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Lake Laberge Fisheries Inventory and Contaminants Data Report, 1993

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INTRODUCTION

Lake Laberge is situated directly downstream of the City of Whitehorse and the confluence of the Takhini and Yukon Rivers. It forms part of the headwater lake system of the upper Yukon River drainage and historically has been an important source for food and navigation corridor during the early history of the Territory. Fish from Lake Laberge were tested for the presence of organochlorine contaminants in 1990 and 1991. The results revealed high levels of toxaphene, DDT and PCB's in some fish tissues. As a result of the specifically high toxaphene levels, Health Canada advised Yukoners to limit consumption of the livers of burbot and the flesh of lake trout from this lake. The advisory had an immediate effect on people in the Yukon, particularly on the Ta'an Kwach'an First Nation which relied on fish from Lake Laberge. The small commercial fishery in the lake closed in April 1993 and the non-native domestic food fishery was reduced.

In response to growing concern about contaminants in fish, a program of sampling, research and monitoring was initiated through all levels of Government and funded by the Federal Environmental Strategy. As part of the larger contaminants program this study was initiated specifically within Lake Laberge to:

- establish baseline information to describe the fish community structure, with a primary emphasis on the dominant fish species within the lake.

- determine current levels of organochlorines in lake trout muscle and burbot livers for future reference.

STUDY AREA

Lake Laberge, a riverine lake on the Yukon River, is located 24 km north of Whitehorse, Yukon, at 61° 00' N and 135° 00' W. Situated on the Lewes Plateau at 628 m elevation, it covers approximately 201 km^2. The lake has a mean depth of 54 m, a maximum depth of 146 m, a total length of 48 km (on a north/south axis), and a mean width of 4.2 km. The Yukon River flows into the relatively shallow southern end of the lake, and exits at the northern end. Numerous bays exist, particularly along the west shore (Fig. 1). The total upstream catchment area of the lake covers 28,144 km^2 and has a subjacent catchment (immediate drainage basin) of 2,189 km^2. The lake has a mean annual bulk residence time (average residence time of water in the lake) of 1.06 years (NWRI, 1982).

Lake Laberge is located in the *Lake Laberge Ecoregion*, a region characterized by a cold continental climate modified slightly by marine influences from the Gulf of Alaska (Oswald and Brown,1986). Rolling topography predominates with bedrock outcrops or terraced slopes of glacial till. Predominant vegetation consists of spruce/pine forest and trembling aspen stands. Open hillsides with low ground cover are also common. An extensive and recent burn area is found on the north east side of the lake.

Rural developments along the lakes west side exist at Deep Creek, Jackfish Bay, and Shallow Bay. Developments also exist along the Yukon River immediately upstream of the lake. Currently the City of Whitehorse discharges domestic sewage into the Yukon River, although construction of a new sewage treatment plant has been approved for completion in the fall of 1996. A site near the Yukon River, downstream of the City of Whitehorse was used as an industrial area and garbage dump in the past. Recently, agricultural activity has increased in the areas along the Yukon and Takhini Rivers, upstream of Lake Laberge.

METHODS AND MATERIALS

Lake Laberge was surveyed for this study over a period of 18 days from 27 July to 12 August, 1993. The survey was conducted by setting gillnets in different locations to give coverage to the entire lake and its representative depths and bottom types. Nets were set off points of land, perpendicular to the shore. Twenty experimental gillnet sets were set in Lake Laberge. Eleven of these sets were placed in the same locations as in the YTG's 1991 survey (YTG unpublished document). The remaining sets were placed in order to extend the coverage of the lake survey (Table 1, Fig.1).

SAMPLE COLLECTION

Experimental gillnetting was carried out using standard gangs consisting of seven sinking panels with mesh sizes arranged in the following order: 3.8 cm, 11.4 cm, 6.4 cm, 8.9 cm, 12.7 cm, 10.2 cm, and 7.6 cm (stretched measure). Each panel measured 22.9 meters in length and 2.4 meters in depth. The gangs were set with the 3.8 cm mesh at the shoreline, and then stretched out perpendicular to the shore. Gangs were set overnight with an average set duration of 23.5 hours.

The location and depth of each set, as well as the date and time of set and lift, were recorded in a field notebook. Other pertinent data, such as air and water temperature at the time of the set and lift, were also recorded. Temperatures (°C) were taken with an electronic thermometer (+/- 0.1°C). Large active lake trout were weighed and measured for fork length then released unharmed, active chinook salmon were also released unharmed. A record of the number of fish caught by mesh size and species was compiled at the time the nets were lifted. The captured fish were sorted by mesh size, placed in separate fish tubs, and then sampled as soon as possible after capture.

The eleven fish species caught are as follows: lake trout (*Salvelinus namaycush* Walbaum), burbot (*Lota lota* Linnaeus), lake whitefish (*Coregonus clupeaformis* Mitchill), broad whitefish (*Coregonus nasus* Pallas), least cisco (*Coregonus sardinella* Valenciennes), round whitefish (*Prosopium cylindraceum* Pallas), Arctic grayling (*Thymallus arcticus* Pallas), inconnu (*Stenodus leucichthys* Guldenstadt), longnose sucker (*Catastomus catastomus* Forster), northern pike (*Esox lucius* Linnaeus), and chinook salmon (*Oncorhynchus tshawytscha* Walbaum). General biology and species description can be found in Scott and Crossman, 1973.

SAMPLE ANALYSIS

Fish were sampled for fork length (+/- 1mm), round weight (+/- 25 g; fish less than 200 g were weighed to +/- 1 g), sex and sexual condition, fullness of stomach, and stomach contents. For the purpose of age determination, sagittal otoliths were taken from lake trout, burbot, lake whitefish, broad whitefish, inconnu, longnose sucker, and least cisco; scale samples were taken from below the dorsal fin and above the lateral line from Arctic grayling; and cleithra were taken from northern pike. All aging structures were cleaned, dried, and then stored individually in small zip lock bags.

Stomach contents were analyzed for all lake trout, broad whitefish, burbot, and northern pike. Representative sub samples were analyzed for lake whitefish, round whitefish and Arctic grayling. Each stomach was assessed separately, using a modification of the Hynes points method (Hynes, 1950). Stomach fullness was awarded a point value which ranged from a low of 0 (zero) for trace, to a maximum of 20 for full or distended stomachs. Food items in the stomach were identified to species or genus when possible, and allotted points according to the volume present in the stomach. The number of points allotted to each stomach was either 1, 2, 4, 8, 10, 16 or 20. Values were then assigned to individual food items so that the sum for the combined stomach contents equaled the fullness value originally awarded.

Sex and maturity were determined and recorded for all fish sampled. Mature fish were further differentiated by visual inspection of the gonads as resting or in condition to spawn in 1993.

CONTAMINANT SAMPLES

A portion of the catch were sampled for organoclorine contaminants. For this purpose, a total of 17 lake trout and 15 burbot were analyzed. Fish were subjectively chosen to provide a range in size as representative of the catch. Sampled lake trout ranged in length from 372 to 716 mm (500 to 5900 gms) and burbot from 390 to 695 mm (300 to 2500 gms). Whole fish were stored in a low temperature freezer (-80°) until prepared for laboratory analysis. Muscle tissue from lake trout and whole liver from burbot were prepared for analysis using the methodology described by Burns, 1994. Samples were analyzed at AXYS Analytical laboratories in Sydney, British Columbia.

AGE STRUCTURE PREPARATION

Otoliths were mounted in clear epoxy, thin sectioned on an Isomet Saw, and then mounted on a glass slide. Shannon mount was used to glue and cover the thin sections on the glass slides. A microfiche reader was used to read the annuli of mounted otolith sections and scales. Cleithra were cleansed of tissue and aged using an illuminated magnifying glass.

DATA ANALYSIS

Catch and sample records were transposed from field records on a daily basis. At the completion of the field program, all data was entered into a Dbase data file and stored at the Yukon Department of Renewable Resources, Fisheries Section. Data was analyzed using a Microsoft Excel (ver4) spreadsheet program. Length-weight scatter plots were curve fitted by least squares regression of logarithmically transformed data. Relative condition factor (K) was determined using the formula:

$$K=W*10^5/L^3$$

where W=round weight in grams

L=fork or total length in millimeters

All catch per unit effort statistics (CPUE) were calculated and expressed as numbers caught or kilograms captured in 100 meters of index netting over a 24 hour period.

For contaminant summary data, for those chemicals which were not found in quantities that could be detected at the sensitivity level of the respective test, numbers were assigned according to statistical procedures described in Burns (1994) to calculate sum, mean and standard deviation.

RESULTS

CATCH AND EFFORT STATISTICS

Catch per unit of effort (CPUE) and a description of the physical parameters for each net set is presented in Table 2. A total of 1,877 fish were caught for a combined weight of 1433.61 kg. The number, weight and CPUE of each species by mesh is presented in Table 3. The overall CPUE for the survey was 59.23 fish/100m/24hr or 46.25 kg/100m/24hr. Longnose sucker had the highest CPUE (28.94 fish or 23.23 kg/100m/24hr) over all other species. The most efficient mesh size for the capture of fish was the 38 mm mesh with a CPUE of 106.17 fish/100m/24hr (23.58 kg/100m/24hr) . By weight, the most efficient mesh was the 89 mm with a CPUE of 73.63 kg/100m/24hr (74.77 fish/100m/24hr). The 127 mm mesh was the least efficient mesh at capturing fish.

Species composition, as a percentage of the total catch by number and weight is presented in Table 4. Longnose sucker comprised the greatest percent of the catch both by number and weight of the catch.

BIOLOGICAL ANALYSIS

Length - Weight Relationships

The weight at length and the logarithmic regression comparison for all species is presented in Table 5. Weight at length and length at age scatter plots are presented for each species in Appendix 1.

Lake trout

The mean length of lake trout caught by the experimental gillnets was 471 mm (range = 71 to 854 mm). Mean weight was 1597 g (range = 5 to 9500 g) and the mean condition factor (K) was 1.30 (range = 0.97 to 1.65)(Table 7). Length frequency histograms show a modal length class for lake trout at 440 mm (Fig.2).

Mean age of lake trout from Lake Laberge was 11 years (range = 2 to 30 years). Age frequency histograms show a modal age of 8 years and strong year classes at 15 and 16 (Fig. 11). Males were mature by age 7+, females were mature by age 9+ (Table 8). Of the 32 females sampled, 24 were mature and 6 of these (25%) had gonads in condition to spawn this year. Of the six females with gonads in pre spawn condition, two had large numbers of atretic (partially resorbed) eggs from last years spawn. One of the mature non-spawners had an entire body cavity full of atretic eggs from last year. It appeared that none of that year's egg crop had been exuded

Stomach content analysis showed the lake trout to be strictly pisciverous, with least cisco comprising 74% of the diet. Five other species of fish were also consumed (Table 6).

Burbot

The mean length of burbot caught by the experimental gillnets was 509mm (range = 230 to 730mm). Mean weight was 1,017 g (range = 100 to 2,300 g), and the mean condition factor (k) was 0.70 (range = 0.59 to 1.33) (Table 9). Length frequency histograms show bimodal length classes for burbot at 440-450mm and at 500-510mm (Fig. 3).

The mean age of burbot from Lake Laberge was 10 years (range = 3 to 24 years.) (Table 10). Age frequency histograms show a modal age of 7+ years and a minor mode at 12+ years (Fig.12). Female burbot were mature by age 6+ years and male burbot were mature by age 10+ years.

Stomach analysis showed the burbot to be strictly pisciverous. As with lake trout, least cisco comprised a high proportion of stomach contents analyzed (68%). Four other fish species were consumed, including burbot (Table 6).

Lake whitefish

The mean length of lake whitefish caught by experimental gillnets was 321 mm (range = 145 to 447mm), mean weight was 478 g (range = 25 to 1500 g),and mean condition factor (k) was 1.24 (range = 0.82 to 1.75) (Table 11). Length frequency histograms show a modal length of 340-350 mm with a minor mode at 170-180mm (Fig. 4).

Mean age of lake whitefish was 10+ years (range = 2 to 35 years) (Table 12). Age frequency histograms show a modal age of 9+ years with a strong year class at age 3+ (Fig. 13).

Females were mature by age 8 years; males were mature by age 10 years. However males were 50% mature by age 5. Dramatic differences were noted in the coloration of female lake whitefish ovaries. Colors ranged from bright orange to a pasty white and had various amounts of blood present throughout the color variations. Similarly, the level of maturity was not necessarily consistent with the size of the fish.

Twelve different food items were found in lake whitefish stomachs including three species of fish. The main component of stomachs analyzed at 63% was the snail *Gyralus* sp.(Table 6).

Broad whitefish

The mean length of broad whitefish caught by experimental gillnetting was 408 mm (range =336 to 756mm). The mean weight was 901 g (range = 475 to 1900 g), and the mean condition factor (k) was 1.33. Length frequency histograms show a modal length at 370-380mm (Fig. 5).

Mean age of broad whitefish was 9+ years (range = 6 to 14 years) (Fig. 14).

Of analysed stomachs containing food items, chironomids predominated the diet (74%) (Table 6).

Long nose sucker

The mean length of long nose suckers caught by experimental gillnets was 391 mm (range = 149 to 507). The mean weight was 845 grams. The mean condition factor (k) was 1.28 (Table 13). Length frequency histograms show a main modal length class at 410 mm, and a minor mode at 170 and 300 mm. (Fig. 6).

Mean age of long nose suckers was 15 years (range = 3 to 36 years) (Table 14). The modal age was 17 years (Fig. 15). Female long nose suckers were mature at age 10+ years, males were mature by age 11+ years.

Northern pike

The mean length of northern pike caught by experimental gillnets was 682 mm (range = 149 to 1020 mm). Mean weight was 2607 gm, and the mean condition factor (k) was 0.79 (range = 0.61 to 0.97) (Table 15). Length frequency histograms show a modal length class at 650-660mm (Fig. 7).

Mean age of northern pike was 6+ years (range = 3 to 11 years) (Table 16). Age frequency histograms show the modal age to be 5+ years (Fig.16). Females were mature by age 4+ years and males were mature by age 3+ years.

Stomach analysis showed northern pike to be strictly pisciverous, with cisco composing 56% of stomach contents (Table 6).

Round whitefish

The mean length of round whitefish caught by experimental gillnets was 247 mm (range = 175 to 466 mm), mean weight was 173 g (range = 50 to 1,200 g), and the mean condition factor (K) was 0.93. Length frequency histograms show small nodes at length classes 220-230 and 360-370mm. (Fig. 8). The mean age of round whitefish was 5+ years (range = 2 to 19 years). Age frequency histograms show an abrupt decline after age 4+ years Fig. 17).

The snail *Gyralus* sp. composed the majority of the stomach contents analyzed at 41% (Table 6).

Least cisco

The mean length of least cisco caught by experimental gillnets was 224 mm (range = 156 to 355 mm), mean weight was 132 g (range 25 to 200 g) and the mean condition factor (K) was 1.13. Length frequency distributions show a modal length class at 230-240 mm. (Fig.9). The mean age of least cisco was 4+ years (range = 2 to 14 years). Age frequency histograms show a modal age at the 3+ and 4+ year class (Fig. 18).

Arctic grayling

The mean length of Arctic grayling caught by experimental gillnets was 203mm (range = 164 to 365), mean weight was 93g (range = 25 to 400 g) and the mean condition factor(K) was 0.982. Length frequency histograms show a modal length class at 200mm. (Fig. 10). Arctic grayling captured during the study were either 2 or 3 years old (60% were 2 years and 40% were 3 years).

Stomach contents for grayling were found to be comprised primarily of terrestrial insects (Table 6).

Inconnu

Seven inconnu were taken during the experimental gillnetting program, mean weight was 2,904 g (range = 1,550 to 4,9900 g), mean length was 625 mm (range = 541 to 724 mm) and the mean condition factor (K) was 1.11.The age of the inconnu ranged from 10 years to 16 years.

Chinook salmon

Four chinook salmon were taken during the experimental gillnetting program. Two of these were released unharmed while the other two died in the nets. The two dead fish were measured for fork length and weighed. The carcasses and the catch information were given to the Department of Fisheries and Oceans, Whitehorse, Yukon.

Contaminant Samples

Lake Trout

Concentrations of the sum of DDT, sum of PCB and Toxaphene contained in sampled lake trout muscle tissue is presented in Table 17. The lipid content in lake trout muscle tissue analyzed ranged from 8.2% to 1.4% (mean = 3.6%). The sum of DDT in the ranged from 835.2ppb to 19.5 ppb (mean = 154.3 ppb). The sum of PCB in the lake trout muscle tissue ranged from 515.5 ppb to 21.6 ppb (mean = 86.5ppb). Toxaphene levels in the tissue sampled ranged from 420 ppb to 53 ppb (mean = 159.8ppb).

Burbot

Concentrations of the sum of DDT, sum of PCB and Toxaphene contained in sampled burbot livers is presented in Table 18. The lipid content in Burbot livers analyzed ranged from 59% to 33% (mean = 45.2%). The sum of DDT in the livers ranged from 4348.2 ppb to 696.1 ppb (mean = 2290.6 ppb). The sum of PCB in the burbot livers ranged from 1919.1ppb to 708.3 ppb (mean = 1158.6). Toxaphene levels ranged from 2900ppb to 800 ppb (mean = 1629.3).

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REFERENCES

Burns, Bonnie. 1994. Levels of Contaminants found in fish from Yukon Lakes, 1991-92. Department of Indian and Northern Affairs, Whitehorse, in prep.

de Graff, Nick. 1992. Fish Stock Assessment of Bennett, Frances and Kluane Lakes, 1990. Fish and Wildlife Branch, Yukon Dep. Ren. Res..

de Graff, Nick. 1994. Personal communications, March 1994.

Hynes, H.B.N.. 1950. The food of fresh-water Sticklebacks (*Gasterosteus aculeatus* and *Pygosteus pungitius*), with a review of methods used in studies of the food of fishes.

Mackay, W.C. , G.R. Ash, and H.J. Norris, 1990. Fish ageing methods for Alberta. R.L.& L .Environmental Services Ltd. in assoc. with Alberta Fish and Wildlife. Div. and Univ. of Alberta, Edmonton. 113p.

NWRI 1982. Lake Laberge Bathometric map. National Research Institute, Pacific and Yukon Region, Inland Waters Directorate, Environment Canada, August 1982.

Oswald, E.T. , and B.N. Brown, 1986. Forest communities in Lake Laberge Ecoregion, Yukon Territory. Canadian Forest Service, Pacific Forestry Centre. Victoria, B.C.

Paish, Howard. 1984. A physical description of lakes and rivers in the Yukon river basin. Howard Paish and associated Ltd. , Coquitlam, B.C.

Scott, W.B., and E.J. Crossman, 1973. Freshwater Fishes of Canada. Fish. Res. Board Can. Bull. 184: 966p. .

Thompson, Susan. 1996. Fish Stock Assessment of Kusawa, Laberge and Teslin Lakes, 1991-93. Fish and Wildlife Branch, Yukon Dep. Ren. Res. , in prep.

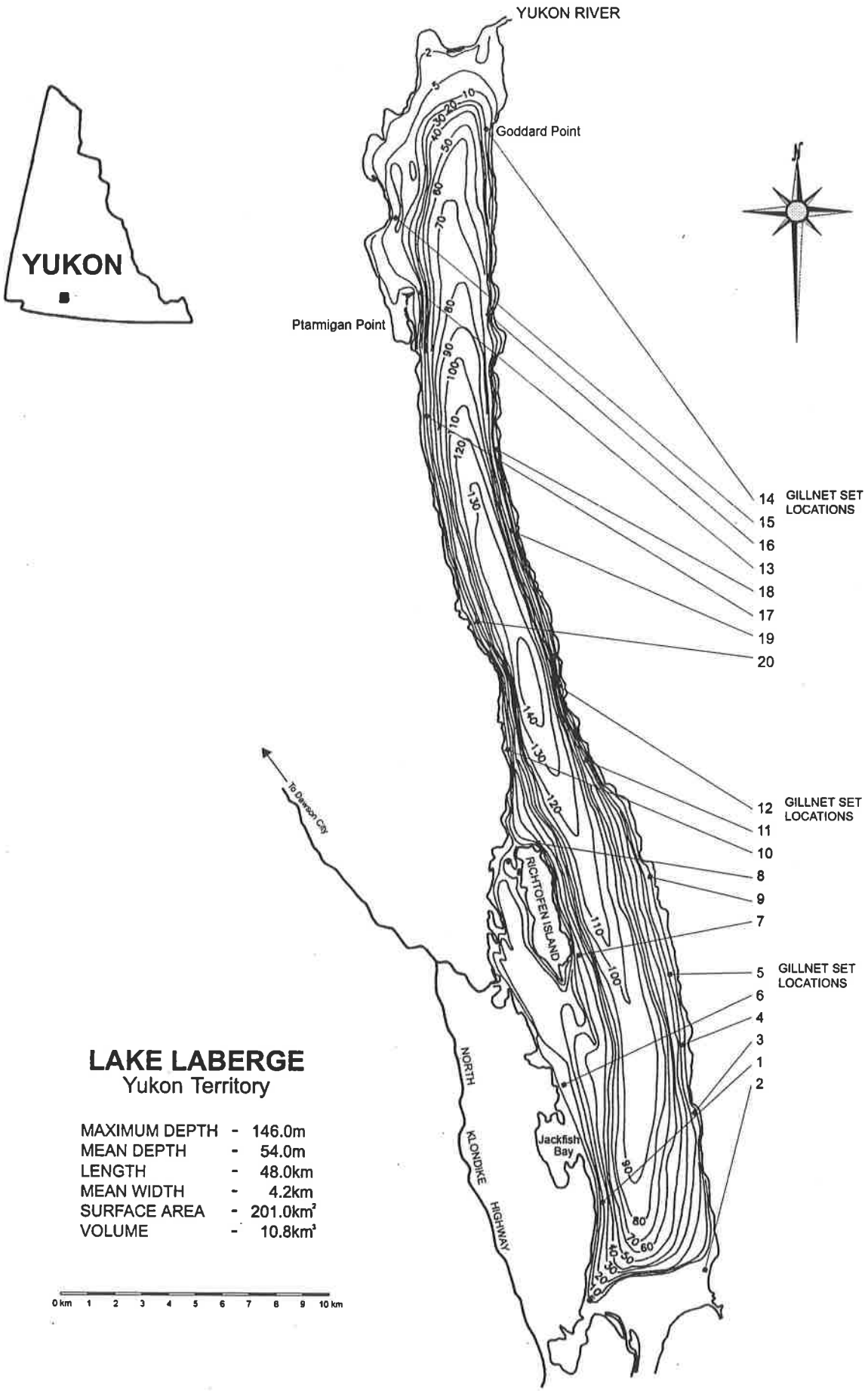

Figure 1. Bathometric map of Lake Laberge, showing 1993 experimental gillnet locations.

Table 1. UTM Grid Locations of Experimental Gillnets set on Lake Laberge 1993.

SET	UTM LOCATION	MAP SHEET
set #1	493 45E 6763 30N	105 E/3E
set #2	498 10E 6761 50N	105 D/14
set #3	497 45E 6766 00N	105 E/3E
set #4	496 75E 6769 25N	105 E/3E
set #5	496 35E 6771 00N	105 E/3E
set #6	491 95E 6767 00N	105 E/3E
set #7	492 20E 6772 10N	105 E/3E
set #8	490 55E 6776 15N	105 E/3E
set #9	495 20E 6775 40N	105 E/3E
set #10	489 40E 6780 20N	105 E/3E
set #11	493 25E 6778 45N	105 E/3E
set #12	491 40E 6781 90N	105 E/3E
set #13	485 30E 6795 00N	105 E/6E
set #14	487 70E 6802 70N	105 E/6E
set #15	484 10E 6799 50N	105 E/6E
set #16	488 00E 6797 00N	105 E/6E
set #17	485 60E 6791 90N	105 E/6E
set #18	488 60E 6790 95N	105 E/6E
set #19	489 60E 6787 50N	105 E/3E
set #20	487 80E 6784 35N	105 E/3E

Table 2. Experimental Gillnet set descriptions.

Set #	Total CPUE (# fish/100m/24hr)	Max. depth (m)	Water temperature (°C)		Bottom substrate	
			set	lift	shore	deep
1	71	12		14.7	silt	cobble
2	31	3.5	16.9	17.9	silt	cobble
3	46	25	16.3	16.1	bedrock	cobble
4	30	4	16.1	16	gravel	silt
5	53	17.5	16		bedrock	gravel
6	130	7	16	16	bedrock	silt
7	40	42.5	15	15	rock	rock
8	81	20.5	15		bedrock	silt, rock
9	63	33	15.6		rock	rock
10	79	57	15		bedrock	rock
11	42	61	16.9	16.2	bedrock	rock
12	16	92	16.1		bedrock	rock
13	33	12	15.6	15.6	gravel	silt
14	108	31	15.6	15	gravel	silt
15	57	25	15	14.5	cobble	silt
16	46	60	11.1	14.5	bedrock	rock
17	82	26	14.5	14	gravel,	cobble, silt
18	41	30	14.7	14.3	bedrock	rock, boulder
19	44	67	14.9	14.3	bedrock	rock
20	110	16	14	11.6	bedrock	rock, silt
mean	**60**	**32.1**	**15.3**	**15.0**		

Table 3. Catch per unit effort (# of fish or kg of fish/100m of net/24hr) by mesh size Lake Laberge,1993.

species		mesh size (mm)							
Arctic Grayling		38	64	76	89	102	114	127	Total
	number of fish	41	0	0	0	0	0	0	41
	CPUE (n)	9.26	0	0	0	0	0	0	1.32
	kg of fish	3.53	0	0	0	0	0	0	3.53
	CPUE(kg)	0.80	0	0	0	0	0	0	0.11
Burbot									
	number of fish	2	5	44	13	7	10	11	92
	CPUE (n)	0.45	1.12	9.94	2.94	1.58	2.26	2.49	2.97
	kg of fish	0.20	2	32.05	10.78	8.43	18.45	24.35	96.25
	CPUE(kg)	0.45	0.45	7.24	2.43	1.90	4.17	5.50	3.11
Lake Trout									
	number of fish	1	10	22	9	17	10	2	71
	CPUE (n)	0.23	2.26	4.97	2.03	3.84	2.26	0.45	2.29
	kg of fish	0.00	19.68	24.78	15.88	28.65	16.83	5.15	110.96
	CPUE(kg)	0	4.45	5.97	3.59	6.47	3.80	1.16	3.58
L. Cisco									
	number of fish	80	0	0	0	0	0	0	80
	CPUE (n)	18.07	0	0	0	0	0	0	2.58
	kg of fish	7.78	0	0	0	0	0	0	7.78
	CPUE(kg)	1.76	0	0	0	0	0	0	0.25
Broad Whitefish									
	number of fish	0	10	17	13	17	5	1	63
	CPUE (n)	0	2.26	3.84	2.94	3.84	1.13	0.23	2.03
	kg of fish	0	6.25	15.90	10.45	14.25	6.80	1.30	54.95
	CPUE(kg)	0	1.41	3.59	2.36	3.22	1.54	0.29	1.77
N. Pike									
	number of fish	11	11	6	12	7	33	1	81
	CPUE (n)	2.49	2.49	1.36	2.71	1.58	7.46	0.23	2.16
	kg of fish	24.65	28.70	12.75	28.90	15.20	95.03	3.30	208.53
	CPUE(kg)	5.57	6.48	2.88	6.53	3.43	21.47	0.75	6.73
Round Whitefish									
	number of fish	118	11	3	2	0	0	0	134
	CPUE (n)	26.32	2.49	0.68	0.45	0	0	0	4.33
	kg of fish	14.75	5.35	1.30	1.15	0	0	0	22.55
	CPUE(kg)	3.33	1.21	0.29	0.26	0	0	0	0.73
Lake Whitefish									
	number of fish	94	172	84	41	12	5	0	408
	CPUE (n)	21.24	38.86	18.98	9.26	2.71	1.13	0	13.16
	kg of fish	19.09	75.69	47.06	33.33	10.50	5.95	0	191.61
	CPUE(kg)	4.31	17.10	10.63	7.53	2.37	1.34	0.00	6.18
Longnose Sucker									
	number of fish	123	211	109	240	160	54	0	897
	CPUE (n)	27.79	47.67	24.62	54.22	36.14	12.20	0	28.94
	kg of fish								
	CPUE(kg)	34.39	141.68	86.48	223.58	166.65	67.25	0	720.02
	CPUE(kg)	7.77	32.00	19.54	50.51	37.65	15.19	0	23.23
Inconnu									
	number of fish	0	1	0	1	1	2	1	6
	CPUE (n)	0	0.23	0	0.23	0.23	0.45	0.23	0.19
	kg of fish	0	1.55	0	1.90	2.30	6.78	4.90	17.43
	CPUE(kg)	0	0.35	0	0.43	0.52	1.53	1.11	0.56
Chinook Salmon									
	number of fish	0	0	0	0	0	4	0	4
	CPUE (n)	0	0	0	0	0	0.90	0	0.13
	kg of fish								
	CPUE(kg)								
TOTALS									
	number of fish	470	431	285	331	221	123	16	1877
	CPUE (n)	106.17	97.36	64.38	74.77	49.92	27.79	3.61	59.23
	kg of fish	104.38	280.89	220.31	325.95	245.98	217.08	39.00	1433.61
	CPUE(kg)	23.58	63.45	49.77	73.63	55.57	49.04	8.81	46.25

Table 4. Species composition , presented as a percentage of the total catch by number and weight from summer index netting survey within Lake Laberge, 1993.

Scientific Name	Species	% Catch by Number*	% Catch by Weight*
Thymallus arcticus	Arctic grayling	2.2	.3
Lota lota	burbot	4.9	6.7
Salvelinus namaycush	lake trout	3.8	7.7
Coregonus sardinella	least ciscoe	4.3	.5
Coregonus nasus	broad whitefish	3.4	3.8
Esox lucius	northern pike	4.3	14.6
Prosopium cylindraceum	round whitefish	7.1	1.6
Coregonus clupeaformis	lake whitefish	21.8	13.4
Catostomus catostomus	longnose sucker	47.9	50.2
Stenodus leucichthys	inconnu	.3	1.2

* capture of migrating chinook salmon (Oncorhynchus tshawytacha) excluded from analysis

Table 5. Weight at length relationships for fish species in Lake Laberge 1993. (log weight in g = b. log length in mm + a).

species	sex	N	Y-intercept (a)	slope (b)	r square
burbot	male	42	-5.14	2.99	0.95
	female	49	-4.54	2.77	0.91
	combined	94	-4.78	2.86	0.92
lake trout	male	36	-5.88	3.37	0.97
	female	34	-5.08	3.07	0.98
	combined	72	-5.19	3.11	0.98
lake whitefish	male	152	-5.22	3.12	0.97
	female	241	-5.04	3.05	0.96
	combined	401	-5.16	3.10	0.96
Arctic grayling	male	17	-4.32	2.70	0.68
	female	18	-4.63	2.84	0.87
	combined	38	-4.80	2.90	0.77
least cisco	male	25	-4.49	2.80	0.91
	female	34	-3.55	2.40	0.56
	combined	59	-4.00	2.59	0.71
broad whitefish	male	32	-5.75	3.34	0.94
	female	29	-4.26	2.76	0.91
	combined	61	-4.93	3.02	0.91
northern pike	male	36	-6.54	3.51	0.89
	female	44	-5.08	2.99	0.68
	combined	80	-5.16	3.02	0.75
round whitefish	male	52	-5.28	3.10	0.85
	female	71	-6.28	3.51	0.90
	combined	127	-5.89	3.35	0.88
longnose sucker	male	407	-4.38	2.80	0.92
	female	372	-4.42	2.81	0.96
	combined	893	-4.60	2.88	0.93

Table 6. Diet analyses (% by volume) by species for fish captured by experimental gillnets at Lake Laberge, 1993.

food species	*fish species*						
	lake trout	burbot	northern pike	lake whitefish.	broad whitefish.	round whitefish.	Arctic. grayling
least cisco	74	68	56	2	0	0	0
broad whitefish	2	0	2	0	0	0	0
longnose sucker	8	0	8	0	0	0	0
slimy sculpin	9	10	1	4.5	0	0	0
lake whitefish	3	9	2	0	0	0	0
round whitefish	4	2	23	2	0	0	0
northern pike	0	0	7	0	0	0	0
burbot	0	11	1	0	0	0	0
midges (chironomids)	0	0	0	10	74	18	1
snails unidentified (gastropods)	0	0	0	4	0	0	0
snails (*fossaria* sp.)	0	0	0	8	0	11	0
snails (*gyralus* sp.)	0	0	0	63	4	41	0
fingernail clams	0	0	0	1	21	0	0
ants	0	0	0	1	1	18	88
hydracarina	0	0	0	2	0	0	0
beetles	0	0	0	0.5	0	0	5
caddisfly	0	0	0	2	0	12	0
spider	0	0	0	0	0	0	1
wasp	0	0	0	0	0	0	5

Table 7. Biological data by length group for lake trout captured by experimental Gillnets at Lake Laberge, 1993.

	Combined						*Males*						*Females*					
		length (mm)	weight (g)					length (mm)	weight (g)					length (mm)	weight (g)			
length interval (mm)	N	mean	mean	SD	K	% mat.	N	mean	mean	SD	K	% mat.	N	mean	mean	SD	K	% mat.
80 -70	1	71	5		1.39	0	0						0					
310 -300	1	303	300		1.08	0	1	303	300		1.08	0	0					
350 -340	3	343	450	90	1.12	0	0						3	343	450	90	1.12	0
380 -370	1	372	500		0.97	0	1	372	500		0.97	0	0					
390 -380	3	388	667	58	1.14	67	2	388	700	0	1.2	50	1	387	600		1.04	100
400 -390	2	391	750	71	1.25	0	0						2	391	750	71	1.25	0
410 -400	5	405	900	200	1.36	40	2	406	800	0	1.2	0	3	404	967	252	1.46	67
420 -410	4	411	900	82	1.29	50	3	410	900	100	1.31	67	1	415	900		1.26	0
430 -420	4	424	1025	87	1.35	75	2	422	1000	0	1.34	100	2	426	1050	141	1.36	50
440 -430	3	433	950	50	1.17	0	0						3	433	950	50	1.17	0.00
450 -440	6	443	1196	214	1.37	83	4	443	1106	101	1.27	75	2	444	1375	318	1.57	100
460 -450	3	454	1067	115	1.14	33	2	456	1100	141	1.16	0	1	450	1000		1.1	100
470 -460	3	464	1200	180	1.2	33	2	461	1100	71	1.12	0	1	469	1400		1.36	100
480 -470	2	473	1200	0	1.13	100	2	473	1200	0	1.13	100	0					
490 -480	5	484	1460	164	1.29	100	1	488	1550		1.33	100	4	484	1438	180	1.27	100
500 -490	3	494	1542	138	1.28	33	1	494	1675		1.39	0	1	497	1400		1.14	100
510 -500	3	506	1583	126	1.22	100	2	506	1525	106	1.18	100	1	507	1700		1.3	100
530 -520	1	522	2350		1.65	100	1	522	2350		1.65	100	0					
540 -530	4	536	2125	263	1.39	100	1	537	2000		1.29	100	3	535	2167	306	1.42	100
550 -540	4	544	2100	71	1.3	100	2	544	2075	106	1.29	100	2	544	2125	35	1.32	100
570 -560	2	567	2400	424	1.32	100	2	567	2400	424	1.32	100	0					
580 -570	3	572	2600	247	1.39	100	3	572	2600	180	1.39	100	0					
590 -580	1	586	3100		1.54	100	0						1	586	3100		1.54	100
600 -590	1	590	3150		1.53	100	1	590	3150		1.53	100	0					
650 -640	1	646	3700		1.37	100	1	646	3700		1.37	100	0					
720 -710	1	716	5900		1.6	100	0						1	716	5900		1.61	100
860 -850	1	854	9500		1.53	100	0						1	854	9500		1.53	100
Total	71						36						33					
Mean		471	1597	143	1.3			475	1499	102.5	1.27			477	1749	160	1.32	

Table 8. Biological data by age group for lake trout captured by experimental gillnets at Lake Laberge, 1993.

	Combined								*Males*							*Females*							
		length (mm)			weight (g)					length (mm)			weight (g)				length (mm)				weight (g)			
age	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K
2	1	71			5		0	1.4	0								0							
5	2	367	90	124	625	460	0	1.19	1	303			300		0	1.08	1	430			950		0	1.19
6	2	400	14	20	800	141	50	1.23	1	410			900		100	1.31	1	390			700		0	1.18
7	8	423	80	55	1034	783		1.24	5	455	82	72	1310	882	60	1.22	0							
8	10	482	62	38	1250	591		1.21	5	461	69	60	1300	710	66.6	1.25	5	442	60	53	1200	524	40	1.35
9	4	523	92	90	2138	1307	100	1.36	2	480	81	112	1500	707	100	1.31	1	641			4000		100	1.52
10	7	457	58	43	1250	558		1.38	4	465	76	75	1363	756	75	1.26	3	446	35	40	1100	132	67	1.25
11	3	474	24	27	1200	200	100	1.12	1	475			1200		100	1.12	2	474	33	46	1200	283	100	1.12
12	4	464	44	43	1350	242	100	1.36	1	504			1450		100	1.13	3	450	42	48	1317	284	100	1.43
13	3	489	68	77	1433	580	100	1.2	2	513	75	104	1575	742	100	1.12	1	440			1150		100	1.35
14	1	586			3100		100	1.54	0								1	586			3100		100	1.54
15	3	485	52	59	1458	605	67	1.23	2	456	21	29	1113	124	50	1.17	1	543			2150		100	1.34
16	5	472	47	40	1610	603		1.2	2	449	55	76	1175	530	50	1.25	3	487	42	48	1900	520	100	1.63
18	3	535	38	43	2158	579	66.6	1.43	3	535	38	43	2158	579	100	1.39	0							
24	1	590			3150		100	1.53	1	590			3150		100	1.53	0							
29	1	716			5900		100	1.61	0								1	716			5900		100	1.61
30	1	539			1900		100	1.21	0								1	539			1900		100	1.21
Total	59								30								24							
Mean		471	56		1597	554		1.3		475	62.2		1533	629		1.27		477	43		1749	349		1.32
Mean age	11																							

Table 9. Biological data by length group for burbot captured by experimental gillnets at Lake Laberge, 1993.

	Combined						*Males*						*Females*					
		length (mm)	weight (g)					length (mm)	weight (g)					length (mm)	weight (g)			
length interval (mm)	N	mean	mean	SD	K	%mat	N	mean	mean	SD	K	% mat.	N	mean	mean	SD	K	% mat.
240 -230	1	230	100		0.82	0	0						1	230	100		0.822	0
250 -240	1	240	100		0.72	0	0						1	240	100		0.723	0
350 -340	1	346	275		0.66	0	1	346	275		0.66	0	0					
360 -350	1	356	600		1.33	0	0						1	356	600		1.329	0
370 -360	2	363	338	88	0.7	50	1	360	275		0.59	0	1	366	400		0.815	100
380 -370	1	374	400		0.76	100	1	374	400		0.76	100	0					
390 -380	3	384	375	66	0.66	67	2	386	413	18	0.72	100	1	380	300		0.546	0
400 -390	1	390	450		0.76	0	1	390	400		0.76	0	0					
420 -410	1	410	400		0.58	0	0						1	410	400		0.58	0
430 -420	6	425	608	102	0.79	33	4	423	625	126	0.82	50	2	428	575	35	0.734	0
440 -430	4	434	600	0	0.74	75	0						3	434	600	0	0.732	67
450 -440	8	444	644	108	0.74	88	2	442	525	35	0.61	50	6	444	683	93	0.779	100
460 -450	8	455	638	74	0.68	88	4	455	600	0	0.64	100	4	454	675	96	0.723	75
470 -460	3	463	583	29	0.59	100	1	462	600		0.61	100	2	463	575	35	0.58	100
480 -470	3	475	850	132	0.79	33	1	470	900		0.87	0	2	478	825	177	0.758	50
490 -480	4	485	763	48	0.67	100	3	486	767	58	0.67	100	1	483	750		0.665	100
500 -490	2	494	600	424	0.49	50	1	497	900		0.73	100	1	490	300		0.255	0
510 -500	6	505	871	149	0.68	83	5	505	835	134	0.65	100	1	505	1050		0.815	0
520 -510	3	512	883	76	0.66	67	2	513	875	106	0.65	100	1	510	900		0.678	0
540 -530	2	531	950	141	0.63	100	0						2	531	950	141	0.635	100
560 -550	3	552	1083	76	0.64	67	0						3	552	1083	71	0.643	67
570 -560	2	566	1225	389	0.68	100	2	566	1225	389	0.68	100	0					
580 -570	2	574	1350	0	0.71	50	2	574	1350	0	0.71	50	0					
600 -590	4	593	1431	221	0.69	75	0						4	593	1431	204	0.687	75
610 -600	1	604	1525		0.69	100	0						1	604	1525		0.692	100
620 -610	1	613	1700		0.74	100	0						1	613	1700		0.738	100
630 -620	4	624	1663	125	0.69	100	1	625	1800		0.74	100	2	622	1600	141	0.665	100
640 -630	3	635	1833	355	0.72	67	1	633	1900		0.75	100	2	637	1800	495	0.699	50
650 -640	1	645	2200		0.82	0	0						0					
660 -650	4	656	1963	304	0.7	75	4	656	1963	304	0.7	75	0					
670 -660	1	660	1950		0.68	100	1	660	1950		0.68	100	0					
680 -670	1	675	2250		0.73	100	0						1	675	2250		0.731	100
690 -680	2	685	2200	424	0.68	50	1	685	2500		0.78	0	1	685	1900		0.591	100
700 -690	1	695	2250		0.67	100	0						1	695	2250		0.67	100
710 -700	1	708	2350		0.66	100	1	708	2350		0.66	100	0					
730 -720	1	725	2450		0.64	100	0						1	725	2450		0.643	100
740 -730	1	730	2300		0.59	100	0						1	730	2300		0.591	100
Total	94						323442						49					
Mean		509	1017	159	0.71			507	1007	117	0.7			507	1010	135	0.704	

Table 10. Biological data by age group for burbot captured by experimental gillnets at Lake Lebarge, 1993.

	Combined								*Males*								*Females*							
		length (mm)			**weight (g)**					**length (mm)**			**weight (g)**					**length (mm)**			**weight (g)**			
age	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K
3	1	230			100		0	0.82	0								1	230			100		0	0.82
4	1	240			100		0	0.72	0								1	240			100		0	0.72
5	8	411	43	30	500	158	38	0.69	6	405	48	38	450	147	33	0.70	2	438	3.5	4.9	650	70.7	50	0.78
6	10	422	45	28	540	129	70	0.73	2	422	48	67	500	141	100	0.70	8	413	45	33	550	134	50	0.75
7	14	457	38	20	701.8	144	71	0.74	6	445.7	41	33	704	171	67	0.80	8	466	36	25	700	134	75	0.69
8	7	466	62	46	733.3	306	57	0.71	3	463	77	87	717	284	100	0.70	4	468	62	60	762.5	320	25	0.71
9	7	498	66	49	882.1	351	86	0.69	4	474.8	62	61	825	450	100	0.70	3	528	71	80	958.3	227	66.7	0.65
10	3	494	55	62	850	278	100	0.69	1	488			800		100	0.70	2	497	77	107	875	389	100	0.69
11	7	532	83	62	1057	437	43	0.67	4	507.8	56	55	925	348	50	0.70	2	536	145	201	1025	601	50	0.65
12	11	530	69	41	1089	468	82	0.7	5	523.6	81	71	945	569	100	0.60	6	535	65	52	1208	375	66.7	0.78
13	7	596	56	42	1421	416	86	0.66	4	596.3	74	72	1517	501	75	0.60	3	596	36	41	1467	404	100	0.68
14	8	679	43	30	2100	314	100	0.67	2	670.5	53	74	2125	318	100	0.70	6	682	45	36	2092	343	100	0.66
15	2	623	74	103	1800	636	100	0.73	1	570			1350		100	0.70	1	675			2250		100	0.73
16	2	665	28	39	2350	212	0	0.8	1	685			2500		0	0.80								
17	0								0															
18	2	640	21	29	1825	35	100	0.7	2	640	21	29.4	1825	35.4	100	0.70								
24	1	655			2400		100	0.85	1	655			2400		100	0.90								
Total	91								42								47							
Mean		509	53		1024	299		0.7		507	56		1007	296		0.70		507	58		1010	300		0.7
Mean age		10																						

Table 11. Biological data by length for lake whitefish captured by experimental gillnets at Lake Laberge, 1993.

	Combined						Males						Females					
		length(mm)	weight (g)					length (mm)	weight (g)					length (mm)	weight (g)			
length interval (mm)	N	mean	mean	SD	K	%mat	N	mean	mean	SD	K	% mat.	N	mean	mean	SD	K	% mat.
150 -140	1	145	25		0.82	0	0						1	145	25		0.82	0
160 -150	2	157	38	18	0.98	0	0						0					
170 -160	11	166	57	16	1.25	0	4	166	50	0	1.11	0	6	167	63	21	1.36	0
180 -170	19	173	58	14	1.12	0	10	173	56	15	1.06	0	8	173	63	13	1.21	0
190 -180	11	184	83	14	1.34	0	8	184	83	15	1.34	0	2	182	88	18	1.45	0
200 -190	9	196	100	0	1.33	0	3	196	100	0	1.32	0	5	195	100	0	1.35	0
210 -200	8	203	100	0	1.2	0	3	204	100	0	1.19	0	4	202	100	0	1.21	0
220 -210	3	213	108	14	1.12	0	0						3	213	108	14	1.12	0
230 -220	2	223	100	0	0.91	0	0						2	223	100	0	0.91	0
240 -230	1	235	125		0.96	0	0						1	235	125		0.96	0
260 -250	4	252	279	155	1.75	0	1	253	150		0.93	0	2	252	350	212	2.19	0
280 -270	6	275	233	44	1.12	17	4	276	238	52	1.13	25	2	273	225	35	1.11	0
290 -280	5	284	260	42	1.13	20	2	286	225	35	0.97	0	3	284	283	29	1.24	33
300 -290	20	295	310	76	1.21	55	11	296	330	97	1.28	91	9	294	286	28	1.13	11
310 -300	20	304	335	37	1.2	60	10	304	325	26	1.16	100	10	304	345	44	1.23	20
320 -310	28	315	391	45	1.26	79	14	314	389	35	1.26	93	14	315	393	54	1.26	64
330 -320	36	324	415	44	1.22	89	14	323	395	37	1.17	93	22	324	427	44	1.26	86
340 -330	36	334	461	45	1.24	89	9	333	467	43	1.26	100	27	334	461	46	1.23	85
350 -340	39	344	511	50	1.26	95	13	344	523	70	1.29	100	26	344	505	37	1.24	92
360 -350	21	354	542	85	1.22	90	5	355	525	35	1.18	100	16	353	547	96	1.24	88
370 -360	18	365	585	103	1.21	89	9	364	611	82	1.27	89	9	365	558	120	1.14	89
380 -370	31	374	652	64	1.25	94	10	374	650	58	1.24	100	21	374	652	68	1.25	90
390 -380	12	383	717	54	1.27	100	5	383	730	45	1.3	100	7	383	707	61	1.26	100
400 -390	11	396	814	74	1.31	100	5	396	820	91	1.32	100	6	395	808	67	1.31	100
410 -400	12	404	871	103	1.32	100	4	405	838	75	1.26	100	8	404	888	116	1.34	100
420 -410	10	414	975	101	1.38	90	2	414	950	71	1.34	100	8	414	981	110	1.39	88
430 -420	6	424	1022	100	1.34	100	1	423	956		1.26	100	5	424	1035	105	1.36	100
440 -430	11	435	1093	137	1.33	100	5	434	1055	101	1.29	100	6	436	1125	164	1.36	100
450 -440	3	447	1233	76	1.38	100	0						3	447	1233	76	1.38	100
460 -450	2	454	800	354	0.86	100	0						2	454	800	354	0.86	100
470 -460	1	462	1500		1.52	100	0						1	462	1500		1.52	100
480 -470	2	477	1300	0	1.2	100	0						2	477	1300	0	1.2	100
Total	401						152						241					
Mean		321	478	64	1.24			312	436	47	1.23			331	517	69	1.26	

Table 12. Biological data by age group for lake whitefish captured by experimental gillnets at Lake Laberge, 1993.

	Combined								*Males*								*Females*							
		length (mm)			weight (g)					length (mm)			weight (g)					length (mm)			weight (g)			
age	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K
2	8	164	10	7	44	11	0	1	3	169	5.9	7	43	12	0	0.91	3	163	16	18	42	14	0	0.93
3	44	182	14	4	76	23	0	1.25	21	182	12	5	74	21	0	1.21	22	182	16	7	81	23	0	1.32
4	11	212	26	15	107	36	0	1.11	3	188	14	16	83	29	0	1.24	7	223	24	18	118	37	0	1.05
5	6	272	43	34	263	109	33	1.24	2	288	16	23	288	88	50	1.19	3	286	35	40	300	100	33	1.26
6	14	310	36	19	395	150	50	1.38	6	309	37	29	421	195	83	1.4	8	311	37	26	375	116	25	1.36
7	27	310	26	10	362	109	59	1.19	9	304	23	15	317	90	89	1.11	17	317	23	11	391	112	47	1.2
8	18	317	19	9	392	87	83	1.21	10	307	16	10	340	77	70	1.16	8	330	15	10	456	50	100	1.27
9	32	325	19	6	413	82	88	1.19	14	322	17	9	404	63	93	1.21	18	328	20	9	421	94	83	1.18
10	26	332	15	6	448	80	77	1.21	10	335	19	12	465	91	100	1.22	16	330	13	6	438	73	63	1.21
11	26	346	22	8	512	120	88	1.22	10	347	27	17	518	138	100	1.21	16	345	19	9	508	111	81	1.22
12	22	349	19	8	552	109	100	1.29	11	350	24	14	568	127	100	1.31	11	348	15	9	536	90	100	1.27
13	23	371	31	13	663	185	100	1.27	12	370	30	17	675	175	100	1.31	11	372	34	20	650	202	100	1.23
14	17	366	27	13	644	166	94	1.28	6	370	20	16	642	146	100	1.25	11	364	30	18	646	182	91	1.3
15	14	372	24	13	643	144	93	1.23	6	382	30	24	693	207	100	1.21	8	365	16	11	606	62	88	1.25
16	6	402	23	18	879	211	100	1.34	2	382	23	32	750	212	100	1.33	4	412	17	17	944	207	100	1.34
17	15	388	29	15	730	197	87	1.25	2	378	45	62	700	283	100	1.26	13	389	28	15	735	196	85	1.25
18	8	390	29	20	800	191	88	1.33	1	394			900		100	1.47	7	390	31	23	786	201	86	1.31
19	2	423	23	31	1025	35	100	1.36	0								2	423	23	31	1025	35	100	1.36
20	8	412	34	24	981	310	100	1.36	2	411	36	50	900	283	100	1.27	6	412	37	30	1008	272	100	1.39
21	4	427	47	46	1063	354	100	1.32	0								4	427	47	46	1063	354	100	1.32
22	4	413	15	15	975	225	100	1.37	0								4	413	15	15	975	225	100	1.37
23	1	438			900		100	1.07	0								1	438			900		100	1.07
24	2	433	6	9	1100	0	100	1.36	1	437			1100		100	1.32	1	428			1100		100	1.4
26	1	447			1250		100	1.4	0								1	447			1250		100	1.4
27	3	411	59	66	842	406	100	1.15	0								3	411	59	66	842	406	100	1.15
31	1	446			1150		100	1.3	0								1	446			1150		100	1.3
35	1	432			1100		100	1.36	1	432			1100		100	1.36	0							
Total	344								132								206							
Mean		321	25.9		478	145		1.24		312	23		436	132		1.23		331	26		517	144		1.26
Mean age	10																							

Table 13. Biological data by length group for longnose sucker captured by experimental gillnets at Lake Laberge, 1993.

	Combined						*Males*						*Females*					
		length (mm)	weight (g)					length (mm)	weight (g)					length (mm)	weight (g)			
length interval (mm)	N	mean	mean	SD	K	% mat.	N	mean	mean	SD	K	% mat.	N	mean	mean	SD	K	% mat.
150 -140	1	149	25		0.76	0	0						0					
160 -150	6	154	53	30	1.45	0	2	155	88	18	2.4	0	0					
170 -160	20	165	70	80	1.55	0	6	166	48	4	1.07	0	5	163	50	15	1.16	0
180 -170	20	174	102	96	1.93	0	4	175	75	139	2.64	0	5	175	73	18	1.37	0
190 -180	16	184	88	59	1.41	0	5	184	70	21	1.12	0	6	184	123	88	1.97	0
200 -190	7	193	139	115	1.97	0	5	192	94	137	2.21	0	2	194	100	0	1.37	0
220 -210	2	215	250	212	2.47	0	1	213	100		1.03	0	0					0
230 -220	2	223	125	35	1.12	0	0						1	226	150		3.91	0
240 -230	1	239	150		1.1	0	0						0					
250 -240	1	249	170		1.1	0	0						1	249	170		1.3	0
260 -250	1	254	175		1.07	0	1	254	175		1.07	0	0					
270 -260	2	265	400	141	2.19	0	1	260	500		2.84	0	1	269	300		1.1	0
280 -270	8	274	263	87	1.28	0	3	274	325	115	1.59	0	3	275	242	52	1.16	0
290 -280	11	283	298	88	1.31	0	2	282	300	0	1.34	0	8	283	266	30	1.17	0
300 -290	17	294	327	77	1.28	12	7	295	314	38	1.23	29	10	294	335	97	1.31	0
310 -300	17	304	363	52	1.3	6	10	304	375	54	1.34	10	5	304	350	35	1.25	0
320 -310	14	312	396	24	1.3	31	6	311	392	20	1.3	50	7	313	400	32	1.31	14
330 -320	13	323	452	103	1.34	42	6	323	442	49	1.32	17	6	324	483	137	1.42	67
340 -330	11	333	466	53	1.26	45	3	335	500	0	1.33	67	7	332	461	57	1.26	43
350 -340	19	344	518	42	1.27	58	7	345	507	45	1.24	86	11	344	527	41	1.29	45
360 -350	22	364	552	72	1.26	82	17	353	553	78	1.26	82	4	354	563	48	1.27	100
370 -360	23	364	626	74	1.29	82	14	365	643	73	1.32	93	8	364	600	76	1.25	63
380 -370	17	374	659	59	1.26	93	10	374	655	64	1.25	100	5	375	690	22	1.31	80
390 -380	31	384	740	89	1.3	97	20	384	743	96	1.31	100	10	386	740	81	1.29	90
400 -390	53	395	782	84	1.27	98	40	395	790	85	1.28	100	13	395	758	79	1.23	100
410 -400	74	405	836	90	1.26	100	56	405	847	93	1.28	100	17	404	794	68	1.2	100
420 -410	110	414	899	80	1.27	100	74	414	901	75	1.27	100	23	413	867	91	1.23	100
430 -420	83	424	944	100	1.24	100	51	424	938	94	1.23	100	20	425	920	94	1.2	100
440 -430	81	434	1008	76	1.23	100	31	433	1006	56	1.24	100	39	435	1001	74	1.22	100
450 -440	58	444	1047	85	1.2	100	12	444	1083	96	1.24	100	36	444	1023	77	1.17	100
460 -450	46	454	1135	105	1.21	100	7	454	1143	207	1.22	100	31	454	1124	77	1.2	100
470 -460	42	464	1179	85	1.18	100	1	464	1200		1.2	100	34	464	1171	85	1.17	100
480 -470	30	474	1245	155	1.17	100	2	473	950	354	0.9	100	24	474	1262	122	1.18	100
490 -480	16	484	1350	100	1.19	100	0						15	484	1350	104	1.19	100
500 -490	14	494	1188	343	0.99	92	3	493	750	35	0.63	100	10	494	1358	239	1.13	90
510 -500	4	505	1400	82	1.09	100	0						4	505	1400	82	1.09	100
Total	893						407						371					
Mean		388	804	93	1.28			384	766	79	1.29			404	873	72	1.24	

Table 14. Biological data by age group for longnose sucker captured by experimental gillnets at Lake Laberge, 1993.

	Combined								Males								Females							
		length (mm)			weight (g)					length (mm)			weight (g)					length (mm)			weight (g)			
age	N	mean	SD	95%len	mean	SD	%mat	K	N	mean	SD	95%len	mean	SD	%mat	K	N	mean	SD	95%len	mean	SD	%mat	K
3	4	174	10	10	69	24	0	1.26	1	170			50		0	1.02	3	176	12	13	75	25	0	1.35
4	12	173	8	4	101	85	0	1.88	3	173	4	4	75	25	0	1.42	5	173	10	9	107	111	0	1.87
5	8	180	33	23	126	155	0	1.37	4	192	46	45	163	225	0	1.49	2	168	11	15	75	0	0	1.62
6	7	237	62	46	236	152	0	1.70	4	267	68	66	263	155	0	1.20	2	207	14	20	250	212	0	2.61
7	7	245	59	44	229	158	14	1.32	6	243	67	54	233	172	17	1.38	0							
8	16	318	25	12	416	117	25	1.26	4	334	41	40	375	49	25	1.25	11	320	33	20	432	172	27	1.26
9	8	314	36	25	425	122	14	1.39	1	315			500		0	1.12	6	337	36	29	500	130	17	1.27
10	7	354	29	22	586	149	83	1.31	3	332	32	37	583	104	67	1.29	4	400	83	82	875	450	100	1.32
11	12	354	29	16	579	141	58	1.30	3	376	30	34	600	100	100	1.32	8	339	35	24	519	167	50	1.32
12	9	399	29	19	744	98	100	1.19	6	407	24	19	775	76	100	1.15	3	369	37	42	633	144	100	1.26
13	11	407	43	25	811	206	91	1.22	2	425	96	133	738	18	100	0.90	9	396	40	26	811	253	89	1.28
14	17	377	37	17	715	230	93	1.30	8	392	33	23	713	201	88	1.29	8	375	46	32	706	261	88	1.29
15	10	407	42	26	805	177	90	1.21	5	391	62	55	740	207	80	1.18	5	409	16	14	870	130	100	1.23
16	6	423	19	15	992	159	100	1.31	3	408	9	10	917	229	100	1.35	3	438	6	7	1033	126	100	1.27
17	13	427	24	13	973	145	100	1.25	7	408	13	10	879	91	100	1.29	6	448	15	12	1083	117	100	1.20
18	5	431	16	14	980	179	100	1.22	1	405			1000		100	1.33	4	434	18	18	975	206	100	1.19
19	7	440	32	24	1011	242	100	1.17	2	407	21	29	825	35	100	1.21	5	440	17	15	985	99	100	1.16
20	4	420	14	14	925	126	100	1.25	2	425	5	7	850	71	100	1.23	2	460	46	64	1200	424	100	1.26
21	9	432	18	12	983	87	100	1.22	3	420	26	30	933	153	100	1.25	6	437	11	9	1025	42	100	1.21
22	12	452	29	17	1125	217	100	1.20	4	413	20	20	925	150	100	1.23	8	467	20	14	1225	173	100	1.19
23	6	447	29	24	1108	191	100	1.24	3	438	16	19	1033	252	100	1.31	3	457	15	17	1150	150	100	1.16
24	5	441	26	23	1070	199	100	1.24	3	421	27	30	1083	126	100	1.32	2	448	35	49	950	212	100	1.11
25	3	438	30	34	983	126	100	1.18	2	427	15	21	925	106	100	1.24	1	481			1300		100	1.05
27	1	478			1400		100	1.28	0								1	472			1100		100	1.28
28	2	422	2	3	875	35	100	1.17	2	424	1	2	875	35	100	1.17	0							
29	2	466	25	34	1150	71	100	1.14	0								2	463	21	29	1250	212	100	1.14
30	2	466	6	8	1200	141	100	1.18	0								2	473	15	21	1150	71	100	1.18
31	1	464			1250		100	1.25	0								1	470			1300		100	1.25
32	3	448	34	39	1133	153	100	1.38	1	420			1000		100	1.46	2	464	0		1275	35	100	1.17
33	1	487			1300		100	1.13	0								1	472			1100		100	1.13
34	2	494	18	24	1400	141	100	1.16	0								2	484	4	6	1300	0	100	1.16
35	1	432			900		100	1.12	1	409			900		100	1.12	0							
36	1	459			1300		100	1.34	1	432			1300		100	1.34	0							
Total	214								85								117							
Mean		391	27		845	144		1.28		366	31		713	123		1.25		396	24		871	157		1.30
Mean age	15																							

Table 15. Biological data by length group for northern pike captured by experimental gillnets at Lake Laberge, 1993.

	Combined						Males						Females					
		length(mm)	weight (g)					length (mm)	weight (g)					length (mm)	weight (g)			
length interval (mm)	N	mean	mean	SD	K	%mat	N	mean	mean	SD	K	% mat.	N	mean	mean	SD	K	% mat.
540 -530	2	533	1150	212	0.76	100	2	533	1150	212	0.76	100	0					
570 -560	1	565	1400		0.78		1	565	1400		0.78	100	0					
580 -570	1	573	1500		0.8	100	1	573	1500		0.80	100	0					
590 -580	1	588	1250		0.61		1	588	1250		0.62	100	0					
600 -590	1	595	1600		0.76	100	1	595	1600		0.76	100	0					
620 -610	5	613	1880	266	0.82	100	2	610	1875	530	0.83	100	3	615	1883	29	0.81	100
640 -630	7	634	2021	147	0.79	100	3	633	2067	153	0.81	100	4	634	1988	155	0.78	100
650 -640	6	644	2200	89	0.82	100	5	644	2190	96	0.82	100	1	647	2250		0.83	100
660 -650	11	655	2189	168	0.78	100	5	655	2215	74	0.79	100	6	655	2167	225	0.77	100
670 -660	8	663	2281	237	0.78	100	3	661	2183	189	0.76	100	5	664	2340	263	0.8	100
680 -670	3	675	2500	132	0.81	100	1	677	2650		0.85	100	2	675	2425	35	0.79	100
690 -680	5	685	2610	124	0.81	100	4	685	2588	132	0.81	100	1	688	2700		0.83	
700 -690	2	691	2600	0	0.79	100	2	691	2600	0	0.79	100	0					
710 -700	9	706	2622	783	0.75	88	3	706	2983	362	0.85	100	6	706	2442	900	0.7	80
720 -710	1	719	3600		0.97	100	1	719	3600		0.97	100	0					
730 -720	4	722	3175	287	0.84	100	1	725	3600		0.95	100	3	721	3033	58	0.81	100
740 -730	1	730	2800		0.73	100	0						1	730	2850		0.73	100
750 -740	2	744	3600	707	0.87	100	0						2	744	3600	707	0.87	100
760 -750	2	757	3475	318	0.8	100	0						2	757	3475	318	0.8	100
770 -760	1	764	3200		0.72	100	0						1	764	3200		0.72	100
780 -770	2	775	3150	212	0.68	100	0						2	775	3150	212	0.68	100
800 -790	1	792	4000		0.81	100	0						1	792	4000		0.81	100
860 -850	1	851	4750		0.77	100	0						1	851	4750		0.77	100
870 -860	1	860	5000		0.79	100	0						1	860	5000		0.79	100
940 -930	1	938	7000		0.85	100	0						1	938	7000		0.85	100
1030 -1020	1	1020	8500		0.8	100	0						1	1020	8500		0.8	100
Total	80						36						44					
Mean		682	2607	263	0.79			648	2248	194	0.81			710	2900	290	0.78	

Table 16. Biological data by age group for northern pike captured by experimental gillnets at Lake Laberge, 1993.

	Combined								Males								Females							
	length (mm)				weight (g)				length (mm)				weight (g)				length (mm)				weight (g)			
age	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K	N	mean	SD	95% conf	mean	SD	%mat	K
3	1	532			1300		100	0.86	1	532			1300		100	0.86	0							
4	7	637	38	28	1793	573	100	0.72	6	625	23	18	1975	339	100	0.81	1	709			700		100	0.2
5	26	650	34	13	2166	357	100	0.78	13	646	35	19	2125	388	100	0.78	13	655	34	19	2208	335	100	0.79
6	16	663	55	27	2309	578	100	0.78	7	631	59	44	2057	638	100	0.79	9	688	37	24	2506	471	100	0.76
7	10	701	35	22	2870	443	90	0.83	4	699	15	15	2900	339	100	0.85	6	702	46	37	2850	532	83	0.82
8	10	724	70	43	3110	892	100	0.8	4	691	36	36	2888	829	100	0.86	6	746	80	64	3258	977	100	0.77
9	4	759	132	129	3700	2273	100	0.77	1	692			2600		100	0.78	3	782	152	172	4067	2635	100	0.77
10	3	771	80	91	4067	950	100	0.88	0								3	771	80	91	4067	950	100	0.88
Total	77								36								41							
Mean		682	63		2607	867		0.79		652	34		2298	506		0.81		710	71		2900	983		0.78
Mean age	6																							

Table 17. Concentrations of sDDT, sPCB and Toxaphene contained in sampled lake trout muscle tissue from Lake Laberge, 1993.

Fish Number	Age (years)	Fork Length (mm)	Weight (gm)	Sex	% Lipid	sDDT (ppb)	sPCB (ppb)	Toxaphene (ppb)
1	15	441	1025	male	2.6	58.3	43.5	63
2	8	407	1200	female	6.7	166.7	90.0	260
3	-	441	1100	male	2.2	29.3	22.7	59
4	-	716	5900	female	5.4	509.2	200.8	300
5	12	402	1000	female	1.8	25.8	25.5	130
6	8	435	900	female	2.0	52.8	32.8	120
7	-	590	3150	male	3.9	835.2	515.5	420
8	10	459	1200	male	1.9	50.5	29.9	110
9	7	372	500	male	1.5	31.7	23.1	53
10	8	392	800	female	2.9	51.0	32.3	80
11	9	491	1550	-	8.2	150.2	86.2	240
12	8	447	1250	male	3.1	52.4	28.8	100
13	-	403	700	female	3.9	69.4	33.5	85
14	16	410	800	male	1.4	19.5	21.6	56
15	-	447	1600	female	2.5	230.5	125.3	220
16	9	641	4000	female	7.2	156.9	91.5	220
17	14	586	3100	-	4.6	134.3	69.0	200
Mean	10.3	475.3	1751.5	-	3.6	154.3	86.5	159.8
SD	3.1	98.1	1451.0	-	2.1	212.1	120.4	104.5

Table 18. Concentrations of sDDT, sPCB and Toxaphene contained in sampled burbot liver from Lake Laberge, 1993.

Fish Number	Age (years)	Total Length (mm)	Weight (gms)	Sex	% lipid	sDDT (ppb)	sPCB (ppb)	Toxaphene (ppb)
1	-	490	300	female	59	2097.8	1006.3	1700
2	18	655	1850	male	47	2181.3	965.1	1600
3	11	578	1350	male	57	3737.0	1584.6	2400
4	5	420	500	male	36	2120.0	780.0	2400
5	16	685	2500	male	50	2189.4	1181.7	1850
6	13	621	1700	female	48	4348.2	1919.1	2900
7	-	431	600	male	36	696.1	928.0	890
8	5	390	450	male	33	1283.0	768.6	1100
9	14	635	2150	female	49	1655.6	895.0	1400
10	12	505	1050	female	53	1723.1	948.8	1400
11	12	660	1950	male	45	3216.3	1477.6	1800
12	9	457	700	female	41	2121.4	989.5	1300
13	8	410	400	female	47	1073.1	708.3	800
14	14	695	2250	female	37	3575.8	1739.6	1700
15	11	625	1650	female	40	2341.5	1487.4	1200
Mean	11.4	550	1293	-	45.2	2290.6	1158.6	1629.3
SD	3.9	111	763	-	8.0	1025.4	383.8	585.8

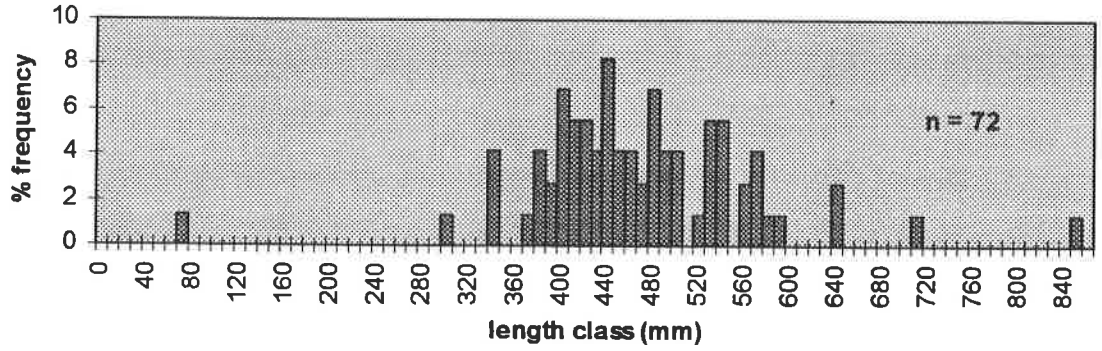

Figure 2. Length-frequency histogram for lake trout captured by experimental gillnets at Lake Laberge, 1993.

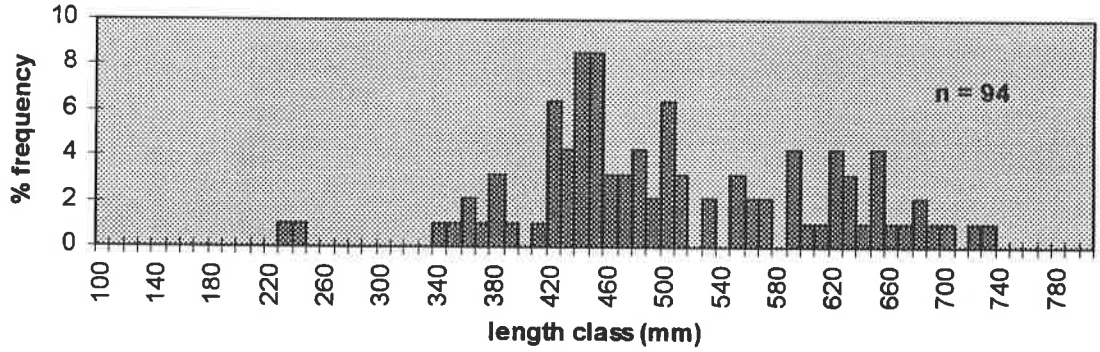

Figure 3. Length-frequency histogram for burbot captured by experimental gillnets at Lake Laberge, 1993.

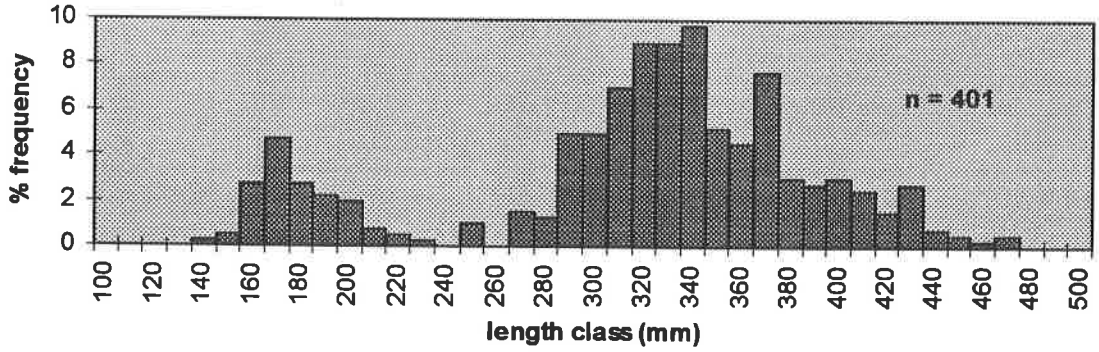

Figure 4. Length-frequency histogram for lake whitefish captured by experimental gillnets at Lake Laberge, 1993.

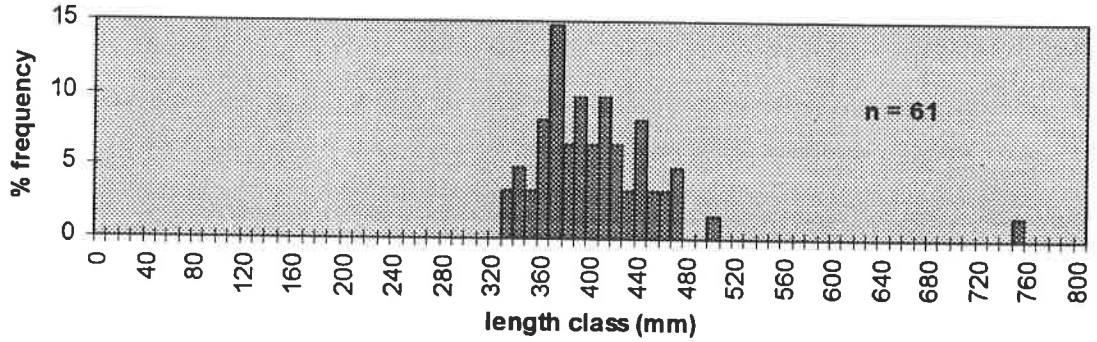

Figure 5. Length-frequency histogram for broad whitefish captured by experimental gillnets at Lake Laberge, 1993.

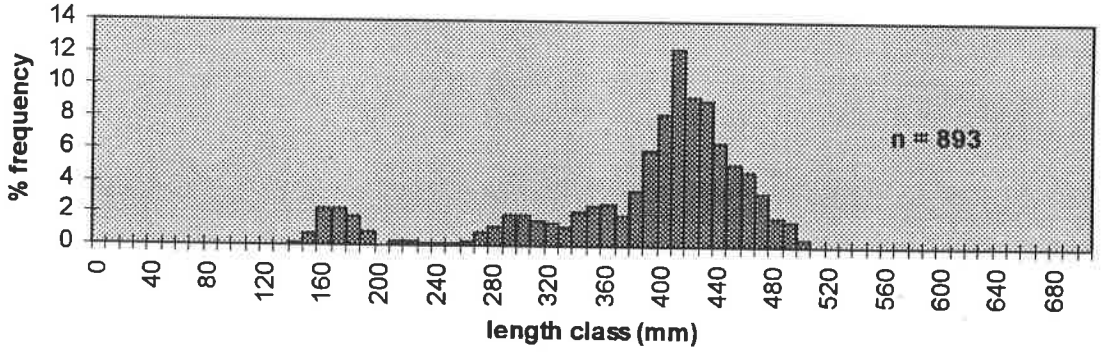

Figure 6. Length-frequency histogram for longnose sucker captured by experimental gillnets at Lake Laberge, 1993.

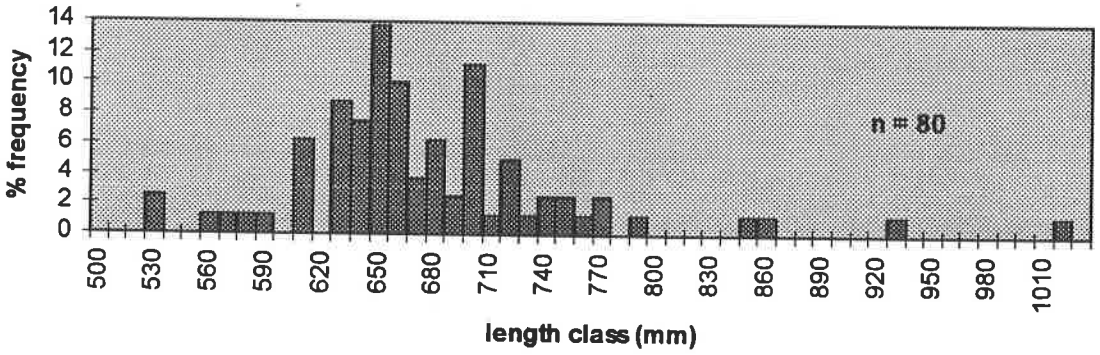

Figure 7. Length-frequency histogram for northern pike captured by experimental gillnets at Lake Laberge, 1993.

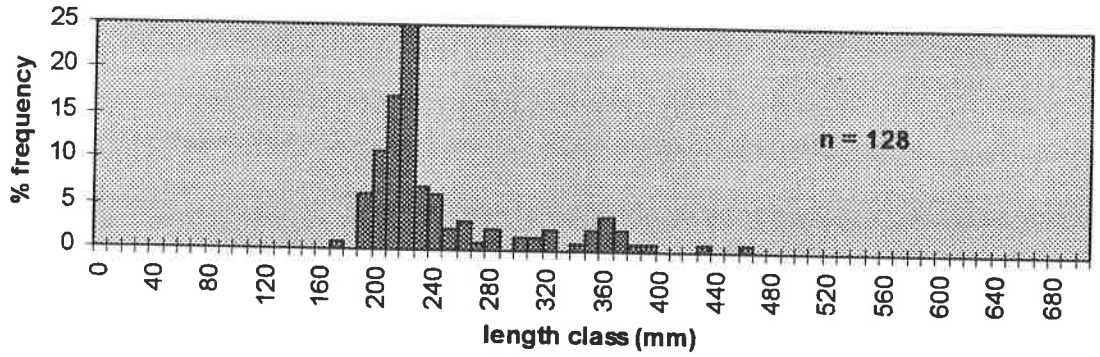

Figure 8. Length-frequency histogram for round whitefish captured by experimental gillnets at Lake Laberge, 1993.

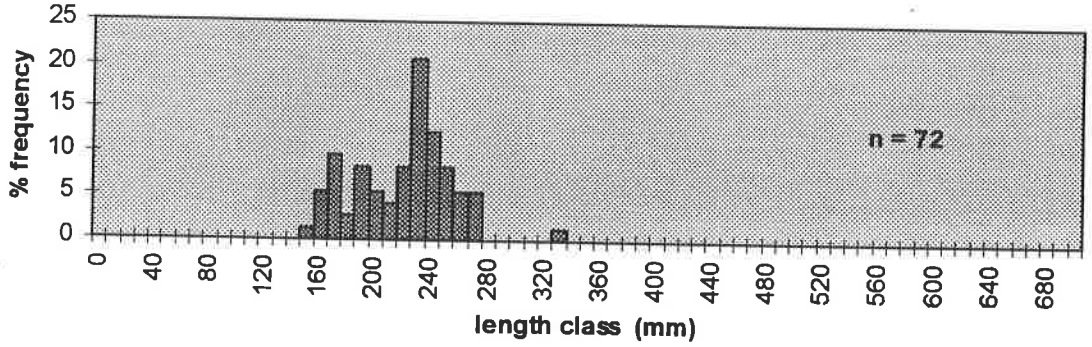

Figure 9. Length-frequency histogram for least cisco captured by experimental gillnets at Lake Laberge, 1993.

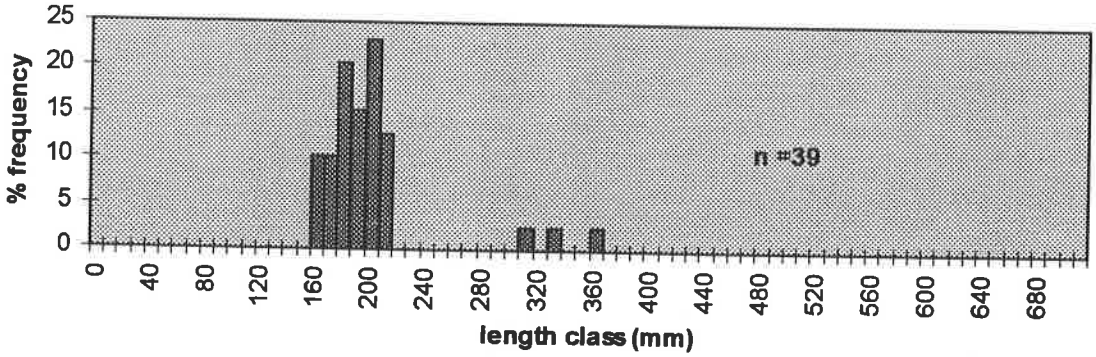

Figure 10. Length-frequency histogram for Arctic grayling captured by experimental gillnets at Lake Laberge, 1993.

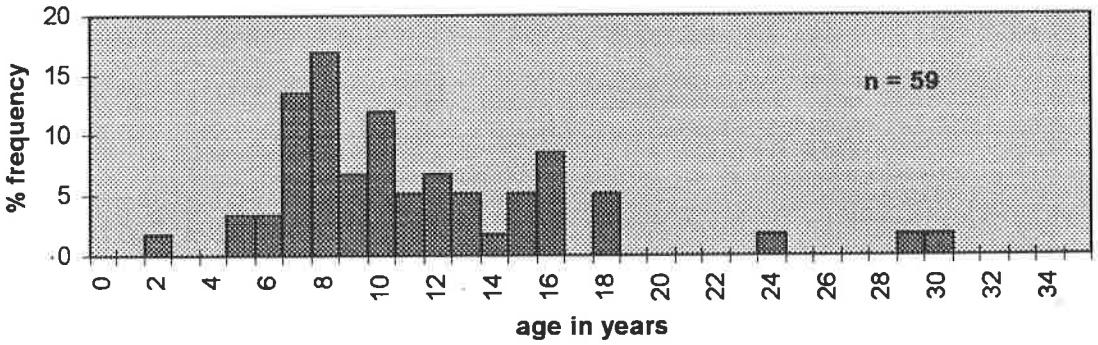

Figure 11.Age-frequency histogram for lake trout captured by experimental gillnets at Lake Laberge, 1993.

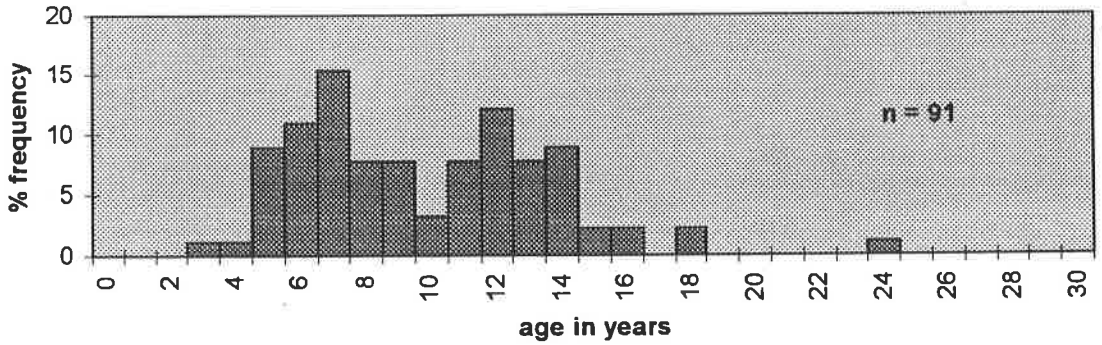

Figure 12. Age-frequency histogram for burbot captured by experimental gillnets at Lake Laberge, 1993.

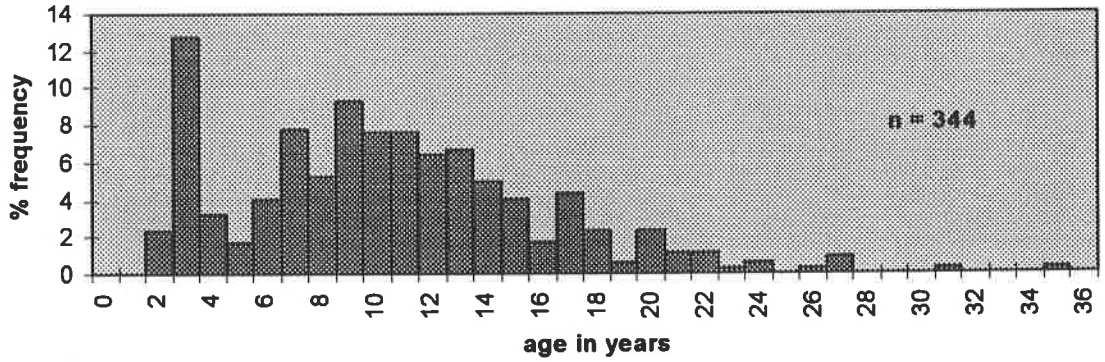

Figure 13. Age-frequency histogram for lake whitefish captured by experimental gillnets at Lake Laberge, 1993.

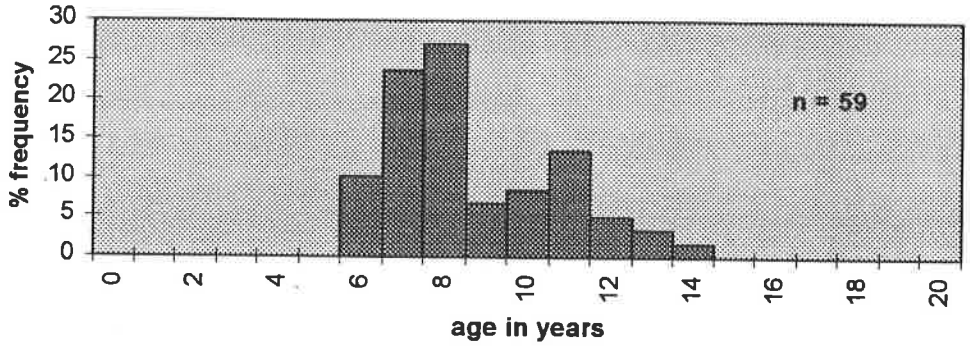

Figure 14. Age-frequency histogram for broad whitefish captured by experimental gillnets at Lake Laberge, 1993.

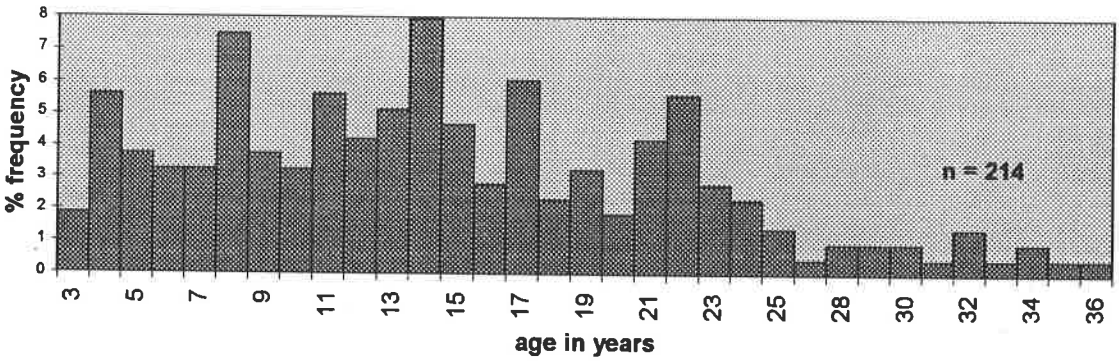

Figure 15. Age-frequency histogram for longnose sucker captured by experimental gillnets at Lake Laberge, 1993.

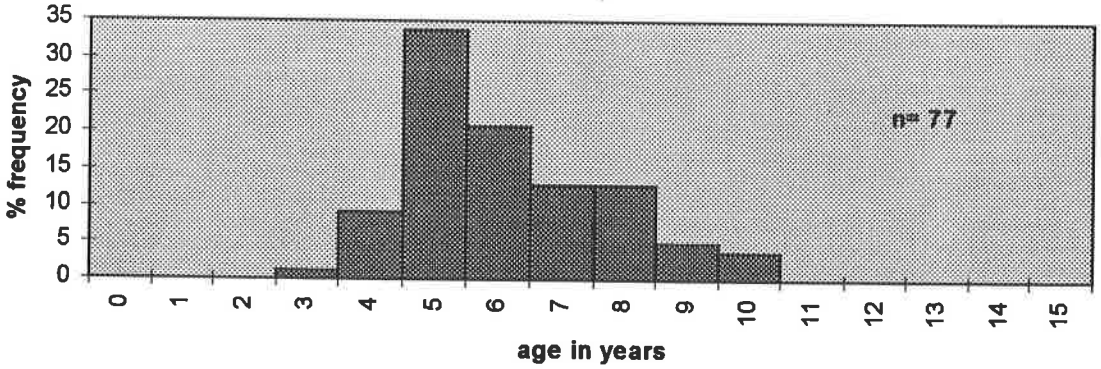

Figure 16. Age-frequency histogram for northern pike captured by experimental gillnets at Lake Laberge, 1993.

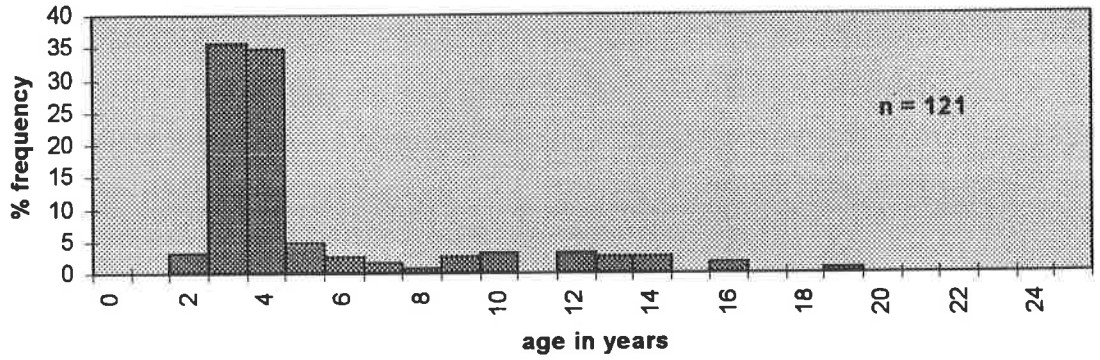

Figure 17. Age-frequency histogram for round whitefish captured by experimental gillnets at Lake Laberge, 1993.

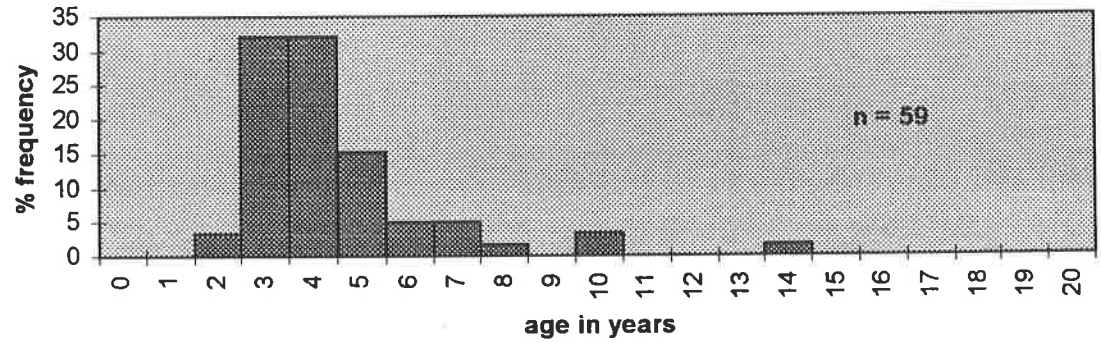

Figure 18. Age-frequency histogram for least cisco captured by experimental gillnets at Lake Laberge, 1993.

APPENDIX 1

Weight at Length and Length at age scatter plots for all fish species

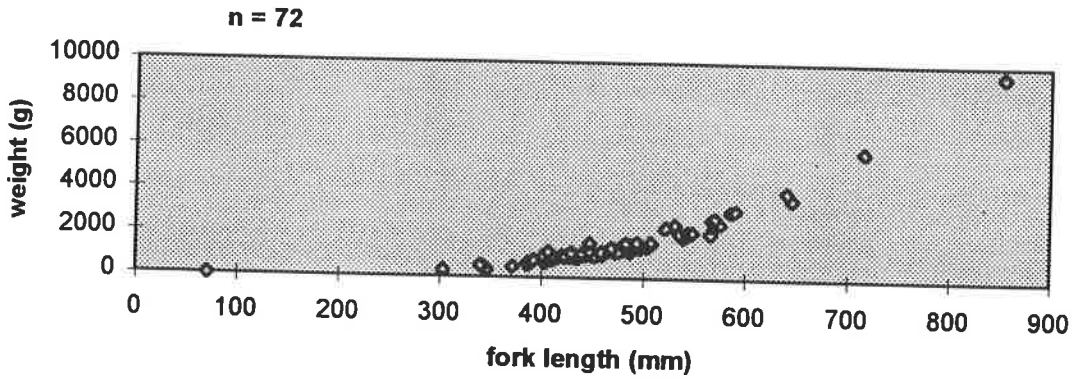

Figure A1. Weight at length scatter plot for lake trout captured by experimental gillnets at Lake Laberge, 1993.

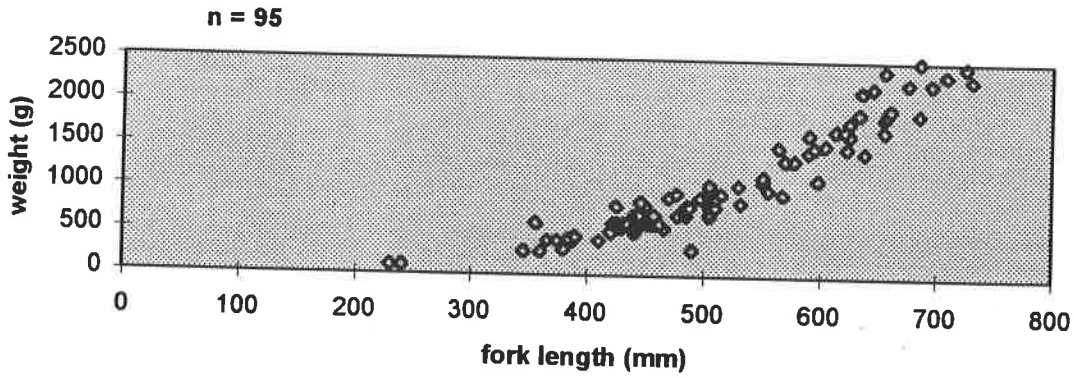

Figure A2. Weight at length scatter plot for burbot captured by experimental gillnets at Lake Laberge, 1993.

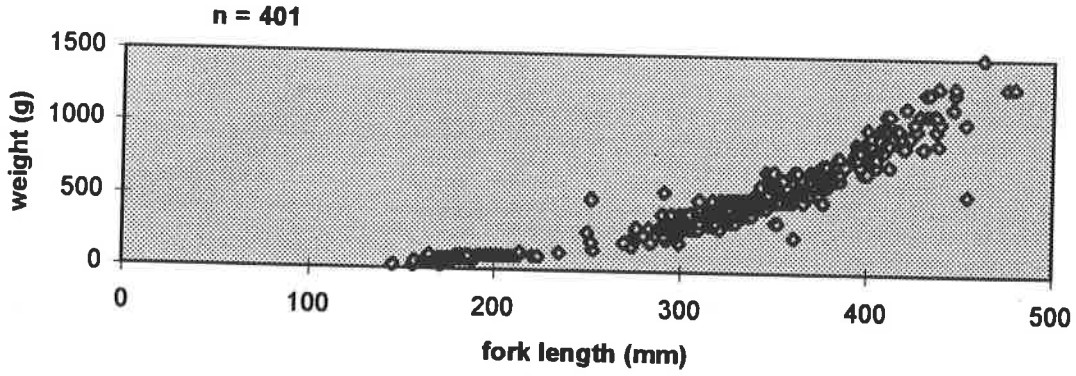

Figure A3. Weight at length scatter plot for lake whitefish captured by experimental gillnets at Lake Laberge, 1993.

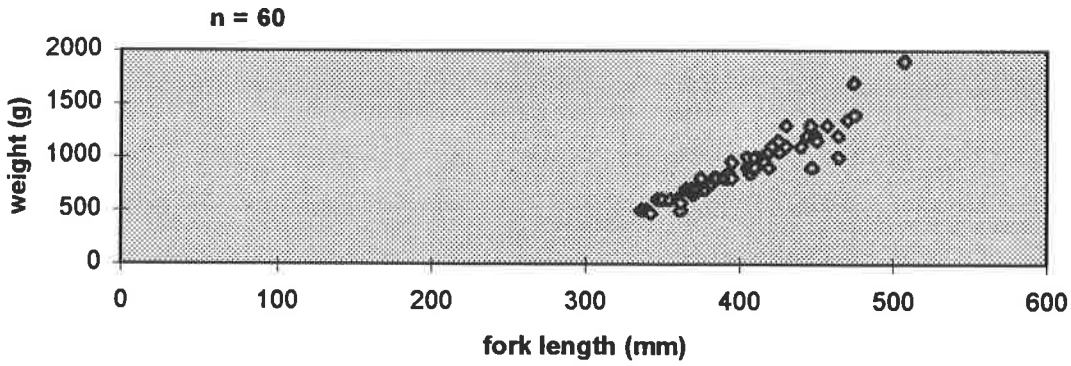

Figure A4. Weight at length scatter plot for broad whitefish captured by experimental gillnets at Lake Laberge, 1993.

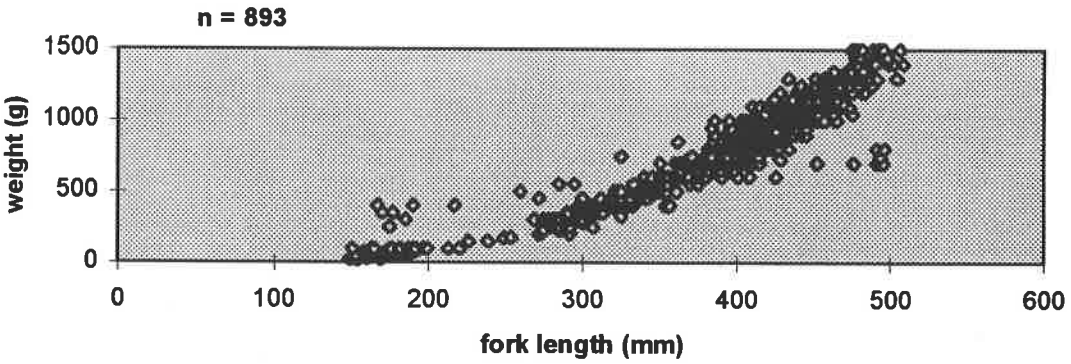

Figure A5. Weight at length scatter plot for longnose sucker captured by experimental gillnets at Lake Laberge, 1993.

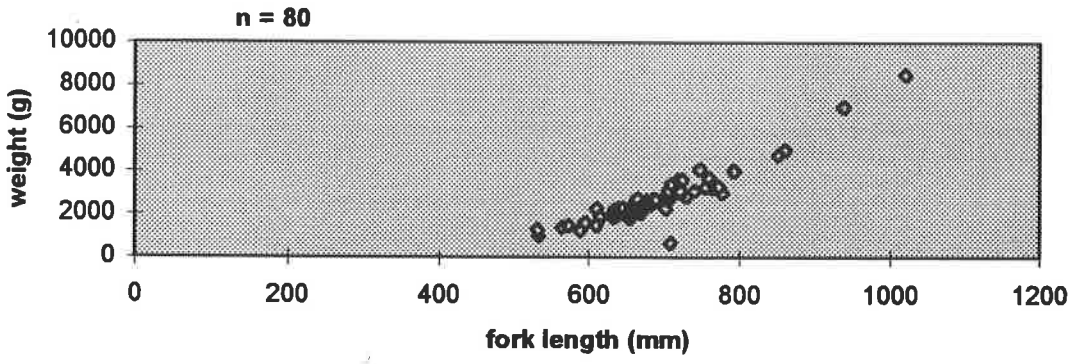

Figure A6. Weight at length scatter plot for northern pike captured by experimental gillnets at Lake Laberge, 1993.

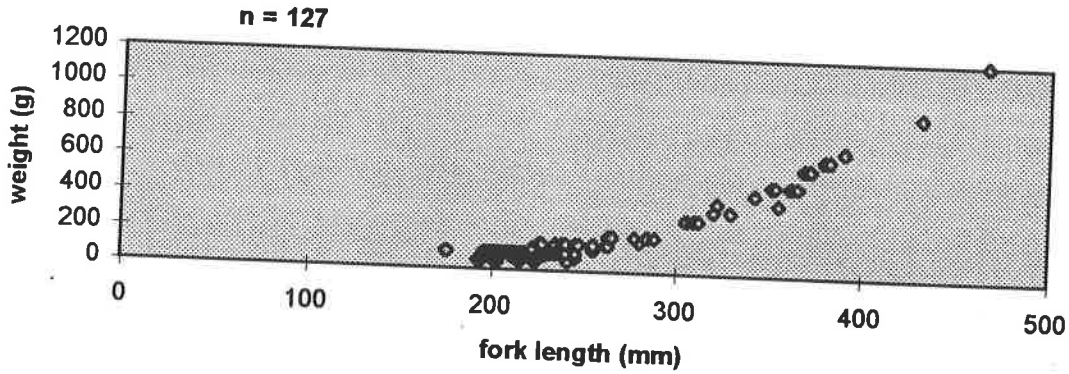

Figure A7. Weight at length scatter plot for round whitefish captured by experimental gillnets at Lake Laberge, 1993

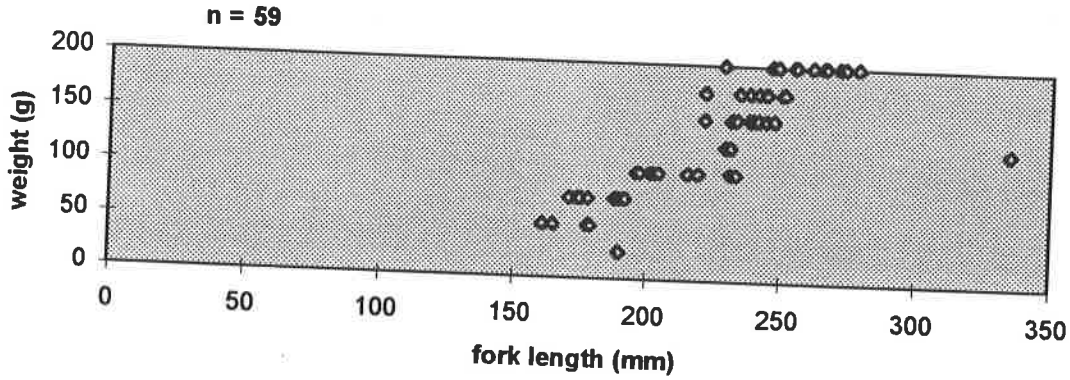

Figure A8. Weight at length scatter plot for least cisco captured by experimental gillnets at Lake Laberge, 1993.

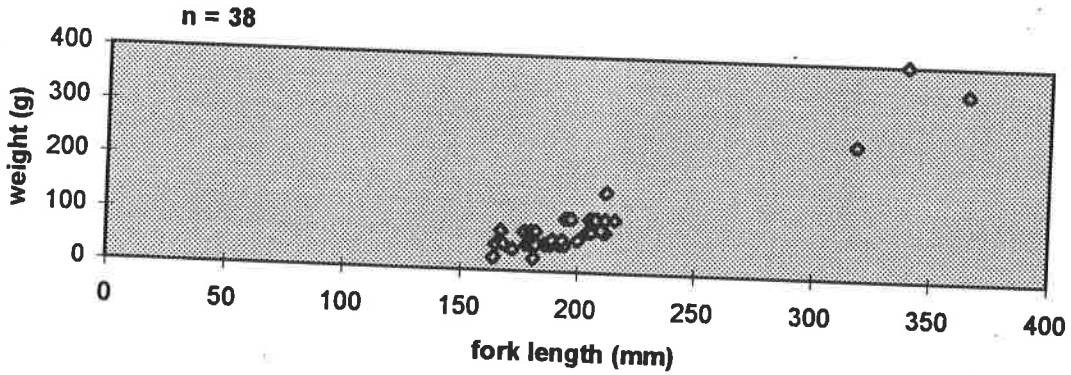

Figure A9. Weight at length scatter plot for Arctic grayling captured by experimental gillnets at Lake Laberge, 1993.

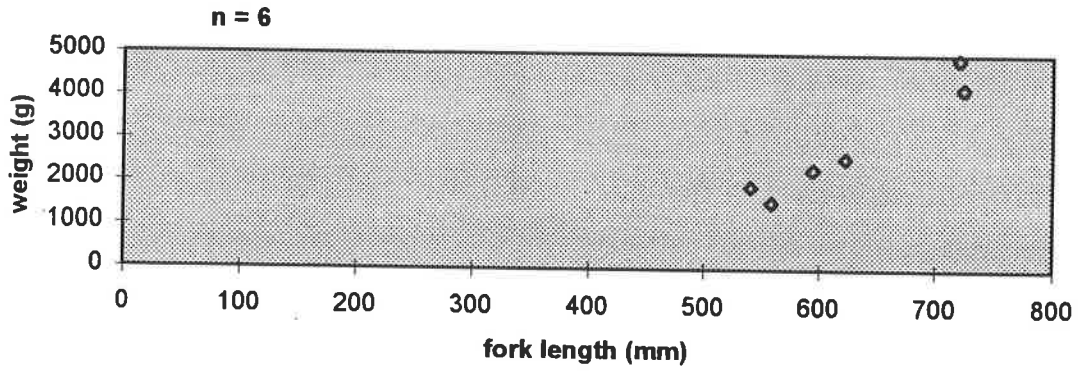

Figure A10. Weight at length scatter plot for inconnu captured by experimental gillnets at Lake Laberge, 1993.

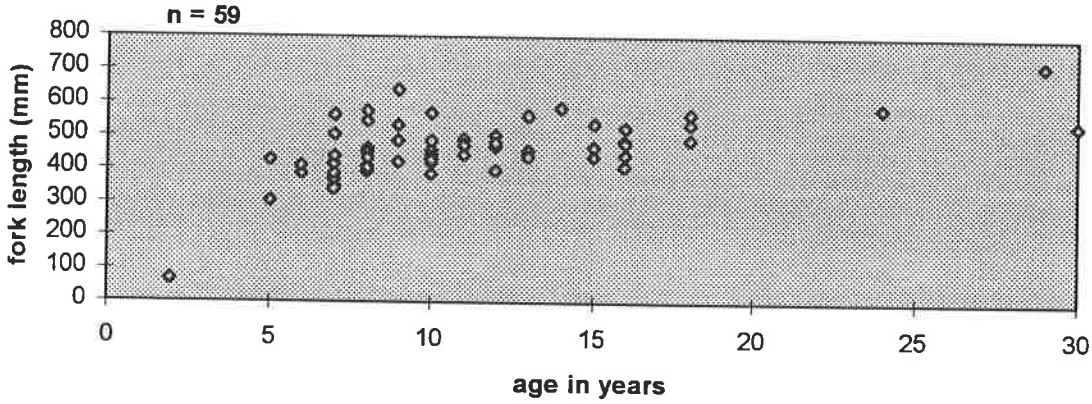

Figure A11. Length at age scatter plot for lake trout captured by experimental gillnets at Lake Laberge, 1993.

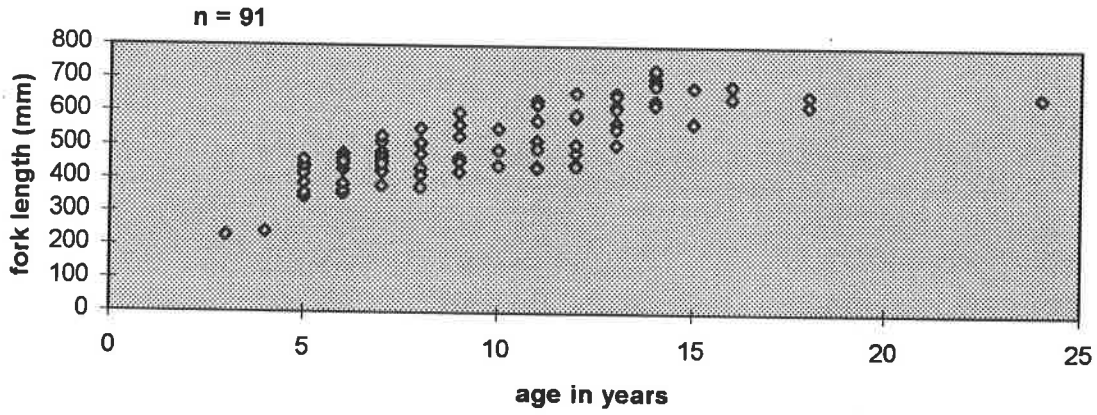

Figure A12. Length at age scatter plot for burbot captured by experimental gillnets at Lake Laberge, 1993.

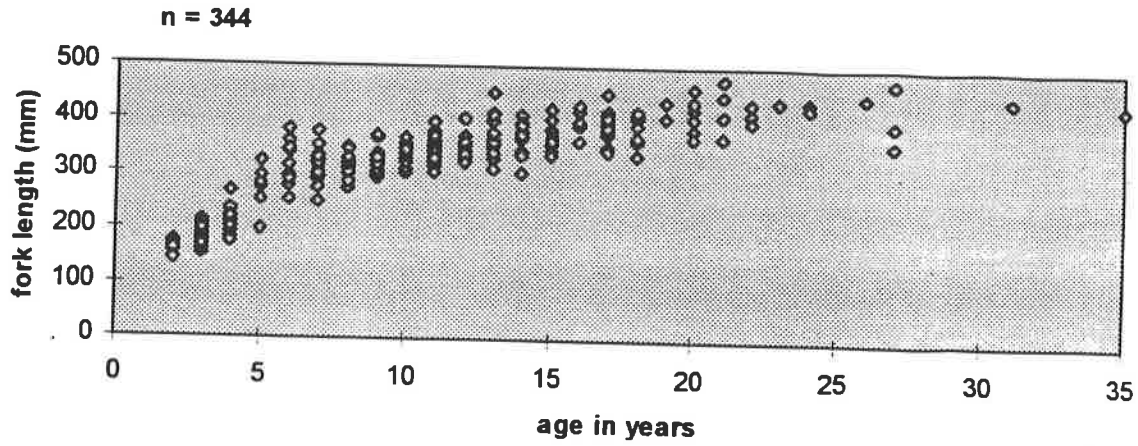

Figure A13. Length at age scatter plot for lake whitefish captured by experimental gillnets at Lake Laberge, 1993.

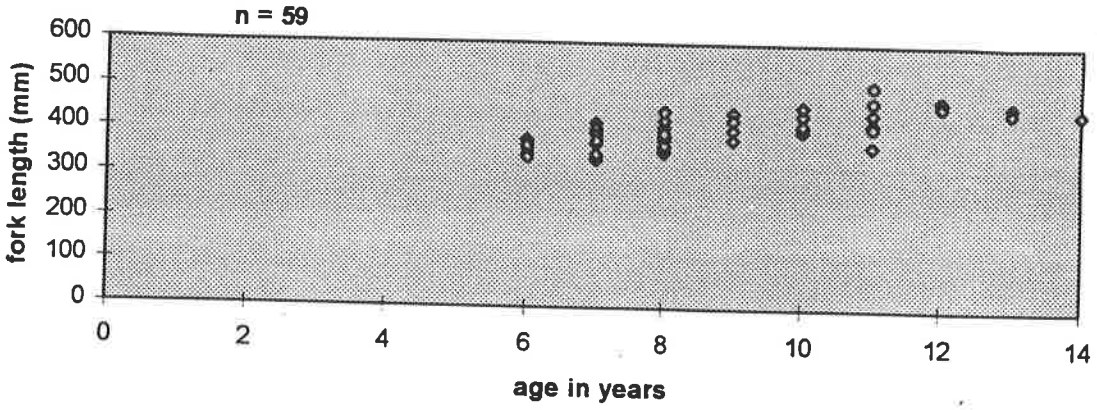

Figure A14. Length at age scatter plot for broad whitefish captured by experimental gillnets at Lake Laberge, 1993.

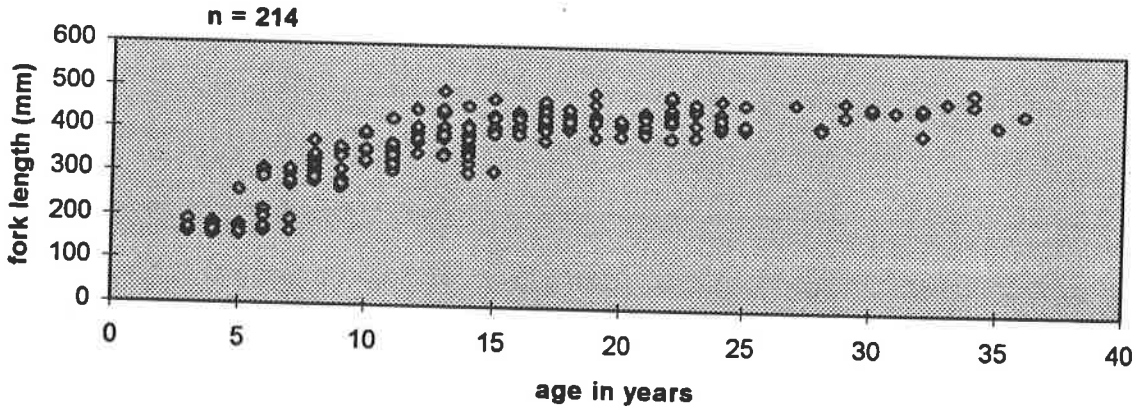

Figure A15. Length at age scatter plot for longnose sucker captured by experimental gillnets at Lake Laberge, 1993.

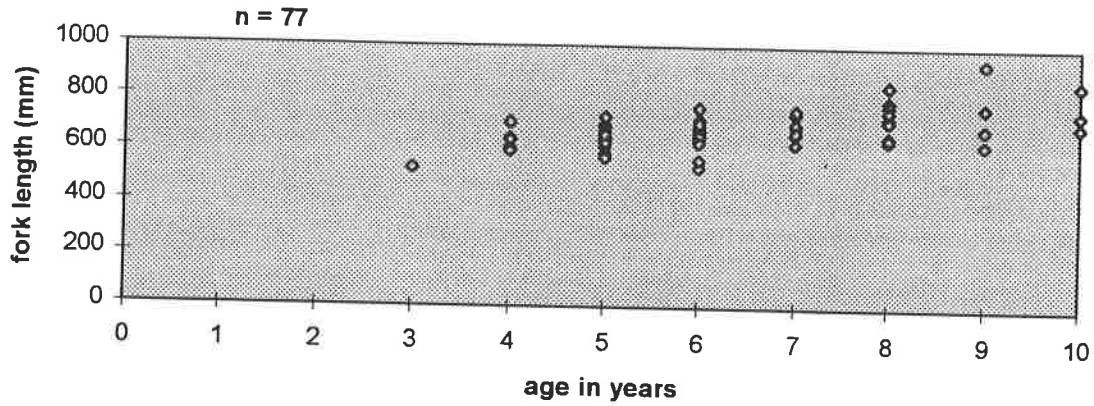

Figure A16. Length at age scatter plot for northern pike captured by experimental gillnets at Lake Laberge, 1993.

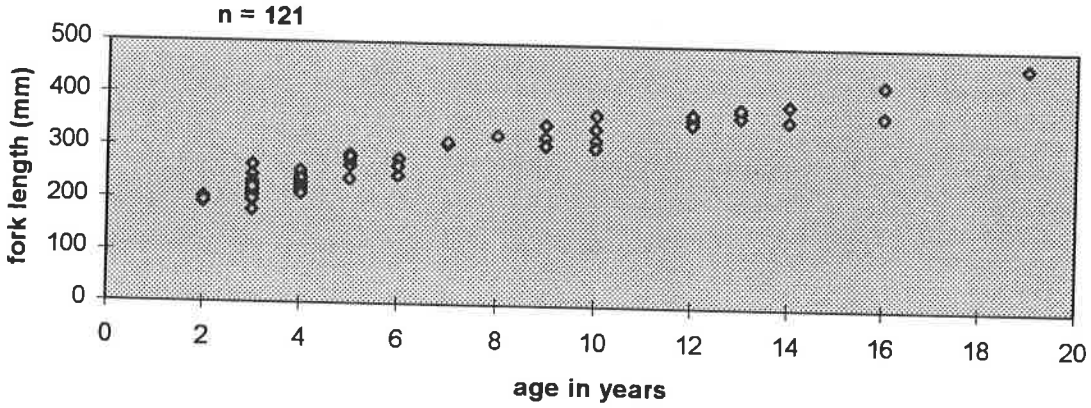

Figure A17. Length at age scatter plot for round whitefish captured by experimental gillnets at Lake Laberge, 1993.

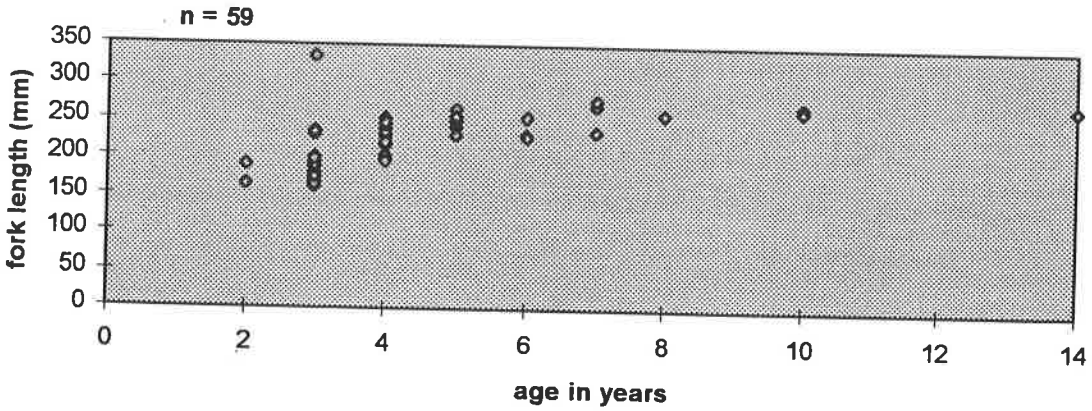

Figure A18. Length at age scatter plot for least cisco captured by experimental gillnets at Lake Laberge, 1993.