This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries, The views in this report are the author's and do not necessarily represent the views of BPA.

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LAKE ROOSEVELT FISHERIES MONITORING PROGRAM

1993 ANNUAL REPORT

Prepared by:

Keith Underwood
and
John Shields

Department of Natural Resources
Spokane Tribe of Indians
Wellpinit, WA

Prepared for:

U. S. Department of Energy
Bonneville Power Administration
Environment, Fish and Wildlife
P.O. Box 3621
Portland, OR 97208-3621

Project Number 88-63
Contract Number DE-8179-88DP91819

June 1996

ABSTRACT

The first three years of this study were used to collect pre-hatchery baseline data on the fishery. The Spokane Tribal Hatchery began stocking kokanee and rainbow trout in 1991 and Sherman Creek Hatchery began stocking by 1992. The estimated number of kokanee (13,986) harvested in 1993 was similar to harvest numbers in the previous years, but the number of rainbow trout (403,277) and walleye (337,413) harvested doubled from estimates made in past years. Related studies have identified that stocking hatchery origin kokanee fry into Lake Roosevelt does not translate into returning adults based on coded wire tag returns. Of all the coded wire tagged kokanee recovered in 1993, 1% were from fry releases and the rest were yearling releases. However, 72% of the coded wire tagged kokanee considered available for harvest were fry. The stocking of yearling kokanee began in 1992, totaling approximately 140,000 yearlings. The yearlings were not expected to begin entering the creel until 1993 with the main harvest in 1994. As a result, it was too early to speculate on the effect of stocking yearlings instead of fry on the creel. The 1993 rainbow trout harvest escalated due to some of the reasons were: (1) the number of angler trips doubled in 1993 from previous years; (2) the number of rainbow trout released was greater than in years past and (3) the spring drawdown in 1993 was relatively small (limiting entrainment). The increased number of walleye harvested was believed to be from the increased angler pressure. Kokanee salmon and rainbow trout growth appeared to be similar to previous years. The growth of walleye (when determined by back calculations from scales) was less than in year past, but the average size of walleye in .the creel increased. The feeding habits of kokanee, rainbow trout and walleye in 1993 were similar to previous years. Kokanee salmon and rainbow trout fed mainly on daphnia spp. and chironomids, and walleye mainly feed on fish. Overall, the fishery appears to be building in the number of fish caught and the number of anglers utilizing the lake. 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. Data collected in 1994 will help determine whether walleye food was scarce.

ACKNOWLEDGMENTS

We gratefully acknowledge John Hisata (Washington Department of Fish and Wildlife), and Jerry Marco (Colville Confederated Tribes), for advise and coordination in all aspects of this study. Creel clerks William Matt Sr. (Spokane Tribe of Indians), Jim Meskan (WDFW), and Leroy Williams (Colville Confederated Tribes), for collection of creel data. We thank Amy Voeller, Mike Thatcher, Sam Abrahamson, Del Brown, Hank Etue, Bart Kieffer, William Matt Jr., and Tim Peone for their help in the collection of field data and laboratory analysis. We thank Hank Etue and Del Brown for equipment repair and maintenance.

We acknowledge the following individuals for their support: Kelly Cash (NPS), and Gary Kuiper (NPS), who provided camping at no cost to the project; Marty Blum, Roy Graffis, Winn Self, and students from Hunters High School who provided assistance in rainbow trout net-pen tagging operations.

This project was supported by a contract from the U.S. Department of Energy, Bonneville Power Administration (BPA), Contract number DE-8 179-88BP91819; BPA project number 88-63. 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 No. P12614208001). Capitol equipment for this project was supplied by the UCUT Fisheries Center.

Special thanks goes to Charlie Craig (BPA, Division of Fish and Wildlife), who served as BPA project manager, Larry Goodrow (Executive Director, Spokane Tribe of Indians and UCUT Administrator), and Carol Evans (Accountant, Spokane Tribe of Indians), for administration of these contracts.

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1.0 INTRODUCTION

1.1 Project History

The Lake Roosevelt Monitoring Program (Monitoring Program) began to collect baseline fisheries data in 1988. Data collected from 1988 through 1990 prior to Sherman Greek and Spokane Tribal Hatcheries going on line was considered baseline pre-hatchery data. 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; collect limnological parameters on the lake (i.e. temperature, pH, redox); collect food availability data (e.g. zooplankton); and to collect fishery 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). The 1988 / 89 and 1990 annual reports contain pre-hatchery fisheries data and their accompanying analyses (Peone et al. 1990, and Griffith and Scholz 1991).

Large scale stocking of kokanee salmon began in 1991. Data collected from 1991 to present was considered post-stocking information. Data collection methods used during post-stocking were similar to those used in pre-stocking. The annual reports for these years contain a comparison of the fishery before and after the stocking of kokanee into Lake Roosevelt. These reports focus on changes in the lake biota and fishery, attempting to identify whether changes were due to kokanee stocking, lake operations or other unforeseen reasons (Thatcher et al. 1993, and Thatcher et al. 1994).

An additional aspect was added to the scope of the Monitoring Program during 1991. In order to determine the best kokanee stocking strategy, a better understanding of kokanee imprinting was needed. Since imprinting and smoltification are believed to be linked, physiological tests to determine kokanee smoltification timing and extent were conducted. The goal of these experiments was to develop imprinting methods which maximized the homing of kokanee back to release sites. Field tests were also conducted by exposing kokanee at different life stages to various imprinting chemicals. These artificially imprinted fish were then coded wire tagged prior to stocking. Later, kokanee adults were collected during the spawning period and checked for tags to determine which life stage exposed to imprinting chemicals homed better to its release site. Scholz et al. (1992 and 1993), and Tilson et al. (1994) wrote supplemental reports to the Monitoring Program on kokanee imprinting and recommend kokanee stocking strategies which maximize homing to egg collection sites.

During 1991, another project was started on Lake Roosevelt called the Lake Roosevelt Data Collection Project (Data Collection Project). This project was funded through the Systems Operation Review process which sought to develop an operational scenario of 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 build a biological model of the lake to determine which lake operation best suited the biota of the lake. The Monitoring Program and the Data Collection Project were dependent upon one another for data in order to complete each project's respective analysis. As a result, much of the data reported by the Monitoring Program is also reported by the Data Collection Project. The Monitoring Program was primarily concerned with kokanee and the effect of stocking on the ecosystem, while the Data Collection Project was involved in studying the effect of lake operations on the biota. Griffith et al. (1991), Griffith and McDowell (1993) and Voeller (1996) wrote the annual reports for the Data Collection Project.

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. The rainbow trout held in the net pens until May or June and then released as yearlings. The Net Pen Program was operated by the Lake Roosevelt Developmental 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 early 1940's 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. 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 1993 Study Objectives

Objectives of the Lake Roosevelt Monitoring for 1993 were as follows:

1) Year round reservoir wide creel survey of Lake Roosevelt;

2) Fishery surveys by electrofishing and gill nets during May, August and October to obtain relative abundance and meristic measures;

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 1993 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

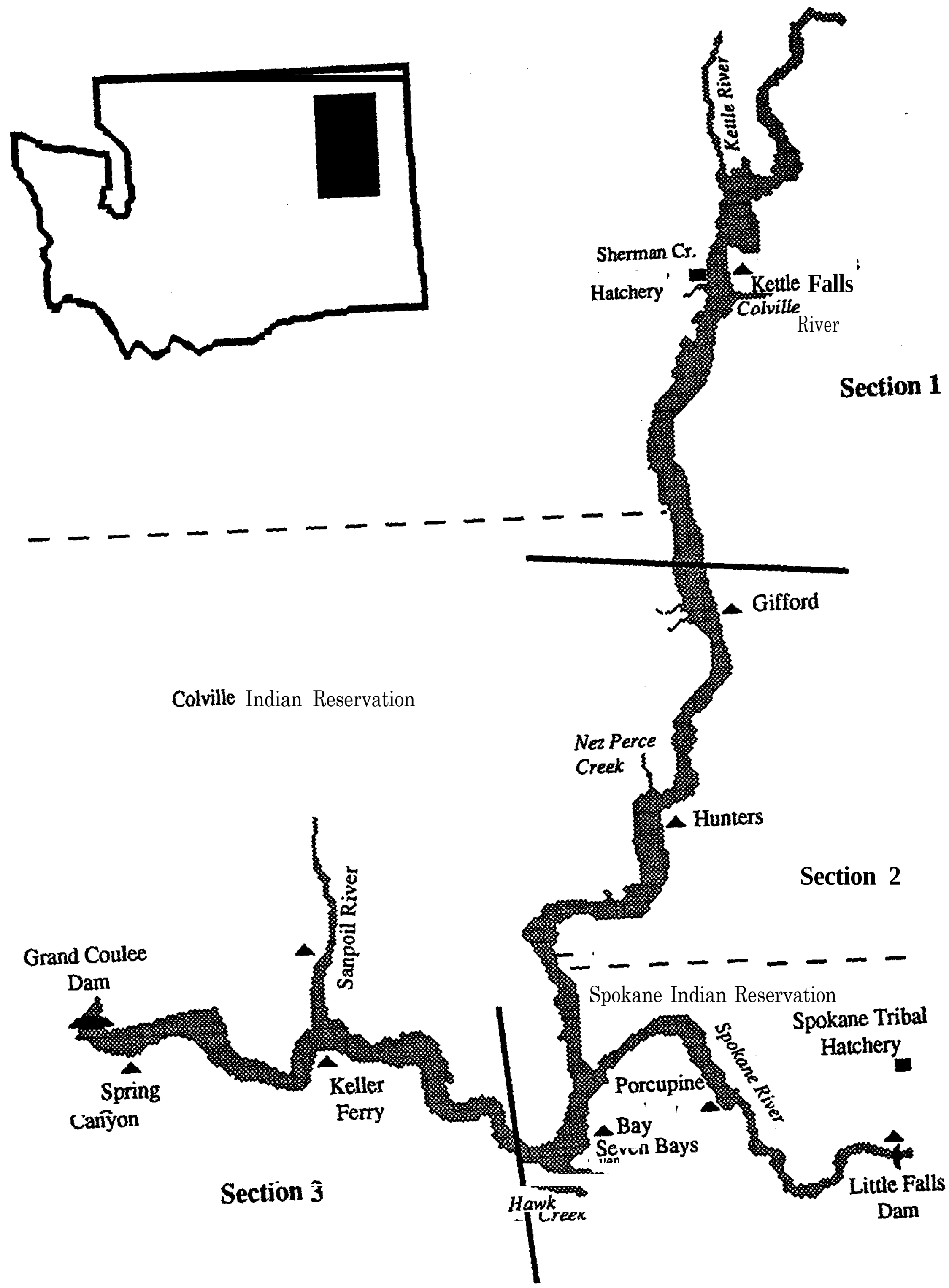

Figure 2.1. Map of Lake Roosevelt, Washington. "▲" indicates fish sampling stations.

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 nip, 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:

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:

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

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

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

Where:

n = number of hours sampled for each stratum per month;
D_S = number of days per month within each stratum; and
H_{ci} = mean number of hours creeled per day for each stratum per month.

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

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

Where:

Xd = mean number of shore anglers per day for each stratum per month from pressure counts;
Pd = number of pressure counts conducted for each stratum per month; and
Spi = 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 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 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. estimates were calculated by summing the eight stratum values for angler pressure and summing the 95% C.I. Annual angler pressure and 95% C.I. estimates were calculated by summing monthly angler pressure estimates and 95% C.I. 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 nip 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
T_h = total hours spent fishing for each stratum per month.

Monthly CPUE of a particular fish species was calculated by dividing the total catch for the entire month (all stratum) by the total angler hours (all stratum). 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:

$$Harvest = (H_{cpue})(PE_s)$$

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 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.

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:

$$D_{93} = \left(\frac{C_{85} x C_{93}}{D_{85}} \right)$$

where:

$D93$	=	dollar value per fishing trip for the Lake Roosevelt Fishery in 1993;
$C85$	=	regional CPI for 1985;
$C93$	=	regional CPI for 1993; and
$D85$	=	dollar value per fishing trip for the Lake Roosevelt Fishery in 1985 ($26.00).

The 1993 dollar value was multiplied by total number of angler trips in 1993 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 electrof'ishing 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 cellulose pad 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 overemphasize 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 coeffkients 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.

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 1992 through November 1993. December 1992 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 1992 through February 1993 (winter), March 1993 through May 1993 (spring), June 1993 through August 1993 (summer), and September 1993 through November 1993 (fall). Quarters were established based on historic weather trends and angler use of the fishery. For example, a quarterly average was used is 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”.

Pressure estimates made for Section 1 during the months of March and Augusts were not estimated from data collected during those months. The data was misplaced, so we used the average between the month prior to and immediately after March and August to obtain a pressure estimate for that month.

During the months of March and May in Section 2 few data points were collected causing an inflation in the estimated hours spent fishing in Section 2. Thus, Section 2 March and May estimates must be viewed with caution.

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 1992 through

Table 3.1. Total monthly angler pressure estimates in hours (± 95% CI), by creel section on Lake Roosevelt from December 1992 through November 1993.

	Section 1	Section 2	Section 3	Total
Dec	3,120 ± 216	32,470 ± 681	1,310 ± 89	36,900 ± 986
Jan	1,637 ± 213	9,721 ± 1,242	2,439 ± 4%	13,797 4 1,951
Feb	2,305 ± 265	14,621 ± 2,203	14,543 ± 1,273	31,469 ± 3,741
Mar	2,327 ± 229	228,846 ± 7,919	11,720 ± 915	242,893 4 9,063
Apr	4,450 f213	66,906 ± 2,091	20,262 ± 517	91,618 ± 2,821
May	30,835 ± 1,134	376,943 ± 8,866	122,763 ± 5,501	530,541 ± 15,501
Jun	32,828 ± 1,218	47,671 ± 2,200	205,096 ± 6,126	285,595 ± 9,544
Jul	30,295 ± 1,573	49,877 ± 2,278	108,073 ± 4,398	188,245 ± 8,249
Aug	24,785 ± 1,085	19,145 ± 803	321,251 ± 9,856	365,181 ± 11,744
Sep	14,305 ± 763	46,018 ± 3,731	82,320 ± 4,700	142,643 ± 9,194
Oct	11,497 ± 711	461,586 ± 8,851	24,292 ± 993	497,375 ± 10,555
Nov	14,140 ± 756	51,210 ± 1,855	8,576 ± 829	73,926 ± 3,440
Total	**172,524 ± 8,376**	**1,405,014 ± 42,720**	**922,645 ± 35,693**	**2,500,183 ± 86,789**

* estimated by averaging the months prior to and after the marked month.

November 1993 was 594,508 angler trips. The greatest number of trips regardless of section were during May with 121,578 trips, October with 93,267 trips and 84,688 trips in August. A total of 28,868 trips were made in Section 1, 325,784 angler trips in Section 2 and 239,856 trips in Section 3.

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 0.0162 HPUE (6.2 angler hrs/fish); 0.079 HPUE (12.7 angler hrs/fish) for walleye; 0.063 (15.8 angler

Table 3.2. Angler trip estimates by section based on angler hours (hrs) and average trip length for Lake Roosevelt from December 1992 through November 1993.

	Section	Mean Trip Length	No. Angler Hours	No. Angler Trips
December	1	4.88	3,120	639
	2	2.73	32,470	11,915
	3	2.49	1,310	527
January	1	4.96	1,637	330
	2	2.82	9,721	3,443
	3	2.28	2,439	1,071
February	1	4.61	2,305	500
	2	1.26	14,621	11,619
	3	2.45	14,543	5,948
March	1	4.87	2,327	478
	2	4.53	228,846	50,532
	3	1.94	11,720	6,045
April	1	5.46	4,450	816
	2	2.35	66,906	28,496
	3	2.39	20,262	8,479
May	1	5.84	30,835	5,283
	2	4.86	376,943	77,618
	3	3.17	122,763	38,677
June	1	6.24	32,828	5,261
	2	3.69	47,671	12,924
	3	7.33	205,096	27,984
July	1	6.10	30,295	4,967
	2	3.71	49,877	13,429
	3	3.04	108,073	35,534
August	1	6.21	24,785	3,989
	2	3.51	19,145	5,453
	3	4.16	321,251	77,246
September	1	6.28	14,305	2,277
	2	3.30	46,018	13,927
	3	3.11	82,320	26,486
October	1	5.91	11,497	1,946
	2	5.55	461,586	83,100
	3	2.96	24,292	8,221
November	1	5.94	14,140	2,382
	2	3.84	51,210	13,328
	3	2.36	8,576	3,638
Total		4.09	2,500,181	594,508

hrs/fish) for smallmouth bass and 0.007 HPUE (142 angler hrs/fish) for kokanee. Section 3 had the quickest harvest rate for rainbow trout (0.338 HPUE (3.0 angler hrs/fish)) and smallmouth bass (0.053 HPUE (18.9 angler hrs/fish)). Section 1 had the quickest mean annual harvest rate for walleye (0.129 HPUE (7.8 angler hrs/fish)) and Section 2 had the shortest for kokanee (0.013 HPUE (73 angler hrs/fish)).

The harvest/catch per unit of effort reported in this paper is somewhat missleading because the total number of angler hours spent fishing regardless of target species was used. The reason angler hours were not split by target species was to maintain consistency between previous reports. As a result, the number of hours spent fishing per fish harvested was over-estimated (Thatcher et al. 1992, 1993). For example, anglers fishing for kokanee were unlikely to harvest sturgeon or smallmouth bass. On the other hand, anglers fishing for kokanee were likely to catch rainbow trout. Furthermore, anglers targeting rainbow trout were likely to catch walleye or kokanee. Appendix A contains CPUE data by section, month and species.

The 1993 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 0.079 HPUE (12.7 angler hrs/fish), but catch was 0.120 CPUE (8.3 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 slot limit was walleye between 16 and 20 inches had to be released and only one fish over 20 inches could be kept. This meant that alphough it took 8.3 hours to catch a walleye anglers had to release those which were not in the slot limit. Therefore, harvest was higher at 12.7 hrs/fish. The second difference between catch and harvest rates was the catch rate for fish other than kokanee, rainbow trout, walleye, smallmouth bass and sturgeon increased from greater than 1,000 angler hours per “other fish” harvested to 250 hours spent per “other fish” caught. A majority of the fish in the “other” category were yellow perch, but suckers, carp and lake whitefish were also in the catch. This means that the majority of other species caught were “trash fish”.

The largest contribution to the fishery in terms of harvest (kept only) numbers were rainbow trout (398,943 fish) followed by walleye (307,663) and smallmouth bass (103,687). Kokanee harvest estimates were 13,960 fish. The majority of the rainbow trout (238,533), kokanee (7,435) and smallmouth bass (94,232) harvested were in Section

Table 3.3. Harvest (kept fish) catch per unit effort (HPUE) by section from December 1992 through November 1993 at Lake Roosevelt.

	Section			
	1	2	3	Annual
kokanee	<0.001	0.013	0.008	0.007
rainbow trout	0.039	0.110	0.338	0.162
walleye	0.129	0.095	0.014	0.079
smallmouth bass	0.002	0.008	0.053	0.063
sturgeon	<0.001	0.000	0.000	<0.001
other species	0.001	0.000	0.000	<0.001
Annual HPUE	**0.029**	**0.038**	**0.069**	**0.052**

Table 3.4. Catch (kept and released fish) catch per unit effort (CPUE) by section from December 1992 through November 1993 at Lake Roosevelt.

	Section			
	1	2	3	Annual
kokanee	<0.00 1	0.013	0.008	0.007
rainbow trout	0.039	0.112	0.345	0.165
walleye	0.210	0.133	0.016	0.120
smallmouth bass	0.011	0.014	0.183	0.069
sturgeon	0.001	0.000	0.000	<0.001
other species	0.002	0.007	0.004	0.004
Annual CPUE	**0.044**	**0.047**	**0.093**	**0.061**

3. The majority of walleye (268,588) harvested were in Section 2. Section 1 was the only section where sturgeon (66) were harvested. 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.

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 lengths and weights with standard deviations by section and are reported in Table 3.7. The kokanee and rainbow trout observed in the creel appeared to be larger in Section 1 and 3 in comparison to Section 2. Walleye were larger in Section 1 than in Section 2 or 3. The

Table 3.5. Number of fish harvested (kept), with ± 95% confidence intervals, for Lake Roosevelt during December 1992 through November 1993.

	Section			
	1	2	3	Total
kokanee	27 (±1)	6,498 (±464)	7,435 (±322)	13,960 (±787)
rainbow trout	7,071 (±42 1)	153,339 (±4,689)	238,533 (±11,559)	398,943 (±16,669)
walleye	26,232 (±1,098)	268,588 (±6,677)	12,843 (±447)	307,663 (±8,222)
smallmouth bass	267 (±15)	9,188 (±264)	94,232 (±3,577)	103,687 (±3,856)
sturgeon	66 (±3)	0 (±--)	0 (±--)	66 (±3)
other species	296 (±11)	0 (±--)	0 (±--)	296 (±11)
Annual Harvest	**35,093 (±1,628)**	448,777 (±12,328)	353,042 (±15,905)	**836,912 (±29,861)**

mean length of walleye in Section 1 had a mean length of 378 mm (n = 474) for fish in the smaller than 16 inch slot limit and fish harvested in the 20 inches slot limit had a mean length of 551 mm (n = 27). The mean length of walleye in Section 2 and Section 3 was smaller than walleye caught in Section 1. In Section 2 walleye smaller than 16 inches had a mean length of 319 mm (n = 73) and walleye larger than 20 inches had a mean length of 591 mm (n = 4). In Section 3 the mean length of walleye was 354 mm (n = 37) for walleye in the 16 inch or smaller slot limit and 508 mm (n=l) for the 20 inch or larger slot limit.

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 are satisfied with the

Table 3.6. Number of fish caught (kept and released), with ± 95% confidence intervals, for Lake Roosevelt during December 1992 through November 1993.

	Section			
	1	2	3	Total
kokanee	53 (±3)	6,498 (±464)	7,435 (±322)	13,986 (±789)
rainbow trout	7,130 (±423)	153,750 (±4,708)	242,397 (±11,710)	403,277 (±16,841)
walleye	43,407 (±1,809)	278,57 1 (±7,135)	15,435 (±525)	337,413 (±9,469)
smallmouth bass	2,747 (±118)	10,420 (±32 1)	187,151 (±6,602)	200,318 (±7,041)
sturgeon	138 (±6)	0 (±--)	0 (±--)	138 (±6)
other species	409 (±16)	1,438 (±66)	3,050 (±137)	4,897 (f219)
Annual Catch	**54,991 (±2,453)**	**461,842 (±12,927)**	**455,438 (±19,297)**	**972,271 (±34,677)**

kokanee **(78%),** rainbow trout (58%) and walleye (65%) fisheries. However, **the** rainbow fishery in Section 1 did not appear to be doing well. The majority of rainbow trout anglers in Section 1 were not satisfied. Also, summer and fall periods were less satisfying periods than spring and winter for kokanee anglers regardless of section.

Of all the anglers who fished on Lake Roosevelt during **1993, 61%** targeted rainbow, 29% targeted walleye, 5% 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. The winter fishery appears to be primarily centered around Section 2. In spring, the rainbow fishery began tailing off in Section 1 and the walleye fishery began

Table 3.7. Annual numbers (n), mean lengths (mm) and weights (g) with standard deviations for all fish harvested on Lake Roosevelt from December 1992 through November 1993.

	Kokanee	Rainbow	Walleye	Small-mouth Bass	Sturgeon	Yellow Perch
Sec 1						
Ln	1	177	548	11	1	7
Wt	1,829 567	913 ± 382 443 ± 62	464 ± 197 390 ± 54	261 ± 102 186 ± 54	1422 --	276 274 ± ±19
						76
Sec 2						
				8	- -	- -
Ln	**459 13 ± 94**	418 1 ± 261	**332 ± 72**	**257 ± 47**	- -	- -
Wt	**1,038 ± 554**	**921 ± 358**	**290 ± 183**	**252 ± 162**	--	--
Sec 3						
n	31	1,085	42	166	--	--
	494 ± 48	**483 ± 63**				
k	**1,069 ± 331**	**1,068 ± 195**	428 366+56 f203	184 ± 238 238 ± 94	----	----
Total						
n	**45**	**1,474**	**672**	**185**	**1**	7
Ln	**486 ± 66**	**471±72**	**382±60**	**187±59**	**1422**	274 **±19**
Wt	**1,077±415**	**833±253**	**441±203**	**239±203**	**- -**	**276±76**

Table 3.8. Percent of anglers satisfied with the fishery by species, section and season from December 1992 through November 1993.

Quarter Section	Kokanee Yes	Kokanee No	Rainbow trout Yes	Rainbow trout No	Walleye Yes	Walleye No
Winter						
One	--	--	44%	65%	--	--
Two	--	--	91%	56%	--	--
Three	100%	0%		9%	--	--
Spring						
One	--	--	6%	94%	66%	34%
Two		--	22%	78%	50%	50%
Three	100%	0%	91%	9%	--	--
Summer						
One	--	--	43%	57%	70%	30%
Two	50%	50%	76%	24%	31%	69%
Three	59%	41%	70%	30%	100%	0%
Fall						
One	--	--	41%	59%	69%	31%
Two	50%	50%	85%	15%	100%	0%
Three	--	--	11%	89%	--	--
Qrtly Totals						
Winter	100%	0%	63%	37%	--	--
Spring	100%	0%	78%	22%	66%	34%
Summer	57%	43%	66%	34%	64%	36%
Fall	50%	50%	31%	69%	66%	34%
Annual Total	78%	22%	58%	42%	65%	35%

Table 3.9. Percent of anglers targeting various fish species by section and season on Lake Roosevelt from December 1992 through November 1993.

Quarter Section	Kokanee	Rainbow	Walleye	Other*	% angling
Winter					
One	0%	100%	0%	0%	6%
Two	0%	100%	0%	0%	31%
Three	7%	93%	0%	0%	6%
Spring					
One	0%	19%	79%	2%	20%
Two	0%	72%	28%	0%	10%
Three	11%	89%	0%	0%	20%
Summer					
One	0%	15%	84%	1%	39%
Two	8%	18%	74%	0%	39%
Three	9%	76%	7%	8%	39%
Fall					
One	0%	57%	16%	26%	36%
Two	34%	56%	10%	0%	20%
Three	0%	100%	0%	0%	36%
Qrtly Totals					
Winter	3%	97%	0%	0%	
Spring	7%	64%	28%	1%	
Summer	5%	41%	50%	4%	
Fall	4%	70%	11%	15%	
Annual Total	5%	61%	29%	5%	

picking up in Section 3. 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 decreased independent of section.

Table 3.10 shows the economic value of the sport fishery based on total number of angler trips of 594,504 at $34.77 for each trip. The economic value was **$20,671,043.**

Table 3.10 Economic value of the sport fishery at Lake Roosevelt during December 1992 through November 1993.

	1985	**1993**
Consumer Price Index	$167.87	**$224.50**
Dollars Spent per Angler Trip	**$26.00**	**$34.77**
Number of Angler Trips		**594,504**
Economic Value of Fishery		**$20,671,043**

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 46% based on all fish sampled (Table 3.11). The second most abundant fish was walleye (11%) and yellow perch (11%) followed by smalhnouth bass (9%) and rainbow trout (11%). Kokanee made up 1% 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 periods during 1993. The annual sampling effort was 833 minutes electrofishing and 5,646 minutes of gillnetting making a grand total of 6,479 minutes sampling effort. Unfortunately, mechanical breakdowns limited the frequency of sampling in 1993, resulting in missing all by one site in August and five of the nine sites in November. Hence, caution must be taken when comparing annual relative abundance and CPUE data with previous or future years. 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 1993.

Family species	Common Name	Electro-	Gillnet	Annual
Catostomidae				
Catostomus macrocheilus	largescale sucker	46%	16%	45%
Centrarchidae				
Microptuerus dolomieui	smallmouth bass	9%	0%	9%
Cottidae				
Cottus beldingi	piute sculpin	3%	0%	3%
Cyprinidae				
Acrocheilus alutaceus	carp	1%	0%	1%
Prychocheilus oregonensis	squawfish	8%	0%	8%
Gadidae				
Lota lota	burbot	0%	7%	c1%
Ictaluridae				
Ictalurus nebulosus	brown bullhead	<1%	0%	c1%
Percidae				
Stizostedion vitreum vitreum	walleye	11%	35%	11%
Perca flavescens	yellow perch	11%	5%	11%
Salmonidae				
Savelinus fontinalis	brown trout	1%	0%	1%
Salmo trutta	brook trout	<1%	0%	<1%
Oncorhynchus tshawytscha	chinook salmon	<1%	0%	<1%
Oncorhynchus nerka	kokanee salmon	1%	2%	1%
Coregonus clupeaformis	lake whitefish	<1%	33%	1%
Prosopium williamsoni	mt. whitefish	<1%	0%	<1%
Oncorhynchus mykiss	rainbow trout	9%	2%	9%

Table 3.12. Catch per unit effort based on time (minutes) for fish captured by electrofishing boat or gillnets during 1993.

	Electrofish		Gillnet		Total	
	CPUE	No.	CPUE	No.	CPUE	No.
largescale sucker	1.203	1,002	0.001	7	0.156	1,009
smallmouth bass	0.248	207	0.000	0	0.032	207
cothls spp.	0.074	62	0.000	0	0.010	62
carp	0.026	22	0.000	0	0.003	22
squawfish	0.220	183	0.000	0	0.028	183
burbot	0.000	0	0.001	3	0.000	3
brown bullhead	0.004	3	0.000	0	0.000	3
walleye	0.280	233	0.003	5	0.038	248
yellow perch	0.294	245	CO.001	2	0.038	247
brown trout	0.019	16	0.000	0	0.002	16
brook trout	0.002	2	0.000	0	0.000	2
chinook salmon	0.001	1	0.000	0	0.000	1
kokanee salmon	0.017	14	0.000	1	0.002	15
lake whitefish	0.001	1	0.002	14	0.002	15
mountain whitefish	0.002	2	0.000	0	0.000	2
rainbow trout	0.241	201	CO.001	1	0.031	202
Totals	2.634	2,194	0.008	43	0.345	2,237

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. The back calculated length at age is reported in table 3.14. The low number of kokanee sampled during 1993 resulted in limited length, weight, condition or back calculation data. Based on the two fish sampled condition appeared to be normal as was length and weight.

Table 3.13. Lengths, weights, and condition factors (mean ± standard deviation) of kokanee salmon collected during 1993.

Age	n	Length (mm)	Weight (g)	Condition Factor
o+	-	- I L -	- * -	- ± -
1+	-	- ± -	- ± -	- ± -
2+	-	- f -	- + -	- ± -
3+	2	462 ± 123	1,025 ± 248	1.03 ± 0.17

Table 3.14. Back calculated fork length (mean ± standard deviation) of kokanee salmon sampled during 1993.

		Back Calculated Fork Length (mm) at Annulus		
Cohort	**n**	1	2	3
1992	-	--- +	- + -	-- + -
1991	-	- ± -	- ± -	- ± -
1990	2	190 ± 4	321 ± 75	444 ± 19
Mean Annual Growth (mm)		**190**	**131**	**123**

The lengths, weights and condition factors of rainbow trout collected during 1993 are identified in Table 3.15. The results of the back calculated length of fishfor each age based on scales are in Table 3.16. Rainbow trout collected during 1993 appeared to have quick growth rates and good condition factor. The back calculated lengths suggest that more recent cohorts had faster growth rates than less recent cohorts. 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 1993.

Age	n	Length (mm)	Weight (g)	Condition Factor
o+	13	167 ± 59	134 ± 80	1.52 ± 0.66
1+	7	222 ± 40	153 ± 53	1.29 ± 0.26
2+	6	382 ± 84	595 ± 286	1.07 ± 0.35
3+	11	428 ± 32	862 ± 142	1.10 ± 0.11

Table 3.16. Back calculated fork length (mean ± standard deviation) of rainbow trout sampled during 1993.

		Back Calculated Fork Length (mm) at Annulus		
Cohort	**n**	1	2	3
1992	7	154 ± 18	- f -	-- + -
1991	6	150 ± 63	296 ± 96	± -
1990	11	137 ± 35	230 ± 40	348 ± 28
Grand Mean		**145 ± 39**	**254** ± 70	348 ± 28
Mean Annual Growth (mm)		**145**	**109**	94

The length, weight and condition factor of walleye sampled by electrofishing and gillnet sets are summarized in Table 3.17. Back calculated length using scales by cohort is reported in Table 3.18. These tables suggest that walleye were in good condition. Back calculations suggest that more recent cohorts were growing faster than less recent cohorts.

Table 3.17. Lengths, weights, and condition factors (mean ± standard deviation) of walleye collected during 1993.

Age	n	Length (mm)	Weight (g)	Condition Factor
o+	10	189 ± 30	65 ± 38	0.89 ± 0.24
1+	11	267 ± 39	176 ± 79	0.87 ± 0.19
2+	8	382 ± 49	441 ± 230	0.74 ± 0.28
3+	13	419 ± 31	663 ± 171	0.89 ± 0.12
4+	9	467 ± 48	992 ± 344	0.94 ± 0.14
5+	6	551 ± 71	1,607 ± 631	0.92 ± 0.10
6+	1	535 ± -	1,480 ± -	0.97 ± -

Table 3.18. Back calculated fork length (mean ± standard deviation) of walleye sampled during 1993.

		Back Calculated Fork Length (mm) at Annulus					
Cohort	**n**	1	2	3	4	5	6
1992	11	146 ± 25	±	±	±	±	±
1991	8	166 ± 31	307 ± 36	±	±	±	±
1990	13	158 ± 25	256 ± 43	346 ± 44	±	±	±
1989	9	123 ± 24	221 ± 27	297 ± 34	394 ±	±	±
1988	6	116 ± 31	233 ± 39	323 ± 60	417 ± 39	491 ± 63	±
1987	1	84 ± -	133 ± -	203 ± -	296 ± 70	380 ± -	455 ± -
Grand Mean		**144 ± 32**	**251 ± 51**	**321 ± 53**	**397f 58**	**475 ± 71**	**455 ± -**
Annual Growth		144	107	70	76	78	-

3.4 Feeding Habits

Feeding habits were based on fish sampled during electrofishing and gillnet sets. A total of 21 kokanee, 73 rainbow trout and 47 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.

Kokanee's primary food item was Daphnia spp. based on the IRI. The IRI indicates that Daphnia spp and chironmonidae larvae were the two most important food items for rainbow trout. Walleye's most important food items were fish and chironmidae pupa.

Diet overlap analysis predicted that kokanee and rainbow trout overlap was 0.84 (high-moderate overlap). Kokanee and walleye diet overlap was 0.35 (low overlap) and rainbow and walleye diet overlap was 0.57 (moderate overlap).

Table 3.19. Index of relative importance for rainbow trout, walleye and kokanee from fish collected during 1993. '--' indicates no organisms found.

	Index of Relative Importance		
PREY ITEM	Kokanee	Rainbow	Walleye
Osteichthyes			
Cottidae	--	4.60	9.22
Cyprinidae	--	--	2.23
Percidae	--	--	7.99
Salmonidae	--	--	7.77
Unidentified fish	--	--	18.74
Cladocera			
L. kindtii	--	0.73	--
Daphnia spp.	90.84	50.96	17.29
Eucopepoda			
E. nevadensis	--	0.72	--
Decapoda			
Astacidae	--	--	0.61
Basommatophora			
Physidae	--	1.07	--
Diptera			
Chironomidae pupa	3.87	9.63	19.76
Chironomidae larvae	3.15	12.78	5.82
Chironomidae adult	--	0.34	--
Simuliidae larvae	--	0.35	--
Trichoptera			
Limnephilidae	--	0.72	0.62
Leptoceridae	--	0.35	--
Hydropyschidae	--	1.06	--
Hemiptera			
Corixidae	--	4.23	2.05
Notonectidae	--	0.34	—
Plecoptera			
Capniidae	--		0.59
Pteronarcydae	--	0.53	--
Ephemeroptera			
Baetidae	--	0.78	4.32
Ephemerellidae	--	0.43	--
Leptophlebiidae	--	0.35	—
Odonata			
Anisoptera	--	--	0.59
Zygoptera	--	--	0.59
Coleoptera			
Elmidae	--	0.52	--
Oligochaeta			
Lumbriculidae	--	--	0.61
Hydrachnellae			
Hydracharina	2.14	2.05	--
Terrestrial	--	4.93	--
Other			
A. gammeras	--	1.06	1.18
Decapoda	--	1.47	--

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 variable, not under Lake Roosevelt Fish Managers control, was lake operations. Mother nature, economics and politics (ie. rainfall, snow pack, power demand, irrigation) controlled the operation of the lake. Stocking protocols and lake operations for the past six years are reviewed in the following.

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 (141,000 fry). WDFW continued stocking approximately the same number of kokanee at Sherman Creek and Spokane River in 1989 and 1990 as in 1988. 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 1993.

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

Table 4.2 Summary of hatchery origin kokanee released into Lake Roosevelt from 1988 though 1993.

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	8 19,220	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

[a] size transferred from Spokane Tribal Hatchery not 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 1988 through 1993 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 1988 and 1993 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 1993 there was a steady increase in the number 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 reasons. First,

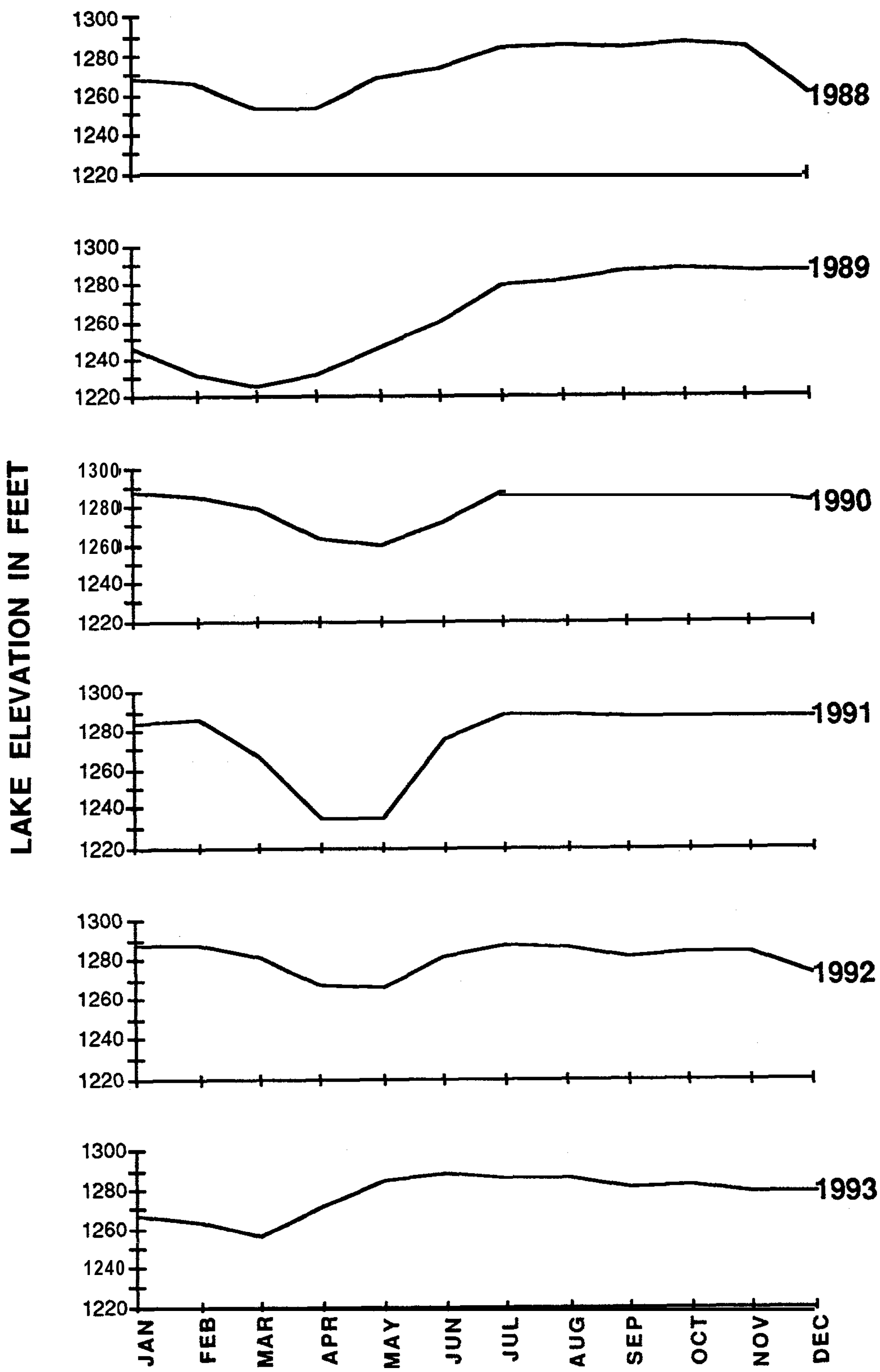

Figure 4.1 Lake elevations for Lake Roosevelt from 1988 through 1993.

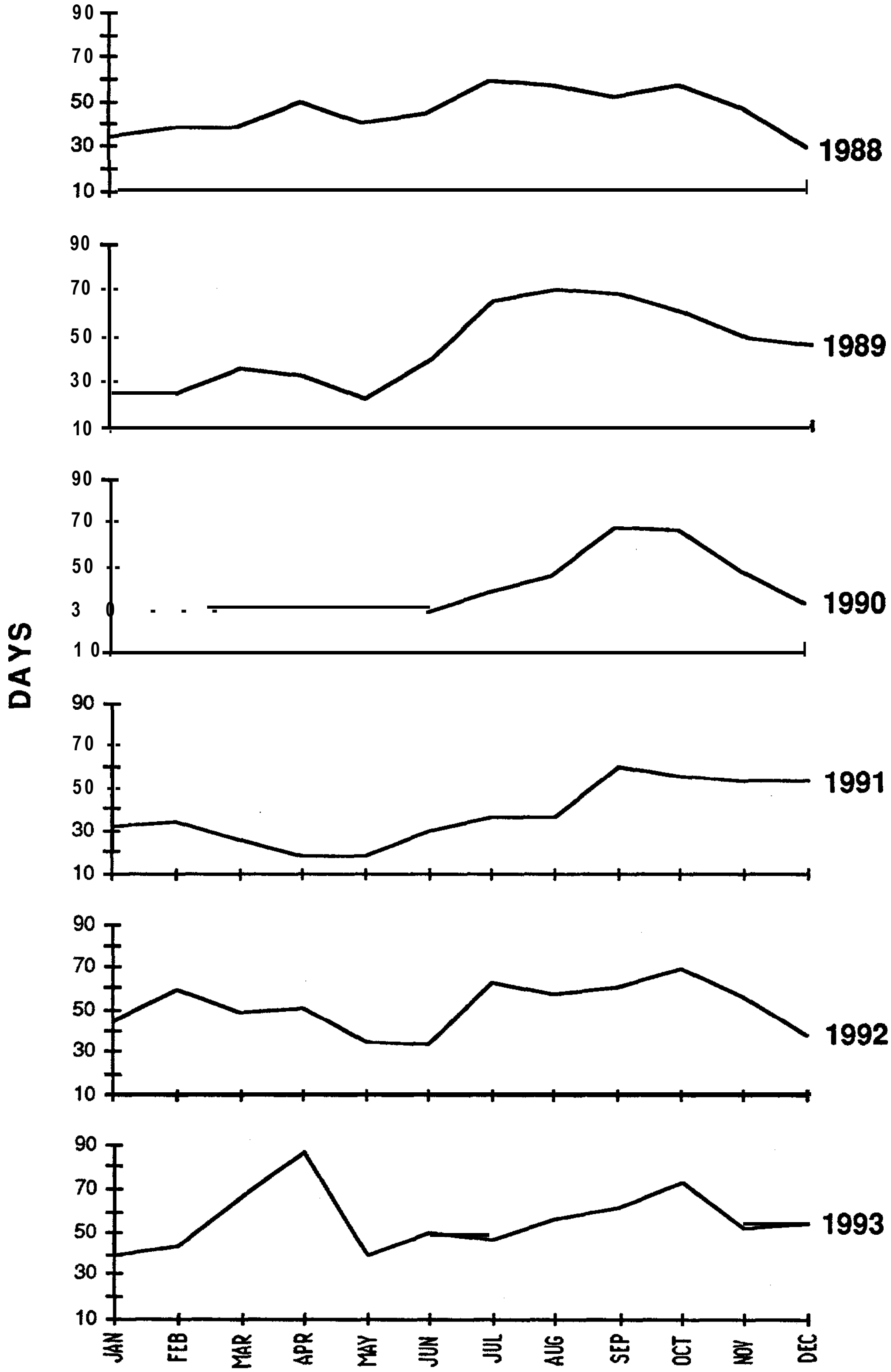

Figure 4.2 Water retention times for Lake Roosevelt from 1988 though 1993

the lowered lake level from the drawdown dewatered a majority of the boat ramps surrounding the lake limiting angler access. Secondly, the decreased water retention time (a result of the drawdown) caused entrainment of rainbow through Grand Coulee Dam (Griffith and McDowell993). 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 1993 rainbow trout harvest escalated to over twice the number estimated in previous years. We believe the 1993 harvest estimate was greater than past years for three reasons. First, the number of rainbow trout provided by the hatcheries to the net pen program steadily increased over the years. Second, the number of angler trips to the lake has almost doubled, and third the spring drawdown was small.

4.2.2 Kokanee Salmon

The recruitment of hatchery origin kokanee 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 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), Scholz et al. (1992 and 1993) identified that kokanee go through a partial smoltification phase 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. Further evidence of kokanee fry's inability 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, but the number of kokanee harvested in 1992 diminished by a third (Table 4.3). A 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 appeared to be increasing slightly, but it was still half of what was estimated for 1991's harvest. However, the number of kokanee harvested may vary from year to year due to the design of the creel instead of drawdowns. Creel clerks have limited contact with kokanee anglers. Many anglers fish past dark while one of the assumptions of the creel survey was fish were only caught from sunrise to sunset. As a result, creel clerks shift ends at dark. The random design of the creel survey also limits the number of kokanee seen by the clerks (less than 100 a year). Spring Canyon was the most frequent access point for angler harvest of kokanee, however, less than a fifth of the creel clerks time was spent at Spring Canyon. This reduced the creel clerks chances of contacting an angler with kokanee. The creel clerks limited contact with kokanee anglers may be amplifying the variance of the harvest estimates. As a result, the laws of probabilities may be changing the kokanee harvest estimates rather than actual changes in the number kokanee harvested.

4.2.3. Walleye

The estimated harvest of walleye for 1993 was double in comparison to previous years (Table 4.3). In general, the number of walleye harvested appears to be increasing over time. Walleye have not been stocked into the lake and therefore, the increased number of harvested walleye was the result of increased pressure (angler trips). The harvest per unit effort supports this idea. The HPUE has remained relatively constant over the last five year. Therefore, the same rate of harvest was occurring but the number of anglers had increased resulting in more walleye kept.

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 1993.**

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

4.3 Growth and Feeding.

Peone et al. (1990) examine 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. Peon et al. 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 1993 for rainbow trout and kokanee. However, their statement does not hold true for walleye. The back calculated length of walleye sampled in 1993 was below the walleye length average of area lakes by approximately three centimeters per year of life. However, the back calculated lengths of walleye for 1993 may be misleading. Samples of walleye scales were taken while electrofishing by boat. In 1993, sampling by boat was limited due to mechanical failures. As a result few walleye were collected for growth analysis (n = 48) and these fish were many sampled in May during the spawning period. The back calculations may not be accurate due to the scale absorption which accompanies the spawning period. In addition, walleye observed in the creel exhibited an increase in the mean length of walleye harvested which reinforces the presumption that growth measurements were not accurate.(Table 4.3).

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 (0.84) meaning kokanee and rainbow trout used the same food where as kokanee and walleye did not use the same food (0.35). Rainbow and walleye diet overlapped moderately (0.57). 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 no different than past years. Results from 1993 and 1995 will determine the accuracy of walleye growth and help determine if food was limiting.

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 (ie. 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	Dee-Feb	3.49	1.92	2.01	**2.57**	**2.50 ± 0.72**	**2.291 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	**Dee-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 1993 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	1.00	1.00	2.0	0.8	3.2	1.3
	WE	2.67	0.80	1.00	2.0	0.8	4.3	1.7
January	WD	1.60	0.10	1.00	2.0	0.8	0.3	0.1
	WE	2.67	1.00	1.00	2.0	0.8	5.3	2.1
February	WD	1.60	0.50	1.00	2.0	0.8	1.6	0.6
	WE	2.67	0.90	1.00	2.0	0.8	4.8	1.9
March	WD	1.46	1.10	0.93	2.0	0.8	3.0	1.2
	WE	1.28	2.80	0.59	2.0	0.8	4.2	1.7
April	WD	1.46	1.70	1.00	1.9	0.5	4.7	1.2
	WE	1.28	4.80	1.00	2.3	0.6	14.1	3.7
May	WD	1.46	6.00	0.97	2.1	1.0	17.9	8.5
	WE	1.28	25.00	1.00	2.2	0.5	70.4	16.0
June	WD	0.90	14.50	0.82	2.3	0.9	24.5	9.6
	WE	1.20	37.20	0.67	2.0	0.5	59.8	15.0
July	WD	0.90	11.80	0.85	2.1	0.8	19.0	7.3
	WE	1.20	47.50	0.54	2.2	0.9	67.1	27.4
August	WD	0.90	10.40	0.84	2.0	0.8	15.7	6.3
	WE	1.20	31.60	0.59	3.3	0.9	72.7	19.9
September	WD	1.07	9.00	0.69	2.0	0.8	13.3	5.3
	WE	1.21	15.70	0.82	2.2	1.0	34.2	15.6
October	WD	1.07	12.00	0.96	1.9	0.9	23.3	11.0
	WE	1.21	9.80	0.71	1.6	0.5	13.4	4.2
November	WD	1.07	7.20	1.00	1.6	0.5	12.3	3.9
	WE	1.21	11.80	1.00	1.6	0.5	22.8	7.1
Annual	WD	1.26	6.28	0.92	2.0	0.8	11.6	4.7
	WE	1.59	15.74	0.83	2.1	0.7	31.1	9.7

Table A.4 Section 2 pressure estimates for boat anglers in 1993 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	4.80	1.00	2.0	0.0	15.4	0.0
	WE	2.61	7.20	1.00	2.0	0.0	38.4	0.0
January	WD	1.60	1.40	1.00	2.0	0.0	4.5	0.0
	WE	2.67	3.60	1.00	2.0	0.0	19.2	0.0
February	WD	1.60	0.50	1.00	2.0	0.0	1.6	0.0
	WE	2.67	0.90	1.00	2.0	0.0	4.8	0.0
March	WD	1.46	13.60	1.00	2.5	0.7	49.6	13.9
	WE	1.28	53.80	1.00	2.3	1.5	158.4	103.3
April	WD	1.46	14.00	1.00	2.0	0.0	40.9	0.0
	WE	1.28	22.00	1.00	2.6	0.8	73.2	22.5
May	WD	1.46	13.80	1.00	2.0	0.9	40.3	18.1
	WE	1.28	43.30	1.00	2.2	0.9	121.9	49.9
June	WD	0.90	37.80	0.78	2.0	0.5	51.7	13.3
	WE	1.20	37.80	0.78	2.1	0.7	74.3	24.8
July	WD	0.90	37.70	0.47	2.0	0.5	32.0	8.0
	WE	1.20	66.80	0.78	2.2	0.7	137.6	43.8
August	WD	0.90	46.50	0.22	1.5	0.7	13.8	6.4
	WE	1.20	116.50	0.22	2.0	0.0	61.5	0.0
September	WD	1.07	54.00	1.00	2.0	0.9	115.6	52.0
	WE	1.21	33.00	1.00	2.6	0.5	103.8	20.0
October	WD	1.07	33.50	1.00	2.0	1.0	71.7	35.8
	WE	1.21	39.50	1.00	2.6	0.5	124.3	23.9
November	WD	1.07	8.70	0.96	2.0	1.0	17.9	9.0
	WE	1.21	14.00	1.00	2.6	0.5	44.0	8.5
Annual	WD	1.26	22.19	0.87	2.0	0.7	37.9	13.0
	WE	1.59	36.53	0.90	2.3	0.7	80.1	24.7

Table A.5 Section 3 pressure estimates in hours for boat anglers in 1993 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	0.40	1.00	2.0	0.0	1.3	0.0
	WE	2.67	1.00	1.00	2.0	0.0	5.3	0.0
January	WD	1.60	0.20	1.00	2.0	0.0	0.6	0.0
	WE	2.67	1.80	1.00	2.0	0.0	9.6	0.0
February	WD	1.60	5.80	1.00	1.5	0.7	13.9	6.5
	WE	2.67	7.30	1.00	2.0	0.0	39.0	0.0
March	WD	1.46	8.40	1.00	1.0	0.0	12.3	0.0
	WE	1.28	18.90	1.00	2.2	0.9	53.2	21.8
April	WD	1.46	13.90	1.00	2.0	0.0	40.6	0.0
	WE	1.28	9.40	1.00	2.6	0.8	30.7	10.0
May	WD	1.46	26.80	1.00	2.9	0.8	113.5	31.3
	WE	1.28	73.20	1.00	2.9	0.7	271.7	65.6
June	WD	0.90	66.50	0.72	2.2	0.9	94.8	38.8
	WE	1.20	118.80	0.24	2.6	1.9	87.1	63.7
July	WD	0.90	78.10	0.72	2.9	0.8	147.9	40.8
	WE	1.20	86.40	0.24	3.0	0.6	73.1	14.6
August	WD	0.90	118.50	0.22	3.7	2.1	86.8	49.3
	WE	1.20	131.00	0.24	3.5	0.7	129.3	25.9
September	WD	1.07	52.40	1.00	2.5	0.8	140.2	44.9
	WE	1.21	66.90	1.00	2.9	0.6	234.8	48.6
October	WD	1.07	12.50	1.00	2.8	0.4	37.5	5.4
	WE	1.21	22.60	1.00	2.8	0.5	16.6	13.7
November	WD	1.07	3.40	1.00	3.0	0.0	10.9	0.0
	WE	1.21	2.20	1.00	2.9	0.5	7.7	1.3
Annual	WD	1.26	32.29	0.89	2.4	0.5	58.4	18.1
	WE	1.59	44.96	0.81	2.6	0.6	84.8	22.1

Table A.6 Section 1 angling pressure estimates in hours for 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 Nsln	Angler hours per angler Ha	Mean anglers per day Xd	Mean anglers per month x s	± anglers per day Sd	± anglers per month s s	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	53.63	3.45	2.29	2.3	50.6	1.2	26.4	399	2,402	69
Boat	8.40	22	184.80	53.63	3.45	6.00	3.2	70.4	1.3	28.6	1,456	2,819	74
WEEKEND													
Shore	8.40	9	75.60	15.00	5.04	3.50	0.6	5.4	0.9	8.1	95	331	25
Boat	8.40	9	75.60	15.00	5.04	6.00	4.3	38.7	1.7	15.3	1,170	1,180	48
TOTAL	8.40	31	260.40	68.63			10.4	165.1	5.1	78.4	3,120	6,731	216
JANUARY													
WEEKDAY													
Shore	8.83	20	176.60	57.75	3.06	3.39	1.0	20.0	1.5	30.0	208	2,752	73
Boat	8.83	20	176.60	57.75	3.06	6.00	0.3	6.0	0.1	2.0	110	12	5
WEEKEND													
Shore	8.83	11	97.13	31.98	3.04	3.50	2.2	24.2	2.9	31.9	257	3.090	78
Boat	8.83	11	97.13	31.98	3.04	6.00	5.3	58.3	2.1	23.1	1.062	1,621	56
TOTAL	8.83	31	273.73	89.73			8.8	108.5	6.6	87.0	1,637	7,475	213
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	61.52	3.17	3.18	2.8	53.2	2.5	47.5	536	7.143	118
Boat	10.25	19	194.75	61.52	3.17	6.00	1.6	30.4	0.6	11.4	577	411	28
WEEKEND													
Shore	10.25	9	92.25	27.13	3.40	3.50	2.9	26.1	3.2	28.8	311	2,820	74
Boat	10.25	9	92.25	27.13	3.40	6.00	4.8	43.2	1.9	17.1	881	994	
TOTAL	10.25	28	287.00	88.65			12.1	152.9	8.2	104.8	2,305	11,368	2 %

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 x s	± anglers per day Sd	± anglers per month s s	Pressure estimate per month PE	Variance of pressure estimate per month VPE	95% C .I. per month CI
MARCH													
WEEKDAY													
Shore	11.97	21	251.37	78.44	3.20	2.39	1.8	36.8	1.8	36.8	281	4,328	92
Boat	11.97	21	251.37	78.44	3.20	5.97	3.0	63.0	1.2	25.2	1,205	2,035	63
WEEKEND													
Shore	11.97	8	95.76	27.78	3.45	4.54	1.6	12.4	1.9	14.8	194	755	38
Boat	11.97	8	95.76	27.78	3.45	5.58	4.2	33.6	1.7	13.6	646	638	35
TOTAL	11.97	29	347.13	106.21			10.5	145.8	6.5	90.4	2,327	7,756	229
APRIL													
WEEKDAY													
Shore	13.68	22	300.96	95.35	3.16	2.38	0.7	15.4	1.0	22.0	116	1.528	55
Boat	13.68	22	300.96	95.35	3.16	4.43	4.7	103.4	1.2	26.4	1,446	2,200	66
WEEKEND													
Shore	13.68	8	109.44	28.42	3.85	5.58	0.2	1.6	0.5	4.0	34	62	11
Boat	13.68	8	109.44	28.42	3.85	6.57	14.1	112.8	3.7	29.6	2,854	3,374	81
TOTAL	13.68	30	410.40	123.77			19.7	233.2	6.4	82.0	4,450	7,163	213
MAY													
WEEKDAY													
Shore	15.20	20	304.00	72.03	4.22	2.50	0.8	16.0	1.1	22.0	169	2,043	63
Boat	15.20	20	304.00	72.03	4.22	6.78	17.9	358.0	8.5	170.0	10.244	121,966	489
WEEKEND													
Shore	15.20	11	167.20	35.45	4.72	9.25	1.0	11.0	1.4	15.4	480	1,119	47
Boat	15.20	11	167.20	35.45	4.72	5.46	70.4	774.4	16.0	176.0	19.942	146,098	535
TOTAL	15.20	31	471.20	107.48			90.1	1159.4	27.0	383.4	30,835	271,226	1,134
JUNE													
WEEKDAY													
Shore	16.02	22	352.44	73.82	4.77	1.50	0.5	11.0	0.7	15.4	79	1,132	47
Boat	16.02	22	352.44	73.82	4.77	6.10	24.5	539.0	9.6	211.2	15,698	212,969	646
WEEKEND													
Shore	16.02	8	128.16	24.75	5.18	6.50	3.8	30.4	5.6	44.8	1.023	10393	143
Boat	16.02	8	128.16	24.75	5.18	6.47	59.8	478.4	15.0	120.0	16,028	74,566	382
TOTAL	16.02	30	480.60	98.57			88.6	1058.8	30.9	391.4	32,828	299,060	1,218

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	21	329.07	87.95	3.74	1.50	1.5	31.5	3.0	63.0	177	14,850	171
Boat	15.67	21	329.07	87.95	3.74	5.47	19.0	399.0	7.3	153.3	8.166	87,930	415
WEEKEND													
Shore	15.67	10	156.70	32.50	4.82	9.00	2.5	25.0	4.7	47.0	1,085	10,651	144
Boat	15.67	10	156.70	32.50	4.82	6.45	67.1	671.0	27.4	274.0	20,867	361,982	842
TOTAL	15.67	31	485.77	120.45			90.1	1126.5	42.4	537.3	30,295	475,413	1,573
AUGUST													
WEEKDAY													
Shore	14.38	22	316.36	72.56	4.36	4.68	0.9	18.7	1.6	35.2	381	5,402	103
Boat	14.38	22	316.36	72.56	4.36	5.59	15.7	345.4	6.3	138.6	8,418	83,755	405
WEEKEND													
Shore	14.38	9	129.42	37.69	3.43	8.94	5.0	45.0	4.8	43.2	1.381	6,408	112
Boat	14.38	9	129.42	37.69	3.43	6.50	72.7	654.3	19.9	179.1	14,604	110,145	465
TOTAL	14.38	31	445.78	110.25			94.3	1063.4	32.6	396.1	24,785	205,711	1,085
SEPTEMBER													
WEEKDAY													
Shore	12.45	21	261.45	57.17	4.57	7.85	0.2	4.2	0.2	4.2	151	81	13
Boat	12.45	21	261.45	57.17	4.57	5.73	13.3	279.3	5.3	111.3	7,319	56,654	333
WEEKEND													
Shore	12.45	9	112.05	42.88	2.61	8.88	7.5	67.5	4.9	44.1	1,566	5,082	100
Boat	12.45	9	112.05	42.88	2.61	6.55	34.2	307.8	15.6	140.4	5,268	51,510	318
TOTAL	12.45	30	373.50	100.05			55.2	658.8	26.0	300.0	14,305	113,327	763
OCTOBER													
WEEKDAY													
Shore	10.73	21	225.33	91.07	2.47	7.30	0.5	10.5	0.7	14.7	190	535	32
Boat	10.73	21	225.33	91.07	2.47	6.09	23.3	489.3	11.0	231.0	7,373	132.033	509
WEEKEND													
Shore	10.73	10	107.30	22.10	4.86	8.12	1.2	12.0	1.3	13.0	473	821	40
Boat	10.73	10	107.30	22.10	4.86	5.32	13.4	134.0	4.2	42.0	3,461	8,565	130
TOTAL	10.73	31	332.63	113.17			38.4	645.8	17.2	300.7	11,497	141,953	711

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 x s	± anglers per day Sd	± anglers per month s s	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	54.02	3.58	3.11	0.5	10.5	0.7	14.7	117	773	39
Boat	9.20	21	193.20	54.02	3.58	5.83	12.3	258.3	3.9	81.9	5,386	23,991	217
WEEKEND		9											
Shore	9.20	9	82.80	12.00	6.90	2.80	0.5	0.7	8.0	72.0	14	35.770	265
Boat	9.20		82.80	12.00	6.90	6.09	22.8	205.2	7.1	63.9	8,624	28,174	235
TOTAL	9.20	30	276.00	66.02			36.1	474.7	19.7	232.5	14,140	88,707	756
ANNUAL TOTAL	146.8	363.0	4,444.0	1,193.0			554.3	6,993	229.0	2,984	172,524	1,635,891	8,375

Table A.7 Section 2 angling pressure estimates in hours for 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 x s	± anglers per day Sd	± anglers per month s s	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	26.14	7.07	2.29	11.5	253.0	7.5	165.0	4,096	192.471	614
Boat	8.40	22	184.80	26.14	7.07	2.91	15.4	338.8	0.0	0.0	6.970	0	0
WEEKEND													
Shore	8.40	9	75.60	6.02	12.56	2.59	30.2	271.8	1.5	13.5	8,840	2,289	67
Boat	8.40	9	75.60	6.02	12.56	2.91	38.2	343.8	0.0	0.0	12.564	0	0
TOTAL	8.40	31	260.40	32.16			95.3	1207.4	9.0	178.5	32,470	194,759	681
JANUARY													
WEEKDAY													
Shore	8.83	20	176.60	30.00	5.89	2.92	8.6	172.0	5.4	108.0	2,957	68,662	367
Boat	8.83	20	176.60	30.00	5.89	2.91	4.5	90.0	0.0	0.0	1,542	0	0
WEEKEND													
Shore	8.83	11	97.13	24.62	3.95	2.62	24.6	270.6	28.6	314.6	2,797	390,513	875
Boat	8.83	11	97.13	24.62	3.95	2.91	19.2	211.2	0.0	0.0	2,425	0	0
TOTAL	8.83	31	273.73	54.62			56.9	743.8	34.0	422.6	9,721	459,175	1,242
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	51.42	3.79	2.62	10.8	205.2	9.0	171.0	2,036	110,755	466
Boat	10.25	19	194.75	51.42	3.79	2.91	1.6	30.4	0.0	0.0	335	0	0
WEEKEND													
Shore	10.25	9	92.25	5.00	18.45	1.00	59.8	538.2	32.1	288.9	9.930	1,539,896	1,737
Boat	10.25	9	92.25	5.00	18.45	2.91	4.8	43.2	0.0	0.0	2.319	0	0
TOTAL	10.25	28	287.00	56.42			77.0	817.0	41.1	459.9	14,621	1,650,651	2,203

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 Nsln	Angler hours per angler Ha	Mean anglers per day Xd	Mean anglers per month x s	± anglers per day Sd	± anglers per month s s	Pressure estimate per month PE	Variance of pressure estimate per month VPE	95% C.I. per month CI
MARCH													
WEEKDAY													
Shore	11.97	21	251.37	22.20	11.32	1.50	16.0	336.0	2.2	46.2	5.707	24,168	218
Boat	11.97	21	251.37	22.20	11.32	5.71	49.6	1041.6	13.9	291.9	67,344	964.781	1,375
WEEKEND													
Shore	11.97	8	95.76	4.75	20.16	3.67	58.2	465.6	22.5	180.0	34,448	653.184	1,131
Boat	11.97	8	95.76	4.75	20.16	4.75	158.4	1267.2	103.3	826.4	121,347	13,768,009	5,195
TOTAL	11.97	29	347.13	26.95			282.2	3110.4	141.9	1344.5	228,846	15,410,142	7,919
APRIL													
WEEKDAY													
Shore	13.68	22	300.96	15.00	20.06	1.50	7.4	162.8	6.2	136.4	4,900	373.290	855
Boat	13.68	22	300.96	15.00	20.06	2.50	40.9	899.8	0.0	0.0	45,134	0	0
WEEKEND													
Shore	13.68	8	109.44	10.70	10.23	1.60	14.5	116.0	12.0	96.0	1.898	94,262	430
Boat	13.68	8	109.44	10.70	10.23	2.50	73.2	585.6	22.5	180.0	14,974	331,388	806
TOTAL	13.68	30	410.40	25.70			136.0	1764.2	40.7	412.4	66,906	798,940	2,091
MAY													
WEEKDAY													
Shore	15.20	20	304.00	5.00	60.80	1.50	11.9	238.0	7.0	140.0	21,706	1,191,680	1,528
Boat	15.20	20	304.00	5.00	60.80	6.00	40.3	806.0	18.1	362.0	294.029	7,967,475	3.952
WEEKEND													
Shore	15.20	11	167.20	21.54	7.76	3.15	43.7	480.7	29.0	319.0	11.756	790.083	1,244
Boat	15.20	11	167.20	21.54	7.76	4.75	121.9	1340.9	49.9	548.9	49,452	2,339,257	2.141
TOTAL	15.20	31	471.20	26.54			217.8	2865.6	104.0	1369.9	376,943	12,288,495	8,866
JUNE													
WEEKDAY													
Shore	16.02	22	352.44	46.20	7.63	2.00	1.6	35.2	2.5	55.0	537	23,076	213
Boat	16.02	22	352.44	46.20	7.63	3.80	51.7	1137.4	13.3	292.6	32,972	653.118	1.131
WEEKEND													
Shore	16.02	8	128.16	21.53	5.95	2.27	9.2	73.8	6.5	52.1	997	16,149	178
Boat	16.02	8	128.16	21.53	5.95	3.72	74.3	594.4	24.8	198.4	13.165	234,365	678
TOTAL	16.02	30	480.60	67.73			136.8	1840.8	47.1	598.1	47,671	926,709	2,200

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 s s	Pressure estimate per month PE	Variance of pressure estlmate per month VPE	95% C.I. per month CI
JULY													
WEEKDAY													
Shore	15.67	21	329.07	34.45	9.55	1.75	0.9	18.9	1.5	31.5	316	9,478	136
Boat	15.67	21	329.07	34.45	9.55	3.80	32.0	672.0	8.0	168.0	24,392	269,599	727
WEEKEND													
Shore	15.67	10	156.70	32.35	4.84	2.27	3.4	34.0	2.1	21.0	374	2,136	65
Boat	15.67	10	156.70	32.35	4.84	3.72	137.6	1376.0	43.8	438.0	24,795	929,272	1,350
TOTAL	15.67	31	485.77	66.80			173.9	2100.9	55.4	658.5	49,877	1,210,485	2,278
AUGUST													
WEEKDAY													
Shore	14.38	22	316.36	43.00	7.36	1.22	1.6	35.2	2.5	55.0	316	22,256	209
Boat	14.38	22	316.36	43.00	7.36	3.60	13.8	303.6	6.4	140.8	8.041	145.854	535
WEEKEND													
Shore	14.38	9	129.42	25.54	5.07	2.27	3.4	30.6	2.1	18.9	352	1.810	60
Boat	14.38	9	129.42	25.54	5.07	3.72	61.5	553.5	0.0	0.0	10,436	0	0
TOTAL	14.38	31	445.78	68.54			80.3	922.9	11.0	214.7	19,145	169,920	803
SEPTEMBER													
WEEKDAY													
Shore	12.45	21	261.45	57.17	4.57	2.09	3.5	73.5	0.7	14.7	703	988	44
Boat	12.45	21	261.45	57.17	4.57	2.80	115.6	2427.6	52.0	1092.0	31,087	5,453,666	3,269
WEEKEND													
Shore	12.45	9	112.05	42.88	2.61	1.50	2.0	18.0	0.5	4.5	71	53	10
Boat	12.45	9	112.05	42.88	2.61	5.80	103.8	934.2	20.0	180.0	14,158	84,659	407
TOTAL	12.45	30	373.50	100.05			224.9	3453.3	73.2	1291.2	46,018	5,539,366	3,731
OCTOBER													
WEEKDAY													
Shore	10.73	21	225.33	5.00	45.07	1.93	5.0	105.0	2.8	58.8	9,133	155,813	553
Boat	10.73	21	225.33	5.00	45.07	5.80	71.7	1505.7	35.8	751.8	393,564	25,471,449	7,066
WEEKEND													
Shore	10.73	10	107.30	13.30	8.07	1.50	6.0	60.0	7.1	71.0	726	40,669	282
Boat	10.73	10	107.30	13.30	8.07	5.80	124.3	1243.0	23.9	239.0	58,163	460.833	950
TOTAL	10.73	31	332.63	18.30			207.0	2913.7	69.6	1120.6	461,586	26,128,765	8,851

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 x s	± anglers per day Sd	± anglers per month s s	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	49.50	3.90	1.67	13.9	291.9	6.9	144.9	1.903	81,948	401
Boat	9.20	21	193.20	49.50	3.90	2.43	17.6	369.6	9.0	189.0	3.505	139.420	523
WEEKEND		9											
Shore	9.20	9	82.80	4.75	17.43	1.50	24.5	220.5	9.2	82.8	5,765	119,508	484
Boat	9.20		82.80	4.75	17.43	5.80	44.0	396.0	8.5	76.5	40,037	102,014	447
TOTAL	9.20	30	276.00	54.25			100.0	1278.0	33.6	493.2	51,210	442,890	1,855
ANNUAL TOTAL	146.8	363	4,444	598			1,788	23,018	661	8,564	1,405,012	65,220,297	42,719

Table A.8 Section 3 angling pressure estimates in hours for 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 x s	± anglers per day Sd	± anglers per month s s	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	25.00	7.39	2.50	0.4	8.8	0.8	18	163	2,290	67
Boat	8.40	22	184.80	25.00	7.39	2.50	1.3	28.6	0.0	0	529	0	0
WEEKEND													
Shore	8.40	9	75.60	15.50	4.88	2.13	0.4	3.6	0.8	7	37	253	22
Boat	8.40	9	75.60	15.50	4.88	2.50	5.3	47.7	0.0	0	582	0	0
TOTAL	8.40	31	260.40	40.50			7.4	88.7	1.6	25	1,310	2,543	89
JANUARY													
WEEKDAY													
Shore	8.83	20	176.60	15.00	11.77	1.75	0.7	14.0	1.5	30	288	10,596	144
Boat	8.83	20	176.60	15.00	11.77	2.50	0.6	12.0	0.0	0	353	0	0
WEEKEND													
Shore	8.83	11	97.13	22.50	4.32	2.13	6.5	71.5	11.0	121	657	63.204	352
Boat	8.83	11	97.13	22.50	4.32	2.50	9.6	105.6	0.0	0	1,140	0	0
TOTAL	8.83	31	273.73	37.50			17.4	203.1	12.5	151	2,439	73,800	496
FEBRUARY													
WEEKDAY													
Shore	10.25	19	194.75	33.90	5.74	1.83	7.2	136.8	7.9	150	1.438	129,43 1	504
Boat	10.25	19	194.75	33.90	5.74	2.75	13.9	264.1	6.5	124	4,172	87,622	414
WEEKEND													
Shore	10.25	9	92.25	10.25	9.00	2.13	6.0	54.0	9.4	85	1.035	64,414	355
Boat	10.25		92.25	10.25	9.00	2.50	39.0	351.0	0.0	0	7,898	0	0
TOTAL	10.25	298	287.00	44.15			66.1	805.9	23.8	358	14,543	281,467	1,273

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 x s	± anglers per day Sd	± anglers per month s s	Pressure estimate per month PE	Variance of pressure estimate per month VPE	95% C.I. per month CI
MARCH													
WEEKDAY													
Shore	11.97	21	251.37	20.80	12.09	0.61	4.1	86.1	2.7	57	635	38,852	276
Boat	11.97	21	251.37	20.80	12.09	2.00	12.3	258.3	0.0	0	6,243	0	0
WEEKEND													
Shore	11.97	8	95.76	25.75	3.72	1.42	10.1	80.8	7.8	62	427	14,480	168
Boat	11.97	8	95.76	25.75	3.72	2.79	53.2	425.6	21.8	174	4,416	113,110	471
TOTAL	11.97	29	347.13	46.55			79.7	850.8	32.3	294	11,720	166,442	915
APRIL													
WEEKDAY													
Shore	13.68	22	300.96	43.58	6.91	2.05	6.9	151.8	2.4	53	2,149	19,251	194
Boat	13.68	22	300.96	43.58	6.91	2.50	40.6	893.2	0.0	0	15,420	0	0
WEEKEND													
Shore	13.68	8	109.44	25.17	4.35	0.83	5.6	44.8	3.8	30	162	4.019	89
Boat	13.68	8	109.44	25.17	4.35	2.37	30.7	245.6	10.0	80	2,531	27,831	234
TOTAL	13.68	30	410.40	68.75			83.8	1335.4	16.2	163	20,262	51,101	517
MAY													
WEEKDAY													
Shore	15.20	20	304.00	31.00	9.81	3.00	7.9	158.0	4.3	86	4.648	72,529	377
Boat	15.20	20	304.00	31.00	9.81	3.36	113.5	2270.0	31.3	626	74,796	3,842,913	2,744
WEEKEND													
Shore	15.20	11	167.20	36.00	4.64	1.70	19.3	212.3	6.2	68	1,676	21,602	206
Boat	15.20	11	167.20	36.00	4.64	3.00	271.7	2988.7	65.5	721	41.643	2,411,025	2,174
TOTAL	15.20	31	471.20	67.00			412.4	5629.0	107.3	1,501	122,763	6,348,069	5,501
JUNE													
WEEKDAY													
Shore	16.02	22	352.44	36.95	9.54	5.18	9.1	200.2	3.3	73	9,892	SO,274	314
Boat	16.02	22	352.44	36.95	9.54	7.19	94.8	2085.6	38.8	854	143.031	6,949,916	3,691
WEEKEND													
Shore	16.02	8	128.16	17.50	7.32	3.38	18.4	147.2	6.3	50	3,644	18,603	191
Boat	16.02	8	128.16	17.50	7.32	9.51	87.1	696.8	63.7	510	48,529	1.901.837	1,931
TOTAL	16.02	30	480.60	54.45			209.4	3129.8	112.1	1,486	205,096	8,920,630	6,126

Table A.8 Continued.

STRATA	Hours per day (naut) Hd	Days per month (cal) Ds	Hours per month Ns	Hours creeied per month n	Time correction factor Nsln	Angler hours per angler Ha	Mean anglers per day Xd	Mean anglers per month x s	± anglers per day Sd	± anglers per month s s	Pressure estimate per month PE	Variance of pressure estimate per month VPE	95% C.I. per month CI
JULY													
WEEKDAY													
Shore	15.67	21	329.07	38.00	8.66	3.00	4.3	90.3	1.3	27	2,346	6,454	112
Boat	15.67	21	329.07	38.00	8.66	2.85	147.9	3105.9	40.8	857	76,654	6,357,167	3,530
WEEKEND													
Shore	15.67	10	156.70	15.00	10.45	3.38	2.1	21 .o	2.1	21	742	4,607	95
Boat	15.67	10	156.70	15.00	10.45	3.71	73.1	731.0	14.6	146	28,331	222.681	661
TOTAL	15.67	31	485.77	53.00			227.4	3948.2	58.8	1,051	108,073	6,590,909	4,398
AUGUST													
WEEKDAY													
Shore	14.38	22	316.36	9.50	33.30	1.00	6.0	132.0	1.1	24	4,396	19.502	196
Boat	14.38	22	316.36	9.50	33.30	4.45	86.0	1892.0	48.8	1074	280,375	38,383,358	8.674
WEEKEND													
Shore	14.38	9	129.42	15.50	8.35	3.38	1.7	15.3	1.2	11	432	974	44
Boat	14.38	9	129.42	15.50	8.35	3.71	129.3	1163.7	25.9	233	36,048	453,685	943
TOTAL	14.38	31	445.78	25.00			223.0	3203.0	77.0	1,342	321,251	38,857,519	9,856
SEPTBMBER													
WEEKDAY													
Shore	12.45	21	261.45	42.75	6.12	1.84	3.5	73.5	3.0	63	827	24,274	218
Boat	12.45	21	261.45	42.75	6.12	3.28	140.2	2944.2	44.9	943	59,060	5,437,306	3,265
WEEKEND													
Shore	12.45	9	112.05	30.00	3.74	0.70	4.1	36.9	1.4	13	96	593	34
Boat	12.45	9	112.05	30.00	3.74	2.83	234.8	2113.2	48.6	437	22.337	714,576	1.183
TOTAL	12.45	30	373.50	72.75			382.6	5167.8	97.9	1,456	82,320	6,176,748	4,700
OCTOBER													
WEEKDAY													
Shore	10.73	21	225.33	48.00	4.69	1.84	2.1	44.1		53	381	12,939	159
Boat	10.73	21	225.33	48.00	4.69	3.28	37.5	787.5	2::	113	12.126	60,368	344
WEEKEND													
Shore	10.73	10	107.30	20.00	5.37	0.75	3.9	38.7	1.4	14	156	1,052	45
Boat	10.73	10	107.30	20.00	5.37	2.83	76.6	766.0	13.7	137	11.630	100,696	
TOTAL	10.73	31	332.63	68.00			126.1	1636.3	23.0	317	24,292	175,054	9 %

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 x s	± anglers per day Sd	± anglers per month s s	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	40.00	4.83	1.84	9.7	203.7	7.5	158	1,810	119,814	485
Boat	9.20	21	193.20	40.00	4.83	2.50	10.9	228.9	0.0	0	2,764	0	0
WEEKEND													
Shore	9.20	9	82.80	9.00	9.20	1.79	11.0	99.0	7.7	69	1,630	44,183	294
Boat	9.20	9	82.80	9.00	9.20	3.72	7.7	69.3	1.3	12	2,372	1,259	50
TOTAL	9.20	30	276.00	49.00			39.3	600.9	16.5	239	8,576	165,256	829
ANNUAL TOTAL	146.8	363.0	4444.1	626.7			1,869	26,599	579.0	8,382	922,645	67,809,538	35,693

Table A.9 Section one catch per unit effort (fish/hour) of the harvest (fish kept) by species and month on Lake Roosevelt from December, 1992 through November, 1993.

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	0.001	0.000	0.000	0.000	0.000	0.000
rainbowtrout	0.364	0.235	0.092	0.098	0.100	0.001	0.006	0.044	0.030	0.017	0.062	0.179	0.037
walleye	0.000	0.000	0.000	0.000	0.011	0.196	0.310	0.208	0.117	0.035	0.009	0.011	0.129
smallmouth bass	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.009	0.000	0.002
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0,000	0.001	0.000	0.000	0.000
otherspecies*	0.000	0.000	0.000	0.000	0.000	0.006	0.007	0.001	0.000	0.000	0.000	0.000	0.001
Monthly Mean	0.061	0.039	0.015	0.016	0.019	0.034	0.054	0.043	0.025	0.009	0.013	0.032	0.028

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

Table A.10 Section two catch per unit effort (fish/hour) of the harvest (fish kept) by species and month on Lake Roosevelt from December, 1992 through November, 1993.

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	0.084	0.106	0.000	0.000	0.013
rainbowtrout	0.344	0.208	0.071	0.000	0.914	0.000	0.062	0.054	0.067	0.000	0.118	0.542	0.110
walleye	0.000	0.000	0.000	0.000	0.000	0.667	0.133	0.128	0.151	0.000	0.000	0.033	0.095
smallmouthbass	0.000	0.000	0.000	0.000	0.000	0.019	0.027	0.012	0.017	0.000	0.000	0.000	0.008
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	0.057	0.035	0.012	0.000	0.152	0.114	0.037	0.032	0.053	0.018	0.020	0.096	0.038

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

Table A.11 Section three catch per unit effort (fish/hour) of the harvest (fish kept) by species and month on Lake Roosevelt from December, 1992 through November, 1993.

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.218	0.000	0.086	0.042	0.020	0.000	0.008	0.003	0.010	0.000	0.000	0.000	0.008
rainbowtrout	0.545	0.528	1.367	0.889	0.556	0.598	0.082	0.503	0.057	0.163	0.559	0.691	0.338
walleye	0.000	0.000	0.000	0.000	0.000	0.000	0.027	0.003	0.015	0.025	0.000	0.000	0.014
smallmouthbass	0.000	0.000	0.000	0.000	0.000	0.000	0.034	0.003	0.185	0.305	0.103	0.000	0.053
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	0.127	0.088	0.242	0.155	0.096	0.100	0.025	0.085	0.045	0.082	0.110	0.115	0,069

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

Table A.12 Section one catch per unit effort (fish/hour) of the total catch (harvest and release) by species and month on Lake Roosevelt from December, 1992 through November, 1993.

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	0.002	0.000	0.000	0.000	0.000	0.000
rainbow trout	0.364	0.235	0.092	0.098	0.100	0.001	0.006	0.044	0.030	0.018	0.064	0.179	0.038
walleye	0.000	0.000	0.000	0.000	0.039	0.326	0.535	0.326	0.182	0.054	0.026	0.011	0.211
smallmouthbass	0.000	0.000	0.000	0.000	0.000	0.000	0.053	0.012	0.003	0.001	0.009	0.032	0.011
sturgeon	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.003	0.001	0.000	0.001
other species*	0.000	0.000	0.000	0.000	0.000	0.017	0.007	0.003	0.000	0.001	0.000	0.000	0.002
Monthly Mean	0.061	0.039	0.015	0.016	0.023	0.057	0.100	0.065	0.036	0.013	0.017	0.037	0.044

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

Table A.13 Section two catch per unit effort (fish/hour) of the total catch (harvest and release) by species and month on Lake Roosevelt from December, 1992 through November, 1993.

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	0.084	0.106	0.000	0.000	0.013
rainbowtrout	0.344	0.208	0.071	0.000	0.914	0.000	0.062	0.062	0.067	0.000	0.118	0.542	0.112
walleye	0.000	0.000	0.000	0.000	0.000	0.667	0.222	0.243	0.151	0.000	0.000	0.033	0.133
smallmouthbass	0.000	0.000	0.000	0.000	0.000	0.019	0.027	0.037	0.017	0.000	0.000	0.000	0.014
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	0.029	0.000	0.000	0.000	0.000	0.007
Monthly Mean	0.057	0.035	0,012	0.000	0.152	0.114	0.052	0.062	0.053	0.018	0.020	0.096	0.047

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

Table A.14 Section three catch per unit effort (fish/hour) of the total catch (harvest and release) by species and month on Lake Roosevelt from December, 1992 through November, 1993.

Species	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Annual Mean
kokanee	0.218	0.000	0.086	0.042	0.020	0.000	0.008	0.003	0.010	0.000	0.000	0.000	0.008
rainbowtrout	1.164	0.528	1.367	0.952	0.561	0.598	0.096	0.503	0.057	0.163	0.559	0.691	0.345
walleye	0.000	0.000	0.000	0.000	0.005	0.000	0.031	0.003	0.021	0.025	0.000	0.000	0.016
smallmouthbass	0.000	0.000	0.000	0.000	0.000	0.008	0.301	0.185	0.237	0.305	0.138	0.000	0.183
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
otherspecies*	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Monthly Mean	0.230	0.088	0.242	0.166	0.098	0.105	0.073	0.116	0.054	0.082	0.116	0.115	0.093

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

Table A.15 Monthly and annual harvest estimates with ± 95% confidence intervals for all fish species harvested by all anglers on Lake Roosevelt from December, 1992 through November, 1993.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	286 ±19	0 ±0	1,256 ±110	496 ±39	409 ±10	0 ±0	1,676 ±50	321 ±13	4,912 ±168	4,889 f396	0 ±0	0 ±0	13,960 ±787
rainbow trout	13.014 f362	3,696 ±571	21,136 ±1,921	10,647 ±835	72,835 ±2,219	73,500 ±3,293	19,935 ±646	58,400 ±2,405	20,187 ±643	13,654 ±778	68,731 ±1,643	36,219 f1.714	411,954 ±17,030
walleye	0 ±0	0 ±0	0 ±0	0 ±0	50 ±2	257,352 ±6,134	22,053 f836	12,972 ±631	10,740 f399	2,559 ±145	107 ±7	1,832 ±69	307,665 ±8,223
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	6,980 f164	8,142 f264	1,069 ±48	59,782 ±1,837	25,091 ±1,433	2,620 ±110	0 ±0	103,684 ±3,856
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	46 ±2	0 ±0	0 ±0	20 ±1	0 ±0	0 ±0	66 ±3
other species*	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	25 ±1	229 ±8	42 ±2	0 ±0	0 ±0	0 ±0	0 ±0	296 fll
Monthly Total	13,300 ±381	3,696 ±571	22,392 ±2,031	11,143 ±874	73,294 ±2,231	337,857 ±9,592	52,081 ±1,806	72,804 ±3,099	95,621 ±3,047	46,213 52,753	71,458 ±1,760	38,051 ±1,783	837,910 ±29,928

*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, 1992 through November, 1993.

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	27 ±1	0 ±0	0 ±0	0 ±0	0 ±0	27 ±1
rainbow trout	1,135 ±79	385 ±50	213 ±24	229 ±22	446 ±21	46 ±2	211 ±8	1,325 ±69	732 ±32	249 ±13	709 ±44	2,525 ±135	7,071 f421
walleye	0 ±0	0 ±0	0 ±0	0 ±0	50 ±2	6,057 f223	10,176 It378	6,309 ±328	2,889 ±126	497 ±27	107 ±7	149 ±8	26,232 ±1,098
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	159 ±8	0 ±0	0 ±0	107 ±7	0 ±0	267 ±15
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	46 ±2	0 ±0	0 ±0	20 ±1	0 ±0	0 ±0	66 ±3
other species*	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	25 ±1	229 ±8	42 ±2	0 ±0	0 ±0	0 ±0	0 ±0	296 fll
Monthly Total	1,135 ±79	385 ±50	213 ±24	229 ±22	496 ±24	6,128 f226	10,662 f396	7,862 ±408	3,621 ±159	766 ±41	924 ±57	2,674 ±143	35,095 ±1,628

*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, 1992 through November, 1993.

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	1,609 ±67	4,889 f396	0 ±0	0 ±0	6,498 f464
rainbow trout	11,164 ±234	2,023 ±259	1,044 ±157	0 ±0	61,132 f1.911	0 ±0	2,961 f137	2,671 f122	1,287 ±54	0 ±0	54,452 ±1,044	27,767 ±1,006	153,339 ±4,689
walleye	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	251,295 ±5,911	6,345 f293	6,369 ±291	2,896 ±121	0 ±0	0 ±0	1,683 ±61	268,588 ±6,677
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	6,980 ±164	1,269 ±59	616 ±28	322 ±13	0 ±0	0 ±0	0 ±0	9,188 f264
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	11,164 f234	2,023 ±259	1,044 ±157	0 ±0	61,132 ±1,911	258,276 ±6,075	10,575 ±488	9,657 ±441	6,114 ±256	4,889 f396	54,452 ±1,044	29,450 ±1,067	448,776 ±12,328

*Includes yellow perch, large-mouth 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, 1992 through November, 1993.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	286 ±19	0 ±0	1,256 ±110	496 ±39	409 ±10	0 ±0	1,676 ±50	294 ±12	3,303 ±101	0 ±0	0 ±0	0 ±0	7,435 ±322
rainbow trout	715 ±49	1,288 f262	19,879 ±1,740	10,418 ±813	11,257 ±287	73,454 ±3,291	16,763 ±501	54,404 ±2,214	18,168 ±557	13,405 ±765	13,570 ±555	5,927 ±573	238,533 ±11,559
walleye	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	5,532 ±165	294 ±12	4,955 ±152	2,062 ±118	0 ±0	0 ±0	12,843 ±447
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	6,873 ±205	294 ±12	59,460 ±1,824	25,091 ±1,433	2,513 f103	0 ±0	94,232 ±3,577
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	1,001 ±68	1,288 f262	21,134 ±1,850	10,914 ±852	11,666 ±298	73,454 ±3,291	30,844 ±921	55,286 ±2,250	85,887 ±2,635	40,558 ±2,316	16,083 ±657	5,927 ±573	354,042 ±15,973

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

Table A.19 Monthly and annual catch estimates ± 95% confidence intervals for all fish species surveyed by creel clerks on Lake Roosevelt from December, 1992 through November, 1993.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	286 ±19	0 ±0	1,256 ±110	496 ±39	409 ±10	0 ±0	1,676 ±50	347 ±15	4,912 ±168	4,889 ±396	0 ±0	0 ±0	13,986 ±789
rainbow trout	13,823 ±417	3,696 ±571	21,136 ±1,921	11,391 ±893	72,937 ±2,222	73,500 ±3,293	22,952 ±736	58,8 11 ±2,424	20,187 ±643	13.664 ±779	68,753 ±1,644	36,219 ±1,714	403,250 ±16,841
walleye	0 ±0	0 ±0	0 ±0	0 ±0	276 f11	261,344 ±6,282	34,510 ±1,330	22,304 f1.079	14,019 It522	2,829 ±159	301 ±19	1,832 ±69	337,413 ±9,469
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	7,997 ±210	64,688 ±1,966	22,217 ±917	76,380 f2.348	25,102 ±1,434	3,458 f144	446 ±24	200,288 ±6,947
sturgwn	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	46 ±2	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	46 ±2
other species*	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	3,124 ±141	229 ±8	1,522 ±69	0 ±0	20 ±1	0 ±0	0 ±0	4,897 f219
Monthly Total	14,109	3,696	22,391	11,887	73,623	345,966	124,102	105,201	115,499	46,585	72,523	38,497	974,079

Total f 4 3 6 6 f 3 3 7 ±2,031 f 9 3 2 ±2,243 ±9,926 ±4,091 ±4,504 ±3,682 ±2,773 ±1,808 ±1,807 ±34,570

*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, 1992 through November, 1993.

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	53 ±3	0 ±0	0 ±0	0 ±0	0 ±0	53 ± 3
rainbow trout	1,135 ±79	385 ±50	213 ±24	229 ±22	446 ±21	46 ±2	211 ±8	1,325 ±69	732 ±32	259 ±14	731 ±45	2,525 ±135	7,103 ±423
walleye	0 ±0	0 ±0	0 ±0	0 ±0	174 ±8	10,049 f371	17,565 ±652	9,887 ±513	4,516 ±198	767 ±41	301 ±19	149 ±8	43,407 ±1,809
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	1,731 ±64	371 ±19	81 ±4	11 ±1	107 ±7	446 ±24	2,747 ±24
sturgeon	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	46 ±2	0 ±0	0 ±0	81 ±4	11 ±1	0 ±0	138 ± 6
other species*	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	74 ±4	229 ±8	84 ±3	0 ±0	20 ±1	0 ±0	0 ±0	409 ±16
Monthly Total	1,135 ±79	385 ±50	213 ±24	229 ±22	620 ±29	10,169 f377	19,782 ±734	11,720 ±607	5,329 f234	1,138 ±61	1,150 ±72	3,120 f167	54,990 ±2,453

*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, 1992 through November, 1993.

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	1,609 ±67	4,889 f396	0 ±0	0 ±0	6,498 ±464
rainbow trout	11,164 ±234	2,023 ±259	1,044 ±157	0 ±0	61,132 ±1,911	0 ±0	2,961 f137	3,082 ±141	1,287 ±54	0 ±0	54,452 ±1,044	27,767 ±1,006	153,750 ±4,708
walleye	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	251,295 ±5,911	10.575 ±488	12,123 It554	2,896 f121	0 ±0	0 ±0	1,683 ±61	278,571 ±7,135
smallmouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	6,980 f164	1,269 ±59	1,849 ±84	322 ±13	0 ±0	0 ±0	0 ±0	10,420 f321
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	1,438 ±66	0 ±0	0 ±0	0 ±0	0 ±0	1,438 ±66
Monthly Total	11,164 ±234	2,023 ±25	1,044 ±157	0 ±0	61,132 ±1,911	258,276 ±6,075	14,805 ±683	18,492 ±845	6,114 i-256	4,889 f396	54,452 ±1,044	29,450 ±1,067	461,842 ±12,927

*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, 1992 through November, 1993.

SPECIES	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	TOTAL
kokanee	286 ±19	0 ±0	1,256 ±110	496 ±39	409 ±10	0 ±0	1,676 ±50	294 ±12	3,303 ±101	0 ±0	0 ±0	0 ±0	7,435 f322
rainbow trout	1,524 f104	1,288 f262	19,879 ±1,740	11,162 ±871	11,359 f290	73,454 ±3,291	19,780 ±591	54,404 ±2,214	18.168 ±557	13,405 ±765	13,570 ±555	5,927 ±573	242,397 ±11,710
walleye	0 ±0	0 ±0	0 ±0	0 ±0	102 ±3	0 ±0	6,370 f190	294 ±12	6,607 ±203	2,062 ±118	0 ±0	0 ±0	15,435 ±525
smalhnouth bass	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	1,017 ±46	61,688 f1.843	19,997 ±814	75,977 ±2,331	25,091 ±1,433	3,351 f137	0 ±0	187,121 ±6,602
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	3,050 f137	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	3,050 f137
Monthly Total	1,810 f123	1,288 f262	21,134 ±1,850	11,658 f910	11,871 f303	77,521 ±3,474	89,515 ±2,674	74,989 ±3,052	104,056 ±3,192	40,558 ±2,316	16,921 f692	5,927 ±573	455,438 ±19,297

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

APPENDIX B

Fish Survey Data

Table B.l. Annual electrofishing results for 1993 split by sampling period including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min) for fish captured by electrofishing during 1993.

	May			July			November			Total		
Effort (min)	390			48			396			833		
Species	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**
largescale sucker	925	52	2.37	26	38	0.55	51	14	0.12	1,002	46	1.20
smallmouth bass	142	8	0.36	3	4	0.06	62	18	0.16	207	9	0.25
cottus spp.	57	3	0.15	1	1	0.02	4	1	0.01	22	3	0.07
carp	22	1	0.06	0	0	0.00	0	0	0.00	183	1	0.03
squawfish	181	10	0.46	2	3	0.04	0	0	0.00		8	0.22
brown bullhead	0	0	0.00	0	0	0.00	3	1	0.01	3	c l	co.00
walleye	222	13	0.57	9	13	0.19	2	1	0.01	233	11	0.28
yellow perch	28	2	0.07	1	1	0.02	216	61	0.55	245	11	0.29
brown trout	2	0	0.01	13	19	0.27	1	0	co.01	16	1	0.02
brook trout	2	0	0.01	0	0	0.00	0	0	0.00	2	<1	co.01
chinook salmon	0	0	0.00	1	1	0.02	0	0	0.00	1	c l	co.01
kokanee salmon	4	0	0.01	10	14	0.21	0	0	0.00	14	1	0.02
lake whitefish	1	0	<0.01	0	0	0.00	0	0	0.00	1	<1	co.01
mountain whitefish	2	0	0.01	0	0	0.00	0	0	0.00	2	<1	co.01
rainbow trout	185	10	0.47	3	4	0.06	13	4	0.03	201	9	0.24
Totals	1,773		4.54	69		1.45	352		0.89	2,194		2.63

Table B.2. May electrofishing results for 1993 split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort **(CPUE)** based on time (min) for fish captured by electrofishing during 1993.

Effort (min)	Kettle Falls 60			Gifford 65			Hunters 73			Porcupine Bay 43		
Species	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**
largescale sucker	446	81	7.39	348	59	5.40	22	11	0.30	8	7	0.18
smallmouth bass	1	0	0.02	0	0	0.00	9	5	0.12	83	77	1.92
piute sculpin	2	0	0.03	3	1	0.05	50	26	0.69	0	0	0.00
carp	1	0	0.02	7	1	0.11	2	1	0.03	5	5	0.12
squawfish	36	7	0.60	120	20	1.86	2	1	0.03	1	1	0.02
										1	**1**	**0.02**
walleye / yellow perch	5[illegible]	[illegible]	0.[illegible]	48	[illegible]	0.[illegible]	1[illegible]	3[illegible]	0.[illegible]	**0**	**0**	**0.00**
brook trout	2	0	0.03	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
lake whitefish	0	0	0.00	0	0	0.00	0	0	0.00	**1**	**1**	**0.02**
mountain whitefish	2	0	0.03	0	0	0.00	0	0	0.00	**0**	**0**	**0.00**
rainbow trout	5	1	0.08	63	11	0.98	22	11	0.30	9	8	**0.21**
Total	**551**		**9.13**	593		9.19	194		2.68	**108**		2.49

Effort (min)	Seven Bays 48			Keller Ferry 32			Sanpoil R. 20			Spring Canyon 502		
Species	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**
largescale sucker	75	39	1.56	7	13	0.22	5	19	0.25	14	26	0.03
smallmouth bass	19	10	0.40	7	13	0.22	13	48	0.65	10	19	0.02
piute sculpin	1	1	0.02	1	2	0.03	0	0	0.00	0	0	0.00
carp	1	1	0.02	6	11	0.19	0	0	0.00	0	0	0.00
squawfish	22	11	0.46	0	0	0.00	0	0	0.00	0	0	0.00
walleye	28	15	0.58	19	35	0.60	2	7	0.10	4	8	0.01
yellow perch	1	1	0.02	0	0	0.00	0	0	0.00	1	2	0.00
brook 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	4	8	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
rainbow trout	46	24	0.96	14	26	0.44	6	22	0.30	20	38	0.04
Total	193		4.02	54		**1.71**	27		1.35	53		0.11

Table B.3, July electrofishing results for 1993 split by sample station including number of fish collected (No.), relative abundance **(%)** and catch per unit effort (CPUE) based on time (min) for fish captured by electrofishing during 1993.

	Little Falls		
Effort (min)	**48**		
Species	**No.**	**%**	**CPUE**
largescale sucker	**26**	**38**	**0.55**
smallmouth bass	**3**	**4**	**0.06**
cottus spp.	**1**	1	002
squawfish	**2**	**3**	**0.04**
walleye	**9**	**13**	**0.19**
yellow perch	1	1	0.02
brown trout	13	19	0.27
chinook salmon	**1**	1	002
kokanee salmon	10	15	0.21
rainbow trout	**3**	**4**	**0.06**
Totals	**69**		**1.45**

Table B.4. November electrofishing results for 1993 split by sample station including number of fish collected (No.), relative abundance (%) and catch per unit effort (CPUE) based on time for fish captured by electrofishing during 1993.

	Kettle Falls			Porcupine Bay			Seven Bays			Spring Canyon		
Effort (min)	107			53			93			143		
Species	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**
largescale sucker	9	8	0.08	5	8	0.10	22	10	0.24	15	5	0.10
smallmouth bass	0	0	0.00	0	0	0.00	4	2	0.04	62	20	0.43
cottus spp.	6	5	0.06	12	19	0.23	25	11	0.27	4	1	0.03
carp	1	1	0.01	0	0	0.00	1	0	0.01	0	0	0.00
redside shiner	2	2	0.02	0	0	0.00	0	0	0.00	0	0	0.00
squawfish	1	1	0.01	0	0	0.00	0	0	0.00	0	0	0.00
walleye	6	5	0.06	0	0	0.00	13	6	0.14	2	1	0.01
yellow perch	27	25	0.25	8	13	0.15	104	47	1.11	216	68	1.51
brown trout	2	2	0.02	0	0	0.00	0	0	0.00	1	0	0.01
kokanee salmon	18	16	0.17	12	19	0.23	18	8	0.19	0	0	0.00
lake whitefish	30	27	0.28	0	0	0.00	1	0	0.01	0	0	0.00
rainbow trout	8	7	0.07	25	40	0.48	34	15	0.36	13	4	0.09
Totals	110		1.03	62		1.18	222		2.38	316		2.20

Table B.5. May gillnet set results for 1993 split by sample station including number of fish collected (No.), relative abundance (%) and catch per unit effort (CPUE) based on time (min) for fish captured by electrofishing during 1993.

	Kettle Falls			Gifford			Hunters			Porcupine Bay		
Effort	780			**768**			600			300		
Species	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**
largescale sucker	1	14	<0.01	1	33	<0.01	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
walleye	4	57	0.01	2	67	<0.01	1	25	<0.01	2	20	0.01
yellow perch	1	14	<0.01	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
lake whitefish	1	14	<0.01	0	0	0.00	3	75	0.01	8	80	0.03
rainbow trout	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00
Totals	7		**0.01**	3		**co.01**	4		**0.01**	**10**		0.03

	Seven Bays			San 606 Pol R.			Spring Canyon			Total		
Effort	**1,170**						930			**5,148**		
Species	**No.**	**%**	**CPUE**	No.	%	CPUE	**No.**	**%**	**CPUE**	**No.**	**%**	**CPUE**
largescale sucker	4	40	<0.01	1	20	<0.01	**0**	**0**	**0.00**	7	16	**<0.01**
burbot	1	10	co.01	2	40	<0.01	**0**	**0**	**0.00**	3	7	co.01
walleye	4	40	co.01	0	0	0.00	2	50	co.01	15	35	co.01
yellow perch	0	0	0.00	1	20	<0.01	0	0	0.00	2	5	co.01
kokanee salmon	0	0	0.00	0	0	0.00	1	25	<0.01	1	2	co.01
lake whitefish	1	10	co.01	1	20	co.01	0	0	0.00	14	33	co.01
rainbow trout	0	0	0.00	0	0	0.00	1	25	<0.01	1	2	co.01
Totals	10		0.01	**5**		**0.01**	4		0.00	43		0.01

APPENDIX C

Feeding Habits by Species and Age Group

Table C.l **Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for all kokanee (n = 21) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	99.57	95.01	95.24	90.84
Diptera				
Chironomidae pupa	0.25	2.58	9.52	3.87
Chironomidae larvae	0.15	0.36	9.52	3.15
Hydrachnellae				
Hydracharina	0.03	2.05	4.76	2.14

Table C.2 **Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 1+ kokanee (n = 3) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	99.71	98.52	100.00	89.47
Diptera				
Chironomidae larvae	0.29	1.48	33.33	10.53

Table C.3 **Percent by number, frequency of occurrence, percent by weight and index of relative importance (IRI) of food items for 2+ kokanee (n = 12) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	99.72	91.32	91.67	89.28
Diptera				
Chironomidae pupa	0.05	2.64	8.33	3.48
Chironomidae larvae	0.18	0.39	8.33	2.81
Hydrachnellae				
Hydracharina	0.05	5.66	8.33	4.43

Table C.4 **Percent by number, frequency of occurrence, percent by weight and index of relative importance (IRI) of food items for 3+ kokanee (n = 6) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
Daphnia spp.	99.15	96.65	100.00	93.41
Diptera				
Chironomidae pupa	0.85	3.35	16.67	6.59

Table C.5 **Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for all rainbow trout (n = 73) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cottidae	0.51	12.73	5.48	4.60
Cladocera				
L. kindtii	0.05	0.18	2.74	0.73
Daphnia spp.	93.64	54.8 1	58.90	50.96
Eucopepoda				
E. nevudensis	0.08	**0.09**	2.74	0.72
Basommatophora				
Physidae	0.02	**2.95**	1.37	1.07
Diptera				
Chironomidae pupa	0.76	2.82	35.62	**9.63**
Chironomidae larvae	4.02	9.64	38.36	12.78
Chironomidae adult	0.00	0.02	1.37	0.34
Simuliidae larvae	0.00	0.03	1.37	0.35
Trichoptera				
Limnephilidae	0.01	0.17	2.74	0.72
Leptoceridae	0.00	0.06	1.37	0.35
Hydropyschidae	0.03	0.18	4.11	1.06
Hemiptera				
Corixidae	***0.39***	5.87	10.96	4.23
Notonectidae	***0.00***	0.00	1.37	0.34
Plecoptera				
Pteronarcydae	**0.00**	**0.79**	1.37	0.53
Ephemeroptera				
Baetidae	0.15	0.28	2.74	0.78
Ephemerellidae	0.09	0.29	1.37	0.43
Leptophlebiidae	0.00	0.04	1.37	0.35
Coleoptera				
Elmidae	0.05	0.70	1.37	0.52
Hydrachnellae				
Hydracharina	0.02	0.10	8.22	2.05
Terrestrial	0.18	3.43	16.44	4.93
Other				
A. gammeras	0.01	0.20	4.11	1.06
Decapoda	0.00	4.61	1.37	1.47

Table C.6 **Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 0+ rainbow trout (n = 1) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Trichoptera				
Limnephilidae	100.00	100.00	100.00	100.00

Table C.7 **Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 1+ rainbow trout (n = 25) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cottidae	1.77	7.92	**8.00**	**4.25**
Cladocera				
Daphnia spp.	87.15	68.88	52.00	50.01
Eucopepoda				
E. nevadensis	0.32	0.29	4.00	1.11
Diptera				
Chironomidae pupa	1.21	3.66	40.00	10.79
Chironomidae larvae	8.15	9.37	40.00	13.83
Chironomidae adult	0.02	0.09	4.00	0.99
Trichoptera				
Hydropyschidae	0.05	0.72	8.00	2.11
Hemiptera				
Corixidae	0.14	1.16	12.00	3.20
Notonectidae	0.01	0.02	4.00	0.97
Ephemeroptera				
Baetidae	0.61	1.32	4.00	1.43
Ephemerellidae	0.35	1.57	4.00	1.42
Hydrachnellae				
Hydracharina	0.01	0.08	4.00	0.98
Terrestrial	0.21	4.15	28.00	7.78
Other				
A.gammeras	0.01	0.78	4.00	1.15

Table C.8 **Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 2+ rainbow trout (n = 23) sampled in 1993.**

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Cladocera				
L. kindtii	0.03	0.24	4.35	1.17
Daphnia spp.	98.49	75.67	73.91	62.86
Eucopepoda				
E. nevadensis	0.01	0.14	4.35	1.14
Basommatophora				
Physidae	0.05	10.13	4.00	**3.59**
Diptera				
Chironomidae pupa	0.58	2.57	36.00	**9.92**
Chironomidae larvae	0.38	2.87	32.00	**8.93**
Trichoptera				
Leptoceridae	0.01	0.22	4.00	1.07
Coleoptera				
Elmidae	0.13	2.41	4.00	1.66
Hydrachnellae				
Hydracharina	0.03	0.30	16.00	4.14
Terrestrial	0.29	5.28	8.00	3.44
Other				
A. gammeras	0.01	0.19	8.00	2.08

Table C.9 Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 3+ rainbow trout (n = 14) sampled in 1993.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cottidae	0.41	29.64	14.29	10.89
Cladocera				
L. Kindtii	0.20	0.29	7.14	1.88
Daphnia spp.	88.95	33.3 1	50.00	42.31
Diptera				
Chironomidae pupa	0.12	0.29	21.43	5.36
Chironomidae larvae	10.18	18.41	50.00	19.30
Trichoptera				
Limnephilidae	0.03	0.29	7.14	1.83
Hemip tera				
Corixidae	0.01	0.56	7.14	1.89
Plecoptera				
Pteronarcydae	0.01	2.08	7.14	2.27
Ephemeroptera				
Baetidae	0.01	0.10	7.14	1.78
Leptophlebiidae	0.01	0.10	7.14	1.78
Hydrachnellae				
Hydracharina	0.01	0.01	7.14	1.76
Terrestrial	0.04	2.82	14.29	4.21
Other				
Decapoda	0.01	12.11	7.14	4.73

Table C.10 Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for all walleye (n = 47) sampled in 1993.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Ostelchthyes				
Cottidae	1.00	16.12	17.02	9.22
Cyprinidae	0.29	3.70	4.26	2.23
Percidae	0.29	18.63	10.64	7.99
Salmonidae	0.06	26.58	2.13	7.77
Unidentified fish	1.23	34.12	34.04	18.74
Cladocera				
Daphnia spp.	46.89	0.10	17.02	17.29
Decapoda				
Astacidae	0.06	0.08	2.13	0.61
Diptera				
Chironomidae pupa	34.45	0.40	38.30	19.76
Chironomidae larvae	4.46	0.08	17.02	5.82
Trichoptera				
Limnephilidae	0.18	0.00	2.13	0.62
Hemiptera				
Corixidae	1.17	0.04	6.38	2.05
Plecoptera				
Pteronarcydae	0.06	0.00	2.13	0.59
Ephemeroptera				
Baetidae	9.51	0.09	6.38	4.32
Odonata				
Anisoptera	0.06	0.00	2.13	0.59
Zygoptera	0.06	0.01	2.13	0.59
Oligochaeta				
Lumbriculidae	0.12	0.02	2.13	0.61
Other				
A. gammeras	0.12	0.01	4.26	1.18

Table C.ll Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 0+ walleye (n = 9) sampled in 1993.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Unidentified fish	0.21	26.08	22.22	11.80
Cladocera				
Daphnia spp.	76.49	26.94	55.56	38.67
Diptera				
Chironomidae pupa	13.76	26.39	66.67	25.98
Chironomidae larvae	2.87	6.51	44.44	13.09
Ephemeroptera				
Baetidae	6.57	10.09	11.11	6.76
Odonata				
Zygoptera	0.10	3.99	11.11	3.70

Table C.12 Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 1+ walleye (n = 6) sampled in 1993.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cottidae	0.53	1.92	16.67	4.99
Percidae	0.53	93.92	16.67	28.99
Unidentified fish	0.53	0.60	16.67	4.64
Diptera				
Chironomidae pupa	34.39	1.43	66.67	26.74
Chironomidae larvae	12.17	0.57	33.33	12.02
Plecoptera				
Capnildae	0.53	0.06	16.67	4.50
Ephemeroptera				
Baetidae	51.32	1.49	16.67	18.13

Table C.13 Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 2+ walleye (n = 10) sampled in 1993.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Cottidae	2.74	28.06	30.00	17.37
Percidae	0.25	44.70	10.00	15.70
Unidentified fish	0.50	24.72	20.00	12.92
Cladocera				
Daphnia spp.	4.48	0.09	10.00	4.16
Diptera				
Chironomidae pupa	87.31	2.17	30.00	34.14
Chironomidae larvae	3.23	0.16	10.00	3.83
Trichoptera				
Limnephilidae	0.75	0.01	10.00	3.07
Ephemeroptera				
Baetidae	0.25	0.01	10.00	2.93
Other				
A. gammeras	0.50	0.08	20.00	5.88

Table C.14 Percent by number, percent by weight, frequency of occurrence and index of relative importance (IRI) of food items for 3+ walleye (n = 7) sampled in 1993.

PREY ITEM	% by Number	% by Weight	Frequency of Occurrence	IRI
Osteichthyes				
Unidentified fish	3.41	92.76	42.86	38.93
Cladocera				
Daphnia spp.	40.91	1.07	28.57	19.75
Diptera				
Chironomidae pupa	42.05	3.57	71.43	32.77
Chironomidae larvae	13.64	2.60	14.29	8.55