SECTION K

FISH RESOURCES OF THE ATNA LAKE SYSTEM, 1980

TABLE OF CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

This section presents the results of field studies conducted in 1980 on the fish resources of the Atna Lake system. The objective of the study was to determine the relative abundance and the spatial and seasonal distribution of fish species in Atna Lake and its tributaries, with particular emphasis on migratory species.

The Atna Lake drainage basin (Figure 1.1) is located in the Kitimat and Bulkley Mountain Ranges. It drains an area of 243 km^2 and is second in size only to the Nanika-Kidprice Lake system as a tributary system of Morice Lake.

Atna Lake is a small, glacial lake located at an elevation of 774 m above sea level, and 10m above Morice Lake. It has an area of approximately 5 km^2 and a maximum depth of 60 m. Its waters are very turbid due to glacial silt discharged from the Atna River (secchi disc less than 1 meter). The bay at the northwest end of the lake is relatively clear, receiving inflows from spring fed streams. Much of the shoreline along the north and south sides of the lake is comprised of cobble and rubble substrate and has a steep gradient. The most extensive littoral areas occur on the mudflats of the Atna River delta and in the northwest bay area. The southeast basin of the lake also has some shallow water habitat.

The major tributaries entering Atna Lake include the Atna River, and the designated creeks (C1-C10) at the northwest end of the lake. The remaining unnamed creeks shown in Figure 1.1 are steep and intermittent with no fish habitat value. These creeks are identifiable by changes in vegetation patterns on the mountain slopes and gravel deposits at their mouths.

The Atna River originates in the icefields and is characterized by cold, turbid waters. The lower 11 km of the Atna River has a moderate gradient and a substrate of gravel and cobble. For the most part, the river flows in a single channel but a number of gravel bars and islands provide some side channel and backwater habitat. Pool habitat is limited to a small section of the river above Tributary T3. In the upper reaches of the river (above T13), the gradient increases, the substrate consists of cobble and boulders and the channel becomes increasingly braided, particularly past the canyon approximately 12 km upstream from Atna Lake.

Seven major tributaries enter the Atna River in its lower reaches. Four (T2, T9, T10 and T13) drain glacial and snowmelt waters and are typically cold and turbid. Substrate in these streams consists of gravel and cobble and water velocities in the mainstem are moderate to fast. The remaining three streams (T1, T3 and T6) drain the extensive marsh meadows typical of the Atna River floodplain. These streams and sloughs generally have clear, humic-stained waters, slow to negligible flows and relatively warm temperatures. Beavers are common. Tributary T3 has the largest drainage area. It is slough-like near the mouth but has a gravel substrate in its middle and upper reaches. Tributaries T1 and T6, as well as the smaller tributary systems shown in Figure 1.1, are sloughs and beaver ponds with low flows, muddy substrates and abundant aquatic vegetation.

The outlet of Atna Lake (lower Atna River) is 2 km long. It also receives snow melt and groundwater from two tributaries and widens in places to form two small lakes. The upper lake is relatively shallow, and has a wide sedge band along its northern shore. The lower lake is more steep-sided. Between these lakes are two waterfalls formed from bedrock ledges. The upper and lower falls are three and four meters high, respectively. These falls present a barrier to some fish species. Salmon can negotiate the lower falls near the south bank only, where the falls form a series of steps.

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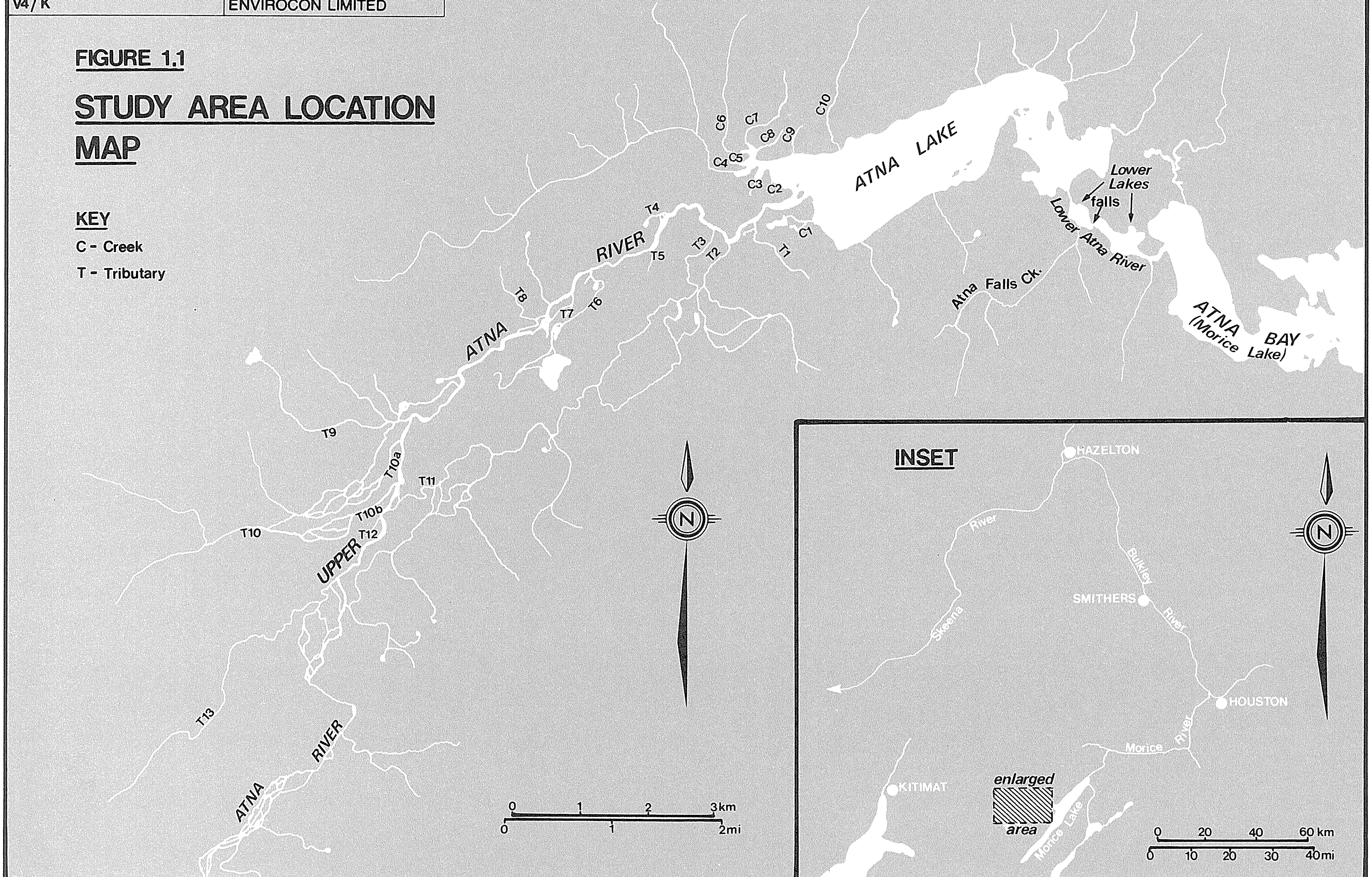
FIGURE 1.1

STUDY AREA LOCATION MAP

KEY

C - Creek

T - Tributary



2.0 METHODS

Field studies were conducted in the Atna system during the following periods: May 23 to June 25, July 28 to August 26 and September 3 to October 8, 1980. Sampling programs included fish sampling in Atna Lake and tributary streams, limnological measurements in Atna Lake and monitoring of discharge and temperatures in the upper and lower Atna River. Fish sampling consisted of spawning surveys; salmon migration counts and carcass recovery; downstream trapping to monitor juvenile migrations; and gill netting, beach seining, minnow trapping and electroshocking to determine fish distributions.

Sampling sites in the lake and streams are shown in Figures 2.1 and 2.2. A detailed description of the methods used is presented in the following sections.

2.1 Fish Studies

2.1.1 Adults

a) Spawning Surveys:

Programs to document the presence, distribution and abundance of salmon and trout spawners included aerial and boat surveys, daily counts of migrating salmon at Atna Falls and a carcass recovery program in Atna Lake. During the field season, 16 helicopter surveys were conducted in the Atna system. Flights were scheduled in May and June to determine the presence of spring spawners, in particular rainbow trout, and to assess potential spawning habitat in the upper Atna River and its tributaries. In September, October and November, aerial surveys were conducted on the upper Atna River and along the shores of Atna Lake to document evidence of any sockeye and coho salmon spawning activity.

To estimate the number of salmon spawners (particularly sockeye salmon) returning to the Atna system, periodic observations at the lower end of Atna Falls began on August 4. From August 8 to August 24, daily 12 hour observations were conducted from approximately 0900 to 2100 hours. Adult spawners were counted as they jumped a section of the lower falls near the south bank which consisted of a series of steps and appeared to be the only route passable to migrating salmon. Salmon species, number of jumps, and number of successful jumps were recorded.

A program of sockeye carcass recovery was conducted from September 3 to October 29. This consisted of surveys of the lake shoreline, and of the upper Atna River and its tributaries. From September 8 to October 8, lake surveys were conducted once or twice daily by boat, and river surveys twice weekly by helicopter. Additional surveys of the Atna River mainstem were conducted by boat. From October 8 to the end of the month, weekly surveys were conducted from helicopters for both lake and river observations. For each salmon carcass recovered, location was mapped and species, sex and post-orbital hypural length were recorded. Scales were taken for age determination and females were also examined for residual eggs. Carcasses were cut in half to prevent recounts on subsequent surveys.

b) Survey of Lake Fish:

In the spring, gillnets were set at fifteen stations in Atna Lake and at four stations in the lake below the falls. Gillnet sets consisted of three (15.2 x 2.4 m) gillnet panels with mesh sizes ranging from 25.4 to 88.9 mm. Nets were generally set perpendicular to the shore with the smaller mesh placed near shore. Gillnets were set during the day and checked every two hours. For each catch, fish species and numbers were recorded. Fork lengths of fish of selected species were measured and scales taken for age determination.

2.1.2 Juveniles

a) Migration Studies:

A trapping program to monitor the migration of salmon fry and smolts and other species was conducted during each sampling period. An incline plane trap (0.6 by 0.9 m) and a fyke net (1.2 by 1.2 m) were installed in the upper Atna River (just upstream of the mouth) and at the lake outlet, respectively. Both traps were tended daily in the morning and evening. This involved removing accumulated debris, checking the live box for fish, and adjusting the location of the traps (and the apron of the incline plane trap) when necessary. Depending on flow conditions, two or three 2.4m wing panels (6.4 mm wire mesh) were used to increase the efficiency of the traps. For each catch, fish species, numbers and fork lengths were recorded.

b) Lake Distribution:

Twenty-two stations in Atna Lake and eight stations in the lake above Atna Falls were established as beach seine sites to determine the distribution of juvenile fish,

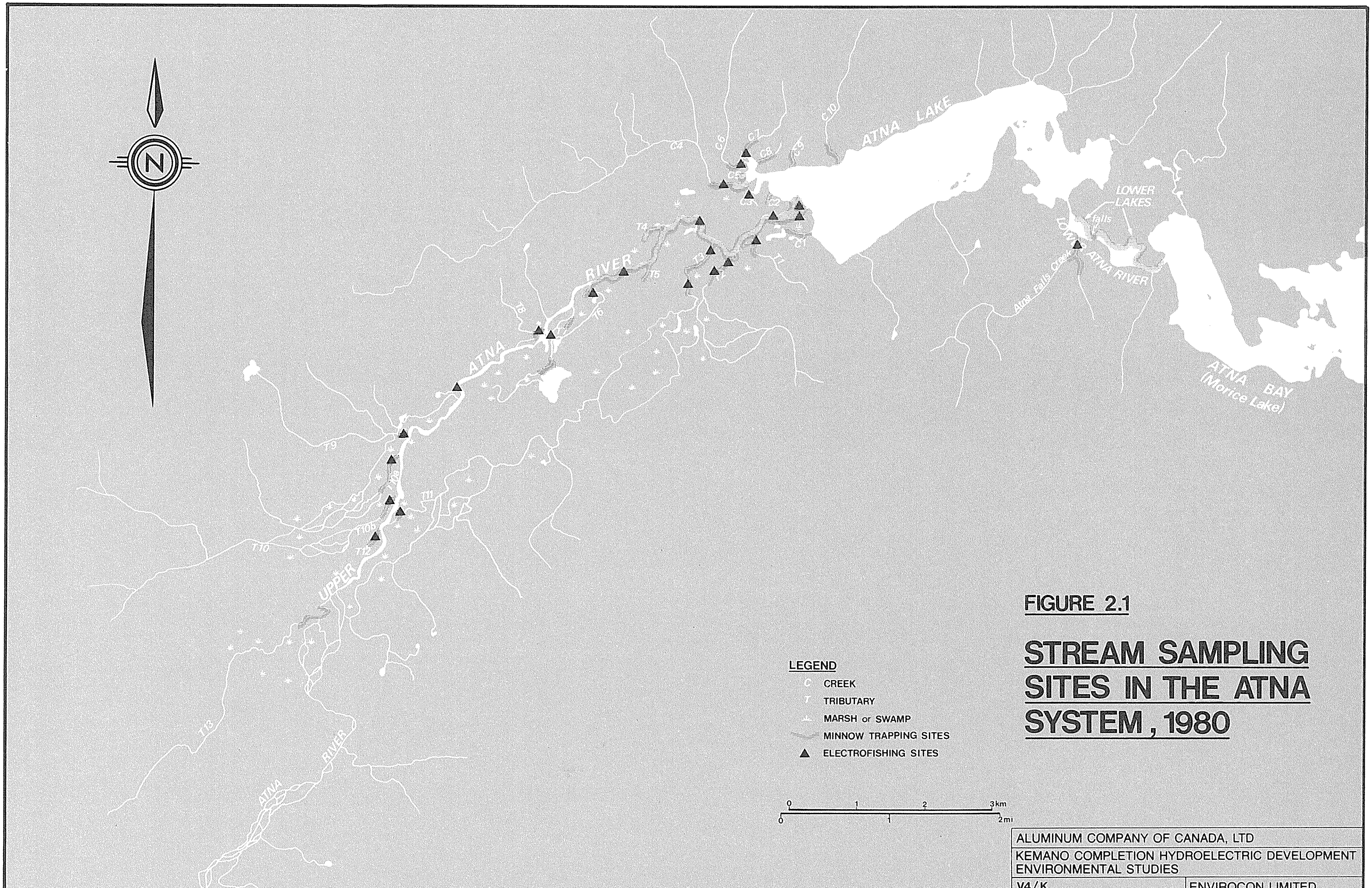


FIGURE 2.1

STREAM SAMPLING SITES IN THE ATNA SYSTEM, 1980

LEGEND

- C CREEK
- T TRIBUTARY
- MARSH or SWAMP
- MINNOW TRAPPING SITES
- ▲ ELECTROFISHING SITES

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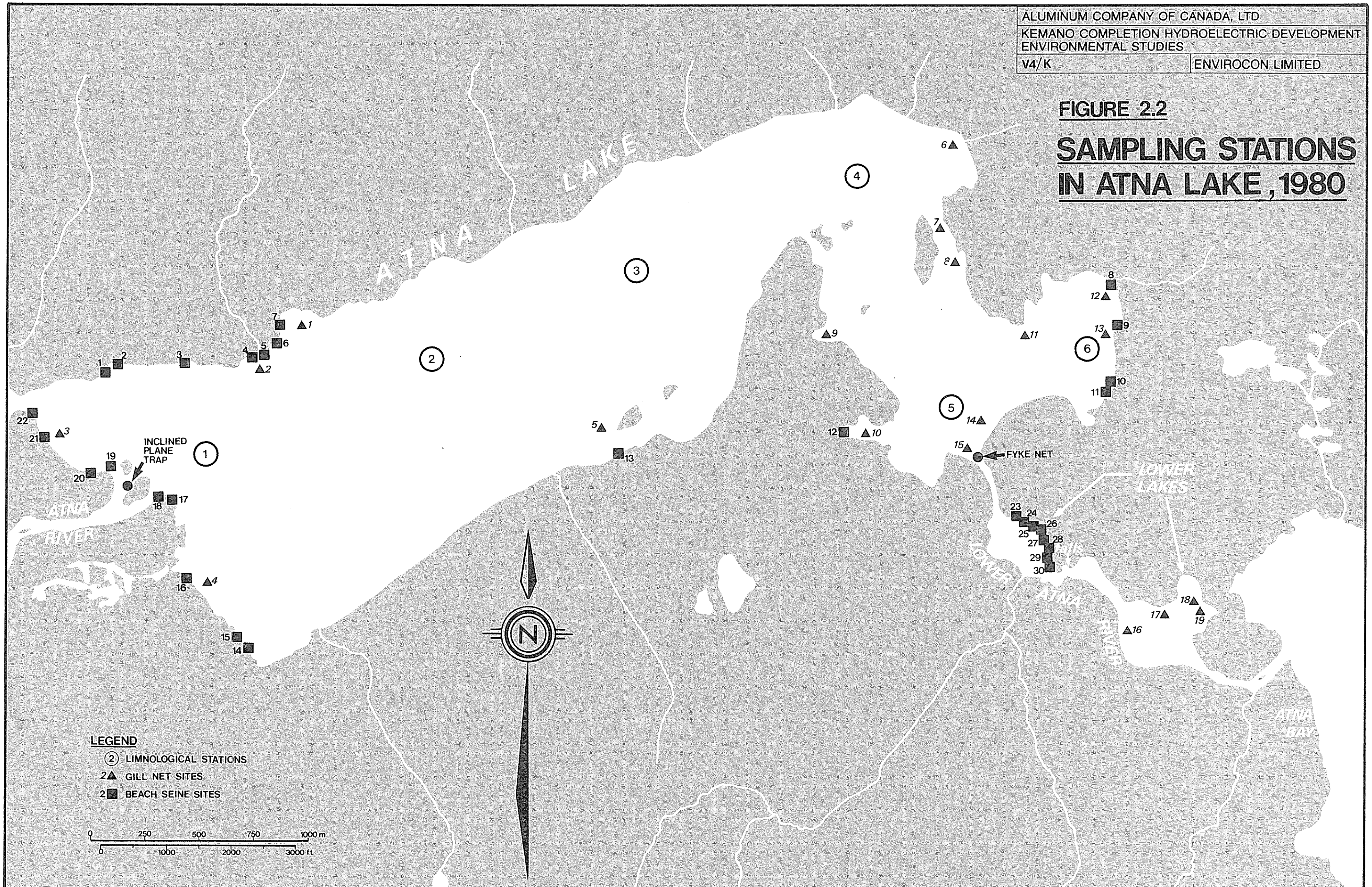

FIGURE 2.2

SAMPLING STATIONS IN ATNA LAKE, 1980

particularly sockeye salmon fry. These stations were sampled a total of eight times over the three field sampling periods. The interval between sampling times was 7 to 10 days.

Beach seining was conducted in the evenings. At each station a 10 m seine, with a mesh size of 3.2 mm, was hauled parallel to the shore for approximately 20 to 25 m before being pulled in. Depending on water depth, seines were hauled either by wading or by boat. For each seine sample, fish species and numbers were recorded. Fork lengths were measured and scales for age determination were taken from subsamples of selected species.

c) Stream Distribution:

Minnow trapping and electrofishing were utilized to determine the stream distribution of juvenile fishes. Minnow traps were used most frequently since they could fish in a variety of stream habitats. The turbidity of the Atna River and many of its tributaries reduced the recovery of fish taken by electrofishing. In many slough and beaver ponds, excessive depth or extremely soft mud substrates also reduced the effectiveness of electrofishing. Electrofishing did, however, provide some good supplementary information in specific areas and sampled fish species and sizes not effectively sampled by minnow trapping.

Minnow trap sites were established in the spring in representative habitats in the upper and lower Atna River and tributaries, and in the creeks tributary to Atna Lake. Minnow traps were set in similar locations during the summer and fall periods. Some adjustments were made in the fall; the lower river was not sampled and new trap sites were established in the upper river. Over the field season a total of 1,024 minnow traps was set.

Minnow traps were baited with canned salmon wrapped in cheese cloth and fished for 24 hours. Habitat characteristics including water temperature, turbidity, estimates of water velocity, depth, substrate and cover were noted for each site. For each catch, fish species and numbers were recorded. Fork lengths of selected species were measured, and scales were taken for age determination.

In August and September, sites in the upper Atna River and most of the major tributaries and creeks were electrofished. Stream margins were sampled for a distance of 100 to 200 meters using either a Coffelt BP-3 or Smithroot Type VII electroshocker. For each site, general features of fish habitat, including water temperature, substrate, cover and water depth were assessed. Fish caught were identified and enumerated, and fork lengths of selected species were measured.

2.2 Stream Discharge and Temperature Measurements

Throughout the field season, water temperatures were recorded continuously at the mouth of the upper Atna River by a Peabody-Ryan Model J Thermograph and at the lake outlet by a temperature sensor installed by Crippen Consultants on June 10, 1980. Minimum/maximum thermometers and staff gauges, installed in the lower and upper river, were read daily during trap checks. Water levels at the lake outlet were also recorded continuously by Crippen's water stage manometer.

To estimate river discharges of the upper Atna River, transects were established on both channels just upstream of the mouth and depth/velocity measurements were made using a Marsh-McBirney flow meter. To develop a graph of discharge versus stage, the upper river was metered on six occasions, each at different water levels. Discharge data for the lower river were obtained from Crippen Consultants.

2.3 Limnological Measurements

a) Bathymetry:

On June 22, 1980 nineteen transects on Atna Lake were sounded using a Furuno FG-200 Mark III Echosounder. The depth data obtained from the transects were used to produce a bathymetric map of the lake.

b) Dissolved Oxygen and Temperature Profiles:

On June 14 and August 16, 1980 dissolved oxygen and temperature profiles were measured at six stations in Atna Lake using a YSI model 54 oxygen-temperature meter with a 15m probe. Water temperature and dissolved oxygen readings were recorded at the lake surface and at 1m intervals to a depth of 15 meters. A Secchi disc was used to determine lake transparency at each station.

c) Plankton Sampling:

Phytoplankton and zooplankton samples were collected at each of the above stations. Zooplankton was sampled using a 25 cm diameter plankton net with a mesh size of 70 microns. Vertical hauls were taken from a depth of 15 m at each station, and the samples were preserved using 10% formalin. Phytoplankton was collected by filling a 500-ml polyethylene bottle at a depth of 0.5 meters. Samples were preserved with Lugol's solution. The species composition and relative abundance of organisms in the phytoplankton and zooplankton samples were determined in the laboratory.

3.0 RESULTS AND DISCUSSION

3.1 Fish Resources

Fish species present in the Atna Lake system include sockeye salmon (Oncorhynchus nerka), coho salmon (O. kisutch), Dolly Varden char (Salvelinus malma), lake char (S. namaycush), mountain whitefish (Prosopium williamsoni) and longnose suckers (Catastomus catastomus). Chinook salmon and rainbow trout were not observed.

In Atna Lake, the resident fish community consisted of Dolly Varden char, lake char, mountain whitefish and longnose suckers. Sockeye salmon spawned in the lake and juveniles may rear in the lake for one or two years. Sockeye fry are the dominant species in littoral areas during spring and summer prior to moving into the offshore region of the lake. Dolly Varden char, coho salmon juveniles, and longnose suckers predominated in streams. Dolly Varden were ubiquitous in the system while coho salmon and longnose suckers were more restricted in their distribution. The following section provides information on life history, distribution and relative abundance of both the anadromous and resident species found in the Atna Lake system.

3.1.1 Sockeye Salmon

3.1.1.1 Adult Sockeye:

Upstream Migration

Sockeye salmon migration into the Morice system usually starts in early August, peaking in the middle of the month (Shepherd 1979). At Atna Falls, sockeye were present during the observation period from August 4 to August 24 and were likely present prior to our first observations. Based on sockeye counts at Owen Creek counting tower in the Morice River, migration in 1980 was approximately two weeks early, extending from July 25 to August 10 (Farina 1982).

Based on periodic counts from August 4 to August 8 and daily counts from August 8 to August 20, the total estimated number of sockeye successfully jumping the falls was approximately 200 fish. The daily number of migrants is shown in Figure 3.1. Figure 3.1 also presents the hourly migration rates combining data from August 8 to August 20. Migration over the falls was not expected to occur at night. Banks (1969) suggests that night migration does not usually occur at an obstruction. Although peak activity was from 1600 to 2000 hr, some activity may have occurred before and after the daily

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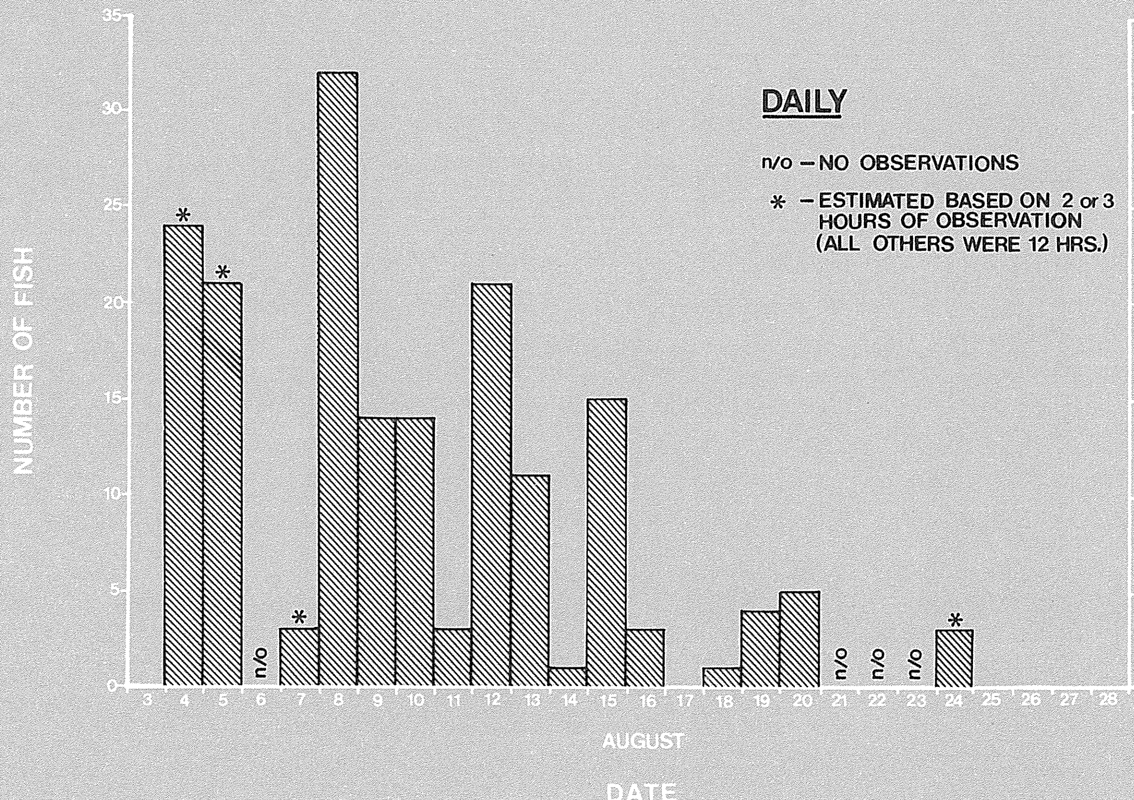
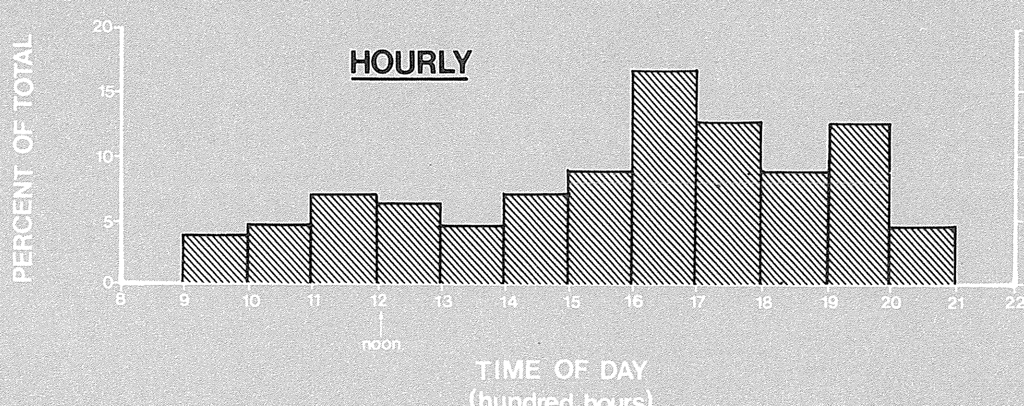
FIGURE 3.1

DAILY AND HOURLY MIGRATION OF SOCKEYE SALMON AT ATNA FALLS, 1980





period of observation, resulting in an underestimate of daily counts. These data suggest that migration into Atna Lake was either at or just past its peak when observations began. Assuming that sockeye did not delay in Morice Lake, but entered Atna River shortly after July 25, the spawning population in Atna Lake was estimated by doubling the count to account for fish which migrated before initiation of counts on August 4 or before 0900 and after 2100 hrs during the enumeration period.

During the period of migration, daily discharges ranged from 20 to 40 m^3/s and temperatures at the lake outlet averaged about 11°C.

Spawning

Sockeye salmon in the Atna Lake system appeared to be exclusively beach spawners. Extensive aerial and boat surveys in September and October did not indicate any spawning activity in the tributaries. Since the turbidity of Atna Lake precluded visual assessments, the following description of the timing, distribution and population characteristics of lake spawners is based on carcass recoveries.

Figure 3.2 presents data on 128 carcasses recovered between September 13 and October 16, 1980. These data suggest that sockeye spawning likely began in early September, peaked in mid- to late September and ended in early October. This assumes an average residency time on the redds of 8 to 15 days as reported for other sockeye stocks (Killick 1955). The timing of recovery of male and female sockeye carcasses differed. Male carcasses were the first to be observed with 50% recovered by September 28. Over 50% of the female carcasses were recovered one week later. Of the recovered fish, 40% were males. A higher percentage of females is common in Skeena River stocks (Killick and Clemens 1963; Foerster 1968).

The major spawning area in Atna Lake was in the northeast section as shown in Figure 3.3. Over 50% of the carcasses were recovered in Area 4 and 10% in each of the adjoining Areas 3 and 5. This section of the lake receives inflows from the surrounding terrain which likely results in areas of upwelling and suitable spawning habitat. The depth of spawning could not be determined, but sockeye are known to spawn as deep as 10 m in Morice Lake (Shepherd 1979) and 30 m in an Alaskan Lake (Koo 1962). The substrate along the shoreline consisted of cobble and smaller gravel patches, particularly at creek mouths. Based on cursory studies in 1961, the major spawning area was in Area 1 (Department of Fisheries & Oceans unpublished data). However, only a small percentage of carcasses were recovered in this area in 1980.

Stock Characteristics

Length frequency and age-length data for male and female sockeye are presented in Appendix K2, Figures K2.1 and K2.2. The mean length of males was 49.0 cm and was significantly greater ($p < 0.05$) than that of 45.4 cm for females.

The spawning population consisted of fish which had spent 3 or 4 years in the ocean and 1 or 2 years in freshwater. The dominant group (58%) were 5_3's, (fish that had spent 2 years in freshwater and 3 years in the ocean). The subdominant group (4_2's), representing about 29% of the run, had spent 1 year and 3 years in freshwater and seawater, respectively. As shown in Appendix K2, Figure K2.2, the mean lengths of sockeye for different age classes indicate that size is determined largely by number of years in the ocean environment. For example, the mean length of age classes 4_2 and 5_3 (3 years ocean residence) are comparable. Similarly, the mean lengths of age classes 5_2 and 6_3 (4 years ocean residence) do not appear significantly different.

The age distribution of Atna Lake sockeye differed from both the Nanika and other Skeena stocks. Age data for Nanika River sockeye (1965-74) indicate that the major proportion of spawners were five and six years old, both having spent two years in freshwater (Shepherd 1979). The percentage of 4_2's was minor except in 1972 when 45% of the spawners were in this age category. This differs from other Skeena stocks (particularly Babine stocks) which are primarily (91%) 4_2's and 5_2's (Shepherd 1979).

3.1.1.2 Juvenile Sockeye:

Age and Growth

Emergence of sockeye fry in Atna Lake commenced before the end of May and likely extended through July. This is consistent with Nanika River sockeye which are reported to emerge between May and late July with peak emergence in mid-June (Shepherd 1979). Length frequency distributions of sockeye fry during each sampling period are shown in Appendix K2, Figure K2.3. The mean length of fry in Atna Lake increased from 34.0 mm in early summer to 52.0 mm in September. Although young-of-the-year sockeye predominated in the beach seine and fyke net catches, juvenile sockeye of other size classes were present. In June, individuals ranging from 60 to 80 mm were yearlings (sub-2 smolts) and fish over 100 mm may have been two year old fish (sub-3 smolts). The average length of sub-2 and sub-3 smolts from Morice Lake in 1980 was 87.3 mm (64 -120 mm) and 117.8 mm (74 -147 mm), respectively (Kadawaki unpublished data).

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FIGURE 3.2

RECOVERY OF SOCKEYE CARCASSES IN ATNA LAKE, 1980

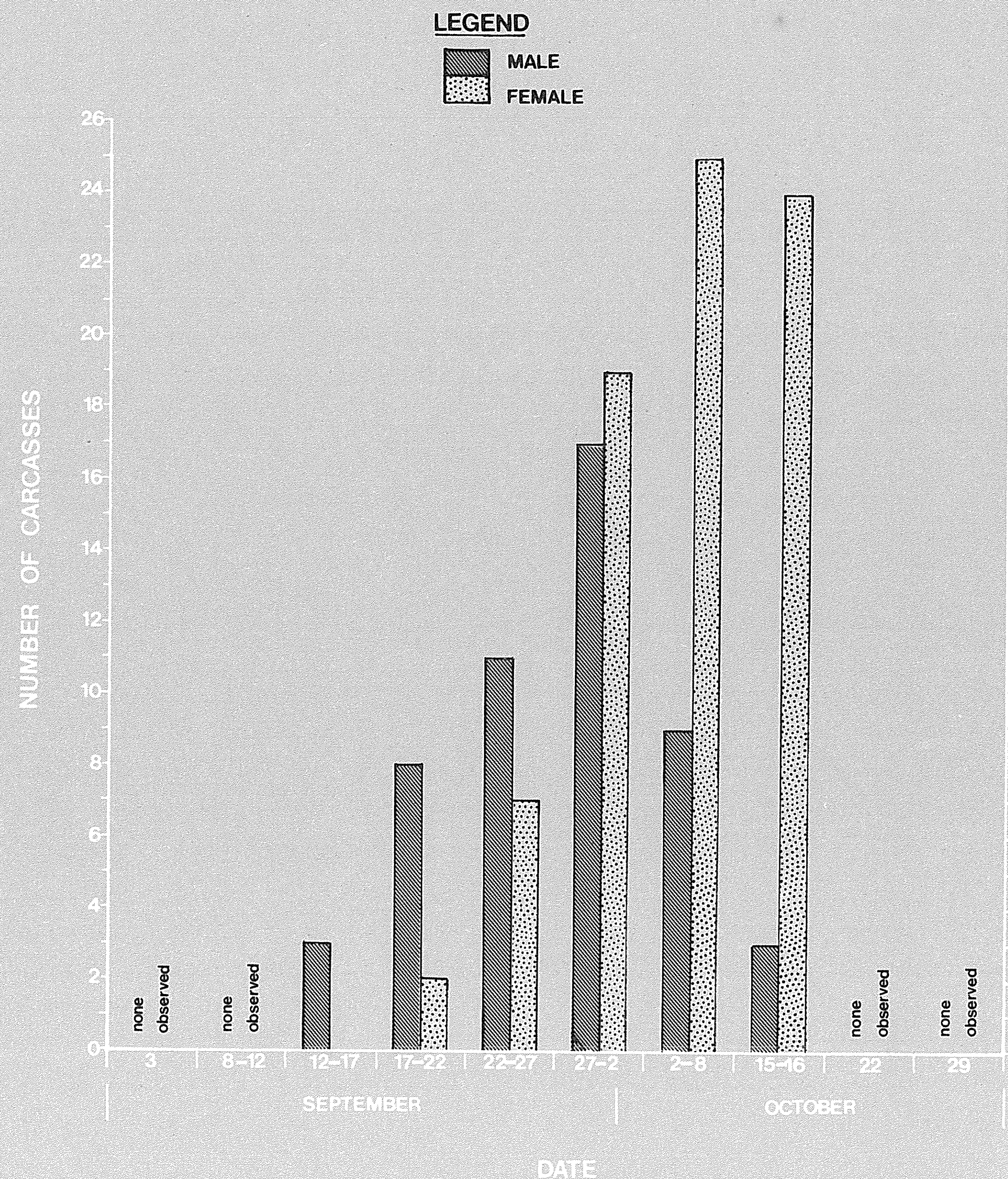

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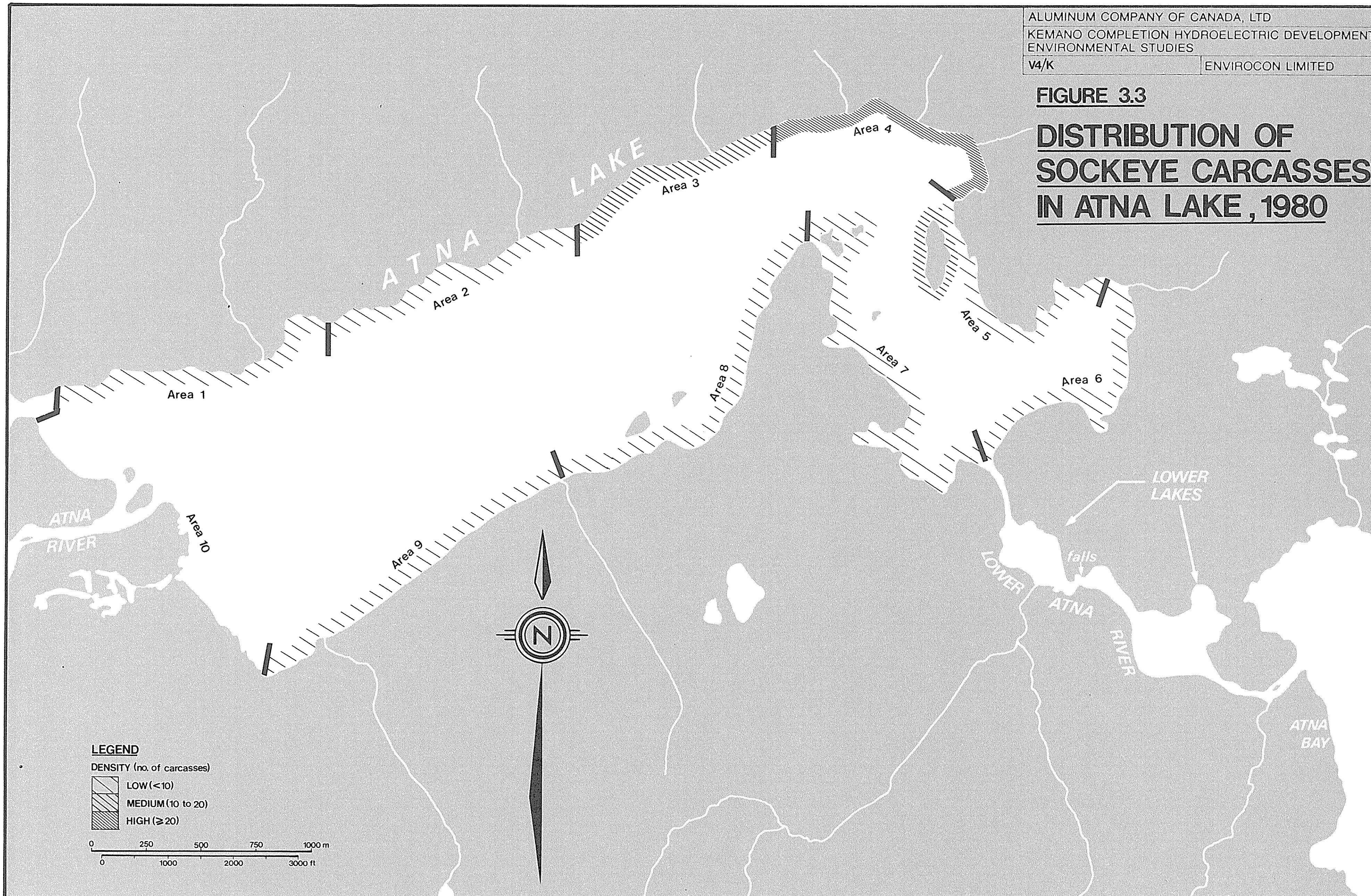
FIGURE 3.3

DISTRIBUTION OF SOCKEYE CARCASSES IN ATNA LAKE, 1980



Distribution and Abundance

Sockeye juveniles rear in Atna Lake and in the small lakes in the lower Atna system. A summary of sampling results is presented in Appendix K3, Tables K3.1-K3.3. Sockeye fry comprised over 90% of the total littoral fish population. A small number of sockeye fry were also observed in the channels at the northwest end of the lake and in the lower reaches of Creek C9. These fish had likely dispersed into these areas from the lake. No sockeye fry were observed in the upper Atna River or any of its tributaries.

The lake distribution of sockeye fry was characteristic of that in other sockeye rearing lakes (Burgner 1958). During the late spring - early summer period, sockeye fry are concentrated along the shoreline with peak abundance occurring in late June. As shown in Figure 3.4, numbers declined significantly from mid-summer through fall; average catch per set decreased from greater than 100 to less than 10. This decrease is primarily associated with movement offshore. Although offshore areas were not sampled, visual observations on calm evenings indicated that juvenile sockeye were well distributed in the offshore regions. Schools were observed at the surface.

The behaviour of sockeye fry has been described by Burgner (1958). After emergence, sockeye fry have limited swimming ability and seek sheltered, inshore areas where cover in the form of gravel or cobble and rooted vegetation is available. In this habitat, the young fry feed on microbenthos. As fry increase in size, they move offshore and begin feeding on zooplankton. They often exhibit two major diel movements; moving into deeper waters in the early morning and to the surface in the evenings. Dispersal in the lake is largely dependent on lake morphology and water currents. In multibasin lakes, distribution may be restricted to a particular water mass. However, in less complex lake systems like Atna Lake, sockeye may be distributed throughout the lake.

Visual observations and sampling in early summer indicated that sockeye were dispersed along much of the lake periphery. The distribution was related to types of habitat. Sockeye fry favored sheltered beaches and were concentrated in flooded marshes along the lake edge (Stations 14 and 15 and 8 to 11). This kind of habitat was also prevalent in the lake above the falls. These areas were often characterized by warm temperatures, and abundant vegetation for cover, and were probably relatively rich in microbenthos. The fry were also common along gravel beaches but were scarce in the northwest section of the lake along the sand/silt mudflats up to Atna River delta (Stations 19 - 22). An analysis of the size distribution of fry from the different sampling areas indicates a larger mean size at the outlet end of Atna Lake (Stations 8 to 11) and in the lower lake during both early and late summer. This could result from movement of larger fry downstream to these areas or an increased growth rate in these habitats.

It should be noted that all habitats could not be compared as beach seining was limited to gradual sloping beaches with silt or small gravel substrates. Much of the Atna Lake shoreline is characterized by cobble and log debris which could not be effectively sampled. Sockeye fry were observed in these areas including the northeast section of the lake identified as the major sockeye spawning grounds.

Downstream Migrations

Movement of sockeye fry out of Atna Lake was observed from late May through August. No fish were recovered at the lake outlet in September. The total number of fry sampled in the fyke net was 186. The catch over the sampling period is shown in Figure 3.5. Catches showed a similar trend to beach seining results; numbers peaked in early summer and declined later in the season. Previous studies also indicated fry movement out of Atna Lake (pers. comm., R. Palmer, Department of Fisheries and Oceans), with over 500 fry sampled in a fyke net below the falls during 264 hours of operation in August 1961. These fry probably reared in Morice Lake before smolting.

The length distribution of fry sampled at the outlet is shown in Appendix K2, Figure K2.4. In June, the mean length was similar to that of fry sampled by beach seine in Atna Lake. In the summer sample, the mean length of fry in the fyke net appeared greater (45 mm compared with 41 mm in Atna Lake). The difference may be due to the small sample size.

No sockeye fry migration into Atna Lake from the upper Atna River was observed between late May and the end of June. Observations in the fall indicated that sockeye did not spawn in the Atna River. Some downstream movement of sockeye fry would have been expected during this period if sockeye salmon had spawned in the river. One fry was trapped in mid-summer but it may have moved into the river from the lake.

No sockeye smolts were sampled in the fyke net at the lake outlet, although a few sub-2 smolts and sub-3 smolts were sampled in the lake above the falls. Sockeye smolts which may have originated in Atna Lake were also noted in Atna Bay in June. The peak downstream migration of sockeye smolts from Atna Lake likely occurred shortly after ice break-up, prior to installation of the trap. Peak migration at the outlet of

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FIGURE 3.5

FYKE NET CATCHES OF JUVENILE SOCKEYE AT THE OUTLET OF ATNA LAKE, 1980

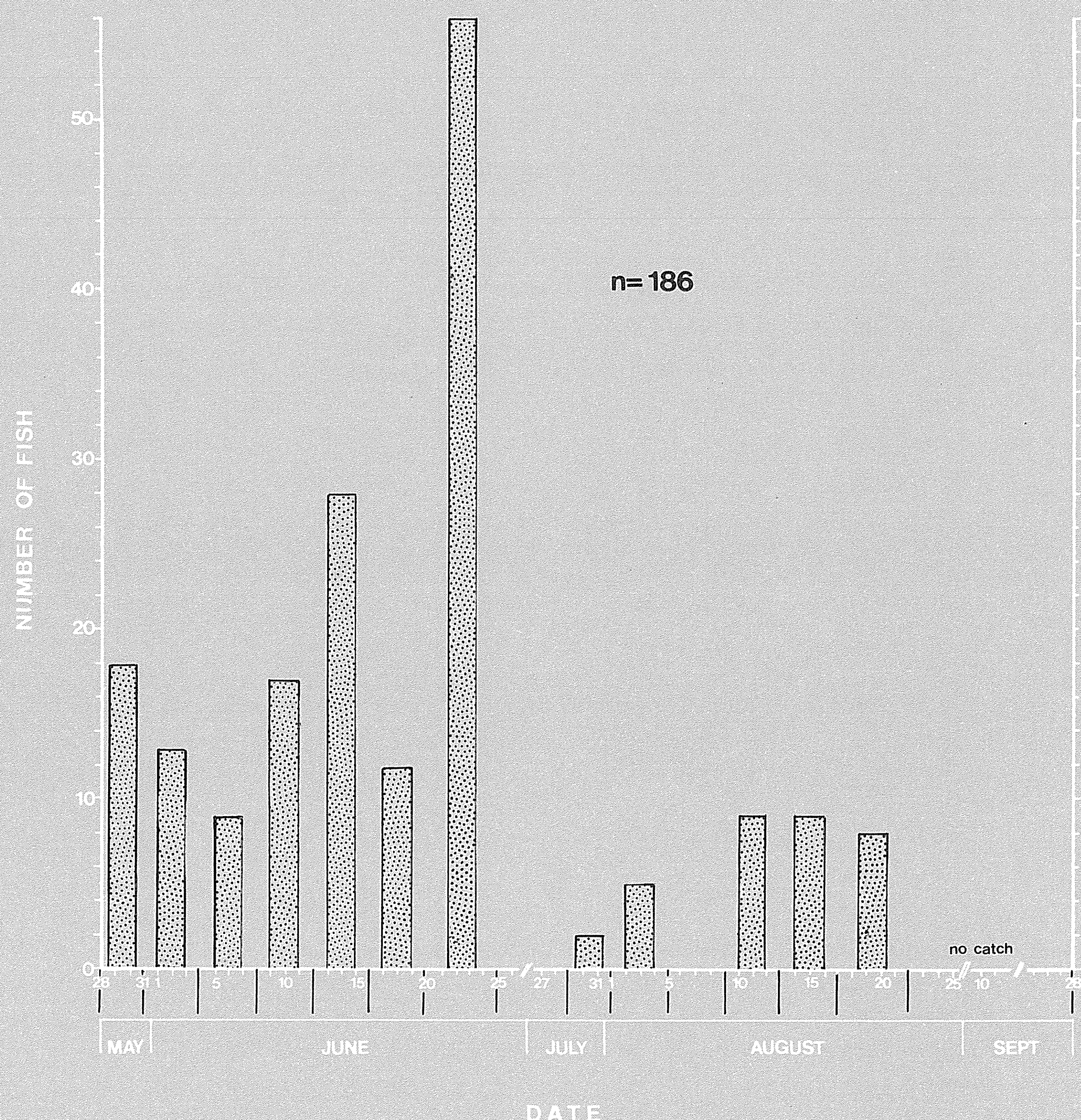

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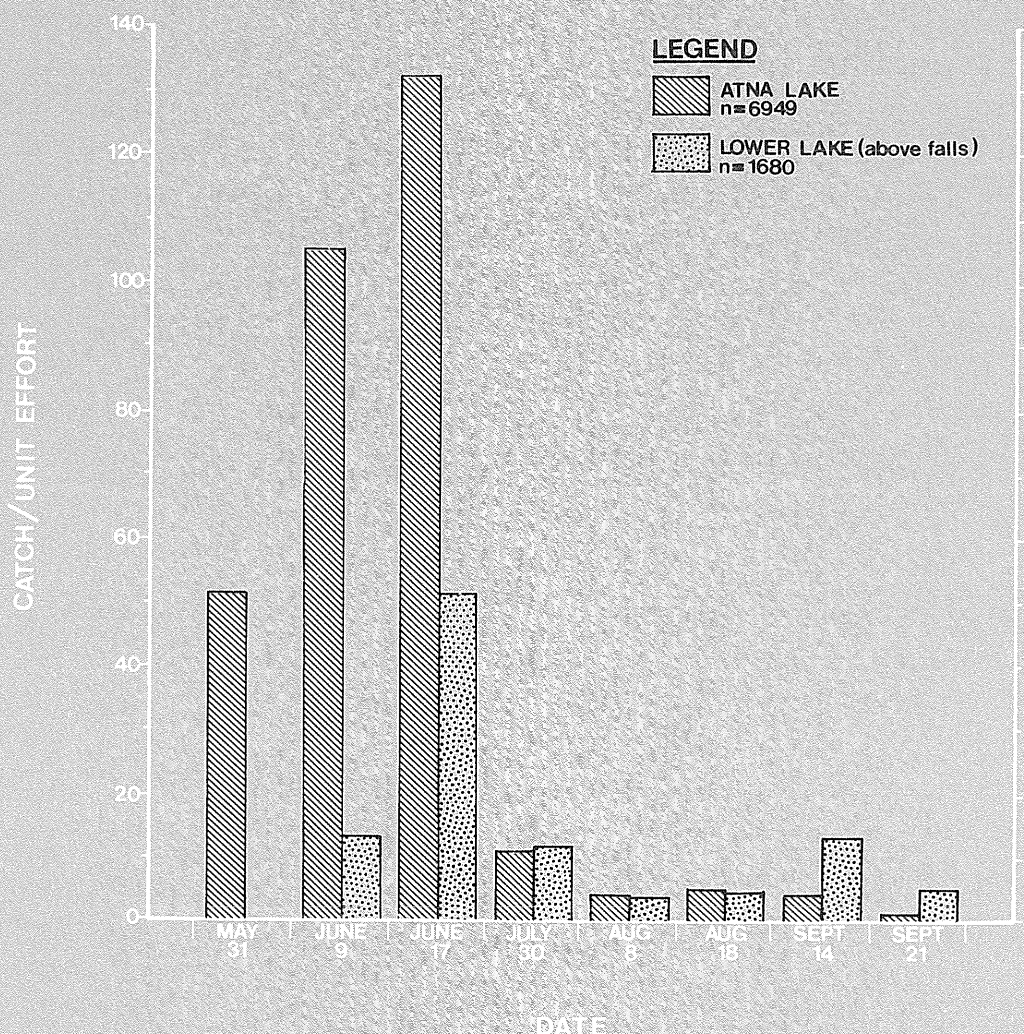
FIGURE 3.4

BEACH SEINE CATCHES OF JUVENILE SOCKEYE IN THE ATNA LAKE SYSTEM, 1980



Morice Lake usually occurs in mid - May (Shepherd 1979). In 1980, 75% of the smolts migrated during a 10 day period in mid-May; a secondary peak occurred in late May and only a few smolts were recovered in June (pers. comm., R. Kadawaki, Department of Fisheries and Oceans).

3.1.2 Coho Salmon

3.1.2.1 Adult Coho:

Upstream Migration and Spawning

Peak migration of coho salmon in the Morice River is reported to occur from mid-August to early September and peak spawning from mid- to late November (Shepherd 1979). In 1980, observations at the Owen Creek counting tower indicated that the migration of coho extended from August 7 until early October (Anon. 1980). Coho spawners were observed at the outlet of Morice lake through the month of November.

Adult coho were not observed in the Atna system despite extensive boat and aerial surveys from early September to mid-October and weekly aerial surveys from the end of October to early December. In addition, no coho salmon were identified during the observations at Atna Falls in August. In mid-November when spawning in the Morice River appeared to be at its peak, no spawners were observed in the Atna River even though visibility was good. However, small numbers of coho spawning in the system could have been missed. Shepherd (1979) reported 5 adult coho in the upper Atna River, two to three kilometers upstream of its mouth in November 1974.

The occurrence of fry and yearlings in the Atna River and tributaries indicates that some coho salmon spawn in the system. Although the Atna river mainstem has suitable spawning gravel throughout its lower and middle reaches, cold temperatures, unstable flows and glacial silt resulting in compacted gravels may limit its spawning potential. The distribution of fry did not aid in the identification of spawning areas except to indicate that spawning may occur up to 9 km in the Atna River.

Based on a qualitative assessment of physical stream characteristics (substrate composition, flow stability, turbidity and temperatures), several tributaries were identified as having potential coho spawning habitat. These included the upper reaches of T3 and T13, Creek C4 at the northwest end of the lake and possibly T8, a side channel of the Atna River that has some groundwater seepage.

3.1.2.2 Juvenile Coho:

Coho juveniles were present in small numbers in the Atna River and several of its tributaries, and in lake tributaries. A total of 87 coho was sampled from June to October from 1,024 minnow trap sets. Juvenile coho represented 10% of the salmonid catch and 3% of the total catch. Sampling results are presented in Appendix K3, Tables K3.4 to K3.6.

Age and Growth

The majority of coho juveniles sampled were fry (0+ age class) and yearlings (1+). Length frequencies are presented in Appendix K2, Figure K2.5. In June, coho ranged from 55 to 125 mm. Most of these were yearlings, although age interpretation of scales indicates some overlap of yearlings and two year old fish (2+) in the 100 mm range. The length distributions of coho in the Atna system are consistent with the size ranges reported for the Morice River; yearlings ranged from 60 to 100 mm and juveniles in their third year (sub- 3 smolts) were 100 to 125 mm long. Coho smolts sampled in Atna Lake and Atna Bay averaged about 115 mm and were likely in their third year.

Coho fry were first observed in August and ranged from 30 to 50 mm. Near the end of the growing season, fry measured 50 to 70 mm and yearlings from 80 to 135 mm.

Distribution of Juvenile Coho

The distribution of coho fry and yearlings is shown in Figure 3.6. Although the sample size is small, macrohabitat preferences of coho juveniles were apparent. Coho juveniles were absent or were very rare in glacial fed streams. The systems where coho were more commonly found had clear, humic stained waters, a muddy substrate, slow to negligible flows and abundant cover in the form of aquatic macrophytes and/or streamside vegetation. Temperatures were often several degrees warmer than the glacial streams. In some sloughs, the difference in temperatures was greater than 10°C. Coho preference for these kinds of habitat has been documented elsewhere (Shepherd 1979; Section A of this volume).

A comparison of minnow trap catches provides a perspective on relative abundance of coho juveniles. Minnow trapping in relatively productive ponds and sloughs in the Morice river system yielded an average of 5 to 10 yearlings (1+) per trap (Section A). In the Atna system, average minnow trap catches never exceeded 1 coho per trap. In

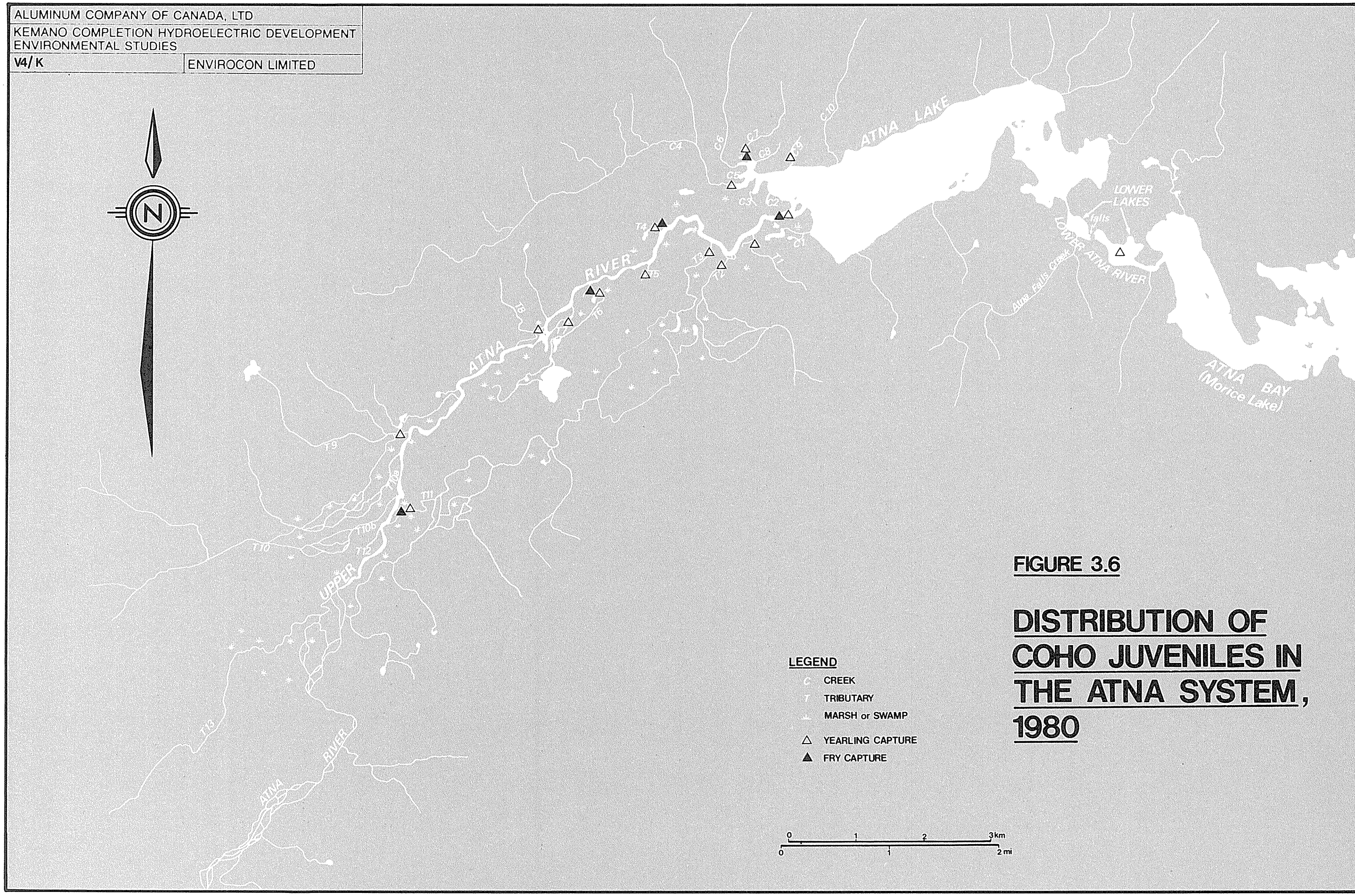


FIGURE 3.6

DISTRIBUTION OF COHO JUVENILES IN THE ATNA SYSTEM, 1980

the Morice and Nanika River mainstems, average catch per trap was 0.7 and 1.5 yearlings per trap, respectively, compared with an average catch of less than 0.1 in the mainstem of the Atna River. Electrofishing results in August confirmed the distribution pattern and low density of coho juveniles.

Although sloughs and beaver ponds are common in the sedge meadows of the upper Atna River, the total amount of coho rearing habitat is reduced by restricted access resulting from beaver activity. Tributary T6, for example, appeared to have excellent rearing habitat throughout although only suckers were taken in the upper reaches.

Tributary T3 is one of the largest tributaries to the Atna River and appeared to have good rearing opportunities throughout its length and potential coho spawning habitat in the upper reaches. Due to access problems, juvenile sampling extended only 2 km upstream to a point below the first series of beaver dams. This section of the river exhibited two types of habitat: a lower slough-like reach and an upper reach with a gravel substrate and pool-riffle characteristics. Sampling using both minnow trapping and electrofishing techniques in both habitats yielded relatively small numbers of coho yearlings and no fry. Aerial observations in the fall also failed to locate any adult coho in this stream. Therefore, distribution of coho juveniles above the first series of dams has not been confirmed.

Coho fry were first sampled by electrofishing in August. Size ranges of 30 - 50 mm indicated that, although some fry had recently emerged, emergence had probably begun before August. In the Nanika River, fry emergence extended from mid-May to July, peaking in June. The systems utilized by fry were similar to that inhabited by yearlings as shown in Figure 3.6. The very small numbers of fry sampled may have reflected a small escapement in 1979. The Morice River escapement that year was the smallest on record.

Coho fry and yearlings did not utilize the littoral habitat of Atna Lake and the lower lakes for rearing to any great extent. Three smolts were sampled in inshore areas of Atna Lake in early summer; however no other juveniles were observed in late summer or fall. In the lower Atna system, a few yearlings were present in the lake below the falls.

<u>Downstream Migration of Juvenile Coho</u>

Downstream migrations include movements of fry and seaward migration of smolts. Downstream migrations in the upper Atna River were not detected with the incline plane trap. However, five fry ranging from 35 to 45 mm were caught in the fyke net at the lake outlet in mid-August.

No smolts were captured either in the incline plane trap or the fyke net. In June, three smolts were netted in Atna Lake and, in a separate study, 28 coho smolts were netted in Atna Bay. The mean length of these smolts was 115 mm and they were likely in their third year (Sub - 3s). Coho greater than 100 mm in the June minnow trap sample may have been pre-smolts and would migrate later in the season. Coho smolts in the Morice River were recovered from mid-May to mid-June. The migration period was longer than that for sockeye. However, total numbers were less than 100 smolts.

3.1.3 Dolly Varden Char

Dolly Varden char were the most abundant salmonid species in Atna Lake tributary systems. A total of 774 char was sampled by minnow trapping with an average catch of approximately 0.8 fish per trap. Dolly Varden represented 90% of the total salmonid catch and 27% of the total fish catch. Sampling results are presented in Appendix K3, Tables K3.7 to K3.9.

Dolly Varden char sampled in streams may represent two populations: 1) a juvenile population which migrates to the lake after rearing two to four years, and 2) stream residents. The length frequencies and size at maturity observed in the Atna system indicate a dwarf population. Stunted populations are common in high altitude, inland or northern areas (Scott and Crossman 1973). The characteristics of such populations, which have been studied in Alaskan systems, are small size, early maturity, reduced fecundity and shortened life span (Armstrong and Morrow 1980). These fish are also paedomorphic, retaining their parr marks throughout their lives.

Age and Growth

Dolly Varden char in the Atna system ranged from 20 to 200 mm. Although minnow traps are size selective and limit the maximum size of fish sampled, larger individuals were not obtained by electrofishing, beach seining or gill netting. This size range is consistent with observations in many Alaskan streams and lakes where resident Dolly Varden do not exceed 150 mm and 200 mm, respectively.

The length frequency distributions and age-length relationship of Dolly Varden for each sampling period are shown in Appendix K2, Figure K2.6. Based on scale interpretation, 2 year old fish had a mean length of 113 mm (64-130 mm) and 3 year old fish were 147 mm (128-165 mm) in late summer.

Distribution and Abundance

Dolly Varden char were ubiquitous in the Atna streams (Figure 3.7). Dolly Varden inhabited the upper Atna River and its tributaries, Atna Lake and inlet creeks, and the lower river section. They were found in both the fast flowing, turbid glacial streams (T2, T9, T10 and T13) as well as the spring fed streams and sloughs. Dolly Varden was often the only species sampled in the glacial tributaries of the Atna River. The distribution of Dolly Varden in headwater areas least utilized by juvenile salmon and trout was also observed in the Morice River system (Section A).

A comparison of the relative abundance of Dolly Varden char in the two major types of stream habitat did not indicate any differences in June. However, a seasonal trend was indicated. Some tributaries, particularly C4 and T3, exhibited a large increase in Dolly Varden catches in the fall. This increase likely reflected the migration of spawners into these streams, the addition of young-of-the year fish in the minnow traps and/or the movement of juvenile fish to overwintering habitat.

Some observations were made on the distribution of Dolly Varden char in relation to specific habitat characteristics (i.e., temperature, cover, velocity and depth) recorded at each minnow trap site. Dolly Varden were tolerant of a wide range of temperatures (from 4°C to 20°C). At temperatures greater than 20°C, which occurred in some sloughs in the summer, Dolly Varden were absent or numbers declined and longnose suckers predominated.

Cover and velocity appeared to be important components of Dolly Varden char rearing habitat. In glacial streams where velocities were often moderate to fast, Dolly Varden were usually present along stream margins or in side or back channels where velocities were slower and overhanging vegetation and banks provided good cover. Areas with no cover and medium to fast flows (riffles) generally had poor catches. This distribution in the Atna mainstem and some of the major streams was confirmed by electrofishing at representative sites. No obvious differences in abundance were noted in regard to water depth, which ranged from 0.2 to 1.5 m, or turbidity.

The moderate abundance of Dolly Varden char in beaver ponds, sloughs and backwater habitats could result in potential competition with coho juveniles. Studies of sympatric populations of coho and Dolly Varden have indicated that interactive segregation occurs (Armstrong and Elliott 1972). Dolly Varden tended to occupy the benthic region while coho inhabited the middle and upper parts of the water column.

Some Dolly Varden fry rear in the littoral zone of Atna lake and the lake above the falls although this does not appear significant. Only a few newly emerged fry were observed in the lower lake in late June and several young-of-the year were sampled in both lakes during summer and fall. In Atna Lake, a few Dolly Varden ranging from 125 to 185 mm were sampled in inshore areas by seine and gill net. Minnow trap catches along the shore of the lake above the falls were comparable with the upper Atna river (0.5 to 0.7 fish per trap). These fish ranged from 80 to 150 mm. As this size class was not effectively represented in the beach seine catches at similar sites, the relative abundance of Dolly Varden in Atna Lake may be underestimated. In the lake below the falls and lower river, Dolly Varden are noticeably less abundant with catches per trap averaging less than 0.1. Catches in these traps were often dominated by prickly sculpin which are not present above the falls.

Dolly Varden Spawning and Emergence

Dolly Varden char are fall spawners, reported to spawn between September and November depending on the geographic area (Scott and Crossman 1973). Males with ripening gonads were observed in late September and early October in Tributaries C4, C7, C8, T3, T4 and T8. These fish ranged from 90 -150 mm and the mean fork length of 20 male spawners was 127 mm. Two mature females were 135 and 140 mm. Based on observed length frequencies of Dolly Varden and age interpretation of scales, these fish would represent age classes 2+ and 3+. Age at maturity for Dolly Varden char is reported to be three years or older (Scott and Crossman 1973). However, mature two year olds have been documented for some dwarf populations (Armstrong and Morrow 1980). In an Alaskan stream, the average fork length of mature fish was 114 mm (91 to 207 mm) which is comparable to the Atna population. The Alaskan fish were apparently three and four year olds.

Spawning Dolly Varden char were first observed at the end of October on redds in Tributary C4 at the northwest end of Atna Lake. In early November, between 60 and 75 Dolly Varden ranging from 100 to 250 mm long were spawning in a small creek entering C4. The spawning subtrate consisted of small gravels (1-2 cm) and sand. Water depth was between 20 and 30 cm and water velocity was slow (2 to 3 cm/s). Water temperature was 4^{o}C, colder than other reported spawning temperatures of 5.2 to 7.8 ^{o}C (Scott and Crossman 1973; Armstrong and Morrow 1980). Observations a week later indicated that spawning was completed.

Emergence of Dolly Varden fry was noted in late June. This is about one month later than the emergence date reported for more southern populations (Scott and Crossman

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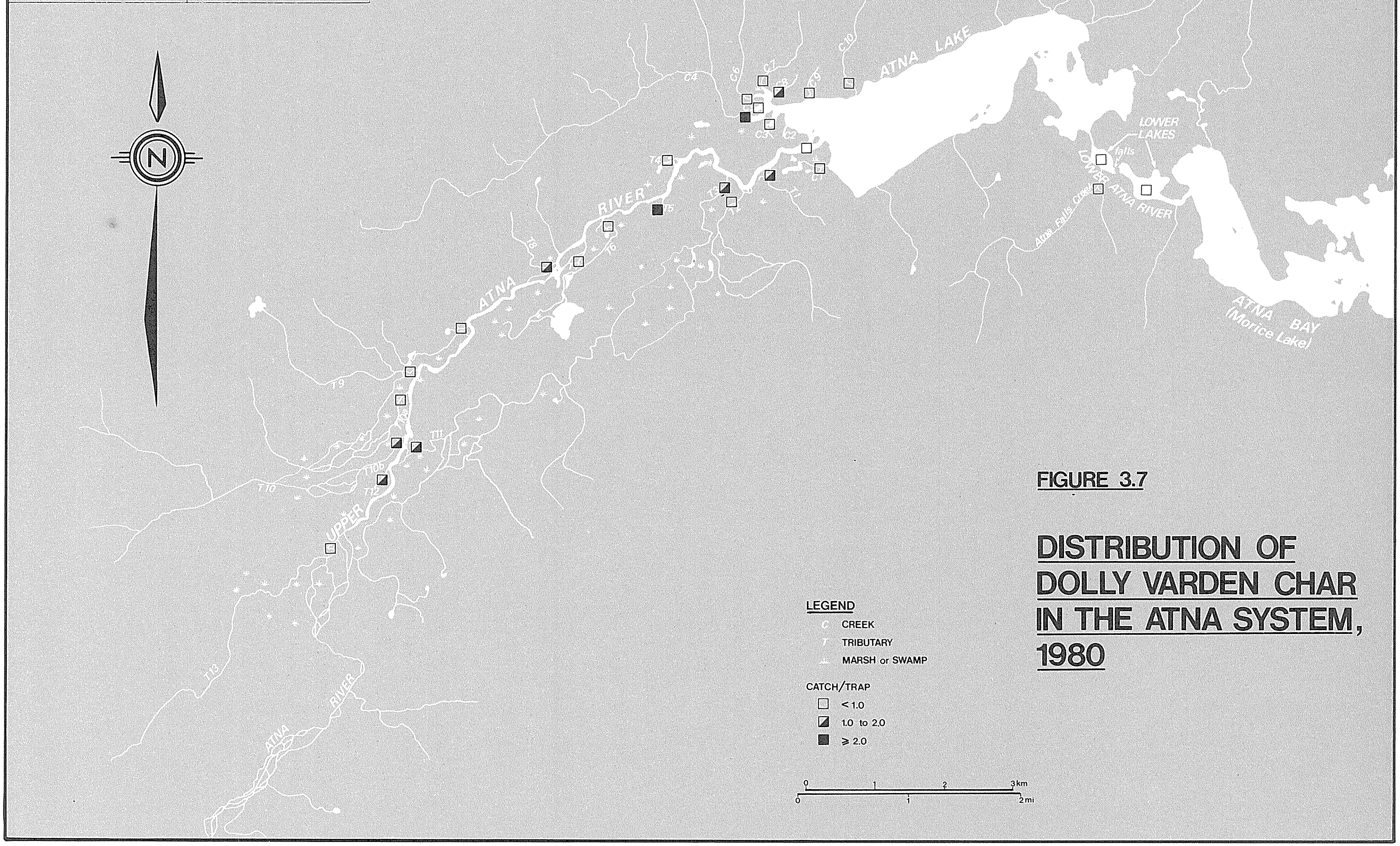

FIGURE 3.7

DISTRIBUTION OF DOLLY VARDEN CHAR IN THE ATNA SYSTEM, 1980

1973). Dolly Varden fry ranging from 20-30 mm were electrofished from the gravels in C4 and were observed concentrated at the mouth of small inlet creeks. The water temperature was 7°C. By August, Dolly Varden fry had moved from the gravels to stream margins and beaver ponds where cover was available.

Although spawning and emergence of Dolly Varden was observed in C4 only, potential spawning areas include the lake tributaries C8 and C9 and Atna River tributaries T3 and T8. These have suitable small gravel substrates, slow to moderate velocities, relatively stable flows and higher temperatures than the mainstem river. Other major streams including the mainstem Atna River and upper tributaries have extensive gravels but spawning may be limited by high silt loads, unstable flows and temperatures near 0°C. In these streams spawning might occur in side channels which have some groundwater influence.

3.1.4 Mountain Whitefish

Mountain whitefish were found in Atna Lake, in the upper Atna River and several tributaries, and in the lower lakes. Mountain whitefish were relatively common in Atna Lake, representing about 20% of the gill net catches and up to 50% of the beach seine catches. However, they were not abundant in the streams, where only 16 whitefish were caught during the field season. Sampling results are presented in Appendix K3, Tables K3.10 to K3.12.

Age and Growth

Length frequency distributions and length-age relationships for mountain whitefish are shown in Appendix K2, Figures K2.7 to K2.9. Age categories of juvenile fish correspond with the modes in length distribution. It should be noted that the 1+ age class was sampled in late summer while most of the older age classes were sampled in June. Yearlings at the beginning of their second year would be about 55 to 75 mm. Young-of-the-year (0+) whitefish ranged from 25 to 45 mm in summer and were between 45 and 65 mm in September. Growth rate is slow compared with those reported for mountain whitefish populations in other British Columbia and Alberta populations (Scott and Crossman 1973). Maturity is reported to occur at three or four years of age. Fish less than 200 mm are therefore considered juveniles.

Distribution and Abundance

Adult whitefish were common in Atna Lake and measured up to 350 mm in length. Only two adult mountain whitefish were sampled in the upper Atna River although this does not necessarily reflect low abundance. Adult mountain whitefish were frequently observed during snorkel surveys in deep fast water in the Morice River (Section A). These habitats were not easily sampled with the methods utilized in this study. Cover and depth did not appear to be important habitat characteristics and mountain whitefish were often in midstream areas (Section A).

Juvenile whitefish reared in the littoral areas of Atna Lake and the lower lake. Beach seine catches in Atna Lake and the lower lake are shown in Figure 3.8. Catch per unit effort ranged from less than 1 to 8 whitefish. An analysis of the seasonal trend in catches indicates that the highest density of whitefish occurred in July in Atna Lake and in September in the lower lake. These catches reflect the addition of whitefish young-of-the-year in the samples.

Beach seine catches indicated that preferred habitats were beaches with muddy substrate and abundant submerged vegetation. As shown in Appendix K3, Table K3.12, the average catch per set was higher on the mudflats at the west and east ends of the lake (Stations 14-22 and 8-11) than on the gravel beaches of the north shore (Stations 1-7). At Stations 14 and 15, catches were always larger on the flooded mudflats and marshes during high water than on the gravel beach which was also sampled at lower water levels.

Catches of juvenile mountain whitefish in streams were low but confirmed the presence of mountain whitefish in the Atna River and in Tributaries T3, T4, T6 and lake tributary C7. Whitefish sampled ranged from 37 to 180 mm, indicating juvenile rearing in the Atna River and some tributaries. Due to the small number of whitefish sampled, information on habitat preferences is limited. The whitefish fry were associated with stream shallows and gravel substrate. Most of the older juveniles were found in backwater habitats with both Dolly Varden char and coho salmon.

Spawning and Emergence

Spawning whitefish were not observed in the Atna Lake system. Spawning is reported to occur in the late fall or early winter over gravel (Scott and Crossman 1973). Lake dwelling populations usually spawn in streams but lake spawners have also been reported (Hagen 1970).

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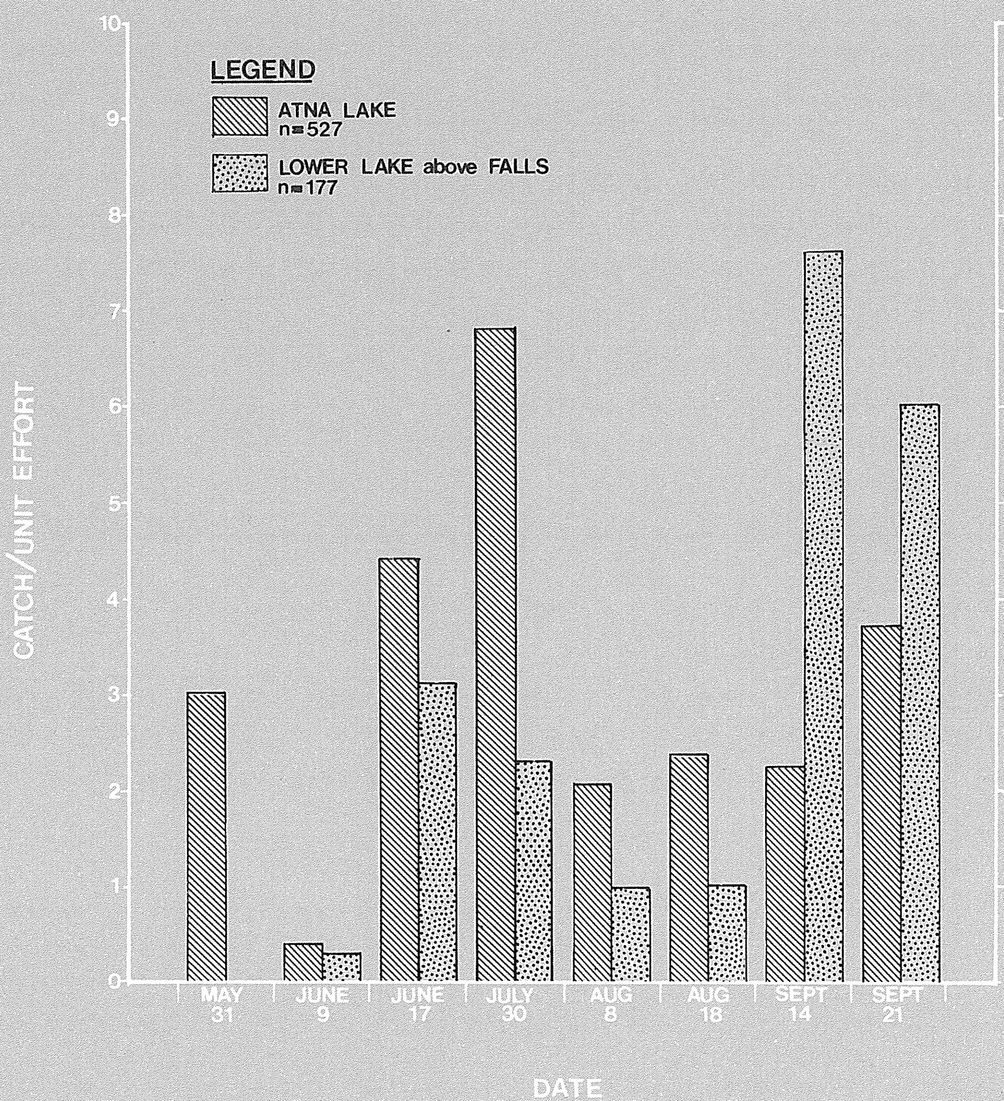
FIGURE 3.8

BEACH SEINE CATCHES OF MOUNTAIN WHITEFISH IN THE ATNA LAKE SYSTEM, 1980



Newly emerged fry ranging from 25-45 mm were first observed in Atna Lake and the lake above the falls in July. It is not known whether these fry originated from lake or stream spawners. Only five whitefish ranging between 30 and 39 mm were sampled in the incline plane trap at the mouth of the upper Atna River in late July and August. However, migration of whitefish fry into the lake could have occurred in early or mid-July when the trap was not operating.

3.1.5 Longnose Suckers

Longnose suckers were common in the Atna Lake system. In Atna Lake, adult suckers represented 48% of the total catch. Juvenile suckers were present in the littoral area but numbers were low, with an average beach seine catch less than 0.5. Suckers represented 67% of the total catch in the Atna streams. Tables K3.13-K3.18 in Appendix K3 present detailed sampling results.

Age and Growth

Length frequency data for longnose suckers are presented in Appendix K2, Figures K2.7, K2.10 and K2.11. Ages were not interpreted from scales and are not readily determined from the length distributions.

Longnose suckers gill netted in Atna Lake ranged from 100 to 400 mm. Suckers from 150 - 300 mm were the largest size class and made up the majority of the spawning run. Suckers in tributary streams and in the littoral area of Atna Lake were mostly under 150 mm and were likely juveniles. Longnose sucker young-of-the-year measured 15 -25 mm in early August.

Distribution and Abundance

The distribution of longnose suckers is presented in Figure 3.9. Juvenile suckers were present in low numbers in the Atna River mainstem, were absent in cold glacial tributaries, but were abundant in sloughs and beaver ponds. The lake tributaries, in particular C1 and the channels of the northwest bay (C3 - C7), were very productive sucker habitat. In the Atna River, Tributary T6 provided excellent habitat for suckers. In its upper reaches and along the margins of the lake, suckers were the only species sampled.

Although suckers dominated in terms of total catch in the minnow traps, they had a more limited distribution than Dolly Varden. Numbers were very high (greater than 20 fish/trap) in specific areas. These habitats were generally characterized by warm temperatures (greater than 20°C in C3), muddy substrate, submerged vegetation and little or no flow.

In Atna Lake proper, juvenile suckers were found in small numbers in the littoral habitat and were most abundant in muddy foreshores compared to gravel beaches. Although habitat in the lower lake appeared suitable, suckers were rare (0.1 fish per set).

Spawning and Emergence

Longnose suckers exhibiting a bright red band along the lateral line, a characteristic of spawning fish, were observed in Tributaries T3, C4 and C7. They were first observed on June 7 in the gravelly reaches of T3. About 150 suckers were observed, ranging from 200 to 300 mm long. Water temperature was about 10°C. On June 25 several hundred spawners were also observed in a small slough off C7. Temperature was 22°C and the channel consisted of a soft mud substrate and sedge. Size ranged from about 150 to 300 mm. Although longnose suckers are reported to spawn on gravels, there were no gravels in this tributary. In C4, four suckers, also exhibiting spawning colours, were observed over the gravels at the mouth of a small creek.

Recently emerged fry were first observed on August 8 at the southwest end of the lake (Stations 14 and 15). The fry may have originated from lake spawners or may have migrated into the lake from the northwest lake tributaries. Sucker fry were distributed at the east end of the lake by mid-August. In streams where spawners were observed (T3 and C7), sucker fry were abundant in the stream shallows in August. Sucker fry were also noted in the upper reaches of Tributary T6, a stream not observed during the spawning season.

3.1.6 Lake Char

Lake char represented 28.2% of the gill net catch in Atna Lake. Lake char generally inhabited deep waters but they were also observed and sampled inshore. No lake char adults or juveniles were present in the upper Atna River system or in the channels of the northwest bay area.

In Atna Lake, lake char sampled by gill net ranged from 150 - 750 mm. Length frequencies and age length relationships are shown in Appendix K2, Figures K2.7 and K2.12. Age classes from 2 to 11 years were represented. However, age was

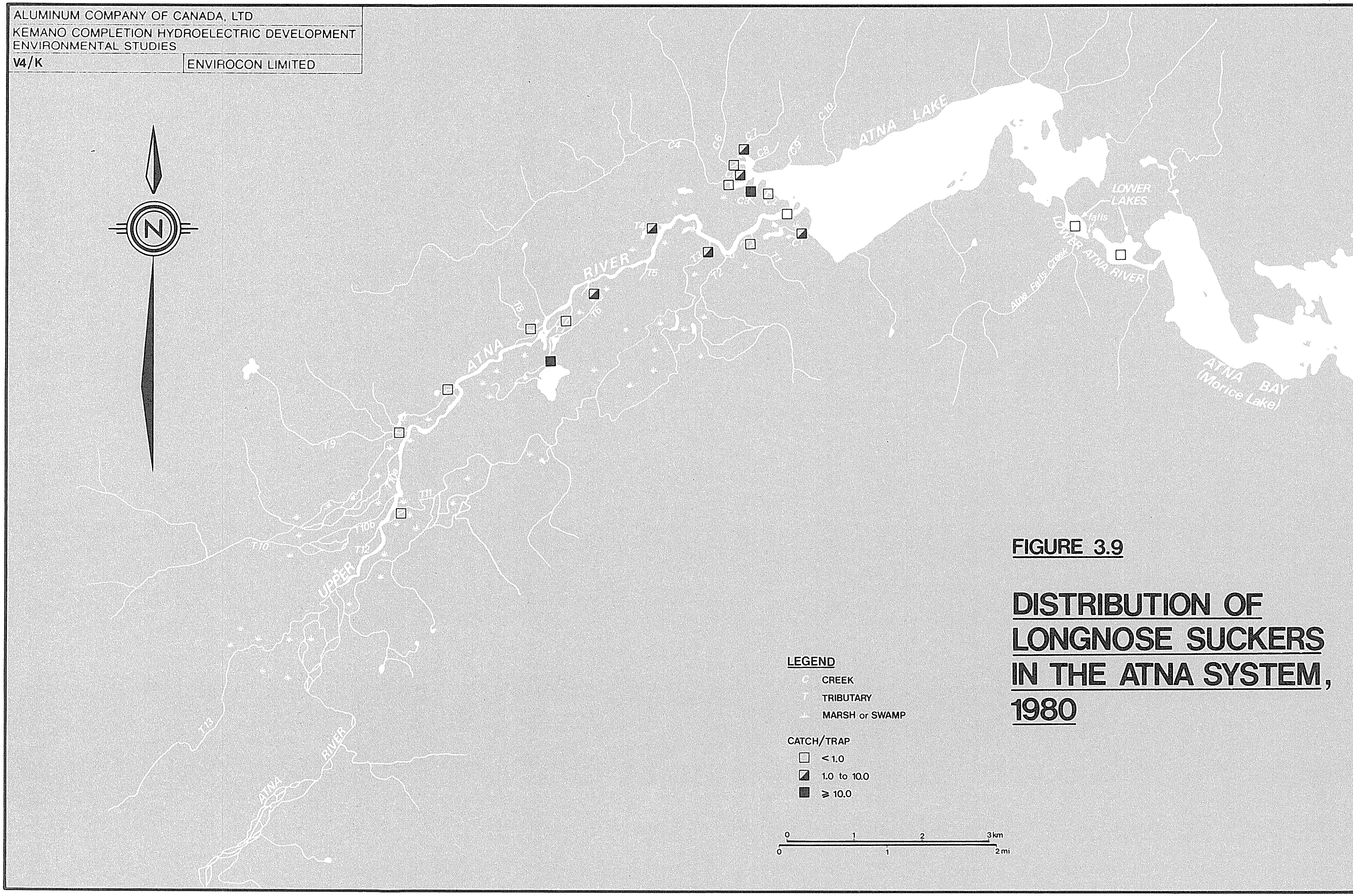


FIGURE 3.9

DISTRIBUTION OF LONGNOSE SUCKERS IN THE ATNA SYSTEM, 1980

determined by scale interpretation which may underestimate ages of fish older than 6 years (Martin and Olver 1980).

A few char of the smaller size classes (175-320 mm) were present in the littoral areas of Atna Lake and the lake above the falls. Char were observed in the inshore areas in the evening feeding on juvenile sockeye. Only one young-of-the-year lake char (45 mm) was sampled along the lake shoreline.

Little information was collected on lake char since they inhabit deep water areas during both juvenile and adult stages. Lake char are lake spawners and generally spawn in the fall along exposed shorelines or lake shoals consisting of a rubble substrate (Martin and Olver 1980). Depth of spawning may be as deep as 60 meters so that spawning and emergence are not readily observed.

3.2 Stream Discharge and Temperature

Daily stream discharges and temperature of the upper and lower Atna River are shown in Figures 3.10 and 3.11. The mean monthly discharge at the outlet (Appendix K1, Table K1.1) was highest (37.6 m^3/s) during the spring freshet in May and June. Flows gradually decreased through summer and fall to a low of 18.3 m^3/sec in November. Short term fluctuations in flow were common. Flows increased from glacial melt on warm days or after rainfall. Discharges in the upper Atna River were approximately 60 to 70% of the Atna Lake discharge. Range in mean discharge of the upper Atna River was from 27.9 m^3/s in June to 13.4 m^3/s in September/October (Appendix K1, Table K1.1).

Temperature of the upper Atna River is relatively cold year-round (Figure 3.11). The mean temperature through summer was 5.7 °C and decreased to 3.8°C in October. The maximum temperature was 10.5°C in June. Temperatures showed considerable fluctuation from day to day and varied by as much as 7°C within a day. Minimum daily temperature usually occurred between 0600 and 0900 hours and maximum temperatures between 1600 and 1900 hours.

The effect of the lake on temperatures is evident at the lake outlet. Mean temperature in the lower Atna River was 10.2°C following a sharp increase in temperature in early June (Figure 3.10). During the summer, temperature variation within a day averaged about 2°C compared with 4°C for the upper river.

The range of temperatures measured in tributary systems indicates considerable variation among the streams (Appendix K1, Table K1.3). There is a marked difference in the temperatures of the groundwater-fed and the glacial-fed systems. The latter did not usually exceed 10°C; in contrast, some of the sloughs and beaver ponds had temperatures greater than 20°C in mid-summer.

3.3 Limnology

The bathymetry of Atna Lake is shown in Figure 3.12. The maximum depth of the main basin is 60 m. The smaller basin near the lake outlet is shallower with a maximum depth of 20 meters. The north and south shores of the lake are steep-sided with little shoreline development. Littoral habitat is most extensive at the west and east end of the lake.

The temperature and oxygen profiles in Atna Lake are presented in Appendix K1 Tables K1.4 and K1.5. Oxygen saturation occurs throughout the 15 meters measured, which is typical of oligotrophic lakes. Temperature profiles do not indicate a distinct thermocline but rather a steady decrease in temperature with depth. In June, surface temperatures ranged from 10 to 12.5°C and temperatures at 15 meters ranged from 4 to 5°C. In August, they ranged from 7.5 to 11.5 °C at the surface and 5 to 7°C at 15 m depth. Temperatures generally increased along the longitudinal axis from west to east.

Phytoplankton and zooplankton samples taken in June and August indicate very low standing crops (Appendix K1, Tables K1.6 and K1.7). Phytoplankton consisted of 19 species of diatoms. Cell counts were extremely low (1.2 to 6.4 cells/ml) and no dominant species could be defined. Numbers were consistently high at Station 1 which was near the mouth of the Atna River.

Only two species of copepods were present in the zooplankton samples; *Cyclops bicuspidatus* and *Diaptomus franciscanus*. The smaller *Cyclops* species was generally more abundant and widely dispersed in the lake. The biomass of the zooplankton was 3.02×10^{-3} mg/l in June and 2.53×10^{-3} mg/l in August. Zooplankton biomass was within the range reported for other oligotrophic glacial lakes (1.5 to 7.6×10^{-3} mg/l) (Stockner and Shortreed 1978; Stockner and Shortreed 1979). Estimates of zooplankton biomass for Morice Lake, determined in the studies referenced above, were 3.5×10^{-3} and 2.2×10^{-2} in 1977 and 1978, respectively.

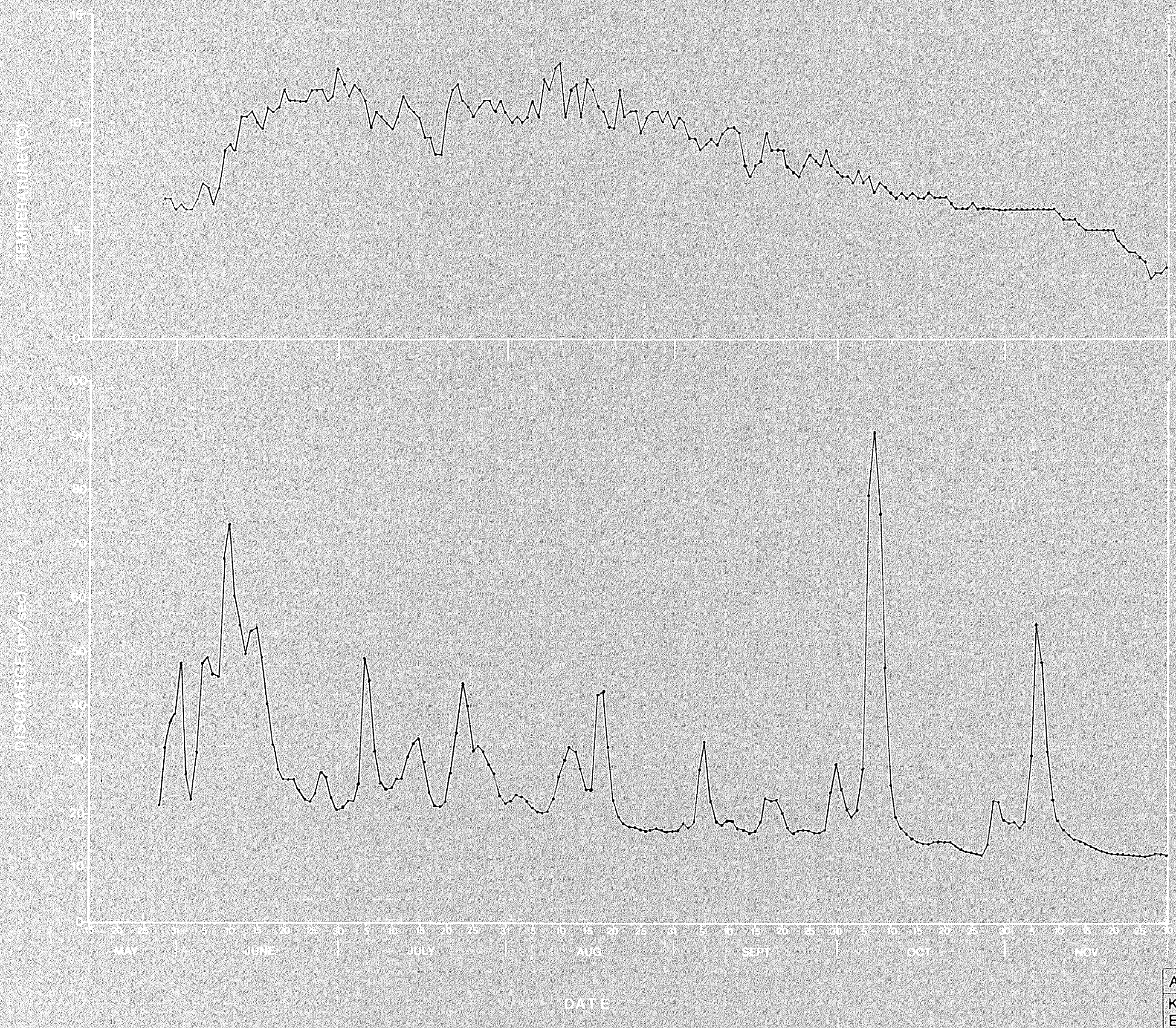


FIGURE 3.10

MEAN DAILY DISCHARGE AND TEMPERATURE AT THE OUTLET OF ATNA LAKE, 1980

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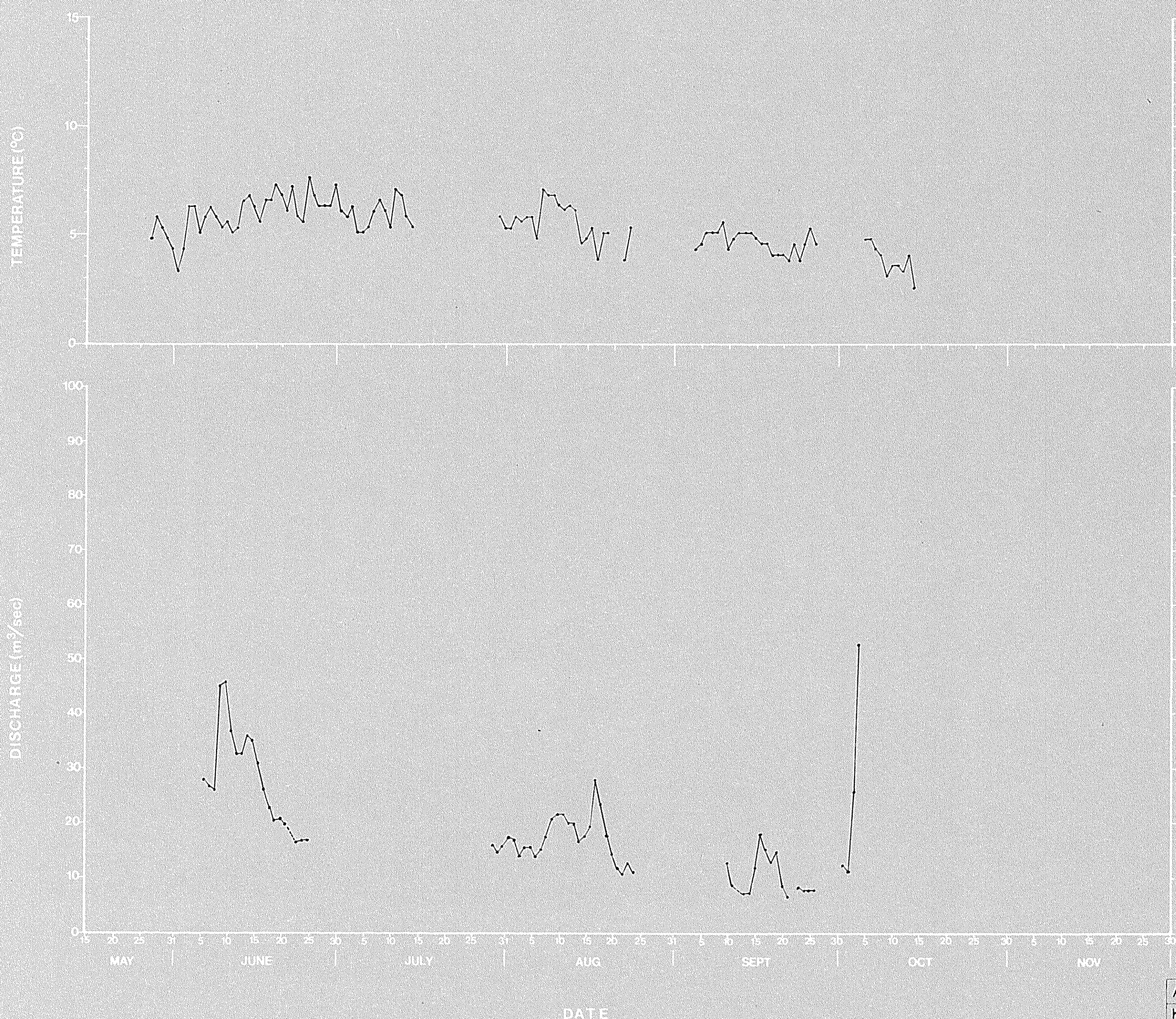

FIGURE 3.11

MEAN DAILY DISCHARGE AND TEMPERATURE IN THE UPPER ATNA RIVER, 1980

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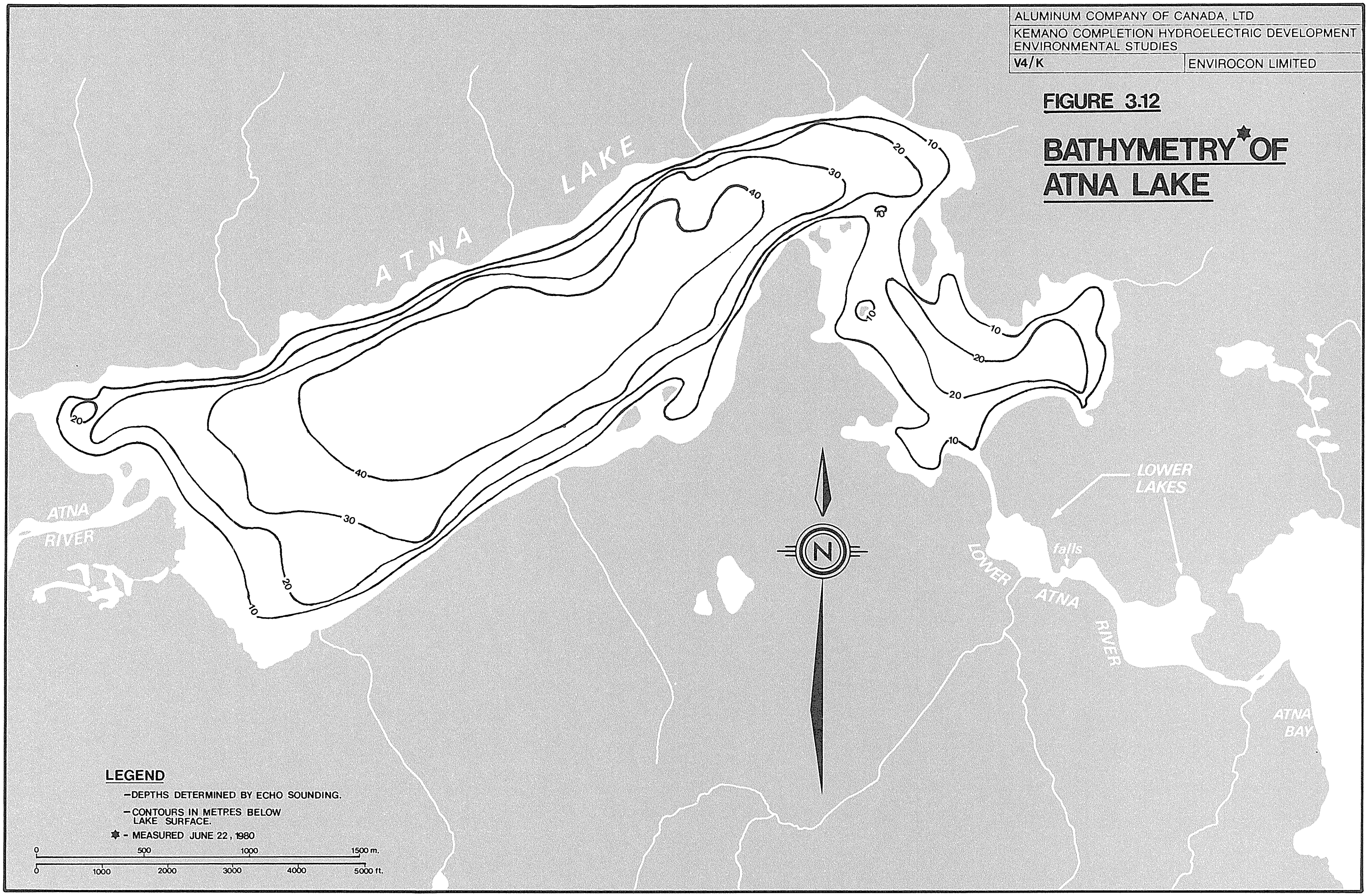
FIGURE 3.12

BATHYMETRY* OF ATNA LAKE



LEGEND

- DEPTHS DETERMINED BY ECHO SOUNDING.
- CONTOURS IN METRES BELOW LAKE SURFACE.

* - MEASURED JUNE 22, 1980

4.0 SUMMARY

The low productivity of the Atna Lake system is a result of its glacial origin. The species composition and low biomass of plankton communities in the lake indicate extreme oligotrophy. These conditions are reflected in the low abundance and slow growth rates of the fish species in the Atna Lake system. Dolly Varden char, the major salmonid species, exists as a dwarf population, as reflected by the small size of spawners. This is common in cold, unproductive systems in northern areas. Other resident species include lake char, mountain whitefish and longnose suckers. Juvenile sockeye and coho salmon rear in the system, usually spending an additional year in freshwater compared with stocks from more productive areas.

Anadromous Species

The major salmon species in Atna Lake is sockeye. Sockeye escapement in 1980 was estimated to be 400+ fish. This is comparable with the Nanika River sockeye escapement in 1980 of 400 to 500 fish (Fisheries and Oceans and Alcan estimates).

Sockeye salmon migrate past Atna Falls in early August and spawn in Atna Lake in September and October. Sockeye fry emerge in May and are abundant in the littoral zone of the lake until late summer when they move offshore. Sockeye rear in the lake for one or two years. Some downstream movement of fry occurs and a percentage of the sockeye rear in the lower lakes or in Morice Lake. Smolt migration was not observed and probably occurs shortly after ice break-up in early to mid-May.

The low abundance of coho salmon fry and yearlings in the Atna River system indicates a small spawning population. Spawners were not observed in October and November and the small number of fry, which probably reflected a very low escapement in 1979, did not permit identification of spawning areas.

The most productive coho rearing habitats were the groundwater-fed tributaries, sloughs and beaver ponds. Coho likely spend two years in the Atna system prior to seaward migration. Some movement of fry occurs out of Atna Lake.

Resident Species

The resident fish community consists of lake char, mountain whitefish, longnose suckers and Dolly Varden char. In Atna Lake, juvenile whitefish were found along the shoreline. The young of other species were less common in this habitat. The tributary

creeks in the northwest bay area of the lake provide spawning and rearing habitat for both Dolly Varden char and longnose suckers.

The upper Atna River and glacial tributaries are relatively unproductive and Dolly Varden char was the dominant or sole species in these habitats. Dolly Varden char was also found, as were juvenile coho salmon, longnose suckers and mountain whitefish in the more productive rearing habitats outside the mainstem in the upper Atna River system.

In the lower Atna River, the shallow lake above the falls provides rearing habitat for mountain whitefish and Dolly Varden char as well as juvenile sockeye. Below the falls, species composition and relative abundance is markedly different than in similar habitats upstream. Two additional species, slimy sculpins and rainbow trout, were present and sculpins rather than Dolly Varden char dominated.

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APPENDIX K1

Stream Characteristics and Limnological Measurements

TABLE KI.I
Mean Discharges in the Upper and Lower Atna River, 1980

Upper Atna River

Date	Range of Mean Daily Discharge (m^3/s)	Mean Discharge (m^3/s)
June 6-25	16.1 - 45.7	27.9
July 29-Aug 24	10.5 - 27.8	16.8
Sept 10-Oct 6	6.5 - 52.5	13.4

Lower Atna River

Date	Range of Mean Daily Discharge (m^3/s)	Mean Discharge (m^3/s)
May 28-June 30	20.9 - 73.8	37.6
July 1-31	21.4 - 49.0	29.3
Aug 1-31	17.0 - 43.0	23.5
Sept 1-30	16.2 - 33.4	19.8
Oct 1-31	12.2 - 90.6	24.5
Nov 1-30	12.1 - 55.0	18.3

TABLE K1.2
Mean Water Temperatures in the Upper Atna River and at the Lake Outlet, 1980

Upper Atna River

Date	Range of Mean Daily Temperatures (°C)	Mean Temperature (°C)
May 26-June 30	3.3 - 7.5	5.8
July 1-14	5.0 - 7.0	5.8
July 30-Aug 24	3.8 - 7.0	5.5
Sep 4-26	3.8 - 5.5	4.6
Oct 4-14	2.5 - 4.8	3.8

Atna Lake Outlet

Date	Range of Mean Daily Temperatures (° C)	Mean Temperature (°C)
May 28-June 30	6.0 - 12.5	9.3
July 1-31	8.5 - 11.8	10.5
Aug 1-31	9.8 - 12.8	10.8
Sept 1-30	7.5 - 10.3	8.7
Oct 1-31	6.0 - 7.8	6.6
Nov 1-30	2.8 - 6.0	4.9

TABLE K1.3
Temperature Ranges of Streams of the Atna Lake System, 1980

	Date	Range	Mean
Atna Lake Creeks			
C1	June 3,4,6	11.0 - 18.0	14.4
	Aug 11,12	13.0 - 19.5	16.1
C2	June 18,19	4.5 - 16.0	10.0
	Aug 18,19	6.0 - 11.0	8.6
C3	June 4,5	9.0 - 22.0	15.7
	Aug 11,12	17.0 - 23.0	19.3
	Sept 24,25	8.5 - 15.0	11.5
C4	June 1,2,3	3.0 - 6.0	4.4
	Aug 11,12	8.0 - 20.0	14.3
	Sept 24,25	7.5 - 13.0	8.4
C5	June 1,2,3	7.0 - 15.0	10.4
	Aug 11,12	18.0 - 24.0	21.4
	Sept 24,25	8.5 - 14.5	11.3
C6	June 1,2,3	5.0 - 6.0	5.7
	Aug 11,12	7.0 - 22.0	17.0
	Sept 24,25	7.0 - 14.0	10.3
C7	June 1,2,3	9.0 - 15.0	11.4
	Aug 11,12	15.0 - 23.5	21.4
	Sept 24,25	10.5 - 16.5	13.8
C8	June 3,4	4.5 - 5.0	4.8
	Aug 18,19	7.0 - 10.0	7.6
	Sept 24,25	-	7.0
C9	June 5,6	10.0 - 17.0	13.9
	Aug 18,19	9.0 - 17.0	12.0
	Oct 6,7	8.5 - 9.5	9.1
C10	June 5,6	4.5 - 5.0	4.8
	Oct 6,7	7.5 - 8.5	7.8

TABLE K1.3 (Continued)

	Date	Range	Mean
Upper Atna River Tributaries			
T1	June 18,19	11.0 - 13.0	12.1
	July 31		
	Aug 1	8.0 - 9.0	8.5
	Oct 4,5	5.5 - 7.5	6.8
T2	June 6,7	9.0 - 10.0	9.5
	July 31		
	Aug 1	7.0 - 8.0	7.4
	Sept 22,23	5.0 - 7.0	5.9
T3	June 7,8	10.0 - 11.0	12.5
	Aug 1,2	11.0 - 13.0	11.7
	Oct 4,5	7.5 - 8.5	7.8
T4	Sept 30		
	Oct 1	7.5 - 9.5	8.4
T5	Sept 30		
	Oct 1	6.0 - 7.0	6.7
T6 (lower)	June 11,12		
	13,14	10.5 - 18.0	13.5
	Aug 6,8	7.0 - 17.0	12.9
	Sept 21,22	9.0 - 10.5	9.9
T6 (upper)	Sept 21,22	9.0 - 12.0	10.7
T7	Oct 2,3	9.0 - 11.0	9.4
T8	Oct 2,3	6.5 - 11.0	8.5
T9	June 16,17	6.0 - 10.0	7.5
	Aug 5,6	4.0 - 11.0	5.8
T10a	June 16,17	7.0 - 12.0	8.8
	Aug 4,6	4.0 - 9.0	6.5
T10b	June 16,17	6.0 - 12.0	7.1
	Aug 4,5	4.0 - 12.0	5.7
T11	June 17,18	-	20.0
	Aug 4,5	11.0 - 18.0	15.5
T12	June 16,17	12.0 - 13.0	12.5
	Aug 4,5	8.5 - 13.5	11.7
T13	June 16,17	7.0 - 11.5	9.1
	Aug 4,5	5.0 - 10.0	6.2

(Continued)

TABLE K1.3 (Continued)

	Date	Range	Mean
Lower Atna River			
Lake above	June 9,10	8.5 - 13.0	10.6
falls Aug 13,14	11.5	- 20.0	13.4
Atna Falls	June 10,11	3.5 - 7.5	4.9
Creek	Aug 13,14	6.0 - 11.0	7.8
Lake & River	June 7,8	7.0 - 13.5	8.8
Below falls	Aug 13,14	11.0 - 16.0	12.3

TABLE KI.4
Temperature and Dissolved Oxygen Levels in Atna Lake, June 1980

Depth	Stn. 1		Stn. 2		Stn. 3		Stn. 4		Stn. 5		Stn. 6	
(m)	T°C	DO	T°C	DO	T°C	DO	T°C	DO	T°C	DO	T°C	DO
Surface	10.9	10.6	10.0	11.0	10.0	11.0	11.5	11.2	11.5	10.6	12.5	10.8
1	9.5	10.8	9.5	11.1	10.0	10.8	11.0	11.0	11.0	10.6	12.0	10.9
2	8.0	10.8	8.0	10.9	9.0	10.8	10.0	11.2	9.0	10.8	11.5	10.8
3	7.0	11.0	7.0	10.9	8.0	10.8	9.0	10.9	8.0	10.8	11.0	10.8
4	6.0	10.8	7.0	10.9	7.5	10.6	8.0	10.9	8.0	10.4	9.0	11.0
5	6.0	10.8	6.5	10.9	7.0	10.8	7.0	10.9	7.5	10.4	8.5	11.0
6	6.0	11.0	6.5	10.9	6.0	11.0	6.0	10.9	7.0	10.8	7.5	11.0
7	6.0	11.0	6.0	11.1	5.0	11.0	5.5	10.9	6.0	10.6	6.0	11.1
8	5.5	11.0	5.5	11.1	5.0	10.6	5.0	11.0	5.0	10.6	6.0	11.0
9	5.0	10.8	5.0	10.9	4.5	10.6	5.0	10.9	5.0	10.5	5.0	11.0
10	5.0	10.8	5.0	11.0	4.5	10.6	5.0	11.0	5.0	10.4	5.0	10.8
11	5.0	10.8	5.0	10.9	4.0	10.6	5.0	10.8	4.5	10.4	5.0	10.8
12	4.5	11.0	5.0	10.9	4.0	10.6	5.0	10.8	4.5	10.4	5.0	10.8
13	4.5	11.0	5.0	10.9	4.0	10.6	5.0	10.8	4.5	10.4	5.0	10.8
14	4.5	11.0	5.0	11.0	4.0	10.6	4.5	10.9	4.0	10.4	5.0	10.8
15	4.0	10.0	4.5	10.8	4.0	10.6	4.5	10.9	4.0	10.4	5.0	10.7

TABLE KI.5
Temperature and Dissolved Oxygen Levels in Atna Lake, August 1980

Depth	Stn. 1		Stn. 2		Stn. 3		Stn. 4		Stn. 5		Stn. 6	
(m)	T°C	DO	T°C	DO	T°C	DO	T°C	DO	T°C	DO	T°C	DO
Surface	7.5	10.2	8.2	10.4	8.5	10.8	9.2	10.0	10.0	9.6	11.5	10.0
1	7.5	10.5	8.2	10.5	8.5	10.6	9.2	10.0	10.0	9.5	11.5	10.0
2	7.0	10.6	8.0	10.5	8.2	10.5	9.0	10.0	10.0	9.5	11.5	9.5
3	7.0	10.5	7.5	10.6	8.2	10.6	9.0	10.0	10.0	9.4	11.5	10.0
4	6.8	10.4	7.5	10.6	8.0	10.4	9.0	9.9	9.8	9.4	11.5	9.5
5	6.5	10.4	7.5	10.6	8.0	10.4	9.0	9.9	8.0	10.0	11.5	9.5
6	6.2	10.4	7.0	10.6	8.0	10.4	8.8	9.8	7.0	10.0	11.5	9.5
7	6.2	10.4	6.8	10.7	7.2	10.5	8.8	9.9	6.5	10.1	11.5	9.5
8	6.0	10.4	6.8	10.6	7.0	10.7	8.8	9.9	6.2	10.1	11.2	9.5
9	5.5	10.5	6.5	10.7	6.8	10.6	8.8	9.9	6.0	10.1	9.0	10.4
10	5.5	10.6	6.5	10.6	6.5	10.6	8.5	9.9	6.0	10.0	8.0	10.5
11	5.2	10.4	6.2	10.7	6.5	10.5	8.5	9.9	6.0	10.0	7.5	10.5
12	5.2	10.4	6.0	10.7	6.2	10.5	7.8	10.0	6.0	9.9	7.5	10.5
13	5.5	10.5	6.0	10.7	6.0	10.5	7.5	10.1	6.0	9.9	7.0	10.4
14	5.0	10.4	5.8	10.7	6.0	10.5	7.0	10.2	6.0	10.0	7.0	10.4
15	5.0	10.4	5.5	10.6	6.0	10.6	6.8	10.2	5.5	10.0	7.0	10.4

APPENDIX K2

Length Distributions and Age-Length Relationships of Fish

TABLE K1.6
Summary of Phytoplankton Species in Atna Lake, 1980

Species	June						August					
	1	2	3	4	5	6	1	2	3	4	5	6
Achnanthes minutissima					X				X	X		
Asterionella formosa							X					
Chroomonas acuta	X[1]		X		X				X	X		X
Cocconesis placentula	X											
Cyclotella sp.									X	X		X
Cyclotella ocellata			X									
Cymbella prostrata									X	X		
Diatoma tenue v. elongatum							X	X	X	X	X	X
Fragilaria capucina	X					X						
Flagilaria crotonensis	X						X	X				
Fragilaria vaucheria		X										
Gomphonema olivaceum		X		X					X	X		
Hannaea arcus		X										X
Navicula sp.	X	X		X	X	X	X		X		X	X
Nitzschia dissipata												X
Nitzschia palea						X					X	
Ochromonas sp.	X	X	X	X				X	X			
Synedra ulna												X
Tabellaria fenestrata	X		X				X		X			
Cells per ml.	6.4	3.3	1.8	2.0	2.8	2.1	6.0	1.2	1.5	1.8	1.2	3.9

1 X indicates presence

TABLE K1.7
Summary of Zooplankton Species in Atna Lake, 1980

Date and Sampling Station	Diaptomus franciscanus No.	Diaptomus franciscanus No./Liter	Juvenile copepods[1] No.	Juvenile copepods[1] No./Liter	Nauplii No.	Nauplii No./Liter	Dry Weight[2] Mg/Liter
June 14							
Stn 1	-	-	6,576	8.9	-	-	8.7×10^{-3}
2	48	0.1	4,896	6.7	-	-	6.9×10^{-3}
3	40	0.1	632	0.9	8	<0.05	1.2×10^{-3}
4	-	-	432	0.6	-	-	5.7×10^{-4}
5	-	-	116	0.2	4	<0.05	1.5×10^{-4}
6	-	-	384	0.5	1,736	2.36	5.3×10^{-4}
August 16, 17							
Stn 1	40	0.1	1,144	1.6	32	0.1	1.9×10^{-3}
2	13	<0.05	1,128	1.5	56	0.1	1.6×10^{-3}
3	1	<0.05	3,504	4.8	72	0.1	4.7×10^{-3}
4	-	-	3,064	4.2	152	0.2	4.1×10^{-3}
5	102	0.1	176	0.2	8	<0.05	1.2×10^{-3}
6	176	0.2	96	0.1	-	-	1.8×10^{-3}

1 Juvenile copepods included Diaptomus franciscanus and Cyclops bicuspidatus thomasi (ratio 1:3)

2 Dry weight calculated from length

FIGURE K2.1

LENGTH-FREQUENCY OF SOCKEYE SPAWNERS IN ATNA LAKE, 1980

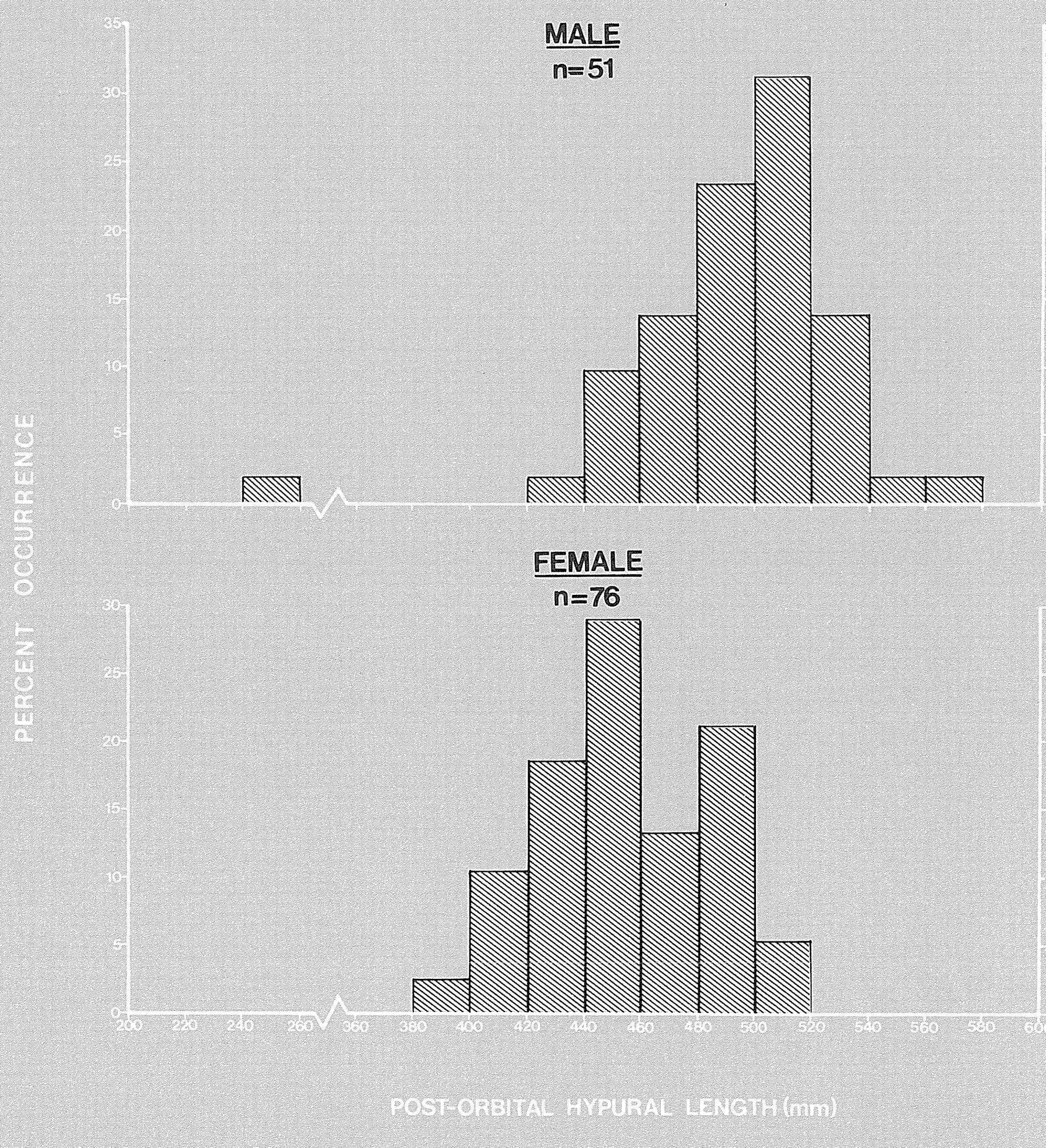

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FIGURE K2.2

AGE-LENGTH RELATIONSHIP OF SOCKEYE SPAWNERS IN ATNA LAKE, 1980

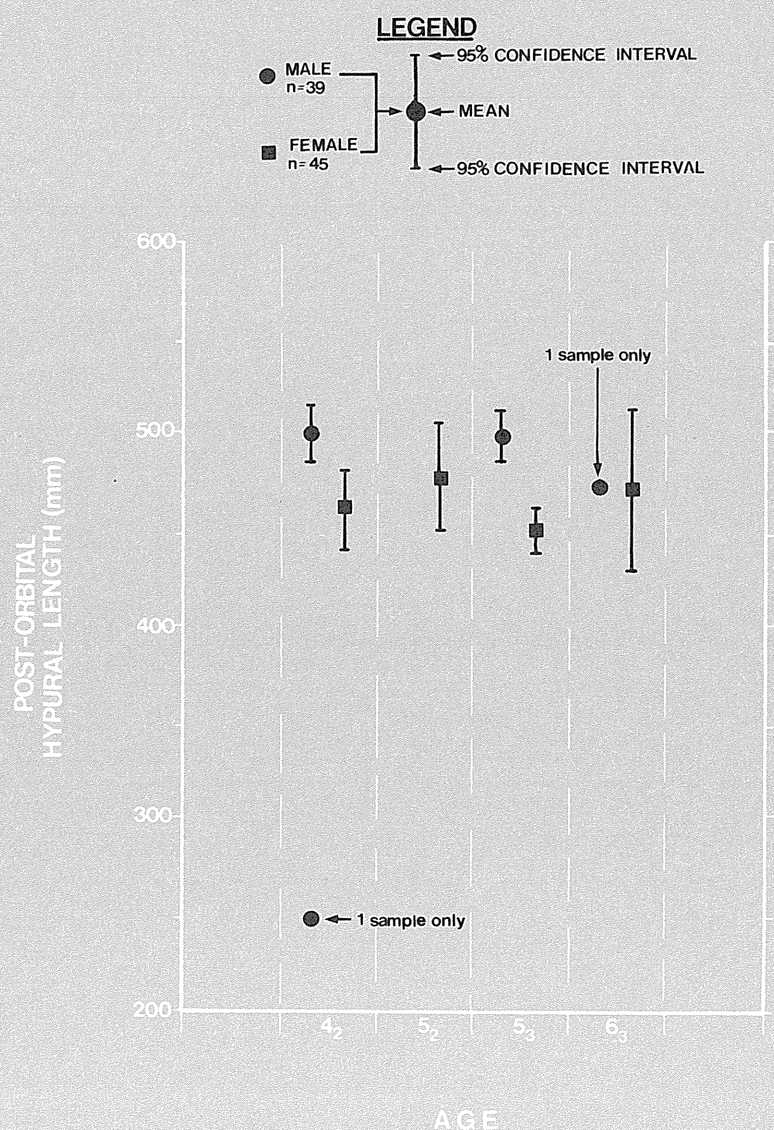

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FIGURE K2.3

LENGTH-FREQUENCY OF JUVENILE SOCKEYE SEINED IN THE ATNA LAKE SYSTEM, 1980

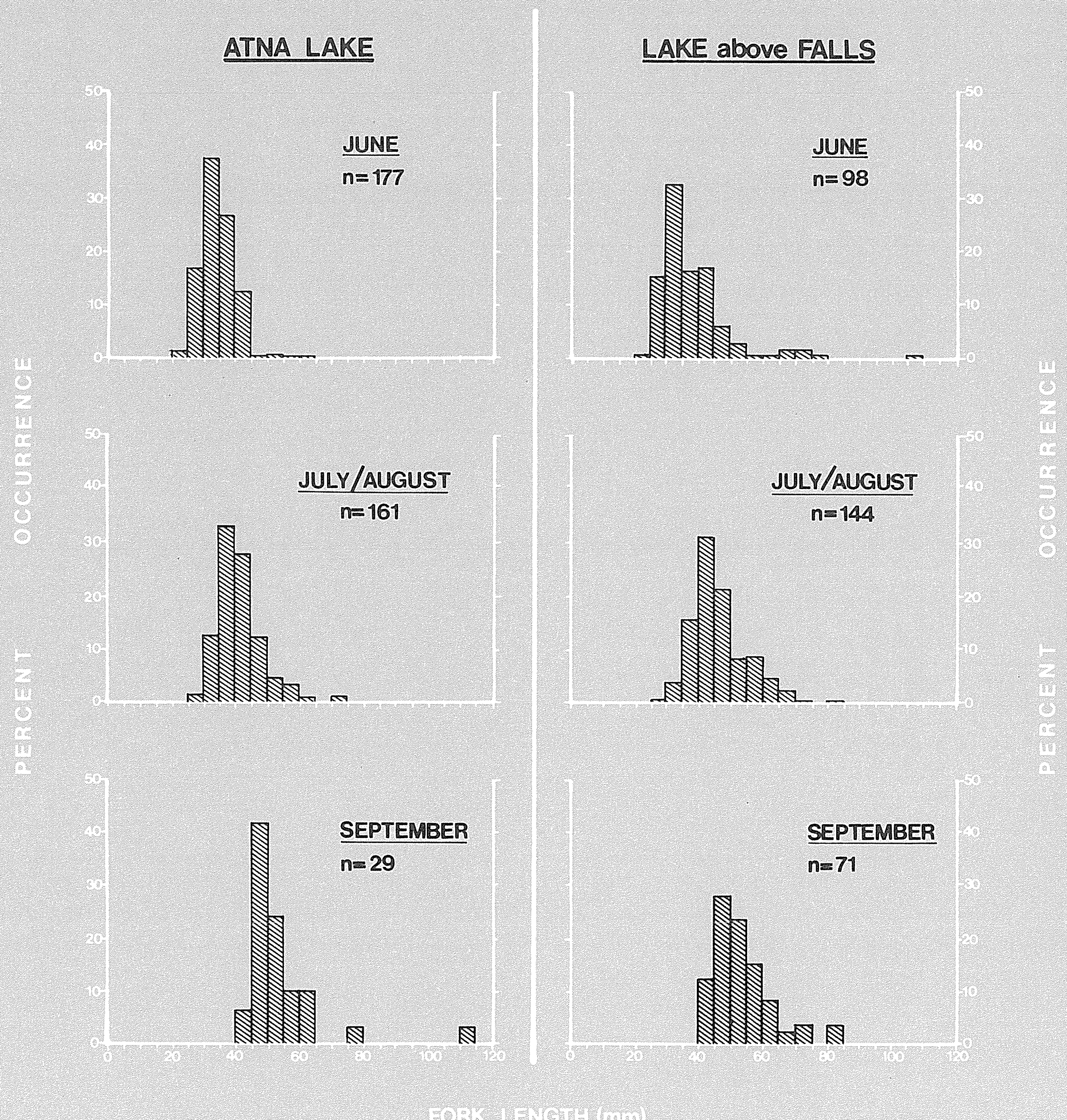

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FIGURE K2.4

LENGTH-FREQUENCY OF SOCKEYE FRY SAMPLED BY FYKE NET AT THE OUTLET OF ATNA LAKE, 1980

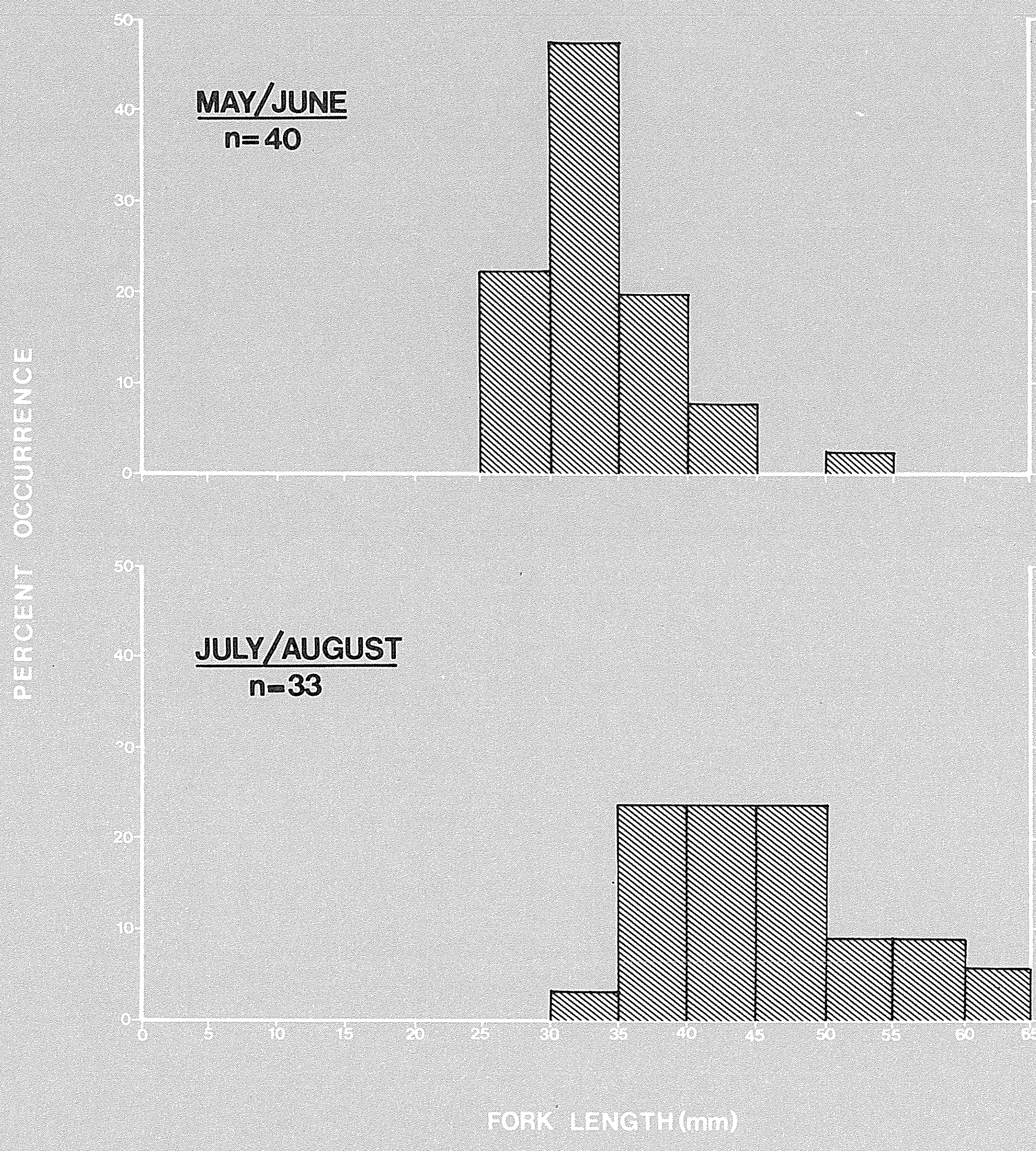

FIGURE K2.5

LENGTH-FREQUENCY OF COHO JUVENILES IN THE ATNA LAKE SYSTEM, 1980

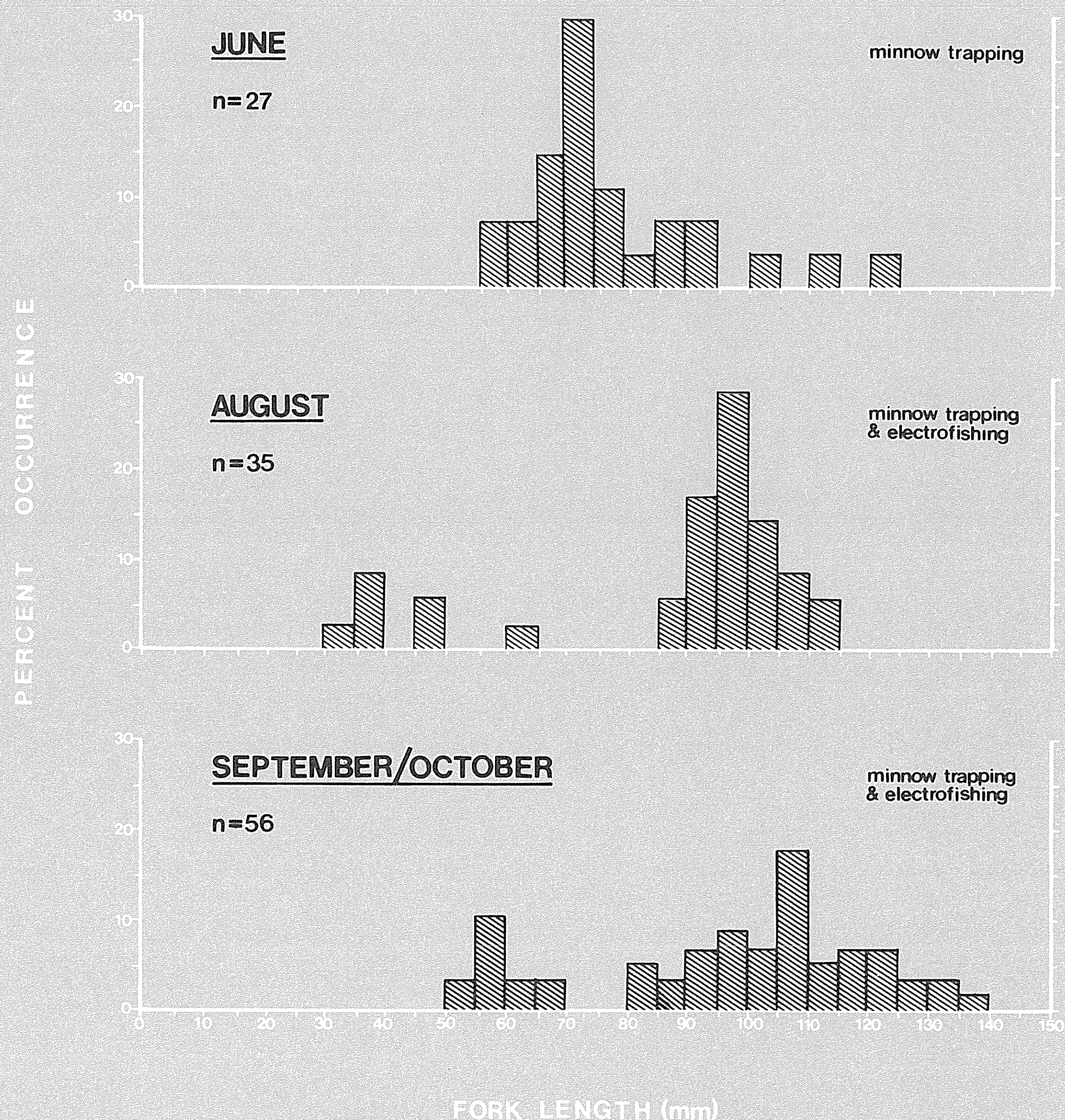

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FIGURE K2.6

LENGTH-FREQUENCY OF DOLLY VARDEN IN THE ATNA LAKE SYSTEM, 1980

NOTE : minnow trapping & electrofishing data pooled for each sample period

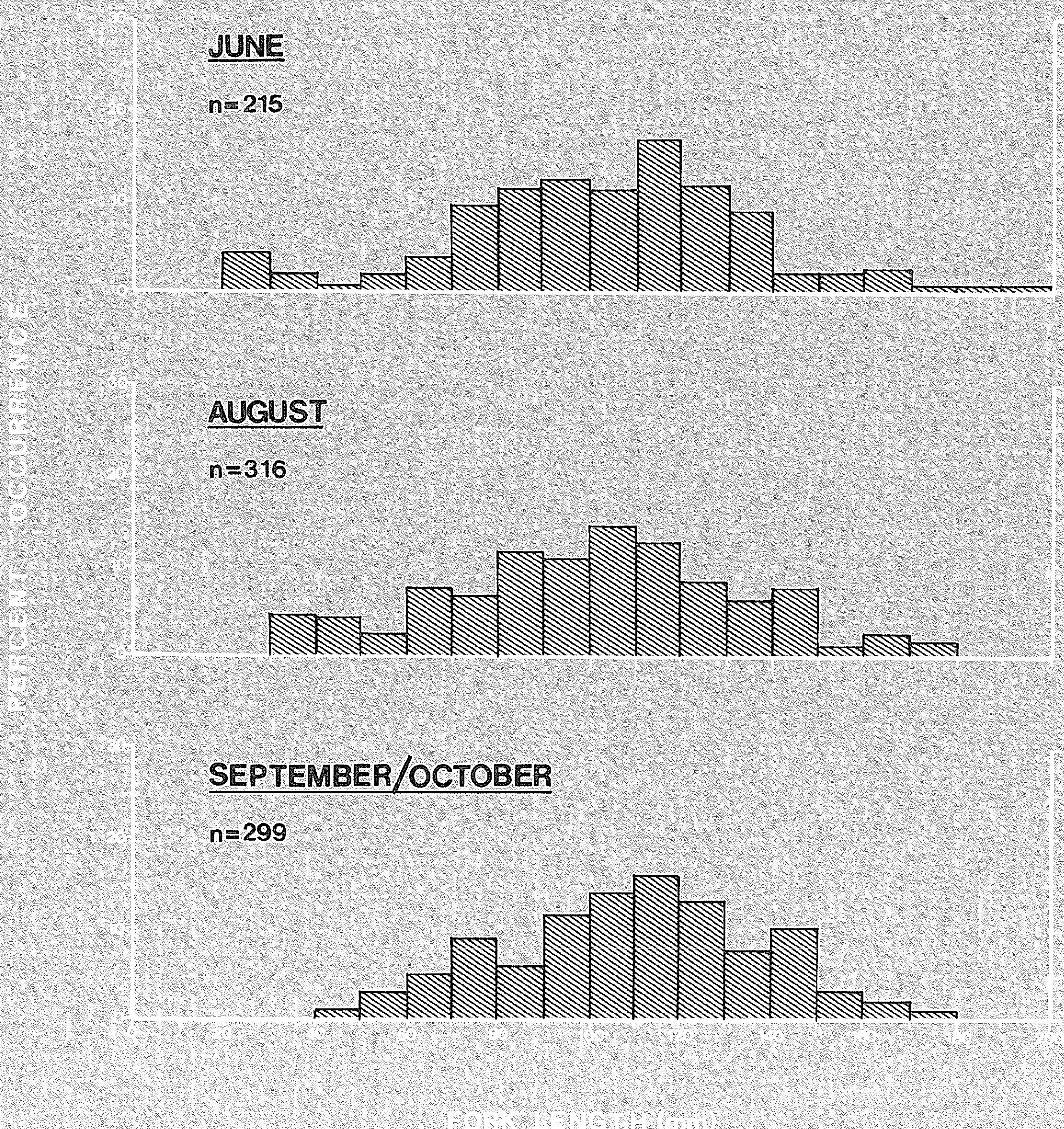

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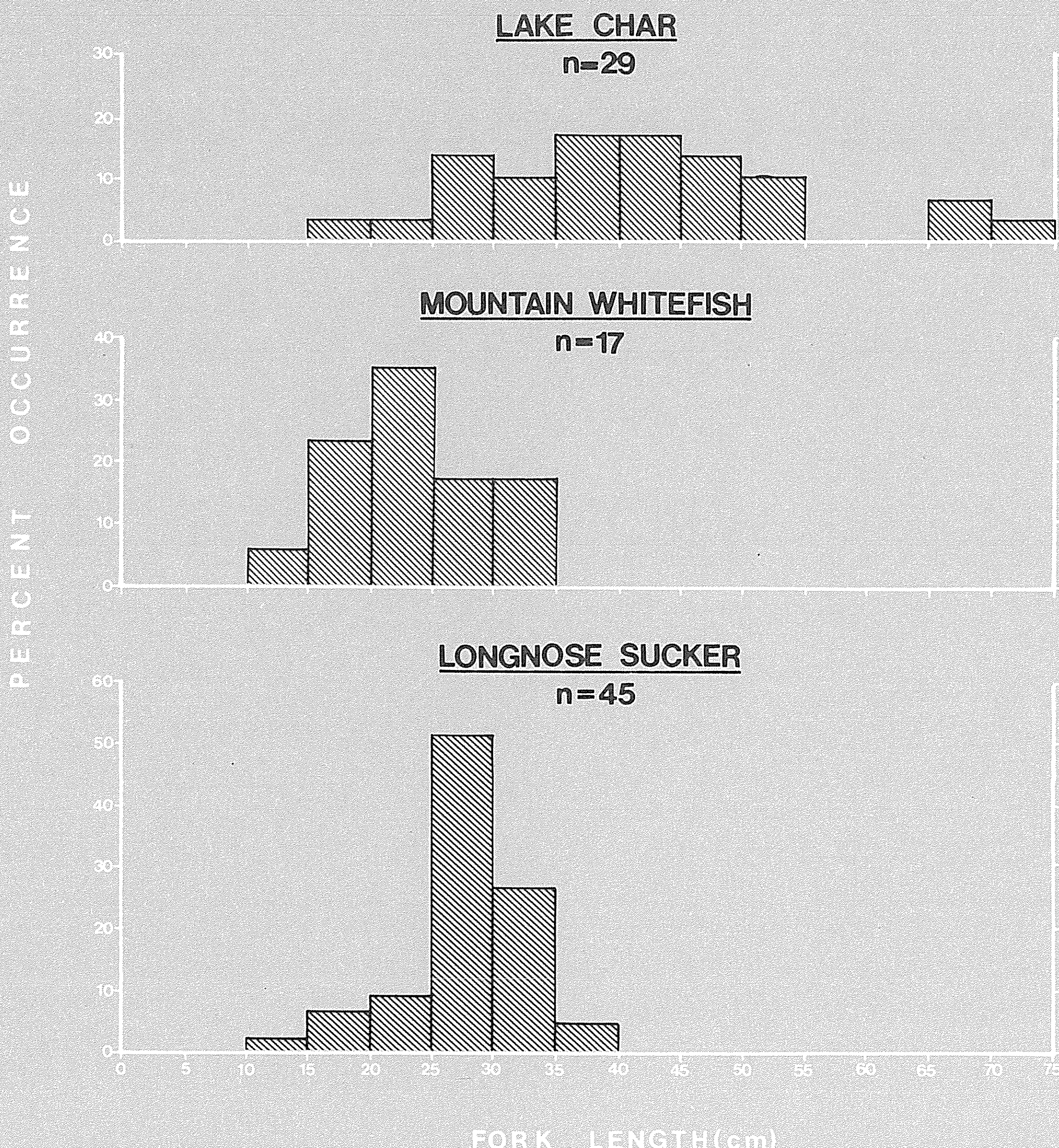
FIGURE K2.7

LENGTH-FREQUENCY OF FISH SPECIES GILL NETTED IN ATNA LAKE, 1980



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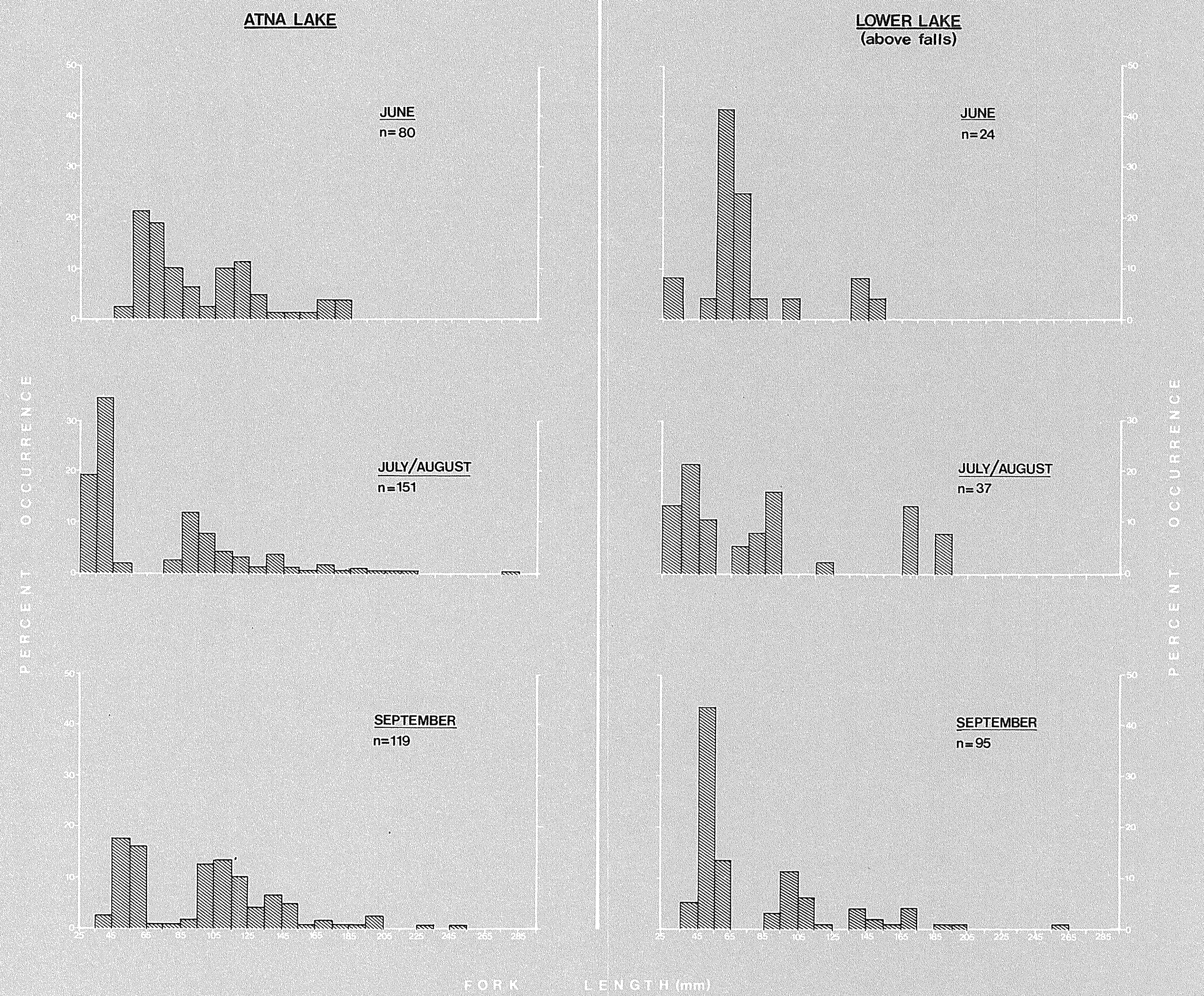

FIGURE K2.8

LENGTH-FREQUENCY OF MOUNTAIN WHITEFISH IN THE ATNA LAKE SYSTEM, 1980

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FIGURE K2.9

AGE-LENGTH RELATIONSHIP OF MOUNTAIN WHITEFISH IN ATNA LAKE, 1980

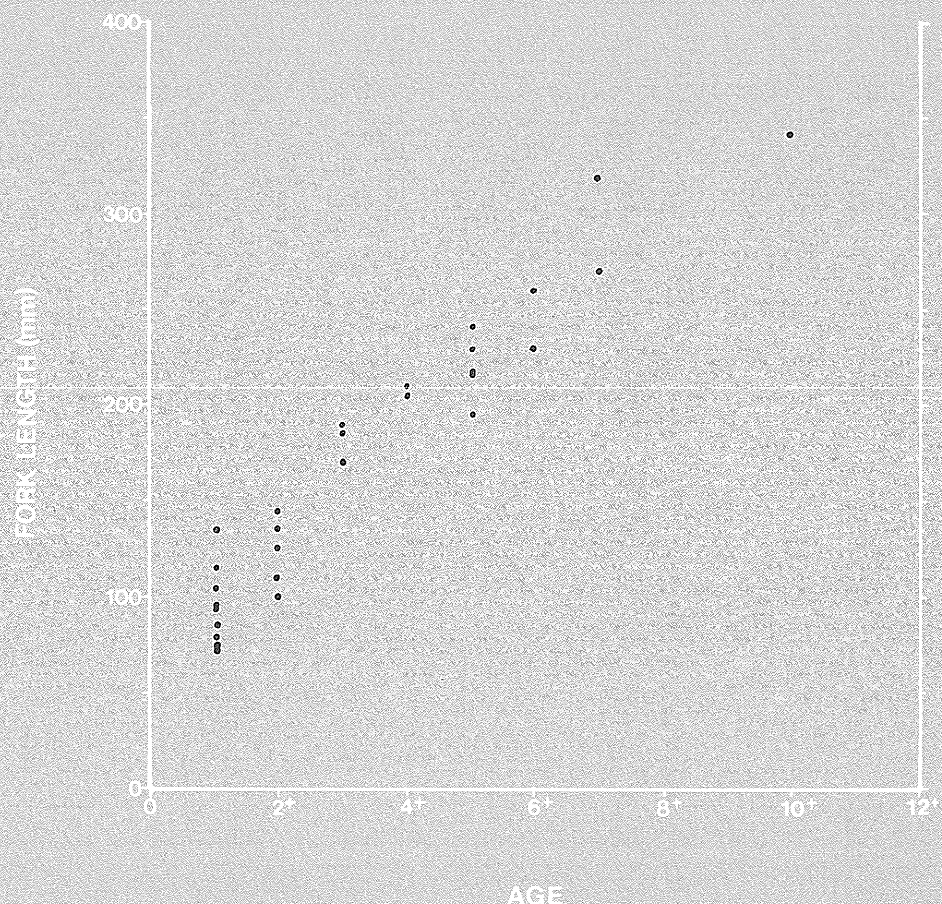

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FIGURE K2.10

LENGTH-FREQUENCY OF LONGNOSE SUCKERS SEINED IN ATNA LAKE, 1980

NOTE: minnow trapping & electrofishing data pooled for each sample period

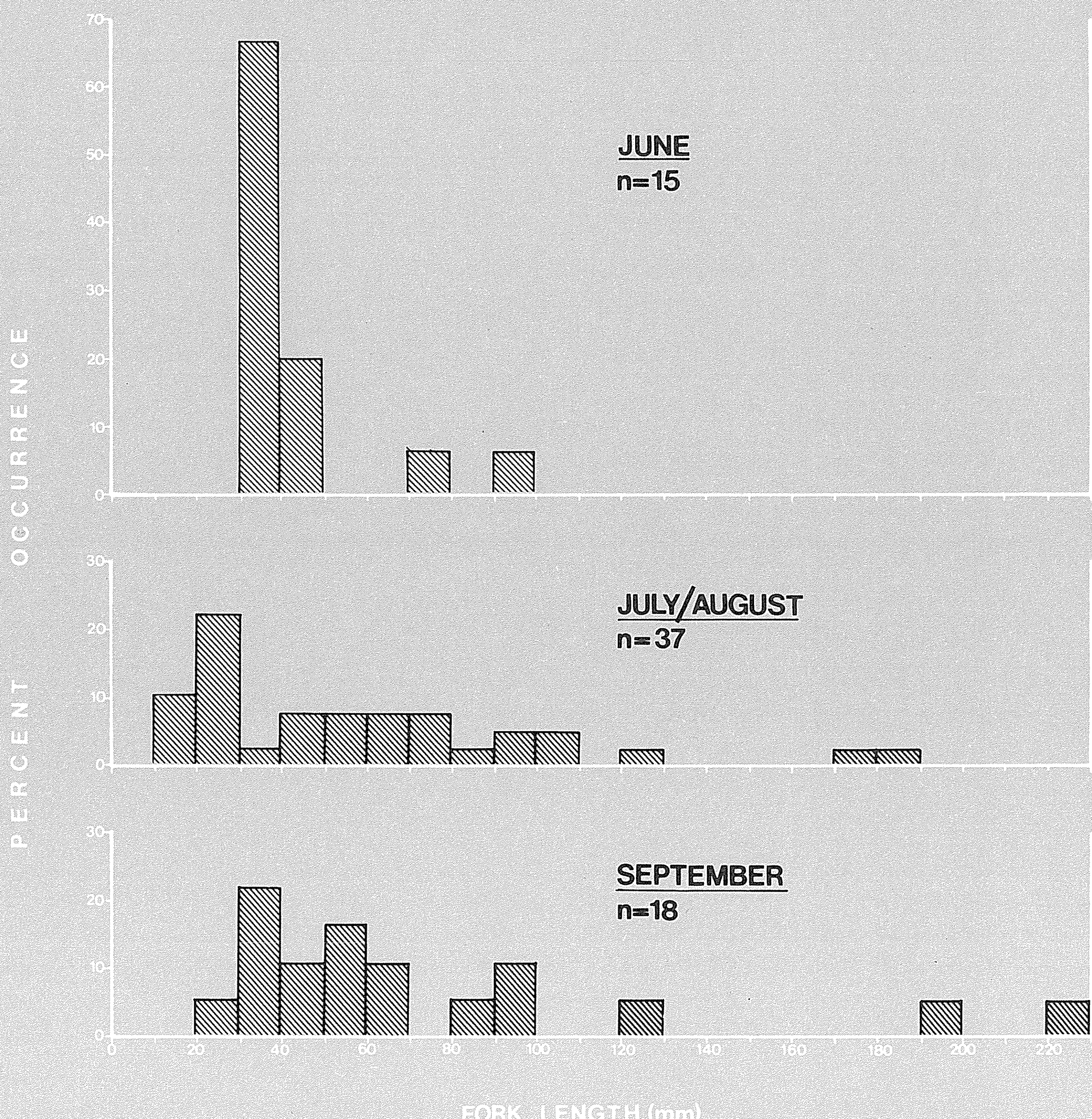

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FIGURE K2.11

LENGTH-FREQUENCY OF LONGNOSE SUCKERS IN THE ATNA LAKE SYSTEM, 1980

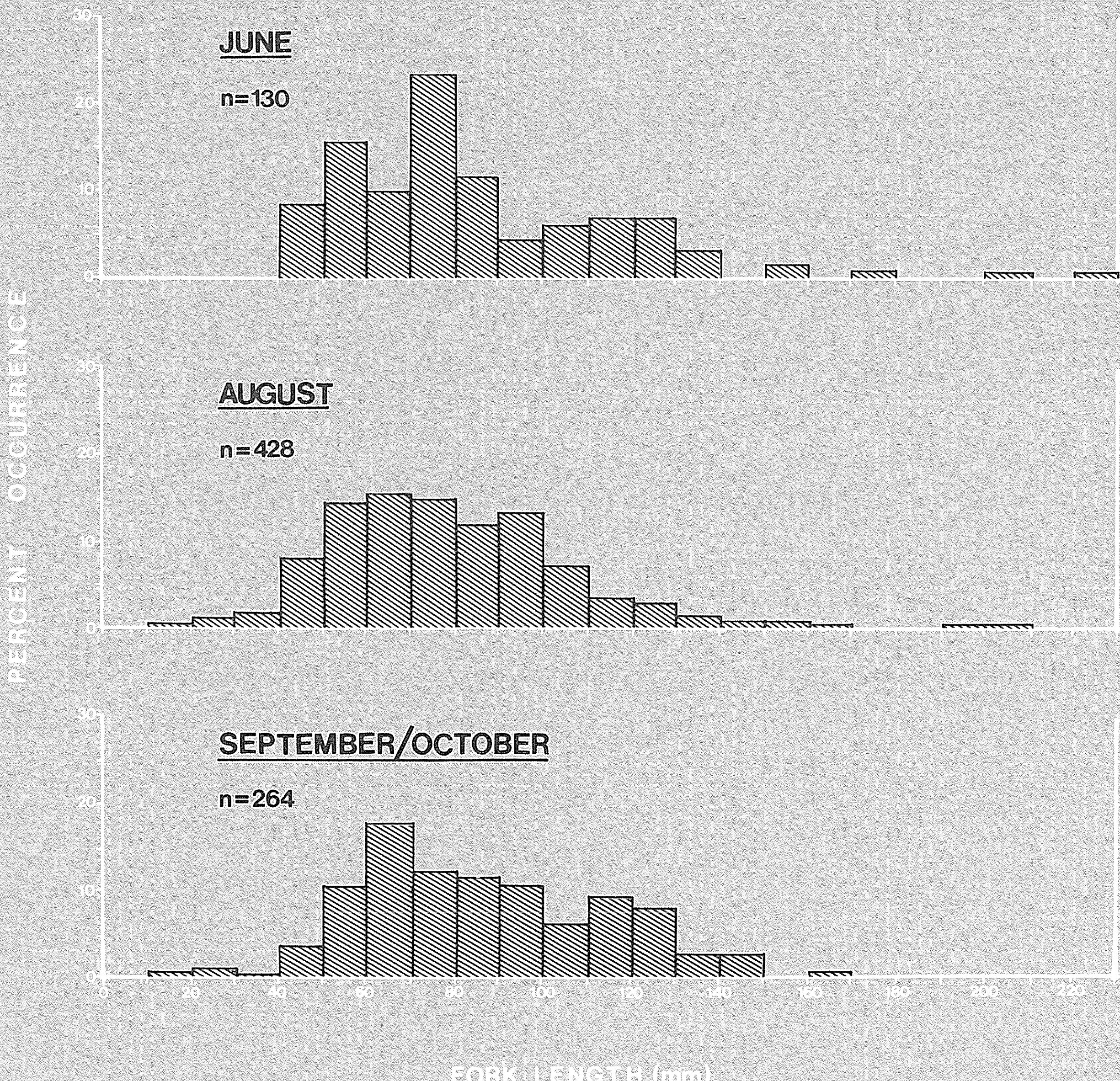

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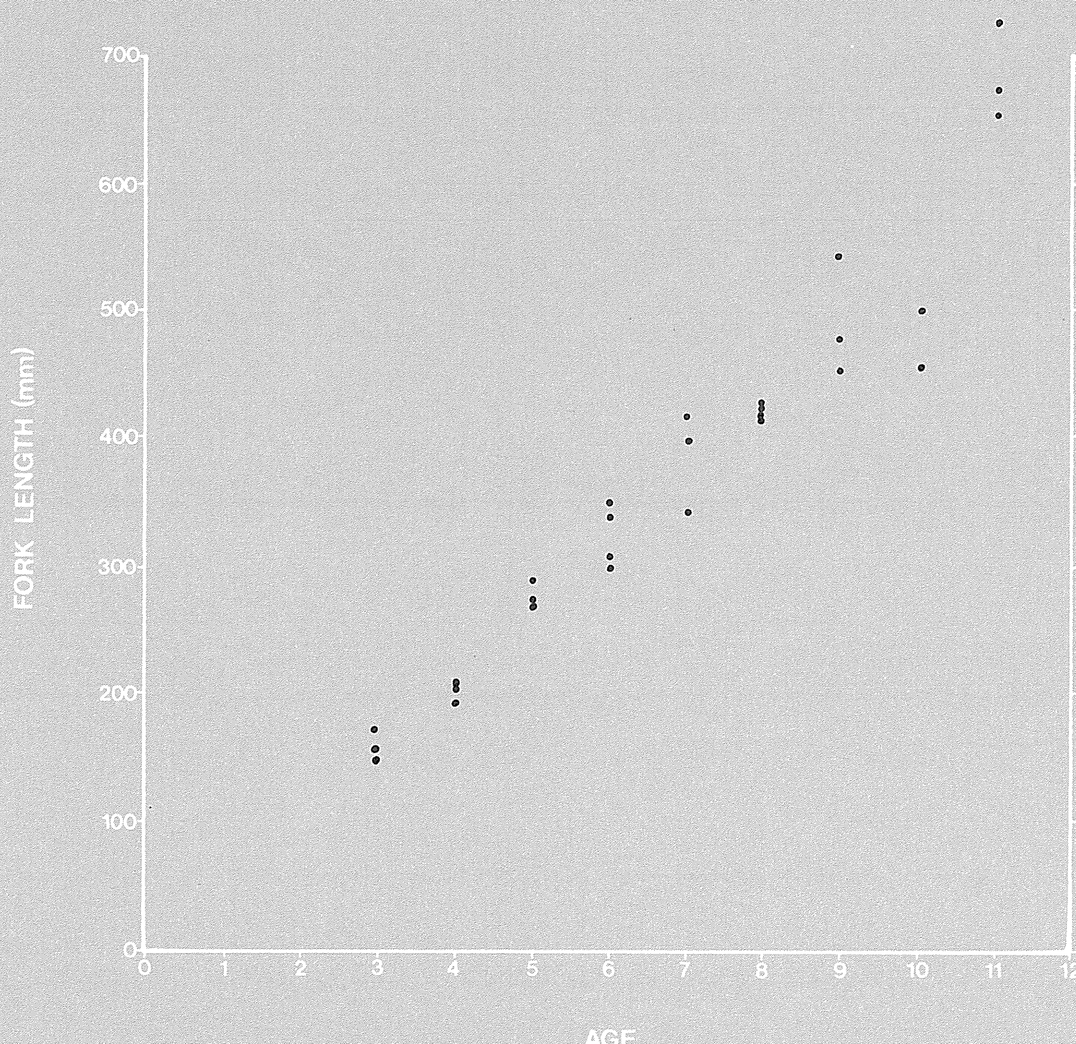
FIGURE K2.12

AGE-LENGTH RELATIONSHIP OF LAKE TROUT IN ATNA LAKE, 1980



APPENDIX K3

Summary Tables of Fish Sampling Results

TABLE K3.1
Seasonal Summary of Beach Seine Catches of Juvenile Sockeye Salmon, 1980

Location and Date	No. of Sets	Total Catch	Catch per Set	Species[1] Composition (%)	Mean Fork Length (mm)	Range Fork Length (mm)
Atna Lake						
May/June	67	6,471	96.6	97.1	34.0	21-63
July/August	63	394	6.3	58.2	40.9	26-70
September	41	84	2.0	37.0	51.8	43-75
Subtotal	171	6,949	40.6	91.8	38.4	21-75
Lake Above Falls						
May/June	16	1,070	66.9	96.5	38.2	21-105
July/August	24	322	13.4	89.3	45.5	29-80
September	17	288	16.9	71.1	51.5	40-80
Subtotal	57	1,680	29.5	89.6	44.6	21-80
Total	**228**	**8,629**	**37.8**	**91.4**	**41.3**	**21-80**

1 Percentage of total fish catch by beach seine

TABLE K3.2
Summary of Beach Seine Catches of Juvenile Sockeye Salmon for Each Sampling Date, 1980

	Atna Lake		Lower Lake		Atna & Lower Lake	
Date	Total Catch	Catch/ Set	Total Catch	Catch/ Set	Total Catch	Catch/ Set
May 31/1	1,120	50.9	-	-	1,120	50.9
June 9/12	2,319	105.4	215	26.9	2,534	84.5
June 17/24	3,032	131.8	855	106.9	3,887	125.4
July 30/1	212	10.6	184	26.3	396	14.7
Aug 8/10	78	3.5	55	6.9	133	4.4
Aug 18/19	104	5.0	83	9.2	187	6.2
Sept 14/16	76	3.6	213	23.7	289	9.6
Sept 21/23	8	0.4	75	9.4	83	3.0
Total	**6,949**	**40.6**	**1,680**	**29.5**	**8,629**	**37.8**

TABLE K3.3
Sockeye Salmon Beach Seine Catch per Unit Effort at Sampling Sites in Atna Lake and Lake above the Falls, 1980

Seine Site	June No. of Sets	June Catch/ Set	July/Aug No. of Sets	July/Aug Catch/ Set	Sept No. of Sets	Sept Catch/ Set
Atna Lake:						
1-7	23	113.8	21	4.3	14	0.1
8-11	13	165.2	12	12.4	8	8.5
12	3	36.3	3	21.0	1	10.0
13	3	136.7	3	0.3	2	0
14-18	13	85.5	15	4.7	8	0.5
19-22	12	6.3	9	2.2	8	0
Lower Lake:						
23-30	16	66.9	24	13.4	17	16.9

TABLE K3.4
Summary of Minnow Trap Catches of Coho Salmon Juveniles, 1980

Location	June			August			Sept/Oct		
	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap
Atna River	65	3	*	71	6	0.1	54	2	*
Atna River Tributaries:									
1	15	1	0.1	16	1	0.1	10	3	0.3
2	9	0	0	10	0	0	18	1	0.1
3	19	1	0.1	19	3	0.2	19	5	0.3
4	-	-	-	-	-	-	20	10	0.5
5	-	-	-	-	-	-	9	3	0.3
6 (Lower)	22	2	0.1	22	0	0	9	5	0.6
6 (Upper)	-	-	-	-	-	-	25	0	0
7	-	-	-	-	-	-	9	5	0.6
8	-	-	-	-	-	-	20	6	0.3
9	7	2	0.3	7	0	0	-	-	-
10a	12	0	0	12	0	0	-	-	-
10b	14	0	0	14	0	0	-	-	-
11	5	3	0.6	4	1	0.3	-	-	-
12	6	0	0	6	0	0	-	-	-
13	13	0	0	13	0	0	-	-	-
Total	122	9	0.1	123	5	*	139	38	0.3

(Continued)

TABLE K3.4 (Continued)

Location	June			August			Sept/Oct		
	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap
Atna Lake Creeks:									
1	15	0	0	15	0	0	-	-	-
2	11	0	0	11	0	0	-	-	-
3	14	6	0.4	15	0	0	15	0	0
4	19	0	0	19	1	0.1	19	0	0
5	10	0	0	9	0	0	7	0	0
6	10	0	0	9	0	0	5	0	0
7	10	2	0.2	9	0	0	5	2	0.4
8	10	0	0	10	0	0	10	0	0
9	20	8	0.4	15	1	0.1	19	0	0
10	10	0	0	-	-	-	10	0	0
Total	129	16	0.1	112	2	*	90	2	*
Lower Atna River									
Lake above falls	14	0	0	15	0	0	-	-	-
Atna Falls Creek	22	0	0	18	0	0	-	-	-
Lake and river below falls	25	2	0.1	25	2	0.1	-	-	-
Total	61	2	*	58	2	*	-	-	-

* Greater than 0 and less than 0.05

TABLE K3.5

Seasonal Summary of Minnow Trap Catches of Coho Salmon Juveniles, 1980

Sampling Period	No. of Traps	Total Catch	Catch per Trap	Species Composition (%)	Mean Fork Length (mm)	Range Fork Length (mm)
June	377	30	0.1	6.0	76.2	50-120
August	364	15	*	1.4	91.2	60-105
September/ October	283	42	0.2	3.3	94.4	50-135
Total	**1,024**	**87**	**0.1**	**3.0**	**88.2**	**50-135**

TABLE K3.6
Summary of Electrofishing Results for Coho Salmon Juveniles, 1980

Location	August, 1980 Stream Margin (m)	Total Catch	Catch per 100 m
Atna River	1,395	1	0.1
Atna River Tributaries			
T 1	125	-	
T 2	235	1	0.4
T 3	335	1	0.3
T 6	200	11	5.5
T 9	135	0	0
T 10a	150	0	0
T 10b	290	0	0
T 11	100	1	1.0
T 12	130	0	0
	1,700	14	0.8
Lake Creeks			
C 3	130	0	0
C 4	250	0	0
C 6	100	0	0
C 7	120	5	4.2
C 9	270	0	0
	870	5	0.6

Location	September, 1980 Stream Margin (m)	Total Catch	Catch per 100 m
Atna River			
Sidechannel Near Upper T 6	66	4	6.1
Atna River Tributaries			
T 1	180	0	0
T 3	200	2	1.0
T 4	70	0	0
T 6 (Lower)	200	10	5.0
T 6 (Upper)	110	0	0
T 7	25	0	0
T 8	180	1	0.6
	965	13	1.3
Lower Atna River			
Atna Falls Creek	150	0	0

TABLE K3.7 (Continued)

Location	June			August			Sept/Oct		
	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap
Atna Lake Creeks:									
1	15	4	0.3	15	6	0.4	-	-	-
2	11	0	0	11	0	0	-	-	-
3	14	4	0.3	15	4	0.3	15	5	0.3
4	19	18	1.0	19	50	2.6	19	56	3.0
5	10	9	0.9	9	2	0.2	7	5	0.7
6	10	0	0	9	6	0.7	5	14	2.8
7	10	2	0.2	9	0	0	5	13	2.6
8	10	12	1.2	10	21	2.1	10	19	1.9
9	20	38	1.9	15	5	0.3	19	8	0.4
10	10	0	0	-	-	-	10	4	0.4
Total	129	87	0.7	112	94	0.8	90	124	1.4
Lower Atna River									
Lake above falls	14	10	0.7	15	8	0.5	-	-	-
Atna Falls Creek	22	9	0.4	18	1	0.1	-	-	-
Lake & river below falls	25	3	0.1	25	2	0.1	-	-	-
Total	61	22	0.4	58	11	0.2	-	-	-

TABLE K3.8
Summary of Minnow Trap Catches of Dolly Varden Char, 1980

Sampling Period	No. of Traps	Total Catch	Catch per Trap	Species Composition (%)	Mean Fork Length (mm)	Range Fork Length (mm)
June	377	231	0.6	46.4	106.2	40-192
August	364	250	0.7	22.7	105.4	55-172
September/ October	283	293	1.0	23.0	118.0	40-170
Total	**1,024**	**774**	**0.8**	**26.9**	**110.7**	**40-192**

TABLE K3.10
Seasonal Summary of Beach Seine (:s of Mountain Whitefish, 1980

Location and Date	No. of Sets	otal itch	Catch per Set	Species Composition[1] (%)	Mean Fork Length (mm)	Range Fork Length (mm)
Atna Lake						
May/June	67	75	2.6	2.6	90.8	45-180
July/August	63	31	3.7	34.1	70.3	25-220
September	41	21	3.0	53.3	98.2	40-250
Subtotal	171	27	3.1	7.0	84.5	25-250
Lower Lake Above Falls						
May/June	16	27	1.7	2.4	69.8	23-150
July/August	24	34	1.4	9.4	82.5	28-190
September	17	16	6.8	28.6	79.3	35-260
Subtotal	57	,77	3.1	9.4	78.6	28-260
Total	**228**	**704**	**3.1**	**7.5**	**82.7**	**25-260**

1 Percentage of total fish catch by beach seine

TABLE K3.11
Summary of Beach Seine Catches of Mountain Whitefish for Each Sampling Date, 1980

Date	Atna Lake		Lower Lake		Atna & Lower Lake	
	Total Catch	Catch/ Set	Total Catch	Catch/ Set	Total Catch	Catch/ Set
May 31/1	65	3.0	-	-	65	3.0
June 9/12	9	0.4	2	0.3	11	0.4
June 17/24	101	4.4	25	3.1	126	4.1
July 30/1	135	6.8	16	2.3	151	5.6
Aug 8/10	46	2.1	8	1.0	54	1.8
Aug 18/19	50	2.4	10	1.1	60	2.0
Sept 14/16	48	2.3	68	7.6	116	3.9
Sept 21/23	73	3.7	48	6.0	121	4.3
Total	**527**	**3.1**	**177**	**3.1**	**704**	**3.1**

TABLE K3.12
Mountain Whitefish Beach Seine Catch per Unit Effort at Sampling Sites in Atna Lake and Lower Lake Above the Falls, 1980

Seine Site	June No. of Sets	June Catch/ Set	July/Aug No. of Sets	July/Aug Catch/ Set	Sept No. of Sets	Sept Catch/ Set
Atna Lake:						
1-7	23	2.9	21	2.6	14	1.8
8-11	13	4.1	12	6.8	8	4.4
12	3	0.3	3	1.0	1	.0
13	3	1.3	3	0	2	0.5
14-18	13	0.3	15	3.1	8	2.9
19-22	12	3.9	9	5.0	8	4.6
Lower Lake: (above the falls)						
23-30	16	1.7	24	1.4	17	6.8

TABLE K3.13
Seasonal Summary of Beach Seine Catches of Longnose Suckers, 1980

Location and Date	No. of Sets	Total Catch	Catch per Set	Species Composition (%)	Mean Fork Length (mm)	Range Fork Length (mm)
Atna Lake						
May/June	67	16	0.2	0.2	41.6	30-92
July/August	63	51	0.8	7.5	55.3	15-185
September	41	18	0.4	7.9	74.9	25-220
Subtotal	171	85	0.5	1.1	57.4	15-220
Lower Lake Above Falls						
May/June	16	2	0.1	0.2	130.0	40-220
July/August	24	2	0.1	0.5	170.0	165-175
September	17	0	0	-	-	-
Subtotal	57	4	0.1	0.2	150	40-220
Total	228	89	0.4	0.9	62.4	15-220

TABLE K3.14
Summary of Beach Seine Catches of Longnose Suckers for Each Sampling Date, 1980

	Atna Lake			Lower Lake			Atna & Lower Lake		
Date	Total Catch	Catch/ Set	% Catch	Total Catch	Catch/ Set	% Catch	Total Catch	Catch/ Set	% Catch
May 31/1	1	<0.05	0.2	-	-	-	1	<0.05	-
June 9/12	4	0.2	4.7	1	0.1	25.0	5	0.2	5.7
June 17/24	11	0.5	12.9	1	0	25.0	12	0.4	13.6
July 30/1	0	0	0	0	0	0	0	0	0
Aug 8/10	39	1.8	45.9	0	0	0	39	1.3	44.3
Aug 18/19	12	0.6	14.1	2	0.2	50.0	14	0.5	15.9
Sept 14/16	10	0.5	11.8	0	0	0	10	0.3	11.4
Sept 21/23	8	0.4	9.4	0	0	0	8	0.3	9.1
Total	**85**	**0.5**		**4**	**0.1**		**89**	**0.4**	

TABLE K3.15
Longnose Sucker Beach Seine Catch per Unit Effort at Sampling Sites in Atna Lake and Lower Lake Above the Falls, 1980

Seine Site	June No. of Sets	June Catch/Set	July/Aug No. of Sets	July/Aug Catch/Set	Sept No. of Sets	Sept Catch/Set
Atna Lake:						
1-7	23	0	21	0	14	0
8-11	13	0.8	12	2.0	8	1.6
12	3	1.3	3	0	1	0
13	3	0	3	0	2	0
14-18	13	0	15	1.7	8	0
19-22	12	0.1	9	0.1	8	0.6
Lower Lake: (above the falls)						
23-30	16	0.1	24	0.1	17	0

TABLE K3.16
Summary of Minnow Trap Catches of Longnose Suckers, 1980

	June			August			Sept/Oct		
Location	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap	No. of Traps	Total Catch	Catch per Trap
Atna River	65	8	0.1	71	6	0.1	54	4	0.01
Atna River Tributaries:									
1	15	1	0.1	16	1	0.1	10	0	0
2	9	0	0	10	0	0	18	0	0
3	19	68	3.6	19	5	0.3	19	10	0.5
4	-	-	-	-	-	-	20	24	1.2
5	-	-	-	-	-	-	9	0	0
6 (Lower)	22	29	1.3	22	149	6.8	9	13	1.4
6 (Upper)	-	-	-	-	-	-	25	526	21.0
7	-	-	-	-	-	-	9	5	0.6
8	-	-	-	-	-	-	20	1	0.1
9	7	0	0	7	1	0.1	-	-	-
10a	12	0	0	12	0	0	-	-	-
10b	14	0	0	14	0	0	-	-	-
11	5	0	0	4	1	0.3	-	-	-
12	6	0	0	6	0	0	-	-	-
13	13	0	0	13	0	0	-	-	-
Total	122	98	0.8	123	157	1.3	139	579	4.2

(Continued)

TABLE K3.16 (Continued)

Location	June No. of Traps	June Total Catch	June Catch per Trap	August No. of Traps	August Total Catch	August Catch per Trap	Sept/Oct No. of Traps	Sept/Oct Total Catch	Sept/Oct Catch per Trap
Atna Lake Creeks:									
1	15	47	3.1	15	56	3.7	-	-	-
2	11	3	0.3	11	7	0.6	-	-	-
3	14	1	0.1	15	316	21.0	15	332	21.5
4	19	0	0	19	34	1.8	19	0	0
5	10	43	4.3	9	109	12.1	7	19	2.7
6	10	0	0	9	17	1.9	5	1	0.2
7	10	19	1.9	9	68	7.6	5	2	0.4
8	10	0	0	10	0	0	10	0	0
9	20	0	0	15	0	0	19	0	0
10	10	0	0	-	-	-	10	0	0
Total	129	113	0.9	112	607	5.4	90	354	3.9
Lower Atna River									
Lake above falls	14	2	0.1	15	0	0	-	-	-
Atna Falls Creek	22	0	0	18	0	0	-	-	-
Lake & river below falls	25	0	0	25	2	0.1	-	-	-
Total	61	2	<0.05	58	2	<0.05	-	-	-

TABLE K3.17
Summary of Minnow Trap Catches of Longnose Suckers, 1980

Sampling Period	No. of Traps	Total Catch	Catch per Trap	Species Composition (%)	Mean Fork Length (mm)	Range Fork Length (mm)
June	377	221	0.6	44.4	80.8	40-170
August	364	772	2.1	70.1	78.2	33-160
September/ October	283	937	3.3	73.5	83.1	40-160
Total	1,024	1,930	1.9	67.2	80.3	33-170

TABLE K3.18
Summary of Electrofishing Results for Longnose Suckers, 1980

Location	August, 1980 Stream Margin (m)	Total Catch	Catch per 100 m
Atna River	1,395	1	0.1
Atna River Tributaries			
T 1	125	-	-
T 2	235	-	-
T 3	335	80+	23.9
T 6	200	15	7.5
T 9	135	0	0
T 10a	150	0	0
T 10b	290	0	0
T 11	100	0	0
T 12	130	0	0
	1,700	95	5.6
Lake Creeks			
C 3	130	64	49.2
C 4	250	1	0.4
C 6	100	0	0
C 7	120	75	62.5
	600	140	23.3

Location	September, 1980 Stream Margin (m)	Total Catch	Catch per 100 m
Atna River			
Sidechannel Near Upper T 6	66	1	1.5
Atna River Tributaries			
T 1	180	0	0
T 3	200	10	5.0
T 4	70	1	1.4
T 6 (Lower)	200	2	1.0
T 6 (Upper)	110	44	40.0
T 7	25	0	0
T 8	180	0	0
	965	57	5.9
Lower Atna River			
Atna Falls Creek	150	0	0