Horne and Goldman 1994, Wetzel 2001, Anneville et al. 2002). *Asterionella formosa* has been observed to mechanically interfere with *Bosmina longirostris* and potentially other zooplankton feeding apparatus (Balseiro et al. 1991). *Asterionella formosa* had the greatest relative biovolume of all phytoplankton from both shore (29%) and pelagic (33%) sampling in the current study. Its dominance of relative biovolume could be a result of zooplankton feeding interference just as filamentous cyanobacteria such as *Oscillatoria sp.* can “clog” zooplankton feeding apparati (Edmondson and Litt 1982, Kurmayer

2001). Cyanobacteria peaked in July (438 cells/ml) of which *Oscillatoria sp.* contributed 0.3% of the relative biovolume to Lake Roosevelt phytoplankton in 2000. Cyanobacteria typically peak sometime during the summer and are generally low in nutritional value to zooplankton (Wetzel 2001, Carpenter 1989).

Phytoplankton density, biovolume, and chlorophyll *a* were positively correlated with inflow. Nutrients associated with spring inflows may drive the increase in phytoplankton, especially phosphorus because of the large N:P ratios. Orthophosphorus and total phosphorus were not significantly correlated with inflow or phytoplankton measures ($p > 0.05$). Methodologies used in phosphorus analysis (Ortho-P, report limit 1-10 µg/L; Total P, report limit 5 µg/L) from the current study may be too coarse to detect the minute increases necessary to stimulate phytoplankton growth (RAASC 1999). Growth rates of unicellular planktonic algae have been found to saturate under phosphorus concentrations of < 1 µg/L and attached benthic algae growth rates can saturate at even lower phosphorus concentrations (0.3-0.6 µg/L; Brown and Button 1979, Bothwell 1988). Efforts should be made to increase resolution in nutrient analysis.

Phytoplankton measures were all highly correlated with each other, corroborating the different method's results. There were no detectable differences between shore and pelagic phytoplankton density and biovolume. During the growing season phytoplankton chlorophyll *a* at shore sites (4.6 $mg/m^3$) was greater than pelagic sites (2.4 $mg/m^3$). The higher shore chlorophyll concentrations were partly due to the high concentrations at the Porcupine Bay shore site (Blue Creek). Blue Creek is a protected embayment and phytoplankton are likely more sheltered than main channel communities. Phytoplankton chlorophyll *a* concentrations at shore sites were greater than pelagic sites during 1999 sampling on Lake Roosevelt (McLellan et al. 2003). Productivity in littoral zones is frequently higher than open water zones (Horne and Goldman 1994). Mean littoral phytoplankton chlorophyll *a* (2.6 $mg/m^3$) was slightly greater than the pelagic mean (2.4 $mg/m^3$) in the Rocky Reach Reservoir (CCPUD 2001).

Trophic state indices place Lake Roosevelt in the oligotrophic to meso-oligotrophic range <40 (Carlson and Simpson 1996). Mean TSI values were comparable to 1999 Lake Roosevelt mean values (26-37) and Rocky Reach Reservoir mean values (33-46; CCPUD 2001, McLellan et al. 2003). Interestingly, in the current study, the mean chlorophyll *a* TSI value (22) was about 40%

less than other TSI values (Secchi 37, TN 34, and TP 39). Wilson et al. (1996) reported that chlorophyll *a* TSI during 1994 and 1995 was greater than Secchi TSI and total P TSI in Lake Roosevelt. Secchi TSI values were greater because of erosion related turbidity which is not directly related to phytoplankton chlorophyll. The lower chlorophyll *a* TSI values could be due to many different factors. The chlorophyll, transparency, and nutrient relationships in the TSI model may not fit as closely in a large impounded river system (CCPUD 2001). Additionally, sampling bias and random error are likely factors. Another possibility is algal suppression. Phytoplankton can be suppressed in numerous ways such as metal contamination or solar radiation (Scott et al. 1999, Mann 2002). There are elevated metal concentrations in Lake Roosevelt sediments (Bortleson et al. 1994). However, it is unknown whether contaminant metal concentrations in Lake Roosevelt suppress algal communities. Additionally, the results are based on one year's data and should be viewed in that context.

Attached algae collected from glass slides were dominated by the diatoms in both relative abundance (95%) and relative biovolume (85%). Attached diatoms frequently dominate algal assemblages in Idaho and have been observed to dominate Lake Roosevelt samples in prior studies (Fore and Grafe 2002, McLellan et al. 2003). *Melosira varians* (36%), *Achnanthes sp.* (13%), and *Amphora sp.* (11%) had the greatest relative biovolumes in the current study. All three of these taxa have been associated with frequently disturbed systems (Triska et al. 1995, Hill 1996, Fore and Grafe 2002). The attached algae observed likely represent an early seral community.

Algal assemblages grown on artificial substrates may differ considerably from natural substrates but considering the amount of littoral disturbance in Lake Roosevelt the dominance of those taxa would not be unexpected (Lowe and Pan 1996, Wetzel 2001). Attached algae density, biovolume, and chlorophyll *a* were higher at the Spring Canyon sampling station. Glass slides were incubated in small embayments at each location and it is likely that conditions at the Spring Canyon location favored greater growth. Mean chlorophyll *a* content of attached algae (14 $mg/m^2$) was below the oligotrophic/mesotrophic threshold (20 $mg/m^2$) referred to by Dodds et al. (1998).

Observed zooplankton biomass was similar to recent past years in Lake Roosevelt and other systems. In the current study, zooplankton biomass was also elevated at the Sanpoil River location. Monthly mean biomass ranged from 180 to 17,381 µg/m$^3$ annually at the Sanpoil River location. Wilson et al. (1996) reported ranges of 50,000 to 600,000 µg/m$^3$ in 1994 and 50,000 to 2,640,000 µg/m$^3$ in1995 across Lake Roosevelt. Large biomass values reported by Wilson et al. (1996) resulted from zooplankton collected at Nine Mile reach (between Spokane River Confluence and Hunters) and in the Sanpoil River arm. Biomass values observed by Wilson et al. (1996) were likely greater since their tows were taken from shallower depths (5-16 m) where zooplankton may be concentrating. They observed greater biomass in the shallower tows, whereas the tows in the current study were largely from 33 m.

The high zooplankton biomass in the Sanpoil arm is likely due to higher temperatures and food availability. Increases in water temperature have been strongly correlated to increases in zooplankton biomass and density (McLellan et al. 2003). The Sanpoil arm showed relatively more stability in the water column than other sites as seen by the temporary stratification. Zooplankton likely benefit from this increased stability. Annual mean zooplankton biomass in the Rocky Reach Reservoir was 2,250 µg/m$^3$ in 1999, whereas to the annual mean in the current study across all locations was 1,163 µg/m$^3$ (CCPUD 2001). Zooplankton in the run-of-the-river (water retention time 1.8 d) Rocky Reach Reservoir are supplied in part by Lake Roosevelt (Beckman et al. 1985, CCPUD 2001). Cladocera were an important diet item for kokanee and rainbow trout in Lake Roosevelt. Cladocera composed 100% of kokanee stomach (n=61 stomachs) contents and 54% of rainbow trout stomach (n=166 stomachs) contents (Table 94 and Table 95).

## Fishery

### Fisheries Surveys

Electrofishing CPUE in Lake Roosevelt has been variable throughout the years (Table 70). Several fish species were collected during surveys in 2000 that had not been captured the previous year, including: redside shiner, brown bullhead, sculpin, and largemouth bass (Table 70). Brown bullhead were collected for the first time in five years, and redside shiners had not been collected since 1997 (Table 70). The number of rainbow trout and kokanee salmon showed slight decreases in CPUE during 2000 from the previous year (-0.66 and -1.78, respectively; Table 70). Smallmouth bass and walleye both showed an increased CPUE (+0.62 and +1.38, respectively). Yellow perch CPUE, although up slightly from 1999, remained lower than in previous years (Table 70).

Lake whitefish had the highest CPUE in 2000 gill net sampling (0.08) followed by walleye, which showed an increase from 0.05 in 1999 to 0.07 (Table 71). Other species with an increase in CPUE in 2000 include mountain whitefish, burbot, smallmouth bass and black crappie, whereas lake whitefish decreased in CPUE from 1999 (Table 71). Chinook salmon and black crappie were not collected during 2000 sampling, although they had been found in previous surveys (Table 71).

The relative abundance of fish species captured during electrofishing has remained fairly stable with a few notable changes. The most abundant species captured through electrofishing were walleye, largescale sucker and rainbow trout (Table 72). Redside shiner, bullhead, sculpin, and largemouth bass were captured in 2000 but were not present in 1999 sampling. Rainbow trout were the third highest in relative abundance in electrofishing surveys (Table 72). Species that increased in relative abundance in 2000 included smallmouth bass, yellow perch and walleye. Species that decreased in relative abundance from the previous year included kokanee salmon, brown trout, and eastern brook trout (Table 72).

The relative abundance of species captured via gill net surveys had few variations from the previous year (Table 73). Lake whitefish had the highest relative abundance followed by walleye, burbot and longnose suckers. Walleye had the largest increase of all fish species (20-25%), followed by smallmouth bass, rainbow trout, and longnose suckers (Table 73). Lake whitefish showed the largest decrease in relative abundance (43-36%), followed by mountain whitefish, yellow perch, and sculpin.

Table 70. Effort (hrs) and catch-per-unit-effort (fish/hr) of fish collected via boat electrofishing in Lake Roosevelt, WA (1993-2000).

| **Year** | **1993** | **1994** | **1995** | **1996** | **1997** | **1998** | **1999** | **2000** |
|---|---|---|---|---|---|---|---|---|
| **Effort (hrs)** | **13.9** | **36.3** | **118.0** | **27.0** | **34.3** | **41.5** | **40.7** | **41.0** |
| White sturgeon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Carp | 0.03 | 0.05 | 1.75 | 2.18 | 8.46 | 2 | 0.1 | 0 |
| Northern pikeminnow | 0.22 | 0.14 | 1.81 | 2.04 | 2.42 | 1.37 | 0.2 | 0.29 |
| Tench | 0 | <0.01 | 0 | 0.11 | 0.06 | 0.12 | 0.05 | 0.02 |
| Peamouth | 0 | 0 | 0 | 0 | 0.03 | 0.02 | 0 | 0 |
| Redside shiner | 0 | <0.01 | 0.01 | 0 | 0.35 | 0 | 0 | 0.17 |
| Longnose sucker | 0 | 0.07 | 0.21 | 1.33 | 0.32 | 0.82 | 0.34 | 0.49 |
| Bridgelip sucker | 0 | <0.01 | 0.7 | 2.22 | 0.32 | 0.05 | 0.05 | 0 |
| Largescale sucker | 1.20 | 1.37 | 22.7 | 45.15 | 59.21 | 44.59 | 6.22 | 5.98 |
| Brown bullhead | <0.01 | <0.01 | 0.05 | 0 | 0 | 0 | 0 | 0.1 |
| Lake whitefish | <0.01 | 0.01 | 0.34 | 0.59 | 0.93 | 0.68 | 0.37 | 0.12 |
| Rainbow trout | 0.24 | 0.25 | 3.88 | 6.92 | 5.19 | 19.85 | 5.73 | 5.07 |
| Kokanee salmon | 0.02 | 0.14 | 17.01 | 4.4 | 1.66 | 12.54 | 2.92 | 1.14 |
| Chinook salmon | <0.01 | <0.01 | 0.02 | 0 | 0.09 | 0.07 | 0.02 | 0.02 |
| Mountain whitefish | <0.01 | <0.01 | 0.08 | 0.07 | 0.12 | 0.17 | 0.12 | 0.22 |
| Brown trout | 0.02 | 0.01 | 0.31 | 2.15 | 0.47 | 0.41 | 0.59 | 0.1 |
| Bull trout | 0 | <0.01 | 0.01 | 0 | 0 | 0 | 0 | 0 |
| Eastern Brook trout | <0.01 | 0.01 | 0.18 | 0.96 | 0.23 | 1.37 | 0.54 | 0.12 |
| Burbot | 0 | 0.04 | 0.26 | 3.55 | 4.06 | 3.04 | 0.84 | 0.73 |
| Sculpin | 0.07 | 0.63 | 4.73 | 1.04 | 2.07 | 9.82 | 0 | 0.02 |
| Smallmouth bass | 0.25 | 0.32 | 7.96 | 6.62 | 9.83 | 9.04 | 1.87 | 2.49 |
| Largemouth bass | 0 | 0 | 0 | 0 | 0.03 | 0.05 | 0 | 0.17 |
| Black crappie | 0 | <0.01 | 0.08 | 0 | 0 | 0.17 | 0.02 | 022 |
| Yellow perch | 0.29 | 0.46 | 5.45 | 1.78 | 3.59 | 0.17 | 0.02 | 0.85 |
| Walleye | 0.28 | 0.26 | 8.74 | 20.06 | 13.31 | 55.01 | 6.68 | 8.03 |
| **Totals** | **2.63** | **3.85** | **76.39** | **99.04** | **113** | **161.6** | **26.86** | **26.5** |

Table 71. Effort (hrs) and catch-per-unit-effort (fish/hr) for fish collected via gill net surveys in Lake Roosevelt, WA (1993-2000).

| **Years**<br>**Effort (hrs)** | **1993**<br>**94.1** | **1994**<br>**642.9** | **1995**<br>**2099.0** | **1996**<br>**201.2** | **1997**<br>**1689.2** | **1998**<br>**2624.4** | **1999**<br>**2211.1** | **2000**<br>**2082.5** |
|---|---|---|---|---|---|---|---|---|
| White sturgeon | 0 | 0 | 0 | 0 | 0 | < 0.01 | <0.01 | <0.01 |
| Carp | 0 | <0.01 | 0.03 | 0.02 | < 0.01 | < 0.01 | 0 | 0 |
| Northern pikeminnow | 0 | <0.01 | 0.03 | 0.01 | 0.01 | 0.01 | <0.01 | <0.01 |
| Tench | 0 | 0 | < 0.01 | 0 | 0 | < 0.01 | 0 | 0 |
| Peamouth | 0 | 0 | 0 | 0 | < 0.01 | 0 | 0 | 0 |
| Redside shiner | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Longnose sucker | 0 | <0.01 | 0.03 | 0.02 | 0.01 | 0.02 | 0.03 | 0.04 |
| Bridgelip sucker | 0 | 0 | 0.05 | < 0.01 | < 0.01 | 0 | 0 | 0 |
| Largescale sucker | <0.01 | <0.01 | 0.06 | 0.11 | 0.03 | 0.01 | <0.01 | 0.01 |
| Brown bullhead | 0 | 0 | 0 | <0.01 | 0 | 0 | 0 | 0 |
| Lake whitefish | <0.01 | <0.01 | 0.68 | 0.91 | 0.13 | 0.15 | 0.11 | 0.08 |
| Rainbow trout | < 0.01 | <0.01 | 0.06 | 0.11 | < 0.01 | 0.02 | <0.01 | 0.01 |
| Kokanee salmon | < 0.01 | <0.01 | 0.07 | 0.08 | < 0.01 | < 0.01 | <0.01 | <0.01 |
| Chinook salmon | 0 | 0 | 0 | 0 | 0 | 0 | <0.01 | 0 |
| Mountain whitefish | 0 | 0 | < 0.01 | 0 | 0 | 0 | <0.01 | 0.02 |
| Brown trout | 0 | 0 | < 0.01 | 0 | < 0.01 | 0 | 0 | 0 |
| Bull trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Brook trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Burbot | 0.01 | <0.01 | 0.07 | 0.18 | 0.04 | 0.03 | 0.03 | 0.04 |
| Sculpin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Smallmouth bass | 0 | <0.01 | 0.04 | 0 | 0.01 | 0.04 | 0.01 | 0.02 |
| Largemouth bass | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black crappie | 0 | <0.01 | 0 | 0 | < 0.01 | 0 | <0.01 | 0 |
| Yellow perch | < 0.01 | <0.01 | 0.1 | 0.05 | 0.01 | 0.01 | <0.01 | <0.01 |
| Walleye | <0.01 | <0.01 | 0.26 | 0.26 | 0.1 | 0.07 | 0.05 | 0.07 |
| **Totals** | **<0.01** | **0.01** | **1.47** | **1.78** | **0.35** | **0.37** | **0.26** | **0.29** |

Table 72. Summary of the percent relative abundance of fish species collected via boat electrofishing in Lake Roosevelt, WA (1989-2000).

| Species | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| White sturgeon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chiselmouth | 0 | <1 | 0 | <1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Carp | 2 | 2 | <1 | 2 | 1 | 1 | 2 | 2 | 7 | 1 | <1 | 0 |
| Peamouth | <1 | 0 | <1 | <1 | 0 | 0 | 0 | 0 | <1 | <1 | 0 | 0 |
| N.pikeminnow | 4 | 6 | 3 | 2 | 8 | 4 | 2 | 2 | 2 | <1 | <1 | 1 |
| Redside shiner | 0 | <1 | 0 | <1 | 0 | <1 | <1 | 0 | <1 | 0 | 0 | 1 |
| Tench | <1 | <1 | <1 | <1 | 0 | <1 | <1 | <1 | <1 | <1 | <1 | <0 |
| Longnose sucker | <1 | 2 | <1 | <1 | 0 | 2 | <1 | 1 | <1 | <1 | 1 | 2 |
| Bridgelip sucker | 1 | <1 | <1 | <1 | 0 | <1 | <1 | 2 | <1 | <1 | <1 | 0 |
| Largescale sucker | 12 | 19 | 35 | 46 | 46 | 36 | 30 | 44 | 52 | 28 | 23 | 23 |
| Unidentified sucker | 7 | 0 | 0 | 0 | 0 | 0 | <1 | 5 | 0 | 0 | 0 | 0 |
| Bullhead | <1 | <1 | <1 | 0 | <1 | <1 | <1 | 0 | 0 | 0 | 0 | <1 |
| Lake whitefish | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 1 | <1 |
| Cutthroat trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <1 | 0 | 0 | 0 | 0 |
| Rainbow trout | 6 | 3 | 4 | 6 | 9 | 7 | 5 | 7 | 5 | 12 | 21 | 20 |
| Kokanee salmon | 2 | <1 | <1 | 3 | 1 | 4 | 22 | 4 | 1 | 8 | 11 | 4 |
| Chinook salmon | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 0 | <1 | <1 | <1 | <1 |
| Mountain whitefish | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Brown trout | <1 | <1 | <1 | <1 | 1 | <1 | <1 | 2 | <1 | <1 | 2 | <1 |
| Bull trout | <1 | <1 | 0 | 0 | 0 | <1 | <1 | 0 | 0 | 0 | 0 | 0 |
| Eastern Brook trout | <1 | <1 | <1 | 1 | <1 | <1 | <1 | 1 | <1 | <1 | 2 | <1 |
| Burbot | <1 | <1 | <1 | <1 | 0 | <1 | <1 | 3 | 4 | 2 | 3 | 3 |
| Sculpin spp. | 2 | 2 | <1 | 2 | 3 | 16 | 6 | 1 | 2 | 6 | 0 | <1 |
| Pumpkinseed | <1 | <1 | 0 | 0 | 0 | 2 | 0 | 0 | <1 | 0 | 0 | 0 |
| Smallmouth bass | 1 | 3 | 15 | 7 | 9 | 8 | 10 | 6 | 9 | 6 | 7 | 9 |
| Largemouth bass | <1 | <1 | <1 | <1 | 0 | 0 | 0 | 0 | <1 | <1 | 0 | 1 |
| Black crappie | <1 | <1 | <1 | 1 | 0 | <1 | <1 | 0 | 0 | <1 | <1 | 1 |
| Yellow perch | 44 | 48 | 30 | 20 | 11 | 12 | 7 | 2 | 3 | <1 | <1 | 3 |
| Walleye | 16 | 13 | 11 | 8 | 11 | 7 | 11 | 19 | 12 | 34 | 25 | 30 |

Table 73. Summary of the percent relative abundance of fish species collected via horizontal and vertical gill netting in Lake Roosevelt, WA (1989-2000).

| Species | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| White sturgeon | <1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <1 | <1 | <1 |
| Chiselmouth | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Carp | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | <1 | <1 | 0 | 0 |
| Peamouth | <1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <1 | 0 | 0 | 0 |
| N. pikeminnow | 5 | 4 | 5 | 3 | 0 | 2 | 2 | <1 | 2 | 2 | 1 | 1 |
| Redside shiner | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tench | 0 | 0 | 0 | 0 | 0 | 0 | <1 | 0 | 0 | <1 | 0 | 0 |
| Longnose sucker | 1 | 2 | <1 | 2 | 0 | 1 | 2 | 1 | 4 | 5 | 11 | 13 |
| Bridgelip sucker | 1 | 0 | <1 | 0 | 0 | 0 | 3 | <1 | <1 | 0 | 0 | 0 |
| Largescale sucker | 15 | 20 | 11 | 6 | 16 | 15 | 4 | 6 | 9 | 3 | <1 | 2 |
| Unidentified sucker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bullhead | <1 | 0 | 0 | 0 | 0 | 0 | 0 | <1 | 0 | 0 | 0 | 0 |
| Lake whitefish | 31 | 33 | 23 | 15 | 33 | 40 | 46 | 51 | 37 | 40 | 43 | 36 |
| Cutthroat trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Rainbow trout | 2 | 8 | 9 | 14 | 2 | 2 | 4 | 6 | <1 | 6 | <1 | 3 |
| Kokanee salmon | <1 | 2 | <1 | <1 | 2 | 1 | 5 | 5 | <1 | 1 | 2 | 2 |
| Chinook salmon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mountain whitefish | <1 | 0 | 0 | 0 | 0 | 0 | <1 | 0 | 0 | 0 | 2 | 0 |
| Brown trout | 0 | 0 | 0 | 0 | 0 | 0 | <1 | 0 | <1 | 0 | 0 | 0 |
| Bull trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eastern brook trout | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Burbot | <1 | <1 | 1 | 0 | 7 | 4 | 4 | 10 | 13 | 9 | 13 | 13 |
| Sculpin spp. | 0 | <1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | <1 | 0 |
| Pumpkinseed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Smallmouth bass | 6 | 3 | 7 | 10 | 0 | 6 | 3 | 0 | 3 | 12 | 4 | 7 |
| Largemouth bass | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black crappie | 0 | 0 | 0 | 0 | 0 | <1 | 0 | 0 | <1 | 0 | <1 | 0 |
| Yellow perch | 5 | 46 | 3 | 3 | 5 | 10 | 7 | 3 | 3 | 2 | 2 | 1 |
| Walleye | 32 | 21 | 39 | 48 | 35 | 19 | 18 | 15 | 27 | 19 | 20 | 25 |

## Age and Growth

Mean condition factors for salmonids were lower than 1999 values for all species except kokanee salmon, which were slightly greater, and walleye, which were nearly identical (Table 74 and Table 75). Hatchery rainbow trout had a higher condition than wild rainbow trout, as was seen in all previous years (Table 74). The hatchery stock of rainbow trout planted into most waters of western Washington originated as a coastal strain of rainbow trout and generally has a more stout body shape than the longer more slender wild fish that originated in the lotic waters of the Columbia River. Hatchery rainbow trout in Lake Roosevelt had higher condition factors than those collected in Rock Lake, Whitman County, WA and Deer Lake, Stevens County, WA, but slightly lower than Sprague Lake, WA (Table 74). Condition factors of brown trout collected in Lake Roosevelt were lower than in 1998 and 1999, but were greater than brown trout found in Rock Lake and Box Canyon Reservoir, WA on the Pend Orielle River (Table 74). Wild and hatchery origin kokanee were not distinguished in 1997 and 1998, however, wild kokanee salmon had greater condition than kokanee salmon from hatchery origin in 1999 and 2000 (Table 74). Wild kokanee salmon (387.8 ± SD 110.9) had a greater mean total length than hatchery kokanee salmon (275.6 ± SD 46.8) and represent a different age class in general. Kokanee salmon collected in Lake Roosevelt in 2000, of both wild and hatchery origin, had greater condition factors than kokanee salmon collected in Lake Roosevelt in 1999 (Table 74).

Condition factors of northern pikeminnow and largescale suckers were lower in 2000 compared to previous years (Table 75). Condition of other non-game fish and other game fish appeared relatively stable with relatively minimal differences (Table 75). Walleye condition was similar to previous years in Lake Roosevelt, but lower than fish found in Sprague Lake, WA, Banks Lake, WA and Moses Lake, WA (Table 75). Few comparisons are available for species other than walleye in local waters.

Kokanee salmon ages ranged from one to three years in 2000 with age three fish averaging 387 TL (± SD 60), considerably greater than 1999 kokanee salmon (332 ± SD 86; McLellan 2003). Low sample sizes in both years of comparison (1999, n = 30; and 2000, n = 13) could have resulted in the annual mean TL differences in Lake Roosevelt kokanee salmon. Additionally, hatchery and wild kokanee were not differentiated in scale analysis, which, depending on the composition, could skew the mean TL. Hatchery kokanee salmon are held in net pens throughout their first winter and fed a stable diet, decreasing the chance of a distinct annuli forming. Since age analysis is based on alternating periods of fast growth (spring and summer) and slow growth (fall and winter; DeVries and Frie 1996) resulting in annuli formation, an undeveloped annuli could result in a misidentified age, skewing the mean TL at annulus formation. In future analysis, wild and hatchery scales should be differentiated to identify any differences in annuli formation and annual growth.

Rainbow trout ages ranged from one to four for hatchery origin fish and one to three for wild fish. Mean TL of age three hatchery fish (n = 47) was 321 mm (± SD 57) while the total length of the only three-year old wild rainbow trout was 217mm (Table 3). The mean back-calculated TL at formation of the third annulus in 1999 rainbow trout was 310 mm (± SD 58; McLellan et al. 2003), with wild and hatchery origin fish combined for analysis (McLellan et al. 2003). Age two hatchery origin rainbow trout averaged 232 mm (± 46 SD) and wild origin rainbow trout averaged 184 mm (± 55 SD) in 2000. Whereas, mean TL of age two rainbow trout (combined hatchery and wild) in 1999 was 264 mm (± 64 SD). Hatchery origin rainbow trout in Lake Roosevelt, like hatchery kokanee salmon, over-winter in a hatchery or net pens, which could result in the differences in mean TL at annulus formation seen between and within years in comparison with wild fish.

Walleye growth in Lake Roosevelt was similar to previous years until age three when growth was reduced compared to earlier years (Figure 15). The decrease in growth could be related to a reduction in forage fish species in Lake Roosevelt and the age at which walleye rely heavily on fish in their diet. Baldwin et al. (2002) observed that 3 and 4 year-old walleye had the greatest impact on hatchery-released kokanee and that smaller walleye did not have access to many salmonids. It was also noted that daily consumption of kokanee increased with age (Baldwin et al. 2002), suggesting that daily consumption of other species would also have to increase with age when kokanee are not available. The occurrence of age eight and nine fish having a smaller mean TL than age seven fish is probably a result of small sample size (Table 49). Although sample size of walleye greater than six years of age was small, the data suggests that decreasing growth with age compared to past years may be occurring in Lake Roosevelt (Table 76 and

Figure 15). Larger sample sizes are necessary to determine if decreased growth is actually occurring. Alternative aging structures should be used in the future to cross reference the aging performed by scale analysis.

2000 marked the second consecutive year that scale analysis was performed on species other than rainbow trout, kokanee salmon, and walleye. Sample sizes were small for most species and consistent growth patterns were not obvious for comparison with other systems or with other years in Lake Roosevelt. Other species included lake whitefish, mountain whitefish, brown trout, eastern brook trout, northern pikeminnow, smallmouth bass, largemouth bass, black crappie, and yellow perch. A greater number of scales from these species will have to be collected in future years in order to compare growth across years and with other lakes and reservoirs.

Table 74. Comparison of Salmonidae condition factors (C.F.) and standard deviation (SD) of fish collected at Lake Roosevelt, WA since 1997, and from other lakes and reservoirs in eastern Washington.

| Species and Location | n | C.F. (SD) | Species and Location | n | C.F. (SD) |
|---|---|---|---|---|---|
| Brown trout | | | Rainbow trout (hatchery) | | |
| FDR 97 | 19 | 1.06 (0.27) | FDR 97 | 50 | 1.30 (0.24) |
| FDR 98 | 5 | 1.15 (0.17) | FDR 98 | 154 | 1.39 (0.25) |
| FDR 99 | 20 | 1.14 (0.40) | FDR 99 | 59 | 1.13 (0.27) |
| FDR 00 | 4 | 1.09 (0.11) | FDR 00 | 132 | 1.13 (0.29) |
| Rock Lake, WA[1] | 593 | 0.89 (0.14) | Rock Lake, WA[1] | 266 | 0.98 (0.20) |
| Box Canyon Reservoir, WA[2] | | 0.90 | Sprague Lake, WA[3] | 86 | 1.14 (0.16) |
| | | | Deer Lake, WA[4] | | 1.07 (----) |
| Chinook | | | | | |
| FDR 97 | 3 | 0.85 (0.59) | Rainbow trout (wild) | | |
| FDR 98 | 1 | 1.05 (0.00) | FDR 97 | 31 | 1.16 (0.24) |
| FDR 99 | 2 | 0.85 (0.07) | FDR 98 | 50 | 1.25 (0.30) |
| FDR 00 | 1 | 0.61 | FDR 99 | 20 | 1.00 (0.25) |
| | | | FDR 00 | 26 | 0.98 (0.24) |
| Eastern brook trout | | | | | |
| FDR 97 | 7 | 1.38 (0.18) | Mountain whitefish | | |
| FDR 98 | 7 | 0.84 (0.11) | FDR 97 | 4 | 0.91 (0.14) |
| FDR 99 | 17 | 1.02 (0.26) | FDR 98 | 18 | 1.13 (0.20) |
| FDR 00 | 5 | 0.93 (0.14) | FDR 99 | 14 | 1.16 (0.33) |
| | | | FDR 00 | 60 | 1.07 (0.24) |
| Kokanee | | | | | |
| FDR 97 | 39 | 1.12 (0.34) | Lake whitefish | | |
| FDR 98 | 359 | 1.18 (0.15) | FDR 97 | 214 | 1.25 (0.20) |
| FDR 99 (hatchery) | 67 | 1.08 (0.26) | FDR 98 | 418 | 1.26 (0.27) |
| FDR 99 (wild) | 9 | 1.13 (0.19) | FDR 99 | 264 | 1.27 (0.23) |
| FDR 00 (hatchery) | 24 | 1.17 (0.24) | FDR 00 | 165 | 1.24 (0.94) |
| FDR 00 (wild) | 9 | 1.19 (0.39) | | | |

[1]McLellan 2000,
[2]Barber et al. 1990
[3]Taylor 2000
[4]Scholz et al. 1988

Table 75. Comparison of game fish and non-game fish condition factors (C.F.) and standard deviation (SD) of fish collected at Lake Roosevelt, WA since 1997, and from other lakes and reservoirs in eastern Washington.

| Game fish | n | C.F. (SD) | Non Game Fish | n | C.F. (SD) |
|---|---|---|---|---|---|
| Burbot | | | Northern pikeminnow | | |
| FDR 97 | 113 | 0.59 (0.12) | FDR 97 | 46 | 1.04 (0.29) |
| FDR 98 | 168 | 0.57 (0.16) | FDR 98 | 58 | 1.09 (0.21) |
| FDR 99 | 110 | 0.56 (0.12) | FDR 99 | 14 | 1.12 (0.29) |
| FDR 00 | 105 | 0.53 (0.14) | FDR 00 | 16 | 0.89 (0.17) |
| Smallmouth bass | | | Longnose sucker | | |
| FDR 97 | 66 | 1.53 (0.25) | FDR 97 | 39 | 1.20 (0.25) |
| FDR 98 | 239 | 1.54 (0.56) | FDR 98 | 75 | 1.28 (0.42) |
| FDR 99 | 99 | 1.34 (0.16) | FDR 99 | 80 | 1.29 (0.33) |
| FDR 00 | 142 | 1.39 (0.40) | FDR 00 | 94 | 1.25 (0.30) |
| Yellow perch | | | Largescale sucker | | |
| FDR 97 | 30 | 1.26 (0.21) | FDR 97 | 193 | 1.11 (0.17) |
| FDR 98 | 28 | 1.43 (0.25) | FDR 98 | 278 | 1.08 (0.20) |
| FDR 99 | 22 | 1.24 (0.22) | FDR 99 | 255 | 1.14 (0.18) |
| FDR 00 | 43 | 1.22 (0.53) | FDR 00 | 259 | 0.98 (0.21) |
| Walleye | | | Rock Lake[1] | 320 | 1.17 (0.26) |
| FDR 90 | 333 | 0.88 | Pend Oreille River, WA[2] | -- | 0.99 |
| FDR 97 | 554 | 0.87 (0.17) | | | |
| FDR 98 | 737 | 1.00 (0.22) | | | |
| FDR 99 | 388 | 0.81 (0.17) | | | |
| FDR 00 | 473 | 0.83 (0.21) | | | |
| Sprague Lake, WA[3] | 655 | 1.02 (0.47) | | | |
| Banks Lake, WA[4] | 319 | 0.89 (0.15) | | | |
| Moses Lake, WA[5] | 372 | 0.90 (0.15) | | | |

[1]McLellan 2000,
[2]Scholz et al. 1988
[3]Taylor 2000
[4] Polacek, M. WDFW 2002 unpublished data
[5] Burgess, D. WDFW 1999 unpublished data

Table 76. Comparison of walleye mean back-calculated total lengths (mm) at annulus formation between an average from 16 lakes and rivers in the United States and British Columbia (average) and Lake Roosevelt (FDR), WA.

| | | **Mean Total Length (mm) at Annulus Formation** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Location** | **n** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| Average[a] | | 177 | 280 | 368 | 431 | 483 | 530 | 554 | 548 | 675 | 675 | 728 | | |
| FDR, 1980-83[b] | 3,248 | 189 | 307 | 385 | 450 | 515 | 569 | 629 | 668 | 702 | 742 | 740 | 761 | 780 |
| FDR, 1988[a] | 369 | 204 | 273 | 348 | 410 | 470 | 532 | 590 | 635 | 688 | 689 | | | |
| FDR, 1989[b] | 467 | 210 | 282 | 351 | 418 | 493 | 571 | 603 | | | | | | |
| FDR, 1990[c] | 311 | 184 | 295 | 380 | 439 | 511 | 597 | 651 | 698 | 734 | | | | |
| FDR, 1995[d] | 360 | 121 | 224 | 315 | 380 | 444 | 481 | 539 | 556 | 611 | 695 | 726 | | |
| FDR, 1996[e] | 240 | 114 | 223 | 315 | 398 | 458 | 509 | 587 | | | | | | |
| FDR 1997[f] | 314 | 109 | 214 | 307 | 382 | 461 | 531 | 539 | 636 | 674 | 710 | | | |
| FDR 1998[g] | 301 | 129 | 222 | 303 | 392 | 472 | 541 | 609 | 648 | | | | | |
| *FDR, 1997[h]* | *2,355* | *172* | *279* | *363* | *424* | *478* | *535* | *617* | *662* | | | | | |
| *FDR, 1998[h]* | *302* | *179* | *290* | *364* | *427* | *481* | *530* | *576* | *616* | *667* | *717* | *748* | *801* | *829* |
| *FDR, 1999[h]* | *171* | *188* | *301* | *375* | *427* | *476* | *518* | *578* | *643* | | | | | |
| FDR, 1999[i] | 361 | 137 | 239 | 309 | 364 | 403 | | | | | | | | |
| **FDR, 2000[j]** | 354 | **129** | **221** | **287** | **330** | **368** | **444** | **497** | **464** | **494** | | | | |

[a]Peone et al. 1990
[b]Beckman et al. 1985
[c]Griffith and Scholz 1991
[d]Underwood et al. 1996b
[e]Cichosz et al. 1997
[f]Cichosz et al. 1999
[g]Spotts et al. 2002
[h]McLellan et al. 2002 (adjusted standard intercept of 55 mm used)
[i]McLellan et al. 2003
[j]Current Study 2003

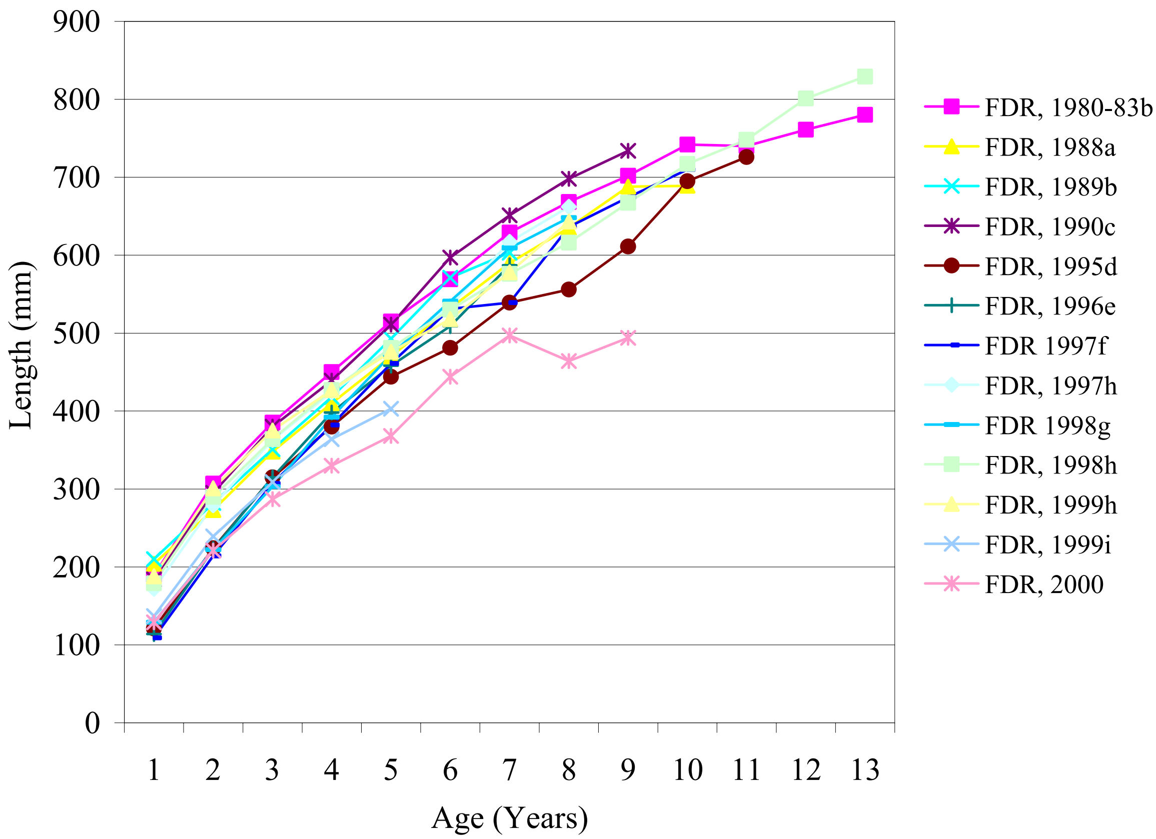


Figure 15. Length to age of walleye collected in Lake Roosevelt, WA (1980-2000).

**Diet**

Feeding habits of fish species in Lake Roosevelt in 2000 experienced few changes from previous years. Cladocerans have consistently made up a substantial portion of the prey items in the diets of species of fish in the reservoir sinced 1997. Cladocera, Osteichthyes and Diptera, were the most common diet items among fish species in the reservoir.

There has been virtually no change in the food preference of kokanee salmon and rainbow trout since studies began in Lake Roosevelt. Cladocera remain the most important item in the diet of both species, with $R_{ia}$ values of 90.6 and 61.7, respectively, resulting in the high diet overlap of kokanee salmon and rainbow trout (0.78; Table 52). Cladocera were also a primary food item of lake whitefish ($R_{ia}$ = 85.7), which is reflected in their diet overlap with kokanee salmon and rainbow trout (0.99 and 0.79, respectively). The importance of Cladocera as a food item for these species has been indicated in previous studies (Simpson and Wallace 1982; Wydoski and Whitney 1979; Carlander, 1969).

Burbot, smallmouth bass, and walleye were the most piscivorous species analyzed, with $R_{ia}$ values of 64.1, 54.6, and 52.7, respectively. Percidae were once again found in the diet of these species in 2000, after being absent in 1999. Since walleye are the most abundant piscivore, their impact on prey species is likely greatest, despite the higher relative importance of Osteichthyes in the diets of burbot and smallmouth bass. It is known that walleye are opportunistic feeders, even somewhat cannibalistic, and therefore changes in their diet may reflect changes in the species composition of the reservoir (Carlander, 1999; McLellan et al 2003). Yellow perch were once a primary food source for the walleye, but their numbers have declined over the years, most likely due to predation piscivorous species in Lake Roosevelt (Spotts, et al. 1998; Carlander, 1999). Additionally, walleye are capitalizing on kokanee salmon and rainbow trout stocking, which is reflected in their salmonid $R_{ia}$ value of 23.96 (Table 77). Unlike the previous year, burbot were not found in the diet of walleye in 2000. The $R_{ia}$ of Cottidae increased substantially in the diet of smallmouth bass, from 10.2 in 1999 to 27.0 in 2000. The $R_{ia}$ of Cottidae also increased in the diet of burbotin 2000, from 10.1 to 18.4.

High diet overlap was found between longnose and largescale suckers (0.80) and between black crappie and yellow perch (0.82). All four of these species relied Cladocera as the main component of their diets (Appendix B).

Table 77. Relative importance values of fish prey items in the diet of walleye collected in Lake Roosevelt, WA (1997-2000).

| Species | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|
| Catostomidae | - | 1.43 | 1.17 | 3.25 | 11.49 | 3.33 | 0.35 | 0.24 |
| Centrarchidae | - | - | - | - | 2.34 | 0.39 | 0.24 | 0.23 |
| Cottidae | 9.22 | 8.00 | 15.62 | 11.68 | 11.84 | 13.47 | 16.56 | 10.07 |
| Cyprinidae | 2.23 | - | 4.02 | 1.94 | 13.48 | 3.04 | 2.01 | 0.27 |
| Gadidae | - | - | - | - | - | - | 0.25 | - |
| Percidae | 7.99 | 11.02 | 16.40 | 5.35 | 3.07 | 8.59 | - | 1.67 |
| Salmonidae | 7.77 | 9.24 | 11.19 | 28.31 | - | 9.85 | 17.94 | 23.96 |
| Unidentified | 18.74 | 18.98 | 18.98 | 26.63 | 24.64 | 12.92 | 15.45 | 16.25 |

### Tagging Studies

Tagging studies have been conducted on rainbow trout in Lake Roosevelt since 1988 in an attempt to gather information on movement within the reservoir and entrainment. In 2000, a total of 39,188 rainbow trout were tagged and released from Kettle Falls and Seven Bays to evaluate entrainment as a component of fish loss, movement within the reservoir, and stock performance (Table 78). The pecent of tags recovered in 2000 was similar to those recovered the previous year (1.08 and 1.06, respectively). There were a total of 323 tags recovered, most of which (n = 240) originated from fish released during 2000 (Table 53 and Table 79). The majority of fish tags recovered at Seven Bays (n = 148) were from fish that had been tagged and released at Seven Bays (n = 120; Table 54). Although the highest percentage (28%) of Phalon Lake stock rainbow trout tags were recovered at Kettle Falls, tags from this stock were also recovered throughout Lake Roosevelt, as well as below Grand Coulee Dam (Table 54). These findings were inconsistent with 1999, in which Phalon Lake stock rainbow trout tags were not found outside the area of Kettle Falls. Of the Spokane stock rainbow trout released, 48.6 percent were recovered downstream from the release location (Table 54). This may be attributed, in part, to higher densities of zooplankton in the lower reservoir (McLellan et al., 2003). In previous years, entrainment has been negatively correlated to water residence time in Lake Roosevelt (Cichosz et al. 1999). In years that have experienced low mean water residence times (<30 days) for extended periods of time, including 1990, 1991, 1996, 1997, and 1999, tag recoveries below Grand Coulee Dam were elevated (13.6-96.7 %; Figure 16). During normal water years, such as 2000, tag recoveries from below Grand Coulee Dam have been relatively low (1.7-10.2 %; McLellan et al., 2003).

The mean number of days between tag date and capture of Spokane stock rainbow trout from Kettle Falls and Seven Bays did not vary substantially in 2000 (265.6 ± SD 179.7 and 227.5 ± SD 147.2, respectively; Table 55). The mean number of days these fish remained in the fishery had declined from 1999, in which Spokane stock rainbow trout from Kettle falls resided in the fishery for an average of 321.4 (± SD 84.4) days, and those from Seven Bays for an average of 310.8 (± SD 186.3) days. Phalon Lake stock rainbow trout were in the fishery was for considerably less time, averaging 183.3 (± SD 94.2) days. However this number increased substantially from 1999, in which the fish spent an average of 65.7 (± SD 22.7) days in the reservoir before recruiting to the creel. (Table 55).

Slower growth of fish released at Kettle Falls would be expected due to reduced densities of zooplankton, the main diet item of rainbow trout, in the upper reservoir, compared to the lower reservoir (McLellan et al. 2003). Spokane stock rainbow trout released at Kettle Falls had similar growth in total length to Spokane stock rainbow trout released at Seven Bays, however the growth in weight was much lower for fish released at Kettle Falls. Phalon Lake stock rainbow trout had higher growth rates in total length than both release groups of Spokane stock rainbow trout. Phalon Lake stock rainbow trout had greater growth in weight than Spokane stock rainbow trout released at Kettle Falls. Phalon Lake stock rainbow trout may possess a more slender body shape than the coastal strain and may be more adapted to the semi-lotic environment of the upper reservoir. This may account for the greater growth Phalon Lake stock rainbow trout compared to Spokane stock rainbow trout released. Phalon Lake stock rainbow trout, on average, recruited to the creel sooner than Spokane Stock rainbow trout, which could influence the growth rates (Table 55). Fish released at Seven Bays experience higher densities of zooplankton, possibly accounting for the high growth in weight.

Table 78. Number of marked hatchery rainbow trout and kokanee salmon released into Lake Roosevelt, WA (1996-2000).

| **Release Location** | **Year Released** | | | | |
|---|---|---|---|---|---|
| | **1996** | **1997** | **1998** | **1999** | **2000** |
| **Kettle Falls** | | | | | |
| Rainbow trout (Spokane stock) | 4,998 | 10,000 | 9,992 | 9,977 | 9,999 |
| Rainbow trout (Phalon Lake stock) | 0 | 0 | 0 | 9,142 | 9,995 |
| Kokanee (Lake Whatcom stock) | 0 | 0 | 0 | 9,621 | 0 |
| **Seven Bays** | | | | | |
| Rainbow trout (Spokane stock) | 9,950 | 10,000 | 9,989 | 9,995 | 9,968 |
| Rainbow trout (triploids) | 0 | 0 | 0 | 0 | 9,226 |
| **Totals** | **14,948** | **20,000** | **19,981** | **38,735** | **39,188** |

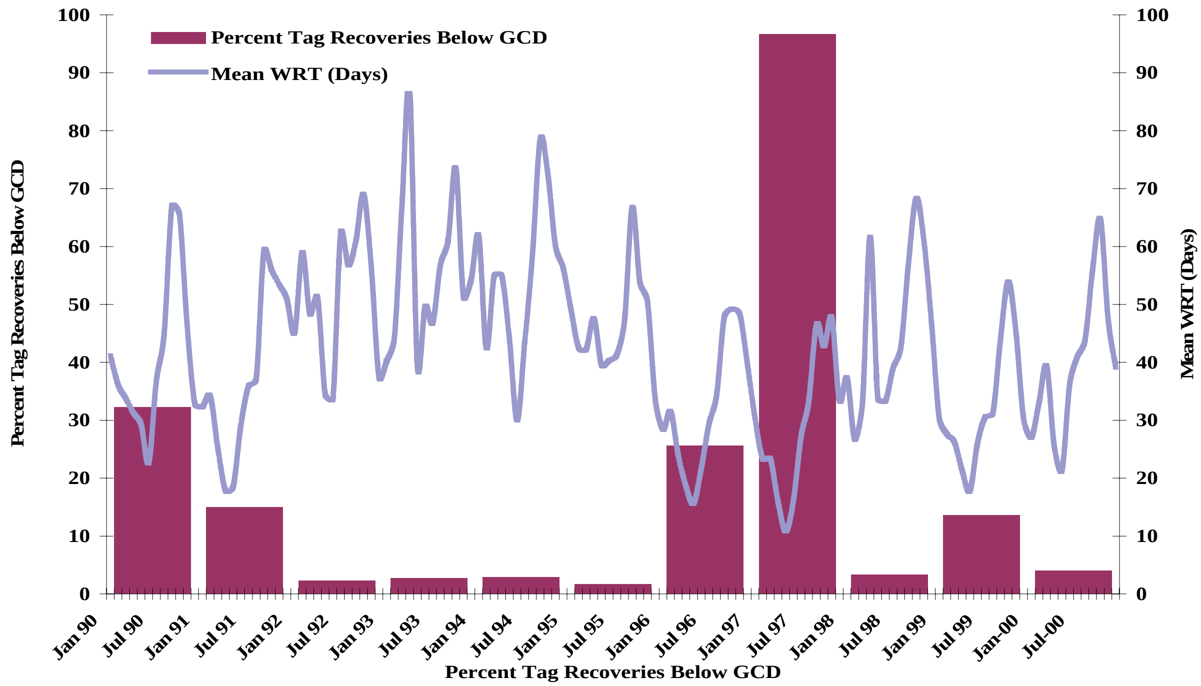


Figure 16. Percent tag recoveries collected below Grand Coulee Dam compared to monthly mean water residence time in Lake Roosevelt, WA (1990-2000).

Table 79. Number of rainbow trout tagged by year and tag returns by release year in Lake Roosevelt, WA and below Grand Coulee Dam (GCD). Parentheses denote tags recovered below GCD.

| **Release Year** | **No.Fish Tagged** | **Release Year Tag Recoveries** | **+1 Year** | **+2 Year** | **+3 Year** | **+4 Year** | **+5 Year** | **Tags Returned** | **Tag Recovery Rate (%)** | **Tag Recovery Below GCD (%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1988 | 1,171 | 77 (0) | 16 (0) | 1 (0) | | | | 94 (0) | 8.03 | 0 |
| 1989 | 1,753 | 15 (2) | 28 (2) | 1 (0) | 3 (0) | | 2 (1) | 49 (5) | 2.80 | 10.2 |
| 1990 | 4,361 | 72 (21) | 19 (8) | 3 (0) | 1 (1) | 1 (1) | | 96 (31) | 2.20 | 32.29 |
| 1991 | 4,345 | 205 (32) | 45 (4) | 2 (1) | 1 (1) | | | 253 (38) | 5.82 | 15.02 |
| 1992 | 20,997 | 509 (12) | 10 (0) | | | | | 519 (12) | 2.47 | 2.31 |
| 1993 | 21,261 | 108 (2) | 34 (2) | 3 (0) | | | | 145 (4) | 0.68 | 2.76 |
| 1994 | 26,975 | 307 (8) | 64 (3) | 3 (0) | 1 (0) | | | 375 (11) | 1.39 | 2.93 |
| 1995 | 12,984 | 104 (1) | 12 (1) | 4 (0) | | | | 120 (2) | 0.92 | 1.67 |
| 1996 | 14,948 | 202 (55) | 40 (7) | | | | | 242 (62) | 1.62 | 25.62 |
| 1997 | 20,000 | 151 (146) | | | | | | 151 (146) | 0.75 | 96.69 |
| 1998 | 19,981 | 601 (19) | | | | | 7 (2) | 629 (21) | 3.15 | 3.34 |
| 1999 | 29,114 | 82 (14) | 220 (26) | 1 (1) | 6 (1) | | | 309 (42) | 1.06 | 13.59 |
| 2000 | 29,962 | 240 (3) | 65 (10) | 18 | | | | 323 (13) | 1.08 | 11.71 |
| **Totals** | **207,852** | **2,673(315)** | **553(63)** | **36(2)** | **12(3)** | **1(1)** | **9(3)** | **3,305(387)** | **1.59** | **11.71** |

## Creel

Creel surveys in 2000 were conducted for 9 months on all sections of Lake Roosevelt. Therefore, the pressure, harvest, and economic value estimates are not based on 12 months, as in years prior to 1999. The economic value of the Lake Roosevelt fishery was calculated using an adjusted rate from the most recent U.S Fish and Wildlife Service report (U.S. Fish and Wildlife Service 1998). When adjusted for inflation, we estimate that anglers spent an average of $27.44 per trip. This method was also used to estimate the economic value of the Lake Roosevelt fishery for 1999 (McLellan et al. 2003). Prior to that, economic value was calculated using an adjusted rate from the 1985 Annual Report (Spotts et al. 2002), which after adjusting for inflation had the estimated cost per trip as high as $40.68 in 1998. This inflated cost per trip may have overestimated the economic value of the Lake Roosevelt fishery in past years. The estimated number of angler trips in 2000 was the second lowest (170,930) since 1990 (Table 80 and Figure 14). The reduced cost per trip and the low number of angler trips resulted in the lowest estimated economic value of the Lake Roosevelt Fishery ($4.7 million) since 1990 (Table 80). The creel was reduced to nine months in 1999 and pressure estimates were not calculated for months that were not creeled. The reduced creel effort accounts for some of the reduction in angler trips and economic value of the fishery. Although the cost per trip value used in the current report utilizes estimates from the most current survey available, this is likely an underestimate because of the unique properties of the Lake Roosevelt fishery.

Lake Roosevelt has developed into a destination fishery, with people traveling great distances to angle the vast waters of the blocked area. The majority of anglers on Lake Roosevelt originated from Spokane (41.9%), Stevens (16.7%), Lincoln (11.6), and Grant (11.0%) counties (Table 69). Additionally, 3.0% of anglers originated from western Washington and 1.4% of anglers were interstate travelers (Table 69).

The number of fish harvested from Lake Roosevelt has varied widely over the past ten years (Table 80 and Figure 14). Kokanee harvest (12,129) in 2000 was the highest since its peak in (32,353) in 1995, after rebounding from a low (588) in 1997 (Table 80; Figure 14). Rainbow trout harvest made a comeback in 1998 from a low (588) in 1997 (Table 80). However, harvest steadily declined from 1998 (226,809) to 2000 (104,164) (Table 80 and Figure 14). Walleye harvest in 2000 (62,680) was the lowest since 1990 (Table 80; Figure 14). The reduced harvest is probably closely related to the decrease in angler trips to Lake Roosevelt. The mean length of kokanee salmon, rainbow trout and walleye increased compared to 1999, however these increases were minimal, except for kokanee in which mean lengths from 1999 were based on few (n = 3) fish (McLellan et al. 2003).

A supplementary creel was performed on Section 2 during August, September and October, 2000 to validate the current creel efforts in that section. Over the same three months, the estimated pressure was lower for the supplementary creel (105,531 ± SD 6,275) than during the normal creel (135,076 ± 9,763), however, pressure was greater during September (52,801 ± 3,497) and October (17,771 ± SD 1,141) for the supplementary creel than during the same months in the normal creel for Section 2 (17,720 ± SD 1,328 and 14,732 ± SD 1,158, respectively) (Appendix B, Table 107). The estimated number of angler trips was lower for the supplementary creel (16,152) than for the normal creel (26,681) over the same time period (Appendix B; Table 109). HPUE across all species was also lower for the supplemental creel (0.128 fish/angler hour) than the normal creel (0.153 fish/angler hour). However, HPUE for rainbow trout was greater in the supplemental creel (0.113 fish/angler hour) than the normal creel (0.073 fish/angler hr) during the same months (Appendix B, Table 103 and Table 105). The higher HPUE of walleye in the normal creel is the result of anglers targeting walleye more in the spring and summer in Section 2. The number of actual hours fished was nearly four times greater during the supplementary creel than for the same time period during the normal creel. This indicates there is a potential to encounter more anglers that have completed their trip later in the day, which in turn may increase the estimated harvest.

Table 80. Economic value of the Lake Roosevelt fishery, estimated number of angler trips, number of fish caught, and number of fish harvested (1999-2000).

| Year of Record | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Economic Value Million/Dollars** | $5.30 | $12.80 | $9.70 | $20.70 | $19.20 | $8.70 | $6.90 | $5.80 | $8.00 | $6.12 | $4.66 |
| **Angler Trips** | 171,725 | 398,408 | 291,380 | 594,508 | 469,998 | 232,202 | 176,769 | 146,264 | 196,775 | 230,513 | 170,930 |
| **No. Fish Caught** | | | | | | | | | | | |
| Kokanee salmon | 17,756 | 31,651 | 8,146 | 13,986 | 16,567 | 32,353 | 1,265 | 588 | 10,188 | 1,730 | 16,815 |
| Rainbow trout | 81,560 | 81,529 | 167,156 | 402,277 | 499,460 | 125,958 | 76,915 | 5,356 | 233,036 | 232,019 | 117,210 |
| Walleye | 116,473 | 231,813 | 163,995 | 337,413 | 123,612 | 73,667 | 142,873 | 147,316 | 133,241 | 236,738 | 62,680 |
| **No. Fish Harvested** | | | | | | | | | | | |
| Kokanee salmon | 17,403 | 31,651 | 8,021 | 13,960 | 16,567 | 32,353 | 1,265 | 588 | 9,980 | 1,730 | 12,129 |
| Rainbow trout | 79,683 | 73,777 | 140,609 | 398,943 | 499,293 | 122,939 | 76,782 | 5,356 | 226,809 | 197,115 | 104,164 |
| Walleye | 82,284 | 168,736 | 118,863 | 307,663 | 53,589 | 40,185 | 104,055 | 87,515 | 119,346 | 188,290 | 39,963 |

## Recommendations

Lake Roosevelt is a dynamic system complicated by large reservoir drawdowns that reduce pelagic and benthic food resources, reduce water retention times, and entrain fish species. This, coupled with non-native piscivorous predators that prey heavily on hatchery reared rainbow trout and kokanee salmon make managing the fishery a challenging task.

The following recommendations will address the most urgent limiting factors influencing fish production and ecosystem attributes, within the context of multiple water uses.

### Limnology

1. Continue to work with stakeholders to maximize benefits of hydro-operations while minimizing detrimental effects to the Lake Roosevelt ecosystem
2. Maintain current zooplankton and water quality sampling locations and intensity to better relate the effects of reservoir operations on zooplankton production.
3. Examine the influence macronutrients (nitrogen and phosphorus) in the reservoir have on algal primary production and trophic state.
4. Investigate differences in zooplankton and water quality between littoral and pelagic areas of the reservoir.
5. Compare multiple year zooplankton lengths to assess food limitation and predation stress.
6. Assess macroinvertebrate abundance as related to habitat type.

### Fishery

1. Monitor and evaluate the artificial production program with respect to: entrainment, fish culture, stocking strategies, and stock utilization.
2. Continue a reservoir wide creel survey to estimate angler pressure, harvest, and the economic value of the Lake Roosevelt fishery.
3. Continue standardized fishery surveys to assess long-term changes in the Lake Roosevelt fishery including collecting information on relative abundance, feeding habits, age, growth, and angler harvest.
4. Floy tag 40,000 hatchery reared rainbow trout to evaluate the success of the net pen raised fish.
5. Continue monitoring hatchery reared kokanee adult returns to stocking locations through paired release studies.

6. Assess predation, primarily walleye, as a limiting factor to the artificial production program.
7. Examine habitat utilization by fishes.

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# Appendices

## Appendix A.

Table 81. Phytoplankton taxa list, relative density, and relative biovolume from all locations on Lake Roosevelt, WA (January and March 2001).

| **Division** | **Class** | *Species* | **% of Total Den.** | **% of Total Biovol.** |
|---|---|---|---|---|
| **Chlorophyta** | | | | |
| | **Chlorophyceae** | | **17.6** | **9.8** |
| | | *Ankistrodesmus falcatus* | 1.0 | 0.3 |
| | | *Chlamydomonas sp.* | 12.9 | 7.0 |
| | | *Eudorina elegans* | 3.1 | 2.1 |
| | | *Raciborskiella sp.* | 0.3 | 0.4 |
| | | *Scenedesmus bijuga* | 0.3 | 0.1 |
| | | *Scenedesmus quadricauda* | 0.1 | 0.0 |
| **Chrysophyta** | | | | |
| | **Bacillariophyceae** | | **32.1** | **61.6** |
| | | *Achnanthes sp.* | 0.0 | 0.0 |
| | | *Amphora sp.* | 0.0 | 0.1 |
| | | *Asterionella formosa* | 21.4 | 41.8 |
| | | *Cocconeis sp.* | 0.0 | 0.1 |
| | | *Cyclotella sp.* | 0.5 | 3.1 |
| | | *Fragilaria crotonensis* | 1.3 | 2.9 |
| | | *Fragilaria sp.* | 1.5 | 0.9 |
| | | *Gomphonema sp.* | 0.8 | 0.2 |
| | | *Melosira distans* | 0.3 | 0.7 |
| | | *Melosira italica* | 0.9 | 3.2 |
| | | *Melosira varians* | 0.4 | 5.3 |
| | | *Navicula sp.* | 0.0 | 0.1 |
| | | *Rhizosolenia sp.* | 0.8 | 2.3 |
| | | *Synedra sp.* | 4.2 | 0.9 |
| **Chrysophyta** | | | | |
| | **Chrysophyceae** | | **2.8** | **4.3** |
| | | *Dinobryon sertularia* | 2.4 | 2.1 |
| | | *Mallomonas sp.* | 0.3 | 2.3 |
| **Cryptophyta** | | | | |
| | **Cryptophyceae** | | **22.4** | **16.3** |
| | | *Cryptomonas sp.* | 1.6 | 6.3 |
| | | *Rhodomonas sp.* | 20.7 | 10.0 |
| **Cyanophyta** | | | | |
| | **Cyanophyceae** | | **7.5** | **4.5** |
| | | *Gloeocapsa sp.* | 1.4 | 0.8 |
| | | *Oscillatoria sp.* | 6.1 | 3.7 |
| | | **Microplankton** | **17.7** | **3.3** |

Table 82. Mean, standard deviation (SD), number (n), minimum and maximum pelagic zooplankton densities (organisms/$m^3$) for all locations, Lake Roosevelt, WA (2000).

| Grouping | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| Jan | 70 | 233 | 193 | 0 | 2,099 |
| Feb | 103 | 296 | 198 | 0 | 2,346 |
| Mar | 134 | 456 | 198 | 0 | 3,704 |
| Apr | 234 | 553 | 198 | 0 | 3,599 |
| May | 1,205 | 2,664 | 294 | 0 | 20,619 |
| Jun | 1,437 | 3,797 | 282 | 0 | 34,077 |
| Jul | 2,227 | 5,624 | 288 | 0 | 47,411 |
| Aug | 1,816 | 3,645 | 288 | 0 | 26,792 |
| Sep | 1,124 | 1,770 | 288 | 0 | 8,149 |
| Oct | 895 | 1,567 | 288 | 0 | 11,112 |
| Nov | 1,099 | 2,037 | 108 | 0 | 11,235 |
| Dec | 322 | 828 | 180 | 0 | 4,939 |
| **Overall Copepoda** | **995** | **2,846** | **2,803** | **0** | **47,411** |
| Jan | 12 | 87 | 192 | 0 | 1,049 |
| Feb | 23 | 202 | 198 | 0 | 2,469 |
| Mar | 13 | 111 | 198 | 0 | 1,111 |
| Apr | 4 | 21 | 198 | 0 | 189 |
| May | 142 | 1,106 | 294 | 0 | 14,569 |
| Jun | 73 | 455 | 282 | 0 | 5,186 |
| Jul | 257 | 723 | 288 | 0 | 6,667 |
| Aug | 283 | 730 | 288 | 0 | 7,655 |
| Sep | 216 | 727 | 288 | 0 | 6,420 |
| Oct | 143 | 533 | 288 | 0 | 5,062 |
| Nov | 269 | 1,108 | 108 | 0 | 9,383 |
| Dec | 213 | 1,053 | 180 | 0 | 9,754 |
| **Overall *Daphnia*** | **142** | **687** | **2,802** | **0** | **14,569** |
| Jan | 1 | 7 | 352 | 0 | 123 |
| Feb | 0 | 7 | 363 | 0 | 123 |
| Mar | 2 | 18 | 363 | 0 | 247 |
| Apr | 0 | 4 | 363 | 0 | 51 |
| May | 7 | 47 | 539 | 0 | 741 |
| Jun | 20 | 171 | 517 | 0 | 2,603 |
| Jul | 17 | 72 | 528 | 0 | 741 |
| Aug | 42 | 199 | 528 | 0 | 2,346 |
| Sep | 8 | 38 | 528 | 0 | 370 |
| Oct | 11 | 53 | 528 | 0 | 710 |
| Nov | 17 | 90 | 198 | 0 | 864 |
| Dec | 2 | 12 | 330 | 0 | 123 |
| **Overall Other Cladocera** | **12** | **93** | **5,137** | **0** | **2,603** |
| **Overall Zooplankton** | **302** | **1,553** | **10,742** | **0** | **47,411** |

Table 83. Mean, standard deviation (SD), number (n), minimum and maximum pelagic zooplankton biomass (µg/m$^3$) for all locations, Lake Roosevelt, WA (2000).

| Grouping | Mean | SD | n | Min | Max |
|---|---|---|---|---|---|
| Jan | 55 | 237 | 193 | 0 | 2,280 |
| Feb | 193 | 894 | 198 | 0 | 7,970 |
| Mar | 139 | 534 | 198 | 0 | 5,113 |
| Apr | 151 | 326 | 198 | 0 | 2,276 |
| May | 1,391 | 3,932 | 294 | 0 | 37,644 |
| Jun | 1,616 | 4,429 | 282 | 0 | 34,195 |
| Jul | 2,874 | 7,553 | 288 | 0 | 57,625 |
| Aug | 2,924 | 6,409 | 288 | 0 | 72,222 |
| Sep | 2,507 | 5,665 | 288 | 0 | 31,582 |
| Oct | 2,527 | 7,034 | 288 | 0 | 50,800 |
| Nov | 2,448 | 7,770 | 108 | 0 | 55,660 |
| Dec | 918 | 3,279 | 180 | 0 | 22,167 |
| **Overall Copepoda** | **1,613** | **5,124** | **2,803** | **0** | **72,222** |
| Jan | 150 | 1,532 | 192 | 0 | 21,037 |
| Feb | 287 | 2,583 | 198 | 0 | 32,438 |
| Mar | 117 | 970 | 198 | 0 | 10,371 |
| Apr | 27 | 199 | 198 | 0 | 2,287 |
| May | 2,198 | 17,487 | 294 | 0 | 221,129 |
| Jun | 1,068 | 8,702 | 282 | 0 | 128,642 |
| Jul | 4,445 | 17,617 | 288 | 0 | 167,469 |
| Aug | 7,052 | 26,200 | 288 | 0 | 307,591 |
| Sep | 4,880 | 18,461 | 288 | 0 | 176,332 |
| Oct | 2,168 | 8,931 | 288 | 0 | 91,467 |
| Nov | 6,048 | 28,498 | 108 | 0 | 229,059 |
| Dec | 3,957 | 18,575 | 180 | 0 | 127,086 |
| **Overall *Daphnia*** | **2,773** | **15,621** | **2,802** | **0** | **307,591** |
| Jan | 1 | 7 | 352 | 0 | 128 |
| Feb | 1 | 12 | 363 | 0 | 218 |
| Mar | 2 | 28 | 363 | 0 | 457 |
| Apr | 1 | 5 | 363 | 0 | 80 |
| May | 12 | 87 | 539 | 0 | 1,466 |
| Jun | 25 | 178 | 517 | 0 | 2,638 |
| Jul | 62 | 797 | 528 | 0 | 18,044 |
| Aug | 191 | 1,517 | 528 | 0 | 22,763 |
| Sep | 45 | 375 | 528 | 0 | 6,100 |
| Oct | 28 | 275 | 528 | 0 | 6,100 |
| Nov | 27 | 128 | 198 | 0 | 1,321 |
| Dec | 5 | 22 | 330 | 0 | 191 |
| **Overall Other Cladocera** | **39** | **575** | **5,137** | **0** | **22,763** |
| **Overall Zooplankton** | **1,163** | **8,484** | **10,742** | **0** | **307,591** |

Table 84. Mean Copepoda density (organisms/$m^3$) across locations in Lake Roosevelt, WA (2000).

| Location Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evans Landing | 25 | 22 | 19 | 289 | 192 | 430 | 659 | 390 | 12 | 15 | | 15 | **188** |
| Gifford | 17 | 32 | 28 | 256 | 562 | 357 | 466 | 499 | 235 | 58 | 46 | 42 | **253** |
| Hunters | 25 | 35 | 51 | 236 | 1,181 | 480 | 460 | 972 | 1,276 | 91 | | 45 | **441** |
| Keller Ferry | 30 | 90 | 41 | 209 | 2,219 | 665 | 1,684 | 2,075 | 1,427 | 1,588 | | 156 | **926** |
| Kettle Falls | 9 | 18 | 17 | 277 | 330 | 174 | 480 | 238 | 29 | 24 | | 18 | **147** |
| Porcupine Bay | 178 | 95 | 374 | 619 | 979 | 1,291 | 1,596 | 2,284 | 1,219 | 1,032 | 1,320 | 926 | **1,147** |
| Sanpoil R | 345 | 610 | 672 | 23 | 2,056 | 3,759 | 5,933 | 3,419 | 1,442 | 2,193 | 1,104 | 308 | **2,259** |
| Sanpoil R Confluence | 35 | 83 | 69 | 158 | 765 | 1,475 | 2,070 | 1,826 | 1,763 | 865 | 2,723 | 86 | **1,143** |
| Seven Bays | 36 | 42 | 51 | 259 | 1,254 | 1,103 | 953 | 1,383 | 1,446 | 1,426 | 622 | 120 | **903** |
| Spokane R Confluence | 30 | 42 | 91 | 146 | 2,360 | | | | | | | | **534** |
| Spring Canyon | 75 | 65 | 63 | 105 | 1,276 | 2,640 | 5,158 | 3,279 | 1,519 | 731 | 776 | 1,502 | **1,766** |
| **Overall** | **70** | **103** | **134** | **234** | **1,205** | **1,437** | **2,227** | **1,816** | **1,124** | **895** | **1,099** | **322** | **995** |

Table 85. Mean Copepoda biomass (μg/$m^3$) across locations in Lake Roosevelt, WA (2000).

| Location Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evans Landing | 18 | 25 | 13 | 247 | 10 | 77 | 74 | 358 | 17 | 11 | | 13 | **78** |
| Gifford | 5 | 26 | 19 | 77 | 183 | 87 | 288 | 865 | 189 | 91 | 18 | 18 | **198** |
| Hunters | 10 | 26 | 38 | 134 | 311 | 68 | 329 | 1,121 | 4,738 | 442 | | 19 | **658** |
| Keller Ferry | 24 | 66 | 57 | 197 | 1,699 | 1,009 | 3,396 | 2,312 | 1,516 | 4,524 | | 234 | **1,367** |
| Kettle Falls | 1 | 15 | 27 | 275 | 128 | 13 | 103 | 306 | 53 | 14 | | 11 | **86** |
| Porcupine Bay | 20 | 24 | 93 | 274 | 795 | 1,558 | 2,100 | 5,081 | 2,054 | 2,217 | 2,504 | 3,253 | **1,912** |
| Sanpoil R | 398 | 1,704 | 1,023 | 22 | 5,319 | 3,506 | 7,674 | 5,571 | 2,296 | 7,228 | 1,115 | 341 | **3,766** |
| Sanpoil R Confluence | 18 | 81 | 76 | 165 | 628 | 2,540 | 3,111 | 2,036 | 4,637 | 1,609 | 6,768 | 209 | **2,015** |
| Seven Bays | 21 | 52 | 19 | 95 | 733 | 1,055 | 1,724 | 2,211 | 3,804 | 4,455 | 3,396 | 135 | **1,760** |
| Spokane R Confluence | 11 | 25 | 36 | 108 | 1,619 | | | | | | | | **360** |
| Spring Canyon | 67 | 81 | 129 | 63 | 1,879 | 3,757 | 6,144 | 5,576 | 3,911 | 2,120 | 890 | 4,942 | **2,941** |
| **Overall** | **55** | **193** | **139** | **151** | **1,391** | **1,616** | **2,874** | **2,924** | **2,507** | **2,527** | **2,448** | **918** | **1,613** |

Table 86. Mean *Daphnia* density (organisms/m$^3$) across locations in Lake Roosevelt, WA (2000).

| Location Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evans Landing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 | 1 | 0 | | 0 | **6** |
| Gifford | 0 | 0 | 0 | 0 | 1 | 0 | 45 | 72 | 161 | 38 | 6 | 1 | **37** |
| Hunters | 0 | 0 | 0 | 3 | 0 | 0 | 65 | 147 | 364 | 152 | | 2 | **67** |
| Keller Ferry | 3 | 0 | 1 | 9 | 10 | 14 | 206 | 154 | 14 | 31 | | 87 | **48** |
| Kettle Falls | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 20 | 3 | 4 | | 0 | **3** |
| Porcupine Bay | 0 | 0 | 0 | 0 | 1 | 46 | 220 | 610 | 230 | 467 | 442 | 477 | **230** |
| Sanpoil R | 116 | 250 | 144 | 26 | 1,116 | 422 | 737 | 432 | 139 | 286 | 9 | 15 | **379** |
| Sanpoil R Confluence | 1 | 1 | 1 | 0 | 2 | 49 | 288 | 285 | 600 | 33 | 271 | 219 | **169** |
| Seven Bays | 1 | 0 | 0 | 0 | 2 | 28 | 118 | 255 | 223 | 117 | 876 | 49 | **134** |
| Spokane R Confluence | 1 | 0 | 1 | 2 | 3 | | | | | | | | **1** |
| Spring Canyon | 10 | 3 | 1 | 3 | 31 | 29 | 508 | 422 | 185 | 111 | 7 | 1,276 | **215** |
| **Overall** | **12** | **23** | **13** | **4** | **142** | **73** | **257** | **283** | **216** | **143** | **269** | **213** | **142** |

Table 87. Mean *Daphnia* biomass ($\mu g/m^3$) across locations in Lake Roosevelt, WA (2000).

| Location Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evans Landing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 471 | 17 | 1 | | 1 | **44** |
| Gifford | 0 | 0 | 0 | 1 | 28 | 0 | 172 | 870 | 2,153 | 209 | 44 | 12 | **398** |
| Hunters | 0 | 0 | 0 | 5 | 0 | 0 | 242 | 1,470 | 6,848 | 1,424 | | 22 | **910** |
| Keller Ferry | 17 | 1 | 5 | 37 | 164 | 27 | 1,424 | 1,543 | 568 | 316 | | 1,560 | **515** |
| Kettle Falls | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 134 | 77 | 21 | | 0 | **22** |
| Porcupine Bay | 0 | 1 | 1 | 0 | 0 | 465 | 2,892 | 21,537 | 5,375 | 8,180 | 10,170 | 15,858 | **5,826** |
| Sanpoil R | 1,440 | 3,111 | 1,266 | 248 | 17,381 | 6,768 | 17,057 | 12,762 | 3,326 | 4,103 | 204 | 180 | **7,180** |
| Sanpoil R Confluence | 7 | 21 | 5 | 0 | 25 | 823 | 3,403 | 4,678 | 14,741 | 544 | 3,106 | 2,399 | **3,039** |
| Seven Bays | 19 | 0 | 0 | 0 | 1 | 108 | 1,946 | 2,859 | 4,956 | 2,083 | 22,722 | 1,189 | **2,658** |
| Spokane R Confluence | 1 | 0 | 4 | 2 | 4 | | | | | | | | **2** |
| Spring Canyon | 116 | 21 | 6 | 7 | 445 | 328 | 9,256 | 11,905 | 4,738 | 1,344 | 44 | 18,348 | **4,143** |
| **Overall** | **150** | **287** | **117** | **27** | **2,198** | **1,068** | **4,445** | **7,052** | **4,880** | **2,168** | **6,048** | **3,957** | **2,773** |

Table 88. Mean other Cladocera density (organisms/m$^3$) across locations in Lake Roosevelt, WA (2000).

| Location Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evans Landing | 1 | 0 | 0 | 2 | 0 | 6 | 4 | 54 | 1 | 2 | | 2 | **6** |
| Gifford | 0 | 0 | 0 | 0 | 2 | 3 | 7 | 46 | 3 | 7 | 4 | 1 | **8** |
| Hunters | 0 | 0 | 0 | 1 | 0 | 3 | 9 | 165 | 15 | 53 | | 1 | **22** |
| Keller Ferry | 0 | 0 | 0 | 1 | 4 | 15 | 9 | 34 | 2 | 8 | | 4 | **7** |
| Kettle Falls | 0 | 0 | 0 | 1 | 3 | 2 | 11 | 37 | 1 | 4 | | 1 | **5** |
| Porcupine Bay | 2 | 1 | 1 | 0 | 3 | 108 | 28 | 0 | 20 | 2 | 2 | 6 | **19** |
| Sanpoil R | 4 | 4 | 15 | 0 | 36 | 7 | 28 | 22 | 10 | 6 | 5 | 1 | **14** |
| Sanpoil R Confluence | 0 | 0 | 0 | 0 | 5 | 10 | 18 | 22 | 4 | 9 | 42 | 4 | **10** |
| Seven Bays | 0 | 0 | 0 | 1 | 5 | 12 | 22 | 72 | 16 | 24 | 47 | 1 | **19** |
| Spokane R Confluence | 0 | 0 | 0 | 0 | 4 | | | | | | | | **1** |
| Spring Canyon | 0 | 0 | 0 | 0 | 4 | 8 | 21 | 28 | 4 | 4 | 5 | 4 | **8** |
| **Overall** | **1** | **0** | **2** | **0** | **7** | **20** | **17** | **42** | **8** | **11** | **17** | **2** | **12** |

Table 89. Mean other Cladocera biomass (μg/m$^3$) across locations in Lake Roosevelt, WA (2000).

| Location Name | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Evans Landing | 0 | 0 | 0 | 0 | 0 | 7 | 2 | 156 | 2 | 2 | | 13 | **17** |
| Gifford | 0 | 0 | 2 | 0 | 3 | 2 | 4 | 59 | 5 | 12 | 8 | 2 | **10** |
| Hunters | 0 | 0 | 0 | 1 | 0 | 1 | 6 | 188 | 402 | 61 | | 1 | **60** |
| Keller Ferry | 0 | 0 | 0 | 1 | 2 | 25 | 4 | 53 | 1 | 12 | | 5 | **9** |
| Kettle Falls | 0 | 0 | 0 | 2 | 2 | 3 | 10 | 50 | 3 | 7 | | 2 | **7** |
| Porcupine Bay | 1 | 1 | 1 | 0 | 7 | 96 | 329 | 0 | 67 | 93 | 13 | 7 | **68** |
| Sanpoil R | 4 | 7 | 22 | 0 | 53 | 44 | 42 | 695 | 18 | 14 | 11 | 2 | **99** |
| Sanpoil R Confluence | 0 | 0 | 0 | 0 | 14 | 10 | 27 | 32 | 1 | 8 | 59 | 8 | **14** |
| Seven Bays | 0 | 0 | 0 | 1 | 9 | 16 | 50 | 317 | 61 | 47 | 67 | 1 | **60** |
| Spokane R Confluence | 0 | 0 | 0 | 0 | 11 | | | | | | | | **2** |
| Spring Canyon | 1 | 1 | 1 | 0 | 8 | 10 | 28 | 199 | 4 | 7 | 7 | 6 | **29** |
| **Overall** | **1** | **1** | **2** | **1** | **12** | **25** | **62** | **191** | **45** | **28** | **27** | **5** | **39** |

Table 90. Pelagic zooplankton density (organisms/$m^3$) mean, standard deviation (SD), number (n), minimum, maximum, total density per species (sum), and the percentage each species comprised of overall pelagic zooplankton density in Lake Roosevelt, WA (2000).

| Groping | Mean | SD | n | Min | Max | Sum | % |
|---|---|---|---|---|---|---|---|
| *Diacyclops bicuspidatus thomasi* | 1,246 | 2,112 | 467 | 0 | 15,063 | 581,768 | 17.9038 |
| *Epischura nevadensis* | 49 | 181 | 467 | 0 | 2,963 | 23,043 | 0.7091 |
| Harpacticoid | 0 | 4 | 468 | 0 | 51 | 183 | 0.0056 |
| *Leptodiaptomus ashlandi* | 767 | 1,489 | 467 | 0 | 11,112 | 358,308 | 11.0269 |
| *Mesocyclops edax* | 45 | 158 | 467 | 0 | 1,667 | 21,073 | 0.6485 |
| Nauplii | 3,865 | 5,550 | 467 | 8 | 47,411 | 1,804,783 | 55.5420 |
| **Overall Copepoda** | **995** | **2,846** | **2,803** | **0** | **47,411** | **2,789,157** | **86** |
| *Daphnia galeata mendotae* | 89 | 214 | 467 | 0 | 1,729 | 41,728 | 1.2842 |
| *Daphnia pulex* | 712 | 1,539 | 467 | 0 | 14,569 | 332,668 | 10.2378 |
| *Daphnia retrocurva* | 41 | 157 | 467 | 0 | 1,729 | 18,994 | 0.5845 |
| *Daphnia rosea* | 0 | 3 | 467 | 0 | 62 | 62 | 0.0019 |
| *Daphnia thorata* | 2 | 15 | 467 | 0 | 247 | 822 | 0.0253 |
| Juvenile *Daphnia* | 10 | 53 | 467 | 0 | 494 | 4,893 | 0.1506 |
| **Overall *Daphnia*** | **142** | **687** | **2,802** | **0** | **14,569** | **399,167** | **12** |
| *Acroperus harpae* | 0 | 0 | 467 | 0 | 2 | 8 | 0.0002 |
| *Alona quadrangularis* | 1 | 8 | 467 | 0 | 102 | 613 | 0.0189 |
| *Bosmina longirostris* | 111 | 288 | 467 | 0 | 2,603 | 51,788 | 1.5938 |
| *Ceriodaphnia quadrangula* | 0 | 3 | 467 | 0 | 38 | 139 | 0.0043 |
| *Ceriodaphnia reticulata* | 0 | 2 | 467 | 0 | 44 | 44 | 0.0014 |
| *Chydorus sphaericus* | 5 | 17 | 467 | 0 | 123 | 2,118 | 0.0652 |
| *Diaphanosoma brachyurum* | 6 | 31 | 467 | 0 | 370 | 2,837 | 0.0873 |
| *Ilyocryptus acutifrons* | 0 | 1 | 467 | 0 | 14 | 21 | 0.0007 |
| *Ilyocryptus sordidus* | 0 | 1 | 467 | 0 | 25 | 25 | 0.0008 |
| *Leptodora kindtii* | 6 | 27 | 467 | 0 | 247 | 2,724 | 0.0838 |
| *Sida crystallina* | 2 | 12 | 467 | 0 | 123 | 758 | 0.0233 |
| **Overall Other Cladocera** | **12** | **93** | **5,137** | **0** | **2,603** | **61,077** | **2** |
| **Overall Zooplankton** | **302** | **1,553** | **10,742** | **0** | **47,411** | **3,249,401** | **100** |

Table 91. Pelagic zooplankton biomass (µg/m$^3$) mean, standard deviation (SD), number (n), minimum, maximum, total density per species (sum), and the percentage each species comprised of overall pelagic zooplankton density in Lake Roosevelt, WA (2000).

| Groping | Mean | SD | n | Min | Max | Sum | % |
|---|---|---|---|---|---|---|---|
| *Diacyclops bicuspidatus thomasi* | 4,048 | 8,246 | 467 | 0 | 72,222 | 1,890,500 | 15.1383 |
| *Epischura nevadensis* | 600 | 2,214 | 467 | 0 | 21,752 | 280,140 | 2.2432 |
| Harpacticoid | 0 | 4 | 468 | 0 | 75 | 111 | 0.0009 |
| *Leptodiaptomus ashlandi* | 4,081 | 8,030 | 467 | 0 | 55,660 | 1,905,734 | 15.2603 |
| *Mesocyclops edax* | 325 | 1,202 | 467 | 0 | 14,582 | 151,541 | 1.2135 |
| Nauplii | 625 | 844 | 467 | 1 | 6,864 | 291,874 | 2.3372 |
| **Overall Copepoda** | **1,613** | **5,124** | **2,803** | **0** | **72,222** | **4,519,900** | **36** |
| *Daphnia galeata mendotae* | 936 | 3,070 | 467 | 0 | 42,057 | 437,093 | 3.5001 |
| *Daphnia pulex* | 15,213 | 35,593 | 467 | 0 | 307,591 | 7,104,541 | 56.8902 |
| *Daphnia retrocurva* | 416 | 1,845 | 467 | 0 | 19,705 | 194,243 | 1.5554 |
| *Daphnia rosea* | 4 | 76 | 467 | 0 | 1,638 | 1,638 | 0.0131 |
| *Daphnia thorata* | 50 | 499 | 467 | 0 | 7,968 | 23,335 | 0.1869 |
| Juvenile *Daphnia* | 17 | 81 | 467 | 0 | 853 | 7,730 | 0.0619 |
| **Overall *Daphnia*** | **2,773** | **15,621** | **2,802** | **0** | **307,591** | **7,768,580** | **62** |
| *Acroperus harpae* | 0 | 0 | 467 | 0 | 6 | 18 | 0.0001 |
| *Alona quadrangularis* | 9 | 137 | 467 | 0 | 2,951 | 4,130 | 0.0331 |
| *Bosmina longirostris* | 126 | 312 | 467 | 0 | 2,638 | 58,674 | 0.4698 |
| *Ceriodaphnia quadrangula* | 0 | 4 | 467 | 0 | 63 | 159 | 0.0013 |
| *Ceriodaphnia reticulata* | 0 | 3 | 467 | 0 | 57 | 57 | 0.0005 |
| *Chydorus sphaericus* | 3 | 13 | 467 | 0 | 119 | 1,407 | 0.0113 |
| *Diaphanosoma brachyurum* | 22 | 119 | 467 | 0 | 1,541 | 10,365 | 0.0830 |
| *Ilyocryptus acutifrons* | 0 | 7 | 467 | 0 | 154 | 172 | 0.0014 |
| *Ilyocryptus sordidus* | 0 | 0 | 467 | 0 | 0 | 0 | 0.0000 |
| *Leptodora kindtii* | 253 | 1,855 | 467 | 0 | 22,763 | 118,018 | 0.9450 |
| *Sida crystallina* | 14 | 119 | 467 | 0 | 1,606 | 6,681 | 0.0535 |
| **Overall Other Cladocera** | **39** | **575** | **5,137** | **0** | **22,763** | **199,681** | **2** |
| **Overall Zooplankton** | **1,163** | **8,484** | **10,742** | **0** | **307,591** | **12,488,161** | **100** |

Table 92. Mean zooplankton length for species found in Lake Roosevelt, WA (2000).

| Species | Evan's Landing | Kettle Falls | Gifford | Hunters | Porcupine Bay | Spokane R. Confl. | Seven Bays | Keller Ferry | Sanpoil Arm | Sanpoil R. Confl. | Spring Canyon |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***Daphnia*** | | | | | | | | | | | |
| *Daphnia galeata mendotae* | 1.12 | 1.00 | 1.00 | 1.18 | 1.47 | 0.58 | 1.07 | 0.99 | 1.27 | 1.31 | 1.27 |
| *Daphnia pulex* | 1.16 | 1.11 | 1.23 | 1.37 | 1.60 | 0.69 | 1.46 | 1.19 | 1.44 | 1.42 | 1.45 |
| *Daphnia retrocurva* | | 1.35 | 0.93 | 0.92 | 1.10 | | 1.09 | 1.07 | 1.30 | 1.08 | 1.18 |
| *Daphnia rosea* | | | | | | | | 1.84 | | | |
| *Daphnia thorata* | 1.96 | | 1.86 | 1.82 | | | 1.87 | | 1.68 | 2.10 | 2.15 |
| Juvenile *Daphnia* | | | 0.48 | 0.51 | 0.42 | | 0.49 | | 0.44 | 0.50 | 0.47 |
| **Other Cladocera** | | | | | | | | | | | |
| *Acroperus* sp. | 0.60 | 0.63 | | | | | | | | | |
| *Alona quadrangularis* | 0.55 | 0.51 | 0.39 | 0.35 | 0.27 | | | 0.35 | 0.34 | | 0.44 |
| *Bosmina longirostris* | 0.34 | 0.36 | 0.37 | 0.34 | 0.32 | 0.44 | 0.35 | 0.34 | 0.36 | 0.35 | 0.34 |
| *Ceriodaphnia quadrangula* | 0.49 | 0.81 | 0.66 | 0.78 | 0.32 | | | | | | |
| *Ceriodaphnia reticulata* | | 0.44 | | | | | | | | | |
| *Chydorus sphaericus* | 0.27 | 0.27 | 0.29 | 0.28 | 0.31 | 0.27 | 0.22 | 0.23 | 0.24 | | |
| *Diaphanosoma brachyurum* | 0.38 | 0.74 | 0.70 | 0.82 | 0.99 | | 0.94 | 1.12 | 0.97 | 0.96 | 1.09 |
| *Ilyocryptus acutifrons* | 0.59 | 0.49 | | | | | | | | | |
| *Ilyocryptus sordidus* | | | | | 0.20 | | | | | | |
| *Leptodora kindti* | | | | 5.36 | 6.56 | | 3.13 | 2.82 | 4.17 | 1.71 | 3.86 |
| *Sida crystallina* | 0.87 | 1.06 | 1.24 | 1.46 | | | 1.54 | | | | |
| **Copepoda** | | | | | | | | | | | |
| *Diacyclops b. thomasi* | 0.64 | 0.66 | 0.61 | 0.67 | 0.62 | 0.52 | 0.66 | 0.65 | 0.71 | 0.65 | 0.69 |
| *Epischura nevadensis* | 1.90 | 1.18 | 1.02 | 0.91 | 1.30 | 1.24 | 0.85 | 0.72 | 1.00 | 1.16 | 0.94 |
| *Leptodiaptomus ashlandi* | 0.78 | 0.88 | 0.78 | 0.82 | 0.75 | 0.80 | 0.81 | 0.75 | 0.77 | 0.78 | 0.79 |
| *Mesocyclops edax* | 0.40 | 0.46 | 0.84 | 0.59 | 0.93 | | 0.95 | 1.06 | 0.99 | 0.94 | 0.96 |
| Harpacticoid | 0.59 | 0.38 | 0.38 | 0.32 | | 0.35 | | | | | |
| Nauplii | 0.14 | 0.14 | 0.16 | 0.17 | 0.16 | 0.17 | 0.16 | 0.16 | 0.15 | 0.16 | 0.16 |

**Appendix B.**

Table 93. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for eastern brook trout and brown trout collected in Lake Roosevelt, WA (2000).

| Species Diet Category | | Eastern brook trout (n=4) | | | | Brown trout (n=1) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| Osteichthyes | | | | | | | | | |
| | Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cottidae | 18.64 | 0.10 | 25.00 | 7.61 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Osteichthyes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Amphipoda | | | | | | | | | |
| | Gammaridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Arachnoidea | | | | | | | | | |
| | Unidentified Arachnoidea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cladocera | | | | | | | | | |
| | Daphnidae | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| | Unidentified Cladocera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera/Copepoda | 2.80 | 89.72 | 25.00 | 20.44 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coleoptera | | | | | | | | | |
| | Elmidae | 0.43 | 0.10 | 25.00 | 4.44 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydrophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 93. Continued

| Species Diet Category | | Eastern brook trout (n=4) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Brown trout (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Unidentified Coleoptera | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Megaloptera | | | | | | | | | |
| | Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Diptera | | | | | | | | | |
| | Chironomidae | 0.00 | 0.29 | 25.00 | 4.40 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae larvae | 0.00 | 0.10 | 25.00 | 4.36 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae pupae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Simuliidae | 0.68 | 1.24 | 25.00 | 4.68 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tabanidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tipulidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hemiptera | | | | | | | | | |
| | Baetidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephemerellidae | 0.00 | 0.19 | 25.00 | 4.38 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 93. Continued

| Species Diet Category | | Eastern brook trout (n=4) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Brown trout (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Corixidae | 19.97 | 6.57 | 50.00 | 13.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lepidoptera | | | | | | | | | |
| | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Odonata | | | | | | | | | |
| | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Trichoptera | | | | | | | | | |
| | Brachycentridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.00 | 0.10 | 25.00 | 4.36 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 1.75 | 0.19 | 25.00 | 4.68 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 94. Continued

| Species<br>Diet Category | | Eastern brook trout (n=4) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Brown trout (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| Plecoptera | | | | | | | | | |
| | Chloroperlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Gastropoda | | | | | | | | | |
| | Lymnaeidae | 54.03 | 1.14 | 25.00 | 13.94 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Planorbidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pelecypoda | | | | | | | | | |
| | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annelida | | | | | | | | | |
| | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nematoda | | | | | | | | | |
| | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ephemeroptera | | | | | | | | | |
| | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 93. Continued

| Species<br>Diet Category | | Eastern brook trout (n=4) | | | | Brown trout (n=1) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| Platyhelminthes | | | | | | | | | |
| | Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lithobiomorpha | | | | | | | | | |
| | Unidentified Lithobiomopha | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Arthropoda | | | | | | | | | |
| | Unidentified Arthropoda | 1.71 | 0.19 | 50.00 | 9.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Terrestrial | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other | | 0.00 | 0.10 | 25.00 | 4.36 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 94. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for rainbow trout and chinook salmon collected in Lake Roosevelt, WA (2000).

| Species | Diet Category | Rainbow trout (n=166) | | | | Chinook salmon (n=1) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| Osteichthyes | | | | | | | | | |
| | Catostomidae | 0.59 | 0.00 | 0.60 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cottidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Salmonidae | 0.00 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Osteichthyes | 0.50 | 0.06 | 4.22 | 1.23 | 64.36 | 38.46 | 100.00 | 33.80 |
| Amphipoda | | | | | | | | | |
| | Gammaridae | 0.00 | 0.00 | 1.20 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Amphipoda | 0.01 | 0.01 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| Arachnoidea | | | | | | | | | |
| | Unidentified Arachnoidea | 0.01 | 0.00 | 3.01 | 0.78 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cladocera | | | | | | | | | |
| | Daphnidae | 39.04 | 73.99 | 63.86 | 45.67 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera | 14.16 | 24.17 | 19.88 | 15.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera/Copepoda | 0.82 | 1.11 | 1.81 | 0.97 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coleoptera | | | | | | | | | |
| | Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydrophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 94. Continued

| Species<br>Diet Category | | Rainbow trout (n=166) | | | | Chinook salmon (n=1) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| | Unidentified Coleoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Megaloptera | | | | | | | | | |
| | Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Diptera | | | | | | | | | |
| | Chironomidae | 0.19 | 0.04 | 3.01 | 0.84 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae larvae | 0.37 | 0.10 | 10.24 | 2.76 | 6.93 | 7.69 | 100.00 | 19.10 |
| | Chironomidae pupae | 0.28 | 0.10 | 12.65 | 3.36 | 13.86 | 46.15 | 100.00 | 26.67 |
| | Simuliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tabanidae | 0.05 | 0.00 | 0.60 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heleidae | 0.00 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tipulidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hemiptera | | | | | | | | | |
| | Baetidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephemerellidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 94. Continued

| Species Diet Category | | Rainbow trout (n=166) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Chinook salmon (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Corixidae | 1.12 | 0.08 | 7.83 | 2.33 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Mesoveliidae | 0.02 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lepidoptera | | | | | | | | | |
| | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.03 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Odonata | | | | | | | | | |
| | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.02 | 0.01 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| Trichoptera | | | | | | | | | |
| | Brachycentridae | 0.01 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Coenagrionidae | 0.01 | 0.00 | 1.20 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.53 | 0.00 | 0.60 | 0.29 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.05 | 0.00 | 1.20 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 0.23 | 0.00 | 1.20 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.02 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.03 | 0.00 | 4.82 | 1.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 94. Continued

| Species<br>Diet Category | | Rainbow trout (n=166) | | | | Chinook salmon (n=1) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| Plecoptera | | | | | | | | | |
| | Chloroperlidae | 0.06 | 0.01 | 0.60 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.60 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Gastropoda | | | | | | | | | |
| | Lymnaeidae | 0.19 | 0.00 | 0.60 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 2.59 | 0.01 | 1.81 | 1.14 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Planorbidae | 0.02 | 0.01 | 1.81 | 0.48 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pelecypoda | | | | | | | | | |
| | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annelida | | | | | | | | | |
| | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 4.88 | 0.00 | 0.60 | 1.42 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nematoda | | | | | | | | | |
| | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ephemeroptera | | | | | | | | | |
| | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 94. Continued

| Species<br>Diet Category | | Rainbow trout (n=166) | | | | Chinook salmon (n=1) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| Platyhelminthes | | | | | | | | | |
| | Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lithobiomorpha | | | | | | | | | |
| | Unidentified Lithobiomopha | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Arthropoda | | | | | | | | | |
| | Unidentified Arthropoda | 4.71 | 0.00 | 7.83 | 3.24 | 0.00 | 0.00 | 0.00 | 0.00 |
| Terrestrial | | 18.97 | 0.26 | 7.83 | 6.99 | 0.00 | 0.00 | 0.00 | 0.00 |
| Other | | 10.47 | 0.01 | 22.29 | 8.46 | 14.85 | 7.69 | 100.00 | 20.42 |

Table 95. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for lake whitefish and mountain whitefish collected in Lake Roosevelt, WA (2000).

| Species Diet Category | Lake whitefish (n=4) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Mountain whitefish (n=4) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|
| **Osteichthyes** | | | | | | | | |
| Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cottidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Osteichthyes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.01 | 25.00 | 0.00 |
| **Amphipoda** | | | | | | | | |
| Gammaridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arachnoidea** | | | | | | | | |
| Unidentified Arachnoidea | 0.03 | 0.01 | 25.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cladocera** | | | | | | | | |
| Daphnidae | 99.95 | 99.98 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Cladocera | 0.00 | 0.00 | 0.00 | 0.00 | 2.17 | 89.70 | 25.00 | 0.00 |
| Unidentified Cladocera/Copepoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Coleoptera** | | | | | | | | |
| Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 95. Continued

| Species<br>Diet Category | Lake whitefish (n=4) | | | | Mountain whitefish (n=4) | | | |
|---|---|---|---|---|---|---|---|---|
| | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| Unidentified Coleoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Megaloptera** | | | | | | | | |
| Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Diptera** | | | | | | | | |
| Chironomidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Chironomidae larvae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Chironomidae pupae | 0.03 | 0.01 | 25.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Simuliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tabanidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Tipulidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hemiptera** | | | | | | | | |
| Baetidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ephemerellidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 95. Continued

| Species Diet Category | | Lake whitefish (n=4) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Mountain whitefish (n=4) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Corixidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lepidoptera** | | 0 | 0 | 0 | | 0 | 0 | 0 | |
| | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Odonata** | | | | | | | | | |
| | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Trichoptera** | | | | | | | | | |
| | Brachycentridae | 0.00 | 0.00 | 0.00 | 0.00 | 23.01 | 9.70 | 25.00 | 0.00 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 95. Continued

| Species<br>Diet Category | | Lake whitefish (n=4)<br>% by Weight | % by Number | Frequency of Occurrence | Relative Importance | Mountain whitefish (n=4)<br>% by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Plecoptera** | | | | | | | | | |
| | Chloroperlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Gastropoda** | | | | | | | | | |
| | Lymnaeidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 0.00 | 0.00 | 0.00 | 0.00 | 4.20 | 0.40 | 25.00 | 0.00 |
| | Planorbidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 70.62 | 0.10 | 25.00 | 0.00 |
| **Pelecypoda** | | | | | | | | | |
| | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Annelida** | | | | | | | | | |
| | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Nematoda** | | | | | | | | | |
| | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Ephemeroptera** | | | | | | | | | |
| | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 95. Continued

| Species<br>Diet Category | Lake whitefish (n=4)<br>% by Weight | % by Number | Frequency of Occurrence | Relative Importance | Mountain whitefish (n=4)<br>% by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|
| **Platyhelminthes** | | | | | | | | |
| Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lithobiomorpha** | | | | | | | | |
| Unidentified Lithobiomopha | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arthropoda** | | | | | | | | |
| Unidentified Arthropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Terrestrial** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Other** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 96. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for kokanee salmon and burbot collected in Lake Roosevelt, WA (2000).

| Species<br>Diet Category | Kokanee salmon (n=61) | | | | Burbot (n=15) | | | |
|---|---|---|---|---|---|---|---|---|
| | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Osteichthyes** | | | | | | | | |
| Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cottidae | 0.00 | 0.00 | 0.00 | 0.00 | 18.00 | 21.43 | 60.00 | 18.41 |
| Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 61.83 | 2.38 | 6.67 | 13.13 |
| Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 52.20 | 14.29 | 40.00 | 19.72 |
| Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 6.10 | 16.67 | 46.67 | 12.86 |
| Unidentified Osteichthyes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Amphipoda** | | | | | | | | |
| Gammaridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 6.12 | 26.19 | 73.34 | 19.57 |
| **Arachnoidea** | | | | | | | | |
| Unidentified Arachnoidea | 0.00 | 0.00 | 1.64 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cladocera** | | | | | | | | |
| Daphnidae | 99.69 | 99.85 | 93.44 | 89.58 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Cladocera | 0.00 | 0.02 | 1.64 | 0.51 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Cladocera/Copepoda | 0.04 | 0.07 | 1.64 | 0.53 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Coleoptera** | | | | | | | | |
| Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 2.38 | 6.67 | 1.68 |
| Hydrophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 96. Continued

| Species Diet Category | | Kokanee salmon (n=61) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Burbot (n=15) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Unidentified Coleoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Megaloptera** | | | | | | | | | |
| | Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Diptera** | | | | | | | | | |
| | Chironomidae | 0.04 | 0.02 | 1.64 | 0.52 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae larvae | 0.02 | 0.00 | 3.28 | 1.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae pupae | 0.12 | 0.04 | 3.28 | 1.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Simuliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tabanidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tipulidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hemiptera** | | | | | | | | | |
| | Baetidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephemerellidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 96. Continued

| Species<br>Diet Category | | Kokanee salmon (n=61) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Burbot (n=15) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Corixidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lepidoptera** | | | | | | | | | |
| | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Odonata** | | | | | | | | | |
| | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Trichoptera** | | | | | | | | | |
| | Brachycentridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 2.38 | 6.67 | 1.70 |
| | Helicopsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 96. Continued

| Species<br>Diet Category | | Kokanee salmon (n=61) | | | | Burbot (n=15) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Plecoptera** | | | | | | | | | |
| | Chloroperlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Gastropoda** | | | | | | | | | |
| | Lymnaeidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Planorbidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Pelecypoda** | | | | | | | | | |
| | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Annelida** | | | | | | | | | |
| | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 17.23 | 0.00 | 5.27 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Nematoda** | | | | | | | | | |
| | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Ephemeroptera** | | | | | | | | | |
| | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 96. Continued

| Species<br>Diet Category | Kokanee salmon (n=61) | | | | Burbot (n=15) | | | |
|---|---|---|---|---|---|---|---|---|
| | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Platyhelminthes** | | | | | | | | |
| Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lithobiomorpha** | | | | | | | | |
| Unidentified Lithobiomopha | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arthropoda** | | | | | | | | |
| Unidentified Arthropoda | 0.08 | 0.00 | 3.28 | 1.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Terrestrial** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Other** | 0.00 | 0.00 | 0.00 | 0.00 | 15.56 | 14.29 | 40.00 | 12.94 |

Table 97. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for brown bullhead and longnose suckers collected in Lake Roosevelt, WA (2000).

| Species<br>Diet Category | Brown bullhead (n=1) | | | | Longnose sucker (n=14) | | | |
|---|---|---|---|---|---|---|---|---|
| | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| Osteichthyes | | | | | | | | |
| Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cottidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Percidae | 87.01 | 33.33 | 100.00 | 44.07 | 0.00 | 0.00 | 0.00 | 0.00 |
| Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Osteichthyes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Amphipoda | | | | | | | | |
| Gammaridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Arachnoidea | | | | | | | | |
| Unidentified Arachnoidea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cladocera | | | | | | | | |
| Daphnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.51 | 7.45 | 7.14 | 2.35 |
| Unidentified Cladocera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Cladocera/Copepoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Coleoptera | | | | | | | | |
| Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 97. Continued

| Species<br>Diet Category | | Brown bullhead (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Longnose sucker (n=14) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Unidentified Coleoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 7.14 | 1.11 |
| | Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.04 | 14.29 | 2.23 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Megaloptera | | | | | | | | | |
| | Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Diptera | | | | | | | | | |
| | Chironomidae | 0.00 | 0.00 | 0.00 | 0.00 | 1.33 | 2.21 | 21.43 | 3.88 |
| | Chironomidae larvae | 0.00 | 0.00 | 0.00 | 0.00 | 19.27 | 87.93 | 50.00 | 24.45 |
| | Chironomidae pupae | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.41 | 50.00 | 7.87 |
| | Simuliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.01 | 7.14 | 1.12 |
| | Tabanidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 | 7.14 | 1.12 |
| | Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.26 | 7.14 | 1.17 |
| | Tipulidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 7.14 | 1.11 |
| | Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.14 | 14.29 | 2.26 |
| Hemiptera | | | | | | | | | |
| | Baetidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephemerellidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.04 | 7.14 | 1.12 |

Table 97. Continued

| Species<br>Diet Category | | Brown bullhead (n=1)<br>% by Weight | % by Number | Frequency of Occurrence | Relative Importance | Longnose sucker (n=14)<br>% by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Corixidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 7.14 | 1.11 |
| Lepidoptera | | | | | | | | | |
| | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.03 | 14.29 | 2.23 |
| Odonata | | | | | | | | | |
| | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Trichoptera | | | | | | | | | |
| | Brachycentridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.02 | 7.14 | 1.13 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 5.64 | 1.03 | 7.14 | 2.15 |
| | Hydropsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.55 | 0.27 | 21.43 | 3.46 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 7.14 | 1.12 |
| | Limnephilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.01 | 7.14 | 1.14 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 7.14 | 1.12 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 97. Continued

| Species Diet Category | | Brown bullhead (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Longnose sucker (n=14) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| Plecoptera | | | | | | | | | |
| | Chloroperlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.58 | 0.00 | 7.14 | 1.20 |
| Gastropoda | | | | | | | | | |
| | Lymnaeidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 7.14 | 1.11 |
| | Physidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 7.14 | 1.11 |
| | Planorbidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Pelecypoda | | | | | | | | | |
| | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Annelida | | | | | | | | | |
| | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 7.14 | 1.11 |
| Nematoda | | | | | | | | | |
| | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Ephemeroptera | | | | | | | | | |
| | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 97. Continued

| Species Diet Category | | Brown bullhead (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Longnose sucker (n=14) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| Platyhelminthes | | | | | | | | | |
| | Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Lithobiomorpha | | | | | | | | | |
| | Unidentified Lithobiomopha | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Arthropoda | | | | | | | | | |
| | Unidentified Arthropoda | 7.19 | 33.33 | 100.00 | 28.10 | 1.73 | 0.02 | 35.71 | 5.83 |
| Terrestrial | | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 14.29 | 2.23 |
| Other | | 5.80 | 33.33 | 100.00 | 27.83 | 69.47 | 0.04 | 85.71 | 24.15 |

Table 98. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for largescale suckers and northern pikeminnow collected in Lake Roosevelt, WA (2000).

| Species<br>Diet Category | Largescale sucker (n=147) | | | | Northern pikeminnow (n=8) | | | |
|---|---|---|---|---|---|---|---|---|
| | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Osteichthyes** | | | | | | | | |
| Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cottidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 10.54 | 0.03 | 12.50 | 5.95 |
| Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Osteichthyes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Amphipoda** | | | | | | | | |
| Gammaridae | 0.01 | 0.02 | 1.36 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| Unidentified Amphipoda | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arachnoidea** | | | | | | | | |
| Unidentified Arachnoidea | 0.00 | 0.00 | 6.80 | 1.12 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cladocera** | | | | | | | | |
| Daphnidae | 2.54 | 15.09 | 8.16 | 4.24 | 13.16 | 58.24 | 12.50 | 21.65 |
| Unidentified Cladocera | 3.26 | 33.67 | 11.56 | 7.97 | 4.75 | 36.76 | 12.50 | 13.94 |
| Unidentified Cladocera/Copepoda | 4.68 | 24.31 | 6.80 | 5.89 | 13.48 | 2.31 | 12.50 | 7.30 |
| Unidentified Cladocera/Copepoda/Ostracoda | 0.01 | 0.09 | 0.68 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Coleoptera** | | | | | | | | |
| Elmidae | 0.81 | 0.54 | 13.61 | 2.46 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrophilidae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| Staphylinidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 98. Continued

| Species Diet Category | | Largescale sucker (n=147) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Northern pikeminnow (n=8) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Unidentified Coleoptera | 0.01 | 0.00 | 2.04 | 0.34 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dytiscidae | 0.00 | 0.02 | 3.40 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Megaloptera** | | | | | | | | | |
| | Unidentified Megaloptera | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Diptera** | | | | | | | | | |
| | Chironomidae | 2.00 | 9.60 | 19.05 | 5.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae larvae | 2.88 | 12.58 | 26.53 | 6.91 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae pupae | 0.05 | 0.26 | 26.53 | 4.41 | 0.00 | 0.10 | 12.50 | 3.25 |
| | Simuliidae | 0.00 | 0.00 | 3.40 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tabanidae | 0.35 | 0.00 | 4.08 | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 1.49 | 3.41 | 0.68 | 0.92 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 2.04 | 0.34 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.01 | 0.05 | 12.93 | 2.14 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tipulidae | 0.00 | 0.00 | 2.04 | 0.34 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephyridae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hemiptera** | | | | | | | | | |
| | Baetidae | 0.00 | 0.00 | 4.08 | 0.67 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephemerellidae | 0.43 | 0.01 | 8.84 | 1.53 | 0.04 | 0.07 | 12.50 | 3.25 |

Table 98. Continued

| Species Diet Category | | Largescale sucker (n=147) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Northern pikeminnow (n=8) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Heptageniidae | 0.28 | 0.01 | 2.04 | 0.38 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Corixidae | 0.04 | 0.01 | 10.20 | 1.69 | 9.17 | 1.47 | 12.50 | 5.97 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lepidoptera** | | | | | | | | | |
| | Unidentified Lepidoptera | 0.30 | 0.01 | 2.72 | 0.50 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.01 | 0.00 | 4.08 | 0.67 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Odonata** | | | | | | | | | |
| | Aeshnidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.01 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Trichoptera** | | | | | | | | | |
| | Brachycentridae | 0.02 | 0.00 | 5.44 | 0.90 | 9.24 | 0.03 | 12.50 | 5.62 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.02 | 0.00 | 3.40 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.07 | 0.05 | 6.80 | 1.14 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.02 | 0.02 | 8.84 | 1.46 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 3.40 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.01 | 0.01 | 6.80 | 1.12 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Polycentropodidae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 98. Continued

| Species<br>Diet Category | | Largescale sucker (n=147) | | | | Northern pikeminnow (n=8) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Plecoptera** | | | | | | | | | |
| | Chloroperlidae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.03 | 0.00 | 1.36 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 1.36 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Gastropoda** | | | | | | | | | |
| | Lymnaeidae | 0.23 | 0.02 | 7.48 | 1.27 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 0.08 | 0.00 | 4.08 | 0.68 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Planorbidae | 0.21 | 0.06 | 12.93 | 2.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Pelecypoda** | | | | | | | | | |
| | Unidentified Pelecypoda | 0.10 | 0.00 | 1.36 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Annelida** | | | | | | | | | |
| | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 4.71 | 0.77 | 12.50 | 4.64 |
| | Piscicolidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.00 | 2.72 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Nematoda** | | | | | | | | | |
| | Unidentified Nematoda | 0.08 | 0.00 | 2.72 | 0.46 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Ephemeroptera** | | | | | | | | | |
| | Tricorythidae | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 98. Continued

| Species<br>Diet Category | Largescale sucker (n=147) | | | | Northern pikeminnow (n=8) | | | |
|---|---|---|---|---|---|---|---|---|
| | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Platyhelminthes** | | | | | | | | |
| Unidentified Platyhelminthes | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lithobiomorpha** | | | | | | | | |
| Unidentified Lithobiomopha | 0.00 | 0.00 | 0.68 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arthropoda** | | | | | | | | |
| Unidentified Arthropoda | 4.82 | 0.01 | 42.86 | 7.84 | 33.12 | 0.17 | 62.50 | 24.72 |
| | | | | | | | | |
| **Terrestrial** | 0.04 | 0.07 | 10.20 | 1.70 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Other** | 75.06 | 0.02 | 82.99 | 25.99 | 1.80 | 0.03 | 12.50 | 3.70 |

Table 99. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for redside shiner and black crappie collected in Lake Roosevelt, WA (2000).

| Species Diet Category | | Redside shiner (n=1) | | | | Black crappie (n=8) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Osteichthyes** | | | | | | | | | |
| | Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 51.63 | 0.05 | 25.00 | 17.54 |
| | Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cottidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 14.64 | 0.03 | 12.50 | 6.22 |
| | Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Osteichthyes | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.03 | 12.50 | 2.96 |
| **Amphipoda** | | | | | | | | | |
| | Gammaridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arachnoidea** | | | | | | | | | |
| | Unidentified Arachnoidea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cladocera** | | | | | | | | | |
| | Daphnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera | 0.00 | 0.00 | 0.00 | 0.00 | 19.61 | 98.91 | 62.50 | 41.41 |
| | Unidentified Cladocera/Copepoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Coleoptera** | Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydrophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 99. Continued

| Species | Diet Category | Redside shiner (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Black crappie (n=8) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Unidentified Coleoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Megaloptera** | Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Diptera** | Chironomidae | 0.00 | 0.00 | 0.00 | 0.00 | 6.54 | 0.61 | 25.00 | 7.35 |
| | Chironomidae larvae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae pupae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Simuliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tabanidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tipulidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hemiptera** | Baetidae | 0.00 | 0.00 | 0.00 | 0.00 | 1.16 | 0.10 | 25.00 | 6.01 |
| | Ephemerellidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 99. Continued

| Species Diet Category | | Redside shiner (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Black crappie (n=8) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Corixidae | 0.00 | 0.00 | 0.00 | 0.00 | 2.71 | 0.18 | 25.00 | 6.38 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lepidoptera** | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Odonata** | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Trichoptera** | Brachycentridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.03 | 12.50 | 2.89 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 99. Continued

| Species | Diet Category | Redside shiner (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Black crappie (n=8) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Plecoptera** | Chloroperlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Gastropoda** | Lymnaeidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Planorbidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Pelecypoda** | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Annelida** | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Nematoda** | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Ephemeroptera** | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 99. Continued

| Species Diet Category | | Redside shiner (n=1) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Black crappie (n=8) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Platyhelminthes** | Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lithobiomorpha** | Unidentified Lithobiomopha | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arthropoda** | Unidentified Arthropoda | 100.00 | 100.00 | 100.00 | 100.00 | 1.76 | 0.51 | 25.00 | 6.24 |
| **Terrestrial** | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Other** | | 0.00 | 0.00 | 0.00 | 0.00 | 0.61 | 0.03 | 12.50 | 3.00 |

Table 100. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for largemouth bass and smallmouth bass collected in Lake Roosevelt, WA (2000).

| Species Diet Category | | Largemouth bass (n=5) | | | | Smallmouth bass (n=50) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Osteichthyes** | | | | | | | | | |
| | Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 2.66 | 5.66 | 4.00 | 3.37 |
| | Cottidae | 13.36 | 0.00 | 20.00 | 9.39 | 55.62 | 11.05 | 32.00 | 26.96 |
| | Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 7.23 | 0.54 | 4.00 | 3.22 |
| | Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 14.11 | 1.35 | 4.00 | 5.32 |
| | Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 6.32 | 3.50 | 12.00 | 5.96 |
| | Unidentified Osteichthyes | 77.66 | 0.00 | 40.00 | 33.10 | 5.64 | 8.09 | 22.00 | 9.76 |
| **Amphipoda** | | | | | | | | | |
| | Gammaridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arachnoidea** | | | | | | | | | |
| | Unidentified Arachnoidea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cladocera** | | | | | | | | | |
| | Daphnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera/Copepoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 37.74 | 6.00 | 11.99 |
| | Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Coleoptera** | Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydrophilidae | 0.00 | 95.45 | 0.00 | 26.85 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 100. Continued

| Species<br>Diet Category | | Largemouth bass (n=5) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Smallmouth bass (n=50) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Osteichthyes** | | | | | | | | | |
| | Catostomidae | 0.00 | 0.00 | 0.00 | 0.00 | 2.66 | 5.66 | 4.00 | 3.37 |
| | Centrarchidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cottidae | 13.36 | 0.00 | 20.00 | 9.39 | 55.62 | 11.05 | 32.00 | 26.96 |
| | Cyprinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Percidae | 0.00 | 0.00 | 0.00 | 0.00 | 7.23 | 0.54 | 4.00 | 3.22 |
| | Salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 14.11 | 1.35 | 4.00 | 5.32 |
| | Unidentified non-salmonidae | 0.00 | 0.00 | 0.00 | 0.00 | 6.32 | 3.50 | 12.00 | 5.96 |
| | Unidentified Osteichthyes | 77.66 | 0.00 | 40.00 | 33.10 | 5.64 | 8.09 | 22.00 | 9.76 |
| **Amphipoda** | | | | | | | | | |
| | Gammaridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arachnoidea** | | | | | | | | | |
| | Unidentified Arachnoidea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cladocera** | | | | | | | | | |
| | Daphnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Cladocera/Copepoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 37.74 | 6.00 | 11.99 |
| | Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Coleoptera** | Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydrophilidae | 0.00 | 95.45 | 0.00 | 26.85 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 100. Continued

| Species | Diet Category | Largemouth bass (n=5) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Smallmouth bass (n=50) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Unidentified Coleoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 0.27 | 2.00 | 0.70 |
| **Megaloptera** | Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Diptera** | Chironomidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 | 2.00 | 0.62 |
| | Chironomidae larvae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae pupae | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 7.55 | 10.00 | 4.82 |
| | Simuliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tabanidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tipulidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 1.62 | 2.00 | 1.10 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hemiptera** | Baetidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephemerellidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 100. Continued

| Species | Diet Category | Largemouth bass (n=5) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Smallmouth bass (n=50) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Corixidae | 1.91 | 0.00 | 60.00 | 17.42 | 0.49 | 2.96 | 10.00 | 3.67 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lepidoptera** | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Odonata** | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Trichoptera** | Brachycentridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 2.43 | 4.00 | 1.77 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.27 | 2.00 | 0.63 |

Table 100. Continued

| Species | Diet Category | Largemouth bass (n=5) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Smallmouth bass (n=50) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Plecoptera** | Chloroperlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Gastropoda** | Lymnaeidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Planorbidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Pelecypoda** | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Annelida** | Hirudinea | 0.00 | 0.00 | 0.00 | 0.00 | 0.37 | 0.27 | 2.00 | 0.72 |
| | Oligochaeta | 0.00 | 0.00 | 0.00 | 0.00 | 1.80 | 5.93 | 12.00 | 5.39 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Nematoda** | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.48 | 4.58 | 4.00 | 2.48 |
| **Ephemeroptera** | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 100. Continued

| Species | Diet Category | Largemouth bass (n=5) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Smallmouth bass (n=50) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Platyhelminthes** | Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lithobiomorpha** | Unidentified Lithobiomopha | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arthropoda** | Unidentified Arthropoda | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 1.08 | 8.00 | 2.84 |
| **Terrestrial** | | 4.67 | 0.00 | 20.00 | 6.94 | 0.42 | 2.16 | 4.00 | 1.80 |
| **Other** | | 2.40 | 0.00 | 20.00 | 6.30 | 2.57 | 2.70 | 20.00 | 6.90 |

Table 101. Percent by dry weight, percent by number, frequency of occurrence, and relative importance values of diet categories for walleye and yellow perch collected in Lake Roosevelt, WA (2000).

| Species | Diet Category | Walleye (n=133) | | | | Yellow perch (n=18) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | % by Weight | % by Number | Frequency of Occurrence | Relative Importance | % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
| **Osteichthyes** | | | | | | | | | |
| | Catostomidae | 0.10 | 0.05 | 0.75 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Centrarchidae | 0.04 | 0.05 | 0.75 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cottidae | 11.08 | 5.26 | 21.05 | 10.07 | 27.78 | 0.04 | 5.56 | 9.54 |
| | Cyprinidae | 0.22 | 0.05 | 0.75 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Percidae | 1.25 | 0.42 | 4.51 | 1.67 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Salmonidae | 69.03 | 1.91 | 18.05 | 23.96 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified non-salmonidae | 17.29 | 5.07 | 27.07 | 13.31 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Osteichthyes | 0.24 | 2.42 | 8.27 | 2.94 | 11.64 | 0.08 | 11.11 | 6.52 |
| **Amphipoda** | | | | | | | | | |
| | Gammaridae | 0.00 | 0.05 | 0.75 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Amphipoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Arachnoidea** | | | | | | | | | |
| | Unidentified Arachnoidea | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Cladocera** | | | | | | | | | |
| | Daphnidae | 0.00 | 10.66 | 2.26 | 3.48 | 6.78 | 16.17 | 5.56 | 8.15 |
| | Unidentified Cladocera | 0.02 | 14.90 | 1.50 | 4.42 | 36.80 | 69.47 | 27.78 | 38.30 |
| | Unidentified Cladocera/Copepoda | 0.00 | 0.00 | 0.00 | 0.00 | 1.59 | 13.73 | 11.11 | 7.55 |
| | Unidentified Cladocera/Copepoda/Ostracoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Coleoptera** | Elmidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydrophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Staphylinidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 101. Continued

| Species | Diet Category | Walleye (n=133) % by Weight | Walleye (n=133) % by Number | Walleye (n=133) Frequency of Occurrence | Walleye (n=133) Relative Importance | Yellow perch (n=18) % by Weight | Yellow perch (n=18) % by Number | Yellow perch (n=18) Frequency of Occurrence | Yellow perch (n=18) Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Unidentified Coleoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dytiscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psephenidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Megaloptera** | Unidentified Megaloptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Diptera** | Chironomidae | 0.00 | 0.79 | 3.76 | 1.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae larvae | 0.04 | 2.00 | 7.52 | 2.57 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Chironomidae pupae | 0.25 | 49.91 | 10.53 | 16.34 | 0.02 | 0.07 | 11.11 | 3.20 |
| | Simuliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tabanidae | 0.00 | 0.05 | 0.75 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Diptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ceratopogonidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Culicidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Empididae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Heleidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Muscidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Stratiomyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Psychodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Tipulidae | 0.01 | 0.05 | 0.75 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Dolichopodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephyridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hemiptera** | Baetidae | 0.00 | 0.05 | 0.75 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Ephemerellidae | 0.00 | 0.05 | 0.75 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 101. Continued

| Species | Diet Category | Walleye (n=133) % by Weight | Walleye % by Number | Walleye Frequency of Occurrence | Walleye Relative Importance | Yellow perch (n=18) % by Weight | Yellow perch % by Number | Yellow perch Frequency of Occurrence | Yellow perch Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| | Heptageniidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Corixidae | 0.00 | 0.09 | 0.75 | 0.23 | 3.15 | 0.28 | 27.78 | 8.92 |
| | Mesoveliidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Hemiptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lepidoptera** | Unidentified Lepidoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Cossidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Pyralidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Odonata** | Aeshnidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Odonata | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Zygoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Anisoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Trichoptera** | Brachycentridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Coenagrionidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Glossosomatidae | 0.00 | 0.09 | 0.75 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Helicopsychidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydropsychidae | 0.01 | 28.00 | 2.26 | 8.15 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Hydroptilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Limnephilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Nemouridae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Trichoptera | 0.00 | 0.23 | 1.50 | 0.47 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptidostimotidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Leptoceridae | 0.02 | 1.30 | 3.76 | 1.37 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Polycentropodidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 101. Continued

| Species | Diet Category | Walleye (n=133) % by Weight | % by Number | Frequency of Occurrence | Relative Importance | Yellow perch (n=18) % by Weight | % by Number | Frequency of Occurrence | Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Plecoptera** | Chloroperlidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlidae | 0.01 | 0.05 | 0.75 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Perlodidae | 0.00 | 0.00 | 0.00 | 0.00 | 5.99 | 0.02 | 5.56 | 3.30 |
| | Pteronarcyidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Rhyacophilidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Plecoptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Gastropoda** | Lymnaeidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Physidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Planorbidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Gastropoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Pelecypoda** | Unidentified Pelecypoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Annelida** | Hirudinea | 0.11 | 0.05 | 0.75 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Oligochaeta | 0.01 | 0.14 | 1.50 | 0.45 | 4.28 | 0.02 | 5.56 | 2.82 |
| | Piscicolidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Lumbriculidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Diphyllobothriidae | 0.00 | 0.05 | 0.75 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Nematoda** | Unidentified Nematoda | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Ephemeroptera** | Tricorythidae | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Unidentified Ephemeroptera | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Table 101. Continued

| Species | Diet Category | Walleye (n=133) % by Weight | Walleye (n=133) % by Number | Walleye (n=133) Frequency of Occurrence | Walleye (n=133) Relative Importance | Yellow perch (n=18) % by Weight | Yellow perch (n=18) % by Number | Yellow perch (n=18) Frequency of Occurrence | Yellow perch (n=18) Relative Importance |
|---|---|---|---|---|---|---|---|---|---|
| **Platyhelminthes** | Unidentified Platyhelminthes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Lithobiomorpha** | Unidentified Lithobiomopha | 0.00 | 0.23 | 1.50 | 0.47 | 0.07 | 0.02 | 5.56 | 1.61 |
| **Arthropoda** | Unidentified Arthropoda | 0.06 | 0.37 | 6.02 | 1.74 | 0.19 | 0.02 | 5.56 | 1.65 |
| **Terrestrial** | | 0.03 | 2.65 | 1.50 | 1.13 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Other** | | 0.16 | 0.74 | 11.28 | 3.28 | 1.68 | 0.09 | 27.78 | 8.44 |

Table 102. Harvest and catch per unit effort calculations for all species caught by anglers in Section 1 of Lake Roosevelt, WA (2000).

| | ANGLER | NO. OF KOKANEE | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL | CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 28.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 122 | 46 | 0 | 0 | 0 | 0 |
| **FEB** | 57.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 533 | 128 | 0 | 0 | 0 | 0 |
| **MAR** | 62.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 568 | 123 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 102.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 939 | 133 | 0 | 0 | 0 | 0 |
| **JUN** | 153.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 11,881 | 700 | 0 | 0 | 0 | 0 |
| **JUL** | 152.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 18,393 | 1,172 | 0 | 0 | 0 | 0 |
| **AUG** | 177.3 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 18,638 | 198 | 0 | 0 | 0 | 0 |
| **SEP** | 56.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,985 | 319 | 0 | 0 | 0 | 0 |
| **OCT** | 94.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,355 | 254 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **883.9** | **0** | **0** | **0** | **0.000** | **0.000** | **0.000** | **57,414** | **3,073** | **0** | **0** | **0** | **0** |

Table 102. Continued

| | ANGLER HOURS | NO. OF RAINBOW TROUT HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 28.0 | 6 | 3 | 9 | 0.214 | 0.107 | 0.321 | 122 | 46 | 26 | 10 | 39 | 15 |
| **FEB** | 57.7 | 1 | 0 | 1 | 0.017 | 0.000 | 0.017 | 533 | 128 | 9 | 2 | 9 | 2 |
| **MAR** | 62.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 568 | 123 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 102.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 939 | 133 | 0 | 0 | 0 | 0 |
| **JUN** | 153.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 11,881 | 700 | 0 | 0 | 0 | 0 |
| **JUL** | 152.0 | 9 | 0 | 9 | 0.059 | 0.000 | 0.059 | 18,393 | 1,172 | 1,089 | 69 | 1,089 | 69 |
| **AUG** | 177.3 | 1 | 0 | 1 | 0.006 | 0.000 | 0.006 | 18,638 | 198 | 105 | 1 | 105 | 1 |
| **SEP** | 56.7 | 4 | 0 | 4 | 0.071 | 0.000 | 0.071 | 3,985 | 319 | 281 | 23 | 281 | 23 |
| **OCT** | 94.2 | 38 | 0 | 38 | 0.403 | 0.000 | 0.403 | 2,355 | 254 | 950 | 102 | 950 | 102 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **883.9** | **59** | **3** | **62** | **0.067** | **0.003** | **0.070** | **57,414** | **3,073** | **2,461** | **208** | **2,474** | **212** |

Table 102. Continued

| | ANGLER HOURS | NO. OF WALLEYE HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 28.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 122 | 46 | 0 | 0 | 0 | 0 |
| **FEB** | 57.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 533 | 128 | 0 | 0 | 0 | 0 |
| **MAR** | 62.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 568 | 123 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 102.6 | 52 | 20 | 72 | 0.507 | 0.195 | 0.702 | 939 | 133 | 476 | 67 | 659 | 93 |
| **JUN** | 153.4 | 26 | 26 | 52 | 0.170 | 0.170 | 0.339 | 11,881 | 700 | 2,014 | 119 | 4,028 | 237 |
| **JUL** | 152.0 | 37 | 16 | 53 | 0.244 | 0.105 | 0.349 | 18,393 | 1,172 | 4,479 | 285 | 6,415 | 409 |
| **AUG** | 177.3 | 26 | 4 | 30 | 0.147 | 0.023 | 0.169 | 18,638 | 198 | 2,733 | 29 | 3,154 | 34 |
| **SEP** | 56.7 | 17 | 2 | 19 | 0.300 | 0.035 | 0.335 | 3,985 | 319 | 1,195 | 96 | 1,335 | 107 |
| **OCT** | 94.2 | 5 | 0 | 5 | 0.053 | 0.000 | 0.053 | 2,355 | 254 | 125 | 13 | 125 | 13 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **883.9** | **163** | **68** | **231** | **0.184** | **0.077** | **0.261** | **57,414** | **3,073** | **11,022** | **610** | **15,717** | **893** |

Table 102. Continued

| | ANGLER | NO. OF SMALLMOUTH | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL | CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 28.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 122 | 46 | 0 | 0 | 0 | 0 |
| **FEB** | 57.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 533 | 128 | 0 | 0 | 0 | 0 |
| **MAR** | 62.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 568 | 123 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 102.6 | 1 | 0 | 1 | 0.010 | 0.000 | 0.010 | 939 | 133 | 9 | 1 | 9 | 1 |
| **JUN** | 153.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 11,881 | 700 | 0 | 0 | 0 | 0 |
| **JUL** | 152.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 18,393 | 1,172 | 0 | 0 | 0 | 0 |
| **AUG** | 177.3 | 2 | 0 | 2 | 0.011 | 0.000 | 0.011 | 18,638 | 198 | 210 | 2 | 210 | 2 |
| **SEP** | 56.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,985 | 319 | 0 | 0 | 0 | 0 |
| **OCT** | 94.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,355 | 254 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **883.9** | **3** | **0** | **3** | **0.003** | **0.000** | **0.003** | **57,414** | **3,073** | **219** | **4** | **219** | **4** |

Table 102.    Continued

| | ANGLER HOURS | NO. OF LAKE WHITEFISH HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 28.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 122 | 46 | 0 | 0 | 0 | 0 |
| **FEB** | 57.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 533 | 128 | 0 | 0 | 0 | 0 |
| **MAR** | 62.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 568 | 123 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 102.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 939 | 133 | 0 | 0 | 0 | 0 |
| **JUN** | 153.4 | 1 | 0 | 1 | 0.007 | 0.000 | 0.007 | 11,881 | 700 | 77 | 5 | 77 | 5 |
| **JUL** | 152.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 18,393 | 1,172 | 0 | 0 | 0 | 0 |
| **AUG** | 177.3 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 18,638 | 198 | 0 | 0 | 0 | 0 |
| **SEP** | 56.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,985 | 319 | 0 | 0 | 0 | 0 |
| **OCT** | 94.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,355 | 254 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **883.9** | **1** | **0** | **1** | **0.001** | **0.000** | **0.001** | **57,414** | **3,073** | **77** | **5** | **77** | **5** |

Table 102. Continued

| | ANGLER HOURS | NO. OF SUCKERS HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 28.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 122 | 46 | 0 | 0 | 0 | 0 |
| **FEB** | 57.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 533 | 128 | 0 | 0 | 0 | 0 |
| **MAR** | 62.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 568 | 123 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 102.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 939 | 133 | 0 | 0 | 0 | 0 |
| **JUN** | 153.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 11,881 | 700 | 0 | 0 | 0 | 0 |
| **JUL** | 152.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 18,393 | 1,172 | 0 | 0 | 0 | 0 |
| **AUG** | 177.3 | 0 | 1 | 1 | 0.000 | 0.006 | 0.006 | 18,638 | 198 | 0 | 0 | 105 | 1 |
| **SEP** | 56.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,985 | 319 | 0 | 0 | 0 | 0 |
| **OCT** | 94.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,355 | 254 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **883.9** | **0** | **1** | **1** | **0.000** | **0.001** | **0.001** | **57,414** | **3,073** | **0** | **0** | **105** | **1** |

Table 102. Continued

| | ANGLER HOURS | GRAND HARVEST | GRAND RELEASE | GRAND TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | GRAND PE | GRAND ±95% CI | GRAND HARVEST | HARVEST ±95% CI | GRAND CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 28.0 | 6 | 3 | 9 | 0.214 | 0.107 | 0.321 | 122 | 46 | 26 | 10 | 39 | 15 |
| **FEB** | 57.7 | 1 | 0 | 1 | 0.017 | 0.000 | 0.017 | 533 | 128 | 9 | 2 | 9 | 2 |
| **MAR** | 62.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 568 | 123 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 102.6 | 53 | 20 | 73 | 0.517 | 0.195 | 0.712 | 939 | 133 | 485 | 69 | 668 | 95 |
| **JUN** | 153.4 | 27 | 26 | 53 | 0.176 | 0.170 | 0.346 | 11,881 | 700 | 2,092 | 123 | 4,106 | 242 |
| **JUL** | 152.0 | 46 | 16 | 62 | 0.303 | 0.105 | 0.408 | 18,393 | 1,172 | 5,568 | 355 | 7,505 | 478 |
| **AUG** | 177.3 | 29 | 5 | 34 | 0.164 | 0.028 | 0.192 | 18,638 | 198 | 3,049 | 32 | 3,574 | 38 |
| **SEP** | 56.7 | 21 | 2 | 23 | 0.370 | 0.035 | 0.406 | 3,985 | 319 | 1,476 | 118 | 1,616 | 129 |
| **OCT** | 94.2 | 43 | 0 | 43 | 0.456 | 0.000 | 0.456 | 2,355 | 254 | 1,075 | 116 | 1,075 | 116 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **883.9** | **226** | **72** | **298** | **0.256** | **0.081** | **0.337** | **57,414** | **3,073** | **13,779** | **825** | **18,592** | **1,115** |

Table 103. Harvest and catch per unit effort calculations for all species caught by anglers in Section 2 of Lake Roosevelt, WA (2000).

| | ANGLER | NO. OF KOKANEE | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL | CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,568 | 486 | 0 | 0 | 0 | 0 |
| **FEB** | 198.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,377 | 534 | 0 | 0 | 0 | 0 |
| **MAR** | 169.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,598 | 1,600 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,524 | 582 | 0 | 0 | 0 | 0 |
| **JUN** | 238.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 45,532 | 3,099 | 0 | 0 | 0 | 0 |
| **JUL** | 276.5 | 1 | 0 | 1 | 0.004 | 0.000 | 0.004 | 93,589 | 6,343 | 338 | 23 | 338 | 23 |
| **AUG** | 366.0 | 2 | 12 | 14 | 0.005 | 0.033 | 0.038 | 102,624 | 7,277 | 561 | 40 | 3,926 | 278 |
| **SEP** | 31.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,720 | 1,328 | 0 | 0 | 0 | 0 |
| **OCT** | 26.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 14,732 | 1,158 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **3** | **12** | **15** | **0.002** | **0.008** | **0.010** | **301,264** | **22,407** | **899** | **63** | **4,264** | **301** |

Table 103. Continued

| | ANGLER HOURS | NO. OF RAINBOW TROUT HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 11 | 0 | 11 | 0.118 | 0.000 | 0.118 | 3,568 | 486 | 422 | 57 | 422 | 57 |
| **FEB** | 198.4 | 21 | 3 | 24 | 0.106 | 0.015 | 0.121 | 10,377 | 534 | 1,098 | 57 | 1,255 | 65 |
| **MAR** | 169.7 | 4 | 5 | 9 | 0.024 | 0.029 | 0.053 | 10,598 | 1,600 | 250 | 38 | 562 | 85 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 1 | 0 | 1 | 0.018 | 0.000 | 0.018 | 2,524 | 582 | 46 | 11 | 46 | 11 |
| **JUN** | 238.5 | 10 | 0 | 10 | 0.042 | 0.000 | 0.042 | 45,532 | 3,099 | 1,909 | 130 | 1,909 | 130 |
| **JUL** | 276.5 | 1 | 23 | 24 | 0.004 | 0.083 | 0.087 | 93,589 | 6,343 | 338 | 23 | 8,123 | 551 |
| **AUG** | 366.0 | 21 | 8 | 29 | 0.057 | 0.022 | 0.079 | 102,624 | 7,277 | 5,889 | 418 | 8,132 | 577 |
| **SEP** | 31.2 | 3 | 0 | 3 | 0.096 | 0.000 | 0.096 | 17,720 | 1,328 | 1,706 | 128 | 1,706 | 128 |
| **OCT** | 26.8 | 7 | 0 | 7 | 0.261 | 0.000 | 0.261 | 14,732 | 1,158 | 3,850 | 303 | 3,850 | 303 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **79** | **39** | **118** | **0.054** | **0.027** | **0.081** | **301,264** | **22,407** | **15,508** | **1,163** | **26,005** | **1,905** |

Table 103. Continued

| | ANGLER HOURS | NO. OF WALLEYE HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,568 | 486 | 0 | 0 | 0 | 0 |
| **FEB** | 198.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,377 | 534 | 0 | 0 | 0 | 0 |
| **MAR** | 169.7 | 25 | 5 | 30 | 0.147 | 0.029 | 0.177 | 10,598 | 1,600 | 1,561 | 236 | 1,874 | 283 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 0 | 7 | 7 | 0.000 | 0.127 | 0.127 | 2,524 | 582 | 0 | 0 | 320 | 74 |
| **JUN** | 238.5 | 81 | 49 | 130 | 0.340 | 0.205 | 0.545 | 45,532 | 3,099 | 15,467 | 1,053 | 24,823 | 1,690 |
| **JUL** | 276.5 | 12 | 16 | 28 | 0.043 | 0.058 | 0.101 | 93,589 | 6,343 | 4,061 | 275 | 9,477 | 642 |
| **AUG** | 366.0 | 28 | 3 | 31 | 0.077 | 0.008 | 0.085 | 102,624 | 7,277 | 7,852 | 557 | 8,693 | 616 |
| **SEP** | 31.2 | 0 | 3 | 3 | 0.000 | 0.096 | 0.096 | 17,720 | 1,328 | 0 | 0 | 1,706 | 128 |
| **OCT** | 26.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 14,732 | 1,158 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **146** | **83** | **229** | **0.100** | **0.057** | **0.157** | **301,264** | **22,407** | **28,941** | **2,120** | **46,893** | **3,433** |

Table 103. Continued

| | ANGLER | NO. OF SMALLMOUTH | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL | CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,568 | 486 | 0 | 0 | 0 | 0 |
| **FEB** | 198.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,377 | 534 | 0 | 0 | 0 | 0 |
| **MAR** | 169.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,598 | 1,600 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 0 | 1 | 1 | 0.000 | 0.018 | 0.018 | 2,524 | 582 | 0 | 0 | 46 | 11 |
| **JUN** | 238.5 | 8 | 39 | 47 | 0.034 | 0.164 | 0.197 | 45,532 | 3,099 | 1,528 | 104 | 8,975 | 611 |
| **JUL** | 276.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 93,589 | 6,343 | 0 | 0 | 0 | 0 |
| **AUG** | 366.0 | 3 | 17 | 20 | 0.008 | 0.046 | 0.055 | 102,624 | 7,277 | 841 | 60 | 5,608 | 398 |
| **SEP** | 31.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,720 | 1,328 | 0 | 0 | 0 | 0 |
| **OCT** | 26.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 14,732 | 1,158 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **11** | **57** | **68** | **0.008** | **0.039** | **0.047** | **301,264** | **22,407** | **2,369** | **164** | **14,629** | **1,019** |

Table 103. Continued

| | ANGLER | NO. OF EASTERN BROOK TROUT | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL | CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,568 | 486 | 0 | 0 | 0 | 0 |
| **FEB** | 198.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,377 | 534 | 0 | 0 | 0 | 0 |
| **MAR** | 169.7 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,598 | 1,600 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,524 | 582 | 0 | 0 | 0 | 0 |
| **JUN** | 238.5 | 0 | 2 | 2 | 0.000 | 0.008 | 0.008 | 45,532 | 3,099 | 0 | 0 | 382 | 26 |
| **JUL** | 276.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 93,589 | 6,343 | 0 | 0 | 0 | 0 |
| **AUG** | 366.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 102,624 | 7,277 | 0 | 0 | 0 | 0 |
| **SEP** | 31.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,720 | 1,328 | 0 | 0 | 0 | 0 |
| **OCT** | 26.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 14,732 | 1,158 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **0** | **2** | **2** | **0.000** | **0.001** | **0.001** | **301,264** | **22,407** | **0** | **0** | **382** | **26** |

Table 103. Continued

| | ANGLER HOURS | NO. OF CHINOOK SALMON HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,568 | 486 | 0 | 0 | 0 | 0 |
| **FEB** | 198.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,377 | 534 | 0 | 0 | 0 | 0 |
| **MAR** | 169.7 | 0 | 2 | 2 | 0.000 | 0.012 | 0.012 | 10,598 | 1,600 | 0 | 0 | 125 | 19 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,524 | 582 | 0 | 0 | 0 | 0 |
| **JUN** | 238.5 | 1 | 0 | 1 | 0.004 | 0.000 | 0.004 | 45,532 | 3,099 | 191 | 13 | 191 | 13 |
| **JUL** | 276.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 93,589 | 6,343 | 0 | 0 | 0 | 0 |
| **AUG** | 366.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 102,624 | 7,277 | 0 | 0 | 0 | 0 |
| **SEP** | 31.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,720 | 1,328 | 0 | 0 | 0 | 0 |
| **OCT** | 26.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 14,732 | 1,158 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **1** | **2** | **3** | **0.001** | **0.001** | **0.002** | **301,264** | **22,407** | **191** | **13** | **316** | **32** |

Table 103. Continued

| | ANGLER HOURS | NO. OF BROWN TROUT HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,568 | 486 | 0 | 0 | 0 | 0 |
| **FEB** | 198.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,377 | 534 | 0 | 0 | 0 | 0 |
| **MAR** | 169.7 | 0 | 3 | 3 | 0.000 | 0.018 | 0.018 | 10,598 | 1,600 | 0 | 0 | 187 | 28 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,524 | 582 | 0 | 0 | 0 | 0 |
| **JUN** | 238.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 45,532 | 3,099 | 0 | 0 | 0 | 0 |
| **JUL** | 276.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 93,589 | 6,343 | 0 | 0 | 0 | 0 |
| **AUG** | 366.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 102,624 | 7,277 | 0 | 0 | 0 | 0 |
| **SEP** | 31.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,720 | 1,328 | 0 | 0 | 0 | 0 |
| **OCT** | 26.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 14,732 | 1,158 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **0** | **3** | **3** | **0.000** | **0.002** | **0.002** | **301,264** | **22,407** | **0** | **0** | **187** | **28** |

Table 103. Continued

| | ANGLER HOURS | NO. OF YELLOW PERCH HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 3,568 | 486 | 0 | 0 | 0 | 0 |
| **FEB** | 198.4 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 10,377 | 534 | 0 | 0 | 0 | 0 |
| **MAR** | 169.7 | 1 | 0 | 1 | 0.006 | 0.000 | 0.006 | 10,598 | 1,600 | 62 | 9 | 62 | 9 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 2,524 | 582 | 0 | 0 | 0 | 0 |
| **JUN** | 238.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 45,532 | 3,099 | 0 | 0 | 0 | 0 |
| **JUL** | 276.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 93,589 | 6,343 | 0 | 0 | 0 | 0 |
| **AUG** | 366.0 | 1 | 0 | 1 | 0.003 | 0.000 | 0.003 | 102,624 | 7,277 | 280 | 20 | 280 | 20 |
| **SEP** | 31.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,720 | 1,328 | 0 | 0 | 0 | 0 |
| **OCT** | 26.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 14,732 | 1,158 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **2** | **0** | **2** | **0.001** | **0.000** | **0.001** | **301,264** | **22,407** | **343** | **29** | **343** | **29** |

Table 103. Continued

| | ANGLER HOURS | GRAND HARVEST | GRAND RELEASE | GRAND TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | GRAND PE | GRAND ±95% CI | GRAND HARVEST | HARVEST ±95% CI | GRAND CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 93.1 | 11 | 0 | 11 | 0.118 | 0.000 | 0.118 | 3,568 | 486 | 422 | 57 | 422 | 57 |
| **FEB** | 198.4 | 21 | 3 | 24 | 0.106 | 0.015 | 0.121 | 10,377 | 534 | 1,098 | 57 | 1,255 | 65 |
| **MAR** | 169.7 | 30 | 15 | 45 | 0.177 | 0.088 | 0.265 | 10,598 | 1,600 | 1,874 | 283 | 2,810 | 424 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 55.2 | 1 | 8 | 9 | 0.018 | 0.145 | 0.163 | 2,524 | 582 | 46 | 11 | 412 | 95 |
| **JUN** | 238.5 | 100 | 90 | 190 | 0.419 | 0.377 | 0.797 | 45,532 | 3,099 | 19,095 | 1,300 | 36,280 | 2,469 |
| **JUL** | 276.5 | 14 | 39 | 53 | 0.051 | 0.141 | 0.192 | 93,589 | 6,343 | 4,738 | 321 | 17,938 | 1,216 |
| **AUG** | 366.0 | 55 | 40 | 95 | 0.150 | 0.109 | 0.260 | 102,624 | 7,277 | 15,423 | 1,094 | 26,640 | 1,889 |
| **SEP** | 31.2 | 3 | 3 | 6 | 0.096 | 0.096 | 0.193 | 17,720 | 1,328 | 1,706 | 128 | 3,411 | 256 |
| **OCT** | 26.8 | 7 | 0 | 7 | 0.261 | 0.000 | 0.261 | 14,732 | 1,158 | 3,850 | 303 | 3,850 | 303 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1455.3** | **242** | **198** | **440** | **0.166** | **0.136** | **0.302** | **301,264** | **22,407** | **48,252** | **3,552** | **93,019** | **6,774** |

Table 104. Harvest and catch per unit effort calculations for all species caught by anglers in Section 3 of Lake Roosevelt, WA (2000).

| | ANGLER HOURS | NO. OF KOKANEE HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 150.1 | 4 | 31 | 35 | 0.027 | 0.207 | 0.233 | 1,121 | 422 | 30 | 11 | 261 | 98 |
| **FEB** | 234.6 | 0 | 31 | 31 | 0.000 | 0.132 | 0.132 | 8,240 | 1,359 | 0 | 0 | 1,089 | 180 |
| **MAR** | 236.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 12,801 | 554 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 98.6 | 5 | 0 | 5 | 0.051 | 0.000 | 0.051 | 23,663 | 1,581 | 1,200 | 80 | 1,200 | 80 |
| **JUN** | 63.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,118 | 416 | 0 | 0 | 0 | 0 |
| **JUL** | 23.5 | 3 | 0 | 3 | 0.128 | 0.000 | 0.128 | 78,334 | 2,221 | 10,000 | 284 | 10,000 | 284 |
| **AUG** | 103.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 207,151 | 4,970 | 0 | 0 | 0 | 0 |
| **SEP** | | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,911 | 4,986 | 0 | 0 | 0 | 0 |
| **OCT** | 9.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,051 | 1,442 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **919.4** | **12** | **62** | **74** | **0.013** | **0.067** | **0.080** | **499,390** | **17,951** | **11,230** | **375** | **12,551** | **642** |

Table 104. Continued

| | ANGLER | NO. OF RAINBOW TROUT | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL | CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 150.1 | 51 | 17 | 68 | 0.340 | 0.113 | 0.453 | 1,121 | 422 | 381 | 143 | 508 | 191 |
| **FEB** | 234.6 | 83 | 0 | 83 | 0.354 | 0.000 | 0.354 | 8,240 | 1,359 | 2,916 | 481 | 2,916 | 481 |
| **MAR** | 236.2 | 60 | 1 | 61 | 0.254 | 0.004 | 0.258 | 12,801 | 554 | 3,252 | 141 | 3,306 | 143 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 98.6 | 10 | 0 | 10 | 0.101 | 0.000 | 0.101 | 23,663 | 1,581 | 2,400 | 160 | 2,400 | 160 |
| **JUN** | 63.8 | 13 | 2 | 15 | 0.204 | 0.031 | 0.235 | 75,118 | 416 | 15,306 | 85 | 17,661 | 98 |
| **JUL** | 23.5 | 6 | 0 | 6 | 0.255 | 0.000 | 0.255 | 78,334 | 2,221 | 20,000 | 567 | 20,000 | 567 |
| **AUG** | 103.2 | 20 | 0 | 20 | 0.194 | 0.000 | 0.194 | 207,151 | 4,970 | 40,146 | 963 | 40,146 | 963 |
| **SEP** | 0.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,911 | 4,986 | 0 | 0 | 0 | 0 |
| **OCT** | 9.5 | 1 | 0 | 1 | 0.105 | 0.000 | 0.105 | 17,051 | 1,442 | 1,795 | 152 | 1,795 | 152 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **919.5** | **244** | **20** | **264** | **0.265** | **0.022** | **0.287** | **499,390** | **17,951** | **86,195** | **2,692** | **88,731** | **2,755** |

Table 104. Continued

| | ANGLER | NO. OF WALLEYE | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL CATCH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **HOURS** | **HARVEST** | **RELEASE** | **TOTAL** | **HARV.** | **RELEASE** | **TOTAL** | **PE** | **±95% CI** | **HARVEST** | **±95% CI** | **CATCH** | **±95% CI** |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 150.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 1,121 | 422 | 0 | 0 | 0 | 0 |
| **FEB** | 234.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 8,240 | 1,359 | 0 | 0 | 0 | 0 |
| **MAR** | 236.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 12,801 | 554 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 98.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 23,663 | 1,581 | 0 | 0 | 0 | 0 |
| **JUN** | 63.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,118 | 416 | 0 | 0 | 0 | 0 |
| **JUL** | 23.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 78,334 | 2,221 | 0 | 0 | 0 | 0 |
| **AUG** | 103.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 207,151 | 4,970 | 0 | 0 | 0 | 0 |
| **SEP** | | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,911 | 4,986 | 0 | 0 | 0 | 0 |
| **OCT** | 9.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,051 | 1,442 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **919.4** | **0** | **0** | **0** | **0.000** | **0.000** | **0.000** | **499,390** | **17,951** | **0** | **0** | **0** | **0** |

Table 104. Continued

| | ANGLER | NO. OF SMALLMOUTH | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL CATCH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 150.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 1,121 | 422 | 0 | 0 | 0 | 0 |
| **FEB** | 234.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 8,240 | 1,359 | 0 | 0 | 0 | 0 |
| **MAR** | 236.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 12,801 | 554 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 98.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 23,663 | 1,581 | 0 | 0 | 0 | 0 |
| **JUN** | 63.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,118 | 416 | 0 | 0 | 0 | 0 |
| **JUL** | 23.5 | 5 | 0 | 5 | 0.213 | 0.000 | 0.213 | 78,334 | 2,221 | 16,667 | 473 | 16,667 | 473 |
| **AUG** | 103.2 | 0 | 41 | 41 | 0.000 | 0.397 | 0.397 | 207,151 | 4,970 | 0 | 0 | 82,325 | 1,975 |
| **SEP** | | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,911 | 4,986 | 0 | 0 | 0 | 0 |
| **OCT** | 9.5 | 0 | 4 | 4 | 0.000 | 0.420 | 0.420 | 17,051 | 1,442 | 0 | 0 | 7,167 | 606 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **919.4** | **5** | **45** | **50** | **0.005** | **0.049** | **0.054** | **499,390** | **17,951** | **16,667** | **473** | **106,159** | **3,054** |

Table 104. Continued

| | ANGLER HOURS | NO. OF CHINOOK SALMON HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH CATCH | ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 150.1 | 1 | 0 | 1 | 0.007 | 0.000 | 0.007 | 1,121 | 422 | 7 | 3 | 7 | 3 |
| **FEB** | 234.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 8,240 | 1,359 | 0 | 0 | 0 | 0 |
| **MAR** | 236.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 12,801 | 554 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 98.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 23,663 | 1,581 | 0 | 0 | 0 | 0 |
| **JUN** | 63.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,118 | 416 | 0 | 0 | 0 | 0 |
| **JUL** | 23.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 78,334 | 2,221 | 0 | 0 | 0 | 0 |
| **AUG** | 103.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 207,151 | 4,970 | 0 | 0 | 0 | 0 |
| **SEP** | | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,911 | 4,986 | 0 | 0 | 0 | 0 |
| **OCT** | 9.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,051 | 1,442 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **919.4** | **1** | **0** | **1** | **0.001** | **0.000** | **0.001** | **499,390** | **17,951** | **7** | **3** | **7** | **3** |

Table 104. Continued

| | ANGLER | NO. OF BROWN TROUT | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL CATCH | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 150.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 1,121 | 422 | 0 | 0 | 0 | 0 |
| **FEB** | 234.6 | 1 | 0 | 1 | 0.004 | 0.000 | 0.004 | 8,240 | 1,359 | 35 | 6 | 35 | 6 |
| **MAR** | 236.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 12,801 | 554 | 0 | 0 | 0 | 0 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 98.6 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 23,663 | 1,581 | 0 | 0 | 0 | 0 |
| **JUN** | 63.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,118 | 416 | 0 | 0 | 0 | 0 |
| **JUL** | 23.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 78,334 | 2,221 | 0 | 0 | 0 | 0 |
| **AUG** | 103.2 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 207,151 | 4,970 | 0 | 0 | 0 | 0 |
| **SEP** | | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,911 | 4,986 | 0 | 0 | 0 | 0 |
| **OCT** | 9.5 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,051 | 1,442 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **919.4** | **1** | **0** | **1** | **0.001** | **0.000** | **0.001** | **499,390** | **17,951** | **35** | **6** | **35** | **6** |

Table 104. Continued

| | ANGLER HOURS | GRAND HARVEST | GRAND RELEASE | GRAND TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | GRAND PE | GRAND ±95% CI | GRAND HARVEST | HARVEST ±95% CI | GRAND CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | 150.1 | 56 | 48 | 104 | 0.373 | 0.320 | 0.693 | 1,121 | 422 | 418 | 157 | 777 | 292 |
| **FEB** | 234.6 | 84 | 31 | 115 | 0.358 | 0.132 | 0.490 | 8,240 | 1,359 | 2,951 | 487 | 4,040 | 666 |
| **MAR** | 236.2 | 60 | 1 | 61 | 0.254 | 0.004 | 0.258 | 12,801 | 554 | 3,252 | 141 | 3,306 | 143 |
| **APR** | | | | | | | | | | | | | |
| **MAY** | 98.6 | 15 | | 15 | 0.152 | 0.000 | 0.152 | 23,663 | 1,581 | 3,600 | 241 | 3,600 | 241 |
| **JUN** | 63.8 | 13 | 2 | 15 | 0.204 | 0.031 | 0.235 | 75,118 | 416 | 15,318 | 85 | 17,675 | 98 |
| **JUL** | 23.5 | 14 | 0 | 14 | 0.596 | 0.000 | 0.596 | 78,334 | 2,221 | 46,667 | 1,323 | 46,667 | 1,323 |
| **AUG** | 103.2 | 20 | 41 | 61 | 0.194 | 0.397 | 0.591 | 207,151 | 4,970 | 40,159 | 963 | 122,483 | 2,939 |
| **SEP** | | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 75,911 | 4,986 | 0 | 0 | 0 | 0 |
| **OCT** | 9.5 | 1 | 4 | 5 | 0.105 | 0.420 | 0.525 | 17,051 | 1,442 | 1,792 | 152 | 8,958 | 758 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **919.4** | **263** | **127** | **390** | **0.286** | **0.138** | **0.424** | **499,390** | **17,951** | **114,157** | **3,548** | **207,507** | **6,460** |

Table 105. Harvest and catch per unit effort calculations for all species caught by anglers in Section 2 (supplementary creel) of Lake Roosevelt, WA (2000).

| | ANGLER HOURS | NO. OF KOKANEE HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | | | | | | | | | | | | | |
| **FEB** | | | | | | | | | | | | | |
| **MAR** | | | | | | | | | | | | | |
| **APR** | | | | | | | | | | | | | |
| **MAY** | | | | | | | | | | | | | |
| **JUN** | | | | | | | | | | | | | |
| **JUL** | | | | | | | | | | | | | |
| **AUG** | 218.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 34,959 | 1,636 | 0 | 0 | 0 | 0 |
| **SEP** | 780.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 52,801 | 3,497 | 0 | 0 | 0 | 0 |
| **OCT** | 618.0 | 1 | 0 | 1 | 0.002 | 0.000 | 0.002 | 17,771 | 1,141 | 29 | 2 | 29 | 2 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1616.9** | **1** | **0** | **1** | **0.001** | **0.000** | **0.001** | **105,531** | **6,275** | **29** | **2** | **29** | **2** |

Table 105. Continued

| | ANGLER HOURS | NO. OF RAINBOW TROUT HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | | | | | | | | | | | | | |
| **FEB** | | | | | | | | | | | | | |
| **MAR** | | | | | | | | | | | | | |
| **APR** | | | | | | | | | | | | | |
| **MAY** | | | | | | | | | | | | | |
| **JUN** | | | | | | | | | | | | | |
| **JUL** | | | | | | | | | | | | | |
| **AUG** | 218.8 | 12 | 0 | 12 | 0.055 | 0.000 | 0.055 | 34,959 | 1,636 | 1,918 | 90 | 1,918 | 90 |
| **SEP** | 780.1 | 61 | 0 | 61 | 0.078 | 0.000 | 0.078 | 52,801 | 3,497 | 4,129 | 273 | 4,129 | 273 |
| **OCT** | 618.0 | 109 | 4 | 113 | 0.176 | 0.006 | 0.183 | 17,771 | 1,141 | 3,135 | 201 | 3,250 | 209 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1616.9** | **182** | **4** | **186** | **0.113** | **0.002** | **0.115** | **105,531** | **6,275** | **9,181** | **565** | **9,296** | **572** |

Table 105. Continued

| | ANGLER | NO. OF WALLEYE | | | HPUE | CPUE | CPUE | | | | HARVEST | TOTAL | CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | | | | | | | | | | | | | |
| **FEB** | | | | | | | | | | | | | |
| **MAR** | | | | | | | | | | | | | |
| **APR** | | | | | | | | | | | | | |
| **MAY** | | | | | | | | | | | | | |
| **JUN** | | | | | | | | | | | | | |
| **JUL** | | | | | | | | | | | | | |
| **AUG** | 218.8 | 10 | 0 | 10 | 0.046 | 0.000 | 0.046 | 34,959 | 1,636 | 1,598 | 75 | 1,598 | 75 |
| **SEP** | 780.1 | 10 | 0 | 10 | 0.013 | 0.000 | 0.013 | 52,801 | 3,497 | 677 | 45 | 677 | 45 |
| **OCT** | 618.0 | 1 | 5 | 6 | 0.002 | 0.008 | 0.010 | 17,771 | 1,141 | 29 | 2 | 173 | 11 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1616.9** | **21** | **5** | **26** | **0.013** | **0.003** | **0.016** | **105,531** | **6,275** | **2,304** | **121** | **2,447** | **131** |

Table 105. Continued

| | ANGLER | NO. OF SMALLMOUTH | | | HPUE | CPUE | CPUE | | | | HARVEST | | TOTAL CATCH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HOURS | HARVEST | RELEASE | TOTAL | HARV. | RELEASE | TOTAL | PE | ±95% CI | HARVEST | ±95% CI | CATCH | ±95% CI |
| **DEC** | | | | | | | | | | | | | |
| **JAN** | | | | | | | | | | | | | |
| **FEB** | | | | | | | | | | | | | |
| **MAR** | | | | | | | | | | | | | |
| **APR** | | | | | | | | | | | | | |
| **MAY** | | | | | | | | | | | | | |
| **JUN** | | | | | | | | | | | | | |
| **JUL** | | | | | | | | | | | | | |
| **AUG** | 218.8 | 2 | 0 | 2 | 0.009 | 0.000 | 0.009 | 34,959 | 1,636 | 320 | 15 | 320 | 15 |
| **SEP** | 780.1 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 52,801 | 3,497 | 0 | 0 | 0 | 0 |
| **OCT** | 618.0 | 0 | 6 | 6 | 0.000 | 0.010 | 0.010 | 17,771 | 1,141 | 0 | 0 | 173 | 11 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1616.9** | **2** | **6** | **8** | **0.001** | **0.004** | **0.005** | **105,531** | **6,275** | **320** | **15** | **492** | **26** |

Table 105. Continued

| | ANGLER HOURS | NO. OF YELLOW PERCH HARVEST | RELEASE | TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | PE | ±95% CI | HARVEST | HARVEST ±95% CI | TOTAL CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | | | | | | | | | | | | | |
| **FEB** | | | | | | | | | | | | | |
| **MAR** | | | | | | | | | | | | | |
| **APR** | | | | | | | | | | | | | |
| **MAY** | | | | | | | | | | | | | |
| **JUN** | | | | | | | | | | | | | |
| **JUL** | | | | | | | | | | | | | |
| **AUG** | 218.8 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 34,959 | 1,636 | 0 | 0 | 0 | 0 |
| **SEP** | 780.1 | 1 | 0 | 1 | 0.001 | 0.000 | 0.001 | 52,801 | 3,497 | 68 | 4 | 68 | 4 |
| **OCT** | 618.0 | 0 | 0 | 0 | 0.000 | 0.000 | 0.000 | 17,771 | 1,141 | 0 | 0 | 0 | 0 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1616.9** | **1** | **0** | **1** | **0.001** | **0.000** | **0.001** | **105,531** | **6,275** | **68** | **4** | **68** | **4** |

Table 105. Continued

| | ANGLER HOURS | GRAND HARVEST | GRAND RELEASE | GRAND TOTAL | HPUE HARV. | CPUE RELEASE | CPUE TOTAL | GRAND PE | GRAND ±95% CI | GRAND HARVEST | HARVEST ±95% CI | GRAND CATCH | CATCH ±95% CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEC** | | | | | | | | | | | | | |
| **JAN** | | | | | | | | | | | | | |
| **FEB** | | | | | | | | | | | | | |
| **MAR** | | | | | | | | | | | | | |
| **APR** | | | | | | | | | | | | | |
| **MAY** | | | | | | | | | | | | | |
| **JUN** | | | | | | | | | | | | | |
| **JUL** | | | | | | | | | | | | | |
| **AUG** | 218.8 | 24 | 0 | 24 | 0.110 | 0.000 | 0.110 | 34,959 | 1,636 | 3,835 | 179 | 3,835 | 179 |
| **SEP** | 780.1 | 72 | 0 | 72 | 0.092 | 0.000 | 0.092 | 52,801 | 3,497 | 4,873 | 323 | 4,873 | 323 |
| **OCT** | 618.0 | 111 | 15 | 126 | 0.180 | 0.024 | 0.204 | 17,771 | 1,141 | 3,192 | 205 | 3,624 | 233 |
| **NOV** | | | | | | | | | | | | | |
| **TOT** | **1616.9** | **207** | **15** | **222** | **0.128** | **0.009** | **0.137** | **105,531** | **6,275** | **11,900** | **707** | **12,332** | **735** |

Table 106. Total angler pressure estimates for Section 1 of Lake Roosevelt, WA (2000).

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JANUARY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 8.83 | 23 | 203.09 | 105.23 | 1.93 | 2.11 | 0.18 | 4.14 | 0.39 | 8.97 | 17 | 155 | 24 |
| BOAT | 8.83 | 23 | 203.09 | 105.23 | 1.93 | 5.69 | 0.10 | 2.30 | 0.00 | 0.00 | 25 | 0 | 0 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 8.83 | 8 | 70.64 | 24.22 | 2.92 | 3.42 | 1.00 | 8.00 | 0.82 | 6.56 | 80 | 126 | 22 |
| BOAT | 8.83 | 8 | 70.64 | 24.22 | 2.92 | 6.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| TOTAL | 8.83 | 31 | 273.73 | 129.45 | | | 1.28 | 14.44 | 1.21 | 15.53 | 122 | 281 | 46 |
| FEBRUARY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 10.25 | 20 | 205.00 | 100.10 | 2.05 | 2.80 | 0.88 | 17.60 | 1.27 | 25.40 | 101 | 1,321 | 71 |
| BOAT | 10.25 | 20 | 205.00 | 100.10 | 2.05 | 5.69 | 0.30 | 6.00 | 0.10 | 2.00 | 70 | 8 | 6 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 10.25 | 8 | 82.00 | 23.90 | 3.43 | 3.04 | 1.75 | 14.00 | 1.26 | 10.08 | 146 | 349 | 37 |
| BOAT | 10.25 | 8 | 82.00 | 23.90 | 3.43 | 6.05 | 1.30 | 10.40 | 0.50 | 4.00 | 216 | 55 | 15 |
| TOTAL | 10.25 | 28 | 287.00 | 124.00 | | | 4.23 | 48.00 | 3.13 | 41.48 | 533 | 1,733 | 128 |
| MARCH | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 11.97 | 21 | 251.37 | 120.42 | 2.09 | 2.13 | 0.15 | 3.15 | 0.67 | 14.07 | 14 | 413 | 40 |
| BOAT | 11.97 | 21 | 251.37 | 120.42 | 2.09 | 3.22 | 1.00 | 21.00 | 0.00 | 0.00 | 141 | 0 | 0 |

Table 106. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 11.97 | 10 | 119.70 | 24.55 | 4.88 | 4.58 | 1.00 | 0.00 | 1.41 | 14.10 | 0 | 969 | 61 |
| BOAT | 11.97 | 10 | 119.70 | 24.55 | 4.88 | 6.05 | 1.40 | 14.00 | 0.50 | 5.00 | 413 | 122 | 22 |
| TOTAL | 11.97 | 31 | 371.07 | 144.97 | | | 3.55 | 38.15 | 2.58 | 33.17 | 568 | 1,504 | 123 |
| | | | | | | | | | | | | | |
| MAY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 15.2 | 22 | 334.40 | 138.72 | 2.41 | 2.25 | 0.26 | 5.72 | 0.92 | 20.24 | 31 | 988 | 62 |
| BOAT | 15.2 | 22 | 334.40 | 138.72 | 2.41 | 4.45 | 2.10 | 46.20 | 0.70 | 15.40 | 496 | 572 | 47 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 15.2 | 9 | 136.80 | 35.33 | 3.87 | 3.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 15.2 | 9 | 136.80 | 35.33 | 3.87 | 5.91 | 2.00 | 18.00 | 0.70 | 6.30 | 412 | 154 | 24 |
| TOTAL | 15.2 | 31 | 471.20 | 174.05 | | | 4.36 | 69.92 | 2.32 | 41.94 | 939 | 1,713 | 133 |
| | | | | | | | | | | | | | |
| JUNE | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 16.02 | 21 | 336.42 | 106.90 | 3.15 | 1.76 | 0.16 | 3.36 | 0.69 | 14.49 | 19 | 661 | 50 |
| BOAT | 16.02 | 21 | 336.42 | 106.90 | 3.15 | 5.49 | 14.80 | 310.80 | 5.70 | 119.70 | 5,370 | 45,091 | 416 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 16.02 | 9 | 144.18 | 11.85 | 12.17 | 3.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 16.02 | 9 | 144.18 | 11.85 | 12.17 | 6.05 | 9.80 | 88.20 | 3.80 | 34.20 | 6,492 | 14,231 | 234 |
| TOTAL | 16.02 | 30 | 480.60 | 118.75 | | | 24.76 | 402.36 | 10.19 | 168.39 | 11,881 | 59,983 | 700 |

Table 106. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JULY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 15.67 | 23 | 360.41 | 108.33 | 3.33 | 1.76 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 15.67 | 23 | 360.41 | 108.33 | 3.33 | 6.19 | 22.60 | 519.80 | 9.30 | 213.90 | 10,705 | 152,219 | 765 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 15.67 | 8 | 125.36 | 24.12 | 5.20 | 3.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 15.67 | 8 | 125.36 | 24.12 | 5.20 | 5.62 | 32.90 | 263.20 | 11.40 | 91.20 | 7,688 | 43,229 | 408 |
| TOTAL | 15.67 | 31 | 485.77 | 132.45 | | | 55.50 | 783.00 | 20.70 | 305.10 | 18,393 | 195,448 | 1,172 |
| AUGUST | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 14.38 | 21 | 301.98 | 122.58 | 2.46 | 0.85 | 0.40 | 8.40 | 0.82 | 17.22 | 18 | 731 | 53 |
| BOAT | 14.38 | 21 | 301.98 | 122.58 | 2.46 | 6.55 | 3.80 | 79.80 | 1.40 | 29.40 | 1,288 | 2,129 | 90 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 14.38 | 10 | 143.80 | 24.17 | 5.95 | 3.60 | 1.00 | 10.00 | 1.15 | 11.50 | 214 | 787 | 55 |
| BOAT | 14.38 | 10 | 143.80 | 24.17 | 5.95 | 6.31 | 45.60 | 456.00 | 0.00 | 0.00 | 17,119 | 0 | 0 |
| TOTAL | 14.38 | 31 | 445.78 | 146.75 | | | 50.80 | 554.20 | 3.37 | 58.12 | 18,638 | 3,647 | 198 |
| SEPTEMBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 12.45 | 22 | 273.90 | 100.70 | 2.72 | 1.76 | 0.18 | 3.96 | 0.53 | 11.66 | 19 | 370 | 38 |
| BOAT | 12.45 | 22 | 273.90 | 100.70 | 2.72 | 6.73 | 6.80 | 149.60 | 2.60 | 57.20 | 2,738 | 8,899 | 185 |

Table 106. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 12.45 | 8 | 99.60 | 33.83 | 2.94 | 3.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 12.45 | 8 | 99.60 | 33.83 | 2.94 | 6.77 | 7.70 | 61.60 | 3.60 | 28.80 | 1,228 | 2,442 | 97 |
| TOTAL | 12.45 | 30 | 373.50 | 134.53 | | | 14.68 | 215.16 | 6.73 | 97.66 | 3,985 | 11,711 | 319 |
| | | | | | | | | | | | | | |
| OCTOBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 10.73 | 23 | 246.79 | 110.83 | 2.23 | 2.90 | 0.06 | 1.38 | 0.24 | 5.52 | 9 | 68 | 16 |
| BOAT | 10.73 | 23 | 246.79 | 110.83 | 2.23 | 5.50 | 5.60 | 128.80 | 2.50 | 57.50 | 1,577 | 7,362 | 168 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 10.73 | 8 | 85.84 | 29.95 | 2.87 | 3.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 10.73 | 8 | 85.84 | 29.59 | 2.90 | 6.13 | 5.40 | 43.20 | 2.60 | 20.80 | 768 | 1,255 | 69 |
| TOTAL | 10.73 | 31 | 332.63 | 140.78 | | | 11.06 | 173.38 | 5.34 | 83.82 | 2,355 | 8,685 | 254 |
| | | | | | | | | | | | | | |
| ANNUAL TOTAL | | | | | | | | | | | 57,413 | 284,705 | 3,074 |

Table 107 Total angler pressure estimates for Section 2 of Lake Roosevelt, WA (2000).

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JANUARY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 8.83 | 23 | 203.09 | 77.17 | 2.63 | 2.74 | 1.93 | 44.39 | 2.20 | 50.60 | 320 | 6,738 | 161 |
| BOAT | 8.83 | 23 | 203.09 | 77.17 | 2.63 | 5.29 | 1.90 | 43.70 | 0.90 | 20.70 | 608 | 1,128 | 66 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 8.83 | 8 | 70.64 | 26.35 | 2.68 | 3.00 | 3.50 | 28.00 | 1.91 | 15.28 | 225 | 626 | 49 |
| BOAT | 8.83 | 8 | 70.64 | 26.35 | 2.68 | 4.75 | 23.70 | 189.60 | 8.20 | 65.60 | 2,414 | 11,537 | 211 |
| TOTAL | 8.83 | 31 | 273.73 | 103.52 | | | 31.03 | 305.69 | 13.21 | 152.18 | 3,568 | 20,028 | 486 |
| FEBRUARY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 10.25 | 20 | 205.00 | 107.53 | 1.91 | 3.61 | 5.50 | 110.00 | 5.16 | 103.20 | 757 | 20,304 | 279 |
| BOAT | 10.25 | 20 | 205.00 | 107.53 | 1.91 | 5.44 | 8.50 | 170.00 | 3.20 | 64.00 | 1,763 | 7,809 | 173 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 10.25 | 8 | 82.00 | 24.52 | 3.34 | 3.00 | 10.00 | 80.00 | 2.83 | 22.64 | 803 | 1,714 | 81 |
| BOAT | 10.25 | 8 | 82.00 | 24.52 | 3.34 | 5.15 | 51.20 | 409.60 | 0.00 | 0.00 | 7,054 | 0 | 0 |
| TOTAL | 10.25 | 28 | 287.00 | 132.05 | | | 75.20 | 769.60 | 11.19 | 189.84 | 10,377 | 29,827 | 534 |
| MARCH | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 11.97 | 21 | 251.37 | 103.77 | 2.42 | 5.22 | 2.73 | 57.33 | 2.74 | 57.54 | 725 | 8,020 | 176 |
| BOAT | 11.97 | 21 | 251.37 | 103.77 | 2.42 | 5.43 | 18.00 | 378.00 | 8.20 | 172.20 | 4,972 | 71,830 | 525 |

Table 107. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 11.97 | 10 | 119.70 | 23.47 | 5.10 | 3.00 | 9.25 | 0.00 | 10.90 | 109.00 | 0 | 60,595 | 482 |
| BOAT | 11.97 | 10 | 119.70 | 23.43 | 5.11 | 4.59 | 20.90 | 209.00 | 9.40 | 94.00 | 4,901 | 45,142 | 416 |
| TOTAL | 11.97 | 31 | 371.07 | 127.24 | | | 50.88 | 644.33 | 31.24 | 432.74 | 10,598 | 185,587 | 1,600 |
| | | | | | | | | | | | | | |
| MAY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 15.20 | 22 | 334.40 | 104.53 | 3.20 | 1.85 | 1.33 | 29.26 | 2.14 | 47.08 | 173 | 7,091 | 165 |
| BOAT | 15.20 | 22 | 334.40 | 104.53 | 3.20 | 4.22 | 7.20 | 158.40 | 5.40 | 118.80 | 2,138 | 45,150 | 416 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 15.20 | 9 | 136.80 | 18.77 | 7.29 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 15.20 | 9 | 136.80 | 18.77 | 7.29 | 5.40 | 0.60 | 5.40 | 0.00 | 0.00 | 213 | 0 | 0 |
| TOTAL | 15.20 | 31 | 471.20 | 123.30 | | | 9.13 | 193.06 | 7.54 | 165.88 | 2,524 | 52,241 | 582 |
| | | | | | | | | | | | | | |
| JUNE | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 16.02 | 21 | 336.42 | 94.15 | 3.57 | 3.32 | 7.06 | 148.26 | 6.64 | 139.44 | 1,759 | 69,476 | 517 |
| BOAT | 16.02 | 21 | 336.42 | 94.15 | 3.57 | 5.59 | 37.60 | 789.60 | 13.50 | 283.50 | 15,772 | 287,189 | 1,050 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 16.02 | 9 | 144.18 | 26.63 | 5.41 | 3.00 | 7.00 | 63.00 | 6.63 | 59.67 | 1,023 | 19,277 | 272 |
| BOAT | 16.02 | 9 | 144.18 | 26.63 | 5.41 | 5.46 | 101.40 | 912.60 | 30.70 | 276.30 | 26,978 | 413,329 | 1,260 |
| TOTAL | 16.02 | 30 | 480.60 | 120.78 | | | 153.06 | 1,913.46 | 57.47 | 758.91 | 45,532 | 789,271 | 3,099 |

Table 107. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JULY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 15.67 | 23 | 360.41 | 83.65 | 4.31 | 3.32 | 1.54 | 35.42 | 1.76 | 40.48 | 507 | 7,060 | 165 |
| BOAT | 15.67 | 23 | 360.41 | 83.65 | 4.31 | 6.76 | 77.20 | 1,775.60 | 42.60 | 979.80 | 51,716 | 4,136,240 | 3,986 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 15.67 | 8 | 125.36 | 17.75 | 7.06 | 3.00 | 3.33 | 26.64 | 3.51 | 28.08 | 564 | 5,569 | 146 |
| BOAT | 15.67 | 8 | 125.36 | 17.75 | 7.06 | 6.80 | 106.20 | 849.60 | 49.10 | 392.80 | 40,802 | 1,089,692 | 2,046 |
| TOTAL | 15.67 | 31 | 485.77 | 101.40 | | | 188.27 | 2,687.26 | 96.97 | 1,441.16 | 93,589 | 5,238,561 | 6,343 |
| AUGUST | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 14.38 | 21 | 301.98 | 108.35 | 2.79 | 4.10 | 2.94 | 61.74 | 4.08 | 85.68 | 706 | 20,460 | 280 |
| BOAT | 14.38 | 21 | 301.98 | 108.35 | 2.79 | 4.87 | 76.20 | 1,600.20 | 40.00 | 840.00 | 21,720 | 1,966,563 | 2,749 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 14.38 | 10 | 143.80 | 17.68 | 8.13 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 14.38 | 10 | 143.80 | 17.68 | 8.13 | 5.08 | 194.10 | 1,941.00 | 76.00 | 760.00 | 80,198 | 4,697,900 | 4,248 |
| TOTAL | 14.38 | 31 | 445.78 | 126.03 | | | 273.24 | 3,602.94 | 120.08 | 1,685.68 | 102,624 | 6,684,923 | 7,277 |
| SEPTEMBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 12.45 | 22 | 273.90 | 72.37 | 3.78 | 3.32 | 1.42 | 31.24 | 1.88 | 41.36 | 393 | 6,474 | 158 |
| BOAT | 12.45 | 22 | 273.90 | 72.37 | 3.78 | 4.45 | 17.90 | 393.80 | 6.60 | 145.20 | 6,632 | 79,793 | 554 |

Table 107. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 12.45 | 8 | 99.60 | 10.58 | 9.41 | 3.00 | 1.50 | 12.00 | 2.12 | 16.96 | 339 | 2,708 | 102 |
| BOAT | 12.45 | 8 | 99.60 | 10.58 | 9.41 | 5.15 | 26.70 | 213.60 | 10.70 | 85.60 | 10,356 | 68,980 | 515 |
| TOTAL | 12.45 | 30 | 373.50 | 82.95 | | | 47.52 | 650.64 | 21.30 | 289.12 | 17,720 | 157,955 | 1,328 |
| | | | | | | | | | | | | | |
| OCTOBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 10.73 | 23 | 246.79 | 54.22 | 4.55 | 3.32 | 0.20 | 4.60 | 0.63 | 14.49 | 70 | 956 | 61 |
| BOAT | 10.73 | 23 | 246.79 | 54.22 | 4.55 | 5.36 | 17.00 | 391.00 | 9.20 | 211.60 | 9,539 | 203,798 | 885 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 10.73 | 8 | 85.84 | 6.42 | 13.37 | 3.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 10.73 | 8 | 85.84 | 6.42 | 13.37 | 5.15 | 9.30 | 74.40 | 3.70 | 29.60 | 5,123 | 11,715 | 212 |
| TOTAL | 10.73 | 31 | 332.63 | 60.64 | | | 26.50 | 470.00 | 13.53 | 255.69 | 14,732 | 216,468 | 1,158 |
| | | | | | | | | | | | | | |
| ANNUAL TOTAL | | | | | | | | | | | 301,263 | 13,374,862 | 22,406 |

Table 108. Total angler pressure estimates for Section 3 of Lake Roosevelt, WA (2000).

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JANUARY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 8.83 | 23 | 203.09 | 108.00 | 1.88 | 2.99 | 2.73 | 62.79 | 4.46 | 102.58 | 353 | 19,787 | 276 |
| BOAT | 8.83 | 23 | 203.09 | 108.00 | 1.88 | 5.63 | 1.80 | 41.40 | 1.60 | 36.80 | 438 | 2,547 | 99 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 8.83 | 8 | 70.64 | 37.33 | 1.89 | 0.96 | 1.00 | 8.00 | 1.41 | 11.28 | 15 | 241 | 30 |
| BOAT | 8.83 | 8 | 70.64 | 37.33 | 1.89 | 6.50 | 3.20 | 25.60 | 0.80 | 6.40 | 315 | 78 | 17 |
| TOTAL | 8.83 | 31 | 273.73 | 145.33 | | | 8.73 | 137.79 | 8.27 | 157.06 | 1,121 | 22,652 | 422 |
| FEBRUARY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 10.25 | 20 | 205.00 | 83.92 | 2.44 | 2.99 | 5.08 | 101.60 | 4.29 | 85.80 | 742 | 17,983 | 263 |
| BOAT | 10.25 | 20 | 205.00 | 83.92 | 2.44 | 7.58 | 9.10 | 182.00 | 12.80 | 256.00 | 3,370 | 160,092 | 784 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 10.25 | 8 | 82.00 | 46.83 | 1.75 | 3.75 | 2.67 | 21.36 | 3.44 | 27.52 | 140 | 1,326 | 71 |
| BOAT | 10.25 | 8 | 82.00 | 46.83 | 1.75 | 6.50 | 43.80 | 350.40 | 11.60 | 92.80 | 3,988 | 15,079 | 241 |
| TOTAL | 10.25 | 28 | 287.00 | 130.75 | | | 60.65 | 655.36 | 32.13 | 462.12 | 8,240 | 194,480 | 1,359 |
| MARCH | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 11.97 | 21 | 251.37 | 106.33 | 2.36 | 3.58 | 4.82 | 101.22 | 3.80 | 79.80 | 857 | 15,054 | 240 |
| BOAT | 11.97 | 21 | 251.37 | 106.33 | 2.36 | 4.33 | 31.40 | 659.40 | 0.00 | 0.00 | 6,750 | 0 | 0 |

Table 108. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 11.97 | 10 | 119.70 | 32.50 | 3.68 | 2.61 | 3.25 | 0.00 | 2.63 | 26.30 | 0 | 2,548 | 99 |
| BOAT | 11.97 | 10 | 119.70 | 32.50 | 3.68 | 6.50 | 21.70 | 217.00 | 5.70 | 57.00 | 5,195 | 11,966 | 214 |
| TOTAL | 11.97 | 31 | 371.07 | 138.83 | | | 61.17 | 977.62 | 12.13 | 163.10 | 12,801 | 29,568 | 554 |
| | | | | | | | | | | | | | |
| MAY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 15.2 | 22 | 334.40 | 88.92 | 3.76 | 3.75 | 1.14 | 25.08 | 1.66 | 36.52 | 354 | 5,016 | 139 |
| BOAT | 15.2 | 22 | 334.40 | 88.92 | 3.76 | 7.14 | 11.20 | 246.40 | 9.10 | 200.20 | 6,616 | 150,728 | 761 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 15.2 | 9 | 136.80 | 33.00 | 4.15 | 5.50 | 0.75 | 6.75 | 0.96 | 8.64 | 154 | 309 | 34 |
| BOAT | 15.2 | 9 | 136.80 | 33.00 | 4.15 | 6.50 | 68.20 | 613.80 | 18.00 | 162.00 | 16,539 | 108,793 | 646 |
| TOTAL | 15.2 | 31 | 471.20 | 121.92 | | | 81.29 | 892.03 | 29.72 | 407.36 | 23,663 | 264,847 | 1,581 |
| | | | | | | | | | | | | | |
| JUNE | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 16.02 | 21 | 336.42 | 93.42 | 3.60 | 2.92 | 2.54 | 53.34 | 4.52 | 94.92 | 561 | 32,446 | 353 |
| BOAT | 16.02 | 21 | 336.42 | 93.42 | 3.60 | 8.58 | 54.10 | 1,136.10 | 0.00 | 0.00 | 35,103 | 0 | 0 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 16.02 | 9 | 144.18 | 14.67 | 9.83 | 2.93 | 1.00 | 9.00 | 1.14 | 10.26 | 259 | 1,035 | 63 |
| BOAT | 16.02 | 9 | 144.18 | 14.67 | 9.83 | 7.17 | 61.80 | 556.20 | | 0.00 | 39,194 | 0 | 0 |
| TOTAL | 16.02 | 30 | 480.60 | 108.09 | | | 119.44 | 1,754.64 | 5.66 | 105.18 | 75,118 | 33,480 | 416 |

Table 108. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JULY | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 15.67 | 23 | 360.41 | 69.75 | 5.17 | 4.67 | 0.80 | 18.40 | 1.14 | 26.22 | 444 | 3,552 | 117 |
| BOAT | 15.67 | 23 | 360.41 | 69.75 | 5.17 | 1.50 | 179.90 | 4,137.70 | 0.00 | 0.00 | 32,070 | 0 | 0 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 15.67 | 8 | 125.36 | 41.50 | 3.02 | 2.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 15.67 | 8 | 125.36 | 41.50 | 3.02 | 6.50 | 291.70 | 2,333.60 | 77.20 | 617.60 | 45,820 | 1,152,194 | 2,104 |
| TOTAL | 15.67 | 31 | 485.77 | 111.25 | | | 472.40 | 6,489.70 | 78.34 | 643.82 | 78,334 | 1,155,746 | 2,221 |
| | | | | | | | | | | | | | |
| AUGUST | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 14.38 | 21 | 301.98 | 92.50 | 3.26 | 2.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 14.38 | 21 | 301.98 | 92.50 | 3.26 | 6.63 | 187.50 | 3,937.50 | 0.00 | 0.00 | 85,161 | 0 | 0 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 14.38 | 10 | 143.80 | 31.25 | 4.60 | 2.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 14.38 | 10 | 143.80 | 31.25 | 4.60 | 6.39 | 415.00 | 4,150.00 | 118.20 | 1,182.00 | 121,989 | 6,429,006 | 4,970 |
| TOTAL | 14.38 | 31 | 445.78 | 123.75 | | | 602.50 | 8,087.50 | 118.20 | 1,182.00 | 207,151 | 6,429,006 | 4,970 |
| | | | | | | | | | | | | | |
| SEPTEMBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 12.45 | 22 | 273.90 | 57.30 | 4.78 | 2.92 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 12.45 | 22 | 273.90 | 57.30 | 4.78 | 6.29 | 60.50 | 1,331.00 | 40.50 | 891.00 | 40,019 | 3,794,834 | 3,818 |

Table 108. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 12.45 | 8 | 99.60 | 16.58 | 6.01 | 2.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 12.45 | 8 | 99.60 | 16.58 | 6.01 | 6.50 | 114.90 | 919.20 | 30.40 | 243.20 | 35,892 | 355,306 | 1,168 |
| TOTAL | 12.45 | 30 | 373.50 | 73.88 | | | 175.40 | 2,250.20 | 70.90 | 1,134.20 | 75,911 | 4,150,140 | 4,986 |
| | | | | | | | | | | | | | |
| OCTOBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 10.73 | 23 | 246.79 | 69.00 | 3.58 | 1.17 | 0.14 | 3.22 | 0.53 | 12.19 | 13 | 531 | 45 |
| BOAT | 10.73 | 23 | 246.79 | 69.00 | 3.58 | 6.29 | 21.40 | 492.20 | 14.30 | 328.90 | 11,073 | 386,907 | 1,219 |
| | | | | | | | | | | | | | |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 10.73 | 8 | 85.84 | 11.75 | 7.31 | 2.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 10.73 | 8 | 85.84 | 11.75 | 7.31 | 6.50 | 15.70 | 125.60 | 4.20 | 33.60 | 5,964 | 8,248 | 178 |
| TOTAL | 10.73 | 31 | 332.63 | 80.75 | | | 37.24 | 621.02 | 19.03 | 374.69 | 17,051 | 395,686 | 1,442 |
| | | | | | | | | | | | | | |
| ANNUAL TOTAL | | | | | | | | | | | 499,390 | 12,675,605 | 17,951 |

Table 109. Total angler pressure estimates for Section 2 (supplementary creel) of Lake Roosevelt, WA (2000).

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AUGUST | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 14.38 | 21 | 301.98 | 39.70 | 7.61 | 1.87 | 2.00 | 42.00 | 3.21 | 67.41 | 596 | 34565 | 364 |
| BOAT | 14.38 | 21 | 301.98 | 39.70 | 7.61 | 4.85 | 44.40 | 932.40 | 11.20 | 235.20 | 34362 | 420787 | 1271 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | X | X | X | X | X | X | X | X | X | X | X | X | X |
| BOAT | X | X | X | X | X | X | X | X | X | X | X | X | X |
| TOTAL | 14.38 | 31 | 445.78 | 39.70 | | | 46.40 | 974.40 | 14.41 | 302.61 | 34959 | 455352 | 1636 |
| SEPTEMBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 12.45 | 22 | 273.90 | 84.48 | 3.24 | 1.09 | 0.50 | 11.00 | 1.09 | 23.98 | 39 | 1864 | 85 |
| BOAT | 12.45 | 22 | 273.90 | 84.48 | 3.24 | 6.48 | 44.40 | 976.80 | 11.20 | 246.40 | 20535 | 196843 | 870 |
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 12.45 | 8 | 99.60 | 30.83 | 3.23 | 5.81 | 3.00 | 24.00 | 4.24 | 33.92 | 450 | 3717 | 119 |
| BOAT | 12.45 | 8 | 99.60 | 30.83 | 3.23 | 6.22 | 197.80 | 1582.40 | 86.00 | 688.00 | 31777 | 1529194 | 2424 |
| TOTAL | 12.45 | 30 | 373.50 | 115.31 | | | 245.70 | 2594.20 | 102.53 | 992.30 | 52801 | 1731619 | 3497 |
| OCTOBER | | | | | | | | | | | | | |
| WEEKDAY | | | | | | | | | | | | | |
| SHORE | 10.73 | 23 | 246.79 | 97.33 | 2.54 | 6.37 | 1.20 | 27.60 | 1.70 | 39.10 | 446 | 3876 | 122 |
| BOAT | 10.73 | 23 | 246.79 | 97.33 | 2.54 | 6.82 | 35.30 | 811.90 | 14.20 | 326.60 | 14044 | 270466 | 1019 |

Table 109. Continued

| Strata | Hours per day Hd | Days per month Ds | Hours per month Ns | Hours creeled per month n | Time correction factor Ns/n | Angler hours per angler Ha | Mean anglers per day Xd | Mean anglers per month Xs | ± anglers per day Sd | ± anglers per month Ss | Pressure estimate per month PE | Variance of PE per month VPE | 95% C.I. per month CI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WEEKEND | | | | | | | | | | | | | |
| SHORE | 10.73 | 8 | 85.84 | 13.53 | 6.34 | 4.65 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 |
| BOAT | 10.73 | 8 | 85.84 | 13.53 | 6.34 | 6.22 | 10.40 | 83.20 | 0.00 | 0.00 | 3281 | 0 | 0 |
| TOTAL | 10.73 | 31 | 332.63 | 110.86 | | | 46.90 | 922.70 | 15.90 | 365.70 | 17771 | 274343 | 1141 |
| ANNUAL TOTAL | | | | | | | | | | | 105531 | 2461313 | 6275 |

Table 110. Total boat angler pressure for Section 1 of Lake Roosevelt, WA (2000).

| STRATA | | Correction factor (Air/ground) | Sum of boats | Sum of days sampled | Mean Boat Trailers for the day | % Boats Fishing | Mean Number Angler/boat | Number Angler/boat S.D. | Corrected mean angler (Xd) | Corrected Xd angler S.D. |
|---|---|---|---|---|---|---|---|---|---|---|
| **December** | WD | 1.539 | X | X | X | X | X | X | X | X |
| | WE | 2.275 | X | X | X | X | X | X | X | X |
| **January** | WD | 1.539 | 1 | 17 | 0.059 | 76 | 1.654 | 0.683 | 0.1 | 0.0 |
| | WE | 2.275 | 0 | 4 | 0 | 75 | 1.600 | 0.507 | 0.0 | 0.0 |
| **February** | WD | 1.539 | 3 | 17 | 0.176 | 76 | 1.654 | 0.683 | 0.3 | 0.1 |
| | WE | 2.275 | 2 | 4 | 0.5 | 75 | 1.600 | 0.507 | 1.4 | 0.4 |
| **March** | WD | 1.390 | 12 | 20 | 0.6 | 57 | 2 | 0 | 1.0 | 0.0 |
| | WE | 0.974 | 5 | 4 | 1.25 | 75 | 1.600 | 0.507 | 1.5 | 0.5 |
| **April** | WD | 1.390 | X | X | X | X | X | X | X | X |
| | WE | 0.974 | X | X | X | X | X | X | X | X |
| **May** | WD | 1.390 | 31 | 23 | 1.348 | 100 | 1.14 | 0.38 | 2.1 | 0.7 |
| | WE | 0.974 | 11 | 6 | 1.833 | 75 | 1.5 | 0.55 | 2.0 | 0.7 |
| **June** | WD | 0.893 | 185 | 19 | 9.737 | 85 | 2 | 0.77 | 14.8 | 5.7 |
| | WE | 1.261 | 14 | 2 | 7 | 75 | 1.600 | 0.507 | 10.6 | 3.4 |
| **July** | WD | 0.893 | 244 | 18 | 18.769 | 74 | 1.82 | 0.75 | 22.6 | 9.3 |
| | WE | 1.261 | 125 | 4 | 31.25 | 50 | 1.67 | 0.58 | 32.9 | 11.4 |

Table 110. Continued

| STRATA | | Correction factor (Air/ground) | Sum of boats | Sum of days sampled | Mean Boat Trailers for the day | % Boats Fishing | Mean Number Angler/boat | Number Angler/boat S.D. | Corrected mean angler (Xd) | Corrected Xd angler S.D. |
|---|---|---|---|---|---|---|---|---|---|---|
| **August** | WD | 0.893 | 238 | 20 | 11.9 | 25 | 1.44 | 0.53 | 3.8 | 1.4 |
| | WE | 1.261 | 201 | 4 | 50.25 | 36 | 2 | 0 | 45.6 | 0.0 |
| **September** | WD | 1.144 | 76 | 16 | 4.75 | 83 | 1.5 | 0.58 | 6.8 | 2.6 |
| | WE | 1.382 | 43 | 5 | 8.6 | 43 | 1.5 | 0.71 | 7.7 | 3.6 |
| **October** | WD | 1.144 | 45 | 18 | 3.462 | 87 | 1.63 | 0.74 | 5.6 | 2.5 |
| | WE | 1.382 | 13 | 5 | 2.6 | 100 | 1.5 | 0.71 | 5.4 | 2.6 |
| **November** | WD | 1.144 | X | X | X | X | X | X | X | X |
| | WE | 1.382 | X | X | X | X | X | X | X | X |
| **Annual** | **WD** | **1.242** | **835** | **168** | **5.64** | **76** | **1.65** | **0.68** | **8.8** | **3.7** |
| | **WE** | **1.473** | **414** | **38** | **11.48** | **75** | **1.60** | **0.51** | **20.3** | **6.4** |
| **Grand Totals** | | **1.357** | **1249** | **206** | **8.56** | **76** | **1.64** | **0.64** | **14.5** | **5.7** |

Table 111 Total boat angler pressure for Section 2 of Lake Roosevelt, WA (2000).

| STRATA | | Correction factor (Air/ground) | Sum of boats | Sum of days sampled | Mean Boat Trailers for the day | % Boat Fishing | Mean Number Angler/boat | Number Angler/boat S.D. | Corrected mean angler | Corrected X angler S.D. |
|---|---|---|---|---|---|---|---|---|---|---|
| **December** | WD | 1.539 | X | X | X | X | X | X | X | X |
| | WE | 2.275 | X | X | X | X | X | X | X | X |
| **January** | WD | 1.539 | 13.000 | 14 | 0.93 | 72.330 | 2.461 | 1.279 | 2.5 | 1.3 |
| | WE | 2.275 | 25.000 | 4 | 6.25 | 100.000 | 1.667 | 0.577 | 23.7 | 8.2 |
| **February** | WD | 1.539 | 47.000 | 19 | 2.47 | 100.000 | 2.222 | 0.833 | 8.5 | 3.2 |
| | WE | 2.275 | 30.000 | 4 | 7.50 | 100.000 | 3.000 | 0.000 | 51.2 | 0.0 |
| **March** | WD | 1.390 | 102.000 | 17 | 6.00 | 100.000 | 2.154 | 0.987 | 18.0 | 8.2 |
| | WE | 0.974 | 43.000 | 4 | 10.75 | 100.000 | 2.000 | 0.894 | 20.9 | 9.4 |
| **April** | WD | 1.390 | X | X | X | X | X | X | X | X |
| | WE | 0.974 | X | X | X | X | X | X | X | X |
| **May** | WD | 1.390 | 44.000 | 18 | 2.44 | 87.500 | 2.429 | 1.813 | 7.2 | 5.4 |
| | WE | 0.974 | 1.000 | 3 | 0.33 | 100.000 | 2.000 | 0.000 | 0.6 | 0.0 |
| **June** | WD | 0.893 | 531.000 | 16 | 33.19 | 53.520 | 2.447 | 1.032 | 38.8 | 16.4 |
| | WE | 1.261 | 422.000 | 5 | 84.40 | 38.100 | 2.500 | 0.756 | 101.4 | 30.7 |
| **July** | WD | 0.893 | 1054.000 | 14 | 75.29 | 42.030 | 2.759 | 1.527 | 78.0 | 43.1 |
| | WE | 1.261 | 452.000 | 3 | 150.67 | 20.590 | 2.714 | 1.254 | 106.2 | 49.1 |
| **August** | WD | 0.893 | 1511.000 | 20 | 75.55 | 41.000 | 2.756 | 1.445 | 76.2 | 40.0 |
| | WE | 1.261 | 455.000 | 2 | 227.50 | 23.530 | 2.875 | 1.126 | 194.1 | 76.0 |

Table 111. Continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **September** | WD | 1.144 | 230.000 | 12 | 19.17 | 54.550 | 1.500 | 0.548 | 17.9 | 6.6 |
| | WE | 1.382 | 46.000 | 2 | 23.00 | 34.000 | 2.471 | 0.992 | 26.7 | 10.7 |
| **October** | WD | 1.144 | 148.000 | 11 | 13.45 | 100.000 | 2.091 | 1.136 | 32.2 | 17.5 |
| | WE | 1.382 | 8.000 | 1 | 8.00 | 34.000 | 2.471 | 0.992 | 9.3 | 3.7 |
| **November** | WD | 1.144 | X | X | X | X | X | X | X | X |
| | WE | 1.382 | X | X | X | X | X | X | X | X |
| **Annual** | **WD** | **1.242** | **3680.000** | **142** | **25.39** | **72.33** | **2.46** | **1.28** | **56.1** | **29.2** |
| | **WE** | **1.473** | **1482.000** | **30** | **57.60** | **34.00** | **2.47** | **0.99** | **71.3** | **28.6** |
| **Grand Totals** | | **1.357** | **5162.000** | **172** | **30.01** | **53.16** | **2.47** | **1.14** | **53.4** | **24.7** |

Table 112. Total boat angler pressure for Section 3 of Lake Roosevelt, WA (2000).

| STRATA | | Correction factor (Air/ground) | Sum of boats | Sum of days sampled | Mean Boat Trailers for the day | % Boats Fishing | Mean Number Angler/boat | Number Angler/boat S.D. | Corrected mean angler | Corrected Xd angler S.D. |
|---|---|---|---|---|---|---|---|---|---|---|
| **December** | WD | 1.539 | X | X | X | X | X | X | X | X |
| | WE | 2.275 | X | X | X | X | X | X | X | X |
| **January** | WD | 1.539 | 26 | 15 | 1.73 | 66.67 | 1.00 | 0.89 | 1.8 | 1.6 |
| | WE | 2.275 | 4 | 5 | 0.80 | 100.00 | 1.75 | 0.46 | 3.2 | 0.8 |
| **February** | WD | 1.539 | 102 | 13 | 7.85 | 50.00 | 1.50 | 2.12 | 9.1 | 12.8 |
| | WE | 2.275 | 66 | 6 | 11.00 | 100.00 | 1.75 | 0.46 | 43.8 | 11.6 |
| **March** | WD | 1.390 | 128 | 17 | 7.53 | 100.00 | 3.00 | 0.00 | 31.4 | 0.0 |
| | WE | 0.974 | 51 | 4 | 12.75 | 100.00 | 1.75 | 0.46 | 21.7 | 5.7 |
| **April** | WD | 1.390 | X | X | X | X | X | X | X | X |
| | WE | 0.974 | X | X | X | X | X | X | X | X |
| **May** | WD | 1.390 | 101 | 14 | 7.21 | 80.00 | 1.40 | 1.14 | 11.2 | 9.1 |
| | WE | 0.974 | 160 | 4 | 40.00 | 100.00 | 1.75 | 0.46 | 68.2 | 18.0 |
| **June** | WD | 0.893 | 394 | 13 | 30.31 | 100.00 | 2.00 | 0.00 | 54.1 | 0.0 |
| | WE | 1.261 | 49 | 2 | 24.50 | 100.00 | 2.00 | 0.00 | 61.8 | 0.0 |
| **July** | WD | 0.893 | 1007 | 10 | 100.70 | 100.00 | 2.00 | 0.00 | 179.9 | 0.0 |
| | WE | 1.261 | 661 | 5 | 132.20 | 100.00 | 1.75 | 0.46 | 291.7 | 77.2 |
| **August** | WD | 0.893 | 1260 | 12 | 105.00 | 100.00 | 2.00 | 0.00 | 187.5 | 0.0 |
| | WE | 1.261 | 768 | 4 | 192.00 | 100.00 | 1.71 | 0.49 | 415.0 | 118.2 |

Table 112. Continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **September** | WD | 1.144 | 325 | 8 | 40.63 | 85.24 | 1.53 | 1.02 | 60.5 | 40.4 |
| | WE | 1.382 | 95 | 2 | 47.50 | 100.00 | 1.75 | 0.46 | 114.9 | 30.4 |
| **October** | WD | 1.144 | 201 | 14 | 14.36 | 85.24 | 1.53 | 1.02 | 21.4 | 14.3 |
| | WE | 1.382 | 13 | 2 | 6.50 | 100.00 | 1.75 | 0.46 | 15.7 | 4.2 |
| **November** | WD | 1.144 | X | X | X | X | X | X | X | X |
| | WE | 1.382 | X | X | X | X | X | X | X | X |
| **Annual** | **WD** | **1.242** | **3544** | **116** | **35.03** | **85.24** | **1.53** | **1.02** | **56.6** | **37.8** |
| | **WE** | **1.473** | **1867** | **34** | **51.92** | **100.00** | **1.75** | **0.46** | **133.8** | **35.4** |
| **Grand Totals** | | **1.357** | **5411** | **150** | **36.07** | **92.62** | **1.59** | **1.21** | **72.2** | **54.8** |

Table 113 Total boat angler pressure for Section 2 (supplemental creel) of Lake Roosevelt, WA (2000).

| STRATA | | Correction factor (Air/ground) | Sum of boats | Sum of days sampled | Mean Boat Trailers for the day | % Boats Fishing | Mean Number Angler/boat | Number Angler/boat S.D. | Corrected mean angler | Corrected Xd angler S.D. |
|---|---|---|---|---|---|---|---|---|---|---|
| **December** | WD | 1.539 | X | X | X | X | X | X | X | X |
| | WE | 2.275 | X | X | X | X | X | X | X | X |
| **January** | WD | 1.539 | X | X | X | X | X | X | X | X |
| | WE | 2.275 | X | X | X | X | X | X | X | X |
| **February** | WD | 1.539 | X | X | X | X | X | X | X | X |
| | WE | 2.275 | X | X | X | X | X | X | X | X |
| **March** | WD | 1.390 | X | X | X | X | X | X | X | X |
| | WE | 0.974 | X | X | X | X | X | X | X | X |
| **April** | WD | 1.390 | X | X | X | X | X | X | X | X |
| | WE | 0.974 | X | X | X | X | X | X | X | X |
| **May** | WD | 1.390 | X | X | X | X | X | X | X | X |
| | WE | 0.974 | X | X | X | X | X | X | X | X |
| **June** | WD | 0.893 | X | X | X | X | X | X | X | X |
| | WE | 1.261 | X | X | X | X | X | X | X | X |
| **July** | WD | 0.893 | X | X | X | X | X | X | X | X |
| | WE | 1.261 | X | X | X | X | X | X | X | X |

Table 113. Continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **August** | WD | 0.893 | 447 | 7 | 63.86 | 45.450 | 3.400 | 2.370 | 88.1 | 61.4 |
| | WE | 1.261 | X | X | X | X | X | X | X | X |
| **September** | WD | 1.144 | 305 | 14 | 21.79 | 90.240 | 1.973 | 0.499 | 44.4 | 11.2 |
| | WE | 1.382 | 363 | 5 | 72.60 | 71.420 | 2.76 | 1.200 | 197.8 | 86.0 |
| **October** | WD | 1.144 | 203 | 15 | 13.53 | 97.440 | 2.34 | 0.94 | 35.3 | 14.2 |
| | WE | 1.382 | 15 | 2 | 7.50 | 100.000 | 1.00 | 0.000 | 10.4 | 0.0 |
| **November** | WD | 1.144 | X | X | X | X | X | X | X | X |
| | WE | 1.382 | X | X | X | X | X | X | X | X |
| **Annual** | **WD** | **1.242** | **955** | **36** | **26.53** | **83.33** | **2.31** | **1.13** | **63.3** | **31.1** |
| | **WE** | **1.473** | **378** | **7** | **54.00** | **73.68** | **2.57** | **1.26** | **150.7** | **73.8** |
| **Grand** | | **1.357** | **1333** | **43** | **31.00** | **80.71** | **2.37** | **1.17** | **80.5** | **39.7** |