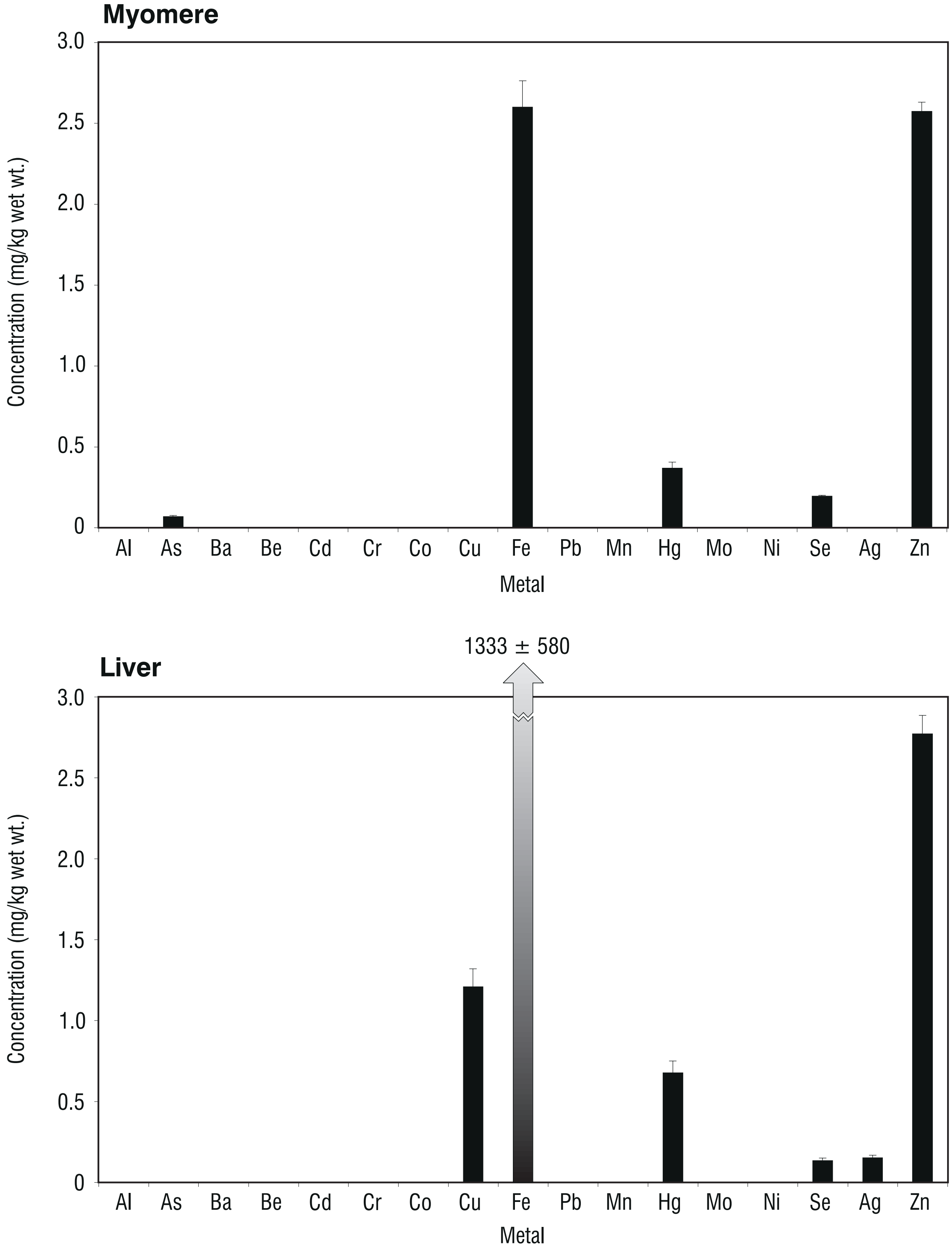


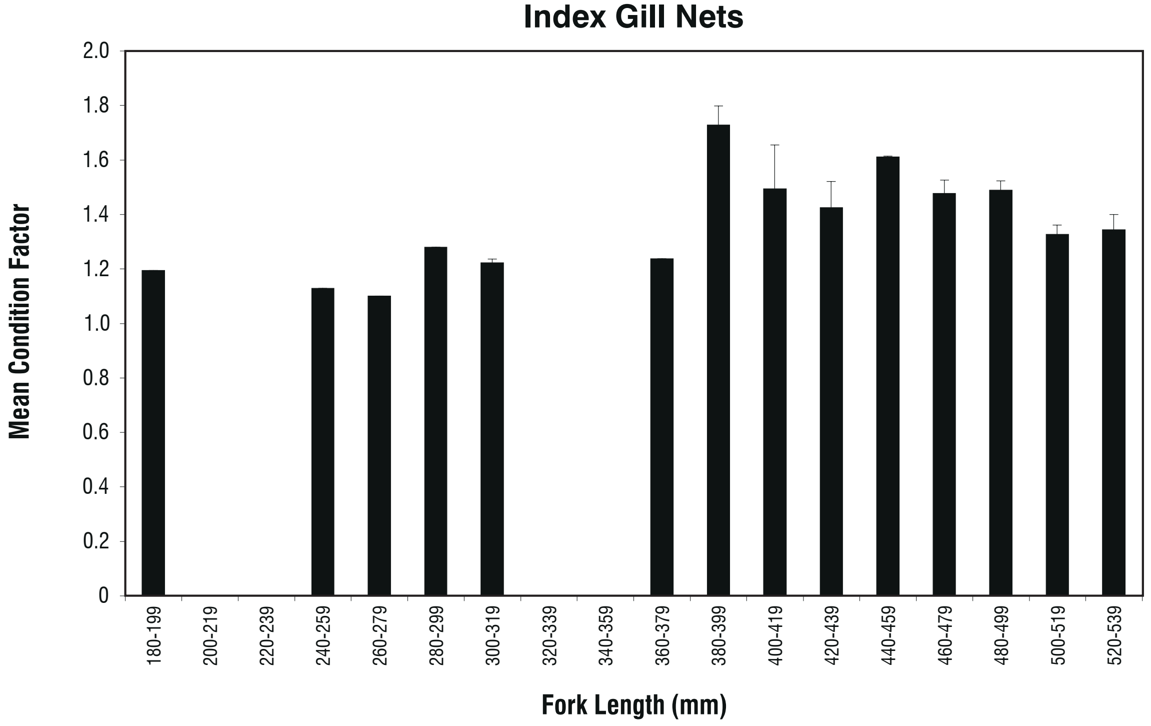
Notes: Error Bars Represent Standard Error
Absent Bars Denote Concentrations Below Detection Limit

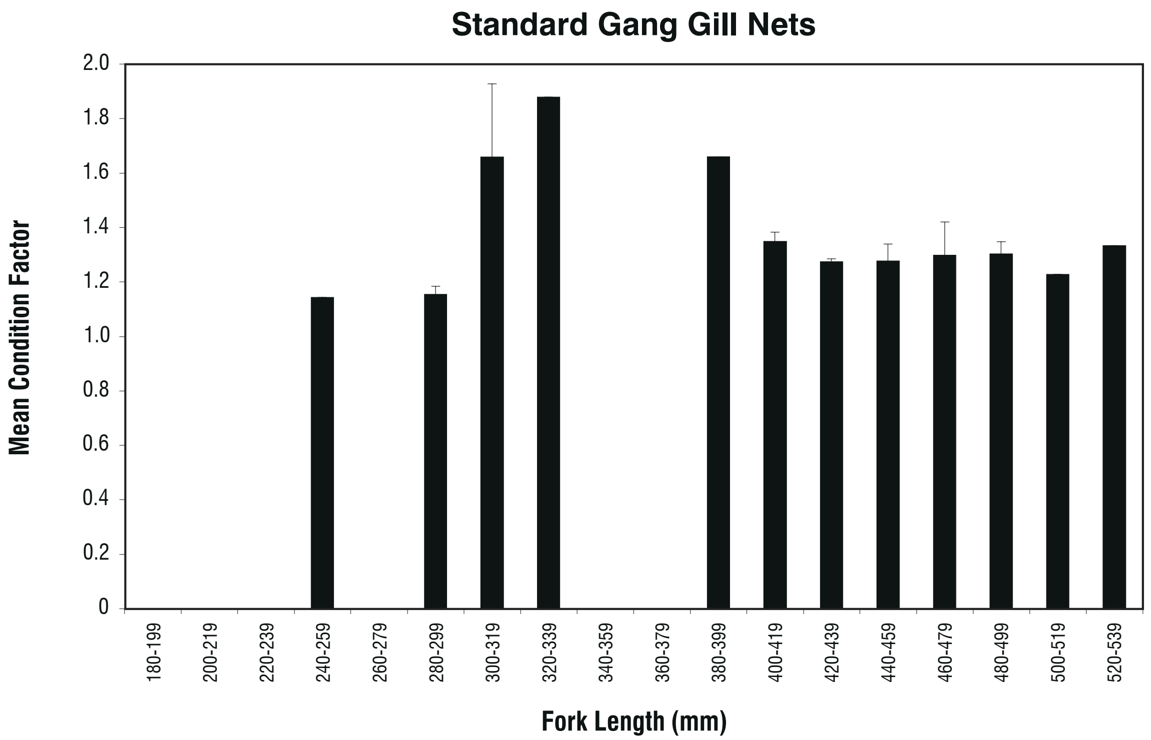
Metal Concentrations in Lake Trout Tissues from Spyder Lake, 1997

FIGURE 10.1-10

BHP

Rescan





Note: Error Bars Represent Standard Error

Mean Condition Factor by Fork Length of Lake Whitefish Caught in Spyder Lake, 1997

FIGURE 10.1-11

BHP

Rescan

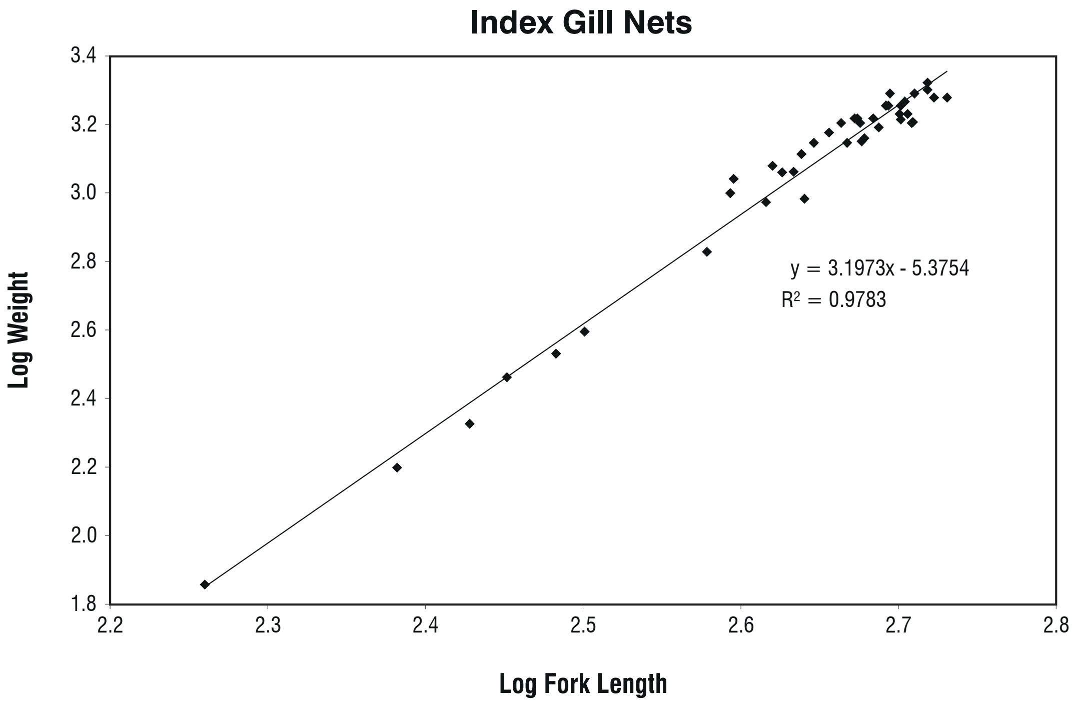
Lake Whitefish

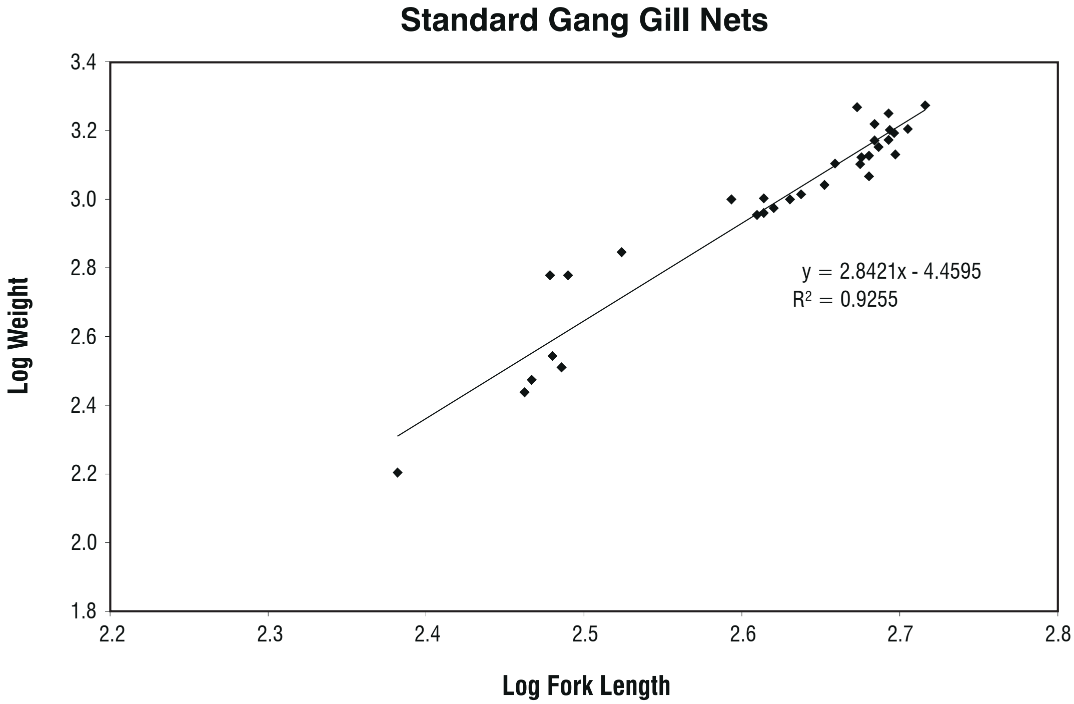
Allometric condition factors and regression analysis of log weight against log fork length were used to examine the energy stores of lake whitefish. Mean condition factor by size classes by method of survey are presented in Figure 10.1-11. When examined together, it appears that lake whitefish condition increased with size from the 180 to 199 mm size class to a peak condition around the 380 to 399 mm size class. Condition then decreased in larger sizes. The initial increase in condition with size class was expected. The reason for the decrease in condition in the larger fish is unclear.

Regressions of the log weight against the log fork length for the lake whitefish captured in both gill net gear types were significant (Figure 10.1-12). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.1-4). The R^2 values indicate that more than 97% of the variation observed among fish weights of lake whitefish caught in index gill nets, and more than 92% of the variation in weights of fish caught in the standard gang nets were attributable to differences in fish length.

A plot of the length frequency distribution of lake whitefish caught in both types of gear show that there was a wider size range of fish captured in the index gill nets (Figure 10.1-13). Combining the catch results of both types of gear shows that at least four size groups of fish were caught, centred around 180 to 199 mm, 280 to 299 mm, 420 to 439 mm, and 460 to 479 mm.

A plot of the mean fork length at age shows that there was a steady increase in fish size with age until 17 years of age after which growth appears to have stopped (Figure 10.1-14). Lake whitefish in this region most likely mature at less than 10 years of age, therefore, the onset of maturity does not appear to affect the rate of growth in these fish. The lake whitefish in Spyder Lake have an exceptionally long life span, living for over 45 years. This is much greater than populations further south (Scott and Crossman 1990). However, this has been observed in other Arctic lakes (Power 1978). The great ages are probably due to the fish attaining a size around 22 years of age which exempts them from predation from all but the very largest lake trout.



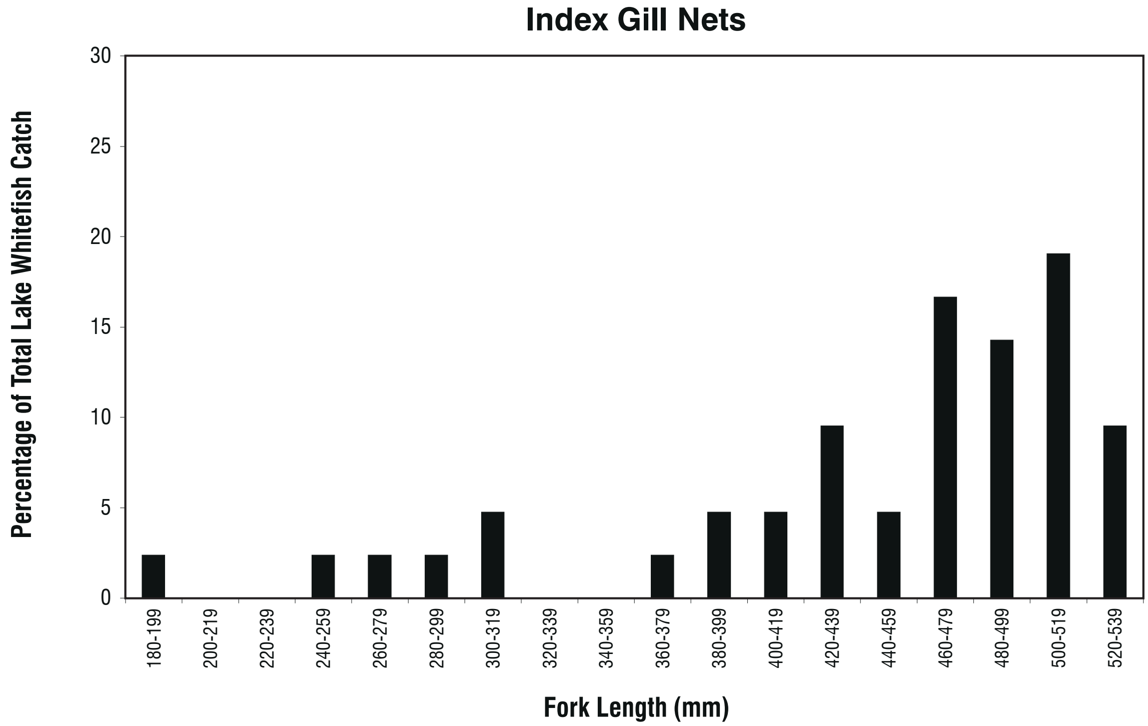


Regression of Log Weight vs. Log Fork Length of Lake Whitefish Caught in Spyder Lake, 1997

FIGURE 10.1-12

BHP

Rescan



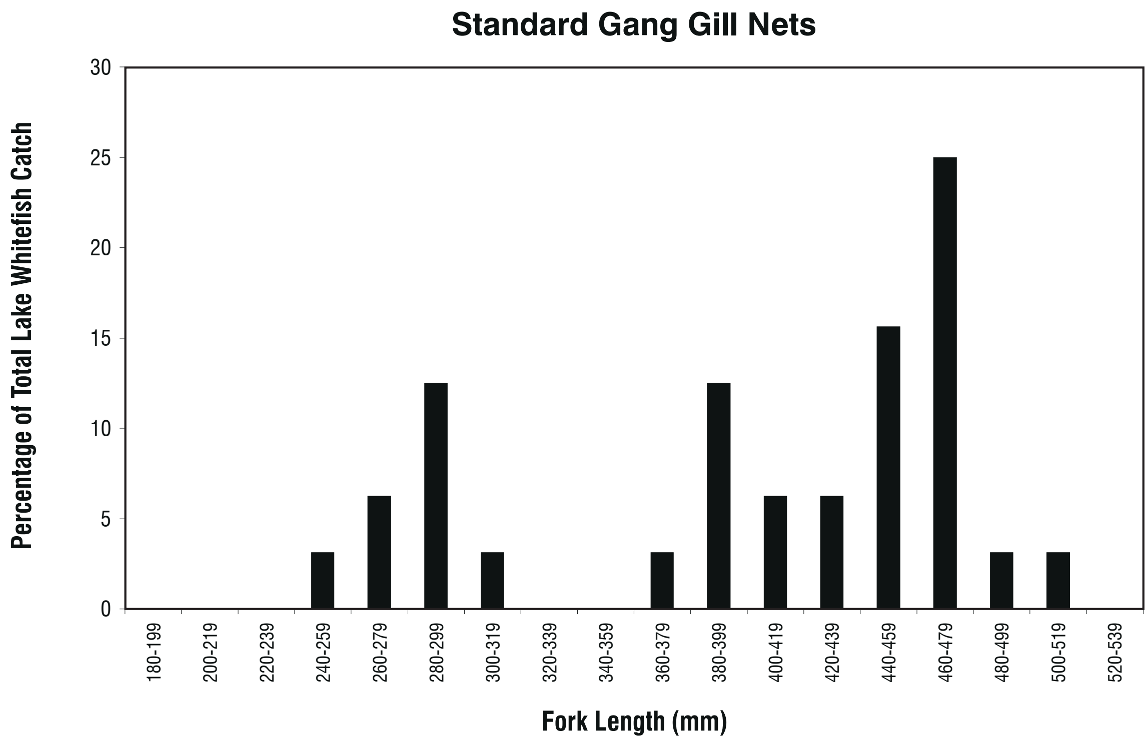
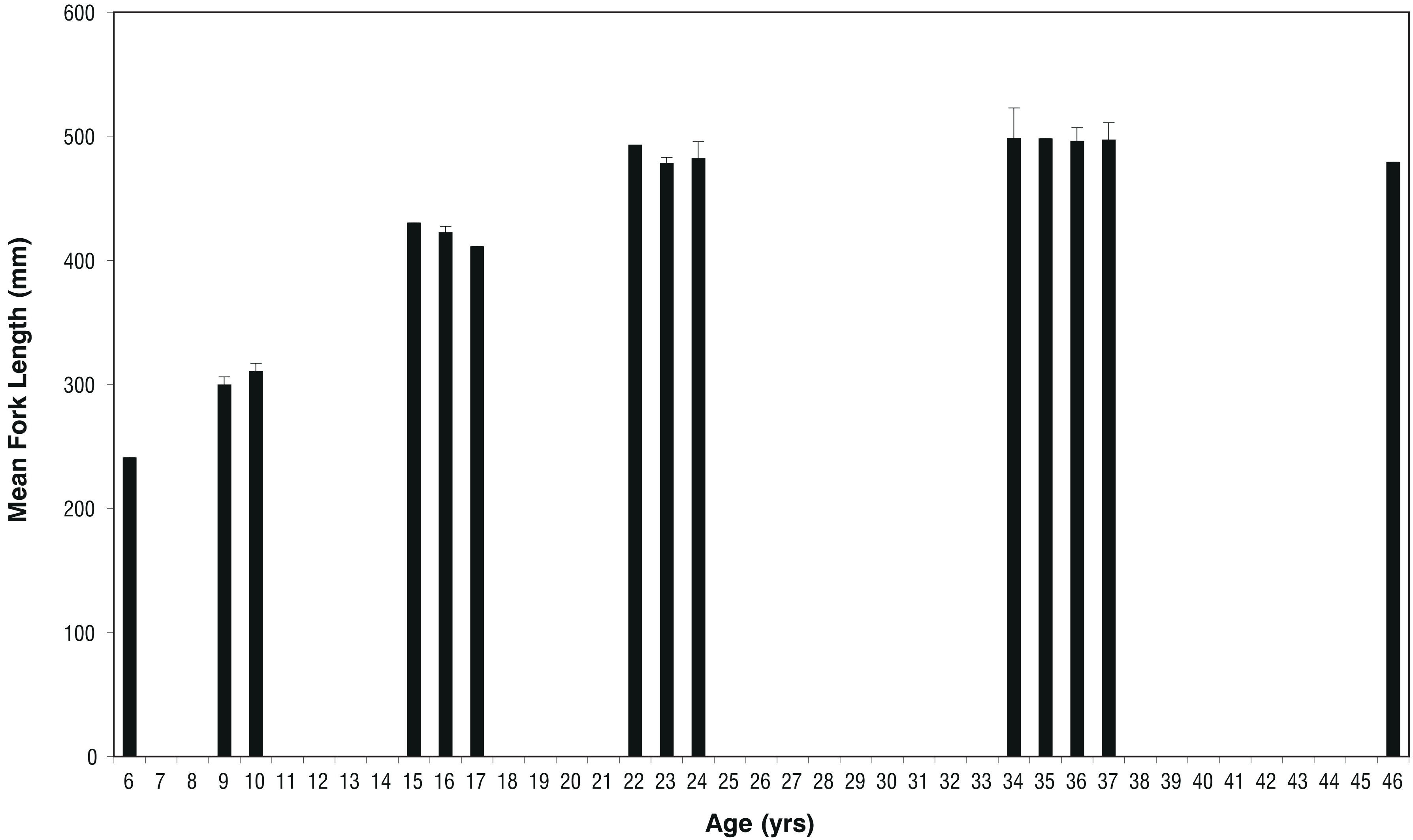


FIGURE 10.1-13

Fork Length Frequency Distribution of Lake Whitefish Caught in Spyder Lake, 1997

BHP

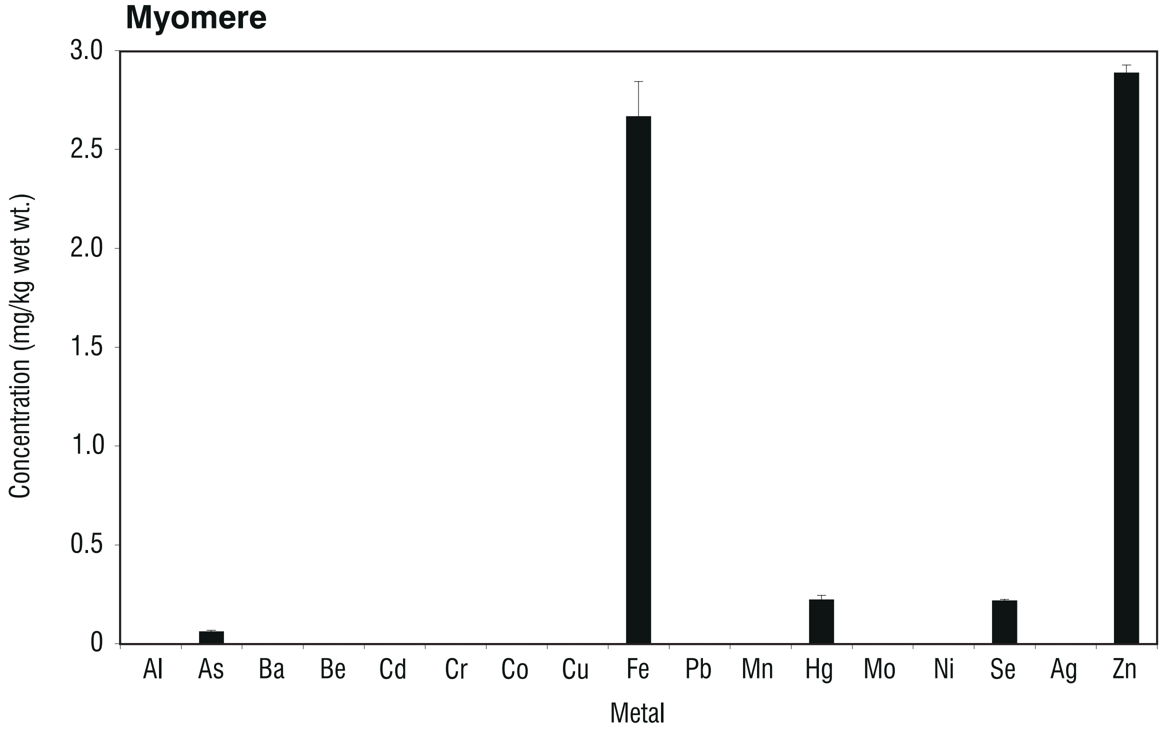
Rescan

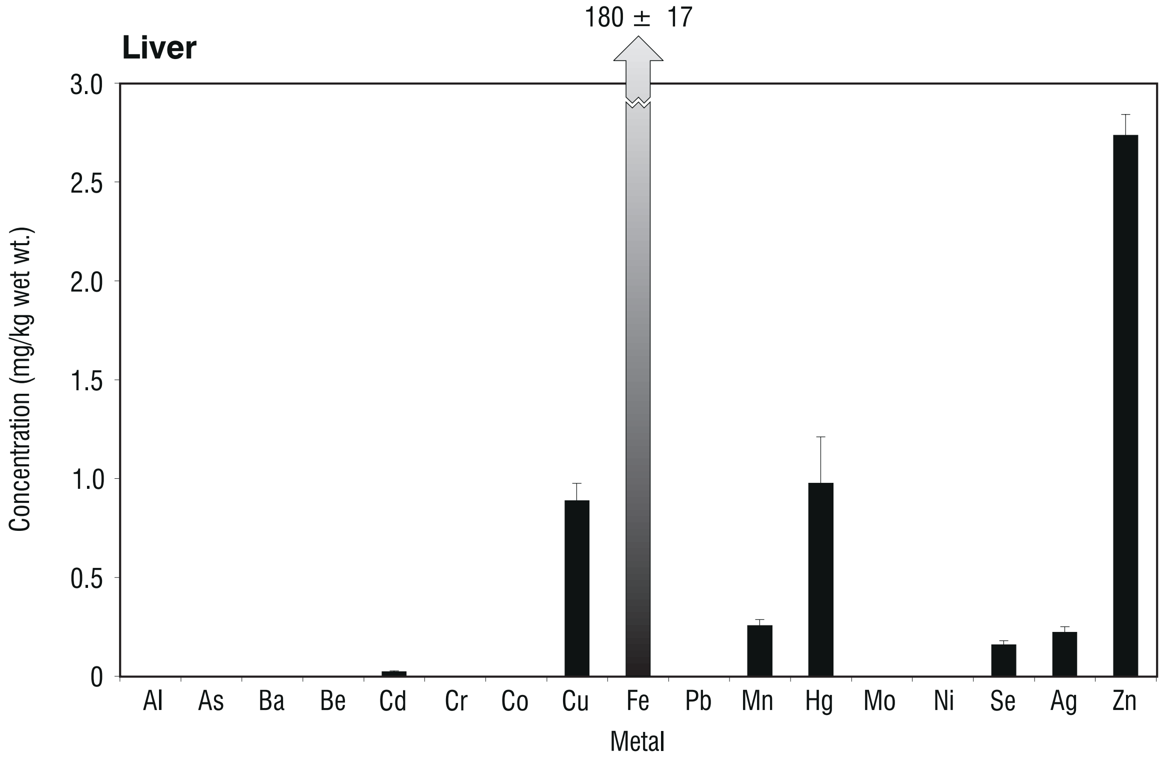


Note: Error bars represent standard error

FIGURE 10.1-14

Mean Fork Length by Age of Lake Whitefish Caught in Spyder Lake, 1997





Notes: Error Bars Represent Standard Error
Absent Bars Denote Concentrations Below Detection Limit

Metal Concentrations in Lake Whitefish Tissues from Spyder Lake, 1997

FIGURE 10.1-15

BHP Rescan

Myomere (muscle) and liver samples were taken from 24 lake whitefish for tissue metal concentration analysis. The results are presented in Figure 10.1-15 and Appendix 10.1-5 and were similar to those found for lake trout. Again, the majority of the metals were below detection limits. Metal mean concentrations tended to be higher in liver tissue than myomere tissue, except for arsenic, selenium and zinc. Mean zinc concentrations were again high in both liver and myomere samples. Mean mercury concentrations in liver tissue exceeded CCREM (1987) guidelines for human consumption (0.5 ppm). However, myomere tissue concentrations of mercury were below 0.5 ppm (Appendix 10.1-5).

These results, however, are not unusual. Tissue concentrations of mercury have been found to be naturally high in major collection basins such as Spyder Lake in other lakes of the region (e.g. Lac de Gras; Rescan 1998). It was also not unusual to find liver tissue mercury concentrations higher than myomere tissue: the liver serves a role in detoxification and binding of metals.

10.1.1.4.2 Stickleback Lake

The standard gang nets were set for a 24 hr period and retrieved. No fish were captured in Stickleback Lake. This was consistent with the results of the 1993 lake survey (Rescan 1993). Though ninespine stickleback were captured in the Stickleback Lake inflow and outflow, no fish were captured in the lake. This indicates that there are probably ninespine stickleback within Stickleback Lake. The lack of larger fish in the lake indicates that the quality of overwintering habitat is poor and/or there are occasional winterkills.

10.1.2 Stream Communities

Stream fish community surveys were conducted twice during the open water season. A spring survey was conducted during the spring freshet when streams have the highest water levels and the potential for use by fishes is greatest. Follow up surveys were conducted during the fall when stream flows were low and the seasonal use of streams by fishes could be contrasted.

10.1.2.1 Methods

Streams flowing into or out of Spyder, Stickleback, and Trout lakes were assessed for fish habitat (Figure 10.1-1). Streams for survey were initially identified from 1:50,000 maps. An aerial assessment survey was conducted by helicopter to determine the potential habitat content of the streams and to add any streams not delineated on the maps. Streams assessed as containing potential fish habitat were identified for a synoptic fish community survey.

Synoptic fisheries surveys were conducted in the monitoring streams during June and August, 1997. During a synoptic survey, an accessible portion of the study stream was selected and, beginning at the downstream end of the section, a single pass electrofishing survey was conducted while proceeding upstream. A Smith-Root model 15C POW electrofisher was used for the synoptic fisheries surveys. After the electrofishing survey, a habitat inventory of the surveyed stream section was conducted. The habitat classification key is presented in Appendix 10.1-1.

All captured fishes were identified to species, measured for fork length (mm), weighed (gm), sampled for aging structures, and released. Left pectoral fins were used for aging structures. For mortalities, sex, maturity, and reproductive status were recorded, and otoliths were removed for use as aging structures.

10.1.2.2 Results and Discussion

Thirty-four streams were assessed during the spring field session (Figure 10.1-1; Appendices 10.1-6 and 7). Fourteen streams were assessed as potentially containing fish habitat and were therefore synoptically surveyed and electrofished (BP01–14). Sixteen streams were assessed as not possessing fish habitat or having barriers to migration for fish colonization from Spyder Lake (BP15-29). Three streams were assessed as providing fish habitat, however high stream flows and turbidity precluded further assessment (Northeast Inflow, Spyder River, and Koignuk River). One stream was assessed and the fish community was surveyed by angling (Spyder Outflow). Unless otherwise noted, the streams were ephemeral, draining snow melt only, with no water flowing during most of the open water season.

The following sections present the results of the stream fish community surveys conducted in the streams discharging into Spyder Lake.

10.1.2.2.1 Stickleback-Spyder Stream (Site BP01)

Stickleback-Spyder Stream was surveyed June 15, 1997. The stream was found to be in flood and covered in some areas by sheets of ice (Plate 10.1-1). The observable stream was flowing over terrestrial grasses and organic matter. There was no observable spawning, overwintering, or adult rearing habitat present, nor was there any potential rearing habitat in the lower reaches. There were no observable barriers to Arctic grayling migration. An electrofishing survey resulted in the capture of two ninespine stickleback near the inflow to Spyder Lake (Table 10.1-4).

10.1.2.2.2 Trout-Spyder Stream (Site BP02)

Trout-Spyder Stream was surveyed June 15, 1997. The stream was found to be in flood, flowing for the most part over terrestrial grasses and organic matter (Plate 10.1-2). There was a narrow strip of cobble substrate down the centre of the channel. There was no observable spawning, overwintering, or adult rearing habitat present, but there was potential rearing habitat throughout the channel. There were no observable barriers to Arctic grayling migration through the stream. An electrofishing survey resulted in the capture of two ninespine stickleback (Table 10.1-4).

10.1.2.2.3 Stream BP03

Stream BP03 was surveyed June 15, 1997. The stream was found to be in flood, draining a series of small ponds through a low marshy area before entering Spyder Lake. The surveyed section of stream flowed for the most part over terrestrial grasses and organic matter (Plate 10.1-3). There was no observable spawning, overwintering, or adult rearing habitat present and there was no potential rearing habitat within the channel. The low marshy area formed a barrier to Arctic grayling migration. An electrofishing survey resulted in the capture of five ninespine stickleback at the mouth of the creek (Table 10.1-4). An Arctic grayling was captured in a small pool, immediately downstream of the marshy area.

Plate 10.1-1 **Stickleback-Spyder Stream, 15 June, 1997, showing the dispersed flow through terrestrial vegetation.**

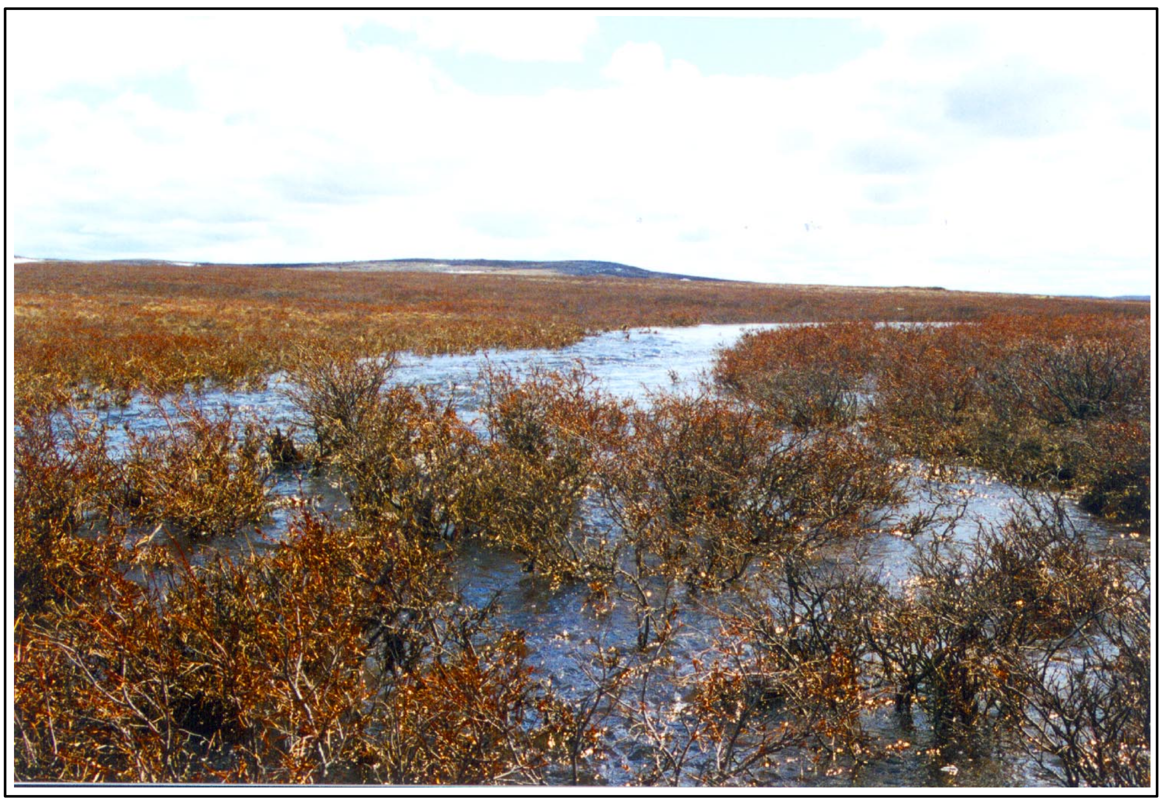


Plate 10.1-2 **Trout-Spyder Stream, 15 June, 1997, showing the dispersed flow through willows and grasses.**

Plate 10.1-3 **Stream BP03, 15 June, 1997, showing the discharge point into Spyder Lake. The water flowed through a depression, over terrestrial grasses, and had no distinct channel.**

Plate 10.1-4 **Stream BP05, 16 June, 1997, showing the discharge point into Spyder Lake. The stream was dispersed among tussocks, following no distinct channel.**

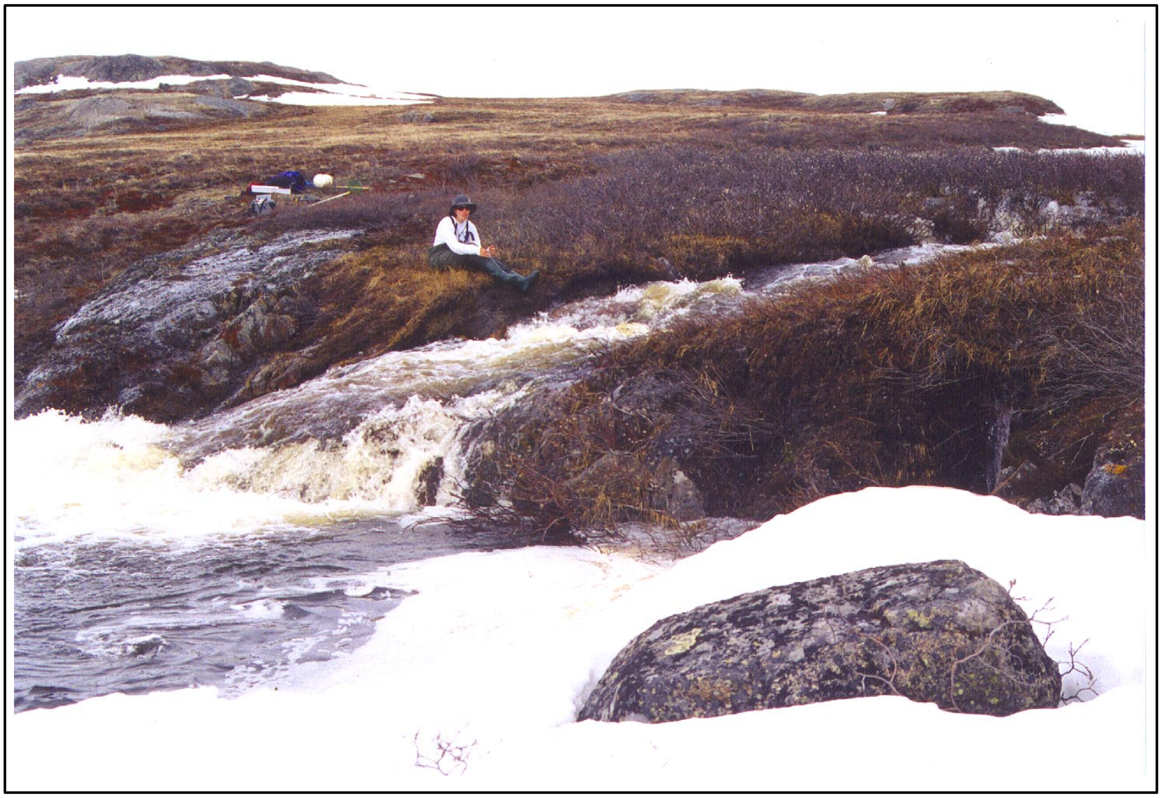


Plate 10.1-5 **Stream BP06, 16 June, 1997, showing the stream discharging into Spyder Lake over a shelf of bedrock. Elevated lake levels diminished the effect of the shelf as a migration barrier in the spring.**

Plate 10.1-6 **Stream BP07, 16 June, 1997, showing the stream discharging into Spyder Lake over a patch of boulders. Elevated lake levels diminished the effect of the migration barrier in the spring.**

Plate 10.1-7 **Stream BP10, 17 June, 1997, showing a series of pool and riffle habitat. The pools were deep, and contained mature Arctic grayling and lake trout.**

Plate 10.1-8 **Stream BP11, 17 June, 1997, showing habitat characteristic of the stream. Ninespine stickleback were captured in the downstream section of this stream.**

Table 10.1-4
Results of the Stream Fish Community Surveys Conducted on the Boston Property, 1997

Site	Species Captured	Number of Fish	Fork Length (mm)	Weight (g)	CPUE (fish/min)
BP01	NNST	2	60 ± 1		0.3
BP02	NNST	2	65 ± 4		0.4
BP03	ARGR	1	358	460	0.1
	NNST	5	47 ± 1		0.5
BP05	ARGR	1	224	102	0.2
	NNST	2	52 ± 3		0.4
BP10	ARGR	1	415	826	0.4
	LKTR	1	733	4050	0.4
	NNST	1	53		0.4
BP11	NNST	7	50 ± 1		2
BP12	NNST	2	64 ± 7		0.4
Total		25			

10.1.2.2.4 Stream BP04

Stream BP04 was surveyed June 16, 1997. The stream was found to be in flood, draining a series of small ponds through a low marshy area before entering Spyder Lake. The surveyed section of stream flowed for the most part over terrestrial grasses and organic matter, and there was no observable spawning, overwintering, or adult feeding habitat present. Similarly, there was no potential rearing habitat within the channel and the low marshy area was a barrier to Arctic grayling migration. An electrofishing survey resulted in no fish captures.

10.1.2.2.5 Stream BP05

Stream BP05 was surveyed June 16, 1997. The stream was found to be in flood, draining a low marshy area into Spyder Lake. The surveyed section of stream flowed for the most part over terrestrial grasses and organic matter (Plate 10.1-4). With no persistent source of water, this stream is most likely ephemeral. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. An electrofishing survey resulted in the capture of one Arctic grayling and two ninespine stickleback near the mouth of the stream.

10.1.2.2.6 Stream BP06

Stream BP06 was surveyed June 16, 1997. The stream was found to be in flood, draining a series of small lakes into Spyder Lake. The surveyed section of stream flowed through a stepped series of rock shelves, pools, and riffles. The substrate was composed of fines, bedrock and for the most part organic matter as the stream overflowed through terrestrial grasses and shrubs. The stream entered Spyder Lake after falling over a rock shelf (Plate 10.1-5). There was observable rearing habitat, but no spawning, overwintering, or adult rearing habitat present. An electrofishing survey resulted in no fish captures. The rock shelf at the mouth of the stream probably provides a barrier to fish migration. The stream was more persistent than others through the open water season, however the lower flows and lower lake level in the late summer increased the effect of the migration barrier.

10.1.2.2.7 Stream BP07

Stream BP07 was surveyed June 16, 1997. The stream was found to be in flood, draining a marshy area into Spyder Lake. The surveyed section of stream flowed for the most part over terrestrial grasses and organic matter. There was no observable spawning, overwintering, or adult feeding habitat present and there was no potential rearing habitat within the channel. An electrofishing survey resulted in no fish captures.

10.1.2.2.8 Stream BP08

Stream BP08 was surveyed June 16, 1997. The stream was found to be in flood, draining melt water from a large snow deposit into Spyder Lake. The surveyed section of stream flowed for the most part over terrestrial grasses and organic matter. There was no observable spawning, overwintering, adult feeding potential rearing habitat within the channel. An electrofishing survey resulted in no fish captures.

10.1.2.2.9 Stream BP09

Stream BP09 was surveyed June 16, 1997. The stream was found to drain a series of small lakes into Spyder Lake. The surveyed section of stream was a series of pools connected by riffles. Because the stream was in flood stage, flowing through terrestrial grasses, the substrate was composed mostly of organic matter. However, the central channel that carried water during the lower flow stages was underlain by fines, cobble, and boulders. This stream possessed the best potential spawning and rearing habitat observed. However, the stream entered Spyder Lake after falling over a rock shelf (Plate 10.1-6). This proved to be a migration barrier as no fish were captured during an electrofishing survey. The stream was more persistent than others through the open water season, however the lower flows and lower lake level in the late summer increased the effect of the migration barrier.

10.1.2.2.10 Stream BP10

Stream BP10 was surveyed June 17, 1997. The stream was found to be in flood, draining a small lake into the northern tip of Spyder Lake. The surveyed section of stream was a series of deep pools connected by riffles over terrestrial grasses (Plate 10.1-7). This habitat series disappeared 200 m upstream in a marshy area of indistinct channels. The substrate was composed mostly of organic matter, with the pools underlain by silt. Though the pools provided good rearing and adult feeding habitat, lower summer water levels isolated the pools. There was no observable spawning or overwintering habitat present. The marshy area most likely provided a migration barrier. An electrofishing survey resulted in the capture of one mature Arctic grayling, one mature lake trout, and a ninespine stickleback (Table 10.1-4). An additional mature Arctic grayling was observed but not captured during the survey.

10.1.2.2.11 Stream BP11

Stream BP11 was surveyed on June 17, 1997. The stream was found to be in flood, draining melt water from a large snow deposit into Spyder Lake. The surveyed section of stream flowed for the most part over terrestrial grasses and organic matter (Plate 10.1-8). There was no observable spawning, overwintering, or adult feeding habitat present and no potential rearing habitat within the channel. The stream is suspected to flow subsurface during the summer. An electrofishing survey resulted in the capture of seven ninespine stickleback (Table 10.1-4).

These fish were all caught near the mouth of the stream suggesting that the fish likely originated from Spyder Lake.

10.1.2.2.12 Stickleback Inflow (Site BP12)

Stream BP12 was surveyed on June 17, 1997. The stream was found to be in flood, draining a series of small lakes and marshy areas into Stickleback Lake. The surveyed section of stream was a series of pools connected for the most part by riffles and to a lesser degree by runs (Plate 10.1-9). Run sections were lined by cutbanks. Because the stream was in flood stage, flowing through terrestrial grasses, the substrate was composed mostly of organic matter. However, the central channel that carried water during the lower flow stages was underlain by fines, cobble, and boulders. This stream was persistent into the late summer. An electrofishing survey resulted in the capture of two ninespine stickleback (Table 10.1-4).

10.1.2.2.13 Stream BP13

Stream BP13 was surveyed June 17, 1997. The stream was found to be in flood, draining a series of small pools through a low marshy area into Spyder Lake. The surveyed section of stream was a series of small pools connected by riffles flowing over terrestrial grasses and organic matter. The pools became disconnected during the late summer. There was no observable spawning, overwintering, or adult feeding habitat present and there was no potential rearing habitat within the channel. An electrofishing survey resulted in no fish captures.

10.1.2.2.14 Stream BP14

Stream BP14 was surveyed June 17, 1997. The stream was found to be in flood, draining a series of small ponds and lakes into Spyder Lake. The surveyed section of stream was steep in gradient and flowed through areas of terrestrial grasses and willows and a set of rapids (Plate 10.1-10). Upstream of the rapids the stream was a series of pools connected by riffles over terrestrial grasses. Only poor spawning, rearing and adult feeding habitat was found and there was no overwintering habitat. In the late summer, the pools became disconnected and the rapids probably provided an additional migration barrier. During an electrofishing survey, one juvenile Arctic grayling was observed but not captured amidst the rapids.

Plate 10.1-9 **Stream BP12, 17 June, 1997, showing a series of riffle/run habitat flooding terrestrial grasses along the water course. Ninespine stickleback were caught in this section of the stream.**

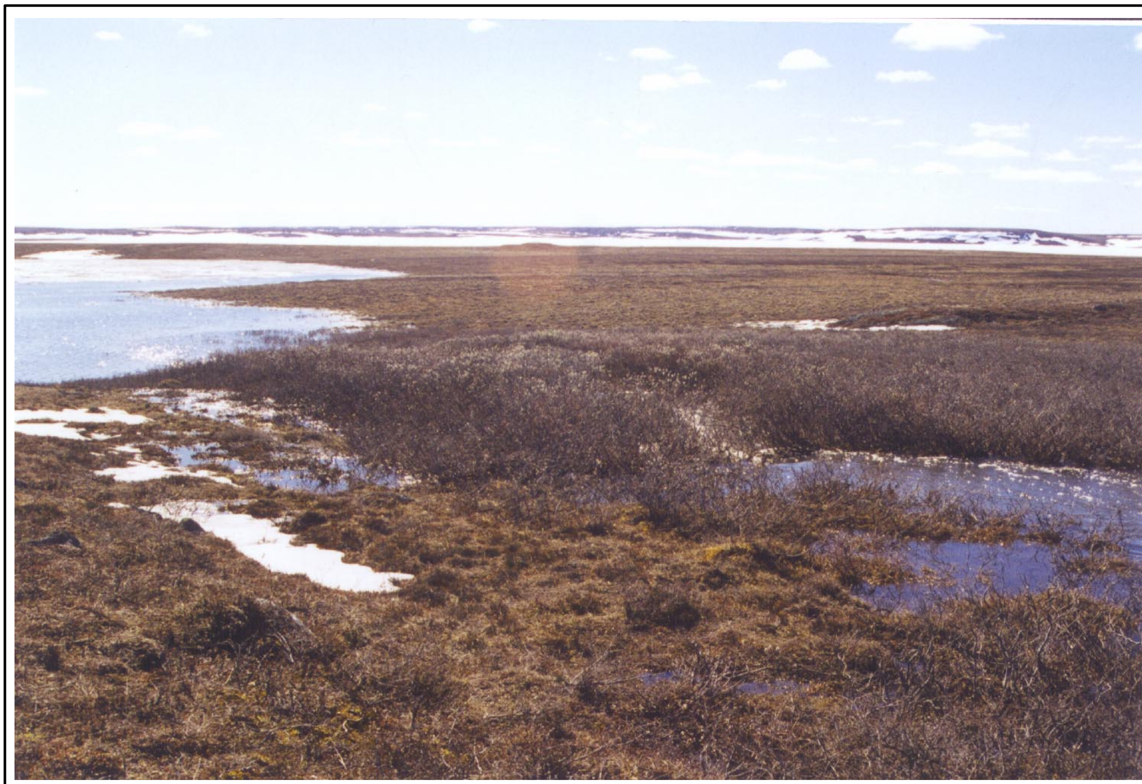


Plate 10.1-10 **Stream BP14, 17 June, 1997, showing a thicket of willows overlaying a boulder garden. A juvenile Arctic grayling was observed in the pool to the right.**

10.1.2.2.15 Streams BP15 - 30

Streams BP15 – 30 were assessed during helicopter surveys (Figure 10.1-1). All streams were found to be ephemeral, draining melt water into Spyder Lake. Stream BP15, though draining a small lake into Spyder Lake, was found to have no distinct channel. This stream suffused through terrestrial grasses, providing no fish habitat. Streams BP16 – 23 were found to carry melt water and had no distinct channels or fish habitat. Streams BP24 – 26 were found to have low flows and steep gradients. These streams did not persist beyond the spring freshet. Streams BP27 - 30 were found to have no distinct channels and no fish habitat present.

10.1.2.2.16 Rivers

There are four rivers associated with Spyder Lake: the Northeast Inflow of Spyder Lake, Spyder River, Spyder Outflow, and the Koignuk River (Figure 10.1-1). High, turbid water conditions did not allow an assessment of these rivers. However, the inflows to Spyder Lake (Northeast and Spyder River) likely provide the majority of stream fish habitat utilized by Spyder Lake fishes, especially Arctic grayling. Spyder Outflow was not electrofished, however angling within the channel resulted in numerous lake trout captures.

In Arctic aquatic systems, stream fish populations tend to be extensions of the downstream lake fish populations. This is because in the winter most streams stop flowing and freeze, providing limited or no overwintering habitat. Stream fish habitat, subject to the vagaries of summer weather, also tends to be more variable that lake fish habitat. With fish populations being dependent upon the habitat present, this means that stream fish populations are more variable from year to year than lake fish populations. Spyder Lake is a large lake and the fish community, encompassing both the lake and seasonal stream populations, would be difficult to accurately characterize. The proposed mine would be underground and tailings disposal would be confined to the Stickleback Lake catchment basin.

Potential effects of the mining operation would therefore be limited to Stickleback and Spyder lakes. Because Spyder Lake would receive any possible effects from mine development, the value of quantifying the highly variable inflow stream populations is dubious.

With the goal of providing accurate, quantitative baseline data for an effective long-term monitoring program in mind, it would be best to concentrate fisheries efforts on collecting quantitative data from the more stable lake fish population for use in the potential monitoring program.

10.2 Doris Property

Fish community data were collected during two field sessions. A spring stream survey was conducted from June 18 to 23, 1997. A lake survey and follow-up stream survey were conducted from August 12 to 25, 1997. Stream and lake survey locations are shown in Figure 10.2-1. Keys to the fish names and habitat unit abbreviations are contained in Appendix 10.1-1.

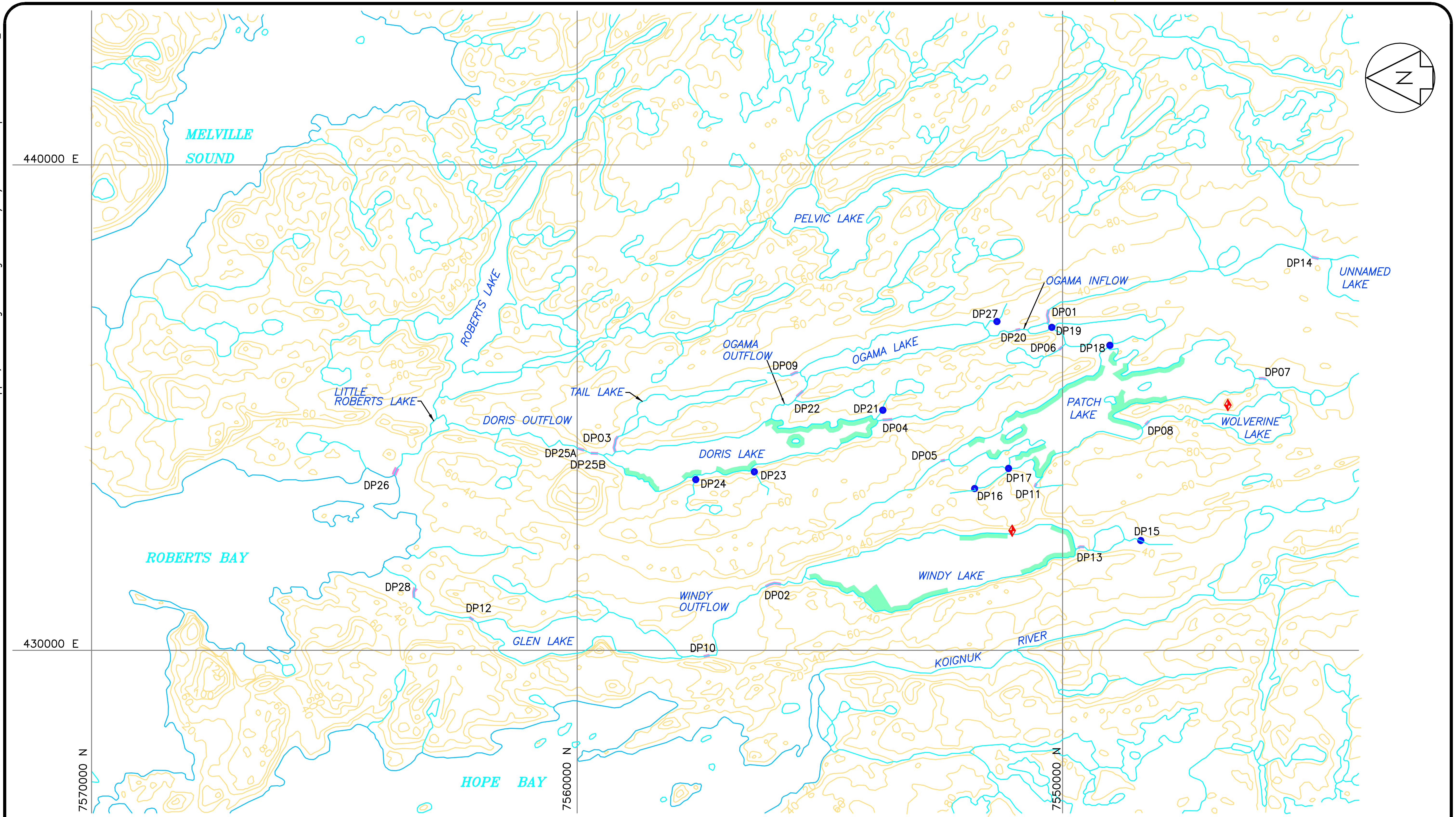
10.2.1 Lake Communities

10.2.1.1 Methods

Doris, Patch, and Windy lakes were surveyed using index gill nets (Figure 10.2-1). The methodology and techniques used to survey the Doris Property lakes followed those described for the Boston Property (Section 10.1.1). Different color Floy tags were used for each lake: orange in Doris Lake, green in Patch Lake and blue in Windy Lake. In addition, red Floy tags were used in tributaries. The use of different color tags facilitates the identification of migrating fishes by researchers. Myomere and liver tissue samples and stomachs were taken from lake trout and lake whitefish in Doris and Patch lakes, and lake trout in Windy Lake. These samples have been archived until spring, 1998 for analysis.

10.2.1.2 Results and Discussion

The following sections present the results of the fish community surveys conducted in Doris, Patch, and Windy lakes.



NOTE:

CONTOUR INTERVAL 20m

LEGEND:

- ELECTROFISHING SURVEY
- GILL NET SURVEY
- ASSESSED, NOT SURVEYED
- CAMP SITE

BHP

FIGURE 10.2–1

Fish Community Survey Locations on the Doris Property

Rescan

Cad No. a3394s Scale: 1:75 000 Job No. 526–1 Source: Klohn–Crippen, 1995 fig3–11.dwg 20/02/1998–08:45pm RES_BF

10.2.1.2.1 Doris Lake

Doris Lake was surveyed using index gill nets for a period of four days (Figure 10.2-1). Fish and gill net raw data are contained in Appendices 10.2-1a and 10.2-2b, respectively. A total of 520 fishes representing three species were captured in Doris Lake: 338 lake cisco, 56 lake trout, and 126 lake whitefish (Table 10.2-1). Of these fishes, two lake cisco, 24 lake trout, and 48 lake whitefish were marked using orange Floy tags.

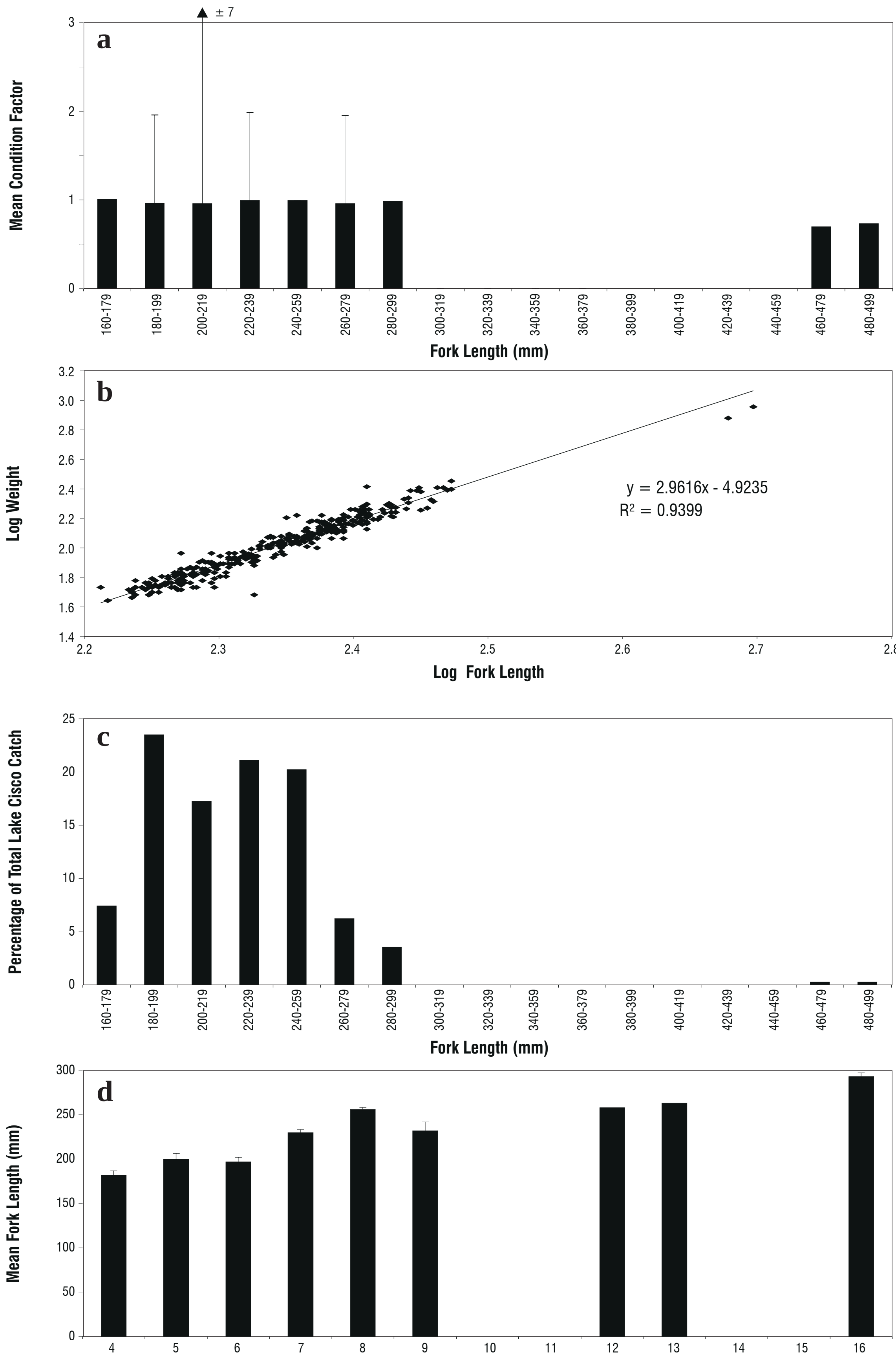
Table 10.2-1
Numbers of Fishes Captured and Mean Catch per Unit Effort for Doris Lake, 1997

Species	Sample Method	Sets	Number of Fish	Mean CPUE ± SE
Lake Cisco	Gill net	27	338	148.2 ± 25.0
Lake Trout	Gill net	27	56	23.4 ± 5.2
Lake Whitefish	Gill net	27	126	51.7 ± 5.7

Lake cisco were the most abundant species, followed by lake whitefish and then lake trout. A summary of the population statistics for each species is presented in Table 10.2-2.

Table 10.2-2
Population Statistics of Fishes Captured in Doris Lake, 1997

Parameter	Mean ± Standard Error					
	Lake Cisco		Lake Trout		Lake Whitefish	
Mean Fork Length (mm)	223 ± 2	n=336	631 ± 23	n=47	363 ± 10	n=122
Mean Weight (g)	116 ± 4	n=334	2708 ± 242	n=47	826 ± 56	n=121
Mean Age (yrs)						
Mean Catch Per Unit Effort	148.2 ± 25.0	n=338	23.4 ± 5.2	n=56	51.7 ± 5.7	n=126
Mean Condition Factor	0.98 ± 0.01	n=334	0.97 ± 0.02	n=47	1.28 ± 0.02	n=121



Note: Error Bars Represent Standard Error

FIGURE 10.2-2

BHP

Population Characteristics of Lake Cisco Caught in Doris Lake, 1997

Rescan

Sufficient numbers of lake cisco, lake trout and lake whitefish were captured to provide for an analysis of data to describe the energy stores, growth, and age structure of the fish populations.

Lake Cisco

The energy stores of lake cisco were examined by calculating allometric condition factors and by conducting regression analysis of log weight against log fork length. Mean condition factor by size class is presented in Figure 10.2-2. Condition appeared to be uniform through the smaller size classes. The two larger fish, representing the two large size classes, had lower condition factors.

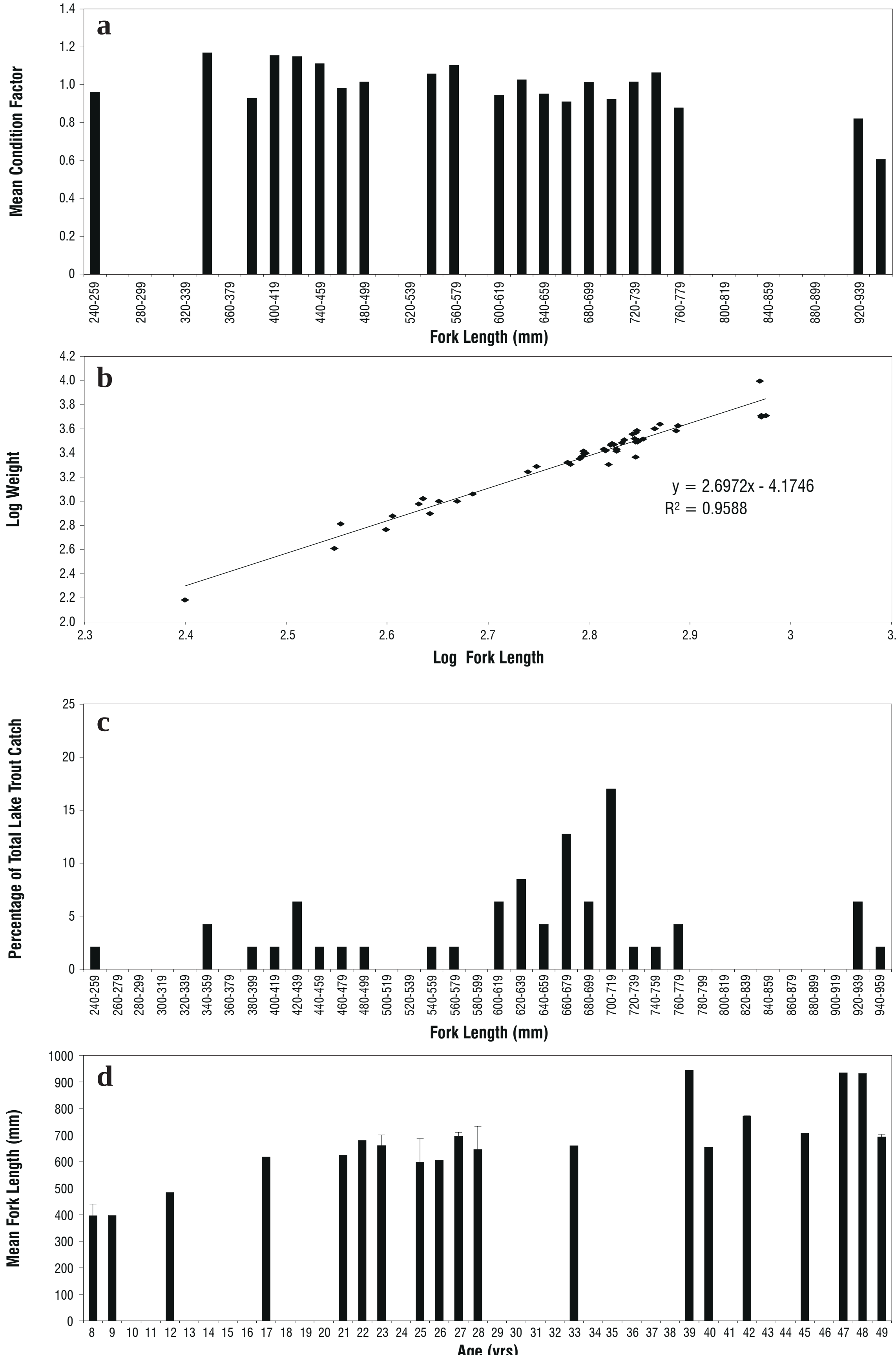
A regression of the log weight against the log fork length for the lake cisco was significant (Figure 10.2-2). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.2-3a). The R^2 values indicate that 94% of the variation observed among fish weights of lake cisco was attributable to differences in fish length.

A plot of the length frequency distribution of lake cisco shows that the range of fish size captured in the index gill nets was narrow (Figure 10.1-2). Only two fish larger than 300 mm were captured. The smaller fish were immature.

A plot of the mean fork length at age shows that there was steady growth in the lake cisco population from 4 years of age to 8 years (Figure 10.2-2). Lake cisco of this region likely mature between 5 and 7 years of age (Scott and Crossman 1990). Therefore, the onset of maturity appears to slightly decrease the rate of growth. Growth appeared to continue through 16 years of age.

Lake Trout

Allometric condition factors and regression analysis of log weight against log fork length were used to examine the energy stores of lake trout. Mean condition factor by size classes by method of survey are presented in Figure 10.2-3. There was a slight decrease in condition with increase in fork length. Regressions of the log weight against the log fork length for the lake trout was significant (Figure 10.2-3). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.1-3a). The R^2 values indicate that more than 95% of the variation observed among fish weights of lake trout was attributable to differences in fish length.



Note: Error Bars Represent Standard Error

FIGURE 10.2-3

Population Characteristics of Lake Trout Caught in Doris Lake, 1997

BHP

Rescan

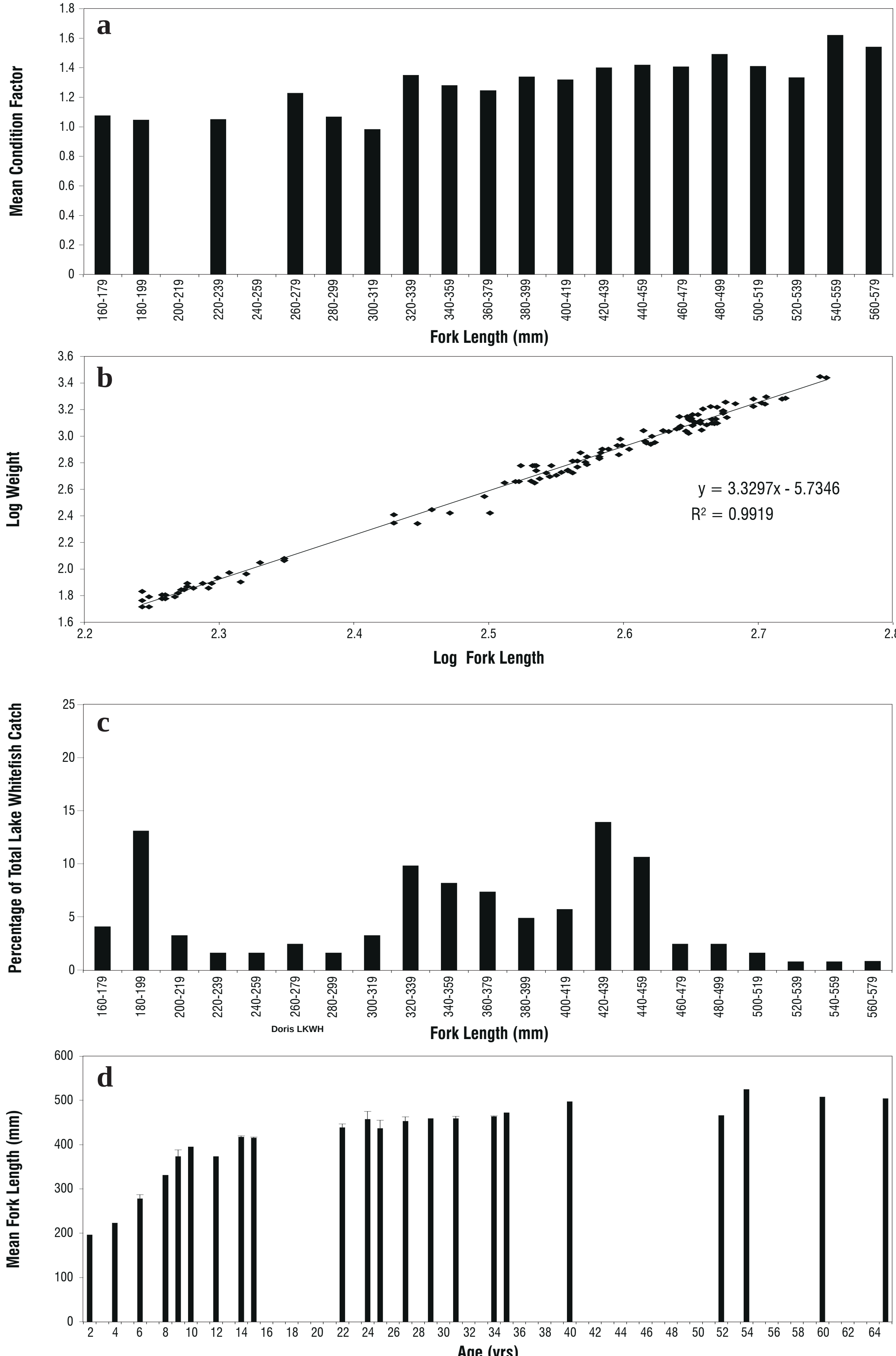
A plot of the length frequency distribution of lake trout shows that there was a wide size range of fish captured in the index gill nets (Figure 10.2-3). The majority of the lake trout captured were of the size classes centred around the 660 to 679 mm size. This is an expected frequency distribution for lake trout in a multi-species community. With dense populations of forage fish present, the average size of lake trout is greater than when there are no forage fish present (*e.g.* Windy Lake; Welch and Klings 1996).

A plot of the mean fork length at age of lake trout showed that the sampled population could be separated into three groups (Figure 10.2-3). The first group comprised the fish between 8 and 17 years of age. This group showed a steady rate of growth. Lake trout in this region mature around 9 years of age. Therefore the onset of maturity appeared not to affect the rate of growth. The second group of fish was composed of fish 17 to 49 years of age. These fish appeared to show no continued growth, producing a relatively uniform size group about the 640 to 659 mm length class. The third size group was composed of fish 39 to 48 years of age and all over 900 mm in length. This stratification of lake trout size structure is not uncommon in Arctic lakes (Welch and Klings 1996). The large fish are most likely indiscriminate piscivores, consuming other lake trout along with forage species (lake cisco and lake whitefish). The multiyear size classes demonstrate that an increase in age does not necessarily lead to an increase in size.

Lake Whitefish

The energy stores of lake whitefish were examined by calculating allometric condition factors and by conducting regression analysis of log weight against log fork length. Mean condition factor by size class is presented in Figure 10.2-4. Condition appeared to increase with fork length. This was an expected result because in larger, more mature fish, a greater proportion of surplus energy is allocated to the seasonal development of gonads.

A regression of the log weight against the log fork length for lake whitefish was significant (Figure 10.2-4). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.2-3a). The R^2 values indicate that more than 99% of the variation observed among fish weights of lake whitefish was attributable to differences in fish length.



Note: Error Bars Represent Standard Error

FIGURE 10.2-4

Population Characteristics of Lake Whitefish Caught in Doris Lake, 1997

BHP

Rescan

A plot of the length frequency distribution of lake whitefish shows that the majority of the fish captured were between 320 and 459 mm (Figure 10.2-4).

A plot of the mean fork length at age shows that there was a steady increase in fish size with age until 15 years of age after which growth decreased steadily until leveling at 22 years of age (Figure 10.2-4). Lake whitefish in this region most likely mature at less than 10 years of age, therefore, the onset of maturity does not appear to affect the rate of growth in these fish. The lake whitefish in Doris Lake have an exceptionally long life span, living for at least 65 years, longer than any other species. However, this has been observed in other Arctic lake systems (Power 1978) and other lakes of the region. The great ages are probably the due to the fish attaining a size around 22 years of age which exempts them from predation from all but the very largest lake trout.

10.2.1.2.2 Patch Lake

Patch Lake was surveyed using index gill nets for a period of four days. Fish and gill net raw data are contained in Appendices 10.2-1b and 10.2-2b, respectively. A total of 163 fishes representing three species were captured in Patch Lake: 31 lake cisco, 55 lake trout, and 77 lake whitefish (Table 10.2-3). Of these fishes, 28 lake trout and 37 lake whitefish were marked using green Floy tags. Lake whitefish were the most abundant species followed by lake trout and then lake cisco. A summary of the population statistics for each species is presented in Table 10.2-4.

Table 10.2-3
Numbers of Fishes Captured and Mean Catch per Unit Effort for Patch Lake, 1997

Species	Sample Method	Sets	Number of Fish	Mean CPUE ± SE
Lake Cisco	Gill net	33	31	15.7 ± 5.5
Lake Trout	Gill net	33	55	24.3 ± 3.1
Lake Whitefish	Gill net	33	77	34.8 ± 5.6

Table 10.2-4
Population Statistics of Fishes Captured in Patch Lake, 1997

Parameter	Mean ± Standard Error					
	Lake Cisco		Lake Trout		Lake Whitefish	
Mean Fork Length (mm)	252 ± 7	n=30	612 ± 21	n=54	401 ± 7	n=76
Mean Weight (g)	170 ± 14	n=30	2239 ± 228	n=44	872 ± 37	n=75
Mean Age (yrs)						
Mean Catch Per Unit Effort	15.7 ± 5.5	n=31	24.3 ± 3.1	n=55	34.8 ± 5.6	n=77
Mean Condition Factor	0.98 ± 0.02	n=30	0.94 ± 0.02	n=44	1.24 ± 0.02	n=75

Sufficient numbers of lake cisco, lake trout and lake whitefish were captured to provide for analysis of data to describe the energy stores, growth, and age structure of the fish populations.

Lake Cisco

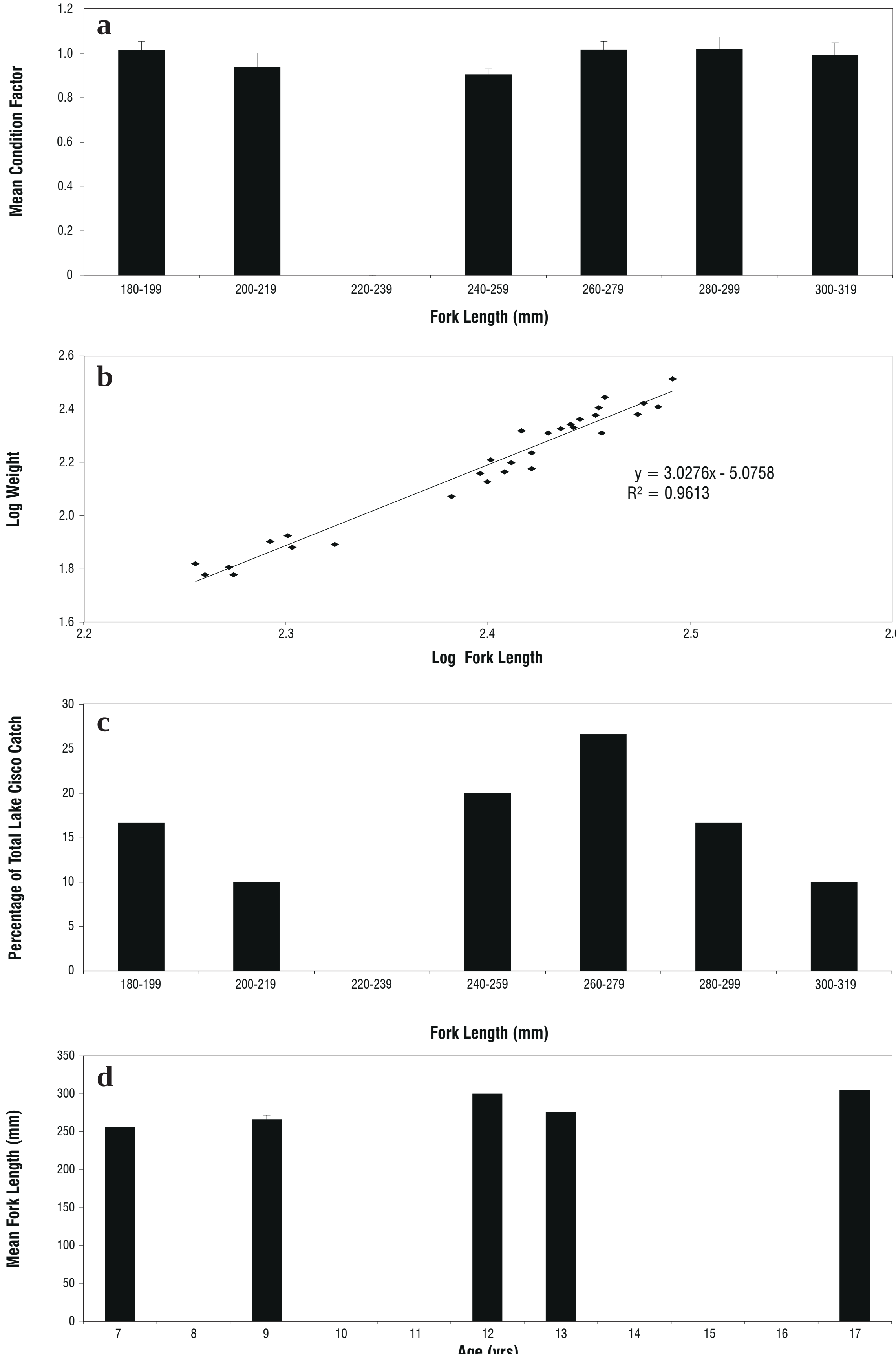
Mean condition factor by size class is presented in Figure 10.2-5. Condition appeared to have been uniform through the size classes. A regression of the log weight against the log fork length for lake cisco was significant (Figure 10.2-5). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.2-3b). The R^2 values indicate that more than 96% of the variation observed among fish weights of lake cisco was attributable to differences in fish length.

A plot of the length frequency distribution of lake cisco shows that the range of fish size captured in the index gill nets was narrow (Figure 10.2-5). No fish larger than 320 mm were captured.

A plot of the mean fork length at age shows that lake cisco in Patch Lake grew little after 12 years of age (Figure 10.1-5). The limited number of lake cisco aging structures available and examined produced only sparse information. No conclusions should be drawn from this data.

Lake Trout

Mean condition factor by size class and by method of survey are presented in Figure 10.2-6. There was a slight decrease in condition with an increase in fork



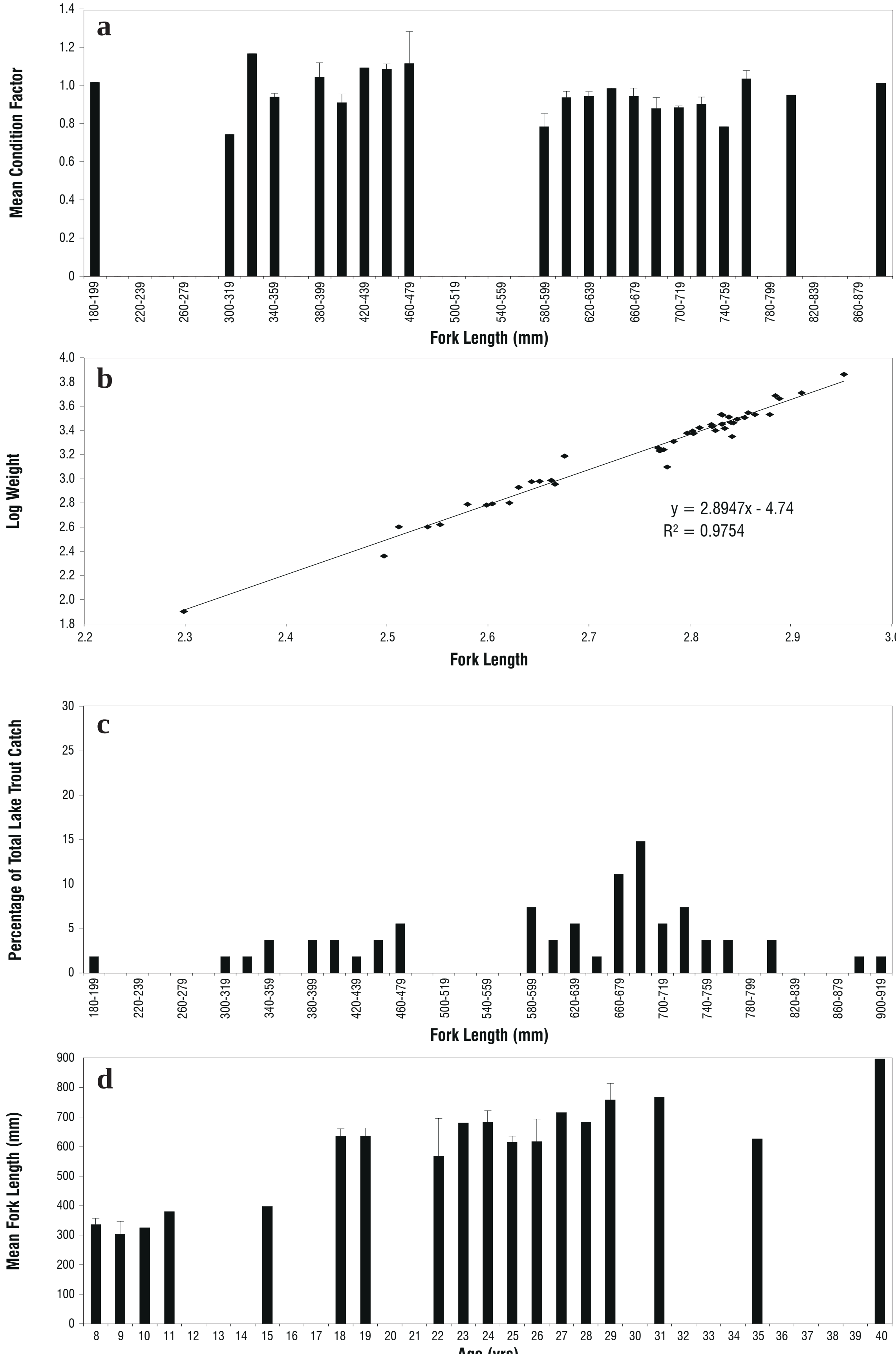
Note: Error Bars Represent Standard Error

Population Characteristics of Lake Cisco Caught in Patch Lake, 1997

FIGURE 10.2-5

BHP

Rescan



Note: Error Bars Represent Standard Error

FIGURE 10.2-6

Population Characteristics of Lake Trout Caught in Patch Lake, 1997

BHP

Rescan

length. Regressions of the log weight against the log fork length for lake trout was significant (Figure 10.2-6). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.2-3b). The R^2 values indicate that more than 97% of the variation observed among fish weights of lake trout was attributable to differences in fish length.

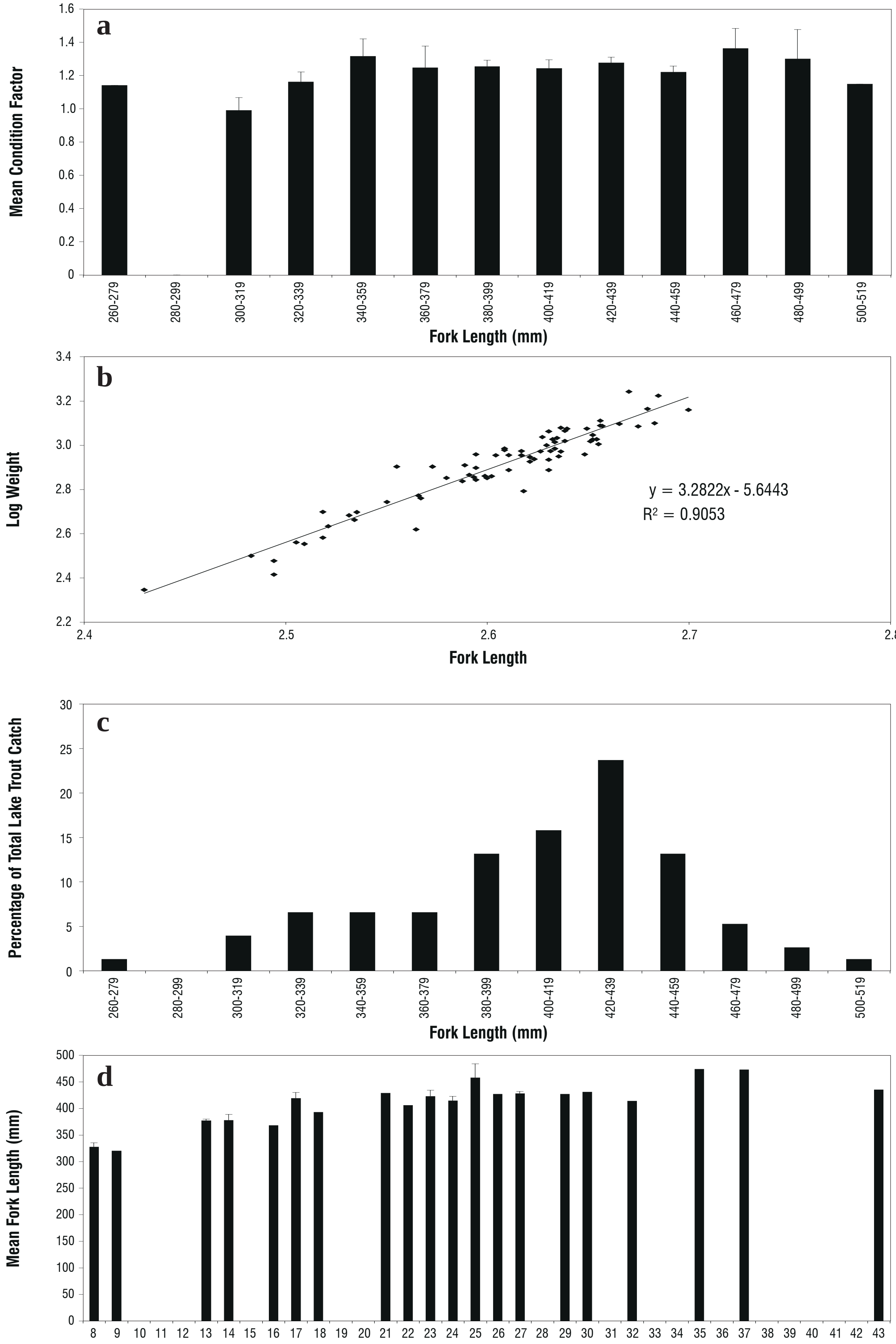
A plot of the length frequency distribution of lake trout shows that there was a wide size range of fish captured in the index gill nets (Figure 10.2-6). The majority of the lake trout captured were of the size classes centred around the 680 to 699 mm size. This is an expected frequency distribution for lake trout in multi-species communities, as the average size of lake trout has been found to be greater in lakes where forage species are present (Welch and Klings 1996).

A plot of the mean fork length at age of lake trout showed that the sampled population could be separated into three groups, similar to Doris Lake lake trout (Figure 10.2-6). The first group comprised the fish between 8 and 15 years of age and was centred around the 360 to 379 mm size class. The second group of fish was composed of fish 18 to 35 years of age. These fish appeared to be highly variable in size and age. As with the Doris Lake lake trout, the second size group was centred about the 640 to 659 mm length class. The third size group was represented by a fish of the 900 to 919 mm size class. This fish was also the oldest lake trout captured in Patch Lake.

Lake Whitefish

Mean condition factor by size class is presented in Figure 10.2-7. Condition appeared to increase slightly with fork length. This was an expected result. As mentioned previously, a greater proportion of surplus energy is allocated to the seasonal development of gonads in large, mature fish.

A regression of the log weight against the log fork length for lake whitefish was significant (Figure 10.2-7). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.2-3b). The R^2 values indicate that more than 90% of the variation observed among fish weights of lake whitefish was attributable to differences in fish length. However, the scatterplot also shows there was greater variation within the Patch Lake lake whitefish population than any other lake whitefish population.



Note: Error Bars Represent Standard Error

FIGURE 10.2-7

Population Characteristics of Lake Whitefish Caught in Patch Lake, 1997

BHP

Rescan

A plot of the length frequency distribution of lake whitefish shows that the majority of the fish captured were between 380 and 459 mm (Figure 10.2-7).

A plot of the mean fork length at age shows that there was a steady increase in fish size from 8 to 21 years of age, after which the growth rate decreased so as to be undetectable (Figure 10.2-7). Lake whitefish in this region most likely mature at less than 10 years of age therefore the onset of maturity does not appear to affect the rate of growth in these fish. The lake whitefish in Patch Lake have a long life span, living for at least 43 years. The great ages are probably the due to the fish attaining a size around 21 years of age which exempts them from predation from all but the very largest lake trout.

10.2.1.2.3 Windy Lake

Windy Lake was surveyed using index gill nets for a period of three days. Fish and gill net raw data are contained in Appendices 10.2-1c and 10.2-2c, respectively. A total of 63 fishes representing two species were captured in Windy Lake: 5 lake cisco and 58 lake trout (Table 10.2-5). Of these fishes, two lake cisco and 31 lake trout were marked using blue Floy tags. Lake trout were the most abundant species captured. Lake cisco captures were incidental, indicating that the lake cisco present in Windy Lake are probably migrants from downstream (Glen Lake) and may not have a reproducing population established. A summary of the population statistics for each species is presented in Table 10.2-6.

Table 10.2-5
Numbers of Fishes Captured and Catch per Unit Effort for Windy Lake, 1997

Species	Sample Method	Sets	Number of Fish	Mean CPUE ± SE
Lake Cisco	Gill net	32	5	1.6 ± 1.3
Lake Trout	Gill net	32	58	19.4 ± 2.9

Sufficient numbers of lake trout were captured to provide for analysis of data to describe the energy stores, growth, and age structure of the fish population.

Table 10.2-6
Population Statistics of Fishes Captured in Windy Lake, 1997

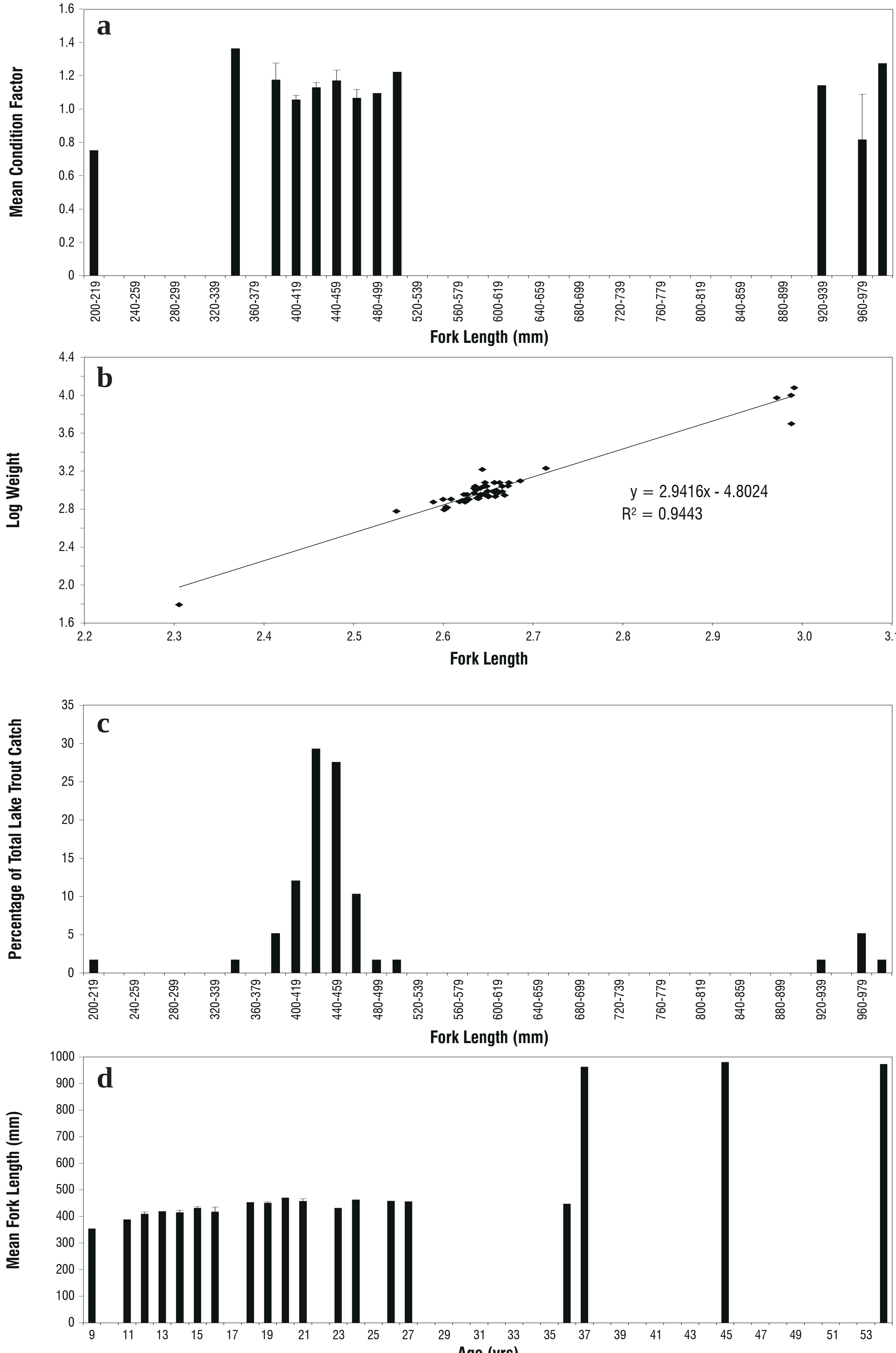
Parameter	Mean ± Standard Error			
	Lake Cisco		Lake Trout	
Fork Length (mm)	344 ± 24	n=5	478 ± 21	n=58
Weight (mm)	442 ± 77	n=5	1505 ± 295	n=57
Age (yrs)				
Catch Per Unit Effort	1.6 ± 1.3	n=5	19.4 ± 2.9	n=58
Condition Factor	1.05 ± 0.04	n=5	1.12 ± 0.03	n=57

Lake Trout

Mean condition factor by size class and by method of survey are presented in Figure 10.2-8. There was no trend in condition with fork length. Regressions of the log weight against the log fork length for the lake trout was significant (Figure 10.2-8). The large F_s values indicate that there was a strong relationship between weight and length (Appendix 10.1-3c). The R^2 values indicate that more than 94% of the variation observed among fish weights of lake trout was attributable to differences in fish length.

A plot of the length frequency distribution of lake trout shows that there was a wide size range of fish captured in the index gill nets but concentrated in three distinct size groups (Figure 10.2-8). The majority of the lake trout captured were of the size classes centred around the 420 – 459 mm size groups. This is an expected frequency distribution for lake trout in a single species lake community. With no forage fish present, the lake trout population stratifies into two distinct size groups, representing two different trophic levels. The smaller, more abundant size group represents mature, invertebrate feeding fish. The less abundant, larger fish are piscivorous cannibals foraging on the smaller lake trout (Welch and Klings 1996). These large fish represent the highest trophic level within the lake.

A plot of the mean fork length at age of lake trout showed that there were two distinct size groups (Figure 10.2-8). The first group comprised the fish between 9 and 36 years of age and was centred around the 420 to 439 mm size class. The growth rate decreased and appeared to stall at 12 years of age. Because lake trout in



Note: Error Bars Represent Standard Error

Population Characteristics of Lake Trout Caught in Windy Lake, 1997

FIGURE 10.2-8

BHP

Rescan

this region begin maturing at 9 years of age, this apparent suspension of growth corresponds with the age after which all lake trout are mature. The second group of fish was composed of fish 37 to 54 years of age. These fish were centred around the 960 to 979 mm size class. The size distribution of the lake trout population in Windy Lake is a classic example of a monospecific fish community (Welch and Klings 1996). There is a uniform size group containing mature, invertevores of a wide range of ages. The other size group is of large, predatory cannibals, also of a wide range in size, which forage on the smaller size group. This population structure is further evidence that there is no substantial forage fish population present.

10.2.2 Stream Communities

Stream fish community surveys were conducted twice during the open water season. A spring survey was conducted during the spring freshet when streams have the highest water levels and the potential for use by fishes is greatest. Follow up surveys were conducted during the fall when stream flows were low.

10.2.2.1 Methods

Streams of the Doris Property were synoptically surveyed following the procedures outlined in Section 10.1.2.1. Of particular concern were the streams connecting the lakes. Because of the proximity of the property to Melville Sound, streams connecting lakes and discharging from the property into the sea were assessed for migration potential.

10.2.2.2 Results and Discussion

Twenty-eight water courses were assessed during the spring field session (Figure 10.2-1; Appendices 10.2-4 and 5). Nineteen streams were assessed as potentially containing fish habitat and were therefore synoptically surveyed and electrofished (DP01–14, 20, 22, 25, 26, and 28). Nine streams were assessed as not possessing fish habitat or having barriers to migration (DP15-19, 21, 23, 24, and 27). Unless otherwise noted, the streams were ephemeral, draining snow melt in the spring, only.

Presented in the following sections are the results of the stream fish community surveys conducted in the streams of the Doris Property.

10.2.2.2.1 Unnamed Stream (Sites DP01 and DP14)

This unnamed stream was surveyed at site DP01 on June 20, 1997 and site DP14 on June 23, 1997 (Figure 10.2-1). The stream was in flood stage during the surveys. At the upstream site (DP14), the stream was found to be a series of deep pools connected by riffles over terrestrial grasses. In the late summer the pools became disconnected. There was no observable fish habitat. At the downstream site (DP01), the stream was found to be flowing through a series of pools connected by riffles and runs before discharging over a bed rock shelf and through a set of rapids into Patch-Ogama Stream (Plate 10.2-1). The stream was surveyed at site DP01 in two locations: within the rapids and above the rapids. The stream channel was well defined with a substrate composed primarily of boulder, bedrock and cobble. There was good spawning and rearing habitat available and, below the rock shelf, adult feeding habitat. There was no observable overwintering habitat present. The rock shelf did not likely prevent Arctic grayling migrations, however lake trout were probably impeded.

An electrofishing survey at the upstream site (DP14) resulted in the observation of one ninespine stickleback (Table 10.2-7). An electrofishing survey at the downstream site (DP01) resulted in the capture of 14 lake trout in the rapids below the rock shelf (Table 10.2-7). The lake trout were probably marshalled to intercept an Arctic grayling spawning run. One lake trout tagged at site DP01 was recaptured in Doris Lake (Figure 10.2-1). This indicates that there is probably fish migration among the lakes of the west side of the Doris Property.

10.2.2.2.2 Windy-Glen Stream (Sites DP02 and DP10)

Windy-Glen Stream was surveyed at site DP01 on June 20, 1997 and at site DP10 on June 22, 1997 (Figure 10.2-1). The stream was found to be in flood, with water exiting Windy Lake through a sparse series of pools, connected by runs and riffles (Plate 10.2-2). The upstream survey section contained a well defined channel underlain by organic matter, cobble, gravel, sand, and boulders. Downstream of the survey section, the stream flow dispersed through a low marshy area. Prior to

Table 10.2-7
Results of the Stream Fish Community Surveys Conducted on the Doris Property, 1997

Site	Species Captured	Number of Fish	Fork Length (mm)	Weight (g)	n=	CPUE (fish/min)
DP01	LKTR	14*	719 ± 12	3713 ± 238	n=4	3
DP02	ARCH	1	185	36		0.1
	LKTR	2	710 ± 34	3100 ± 500		0.2
DP03	NNST	1				0.2
DP04	NNST	3	45 ± 4			0.2
DP05	NNST	11	48 ± 5			1.7
DP07	NNST	1	54			0.2
DP08	NNST	26	40 ± 1			8
DP09	NNST	2	57 ± 6			3.8
DP10	LKTR	9*	464 ±12	1207 ± 36	n=4	1.9
DP11	LKTR	4*				1.7
	NNST	29	50 ± 2			12.2
DP12	ARCH	2*	600	2600	n=1	0.2
	LKTR	5*	390	570	n=1	0.5
DP13	NNST	51*	38 ± 4		n=8	74.6
DP14	NNST	1*				0.1
DP20	LKCS	1	206	74		0.2
	LKTR	2	606 ± 43	1998 ± 338		0.3
	NNST	23*	52 ± 2		n=3	3.7
DP22	LKTR	1	463	1175		0.1
	LKWH	2	302 ± 15	320 ± 40		0.2
	NNST	25*	56 ± 5		n=10	2.6
DP25-B	LKTR	1*				0.2
DP25-A†	ARCH	7	170 ± 32	127 ± 48		1.2
	LKCS	7	245 ± 9	153 ± 15		1.2
	LKTR	6	326 ± 36	391 ± 105		1.1
	LKWH	1	493	1375		0.2
	NNST	7	55 ± 2			1.2
DP26	ARCH	10	146 ± 12	39 ± 9		0.9
	LKTR	3	253 ± 28	181 ± 65		0.3
	NNST	11	47 ± 1			1
DP28	ARCH	3	205 ± 6	70 ± 6		0.3
	NNST	4*				0.4
Total		137				

*** Not all fish observed during the survey were measured. The number of fish measured (fork length and weight if possible) is indicated in the n= column. CPUE is based on all fish observed.**
† CPUE most likely much higher for this site. Numerous fish of each species listed were observed but an accurate count was not possible.

Plate 10.2-1 **Unnamed Stream at site DP14, June 23, 1997, showing the dispersed flow through terrestrial grasses.**

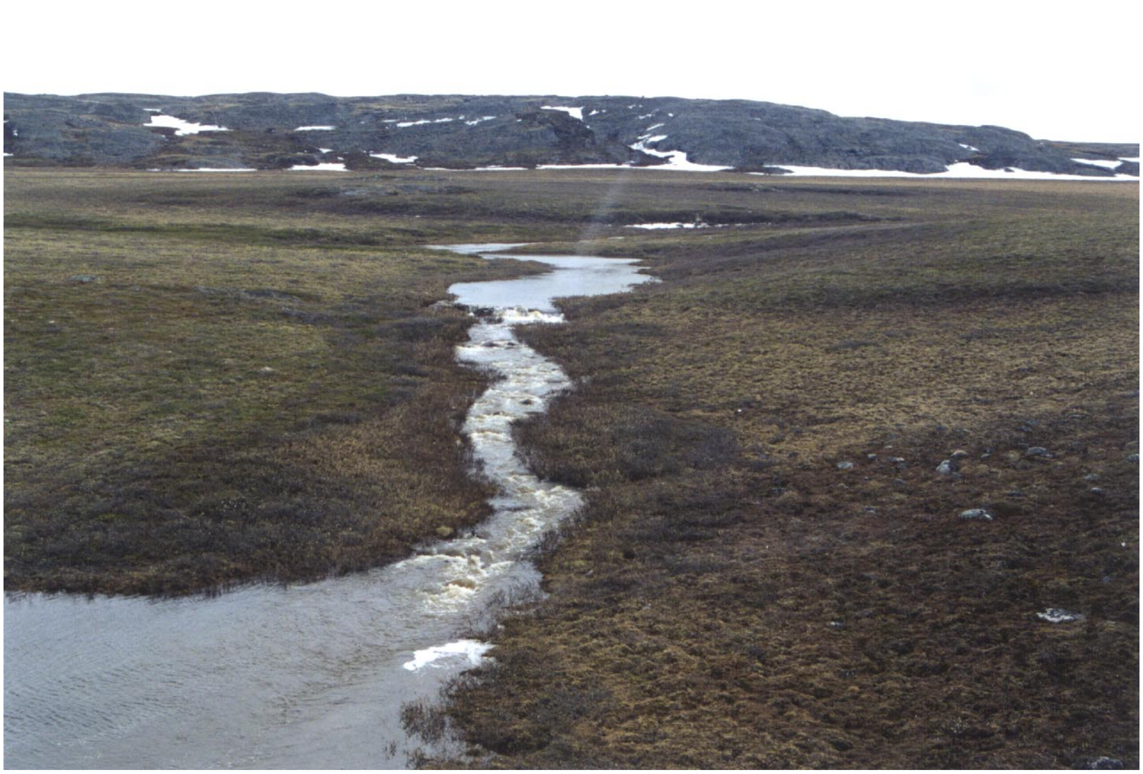


Plate 10.2-2 **Unnamed stream at the confluence with Patch-Ogama Stream, June 20, 1997. Adult lake trout were found in the rapids, but no fish were captured in the upstream pools.**

entering Glen Lake the stream flow once again collected into a well defined channel of sparsely spaced pools connected by runs and riffles. The downstream area of stream channel was underlain by sand, boulders, cobble, and gravel. The low marshy area at the midpoint of the stream probably provides a migration barrier to larger fish. Smaller fish may pass through the channel during freshet.

An electrofishing survey at the upstream site (DP02) resulted in the capture of two mature lake trout and one juvenile Arctic char (Table 10.2-7). The Arctic char may have migrated upstream from Glen Lake as no Arctic char were found in Windy Lake. The lake trout were probably residents of Windy Lake as there was poor migration habitat downstream in Windy-Glen Stream. An electrofishing survey at the downstream site (DP10) resulted in the capture or observation of nine mature lake trout (Table 10.2-7). These fish were probably residents of Glen Lake.

10.2.2.2.3 Tail-Doris Stream (DP03)

Tail-Doris Stream was surveyed June 20, 1997 (Figure 10.2-1). The stream was found to be in flood, flowing for the most part through terrestrial grasses and shrubs (Plate 10.2-3). There was a narrow channel of disjunct cutbanks and scour holes through which the stream flowed during low water seasons. The stream did not provide a migration route at any stage of flow. There was no observable spawning, rearing, overwintering, or adult rearing habitat present. An electrofishing survey resulted in the observation of one ninespine stickleback at the mouth of the creek (Table 10.2-7).

10.2.2.2.4 Stream DP04

Stream DP04 was surveyed June 21, 1997 (Figure 10.2-1). The stream was found to be in flood, draining a series of small ponds through a low marshy area before entering Doris Lake. The surveyed section of stream flowed through a series of small plunge pools and over terrestrial grasses and organic matter. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. Migration was not possible through the stream. The headwater ponds were shallow and did not provide fish habitat. An electrofishing survey resulted in the capture of three ninespine stickleback near the mouth of the stream (Table 10.2-7).

10.2.2.2.5 Stream DP05

Stream DP05 was surveyed June 21, 1997 (Figure 10.2-1). The stream was found to be in flood, draining a series of small ponds through a low marshy area before entering Patch Lake. The surveyed section of stream flowed through a series of small plunge pools and over terrestrial grasses and organic matter. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. Migration was not possible through the stream. The headwater ponds were shallow and did not provide fish habitat. An electrofishing survey resulted in the capture of eleven ninespine stickleback near the mouth of the stream (Table 10.2-7).

10.2.2.2.6 Stream DP06

Stream DP06 was surveyed June 21, 1997 (Figure 10.2-1). The stream was found to be in flood, draining a small unnamed lake through an indistinct channel into the eastern arm of Patch Lake. The surveyed section of stream flowed over terrestrial grasses and shrubs. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. Migration was not possible through the stream. The headwater lake was not assessed, but there was no migration route connection with Patch Lake. An electrofishing survey resulted in no fish captures.

10.2.2.2.7 Stream DP07

Stream DP07 was surveyed June 21, 1997 (Figure 10.2-1). The stream was found to be in flood, draining a series of small ponds into Patch Lake. On the date of the survey, flood waters from Wolverine Lake were sluicing into the stream from the east. The surveyed section of stream flowed through a sparse series of deep pools connected by shallow riffles over terrestrial grasses and organic matter. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. Migration was not possible through the stream. The headwater ponds were shallow and did not provide fish habitat. An electrofishing survey resulted in the capture of one ninespine stickleback near the mouth of the stream (Table 10.2-7).

10.2.2.2.8 Wolverine-Patch Stream (DP08)

Wolverine-Patch Stream was surveyed June 21, 1997 (Figure 10.2-1). The stream was found to be in flood, draining Wolverine Lake through a large, low marshy

Plate 10.2-3 **Tail-Doris Stream, June 20, 1997, showing the dispersed flow through terrestrial grasses and shrubs. There was no fish habitat present.**

Plate 10.2-4 **Wolverine-Patch Stream, June 21, 1997, showing the dispersed flow that was characteristic of this stream for the entire length.**

Plate 10.2-5 **Glenn Outflow at site DP12, 23 June, 1997, showing riffles and rapids flowing through marine sediment deposits, features found throughout this stream. Arctic char and lake trout were caught in this stream section.**

Plate 10.2-6 **Glenn Outflow at site DP28, 15 August, 1997, showing riffles and rapids flowing through marine sediment deposits. Juvenile Arctic char and lake trout were caught in this stream section.**

area of melt water into Patch Lake. The surveyed section of stream flowed over terrestrial grasses and organic matter (Plate 10.2-4). There was no observable spawning, rearing, overwintering, or adult feeding habitat present. This was not a potential migration route for fish to move between Wolverine and Patch lakes. An electrofishing survey resulted in the capture of 26 ninespine stickleback in the mouth of the stream (Table 10.2-7).

10.2.2.2.9 Stream DP09

Stream DP09 was surveyed June 22, 1997 (Figure 10.2-1). The stream was found to be in flood, draining melt water through an indistinct channel into the northern end of Ogama Lake. The surveyed section of stream flowed over terrestrial grasses and shrubs. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. Migration was not possible through the stream. An electrofishing survey resulted in the capture of two ninespine stickleback in the mouth of the stream.

10.2.2.2.10 Stream DP11

Stream DP11 was surveyed June 22, 1997 (Figure 10.2-1). The stream was found to be in flood, draining a series of small ponds and a marshy area of melt water through a sparse series of small plunge pools and indistinct channel into the western side of Patch Lake. The surveyed section of stream flowed over terrestrial grasses and shrubs. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. Migration was not possible through the stream. The headwater ponds were shallow and possessed no potential fish habitat. An electrofishing survey resulted in the capture of 29 ninespine stickleback in the lowest reach of the stream. Four large lake trout were observed in the lake shallows, adjacent to the stream mouth.

10.2.2.2.11 Glen Outflow (DP12 and DP28)

Glen Outflow was surveyed at site DP12 on June 23, 1997 and at site DP28 on August 15, 1997 (Figure 10.2-1). During the spring survey at site DP12, the stream was found to be in flood, draining Glen Lake through a well defined channel composed of a series of deep pools connected by rapids, runs, and riffles (Plate 10.2-5). The surveyed section of stream was underlain by boulder, cobble, and gravel substrate. The stream passed through a deep valley of eroded marine deposits before discharging into Roberts Bay. The marine fines added suspended solids to the stream and cause high turbidity. The stream was assessed as possessing good spawning, rearing, and adult feeding habitat. There were no observable barriers to fish migration. When the downstream portion of the Glen Outflow was surveyed in the late summer, lower water levels had exposed a stepped series of rapids (Plate 10.2-6).

An electrofishing survey conducted at the upstream survey site (DP12) in the spring resulted in the capture or observation of two mature Arctic char and five mature lake trout (Table 10.2-7). An electrofishing survey conducted at the downstream site (DP28) in the late summer resulted in the capture of three juvenile Arctic char and the observation of four ninespine stickleback (Table 10.2-7). Though there are indications that there are Arctic char in Glen Lake, there was no indication of a fall Arctic char run upstream from Roberts Bay into Glen Lake.

10.2.2.2.12 Unnamed Stream (DP13)

Unnamed stream DP13 was surveyed June 23, 1997 (Figure 10.2-1). The stream was found to be in flood, draining a small, unnamed lake through a low marshy area into the southern end of Windy Lake (Figure 10.2-1). The surveyed section of stream passed in a dispersed, shallow riffle over terrestrial grasses and organic matter. There was no observable spawning, rearing, overwintering, or adult feeding habitat present. Migration for fish larger than ninespine stickleback was not possible through the stream. An electrofishing survey resulted in the capture or observation of 51 ninespine stickleback in the lowest reach of the stream (Table 10.2-7).

10.2.2.2.13 Patch-Ogama Stream (DP20)

Patch-Ogama Stream was surveyed August 14, 1997 (Figure 10.2-1). Flows were too high during the spring field session to conduct a safe and effective stream survey. In the summer the stream was found to be a series of deep runs interspersed with occasional deep pools, riffles, and rapids (Plate 10.2-7). The stream was low in gradient and possessed a sand, gravel, and boulder/cobble substrate. There was fair spawning and rearing habitat and good adult feeding

Plate 10.2-7 **Patch-Ogama Stream, August 14, 1997, showing run and riffle habitat. The esker visible in the lower right corner provided sand and gravel substrate for the stream.**

Plate 10.2-8 **Ogama-Doris Stream, August 15, 1997, showing a series of riffles and runs through a boulder garden. Mature and juvenile fish were captured throughout this stream.**