LAKE ROOSEVELT FISHERIES AND LIMNOLOGICAL RESEARCH

1994 ANNUAL REPORT

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PREFACE

This document contains two 1994 annual reports, organized by sections, for projects conducted in Lake Roosevelt. The first section contains the Lake Roosevelt Data Collection Project (BPA Contract No. 94BI32148; Project No. 94-043) report. The second section contains the Lake Roosevelt Monitoring Program (BPA Contract No. DE8179-88DP91819; Project No. 88-63) report.

In previous years, the Monitoring Program and the Data Collection Project were reported in separate documents. These two programs were dependent upon one another for data in order to complete each project's respective analysis. To better understand how these two programs are interconnected, we have combined the two annual reports. Each section includes an abstract, introduction, methods, results, discussion, references and appendices. In each discussion section we have tried to relate the results of the studies to existing knowledge, and speculate on management recommendations.

Section 1 discusses the Data Collection Project which is concerned with the effect of lake operations on the biota. This project was started in 1991 and was funded through the Systems Operation Review process which sought to develop an operational scenario of the Federal Columbia River Hydropower System which minimized the impacts of licensed river operations to all stakeholders of the Columbia River. The objective of the Data Collection Project was to build a biological model of the lake to predict how lake operations impact the biota of the lake.

Section 2 discusses the Monitoring Program which is primarily concerned with the effect of stocking kokanee salmon and rainbow trout on the ecosystem. The Sherman Creek Hatchery (operated by the Washington Department of Fish and Wildlife) and the Spokane Tribal Hatchery (operated by the Spokane Tribe of Indians) were operational in 1991. To evaluate the effectiveness of stocking on the lake biota and fishery, baseline data was collected from 1988 through 1990 (pre-hatchery stocking). These data were compared to baseline fisheries data collected from 1991 through 1994 (post-hatchery stocking). The data generated from sampling was analyzed to determine food availability, utilization and preferences, growth rates, and angler use information (e.g. harvest). The objective of the Monitoring Program was to maximize angler harvest and maximize adult returns to egg collection sites.

In addition, the monitoring program began investigations to determine the critical period for thyroxine-induced olfactory imprinting. Field tests were conducted by exposing juvenile kokanee to the synthetic chemicals morpholine and phenethyl alcohol at different life stages. These artificially imprinted fish were coded wire tagged and stocked into Lake Roosevelt. Adult kokanee salmon were collected during the spawning period and checked for tags to determine which life stage homed better to its release site. Also since imprinting and smoltification both contribute to homing, investigations were initiated in 1992 to determine the degree of smoltification in kokanee salmon in order to minimize entrainment through Grand Coulee Dam. Scholz et al. (1992 and 1993), and Tilson et al. (1994, 1995) wrote supplemental reports to the Monitoring Program on kokanee imprinting and recommended kokanee stocking strategies which maximized homing to egg collection sites.

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SECTION 1

MEASUREMENT OF LAKE ROOSEVELT BIOTA IN RELATION TO RESERVOIR OPERATIONS

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ABSTRACT

This project began collecting biological data from Lake Roosevelt starting in 1991, with a long term goal of developing a computer model which accurately predicts biological responses to reservoir operations as part of the System Operation Review Program. Working in conjunction with the Lake Roosevelt Monitoring Project, this study collected limnological, reservoir operation, zooplankton, creel, net-pen rainbow trout and kokanee tagging data in 1994. Results obtained from current and past years data allow for the quantification of impacts to lake limnology, zooplankton, fish species and fisherman caused by reservoir drawdowns and low water retention times. In Lake Roosevelt, reservoir operations influence lake morphology as well as habitat availability for fish and their food. Lake elevations reached a yearly low of 1,263.90 feet above sea level in April and a yearly high of 1,288.50 feet in October , representing the least significant draw down on Lake Roosevelt since 199 1. Mean yearly reservoir elevation was 1,275.80 feet and the yearly mean water retention time was 56.94 days. Zooplankton data was collected monthly at eight sites in 1994. Lake Roosevelt experienced a peak in *Daphnia* spp. densities during July and August reaching a peak density of nearly 9,000 organisms per m^3 in August at Seven Bays. High densities of zooplankton were found in the lower end of the reservoir which supports the hypothesis that flushing of reservoir water increases downstream plankton densities and biomass as well as increasing entrainment of fishes. In 1994, a total of 26,975 net-pen rainbow trout were tagged at locations throughout the reservoir. Anglers fishing in Lake Roosevelt or below returned 448 tags, of which 399 tags were from fish tagged in 1994. Trends in tag returns continue to indicate that entrainment of Lake Roosevelt net-pen fish are influenced by water retention times and release times. Creel surveys of Rufus Woods were conducted over a six month period in 1993 and seven months in 1994 to estimate entrainment loss of tagged fish, however no tags were observed. Harvest estimates for the creel period were 46, 0 and 55 fish for rainbow trout, kokanee and walleye in 1993 and 384, 5 and 4,856 fish per year respectively in 1994.

ACKNOWLEDGMENTS

We gratefully acknowledge Dr. Allan Scholz (Eastern Washington University), and Dr. Ross Black (EWU), for advise and scientific input on this project. Creel clerks William Matt Sr. (Spokane Tribe of Indians), Jim Meskan (Washington Department of Fish and Wildlife), and Leroy Williams (Collville Confederated Tribes), for collection of creel data and assistance in tagging operations. John Hisata (Washington Department of Fish and Wildlife) and Jerry Marco (Colville Confederated Tribes), for advise and support in all areas. Dan Epstein and Dave Geist (Battelle Pacific Northwest Laboratories), for their oversight and assistance with this research. We give special thanks to Mary Beth Tilson, Amy Voeller, Mike Thatcher, Del Brown, Henry Etue, Bart Kieffer, William Matt Jr., Sam Abrahamson, Jason Wynecoop and Tim Peone for their assistance in the collection and analysis of field data. We further thank Hank Etue and Del Brown for their efficient maintenance and repair of all equipment used in this project.

We acknowledge Kelly Cash (National Park Service), and Gary Kuiper (NPS), for graciously providing camping at no cost to the project. We also thank Winn Self, Marty Blum, Roy Graffis, and students from Hunters High School for their assistance in the feeding and tagging of net-pen rainbow trout. Additional thanks goes to Charlie Craig (BPA, Division of Fish and Wildlife), who served as BPA project manager, Rob Pierson (Bonneville Power Administration), Larry Goodrow (Executive Director, Spokane Tribe of Indians and UCUT Administrator) Mary Verner (Spokane Tribe of Indians- Natural Resource Director), Amy Voeller (previous project manager) and Carol Evans (Accountant, Spokane Tribe of Indians) for administration of contracts.

This project was supported by a contract from the U.S. Department of Energy, Bonneville Power Administration (BPA), Contact No.94BI32148, Modification No. A006, Project No. 94-043. Additional financial support for this project was provided by a grant from the U.S. Department of Interior, Bureau of Indian Affairs to the Upper Columbia United Tribes (UCUT), to fund the operation of the UCUT Fisheries Research Center at Eastern Washington University (Grant #- P1 2614208001). Capitol equipment for this project was supplied by the UCUT Fisheries Center.

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1.0 INTRODUCTION

1.1 Project History

The Lake Roosevelt Data Collection Project (Data Collection Project) began in July, 1991 as part of the Bonneville Power Administration (BPA), Bureau of Reclamation (BOR), and U.S. Army Corps of Engineer's (ACE) System Operation Review process. This process sought to develop an operational scenario for the Federal Columbia River Hydropower System which minimized impacts to all stakeholders of the Columbia River. The objective of the Data Collection Project was to collect data for the development of a biological model for Lake Roosevelt enabling researchers to identify which lake operation scenario best suites the biota of the lake. Major components of the Lake Roosevelt model will be: 1) quantification of impacts to phytoplankton, zooplankton and fish caused by reservoir drawdowns and low water retention times; 2) quantification of number, distribution, and use of fish food organisms in the reservoir by season; 3) determination of seasonal growth of fish species as related to reservoir operations, prey abundance, and utilization; and 4) quantification of entrainment levels of zooplankton and fish as related to reservoir operations and water retention times. Once completed, the model will predict biological responses to different reservoir operation strategies.

This chapter contains the results of the Data Collection Project for Lake Roosevelt from January through December 1994. Previous annual reports for the Data Collection Project were written by Griffith *et al.* (1991), Griffith and McDowell (1996) and Voeller (1996).

1.2 1994 Study Objectives

Objectives of the Lake Roosevelt Data Collection Project for 1994 were as follows:

1. Collect zooplankton biomass and density data at nine locations throughout Lake Roosevelt.

2. Tag rainbow trout in Lake Roosevelt and simultaneously conduct a creel survey at Rufus Woods to estimate rainbow trout entrainment.

3. Collect limnological data on the lake including: pH, temperature, dissolved oxygen, conductivity and oxidative reductive potential at nine sites throughout Lake Roosevelt.

3. Compare and contrast data collected during 1994 with previous years, to identify changes in the lake.

5 Participate in operational decisions on lake Roosevelt by providing technical input to the SOR through the resident fish work group.

2.0 MATERIALS AND METHODS

2.1 Description of Study Area

Lake Roosevelt is a mainstem Columbia River impoundment formed by the construction of Grand Coulee Dam in 1939 (Figure 2.1). Filled in 1941, the reservoir inundates 33,490 hectares at a full pool elevation of 393 m above mean sea level. It has a maximum width of 3.4 km and a maximum depth of 122 m (Stober *et al.* 198 1). 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.

2.2 Reservoir Hydrology

Water quality measurements of temperature, pH, dissolved oxygen, conductivity, and oxygen reduction potential were collected using a Hydrolab Surveyor II at eight sites in the reservoir. Samples were collected mid-channel to a depth of 33 M at Kettle Falls (Location 1), Gifford (location 2), Hunters (location 3), Porcupine Bay (location 4), Seven Bays (location 6), Keller Ferry (location 7), San Poil River (Location 8) and Spring Canyon (location 9) monthly in 1994 (Figure 2.1). Sechii disk readings were taken in conjunction with Hydrolab measurements at each of the above sites. This data collection continues investigations which began in 1991 (Appendix D).

Reservoir elevations and water retention times were calculated from daily midnight reservoir elevation (ft) and total outflow in thousand cubic feet per second per day (kcfs). Reservoir elevation and total outflow values were derived from summary reports for Grand Coulee Dam prepared monthly in 1994 by the U.S. Army Corps of Engineers, Reservoir Control Center in Portland, OR. Reservoir elevation was converted to volume of water stored (kcfsd) using a U.S. Army Corps of Engineers (198 1) reservoir water storage table. Water retention time was calculated using the formula:

$$\text{Water retention time (days)} = \frac{\text{Reservoir volume (kcfsd)}}{\text{Outflow (kcfs)}}$$

Daily values for each category were added and then divided by the number of days in each month to attain mean reservoir elevations and water retention times (Appendix A).

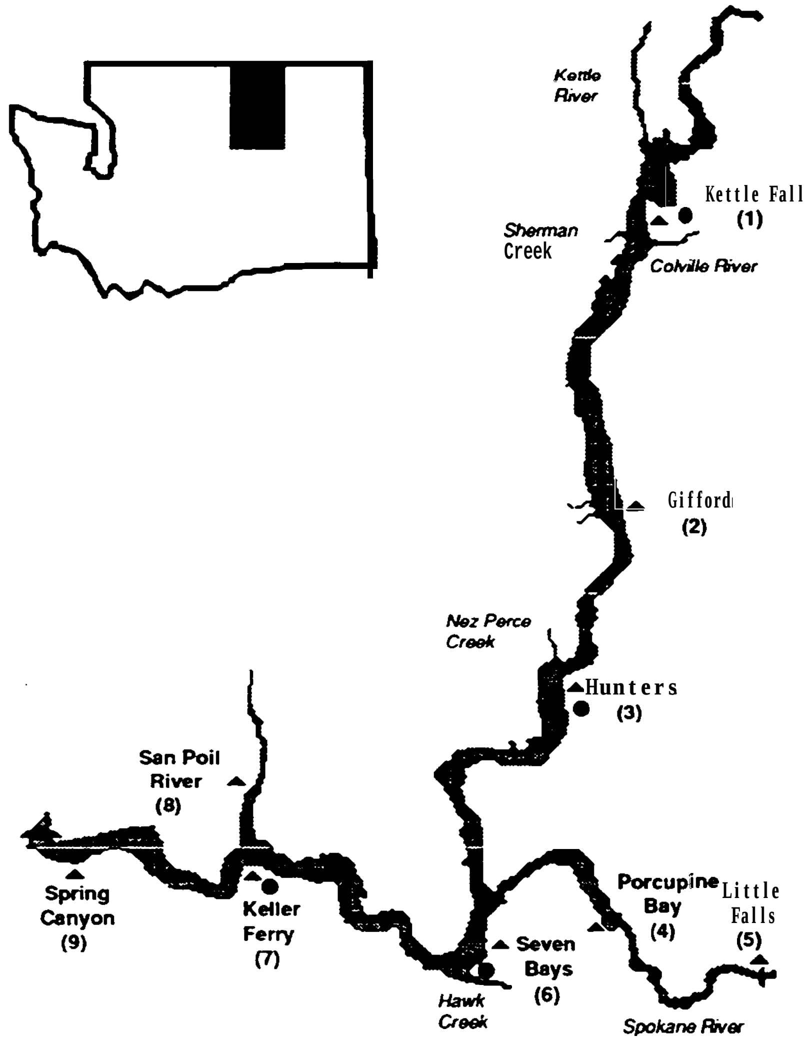

Figure 2.1 Map of Lake Roosevelt, WA. "▲" denotes sampling locations and "●" denotes tagging stations

2.3 Zooplankton

Zooplankton samples were collected mid-channel at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon monthly in 1994. Additional samples were taken at Kettle Falls, Hunters, Keller Ferry, and the San Poil river three times per year in March, August and October as part of the Lake Roosevelt Monitoring Project's annual sampling sessions. Samples were taken using a Wisconsin vertical tow plankton net with an 80 µm silk net and bucket with a radius of 6 cm. Duplicate and some triplicate tows were made from 33 m depth to the surface at each location. After each tow, collected organisms were washed into a 253 ml bottle containing 10 ml of 37% formaldehyde and 0.5 g sugar Rigler (1978). Organisms were stained with 1.0 ml of five percent Lugol's solution and 1.0 ml of saturated eosin-y ethanol stain.

In the laboratory, zooplankton were identified to species using taxonomic keys of Brandlova *et al.* (1972), Brooks (1957), Edmondson (1959), Pennak (1978; 1989), Ruttner-Kolisko (1974), and Stemberger (1979). A Nikon SMZ-10 dissecting microscope with a ring illuminator system and Nikon Optiphot phase contrast microscope were used for identification. In cases where sample densities were high, three sub-samples were counted using a modified counting chamber Ward (1955) until 60 organisms or 25 ml of sample was counted (Edmondson and Winberg 1971, Downing and Rigler 1984). Volumes of sub-samples selected depended upon organism densities in the samples.

Zooplankton density (# organisms/m^3) was calculated using the following sets of equations. First, the volume (L) of sample collected by the Wisconsin plankton sampler was calculated by following formula:

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

where:

V	=	volume of the sample (liters);
Π	=	pi (3.14);
r	=	radius of sampler (cm); and
h	=	depth of sample (m).

Next, microcrustacean zooplankton density (# organisms/ m^3) was calculated by the following equation:

$$D = \frac{\left(\frac{T_c}{S_n} * \frac{SV}{SSV}\right)}{V} DF * 1000$$

where:	D	=	density (# organisms/ m^3);
	Sn	=	number of sub-samples;
	SV	=	sample volume;
	SSV	=	sub-sample volume;
	V	=	volume of entire sample;
	DF	=	dilution factor; and
	Tc	=	total number counted of each species of organisms.

Predominant cladocerans were randomly chosen and measured from the top of the head to the base of the carapace, excluding the spine. Cladocera biomass was determined using species specific length-weight regression equations summarized by Downing and Rigler (1984).

2.4 Tagging Studies

Tagging studies were conducted on Lake Roosevelt using one year old net-pen reared rainbow trout. Fish chosen for this study were randomly netted out of holding pens, anesthetized, measured to the nearest millimeter and tagged by placing individually numbered floy tags into the posterior base of the dorsal fin. In 1994, up to 2,995 fish were tagged and released monthly from each net-pen site in March, April, and May. Net pen sites where tagging occurred included: Kettle Falls, Gifford, Hunters, Seven Bays, and Keller Ferry in 1994. Tag colors were changed by year so that each age class of tagged fish could be easily differentiated. Pink colored tags were used in 1994.

In order to maximize angler tag returns, informational posters describing the Monitoring Program's tagging studies were distributed throughout Lake Roosevelt and Rufus Woods reservoir at locations frequented by anglers. These posters gave a visual description of floy tags and also requested that anglers return tags with recapture information which included: recapture date, location, fish length and fish weight. Any angler that returned tag information was sent a letter informing him or her of the fish release date, location, and length of fish at time of release. The angler was also provided with a brief summary of the tagging program.

Tag return data was compiled and analyzed to determine fish growth rates and movement within Lake Roosevelt and was also used to estimate entrainment rates through Grand Coulee Dam. Movement was analyzed by noting recapture location and plotting it against release location and date.

2.5 Creel Surveys

A two-stage probability sampling scheme was used to determine annual fishing pressure, catch-per-unit-effort (CPUE), and sport fish harvest by species on Rufus Woods Reservoir (Lambou 1961,1966; Malvestuto 1983). Creel surveys were conducted at reservoir boat launches and access points for a total of 8 survey locations (Figure 2.2 and Appendix E). The Rufus Woods creel was conducted with a primary goal of estimating entrainment loss of fish.

One creel clerk was employed to interview anglers at access points along Rufus Woods according to monthly schedules. Creel schedules consisted of instantaneous pressure counts of the entire reservoir and effort counts at access points. Schedules were constructed by dividing each month into weekday and weekend/holiday stratum. Four weekdays and four weekend/holidays were randomly selected to schedule pressure counts and remaining days were scheduled as effort counts. Days were stratified into a.m. (sunrise to 12:00) and p.m. (12:00 to sunset) time periods. Unlike the Monitoring Program's creel survey, no air flights were conducted and as such, there is no correction factor between boats seen on the lake and boat trailers seen at access points. As a result, all trailers seen at access points were counted as boats on the water. An analysis of the percentage of boats fishing versus recreational boats was used to compute the number of boats fishing from the number of trailers seen. Index cards printed with major access locations were used to generate random effort count schedules (Appendix E). Similar cards were used to randomly determine the date, time of day, and major access location to be checked by the creel clerk. Location cards were used once for weekend/holiday stratum and twice for weekday stratum.

During each a.m. and p.m. instantaneous pressure count, boat trailer and shore angler counts were recorded at all access points along the reservoir. No interviews were performed during instantaneous pressure counts.

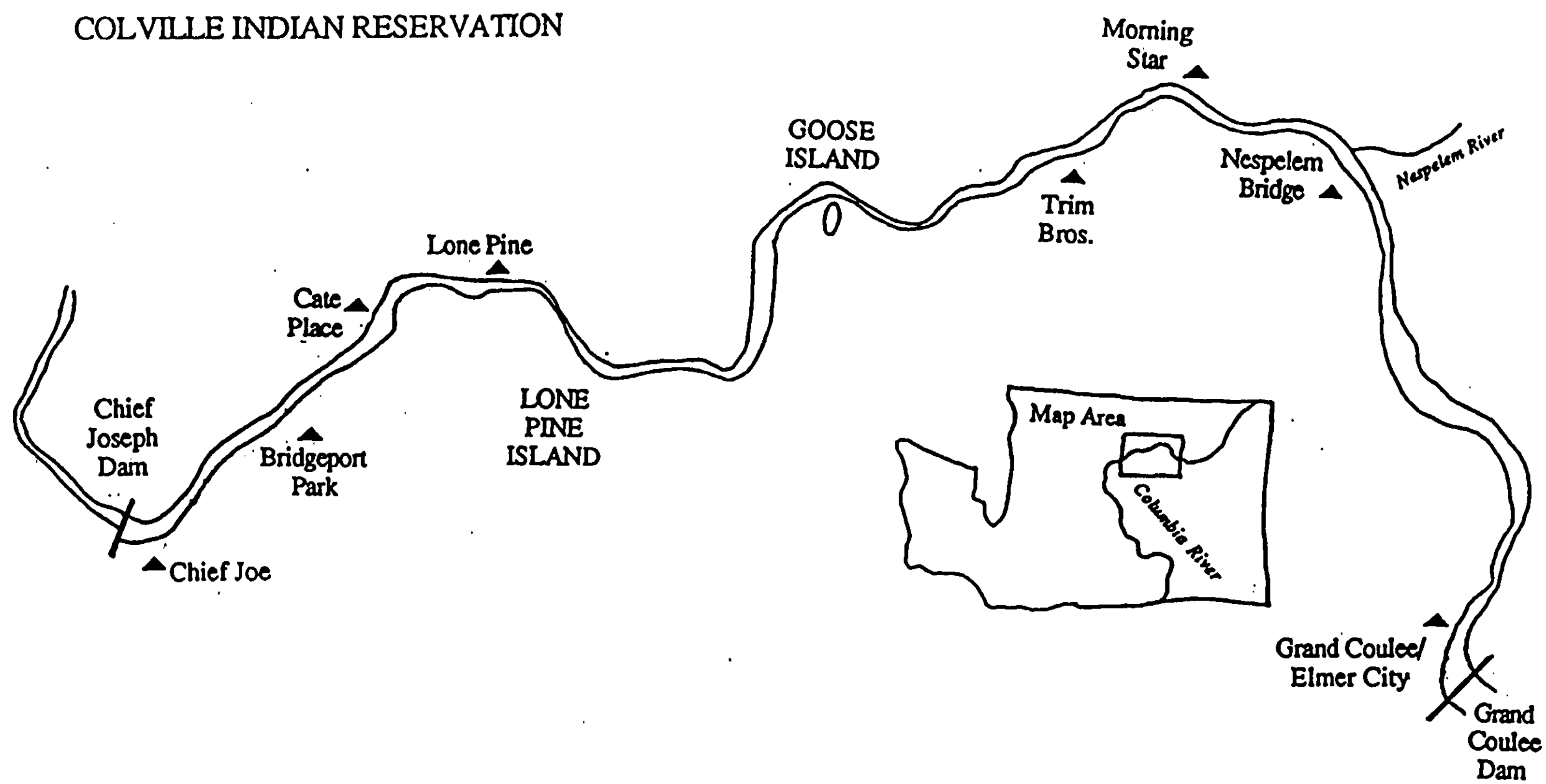

Figure 2.2. Map of Rufus Woods Reservoir study area.

During each a.m. and p.m. effort count, boat trailers and shore anglers were counted. Interview data collected included: angler type (boat or shore), hours fished, completed trip (yes or no), satisfaction level, zip code of origin, target species, the number of fish caught and released. Fish harvested were identified to species, measured in millimeters, weighed in grams 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 rainbow trout of net-pen or hatchery origin from wild fish. Scale samples were collected from representative kokanee, rainbow trout, and walleye, and stomach samples were collected from kokanee. Additionally, incoming boaters were surveyed to determine the number of boats angling and the number of anglers per boat.
For each day (weekday or weekend/holiday) stratum, the number of boat anglers per day was determined by multiplying the number of boat trailers observed at access points by the ratio of anglers to recreational users by month. In winter, all trailers were assumed to be angling.

The number of boats on the reservoir for each stratum per month was calculated by the formula:

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

Where:

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

Cbt = mean boat trailer count from pressure counts for each stratum per month; and

CFb = boat trailer correction factor for each stratum per month.

The number of boats fishing for each stratum per month was calculated by the formula:

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

Where:

Bf = number of boats fishing for each stratum per month;

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

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

The adjusted mean number of boat anglers per day for each stratum per 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;

Ab = 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.

Statistical sampling formulas were used to calculate stratum estimates and confidence intervals for angling pressure, CPUE, and harvest (Lewis 1975, Wonnacott and Wonnacott 1977, Mendel and Schuck 1987, and Williams et al. 1989).

For each day (weekday or weekend/holiday) stratum the following formulas were used to determine the number of hours sampled for each stratum per month:

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

Where:

N_s = number of hours for each stratum per month;

D_s = number of days per month within the stratum; and

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

* The times for sunrise to sunset for Lake Roosevelt were determined from the Nautical Almanac (1991) using the mean latitude of the reservoir (FDR Appendix A).

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 pressure counts 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 was estimated for day stratum (week day or weekend/holiday) and stratum time (a.m. or p.m.) for boat and shore anglers for each month 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 within for each stratum per month;

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

X_s = mean no. 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 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% confidence estimates were calculated by summing the eight stratum values for angler pressure and summing the 95% confidence intervals. Annual angler pressure and 95% confidence estimates were calculated by summing monthly angler pressure estimates and 95% confidence estimates. If data gaps existed in any strata the quarterly average was used to fill the gap.

Studies by Fletcher (1988) and Malvestuto *et al.* (1978) have shown that CPUE values calculated independently from complete and incomplete trip data are 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 for the month by 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

Th = 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). Annual CPUE values of a particular fish species were calculated by averaging the monthly values.

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

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

where:

Harvest = harvest of a particular fish species for each stratum per month;

H_{cpue} = number of fish harvested of a particular fish species for each stratum per month for each stratum per month; and

PE_S = pressure 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. Monthly harvest estimates were combined to calculate annual estimates for each fish species.

3.0 RESULTS

3.1 Hydrology

Table 3.1 summarizes mean monthly reservoir operations for Lake Roosevelt in 1994, while Table 3.2 compares 1994 values to those reported in Voller, (1996). Appendix A summarizes daily reservoir operations from January through December, 1994. Lake Roosevelt avoided a significant drawdown in 1994. The reservoir began at an average elevation of 1,285 feet above sea level in January and was slightly drawn down to an elevation of 1,268 feet in April (Figure 3.1). The reservoir was then refilled toward full pool by May and remained stable within ten feet through the end of the year. Mean reservoir elevations ranged from a low of 1,268 feet in April to a maximum of 1,287 feet in October (Figure 3.1). Mean yearly reservoir elevation was 1,280 feet. Mean outflows ranged from a low of 56 kcsf in September to 136 kcfs in June, 1994 with a yearly mean of 85 kcfs. Mean inflows ranged from a low of 64 kcsf in October to 136 kcfs in June, 1994 with a yearly mean of 88 kcfs. Mean monthly water retention time did not go below thirty days for any month (Figure 3.2). Consult appendix D for water quality measurements taken by Hydrolab Surveyor II.

3.2 **Zooplankton**

3.2.1 **Zooplankton** Densities

A total of 38 species of zooplankton were identified in Lake Roosevelt during 1994 (Table 3.3). Phylum Rotifera were not enumerated. Fifteen species were identified from Order Plioma, the most diverse group, followed by Order Cladocera with 14 species, and 6 species were identified from Order Eucopepoda.

Monthly mean densities (# of organisms/m^3) of microcrustacean zooplankton collected at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon are shown in Tables 3.4 through 3.7. Mean zooplankton densities by species for each location are in Appendix B.

Mean total zooplankton densities at Gifford ranged from 9.38/m^3 in March to 1,769.91/m^3 in October with an annual mean of 265.7/m^3. Mean total zooplankton densities at Porcupine Bay ranged from 20.11/m^3 in March to 6,152.97/m^3 in January with an annual mean of 1,232.8/m^3. Mean total zooplankton densities at Seven Bays ranged from 36.40/m^3 in April to 5,424.90/m^3 in August with an annual mean of 958.9/m^3. Mean total

Table 3.1 Monthly and annual means for reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in 1994.

Month	Inflow (kcfs)	outflow (kcfs)	Reservoir Elevation (Ft)	Storage Capacity (kcfsd)	Water Retention Time (Days)
Jan. 1994	81.0	77.2	1,285.4	4,403.6	61.8
Feb. 1994	97.5	103.6	1,281.8	4,261.2	42.5
Mar. 1994	67.9	77.7	1,276.5	4,061.1	54.9
Apr. 1994	89.5	73.0	1,268.1	3,754.4	55.0
May 1994	112.4	99.6	1,280.6	4,215.0	44.0
Jun. 1994	133.1	135.9	1,276.0	4,041.3	30.1
Jul. 1994	101.7	95.8	1,274.9	3,996.1	43.5
Aug. 1994	82.5	73.3	1,277.1	4,080.0	58.7
Sept. 1994	67.6	55.9	1,281.3	4,244.6	78.4
Oct. 1994	61.6	64.0	1,287.2	4,474.9	72.6
Nov. 1994	75.5	75.7	1,284.7	4,374.9	60.1
Dec. 1994	85.0	83.5	1,284.2	4,356.8	56.3
Mean 1994	**87.9**	**84.6**	**1,279.8**	**4,528.0**	**59.4**

Table 3.2 Synoptic list of zooplankton taxa identified in Lake Roosevelt during the 1994 study period.

Phylum Anthropoda
- **Class Crustacea**
  - **Subclass Brachiopoda**
    - **Order Cladocera**
      - **Family Daphnidae**
        1. *Ceriodaphnia quadranqula*
        2. *Daphnia galeata mendotae*
        3. *Daphnia retrocurva*
        4. *Daphnia schødleri*
        5. *Daphnia thorata*
        6. *Simocephalus serrulatus*
      - **Family Chydoridae**
        7. *Alona guttata*
        8. *Alona quadrangularis*
        9. *Chydorus sphaericus*
      - **Family Sididae**
        10. *Diaphanosoma brachyurum*
        11. *Diaphanosoma birgei*
        12. *Sida crystallina*
      - **Family Bosminidae**
        13. *Bosmina longirostris*
      - **Family Leptodoriidae**
        14. *Leptodora kindti*
  - **Subclass Copepoda**
    - **Order Eucopepoda**
      - **Suborder Calanoida**
        - **FamilyDiaptomidae**
          15. *Leptodiaptomus ashlandi*
          16. *Skistodiaptomus oregonensis*
        - **Family Temoridae**
          17. *Epischura nevadensis*
        - **Suborder Cyclopoida**
        - **Family Cyclopoidae**
          18. *Diacyclops bicuspidatus thomasi*
          19. *Mesocyclop edax*
        - **Suborder Harpacticoida**
        - **Family Harpacticoidae**
          20. *Bryocamptus* spp.

Phylum Rotifera
- **Class Monogononta**
  - **Order Flosculariacea**
    - **Family Conochilidae**
      21. *Conochilus unicornis*
    - **Family Testudinellidae**
      22. *Testudinella* spp.
    - **Family Filiniidae**
      23. *Filinia terminalis*
  - **Order Plioma**
    - **Family Synchaetidae**
      24. *Pleosoma truncatum*
      25. *Polyarthra* spp.
      26. *Synchaeta pectinata*
    - **Family Asplanchnidae**
      27. *Asplanchna herricki*
      28. *Asplanchna priodonta*
    - **Family Brachionidae**
      29. *Brachionus quadridentata*
      30. *Kellicottia longispina*
      31. *Keratella* spp.
      32. *Notholca* spp.
    - **Family Epiphanidae**
      33. *Epiphanes* spp.
    - **Family Euchlanidae**
      34. *Euchlanis dilatata*
      35. *Euchlanis triquetra*
    - **Family Trichotriidae**
      36. *Trichotria tetractis*
    - **Family Trichocercidae**
      37. *Trichocerca* spp.
  - **Family Lecanidae**
    38. *Monostyla lunaris*

Table 3.3 Mean **zooplankton** lengths and densities by month at **Giffford (Index** Station **2)**, in **1994.**

Species	Jan	Feb	Mar	May	Jun	Jul	Oct	Dec	Mean
Daphnia									
#/m^3	12.1	5.4	6.0	25.5	33.1	134.1	1,726.1	9.8	**244.0**
±S.D.	13.3	7.6	8.9	36.0	32.9	85.3	794.7	12.7	**123.9**
Leptodora									
#/m^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
±S.D.	—	—	—	—	—	—	—	—	—
Leptodora **Length**	—	-	—	—	—	—	—	—	--
±S.D.	—	—	—	—	—	—	—	—	--
Cladocera									
#/m^3	12.1	5.4	6.0	25.5	33.1	134.1	1,739.5	9.8	**245.7**
±S.D.	13.3	7.6	8.9	36.0	32.9	85.3	796.2	12.7	124.1
Cladocera Length	0.9	1.2	1.7	0.5	0.5	0.6	1.1	—	**0.9**
±S.D.	0.3	0.2	0.3	0.1	0.1	0.2	0.3	—	**0.2**
Copepoda									
#/m^3	1.3	5.4	3.4	2.7	13.9	4.7	30.4	98.3	**20.0**
±S.D.	1.9	0.0	1.3	3.8	12.0	6.6	1.6	39.5	**8.3**
Nauplii									
#/m^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
±S.D.	—	—	—	—	—	—	—	—	--
Total **Zooplankton**									
#/m^3	13.4	10.7	9.4	28.2	46.9	138.8	1,769.9	108.2	**265.7**
±S.D.	15.2	7.6	10.2	39.8	44.9	92.0	797.7	52.2	**132.4**

Table 3.4 Mean zooplankton lengths and densities by month at Porcupine Bay (Index Station 4), in 1994.

Species	Jan	Feb	Mar	May	Jun	Jul	Aug	Oct	Dec	Mean
Daphnia										
#/m^3	4,633.4	18.8	14.1	28.2	2,005.0	2,093.6	1,026.6	565.8	709.8	**1,232.8**
±S.D.	273.9	3.8	9.1	5.7	1,054.2	1,601.2	205.0	57.7	8.6	**357.7**
Leptodora										
#/m^3	0.0	0.0	0.0	0.0	18.3	14.8	2.3	0.0	0.0	**3.9**
±S.D.	—	—	—	—	8.2	20.9	1.6	--	—	**10.2**
Leptodora Length	—	—	—	—	9.0	9.2	–		—	**9.1**
±S.D.	—	—	—	—	1.4	3.6	—	—	—	**2.5**
Cladocera										
#/m^3	4,633.4	18.8	14.1	28.2	2,024.2	2,108.3	1,043.1	566.7	709.8	**1,238.5**
±S.D.	273.9	3.8	9.1	5.7	1,058.7	1,580.3	204.1	59.0	8.6	**355.9**
Cladocera Length	1.5	1.2	1.7	0.7	*0.5*	0.6	0.7	1.1	—	**1.0**
±S.D.	0.4	0.2	0.3	0.3	0.1	0.2	0.2	0.2		**0.2**
Copepoda										
#/m^3	1,519.6	5.4	6.0	99.2	252.8	341.8	516.1	54.5	744.6	**393.3**
±S.D.	210.7	3.8	2.6	11.4	75.6	333.5	24.4	30.9	264.9	**106.4**
Nauplii										
#/m^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*0.0*	0.0	0.0
±S.D.	—	—	—	—	—	—	—	—	—	--
Total **Zooplankton**										
#/m^3	6,153.0	24.1	20.1	127.4	2,295.3	2,464.8	1,561.4	621.3	1,454.4	**1,635.8**
±S.D.	484.6	7.6	11.7	17.1	1,142.5	1,934.7	230.0	89.9	273.5	**465.7**

Table 3.5 Mean **zooplankton** lengths and densities by month at Seven Bays (Index Station **6**), in 1994.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Mean
Daphnia										
#/m^3	80.5	34.9	64.1	21.2	210.5	360.2	264.2	4,884.0	1,351.6	**807.9**
±S.D.	19.0	—	42.6	18.9	214.3	136.5	26.6	667.1	612.2	**217.2**
Leptodora										
#/m^3	0.0	0.0	0.0	0.0	0.0	13.4	4.0	26.6	0.0	**4.9**
±S.D.	—	—	—	—	—	5.1	3.8	34.7	—	**14.5**
Leptodora Length	—	—	—		—	8.7	11.0	2.0	—	**7.2**
±S.D.	—	—	—	—	—	2.4	1.4	1.0	—	1.9
Cladocera										
#/m^3	80.5	34.9	64.1	21.2	210.5	373.7	268.2	4,910.9	1,453.5	**824.1**
±S.D.	19.0	—	42.6	18.9	214.3	136.5	30.3	700.0	678.5	**230.0**
Cladocera Length	1.6	1.4	1.4	1.2	0.7	1.0	0.6	1.5	1.2	**1.2**
±S.D.	0.3	0.3	0.5	0.2	0.2	0.3	0.2	0.5	0.4	**0.3**
Copepoda										
#/m^3	24.1	8.1	23.2	15.2	85.8	169.8	51.6	441.5	303.0	124.7
±S.D.	3.8	—	13.3	13.2	98.6	54.4	6.6	271.5	77.9	**67.4**
Nauplii										
#/m^3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.6	0.0	8.1
±S.D.	—	—	—	—	—	—	—	102.3	—	102.3
Total **Zooplankton**										
#/m^3	104.6	42.9	87.3	36.4	296.3	556.9	323.8	5,424.9	1,756.5	**958.9**
±S.D.	22.8	—	55.9	32.1	312.9	196.0	40.8	398.0	756.4	**226.9**

Table 3.6 Mean **zooplankton** lengths and densities by month at Spring Canyon (Index Station **9**), in 1994.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Dec	Mean
Daphnia											
#/m^3	876.9	83.1	54.8	176.3	591.3	3,533.1	6,287.1	486.2	38.4	447.0	**1,257.4**
±S.D.	79.6	37.9	10.4	83.8	62.6	1,680.7	779.6	103.9	17.5	149.0	**300.5**
Leptodora											
#/m^3	0.0	0.0	0.0	0.0	4.0	18.0	0.0	1.1	0.0	39.7	**6.3**
±S.D.	—	—	—	—	5.7	2.5	—	1.5	—	45.5	**13.8**
Leptodora Length	—	—	—	—	9.0	8.0	—	7.0	—	—	**8.0**
±S.D.	—	—	—	—	2.0	1.7	—	1.0	—	—	**1.6**
Cladocera											
#/m^3	876.9	83.1	54.8	176.3	595.3	3,552.0	6,287.1	469.3	44.7	486.7	**1,262.5**
±S.D.	79.6	37.9	10.4	83.8	68.3	1,678.2	779.6	104.3	15.7	104.6	**296.3**
Cladocera Length	1.7	1.6	1.5	1.3	0.7	1.3	1.2	1.4	1.4	--	**1.3**
±S.D.	0.4	0.4	0.4	0.2	0.2	0.5	0.5	0.4	0.5	—	**0.4**
Copepoda											
#/m^3	214.5	22.8	18.3	114.2	174.3	962.9	1,147.2	355.1	72.4	7,727.2	**1,080.9**
±S.D.	110.0	17.1	8.5	55.3	19.0	411.5	505.7	65.6	26.4	997.3	**221.6**
Nauplii											
#/m^3	0.00	0.0	0.0	0.0	0.0	0.0	1,318.5	1.1	1.8	0.0	132.1
±S.D.	—	—	—	—	—	—	221.2	1.5	3.1	—	**75.3**
Total **Zooplankton**											
#/m^3	1,091.4	105.9	73.1	290.5	773.7	4,533.7	8,752.	826.5	118.9	8,253.6	**2,481.8**
±S.D.	189.6	55.0	18.9	139.1	92.9	2,092.2	1,506.5	172.8	45.2	1,147.5	**540.1**

zooplankton densities at Spring Canyon ranged from 73.1/m^3 in March to 8,253.6/m^3 in December with an annual mean of 2,481.8/m^3.

In 1994, the reservoir experienced one large peak in ***Daphnia*** spp. densities. This peak occurred between May and September and seemed to start at the lower end of the reservoir first and progress upstream as time progressed (Tables 3.3-3.6). There was a considerable difference in the densities of zooplankton among the sample areas (Tables 3.3-3.6). The highest recorded ***Duphnia*** spp. density was 8,164.2/m^3 at Seven Bays in August followed by a value of 6,287.1/m^3 at Spring Canyon in July. Total zooplankton values were higher (9,296.5/m^3) at Spring Canyon in August than they were at Seven Bays in July (9,028.3/m^3). Yearly low *Daphnia* spp. densities of 5.4/m^3 were recorded at Gifford in February. Total zooplankton densities were also lowest at Gifford with a value of 9.4 organisms/m^3 recorded in March.

3.2.2 **Zooplankton** Biomass

Monthly mean biomass (mg/m^3) values for cladocera collected at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon are shown in Tables 3.7 through 3.10. Mean biomass by species for each location can be found in Appendix B. Total cladocera biomass at Gifford averaged 3.9 mg/m^3 for the year which was the lowest average recorded in 1994 (Table 3.7). Total zooplankton biomass at Porcupine Bay averaged 32.0 mg/m^3 for the year (Table 3.8). Total zooplankton biomass at Seven Bays averaged 25.3 mg/m^3 for the year (Table 3.9). Total zooplankton biomass at Spring Canyon averaged 47.6 mg/m^3 for the year which was the highest average recorded in 1994 (Table 3.10). Overall total cladocera biomass values were highest in August at Seven Bays with a value of 188.7 mg/m^3 observed. Gifford had the lowest overall monthly biomass value of 0.02 mg/m^3 in May. Of all cladocera observed, *Daphnia* made the highest contribution to the total biomass.

3.2.3 **Zooplankton** Lengths

Lengths in millimeters of representative cladocera were taken from randomly selected organisms collected at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon. The results of these measurements are shown in Tables 3.11 through 3.14. Length ranges and mean lengths by species for each location are located in Appendix B. Yearly mean lengths of cladocera at Gifford were: Daphnia *galeata mendotae* - 0.59 mm; *Daphnia retrocurva* -

Table 3.7 Mean monthly biomass values for select Cladocera at Gifford (Index Station **2**), in 1991.

Organism Group	Jan	Feb	Mar	May	Jun	**Jul**	**Oct**	Monthly Mean
Daphnia **mg/m3**	0.10	0.10	0.28	0.02	0.06	1.24	25.82	**3.9**
Leptodora kindti me/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Total Cladocera **mg/m3**	0.10	0.10	0.28	0.02	0.06	1.24	25.82	**3.9**

Table 3.8 Mean monthly biomass values for select Cladocera at Porcupine Bay (Index Station **4**), in 1991.

Organism Group	Jan	Feb	Mar	May	Jun	**Jul**	Aug	**Oct**	Monthly Mean
Daphnia **mg/m3**	169.93	0.58	0.35	0.08	32.16	4.64	36.32	7.63	31.5
Leptodora kindti **mg/m3**	0.00	0.00	0.00	0.00	1.44	2.39	0.76	0.00	**0.6**
Total Cladocera **mg/m3**	169.93	0.58	0.35	0.08	33.60	7.03	37.07	7.63	**32.0**

Table 3.9 Mean monthly biomass values for select Cladocera at Seven Bays (Index Station **6**), in 1994.

Organism Group	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Monthly Mean
Daphnia mg/m^3	3.28	0.91	1.98	0.53	0.60	3.94	4.40	188.54	21.28	25.1
Leptodora kindti mg/m^3	0.00	0.00	0.00	0.00	0.00	1.63	0.55	0.13	0.00	0.3
Total Cladocera mg/m^3	3.28	0.91	1.98	0.53	0.60	5.57	4.94	188.66	21.28	25.3

Table 3.10 Mean monthly biomass values for select Cladocera at Spring Canyon (Index Station **9**), in 1994.

Organism Group	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Monthly Mean
Daphnia mg/m^3	46.98	3.76	1.68	5.40	1.24	55.26	132.68	174.97	1.04	47.0
Leptodora kindti mg/m^3	0.00	0.00	0.00	0.00	0.62	2.64	0.00	2.36	0.00	0.6
Total Cladocera mg/m^3	46.98	3.76	1.68	5.40	1.86	57.91	155.19	177.33	1.04	47.6

Table 3.11 Mean monthly size values (mm) (± S.D.) of different **Cladocera** species at Gifford (Index Station 2) in 1994.

	D. galeata mendotae (mm)	*Daphnia retrocurva* (mm)	*Daphnia schødleri* (mm)	*Daphnia thorata* (mm)	*Leptodora kindti* (mm)
Jan			0.93		
± S.D.			± 0.32		
Feb			1.23		
± S.D.			± 0.15	-	-
Mar			1.65	-	-
± S.D.			± 0.34	-	-
Apr			-	-	-
± S.D.			-	-	-
May	0.52	0.49	0.46	-	-
± S.D.	± 0.13	± 0.06	± 0.11	-	-
Jun	0.52	0.61	0.48		
± S.D.		± 0.24	± 0.11	-	-
Jul	0.55	0.58	0.57	-	-
± S.D.	± 0.22		± 0.23	-	-
Aug			-	-	-
± S.D.			-	-	-
Sep			-	-	-
± S.D.			-	-	-
Oct	0.77		1.14	1.66	
± S.D.	± 0.60		± 0.29	± 0.26	
Nov			-	-	-
± S.D.			-	-	-
Dec			-	-	-
± S.D.			-		
Monthly Mean	**0.59**	0.56	0.92	1.66	-

(- indicates no data were obtained due to lack of sample or organisms in sample.)

Table 3.12 Mean monthly size values (mm) (± S.D.) of different **Cladocera** species at Porcupine Bay (Index Station 4) **in 1994.**

	D. galeata mendotae (mm)	*Daphnia retrocurva* (mm)	*Daphnia schødleri* (mm)	*Daphnia thorata* (mm)	*Leptodora kindti* (mm)
Jan			1.52		
± S.D.	-	-	± 0.36		
Feb	-	-	1.44		
± S.D.	-	-	± 0.34		
Mar			1.36	1.11	
± S.D.	-	-	± 0.22	± 0.18	
Apr					
± S.D.	-	-			
May			0.66		
± S.D.	-	-	± 0.25		
Jun		0.44	1.07		9.00
± S.D.		± 0.05	± 0.38		± 1.41
Jul	*0.45*	0.49	0.62		9.15
± S.D.	± 0.10	± 0.11	± 0.24		± 3.60
Aug	1.71		1.88	1.56	2.00
± S.D.	± 0.24		± 0.40	± 0.11	
Sep					
± S.D.	-	-			
Oct	-	-	1.10		
± S.D.	-	-	± 0.18		
Nov	-	-			
± S.D.	-	-			
Dec	-	-			
± S.D.	-	-			
Monthly Mean	1.08	**0.47**	1.21	1.34	**9.08**

(- indicates no data were obtained due to lack of sample or organisms in sample.)

Table 3.13 Mean monthly size values (mm) (± S.D.) of different **Cladocera** species at Seven Bays (Index Station 6) in 1994.

	D. galeata mendotae (mm)	*Daphnia retrocwva* (mm)	*Daphnia schødleri* (mm)	*Daphnia thorata* (mm)	*Leptodora kindti* (mm)
Jan ± S.D.			1.57 ± 0.29		
Feb ± S.D.			1.36 ± 0.32		
Mar ± S.D.			1.37 ± 0.49		
Apr ± S.D.			1.19 ± 0.18		
May ± S.D.			0.67 ± 0.23		
Jun ± S.D.	0.82 ± 0.03	0.70 ± 0.30	1.04 ± 0.29		8.67 ± 2.39
Jul ± S.D.	0.50 ± 0.09	0.79 ± 0.46	0.56 ± 0.20	1.06	11.00 ± 1.41
Aug ± S.D.	1.31 ± 0.40	1.24 ± 0.42	1.74 ± 0.41	1.82 ± 0.07	2.00 ± 1.00
Sep ± S.D.					
Oct ± S.D.	1.38 ± 0.29		1.16 ± 0.40		
Nov ± S.D.					
Dec ± S.D.					
Monthly Mean	**1.00**	0.91	1.18	1.44	**7.22**

(- indicates no data were obtained due to lack of sample or organisms in sample.)

Table 3.14 Mean monthly size values (mm) (± S.D.) of different Cladocera species at Spring Canyon (Index Station 9) in 1994.

	D. galeata mendotae (mm)	*Daphnia retrocwva* (mm)	*Daphnia schødleri* (mm)	*Daphnia thorata* (mm)	*Leptodora kindti* (mm)
Jan ± S.D.			1.72 ± 0.40	1.39 ± 0.14	
Feb ± S.D.			1.63 ± 0.39		
Mar ± S.D.			1.41 ± 0.53		
Apr ± S.D.			1.54 ± 0.40		
May ± S.D.			0.60 ± 0.28		9.00 ± 2.00
Jun ± S.D.	1.60 ± 0.32	2.20	1.38 ± 0.52	1.36 ± 0.41	4.00 ± 2.65
Jul ± S.D.	1.10 ± 0.42	0.86 ± 0.25	1.05 ± 0.39		
Aug ± S.D.	1.28 ± 0.28	1.11 ± 0.19	1.66 ± 0.46		7.00 ± 1.00
Sep ± S.D.					
Oct ± S.D.			1.38 ± 0.50		
Nov ± S.D.					
Dec ± S.D.					
Monthly Mean	1.33	1.39	1.37	1.38	6.67

(- indicates no data were obtained due to lack of sample or organisms in sample.)

0.56 mm; Daphnia *schødleri* - 0.92 mm; and ***Daphnia thorata*** - 1.66 mm. Yearly mean lengths of cladocera at Porcupine Bay ***were: Daphnia galeata*** *mendotae* - 1.08 mm; ***Daphnia retrocurva -- 0.47*** mm; ***Daphnia*** *schødleri* -1.21mm; ***Daphnia thorata*** -- 1.34 mm, and ***Leptodora*** *kindti* - 9.08 mm. Yearly mean lengths of cladocera at Seven Bays ***were: Daphnia*** *galeata mendotae* - 1.00 mm; ***Daphnia retrocurva*** - 0.91 mm; ***Daphnia*** *schødleri* - 1.18 mm; ***Daphnia thorata*** - 1.44 mm, and *Leptodora* ***kindti - 7.22 mm.*** Yearly mean lengths of cladocera at Spring Canyon were: ***Daphnia galeata*** *mendotae* - 1.33 ***mm; Daphnia*** *retrocurva* - 1.39 mm; ***Daphnia*** *schødleri* - 1.37 mm; ***Daphnia thorata*** - 1.38 mm, and ***Leptodora kindti - 6.67*** mm.

3.3 Rainbow Trout Tagging

In 1994, a total of 26,975 fish were tagged at net-pens in March, April, and May. Of these fish, a total of 448 tags were returned from anglers fishing in Lake Roosevelt or below, yielding an overall recapture rate of 1.7% (Table 3.16). Of these returns, 399 tags were from fish tagged in 1994. An analysis of the returned tags by location shows that 20.1% (n = 80) of these fish were tagged at Kettle Falls, 6.3% (n = 25) were tagged at Gifford, 33.1% (n = 132) were tagged at Hunters, 30.1% (n = 120) were tagged at Seven Bays and 10.0% (n = 40) were tagged at Keller Ferry (Table 3.17). Six tags were recovered at Rock Island dam below Lake Roosevelt from the 1994 releases. Tables 3.16 summarizes fish tag recoveries from each net-pen tagging effort on Lake Roosevelt in 1994. Fish were tagged at Kettle Falls, Gifford, Hunters, Seven Bays and Keller Ferry in March, April and May of 1994. A total of 5,995 tagged fish were released from Kettle Falls in 1994. Of these fish, 80 tags were returned from Lake Roosevelt with no tags returned from below Grand Coulee Dam. This produced an overall return rate of 1.3% for this site. At Gifford, 5,994 tagged fish were released over the three month period in 1994 with 25 returns recorded, yielding a return rate of 0.4%. All Gifford tags were recovered from Lake Roosevelt. At Hunters, 5,994 tagged fish were released over the same period in 1994 and of these fish, 132 were recaptured. 129 of these fish were recaptured in Lake Roosevelt for a recapture rate of 2.2%. Two tags from the 1994 Hunters net pen releases were recaptured in Rufus Woods in 1994. Seven Bays released 4,999 tagged fish with a total of 117 fish recaptured in Lake Roosevelt yielding a recapture rate of 2.3%. Three tags were returned from Rufus Woods from the Seven Bays releases. Finally, 3,993 tagged fish were released from Keller Ferry in 1994. Of these fish, 39 were recaptured in Lake Roosevelt for a recapture rate of 1.0%. One tagged fish was recovered from Rufus Woods from the Keller Ferry releases. Table 3.17 lists rainbow trout release times versus water retention times and their subsequent recapture rates. Based on this information, it can be

Table 3.16 Summary of **release** dates, numbers, and subsequent capture locations of net-pen rainbow trout tagged and released from various net pen locations in **1994.**

Tag Location	Release Date	Total # Tagged	Total # Recovered	Percent Recovered	Number Recovered in FDR	Percent Recovered in FDR	Recoveries B low Grand Coulee # Recovered in Rufus Woods	# Recovered at Rock Is. or McNary	% Recovered Below FDR
1	Mar-94	2,000	22	1%	20	91%	0	0	0%
1	Apr-94	1,000	8	1%	8	100%	0	0	0%
1	Mav-94	2,995	so	2%	48	96%	0	0	0%
2	Mar.-94	2,000	19	2%	19	100%	0	0	0%
2	Apr.-94	1,999	6	<1%	6	100%	0	0	0%
2	May-94	1,995	0	0%	0	0%	0	0	0%
3	Mar-94	2,000	25	1%	25	100%	0	0	0%
3	Apr-94	1,999	40	2%	39	98%	1	0	3%
3	May-94	1,995	67	3%	66	99%	1	0	2%
6	Mar-94	1,999	38	2%	36	95%	2	0	5%
6	Apr-94	2,000	58	3%	57	98%	1	0	2%
6	May-94	1,000	24	2%	24	100%	0	0	0%
7	Ma-94	1,995	11	<1%	11	100%	0	0	0%
7	Apr-94	1,000	11	1%	11	100%	0	0	0%
7	May-94	998	18	2%		94%			6%

Table 3.17 Summary of rainbow trout release times, **water retention** times **and** subsequent recapture numbers and percentages by year.

Release Date	Water Retention Time	# Total Tagged	Total # Recovered	Percent Recovered	Number Recovered in FDR	Percent Recovered in FDR	Recoveries Below Grand Coule: # Recovered in Rufus Woods	# Recovered at Rock Is. or McNary	% Recovered Below FDR
			8	1%				5	
Mar. 89	36	768	7	0%	3	38%	0	3	63%
Mar. 90	32	1,441			4	57%	0		43%
								..	2%
Mar. 92	48	5,999	107	2%	105	98%	2	0	0%
Mar. 94	55	9,994	115	<1%	113	98%	2	0	2%
Apr. 89	33	985	20	2%	11	55%	3	6	45%
Apr. 90	31	1,470	52	4%	38	73%	10	4	27%
Apr. 91	18	2,300	78		52	67%	13	13	33%
				3%			4	0	2%
Apr. 93	87	7,992	48	1%	48	100%	0	0	0%
Apr. 94	55	7,998	123	2%	121	98%	2	0	2%
May 88	40	1,171	99	9%	99	100%	0	0	0%
May 90	29	1,450	54	4%	44	81%	8	2	19%
May 92	34	6,000	295	1%	283	96%	12	0	1%
May 93	39	4,999	66	2%	64	97%	2	0	0%
May 94	44	8,983	159		155	98%	2	0	1%
	34			5%	27		5	0	1%
Jun. 92	50	3,000	139	4%	139	100%	0	0	0%
Jun. 93		296	11		11	100%	0	0	0%
Jul. 91	62	1,749	155	9%	148	97%	7	0	3%

seen that entrainment rates for rainbow trout appear to be low for all months in 1994. Total March release numbers show that only two fish out of a total of 115 returns came from the Rufus woods area, yielding a 2% below dam recapture rate. April 1994 releases showed similar numbers, with two fish recaptured in the Rufus Woods area out of a total of 123 returns for a ˙ below dam recapture rate. May 1994 releases show that one fish out of a total of 159 . ered came from Rufus Woods yielding a 1% below dam recapture rate. Numbers found in Tables 3.16 and 3.17 may not agree with the total number of tags returned due to incomplete angler reported tag return information (i.e. capture location information missing etc...).

3.4 Creel Data

Tables 3.18 through 3.23 summarize the Rufus Woods catch and harvest per unit effort, angler pressure, number of angler trips, and harvest and release rates of fish by species for both 1993 and 1994. Harvest per unit effort (HPUE) estimates increased from 0.009 in 1993 to 0.127 in 1994 (Table 3.18). Catch per unit effort (CPUE) values increased from 0.009 in 1993 to 0.261 in 1994 (Table 3.19). Angler pressure estimates were 25,582 total hours fished in 1993 and 42,618 total hours fished in 1994 (Table 3.21). These estimates corresponded to a total of 5,525 angler trips in 1993 and 7,660 angler trips in 1994 (Table 3.20). Walleye comprised the largest portion of captured fish in both 1993 and 1994 followed by rainbow trout, small mouth bass and kokanee (Tables 3.22 and 3.23). In 1993, the harvest was 101 total fish compared to 5,305 total fish in 1994 (Table 3.22). Total catch and release values increased from 101 total fish kept or released in 1993 to 8,005 total fish kept or released in 1994 (Table 3.23). The Rufus Woods creel survey was only conducted for six months in 1993 and seven months in 1994, as a result, the harvest values presented for 1993 and 1994 only reflect values for the months creeled. No attempt to extrapolate to yearly totals has been made since capture rates varied by month.

Table 3.18 Harvest (kept fish) per unit effort (HPUE) for Rufus Woods Reservoir from July, 1993 through December, 1993 and January, 1994 through September, 1994.

	1993	1994	Study Mean
kokanee	<0.001	0.001	**<0.001**
rainbow trout	0.001	0.010	**0.007**
walleye	0.007	0.116	0.087
smallmouth bass	<0.001	<0.001	**<0.001**
sturgeon	<0.001	<0.001	**<0.001**
other species	<0.001	<0.001	**<0.001**
HPUE	0.009	0.127	0.094

Table 3.19 Catch (kept and released fish) per unit effort **(CPUE)** for Rufus Woods Reservoir from July, 1993 through December, 1993 and January, 1994 through September, 1994.

	1993	1994	Study Mean
kokanee	<0.001	0.001	**<0.001**
rainbow trout	0.001	0.020	**0.015**
walleye	0.007	0.235	0.172
smallmouth bass	<0.001	0.002	0.001
sturgeon	<0.001	<0.001	**<0.001**
other species	<0.001	0.003	0.002
CPUE	0.009	0.261	0.191

Table 3.20 Angler trip estimates based on angler hours and average trip length for Rufus Woods Reservoir from July, 1993 through December, 1993 and January, 1994 through September, 1994.

	Year	Mean Trip Length (hrs)	Angler Hours	Number of Angler Trips
JAN	1993	--	--	--
	1994	4.66	2,178	467
FEB	1993	--	--	--
	1994	4.66	9,522	2,043
MAY	1993	--	--	--
	1994	5.39	6,005	1,114
JUN	1993	--	--	--
	1994	5.34	2,352	440
JUL	1993	1.89	3,784	2,002
	1994	6.58	15,851	2,409
AUG	1993	4.08	2,524	619
	1994	5.66	2,728	482
SEP	1993	4.51	1,984	440
	1994	5.65	3,982	705
OCT	1993	7.50	15,386	2,052
	1994	--	--	--
NOV	1993	6.39	1,904	298
	1994	--	--	--
DEC	1993	4.87	557	114
	1994	--	--	--
TOTAL	1993	4.87	26,139	5,525
	1994	5.55	42,618	7,660

-- Indicates that no data was collected for that month.

Table 3.21 Total monthly angler pressure estimates in hours (± 95% CI), for Rufus Woods Reservoir from July, 1993 through December, 1993 and January, 1994 through September, 1994.

	PRESSURE ESTIMATES					
	1993			1994		
JAN	--	±	--	2,178	±	348
FEB	--	±	--	9,522	±	654
MAY	--	±	--	6,005	±	426
JUN	--	±	--	2,352	±	176
JUL	3,784	±	622	15,851	±	487
AUG	2,524	±	292	2,728	±	163
SEP	1,984	±	216	3,982	±	316
OCT	15,386	±	1,211	--	±	--
NOV	1,904	±	157		±	--
DEC	1,904	±	157		±	--
TOTAL	**25,582**	±	**2,498**	**42,618**	±	**2,570**

-- Indicates that no data was collected for the month.

Table 3.22 Number of fish harvested (kept), with ± 95% confidence intervals, for Rufus Woods Reservoir from July, 1993 through December, 1993 and January, 1994 through September, 1994.

	1993	1994	Total
kokanee	0 (±0)	5 (±0)	5 (±0)
rainbow trout	46 (±8)	384 (±16)	430 (±24)
walleye	55 (±6)	4,856 (±269)	4,911 (±275)
smallmouth bass	0 (±0)	3 (±0)	3 (±0)
sturgeon	0 (±0)	0 (±0)	0 (±0)
other species	0 (±0)	42 (±3)	42 (±3)
Total Harvest	101 (±14)	5,305 (±289)	5,406 (±303)

Table 3.23 Number of fish caught (kept and released), with ± 95% confidence intervals, for Rufus Woods Reservoir from July, 1993 through December, 1993 and January, 1994 through September, 1994.

	1993	1994	Total
kokanee	0 (±0)	5 (±0)	**5** **(±0)**
rainbow trout	46 (±8)	497 (±23)	543 **(±31)**
walleye	55 (±6)	7,324 (±431)	7,379 **(±437)**
smallmouth bass	0 (±0)	34 (±3)	**34** **(±3)**
sturgeon	0 (±0)	0 (±0)	**0** **(±0)**
other species	0 (±0)	130 (±9)	130 **(±9)**
Total Catch	101 **(±14)**	8,005 **(±468)**	8,106 **(±482)**

4.0 DISCUSSION

4.1 Reservoir **operations**

Lake Roosevelt was commissioned by congress to operate for power, flood control and irrigation. However, in 1994, Lake Roosevelt also provided additional water for anadromous fish as a result of the Northwest Power Planing Council's (NWPPC) "water budget" and the National Marine Fisheries Service's (NMFS) Biological Opinion. A combination of power production, flood control and anadromous fish flows caused a drafting of Lake Roosevelt to 1,268 in April. System wide flood control was not shifted from Dworshak to Grand Coulee as prescribed by the Biological Opinion due to the small April 1 runoff forecast of 8.8 maf at the Dalles. Lake Roosevelt continued flow augmentation until the end of July. The reservoir reached its maximum yearly lake elevation of 1,286.4 ft by the end of September. During fall and winter the Northwest Power Council's "water budget" was implemented by storing water above the usual lake levels, resulting in reduced power related drafting. By April, 1994 approximately 3.1 million acre feet (maf) of water had been stored above the normal system operating plan (CRMG, 1994).

4.2 Hydrology

Lake elevations and water retention times were similar for 1993 and 1994 due to below normal predicted spring runoffs. As a result, the extreme spring drawdowns did not occur like those seen in 1991 which were due to high predicted spring runoff (10.7 maf) and power operations. Table 4.1 compares inflows, outflows, reservoir elevations, storage capacities, and water retention times for 1993 and 1994. Figures 4.1 and 4.2 show the changes in monthly reservoir elevations and water retention times from 1991 through 1994. 1991 reservoir operations produced the lowest mean elevations and water retention times when compared to all other years. The reduced water retention times in 1991 were thought to be the cause of significant decreases in zooplankton density and biomass values (Griffith *et al.* 1991). Previous reports by Beckman *et al.* (1985), Peone *et al.* (1990), Griffith and Scholz (1990), and Griffith *et al.* (1991) have shown that reduced water retention times had adverse affects on zooplankton density and fish entrainment levels.

Table 4.24 Monthly and annual means for reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in 1993 and 1994.

Month	Inflow (kcfs)	outflow (kcfs)	Reservoir Elevation (Ft)	Storage Capacity (kcfsd)	Water Retention Time (Days)
Jan. 1994	81.0	77.2	1,285.4	4,403.6	61.8
Jan. 1993	95.0	100.5	1,267.5	3,731.9	40.2
Feb. 1994	97.5	103.6	1,281.8	4,261.2	42.5
Feb. 1993	71.6	85.9	1,263.5	3,594.3	44.0
Mar. 1994	67.9	77.7	1,276.5	4,061.1	54.9
Mar. 1993	57.1	53.9	1,256.0	3,329.6	67.1
Apr. 1994	89.5	73.0	1,268.1	3,754.4	55.0
Apr. 1993	80.4	48.4	1,271.8	3,887.3	87.1
May 1994	112.4	99.6	1,280.6	4,215.0	44.0
May 1993	132.0	119.0	1,284.7	4,375.4	39.4
Jun. 1994	133.1	135.9	1,276.0	4,041.3	30.1
Jun. 1993	100.8	95.7	1,287.5	4,487.3	49.55
Jul. 1994	101.7	95.8	1,274.9	3,996.1	43.5
Jul. 1993	104.1	97.24	1,286.4	4,444.5	46.9
Aug. 1994	82.5	73.3	1,277.1	4,080.0	58.7
Aug. 1993	87.7	81.7	1,285.9	4,422.2	56.8
Sept. 1994	67.6	55.9	1,281.3	4,244.6	78.4
Sept. 1993	67.9	73.0	1,281.3	4,242.7	61.0
Oct. 1994	61.6	64.0	1,287.2	4,474.9	72.6
Oct. 1993	65.0	62.5	1,281.2	4,266.3	73.5
Nov. 1994	75.5	75.7	1,284.7	4,374.9	60.1
Nov. 1993	77.1	84.2	1,278.8	4,150.9	51.4
Dec. 1994	85.0	83.5	1,284.2	4,356.8	56.3
Dec. 1993	86.5	109.9	1,273.0	3,930.8	37.5
Annual 1994	87.9	84.6	1,279.8	4,188.7	54.8
Annual 1993	85.3	84.4	1,276.9	4,072.2	54.8

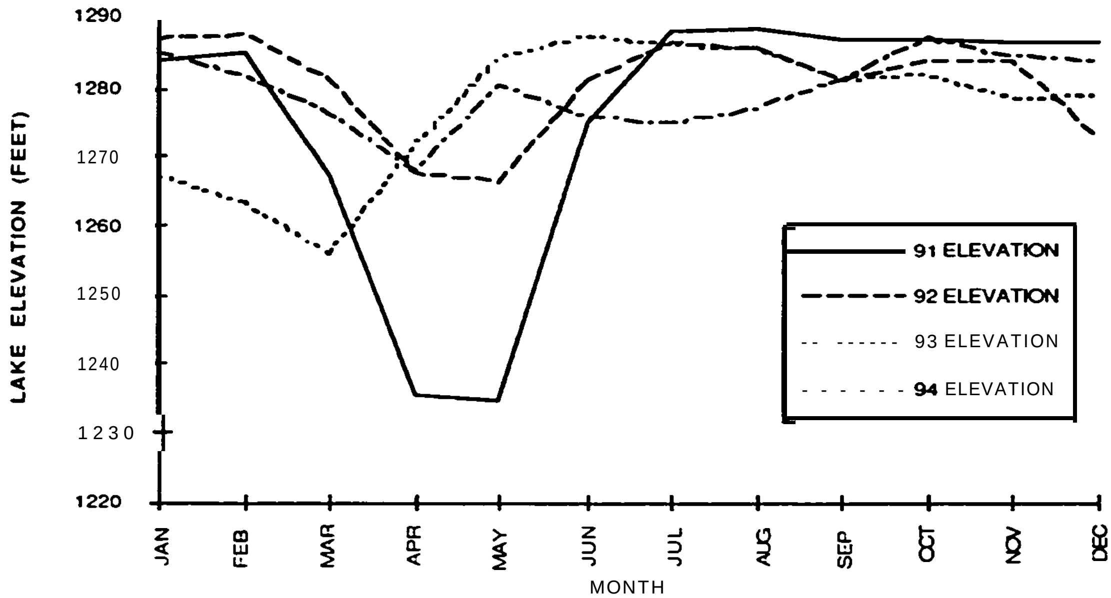

Figure 4.1 Mean monthly Lake Roosevelt reservoir elevations from 1991 through 1994.

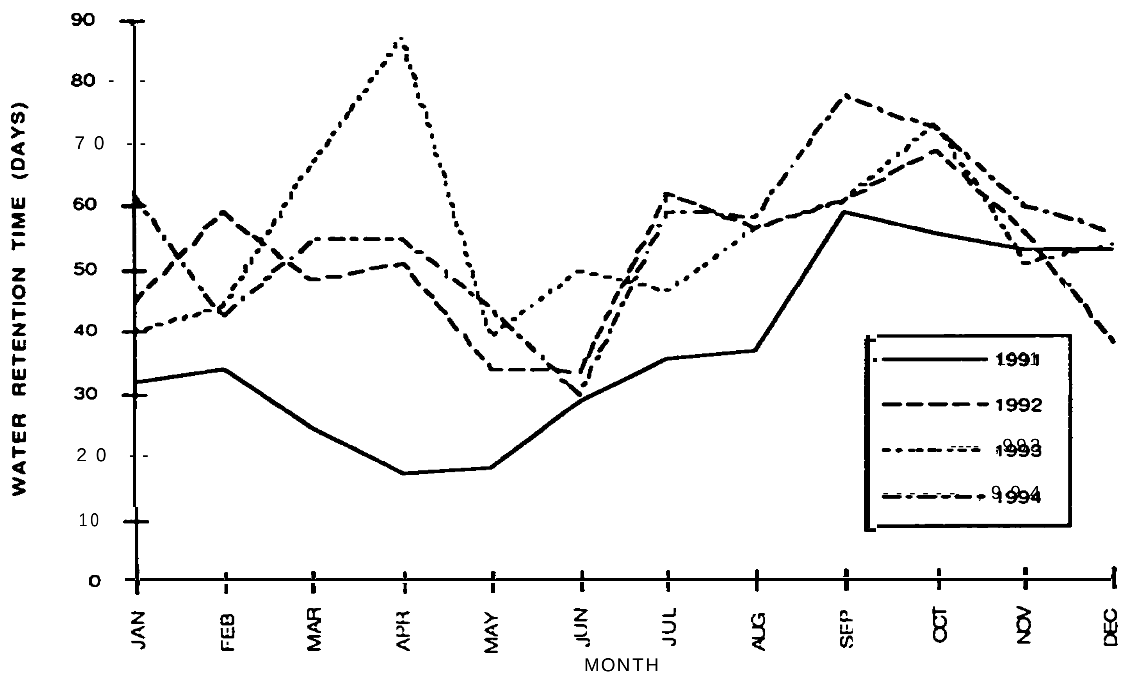

Figure 4.2 Mean monthly water retention times for Lake Roosevelt from 1991 through 1994.

4.3 Affect of Reservoir Operations on Zooplankton Dynamics

Figures 4.3 and 4.4 show the mean monthly *Daphnia* and total zooplankton density values for 1994. These figures indicate that *Daphnia* and total zooplankton densities remained low throughout the spring months after an early peak in January at Porcupine Bay and Spring Canyon. Zooplankton populations started to build in March in the lower river sections and by May, locations further upstream also began to increase. Between July and August, populations peaked and then began receding between August and October. Figures 4.3 and 4.4 also indicate that ***Daphnia*** and total zooplankton densities behaved in a similar manner. The summer peak in zooplankton biomass and density values was probably the result of a large quantity of nutrients and sunlight available for phytoplankton growth, which in turn increased the forage base for zooplankton. Longer water retention times are thought to retain nutrients in the reservoir long enough for them to be assimilated by phytoplankton. Warmer temperatures enhance this assimilation because phytoplankton are poikilothermic organisms (Beckman *et al.* 1985). Short water retention times may not allow enough time for assimilation of nutrients into phytoplankton especially when temperatures are cold and phytoplankton metabolism is low. Peaks in biomass and density values are thought to be related to increased reservoir elevations and water retention times but also may be affected by nutrient concentrations and water temperatures (Goldman and Horne 1983).

Figures 4.5 through 4.8 give the monthly mean total zooplankton densities and water retention times for a four year period beginning in 1991. Figure 4.5 shows a clear relationship between water retention time and zooplankton densities at the Gifford area. During the growing season, as water retention time increases, zooplankton densities increase shortly afterward, which is the pattern you would expect to see if there is a cause and effect. Peaks in water retention time during the winter months are not followed by increased zooplankton densities. This may be due to the fact that since zooplankton are poikilotherms, their metabolism and reproduction rates are much reduced in winter and as such, their populations will remain low regardless of water retention times. Also, figure 4.5 shows that the time of the growing season increases was slightly different each year, corresponding to water retention time and not season. Graphs for downstream areas of the reservoir do not show such a clear relationship between zooplankton densities and water retention time. The reasons for this are currently not known.

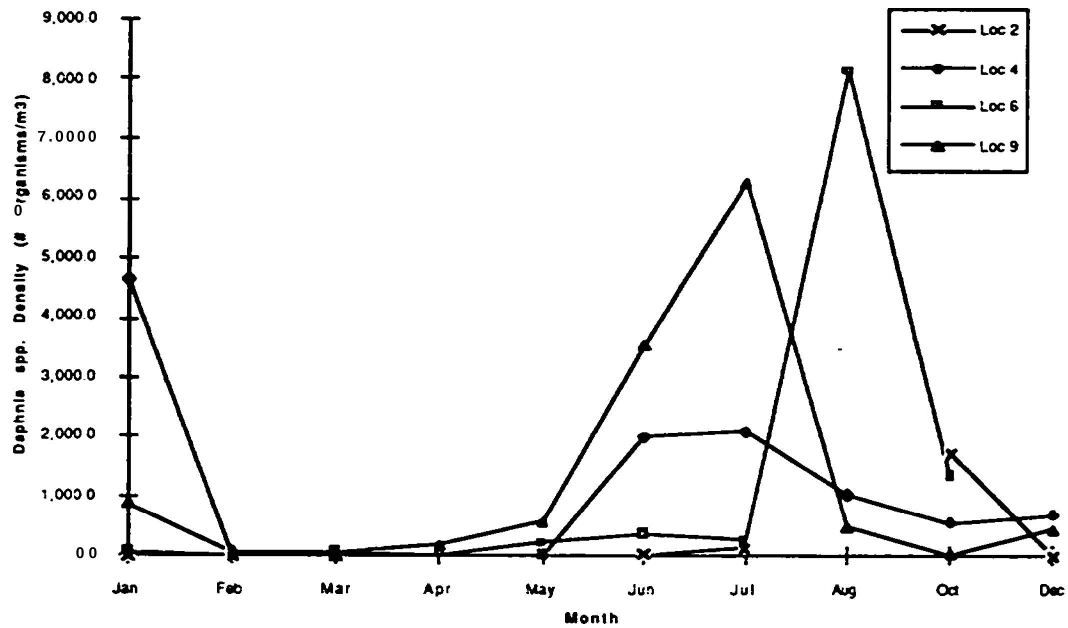

Figure 4.3 Mean monthly ***Daphnia*** spp. densities **(#/m^3)** at Gifford, Porcupine Bay, Seven Bays and Spring Canyon in 1994.

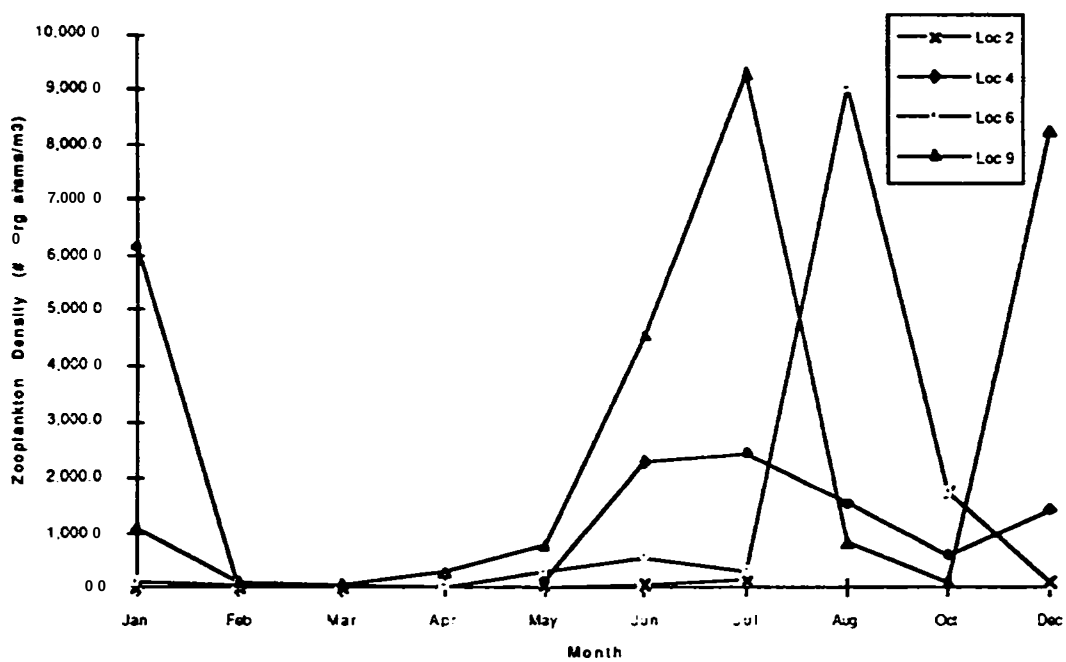

Figure 4.4 Mean monthly total **zooplankton** density **(#/m^3)** at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon in 1994.

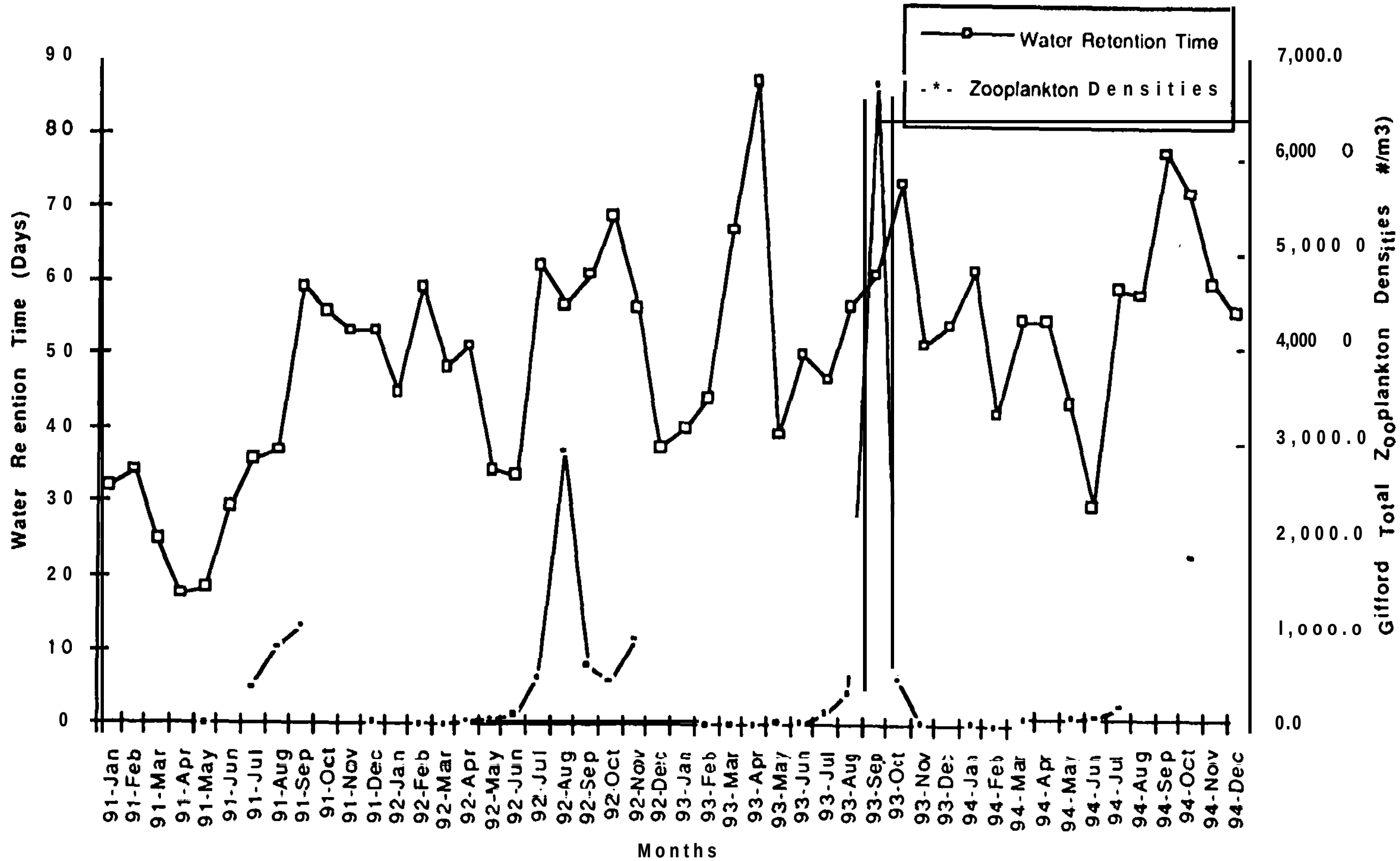

Figure 4.5 Monthly mean total **zooplankton** densities and monthly average water retention times at **Gifford** (Location 2) from 1991 through 1994.

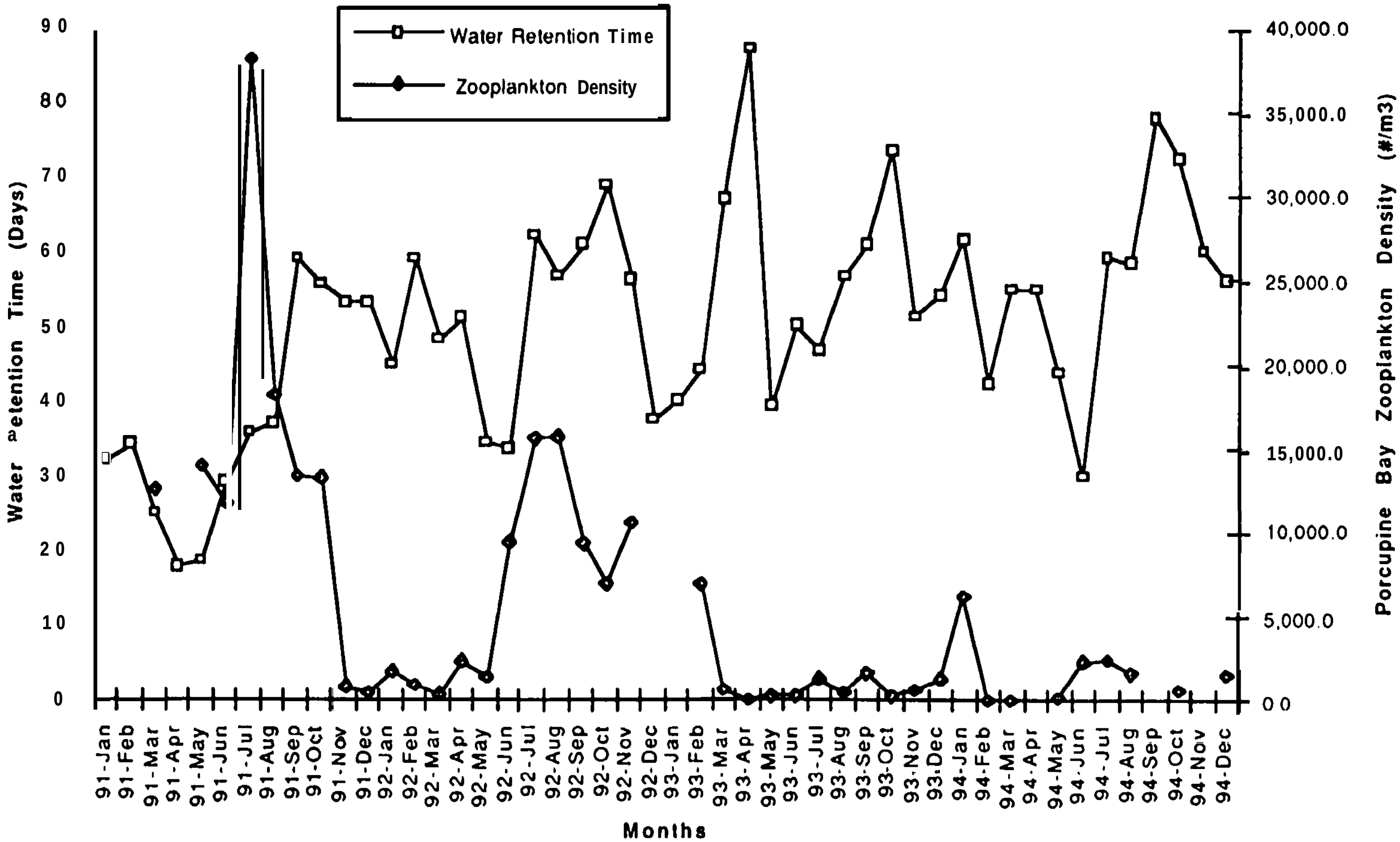

Figure 4.6 Monthly mean total zooplankton densities and montly average water retention times at Porcupine Bay (Location 4) from 1991 through 1994.

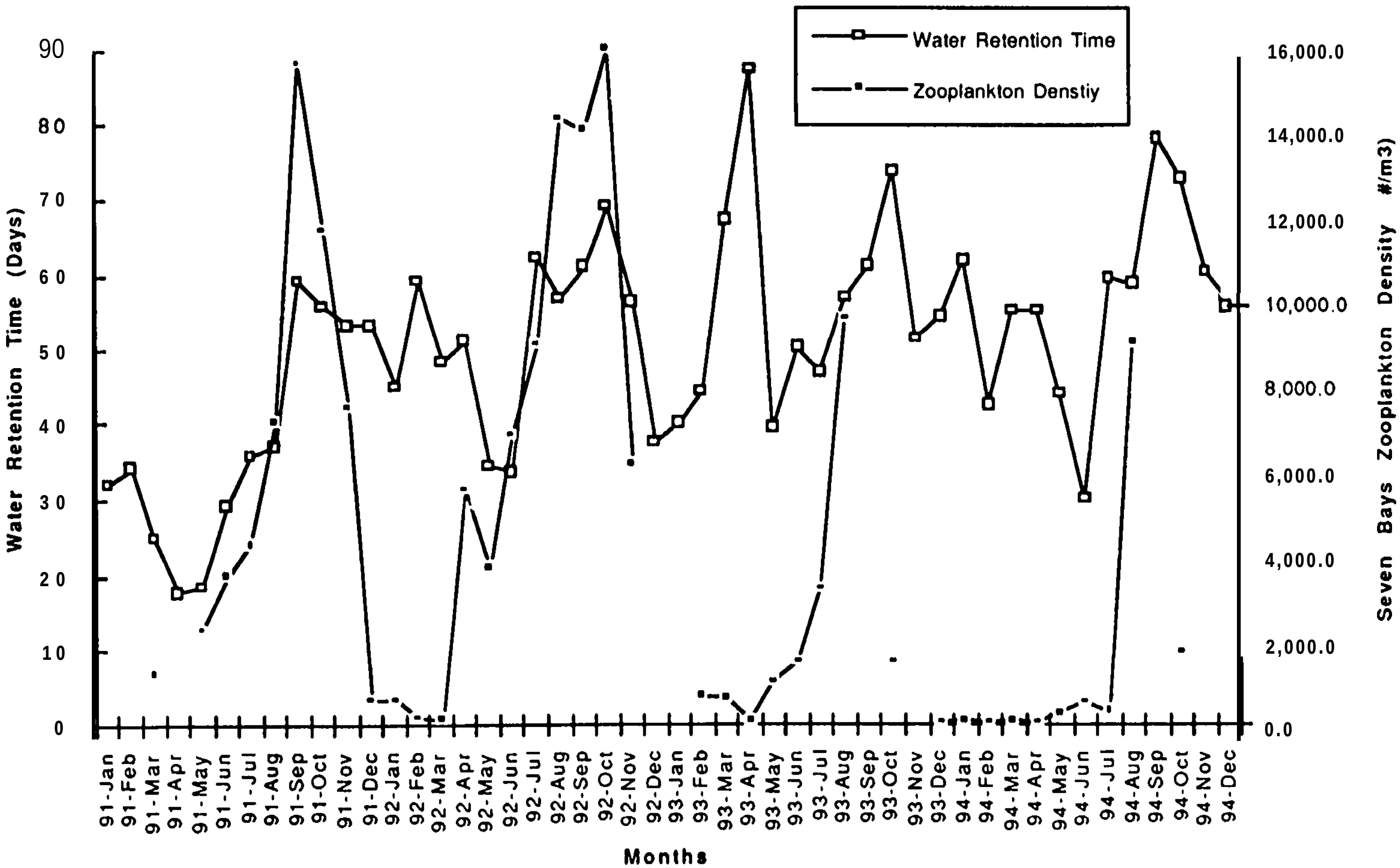

Figure **4.7** Monthly mean total **zooplankton** densities and monthly average water retention times at Seven Bays (Location 6) from 1991 through 1994.

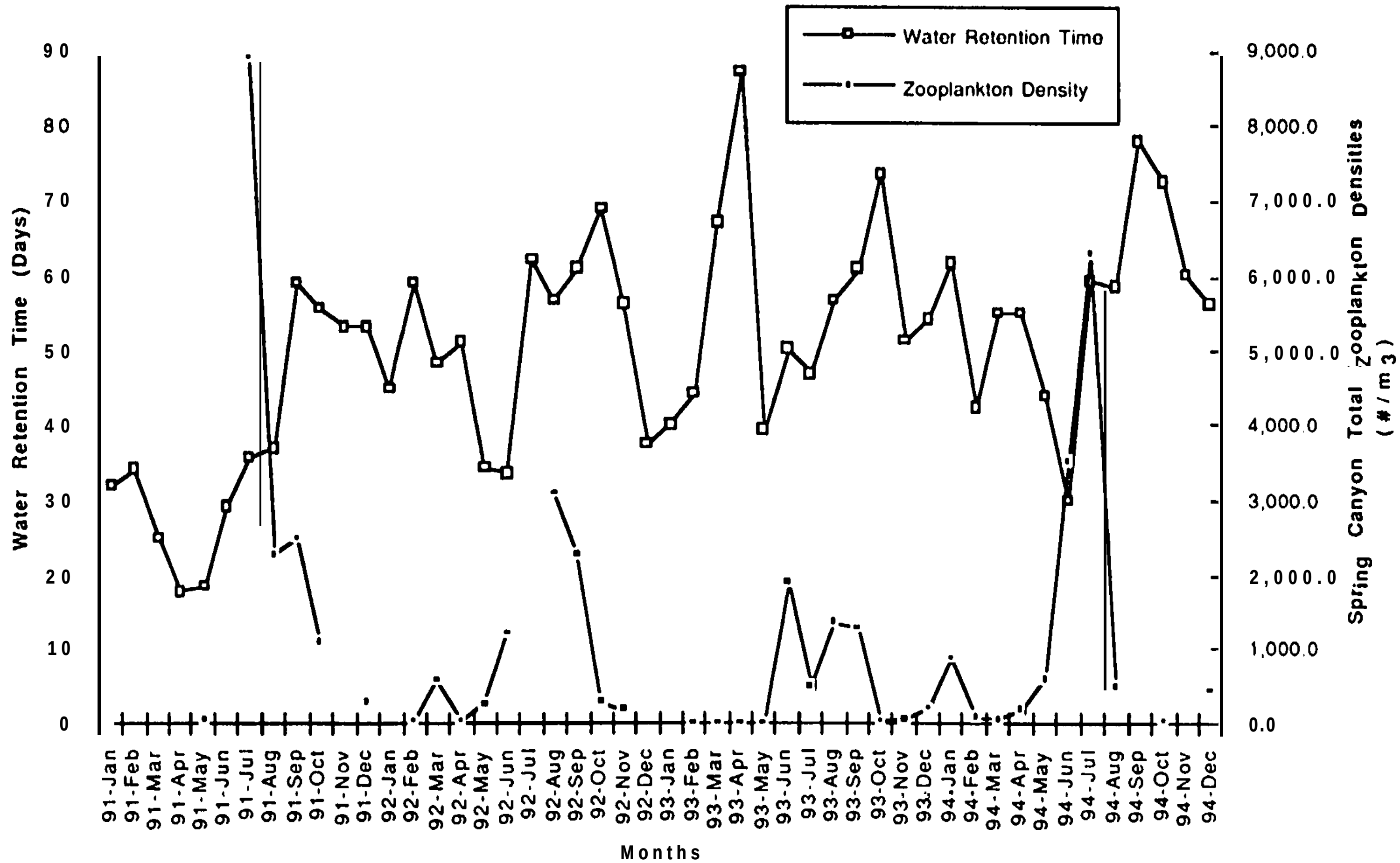

Figure 4.8 Monthly mean total **zooplankton** densities and monthly average water retention times at Spring Canyon (Location 9) from 1991 through 1994.

Overall, mean zooplankton densities and biomass are highest at Locations 6 and 9 in 1994. The higher density values at the lower end of the reservoir may be a result of the flushing of water through the reservoir. In 1994, increases in zooplankton density start first at Spring Canyon and as it recedes, Seven Bays densities increase. A possible explanation for this phenomenon might be that nutrients are being assimilated by zooplankton at Seven Bays thereby limiting zooplankton growth at Spring Canyon. But this may also be a result of point and non-point nutrient inputs coming from the seven bays community.

Declining pool elevation and large releases from the dam may cause extreme downstream loss of zooplankton. When zooplankton are circulated deep into the water column, deep drawdowns in the winter should increase the downstream loss of this valuable fish food resource.

4.4 Rainbow Trout Tagging

The percentage of tagged fish recovered below Grand Coulee Dam is a strong indicator of entrainment and has ranged from 0 to 63% of tag recoveries by month over the past six years (Table 3.17). The highest entrainment rate (based on tag recoveries) appears to occur during periods of less than 40 days water retention time and when fish are released in March or April. Table 3.17 shows that when water retention times average 40 or more days for a month, fish appear less likely to entrain from the reservoir. Also, overall estimated entrainment rates are lowest when fish are held for release in June or July. These data indicate that fish released later in the year, or when water retention times are high, have a higher tendency to remain within the reservoir. Fish released early, or when water retention times are low, have an increased chance of entrainment. When early releases were paired with high water retention times, decreased entrainment levels were observed in 1992, 1993 and 1994. This suggests that water retention time is a stronger influence over release time on the entrainment rates of net pen rainbow trout. Based on the above data, we recommend that net pen reared rainbow trout be held for release until at least June 1, or until the lake water retention times are above forty days- whichever is later. It is not fully understood why low water retention times lead to increased entrainment of rainbow trout, but it is felt that a smoltification process is a contributing factor (Peone et. al, 1990). This process may explain why early release times also lead to higher entrainment estimates. As young trout are released early in the year, or in years where the water retention times are low, the fish is placed in conditions which magnify the smoltification process. It is felt that smoltification will be reduced by holding fish longer thereby giving juvenile trout more time to become residualized.

4.5 Creel Data

The purpose of the Rufus Woods creel was to compile fisheries harvest data from the area below Grand Coulee dam, as well as estimate entrainment loss of tagged net pen rainbow trout.. Unfortunately, in two years of creeling, no tagged rainbow were observed. This was probably due to several factors. For one, the numbers of tagged fish released into Lake Roosevelt were not large enough to have much chance of catching an entrained fish. Also, since mortality of fish entrained through the dam is occurring at an unknown rate, we are further reducing the numbers of live tagged fish available for capture in Rufus Woods. Finally, angler pressure, as seen in table 3.21 is significantly lower in Rufus Woods than that of Lake Roosevelt, thereby further reducing the chance of capturing a tagged fish.

Comparison of the Rufus Woods creel data with that of the Lake Roosevelt Monitoring Project creel showed significantly fewer fish being caught for all species. Walleye comprised the largest portion of captured fish in both 1993 and 1994 followed by rainbow trout, small mouth bass and kokanee (Tables 3.22 and 3.23). Due to the inability of the Rufus Woods creel to find tagged rainbow, it was discontinued in 1994.

5.0 Recommendations

1. Due to low numbers of tagged fish being returned, it is proposed that the numbers of rainbow trout tagging sites be reduced to two sites (Locations 1 and 6), but that the number of fish tagged at these sites be increased to 10,000 per site. This will hopefully increase the statistical significance of tag return data.

2. Attempt to hold net pen rainbow trout until at least June 1 before release in order to reduce smoltification and entrainment losses.

2. Discontinue the Rufus Woods creel survey due to its inability to observe tagged rainbow trout.

3. Increase the sampling frequency and number of samples taken for zooplankton analysis. Due to the extreme variability of zooplankton data it is recommended that a minimum of three zooplankton tows be taken at each site and that samples be taken weekly instead of once per month.

4. Begin to sample for zooplankton in Rufus Woods Reservoir in order to estimate entrainment losses of zooplankton from Lake Roosevelt.

5. Continue to collect zooplankton and water quality data at sites currently being used, in order to build into a model.

6. Begin to collect nutrient and C^{14} data to model the reservoir based on nutrient uptake.

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APPENDIX A
HYDROLOGY

Table A.1 **Daily midnight** reservoir **inflow,** outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in January, 1994. Data from **CORPs** daily summary reports.

JANUARY					
DAY OF MONTH	INFLOW **(KCFS)**	**OUTFLOW** (KCFS)	**RESERVOIR ELEVATION (FT)**	STORAGE CAPACITY **(KCFSD)**	WATER RETENTION TIME **(D)**
1	88.50	38.20	1,282.00	4,270.10	111.78
2	82.90	39.90	1,283.10	4,313.10	108.10
3	88.80	63.60	1,283.75	4,340.60	68.25
4	82.20	64.40	1,284.20	4,356.40	67.65
5	88.90	63.00	1,284.90	4,384.20	69.59
6	93.50	67.50	1,285.50	4,408.20	65.31
7	91.00	91.00	1,285.50	4,408.20	48.44
8	89.40	61.30	1,286.20	4,436.30	72.37
9	92.80	52.40	1,287.00	4,468.60	85.28
10	92.40	76.10	1,287.60	4,493.00	59.04
11	74.60	74.60	1,287.60	4,493.00	60.23
12	70.30	62.10	1,287.80	4,501.10	72.48
13	65.80	78.00	1,287.50	4,488.90	57.55
14	53.50	71.60	1,287.10	4,468.60	62.41
15	58.20	60.30	1,287.00	4,468.60	74.11
16	59.40	51.20	1,287.20	4,476.70	87.44
17	63.80	102.10	1,286.30	4,440.30	43.49
18	63.60	97.60	1,285.40	4,404.20	45.13
19	66.30	90.20	1,284.80	4,380.30	48.56
20	75.80	91.70	1,284.40	4,364.40	47.59
21	81.30	89.30	1,284.20	4,364.40	48.78
22	67.60	55.60	1,284.50	4,368.30	78.57
23	94.30	60.40	1,285.40	4,404.20	72.92
24	89.30	81.30	1,285.60	4,412.20	54.27
25	88.10	94.10	1,285.40	4,404.20	46.80
26	85.00	99.00	1,285.10	4,392.20	44.37
27	87.10	97.10	1,284.80	4,380.30	45.11
28	82.70	94.70	1,284.50	4,368.30	46.13
29	87.80	101.70	1,284.20	4,356.40	42.84
30	101.20	95.30	1,284.30	4,360.40	45.75
31	103.80	127.50	1,283.70	4,336.70	34.01
Average	**80.96**	**77.19**	**1,285.37**	**4,403.63**	**61.75**

Table A.2 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in February, 1994. Data from **CORPs** daily summary reports.

FEBRUARY					
DAY OF MONTH	INFLOW (KCFS)	OUTFLOW (KCFS)	RESERVOIR ELEVATION (FT)	STORAGE CAPACITY (KCFSD)	WATER RETENTION TIME (D)
1	101.40	125.00	1,283.10	4,313.10	34.50
2	105.40	128.90	1,282.50	4,289.50	33.28
3	100.90	135.90	1,281.60	4,254.50	31.31
4	102.20	125.50	1,281.00	4,231.30	33.72
5	100.20	109.80	1,280.80	4,223.60	38.47
6	118.50	116.50	1,280.80	4,223.60	36.25
7	126.20	135.90	1,280.60	4,215.90	31.02
8	124.80	119.00	1,280.70	4,219.70	35.46
9	130.10	116.60	1,281.10	4,235.20	36.32
10	117.10	111.30	1,281.20	4,239.00	38.09
11	113.60	113.60	1,281.20	4,239.00	37.32
12	97.40	89.70	1,281.40	4,246.80	47.34
13	102.60	102.60	1,281.40	4,246.80	41.39
14	113.30	92.00	1,282.00	4,270.10	46.41
15	109.50	95.80	1,282.30	4,281.70	44.69
16	112.90	97.30	1,282.70	4,297.40	44.17
17	114.00	95.40	1,283.20	4,317.00	45.25
18	109.60	97.80	1,283.50	4,328.80	44.26
19	95.40	71.80	1,284.10	4,352.50	60.62
20	81.60	69.70	1,284.40	4,364.40	62.62
21	72.00	95.80	1,283.80	4,340.60	45.31
22	75.80	103.40	1,283.10	4,313.10	41.71
23	74.80	109.90	1,282.20	4,277.80	38.92
24	66.10	103.00	1,281.30	4,242.90	41.19
25	66.20	102.80	1,280.30	4,204.30	40.90
26	66.50	78.10	1,280.00	4,192.80	53.69
27	63.90	71.60	1,279.80	4,185.40	58.46
28	67.60	86.70	1,279.30	4,166.10	48.05
Average	**97.49**	**103.62**	**1,281.76**	**4,261.18**	**42.53**

Table A.3 **Daily midnight reservoir inflow,** outflow, **elevation,** storage capacity, and water retention time for Lake Roosevelt in March, 1994. Data from **CORPs** daily summary reports.

MARCH					
DAY OF MONTH	INFLOW **(KCFS)**	OUTFLOW **(KCFS)**	**RESERVOIR** ELEVATION **(FT)**	STORAGE CAPACITY **(KCFSD)**	WATER RETENTION TIME **(D)**
1	60.80	74.20	1,279.00	4,154.60	55.99
2	59.20	63.00	1,278.90	4,150.80	65.89
3	57.50	55.60	1,278.90	4,150.80	74.65
4	58.40	62.20	1,278.80	4,147.00	66.67
5	63.70	54.20	1,279.05	4,158.50	76.73
6	76.10	58.90	1,279.50	4,173.70	70.86
7	72.00	89.10	1,279.10	4,158.50	46.67
8	67.90	69.80	1,279.00	4,154.60	59.52
9	72.00	81.50	1,278.80	4,147.00	50.88
10	67.90	80.80	1,278.30	4,128.00	51.09
11	68.50	76.10	1,278.10	4,120.50	54.15
12	65.40	55.90	1,278.35	4,131.80	73.90
13	76.50	49.90	1,279.10	4,158.50	83.34
14	74.60	61.20	1,279.40	4,169.90	68.14
15	66.80	70.60	1,279.30	4,166.10	59.01
16	69.30	88.30	1,278.80	4,147.00	46.96
17	74.90	93.20	1,278.30	4,128.00	44.29
18	67.60	95.60	1,277.50	4,097.70	42.86
19	71.70	85.60	1,277.00	4,078.90	47.65
20	74.50	80.60	1,276.70	4,067.60	50.47
21	71.50	116.40	1,275.50	4,022.60	34.56
22	70.00	111.00	1,274.40	3,981.60	35.87
23	68.00	105.00	1,273.40	3,944.50	37.57
24	71.00	78.40	1,273.20	3,937.10	50.22
25	60.40	78.40	1,272.70	3,918.70	49.98
26	77.20	74.20	1,272.60	3,915.00	52.76
27	69.30	55.30	1,272.80	3,922.40	70.93
28	75.20	87.80	1,272.40	3,907.60	44.51
29	64.40	79.90	1,271.90	3,889.30	48.80
30	53.60	89.60	1,270.80	3,849.10	42.96
31	59.50	86.40	1,269.90	3,816.30	44.17
Average	**67.92**	**77.69**	**1,276.50**	**4,061.09**	**54.90**

Table A.4 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in April, 1994. Data from **CORPs** daily summary reports.

APRIL					
DAY OF MONTH	INFLOW (KCFS)	OUTFLOW (KCFS)	RESERVOIR ELEVATION (FT)	STORAGE CAPACITY (KCFSD)	WATER RETENTION TIME (D)
1	60.50	75.40	1,269.30	3,794.60	50.33
2	51.10	68.30	1,268.50	3,765.70	55.13
3	53.30	68.70	1,267.70	3,737.00	54.40
4	63.30	84.10	1,266.90	3,708.40	44.10
5	69.70	97.10	1,266.00	3,676.30	37.86
6	63.10	93.80	1,265.00	3,640.80	38.81
7	62.70	82.20	1,264.30	3,616.10	43.99
8	73.30	76.90	1,264.10	3,609.10	46.93
9	71.60	54.90	1,264.20	3,612.60	65.80
10	77.50	57.00	1,264.50	3,623.20	63.56
11	76.60	70.80	1,264.40	3,619.70	51.13
12	71.40	82.70	1,263.90	3,602.00	43.94
13	78.90	73.60	1,263.90	3,602.00	48.94
14	81.50	66.30	1,264.30	3,616.10	54.54
15	75.00	77.30	1,264.20	3,612.60	46.73
16	76.70	65.20	1,264.20	3,612.60	55.41
17	79.20	55.40	1,264.60	3,623.10	65.40
18	88.20	90.00	1,264.40	3,619.70	40.22
19	87.40	70.40	1,264.80	3,633.80	51.62
20	117.90	71.30	1,265.90	3,672.20	51.50
21	108.00	58.70	1,267.10	3,715.50	63.30
22	123.00	49.70	1,269.00	3,783.40	76.12
23	122.70	36.70	1,271.10	3,860.00	105.18
24	127.30	36.80	1,273.20	3,937.10	106.99
25	129.80	63.00	1,274.80	3,995.50	63.42
26	127.30	81.70	1,275.90	4,037.50	49.42
27	120.10	81.80	1,276.70	4,067.60	49.73
28	116.60	108.30	1,276.80	4,071.30	37.59
29	119.60	107.50	1,276.90	4,075.10	37.91
30	110.20	84.30	1,277.30	4,090.20	48.52
Average	**89.45**	**72.99**	**1,268.13**	**3,754.36**	54.95

Table A.4 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in April, 1994. Data from CORPs daily summary reports.

APRIL					
DAY OF MONTH	INFLOW (KCFS)	OUTFLOW (KCFS)	RESERVOIR ELEVATION (FT)	STORAGE CAPACITY (KCFSD)	WATER RETENTION TIME (D)
1	60.50	75.40	1,269.30	3,794.60	50.33
2	51.10	68.30	1,268.50	3,765.70	55.13
3	53.30	68.70	1,267.70	3,737.00	54.40
4	63.30	84.10	1,266.90	3,708.40	44.10
5	69.70	97.10	1,266.00	3,676.30	37.86
6	63.10	93.80	1,265.00	3,640.80	38.81
7	62.70	82.20	1,264.30	3,616.10	43.99
8	73.30	76.90	1,264.10	3,609.10	46.93
9	71.60	54.90	1,264.20	3,612.60	65.80
10	77.50	57.00	1,264.50	3,623.20	63.56
11	76.60	70.80	1,264.40	3,619.70	51.13
12	71.40	82.70	1,263.90	3,602.00	43.94
13	78.90	73.60	1,263.90	3,602.00	48.94
14	81.50	66.30	1,264.30	3,616.10	54.54
15	75.00	77.30	1,264.20	3,612.60	46.73
16	76.70	65.20	1,264.20	3,612.60	55.41
17	79.20	55.40	1,264.60	3,623.10	65.40
18	88.20	90.00	1,264.40	3,619.70	40.22
19	87.40	70.40	1,264.80	3,633.80	51.62
20	117.90	71.30	1,265.90	3,672.20	51.50
21	108.00	58.70	1,267.10	3,715.50	63.30
22	123.00	49.70	1,269.00	3,783.40	76.12
23	122.70	36.70	1,271.10	3,860.00	105.18
24	127.30	36.80	1,273.20	3,937.10	106.99
25	129.80	63.00	1,274.80	3,995.50	63.42
26	127.30	81.70	1,275.90	4,037.50	49.42
27	120.10	81.80	1,276.70	4,067.60	49.73
28	116.60	108.30	1,276.80	4,071.30	37.59
29	119.60	107.50	1,276.90	4,075.10	37.91
30	110.20	84.30	1,277.30	4,090.20	48.52
Average	**89.45**	**72.99**	**1,268.13**	**3,754.36**	**54.95**

Table A.6 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in June, 1994. Data from **CORPs** daily summary reports.

JUNE					
DAY OF MONTH	INFLOW **(KCFS)**	OUTFLOW **(KCFS)**	RESERVOIR ELEVATION **(FT)**	STORAGE CAPACITY **(KCFSD)**	WATER RETENTION TIME **(D)**
1					
2	107.10	147.60	1,279.50	4,173.70	28.28
3	114.10	133.40	1,278.80	4,147.00	31.09
4	117.10	118.70	1,278.50	4,135.60	34.84
5					
6	135.10	137.30	1,278.20	4,121.30	30.04
8	147.90	135.50	1,278.40	4,131.80	30.95
9	139.60	153.70	1,278.10	4,139.40	31.17
10	130.70	161.30	1,277.10	4,082.60	25.31
11	135.50	155.10	1,276.30	4,052.50	26.13
12	139.90	144.70	1,275.90	4,037.50	27.92
13	130.70	173.10	1,274.60	3,989.00	23.04
14	132.50	129.50	1,274.60	3,985.50	30.80
15	134.90	123.70	1,274.80	3,995.50	32.30
16	146.10	122.50	1,275.30	4,015.10	32.78
17	133.20	128.10	1,275.30	4,015.10	31.34
18	137.10	115.60	1,275.60	4,026.30	34.83
19	141.80	131.60	1,275.60	4,026.30	30.59
20					
21	130.70	133.30	1,274.90	4,000.20	30.01
22	136.10	149.80	1,274.40	3,981.60	26.58
23	131.90	146.80	1,274.40	3,984.60	27.12
24	133.40	139.10	1,273.50	3,948.20	28.38
25					
26	136.00	109.70	1,274.00	3,961.90	36.16
27	137.50	134.20	1,273.80	3,959.30	29.50
28	140.50	127.00	1,274.00	3,966.70	31.23
29	137.40	136.80	1,273.80	3,959.30	28.94
30	139.00	123.70	1,274.00	3,966.70	32.07
Average	133.12	135.94	**1,275.99**	**4,041.30**	**30.05**

Table A.7 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in July, 1994. Data from CORPS daily summary reports.

JULY					
DAY OF MONTH	INFLOW (KCFS)	OUTFLOW (KCFS)	RESERVOIR ELEVATION **(FT)**	STORAGE CAPACITY **(KCFSD)**	WATER RETENTION TIME (D)
1					
2	138.10	194.20	1,274.20	3,974.1	33.67
			1,274.80	3,996.5	42.43
3	102.50	85.80	1,275.20	4,011.4	46.75
5	102.50	87.60	1,275.60	4,026.3	45.96
6	112.20	106.60	1,275.50	4,022.6	36.04
			1,275.60	4,026.3	
7	115.50	115.20	1,275.40	4,018.8	34.89
8	109.50	116.40	1,274.90	4,000.2	34.37
9	107.90	92.80	1,275.00	4,003.9	43.15
10	114.60	81.60	1,275.60	4,026.3	49.34
11	119.50	120.90	1,275.40	4,018.8	33.24
12	112.00	109.80	1,275.20	4,011.4	36.53
13	110.60	98.70	1,275.20	4,011.4	40.64
14	110.30	109.00	1,275.10	4,007.6	36.77
15	91.90	106.60	1,274.70	3,992.7	37.45
16	96.30	70.20	1,275.40	4,018.8	57.25
17	93.90	65.90	1,276.10	4,045.0	61.38
18	89.60	100.80	1,275.80	4,033.8	40.02
19	81.30	100.00	1,275.30	4,015.1	40.15
20	87.50	113.50	1,274.60	3,989.0	35.15
21					
22	87.20	193.10	1,274.00	3,966.7	4236.B7
23	88.80	81.40	1,274.10	3,970.4	48.78
24	88.00	65.80	1,274.60	3,989.0	60.62
25	90.90	101.20	1,274.30	3,977.9	39.31
26	95.50	110.40	1,273.90	3,963.0	35.90
27	96.10	107.20	1,273.60	3,951.9	36.87
28					
29	98.00	84.10	1,273.70	3,959.3	46.74
30	91.20	50.00	1,274.70	3,922.1	78.44
31	100.50	78.00	1,275.00	4,003.9	51.33
Average	101.66	95.77	**1,274.85**	3,996.1	**43.47**

Table A.8 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in August, 1994. Data from **CORPs** daily summary reports.

August					
DAY OF MONTH	INFLOW (KCFS)	OUTFLOW (KCFS)	RESERVOIR ELEVATION (FT)	STORAGE CAPACITY (KCFSD)	WATER RETENTION TIME (D)
1	94.00	93.40	1,274.80	3,995.50	42.78
2	97.40	98.60	1,274.60	3,989.00	40.46
3	101.20	92.10	1,274.60	3,989.00	43.31
4	90.50	87.80	1,274.50	3,985.30	45.39
5	100.00	84.00	1,274.75	3,923.30	46.71
6	101.80	67.30	1,275.40	4,018.80	59.72
7	86.30	66.70	1,275.70	4,030.10	60.42
8	94.60	77.10	1,275.95	4,040.00	52.40
9	90.40	76.30	1,276.20	4,048.80	53.06
10	98.20	84.60	1,276.40	4,056.30	47.95
11	100.30	82.50	1,276.70	4,067.60	49.30
12	98.00	85.80	1,276.90	4,075.10	47.50
13	93.70	62.80	1,277.40	4,094.00	65.19
14	71.60	45.90	1,278.10	4,120.50	89.77
15	80.60	101.40	1,277.50	4,097.70	40.41
16	77.40	86.80	1,277.30	4,090.20	47.12
17	82.70	77.00	1,277.40	4,094.00	53.17
18	77.50	85.00	1,277.20	4,086.40	48.08
19	77.60	66.30	1,277.50	4,097.70	61.81
20	65.80	50.70	1,277.90	4,112.90	81.12
21	61.30	48.10	1,278.30	4,128.00	85.82
22	59.90	65.60	1,278.10	4,120.50	62.81
23	75.40	64.00	1,278.40	4,131.80	64.56
24	67.10	74.70	1,278.20	4,124.30	55.21
25	74.80	70.10	1,278.15	4,122.50	58.81
26	73.70	72.50	1,278.00	4,116.70	56.78
27	71.30	53.10	1,278.30	4,128.00	77.74
28	70.70	39.30	1,278.90	4,150.80	105.62
29	76.30	72.10	1,278.80	4,147.00	57.52
30	76.30	67.40	1,278.90	4,150.80	61.59
31	69.80	71.70	1,278.80	4,147.00	57.84
Average	**82.46**	**73.25**	**1.277.09**	**4,079.99**	**58.71**

Table A.9 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in September, 1994. Data from **CORPs** daily summary reports.

September					
DAY OF MONTH	INFLOW **(KCFS)**	OUTFLOW (KCFS)	RESERVOIR ELEVATION **(FT)**	STORAGE CAPACITY (KCFSD)	WATER RETENTION TIME (D)
1	61.90	65.10	1,278.60	4,139.40	63.68
2	48.40	56.10	1,278.20	4,128.00	73.58
3	50.80	41.50	1,278.30	4,128.00	99.71
4	52.80	45.30	1,278.40	4,131.80	91.41
5	54.80	56.90	1,278.20	4,124.30	72.48
6	55.50	77.80	1,277.45	4,097.70	52.74
7	56.90	64.30	1,277.20	4,086.40	63.55
8	59.20	63.00	1,276.90	4,071.30	64.73
9	79.40	58.70	1,277.30	4,090.20	69.80
10	74.00	35.20	1,278.30	4,128.00	117.27
11	71.40	31.50	1,279.30	4,166.10	81.05
12	68.80	57.30	1,279.60	4,177.50	72.91
13	74.80	48.00	1,280.30	4,204.30	87.59
14	69.80	48.60	1,280.85	4,227.40	87.16
15	78.10	60.60	1,281.30	4,242.90	70.01
16	69.90	60.20	1,281.60	4,254.50	70.79
17	66.30	41.00	1,282.20	4,277.80	104.34
18	69.20	45.80	1,282.80	4,301.80	93.93
19	65.20	73.00	1,282.60	4,293.50	58.82
20	69.00	63.10	1,282.80	4,301.30	68.17
21	75.00	71.00	1,282.90	4,305.20	60.64
22	66.40	56.60	1,283.10	4,313.10	76.34
23	69.00	55.30	1,283.45	4,328.80	78.71
24	76.80	35.20	1,284.50	4,368.30	125.17
25	74.50	48.60	1,285.20	4,396.20	90.64
26	75.30	75.30	1,285.20	4,369.20	58.18
27	72.30	74.30	1,285.10	4,392.20	59.11
28	75.20	55.20	1,285.60	4,412.20	80.08
29	74.60	54.60	1,286.10	4,432.30	81.93
30	73.50	57.40	1,286.50	4,448.40	77.91
Average	**67.63**	**55.88**	**1,281.33**	**4,244.60**	**78.41**

Table A.10 Daily midnight reservoir inflow, outflow, elevation, storage capacity, and water retention time for Lake Roosevelt in October, 1994. Data from **CORPs** daily summary reports.

October					
DAY OF MONTH	INFLOW **(KCFS)**	OUTFLOW (KCFS)	RESERVOIR ELEVATION **(FT)**	STORAGE CAPACITY (KCFSD)	WATER RETENTION TIME (D)
1					
2	58.00	41.70	1,287.00	4,484.80	192.90
3	74.70	62.50	1,287.70	4,497.00	71.95
4	65.70	53.50	1,288.00	4,509.30	84.29
5					
6	56.20	58.30	1,288.30	4,517.50	77.49
8	59.20	73.50	1,287.90	4,505.20	61.30
9	59.30	50.10	1,288.30	4,521.30	84.76
10	65.10	67.10	1,288.20	4,517.50	67.32
11	61.40	57.30	1,288.30	4,521.30	78.91
12	62.50	62.50	1,288.30	4,521.30	72.34
13	65.30	81.70	1,287.90	4,505.20	55.14
14	61.80	69.90	1,287.70	4,497.00	64.33
15	54.10	46.00	1,287.90	4,505.20	97.94
16	68.40	45.90	1,288.50	4,529.70	98.69
17	61.10	77.50	1,288.10	4,513.40	58.24
18	58.60	72.80	1,287.70	4,497.00	61.77
19	56.40	68.60	1,287.40	4,484.80	65.38
20	52.40	80.80	1,286.70	4,456.70	55.16
21	58.70	60.70	1,286.65	4,456.50	73.42
22	57.90	55.90	1,286.70	4,456.50	79.72
23	60.80	52.70	1,286.90	4,464.60	84.72
24	60.50	78.60	1,286.50	4,448.40	56.60
25	63.10	75.20	1,286.20	4,436.20	58.99
26	54.60	78.60	1,285.60	4,412.20	56.13
27	67.20	77.20	1,285.30	4,400.20	57.00
28	62.40	66.40	1,285.20	4,396.20	66.21
29	58.60	60.60	1,285.20	4,396.20	72.54
30					
31	65.30	85.20	1,284.60	4,372.30	51.32
Average	61.56	64.01	**1,287.15**	**4,474.94**	**72.56**

Table A.11 Daily midnight reservoir inflow, outflow elevation, storage capacity, and water retention time for Lake Roosevelt in November, 1994. Data from **CORPs** daily summary reports.

November					
DAY OF MONTH	INFLOW **(KCFS)**	OUTFLOW (KCFS)	RESERVOIR ELEVATION **(FT)**	STORAGE CAPACITY **(KCFSD)**	WATER RETENTION TIME **(D)**
1					
2	66.90	68.90	1,284.30	4,360.40	63.29
3	70.70	76.70	1,284.20	4,356.40	56.80
4	79.20	79.20	1,284.20	4,356.40	55.01
5					
6	69.90	50.70	1,285.30	4,400.20	86.79
8	79.50	73.50	1,285.50	4,408.20	59.98
9	75.00	75.00	1,285.30	4,400.20	55.28
			1,285.30	4,400.20	
10	77.40	75.40	1,285.40	4,404.20	58.41
11	73.00	69.00	1,285.50	4,408.20	63.89
12	76.60	62.60	1,285.80	4,420.20	70.61
13	75.60	49.50	1,286.50	4,444.40	89.79
14	73.80	77.80	1,286.40	4,444.40	57.13
15	63.60	77.70	1,286.00	4,428.30	56.99
16	68.40	88.40	1,285.50	4,408.20	49.87
17	72.10	82.10	1,285.30	4,400.20	53.60
18	64.10	86.10	1,284.70	4,376.30	50.83
20	63.60	91.40	1,284.00	4,348.50	47.58
21	70.40	172.10	1,284.10	4,352.50	60.37
			1,283.30	4,320.90	
22	78.60	98.20	1,282.80	4,301.30	43.80
23	82.70	90.50	1,282.60	4,293.50	47.44
24	76.60	57.10	1,283.10	4,313.10	75.54
25	81.90	54.30	1,283.80	4,340.70	79.94
26	82.50	73.60	1,284.10	4,352.50	59.14
27					
28	187.90	70.00	1,284.60	4,372.30	4462.110
29					
30	86.70	78.70	1,284.50	4,368.30	55.51
Average	**75.53**	**75.67**	**1,284.67**	**4,374.85**	**60.12**

Table A.12 Daily midnight reservoir inflow, outflow elevation, storage capacity, and water retention time for Lake Roosevelt in December, 1994. Data from **CORPs** daily summary reports.

December					
DAY OF MONTH	INFLOW (KCFS)	OUTFLOW (KCFS)	RESERVOIR ELEVATION (FT)	STORAGE CAPACITY (KCFSD)	WATER RETENTION TIME (D)
1	99.30	79.40	1,285.00	4,388.20	55.27
2	89.40	73.40	1,285.40	4,404.20	60.00
3	91.30	81.30	1,285.70	4,416.20	54.32
4	95.30	91.30	1,285.75	4,420.20	48.41
5	90.00	108.90	1,285.30	4,400.20	40.41
6	82.30	98.30	1,284.90	4,384.20	44.60
7	83.30	107.10	1,284.30	4,360.40	40.71
8	84.10	109.80	1,283.70	4,336.70	39.50
9	85.50	91.40	1,283.50	4,328.80	47.36
10	81.00	83.00	1,283.50	4,328.80	52.15
11	87.80	87.80	1,283.50	4,328.80	49.30
12	94.80	102.70	1,283.30	4,320.90	42.07
13	87.50	103.20	1,282.90	4,305.20	41.72
14	92.10	135.00	1,281.80	4,262.30	31.57
15	83.10	104.40	1,281.20	4,239.00	40.60
16	86.20	93.90	1,281.00	4,231.30	45.06
17	78.90	6[illegible].30	1,281.40	4,246.80	65.04
18	89.20	40.60	1,282.60	4,293.50	105.75
19	97.60	74.20	1,283.20	4,317.00	58.18
20	82.00	66.20	1,283.60	4,332.70	65.45
21	89.40	73.60	1,284.00	4,348.50	59.08
22	79.10	79.10	1,284.00	4,348.50	54.97
23	74.40	67.41	1,284.20	4,356.20	64.62
24	76.60	58.60	1,284.70	4,376.30	74.68
25	82.00	54.10	1,285.40	4,404.20	81.41
26	78.20	56.20	1,285.90	4,424.20	78.72
27	87.70	63.60	1,286.50	4,448.40	69.94
28	76.30	80.30	1,286.40	4,444.40	55.35
29	76.00	92.20	1,286.00	4,428.30	48.03
30	79.50	91.50	1,285.70	4,416.20	48.26
31	74.40	74.40	1,285.80	4,420.20	83.55
Average	**84.98**	**83.49**	**1,284.20**	**4,356.80**	**56.33**

APPENDIX **B**
ZOOPLANKTON

Table B.l Mean density (#/m^3) values calculated for zooplankton collected in January 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae				
Daphnia retrocurva				
Daphnia schødleri	12.10	4,633.35	80.45	864.84
Daphnia thorata				12.07
Daphnia pulex				
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alona quadrangularis				
Chydorus sphaericus				
Eurycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum				
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris				
Leptodora kindti				
Eucopepoda				
Leptodiaptomus ashlandi	1.34	879.00	18.77	170.29
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi				36.20
Mesocyclop edax		640.62	5.36	8.05
Bryocamptus spp.				
nauplii				
Total *Daphnia* spp.	12.07	4,633.35	80.45	876.91
Total Cladocera	12.07	4,633.35	80.45	876.91
Total Copepoda	1.34	1,519.62	24.14	214.53
Total Nauplii	0.00	0.00	0.00	0.00
Grand Total	13.41	6,152.98	104.59	1,091.45

Table B.2 Mean density (#/m^3) values calculated for zooplankton collected in February 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae				
Daphnia retrocurva				
Daphnia schødleri	5.36	18.77	34.86	83.13
Daphnia thorata				
Daphnia pulex				
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alona quadrangular-is				
Chydorus sphaericus				
Eurycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum				
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris				
Leptodora kindti				
Eucopepoda				
Leptodiaptomus ashlandi	2.68	5.36	2.68	12.07
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi	2.68		5.36	10.73
Mesocyclop edax				
Bryocamptus spp.				
nauplii				
Total *Daphnia* spp.	5.36	18.77	34.86	83.13
Total Cladocera	5.36	18.77	34.86	83.13
Total Copepoda	5.36	5.36	8.05	22.79
Total Nauplii	0.00	0.00	0.00	0.00
Grand Total	10.73	24.14	42.91	105.93

Table B.3 Mean density (#/m^3) values calculated for **zooplankton** collected in March 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeatamendotae				
Daphnia retrocwva				
Daphnia schødleri	6.03	12.74	96.54	73.75
Daphnia thorata		1.34		
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alona quadrangular-is				
Chydorus sphaericus				
Eurycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum				
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris				
Leptodora kindti				
Eucopepoda				
Leptodiaptomus ashlandi	2.68	5.36	14.08	9.39
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi				6.70
Mesocyclop edax		0.67	8.05	3.35
Bryocamptus spp.				
nauplii				
Total *Daphnia* spp.	5.36	14.08	96.54	73.75
Total Cladocera	5.36	14.08	96.54	73.75
Total Copepoda	2.68	6.03	22.12	19.44
Total Nauplii	0.00	0.00	0.00	0.00
Grand Total	8.05	20.11	118.66	93.19

Table B.4 Mean density (#/m^3) values calculated for zooplankton collected in April 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae				
Daphnia retrocwva				4.02
Daphnia schødleri			15.09	161.58
Daphnia thorata				
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alona quadrangularis				
Chydorus sphaericus				
Eurycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum				
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris				
Leptodora kindti				
Eucopepoda				
Leptodiaptomus ashlandi			2.35	46.93
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi				21.79
Mesocyclop edax			3.69	27.15
Bryocamptus spp.				
nauplii				
Total *Daphnia* spp.	0.00	0.00	15.09	163.59
Total Cladocera	0.00	0.00	15.09	163.59
Total Copepoda	0.00	0.00	6.03	95.87
Total Nauplii	0.00	0.00	0.00	0.00
Grand Total	0.00	0.00	21.12	259.46

Table B.5 Mean density (#/m^3) values calculated for zooplankton collected in May 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae	13.41			
Daphnia retrocurva	4.02			
Daphnia schødleri	8.05	28.16	210.51	591.31
Daphnia thorata				
Megafenestra aurita				
***Simocephalus** serrulatus*				
***Alona** guttata*				
***Alona** quadrangularis*				
Chydorus sphaericus				
Eurycerus lamellatus				
***Pleuroxus** denticulatus*				
***Diaphanosoma** brachyurum*				
*Diaphanosoma **birgei***				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
***Bosmina** longirostris*				
Leptodora kindti				4.02
Eucopepoda				
Leptodiaptomus ashlandi		34.86	45.59	104.59
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi	2.68	49.61	40.23	67.04
***Mesocyclop** edax*		14.75		2.68
Bryocamptus spp.				
nauplii				
Total ***Dapknia*** spp.	**25.48**	**28.16**	210.51	591.31
Total Cladocera	**25.48**	**28.16**	210.51	**595.33**
Total Copepoda	**2.68**	**99.22**	**85.81**	174.31
Total **Nauplii**	0.00	0.00	0.00	0.00
Grand **Total**	28.16	127.38	**296.33**	**769.64**

Table B.6 Mean density (#/m^3) values calculated for **zooplankton** collected in June 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine **Bay** Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae	1.34		2.68	5.36
Daphnia retrocwva	2.68	9.39	6.70	4.02
Daphnia schødleri	14.75	4,384.40	864.84	871.55
Daphnia thorata				
Daphnia thorata				
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alona quadrangularis				
Chydorus sphaericus				
Eurycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum		2.68		
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris				
Leptodora kindti		2.68	16.09	22.79
Eucopepoda				
Leptodiaptomus ashlandi		78.36	146.15	252.08
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi		233.31	117.99	288.28
Mesocyclop edax		33.82	32.18	4.02
Bryocamptus spp.				
nauplii				
Total *Daphnia* spp.	18.77	**4,393.79**	**874.23**	**880.93**
Total **Cladocera**	18.77	**4,399.15**	**890.32**	**903.73**
Total Copepoda	0.00	**345.49**	**296.33**	**544.38**
Total Nauplii	0.00	0.00	0.00	0.00
Grand Total	18.77	**4,744.64**	**1,186.65**	**1,448.11**

Table B.7 Mean density (#/m^3) values calculated for zooplankton collected in July 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae	4.02	36.50	5.36	59.59
Daphnia retrocwva	1.34	18.92	4.02	44.69
Daphnia schødleri	41.57	2,813.68	88.50	6,987.28
Daphnia thorata			1.34	
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alona quadrangularis				
Chydorus sphaericus				
Ewycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum				
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris				
Leptodora kindti		29.50	2.68	253.27
Eucopepoda				
Leptodiaptomus ashlandi	1.34	236.88	13.41	893.89
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi	1.34	246.27	16.09	551.24
Mesocvclop edax		67.64	4.02	59.59
Bryocamptus spp.				
nauplii				2,458.21
Total *Daphnia* spp.	46.93	2,869.10	99.22	7,091.56
Total Cladocera	46.93	2,898.60	101.90	7,344.83
Total Copepoda	2.68	550.79	33.52	1,504.72
Total Nauplii	0.00	0.00	0.00	2,458.21
Grand Total	49.61	3,449.39	135.43	11,307.77

Table B.8 Mean density (#/m^3) values calculated for zooplankton collected in August 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae		18.10	517.03	180.72
Daphnia retrocwva		5.37	1,017.91	112.81
Daphnia schødleri		1,002.28	3,348.50	2,017.55
Daphnia thorata			75.56	1.34
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alonaquadrangularis				
Chydorus sphaericus				
Ewycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum			0.27	
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris				
Leptodorakindti		2.28	26.64	15.44
Eucopepoda				
Leptodiaptomus ashlandi		361.36	313.46	1,353.27
Skistodiaptomus oregonensis				
Epischwa nevadensis		94.66	8.58	10.46
Diacyclops bicuspidatus thomasi		15.55	43.60	43.60
Mesocyclop edax		49.88	90.73	245.14
Bryocamptus spp.				
nauplii			72.59	
Total *Daphnia* spp.	0.00	**1,026.55**	**8,089.75**	**2,312.42**
Total Cladocera	0.00	**1,043.05**	**8,134.44**	**2,327.85**
Total Copepoda	0.00	5 16.09	655.52	**1,652.45**
Total Nauplii	0.00	0.00	**89.39**	**0.54**
Grand Total	0.00	**1,559.13**	**8,879.35**	**3,980.84**

Table B.9 Mean density (#/m^3) values calculated for zooplankton collected in October 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m^3)	Porcupine Bay Mean Density (#/m^3)	Seven Bays Mean Density (#/m^3)	Spring Canyon Mean Density (#/m^3)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae	3.58		3.58	
Daphnia retrocwva				
Daphnia schødleri	1,719.85	565.84	1,347.99	38.44
Daphnia thorata	2.68			
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alonaquadrangularis				
Chydorus sphaericus				
Eurycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum	11.62	0.89	101.90	6.26
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris	1.79			
Leptodora kindti				
Eucopepoda				
Leptodiaptomus ashlandi	19.67	32.18	275.32	69.72
Skistodiaptomus oregonensis				
Epischura nevadensis	3.58	15.20	8.94	1.79
Diacyclops bicuspidatus thomasi	7.15	7.15	18.77	0.89
Mesocyclop edax				
Bryocamptus spp.				
nauplii				1.79
Total *Daphnia* spp.	**1,726.11**	12.01	**1,351.57**	**38.44**
Total Cladocera	**1,739.52**	12.01	**1,453.47**	**44.69**
Total Copepoda	**30.39**	**1.98**	**303.03**	**72.41**
Total Nauplii	**0.00**	**0.00**	**0.00**	**1.79**
Grand Total	**1,769.91**	13.99	**1,756.50**	118.89

Table **B.10** Mean density (#/m³) values calculated for **zooplankton** collected in December 1994 at four sampling locations on Lake Roosevelt, WA

	Gifford Mean Density (#/m³)	Porcupine Bay Mean Density (#/m³)	Seven Bays Mean Density (#/m³)	Spring Canyon Mean Density (#/m³)
Cladocera				
Ceriodaphnia quadranqula				
Daphnia galeata mendotae				
Daphnia retrocurva				
Daphnia schødleri	9.83	709.75	71.51	446.95
Daphnia thorata				
Megafenestra aurita				
Simocephalus serrulatus				
Alona guttata				
Alona quadrangularis				
Chydorus sphaericus				
Eurycerus lamellatus				
Pleuroxus denticulatus				
Diaphanosoma brachyurum				
Diaphanosoma birgei				
Sida crystallina				
Macrothrix laticornis				
Streblocerus serricaudatus				
Bosmina longirostris			6.26	39.73
Leptodora kindti				
Eucopepoda				
Leptodiaptomus ashlandi	67.04	713.33	561.37	7,329.94
Skistodiaptomus oregonensis				
Epischura nevadensis				
Diacyclops bicuspidatus thomasi	31.29	31.29	50.95	397.29
Mesocyclop edax				
Bryocamptus spp.			0.89	
nauplii				
Total *Daphnia* spp.	9.83	709.75	71.51	446.95
Total Cladocera	9.83	709.75	77.77	486.68
Total Copepoda	98.33	744.61	612.32	7,727.22
Total Nauplii	0.00	0.00	0.89	0.00
Grand Total	108.16	1,454.37	690.98	8,213.90

Table B.11 Size ranges (mm), mean lengths (mm) and biomass **values** **(µg/m³)** for **zooplankton** collected at four sampling locations in January 1994 on Lake Roosevelt, WA

	Size range **(mm)**	**Mean** length **(mm)**	Biomass **(µg/m³)**
Location 2 Gifford			
Daphnia galeata mendotae			
Daphnia retrocwva			
Daphnia schødleri	0.52-1.42	0.93	97.21
Daphnia thorata			
Leptodora kindti			
Total Biomass			**97.21**
Location 4 Porcupine Bay			
Daphnia galeata mendotae			
Daphnia ***retrocwva***			
Daphnia schødleri	0.92-2.50	1.52	169,925.22
Daphnia thorata			
Leptodora kindti			
Total Biomass			169,925.22
Location 6 Seven Bays			
Daphnia galeata menabtae			
Daphnia *retrocurva*			
Daphnia thorata *Daphnia schødleri*	0.88-2.06	1.57	3,277.52
Leptodora ***kindti***			
Total **Biomass**			**3,277.52**
Location 9 Spring Canyon			
Daphnia galeata menabtae			
Daphnia retrocwva			
Daphnia *pulex* *Daphnia schødleri*	0.78-2.68	1.72	46,590.51
Daphnia thorata	1.16-1.66	1.39	392.78
Leptodora kindti			
Total Biomass			**46,983.29**

Table B.12 Size ranges (mm), mean lengths (mm) and biomass values (μg/m^3) for zooplankton collected at four sampling locations in February 1994 on Lake Roosevelt, WA

	Size range (mm)	Mean length (mm)	Biomass (μg/m^3)
Location 2 Gifford			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri	1.04-1.40	1.23	100.29
Daphnia thorata			
Leptodora kindti			
Total Biomass			100.29
Location 4 Porcupine Bay			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri	0.74-1.84	1.44	579.78
Daphnia thorata			
Leptodora kindti			
Total Biomass			579.78
Location 6 Seven Bays			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri	0.84-1.84	1.36	911.46
Daphnia thorata			
Leptodora kindti			
Total Biomass			911.46
Location 9 Spring Canyon			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri	1.06-2.62	1.63	3,759.91
Daphnia pulex			
Daphnia thorata			
Leptodora kindti			
Total Biomass			3,759.91

Table B.13 Size ranges (mm), mean lengths (mm) and biomass values ($\mu g/m^3$) for **zooplankton** collected at four sampling locations in March 1994 on Lake Roosevelt, WA

	Size range **(mm)**	Mean length **(mm)**	Biomass **($\mu g/m^3$)**
Location 2 Gifford			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri	1.34-2.34	1.65	281.39
Daphnia thorata			
Leptodora kindti			
Total Biomass			281.39
Location 4 Porcupine Bay			
Daphnia galeata mendotae			
Daphnia retrocwva			
Daphnia schødleri	0.98-1.88	1.36	327.26
Daphnia thorata	0.98-1.24	1.11	24.48
Leptodora kindti			
Total Biomass			351.73
Location 6 Seven Bays			
Daphnia galeata mendotae			
Daphnia retrocwva			
Daphnia schødleri	0.52-2.44	1.37	2,574.48
Daphnia thorata			
Leptodora kindti			
Total **Biomass**			**2,574.48**
Location 9 Spring Canyon			
Daphnia galeata mendotae			
Daphnia retrocwva			
Daphnia schødleri	0.50-2.30	1.48	2,456.20
Daphnia thorata			
Leptodora kindti			
Total Biomass			**2,456.20**

Table **B.14** Size ranges (mm), mean lengths (mm) and biomass values **(μg/m³)** for **zooplankton** collected at four sampling locations in April 1994 on Lake Roosevelt, WA

	Size range **(mm)**	Mean length **(mm)**	Biomass **(μg/m³)**
Location 2 Gifford			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri			
Daphnia thorata			
Leptodora kindti			
Total **Biomass**			
Location 4 Porcupine Bay			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri			
Daphnia thorata			
Leptodora kindti			
Total Biomass			
Location 6 Seven Bays			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri	0.86-1.48	1.19	217.26
Daphnia thorata			
Leptodora kindti			
Total **Biomass**			217.26
Location 9 Spring Canyon			
Daphnia galeata mendotae			
Daphnia retrocurva	0.98-1.42	1.18	28.51
Daphnia schødleri	0.74-1.92	1.33	3,683.12
Daphnia thorata			
Leptodora kindti			
Total Biomass			**3,711.62**

Table B.15 Size ranges (mm), mean lengths (mm) and biomass values ($\mu g/m^3$) for **zooplankton** collected at four sampling locations in May 1994 on Lake Roosevelt, WA

	Size range (mm)	Mean length (mm)	Biomass ($\mu g/m^3$)
Location 2 Gifford			
Daphnia galeata mendotae	0.24-0.70	0.52	11.61
Daphnia retrocwva			
Daphnia schødleri	0.34-0.64	0.46	7.23
Daphnia thorata			
Leptodora kindti			
Total Biomass			20.61
Location 4 Porcupine Bay			
Daphnia galeata mendotae			
Daphnia retrocwva			
Daphnia schødleri	0.22-1.32	0.66	77.46
Daphnia thorata			
Leptodora kindti			
Total Biomass			77.46
Location 6 Seven Bays			
Daphnia galeata mendotae			
Daphnia retrocwva			
Daphnia schødleri	0.24-1.12	0.67	603.91
Daphnia thorata			
Leptodora kindti			
Total **Biomass**			603.91
Location 9 Spring Canyon			
Daphnia galeata mendotae			
Daphnia retrocwva			
Daphnia schødleri	0.20-1.40	0.60	1,235.68
Daphnia thorata			
Leptodora kindti	7.00-11.00	9.00	623.83
Total Biomass			**1,859.51**

Table B.16 Size ranges (mm), mean lengths (mm) and biomass values (μg/m³) for **zooplankton** collected at four sampling locations in June 1994 on Lake Roosevelt, WA

	Size range (mm)	Mean length (mm)	Biomass (μg/m³)
Location 2 Gifford			
Daphnia galeata mendotae	0.52	0.52	1.14
Daphnia retrocwva	0.44-0.78	0.61	2.39
Daphnia schødleri	0.30-0.66	0.48	15.48
Daphnia thorata			
Leptodora kindti			
Total Biomass			19.00
Location 4 Porcupine Bay			
Daphnia galeata mendotae			
Daphnia retrocwva	0.38-0.54	0.44	2.95
Daphnia schødleri	0.44-2.00	1.07	53,228.69
Daphnia thorata			
Leptodora kindti	8.00-10.00	9.00	415.88
Total Biomass			**53.647.52**
Location 6 Seven Bays			
Daphnia galeata mendotae	0.80-0.84	0.82	7.30
Daphnia retrocurva	0.38-1.04	0.70	9.36
Daphnia schødleri	0.44-1.60	1.04	9,755.81
Daphnia thorata			
Leptodora kindti	6.00-13.00	8.67	2,257.52
Total **Biomass**			**12,029.99**
Location 9 Spring Canyon			
Daphnia galeata mendotae	0.80-1.12	0.93	19.87
Daphnia retrocurva	0.78-0.82	0.80	8.38
Daphnia schødleri	0.38-2.70	1.38	23,699.79
Daphnia thorata			
Leptodora kindti	5.00-11.00	8.00	2,582.29
Total Biomass			**26,310.33**

Table B.17 Size ranges (mm), mean lengths (mm) and biomass values ($\mu g/m^3$) for **zooplankton** collected at four sampling locations in July 1994 on Lake Roosevelt, WA

	Size range (mm)	Mean length (mm)	Biomass ($\mu g/m^3$)
Location 2 **Gifford**			
Daphnia galeata mendotae	0.38-0.80	0.55	3.88
Daphnia retrocwva	0.58	0.58	1.02
Daphnia schødleri	0.30-1.00	0.57	73.50
Daphnia thorata			
Leptodora kindti			
Total Biomass‘			**78.40**
Location 4 Porcupine Bay			
Daphnia galeata mendotae	0.32-0.60	0.45	21.57
Daphnia retrocurva	0.34-0.60	0.49	8.50
Daphnia schødleri	0.22-1.12	0.62	6,360.34
Daphnia thorata			
Leptodora kindti	2.00-15.00	9.15	4,784.39
Total Biomass			**11,174.79**
Location 6 Seven Bays			
Daphnia galeata mendotae	0.40-0.62	0.50	4.11
Daphnia retrocurva	0.50-1.32	0.79	7.95
Daphnia schødleri	0.22-1.04	0.56	145.88
Daphnia thorata	1.06	1.06	21.77
Leptodora kindti	10.00-12.00	11.00	710.66
Total **Biomass**			**890.38**
Location 9 Spring Canyon			
Daphnia galeata mendotae	0.38-1.70	1.01	278.38
Daphnia retrocwva	0.64-1.24	0.90	133.56
Daphnia schødleri	0.44-2.40	1.41	202,192.34
Daphnia thorata			
Leptodora kindti	5.00-15.00	9.47	45,031.89
Total Biomass			**247,636.17**

Table B.18 Size ranges (mm), mean lengths (mm) and biomass values ($\mu g/m^3$) for **zooplankton** collected at four sampling locations in August 1994 on Lake Roosevelt, WA

	Size range **(mm)**	Mean length **(mm)**	Biomass **($\mu g/m^3$)**
Location 2 Gifford			
Daphnia galeata menabtae			
Daphnia retrocwva			
Daphnia schødleri			
Daphnia thorata			
Leptodora kindti			
Total Biomass			
Location 4 Porcupine Bay			
Daphnia galeata mendotae	1.10-2.78	1.71	579.11
Daphnia retrocwva			
Daphnia schødleri	0.62-3.20	1.88	69,944.66
Daphnia thorata	1.48-1.68	1.56	69.81
Leptodora kindti	2.00	2.00	1.51
Total Biomass			**70,595.09**
Location 6 Seven Bays			
Daphnia galeata menabtae	0.72-2.08	1.31	8,556.33
Daphnia retrocwva	0.66-2.08	1.24	16,717.71
Daphnia schødleri	0.66-2.26	1.74	283,865.58
Daphnia thorata	1.72-1.88	1.82	4,804.39
Leptodora kindti	1.00-3.00	2.00	125.02
Total **Biomass**			**314,069.03**
Location 9 Spring Canyon			
Daphnia galeata mendotae	0.90-1.84	1.28	2,934.84
Daphnia retrocwva	0.76-1.42	1.11	1,303.74
Daphnia schødleri	0.72-2.26	1.66	170,727.55
Daphnia thorata			
Leptodora kindti	6.00-8.00	7.00	2,363.95
Total Biomass			**177,330.08**

Table B.19 Size ranges (mm), mean lengths (mm) and biomass values ($\mu g/m^3$) for zooplankton collected at four sampling locations in October 1994 on Lake Roosevelt, WA

	Size range (mm)	Mean length (mm)	Biomass ($\mu g/m^3$)
Location 2 Gifford			
Daphnia galeata mendotae	0.44-1.66	0.77	8.16
Daphnia retrocurva			
Daphnia schødleri	0.72	2.00	
Daphnia thorata	1.50-1.96	1.66	25,136.07
Leptodora kindti			
Total Biomass			**25,822.83**
Location 4 Porcupine Bay			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia schødleri / *Daphnia thorata*	0.70-1.60	1.10	7,633.81
Leptodora kindti			
Total Biomass			**7,633.81**
Location 6 Seven Bays			
Daphnia galeata mendotae	1.14-1.80	1.38	36.96
Daphnia retrocurva			
Daphnia thorata / *Daphnia schødleri*	0.52-2.50	1.16	21,243.33
Leptodora kindti			
Total Biomass			**21,280.29**
Location 5 Spring Canyon			
Daphnia galeata mendotae			
Daphnia retrocurva			
Daphnia thorata / *Daphnia schødleri*	0.56-2.64	1.38	1,043.95
Leptodora kindti			
Total Biomass			**1,043.95**

APPENDIX C
YEARLY MEAN ZOOPLANKTON
LENGTH, DENSITY AND BIOMASS VALUES.

Table C.1 Yearly mean zooplankton lengths (mm) and densities in May at Kettle Falls (Index Station 1).

SPECIES	1989	1990	1991	1992	1993
Daphnia					
$\#/m^3$	1.9	0.4	0.0	4.0	2.7
±S.D.	2.7	0.0	—	1.9	3.8
Leptodora					
$\#/m^3$	0.0	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—	—
Leptodora Length	—	—	—	—	—
±S.D.	—	—	—	—	—
Cladocera					
$\#/m^3$	36.4	16.5	21.2	22.8	2.7
±S.D.	10.1	5.9	5.0	1.9	3.8
Cladocera Length	—	0.7	—	0.8	0.8
±S.D.	—	—	—	0.1	0.0
Copepoda					
$\#/m^3$	11.4	5.0	221.2	9.4	6.7
±S.D.	5.0	1.0	7.5	9.5	1.9
Nauplii					
$\#/m^3$	7,891.9	4,907.4	610.6	162.2	2.7
±S.D.	3,064.6	1,105.7	22.5	62.6	3.8
Total **Zooplankton**					
$\#/m^3$	7,939.6	4,928.9	853.1	194.4	12.1
±S.D.	3,079.8	1,112.6	35.1	74.0	9.5

Table C.2 Yearly mean zooplankton lengths (mm) and densities in August at Kettle Falls (Index Station 1).

SPECIES	1989	1990	1991	1992
Daphnia				
#/m^3	2,298.4	28.6	140.8	1,787.8
±S.D.	301.5	8.4	24.7	295.0
Leptodora				
#/m^3	896.0	0.8	0.0	14.9
±S.D.	369.7	0.0	—	21.1
Leptodora Length	7.6	2.7	—	4.0
±S.D.	3.2	—	—	—
Cladocera				
#/m^3	3,427.9	132.2	163.6	1,802.7
±S.D.	674.1	14.8	3.8	316.0
Cladocera Length	—	1.3	1.0	1.1
±S.D.	—	—	0.3	0.3
Copepoda				
#/m^3	35.2	88.8	319.1	2,696.6
±S.D.	4.2	1.0	151.7	273.9
Nauplii				
#/m^3	3,200.8	7,154.8	285.6	4,693.0
±S.D.	989.5	653.0	263.6	1,201.0
Total **Zooplankton**				
#/m^3	7,559.9	7,376.6	768.3	9,207.1
±S.D.	2,037.4	668.8	419.1	1,812.0

Table C.3 Yearly mean zooplankton lengths (mm) and densities in October at Kettle Falls (Index Station 1).

SPECIES	1988	1989	1990	1991	1992	1994
Daphnia						
#/m3	21.5	445.2	3,608.6	491.6	528.3	17.0
±S.D.	2.3	417.8	719.7	0.0	322.4	4.1
Leptodora						
#/m3	0.1	1.0	0.0	0.0	0.0	0.0
±S.D.	0.1	1.3	—	—	—	—
Leptodora Length	9.8	4.5	—	—	—	—
±S.D.	0.0	2.2	—	—	—	—
Cladocera						
#/m3	68.3	822.1	3,742.7	491.6	544.4	20.0
±S.D.	3.0	707.0	466.7	0.0	311.0	5.6
				0.9		
Cladocera Length	—	—	1.1	0.2	1.2	1.2
±S.D.	—	—	—		0.4	0.5
Copepoda						
#/m3	9.1	34.0	419.2	0.0	116.7	5.4
±S.D.	0.2	36.8	71.6	—	66.4	4.6
Nauplii						
#/m3	1,207.9	1,478.2	1,590.4	0.0	87.2	0.0
±S.D.	98.4	741.1	156.8	—	24.7	—
Total **Zooplankton**						
#/m3	1,285.4	2,335.2	5,752.3	491.6	748.2	25.0
±S.D.	101.6	1,486.1	695.0	0.0	402.0	10.2

Table C.4 Yearly mean zooplankton lengths (mm) and densities in November at Kettle Falls (Index Station 1).

SPECIES	1993
Daphnia	
#/m3	12.1
±S.D.	1.9
Leptodora	
#/m3	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
#/m3	12.1
±S.D.	1.9
Cladocera Length	1.2
±S.D.	0.3
Copepoda	
#/m3	0.0
±S.D.	—
Nauplii	
#/m3	0.0
±S.D.	—
Total Zooplankton	
#/m3	12.1
±S.D.	1.9

Table **C.5** Yearly mean zooplankton lengths (mm) and densities in January at Gifford (Index Station 2).

SPECIES	**1994**
Daphnia	
#/m3	12.1
±S.D.	13.3
Leptodora	
#/m3	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
#/m3	12.1
±S.D.	13.3
Cladocera Length	0.9
±S.D.	0.3
Copepoda	
#/m3	1.3
±S.D.	1.9
Nauplii	
#/m3	0.0
±S.D.	—
Total **Zooplankton**	
#/m3	13.4
±S.D.	15.2

Table **C.6** Yearly mean zooplankton lengths (mm) and densities in February at Gifford (Index Station 2).

SPECIES	1992	1993	1994
Daphnia			
#/m3	2.7	0.0	5.4
±S.D.	3.8	—	7.6
Leptodora			
#/m3	0.0	0.0	0.0
±S.D.	—	—	—
Leptodora Length	—	—	—
±S.D.	—	—	—
Cladocera			
#/m3	2.7	0.0	5.4
±S.D.	3.8	—	7.6
Cladocera Length	1.5	—	1.2
±S.D.	0.2	—	0.2
Copepoda			
#/m3	28.2	59.0	5.4
±S.D.	36.0	34.1	0.0
Nauplii			
#/m3	57.7	851.4	0.0
±S.D.	17.1	43.6	—
Total **Zooplankton**			
#/m3	88.5	910.4	10.7
±S.D.	56.7	77.7	7.6

Table C.7 Yearly mean zooplankton lengths (mm) and densities in March at Gifford (Index Station 2).

SPECIES	1992	1993	1994
Daphnia			
#/m3	0.0	1.3	6.0
±S.D.	—	1.9	8.9
Leptodora			
#/m3	0.0	0.0	0.0
±S.D.	—	—	—
Leptodora Length	—	—	—
±S.D.	—	—	—
Cladocera			
#/m3	0.0	1.3	6.0
±S.D.	—	1.9	8.9
Cladocera Length	—	1.4	1.7
±S.D.	—	—	0.3
Copepoda			
#/m3	14.8	14.8	3.4
±S.D.	5.7	5.7	1.3
Nauplii			
#/m3	131.4	40.2	0.0
±S.D.	11.4	3.8	—
Total **Zooplankton**			
#/m3	146.2	56.3	9.4
±S.D.	17.1	11.4	10.2

Table **C.8** Yearly mean zooplankton lengths (mm) and densities in April at Gifford (Index Station 2).

SPECIES	1992	1993
Daphnia		
$\#/m^3$	44.3	0.0
±S.D.	9.5	—
Leptodora		
$\#/m^3$	2.7	0.0
±S.D.	0.0	—
Leptodora Length	2.8	—
±S.D.	0.4	—
Cladocera		
$\#/m^3$	63.0	2.7
±S.D.	5.7	3.8
Cladocera Length	0.7	—
±S.D.	0.2	—
Copepoda		
$\#/m^3$	426.4	1.3
±S.D.	91.0	1.9
Nauplii		
$\#/m^3$	319.1	4.0
±S.D.	22.8	1.9
Total **Zooplankton**		
$\#/m^3$	811.2	8.0
±S.D.	119.5	7.6

Table C.9 Yearly mean zooplankton lengths (mm) and densities in May at Gifford (Index Station 1).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m3	18.6	2.0	0.0	68.4	24.1	25.5
±S.D.	26.4	2.8	—	9.5	26.6	36.0
Leptodora						
#/m3	5.3	5.4	0.0	1.3	0.0	0.0
±S.D.	3.2	2.7	—	1.9	—	—
Leptodora Length	1.1	2.2	—	2.5	—	—
±S.D.	0.6	—	—	—	—	—
Cladocera						
#/m3	79.9	22.8	42.3	84.5	24.1	25.5
±S.D.	46.5	3.0	32.0	1.9	26.6	36.0
Cladocera Length	—	0.6	—	0.8	0.7	0.5
±S.D.	—	—	—	0.2	0.2	0.1
Copepoda						
#/m3	26.5	3.3	186.8	143.5	17.4	2.7
±S.D.	13.0	0.0	13.9	5.7	1.9	3.8
Nauplii						
#/m3	22,790	7,339.0	2,438.5	171.6	4.0	0.0
±S.D.	16,080	480.7	55.6	11.4	1.9	—
Total **Zooplankton**						
#/m3	22,902	7,370.5	2,667.6	400.9	45.6	28.2
±S.D.	16,143	486.4	101.5	20.9	30.4	39.8

Table **C.10** Yearly mean zooplankton lengths (mm) and densities in June at Gifford (Index Station 2).

SPECIES	1992	1993	1994
Daphnia			
#/m^3	108.6	24.1	33.1
±S.D.	24.7	3.3	32.9
Leptodora			
#/m^3	0.0	1.3	0.0
±S.D.	—	1.9	—
Leptodora Length	—	11.0	—
±S.D.	—	—	—
Cladocera			
#/m^3	183.7	40.2	33.1
±S.D.	17.1	3.8	32.9
Cladocera Length	0.9	1.0	0.5
±S.D.	0.3	0.3	0.1
Copepoda			
#/m^3	136.8	8.1	13.9
±S.D.	72.1	0.0	12.0
Nauplii			
#/m^3	720.0	1.3	0.0
±S.D.	36.0	1.9	—
Total **Zooplankton**			
#/m^3	1,040.5	51.0	46.9
±S.D.	125.2	7.6	44.9

Table C.11 Yearly mean zooplankton lengths (mm) and densities in July at Gifford (Index Station 2).

SPECIES	1991	1992	1993	1994
Daphnia				
#/m3	387.4	502.8	130.1	134.1
±S.D.	126.4	51.2	70.2	85.3
Leptodora				
#/m3	1.3	0.0	0.0	0.0
±S.D.	1.9	—	—	—
Leptodora Length	10.0	—	—	—
±S.D.	—	—	—	—
Cladocera				
#/m3	776.1	516.2	132.7	134.1
±S.D.	82.4	47.4	70.2	85.3
Cladocera Length	0.7	0.9	1.0	0.6
±S.D.	0.2	0.3	0.2	0.2
Copepoda				
#/m3	1,102.5	202.5	10.7	4.7
±S.D.	210.7	47.4	7.6	6.6
Nauplii				
#/m3	5,184.6	242.7	18.8	0.0
±S.D.	1,264.2	130.8	3.8	—
Total **Zooplankton**				
#/m3	7,064.5	961.4	162.2	138.8
±S.D.	1,559.1	225.7	81.5	92.0

Table C.12 Yearly mean zooplankton lengths (mm) and densitites in August at Gifford (Index Staton 2).

SPECIES	1988	1989	1990	1991	1992	1993
Daphnia						
#/m^3	2,552.4	3,382.0	13.7	796.5	2,905.2	343.3
±S.D.	1,559.2	602.8	0.0	128.9	231.8	—
Leptodora						
#/m^3	0.6	129.1	1.1	9.4	14.9	0.0
±S.D.	0.1	68.4	0.0	5.7	21.1	—
Leptodora Length	4.2	6.7	2.2	6.1	8.0	—
±S.D.	1.4	1.5	—	3.2	—	—
Cladocera						
#/m^3	2,730.7	3,749.1	41.0	824.6	3,069.0	343.3
±S.D.	1,574.3	570.7	0.0	142.2	379.3	—
Cladocera Length	—	—	1.0	1.2	1.0	0.8
±S.D.	—	—	—	0.4	0.3	0.2
Copepoda						
#/m^3	308.0	102.6	82.9	624.8	1,206.8	13.4
±S.D.	261.4	38.5	0.0	163.1	105.4	—
Nauplii						
#/m^3	420.6	14,606	4,102.2	285.6	1,460.0	0.0
±S.D.	56.1	1,562.3	0.0	130.8	295.0	—
Total **Zooplankton**						
#/m^3	3,459.2	18,587	4,227.2	1,744.4	5,750.7	356.7
±S.D.	1,892.2	2,239.9	0.0	441.8	800.6	—

Table C.13 Yearly mean zooplankton lengths (mm) and densities in September at Gifford (Index Station 2).

SPECIES	1991	1992	1993
Daphnia			
#/m3	1,039.2	612.8	6,763.8
±S.D.	320.5	28.4	—
Leptodora			
#/m3	1.3	1.4	29.8
±S.D.	1.9	1.9	—
Leptodora Length	2.2	4.0	5.0
±S.D.	—	—	—
Cladocera			
#/m3	1,072.7	622.2	6,793.6
±S.D.	318.6	26.7	—
Cladocera Length	1.1	1.1	1.2
±S.D.	0.3	0.4	0.3
Copepoda			
#/m3	197.1	240.0	89.4
±S.D.	9.5	28.4	—
Nauplii			
#/m3	225.3	581.9	29.8
±S.D.	64.5	30.3	—
Total Zooplankton			
#/m3	1,496.4	1,445.4	6,942.6
±S.D.	394.3	87.2	—

Table C.14 Yearly mean zooplankton lengths (mm) and densities in October at Gifford (Index Station 2).

SPECIES	1988	1989	**1990**	1992	1993	1994
Daphnia						
#/m^3	289.8	865.2	2,578.4	470.6	488.1	1,726.1
±S.D.	67.8	115.7	133.5	123.3	60.7	794.7
Leptodora						
#/m^3	0.3	1.3	2.7	1.3	0.0	0.0
±S.D.	0.0	0.2	2.7	1.9	—	—
Leptodora Length	4.6	5.7	6.6	3.5	—	—
±S.D.	4.6	2.7	—	—	—	—
Cladocera						
#/m^3	350.1	1,096.6	3,059.7	484.0	492.1	1,739.5
±S.D.	89.9	3.4	278.2	123.3	62.6	796.2
Cladocera Length	—	—	1.3	1.1	1.4	1.1
±S.D.	—	—	—	0.2	0.2	0.3
Copepoda						
#/m^3	45.3	91.8	94.0	122.0	25.5	30.4
±S.D.	3.0	3.9	19.3	39.8	1.9	1.6
Nauplii						
#/m^3	1,734.6	6,085.1	7,475.2	335.2	0.0	0.0
±S.D.	404.6	572.9	2,463.7	117.6	—	—
Total **Zooplankton**						
#/m^3	2,130.3	7,274.8	10,632	942.6	517.6	1,769.9
±S.D.	497.5	580.4	2,763.9	282.6	64.5	797.7

Table C.15 Yearly mean zooplankton lengths (mm) and densities in November at Gifford (Index Station 2).

SPECIES	1992	1993
Daphnia		
#/m3	902.4	20.1
±S.D.	157.4	1.9
Leptodora		
#/m3	0.0	0.0
±S.D.	—	—
Leptodora Length	—	—
±S.D.	—	—
Cladocera		
#/m3	966.8	20.1
±S.D.	138.4	1.9
Cladocera Length	1.1	1.4
±S.D.	0.3	0.4
Copepoda		
#/m3	201.1	8.1
±S.D.	37.9	3.8
Nauplii		
#/m3	343.3	0.0
±S.D.	91.0	—
Total **Zooplankton**		
#/m3	1,511.1	28.2
±S.D.	267.4	5.7

Table C.16 Yearly mean zooplankton lengths (mm) and densities in December at Gifford (Index Station 2).

SPECIES	1991	1994
Daphnia		
#/m3	16.1	9.8
±S.D.	7.6	12.7
Leptodora		
#/m3	0.0	0.0
±S.D.	—	—
Leptodora Length	15.0	—
±S.D.	—	—
Cladocera		
#/m3	20.1	9.8
±S.D.	9.5	12.7
Cladocera Length	1.3	—
±S.D.	0.5	—
Copepoda		
#/m3	56.3	98.3
±S.D.	41.7	39.5
Nauplii		
#/m3	77.8	0.0
±S.D.	68.3	—
Total Zooplankton		
#/m3	154.2	108.2
±S.D.	119.5	52.2

Table C.17 Yearly mean zooplankton lengths (mm) and densities in May at Hunters (Index Station 3).

SPECIES	1989	1990	1991	1992	1993
Daphnia					
#/m3	8.1	2.0	1.3	258.8	308.4
±S.D.	5.7	0.0	1.8	111.9	0.0
Leptodora					
#/m3	6.0	2.7	0.0	8.1	0.0
±S.D.	1.1	0.0	—	0.0	—
Leptodora Length	1.7	2.4	—	5.0	—
±S.D.	1.1	—	—	2.4	—
Cladocera					
#/m3	28.8	19.0	5.5	268.2	308.4
±S.D.	12.0	11.8	4.2	113.8	0.0
Cladocera Length	—	1.0	0.6	0.9	0.9
±S.D.	—	—	—	0.3	0.3
Copepoda					
#/m3	44.4	19.3	71.6	545.7	170.3
±S.D.	17.7	1.0	6.0	28.4	134.6
Nauplii					
#/m3	20,983.5	7,567.4	1,095.7	403.6	77.8
±S.D.	7,607.4	284.4	95.4	9.5	98.6
Total **Zooplankton**					
#/m3	21,062.8	7,608.4	1,172.8	1,225.5	556.5
±S.D.	7,638.2	297.3	105.5	151.7	233.2

Table C.18 Yearly mean zooplankton lengths (mm) and densities in August at Hunters (Index Station 2).

SPECIES	1988	1989	1990	1991	1992
Daphnia					
#/m3	4,613.9	5,223.6	197.8	1,925.9	7,762.0
±S.D.	959.5	448.4	20.1	317.9	5,267.0
Leptodora					
#/m3	8.8	13.4	21.8	14.9	29.8
±S.D.	2.4	1.9	2.7	21.1	42.1
Leptodora Length	4.9	7.4	4.9	5.0	5.3
±S.D.	1.9	3.5	—	—	2.5
Cladocera					
#/m3	4,933.2	5,559.1	316.7	1,970.6	8,074.9
±S.D.	997.0	48.0	33.0	381.1	379.3
Cladocera Length	—	—	1.4	1.0	1.1
±S.D.	—	—		0.4	0.4
Copepoda					
#/m3	561.8	201.2	580.9	1,772.9	3,396.8
±S.D.	42.9	1.3	60.1	653.2	463.5
Nauplii					
#/m3	2,151.2	34,992.6	18,423.7	3,814.0	3,694.8
±S.D.	769.2	1,818.7	2,039.1	0.0	589.9
Total Zooplankton					
#/m3	7,655.4	40,766.2	19,343.1	7,572.3	15,196.2
±S.D.	1,809.8	1,870.0	2,134.8	1,055.4	1,474.9

Table C.19 Yearly mean zooplankton lengths (mm) and densities in October at Hunters (Index Station 3).

SPECIES	1988	1989	1990	1992
Daphnia				
#/m3	6,778.2	2,045.3	3,734.9	11,084.3
±S.D.	3,627.5	0.0	1,327.8	1,179.9
Leptodora				
#/m3	20.1	3.1	65.7	29.8
±S.D.	1.8	0.0	21.8	0.0
Leptodora Length	7.3	6.7	6.5	4.0
±S.D.	1.7	2.5	—	0.0
Cladocera				
#/m3	7,213.4	2,320.9	4,581.5	11,114.1
±S.D.	3,329.9	0.0	1,449.9	1,179.9
Cladocera Length	—	—	1.6	1.1
±S.D.	—	—	—	0.4
Copepoda				
#/m3	667.4	133.3	803.0	4,380.1
±S.D.	6.1	0.0	127.4	632.1
Nauplii				
#/m3	3,757.6	3,789.7	16,925.4	1,623.9
±S.D.	596.9	0.0	3,088.6	273.9
Total **Zooplankton**				
#/m3	11,658.5	6,247.0	22,375.6	17,147.9
±S.D.	3,934.7	0.0	4,687.7	2,085.9

Table **C.20** Yearly mean zooplankton lengths (mm) and densities in November at Hunters (Index Station 3).

SPECIES	1993	1994
Daphnia		
#/m3	87.2	5,410.5
±S.D.	17.1	2,232.6
Leptodora		
#/m3	—	10.8
±S.D.	—	16.5
Leptodora Length	—	11.5
±S.D.	—	0.7
Cladocera		
#/m3	87.2	5,423.1
±S.D.	17.1	2,232.8
Cladocera Length	1.4	1.7
±S.D.	0.5	0.6
Copepoda		
#/m3	8.1	451.5
±S.D.	0.0	188.1
Nauplii		
#/m3	0.0	0.0
±S.D.	0.0	—
Total **Zooplankton**		
#/m3	95.2	5,874.6
±S.D.	17.1	2,418.5

Table C.21 Yearly mean zooplankton lengths (mm) and densities in January at Porcupine Bay (Index Station 4).

SPECIES	1989	1990	1992	1994
Daphnia				
#/m3	922.4	810.9	682.5	4,633.4
±S.D.	101.4	0.0	74.0	273.9
Leptodora				
#/m3	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—
Leptodora Length	—	—	—	—
±S.D.	—	—	—	—
Cladocera				
#/m3	1,120.0	1,082.7	738.8	4,633.4
±S.D.	93.3	0.0	74.0	273.9
Cladocera Length	—	1.6	1.5	1.5
±S.D.	—	—	0.5	0.4
Copepoda				
#/m3	5,552.2	12,832.5	635.6	1,519.6
±S.D.	910.0	0.0	19.0	210.7
Nauplii				
#/m3	15,198.4	53,670.4	340.6	0.0
±S.D.	2,116.8	0.0	60.7	—
Total Zooplankton				
#/m3	21,870.6	67,585.6	1,714.9	6,153.0
±S.D.	3,120.2	0.0	153.6	484.6

Table C.22 Yearly mean zooplankton lengths (mm) and densities in February at Porcupine Bay (Index Station 4).

SPECIES	1989	1990	1992	1993	1994
Daphnia					
#/m^3	0.0	0.8	123.4	149.0	18.8
±S.D.	—	0.0	7.6	0.0	3.8
Leptodora					
#/m^3	0.0	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—	—
Leptodora Length	—	—	—	—	—
±S.D.	—	—	—	—	—
Cladocera					
#/m^3	0.0	6.3	159.6	193.7	18.8
±S.D.	—	0.0	1.9	21.1	3.8
Cladocera Length	—	1.1	1.5	0.9	1.2
±S.D.	—	—	0.5	0.1	0.2
Copepoda					
#/m^3	1,043.0	53.2	340.6	1,325.9	5.4
±S.D.	214.7	0.0	19.0	105.4	3.8
Nauplii					
#/m^3	9,027.2	5,247.9	382.1	5,393.2	0.0
±S.D.	2,184.0	0.0	20.9	295.0	—
Total Zooplankton					
#/m^3	10,070.2	5,307.4	882.3	6,912.8	24.1
±S.D.	2,398.7	0.0	41.7	421.4	7.6

Table C.23 Yearly mean zooplankton lengths (mm) and densities in March at Porcupine Bay (Index Station 4).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m^3	0.0	0.4	0.0	5.4	9.4	14.1
±S.D.	—	0.0	0.0	0.0	13.3	9.1
Leptodora						
#/m^3	0.0	0.0	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—	—	—
Leptodora Length	—	—	—	—	—	—
±S.D.	—	—	—	—	—	—
Cladocera						
#/m^3	65.3	3.0	147.5	14.8	13.4	14.1
±S.D.	93.3	3.0	69.5	5.7	11.4	9.1
Cladocera Length	—	0.8	—	1.4	1.1	1.7
±S.D.	—	—	—	0.2	0.2	0.3
Copepoda						
#/m^3	3,957.1	3 1.6	4,998.4	195.8	173.0	6.0
±S.D.	910.0	2.0	1,089.3	45.5	43.6	2.6
Nauplii						
#/m^3	9,049.6	5,468.2	7,423.8	116.7	442.5	0.0
±S.D.	2,788.8	256.4	811.2	32.2	30.3	—
Total **Zooplankton**						
#/m^3	13,072	5,502.7	12,570	327.2	628.9	20.1
±S.D.	3,792.2	261.4	1,970.0	83.4	85.3	11.7

Table C.24 Yearly mean zooplankton lengths (mm) and densities in April at Porcupine Bay (Index Station 4).

SPECIES	1989	1990	1992	1993
Daphnia				
$\#/m^3$	0.0	2.8	64.4	5.4
±S.D.	—	2.8	22.8	7.6
Lcptodora				
$\#/m^3$	0.0	1.9	0.0	0.0
±S.D.	—	2.7	—	—
Leptodora Length	—	0.7	—	—
±S.D.	—	—	—	—
Cladocera				
$\#/m^3$	0.0	30.4	143.5	5.4
±S.D.	—	11.8	51.2	7.6
Cladocera Length	—	0.9	1.0	0.9
±S.D.	—	—	0.8	0.1
Copepoda				
$\#/m^3$	43,610.1	47.4	1,457.5	17.4
±S.D.	14,182.2	16.3	259.8	9.5
Nauplii				
$\#/m^3$	18,961.6	7,723.6	682.5	1.3
±S.D.	571.2	1,189.8	51.2	1.9
Total Zooplankton				
$\#/m^3$	62,571.7	7,803.4	2,283.5	24.1
±S.D.	14,753.4	1,220.6	362.2	19.0

Table **C.25** Yearly mean zooplankton lengths (mm) and densities in May at Porcupine Bay (Index Staton 4).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m^3	3.2	31.0	4.0	340.6	20.1	28.2
±S.D.	4.4	14.1	5.7	91.0	5.7	5.7
Leptodora						
#/m^3	0.4	3.4	4.0	17.4	0.0	0.0
±S.D.	0.4	0.0	5.7	9.5	—	—
Leptodora Length	0.7	2.6	0.9	3.7	—	—
±S.D.	0.0	—	—	1.8	—	—
Cladocera						
#/m^3	44.8	100.6	243.6	442.5	88.5	28.2
±S.D.	13.1	14.8	299.0	72.1	37.9	5.7
Cladocera Length	—	1.2	0.8	0.9	1.1	0.7
±S.D.	—	—	—	0.3	0.2	0.3
Copepoda						
#/m^3	544.5	865.3	2,726.4	441.1	104.6	99.2
±S.D.	22.8	90.7	568.9	180.1	49.3	11.4
Nauplii						
#/m^3	25,314	15,259	10,950	513.5	59.0	0.0
±S.D.	232.3	312.5	189.6	96.7	56.9	—
Total **Zooplankton**						
#/m^3	25,904	16,228	13,924	1,414.6	252.1	127.4
±S.D.	268.6	417.9	1,063.2	358.4	144.1	17.1

Table C.26 Yearly mean zooplankton lengths (mm) and densities in June at Porcupine Bay (Index Station 4).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m3	3,251.1	79,086	573.6	1,630.6	96.5	2,005.0
±S.D.	1,904.0	39,928	23.2	19.2	27.0	1,601.2
Leptodora						
#/m3	180.7	1,206.0	11.8	5.4	6.7	18.3
±S.D.	65.7	189.0	12.5	—	5.7	8.2
Leptodora Length	4.0	3.9	2.5	8.5	4.7	9.0
±S.D.	2.2	—	0.5	2.1	2.2	1.4
Cladocera						
#/m3	4,253.8	78,381	1,994.8	1,680.7	118.0	2,024.2
±S.D.	1,973.4	65,417	731.0	40.2	22.8	1,058.7
Cladocera Length	—	1.5	1.0	1.3	1.1	0.5
±S.D.	—	—	0.4	0.6	0.3	0.1
Copepoda						
#/m3	1,871.5	27,884	1,924.8	2,562.5	100.6	252.8
±S.D.	1,042.1	4,550.2	257.0	884.9	55.0	75.6
Nauplii						
#/m3	82,600	28,291	7,833.5	5,244.2	24.1	0.0
±S.D.	39,968	12,835	231.8	2,275.5	11.4	—
Total **Zooplankton**						
#/m3	88,906	135,762	11,765	9,492.7	249.4	2,295.3
±S.D.	43,049	82,992	1,232.3	3,200.6	94.8	1,142.5

Table C.27 Yearly mean zooplankton lengths (mm) and densities in July at Porcupine Bay (Index Station 4).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m^3		43,618	1,884.6	2,741.3	870.2	2,093.6
±S.D.	3,072.5	13,330	162.2	—	347.0	1,601.2
	300.0					
Leptodora						
#/m^3	128.7	180.0	28.0	0.0	6.7	14.8
±S.D.	1.1	0.0	2.1	—	5.7	20.9
Leptodora Length	6.4	3.2	6.3	—	7.0	9.2
±S.D.	3.3	—	2.5	—	2.8	3.6
Cladocera						
#/m^3	3,417.2	44,800	2,633.7	2,741.3	876.9	2,108.3
±S.D.	110.8	13,001	25.3	—	352.7	1,580.3
Cladocera Length	—	1.5	1.1	1.4	1.4	0.6
±S.D.	—	—	0.5	0.4	0.4	0.2
Copepoda						
#/m^3	1,082.1	108,969	8,046.5	5,095.2	335.2	341.8
±S.D.	45.5	3,619.7	579.4	—	121.4	333.5
Nauplii						
#/m^3	86,422	596,445	27,417	7,657.7	41.6	0.0
±S.D.	8,765.2	36,512	2,479.9	—	17.1	—
Total **Zooplankton**						
#/m^3	91,050	750,394	38,126	15,494	1,260.4	2,464.8
±S.D.	8,922.6	53,133	3,086.6	—	496.8	1,934.7

Table C.28 Yearly mean zooplankton lengths (mm) and densities in August at Porcupine Bay (Index Station 4).

SPECIES	1988	1989	1990	1991	1992	1993	1994
Daphnia							
#/m3	3,880.9	4,928.5	1,292.4	2,100.7	1,758.0	232.0	1,026.6
±S.D.	896.3	1,082.8	1.191.5	105.4	—	218.1	205.0
Leptodora							
#/m3	18.7	10.7	19.9	48.7	0.0	1.3	2.3
±S.D.	4.2	1.9	2.7	57.5	—	1.9	1.6
Leptodora Length	6.1	6.1	6.8	4.1	—	3.0	—
±S.D.	1.9	2.7	—	1.9	—	—	—
Cladocera							
#/m3	4,325.6	5,354.0	1,532.4	2,295.5	2,026.2	233.3	1,043.1
±S.D.	998.7	1,154.1	1,384.4	166.9	—	220.0	204.1
Cladocera Length	—	—	1.4	1.2	1.2	1.1	0.7
±S.D.	—	—	—	0.6	0.5	0.3	0.2
Copepoda							
#/m3	3,273.4	2,785.6	1,767.6	5,095.2	7,032.0	105.0	516.1
±S.D.	740.3	623.2	715.4	632.1	—	83.4	24.4
Nauplii							
#/m3	2,2 19.3	136,249	80,245	10,757	6.614.8	77.8	0.0
±S.D.	1,742.6	30,290	38,470	42.1	—	19.0	—
Total Zooplankton							
#/m3	9,837.2	144.399	83,565	18,196	15,673	417.0	1,561.4
±S.D.	3.4 14.9	32,185	40,572	89X.6	—	324.3	230.0

Table C.29 Yearly mean zooplankton lengths (mm) and densities in September at Porcupine Bay (Index Station 4).

SPECIES	1988	1989	1990	1991	1992	1993
Daphnia						
#/m³	2,613.0	4,503.3	1,872.7	1,221.7	1,683.5	244.0
±S.D.	98.1	0.0	53.9	42.1	63.2	—
Leptodora						
#/m³	0.4	0.0	2.3	74.5	14.9	6.7
±S.D.	0.4	—	0.0	21.1	21.1	5.7
Leptodora Length	4.3	—	6.4	6.1	—	5.1
±S.D.	1.3	—	—	2.9	—	1.9
Cladocera						
#/m³	2,842.1	5,058.9	2,553.2	1,430.2	1,713.3	1,395.8
±S.D.	19.5	0.0	77.8	42.1	21.1	297.7
Cladocera Length	—	—	1.6	1.6	1.2	1.1
±S.D.	—	—	—	0.5	0.3	0.4
Copepoda						
#/m³	1,288.1	4,849.3	2,744.2	4,097.0	3,575.6	155.5
±S.D.	106.9	0.0	165.2	105.4	126.4	7.6
Nauplii						
#/m³	1,025.5	125,801	56,669	7,806.7	3,977.8	24.1
±S.D.	360.5	0.0	424.6	0.0	484.6	0.0
Total Zooplankton						
#/m³	5,156.3	136,709	61,949	13,408	9,281.6	1,582.2
±S.D.	487.3	0.0	667.6	168.6	653.2	311.0

Table **C.30** Yearly mean zooplankton lengths (mm) and densities in October at Porcupine Bay (Index Station 4).

SPECIES	1988	1989	1990	1991	1992	1993	1994
Daphnia							
#/m3	2,860.9	2,446.6	96,947	2,502.9	2,994.6	244.0	565.8
±S.D.	738.4	347.8	41,641	1,264.2	906.0	—	57.7
Leptodora							
#/m3	3.7	2.9	252.0	59.6	0.0	0.0	0.0
±S.D.	0.3	0.4	315.0	42.1	—	—	—
Leptodora Length	4.8	5.7	4.7	6.3	—	—	—
±S.D.	1.9	3.4	—	1.7	—	—	—
Cladocera							
#/m3	3,140.6	2,718.1	91,056	2,622.1	3,024.3	244.0	566.7
±S.D.	613.1	41.9	39,069	1,306.3	863.8	—	59.0
Cladocera Length	—	—	1.5	1.6	1.2	1.7	1.1
±S.D.	—	—	—	0.5	0.3	0.5	0.2
Copepoda							
#/m3	2,795.9	3,241.1	245,198	5,259.1	1,877.2	40.2	54.5
±S.D.	249.6	107.1	131,515	147.5	252.8	—	30.9
Nauplii							
#/m3	90,388	64,501	210,672	5,318.7	1,921.9	8.1	0.0
±S.D.	21,693	2,900.4	64,310	1,074.5	1,538.1	—	—
Total Zooplankton							
#/m3	96,328	70,463	547,178	13,259	6,823.4	292.3	621.3
±S.D.	22,556	3,049.7	235,210	2,570.5	2,654.7	—	89.9

Table **C.31** Yearly mean zooplankton lengths (mm) and densities in November at Porcupine Bay (Index Station 4).

SPECIES	1988	1989	1990	1991	1992	1993
Daphnia						
#/m³	22,384	203.9	13,005	119.3	1,623.9	450.5
±S.D.	5,420.2	0.0	283.8	13.3	737.4	—
Leptodora						
#/m³	0.0	0.0	9.0	0.0	0.0	0.0
±S.D.	—	—	0.0	—	—	—
Leptodora Length	—	6.2	3.0	—	—	—
±S.D.	—	—	—	—	—	—
Cladocera						
#/m³	23,729	260.0	13,291	150.2	1,653.7	450.5
±S.D.	2,691.8	0.0	196.0	11.4	695.3	—
Cladocera Length	—	—	1.3	1.1	1.5	1.6
±S.D.	—	—	—	0.4	0.6	0.4
Copepoda						
#/m³	52,209	134.5	27,148	273.5	4,186.4	83.1
±S.D.	3,875.3	0.0	1,370.2	0.0	863.8	—
Nauplii						
#/m³	75,656	9,342.0	24,349	368.7	4,648.3	0.0
±S.D.	20,462.4	0.0	1,500.8	9.5	421.4	—
Total **Zooplankton**						
#/m³	151,594	9,736.5	64,796	792.4	10,488	533.7
±S.D.	27,030	0.0	3,067.0	20.9	1,980.5	--

Table **C.32** Yearly mean zooplankton lengths (mm) and densities in December at Porcupine Bay (Index Station 4).

SPECIES	1988	1989	1990	1991	1993	1994
Daphnia						
#/m3	21,338	270.0	10.1	166.3	1,133.0	709.8
±S.D.	0.0	45.3	4.4	30.3	142.2	8.6
Leptodora						
#/m3	0.0	0.0	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—	—	—
Leptodora Length	—	—	—	—	—	—
±S.D.	—	—	—	—	—	—
Cladocera						
#/m3	21,065	433.0	101.5	207.8	1,133.0	709.8
±S.D.	84.0	10.1	47.8	32.2	142.2	8.6
Cladocera Length	—	—	1.2	1.6	1.3	—
±S.D.	—	—	—	0.4	0.3	—
Copepoda						
#/m3	50,236	370.8	329.0	119.3	107.3	744.6
±S.D.	879.4	30.4	256.1	1.9	19.0	264.9
Nauplii						
#/m3	87,618	21,276	34,776	195.8	0.0	0.0
±S.D.	6,608.0	1,778.7	28,194	41.7	—	—
Total **Zooplankton**						
#/m3	158,919	22,060	35,207	522.9	1,240.3	1,454.4
±S.D.	7,571.4	1,819.2	28,498	75.9	161.2	273.5

Table **C.33** Yearly mean zooplankton lengths (mm) and densities in May at Little Falls (Index Station 5).

SPECIES	1989	1990	1992
Daphnia			
#/m3	38.2	0.8	14.8
±S.D.	48.3	0.0	17.1
Leptodora			
#/m3	0.0	0.8	1.3
±S.D.	—	0.0	1.9
Leptodora Length	—	2.2	1.0
±S.D.	—	—	—
Cladocera			
#/m3	57.1	50.7	38.9
±S.D.	68.9	0.0	17.1
Cladocera Length	—	1.1	1.5
±S.D.	—	—	0.3
Copepoda			
#/m3	68.0	254.1	211.9
±S.D.	80.6	0.0	64.5
Nauplii			
#/m3	2,884.3	6,293.5	108.6
±S.D.	1,874.8	0.0	20.9
Total **Zooplankton**			
#/m3	3,009.4	6,599.1	360.9
±S.D.	2,024.3	0.0	104.3

Table C.34 Yearly mean zooplankton lengths (mm) and densities in August at Little Falls (Index Station 5).

SPECIES	1988	1989	1990	1991	1992
Daphnia					
#/m^3	2,690.1	1,502.3	231.2	3,872.9	63.9
±S.D.	158.2	267.3	79.2	1,065.0	34.8
Leptodora					
#/m^3	3.4	1.1	9.5	0.0	0.0
±S.D.	0.0	0.0	0.0	—	—
Leptodora Length	4.5	5.0	—	—	—
±S.D.	1.4	0.9	—	—	—
Cladocera					
#/m^3	3,252.3	2,069.8	378.9	4,572.2	73.8
±S.D.	142.7	386.7	68.9	1,141.1	34.8
Cladocera Length	—	—	1.4	1.1	1.0
±S.D.	—	—	—	0.4	0.4
Copepoda					
#/m^3	1,817.5	2,757.2	487.0	4,034.3	3,382.5
±S.D.	156.5	953.5	5.0	76.1	292.0
Nauplii					
#/m^3	1,854.8	129,090.0	31,895.9	16,836.3	3,805.3
±S.D.	72.1	45,063.7	7,082.6	2,814.6	236.4
Total Zooplankton					
#/m^3	6,928.4	133,918.2	32,771.3	25,442.7	7,261.6
±S.D.	371.3	46,404.1	7,156.6	4,031.8	563.2

Table C.35 Yearly mean zooplankton lengths (mm) and densities in October at Little Falls (Index Station 5).

SPECIES	1988	1989	1990	1991	1992
Daphnia					
#/m^3	1,002.5	989.0	471.7	323.0	48.3
±S.D.	8.4	149.1	76.8	194.0	0.0
Leptodora					
#/m^3	0.0	2.3	0.0	0.0	0.0
±S.D.	—	0.4	—	—	—
Leptodora Length	—	5.1	—	—	—
±S.D.	—	1.7	—	—	—
Cladocera					
#/m^3	1,365.8	1,346.4	639.8	438.1	93.9
±S.D.	52.0	154.8	92.6	244.1	0.0
Cladocera Length	—	—	1.4	1.3	1.2
±S.D.	—	—	—	0.5	0.3
Copepoda					
#/m^3	1,477.8	1,346.5	1,644.1	920.4	438.5
±S.D.	255.5	160.5	175.2	187.8	108.1
Nauplii					
#/m^3	2,355.5	40,857.4	28,146.3	221.2	528.3
±S.D.	148.2	2,471.7	312.5	12.5	87.2
Total Zooplankton					
#/m^3	5,199.1	43,552.7	31,938.3	1,579.6	1,060.6
±S.D.	455.8	2,787.4	574.4	444.3	195.3

Table C.36 Yearly mean zooplankton lengths (mm) and densities in November at Little Falls (Index Station 5).

SPECIES	1993
Daphnia	
$\#/m^3$	33.5
±S.D.	17.1
Leptodora	
$\#/m^3$	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
$\#/m^3$	33.5
±S.D.	17.1
Cladocera Length	1.5
±S.D.	0.4
Copepoda	
$\#/m^3$	12.1
±S.D.	1.9
Nauplii	
$\#/m^3$	0.0
±S.D.	—
Total **Zooplankton**	
$\#/m^3$	45.6
±S.D.	19.0

Table C.37 Yearly mean zooplankton lengths (mm) and densities in January at Seven Bays (Index Station 6).

SPECIES	1989	1990	1992	1994
Daphnia				
#/m3	334.5	16.9	206.5	80.5
±S.D.	476.4	—	34.1	19.0
Leptodora				
#/m3	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—
Leptodora Length	—	0.3	—	—
±S.D.	—	—	—	—
Cladocera				
#/m3	1,726.7	25.8	227.9	80.5
±S.D.	177.3	—	34.1	19.0
Cladocera Length	—	1.1	1.6	1.6
±S.D.	—	—	0.5	0.3
Copepoda				
#/m3	1,554.2	20.2	177.0	24.1
±S.D.	664.6	—	15.2	3.8
Nauplii				
#/m3	5,252.8	1,954.9	199.8	0.0
±S.D.	1,153.6	—	9.5	—
Total **Zooplankton**				
#/m3	8,533.7	2,000.9	604.7	104.6
±S.D.	1,995.6	—	58.8	22.8

Table C.38 **Yearly mean zooplankton lengths (mm) and densities in February at Seven Bays (Index Station 6).**

SPECIES	1989	1990	1992	1993	1994
Daphnia					
#/m^3	0.0	0.4	13.4	25.5	349.0
±S.D.	—	—	11.4	5.7	—
Leptodora					
#/m^3	0.0	0.0	1.3	0.0	0.0
±S.D.	—	—	1.9	—	—
Leptodora Length	—	—	—	—	—
±S.D.	—	—	—	—	—
Cladocera					
#/m^3	65.3	1.7	14.8	25.5	34.9
±S.D.	84.0	—	13.3	5.7	—
Cladocera Length	—		1.5	1.1	1.4
±S.D.	—	~~0.9~~	0.5	0.2	0.3
Copepoda					
#/m^3	1,278.1	13.1	46.9	122.0	8.1
±S.D.	286.3	—	13.3	17.1	—
Nauplii					
#/m^3	7,392.0	1,181.8	135.4	540.4	0.0
±S.D.	840.0	—	28.4	32.2	—
Total **Zooplankton**					
#/m^3	8,735.5	1,196.6	198.5	687.9	42.9
±S.D.	1,210.3	—	56.9	55.0	—

Table C.39 Yearly mean zooplankton lengths (mm) and densities in March at Seven Bays (Index Station 6).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m³	0.0	0.0	0.0	1.3	5.4	64.1
±S.D.	—	—	—	1.9	3.8	42.6
Leptodora						
#/m³	0.0	0.0	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—	—	—
Leptodora Length	—	1.0	—	—	—	—
±S.D.	—	—	—	—	—	—
Cladocera						
#/m³	0.0	3.4	1.3	1.3	5.4	64.1
±S.D.	—	5.9	1.9	1.9	3.8	42.6
Cladocera Length	—	—	—	1.2	1.4	1.4
±S.D.	—	—	—	—	0.1	0.5
Copepoda						
#/m³	3,885.5	37.3	274.9	60.3	87.2	23.2
±S.D.	818.0	—	20.9	13.3	5.7	13.3
Nauplii						
#/m³	12,051	2,712.1	984.2	64.4	533.7	0.0
±S.D.	1,892.8	905.4	34.1	3.8	41.7	—
Total **Zooplankton**						
#/m³	15,937	2,752.8	1,260.4	126.0	626.2	87.3
±S.D.	2,710.8	911.3	56.9	19.0	51.2	55.9

Table **C.40** Yearly mean zooplankton lengths (mm) and densities in April at Seven Bays (Index Station 6).

SPECIES	1989	1990	1992	1993	1994
Daphnia					
#/m^3	60.8	0.4	149.0	9.4	21.2
±S.D.	91.2	5.6	42.1	13.3	18.9
Leptodora					
#/m^3	0.0	0.4	0.0	0.0	0.0
±S.D.	—	2.7	—	—	—
Leptodora Length	—	1.7	—	—	—
±S.D.	—	—	—	—	—
Cladocera					
#/m^3	0.0	7.2	283.1	9.4	21.2
±S.D.	—	3.0	63.2	13.3	18.9
Cladocera Length	—	0.6	0.7	0.8	1.2
±S.D.	—	—	0.1	0.1	0.2
Copepoda					
#/m^3	7,699.5	9.7	2,219.8	20.1	15.2
±S.D.	265.9	0.0	189.6	1.9	13.2
Nauplii					
#/m^3	18,267.2	2,051.1	3,069.0	61.7	0.0
±S.D.	0.0	84.1	84.3	22.8	—
Total **Zooplankton**					
#/m^3	25,966.7	2,068.3	5,572.0	91.2	36.4
±S.D.	265.9	89.8	337.1	37.9	32.1

Table C.41 Yearly mean zooplankton lengths (mm) and densities in May at Seven Bays (Index Station 6).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m^3	51.1	55.5	14.2	82.4	607.4	210.5
±S.D.	14.5	5.6	5.0	52.0	36.0	214.3
Leptodora						
#/m^3	3.4	13.4	5.3	14.9	0.0	0.0
±S.D.	1.1	2.7	2.5	21.1	—	—
Leptodora Length	1.9	3.7	0.9	2.0	—	—
±S.D.	1.6	—	—	0.0	—	—
Cladocera						
#/m^3	107.4	123.5	19.5	155.4	611.4	210.5
±S.D.	30.0	5.9	7.5	117.4	41.7	214.3
Cladocera Length	—	1.2	0.8	0.9	1.2	0.7
±S.D.	—	—	0.2	0.4	0.4	0.2
Copepoda						
#/m^3	522.4	127.4	324.5	1,245.3	305.7	85.8
±S.D.	136.8	8.2	125.2	1,188.5	3.8	98.6
Nauplii						
#/m^3	47,375	6,846.3	1,935.1	2,341.9	79.1	0.0
±S.D.	2,435.7	737.1	0.0	2,587.5	36.0	—
Total **Zooplankton**						
#/m^3	48,009	7,110.5	2,284.4	3,757.5	996.2	296.3
±S.D.	2,603.6	753.9	135.2	3,914.5	81.5	312.9

Table C.42 **Yearly mean zooplankton lengths (mm) and densities in June at Seven Bays (Index Station 6).**

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m3	1,613.6	32,772	700.6	1,087.6	1,104.9	360.2
±S.D.	491.8	8,241.1	17.4	189.6	60.7	136.5
Leptodora						
#/m3	153.9	90.0	4.4	89.4	42.9	13.4
±S.D.	8.4	126.0	2.1	0.0	11.4	5.1
Leptodora Length	3.7	4.8	2.3	5.2	4.9	8.7
±S.D.	2.1	—	0.8	2.9	2.3	2.4
Cladocera						
#/m3	2,070.5	50,241	1,049.2	1,623.9	1,153.1	373.7
±S.D.	526.4	13,925	15.3	358.2	72.1	136.5
Cladocera Length	—	1.2	0.9	1.0	1.2	1.0
±S.D.	—	—	0.4	0.3	0.4	0.3
Copepoda						
#/m3	916.7	33,763	1,012.8	2,756.2	281.6	169.8
±S.D.	211.1	7,443.9	319.8	779.6	94.8	54.4
Nauplii						
#/m3	35,201	78,904	1,484.8	2,696.6	32.2	0.0
±S.D.	3,280.9	17,338	556.2	273.9	30.3	—
Total **Zooplankton**						
#/m3	38,342	162,999	3,551.1	7,166.1	1,509.8	556.9
±S.D.	4,026.9	38,833	893.5	1,411.6	208.6	196.0

Table C.43 **Yearly mean zooplankton lengths (mm) and densities in July at Seven Bays (Index Station 6).**

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m^3	5,242.4	2,230.1	455.8	2,771.1	2,957.0	264.2
±S.D.	13.3	354.8	54.6	210.7	2,771.0	26.6
Leptodora						
#/m^3	100.1	90.0	12.6	0.0	0.0	4.0
±S.D.	0.4	126.0	0.0	—	—	3.8
Leptodora Length	6.4	2.6	4.0	—	—	11.0
±S.D.	2.6	—	2.0	—	—	1.4
Cladocera						
#/m^3	5,673.5	11,041	1,020.1	2,771.1	2,988.1	268.2
±S.D.	33.0	4,105.7	221.3	210.7	2,811.3	30.3
Cladocera Length	—	1.4	1.1	1.0	1.1	0.6
±S.D.	—	—	0.5	0.3	0.4	0.2
Copepoda						
#/m^3	1,206.7	55,911	1,194.8	1,847.4	174.5	51.6
±S.D.	19.3	6,625.9	40.1	252.8	174.6	6.6
Nauplii						
#/m^3	77,240	63,907	2,053.1	4,395.0	62.3	0.0
±S.D.	2,824.2	30,654	527.2	1,411.6	80.5	—
Total Zooplankton						
#/m^3	84,220	130,949	4,280.7	9,013.4	3,224.9	323.8
±S.D.	2,876.9	41,513	788.6	1,875.2	3,066.4	40.8

Table C.44 Yearly mean zooplankton lengths (mm) and densities in August at Seven Bays (Index Station 6).

SPECIES	1988	1989	1990	1991	1992	1993	1994
Daphnia							
$\#/m^3$	1,809.1	2,012.1	37,374	4,988.7	3,545.8	8,194.0	4,921.2
±S.D.	285.8	843.3	8,747.9	1,956.3	716.4	1,390.6	614.5
Leptodora							
$\#/m^3$	1.5	9.5	252.0	21.5	0.0	74.5	26.6
±S.D.	0.0	0.0	63.0	11.4	—	21.1	34.7
						5.7	
Leptodora Length	4.6	5.5	3.3	4.3	—	0.7	2.0
±S.D.	2.0	2.1	—	2.5	—		1.0
Cladocera							
$\#/m^3$	1,949.7	2,144.3	35,112	5,726.0	3,545.8	8,268.5	4,948.1
±S.D.	282.0	894.0	8,120.0	1,913.9	716.4	1,369.5	647.3
Cladocera Length	—	—	1.2	1.5	1.4	1.5	1.5
±S.D.	—	—	—	0.6	0.4	0.5	0.5
Copepoda							
$\#/m^3$	974.7	739.9	49,817	528.3	5,691.1	387.4	456.4
±S.D.	554.7	440.0	5,787.4	94.8	1,053.5	84.7	292.6
Nauplii							
$\#/m^3$	144.2	66,973	107,139	880.9	5,125.0	864.1	72.6
±S.D.	52.1	1,922.9	9,262.4	66.4	1,095.6	210.7	102.3
Total **Zooplankton**							
$\#/m^3$	3,070.3	69,866	192,320	7,156.7	14,362	9,594.5	5,503.7
±S.D.	888.9	3,257.0	23,233	2,086.5	2,865.4	1,686.0	1,042.3

Table **C.45** Yearly mean zooplankton lengths (mm) and densities in September at Seven Bays (Index Station 6).

SPECIES	1988	1989	1990	1991	1992
Daphnia					
#/m^3	1,787.4	846.0	2,938.3	2,016.6	879.0
±S.D.	293.8	—	176.1	13.5	189.6
Leptodora					
#/m^3	1.1	0.4	8.0	8.1	0.0
±S.D.	0.4	—	0.0	11.4	—
Leptodora Length	—	2.6	7.1	4.9	—
±S.D.	—	1.2	—	2.1	—
Cladocera					
#/m^3	1,940.9	950.2	3,392.0	2,114.1	1,206.8
±S.D.	323.0	—	104.4	2.1	231.8
Cladocera Length	—	—	1.6	1.3	1.1
±S.D.	—	—	—	0.4	0.4
Copepoda					
#/m^3	1,197.1	1,053.1	4,229.1	2,726.4	5,408.1
±S.D.	71.5	—	8.2	21.1	779.6
Nauplii					
#/m^3	332.5	25,738.7	176,085	10,801.2	7,598.1
±S.D.	356.5	—	20,366.6	1,158.8	758.5
Total Zooplankton					
#/m^3	3,471.5	27,742.4	183,714	15,649.7	14,212.9
±S.D.	751.3	—	20,479.3	1,193.4	1,769.8

Table C.46 Yearly mean zooplankton lengths (mm) and densities in October at Seven Bays (Index Station 6).

SPECIES		1988	1989	1990	1991	1992	1993	1994
Daphnia								
	#/m³	3,813.7	1,705.0	1,668.8	1,177.0	2,368.8	1,182.6	1,351.6
	±S.D.	992.6	199.9	148.0	484.6	21.1	—	612.2
Leptodora								
	#/m³	0.0	0.0	1.5	24.1	0.0	0.0	0.0
	±S.D.	—	—	—	3.8	—	—	—
Leptodora	Length	—	—	—	7.2	—	—	—
	±S.D.	—	—	—	2.1	—	—	—
Cladocera								
	#/m³	4,010.2	1,863.0	2,146.3	1,305.4	2,443.3	1,185.3	1,453.5
	±S.D.	1,042.5	186.9	86.7	509.5	42.1	—	678.5
Cladocera	**Length**	—	—	1.5	1.3	1.2	1.5	1.2
	±S.D.	—	—	—	0.4	0.3	0.5	0.4
Copepoda								
	#/m³	2,002.7	1,217.5	1,644.1	3,293.9	5,914.6	337.9	303.0
	±S.D.	578.1	19.6	175.2	1,325.5	147.5	—	77.9
Nauplii								
	#/m³	34,776	23,179	28,146	7,061.8	7,717.3	0.0	0.0
	±S.D.	2,676.0	4,751.1	312.5	4,194.7	505.7	—	—
Total Zooplankton								
	#/m³	40,789	26,259	31,938	11,685	16,075	1,523.2	1,756.5
	±S.D.	4,296.6	4,957.6	574.4	6,033.4	695.3	—	756.4

Table C.47 Yearly mean zooplankton lengths (mm) and densities in November at Seven Bays (Index Station 6).

SPECIES	1988	1989	1990	1991	1992
Daphnia					
#/m^3	57,662.3	2,698.0	7,095.7	4,946.2	774.7
±S.D.	23,641.3	1,499.1	141.9	421.4	168.6
Leptodora					
#/m^3	0.0	0.2	0.0	1.3	0.0
±S.D.	—	0.0	—	1.9	—
Leptodora Length	—	8.3	—	15.0	—
±S.D.	—	1.4	—	—	—
Cladocera					
#/m^3	60,415.7	3,014.4	9,921.3	5,007.2	804.5
±S.D.	23,110.3	1,626.7	196.0	503.8	210.7
Cladocera Length	—	—	1.4	1.5	1.4
±S.D.	—	—	—	0.5	0.3
Copepoda					
#/m^3	13,671.0	527.0	28,313.3	1,072.7	2,204.9
±S.D.	3,987.8	270.2	2,096.2	42.1	379.3
Nauplii					
#/m^3	16,598.4	12,843.3	47,958.4	1,400.4	3,143.5
±S.D.	2,990.4	480.7	4,592.0	126.4	21.1
Total Zooplankton					
#/m^3	90,685.0	16,385.0	86,193.1	7,481.6	6,153.0
±S.D.	30,088.4	2,377.6	6,884.2	674.2	611.0

Table C.48 **Yearly mean zooplankton lengths (mm) and densities in December at Seven Bays (Index Station 6).**

SPECIES	1988	1989	1990	1991	1993
Daphnia					
#/m^3	1,472.0	2,984.8	160.0	296.3	16.1
±S.D.	—	470.5	45.4	24.7	7.6
Leptodora					
#/m^3	0.0	1.9	0.0	0.0	0.0
±S.D.	—	0.0	—	—	—
Leptodora Length	—	7.1	—	—	—
±S.D.	—	1.7	—	—	—
Cladocera					
#/m^3	1,511.7	3,332.0	225.8	331.2	16.1
±S.D.	663.5	510.8	35.5	9.5	7.6
Cladocera Length	—	—	1.9	1.3	1.0
±S.D.	—	—	—	0.5	0.2
Copepoda					
#/m^3	6,850.8	327.7	302.5	160.9	12.1
±S.D.	1,779.2	138.6	8.2	26.6	5.7
Nauplii					
#/m^3	11,636.8	9,173.8	22,914.4	111.3	0.0
±S.D.	2,654.4	3,365.1	1,418.1	77.8	—
Total Zooplankton					
#/m^3	19,999.3	12,835.3	23,442.7	603.4	28.2
±S.D.	5,097.1	4,014.5	1,461.9	113.8	13.3

Table C.49 Yearly mean zooplankton lengths (mm) and densities in March at Keller (Index Station 7).

SPECIES	1994
Daphnia	
#/m3	62.4
±S.D.	50.7
Leptodora	
#/m3	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
#/m3	62.4
±S.D.	50.7
Cladocera Length	1.6
±S.D.	0.5
Copepoda	
#/m3	22.1
±S.D.	15.5
Nauplii	
#/m3	0.0
±S.D.	—
Total Zooplankton	
#/m3	84.5
±S.D.	65.3

Table **C.50** Yearly mean zooplankon lengths (mm) and densities in April at Keller (Index Station 7).

SPECIES	**1994**
Daphnia	
#/m3	225.9
±S.D.	105.3
Leptodora	
#/m3	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
#/m3	225.9
±S.D.	105.3
Cladocera Length	1.5
±S.D.	0.3
Copepoda	
#/m3	134.8
±S.D.	70.2
Nauplii	
#/m3	0.0
±S.D.	—
Total **Zooplankton**	
#/m3	360.7
±S.D.	173.9

Table **C.51** Yearly mean zooplankon lengths (mm) and densities in May at Keller (Index Station 7).

SPECIES	1989	1990	1991	1992	**1993**
Daphnia					
#/m3	8.0	31.0	5.4	298.0	32.2
±S.D.	11.3	2.8	3.8	126.4	15.2
Leptodora					
#/m3	0.0	1.2	9.4	0.0	0.0
±S.D.	—	0.0	1.9	—	—
Leptodora Length	—	2.8	1.8	—	—
±S.D.	—	—	0.7	—	—
Cladocera					
#/m3	65.5	139.5	29.7	372.5	32.2
±S.D.	3.0	8.9	5.7	105.4	15.2
Cladocera Length	—	1.4	1.6	1.1	1.2
±S.D.	—	—	0.6	0.3	0.4
Copepoda					
#/m3	406.6	215.0	1,057.8	2,353.9	261.5
±S.D.	107.4	31.6	63.2	884.9	62.6
Nauplii					
#/m3	30,377.2	6.405.6	2,033.6	3,575.6	156.9
±S.D.	1,273.9	564.9	52.7	210.7	32.2
Total **Zooplankton**					
#/m3	30,549.3	6,791.3	3,130.4	6,302.0	450.5
±S.D.	1,384.2	605.3	123.5	1,201.0	110.0

Table C.52 Yearly mean zooplankton lengths (mm) and densities in June at Keller (Index Station 7).

SPECIES	1994
Daphnia	
#/m3	805.9
±S.D.	165.0
Leptodora	
#/m3	9.4
±S.D.	13.3
Leptodora Length	7.6
±S.D.	2.1
Cladocera	
#/m3	815.2
±S.D.	178.3
Cladocera Length	1.2
±S.D.	0.6
Copepoda	
#/m3	331.2
±S.D.	157.4
Nauplii	
#/m3	0.0
±S.D.	—
Total Zooplankton	
#/m3	1,146.4
±S.D.	335.6

Table **C.53** Yearly mean zooplankton lengths (mm) and densities in July at Keller (Index Station 7).

SPECIES	1994
Daphnia	
#/m3	6,361.6
±S.D.	3,265.7
Leptodora	
#/m3	14.9
±S.D.	21.1
Leptodora Length	4.0
±S.D.	—
Cladocera	
#/m3	6,376.5
±S.D.	3,244.7
Cladocera Length	0.5
±S.D.	0.2
Copepoda	
#/m3	1,743.1
±S.D.	442.5
Nauplii	
#/m3	5,005.8
±S.D.	295.0
Total Zooplankton	
#/m3	13,125.4
±S.D.	3,392.2

Table C.54 Yearly mean zooplankton lengths (mm) and densities in August at Keller (Index Station 7).

SPECIES	1988	1989	1990	1991	1992	1994
Daphnia						
#/m3	716.6	521.8	3,518.6	4,737.6	2,383.7	1,057.9
±S.D.	156.0	78.8	210.3	505.6	42.1	134.6
Leptodora						
#/m3	0.7	0.0	40.5	119.2	0.0	5.4
±S.D.	0.1	—	5.3	126.4	—	3.8
Leptodora Length	4.5	—	6.1	8.1	—	2.0
±S.D.	2.3	—	—	2.5	—	0.7
Cladocera						
#/m3	821.4	645.3	3,787.4	4,917.8	2,398.6	1,063.3
±S.D.	220.1	114.2	224.1	549.7	21.1	130.8
Cladocera Length	—	—	1.8	1.2	1.4	1.2
±S.D.	—	—	—	0.4	0.4	0.4
Copepoda						
#/m3	1,518.9	2,592.1	1,853.8	8,775.1	11,680	151.5
±S.D.	759.9	354.0	168.2	4,403.5	210.7	43.6
Nauplii						
#/m3	26.0	24,725	181,373	13,021	9,266.7	17.4
±S.D.	36.8	100.2	9,3 18.0	9,649.7	632.1	5.7
Total Zooplankton						
#/m3	2,367.1	27,963	187,054	26,833	23,346	1,237.6
±S.D.	1,017.0	568.3	9,715.6	14,729	863.8	180.1

Table **C.55** Yearly mean zooplankton lengths (mm) and densities in October at Keller (Index Station 7).

SPECIES	1988	1989	1990	1991	1992	1994
Daphnia						
#/m³	819.9	328.4	4,632.4	954.8	476.7	388.8
±S.D.	210.3	0.0	1,145.4	293.1	168.6	16.8
Leptodora						
#/m³	8.8	0.0	0.0	0.0	0.0	0.0
±S.D.	2.7	—	—	—	—	—
Leptodora Length	—	—	—	—	—	—
±S.D.	—	—	—	—	—	—
Cladocera						
#/m³	973.8	408.1	7,858.7	999.5	476.7	413.9
±S.D.	189.9	0.0	1,381.3	314.1	168.6	13.8
Cladocera Length	—	—	1.6	1.2	1.1	1.2
±S.D.	—	—	—	0.4	0.3	0.4
Copepoda						
#/m³	456.9	597.2	37,148	3,516.0	2,547.6	103.7
±S.D.	51.9	0.0	4,478.6	800.6	189.6	34.0
Nauplii						
#/m³	16,545	17,979	40,701	3,039.2	5,035.6	0.0
±S.D.	1,053.6	0.0	873.6	379.3	1,011.3	—
Total **Zooplankton**						
#/m³	17,976	18,984	85,707	7,554.8	8,060.0	517.6
±S.D.	1,295.3	0.0	6,733.5	1,494.0	1,369.5	47.7

Table C.56 Yearly mean zooplankton lengths (mm) and densities in November at Keller (Index Station 7).

SPECIES	1993
Daphnia	
$\#/m^3$	131.4
±S.D.	60.7
Leptodora	
$\#/m^3$	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
$\#/m^3$	131.4
±S.D.	60.7
Cladocera Length	1.4
±S.D.	0.4
Copepoda	
$\#/m^3$	194.4
±S.D.	81.5
Nauplii	
#/m3	0.0
±S.D.	—
Total **Zooplankton**	
$\#/m^3$	325.8
±S.D.	20.9

Table C.57 Yearly mean zooplankton lengths (mm) and densities in May at San Poil (Index Station 8).

SPECIES	1989	1990	1991	1992	1993
Daphnia					
#/m³	15.1	187.8	238.4	1,236.6	126.0
±S.D.	2.4	85.3	63.2	189.6	72.1
Leptodora					
#/m³	4.1	1.5	1.3	74.5	16.1
±S.D.	0.4	2.7	1.9	21.1	0.0
Leptodora Length	2.4	1.7	4.8	7.5	2.6
±S.D.	0.6	—	—	2.9	0.9
Cladocera					
#/m³	36.4	478.2	262.1	1,594.1	154.2
±S.D.	4.7	98.5	96.7	189.6	70.2
Cladocera Length	—	1.2	1.1	1.1	1.3
±S.D.	—	—	0.5	0.3	0.4
Copepoda					
#/m³	129.4	149.6	1,020.5	1,564.3	1,045.9
±S.D.	12.5	10.2	642.6	863.8	68.3
Nauplii					
#/m³	16,978	9,734.6	2,137.9	5,765.6	34.9
±S.D.	2,[illegible]223	1,133.7	853.3	358.2	41.7
Total **Zooplankton**					
#/m³	17,148	10,364	3,421.8	8,998.5	1,251.0
±S.D.	2,240.9	1,245.1	1,594.5	1,432.7	180.1

Table C.58 **Yearly mean zooplankton lengths (mm) and densities in August at San Poil (Index Station 8).**

SPECIES	**1988**	**1989**	**1990**	**1991**	**1992**
Daphnia					
#/m3	1,581.9	1,182.2	3,483.6	7,374.6	1,221.7
±S.D.	97.3	441.1	910.0	400.3	632.1
Leptodora					
#/m3	2.7	0.1	27.1	104.3	0.0
±S.D.	1.3	—	5.3	21.1	—
Leptodora Length	8.2	3.2	5.9	7.9	—
±S.D.	3.5	0.1	—	2.7	—
Cladocera					
#/m3	1,759.3	1,295.7	3,715.1	8,134.4	1,221.7
±S.D.	131.1	428.0	956.9	505.7	632.1
Cladocera Length	—	—	1.7	1.2	1.2
±S.D.	—	—	—	0.4	0.3
Copepoda					
#/m3	2,842.6	1,843.4	2,261.8	5,944.4	8,134.4
±S.D.	219.1	561.6	6.1	653.2	1,643.4
Nauplii					
#/m3	940.1	26,415.7	221.657.1	20,172.2	11,575.9
±S.D.	166.6	3,573.4	25,266.0	8,385.6	1,411.6
Total **Zooplankton**					
#/m3	5,544.6	29,554.9	227,661	34,355.4	20,342.5
±S.D.	518.0	4,563.0	26,234.3	9,565.5	3,687.1

Table C.59 Yearly mean zooplankton lengths (mm) and densities in October at San Poil (Index Station 8).

SPECIES	1988	1989	1990	1991	1992	1994
Daphnia						
#/m3	1,395.7	1,194.1	8,900.0	1,162.1	3,486.2	1,085.2
±S.D.	35.3	79.6	4,946.7	674.2	1,053.5	366.9
Leptodora						
#/m3	1.5	0.2	0.0	0.0	0.0	0.0
±S.D.	0.0	0.0	—	—	—	—
Leptodora Length	6.0	8.9	—	—	—	—
±S.D.	3.0	4.4	—	—	—	—
Cladocera						
#/m3	1,699.2	1,542.6	10,537	1,221.7	3,724.6	1,171.0
±S.D.	71.7	57.5	4,750.7	632.1	1,137.7	385.2
Cladocera Length	—	—	1.6	1.3	1.3	1.2
±S.D.	—	—	—	0.5	0.4	0.4
Copepoda						
#/m3	1,180.2	2,022.0	29,755	5,780.5	10,742	406.7
±S.D.	330.8	52.9	8,752.7	2,022.7	21.1	151.6
Nauplii						
#/m3	28,134	29,220	41,496	4,484.4	5,303.8	0.0
±S.D.	3,248.9	1,446.2	6,574.4	3,307.9	1,517.0	—
Total Zooplankton						
#/m3	31,014	32,785	81,788	11,487	17,183	791.9
±S.D.	3,649.4	1,556.6	20,078	5,962.6	2,675.8	536.8

Table **C.60** Yearly mean zooplankton lengths (mm) and densities in November at San Poil (Index Station 8).

SPECIES	1993
Daphnia	
#/m3	832.7
±S.D.	506.3
Leptodora	
#/m3	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
#/m3	832.7
±S.D.	506.3
Cladocera Length	1.4
±S.D.	0.3
Copepoda	
#/m3	206.5
±S.D.	30.3
Nauplii	
#/m3	0.0
±S.D.	—
Total **Zooplankton**	
#/m3	1,039.2
±S.D.	536.6

Table C.61 Yearly mean zooplankton lengths (mm) and densities in January at Spring Canyon (Index Station 9).

SPECIES	1994
Daphnia	
#/m3	876.9
±S.D.	79.6
Leptodora	
#/m3	0.0
±S.D.	—
Leptodora Length	—
±S.D.	—
Cladocera	
#/m3	876.9
±S.D.	79.6
Cladocera Length	1.7
±S.D.	0.4
Copepoda	
#/m3	214.5
±S.D.	110.0
Nauplii	
#/m3	0.0
±S.D.	—
Total Zooplankton	
#/m3	1,091.4
±S.D.	189.6

Table C.62 Yearly mean zooplankton lengths (mm) and densities in February at Spring Canyon (Index Station 9).

SPECIES	1992	1993	1994
Daphnia			
#/m^3	21.5	5.4	83.1
±S.D.	3.8	7.6	37.9
Leptodora			
#/m^3	0.0	0.0	0.0
±S.D.	—	—	—
Leptodora Length	—	—	—
±S.D.	—	—	—
Cladocera			
#/m^3	26.8	5.4	83.1
±S.D.	0.0	7.6	37.9
Cladocera Length	1.3	0.9	1.6
±S.D.	0.3	0.3	0.4
Copepoda			
#/m^3	131.4	164.9	22.8
±S.D.	11.4	32.2	17.1
Nauplii			
#/m^3	173.0	1,318.1	0.0
±S.D.	13.3	77.8	—
Total Zooplankton			
#/m^3	331.2	1,488.3	105.9
±S.D.	24.7	117.6	55.0

Table C.63 Yearly mean zooplankton lengths (mm) and densities in March at Spring Canyon (Index Station 9).

SPECIES	1992	1993	1994
Daphnia			
#/m3	573.9	4.0	54.8
±S.D.	250.3	5.7	10.4
Leptodora			
#/m3	0.0	1.3	0.0
±S.D.	—	1.9	—
Leptodora Length	—	—	—
±S.D.	—	—	—
Cladocera			
#/m3	624.8	5.4	54.8
±S.D.	257.9	7.6	10.4
Cladocera Length	1.2	0.8	1.5
±S.D.	0.4	0.1	0.4
Copepoda			
#/m3	709.3	300.4	18.3
±S.D.	362.2	72.1	8.5
Nauplii			
#/m3	348.6	788.4	0.0
±S.D.	227.6	64.5	—
Total Zooplankton			
#/m3	1,682.8	1,095.5	73.1
±S.D.	847.6	146.0	18.9

Table **C.64** Yearly mean zooplankton lengths (mm) and densities in April at Spring Canyon (Index Station 9).

SPECIES	1992	1993	1994
Daphnia			
#/m^3	38.9	6.7	176.3
±S.D.	9.5	1.9	83.8
Leptodora			
#/m^3	0.0	0.0	0.0
±S.D.	—	—	—
Leptodora Length	—	—	—
±S.D.	—	—	—
Cladocera			
#/m^3	53.6	6.7	176.3
±S.D.	19.0	1.9	83.8
Cladocera Length	1.0	1.2	1.3
±S.D.	0.3	0.3	0.2
Copepoda			
#/m^3	606.1	42.9	114.2
±S.D.	60.7	19.0	55.3
Nauplii			
#/m^3	321.8	40.2	0.0
±S.D.	26.6	15.2	—
Total **Zooplankton**			
#/m^3	981.5	89.8	290.5
±S.D.	106.2	36.0	139.1

Table C.65 Yearly mean zooplankton lengths (mm) and densities in May at Spring Canyon (Index Station 9).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m³	12.0	30.2	44.7	268.2	13.4	591.3
±S.D.	16.9	2.8	21.1	252.8	3.8	62.6
Leptodora						
#/m³	2.5	0.4	9.4	0.0	0.0	4.0
±S.D.	0.3	0.0	1.9	—	—	5.7
Leptodora Length	1.6	2.9	1.8	—	—	9.0
±S.D.	0.6	—	0.2	—	—	2.0
Cladocera						
#/m³	105.7	132.8	54.1	327.8	13.4	595.3
±S.D.	32.6	5.9	23.0	295.0	3.8	68.3
Cladocera Length	—	1.3	1.2	0.8	1.2	0.7
±S.D.	—	—	0.3	0.3	0.2	0.2
Copepoda						
#/m³	759.2	176.6	804.5	1,430.2	162.2	174.3
±S.D.	248.6	6.1	105.4	126.4	28.4	19.0
Nauplii						
#/m³	104,760	6,806.2	1,109.9	5,512.4	63.0	0.0
±S.D.	5,619.9	653.0	158.0	379.3	17.1	—
Total **Zooplankton**						
#/m³	105,628	7,115.9	1,977.9	7,270.3	238.7	773.7
±S.D.	5,901.4	486.4	288.2	800.6	49.3	87.2

Table C.66 Yearly mean zooplankton lengths (mm) and densities in June at Spring Canyon (Index Station 9).

SPECIES	1992	1993	1994
Daphnia			
#/m^3	1,221.7	1,907.0	3,533.1
±S.D.	42.1	42.1	1,680.7
Leptodora			
#/m^3	134.1	89.4	18.9
±S.D.	21.1	42.1	3.8
Leptodora Length	7.3	9.5	8.0
±S.D.	2.3	3.7	1.7
Cladocera			
#/m^3	1,504.7	1,996.4	3,552.0
±S.D.	147.5	84.3	1,676.9
Cladocera Length	1.1	1.6	1.3
±S.D.	0.5	0.4	0.5
Copepoda			
#/m^3	2,935.0	2,562.5	962.9
±S.D.	21.1	42.1	411.5
Nauplii			
#/m^3	8,700.6	1,102.5	0.0
±S.D.	2,022.7	295.0	—
Total Zooplankton			
#/m^3	13,274.3	5,750.7	4,533.7
±S.D.	2,212.3	463.5	2,092.2

Table C.67 **Yearly mean zooplankton lengths (mm) and densities in July at Spring Canyon (Index Station 9).**

SPECIES	1991	1993	**1994**
Daphnia			
#/m^3	8,922.0	494.8	6,287.1
±S.D.	1,050.5	263.6	779.6
Leptodora			
#/m^3	103.2	0.0	417.2
±S.D.	1.9	—	189.6
Leptodora Length	9.0	—	9.5
±S.D.	2.6	—	3.3
Cladocera			
#/m^3	9,473.5	494.8	6,413.7
±S.D.	1,303.4	263.6	811.2
Cladocera Length	1.6	1.1	1.2
±S.D.	0.6	0.3	0.5
Copepoda			
#/m^3	10,034.0	305.7	1,147.2
±S.D.	221.2	257.9	505.7
Nauplii			
#/m^3	16,179.5	4.0	1,318.5
±S.D.	442.5	1.9	221.2
Total **Zooplankton**			
#/m^3	35,790.2	804.5	9,296.5
±S.D.	1,968.9	523.4	1,727.7

Table C.68 **Yearly mean zooplankton lengths (mm) and densities in August at Spring Canyon (Index Station 9).**

SPECIES	1988	1989	1990	1991	1992	1993	1994
Daphnia							
#/m^3	1,832.6	504.2	2,198.0	2,279.4	3,098.8	1,358.3	2,312.4
±S.D.	125.1	15.8	671.1	147.5	295.0	290.1	505.0
Leptodora							
#/m^3	1.2	0.0	2.7	5.4	0.0	0.0	15.4
±S.D.	0.0	—	0.0	7.6	—	—	0.7
Leptodora Length	3.9	—	6.1	7.3	—	—	7.0
±S.D.	1.5	—	—	3.9	—	—	1.0
Cladocera							
#/m^3	2,542.7	587.0	2,335.3	3,029.4	3,098.8	1,358.3	2,327.9
±S.D.	181.8	28.0	703.2	70.8	295.0	290.1	505.2
Cladocera Length	=	=	17	1.2	1.7	1.2	1.4
±S.D.							
Copepoda							
#/m^3	3,770.3	1,536.9	2,005.9	6,063.6	9,788.2	256.1	1,652.5
±S.D.	302.7	309.6	125.4	568.9	147.5	130.8	475.2
Nauplii							
#/m^3	466.9	13,344	116,440	35,383	3,575.6	13.4	0.5
±S.D.	335.4	496.8	8,809.2	6,257.6	1,180.0	7.6	0.7
Total **Zooplankton**							
#/m^3	6,781.2	15,468	120,783	44,482	16,463	1,627.8	3,996.3
±S.D.	819.8	834.3	9,637.8	6,904.8	1,622.3	428.5	981.1

Table C.69 **Yearly mean zooplankton lengths (mm) and densities in September at Spring Canyon (Index Station 9).**

SPECIES	1991	1993	1993
Daphnia			
#/m3	2,507.4	2,443.3	1,296.6
±S.D.	162.2	505.7	168.8
Leptodora			
#/m3	3.0	0.0	0.0
±S.D.	4.2	—	—
Leptodora Length	3.8	—	—
±S.D.	1.1	—	—
Cladocera			
#/m3	2,592.3	2,607.2	1,297.9
±S.D.	134.9	568.9	170.7
Cladocera Length	1.6	1.5	1.4
±S.D.	0.4	0.5	0.4
Copepoda			
#/m3	4,834.5	8,417.5	266.8
±S.D.	1,182.0	189.6	127.1
Nauplii			
#/m3	6,669.9	4,007.6	9.4
±S.D.	1,413.8	2,254.4	13.3
Total **Zooplankton**			
#/m3	14,099.6	15,032.3	1,574.2
±S.D.	2,734.8	3,012.9	311.0

Table **C.70** Yearly mean zooplankton lengths (mm) and densities in October at Spring Canyon (Index Station 9).

SPECIES	1989	1990	1991	1992	1993	1994
Daphnia						
#/m3	1,070.2	405.3	1,102.5	595.9	18.8	38.4
±S.D.	477.7	20.1	210.7	0.0	15.2	17.5
Leptodora						
#/m3	0.0	0.0	0.0	0.0	0.0	0.0
±S.D.	—	—	—	—	—	—
Leptodora Length	—	—	—	—	—	—
±S.D.	—	—	—	—	—	—
Cladocera						
#/m3	1,279.6	488.4	1,147.2	610.8	22.8	44.7
±S.D.	530.5	30.4	273.9	21.1	9.5	15.7
Cladocera Length	—	1.8	1.5	1.3	1.5	1.4
±S.D.	—	—	0.3	0.4	0.4	0.5
Copepoda						
#/m3	420.1	681.0	2,488.0	4,290.7	21.5	72.4
±S.D.	44.2	84.6	653.2	927.1	3.8	26.4
Nauplii						
#/m3	13,885	14,145	3,337.2	6,018.9	6.7	1.8
±S.D.	3,962.0	396.6	758.5	2,612.6	1.9	3.1
Total **Zooplankton**						
#/m3	15,585	15,315	6,972.4	10,920	50.9	118.9
±S.D.	4,536.7	511.6	1,685.5	3,560.7	15.2	45.2

Table C.71 Yearly mean zooplankton lengths (mm) and densities in November at Spring Canyon (Index Station 9).

SPECIES	1992	1993
Daphnia		
#/m3	189.1	41.6
±S.D.	5.7	13.3
Leptodora		
#/m3	0.0	0.0
±S.D.	—	—
Leptodora Length	—	—
±S.D.	—	—
Cladocera		
#/m3	197.1	41.6
±S.D.	1.9	13.3
Cladocera Length	1.0	1.4
±S.D.	0.3	0.4
Copepoda		
#/m3	706.6	29.5
±S.D.	153.6	11.4
Nauplii		
#/m3	261.5	0.0
±S.D.	32.2	—
Total Zooplankton		
#/m3	1,165.2	71.1
±S.D.	187.7	24.7

Table C.72 Yearly mean zooplankton lengths (mm) and densities in December at Spring Canyon (Index Station 9).

SPECIES	1991	1993	1994
Daphnia			
#/m^3	292.3	201.1	447.0
±S.D.	26.6	30.3	149.0
Leptodora			
#/m^3	0.0	0.0	39.7
±S.D.	—	—	45.5
Leptodora Length	—	—	—
±S.D.	—	—	—
Cladocera			
#/m^3	386.2	201.1	486.7
±S.D.	7.6	30.3	104.6
Cladocera Length	1.3	1.4	—
±S.D.	0.4	0.4	—
Copepoda			
#/m^3	961.4	41.6	7,727.2
±S.D.	55.0	13.3	997.3
Nauplii			
#/m^3	942.6	0.0	0.0
±S.D.	36.0	—	—
Total Zooplankton			
#/m^3	2,290.2	242.7	8,253.6
±S.D.	98.6	43.6	1,147.5

Table C.73 Yearly mean zooplankton biomass in May at Kettle Falls (Index Station 1).

ORGANISM GROUP	1989	1990	1991	1992	1993
Daphnia mg/m^3	0.0	0.0	0.0	18.1	13.4
Leptodora kindtii me/m3	0.0	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	0.0	0.0	0.0	18.1	13.4

Table C.74 Yearly mean zooplankton biomass in August at Kettle Falls (Index Station 1).

ORGANISM GROUP	1989	1990	1991	1992
Daphnia mg/m^3	93.4	0.5	0.9	28.3
Leptodora kindti mg/m^3	91.3	0.0	0.0	0.3
Total Cladocera mg/m^3	184.7	0.5	0.9	28.6

Table C.75 **Yearly mean zooplankton biomass in October at Kettle Falls (Index Station 1).**

ORGANISM GROUP	1988	1989	1990	1991	1992	1994
Daphnia **mg/m^3**	0.1	5.0	105.5	3.5	10.2	0.3
Leptodora kindti **mg/m^3**	0.0	0.0	0.0	0.0	0.0	0.0
Total Cladocera **mg/m^3**	0.1	5.1	105.5	3.5	10.2	0.3

Table C.76 **Yearly mean zooplankton biomass in November at Kettle Falls (Index Station 1).**

ORGANISM GROUP	1993
Daphnia **mg/m^3**	0.2
Leptodora kindti **mg/m^3**	0.0
Total Cladocera **mg/m^3**	0.2

Table C.77 Yearly mean zooplankton biomass in January at Gifford (Index Station 2).

ORGANISM GROUP	1994
Daphnia mg/m^3	0.1
Leptodora kindti mg/m^3	0.0
Total Cladocera mg/m^3	0.1

Table C.78 Yearly mean zooplankton biomass in February at Gifford (Index Station 2).

ORGANISM GROUP	1992	1993	1994
Daphnia mg/m^3	0.1	0.0	0.1
Leptodora kindti mg/m^3	0.0	0.0	0.0
Total Cladocera mg/m^3	0.1	0.0	0.1

Table C.79 **Yearly mean zooplankton biomass in March at Gifford (Index Station 2).**

ORGANISM GROUP	1992	1993	1994
Daphnia			
mg/m^3	0.0	0.0	0.3
Leptodora kindti			
mg/m^3	0.0	0.0	0.0
Total Cladocera			
mg/m^3	0.0	0.0	0.3

Table **C.80** **Yearly mean zooplankton biomass in April at Gifford (Index Station 2).**

ORGANISM GROUP	1992	1993
Daphnia		
mg/m^3	0.2	0.0
Leptodora kindti		
mg/m^3	0.0	0.0
Total Cladocera		
mg/m^3	0.2	0.0

Table C.81 **Yearly mean zooplankton biomass in May at Gifford (Index Station 2).**

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	0.1	0.0	0.0	0.3	0.1	0.0
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	0.1	0.0	0.0	0.3	0.1	0.0

Table **C.82** **Yearly mean zooplankton biomass in June at Gifford (Index Station 2).**

ORGANISM GROUP	1992	1993	1994
Daphnia mg/m^3	0.8	0.3	0.1
Leptodora kindti mg/m^3	0.0	0.4	0.0
Total Cladocera mg/m^3	0.8	0.6	0.1

Table C.83 Yearly mean zooplankton biomass in July at Gifford (Index Station 2).

ORGANISM GROUP	1991	1992	1993	1994
Daphnia mg/m^3	0.7	2.6	1.1	1.2
Leptodora kindti mg/m^3	0.3	0.0	0.0	0.0
Total Cladocera mg/m^3	1.0	2.6	1.1	1.2

Table C.84 Yearly mean zooplankton biomass in August at Gifford (Index Station 2).

ORGANISM GROUP	1988	1989	1990	1991	1992	1993
Daphnia mg/m^3	77.0	169.6	0.1	6.1	34.6	1.6
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.5	1.7	0.0
Total Cladocera mg/m^3	77.0	169.[illegible]	0.1	6.6	36.3	1.6

Table C.85 Yearly mean zooplankton biomass in September at Gifford (Index Station 2).

ORGANISM GROUP	1991	1992	1993
Daphnia mg/m^3	8.6	9.2	56.4
Leptodora kindti mg/m^3	0.0	0.0	1.0
Total Cladocera mg/m^3	8.6	9.2	57.3

Table C.86 Yearly mean zooplankton biomass in October at Gifford (Index Station 2).

ORGANISM GROUP	1988	1989	1990	1992	1993	1994
Daphnia mg/m^3	10.4	29.6	42.8	5.6	10.2	25.8
Leptodora kindti mg/m^3	0.0	0.1	0.2	0.0	0.0	0.0
Total Cladocera mg/m^3	10.4	29.7	43.0	5.6	10.2	25.8

Table C.87 Yearly mean zooplankton biomass in November at Gifford (Index Station 2).

ORGANISM GROUP	1991
Daphnia mg/m^3	0.4
Leptodora kindti mg/m^3	0.0
Total Cladocera mg/m^3	0.4

Table **C.88** Yearly mean zooplankton biomass in December at Gifford (Index Station 2).

ORGANISM GROUP	1991
Daphnia mg/m^3	0.4
Leptodora kindti mg/m^3	0.0
Total Cladocera mg/m^3	0.4

Table C.89 **Yearly mean zooplankton biomass in May at Keller (Index Station 3).**

ORGANISM GROUP	1989	1990	1991	1992	1993
Daphnia **mg/m^3**	0.0	0.0	0.0	1.6	2.4
Leptodora kindti **mg/m^3**	0.0	0.0	0.0	0.3	0.0
Total Cladocera **mg/m^3**	0.0	0.0	0.0	1.9	2.4

Table **C.90** **Yearly mean zooplankton biomass in August at Keller (Index Station 3).**

ORGANISM GROUP	1988	1989	1990	1991	1992
Daphnia **mg/m^3**	194.9	98.5	2.9	9.5	62.4
Leptodora kindti **mg/m^3**	0.3	1.3	0.7	0.5	1.1
Total Cladocera **mg/m^3**	195.2	99.8	3.6	10.0	63.5

Table C.91 Yearly mean zooplankton biomass in October at Keller (Index Station 3).

ORGANISM GROUP	1988	1989	1990	1992
Daphnia mg/m^3	378.3	118.9	180.5	182.5
Leptodora kindti mg/m^3	1.8	0.2	4.4	0.5
Total Cladocera mg/m^3	380.1	119.1	184.9	183.0

Table C.92 Yearly mean zooplankton biomass in November at Keller (Index Station 3).

ORGANISM GROUP	1993	1994
Daphnia mg/m^3	2.6	191.2
Leptodora kindti mg/m^3	0.0	0.0
Total Cladocera mg/m^3	2.6	191.0

Table C.93 Yearly mean zooplankton biomass in January at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1989	1990	1992	1994
Daphnia mg/m^3	45.3	33.5	20.7	169.9
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0
Total **Cladocera** mg/m^3	45.3	33.5	20.7	169.9

Table **C.94** Yearly mean zooplankton biomass in February at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1989	1990	1992	1993	1994
Daphnia mg/m^3	0.0	0.1	4.3	1.2	0.6
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	0.0	0.1	4.3	1.2	0.6

Table C.95 Yearly mean zooplankton biomass in March at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	0.0	0.0	0.0	0.1	0.1	0.4
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	0.0	0.0	0.0	0.1	0.1	0.4

Table C.96 Yearly mean zooplankton biomass in April at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1989	1990	1992	1993
Daphnia mg/m^3	0.0	0.0	0.3	0.0
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	0.0	0.0	0.3	0.0

Table C.97 Yearly mean zooplankton biomass in May at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia **mg/m³**	0.0	0.4	0.0	2.3	0.1	0.1
Leptodora kindti **mg/m³**	0.0	0.0	0.0	0.2	0.0	0.0
Total Cladocera **mg/m³**	0.0	0.4	0.0	2.5	0.1	0.1

Table C.98 Yearly mean zooplankton biomass in June at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1989	1991	1992	1993	1994
Daphnia **mg/m³**	71.6	2.2	30.8	0.7	32.2
Leptodora kindti **mg/m³**	3.3	0.1	0.7	0.2	1.4
Total Cladocera **mg/m³**	74.9	2.3	31.5	0.9	33.6

Table C.99 Yearly mean zooplankton biomass in July at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1989	1991	1992	1993	1994
Daphnia mg/m^3	104.1	12.4	61.7	13.5	4.6
Leptodora kindti mg/m^3	8.4	1.7	0.0	0.5	2.4
Total Cladocera mg/m^3	112.6	14.1	61.7	14.0	7.0

Table **C.100** Yearly mean zooplankton biomass in August at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1988	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	189.0	239.4	35.8	20.0	31.5	1.9	36.3
Leptodora kindti mg/m^3	1.1	0.6	1.5	0.9	0.0	0.0	0.8
Total Cladocera mg/m^3	190.1	240.0	37.3	20.9	31.5	1.9	37.1

Table **C.101** Yearly mean zooplankton biomass in September at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1988	1989	1990	1991	1992	1993
Daphnia mg/m^3	139.0	189.0	73.4	35.5	29.4	15.4
Leptodora kindti mg/m^3	0.0	0.0	0.2	4.1	0.0	0.2
Total Cladocera mg/m^3	139.0	189.0	73.6	39.6	29.4	15.6

Table **C.102** Yearly mean zooplankton biomass in October at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1988	1989	1991	1992	1993	1994
Daphnia mg/m^3	181.1	151.8	103.1	49.0	13.2	7.6
Leptodora kindti mg/m^3	0.1	0.1	3.5	0.0	0.0	0.0
Total Cladocera mg/m^3	181.2	151.9	106.6	49.0	13.2	7.6

Table **C.103** Yearly mean zooplankton biomass in November at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1988	1989	1990	1991	1992	1993
Daphnia mg/m^3	906.6	6.4	271.0	1.7	53.7	19.0
Leptodora kindti me/m3	0.0	0.0	0.1	0.0	0.0	0.0
Total Cladocera mg/m^3	906.6	6.4	271.1	1.7	53.7	19.0

Table **C.104** Yearly mean zooplankton biomass in December at Porcupine Bay (Index Station 4).

ORGANISM GROUP	1988	1989	1990	1991	1993
Daphnia mg/m^3	553.3	13.5	0.2	7.0	24.0
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	553.3	13.5	0.2	7.0	24.0

Table **C.105** Yearly mean zooplankton biomass in May at Little Falls (Index Station 5).

ORGANISM GROUP	1989	1990	1992
Daphnia **mg/m^3**	0.0	0.0	0.5
Leptodora kindti **mg/m^3**	0.0	0.0	0.0
Total Cladocera **mg/m^3**	0.0	0.0	0.5

Table **C.106** Yearly mean zooplankton biomass in August at Little Falls (Index Station 5).

ORGANISM GROUP	1988	1989	1990	1991	1992
Daphnia **mg/m^3**	35.7	19.4	3.8	23.9	0.6
Leptodora kindti **mg/m^3**	0.0	0.1	0.0	0.0	0.0
Total Cladocera **mg/m^3**	35.7	19.5	3.8	23.9	0.6

Table **C.107** Yearly mean zooplankton biomass in October at Little Falls (Index Station 5).

ORGANISM GROUP	1988	1989	1990	1991	1992
Daphnia mgim3	12.5	44.2	11.9	7.3	0.7
Leptodora kindti mg/m^3	0.0	0.1	0.0	0.0	0.0
Total Cladocera mg/m^3	12.5	44.3	11.9	7.3	0.7

Table **C.108** Yearly mean zooplankton biomass in November at Little Falls (Index Station 5).

ORGANISM GROUP	1993
Daphnia Spp. mgim3	1.1
Leptodora kindti mg/m^3	0.0
Total Cladocera mg/m^3	1.1

Table **C.109** Yearly mean zooplankton biomass in January at Seven Bays (Index Station 6).

ORGANISM GROUP	1989	1990	1992	1994
Daphnin **mg/m3**	0.1	0.5	9.0	3.3
Leptodora kindti **mg/m3**	—	0.0	0.0	0.0
Total Cladocera **mg/m3**	0.1	0.5	9.0	3.3

Table **C.110** Yearly mean zooplankton biomass in February at Seven Bays (Index Station 6).

ORGANISM GROUP	1990	1992	1994
Daphnia **mg/m3**	0.0	0.7	0.9
Leptodora kindti **mg/m3**	0.0	0.0	0.0
Total **Cladocera** **mg/m3**	0.0	0.7	0.9

Table C.111 **Yearly mean zooplankton biomass in March at Seven Bays (Index Station 6).**

ORGANISM GROUP	1990	1991	1992	1993	1994
Daphnia **mg/m3**	**0.0**	**0.0**	**0.0**	0.1	2.0
Leptodora kindti **mg/m3**	0.0	0.0	0.0	0.0	0.0
Total Cladocera **mg/m3**	0.0	0.0	0.0	0.1	2.0

Table C.112 **Yearly mean zooplankton biomass in April at Seven Bays (Index Station 6).**

ORGANISM GROUP	1989	1990	1992	1993	1994
Daphnia **mg/m3**	0.2	0.0	0.6	0.0	0.5
Leptodora kindti **mg/m3**	0.0	0.0	0.0	0.0	0.0
Total Cladocera **mg/m3**	0.2	0.0	0.6	0.0	0.5

Table C.113 Yearly mean zooplankton biomass in May at Seven Bays (Index Station 6).

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	0.2	1.1	0.1	0.4	10.1	0.6
Leptodora kindti mg/m^3	0.0	0.2	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	0.2	1.3	0.1	0.4	10.1	0.6

Table C.114 Yearly mean zooplankton biomass in June at Seven Bays (Index Station 6).

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	29.0	178.4	2.8	9.0	18.1	3.9
Leptodora kindti mg/m^3	2.3	2.6	0.0	3.2	1.3	1.6
Total Cladocera mg/m^3	31.4	181.0	2.9	12.2	19.4	5.6

Table C.115 **Yearly mean zooplankton biomass in July at Seven Bays (Index Station 6).**

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia **mg/m^3**	176.0	84.6	3.7	20.8	31.1	4.4
Leptodora kindti **mg/m^3**	6.5	0.5	0.2	0.0	0.0	0.6
Total Cladocera **mg/m^3**	182.5	85.1	3.9	20.8	31.1	5.0

Table C.116 **Yearly mean zooplankton biomass in August at Seven Bays (Index Station 6).**

ORGANISM GROUP	1988	1989	1990	1991	1992	1993	1994
Daphnia **mg/m^3**	84.2	82.7	523.0	101.2	117.0	295.0	230.3
Leptodora kindti **mg/m^3**	0.1	0.4	2.6	0.5	0.0	3.4	0.2
Total Cladocera **mg/m^3**	84.3	83.1	525.6	101.7	117.0	298.4	230.5

Table C.117 Yearly mean zooplankton biomass in September at Seven Bays (Index Station 6).

ORGANISM GROUP	1988	1989	1990	1991	1992
Daphnia mg/m^3	100.2	44.3	118.9	41.7	12.6
Leptodora kindti mg/m^3	0.0	0.0	0.7	0.3	0.0
Total Cladocera mg/m^3	100.2	44.3	119.6	42.0	12.6

Table **C.118** Yearly mean zooplankton biomass in October at Seven Bays (Index Station 6).

ORGANISM GROUP	1988	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	179.1	95.8	67.9	39.6	62.3	41.5	21.3
Leptodora kindti mg/m^3	0.0	0.0	0.1	2.1	0.0	0.0	0.0
Total Cladocera mg/m^3	179.1	95.8	68.0	41.7	62.3	41.5	21.3

Table C.119 Yearly mean zooplankton biomass in November at Seven Bays (Index Station 6).

ORGANISM GROUP	1989	1990	1991	1992
Daphnia mg/m^3	259.9	164.8	154.2	20.5
Leptodora kindti mg/m^3	0.0	28.2	0.8	0.0
Total Cladocera mg/m^3	259.9	193.0	155.0	20.5

Table **C.120** Yearly mean zooplankton biomass in December at Seven Bays (Index Station 6).

ORGANISM GROUP	1988	1989	1990	1991	1993
Daphnia mg/m^3	41.5	256.9	11.2	6.7	0.2
Leptodora kindti mg/m^3	0.0	0.2	0.0	0.0	0.0
Total Cladocera mg/m^3	41.5	257.1	11.2	6.7	0.2

Table **C.121** Yearly mean zooplankton biomass in March at Keller (Index Station 7).

ORGANISM GROUP	1994
Daphnia	
mg/m^3	2.8
Leptodora kindti	
mg/m^3	0.0
Total Cladocera	
mg/m^3	2.8

Table C.122 Yearly mean zooplankton biomass in April at Keller (Index Station 7).

ORGANISM GROUP	1994
Daphnia	
mg/m^3	7.9
Leptodora kindti	
mg/m^3	0.0
Total **Cladocera**	
mg/m^3	7.9

Table C.123 **Yearly mean zooplankton biomass in May at Keller (Index Station 7).**

ORGANISM GROUP	1989	1990	1991	1992	1993
Daphnia mg/m^3	0.2	0.6	0.3	4.3	0.5
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	0.2	0.6	0.3	4.3	0.5

Table C.124 **Yearly mean zooplankton biomass in June at Keller (Index Station 7).**

ORGANISM GROUP	1994
Daphnia mg/m^3	14.0
Leptodora kindti mg/m^3	0.9
Total Cladocera mg/m^3	14.9

Table C.125 **Yearly mean zooplankton biomass in July at Keller (Index Station 7).**

ORGANISM GROUP	1994
Daphnia	
mg/m^3	8.3
Leptodora kindti	
mg/m^3	0.3
Total Cladocera	
mg/m^3	8.6

Table C.126 **Yearly mean zooplankton biomass in August at Keller (Index Station 7).**

ORGANISM GROUP	1988	1989	1990	1991	1992	1994
Daphnia						
mg/m^3	47.0	37.1	184.5	58.6	74.0	21.5
Leptodora kindti						
mg/m^3	0.0	0.0	2.3	13.8	0.0	0.0
Total Cladocera						
mg/m^3	47.0	37.1	184.5	72.4	74.0	21.5

Table **C.127** Yearly mean zooplankton biomass in October at Keller (Index Station 7).

ORGANISM GROUP	1988	1989	1990	1991	1992	1994
Daphnia **mg/m3**	35.1	17.4	214.6	20.9	6.6	6.4
Leptodora kindti **mg/m3**	0.0	0.0	0.0	0.0	0.0	0.0
Total Cladocera **mg/m3**	35.1	17.4	214.6	20.9	6.6	6.4

Table **C.128** Yearly mean zooplankton biomass in November at Keller (Index Station 7).

ORGANISM GROUP	1993
Daphnia **mg/m3**	4.3
Leptodora kindti **mg/m3**	0.0
Total Cladocera **mg/m3**	4.3

Table C.129 Yearly mean zooplankton biomass in May at San Poil (Index Station 8).

ORGANISM GROUP	1989	1990	1991	1992	1993
Daphnia mg/m^3	0.1	5.3	3.2	15.3	2.6
Leptodora kindti mg/m^3	0.0	0.0	0.0	7.1	0.1
Total Cladocera mg/m^3	0.1	5.3	3.2	22.4	2.7

Table **C.130** Yearly mean zooplankton biomass in August at San Poil (Index Station 8).

ORGANISM GROUP	1988	1989	1990	1991	1992
Daphnia mg/m^3	132.7	111.2	184.4	70.6	21.5
Leptodora kindti mg/m^3	0.3	0.0	1.4	11.3	0.0
Total Cladocera mg/m^3	133.0	111.2	185.8	81.9	21.5

Table C.131 Yearly mean zooplankton biomass in October at San Poil (Index Station 8).

ORGANISM GROUP	1988	1989	1990	1991	1992	1994
Daphnia **mg/m3**	65.5	114.7	396.1	24.7	84.5	19.4
Leptodora kindti **mg/m3**	0.1	0.0	0.0	0.0	0.0	0.0
Total Cladocera **mg/m3**	65.6	114.7	396.1	24.7	84.5	19.4

Table C.132 Yearly mean zooplankton biomass in November at San Poil (Index Station 8).

ORGANISM GROUP	1993
Daphnia **mg/m3**	25.5
Leptodora kindti **mg/m3**	0.0
Total Cladocera **mg/m3**	25.5

Table C.133 Yearly mean zooplankton biomass in January at Spring Canyon (Index Station 9).

ORGANISM GROUP	1994
Daphnia mg/m³	47.0
Leptodora kindti mg/m³	0 . 0
Total **Cladocera** mg/m³	47.0

Table C.134 Yearly mean zooplankton biomass in February at Spring Canyon (Index Station 9).

ORGANISM GROUP	1992	1993	1994
Daphnia mg/m³	0.5	0.0	3.8
Leptodora kindti mg/m³	0.0	0.0	0.0
Total Cladocera mg/m³	0.5	0.0	3.8

Table C.135 Yearly mean zooplankton biomass in March at Spring Canyon (Index Station 9).

ORGANISM GROUP	1992	1993	1994
Daphnia mg/m^3	9.9	0.0	3.8
Leptodora kindti mg/m^3	0.0	0.0	0.0
Total Cladocera mg/m^3	9.9	0.0	3.8

Table C.136 Yearly mean zooplankton biomass in April at Spring Canyon (Index Station 9).

ORGANISM GROUP	1992	1993	1994
Daphnia mg/m^3	0.4	0.1	5.4
Leptodora kindti mg/m^3	0.0	0.0	0.0
Total Cladocera mg/m^3	0.4	0.1	5.4

Table **C.137** Yearly mean zooplankton biomass in May at Spring Canyon (Index Station 9).

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	0.4	0.7	0.8	1.5	0.3	1.2
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0	0.0	0.6
Total Cladocera mg/m^3	0.4	0.7	0.8	1.5	0.3	1.8

Table C.138 Yearly mean zooplankton biomass in June at Spring Canyon (Index Station 9).

ORGANISM GROUP	1992	1993	1994
Daphnia mg/m^3	18.2	84.0	55.3
Leptodora kindti mg/m^3	12.0	16.0	2.6
Total Cladocera mg/m^3	30.2	100.0	57.9

Table C.139 Yearly mean zooplankton biomass in July at Spring Canyon (Index Station 9).

ORGANISM GROUP	1991	1993	1994
Daphnia mg/m^3	190.1	6.7	132.7
Leptodora kindti mg/m^3	15.8	0.0	22.5
Total Cladocera mg/m^3	205.9	6.7	155.2

Table **C.140** Yearly mean zooplankton biomass in August at Spring Canyon (Index Station 9).

ORGANISM GROUP	1988	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	137.0	35.4	103.6	23.0	135.3	26.1	175.0
Leptodora kindti mg/m^3	0.0	0.0	0.2	0.5	0.0	0.0	2.4
Total Cladocera mg/m^3	137.0	35.4	103.8	23.5	135.3	26.1	177.4

Table **C.141** Yearly mean zooplankton biomass in September at Spring Canyon (Index Station 9).

ORGANISM GROUP	1991	1992	1993
Daphnia mg/m^3	63.2	86.6	36.1
Leptodora kindti mg/m^3	0.0	0.0	0.0
Total Cladocera mg/m^3	63.3	86.6	36.1

Table C.142 Yearly mean zooplankton biomass in October at Spring Canyon (Index Station 9).

ORGANISM GROUP	1989	1990	1991	1992	1993	1994
Daphnia mg/m^3	64.6	23.0	35.8	12.2	0.4	1.0
Leptodora kindti mg/m^3	0.0	0.0	0.0	0.0	0.0	0.0
Total Cladocera mg/m^3	64.6	23.0	35.8	12.2	0.4	1.0

Table C.143 Yearly mean zooplankton biomass in November at Spring Canyon (Index Station 9).

ORGANISM GROUP	1992	1993
Da phnia mg/m³	2.0	1.1
Leptodora kindti mg/m³	0.0	0.0
Total Cladocera mg/m³	2.0	1.1

Table C.144 Yearly mean zooplankton biomass in December at Spring Canyon (Index Station 9).

ORGANISM GROUP	1991	1993
Daphnia mg/m³	6.6	5.3
Leptodora kindti mg/m³	0.0	0.0
Total Cladocera mg/m³	6.6	5.3

APPENDIX D
WATER QUALITY

Table D.1 Water quality measurements taken with a Hydrolab Surveyor II at Gifford and Porcupine Bay in January 1994.

GIFFORD

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.38	7.88	14.10	0.140	0.324
3	3.36	7.88	14.17	0.140	0.323
6	3.41	7.88	14.10	0.139	0.323
9	3.48	7.88	13.91	0.139	0.323
12	3.48	7.88	13.73	0.138	0.322
15	3.48	7.88	13.80	0.140	0.322
18	3.48	7.88	13.82	0.142	0.322
21	3.48	7.88	13.75	0.142	0.322
24	3.48	7.88	13.61	0.138	0.322

PORCUPINE BAY

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	4.13	7.82	12.31	0.168	0.306
3	4.14	7.84	12.08	0.170	0.305
6	4.09	7.85	12.03	0.173	0.305
9	4.04	7.86	11.91	0.172	0.304
12	4.00	7.86	11.88	0.161	0.305
15	3.91	7.86	11.94	0.176	0.305
18	3.89	7.86	12.01	0.164	0.305
21	3.86	7.86	11.98	0.164	0.305
24	3.81	7.87	11.95	0.190	0.305
27	3.76	7.87	11.95	0.175	0.305
30	3.78	7.86	11.94	0.142	0.305

Table D.2 Water quality measurements taken with a Hydrolab Surveyor II at **Gifford,** Porcupine Bay, Seven Bays, and Spring Canyon in February 1994.

GIFFORD

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.46	8.04	13.36	0.139	0.212
3					
6	3.46	8.03	13.37	0.140	0.312
9	3.46	8.03	13.35	0.141	0.313
12	3.46	8.03	13.35	0.141	0.313
15	3.46	8.02	13.31	0.138	0.313
18	3.46	8.02	13.27	0.139	0.314
21	3.46	8.01	13.25	0.137	0.313

PORCUPINE BAY

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.33	7.93	13.40	0.150	0.330
3	3.31	7.95	13.31	0.149	0.330
6	3.31	7.95	13.25	0.153	0.330
9	3.31	7.96	13.20	0.156	0.331
12	3.29	7.97	13.13	0.141	0.331
15	3.31	7.97	13.09	0.153	0.332
18	3.31	7.97	12.97	0.156	0.332
21	3.33	7.97	13.93	0.127	0.333
24	3.31	7.97	12.89	0.149	0.334
27	3.33	7.97	12.76	0.147	0.334
30	3.36	7.97	12.76	0.162	0.335
33	3.38	7.96	12.68	0.177	0.334

Table D.2 Continued;

SEVEN BAYS

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.11	8.09	13.39	0.136	0.315
3	3.12	8.10	13.38	0.136	0.315
6	3.13	8.09	13.36	0.136	0.315
9	3.13	8.11	13.34	0.137	0.314
12	3.13	8.11	13.33	0.136	0.315
15	3.13	8.10	13.28	0.137	0.316
18	3.14	8.10	13.31	0.139	0.315
21	3.17	8.09	13.27	0.138	0.316
24	3.14	8.10	13.24	0.135	0.316
27	3.16	8.09	13.21	0.139	0.316
30	3.18	8.09	13.23	0.137	0.316
33	3.18	8.09	13.18	0.139	0.317

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.19	7.91	18.67	0.145	0.309
3	3.17	7.93	14.97	0.145	0.309
6	3.16	7.95	14.31	0.147	0.309
9	3.17	7.99	14.10	0.145	0.309
12	3.17	8.00	13.88	0.145	0.309
15	3.21	8.01	13.84	0.144	0.310
18	3.21	8.02	13.83	0.147	0.310
21	3.24	8.02	13.79	0.144	0.311
24	3.24	8.02	13.71	0.141	0.312
27	3.24	8.03	13.67	0.144	0.312
30	3.24	8.03	13.63	0.145	0.312
33	3.26	8.05	13.59	0.147	0.312

Table D.3 Water quality measurements taken with a Hydrolab Surveyor II at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon in March 1994.

GIFFORD

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.34	7.81	17.01	0.133	0.342
3	3.27	7.92	13.65	0.133	0.341
6	3.26	7.97	13.61	0.133	0.341
9	3.19	8.04	13.21	0.134	0.342
12	3.21	8.05	13.27	0.136	0.342
15	3.17	8.05	13.30	0.134	0.343
18	3.17	8.05	13.28	0.136	0.344
21	3.19	8.06	13.22	0.136	0.344
24	3.16	8.06	13.19	0.136	0.344
27	3.19	8.06	12.96	0.134	0.343
30	3.17	8.06	13.07	0.134	0.346
33	3.19	8.06	13.05	0.134	0.346

PORCUPINE BAY

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.71	8.28	15.15	0.142	0.322
3					
6	3.68	8.26	13.87	0.144	0.324
9	3.68	8.24	13.73	0.143	0.325
12	3.69	8.23	13.65	0.143	0.325
15	3.68	8.22	13.56	0.145	0.325
18	3.68	8.21	13.48	0.143	0.326
21	3.68	8.20	13.46	0.145	0.327
24	3.69	8.17	13.26	0.144	0.328
27	3.78	8.13	12.94	0.146	0.329

Table D.3 Continued;

SEVEN BAYS

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.17	7.79	14.53	0.132	0.329
3	3.17	7.83	14.24	0.132	0.328
6	3.16	7.91	13.79	0.133	0.328
9	3.16	7.97	13.60	0.133	0.328
12	3.16	8.00	13.52	0.132	0.328
15	3.16	8.01	13.52	0.131	0.328
18	3.16	8.01	13.50	0.134	0.328
21	3.16	8.02	13.44	0.136	0.329
24	3.14	8.02	13.42	0.132	0.329
27	3.14	8.03	13.38	0.135	0.329
30	3.14	8.02	13.34	0.134	0.330
33	3.14	8.03	13.28	0.136	0.329

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.33	7.67	20.25	0.146	0.354
3	3.31	7.78	15.16	0.144	0.352
6	3.31	7.87	14.28	0.146	0.352
9	3.31	7.90	14.08	0.145	0.352
12	3.31	7.93	13.94	0.144	0.352
15	3.29	7.96	13.86	0.144	0.353
18	3.29	7.98	13.80	0.147	0.353
21	3.29	8.00	13.75	0.147	0.354
24	3.29	8.01	13.72	0.143	0.354
27	3.31	8.01	13.68	0.142	0.354
30	3.29	8.02	13.67	0.146	0.354
33	3.29	8.02	13.62	0.144	0.354

Table D.4 Water quality measurements taken with a Hydrolab Surveyor II at **Gifford,** Porcupine Bay, Seven Bays, and Spring Canyon in **May 1994.**

GIFFORD

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	11.16	8.75	16.63	0.124	0.273
3	10.75	8.71	15.51	0.125	0.276
6				0.124	0.277
9	19.74	8.57	15.07	0.124	0.281
12	9.59	8.51	14.83	0.125	0.283
15	9.54	8.48	14.68	0.125	0.284
18	9.40	8.43	14.55	0.123	0.285
21	9.40	8.41	14.38	0.124	0.286
24	9.35	[illegible]	14.22	0.127	0.286
27	9.31	8.40	14.12	0.123	0.287
30	9.28	8.39	14.16	0.136	0.288
33	9.30	8.38	14.01	0.121	0.289

PORCUPINE **BAY**

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	15.81	9.07	13.69	0.089	0.258
3					
6	11.69	8.84	14.65	0.078	0.270
9	11.20	8.61	13.80	0.080	0.276
12	11.02	8.53	13.73	0.081	0.280
15	10.64	8.41	13.57	0.084	0.284
18	10.38	8.34	13.47	0.089	0.287
21					
24	9.[illegible]	8.18	13.56	0.119	0.2[illegible]
27	7.72	8.10	11.78	0.122	0.300

Table D.4 Continued;

SEVEN BAYS

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	12.56	9.16	16.43	0.119	0.253
3	10.92	8.89	14.63	0.118	0.263
6	10.08	8.71	14.07	0.123	0.270
9	9.89	8.68	14.12	0.124	0.272
12	9.66	8.63	14.00	0.124	0.274
15	9.45	8.55	13.8	0	0.125
0.280					
21	8.93	8.42	13.57	0.123	0.282
24	8.83	8.39	13.46	0.126	0.284
27	8.61	8.37	13.44	0.127	0.286
30	8.44	8.35	13.37	0.133	0.287
33	8.30	8.34	13.32	0.131	0.288

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	10.87	9.29	19.08	0.143.	0.163
3		9.28	15.97	0.144	0.164
6	10.54	9.24	15.23	0.142	0.166
9	9.79	9.13	14.93	0.145	0.170
12	9.64	9.08	14.68	0.146	0.172
15	9.24	9.00	14.48	0.144	0.175
18	9.02	8.95	14.39	0.141	0.175
21	8.84	8.92	14.29	0.145	0.179
24	8.32	8.86	14.30	0.144	0.181
27	7.85	8.79	14.23	0.148	0.183
30	7.73	8.69	14.11	0.145	0.187

Table D.5 Water quality measurements taken with a Hydrolab Surveyor II at Gifford, Porcupine Bay, Seven Bays, Keller Ferry and Spring Canyon in June 1994.

GIFFORD

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	13.00	8.40	15.70	0.122	0.211
3	12.97	8.39	12.84	0.122	0.212
6	12.93	8.39	12.49	0.122	0.212
9	12.90	8.38	12.19	0.121	0.213
12	12.82	8.38	11.98	0.123	0.215
15	12.87	8.37	11.80	0.121	0.216
18	12.85	8.36	11.66	0.123	0.217
21	12.85	8.36	13.20	0.121	0.220
24	12.85	8.36	11.95	0.120	0.222
27	12.83	8.35	11.64	0.117	0.222
30	12.82	8.35	11.45	0.123	0.224
33	12.82	8.35	11.37	0.123	0.225

PORCUPINE BAY

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	17.73	8.43	11.72	0.110	0.294
3	17.71	8.44	10.82	0.110	0.295
6	17.63	8.43	10.50	0.108	0.296
9	16.28	8.40	10.46	0.111	0.301
12	15.36	8.31	10.17	0.109	0.306
15	13.99	8.23	9.95	0.100	0.309
18	12.75	8.15	10.07	0.094	0.314
21	11.75	8.09	10.21	0.093	0.318
24	10.49	8.02	10.10	0.099	0.320
27	10.17	7.95	9.84	0.098	0.326
30	9.09	7.90	9.81	0.116	0.331
33	8.30	7.86	9.00	0.123	0.334

Table D.5 Continued;

SEVEN BAYS

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	15.23	8.34	16.72	0.119	0.309
3	14.95	8.38	12.40	0.121	0.312
6	19.75	8.41	11.46	0.122	0.317
9	14.71	8.41	11.21	0.122	0.318
12	14.37	8.40	11.16	0.122	0.320
15	14.09	8.38	11.08	0.125	0.322
18	13.95	8.32	11.06	0.123	0.324
21	13.74	8.37	11.01	0.123	0.326
24	13.62	8.35	10.96	0.127	0.328
27	13.31	8.34	10.90	0.122	0.330
30	12.83	8.30	10.87	0.124	0.334
33	12.72	8.22	10.78	0.124	0.335

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	14.90	8.39	11.74	0.124	0.261
3	14.71	8.40	11.41	0.124	0.262
6	14.30	8.38	11.25	0.124	0.264
9	14.04	8.36	11.13	0.125	0.265
12	13.86	8.34	11.04	0.125	0.267
15	13.84	8.33	10.99	0.123	0.268
18	13.54	8.31	10.96	0.125	0.269
21	13.18	8.30	10.93	0.124	0.270
24	13.00	8.28	10.84	0.122	0.272
27	12.93	8.22	10.77	0.123	0.273
30	12.85	8.26	10.70	0.121	0.275
33	12.69	8.25	10.64	0.124	0.277

Table D.6 Water quality measurements taken with a Hydrolab Surveyor II at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon in July **1994.**

GIFFORD

Depth (m)	**Temp. (°C)**	**pH**	D.O. **(mg/L)**	Conduct. **mmho/cm**	**ORP (V)**
0	21.85	8.66	11.25	0.128	0.294
3	19.75	8.75	11.66	0.127	0.293
6	19.12	8.65	11.37	0.126	0.296
9	18.61	8.42	10.86	0.127	0.301
12	18.35	8.26	10.34	0.127	0.305
15	18.13	8.17	10.07	0.126	0.308
18	18.01	8.13	9.91	0.128	0.310
21	17.98	8.12	9.85	0.126	0.311
24	17.96	8.11	9.80	0.129	0.312
27	17.96	8.08	9.79	0.128	0.313
30	17.72	8.04	9.69	0.128	0.314
33	17.47	8.01	9.63	0.126	0.315

PORCUPINE BAY

Depth **(m)**	Temp. (°C)	**pH**	**D.O. (mg/L)**	Conduct. **mmho/cm**	ORP **(V)**
0	26.32	8.22	11.04	0.142	0.260
3	23.66	8.35	10.69	0.140	0.257
6	22.42	8.40	10.31	0.138	0.257
9	20.14	8.08	10.37	0.139	0.266
12	18.95	7.92	10.14	0.130	0.270
15	17.86	7.73	9.78	0.126	0.275
18	16.57	7.58	9.52	0.123	0.280
21	15.49	7.42	9.10	0.114	0.284
24	14.21	7.29	8.59	0.106	0.288

SEVEN BAYS

Depth **(m)**	Temp. (°C)	**pH**	D.O. **(mg/L)**	Conduct. **mmho/cm**	ORP **(V)**
0	23.70	8.47	11.34	0.129	0.270
3	20.85	8.70	11.74	0.127	0.267
6	20.49	8.66	11.65	0.126	0.268
9	19.96	8.53	11.18	0.126	0.271
12	19.46	8.47	10.95	0.126	0.274
15	18.67	8.30	10.84	0.127	0.278
18	18.20	8.19	10.67	0.124	0.282
21	17.57	8.04	10.46	0.123	0.285
24	17.09	7.97	10.07	0.128	0.287
27	16.86	7.93	10.02	0.125	0.289
30	16.57	7.89	9.89	0.122	0.292
33	16.16	7.85	9.90	0.125	0.294

Table D.6 Continued;

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	21.71	8.33	11.02	0.127	0.296
3	20.66	8.36	10.00	0.127	0.294
6	18.63	8.11	10.74	0.126	0.302
9	17.82	8.07	10.33	0.125	0.303
12	17.47	8.03	10.13	0.124	0.306
15	17.05	8.00	10.07	0.123	0.307
18	16.44	7.91	9.93	0.123	0.311
21	16.22	7.90	9.89	0.125	0.312
24	15.91	7.87	9.93	0.122	0.313
27	15.86	7.86	9.86	0.121	0.314
30	15.74	7.86	9.82	0.124	0.315
33	15.61	7.85	9.82	0.128	0.316

Table D.7 Water quality measurements taken with a Hydrolab Surveyor II at Gifford, Porcupine Bay, Seven Bays, and Spring Canyon in August 1994.

GIFFORD

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	19.11	8.06	11.10	0.114	0.322
3	19.03	8.16	10.71	0.114	0.317
6	19.02	8.19	10.39	0.113	0.314
9	19.02	8.19	10.23	0.114	0.313
12	19.02	8.19	10.15	0.113	0.312
15	19.02	8.19	10.06	0.113	0.312
18	19.01	8.18	10.03	0.115	0.312
21	19.00	8.18	9.97	0.117	0.312
24	18.99	8.18	9.95	0.114	0.312
27	18.99	8.18	10.66	0.113	0.312
30	18.99	8.18	10.05	0.113	0.312
33	18.99	8.18	9.88	0.115	0.312

PORCUPINE BAY

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	23.55	8.40	9.59	0.143	0.320
3	23.51	8.52	10.16	0.144	0.313
6	23.40	8.51	9.56	0.144	0.312
9	20.43	7.70	8.26	0.153	0.328
12	19.70	7.51	7.12	0.137	0.331
15	19.02	7.51	7.43	0.125	0.331
18	18.30	7.44	7.67	0.125	0.334
21	17.38	7.30	6.50	0.123	0.338
24	16.78	7.19	5.62	0.117	0.340
27	14.86	7.11	5.30	0.112	0.344
30	12.11	6.92	3.20	0.111	0.348
33	11.63	6.87	2.17	0.113	0.351

Table D.7 Continued;

SEVEN BAYS

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	22.54	8.39	10.27	0.114	0.315
3	21.89	8.48	10.16	0.114	0.310
6	21.39	8.45	1248	0.113	0.308
9	20.48	8.26	11.12	0.112	0.312
12	19.82	8.15	10.31	0.113	0.314
15	19.67	8.09	10.01	0.112	0.315
18	19.41	8.07	9.95	0.112	0.316
21	19.34	8.03	11.92	0.113	0.317
24	19.17	7.99	9.83	0.113	0.318
27	19.10	7.96	9.72	0.113	0.318
30	19.00	7.94	9.65	0.112	0.319
33	18.76	7.89	9.53	0.115	0.320

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	25.68	8.28	12.51	0.120	0.366
3	23.82	8.56	11.29	0.119	0.321
6	23.58	8.60	12.96	0.119	0.315
9	23.37	8.57	9.82	0.120	0.315
12	23.04	8.55	9.62	0.119	0.315
15	20.99	8.22	9.71	0.117	0.324
18	19.77	7.99	9.58	0.115	0.328
21	19.43	7.95	9.53	0.117	0.329
24	19.10	7.89	9.44	0.117	0.331
27	18.95	7.86	9.42	0.116	0.331
30	18.76	7.84	9.39	0.115	0.332
33	18.61	7.81	9.35	0.115	0.333

Table D.8 Water quality measurements taken with a Hydrolab Surveyor II at **Gifford,** Porcupine Bay, Seven Bays, and Spring Canyon in October 1994.

GIFFORD

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
	14.02	8.96	9.03	0.160	0.246
6	14.04	8.83	9.11	0.141	0.245
9	14.04	8.97	9.10	0.169	0.246
12	14.04	8.96	9.12	0.133	0.247
15	13.99	8.95	9.05	0.174	0.248
18	13.99	8.95	9.05	0.174	0.248
21	13.84	8.91	9.04	0.164	0.250
24	13.84	8.91	8.01	0.160	0.251
27	13.84	8.91	8.99	0.211	0.253
30	13.82	8.90	8.99	0.211	0.253
33	13.82	8.90	8.95	0.153	0.244

PORCUPINE BAY

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mm ho/cm	ORP (V)
0	18.10	8.80	16.44	0.211	0.240
3	17.17	8.78	16.76	0.256	0.243
6	17.17	8.75	8.56	0.214	0.246
9	17.15	8.71	7.65	0.200	0.240
12	17.15	8.70	7.73	0.202	0.246
15	17.15	8.70	7.76	0.208	0.246
18	17.15	8.69	7.86	0.185	0.246
21	17.15	8.69	7.91	0.219	0.247
24	16.97	8.65	8.05	0.203	0.249
27	16.52	8.60	7.76	0.258	0.251
30	16.06	8.57	7.51	0.256	0.235

Table D.8 Continued;

SEVEN BAYS

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	17.91	8.79	13.17	0.154	0.236
3	17.75	8.70	8.67	0.157	0.240
6	17.69	8.67	8.12	0.148	0.241
9	17.68	8.64	8.09	0.155	0.244
12	17.66	8.62	8.10	0.142	0.245
15	17.66	8.60	8.17	0.172	0.246
18	17.64	8.59	8.23	0.148	0.248
21	17.64	8.58	8.27	0.128	0.250
24	17.64	8.57	8.25	0.139	0.250
27	17.64	8.56	8.24	0.170	0.252
30	17.64	8.35	8.16	0.156	0.253
33	17.61	8.34	8.14	0.123	0.254

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mm ho/cm	ORP (V)
0	18.60	8.30	9.03	0.152	0.255
3	18.60	8.27	10.61	0.152	0.257
6	18.56	8.22	10.39	0.157	0.261
9	18.54	8.20	11.01	0.148	0.262
12	18.54	8.18	12.10	0.147	0.264
15	18.54	8.18	12.52	0.147	0.265
18	18.53	8.18	12.15	0.151	0.265
21	18.53	8.17	9.98	0.146	0.266
24	18.53	8.18	13.15	0.145	0.267
27	18.53	8.17	13.23	0.145	0.269
30	18.53	8.17	9.50	0.150	0.270
33	18.53	8.15	7.95	0.147	0.272

Table D.9 Water quality measurements taken with a Hydrolab Surveyor II at Porcupine Bay, Seven Bays, and Spring Canyon in December 1991.

PORCUPINE BAY

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	3.78	9.25	13.24	0.177	0.258
3	3.83	9.26	10.95	0.179	0.258
6	3.83	9.23	10.73	0.189	0.258
9	3.86	9.28	10.65	0.179	0.257
12	3.90	9.25	10.70	0.149	0.258
15	3.96	9.24	10.67	0.174	0.259
18	4.00	9.22	11.86	0.185	0.259
21	4.18	9.20	10.86	0.218	0.261
24	4.59	9.18	10.29	0.176	0.262
27	4.54	9.17	10.25	0.177	0.263
30	4.66	9.17	9.63	0.181	0.263

Table D.9 Continued;

SEVEN BAYS

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	4.03	8.68	14.39	0.162	0.262
3	4.03	8.86	12.02	0.156	0.258
6	4.00	8.96	12.04	0.167	0.257
9	4.00	9.02	11.36	0.166	0.257
12	4.03	9.06	11.19	0.164	0.256
15	4.01	9.10	11.19	0.181	0.257
18	4.00	9.13	11.13	0.180	0.257
21	4.00	9.15	11.12	0.130	0.258
24	3.99	9.17	11.16	0.174	0.258
27	3.98	9.16	11.14	0.187	0.259
30	3.96	9.16	11.12	0.149	0.259
33	3.99	9.17	11.11	0.137	0.260

SPRING CANYON

Depth (m)	Temp. (°C)	pH	D.O. (mg/L)	Conduct. mmho/cm	ORP (V)
0	7.06	9.35	11.59	0.164	0.253
3	7.08	2.92	11.33	0.163	0.255
6	7.08	9.36	10.02	0.155	0.252
9	7.08	9.33	9.95	0.166	0.253
12	7.08	9.29	9.87	0.178	0.255
15	7.08	9.27	9.85	0.158	0.257
18	7.08	9.24	9.93	0.156	0.258
21	7.06	9.22	9.99	0.173	0.259
24	7.06	9.20	9.91	0.149	0.261
27	7.06	9.18	9.89	0.193	0.262
30	6.67	9.16	9.86	0.202	0.264
33	6.43	9.13	9.90	0.200	0.265

APPENDIX E
CREEL DATA

Table E.l Pressure **estimates** in hours for Rufus Woods **boat** anglers in 1993 with intermediate calculations.

STRATA		Mean boat trailers for the day	% of boats fishing	# angler/ boat	# of angler/ boat S.D.	Corrected mean angler	Corrected x angler sd
December	WD	0.73	100.0	1.59	0.46	1.2	0.3
	WE	2.88	100.0	1.58	0.71	4.6	2.0
July	WD	13.50	72.0	1.00	0.00	9.7	0.0
	WE	21.67	64.0	1.00	0.00	13.9	0.0
August	WD	10.07	84.0	1.05	0.29	8.8	2.5
	WE	9.14	85.0	1.03	0.16	8.0	1.2
September	WD	2.33	65.0	1.33	0.66	2.0	1.0
	WE	14.00	77.0	1.41	0.76	15.2	8.2
October	WD	4.36	82.0	2.83	0.41	10.1	1.5
	WE	23.43	100.0	2.89	2.32	67.7	54.2
November	WD	3.33	100.0	1.75	0.89	5.8	3.0
	WE	4.17	100.0	1.58	0.71	6.6	3.0
Annual	**WD**	**13.50**	84.0	1.59	**0.45**	6.3	**1.4**
	WE	**21.67**	**88.0**	**1.58**	0.78	19.3	11.5

Table E.2 Pressure estimates in hours for Rufus Woods boat anglers in 1994 with intermediate calculations.

STRATA		Mean boat trailers for the day	% of boats fishing	# angler/ boat	# of angler/ boat S.D.	Corrected mean angler	Corrected x angler sd
January	WD	3.16	100.0	2.33	0.58	7.4	1.8
	WE	5.22	100.0	2.00	0.57	10.4	3.0
February	WD	4.75	100.0	2.33	0.58	11.1	2.7
	WE	18.00	100.0	2.00	0.57	36.0	10.2
May	WD	2.00	100.0	2.17	0.70	4.3	1.4
	WE	12.00	81.0	2.21	0.98	21.5	9.5
June	WD	1.54	98.0	1.70	0.75	2.6	1.1
	WE	7.50	94.0	2.17	0.83	15.3	5.9
July	WD	5.25	100.0	1.81	0.68	9.5	3.6
	WE	9.33	97.0	2.12	0.70	19.2	6.3
August	WD	5.17	84.0	1.85	0.59	8.0	2.6
	WE	8.42	86.0	2.00	0.57	14.5	4.1
September	WD	5.17	100.0	1.79	0.65	9.3	3.4
	WE	8.42	92.0	2.10	1.19	16.3	9.2
Annual	WD	3.34	97.0	2.00	0.65	7.4	2.4
	WE	10.41	93.0	2.09	0.77	19.0	6.9

Table E.3 Angling pressure estimates in hours for Rufus Woods Reservoir in 1993 with intermediate calculations.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
DECEMBER													
WEEKDAY													
Shore	8.40	22	184.80	125.30	1.47		0.0	0.0	0.0	0.0	0	0	0
Boat	8.40	22	1 R4.80	125.30	1.47	6.40	1.2	26.4	0.3	6.6	249	64	11
WEEKEND													
Shore	8.40	9	75.60	65.00	1.16		0.0	0.0	0.0	0.0	0	0	0
Boat	8.40	9	75.60	65.00	1.16	6.40	4.6	41.4	2.0	18.0	308	377	27
TOTAL	8.40	31	260.40	190.30	· ·	--	5.8	67.8	2.3	24.6	557	441	38
JULY													
WEEKDAY													
Shore	15.67	21	329.07	89.90	3.66	1.50	7.9	166.3	8.9	186.5	913	127,290	499
Boat	15.67	21	329.07	89.90	3.66	2.40	9.7	203.7	0.0	0.0	1,789	0	0
WEEKEND													
Shore	15.67	10	156.70	38.70	4.05	1.40	5.2	51.7	4.4	43.6	293	7,697	123
Boat	15.67	10	156.70	38.70	4.05	1.40	13.9	139.0	0.0	0.0	788	0	0
TOTAL	15.67	31	485.77	128.60	· ·	· ·	36.7	560.7	13.2	230.1	3,784	134,987	622
AUGUST													
WEEKDAY													
Shore	14.38	22	316.36	120.10	2.63	1.10	2.1	45.5	2.6	s7.9	132	8,819	131
Boat	14.38	22	316.36	120.10	2.63	2.90	8.8	193.6	2.5	55.0	1,479	7,968	125
WEEKEND													
Shore	14.38	9	129.42	63.70	2.03	1.10	0.3	2.6	0.8	6.8	6	95	14
Boat	14.38	9	129.42	63.70	2.03	6.20	8.0	72.0	1.2	10.8	907	237	22
TOTAL	14.38	31	445.78	183.80	--	--	19.2	313.8	7.1	130.5	2,524	17,119	292
SEPTEMBER													
WEEKDAY													
Shore	12.45	20	249.00	118.50	2.10		0.0	0.0	0.0	0.0	0	0	0
Boat	12.45	20	249.00	118.50	2.10	4.60	2.0	40.0	1.0	20.0	387	841	41
WEEKEND													
Shore	12.45	10	124.50	53.30	2.34	--	0.0	0.0	0.0	0.0	0	0	0
Boat	12.45	10	124.50	53.30	2.34	4.50	15.2	152.0	8.2	82.0	1,598	15,706	175
TOTAL	12.45	30	373.50	171.80	· ·	--	17.2	192.0	9.2	102.0	1,984	16,547	216

Table E.3 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
OCTOBER													
WEEKDAY													
Shore	10.73	21	225.33	127.00	1.77	--	0.0	0.0	0.0	0.0	0	0	0
Boat	10.73	21	225.33	127.00	1.77	5.60	10.1	212.1	1.5	31.5	2,107	1,761	59
WEEKEND													
Shore	10.73	10	107.30	46.50	2.31		0.0	0.0	0.0	0.0	0	0	0
Boat	10.73	10	107.30	46.50	2.31	8.50	67.7	677.0	54.2	542.0	13,279	677,868	1,153
TOTAL	10.73	31	332.63	173.50	..	--	77.8	889.1	55.7	573.5	15,386	679,629	1,211
NOVEMBER													
WEEKDAY													
Shore	9.20	20	184.00	157.50	1.17		0.0	0.0	0.0	0.0	0	0	0
Boat	9.20	20	184.00	157.50	1.17	6.40	5.8	116.0	3.0	60.0	867	4,206	91
WEEKEND													
Shore	9.20	10	92.00	37.50	2.45	--	0.0	0.0	0.0	0.0	0	0	0
Boat	9.20	10	92.00	37.50	2.45	6.40	6.6	66.0	3.0	30.0	1,036	2,208	66
TOTAL	9.20	30	276.00	195.00	--	--	12.4	182.0	6.0	90.0	1,904	6,414	157
ANNUAL TOTAL	146.78	365.00	4,468.1	1,043.0	--	--	169.1	2,205	93.5	1,151	26,139	855,136	2,536

Table E.4 Angling pressure estimates in hours for Rufus Woods Reservoir in 1994 with intermediate calculations.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
JANUARY													
WEEKDAY													
Shore	8.83	19	167.77	145.30	1.15	3.20	1.8	34.0	8.3	158.1	126	28,854	238
Boat	8.83	19	167.77	145.30	1.15	8.30	7.4	140.6	1.8	34.2	1,347	1,351	51
WEEKEND													
Shore	8.83	12	105.96	78.00	1.36	3.20	0.0	0.0	0.0	0.0	0	0	0
Bont	8.83	12	105.96	78.00	1.36	4.90	10.4	124.8	3.0	36.0	831	1,761	59
TOTAL	8.83	31	273.73	223.30	--	--	19.6	299.4	13.1	228.3	2,304	31,965	348
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	55.50	3.51		0.0	0.0	0.0	0.0	0	0	0
Boat	10.25	19	194.75	55.50	3.51	8.30	11.1	210.9	2.7	51.3	6,142	9,235	135
WEEKEND													
Shore	10.25	9	92.25	54.20	1.70	3.20	13.8	124.5	21.4	192.9	678	63,314	352
Boat	10.25	9	92.25	54.20	1.70	4.90	36.0	324.0	10.2	91.8	2,702	14,343	168
TOTAL	10.25	28	287.00	109.70	--	--	60.9	659.4	34.3	336.0	9,522	86,892	654
MAY													
WEEKDAY													
Shore	15.20	21	319.20	146.00	2.19	2.00	0.0	0.0	0.0	0.0	0	0	0
Boat	15.20	21	319.20	146.00	2.19	5.80	4.3	90.3	1.4	29.4	1,145	1,890	61
WEEKEND													
Shore	15.20	10	152.00	35.00	4.34	1.50	1.5	15.0	3.0	30.0	98	3,909	88
Boat	15.20	10	152.00	35.00	4.34	5.10	21.5	215.0	9.5	95.0	4,762	39,194	277
TOTAL	15.20	31	471.20	181.00	--	--	27.3	320.3	13.9	154.4	6,005	44,993	426
JUNK													
WEEKDAY													
Shore	16.02	22	352.44	127.80	2.76	--	0.0	0.0	0.0	0.0	0	0	0
Boat	16.02	22	352.44	127.80	2.76	4.20	2.6	57.2	1.1	24.2	663	1,615	56
WEEKEND													
Shore	16.02	8	128.16	39.00	3.29		0.0	0.0	0.0	0.0	0	0	0
Boat	16.02	8	128.16	39.00	3.29	4.20	15.3	122.4	5.9	47.2	1,689	7,321	120
TOTAL	16.02	30	480.60	166.80	--	--	17.9	179.6	7.0	71.4	2,352	8,936	176

Table E.4 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
JULY													
WEEKDAY													
Shore	15.67	20	313.40	50.00	6.27	–	0.0	0.0	0.0	0.0	0	0	0
Boat	15.67	20	313.40	50.00	6.27	7.30	9.5	190.0	3.6	72.0	8,694	32,493	252
WEEKEND													
Shore	15.67	11	172.37	29.50	5.84	–	0.0	0.0	0.0	0.0	0	0	0
Boat	15.67	11	172.37	29.50	5.84	5.80	19.2	211.2	6.3	69.3	7,158	28,061	235
TOTAL	15.67	31	485.77	79.50			28.7	401.2	9.9	141.3	15,851	60,555	487
AUGUST													
WEEKDAY													
Shore	14.38	23	330.74	212.90	1.55	5.00	0.1	2.5		0.0	20	0	0
Boat	14.38	23	330.74	212.90	1.55	5.60	X.0	184.0	2.6	59.8	1,601	5,555	104
WEEKEND													
Shore	14.38	8	115.04	71.50	1.61	5.00	0.1	0.8		0.0	6	0	0
Boat	14.38	8	115.04	71.50	1.61	5.90	14.5	116.0	4.1	32.8	1,101	1.731	58
TOTAL	14.38	31	445.78	284.40			22.7	303.3	6.7	92.6	2,728	7,286	163
SEPTEMBER													
WEEKDAY													
Shore	12.45	20	249.00	112.00	2.22	–	0.0	0.0		0.0	0	0	0
Boat	12.45	20	249.00	112.00	2.22	5.30	9.3	186.0	3.4	68.0	2.192	10,280	142
WEEKEND													
Shore	12.45	10	124.50	68.00	1.83		0.0	0.0		0.0	0	0	0
Boat	12.45	10	124.50	68.00	1.83	6.00	16.3	163.0	9.2	92.0	1,791	15,497	174
TOTAL	12.45	30	373.50	180.00			25.6	349.0	12.6	160.0	3,982	25,777	316
ANNUAL TOTAL	146.78	365.00	4468.08	1,224.7	--	..	202.7	2,512	97.6	1,184	42,744	266,403	2,570

Table **E.5** Catch per unit effort (fish/hour) of the harvest (fish kept) by species and month on Rufus Woods Reservoir in 1993.

Species	Jul	Aug	Sep	Oct	Nov	Mean
kokanee	0.000	0.000	0.000	0.000	0.000	**0.000**
rainbow trout	0.012	0.000	0.000	0.000	0.000	**0.001**
walleye	0.000	0.012	0.013	0.000	0.000	**0.007**
smallmouth bass	0.000	0.000	0.000	0.000	0.000	**0.000**
sturgeon	0.000	0.000	0.000	0.000	0.000	**0.000**
other species*	0.000	0.000	0.000	0.000	0.000	**0.000**
Monthly Mean	0.002	0.002	0.002	0.000	0.000	0.001

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table E.6 Catch per unit effort (fish/hour) of the harvest (fish kept) by species
and month on Rufus Woods Reservoir in 1994.

Species	Jan	Feb	May	Jun	Jul	Aug	Sep	Mean
kokanee	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000
rainbow trout	0.000	0.004	0.000	0.000	0.017	0.021	0.004	0.007
walleye	0.000	0.109	0.144	0.198	0.118	0.087	0.094	0.107
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
other species*	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Monthly Mean	0.000	0.020	0.024	0.033	0.068	0.019	0.016	0.019

*Includes yellow perch, largcmouth bass. suckers, squawfish, black crappic, chinook, bullhead, etc...

Table E.7 Catch per unit effort (fish/hour) of the total catch (harvest and release) by species and month on Rufus Woods Reservoir in 1993.

Species	Jul	Aug	Sep	Oct	Nov	Mean
kokanee	0.000	0.000	0.000	0.000	0.000	**0.000**
rainbow trout	0.012	0.000	0.000	0.000	0.000	**0.002**
walleye	0.000	0.012	0.013	0.000	0.000	**0.004**
smallmouth bass	0.000	0.000	0.000	0.000	0.000	**0.000**
sturgeon	0.000	0.000	0.000	0.000	0.000	**0.000**
other species*	0.000	0.000	0.000	0.000	0.000	**0 .000**
Monthly Mean	0.002	0.002	0.002	0.000	0.000	0.001

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table E.8 Catch per unit effort (fish/hour) of the total catch (harvest and release) by species and month on Rufus Woods Reservoir in 1994.

Species	Jan	Feb	May	Jun	Jul	Aug	Sep	Mean
kokanee	0.000	0.000	0.000	0.000	0.000	0.002	0.000	**0.000**
rainbow trout	0.000	0.004	0.000	0.002	0.017	0.050	0.012	**0.014**
walleye	0.000	0.109	0.157	0.257	0.154	0.181	0.452	**0.218**
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.001	0.008	**0.002**
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
other species*	0.000	0.009	0.000	0.004	0.000	0.002	0.008	**0.004**
Monthly Mean	0.000	0.020	0.026	0.044	0.029	0.039	0.080	0.040

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table E.9 Monthly and annual harvest estimates with ± 95% confidence intervals for all fish species harvested by all anglers on Rufus Woods Reservoir in 1993.

SPECIES	Jul	Aug	Sep	Oct	Nov	Total
kokanee	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
rainbow trout	46 (±8)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	46 (±8)
walleye	0 (±0)	30 (±3)	25 (±3)	0 (±0)	0 (±0)	55 (±6)
smallmouth bass	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
sturgeon	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
other species*	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Monthly Total	46 (±8)	30 (±3)	25 (±3)	0 (±0)	0 (±0)	101 (±14)

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

SECTION 2

LAKE ROOSEVELT FISHERIES MONITORING PROGRAM

1994 ANNUAL REPORT

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ABSTRACT

The purpose of the Lake Roosevelt Monitoring Program was to evaluate the effects of releasing hatchery origin kokanee salmon and rainbow trout on the fishery and to determine stocking strategies which increases fish harvest while maximizing the return of spawning kokanee to egg collection facilities. Two hatcheries stock kokanee and rainbow trout into lake Roosevelt, the Spokane Tribal Hatchery and the Sherman Creek Hatchery. The Spokane Tribal Hatchery began stocking fish in 1991 and Sherman Creek Hatchery began stocking in 1992. Approximately, 2.5 million kokanee salmon and 400,000 rainbow trout have been released annually since both hatcheries went on line. We estimated that 499,738 angler trips were taken to Lake Rooseselt totaling $19,050,013. The harvest of kokanee has been steadily increasing from 8,021 fish in 1992 to 16,567 fish in 1994. Rainbow trout harvest has also increased over the last few years from 140,609 fish in 1992 to 499,460 fish in 1994. Walleye harvest jumped from 118,864 fish in 1992 to 307,663 fish in 1993, but fell sharply in 1994 to 53,589 fish. However, the overall accuracy of harvest estimates were questionable. For example, the estimated harvest of rainbow trout exceeded the number of trout stocked into the lake, even after a correction factor was applied for the harvest of wild origin fish. On the other hand, the overall precision of the creel seems to be high because the anglers agree that over the past few years the kokanee salmon and rainbow trout harvest has steadily increased. Growth of kokanee salmon, rainbow trout and walleye appeared to be similar to previous years. Kokanee salmon and rainbow trout exceed the mean growth per age class of fish in area lakes. However, walleye growth was significantly less than those of fish in area lakes. The feeding habits of kokanee, rainbow trout and walleye in 1994 were also similar to previous years. Kokanee salmon and rainbow trout fed mainly on ***Daphnia*** spp. and chironomids, and walleye mainly feed on fish. Food habits and growth suggest that kokanee and rainbow had ample food but the reduced walleye growth may have been the result of food shortages. However, we were unable to determine if walleye's prey base had deminished.

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1.0 INTRODUCTION

1.1 Project History

The primary objective of this project was to determine stocking strategies of hatchery origin kokanee salmon and rainbow trout which maximized angler harvest and return of kokanee to egg collection facilities; and collect baseline data on the fishery to evaluated effects of stocking kokanee and rainbow trout on the environment. Another resposibility of this program was to assess the effectiveness of kokanee hatcheries and rainbow trout program funded by BPA. Tasks of the Monitoring Program were: to conduct a year round reservoir wide creel survey; sample the fishery by electroshocking boat during spring, summer and fall; and collect information on diet, length, weight and age information. The data generated from sampling was analyzed to determine food availability, utilization and preferences, growth rates, and angler use information (e.g. harvest). This 1994 annual report marks the seventh report produced by the Lake Roosevelt Monitoring Program (Monitoring Program). Peone et al. (1990), Griffith and Scholz (1991), Thatcher et al. (1993), Thatcher et al. (1994) and Underwood and Shields (1996) wrote previous Monitoring program reports.

1.2 History of Kokanee and Rainbow Trout Stocking

From 1988 to 1990, kokanee reared at the Ford Hatchery by the Washington Department of Fish and Wildlife were stocked into Lake Roosevelt. Approximately 750,000 kokanee fry were stocked into Sherman Creek and 100,000 kokanee fry were stocked into the Spokane River at Little Falls Dam each year during July or May. Rainbow trout (*Oncorhynchus mykiss*) fry were provided to the Lake Roosevelt Net Pen Program by the Spokane Hatchery (WDFW operated) from 1986 to 1990. The number of rainbow trout provided by the Spokane Hatchery began at 50,000 increasing to 276,500 by 1990. The rainbow trout were stocked in net pens during October. Rainbow trout were held in net pens until May or June and then released as yearlings. The Net Pen Program was operated by the Lake Roosevelt Development Association, a nonprofit volunteer group.

The Spokane Tribal Hatchery went on line in 1990 and began stocking kokanee and rainbow trout into Lake Roosevelt in 1991. The Sherman Creek Hatchery began rearing and releasing kokanee in 1992. Construction and operation of these hatcheries was funded by the Bonneville Power Administration as partial mitigation for the loss of anadromous salmon and steelhead. The loss occurred in the 1939 when the Grand Coulee Dam was installed. The dam was not equipped with a fish ladder, thus blocking the migration path of anadromous salmon and steelhead. The blockage caused the permanent loss of anadromous stocks upstream from the dam.

The Spokane Tribal Hatchery was a full production facility operated by the Spokane Tribe and located on their reservation. The Sherman Creek Hatchery was a part time (spring to fall) rearing facility operated by the Washington Department of Fish and Wildlife and located near Kettle Falls, Washington. The Sherman Creek Hatchery imprinted juvenile kokanee to the creek water, then released the juveniles and collects eggs from returning adults. The collected eggs were transferred to the Spokane Tribal Hatchery for incubation and rearing. However, to start the program and due to limited returning adults a majority of the kokanee eggs have been from Lake Watcom. A portion of the kokanee reared in the Spokane Tribal Hatchery were transferred to Sherman Creek Hatchery in early Spring for imprinting and later released. The hatcheries original production goals were 8 million kokanee salmon fry for release into Lake Roosevelt and 500,000 rainbow trout fry for the Lake Roosevelt Net Pen Program. However, due to a limited water supply at the Spokane Tribal Hatchery, approximately 2.5 million kokanee and 250,000 rainbow trout fry have been released annually.

1.3 1994 Study Goals

Goals of the Lake Roosevelt Monitoring Program for 1994 were as follows:

1) Determine angler pressure, number of fish harvested, average size of fish harvested and economic value of the fishery;

2) Estimate the relative abundance of fish in the lake;

3) Determine diet of kokanee, rainbow trout and walleye;

4) Back calculate length at age using scales from kokanee, rainbow trout and walleye; and

5) Compare and contrast data collected during 1994 with previous years to identify changes in the fishery.

2.0 MATERIALS AND METHODS

2.1 Study Area

Lake Roosevelt is a mainstem Columbia River impoundment formed by the installation of Grand Coulee Dam in 1939 (Figure 2.1). Filled in 1941, the reservoir inundated 33,490 hectares at a full pool elevation of 393 m (1,290 ft) above mean sea level. It has a maximum width of 3.4 km and a maximum depth of 122 m (Stober et al. 1981).

2.2 Creel Design and Procedures

A two-stage probability sampling scheme was used to determine annual fishing pressure, catch-per-unit-effort (CPUE), and sport fish harvest by species on Lake Roosevelt (Lambou 1961;1966, Malvestuto 1983). Creel surveys were conducted at Spokane and Colville tribal campgrounds and National Park Service boat launches for a total of 48 survey locations (Figure 2.1).

Three creel clerks were employed to interview anglers at access points along Lake Roosevelt according to monthly schedules for an average of 21 days per month for each creel clerk. Creel schedules consisted of instantaneous pressure counts of the entire reservoir and effort counts at access points. Schedules were constructed by dividing each month into weekday and weekend/holiday stratum. Four weekdays and four weekend/holidays were randomly selected to schedule pressure counts and remaining days were scheduled as effort counts. Days were stratified into a.m. (sunrise to 12:00) and p.m. (12:00 to sunset) time periods. Four air flights (one flight per stratum) were scheduled to coincide with pressure counts. Index cards printed with major access locations were randomly drawn from a hat to establish the schedules. Similar cards were also used to randomly determine the date, time of day, and major access location to be checked by any given creel clerk. Location cards were used once for weekend/holiday stratum and twice for weekday stratum. Effort count schedules were different for each creel clerk.

During each a.m. and p.m. instantaneous pressure count, boat trailer and shore angler counts were recorded at all access points along the reservoir by all three creel clerks. No

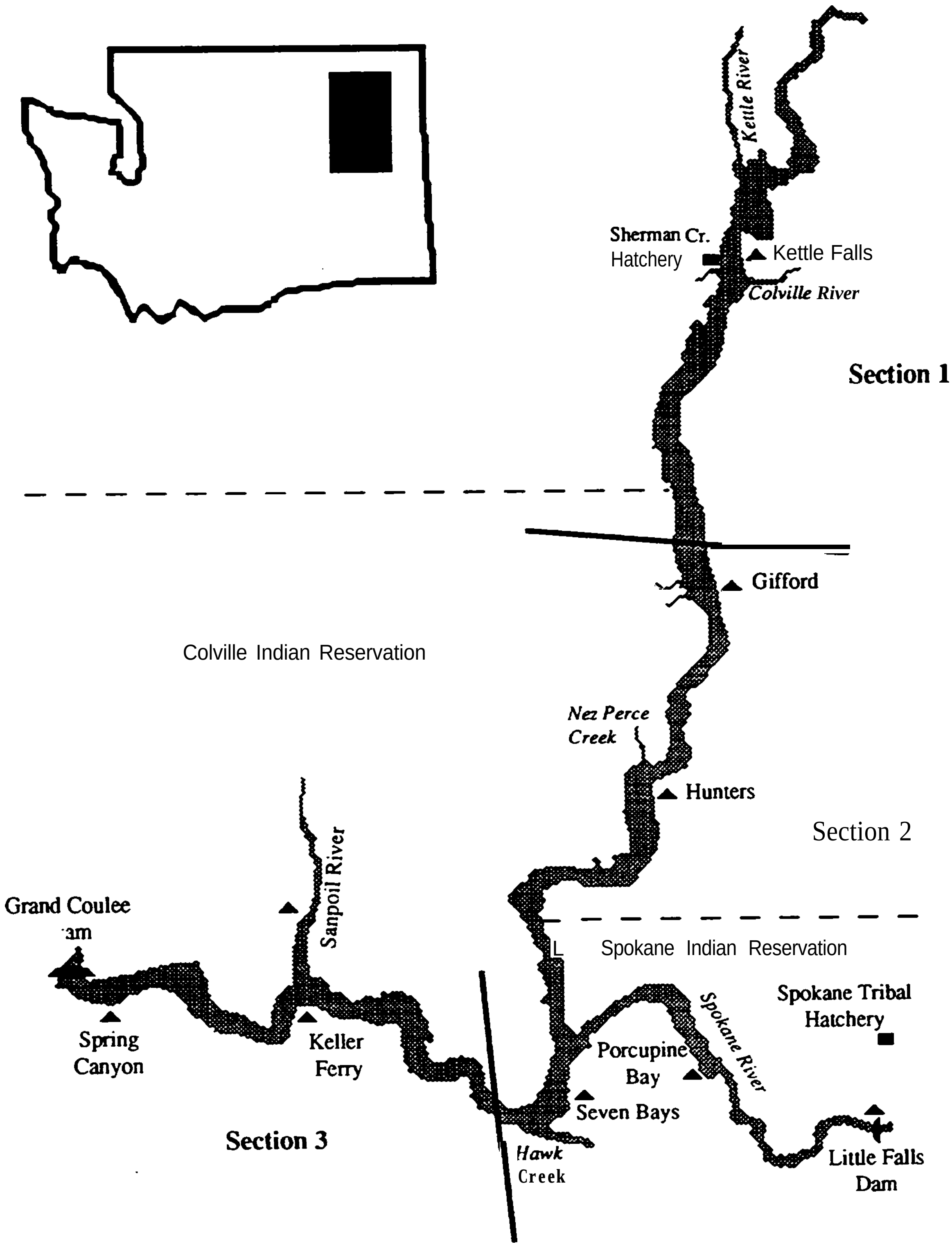

Figure 2.1. Map of Lake Roosevelt, Washington. "▲" indicates fish sampling stations.

interviews were performed during instantaneous pressure counts. The number of boats on the water and the number of shore anglers were counted concurrently during aerial surveys of the reservoir using a Cessna 172 aircraft.

During each a.m. and p.m. effort count, boat trailers and shore anglers were counted. Interview data collected included: angler type, hours fished, completed trip, satisfaction, zip code of origin, target species, and number of fish caught and released. Fish harvested were identified to species, measured in millimeters, weighed in grams 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 rainbow trout of net-pen or hatchery origin from wild fish. Scale samples were collected from representative kokanee, rainbow trout, and walleye, and stomach samples were collected from kokanee. Additionally, incoming boaters were surveyed to determine the number of boats angling and the number of anglers per boat.

A correction factor accounting for boats on the water versus boat trailer at access points was developed by conducting aerial surveys. The correction factor was used to estimate the number of boat anglers on Lake Roosevelt for each stratum. The formulas below were used to determine the number of boat anglers per day for each day type (weekday or weekend/holiday) and section (creel clerk areas: see Figure 2.1) strata:

Boat count data from air flights was compared to boat trailer counts on land by creel clerks on the same day to develop a boat correction factor for each stratum per month. The products of the following formula were averaged by stratum with 1990 through 1993 data to obtain yearly means:

$$CF_b = \left(\frac{B_a}{B_c}\right)$$

Where:

CF_b = boat trailer correction factor for each stratum per month;
B_a = boat count from air survey for each stratum; and
B_c = number of boat trailers counted by creel clerks during air flights for each stratum.

The number of boats on the reservoir for each stratum per month was calculated by the formula:

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

Where:

Tb = number of boats on the water for each stratum per month;
Cbt = mean boat trailer count from pressure counts for each stratum per month; and
CFb = boat trailer correction factor for each stratum per month.

The number of boats fishing for each stratum per month was calculated by the formula:

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

Where:

B_f = number of boats fishing for each stratum per month;
Tb = number of boats on the water for each stratum per month; and
$\%Bf$ = percent of boats fishing for each stratum per month (number is in decimal form).

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

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

Where:

Xd = 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
Bf = number of boats fishing for each stratum per month.

Statistical sampling formulas were used to calculate stratum estimates and confidence intervals for angling pressure, CPUE and harvest (Lewis 1975, Wonnacott and Wonnacott 1977, Mendel and Schuck 1987, and Williams et al. 1989).

For each day (weekday or weekend/holiday) and section (creel clerk) stratum the following formulas were used to determine the number of hours sampled for each stratum per month:

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

Where:

N_S = number of hours for each stratum per month;
D_S = number of days per month within the stratum; and
Hd = 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 pressure counts 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) and stratum time (a.m. or p.m.) for boat and shore anglers for each month 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. was determined by calculating at weekend/weekday levels by boat and shore anglers, then a summing the products for each section. If data gaps existed in any strata the quarterly average was used to fill the gap. Annual angler pressure and 95% C.I. estimates were calculated by summing monthly angler pressure estimates and 95% C.I. estimates for that section. Each section was added together to get full lake estimates.

Studies by Fletcher (1988) and Malvestuto et al. (1978) have shown that CPUE values calculated independently from complete and incomplete trip data are 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 for the month by 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
Th = 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:

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

where:

$Harvest$ = harvest of a particular fish species for each stratum per month;
$Hcpue$ = number of fish harvested of a particular fish species for each stratum per month for each stratum per month; and
PE_S = pressure (hours fishedestimate 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 lake monthly harvest estimates.

Data compiled by the U.S. Fish and Wildlife Service in 1980 and 1985, showed a typical angler spent $23.00/fishing trip in 1980 and $26.00/fishing trip in 1985 in inland waters of Washington State (USFWS 1989). To calculate current dollar amount spent by anglers per trip, the 1985 cost per fishing trip was adjusted for inflation using the regional consumer price index (CPI). The following formula was used:

$$D_{94} = \left(\frac{D_{85} x C_{94}}{C_{85}}\right)$$

where:

$D94$ = dollar value per fishing trip for the Lake Roosevelt Fishery in 1994;
$C85$ = regional CPI for 1985;
$C94$ = regional CPI for 1994; and
$D85$ = dollar value per fishing trip for the Lake Roosevelt Fishery in 1985 ($26.00).

The 1994 dollar value was multiplied by total number of angler trips in 1994 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.

2.3 Fisheries Surveys and Relative Abundance

Fishery samples were collected at nine index stations in the reservoir, which included: Kettle Falls, Gifford, Hunters, Porcupine Bay, Little Falls Dam, Seven Bays, Keller Ferry, Sanpoil, and Spring Canyon (Figure 2.1). Fishery data was collected at each index station over 24 hour periods. Principle target species included kokanee salmon, rainbow trout, and walleye, although all fish were captured in proportion to their relative abundance.

Relative abundance surveys were performed in littoral areas and tributaries by electrofishing 10 minute transects along 0.5 km of shoreline using SR-180 and SR-23 electrofishing boats (Smith Root, Inc., Vancouver, WA) according to procedures outlined by Reynolds (1983) and Novotany and Prigel (1974). Voltage was adjusted to produce a pulsating DC current of approximately 5 amperes. Fish were collected using dip nets and placed into live wells on the boat for examination and data collection. A minimum of six 10 minute transects were performed at each sample station.

Additional relative abundance surveys were performed in pelagic zones with bottom and surface monofilament gillnets using methodologies described by Hubert (1983). The following gillnets were used: two horizontal surface set gillnets measuring 61 m in length by 6.1 m deep, with four 15.2 m long panels graded from 1.3 to 7.6 cm stretch mesh; and two horizontal bottom set gillnets measuring 61 m in length by 6.1 m deep, with four 15.2 m long panels graded from 1.3 to 8.9 cm stretch mesh. Gillnets were set in early afternoon (2:00 p.m.), checked at sunset, and pulled at 10:00 p.m. Nets were managed this way to collect fresh fish for stomach samples.

Fish captured were identified by species using the taxonomic key of Wydoski and Whitney (1979). Total lengths were measured to the nearest millimeter using a metric measuring board and scale samples were removed from target fish species to determine age and growth. Target species were weighed to the nearest gram using an electronic balance. Sexes were determined when possible. Stomach samples were collected from representative sizes of target species. Remaining fish were marked with floy tags and released.

2.4 Age, Back Calculations and Condition Factor

In the field, scales were taken from appropriate locations for each species as described by Jearld (1983) and placed in coin envelopes labeled with fish number, length, weight, location, date, and species for later analysis. In the laboratory, back-calculation measurements and age class of each fish were determined simultaneously. To obtain data, scales were removed from the envelope and placed between two microscope slides. Slides were then placed in a Realist Vantage 5, Model 3315 microfiche reader. Scale images were projected onto the screen and a non-regenerated, uniform scale was selected to determine age and back calculate length at age. Age was determined by counting the number of annuli (Jearld 1983). For back calculations, the annulus distance was measured from the origin of the scale to the last circuli of each respective annulus. Each measurement was made under constant magnification to the nearest millimeter.

Lee's back-calculation method was used to determine the length of the fish at the formation of each annulus (Carlander 1950, 1981; Hile 1970). However, due to a small number of samples the "y" intercept was assumed to be zero.

Back-calculations were computed using the formula:

$$L_i = a + \left(\frac{L_c - a}{S_c} \right) S_i$$

where:

L_i = length of fish (in mm) at each annulus formation;
a = intercept of the body-scale regression line;
L_c = length of fish (in mm) at time of capture;
S_c = distance (in mm) from the focus to the edge of the scale; and
S_i = scale measurement to each annulus.

Condition factors were determined for each fish to serve as an indicator of fish condition (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).

2.5 Feeding Habits

Fish stomachs were collected from kokanee, rainbow, and walleye at each index station. Additional kokanee stomachs were obtained by creel clerks from anglers throughout the year. Stomachs from representative sizes of fish 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 10% formalin.

In the laboratory, stomachs were transferred to a 70% isopropyl alcohol solution. Contents were identified and enumerated by taxa using the taxonomic keys of Brooks (1957), Ward and Whipple (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.

Dry weights were obtained by drying sorted stomach contents in an oven at 105° for 24 hours on a stainless steel wire screen and weighing them on a Sartorius Model H51 analytical balance to the nearest 0.0001 g (Weber 1973, APHA 1976). Weight values were combined for each age class, annual mean and standard deviation.

Index of relative importance values were used to compensate for numerical estimate biases that tend to over-emphasize small prey groups consumed in large numbers and weight estimate biases that overemphasize large prey items consumed in small numbers (Bowen 1983). The index of relative importance (George and Hadley 1979) was calculated using the formula:

$$RI_a = \frac{100AI_a}{\sum_{a=1}^{n} AI_a}$$

where:

RI_a = relative importance of food item a;
AI_a = absolute importance of food item a (*i.e.*, frequency of occurrence + numerical frequency + weight frequency 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 the degree to which intra and inter species competition exists in Lake Roosevelt. Fish diet overlaps were computed by using the overlap formula of Morisita (1959) as modified by Horn (1966). Overlap values were based upon indices obtained from IRI calculations. Overlap index was expressed in the equation:

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

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 IRI values in the equation for the variables Pxi and Pyi. 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), or there may be an abundant food supply and therefore competition does not exist.

2.6 Trawling

A 27.4 m long mid-water trawl with a mouth surface area of 57 meters was pulled by a 32 foot long fishing vessel with dual Volvo 41 engines. The stretch net mesh sizes ranged from 76 mm to 38 mm to 19 mm to 6.4 mm in the body of the net and terminated in a 3 mm mesh cod end. The net was towed at speeds from 0.5 meter per second to 1.5 meters per second. Nets were release to within 20 meters of the bottom resulting in a maximum depth of 92 m. The net was then brought back towards the surface in a step-wise oblique motion. The trawl net was pulled at intervals of 5 minutes at each 15.2 meter step. Net depth was estimated by measuring the length of tow cable paid out. The length of tow cable paid out to net depth was standardized by paying out the tow cable at intervals of 15.2 meters, then a second boat with an ecosounder determined the trawl net depth. A ratio between net depth and length of tow cable paid out was estimated at different boat speeds. The resulting estimates were used to determine net depths during trawls. Rieman (1992) presented a detailed description of the methodology followed in this study.

3.0 RESULTS

3.1 Creel Data

The angler pressure (hours fished) estimates for Lake Roosevelt are reported in Table 3.1 by section and month. Appendix A reports the pressure estimates by the lowest stratification levels.

The results of the creel analyses are reported for the time period December 1993 through November 1994. December 1993 was included in this report so that quarterly averages could be used to fill data gaps at the lowest stratification level. Quarters were split into December 1993 through February 1994 (winter), March 1994 through May 1994 (spring), June 1994 through August 1994 (summer), and September 1994 through November 1994 (fall). Quarters were established based on historic weather trends and angler use of the fishery. For example, a quarterly average was used if no boat anglers were surveyed during the month of January on a weekend in Section 1, but boat trailers were counted at the access points during the weekends. Since no boat anglers were surveyed, we were unable to estimate the average number of hours fished by boat anglers on a weekend in January without using some other means to estimate the number of boat angler hours. As a result, the quarterly average was used to fill the data hole, "weekend boat angler".

Fishing pressure (angler hours) was greatest in section 3 (929,511 hrs) followed by section 2 (820,753 hrs) and then section 1 (176,641 hrs). The annual pressure for the lake was estimated to be 1.9 million hours. Total pressure was greatest during June (470,210 hrs) and July (269,031 hrs). Pressure was least during October (35,496) and April (61,971 hrs).

The number of angler trips to Lake Roosevelt were estimated by dividing the estimated number of angler hours fished by the mean trip length for each section and month (Table 3.2). The total number of trips estimated from the period December 1993 through November 1994 was 499,738 angler trips. A total of 29,470 trips were made in Section 1; 246,766 angler trips in Section 2 and 223,499 trips in Section 3. The greatest number of trips was during June (116,930 trips), July (65,477 trips) and August (54,847 trips).

Table 3.1. Total monthly angler pressure estimates in hours (± 95% CI), by creel section on Lake Roosevelt from December 1993 through November 1994.

	Section			
	1	2	3	Total
Dec	704 ± 181[a]	80,861 ± 2,446	2,674 ± 766	84,239 ± 3,393
Jan	3,535 ± 557[a]	53,784 ± 1,214	15,843 ± 672	73,162 ± 2,443
Feb	1.339 ± 180[a]	37.737 ± 986	24.111 ± 605	63,187 ± 1,771
Mar	8,933 ± 455	131,004 ± 3,082	31,086 ± 1,355	171,023 ± 4,892
Apr	13,494 ± 240	21,414 ± 840	27,063 ± 531	61,971 ± 1,611
May	20,717 ± 278[a]	48,209 ± 1,900	171,512 ± 3,668	240,438 ± 5,846
Jun	17,195 ± 1,028	139299 ± 1,527[a]	313.716 ± 4,941	470,210 ± 7,496
Jul	47,799 ± 2,056	146.828 ± 5,562	74,404 ± 3,552	269,031 ± 11,170
Aug	27,672 ± 2,494	87,380 ± 4.214	73,201 ± 10,108	188,253 ± 16,816
Sep	24,187 ± 1,247	90,198 ± 6,574	66,112 ± 4,324	180,497 ± 12,145
Oct	9,057 ± 459	10,123 ± 1,088	16,316 ± 717	35,496 ± 2,264
Nov	2,007 ± 119	82,374 ± 3,549	4.716 ± 6%	89,097 ± 4,364
Total	176.641 ± 9,294	820,753 ± 21,782	929.511 ± 32,982	1,926,905 ± 64,058

[a] confidence intervals were underestimated due to point estimates instead of averages.

Table 3.2. Angler trip estimates by section based on angler hours **(hrs)** and average trip length for Lake Roosevelt from December 1993 through November 1994.

	Section	Mean Trip Length	No. Angler Hours	No. Angler Trips
December	1	4.0	704	176
	2	3.3	80,861	24,503
	3	1.8	2,674	1,486
January	1	4.1	3,535	862
	2	3.7	53,784	14.536
	3	2.0	15.843	1,337
February	1	3.0	1,339	446
	2	2.9	37,737	13,013
	3	1.9	24,111	8,338
March	1	3.8	8,933	1,951
	2	3.0	131.004	43.668
	3	2.8	31,086	8,611
April	1	4.9	13,494	2,754
	2	2.4	21,414	8,923
	3	2.5	27,063	12.434
May	1	8.1	20,717	2,558
	2	5.8	48,209	8,312
	3	3.9	171,512	43,977
June	1	7.1	17,195	2,422
	2	5.6	139,299	24,875
	3	3.5	313.716	89,633
July	1	5.9	47,799	8,102
	2	4.0	146,828	36,707
	3	3.6	74,404	20,668
August	1	5.8	27,672	4,771
	2	5.8	87,380	15,066
	3	4.3	73,201	17,023
September	1	6.8	24,187	3,557
	2	4.8	90,198	18,791
	3	4.6	66,112	14,372
October	1	6.2	9,057	1,461
	2	2.5	10,123	4,049
	3	5.2	16.316	3.138
November	1	4.9	2,007	410
	2	2.4	82.674	34,323
	3	1.9	4,716	2,482
Total		4.1	1,926,905	499,738

Table 3.3 reports the harvest rates by catch per unit effort (CPUE) for fish harvested during 1993. The annual mean harvest rate for rainbow trout was 0.209 HPUE (4.8 angler hrs/fish); 0.048 HPUE (20.8 angler hrs/fish) for walleye; 0.015 (66.7 angler hrs/fish) for smallmouth bass and 0.004 HPUE (250 angler hrs/fish) for kokanee. Section 3 had the quickest harvest rate for rainbow trout (0.536 HPUE (1.7 angler hrs/fish)) and smallmouth bass (0.046 HPUE (21.7 angler hrs/fish)). Section 1 had the highest mean annual harvest rate for walleye (0.091 HPUE (11 angler hrs/fish)) and Section 2 had the highest for kokanee (0.007 HPUE (143 angler hrs/fish)).

The 1994 catch (kept and released fish) estimates were similar to harvested estimates (Table 3.4). There were two major differences between catch and harvest rates. The first was walleye harvest was 0.048 HPUE (20.8 angler hrs/fish), but catch was 0.078 CPUE (12.8 angler hrs/fish). The difference between the harvest and catch rates for walleye were due to a slot limit enforced by the Washington Department of Fish and Wildlife. The walleye slot limit was no more than one fish over 20 inches and only walleye less than 16 inches may be kept. This meant that although it took 12.8 hours to catch a walleye anglers had to release those which were not in the slot limit. Therefore, harvest was closer to 20.8 hrs/fish. The second was the "other species" category changed significantly from harvest to catch. The harvest was 0.001 per hour (1,000 hrs/fish) and a catch of 0.015 per hour (67 hrs/fish). A majority of the fish in the "other species" category were yellow perch, suckers, carp and lake whitefish. This indicated that most anglers catching these fish species were releasing them.

The largest contribution to the fishery in terms of harvest (kept only) numbers were rainbow trout (499,293 fish) followed by walleye (53,589) and smallmouth bass (39,709). Kokanee harvest estimates were 16,567 fish. Among lake sections, a majority of the rainbow trout (382,240) were harvested in Section 3 and a majority of walleye (29,890) were harvested in Section 2. Of the walleye observed in the creel 4% of the fish were outside of the legal size limit, fish lengths between 406 mm (16in) and 508 mm (20 in). The number of walleye harvested outside of the legal size was estimated to be 2,143 fish. Section 1 was the only area where sturgeon (297) were harvested. However, the estimated number of sturgeon harvest must be viewed with caution. Six sturgeon were seen by creel clerks in 1994. The small sample size may have caused significant errors in the estimate. The estimated number of fish harvested with 95% confidence intervals are reported in Table 3.5. Appendix A also reports harvest by section, month and species.

Table 3.3. Harvest (kept fish) per unit effort (HPUE) by section from December 1993 through November 1994 at Lake Roosevelt.

	Section			
	1	2	3	Annual
kokanee	<0.001	0.007	0.005	**0.004**
rainbow trout	0.073	0.043	0.536	**0.209**
walleye	0.091	0.041	0.000	**0.048**
smallmouth bass	<0.001	0.002	0.046	**0.015**
sturgeon	0.002	0.000	0.000	**<0.001**
other species	0.002	0.001	0.000	0.001
Annual HPUE	0.168	**0.093**	**0.586**	**0.277**

Table 3.4. Catch (kept and released fish) per unit effort (CPUE) by section from December 1993 through November 1994 at Lake Roosevelt.

	Section			
	1	**2**	**3**	Annual
kokanee	0.000	0.007	0.005	**0.004**
rainbow trout	0.074	0.043	0.538	**0.210**
walleye	0.157	0.055	0.000	**0.078**
smallmouth bass	0.000	0.003	0.303	**0.096**
sturgeon	0.003	0.000	0.000	0.001
other species	0.004	0.002	0.015	**0.008**
Annual CPUE	**0.238**	0.110	**0.861**	**0.395**

Table 3.5. Number of fish harvested (kept), with ± 95% confidence intervals, for Lake Roosevelt during December 1993 through November 1994.

	Section			
	1	2	3	Total
kokanee	11 (±1)	14,496 (±608)	2,060 (±76)	16,567 **(±685)**
rainbow trout	9,426 (±631)	107,627 (±4,495)	382,240 (±10,864)	**499,293** **(±15,990)**
walleye	23,699 (±1,269)	29,890 (±983)	0 (±--)	**53,589** **(±2,252)**
smallmouth bass	38 (±2)	1,188 (±60)	38,483 (±3,577)	**39,709** **(±3,639)**
sturgeon	297 (±16)	0 (±--)	0 (±--)	297 **(±16)**
other species	239 (±13)	0 (±--)	0 (±--)	**239** **(±13)**
Annual Harvest	33,710 **(±1,914)**	153,524 **(±6,163)**	422,783 **(±11,906)**	610,017 **(±19,983)**

Table 3.6. Number of fish caught (kept and released), with ± 95% confidence intervals, for Lake Roosevelt during December 1993 through November 1994.

	Section			
		2		Total
kokanee	11 (±1)	14,496 (±608)	2,060 (±76)	16,567 (±685)
rainbow trout	9,462 (±618)	107,627 (±4,495)	382,371 (±10,902)	499,460 (±16,015)
walleye	40,718 (±2,159)	82,531 (±2,978)	363 (±8)	123,612 (±5,145)
smallmouth bass	38 (±2)	1,940 (±114)	364,881 (±8,476)	366,859 (±8,592)
sturgeon	517 (±28)	0 (±--)	0 (±--)	517 (±28)
other species	326 (±24)	887 (±58)	2,888 (±116)	4,101 (±198)
Annual Catch	51,072 (±2,832)	207,481 (±8,253)	752,563 (±19,576)	1,011,116 (±30,661)

Table 3.7. Annual numbers (n), mean lengths (mm) and weights (g) with standard deviations for all fish harvested on Lake Roosevelt from December 1993 through November **1994.**

		Kokanee	Rainbow	Walleye	Small-mouth Bass	Sturgeon	Yellow Perch
Sec	n						
	Ln	451	39425±52	3831±62	2711± -	1,5716± 43	278 ± 25
	Wt	1,009	724 ± 312	443± 282	291 ± -	- -	276 ± 76
Sec 2	n					- -	
	Ln	5291±123	413 ± 8107	388 ± 182	285 ± 34	- -	- -
	Wt	1,343 ± 604	689 ± 316	436 ± 254	371 ± 208	- -	- -
Sec 3	n					- -	
	Ln	4223 1±74	41,4± 49.7	- ±0	192 1215.5	- -	- -
	Wt	814 ± 327	943 ± 277	- ±+	279 ± 138	- -	- -
Total	n	33					
	Ln	481 + 114	1,818	412	129	6	5
			473±64	385±73	196±24	1,571±43	278±21
	Wt	1,109±554	899±298	442±275	282±140	- -	283±90

The number of fish in the catch (kept and released) was similar to the harvest numbers. The two places of deviation were the walleye due to the slot limit and the other fish categories due to catching "trash fish". Table 3.6. identifies the catch numbers by section and species with 95% confidence intervals. Appendix A reports catch by section, month and species. The average length and weight of fish observed in the creel are reported in Table 3.7 by section and species. Section 3 contained the largest rainbow trout (length 491 mm and weight 943 g). Walleye were larger in Section 2 than in Section 1 or 3. The mean length of walleye in Section 1 was 365 mm (n = 278) for fish in the smaller than 16 inch slot limit and fish harvested in the 20 inches slot limit had a mean length of 548 mm (n = 30). In Section 2 walleye smaller than 16 inches had a mean length of 353 mm (n = 73) and walleye larger than 20 inches had a mean length of 625 mm (n = 9). There were 6 illegal sized walleye measured in section 1, averaging 440 mm long and 10 illegal sized walleye in section 2, averaging 444 mm long.

Table 3.8 identifies the percent of anglers satisfied with the fishery by species, section and season. Based on annual figures, a majority of anglers (63%) were satisfied with the walleye fishery. However, fewer anglers were satisfied with the kokanee (27%), rainbow trout (32%) and sturgeon (5%) fisheries. Anglers fishing during the summer and fall appeared to have a higher satisfaction then anglers fishing in the winter and spring.

Of all the anglers who fished on Lake Roosevelt during 1994, 73% targeted rainbow, 18% targeted walleye, 3% targeted kokanee and the rest targeted other species (Table 3.9). The winter fishery consisted of mostly rainbow trout with a few kokanee anglers and no walleye anglers. In spring, the rainbow fishery began tailing off in Section 1 and the walleye fishery began increasing. During the summer period, walleye anglers made up the majority in sections 1 and 2 and rainbow trout angler were the primary anglers in Section 3. Kokanee anglers primarily utilized Section 2 and 3. During fall there was an increased number of kokanee anglers at Section 2, rainbow anglers also increased and the number of walleye anglers decreased independent of section.

Table 3.10 shows the economic value of the sport fishery based on total number of angler trips of 499,738 at $38.12 for each trip. The economic value was $19,050,013.

Table 3.8. Percent of anglers that were satisfied with the fishery by species, section and season from December 1993 through November 1994.

Quarter Section	Kokanee	Rain bow Trout	Walleye	Sturgeon
Winter				
One	--	16%	33%	--
Two	--	16%	--	--
Three	36%	21%	--	--
Spring				
One	--	17%	48%	3%
Two	--	28%	25%	--
Three	5%	31%	--	--
Summer				
One	--	85%	64%	0%
Two	100%	60%	76%	--
Three	100%	39%	--	--
Fall				
One	--	61%	70%	14%
Two	100%	45%	50%	--
Three	0%	32%	--	--
Qrtly Totals				
Winter	**36%**	**18%**	**33%**	**--**
Spring	**5%**	**28%**	**41%**	**3%**
Summer	100%	**42%**	**67%**	**0%**
Fall	**75%**	**46%**	**61%**	**14%**
Annual Total	**27%**	**32%**	**63%**	**5%**

Table 3.9. Percent of anglers targeting various fish species by section and season on Lake Roosevelt from December 1993 through November 1994.

Quarter Section	Kokanee	Rainbow	Walleye	Other*
Winter				
One	0%	98%	2%	0%
Two	0%	78%	2%	20%
Three	7%	93%	0%	0%
Spring				
One	0%	56%	18%	26%
Two	0%	67%	21%	12%
Three	13%	87%	0%	0%
Summer				
One	0%	7%	74%	19%
Two	2%	20%	57%	21%
Three	0%	100%	0%	0%
Fall				
One	0%	72%	9%	19%
Two	5%	62%	19%	14%
Three	2%	93%	0%	5%
Qrtly Totals				
Winter	2%	88%	2%	8%
Spring	8%	76%	8%	8%
Summer	1%	46%	41%	12%
Fall	2%	74%	10%	14%
Annual Total	3%	73%	18%	6%

Table 3.10 Economic value of the sport fishery at Lake Roosevelt during December 1993 through November 1994.

	1985	1994
Consumer Price Index	$167.87	$224.50
Dollars Spent per Angler Trip	$26.00	$38.12
Number of Angler Trips		499,738
Economic Value of Fishery		**$19,050,013**

3.2 Fisheries Surveys

Electrofishing and gillnet sets were used to estimate the relative abundance of each fish species in Lake Roosevelt. The most common fish species was the largescale sucker (*Catostomus macrocheilus*) at 35% based on all fish sampled (Table 3.11). The second most abundant fish was sculpins (16%), yellow perch (12%), smallmouth bass (8%) followed by walleye (7%) and rainbow trout (6%). Kokanee made up 3% of the sample.

The catch per unit effort, based on duration of effort only, was determined for electrofishing and gillnet surveys (Table 3.12). These efforts were from all sampling during 1994. The annual sampling effort was 2,178 minutes electrofishing and 36,397 minutes of gillnetting making a grand total of 38,575 minutes sampling effort. Appendix B lists the number captured, relative abundance, and CPUE by site, month and species.

Table 3.11 Relative abundance of fish collected by electrofishing boat and **gillnets** in Lake Roosevelt during 1994.

Family species	Common Name	Electro-	Gillnet	Annual
Catostomidae				
Catostomus macrocheilus	largescale sucker	36%	15%	35%
Catostomus catostomus	longnose sucker	2%	1%	2%
Catostomus columbianus	bridgelip sucker	<1%	--	<2%
Centrarchidae				
Micropterus dolomieui	smallmouth bass	8%	6%	8%
Lepomis gibbosus	pumpkinseed	2%	--	1%
Pomoxis sp.	crappie sp.	<1%	<1%	<1%
Cottidae				
Cottus beldingi	piute sculpin	16%	0%	16%
Cyprinidae				
Cyprinus carpio	carp	1%	1%	1%
Richardsonius balteatus	redside shiner	<1%	--	<1%
Tinca tinca	tench	<1%	--	<1%
Ptychocheilus oregonensis	squawfish	4%	2%	4%
Gadidae				
Lota lota	burbot	<1%	4%	1%
Ictaluridae				
Ictalurus nebulosus	brown bullhead	<1%	0%	<1%
Percidae				
Stiwstedion vitreum vitreum	walleye	7%	19%	7%
Perca flavescens	yellow perch	12%	10%	12%
Salmonidae				
Savelinus fontinalis	brown trout	<1%	0%	<1%
Salvelinus confluentus	bull trout	<1%	0%	<1%
Salmo trutta	brook trout	<1%	0%	<1%
Oncorhynchus tshawytscha	chinook salmon	<1%	0%	<1%
Oncorhynchus nerka	kokanee salmon	4%	1%	3%
Coregonus clupeaformis	lake whitefish	<1%	40%	2%
Prosopium williamsoni	mt. whitefish	<1%	0%	<1%
Oncorhynchus mykiss	rainbow trout	7%	2%	6%

Table 3.12. Catch per unit effort based on time (minutes) for fish captured by **electrofishing** boat or **gillnets** during 1994.

	Electrofish		Gillnet		Total	
	CPUE	No.	CPUE	No.	CPUE	No.
largescale sucker	1.37	3,004	<0.01	54	**0.08**	**3,058**
Cottus spp.	0.63	1,368	0.00	0	**0.04**	**1,368**
walleye	0.26	570	<0.01	70	**0.02**	**640**
smallmouth bass	0.32	700	<0.01	22	**0.02**	**722**
rainbow trout	0.25	554	<0.01	9	0.01	**563**
squawfish	0.14	308	<0.01	7	0.01	**315**
carp	0.05	117	<0.01	2	**<0.01**	119
yellow perch	0.46	1,015	<0.01	35	**0.03**	1,050
brown trout	0.01	22	0.00	0	**<0.01**	**22**
kokanee salmon	0.14	296	<0.01	2	0.01	**298**
chinook salmon	<0.01	1	0.00	0	**<0.01**	1
crappie	<0.01	4	<0.01	1	**<0.01**	**5**
bull trout	<0.01	1	0.00	0	**<0.01**	1
brook trout	0.01	13	0.00	0	**<0.01**	13
burbot	0.04	78	<0.01	13	**<0.01**	91
lake whitefish	0.01	20	<0.01	146	**<0.0**1	166
mountain whitefish	<0.01	4	0.00	0	**<0.01**	**4**
brown bullhead	<0.01	3	0.00	0	**<0.01**	**3**
longnose sucker	0.07	160	<0.01	4	**<0.01**	**164**
bridgelip sucker	<0.01	1	0.00	0	**<0.01**	1
redside shiner	<0.01	7	0.00	0	**<0.01**	**7**
pumpkinseed	0.06	131	0.00	0	**<0.01**	131
tench	<0.01	10	0.00	0	**<0.01**	10
Totals	**3.85**	**8,389**	0.01	365	0.10	3,754

3.3 Age, Back Calculations and Condition Factor

Length, weight and condition of kokanee collected by electrofishing or gillnet surveys are reported in Table 3.13. Sixty five kokanee were collected during 1994. The condition factor of the kokanee was greater than 1.00 for age classes zero through four. The back calculated growth of kokanee indicated an average growth of 129 mm for the first year of life, 124 mm for the second year and 239 mm for the third year (Table 3.14). This translates into a mean total lengths of 129 mm for age 1 fish, 253 mm for age 2 fish and 363 mm for age three fish.

Table 3.13. Lengths, weights, and condition factors (mean ± standard deviation) of kokanee salmon collected during 1994.

Age	n	Length (mm)	Weight (g)	Condition Factor
0+	1	109 ± 0	15 ± 0	1.16 ± 0
1+	0	- ± -	- ± -	- ± -
2+	11	355 ± 48	507 ± 152	1.13 ± 0.18
3+	41	424 ± 77	835 ± 398	1.04 ± 0.16
4+	1	444 ± 0	1,050 ± 0	1.20 ± 0

Table 3.14. Back calculated total length (mean ± standard deviation) of kokanee salmon sampled during 1994.

		Back Calculated Total Length (mm) at Annulus			
Cohort	n	1	2	3	4
1993	0				
1992	11	139 ± 36	280 ± 51		
1991	41	126 ± 27	246 ± 58	364 ± 69	
1990	1	155 ± 0	237 ± 0	305 ± 0	408 ± 0
Grand Mean	53	**129** ± 29	**253 ± 57**	**363 ± 69**	**408 ± 0**
Annual Growth		129	124	**239**	**45**

The lengths, weights and condition factors of rainbow trout collected during 1994 are identified in Table 3.15. The condition of each age class of rainbow trout was greater than 1.00 regardless of age indicating a healthy population. The back calculated lengths suggest that more recent cohorts had faster growth rates than less recent cohorts (Tablė 3.16). The reason for the increased growth rates were not known. This rainbow trout length data was based primarily on net pen fish. A few wild rainbow were sampled in the Sanpoil River.

Table 3.15. Lengths, weights, and condition factors (mean ± standard deviation) of rainbow trout collected during 1994.

Age	n	Length (mm)	Weight (g)	Condition Factor
0+	9	131 ± 36	35 ± 25	1.30 ± 0.17
1+	26	265 ± 62	262 ± 164	1.24 ± 0.20
2+	34	379 ± 57	653 ± 265	1.15 ± 0.18
3+	30	456 ± 56	1,110 ± 357	1.19 ± 0.27
4+	8	503 ± 45	1,463 ± 196	1.23 ± 0.19

Table 3.16. Back calculated total length (mean ± standard deviation) of rainbow trout sampled during 1994.

		Back Calculated Total Length (mm) at Annulus			
Cohort	n	1	2	3	4
1993	26	169 ± 55			
1992	34	158 ± 44	288 ± 63		
1991	30	141 ± 42	264 ± 56	379 ± 51	
1990	8	116 ± 29	224 ± 56	334 ± 58	432 ± 50
Grand Mean		152 ± 48	271 ± 62	370 ± 55	432 ± 50
Annual Growth		152	119	99	62

The length, weight and condition factor of walleye sampled by electrofishing and gillnet sets are summarized in Table 3.17. One hundred sixty three walleye were measured in 1994. The walleye condition factor ranged from 0.67 to 1.01 depending on the age of the fish. Mean lengths ranged from 151 mm for zero plus fish to 730 mm for age ten fish. The back calculated length by cohort is reported in Table 3.18. The length for age one fish appeared to be 25 mm shorter or less for the 1993 cohort in comparison to the 1992 and 1991 cohorts. The age two fish in the 1992 cohort were less than the 1991 cohort.

Table 3.17. Lengths, weights, and condition factors (mean ± standard deviation) of walleye collected during 1994.

Age	n	Length (mm)	Weight (g)	Condition Factor
0+	11	151 ± 28	35 ± 22	0.92 ± 0.27
1+	29	221 ± 57	111 ± 68	0.94 ± 0.32
2+	26	326 ± 54	230 ± 159	0.80 ± 0.21
3+	38	395 ± 69	535 ± 285	0.71 ± 0.31
4+	25	471 ± 48	959 ± 332	0.88 ± 0.11
5+	18	487 ± 49	1,106 ± 366	0.91 ± 0.46
6+	8	589 ± 69	1,753 ± 665	0.82 ± 0.07
7+	2	600 ± 35	2,245 ± 502	1.03 ± 0.05
8+	3	682 ± 39	2,283 ± 1,770	0.67 ± 0.50
9+	2	638 ± 176	3,173 ± 2,903	1.01 ± 0.25
10+	1	730 ± 0	3,080 ± 0	0.79 ± 0

Table 3.18. Rack calculated total **length** (mean ± standard deviation) of walleye sampled during 1994.

		Back Calculated Total Length (mm) at **Annulus**									
Cohort	**n**	1	2	3	4	5	6	7	8	9	10
1993	29	126 ± 32									
1992	26	141 ± 34	262 ± 45								
1991	38	156 ± 147	280 ± 247	400 ± 421							
1990	25	136 ± 23	241 ± 38	336 ± 48	406 ± 48						
1989	18	133 ± 29	241 ± 46	331 ± 44	391 ± 48	450 ± 46					
1988	8	151 ± 25	262 ± 66	349 ± 72	427 ± 64	499 ± 70	558 ± 70				
1987	2	156 ± 7	245 ± 18	232 ± 100	413 ± 42	481 ± 25	521 ± 3	557 ± 3			
1986	3	127 ± 26	226 ± 52	296 ± 47	381 ± 37	469 ± 8	530 ± 12	593 ± 29	652 ± 35		
1985	2	125 ± 111	234 ± 130	319 ± 149	380 ± 161	435 ± 150	497 ± 169	524 ± 164	570 ± 164	618 ± 162	
1984	1	206 ± 0	247 ± 0	314 ± 0	393 ± 49	457 ± 0	532 ± 0	584 ± 0	625 ± 0	666 ± 0	774 ± 0
Grand Mean		**141 ± 78**	**258 ± 142**	**357 ± 267**	**402 ± 53**	**465 ± 57**	**539 ± 68**	**566 ± 71**	**620 ± 87**	**634** ± 118	**774 ± -**
Annual Growth		141	117	99	**45**	63	74	27	54	14	140

3.4 Feeding Habits

Feeding habits were based on fish sampled during electrofishing and gillnet sets. A total of 21 kokanee, 93 rainbow trout and 91 walleye stomachs were collected and the contents of the stomachs were enumerated by taxa. The annual index of relative importance (IRI) is reported in Table 3.19 for each species regardless of age by food item. Appendix C lists the index of relative importance, percent of food items by number and weight and the frequency of food item occurring for each fish species and age.

According to the IRI, kokanee's primary food item was *Daphnia* spp. (95.17). The two most important food items for rainbow trout were*Daphnia* spp (38.09) and chironmonidae pupa (11.05). The most important food items for walleye were fish (51.90) and chironmidae pupa (22.26).

Diet overlap analysis predicted that kokanee and rainbow trout overlap was 0.67 (high-moderate overlap). Kokanee and walleye diet overlap was 0.18 (low overlap) and rainbow and walleye diet overlap was 0.45 (moderate overlap).

3.5 Trawling

During mid-November six nights were devoted to trawling for kokanee salmon in Lake Roosevelt. Thirty trawls were conducted in the Lake, 14 of the trawls were at night and 16 were during the day. The trawls pulled during the day were used for standardizing the depth of the net at different pull cable pay out lengths and at different boat speeds.

Trawling occurred at Hunters (4 hauls), the confluence of the Spokane River and the Columbia River (6 hauls) and between the dam and Keller Ferry (30 hauls). Night trawling has been reported to be the most efficent time period for capturing kokanee (Bowler et al. 1979) and therefore the night trawls were considered to be an accurate measure of kokanee abundance. Over 37 km were trawled at night, straining over 2.1 million cubic meters (17 million gallons) of water through the net. No kokanee were captured during this trawling period. The only fish captured were cottidae *sp.* (n=9). These fish were captured when the trawl net accidentally touched the bottom.

Table 3.19. Index of relative importance for kokanee (n=21), rainbow trout (n=93), and walleye (n=91) from fish collected during 1994. '--' indicates no organisms found.

PREY ITEM	Index of Relative Importance Kokanee	Rainbow	Walleye
Osteichthyes			
Catostomidae	--	--	1.43
Cottidae	--	--	8.00
Cyprinidae	--	1.15	--
Percidae	--	--	11.02
Salmonidae	--	--	9.24
Unidentified fish	--	0.82	20.11
Fish eggs	--	1.90	2.10
Amphipoda			
Gammeras sp.	--	1.05	0.65
Cladocera			
L. kindtii	--	1.64	0.32
Daphnia spp.	95.17	38.09	9.80
B. longirostris	--	0.25	--
Eucopepoda			
E. nevadensis	1.61	--	--
L. ashlandi	--	1.23	0.32
Copepoda *sp*.	--	0.25	--
Basommatophora			
Lymeaeidae	--	5.66	--
Physidae	--	1.87	--
Pelecypoda			
Sphaeridae	--	4.64	--
Diptera			
Chironomidae pupa	--	11.05	22.26
Chironomidae larvae	--	6.10	9.85
Chironomidae adult	--	1.51	--
Trichoptera			
Limnephilidae	--	0.77	0.67
Leptoceridae	--	--	0.32
Hydropyschidae	--	0.25	0.32
Hemiptera			
Corixidae	--	6.69	0.32
Plecoptera			
Perlodidae	--	0.25	0.59
Ephemeroptera			
Baetidae	--	0.25	0.65
Ephemerellidae	--	0.25	--
Leptophlebiidae	--	0.28	--
Odonata			
Anisoptera	--	0.61	--
Zygoptera	--	1.49	0.32
Coleoptera			
Elmidae	--	1.04	--
Lepidoptera			
Pyralidae	--	0.25	--
Oligochaeta			
Lumbriculidae	--	--	0.67
Hydrachnellae			
Hydracharina	1.59	1.73	--
Terrestrial	1.63	8.95	1.63

4.0 DISCUSSION

The main objective of this study was to monitor and evaluate the effects of stocking Sherman Creek and Spokane Tribal Hatchery reared kokanee salmon and rainbow trout into Lake Roosevelt on the ecosystem and the fishery. Sub-objectives were to identify stocking strategies which: maximize the number of hatchery kokanee and rainbow trout harvested or captured by anglers; maximize the collection of kokanee eggs at egg collection facilities and maximize the quality of fish harvested (large size and good condition). We evaluated the effects of the stocking program on the fishery by comparing data collected prior to stocking Spokane Tribal and Sherman Creek Hatcheries fish (pre hatchery) with data collected after stocking began (post hatchery).

4.1 Historical Stocking and Lake Operations

There were two general factors effecting the recruitment of hatchery origin rainbow trout and kokanee salmon into the fishery. The first was stocking strategies controlled by the Hatchery Coordination Team (Team). One member each from the Washington Department of Fish and Wildlife (WDFW), the Colville Confederated Tribes and the Spokane Tribe of Indians made up the Team. The Team's job was to determine: the number of fish stocked; the size of fish stocked; the time of year to stock the fish; where in the lake to stock the fish and method of stocking (eg. by truck). The other variables, not under Lake Roosevelt Fish Managers control, was lake operations. Mother nature, economics and politics (i.e., rainfall, snow pack, power demand, irrigation) controlled the operation of the lake.

Stocking of rainbow trout began 1986 when the WDFW started supplying rainbow trout fry to the Lake Roosevelt Net Pen Program (operated by a volunteer organization, Lake Roosevelt Development Association). Table 4.1 indicates the number and the source of rainbow trout provided to the net pen operators. By July of 1988, the WDFW began stocking kokanee into the lake (Table 4.2). The kokanee were stocked at Sherman Creek (760,000 fry) and at Little Falls Dam on the Spokane River (14 1,000 fry). WDFW continued stocking approximately the same number of kokanee at Sherman Creek and Spokane River in 1989 and 1990. The Spokane Tribal Hatchery went on line in 1990 and began releasing rainbow trout and kokanee in 1991. Sherman Creek went on line

Table 4.1 Summary of hatchery origin rainbow trout released into Lake Roosevelt from 1988 though 1994.

Year	Hatchery	Number
1986	Spokane (WDFW)	50,000
1987	Spokane (WDFW)	80,000
1988	Spokane (WDFW)	150,00
1989	Spokane (WDFW)	175,00
1990	Spokane (WDFW)	276,500
1991	Spokane Tribal	326,461
1992	Spokane Tribal	424,395
1993	Spokane Tribal	446,798
1994	Spokane Tribal	449,183

Table 4.2 Summary of hatchery origin kokanee released into Lake Roosevelt from 1988 though 1994.

Year	Hatchery	Number	Life Stage	Size (#/lb)
1988	Ford	872,150	fry	500
1989	Ford	861,442	fry	280
1990	Ford	1,025,400	fry	247
1991	Spokane Tribal	1,674,577	fry	119
1992	Spokane Tribal	71,256	yearling	9
1992	Spokane Tribal	819,220	fry	158
1992	Sherman Creek	68,552	yearling	22
1992	Sherman Creek	1,099,000	fry	616[a]
1993	Spokane Tribal	21,190	yearling	7
1993	Spokane Tribal	1,024,293	fry	225
1993	Sherman Creek	72,508	yearling	15
1993	Sherman Creek	675,572	fry	228
1994	Spokane Tribal	123,254	yearling	10
1994	Spokane Tribal	1,910,255	fry	125
1994	Sherman Creek	90,881	yearlings	11[a]
1994	Sherman Creek	1,087,161	fry	372[a]

a size transferred from Spokane Tribal Hatchery nor at release.

and began releasing kokanee in 1992. Once the new hatcheries were operational, close to 450,000 rainbow trout and 2 million kokanee were released annually.

Lake operations for the time period 1989 through 1994 are depicted in Figures 4.1 and 4.2. Figure 4.1 identifies the monthly mean lake elevation above sea level in feet. Figure 4.2 shows the monthly mean water retention time of Lake Roosevelt in days. Generally, when the elevation of the lake falls below 1,240 feet elevation the water retention time falls below thirty days, however, this was dependent of the volume of water flowing into and out of the lake. The years 1989 and 1991 were the two years between 1989 and 1994 which were considered to be extraordinarily bad for the fishery (Thatcher et al. 1993, 1994). The lake elevation fell below 1,240 feet and the water retention time was below 30 days.

Griffith and Scholz (1991) and Thatcher et al.'s (in press) 1991 and 1992 annual reports have identified that water retention times less than thirty days have had dramatic effects on the biota of Lake Roosevelt. The zooplankton population decreased and the entrainment of fish out of the lake through Grand Coulee Dam increased. The resulting decrease of fish food (zooplankton) and decrease of fish (fish entrainment) negatively impacted the fishery.

4.2 Creel Survey Trends.

4.2.1 Rainbow trout

The rainbow trout stocked via net pens were recruited into the fishery the first year of stocking. Tagging studies of net pen rainbow trout showed that a large majority of the rainbow trout were harvest that same year stocked and a small portion were harvested the next year (Peone et al. 1990, Griffith and Scholz 1991, Griffith et al. 1992, Griffith and McDowel 1993, Voeller 1996, Thatcher et al. 1993, and 1994).

Table 4.3 reports the estimated number of rainbow trout caught and harvested. From 1989 through 1994 there was a steady increase in the number of rainbow trout harvested. However, in 1991 the number of rainbow harvested dipped slightly. The reason for the dip was believed to be due to the large spring drawdown of that year (Thatcher et al. 1993, 1994). The drawdown caused a decrease in the number of rainbow harvested for two

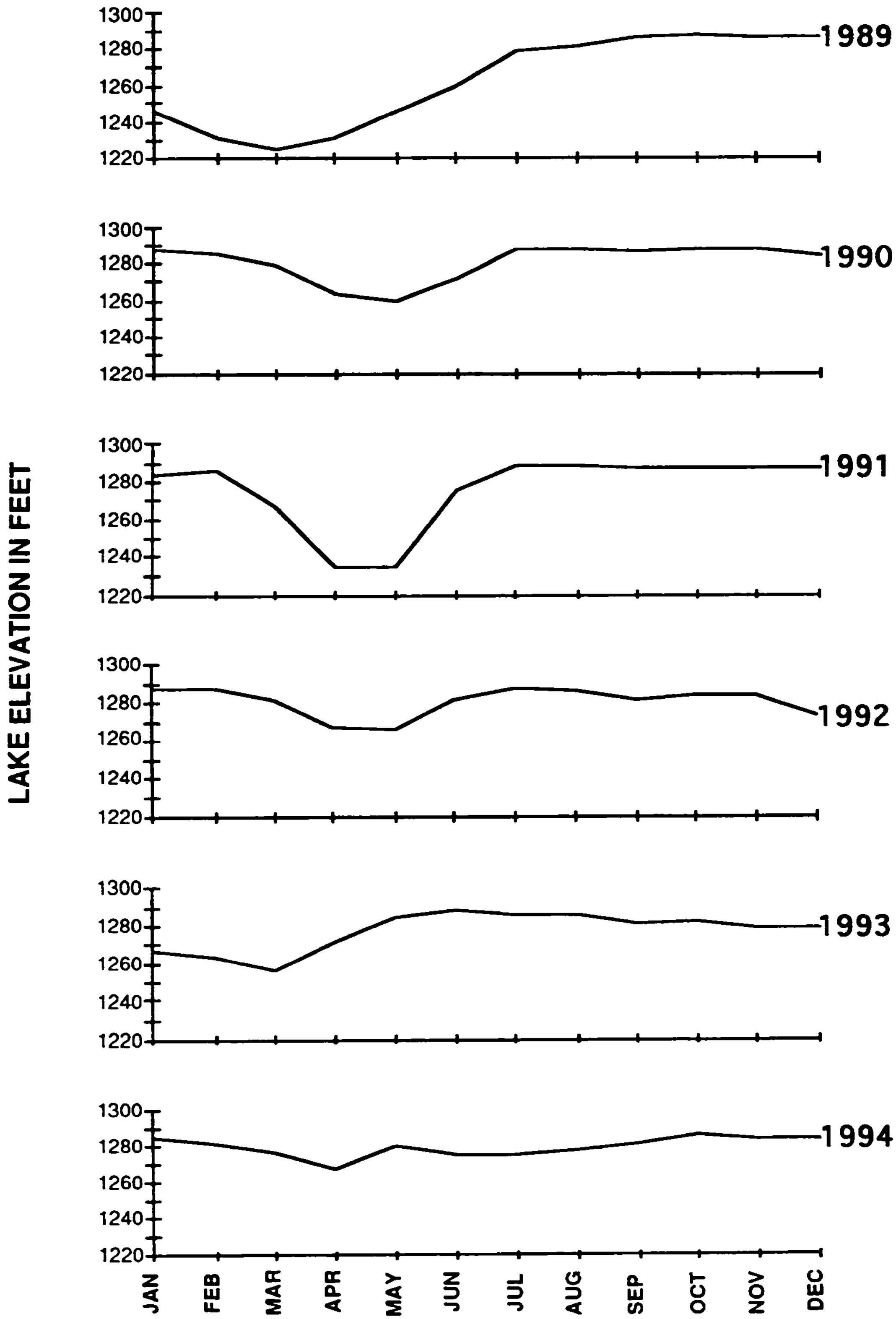

Figure 4.1 Lake elevations for Lake Roosevelt from 1989 through 1994.

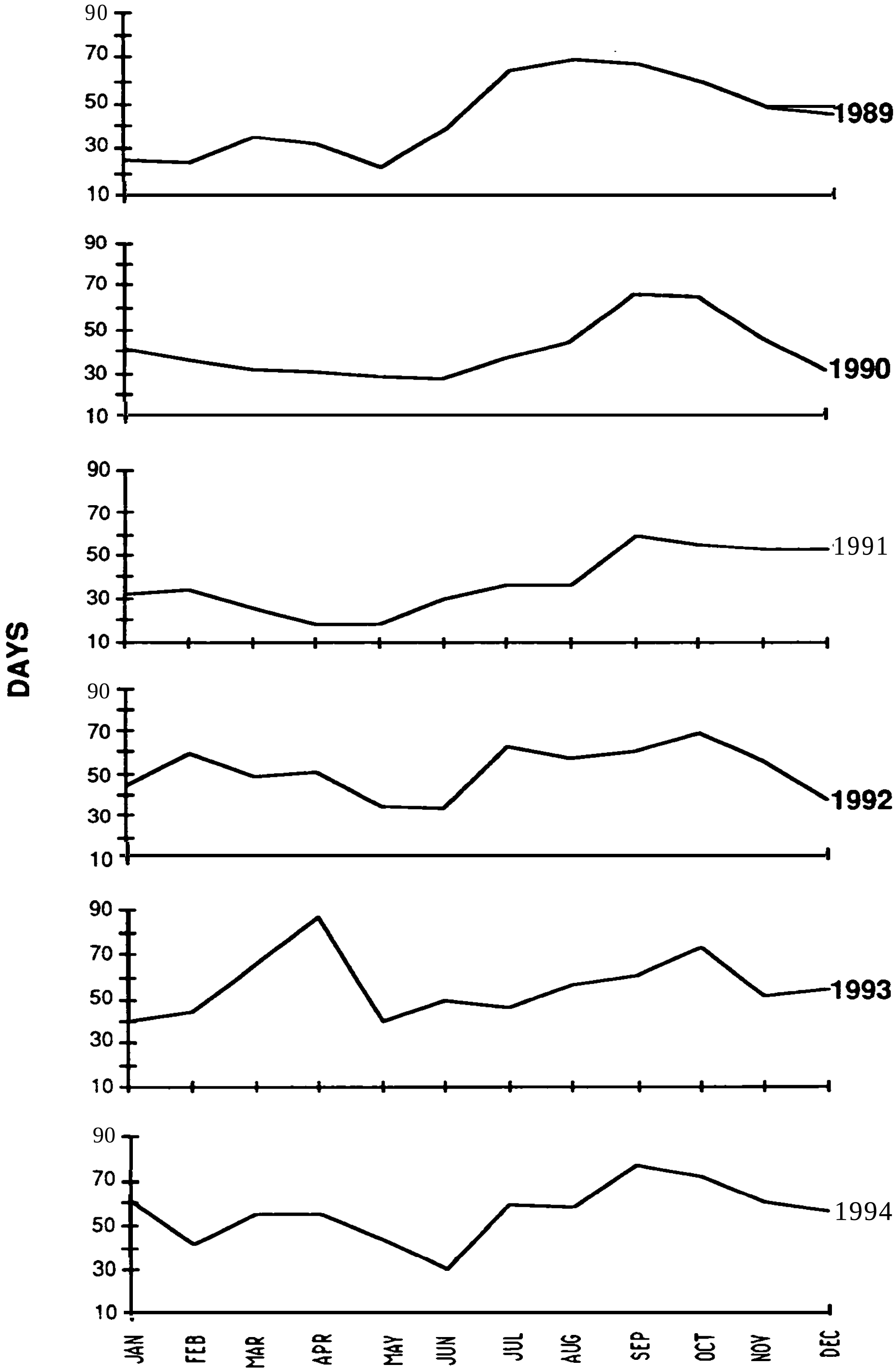

Figure 4.2 Water retention times for Lake Roosevelt from 1989 through 1994.

reasons. First, the lowered lake level from the drawdown dewatered a majority of the boat ramps surrounding the lake limiting angler access. Fewer anglers means less effort resulting in less fish caught. Secondly, the decreased water retention time (a result of the drawdown) caused entrainment of rainbow through Grand Coulee Dam (Griffith and McDowel 1993). The limited time spent by anglers fishing for rainbow and the loss of available rainbow trout for harvest resulted in a decrease in the catch and harvest.

The 1994 rainbow trout harvest increased by 100,000 from 1993 to 1994. The estimated harvest in 1993 was 402,277 fish and in 1994; 499,293 fish were harvested. Although the annual angler pressure had decreased by more than 100,000 hrs the harvest increased. This can be explained by the harvest per unit effort. The harvest per unit effort was 0.16 HPUE (6.25 angler hrs/fish) in 1993 and 0.21 HPUE (4.7 angler hrs/fish) in 1994.

The harvest of rainbow trout increased significantly when comparing harvest estimates of years prior to 1993 and years from 1993 to present. Estimated harvest for the years prior to 1993 ranged from 65,515 to 140,609. For years from 1993 to present the harvest ranged from 398,984 to 499,293 rainbow trout. The increased harvest of rainbow may be due to lake operations. During the spring drawdown in 1989 and 1991, Lake Roosevelt was drawn down to a lake elevation of 1225 and 1234 respectively. Thatcher et al (1994) identified that in years of large drawdowns, such as the years 1989 and 1991, the entrainment of rainbow trout was excessive (25,000 fish or greater). The entrainment caused a reduction in the number of fish available for harvest. In addition angler were unable to launch boats due to dewatered boat ramps causing a reduction in anglers pressure. In years after a large draw down the rainbow harvest appeared to be recovering slightly with a greater number of harvested rainbow. The years 1993 and 1994 marked the first year during the study in which a drawdown had not happened the year before resulting in a significant increase in harvested fish.

4.2.2 Kokanee Salmon

The recruitment of hatchery origin kokanee to the fishery has not been as successful as the rainbow trout. The kokanee stocked in 1988 through 1991 were small fry ranging from 500 fish per pound to 119 fish per pound. The 1992 annual report of this study established that walleye were clustering at stocking sites. The walleye collected at kokanee stocking sites were full of newly stocked kokanee fry (Thatcher et al. 1994). The impact of the walleye on the survival of stocked kokanee has not been quantified, however, we suspect walleye many have a significant impact on the newly stocked kokanee fry population.

Kokanee did not enter the creel until they were approximately 300 mm or greater in length. Kokanee 300 mm long were generally age two or older suggesting that kokanee released as fry must survive in Lake Roosevelt for 1.5 years before recruitment to the creel. Experimental work conducted by Tilson et al. (1994) and Scholz et al. (1992 and 1993) identified that kokanee go through a partial smoltification phase as yearlings during spring. During the smoltification process kokanee have the urge to swim downstream. The time period in which the kokanee have the urge to swim downstream coincides with the spring drawdown. Therefore, kokanee stocked as fry were vulnerable to the fast flowing currents of the spring drawdown and entrainment resulted. Thatcher et al. (1994) estimated over 25,000 rainbow trout were entrained through Grand Coulee in 1991. We believe the number of kokanee entrained that year was great than that of rainbow. Further evidence of kokanee fry's inability to achieve a harvestable size comes from the coded wire tagging studies conducted by Tilson et al. (1994) and Scholz et al. (1992 and 1993). Of all the coded wire tagged fish collected, only (1%) of the recovered fish were stocked as fry. The rest (99%) were stocked as yearlings (post smolts). Yet, 72% of the kokanee stocked with coded wire tags were fry and 28% were yearlings (Tilson et al. 1994).

The number of kokanee harvested from 1989 to 1991 was building in number from 11,906 fish to 31,651 fish. However, the number of kokanee harvested in 1992 fell by a third to 8,021 fish (Table 4.3). The reason for the reduced harvest in 1992 may be the severe drawdown of 1991. The drawdown may have entrained a majority of the year class that would have entered the creel in 1992. The number of kokanee harvested in 1993 (13,960 fish) and 1994 (16,567 fish) appeared to be increasing slightly, but it was still half of what was estimated for 1991's harvest.

4.2.3. Walleye

Up to 1994 the number of walleye harvested steadily increased and reached its pinnacle in 1993 with an estimated 307,668 fish harvested. However in 1994 the harvest of walleye dropped to the lowest estimate in study history at 53,586 fish (Table 4.3). The walleye population in Lake Roosevelt has not been supplemented with artificially propagated fish and therefore, the increased number of harvested walleye was believed to be the result of

Table 4.3 Summary of angler trips, number of fish caught and harvested, Catch and harvest per unit of effort and mean lengths of kokanee, rainbow trout and walleye from 1989 through 1994.

	1989	1990	1991	1992	1993	1994
Angler Trips	179,871	171,725	398,408	291,380	594,508	469,998
No. Caught						
kokanee		17,756	31,651	8,146	13,986	16,567
rainbow		81,560	81,529	167,156	402,277	499,460
walleye		116,473	231,813	163,995	337,413	123,612
No. Harvested						
kokanee	11,906	17,515	31,651	8,021	13,960	16,567
rainbow	65,515	79,683	73,777	140,609	398,943	499,293
walleye	80,626	82,284	168,736	118,863	307,663	53,589
CPUE						
kokanee	0.04	0.03	0.06	0.03	0.01	<0.01
rainbow	0.16	0.13	0.20	0.22	0.17	0.21
walleye	0.20	0.11	0.11	0.15	0.12	0.08
HPUE						
kokanee	0.04	0.02	0.06	0.03	0.01	<0.01
rainbow	0.15	0.12	0.20	0.18	0.16	0.21
walleye	0.09	0.08	0.08	0.11	0.08	0.05
Mean Length						
kokanee	411	391	361	436	486	481
rainbow	403	346	348	422	471	473
walleye	447	376	397	361	382	385

increased angler pressure (hours fished). The harvest per unit effort supports this idea. The HPUE had remained relatively constant over the last five years ranging from 0.09 to 0.11 HPUE. Therefore, the same rate of harvest was occurring but the number of anglers had increased resulting in more walleye kept. In 1994, the number of anglers decreased slightly and the HPUE dropped from 0.8 to 0.05. The reduced HPUE seems to indicate that the number of harvestable walleye had diminished. We believe this was due to overharvest in 1993.

4.2.4 Accuracy and Precision

The estimated harvest of rainbow trout and walleye appeared to be greater than what was possible in 1993 and 1994. Less than 10% of the rainbow trout harvest was composed of wild origin fish and the rest were from net pens according to accounts by the creel clerks. In 1993 and 1994, we estimated that 446,798 and 449,183 net pen origin rainbow were released, respectively. The harvest estimates for 1993 was 398,943 and in 1994 was 499,294 trout. If 90% of the rainbow trout harvested were of net pen origin than the 79% of the released rainbow trout were harvested in 1993 and over 100% in 1994. We do not believe that all of the rainbow trout released were harvested. We have documented walleye prey on released rainbow, and entrainment of rainbow trout over the dam. These factors would reduce the available rainbow trout for harvest. As a result the number of fish harvested appears to be over estimated.

On the other hand, the creel clerks may not be correctly identifying wild (spawn in the wild) verses net pen (hatchery spawn). The way the creel clerks tell a native fish from a wild fish was the morphology of the fish. The wild native fish of Lake Roosevelt were sleek with a reddish steelhead coloration. The net pen fish had a stout body type with a greenish back. It is possible that the net pen stocked rainbow trout have been spawning in tributaries of Lake Roosevelt and Canada. This would cause a large surplus of hatchery genes fish to show up in the creel but be from a wild origin. As a result many more fish would be harvestable.

Until a detailed analysis can be conducted to determine possible sources of error in the creel, the accuracy of the harvest estimates are in question. However, we believe that the survey was relatively precise. The relative magnitude of change in the number of fish harvest correlates closely with the anglers general perception of the fishery. Over the past two years, angler have been stating that the rainbow fishing was very good and the kokanee fishery was getting better.

4.3 Growth and Feeding.

Peone et al. (1990) examined the growth of Lake Roosevelt kokanee, rainbow trout and walleye, in comparison to growth of these species in area lakes. The comparison was made using back calculated lengths from scales. Peone concluded that fish in Lake Roosevelt grew to a larger size at a young age than fish in area lakes. Their statement still hold true in 1994 for rainbow trout and kokanee. However, their statement does not hold true for walleye. The back calculated length of walleye sampled in 1994 was below the walleye length average of area lakes by approximately three centimeters per year of life (Table 4.3). The slower growth rates may be an early indicator that the food base for walleye was limited.

The feeding habits of rainbow trout, kokanee and walleye have not significantly changed over the years. Rainbow trout and kokanee salmon mostly utilize daphnia and chironomids. Walleye fed primarily on fish as adults and chironomids as juveniles. The diet overlap among rainbow trout, kokanee and walleye were similar to previous years. Rainbow and kokanee had a high diet overlap (0.67) meaning kokanee and rainbow trout used similar food types where as kokanee and walleye did not use similar food types (0.18). Rainbow and walleye diet overlapped moderately (0.45). Diet overlap helps predict species which may compete for food provided food was limited. However, food does not appear to be limited. If food was limited we would expect to see a decrease in growth rates or poor condition factors. Nether of these have occurred.

Feeding habits and growth analysis both suggest that rainbow trout and kokanee populations had ample food. This statement was substantiated by the fact that both species had excellent condition factors (1.03 for kokanee and 1.25 for rainbow). On the other hand, walleye growth appeared to be slowing and the availability may be the cause. The condition factor of walleye was 0.89 which was not different than past years. More years of data are required to determine if walleye were experience a limitation of food.

4.4 Trawling

Six November nights of trawling resulted in sifting over 37 km (2.1 million cubic meters or 17 million gallons) of water through a trawl net. Not one kokanee was collected by that sampling effort. This was the second attempt at using trawling as a method to estimate kokanee population density. The first time was during August and not one kokanee was collect during that sampling effort. At the time we thought the reason we were not collecting kokanee was due to the warm water of August causing the kokanee to stay deeper in the water column than the net was able to reach. So we attempted to collect kokanee again in November when the water temperature was cool. Unfortunately the second try resulted in the same out come as the first try. After a lengthy discussion with Meolie (personnel communication 1994), we hypothesized that the density of kokanee was not large enough to easily catch kokanee in a trawl net. He indicated that when lake he had trawled had estimated densities of kokanee of 8 or less fish per hectare they rarely captured a fish. Only when fish were closer to 16 fish per hectare was the trawl net a suitable sampling device. As a result, the trawling system may still be a viable sampling device for the lake but, not until the density increases.

5.0 RECOMMENDATIONS AND RESEARCH NEEDS

1) Quantify the impact of walleye on newly stocked kokanee. This will give us a better estimate of the actual number of kokanee stocked into the lake after walleye have reduced the population.

2) Record origin of every fish sampled so that comparisons can be made between hatchery origin and wild origin fish. We were unable to determine the number of hatchery and wild origin kokanee harvested.

3) Evaluate the scientific design of the creel survey and methods used to compute indices.

4) Attempt sampling kokanee by beam trawl in late fall. Electrofishing and gillnet samples have not successfully sampled zero and yearling age kokanee. Beam trawl would enable use to collect baseline fisheries data (i.e., growth and diet) on age zero and yearling kokanee

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APPENDIX A

Creel Survey Data

Table A.1 Correction factor for boat trailers counted by creel to boats counted by air per quarter in 1993.

STRATA		YEAR 1990	1991	1992	1993	**1990-1993** MEAN ± STDEV	1992-1993 MEAN ± STDEV
WINTER	**Dec-Feb**	3.49	1.92	2.01	2.57	2.50 ± 0.72	**2.29** ± 0.39
SPRING	Mar-May	3.02	3.74	**1.08**	**1.52**	2.34 ± 1.25	**1.30** ± 0.31
SUMMER	**Jun-Aug**	3.71	3.17	1.10	**1.01**	2.25 ± 1.40	**1.06** ± 0.06
FALL	**Aug-Nov**	1.46	3.13	1.17	1.02	1.70 ± 0.97	**1.10** ± 0.11
ANNUAL	**Dec-Nov**	2.92	2.99	1.34	1.53	2.19 ± 0.88	**1.44** ± 0.13

Table A.2 Correction factor for boat trailers counted by creel to boats counted by air in 1993. Split by weekday (WD) and weekend (WE) strata.

STRATA		YEAR 1990	1991	1992	1993	**1990-1993** MEAN ± STDEV	**1992-1993** MEAN ± STDEV
WINTER	**WD**	3.90	1.60	1.07	2.14	**2.18** ± 1.23	1.61 ± 0.76
	WE	1.84	2.24	2.49	2.85	**2.35** ± 0.42	2.67 ± 0.26
SPRING	**WD**	3.65	5.73	1.50	1.43	**3.08** ± 2.05	1.47 ± **0.05**
	WE	2.39	1.75	0.77	1.78	**1.67** ± 0.67	**1.28** ± 0.71
SUMMER	**WD**	3.37	2.96	1.13	0.66	**2.03** ± 1.33	0.90 ± 0.33
	WE	4.12	3.59	1.05	1.35	**2.53** ± 1.55	**1.20** ± 0.22
FALL	**WD**	1.53	4.07	1.27	0.87	**1.93** ± 1.45	1.07 ± 0.28
	WE	1.41	2.20	1.10	1.33	1.51 ± 0.48	1.22 ± 0.16
ANNUAL	WD	3.11	3.59	1.24	1.28	**2.30** ± 1.22	1.26 ± 0.03
	WE	2.44	2.45	1.35	1.83	**2.02** ± 0.53	**1.59** ± 0.34

Table A.3 Section 1 pressure estimates in hours for boat anglers in 1994 with intermediate calculations.

STRATA		Correct. factor	Mean boat trailers for the day	% of boats fishing	# angler/ boat	# of angler/ boat S.D.	Corrected mean angler	Corrected x angler sd
December	WD	1.60	0.00	1.00	2.00		0.0	
	WE	2.67	0.00	1.00	1.00		0.0	
January	WD	1.60	0.60	1.00	2.00		1.9	
	WE	2.67	1.33	1.00	2.30	1.55	8.2	5.5
February	WD	1.60	0.17	1.00	2.00		0.5	
	WE	2.67	0.50	1.00	1.00		1.3	
March	WD	1.46	1.67	0.88	1.29	0.49	2.7	1.0
	WE	1.28	13.33	0.90	1.83	0.41	28.1	6.3
April	WD	1.46	2.20	1.00	1.80	0.84	5.8	2.7
	WE	1.28	13.00	1.00	2.00	0.00	33.3	0.0
May	WD	1.46	2.67	1.00	1.70	0.68	6.8	2.6
	WE	1.28	12.33	1.00	2.00		31.6	
June	WD	0.90	3.25	1.00	1.33	0.52	3.9	1.5
	WE	1.20	30.25	1.00	1.80	0.84	65.2	30.4
July	WD	0.90	23.25	0.65	2.57	0.99	35.2	13.5
	WE	1.20	47.67	0.58	2.77	0.97	91.7	32.1
August	WD	0.90	26.20	0.35	2.41	1.13	19.7	9.2
	WE	1.20	65.50	0.45	2.15	2.15	75.5	75.5
September	WD	1.07	9.33	1.00	1.78	0.67	17.8	6.7
	WE	1.21	39.33	0.62	2.46	1.07	72.6	31.6
October	WD	1.07	6.00	1.00	1.73	0.59	11.1	3.8
	WE	1.21	9.50	1.00	1.40	0.55	16.1	6.3
November	WD	1.07	1.00	1.00	2.17	0.75	2.3	0.8
	WE	1.21	4.33	1.00	1.88	0.64	9.8	3.4
Annual	WD	**1.26**	6.36	0.91	1.90	0.74	9.0	-
	WE	**1.59**	**19.75**	0.88	1.88	0.91	36.1	-

Table A.4 Section 2 pressure estimates for boat anglers in 1994 with intermediate calculations.

STRATA		Correct. factor	Mean boat trailers for the day	% of boats fishing	# angler/ boat	# of angler/ boat S.D.	Corrected mean angler	Corrected x angler sd
December	WD	1.60	6.00	1.00	2.00	1.00	19.2	9.6
	WE	2.67	10.50	1.00	2.00	0.00	56.1	0.0
January	WD	1.60	6.11	1.00	2.00	1.00	19.6	9.8
	WE	2.67	23.33	1.00	2.00	0.00	124.6	0.0
February	WD	1.60	3.78	1.00	2.00	1.00	12.1	6.0
	WE	2.67	14.67	1.00	2.00	0.00	78.3	0.0
March	WD	1.46	15.75	1.00	2.50	0.71	57.5	16.3
	WE	1.28	26.00	1.00	2.07	0.39	68.9	13.0
April	WD	1.46	3.17	1.00	2.00	0.00	9.3	0.0
	WE	1.28	7.00	1.00	2.50	1.29	22.4	11.6
May	WD	1.46	7.33	1.00	1.75	0.96	18.7	10.2
	WE	1.28	35.15	1.00	2.07	0.39	93.1	17.5
June	WD	0.90	35.22	0.99	2.05	0.63	64.0	19.7
	WE	1.20	63.00	1.00	2.00		151.2	
July	WD	0.90	119.00	0.32	2.93	0.98	99.1	33.1
	WE	1.20	210.25	0.18	3.60	1.14	165.1	52.3
August	WD	0.90	105.62	0.29	2.96	1.24	82.2	34.5
	WE	1.20	213.80	0.19	2.96	1.20	140.6	57.0
September	WD	1.07	38.54	0.84	2.08	0.81	71.7	27.9
	WE	1.21	103.50	0.67	3.20	1.88	269.6	158.4
October	WD	1.07	14.77	0.77	1.67	0.62	20.4	7.6
	WE	1.21	22.17	1.00	2.33	0.52	62.5	13.9
November	WD	1.07	11.33	1.00	1.50	0.71	18.2	8.6
	WE	1.21	16.33	1.00	3.07	1.77	60.7	35.0
Annual	WD	1.26	30.55	0.85	2.12	0.80	41.0	15.3
	WE	1.59	62.14	0.84	2.48	0.78	107.8	-

Table A.5 Section 3 pressure estimates in hours for boat anglers in 1994 with intermediate calculations.

STRATA		Correct. factor	Mean boat trailers for the day	% of boats fishing	# angler/ boat	# angler/ boat S.D.	Corrected mean angler	Corrected x angler sd
December	WD	1.60	0.43	1.00	2.00	-	1.4	-
	WE	2.67	0.00	1.00	2.00	0.00	0.0	0.0
January	WD	1.60	4.14	1.00	2.00		13.2	
	WE	2.67	9.25	1.00	2.00	0.00	49.4	0.0
February	WD	1.60	9.33	1.00	2.00		29.9	
	WE	2.67	22.43	1.00	2.00	0.00	119.8	0.0
March	WD	1.46	8.94	1.00	2.00	0.00	26.1	0.0
	WE	1.28	38.00	1.00	2.00	0.56	97.3	27.0
April	WD	1.46	12.00	1.00	2.00	0.00	35.0	0.0
	WE	1.28	26.83	1.00	2.00	0.00	68.7	0.0
May	WD	1.46	31.38	1.00	2.07	0.39	95.0	17.6
	WE	1.28	75.00	1.00	2.14	0.35	205.1	33.7
June	WD	0.90	65.00	1.00	2.00	0.32	117.0	18.7
	WE	1.20	85.00	1.00	2.14	0.38	218.3	38.8
July	WD	0.90	94.13	0.32	1.86	0.36	50.4	9.8
	WE	1.20	211.00	0.18	2.00	0.00	92.1	0.0
August	WD	0.90	145.31	0.29	2.13	0.69	81.4	26.4
	WE	1.20	202.33	0.19	1.87	0.35	84.1	15.7
September	WD	1.07	46.36	0.84	1.50	0.52	62.2	21.6
	WE	1.21	104.20	0.67	1.73	0.65	146.7	55.1
October	WD	1.07	8.07	1.00	2.42	0.79	20.9	6.8
	WE	1.21	11.00	1.00	1.00	0.00	13.3	0.0
November	WD	1.07	1.86	1.00	1.92	0.80	3.8	1.6
	WE	1.21	3.20	1.00		0.65		2.5
Annual	WD	1.26	35.58	0.87	1.99	0.43	44.7	-
	WE	1.59	65.69	0.84	1.90	0.24	-	14.4

Table A.6 Section 1 angling pressure estimates (hrs) from December, 1993 to November, 1994 with intermediate calculations.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
DECEMBER													
WEEKDAY													
Shore	8.40	23	193.20	67.00	2.88	3.11	1.5	34.5	2.4	54.7	309	8.641	130
Boat	8.40	23	193.20	67.00	2.88	4.503	0.0	0.0		0.0	0	0	0
WEEKEND													
Shore	8.40	8	67.20	29.83	2.25	5.48	4.0	32.0	3.0	24.0	395	1.298	50
Boat	8.40	8	67.20	29.83	2.25	5.80	0.0	0.0	-	0.0	0	0	0
TOTAL	8.40	31	260.40	96.83			5.5	66.5	5.4	78.7	704	9,938	181
JASUARY													
WEEKDAY													
Shore	8.83	20	176.60	55.50	3.18	3.77	4.6	92.0	7.7	153.4	1,104	74,877	383
Boat	8.83	20	176.60	55.50	3.18	4.50	1.9	38.0		0.0	544	0	0
WEEKEND													
Shore	8.83	11	97.13	37.82	2.57	4.33	5.1	56.4	1.5	16.8	628	727	38
Boat	8.83	11	97.13	37.82	2.57	5.44	8.2	90.2	5.5	60.5	1,260	9,400	136
TOTAL	8.83	31	273.73	93.32			19.8	276.6	14.7	230.7	3,535	85,005	557
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	74.92	2.60	3.01	3.2	60.2	3.0	57.0	471	8,446	129
Boat	10.25	19	194.75	74.92	2.60	4.50[a]	0.5	9.5		0.0	111	0	0
WEEKEND													
Shore	10.25	10	102.50	15.00	6.83	2.80	1.2	11.7	1.4	14.1	224	1.359	52
Boat	10.25	10	102.50	15.00	6.83	6.00	1.3	13.0		0.0	533	0	0
TOTAL	10.25	29	297.25	89.92			6.1	94.4	4.4	71.1	1,339	9,804	180

a Quarterly average

Table A.6 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
MARCH													
WEEKDAY													
Shore	11.97	23	275.3 1	93.17	2.95	2.99	3.0	69.0	3.0	69.0	610	14,068	166
Boat	11.97	23	275.3 1	93.17	2.95	4.96	2.7	62.1	1.0	23.0	910	1.563	55
WEEKEND													
Shore	11.97	8	95.76	15.13	6.33	4.46	3.0	0.0	2.0	16.0	0	1,620	56
Boat	11.97	8	95.76	15.13	6.33	5.21	28.1	224.8	6.3	50.4	7,413	16,077	178
TOTAL	**11.97**	31	371.07	108.30			36.8	355.9	12.3	158.4	8,933	33,329	455
APRIL													
WEEKDAY													
Shore	13.68	21	287.28	78.28	3.67	4.72	0.2	4.2	0.5	9.5	73	328	25
Boat	13.68	21	287.28	78.28	3.67	4.89	5.8	121.8	2.7	56.7	2,186	11,798	152
WEEKEND													
Shore	13.68	9	123.12	20.00	6.16	4.88	3.0	27.0	2.0	18.0	811	1.995	63
Boat	13.68	9	123.12	20.00	6.16	5.65	33.3	299.7	0.0	0.0	10,424	0	0
TOTAL	**13.68**	30	410.40	98.28			42.3	452.7	5.2	84.2	13,494	14,121	240
MAY													
WEEKDAY													
Shore	15.20	21	319.20	80.00	3.99	9.17	1.6	33.0	1.1	23.7	1,206	2,247	66
Boat	15.20	21	319.20	80.00	3.99	6.47	6.6	138.6	2.6	54.6	3,578	11,895	153
WEEKEND													
Shore	15.20	10	152.00	20.00	7.60	12.00	1.7	16.7	1.5	15.3	1.523	1,779	59
Boat	15.20	10	152.00	20.00	7.60	6.00	31.6	316.0	-	0.0	14,410	0	0
TOTAL	**15.20**	31	471.20	100.00			41.4	504.3	5.3	93.6	20,717	15,921	278
JUNE													
WEEKDAY													
Shore	16.02	22	352.44	75.00	4.70	8.90	1.3	27.5	2.5	55.0	1,150	14.215	167
Boat	16.02	22	352.44	75.00	4.70	7.02	3.9	85.8	1.5	33.0	2.830	5.117	100
WEEKEND													
Shore	16.02	8	128.16	30.00	4.27	8.71	1.8	14.4	2.5	19.9	536	1.695	58
Boat	16.02	8	128.16	30.00	4.27	5.69	65.2	521.6	30.4	243.2	12.679	252,673	704
TOTAL	16.02	30	480.60	105.00			72.2	649.3	36.9	351.1	17,195	273,700	1,028

a Quarterly average

Table A.6 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
JULY													
WEEKDAY													
Shore	15.67	20	313.40	78.27	4.00	8.39[a]	0.8	15.0	1.5	30.0	504	3,604	84
Boat	15.67	20	313.40	78.27	4.00	5.37	35.2	704.0	13.5	270.0	15.137	291,898	756
WEEKEND													
Shore	15.67	11	172.37	30.58	5.64	11.25	2.3	25.6	1.2	12.7	1.625	902	42
Boat	15.67	11	172.37	30.58	5.64	5.37	91.7	1008.7	32.1	353.1	30,532	702,780	1,174
TOTAL	**15.67**	**31**	485.77	**108.85**			130.0	**1753.3**	48.3	665.8	47,799	999,184	2,056
AUGUST													
WEEKDAY													
Shore	14.38	23	330.74	72.07	4.59	13.00	0.2	4.6	0.5	10.4	274	492	31
Boat	14.38	23	330.74	72.07	4.59	5.66	19.7	453.1	9.2	211.6	11,769	205,477	635
WEEKEND													
Shore	14.38	8	115.04	26.00	4.42	9.47'	1.5	12.0	2.1	17.0	503	1,273	50
Boat	14.38	8	115.04	26.00	4.42	5.66	75.5	604.0	75.5	604.0	15.126	1,614,170	1,779
TOTAL	**14.38**	31	445.78	98.07			96.9	1073.7	87.3	842.9	27,672	**1,821,412**	2,494
SEPTEMBER													
WEEKDAY													
Shore	12.45	21	261.45	77.78	3.36	10.65	1.5	31.5	1.6	34.4	1.128	3,987	88
Boat	12.45	21	261.45	77.78	3.36	6.18	17.8	373.8	6.7	140.7	7,765	66,544	361
WEEKEND													
Shore	12.45	9	112.05	30.00	3.74	6.19	0.7	6.0	1.2	10.4	139	400	28
Boat	12.45	9	112.05	30.00	3.74	6.21	72.6	653.4	31.6	284.4	15.155	302,099	769
TOTAL	**12.45**	30	373.50	107.78			92.6	1064.7	**41.1**	469.9	24,187	373,030	1,247
OCTOBER													
WEEKDAY													
Shore	10.73	21	225.33	62.25	3.62	7.45	0.5	10.5	0.6	12.2	283	537	32
Boat	10.73	21	225.33	62.25	3.62	5.15	11.1	233.1	3.8	79.8	4,345	23,051	213
WEEKEND													
Shore	10.73	10	107.30	28.00	3.83	10.00	2.3	22.5	1.5	15.0	862	862	41
Boat	10.73	10	107.30	28.00	3.83	5.78	16.1	161.0	6.3	63.0	3,566	15,210	173
TOTAL	**10.73**	31	332.63	90.25			30.0	427.1	12.2	170.0	9,057	39,660	**459**

a Quarterly average

Table A.6 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
NOVEMBER													
WEEKDAY													
Shore	9.20	21	193.20	85.00	2.27	3.03	0.0	0.0	0.0	0.0	0	0	0
Boat	9.20	21	193.20	85.00	2.27	4.77	2.3	48.3	0.8	16.8	524	642	35
WEEKEND													
Shore	9.20	9	82.80	30.00	2.76	4.00	0.3	3.0	0.6	5.2	33	75	12
Boat	9.20	9	82.80	30.00	2.76	5.96	9.8	88.2	3.4	30.6	1,451	2,584	71
TOTAL	**9.20**	**30**	**276.00**	**115.00**			**12.4**	**139.5**	**4.8**	**52.6**	**2,007**	**3,301**	**119**
ANNUAL TOTAL	**146.78**	**366.0**	**4,478.3**	**1211.6**			**586.0**	**6,858.1**	**277.7**	**3,269.0**	**176,641**	**3,678,405**	**9,294**

a Quarterly average

Table A.7 Section 2 angling pressure estimates (hrs) from December, 1993 to November, 1994 with intermediate calculations.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
DECEMBER													
WEEKDAY													
Shore	8.40	23	193.20	14.42	13.40	3.22	11.29	259.67	8.65	198.95	11,203	530,310	1,020
Boat	8.40	23	193.20	14.42	13.40	8.00[a]	19.20	441.60	9.60	220.80	47,333	653.191	1.131
WEEKEND													
Shore	8.40	8	67.20	9.50	7.07	3.62	16.00	128.00	9.90	79.20	3,278	44.371	295
Boat	8.40	8	67.20	9.50	7.07	6.00[a]	56.10	448.80	0.00	0.00	19,048	0	0
TOTAL	8.40	31	260.40	23.92			102.59	1278.07	28.15	498.95	80,861	1,227,871	2,446
JANUARY													
WEEKDAY													
Shore	8.83	20	176.60	48.05	3.68	3.29	15.11	302.20	10.11	202.20	3,654	150,266	543
Boat	8.83	20	176.60	48.05	3.68	8.00	19.60	392.00	9.80	196.00	11,526	141.192	526
WEEKEND													
Shore	8.83	11	97.13	22.92	4.24	3.31	24.33	267.63	4.59	50.49	3,754	10,803	146
Boat	8.83	11	97.13	22.92	4.24	6.00	124.60	1370.60	0.00	0.00	34,850	0	0
TOTAL	8.83	31	273.73	70.97			183.64	2332.43	24.50	448.69	53,784	302,261	1,214
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	29.78	6.54	3.21	10.89	206.9 1	5.60	106.40	4,343	74,035	381
Boat	10.25	19	194.75	29.78	6.54	8.00[a]	12.10	229.90	6.00	114.00	12,028	84,989	408
WEEKEND													
Shore	10.25	10	102.50	26.52	3.87	2.49	33.33	333.30	7.15	71.50	3,208	19.759	197
Boat	10.25	10	102.50	26.52	3.87	6.00[a]	78.30	783.00	0.00	0.00	18.158	0	0
TOTAL	10.25	29	297.25	56.30			134.62	1553.11	18.75	291.90	37,737	178,783	986

a Quarterly average
b Average between months

Table A.7 Section 2 angling pressure estimates (hrs) from December, 1993 to November, 1994 with intermediate calculations.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
DECEMBER													
WEEKDAY													
Shore	8.40	23	193.20	14.42	13.40	3.22	11.29	259.67	8.65	198.95	11,203	530,310	1,020
Boat	8.40	23	193.20	14.42	13.40	8.00[a]	19.20	441.60	9.60	220.80	47,333	653,191	1,131
WEEKEND													
Shore	8.40	8	67.20	9.50	7.07	3.62	16.00	128.00	9.90	79.20	3,278	44,371	295
Boat	8.40	8	67.20	9.50	7.07	6.00[a]	56.10	448.80	0.00	0.00	19,048	0	0
TOTAL	**8.40**	**31**	**260.40**	**23.92**			**102.59**	**1278.07**	**28.15**	**498.95**	**80,861**	**1,227,871**	**2,446**
JANUARY													
WEEKDAY													
Shore	8.83	20	176.60	48.05	3.68	3.29	15.11	302.20	10.11	202.20	3,654	150,266	543
Boat	8.83	20	176.60	48.05	3.68	8.00	19.60	392.00	9.80	196.00	11,526	141,192	526
WEEKEND													
Shore	8.83	11	97.13	22.92	4.24	3.31	24.33	267.63	4.59	50.49	3,754	10,803	146
Boat	8.83	11	97.13	22.92	4.24	6.00	124.60	1370.60	0.00	0.00	34,850	0	0
TOTAL	**8.83**	**31**	**273.73**	**70.97**			**183.64**	**2332.43**	**24.50**	**448.69**	**53,784**	**302,261**	**1,214**
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	29.78	6.54	3.21	10.89	206.91	5.60	106.40	4,343	74,035	381
Boat	10.25	19	194.75	29.78	6.54	8.00[a]	12.10	229.90	6.00	114.00	12,028	84,989	408
WEEKEND													
Shore	10.25	10	102.50	26.52	3.87	2.49	33.33	333.30	7.15	71.50	3,208	19,759	197
Boat	10.25	10	102.50	26.52	3.87	6.00[a]	78.30	783.00	0.00	0.00	18,158	0	0
TOTAL	**10.25**	**29**	**297.25**	**56.30**			**134.62**	**1553.11**	**18.75**	**291.90**	**37,737**	**178,783**	**986**

a Quarterly average
b Average between months

Table A.7 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
JULY													
WEEKDAY													
Shore	15.67	20	313.40	48.25	6.50	1.00	0.57	11.40	1.51	30.20	74	5.924	108
Boat	15.67	20	313.40	48.25	6.50	3.07	99.10	1982.00	33.10	662.00	39.522	2.846.542	2,362
WEEKEND													
Shore	15.67	11	172.37	14.00	12.31	1.33'	5.67	62.37	4.93	54.23	1,021	36,209	266
Boat	15.67	11	172.37	14.00	12.31	4.75	165.10	1816.10	52.30	575.30	106,210	4,074,951	2,826
TOTAL	**15.67**	**31**	485.77	62.25			270.44	**3871.87**	**91.84**	**1321.73**	146,828	**6,963,626**	5,562
AUGUST													
WEEKDAY													
Shore	14.38	23	330.74	54.58	6.06	1.33[a]	0.92	21.16	1.50	34.50	171	7.213	119
Boat	14.38	23	330.74	54.58	6.06	5.83	82.20	1890.60	34.50	793.50	66,792	3.815.461	2,735
WEEKEND													
Shore	14.38	8	115.04	25.35	4.54	1.33[a]	0.00	0.00	0.00	0.00	0	0	0
Boat	14.38	8	115.04	25.35	4.54	4.00[a]	140.60	1124.80	57.00	456.00	20,418	943,628	1,360
TOTAL	14.38	31	445.78	79.93			223.72	3036.56	**93.00**	1284.00	87,380	**4,766,301**	4,214
SEPTEMBER													
WEEKDAY													
Shore	12.45	21	26 1.45	55.73	4.69	2.00	4.25	89.25	5.99	125.79	837	74,232	381
Boat	12.45	21	26 1.45	55.73	4.69	4.81	71.70	1505.70	27.90	585.90	33,977	1,610,448	1,777
WEEKEND													
Shore	12.45	9	112.05	25.00	4.48	2.50	10.00	90.00	7.16	64.44	1,008	18,612	191
Boat	12.45		112.05	25.00	4.48	5.00	269.60	2426.40	158.40	1425.60	54.376	9,108,927	4,225
TOTAL	**12.45**	390	373.50	80.73			355.55	**4111.35**	199.45	2201.73	**90,198**	**10,812,218**	6,574
OCTOBER													
WEEKDAY													
Shore	10.73	21	225.33	60.90	3.70	4.66[a]	1.08	22.68	1.26	26.46	391	2,590	71
Boat	10.73	21	225.33	60.90	3.70	2.50	20.40	428.40	7.60	159.60	3,963	94,247	430
WEEKEND													
Shore	10.73	10	107.30	25.15	4.27	2.36	4.33	43.30	6.41	64.10	436	17,530	185
Boat	10.73	10	107.30	25.15	4.27	2.00	62.50	625.00	13.90	139.00	5,333	82.43 1	402
TOTAL	**10.73**	**31**	332.63	86.05			88.31	1119.38	29.17	389.16	10,123	196,798	1,088

a Quarterly average
b Average between months

Table A.7 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
NOVEMBER													
WEEKDAY													
Shore	9.20	21	193.20	15.33	12.60	1.83	7.33	153.93	4.93	103.53	3,550	135,082	515
Boat	9.20	21	193.20	15.33	12.60	4.67	18.20	382.20	8.60	180.60	22,494	411,055	898
WEEKEND													
Shore	9.20	9	82.80	4.38'	18.90	6.73[a]	7.17[a]	64.49	4.00	36.00	8,204	24.500	219
Boat	9.20	9	82.80	4.38[a]	18.90	4.66[a]	60.70	546.30	35.00	315.00	48,125	1,875,760	1,917
TOTAL	**9.20**	**30**	**276.00**	**19.71**			**93.40**	**1146.92**	**52.53**	**635.13**	**82,374**	**2,446,397**	**3,549**
ANNUAL TOTAL	**146.8**	**366.0**	**4478.3**	**644.5**			**2,011.6**	**25,468.8**	**641.3**	**8,817.9**	**929,211**	**30,821,155**	**32,983**

a Quarterly average

b Average between months

Table A.8 Section 3 angling pressure estimates (hrs) from December, 1993 to November, 1994 with intermediate calculations.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
DECEMBER													
WEEKDAY													
Shore	8.40	23	193.20	36.75	5.26	1.80	8.93	205.39	8.00	184.00	1,944	177.986	591
Boat	8.40	23	193.20	36.75	5.26	1.50[a]	1.40	32.20		0.00	254	0	0
WEEKEND													
Shore	8.40	8	67.20	17.50	3.84	1.75	8.86	70.88	7.99	63.92	476	15,689	175
Boat	8.40	8	67.20	17.50	3.84	2.00[a]	0.00	0.00		0.00	0	0	0
TOTAL	**8.40**	**31**	**260.40**	**54.25**			**19.19**	**308.47**	**15.99**	**247.92**	**2,674**	**193,675**	**766**
JANUARY													
WEEKDAY													
Shore	8.83	20	176.60	23.50	7.51	2.22	8.31	166.20	5.41	108.20	2,773	87,979	415
Boat	8.83	20	176.60	23.50	7.51	1.50	13.20	264.00		0.00	2,976	0	0
WEEKEND													
Shore	8.83	11	97.13	13.75	7.06	1.83	17.00	187.00	6.28	69.08	2.417	33,710	257
Boat	8.83	11	97.13	13.75	7.06	2.00	49.40	543.40	0.00	0.00	7,677	0	0
TOTAL	**8.83**	**31**	**273.73**	**37.25**			**87.91**	**1160.60**	**11.69**	**177.28**	**15,843**	**121,688**	**672**
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	30.25	6.44	1.76	10.08	191.52	5.07	96.33	2,170	59,741	342
Boat	10.25	19	194.75	30.25	6.44	1.50[a]	29.90	568.10		0.00	5,486	0	0
WEEKEND													
Shore	10.25	10	102.50	17.00	6.03	2.10	15.86	158.60	7.65	76.50	2,008	35,286	263
Boat	10.25	10	102.50	17.00	6.03	2.00[a]	119.80	1198.00	0.00	0.00	14,446	0	0
TOTAL	**10.25**	**29**	**297.25**	**47.25**			**175.64**	**2116.22**	**12.72**	**172.83**	**24,111**	**95,027**	**605**

a Quarterly average

Table A.8 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) Ds	Hours per month Ns	Hours creeled per month n	Time correction factor s/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 pressure estimate per month VPE	95% C.I. per month CI
MARCH													
WEEKDAY													
Shore	11.97	23	275.31	35.25	7.81	2.95	8.00	184.00	3.84	88.32	4,239	60,923	346
Boat	11.97	23	275.31	35.25	7.81	1.81	26.10	600.30	0.00	0.00	8.486	0	0
WEEKEND													
Shore	11.97	8	95.76	15.00	6.38	2.48	20.20	161.60	8.67	69.36	2,559	30,712	245
Boat	11.97	8	95.76	15.00	6.38	3.18	97.30	778.40	27.00	216.00	15,802	297,852	764
TOTAL	11.97	31	371.07	50.25			151.60	1724.30	39.51	373.68	31,086	389,487	1,355
APRIL													
WEEKDAY													
Shore	13.68	21	287.28	40.75	7.05	2.07	5.33	111.93	3.58	75.18	1,633	39,846	279
Boat	13.68	21	287.28	40.75	7.05	1.92	35.00	735.00	0.00	0.00	9,949	0	0
WEEKEND													
Shore	13.68	9	123.12	17.25	7.14	3.20	8.33	74.97	7.47	67.23	1.712	32,260	251
Boat	13.68	9	123.12	17.25	7.14	3.12	68.70	618.30	0.00	0.00	13.769	0	0
TOTAL	13.68	30	410.40	58.00			117.36	1540.20	11.05	142.41	27,063	72,106	531
MAY													
WEEKDAY													
Shore	15.20	21	319.20	19.25	16.58	1.86	2.33	48.93	1.56	32.76	1,509	17,796	187
Boat	15.20	21	319.20	19.25	16.58	2.89	95.00	1995.00	17.60	369.60	95,603	2,265,145	2,107
WEEKEND													
Shore	15.20	10	152.00	23.50	6.47	2.29	3.43	34.30	4.89	48.90	508	15,467	174
Boat	15.20	10	152.00	23.50	6.47	5.57	205.10	2051.00	33.70	337.00	73,892	134,574	1,200
TOTAL	15.20	31	471.20	42.75			305.86	4129.23	57.75	788.26	171,512	3,032,982	3,668
JUNE													
WEEKDAY													
Shore	16.02	22	352.44	20.75	16.99	2.09	4.67	102.74	5.20	114.40	3,647	222,290	660
Boat	16.02	22	352.44	20.75	16.99	3.48	117.00	2574.00	18.70	411.40	152.144	2.874.721	2.374
WEEKEND													
Shore	16.02	8	128.16	7.00	18.31	2.00	1.00	8.00	1.00	8.00	293	1.172	48
Boat	16.02	8	128.16	7.00	18.31	4.93	218.30	1746.40	38.80	310.40	157,632	1,763,997	1,859
TOTAL	16.02	30	480.60	27.75			340.97	4431.14	63.70	844.20	313,716	4,862,179	4,941

Table A.8 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
JULY													
WEEKDAY													
Shore	15.67	20	313.40	27.50	11.40	2.25	4.38	87.60	4.90	98.00	2,246	109,451	463
Boat	15.67	20	313.40	27.50	11.40	3.86	50.40	1008.00	9.80	196.00	44.342	437.803	926
WEEKEND													
Shore	15.67	11	172.37	23.25	7.41	2.00	2.00	22.00	4.90	53.90	326	21.539	205
Boat	15.67	11	172.37	23.25	7.41	3.66	92.10	1013.10	0.00	0.00	27,490	0	0
TOTAL	15.67	31	485.77	50.75			148.88	2130.70	19.60	347.90	74,404	568,792	1,595
AUGUST													
WEEKDAY													
Shore	14.38	23	330.74	47.00	7.04	2.58	3.69	84.87	3.22	74.06	1.541	38,597	275
Boat	14.38	23	330.74	47.00	7.04	4.29	81.40	1872.20	26.40	607.20	56,520	2,594,492	2,255
WEEKEND													
Shore	14.38	8	115.04	24.25	4.74	2.00	1.00	8.00	2.24	17.92	76	1.523	55
Boat	14.38	8	115.04	24.25	4.74	4.72	84.10	672.80	15.70	125.60	15,065	74.837	383
TOTAL	14.38	31	445.78	71.25			170.19	2637.87	47.56	824.78	73,201	2,709,450	2,968
SEPTEMBER													
WEEKDAY													
Shore	12.45	21	261.45	44.50	5.88	2.88'	0.73	15.33	1.35	28.35	259	4,722	96
Boat	12.45	21	261.45	44.50	5.88	4.62	62.20	1306.20	21.60	453.60	35.455	1,208,856	1.539
WEEKEND													
Shore	12.45	9	112.05	22.50	4.98	1.86[a]	3.40	30.60	2.97	26.73	283	3,558	84
Boat	12.45	9	112.05	22.50	4.98	4.58	146.70	1320.30	55.10	495.90	30,114	1.224.666	1.549
TOTAL	12.45	30	373.50	67.00			213.03	2672.43	81.02	1004.58	66,112	2,441,802	3,268
OCTOBER													
WEEKDAY													
Shore	10.73	21	225.33	55.63	4.05	3.15	3.27	68.67	4.74	99.54	876	40,133	280
Boat	10.73	21	225.33	55.63	4.05	6.84	20.90	438.90	6.80	142.80	12,160	82,597	402
WEEKEND													
Shore	10.73	10	107.30	17.75	6.05	2.12	0.50	5.00	1.00	10.00	64	605	34
Boat	10.73	10	107.30	17.75	6.05	4.00	13.30	133.00	0.00	0.00	3.216	0	0
TOTAL	10.73	31	332.63	73.38			37.97	645.57	12.54	252.34	16,316	123,335	717

a Quarterly average

Table A.8 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) 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 pressure estimate per month VPE	95% C.I. per month CI
NOVEMBER													
WEEKDAY													
Shore	9.20	21	193.20	56.00	3.45	2.17	3.86	81.06	4.47	93.87	607	30,400	244
Boat	9.20	21	193.20	56.00	3.45	5.96[a]	3.80	79.80	1.60	33.60	1.641	3,895	87
WEEKEND													
Shore	9.20	9	82.80	14.00	5.91	1.79	10.00	90.00	9.41	84.69	953	42.420	288
Boat	9.20	9	82.80	14.00	5.91	4.52[a]	6.30	56.70	2.50	22.50	1.516	2,994	77
TOTAL	9.20	30	276.00	70.00			23.96	307.56	17.98	234.66	4,716	79,709	696
ANNUAL TOTAL	146.78	366.00	4478.33	649.88			1,792.6	23804.3	391.11	5410.8	820,756	14,690,233	21,783

a Quarterly average

Table A.9 **Section 1 catch per unit effort (fish/hour) of the harvest (fish kept) in Lake Roosevelt from December, 1993 through November, 1994.**

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.001
rainbow trout	0.018	0.047	0.043	0.023	0.006	0.000	0.000	0.013	0.100	0.129	0.196	0.315	0.073
walleye	0.000	0.000	0.007	0.000	0.186	0.033	0.137	0.229	0.217	0.047	0.004	0.000	0.091
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.005	0.004	0.000	0.002
other species*	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.005	0.004	0.000	0.002
Monthly Mean	**0.003**	**0.009**	**0.008**	**0.004**	**0.032**	**0.006**	**0.024**	**0.041**	**0.053**	**0.031**	**0.034**	**0.054**	**0.028**

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie. chinook, bullhead, etc...

Table A.10 Section 2 catch per unit effort (fish/hour) of the harvest (fish kept) in Lake Roosevelt from December, 1993 through November, 1994.

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.087	0.000	0.019	0.000	0.000	0.007
rainbow trout	0.034	0.020	0.035	0.036	0.000	0.000	0.001	0.203	0.107	0.054	0.009	0.645	0.043
walleye	0.000	0.000	0.000	0.000	0.000	0.087	0.090	0.039	0.036	0.048	0.000	0.000	0.041
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.007	0.004	0.000	0.000	0.002
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
other species*	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.001
Monthly Mean	0.006	0.004	0.006	0.006	0.000	0.015	0.016	0.055	0.025	0.021	0.002	0.108	0.016

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead. etc...

Table A.11 Section 3 catch per unit effort (fish/hour) of the harvest (fish kept) in Lake Roosevelt from December, 1993 through November, 1994.

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.000	0.041	0.000	0.000	0.000	0.000	0.000	0.007	0.011	0.000	0.006	0.000	0.005
rainbow trout	0.804	0.918	0.928	1.099	0.471	0.244	0.470	0.645	0.345	0.402	0.187	0.882	0.536
walleye	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.176	0.004	0.000	0.069	0.022	0.035	0.000	0.046
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
other species*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Monthly Mean	**0.134**	**0.160**	**0.155**	**0.183**	**0.079**	**0.070**	**0.079**	**0.109**	**0.071**	**0.071**	**0.038**	**0.147**	**0.098**

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table A.12 Section 1 catch per unit effort (fish/hour) of the total catch (harvest and release) in Lake Roosevelt from December, 1993 through November, 1994.

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000
rainbow trout	0.027	0.047	0.057	0.023	0.006	0.000	0.000	0.013	0.100	0.129	0.196	0.321	0.074
walleye	0.036	0.000	0.007	0.005	0.240	0.114	0.236	0.406	0.362	0.063	0.004	0.000	0.157
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.008	0.012	0.000	0.003
other species*	0.000	0.020	0.007	0.000	0.000	0.000	0.000	0.002	0.000	0.005	0.004	0.011	0.004
Monthly Mean	**0.011**	**0.011**	**0.012**	**0.004**	**0.041**	**0.019**	**0.041**	**0.070**	**0.077**	**0.035**	**0.036**	**0.056**	**0.040**

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie. chinook, bullhead, etc...

Table A.13 Section 2 catch per unit effort (fish/hour) of the total catch (harvest and release) in Lake Roosevelt from December, 1993 through November, 1994.

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.087	0.000	0.019	0.000	0.000	0.007
rainbow trout	0.034	0.020	0.035	0.036	0.000	0.000	0.001	0.203	0.107	0.054	0.009	0.645	0.043
walleye	0.000	0.000	0.000	0.000	0.000	0.087	0.090	0.397	0.036	0.048	0.000	0.000	0.055
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.007	0.013	0.000	0.000	0.003
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
other species*	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.002
Monthly Mean	**0.006**	**0.004**	**0.006**	**0.006**	**0.000**	**0.015**	**0.016**	**0.115**	**0.025**	**0.024**	**0.002**	**0.108**	**0.018**

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead. etc...

Table A.14 Section 3 catch per unit effort (fish/hour) of the total catch (harvest and release) in Lake Roosevelt from December, 1993 through November, 1994.

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.000	0.041	0.000	0.000	0.000	0.000	0.000	0.007	0.011	0.000	0.006	0.000	0.005
rainbow trout	0.853	0.918	0.928	1.099	0.471	0.244	0.470	0.645	0.345	0.402	0.187	0.882	0.538
walleye	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.364	0.562	0.723	0.552	0.473	0.035	0.000	0.303
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
other species*	0.000	0.000	0.000	0.000	0.033	0.000	0.000	0.000	0.000	0.000	0.116	0.022	0.015
Monthly Mean	**0.142**	**0.160**	**0.155**	**0.183**	**0.084**	**0.102**	**0.172**	**0.229**	**0.151**	**0.146**	**0.058**	**0.151**	**0.144**

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table A.15 Total monthly and annual harvest estimates with ± 95% confidence intervals from fish harvested by anglers on all sections of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0 ±0	647 ±27	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	13,305 ±496	808 ±33	1.691 ±123	105 ±5	11 ±1	16,567 ±685
rainbow trout	4,951 ±703	15.797 ±667	23.745 ±604	39,059 ±1,610	12,830 ±251	41,788 ±894	147.596 f2.324	78,502 ±2,187	37,374 ±1,724	34,604 ±1,831	4.919 ±234	58.129 ±2,942	499,294 ±15,971
walleye	0 ±0	0 ±0	10 ±1	0 ±0	2,505 ±45	4,856 ±173	14,942 ±279	16,649 ±687	9.126 ±692	5,467 ±374	35 ±2	0 ±0	53,590 ±2,253
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	30,160 ±645	1.448 ±22	0 ±0	5,673 ±235	1.851 ±100	578 ±25	0 ±0	39,710 ±1,027
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	147 ±9	0 ±0	0 ±0	114 ±6	35 ±2	0 ±0	297 ±16
other species*	0 ±0	149 ±5	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	76 ±3	0 ±0	302 ±20	35 ±2	0 ±0	562 ±30
Monthly Total	4,951 ±703	16,593 ±699	23,755 ±605	39,059 ±1,610	15,335 ±296	76,804 ±1,712	164,133 ±2,634	108,532 ±496	52,981 ±2,684	44,029 ±2,454	5,707 ±270	58,140 ±2,943	610,020 ±19,982

*Includes yellow perch, largemouth bass, suckers, squawfish. black crappie, chinook, bullhead, etc...

Table A.16 Monthly and annual harvest estimates ± 95% confidence intervals for all fish species surveyed in Section 1 of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	11 ±1	11 ±1
rainbow trout	13 ±3	166 ±26	57 ±8	201 ±10	81 ±1	0 ±0	0 ±0	605 ±26	2,763 ±249	3.129 ±161	1,778 ±90	633 ±38	9,426 ±613
walleye	0 ±0	0 ±0	10 ±1	0 ±0	2,505 ±45	686 ±9	2,359 ±141	10,958 ±471	6,003 ±541	1.145 ±59	35 ±2	0 ±0	23,699 ±1,269
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	38 ±2	0 ±0	0 ±0	38 ±2
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	147 ±9	0 ±0	0 ±0	114 ±6	35 ±2	0 ±0	297 ±16
other species*	0 ±0	14 ±2	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	76 ±3	0 ±0	114 ±6	35 ±2	0 ±0	239 ±13
Monthly Total	13 ±3	179 ±28	67 ±9	201 ±10	2,586 ±46	686 ±9	2,506 ±150	11,638 ±501	8,767 ±790	4,541 ±234	1,883 ±95	644 ±38	33,710 ±1,914

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table A.17 Monthly and annual harvest estimates ± 95% confidence intervals for all fish species surveyed in Section 2 of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	12,805 ±485	0 ±0	1.691 ±123	0 ±0	0 ±0	14,496 ±608
rainbow trout	2,788 ±84	1,081 ±24	1.321 ±35	4,685 ±110	0 ±0	0 ±0	188 ±2	29.878 ±1,132	9,369 ±452	4,886 ±356	93 ±10	53,338 ±2,290	107,627 ±4,495
walleye	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	4,170 ±164	12.583 ±138	5.691 ±216	3.123 ±151	4,322 ±315	0 ±0	0 ±0	29,890 ±983
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	188 ±2	0 ±0	625 ±30	376 ±27	0 ±0	0 ±0	1,188 ±60
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0
other species*	0 ±0	135 ±3	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	188 ±14	0 ±0	0 ±0	323 ±17
Monthly Total	2,788 ±84	1,216 ±27	1,321 ±35	4,685 ±110	0 ±0	4,170 ±164	12,959 ±142	48,374 ±1,832	13,116 ±633	11,463 ±835	93 ±10	53,338 ±2,290	153,524 ±6,163

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table A.18 Monthly and annual harvest estimates ± 95% confidence intervals for all fish species surveyed in Section 3 of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0 ±0	647 ±27	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	500 ±11	808 ±33	0 ±0	105 ±5	0 ±0	2,060 ±76
rainbow trout	2.150 ±616	14,550 ±617	22,367 ±561	34,173 i1.490	12,749 ±250	41,788 ±894	147,408 ±2,322	48,019 ±1,029	25.242 i1.023	26,589 ±1,314	3,048 ±134	4,158 ±614	382,240 ±10,864
walleye	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0
smallmouthbass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	30,160 ±645	1,260 ±20	0 ±0	5,048 ±205	1,437 ±71	578 ±25	0 ±0	38,483 ±966
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0
other species*	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0
Monthly Total	2,150 ±616	15,196 ±645	22,367 ±561	34,173 ±1,490	12,749 ±250	71,948 ±1,539	148,668 ±2,342	48,519 ±1,040	31,098 ±1,261	28,026 ±1,385	3,731 ±164	4,158 ±614	422,783 ±11,906

*Includes yellow perch, largemouth bass. suckers. squawfish, black crappie, chinook, bullhead, etc...

Table A.19 Total monthly and annual catch estimates ± 95% confidence intervals from all fish observed by creel clerks on all sections of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0 ±0	647 ±27	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	13,305 f1.293	808 ±33	1.691 ±123	105 ±5	11 ±1	16,567 ±1,482
rainbow trout	5,088 ±742	15,797 ±667	23,764 ±606	39,059 f1.610	12,830 ±251	41,788 ±894	147,596 ±2,324	78,502 ±2,187	37,374 f1.724	34,604 f1.831	28,460 ±234	58,140 f2.942	499,460 ±16,012
walleye	25 ±7	0 ±0	10 ±1	40 ±2	3,232 ±57	6,901 ±204	16,637 ±380	77.755 ±3,045	13.128 ±1,053	5.848 ±394	35 ±2	0 ±0	123,612 ±5,145
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	62,500 11.337	176,574 ±2,780	53,771 ±1,153	41,012 f1.668	32,424 ±1,629	578 ±25	0 ±0	366,859 ±8,592
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	221 ±13	0 ±0	0 ±0	191 ±10	105 ±5	0 ±0	517 ±28
other species*	0 ±0	204 ±14	10 ±1	0 ±0	895 ±18	0 ±0	0 ±0	76 ±3	0 ±0	866 ±61	1,927 ±85	124 ±16	4,102 ±198
Monthly Total	[illegible] ±749	[illegible] ±708	[illegible] ±608	[illegible] ±1,612	[illegible] ±326	111,189 ±2,434	341,028 ±5,497	223,409 ±7,681	92,322 ±4,478	75,624 ±4,048	31,210 ±356	58,275 ±2,959	1,011,117 ±31,457

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie. chinook, bullhead, etc...

Table A.20 Monthly and annual catch estimates ± 95% confidence intervals for all fish species surveyed in Section 1 of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokance	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	11 ±1	11 ±1
rainbow trout	19 ±5	166 ±26	76 ±10	201 ±10	81 ±1	0 ±0	0 ±0	605 ±26	2,763 ±249	3.129 ±161	1,778 ±90	644 ±38	9,462 ±618
walleye	25 ±7	0 ±0	10 ±1	40 ±2	3,232 ±57	2,368 ±32	4,054 ±242	19,422 ±835	10,005 ±902	1,526 79	35 ±2	0 ±0	40,718 ±2,159
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	38 ±2	0 ±0	0 ±0	38 ±2
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	221 ±13	0 ±0	0 ±0	191 ±10	105 ±5	0 ±0	517 ±28
other species*	0 ±0	69 ±11	10 ±1	0 ±0	0 ±0	0 ±0	0 ±0	76 ±3	0 ±0	114 ±6	35 ±2	23 ±1	326 ±24
Monthly Total	44 ±11	235 ±37	96 ±13	242 ±12	3,313 ±59	2,368 ±32	4,275 ±256	20,102 ±865	12,769 ±1,151	4,999 ±258	1,952 ±99	678 ±40	51,072 ±2,832

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead. etc...

Table A.21 Monthly and annual catch estimates ± 95% confidence intervals for all fish species surveyed in Section 2 of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	12,805 ±485	0 ±0	1.691 ±123	0 ±0	0 ±0	14,496 ±608
rainbow trout	2,788 ±84	1,081 ±24	1,321 ±35	4,685 ±110	0 ±0	0 ±0	188 ±2	29,878 ±1,132	9,369 ±452	4,886 ±356	93 ±10	53,338 ±2.290	107,627 ±4,495
walleye	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	4,170 ±164	12,583 ±138	58,333 ±2,210	3.123 ±151	4,322 ±315	0 ±0	0 ±0	82,531 ±2,978
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	188 ±2	0 ±0	625 30	1.127 ±82	0 ±0	0 ±0	1,940 ±114
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0
other species*	0 ±0	135 ±3	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	752 ±55	0 ±0	0 ±0	887 ±58
Monthly Total	2±848	1±276	1±351	±110	±0	4±164	12,959 ±142	101,015 ±3,827	13,116 ±633	12,778 ±931	93 ±10	53,338 ±2,290	207,481 ±8,253

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table A.22 Monthly and annual catch estimates ± 95% confidence intervals for all fish species surveyed in Section 3 of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0 ±0	647 ±27	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	500 ±808	808 ±33	0 ±0	105 ±5	0 ±0	2,060 ±76
rainbow trout	2,281 ±653	14,550 ±617	22,367 ±561	34,173 ±1,490	12,749 ±250	41,788 ±894	147,408 ±2,322	48,019 ±1,029	25,242 f1.023	26,589 ±1,314	3,048 ±134	4.158 ±614	382,371 ±10,902
walleye	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	363 ±8	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	363 ±8
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	62,500 ±1,337	176.386 f2.778	53.77 1 ±1,153	40,387 ±1,638	31,259 ±1,545	578 ±25	0 ±0	364,881 ±8,476
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0
other species*	0 ±0	0 ±0	0 ±0	0 ±0	895 ±18	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	1.892 ±83	101 ±15	2,888 i116
Monthly Total	2,281 ±653	15,196 ±645	22,367 ±561	34,173 ±1,490	13,643 ±268	104,651 ±2,238	323,794 ±5,100	102,290 ±2,193	66,436 ±2,694	57,848 ±2,860	5,623 ±247	4,260 ±629	752,563 ±19,576

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table A.22 Monthly and annual catch estimates ± 95% confidence intervals for all fish species surveyed in Section 3 of Lake Roosevelt from December, 1993 through November, 1994.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	0	647	0	0	0	0	0	500	808	0	105	0	**2,060**
	±0	±27	±0	±0	±0	±0	±0	±808	±33	±0	±5	±0	**±76**
rainbow trout	2,281	14,550	22,367	34,173	12,749	41,788	147,408	48,019	25,242	26,589	3,048	4,158	**382,371**
	±653	±617	±561	±1,490	±250	±894	±2,322	±1,029	±1,023	±1,314	±134	±614	**±10,902**
walleye	0	0	0	0	0	363	0	0	0	0	0	0	**363**
	±0	±0	±0	±0	±0	±8	±0	±0	±0	±0	±0	±0	**±8**
smallmouth bass	0	0	0	0	0	62,500	176,386	53,771	40,387	31,259	578	0	**364,881**
	±0	±0	±0	±0	±0	±1,337	±2,778	±1,153	±1,638	±1,545	±25	±0	**±8,476**
sturgeon	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	±0	±0	±0	±0	±0	±0	±0	±0	±0	±0	±0	±0	**±0**
other species*	0	0	0	0	895	0	0	0	0	0	1,892	101	**2,888**
	±0	±0	±0	±0	±18	±0	±0	±0	±0	±0	±83	±15	**±116**
Monthly	**2,281**	**15,196**	**22,367**	**34,173**	**13,643**	**104,651**	**323,794**	**102,290**	**66,436**	**57,848**	**5,623**	**4,260**	**752,563**
Total	**±653**	**±645**	**±561**	**±1,490**	**±268**	**±2,238**	**±5,100**	**±2,193**	**±2,694**	**±2,860**	**±247**	**±629**	**±19,576**

*Includes yellow perch, largemouth bass, suckers, squawfish, black crappie, chinook, bullhead, etc...

Table B.l. Annual **electrofishing** results for **1994** split by sampling period including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

Effort (min)	**May** 811.8			**August** **548.7**			**October** **817.70**			Total **2,178.2**		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	1,473	43	1.82	933	31	1.70	598	31	0.73	**3,004**	36	1.37
cottus spp.	870	25	1.07	320	11	0.58	178	9	0.22	**1,368**	16	0.63
walleye	302	9	0.37	112	4	0.20	156	8	0.19	570	7	
smallmouth bass	332	10	0.41	319	11	0.58	49	3	0.06	**700**	8	0.26 0.32
rainbow trout	219	6	0.27	107	4	0.20	228	12	0.28	**554**	7	
squawfish	147	4	0.18	145	5	0.26	16	1	0.02	308	4	0.25
carp	52	2	0.06	45	2	0.08	22	1	0.03	117	1:	0.46 0.05
yellow perch	28	1	0.03	829	28	1.51	158	8	0.19	**1,015**		
brown trout	11	0	0.01	2	0	<0.01	9	0	0.01	**22**	<1	0.01
kokanee salmon	5	0	0.01	0	0	0.00	291	15	0.36	**296**	4	0.14
chinook salmon	0	0	0.00	0	0	0.00	1	0	<0.01	1	<1	<0.01
crappie	0	0	0.00	2	0	<0.01	2	0	<0.01	4	c l	<0.01
bull trout	1	0	<0.01	0	0	0.00	0	0	0.00	1	<1	<0.01
brook trout	4	0	0.01	0	0	0.00	9	0	0.01	13	<1	0.01
burbot	2	0	<0.01	7	0	<0.01	69	4	0.08	78	<1	0.04
lake whitefish	3	0	<0.01	3	0	<0.01	14	1	0.02	20	<1	0.01
mountain whitefish	0	0	0.00	0	0	0.00	4	0	0.01	4	<1	<0.01
brown bullhead	1	0	<0.01	2	0	<0.01	0	0	0.00	3	c l	<0.01
longnose sucker	1	0	<0.01	9	0	0.02	150	8	0.18	160	2	0.07
bridgelip sucker	0	0	0.00	0	0	0.00	1	0	<0.01	1	<1	<0.01
redside shiner	6	0	0.01	1	0	<0.01	0	0	0.00		<1	<0.01
pumpkinseed	1	0	<0.01	130	4	0.24	0	0	0.00	13:	2	0.06
tench	8	0	0.01	2	0	<0.01	0	0	0.00	10	<1	<0.01
Totals	3,466		4.27	2,968		5.41	1,955		2.39	8,389		3.85

Table B.2. May **electrofishing** results for **1994** split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

	Kettle Falls			Gifford			Hunters			Porcupine Bay		
Effort (min)	67.5			57.3			92.4			138.8		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
										8	6	
largescale sucker	633	81	9.38	210	71	3.67	25	33	0.27	42	30	0.30 0.06
cottus spp.	42	5	0.62	13	4	0.23	15	20	0.16			
walleye	22	3	0.33	26	9	0.45	12	1	0.13	32	23	0.23
smallmouth bass	0	0	0.00	0	0	0.00	0	0	0.00	31	22	0.22
rainbow trout	14	2	0.21	0	4	0.18	6	8	0.06	21	15	0.15
squawfish	31	4	0.46	10	11	0.56	0	0	0.00			0.00
carp	21	3	0.31	32	0	0.02	1	1	0.01	1	1	0.01
yellow perch	9	1	0.13	1	0	<0.01	7	9	0.07	4	3	0.03
brown trout	1	0	0.02	0	0	0.00	1	1	0.01	0	00	0.00
kokanee salmon	1	0	0.02	0	0	0.00	0	0	0.00	0	0	0.00
chinook salmon	0	0	0.00	0	0	0.00	0	0	0.00			
crappie	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bull trout	0	0	0.00	3	1	0.00.	1	1	0.01	0	0	0.00
brook trout	0	0	0.00	0	0	<00.00	1	1	0.01			0.00
burbot	0	0	0.00			[illegible]	0	0	0.00	0	0	0.00
lake whitefish	1	0	0.02	0	0	0.00	2	3	0.02	0	0	0.00
mountain whitefish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brown bullhead	0	0	0.00	0	0	0.00	0	0	0.00			0.00
longnose sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bridgelip sucker	0	0	0.00			0.00	0	0	0.00	0	0	0.00
redside shiner	5	1	0.07	1	0	<0.01	0	0	0.00	0	0	0.00
pumpkinseed	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
tench	1	0	0.02	0	0	0.00	1	1	0.01	0	0	0.00
Totals	781		11.57	29		5.17	75		0.80	139		.00

Table B.2. Continued

	Little Falls			Seven Bays			Keller Ferry			San Poil		
Effort (min)	**76.9**			**77.3**			**86.5**			**129.2**		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	61	12	0.79	28	7	0.36	14	6	0.16	491	66	3.8
cottus spp.	331	65	4.30	288	71	3.73	59	27	0.68	79	11	0.61
walleye	87	17	1.13	17	4	0.22	19	9	0.22	19	3	0.15
smallmouth bass	3	1	0.04	36	9	0.47	98	45	1.13	44	6	0.34
rainbow trout	16	3	0.21	10	2	0.13	16	7	0.19	35	5	0.27
squawfish	0	0	0.00	0	0	0.00	1	0	0.01	73	10	0.57
carp	0	0	0.00	15	4	0.19	5	2	0.06	4	1	0.03
yellow perch	0	0	0.00	6	1	0.08	2	1	0.02	1	0	0.01
brown trout	10	2	0.13	0	0	0.00	0	0	0.00	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	0	0	0.00	1	0	0.01
chinook salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
crappie	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bull trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brook trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
burbot	1	0	0.01	0	0	0.00	0	0	0.00	1	0	0.01
lake whitefish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
mountain whitefish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brown bullhead	0	0	0.00	0	0	0.00	1	0	0.01	0	0	0.00
longnose sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bridgelip sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
redside shiner	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
pumpkinseed	0	0	0.00	0	0	0.00	1	0	0.01	0	0	0.00
tench	0	0	0.00	5	1	0.07	1	0	0.01	0	0	0.00
Totals	**509**		**6.62**	**406**		**5.25**	217		**2.51**	**748**		**5.79**

Table B.2. Continued

	Spring Canyon		
Effort (min)	84.2		
Species	No.	%	CPUE
largescale sucker	6	3	0.07
cottus spp.	1	0	0.01
walleye	9	4	0.11
smallmouth bass	106	48	1.26
rainbow trout	91	41	1.08
squawfish	0	0	0.00
carp	4	2	0.05
yellow perch	0	0	0.00
brown trout	0	0	0.00
kokanee salmon	3	1	0.04
chinook salmon	0	0	0.00
crappie	0	0	0.00
bull trout	0	0	0.00
brook trout	0	0	0.00
burbot	0	0	0.00
lake whitefish	0	0	0.00
mountain whitefish	0	0	0.00
brown bullhead	0	0	0.00
longnose sucker	0	0	0.00
bridgelip sucker	0	0	0.00
redside shiner	0	0	0.00
pumpkinseed	0	0	0.00
tench	0	0	0.00
Totals	220		2.61

Table B.3. August **electrofishing** results for 1994 split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

	Kettle Falls			Gifford			Hunters			Porcupine Bay		
Effort (min)	73.4			52.5			40.3			82.1		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	67	13	0.91	67	13	1.28	26	29	0.65	17	7	0.21
cottus spp.	2	0	0.03	2	0	0.04	0	0	0.00	4	2	0.05
walleye	52	10	0.71	52	10	0.99	6	7	0.15	3	1	0.04
smallmouth bass	21	4	0.29	21	4	0.40	4	5	0.10	12	5	0.15
rainbow trout	6	1	0.08	6	1	0.11	2	2	0.05	17	7	0.21
squawfish	134	26	1.83	134	26	2.55	0	0	0.00	0	0	0.00
carp	85	17	1.16	85	17	1.62	0	0	0.00	4	2	0.05
yellow perch	138	27	1.88	138	27	2.63	51	57	1.27	202	78	2.46
brown trout	2	0	0.03	2	0	0.04	0	0	0.00	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
crappie salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bull trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brook trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
burbot	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
lake whitefish	2	0	0.03	2	1	0.04	0	0	0.00	0	0	0.00
mountain whitefish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brown bullhead	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
longnose sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bridgelip sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
redside shiner	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
pumpkinseed	1	0	0.01	1	0	0.02	0	0	0.00	0	0	0.00
tench	2	0	0.03	2	1	0.04	0	0	0.00	0	0	0.00
Totals	512		6.98	512		9.75	89		2.21	260		3.17

Table B.3. Continued.

	Little Falls			Seven Bays			Keller Ferry			San Poil		
Effort (min)	81.7			30.9			43.4			60		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	34	10	0.42	336	72	10.87	12	15	0.28	384	66	6.4
cottus spp.	150	46	1.8	0	0	0.00	0	0	0.00	0	0	0.00
walleye	9	3	0.11	10	2	0.32	10	12	0.23	2	0	0.03
smallmouth bass	9	3	0.11	14	3	0.45	29	36	0.67	147	25	2.45
rainbow trout	2	1	0.02	43	9	1.39	1	1	0.02	8	1	0.13
squawfish	4	1	0.05	1	0	0.03	0	0	0.00	1	0	0.02
carp	4	1	0.05	2	0	0.07	5	6	0.12	0	0	0.00
yellow perch	113	35	1.38	62	13	2.01	23	28	0.53	39	7	0.65
brown trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
chinook salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
crappie	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bull trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brook trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
burbot	0	0	0.00	2	0	0.07	0	0	0.00	1	0	0.02
lake whitefish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
mountain whitefish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brown bullhead	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
longnose sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bridgelip sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
redside shiner	0	0	0.00	0	0	0.00	1	1	0.02	0	0	0.00
pumpkinseed	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
tench	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
Totals	325		3.98	470		15.21	81		1.87	582		9.70

Table B.3. **Continued.**

Effort (min)	Spring Canyon		
	84.4		
Species	No.	%	CPUE
largescale sucker	34	21	0.40
cottus spp.	0	0	0.00
walleye	5	3	0.06
smallmouth bass	83	50	0.98
rainbow trout	0	0	0.00
squawfish	0	0	0.00
carp	11	7	0.13
yellow perch	30	18	0.36
brown trout	0	0	0.00
kokanee salmon	0	0	0.00
chinook salmon	0	0	0.00
crappie	0	0	0.00
bull trout	0	0	0.00
brook trout	0	0	0.00
burbot	0	0	0.00
lake whitefish	0	0	0.00
mountain whitefish	0	0	0.00
brown bullhead	2	1	0.02
longnose sucker	0	0	0.00
bridgelip sucker	0	0	0.00
redside shiner	0	0	0.00
pumpkinseed	0	0	0.00
tench	0	0	0.00
Totals	165		1.96

Table B.4. October electrofishing results for 1994 split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

	Kettle Falls			Gifford			Hunters			Porcupine Bay		
Effort (min)	61.5			85.8			81.9			76.6		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	220	74	3.58	35	42	0.41	17	8	0.21	39	38	0.51
										1	1	0.01
walleyepp.	10	3	0.16	15	16	0.06	13	16	0.16	8	8	0.10
smallmouth bass	0	0	0.00	0	0	0.00	0	0	0.00	3	3	0.04
rainbow trout	19	6	0.31	12	14	0.14	30	13	0.37	3	3	0.04
squawfish	4	1	0.06	0	0	0.00	1	0	0.01	0	0	0.00
carp	1	0	0.02	2	2	0.02	2	1	0.02	2	2	0.03
yellow perch	14	5	0.23	16	19	0.19	106	47	1.29	0	0	0.00
										1	1	0.01
kokanee salmon	11	4	0.18	0	0	0.00	0	0	0.00	45	44	0.59
chinook salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
crappie	0	0	0.00	0	0	0.00	4	2	0.05	0	0	0.00
bull trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brook trout	0	0	0.00	1	1	0.01	4	2	0.05	0	0	0.00
burbot	17	6	0.28	2	2	0.02	8	4	0.10	0	0	0.00
lake whitefish	0	0	0.00	0	0	0.00	1	0	0.01	0	0	0.00
mountain whitefish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brown bullhead	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
longnose sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bridgelip sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
redside shiner	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
pumpkinseed	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
tench	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
Totals	296		4.81	84		098 .	224		2.74	102		1.33

Table B.4. Continued.

Effort (min)	Little Falls 155.9			Seven Bays 104.4			Keller Ferry 81.2			San Poil 67.7		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	25	10	0.16	50	17	0.48	61	71	0.01	86	27	1.27
cottus spp.	107	45	0.69	4	1	0.04	6	6	0.07	2	1	0.03
walleye	76	32	0.49	10	3	0.10	[illegible]	[illegible]	[illegible]	21	7	0.31
smallmouth bass	0	0	0.00	0	0	0.00	3	3	0.04	30	9	0.44
rainbow trout	3	1	0.02	52	17	0.50	10	11	0.12	78	24	1.15
squawfish	0	0	0.00	0	0	0.00	1	1	0.01	9	3	0.13
carp	0	0	0.00	1	0	0.01	4	4	0.05	4	1	0.06
yellow perch	1	0	0.01	6	2	0.06	0	0	0.00	15	5	0.22
brown trout	7	3	0.05	1	0	0.01	0	0	0.00	0	0	0.00
kokanee salmon	15	6	0.10	172	57	1.65	0	0	0.00	43	13	0.64
chinook salmon	1	0	0.01	0	0	0.00	0	0	0.00	0	0	0.00
crappie	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bull trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
brook trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
burbot	1	0	0.01	7	2	0.07	0	0	0.00	16	5	0.24
lake whitefish	1	0	0.01	0	0	0.00	0	0	0.00	12	4	0.18
mountain whitefish	0	0	0.00	0	0	0.00	0	0	0.00	4	1	0.06
brown bullhead	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
longnose sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
bridgelip sucker	1	0	0.01	0	0	0.00	0	0	0.00	0	0	0.00
redside shiner	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
pumpkinseed	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
tench	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
Totals	**239**		**1.53**	**303**		**2.90**	**93**		1.14	**320**		**4.73**

Table B.4. Continued.

Effort (min)	Spring Canyon		
	102.7		
Species	No.	%	CPUE
largescale sucker	47	57	0.46
cottus spp.	0	0	0.00
walleye	7	9	0.07
smallmouth bass	5	6	0.05
rainbow trout	19	23	0.19
squawfish	0	0	0.00
carp	4	5	0.04
yellow perch	0	0	0.00
brown trout	0	0	0.00
kokanee salmon	0	0	0.00
chinook salmon	0	0	0.00
crappie	0	0	0.00
bull trout	0	0	0.00
brook trout	0	0	0.00
burbot	0	0	0.00
lake whitefish	0	0	0.00
mountain whitefish	0	0	0.00
brown bullhead	0	0	0.00
longnose sucker	0	0	0.00
bridgelip sucker	0	0	0.00
redside shiner	0	0	0.00
pumpkinseed	0	0	0.00
tench	0	0	0.00
Totals	82		0.80

Table B.S. Annual **gillnet** set results for **1994** split by sampling period including number of **fish** collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

	May			August			October			Total		
Effort (min)	3,765			9,917			22,715			36,397		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	3	9	<0.01	14	14	<0.01	37	16	<0.01	54	15	<0.01
longnose sucker	1	3	0.00	1	1	<0.01	4	2	<0.01	4	1	<0.01
burbot	6	17	<0.01	31	30	<0.01	11	5	<0.01	13	4	<0.01
walleye			<0.01			[illegible]	33	15	<0.01	70	19	<0.01
yellow perch	2	6	<0.01	1	1	<0.01	18	8	<0.01	35	10	<0.01
kokanee salmon	1	3	<0.01	26	25	<0.01	0	0	0.00	2	1	<0.01
lake whitefish	21	60	0.01			[illegible]	99	44	<0.01	146	40	<0.01
rainbow trout	0	0	0.00	8	8	<0.01	1	0	<0.01	9	2	<0.01
smallmouth bass	5	14	<0.01				17	7	<0.01	22	6	<0.01
	0	0	0.00	0	0	0.00					1	<0.01
crappie	0	0	0.00	0	0	0.00	1	0	<0.01	2	0	<0.01
squawfish	1	3	<0.01	2	2	<0.01	4	2	<0.01	7	2	<0.01
Totals	35		0.01	103		0.01	227		0.01	365		0.01

Table B.6. May **gillnet** set results for **1994** split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

Effort	Kettle Falls			Gifford			Hunters			Porcupine Bay		
	not sampled			**555**			**510**			**765**		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	-	-		0	0	0.00	0	30	<0.00	0	0	0.00
burbot				0	0	0.00	0	0	0.00	2	30	<0.00
walleye	=	=		2	15	<0.01						
yellow perch	-	-		2	15	<0.01	0	0	0.00	0	0	0.00
kokanee salmon	-	-		0	0	0.00	0	0	0.00	0	0	0.00
lake whitefish	-	-		8	62	0.01	0	60	<0.00	1	33	<0.01
rainbow trout				0	0	0.00	0	0	0.00	0	0	0.00
smallmouth bass	=	=		0	0	0.00			[illegible]	0	0	0.00
squawfish	-	-		1	8	<0.01	0	0	0.00	0	0	0.00
Totals	-		-	13		**0.02**	**3**		001 .	**3**		**<0.01**

Effort	Seven Bays			Keller Ferry			San Poil R.			Spring Canyon		
	495			**660**			420			360		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	0	0		2	67	<0.01	0	0	<0.01	0	0	0.00
burbot	0	0	0.00	0	0	0.00	1	50	0.00	0	0	0.00
walleye	2	25	<0.00	0	0	0.00	0	0	0.00			0.00
yellow perch	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
kokanee salmon	0	0	0.01	0	30	0.00	0	0	0.00	1	100	<0.01
lake whitefish	6	75	0.00			<0.01	1	50	<0.01	0	0	0.00
rainbow trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
smallmouth bass	0	0	[illegible]	0	0	0.00	0	0	0.00	0	0	0.00
squawfish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
Totals	8		0.02	3		**0.01**	**2**		**0.01**	1		**<0.01**

Table B.7. August **gillnet** set results for **1994** split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

Effort	Kettle Falls			Gifford			Hunters			Porcupine Bay		
	2,032			**1,165**			**1,725**			**1,515**		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	3	25	<0.01	7	58	0.01	4	25	<0.01	0	0	0.00
burbot	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
walleye	3	25	<0.01	1	8	<0.01	5	31	<0.01	0	0	0.00
yellow perch	0	0	0.00	1	8	<0.01	0	0	0.00	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
lake whitefish	5	42	<0.01	3	25	<0.01	6	38	<0.01	4	100	<0.01
rainbow trout	0	0	0.00	0	0	0.00	1	6	<0.01	0	0	0.00
smallmouth bass	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
squawfish	1	8	<0.01	0	0	0.00	0	0	0.00	0	0	0.00
Totals	**12**		**0.01**	12		0.01	**16**		**0.01**	**4**		**<0.01**

Effort	Seven Bays			Keller Ferry			San Poil R.			Spring Canyon		
	495			**720**			**720**			**1,545**		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
burbot	0	0	0.00	0	0	0.00	0	0	0.00	1	25	<0.01
walleye	3	33	0.01	0	0	0.00	17	39	0.02	2	50	<0.01
yellow perch	0	0	0.00	0	0	0.00	14	32	0.02	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	1	2	<0.01	0	0	0.00
lake whitefish	6	67	0.01	0	0	0.00	0	0	0.00	0	0	0.00
rainbow trout	0	0	0.00	0	0	0.00	7	16	0.01	0	0	0.00
smallmouth bass	0	0	0.00	0	0	0.00	5	11	0.01	0	0	0.00
squawfish	0	0	0.00	0	0	0.00	0	0	0.00	1	25	<0.01
Totals	**9**		**0.02**	**0**		**0.00**	**44**		**0.06**	**4**		**<0.01**

Table **B.8.** October **gillnet** set results for **1994** split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min).

Effort / species	Kettle Falls No.	%	CPUE	Gifford No.	%	CPUE	Hunters No.	%	CPUE	Porcupine Bay No.	%	CPUE
Effort	3,515			2,940			1,470			2,730		
largescale sucker	1	2	<0.01	4	25	<0.01	2	16	<0.01	24	67	0.02
longnose sucker	0	0	0.00	0	0	0.00	0	0	<0.01	0	0	0.00
burbot	2	4	<0.01	1	6	<0.01			0.00	0	0	0.00
walleye	0	0	<0.01	6	38	<0.01	3	9	<0.01	6	17	0.01
yellow perch			0.00	0	0	0.00	15	47	0.01	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
lake whitefish	44	88	0.01	5	31	<0.01	7	22	0.01	3	8	<0.01
rainbow trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
smallmouth bass	0	0	0.00	0	0	0.00	0	0	0.00	1	3	<0.01
carp	0	0	0.00	0	0	0.00	0	0	0.00			<0.01
crappie	0	0	0.00	0	0	0.00	0	0	0.00	1	3	<0.01
squawfish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
Totals	50		0.0	16		0.01	32		0.02	36		0.03

Effort / Species	Seven Bays No.	%	CPUE	Keller Ferry No.	%	CPUE	San Poil R. No.	%	CPUE	Spring Canyon No.	%	CPUE
Effort	2,730			3,505			3,620			3,615		
largescale sucker	2	6	<0.01	0	0	0.00	0	0	0.00	1	14	<0.01
longnose sucker	2	6	<0.01	0	0	0.00	0	0	0.00	0	0	0.00
burbot	0	0	0.00	0	0	0.00	5	13	<0.01	1	14	<0.01
walleye	4	12	<0.01	3	25	<0.01	7	18	<0.01	2	29	<0.01
yellow perch	0	0	0.00	0	0	0.00	3	8	<0.01	0	0	0.00
kokanee salmon	0	0	0.00	1	8	0.00	0	0	0.00	0	0	0.00
lake whitefish	22	65	0.01	0	0	0.00	16	40	<0.01	1	14	<0.01
rainbow trout	1	3	<0.01			<0.01	0	0	0.00	0	0	0.00
smallmouth bass	0	0	0.00	7	58	[illegible]	7	18	<0.01	2	29	<0.01
carp	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
crappie	1	3	<0.01	1	8	<0.01	0	0	0.00	0	0	0.00
squawfish	2	6	<0.01	0	0	0.00	2	5	<0.01	0	0	0.00
Totals	34		0.0	12		<0.01	40		0.0	7		<0.01

Table B.8. **October gillnet set results for 1994 split by sample station including number of fish collected (No.), relative abundance (%) and catch per unit effort (CPUE) based on time (min).**

	Kettle Falls			Gifford			Hunters			Porcupine Bay		
Effort	3,515			2,940			1,470			2,730		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	1	2	<0.01	4	25	<0.01	5	16	<0.01	24	67	0.02
longnose sucker	0	0	0.00	0	0	0.00	2	6	<0.01	0	0	0.00
burbot	3	6	<0.01	1	6	<0.01	0	0	0.00	0	0	0.00
walleye	2	4	<0.01	6	38	<0.01	3	9	<0.01	6	17	0.01
yellow perch	0	0	0.00	0	0	0.00	15	47	0.01	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
lake whitefish	44	88	0.01	5	31	<0.01	7	22	0.01	3	8	<0.01
rainbow trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
smallmouth bass	0	0	0.00	0	0	0.00	0	0	0.00	1	3	<0.01
carp	0	0	0.00	0	0	0.00	0	0	0.00	1	3	<0.01
crappie	0	0	0.00	0	0	0.00	0	0	0.00	1	3	<0.01
squawfish	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
Totals	**50**		**0.01**	**16**		**0.01**	**32**		**0.02**	**36**		**0.03**

	Seven Bays			Keller Ferry			San Poil R.			Spring Canyon		
Effort	2,730			3,505			3,620			3,615		
Species	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE	No.	%	CPUE
largescale sucker	2	6	<0.01	0	0	0.00	0	0	0.00	1	14	<0.01
longnose sucker	2	6	<0.01	0	0	0.00	0	0	0.00	0	0	0.00
burbot	0	0	0.00	0	0	0.00	5	13	<0.01	1	14	<0.01
walleye	4	12	<0.01	3	25	<0.01	7	18	<0.01	2	29	<0.01
yellow perch	0	0	0.00	0	0	0.00	3	8	<0.01	0	0	0.00
kokanee salmon	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
lake whitefish	22	65	0.01	1	8	<0.01	16	40	<0.01	1	14	<0.01
rainbow trout	1	3	<0.01	0	0	0.00	0	0	0.00	0	0	0.00
smallmouth bass	0	0	0.00	7	58	<0.01	7	18	<0.01	2	29	<0.01
carp	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
crappie	1	3	<0.01	1	8	<0.01	0	0	0.00	0	0	0.00
squawfish	2	6	<0.01	0	0	0.00	2	5	<0.01	0	0	0.00
Totals	**34**		**0.01**	**12**		**<0.01**	**40**		**0.01**	**7**		**<0.01**

APPENDIX C

Feeding Habits

Table C.1 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for all kokanee (n = 21) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	99.96	99.81	100.00	95.17
Eucopoda				
E. navidensis	0.03	0.05	5.00	1.61
Hydrachnellae				
Hydracharina	0.00	0.00	5.00	1.59
Terrestrial				
Insects	0.00	0.13	5.00	1.63

Table C.2 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 2+ year old kokanee (n = 3) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	99.64	98.30	100.00	81.26
Eucopoda				
E. navidensis	0.34	0.48	33.33	9.31
Terrestrial				
Insects	0.02	1.21	33.33	9.43

Table C.3 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 3+ year old kokanee (n = 16) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	100.00	100.00	100.00	100.00

Table C.4 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 4+ year old kokanee (n = 1) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	99.97	99.94	100.00	74.98
Hydrachnellae				
Hydracharina	0.03	0.06	100.00	25.02

Table C.5 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for all rainbow trout (n = 93) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cyprinidae	0.01	3.96	1.08	1.15
Unidentified fish	0.02	1.42	2.15	0.82
Fish eggs	1.31	0.60	6.45	1.90
Amphipoda				
Gammeras	0.02	0.32	4.30	1.05
Cladocera				
L. kindtii	1.64	1.25	4.30	1.64
Daphnia spp.	90.39	18.00	59.14	38.09
B. longirostris	0.01	0.00	1.08	0.25
Eucopepoda				
L.. ashlandi	0.01	0.02	5.38	1.23
Copepoda	0.00	0.02	1.08	0.25
Basommatopbora				
Lymnaeidae	0.10	22.63	2.15	5.46
Physidae	0.07	6.00	2.15	1.87
Pelecypoda				
Sphaeridae	0.26	19.06	1.08	4.64
Diptera				
Chironomidae pupa	2.29	3.29	43.01	11.05
Chironomidae larvae	0.60	1.50	24.73	6.10
Chironomidae adult	0.08	0.11	6.45	1.51
Trichoptera				
Limnephilidae	0.03	0.15	3.23	0.77
Hydropyschidae	0.00	0.02	1.08	0.25
Hemiptera				
Corixidae	1.52	9.64	18.28	6.69
Plecoptera				
Perlodidae	0.00	0.00	1.08	0.25
Epbemeroptera				
Baetidae	0.00	0.00	1.08	0.25
Ephemerellidae	0.00	0.00	1.08	0.25
Leptophlediidae	0.00	0.17	1.08	0.28
Odonata				
Anisoptera	0.01	0.52	2.15	0.61
Zygoptera	0.02	0.10	6.45	1.49
Coleoptera				
Elmidae	0.02	0.25	4.30	1.04
Lepidoptera				
Pyralidae	0.00	0.03	1.08	0.25
Hydrachnellae				
Hydracharina	0.02	0.04	7.53	1.73
Terrestrial				
Insects	1.58	10.92	26.88	8.95

Table C.6 **Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 0+ year old rainbow trout (n = 10) sampled in 1994.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	80.38	8.95	40.00	33.16
Diptera				
Chironomidae pupa	7.66	41.81	40.00	22.94
Chironomidae larvae	5.86	1.27	50.00	14.65
Hemiptera				
Corixidae	0.12	0.03	10.00	2.60
Odonata				
Zygoptera	0.12	0.63	10.00	2.76
Coleoptera				
Elmidae	0.12	2.40	10.00	3.21
Terrestrial				
Insects	5.74	44.91	30.00	20.68

Table C.7 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 1+ year old rainbow trout (n = 24) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Unidentified fish	0.09	15.46	4.17	3.78
Fish eggs	1.97	1.67	8.33	2.30
Amphipoda				
G[redacted]	0.02	2.28	8.33	2.04
Cladocera				
Daphnia spp.	90.84	28.60	62.50	34.93
Eucopepoda				
L. ashlandi	0.01	0.01	4.17	0.80
Diptera				
Chironomidae pupa	3.25	8.52	50.00	11.86
Chironomidae larvae	0.34	3.60	29.17	6.36
Chironomidae adult	0.43	1.02	16.67	3.48
Trichoptera				
Limnephilidae	0.01	0.04	4.17	0.81
Hydropyschidae	0.02	0.27	4.17	0.86
Hemiptera				
Corixidae	1.14	5.31	33.33	7.64
Plecoptera				
Perlodidae	0.01	0.01	4.17	0.80
Ephemeroptera				
Ephemerellidae	0.01	0.01	4.17	0.80
Leptophlebiidae	0.02	2.00	4.17	1.19
Odonata				
Anisoptera	0.04	1.15	4.17	1.03
Zygoptera	0.06	0.55	12.50	2.52
Coleoptera				
Elmidae	0.05	0.83	8.33	1.77
Hydrachnellae				
Hydracharina	0.07	0.35	16.67	3.28
Terrestrial				
Insects	1.60	28.33	41.67	13.75

Table C.8 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 2+ year old rainbow trout (n = 27) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cyprinidae	0.02	8.29	3.70	2.92
Unidentified fish	0.01	0.22	3.70	0.96
Fish eggs	0.73	0.22	7.41	2.03
Amphipoda				
Gammeras	0.01	0.01	3.70	0.91
Cladocera				
L. kindtii	4.78	2.45	3.70	2.66
Daphnia spp.	88.18	12.02	55.56	37.89
Eucopepoda				
L. ashlandi	0.02	0.04	7.41	1.82
Copepoda	0.01	0.05	3.70	0.91
Basommatophora				
Lymnaeidae	0.21	18.63	3.70	5.48
Physidae	0.09	4.57	3.70	2.03
Pelecypoda				
Sphaeridae	0.82	39.93	3.70	10.81
Diptera				
Chironomidae pupa	0.55	0.52	37.04	9.27
Chironomidae larvae	1.00	2.18	18.52	5.28
Chironomidae adult	0.03	0.04	7.41	1.82
Hemiptera				
Corixidae	0.02	0.02	7.41	1.81
Ephemeroptera				
Baetidae	0.01	0.00	3.70	0.90
Odonata				
Zygoptera	0.01	0.04	3.70	0.91
Coleoptera				
Elmidae	0.02	0.29	3.70	0.98
Hydrachnellae				
Hydracharina	0.04	0.01	7.41	1.81
Terrestrial				
Insects	3.44	10.46	22.22	8.79

Table *C.9* **Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food-items for 3+ year old rainbow trout (a = 25) sampled in 1994.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteicbthyes				
Fish eggs	1.78	2.01	8.00	2.73
Amphipoda				
Gammeras	0.03	0.66	4.00	1.09
Cladocera				
L. kindtii	0.31	0.48	12.00	2.96
Daphnia spp.	93.57	44.63	64.00	46.80
Eucopepoda				
L. ashlandi	0.01	0.01	8.00	1.86
Basommatophora				
Physidae	0.09	21.69	4.00	5.97
Diptera				
Chironomidae pupa	3.38	9.74	48.00	14.15
Chironomidae larvae	0.31	0.76	24.00	5.80
Trichoptera				
Limnephilidae	0.07	0.82	8.00	2.06
Hemiptera				
Corixidae	0.13	0.65	16.00	3.89
Odonata				
Anisoptera	0.00	2.41	4.00	1.48
Zygoptera	0.01	0.13	4.00	0.96
Lepidoptera				
Pyralidae	0.00	0.16	4.00	0.96
Hydrachnellae				
Hydracharina	0.00	0.01	4.00	0.93
Terrestrial				
Insects	0.30	15.83	20.00	8.36

Table **C.10** **Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 4+ year old rainbow trout (n = 7) sampled in 1994.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	83.21	7.47	71.43	45.39
B. longirostris	0.12	0.01	14.29	4.04
Basommatophora				
Lymnaeidae	0.43	55.70	14.29	19.72
Diptera				
Chironomidae pupa	0.27	0.08	28.57	8.10
Hemiptera				
Corixidae	15.97	36.75	28.57	22.76

Table C.ll Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for all walleye (n = 93) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Catostomidae	0.09	2.70	2.15	1.43
Cottidae	1.77	4.42	21.51	8.00
Percidae	0.48		8.60	11.02
Salmonidae	0.52	26.08	5.38	9.24
Unidentified fish	2.42	34.95	32.26	20.11
Fish eggs	4.02	0.02	3.23	2.10
Amphipoda				
Gammeras	0.09	0.00	2.15	0.65
Cladocera				
L. kindtii	0.04	0.00	1.08	0.32
Daphnia spp.	27.36	0.12	6.45	9.80
Eucopepoda				
L. ashlandi	0.04	0.00	1.08	0.32
Diptera				
Chironomidae pupa	40.45	2.22	34.41	22.26
Chironomidae larvae	21.91	0.37	11.83	9.85
Trichoptera				
Limnephilidae	0.17	0.00	2.15	0.67
Leptoceridae	0.04	0.00	1.08	0.32
Hydropyschidae	0.04	0.00	1.08	0.32
Hemiptera				
Corixidae	0.04	0.00	1.08	0.32
Ephemeroptera				
Baetidae	0.09	0.00	2.15	0.65
Odonata				
Zygoptera	0.04	0.00	1.08	0.32
Oligochaeta				
Lumbriculidae	0.13	0.02	2.15	0.67
Terrestrial				
Insects	0.26	0.02	5.38	1.63

Table C.12 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 0+ year old walleye (n = 9) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Unidentified fish	8.78	97.81	50.00	4350
Cladocera				
Daphnia spp.	63.51	1.08	10.00	20.72
Eucopepoda				
L. ashlandi	0.68	0.01	10.00	2.97
Diptera				
Chironomidae pupa	19.59	0.96	60.00	22.38
Chironomidae larvae	7.43	0.14	30.00	10.44

Table C.13 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 1+ year old walleye (n = 22) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteicbthyes				
Catostomidae	0.10	21.05	4.55	6.81
Cottidae				
Percidae	0.97 0.19	28.13 17.71	31.82 4.55	16.15 5.95
Unidentified fish	0.97	21.47	36.36	15.59
Fish eggs	0.29	0.02	4.55	1.29
Amphipoda				
Gammeras	0.10	0.05	4.55	1.24
Cladocera				
L. kindtii	0.10	0.05	4.55	1.24
Daphnia spp.	51.40	1.91	18.18	18.95
Diptera				
Chironomidae pupa	12.37	3.10	27.27	11.33
Chironomidae larvae	32.95	6.40	18.18	15.25
Hemiptera				
Corixidae	0.10	0.02	4.55	1.24
Ephemeroptera				
Baetidae	0.10	0.00	4.55	1.23
Terrestrial				
Insects	0.39	0.09	13.64	3.74

Table C.14 **Percentage** by **number,** percentage by weight, frequency of occurrence and index of reiative importance **(IRI)** of **food** items **for 2+** year **old walleye (n =** 16) **sampled** in **1994.**

PREY ITEM	% by Number	% by Weigbt	Frequency of Occurrence	IRI
Osteichtbyes				
Catostomidae	0.32	32.51	6.25	10.97
Cottidae	6.43	40.84	25.00	23.80
Unidentified fish	3.22	22.86	37.50	14.34
Amphipoda				
Gammeras	0.32	0.00	6.25	1.85
Diptera				
Chironomidae pupa	**39.23**	1.98	50.00	**25.60**
Chironomidae larvae	49.20	1.36	12.50	17.70
Trichoptera				
Limnephilidae	0.32	0.03	6.25	1.85
Leptoceridae	0.32	0.00	6.25	1.85
Oligochaeta				
Lumbriculidae	0.64	0.41	6.25	2.05

Table C.15 **Percentage** by number, percentage by weight; frequency of occurrence and index of reiative importance **(IRI) of** food items for 3+ year oid walleye (n = 20) sampled in **1994.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cottidae	0.41	28.91	25.00	13.85
Percidae	1.23	3.08	25.00	9.16
Salmonidae	0.55	57.96	10.00	21.41
Unidentified fish	0.82	3.38	15.00	**6.00**
Fish eggs	8.22	0.05	5.00	4.15
Cladocera				
Daphnia spp.	**0.96**	0.01	5.00	1.87
Diptera				
Chironomidae pupa	87.40	6.56	30.00	38.74
Chironomidae larvae	0.27	0.03	**10.00**	3.22
Odonata				
Zygoptera	0.14	0.01	5.00	1.61

Table C.16 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 4+ year old walleye (n = 13) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Ost(Cottidae es		**0.24**		
Percidae	3.51 8.77	**79.04**	**23.08**	**32.03**
Unidentified fish	12.28	**20.57**	**23.08**	**16.16**
Fish eggs	52.63	0.03	7.69	**17.44**
Diptera				
Chironomidae pupa	8.77	0.05	**30.77**	**11.44**
Trichoptera				
Limnephilidae	5.26	**0.00**	7.69	3.74
Hydropyschidae	1.75	**0.01**	7.69	2.73
Epbemeroptera				
Baetidae	1.75	0.00	7.69	2.73
Oligochaeta				
Lumbriculidae	1.75	0.01	7.69	2.73
Terrestrial				
Insects	3.51	0.04	15.38	5.47

Table C.17 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 5+ year old walleye (n = 4) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Percidae	6.25	23.47	**25.00**	16.84
Salmonidae	6.25	2.93	**25.00**	**10.52**
Unidentified fish	**12.50**	**69.09**	**50.00**	**40.49**
Diptera				
Chironomidae pupa	**75.00**	4.51	25.00	32.16

Table C.18 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 6+ year old walleye (n = 4) sampled in 1994.

PREY ITEM	% by Number	% by Weigbt	Frequency of Occurrence	IRI
Osteichthyes				
Salmonidae	**14.29**	0.34	**25.00**	13.21
Unidentified fish	57.14	99.62	**50.00**	68.92
Diptera				
Chironomidae pupa	28.57	0.04	25.00	17.87

Table C.19 Percentage by number, percentage by weigbt, frequency of occurrence and index of relative importance (IRI) of food items for 7+ year old walleye (n = 1) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Unidentified fish	100.00	100.00	100.00	100.00

Table C.20 Percentage by number, percentage by weight, frequency of occurrence and index of reiative importance (IRI) of food items for 8+ year old walleye (n = 2) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Unidentified fish	100.00	100.00	100.00	100.00

Table C.21 Percentage by number, percentage by weight, frequency of occurrence and index of relative importance (IRI) of food items for 10+ year old walleye (n = 2) sampled in 1994.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Salmonidae	100.00	100.00	100.00	100.00