RESULTS OF A TEST FISHERY FOR ARCTIC CHARR IN TWO UNNAMED LAKES ON BANKS ISLAND N.W.T., AUGUST, 1987

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1.0 INTRODUCTION

The community of Sachs Harbour within the Inuvialuit Settlement Region of the Western Arctic, expressed interest in initiating a commercial and/or sport fishery for Arctic charr (Salvelinus alpinus) in two unnamed lakes on eastern Banks Island N.W.T. (Fig. 1). In response to their concerns, the Fisheries Joint Management Committee in cooperation with the Department of Fisheries and Oceans, conducted a test fishery for Arctic charr on these two lakes and in the Thomsen River between 11 and 26 August, 1987.

Both are typical Arctic lakes. They are cold, amictic, and unproductive, being ice covered for up to 10 months of the year. The westernmost lake, hereafter named West Lake (73 5 N, 18 45 W), is a lake in the headwaters of the Thomsen River, a major river system flowing north through central Banks Island. The easternmost lake, hereafter named East Lake (73 5 N, 188 15 W), is the largest lake in the headwaters of a small unnamed river which flows into Prince of Wales Strait, south of the Parker River (Fig. 1).

The following report provides a summary of the results of the test fishery for Arctic charr in East and West Lakes, Banks Island.

2.0 MATERIALS AND METHODS

Each lake was fished at several locations (Fig. 2) with two, 50m monofilament gillnet test gangs (1 x 10m panels of 38, 63, 89, 114 and 133 mm stretch measure). Certain locations were also fished on an

itinerant basis with a 50 m, 133 mm stretch mesh cotton gillnet. Nets were set nearshore in the evening, checked the following morning and either reset or moved, depending on the catch.

All Arctic charr captured were measured for fork length (mm) and round weight (g). Sex and state of maturity (after McGowan 1987) were determined by examination of the gonads. Stomach contents were examined and their contents described. Presence or absence of parasites was also noted. Otoliths were removed, stored dry in scale envelopes and returned to Winnipeg for ageing. Catch per unit effort (CPUE) was also calculated for each net set at each location and is reported as the total kg of charr captured/ 100 m net / 24 hours.

Total instantaneous mortality rate (Z) was calculated from catch curves constructed from the log(length) versus age relationship for charr from both lakes (Ricker 1975). The slope of the descending limb of the curve represents the mortality rate of fully recruited members of the population. Because no previous fishing has occured on these lakes, total instantaneous mortality is equivalent to the natural mortality rate.

Lake trout (S. namaycush) which were captured alive were recorded as caught and released. Most mortalities were measured for fork length (mm) and round weight (g). No further biological work was performed on the lake trout.

3.0 RESULTS

3.1 West Lake

West Lake was fished for a total of 212.5 net hours with 76 Arctic charr captured, weighing 128.4 kg (Table 1). This corresponds to a mean yield of 0.60 kg of charr/net hour. Mean length and weight was 537 mm and 1.690 kg respectively (Table 2). The length distribution of charr was fairly uniform with 62% of all fish between 450 and 550 mm. Mean condition factor was low at 1.02. Males were slightly larger and heavier than females and had a significantly different weight-length relationship (Table 3). Maturity data was incomplete for West Lake Arctic charr and therefore cannot be discussed.

Age ranged between 5 and 20 years with a mean of 15.0 years (Table 4). Fifty-eight percent of the fish aged were between 15 and 17 years. Total instantaneous mortality rate (Z) was calculated to be 0.55 between the ages of 16 and 19.

The large majority of charr and lake trout were captured at location A of West Lake (Fig. 2). CPUE's were high, ranging from 16.98 to 89.16 (Table 1). This was one of the deepest spots on the lake (5-8 m) and appeared to be a spawning area for lake trout as several ripe females and running males were captured here. In addition, several of the stomachs of Arctic charr captured here contained eggs.

Few charr were caught at the other locations due to a combination of a sandy bottom several meters offshore and shallow depth. Much of the lake south of location A was very shallow (<1.0 m) and sandy, which made boat travel difficult to impossible south and east of this location. Fishing was therefore limited to the northern area of the lake.

Seventy-five percent of the charr had empty stomachs. The remainder contained primarily benthic worms or polychaetes and to a lesser degree detritus, fish eggs and in one instance, insects.

Lake trout were relatively more abundant than Arctic charr in West Lake as 139 trout were captured, again, primarily from location A. The average size of trout measured was 623 mm (482 - 972 mm) and 2.779 kg (1.225 - 11.250 kg) with a maximum size of 11.250 kg or 25 lbs. No further biological data was collected for lake trout.

One whitefish (Coregonus sp.), possibly a lake whitefish (305 mm, 300 g), was captured at location B. This represents a significant range extension for whitefish as this is the first report of a whitefish for Banks Island (Johnson 1976, Zoltai et al. 1980). It is possible that a relict population has existed in this lake system since the last glacial retreat 8,000 years ago.

3.2 East Lake

East Lake was fished for a total of 365.5 net hours with 120 charr captured weighing 186.5 kg (Table 1). The average yield of 0.51 kg/net hour is slightly less than was found for West Lake. Charr from East Lake were also slightly smaller that West Lake charr, having a

mean length of 524 mm and mean weight of 1.583 kg (Table 5). Condition factor (K) was similar at 1.02. The length distribution of charr was quite uniform with 70% of the fish between 450 and 550 mm.

Males were significantly larger and heavier than females (Table 5) and shared similar length-weight distributions with males and females from West Lake (Table 2). Age was variable, ranging from 5 to 22 years with a mean age of 15.8 years, slightly greater than West Lake charr (15.0 years)(Table 6). The modal age was between 16 and 17 years. Total instantaneous mortality rate (Z) was estimated to be 0.33 between the ages of 16 and 20 years.

The percentage of mature fish captured was relatively high, as 13% of males and 38% of females would spawn the current year. Most of the mature fish were captured from location C (Fig. 2), which was located near a stream outlet, fed by three small lakes. Arctic charr and lake trout were concentrated in large numbers at the stream mouth between August 18 and 23. Because no fish were observed to move up the stream during this time, it is uncertain whether this was simply a staging area for charr and possibly lake trout to move into spawning and overwintering areas off of the main lake, or whether spawning occured at this specific location. Zoltai et al. (1980). indicated that a previous study identified this area as a spawning ground for Arctic charr.

Catch per unit effort for charr ranged between zero and 78.0 kg charr/100 m net/ 24 hours (Table 1). Charr were captured most consistently from location C as CPUE ranged between 24.1 and 78.0 (excluding values recorded when shifting ice pans washed the nets

ashore), with a mean CPUE of 41.8. Charr and trout were not abundant in the lake except in the vicinity of this location, as very few charr were captured from nets set at the outlet of the lake at locations A and B, or at locations E and F (Fig. 2, Table 1). A survey of the lake reaveled that there was no significant inflow into East Lake except from the small lakes south of location C. East Lake is however, much larger and much deeper than West Lake and offers more suitable habitat for Arctic charr and lake trout.

Only 15% of the stomachs examined were empty. The remaining charr fed exclusively on chironomids which had died and fallen in the lake, actually creating black slicks they were so abundant.

Air bladder nematodes were common in the charr. Some individuals were so heavily infested, their air bladders were nearly full of nematodes. Parasites in the gills or the gut were infrequent.

3.3 Thomsen River

A single 50 m test gang was set across the Thomsen River at 73 16' N, 119 40' W between 18 and 19 August, 1987. In 24 hours only four small, silver, anadromous charr were caught. They ranged in length from 405 - 505 mm and 675 - 1350 g in weight. Age ranged from 8 to 13 years. Three were immature females while one was a 10 year old (1250 g) ripe female. One stomach was empty, one contained worms and the other two were full of nine-spine stickleback (Pungitius pungitius), which have previously been reported in the Thomsen River area (Zoltai et al. 1980). It did not appear as if a run of Arctic charr was occuring at this time.

4.0 DISCUSSION

Arctic charr from East and West Lakes on Banks Island were typical of the Eastern form of Arctic charr described by McPhail (1961). Based upon size and age, it is assumed that both are anadromous populations, however no migration of charr into either of these lakes was detected and only four small charr were captured moving up the Thomsen River. It is possible that the upwards migration had been completed by mid-August, or was not detected. No lake resident fish were found.

Few fisheries sudies have been performed on Banks Island, except during early exploratory or geological expeditions (Zoltai et al. 1980). Only six species of fish, Arctic charr, lake trout least and lake cisco, ninespine stickleback and fourhorn sculpin have been reported from the Thomsen River, depauperate by southern standards, yet the Thomsen River supports the most northerly example of a multi-species fish community. The current find of a whitefish expands this list and is significant in that no whitefish has previously been reported for Banks Island.

In East and West Lakes Arctic charr were low in abundance, had a patchy distribution and were generally of poor quality, being slinky and pale. East Lake charr did not differ substantially in biological characteristics from West Lake charr, having similar mean length, weight and age distributions and relationships (Tables 2, 3, 4, 5 and 6). Both populations also had relatively low mortality rates indicating that they have been unexploited.

Geographically, the two systems are extremely close to being joined, despite the fact their outlets are separated by several hundred kilometers. Only a 50 m strip of land, 1-2 m in height separates them at the south end of East Lake (Fig. 2). It is possible that these two systems were only recently separated, thereby explaining the similarity of the charr in the two lake systems.

Despite its size, West Lake is very shallow over much of its area, making boat travel difficult and reducing available habitat for charr and trout. Because of the small area of the lake, it is unlikely that it could support a large population of fish.

East Lake is relatively much larger, being deep over its entire area and could theoretically support a large charr and trout population. Despite this, CPUE was low at all but one fishing location. Shifting ice pans were also a continual problem at the south end of the lake during the study. On the night of August 21, a storm drove ice into two of the nets, tearing and washing them ashore. Persistent ice throughout the summer would hamper any commercial fishing effort on the lake. Zoltai et al. (1980) reported that West Lake is an "excellent sport fishing lake for lake trout and arctic char" but that the lake was "ice bound throughout the year, with leads developing along the shores in summer, allowing fishing from the shore or from boats". Even though the lake was ice free during 1987, this report confirms that during cold or late summers, fishing may be difficult to impossible.

These factors, combined with the distance, extremely high transportation costs, lack of freezing and storage facilities in Sachs Harbour and difficult logistics, would not make a commercial fishing venture for Arctic charr economically viable, or practical in this area.

The presence of a healthy population of trophy size (>20 lbs) lake trout in addition to the Arctic charr population, introduces the potential for a sport fishery on East Lake, and to a lesser degree, West Lake. However, the deterents of high cost, a harsh environment, distance and difficulty in transportation are difficult to overcome.

In conclusion, the Arctic charr populations of East and West Lakes on Banks Island are not abundant enough, or of high enough quality to justify the expense and difficulty of initiating a commercial fishery for Arctic charr. Development of a sport fishery will depend on the amount of interest shown by sport fishermen and the money they are willing to spend. It is recommended that no further biological work on these lakes is necessary.

5.0 LITERATURE CITED

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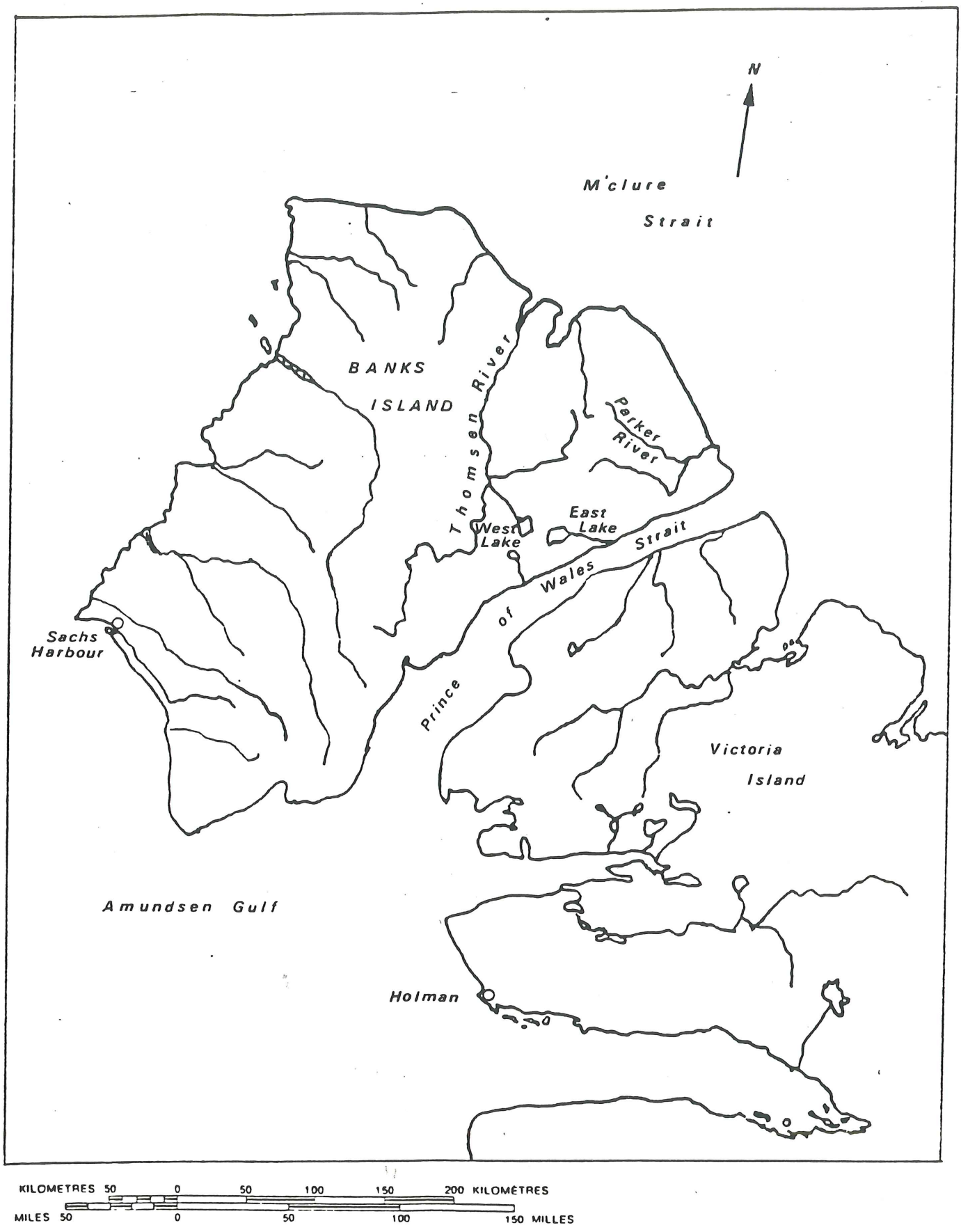

Figure 1. Banks Island, N.W.T. showing the location of East and West Lakes.

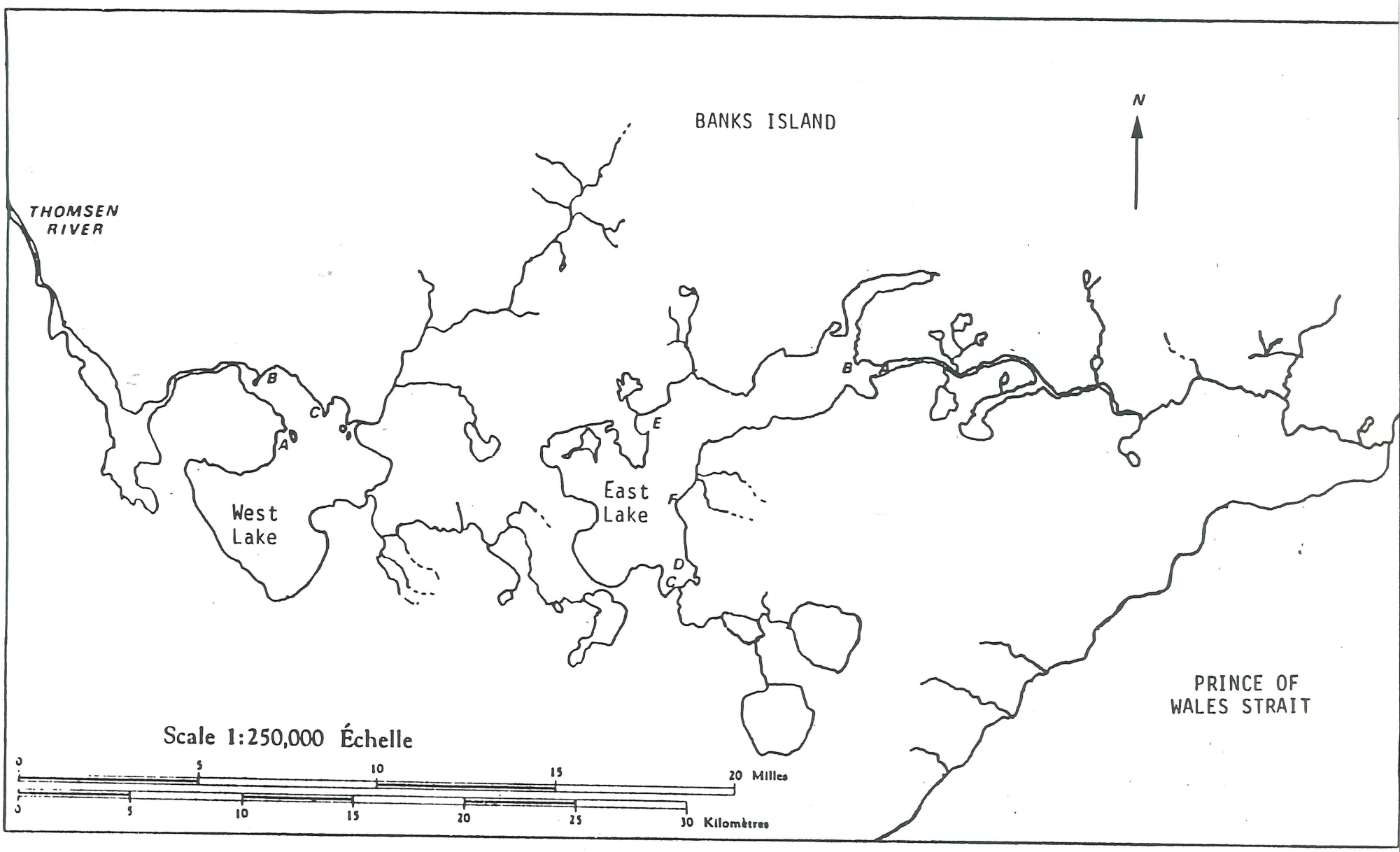

Figure 2. Sampling locations (A - F) on East and West Lakes, Banks Island N.W.T. Location A on West Lake and location C on East Lake are spawning areas for Arctic charr and lake trout.

Table 1. Details of location, hours set, number of nets, yield (kg) and catch per unit effort (CPUE) (kg of charr/100 m/24 hrs) of a test fishery for Arctic charr in East and West Lakes, Banks island.

Lake	Date	Location	# Hours	# Nets	Yield (kg)	CPUE
East	Aug 11	A	24	1	0	0
		B	24	1	0	0
	12	A	15	1	0	0
		B	15	1	5.125	10.25
	13	C	24	1	39.000	78.00
		D	24	1	3.425	6.85
	19	C	18	2	18.125	24.11
	20	C	12.5	1	12.275	48.50
		D	12.0	1	5.125	20.30
	21	C[1,2]	18	1	0	0
		D[1]	12	1	6.675	26.70
	22	C[1]	46	1	18.375	19.17
	23	C[2]	21	2	33.64	38.45
	24	E	24	1	6.453	12.90
		F	24	1	4.173	8.35
	25	C[2]	13	2	17.147	31.66
		C	5	1	3.148	30.32
	26	C	16	1	13.862	41.59
			365.5		186.548	
West	Aug 14	A,B	15	2	21.150	21.20
		A,B	7	2	15.375	52.70
	15	A	16	1	29.725	89.16
		B	16	1	1.850	5.55
	15	A	9.5	1	10.0	50.60
		B	9.5	1	0	0
		C[1]	9.5	1	1.400	7.08
	16	A[1]	14	2	17.60	30.10
		B	14	1	3.875	13.29
	16	A[1]	10	2	7.075	16.98
		B	10	1	0.025	0.12
	17	A[1]	12	2	16.875	33.75
		B	12	1	3.475	6.95
			212.5		128.425	

[1]Shifting ice pans during storm washed nets ashore.
[2]Additional 133 mm, 50 m cotton net set.

Table 2. Mean length (mm), mean weight (g), mean condition factor (K) and percent mature by length interval for Arctic charr collected from West Lake, Banks Island, N.W.T. during August, 1987.

LENGTH INTERVAL (MM)	MALES						FEMALES						COMBINED					
		LENGTH(MM)	WEIGHT(G)			%		LENGTH(MM)	WEIGHT(G)			%		LENGTH(MM)	WEIGHT(G)			%
	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT	N	MEAN	MEAN	SD	K	MAT
150	-	-	-	-	-	-	1	186	25	-	0.39	0	1	186	25	-	0.39	0
300	2	338	325	71	0.84	0	-	-	-	-	-	-	2	338	325	71	0.84	0
350	3	384	583	63	1.03	0	1	395	700	-	1.14	0	4	387	613	78	1.06	0
400	2	447	875	35	0.98	0	1	414	800	-	1.13	0	3	436	850	50	1.03	0
450	4	460	956	341	0.97	0	2	474	1188	194	1.11	0	6	464	1033	302	1.02	0
500	2	525	1638	159	1.13	0	9	526	1556	164	1.07	0	12	525	1585	160	1.09	0
550	19	579	2053	181	1.06	5	16	563	1836	169	1.03	25	35	572	1954	205	1.04	14
600	9	616	2214	326	0.95	22	4	611	2306	366	1.01	0	13	614	2242	326	0.97	15
TOTAL	41						34						76					
MEAN		541	1712	665	1.01			533	1662	496	1.03			537	1690	587	1.02	

Table 4. Mean length (mm), mean weight (g), mean condition factor (K) and mean percent mature by age for Arctic charr collected from West Lake, Banks Island, N.W.T. during August, 1987.

AGE (YR)	MALES							FEMALES							COMBINED						
		LENGTH(MM)		WEIGHT(G)			%		LENGTH(MM)		WEIGHT(G)			%		LENGTH(MM)		WEIGHT(G)			%
	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT	N	MEAN	SD	MEAN	SD	K	MAT
5	-	-	-	-	-	-	-	1	186	-	25	-	0.39	0	1	186	-	25	-	0.39	0
10	-	-	-	-	-	-	-	1	395	-	700	-	1.14	0	1	395	-	700	-	1.14	0
11	3	422	118	950	869	1.05	0	1	414	-	800	-	1.13	0	4	420	96	913	714	1.07	0
12	1	446	-	850	-	0.96	0	2	530	35	1675	530	1.10	0	3	502	55	1400	606	1.06	0
13	4	463	59	1156	484	1.11	0	-	-	-	-	-	-	-	4	463	59	1156	484	1.11	0
14	-	-	-	-	-	-	-	2	516	42	1450	177	1.06	0	2	516	42	1450	177	1.06	0
15	5	540	83	1600	806	0.93	0	6	531	38	1542	286	1.02	0	12	534	57	1583	526	1.00	0
16	3	519	68	1575	602	1.09	0	4	569	47	1975	603	1.05	0	7	548	58	1804	590	1.06	0
17	2	578	20	2188	265	1.13	0	7	552	32	1854	256	1.10	14	9	558	31	1928	282	1.11	11
18	1	576	-	1950	-	1.02	0	2	554	2	1575	71	0.93	0	3	561	13	1700	222	0.96	0
19	1	555	-	1700	-	0.99	0	-	-	-	-	-	-	-	1	555	-	1700	-	0.99	0
20	2	600	13	2113	53	0.98	0	-	-	-	-	-	-	-	2	600	13	2113	53	0.98	0
TOTAL	22							26							49						
MEAN		514	84	1514	670	1.03			520	85	1579	537	1.03			517	83	1553	590	1.04	
MEAN AGE	14.9							14.9							15.0						

Table 3. Length-frequency relationship by sex for East and West Lake Arctic charr of Banks Island, N.W.T. The equation is of the form: $Log_{10}W = a + b\ (Log_{10}L)$ where W = weight (g) and L = fork length (mm).

Lake	Sex	N	a	b	r^2
West	Males	42	-5.38	3.14	92
	Females	34	-6.76	3.65	97
	Combined	76	-6.11	3.41	94
East	Males	62	-5.49	3.18	95
	Females	57	-6.39	3.52	95
	Combined	119	-5.97	3.36	95

Table 5. Mean length (mm), mean weight (g), mean condition factor (K) and percent mature by length interval for Arctic charr collected from East Lake, Banks Island, N.W.T. during August, 1987.

LENGTH INTERVAL (MM)	MALES						FEMALES						COMBINED					
	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	WEIGHT(G) MEAN	SD	K	% MAT
200	2	217	75	0	0.74	0	4	214	63	32	0.62	0	6	215	67	26	0.66	0
350	1	375	551	-	1.04	0	2	362	474	69	1.00	0	3	366	500	66	1.01	0
400	3	433	852	41	1.05	0	3	411	847	101	1.22	0	6	422	850	69	1.13	0
450	4	466	1063	341	1.03	0	6	488	1391	215	1.19	50	10	480	1260	305	1.13	30
500	12	536	1637	216	1.07	8	24	529	1586	187	1.07	46	36	531	1603	196	1.07	33
550	30	575	1901	233	1.00	20	16	564	1761	222	0.99	38	47	571	1850	235	0.99	26
600	9	615	2247	147	0.97	11	1	600	2333	-	1.08	100	10	614	2256	141	0.98	20
TOTAL	61						56						118					
MEAN		544	1712	531	1.01			501	1440	527	1.03			524	1583	542	1.02	

Table 6. Mean length (mm), mean weight (g), mean condition factor (K) and mean percent mature by age for Arctic charr collected from East Lake, Banks Island, N.W.T. during August, 1987.

AGE (YR)	MALES							FEMALES							COMBINED					
	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT	N	LENGTH(MM) MEAN	SD	WEIGHT(G) MEAN	SD	K	% MAT
7	1	209	-	75	-	0.82	0	4	214	13	63	32	0.62	0	5	213	11	65	29	0.66	0
8	1	225	-	75	-	0.66	0	-	-	-	-	-	-	-	1	225	-	75	-	0.66	0
11	-	-	-	-	-	-	-	1	352	-	425	-	0.97	0	1	352	-	425	-	0.97	0
12	3	446	74	960	505	1.02	0	1	371	-	523	-	1.02	0	4	428	71	851	467	1.02	0
13	4	569	77	1760	847	0.88	0	3	471	106	1145	611	1.07	0	7	527	97	1496	769	0.96	0
14	2	505	107	1451	812	1.07	0	-	-	-	-	-	-	-	2	505	107	1451	812	1.07	0
15	1	552	-	1900	-	1.13	0	5	515	63	1562	354	1.15	50	6	521	58	1619	345	1.15	40
16	9	531	66	1594	527	1.07	22	2	547	4	1819	80	1.11	0	11	534	60	1639	475	1.08	18
17	3	537	6	1798	160	1.16	0	9	529	27	1629	237	1.09	57	12	531	23	1671	227	1.11	40
18	5	575	31	1999	509	1.03	25	3	512	17	1514	143	1.13	100	8	551	41	1817	465	1.07	57
19	3	562	42	2054	272	1.16	0	1	541	-	1650	-	1.04	-	4	557	36	1953	300	1.13	0
20	1	571	-	1749	-	0.94	0	1	547	-	1725	-	1.05	0	3	568	19	1733	14	0.95	0
21	2	565	29	1681	401	0.92	0	4	548	16	1730	351	1.05	67	6	553	20	1713	326	1.00	40
22	1	582	-	2000	-	1.01	-	-	-	-	-	-	-	-	1	582	-	2000	-	1.01	-
TOTAL	36							34							71						
MEAN		523	97	1608	653	1.02			478	113	1341	619	1.03			502	107	1480	642	1.03	
MEAN AGE	15.5							15.5							15.8						