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THE BELCHER ISLAND CHAR FISHERY

A STATEMENT OF CONCERN

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Sanikiluaq Hamlet Council

November 1978

Acknowledgements

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INTRODUCTION

In the recent past, the residents of Sanikiluaq have been increasingly concerned about the presence of a sports fishing lodge on the Kasegalik River, Belcher Islands. This report outlines the basis of their concerns, provides background information relevant to these concerns, and draws some conclusions stemming from consideration of the foregoing.

The information and conclusions contained in this report are necessarily tentative, due both to the short time that has been available to research the problem, and the lack of information on the Belcher Island domestic and sport fishery. However, despite these limitations this report has been prepared in the hope that it will in some way assist those people most involved and concerned about the rational management of a valued resource on the Belcher Islands, N.W.T.

THE BASIS OF CONCERN

The reasons most strongly and frequently voiced related to the precarious nature of the renewable resource base on the Belcher Islands and the importance of these resources to the continued sense of well-being of the local residents, the particular importance of arctic char as a resource, the environmentally harmful effects of the tourist operation over the past several years, and the apparent inadequacy of

existing fish management practices. These issues will be addressed immediately below.

(a) Limited resources--general considerations

There are several studies and reports that comment on the biological resource base and subsistence activities of the Belcher Island Inuit (e.g. Burwash 1927; Freeman 1963; 1967; McLaren 1958; 1962; McLaren and Mansfield 1960; Schwartz 1976). These reports confirm the limited range of resources available, and the great extent to which the islanders exploit fully the resource potential available to them. McLaren's work, in particular, illustrates the critical nature of the resource situation, for despite the relative abundance of seals compared to immediately adjacent coastal areas, several (climatic) factors adversely afect successful local harvesting of seals.

A recent study has indicated the extensive land and sea areas covered by the local hunters, whereby all regions of the Belcher Island archipelago continue to be visited for specific resource harvesting activities (Schwartz, 1976). This activity, translated into actual land/sea areas is shown, for selected land use activities, in Figures 4 and 5, and is represented as actual 'square miles' used in Table 1. It is apparent from these data that even following concentration of the population into 'permanent' settlements (starting in 1961), resource harvesting still entails extensive use of the land

PRE-1960					1961-1974			
AREA IN SQUARE MILES			NUMBER OF INFORMANTS	RESOURCES	AREA IN SQUARE MILES			NUMBER OF INFORMANTS
Average	Minimum	Maximum			Average	Minimum	Maximum	
25	9	81	12	Marine Fish	29	9	81	9
51	9	172	26	Freshwater fish	60	9	172	20
58	9	172	19	Walrus	57	9	145	16
79	9	245	23	Beluga	91	9	436	19
120	9	509	10	Polar Bear	419	18	1410	15
153	18	618	27	Wildfowl/ eggs	109	18	309	20
218	27	1237	28	Eider ducks	117	27	309	23
256	18	1219	26	Foxtrapping	195	36	491	23
295	18	1319	28	Geese	264	18	1319	24
2264	100	5660	28	Bearded Seal	1018	45	3758	24
2303	136	5660	28	Ringed Seal	1041	45	3712	24

Table 1. Resource harvesting areas, Belcher Islands, N.W.T. (after Freeman et al 1976).

and surrounding marine areas: e.g. seal hunters range over areas greater than one thousand square miles of sea and sea ice on average, with the most mobile ranging over areas of about 3,700 square miles. Some resource harvesting activities (including fishing) occupy smaller areas, and reflect the highly discriminatory nature of skillful resource harvesting as well as the more restricted distribution of some resources.

(b) Limited resources--arctic char

Arctic char production is not that bountiful on the Belcher Islands. Biological studies in the arctic repeatedly confirm the low productivity of northern freshwater lakes: a recent review of the subject concluded that large arctic lakes are only about one-tenth as productive as lakes in more southerly locations, and that average production of fish in these cold water lakes may only average about from one half to one pound of fish per acre of lake surface (Peterson 1976: 95). Arctic rivers are more productive than lakes, and where fish spend part of the year in the sea (as arctic char do) production rates are higher than achieved in lakes alone. However, in the present context it should be remembered that (1) with the single exception of the Kasegalik River, all rivers and streams on the Belcher Islands are short and shallow, and so do not provide a productive environment for arctic char, and (2) only a proportion of the arctic char in

any lake make the journey to the sea or into rivers in any given year.

In 1959 the Fisheries Research Board of Canada conducted a study of the Kasegalik river and lake arctic char population. In a report on this investigation it is stated: "The growth rate for Arctic Char of Kasegalik Lake show that 16 years are required to produce the average maximum-sized fish. The slow growth rate evidenced indicates relatively low production" (Hunter and Perey, ms.). Furthermore, it must be remembered that (1) the Kasegalik drainage represents an overwhelmingly large proportion of the total arctic char habitat on the archipelago (see Figure 4); (2) that total fish production includes the growth of a large percentage of small fish, of uneatable/uncatchable size; and (3) the exploitation of the fish stock beyond a certain point likely results in a diminished capacity of that stock to sustain that ongoing level of exploitation.

Figures 1, 2 and 3 illustrate the location and extent of current char fishing areas on the archipelago. For purposes of clarity, Kasegalik Lake is omitted from Figures 1 and 2, though some actual locations on the lake (e.g., locations 13, 15, and 16 in Figure 2), and on other lakes associated with the Kasegalik drainage (e.g., locations 28, 31 on Figure 1) are indicated. It is also probable that inshore fishing areas in the sea (e.g., locations 29, 30, 32, on Figure 1) are supplying char originating from the Kasegalik drainage. Later in this report the relative importance of these different

FIGURE 1

BELCHER ISLANDS CURRENT FISHING LOCATIONS

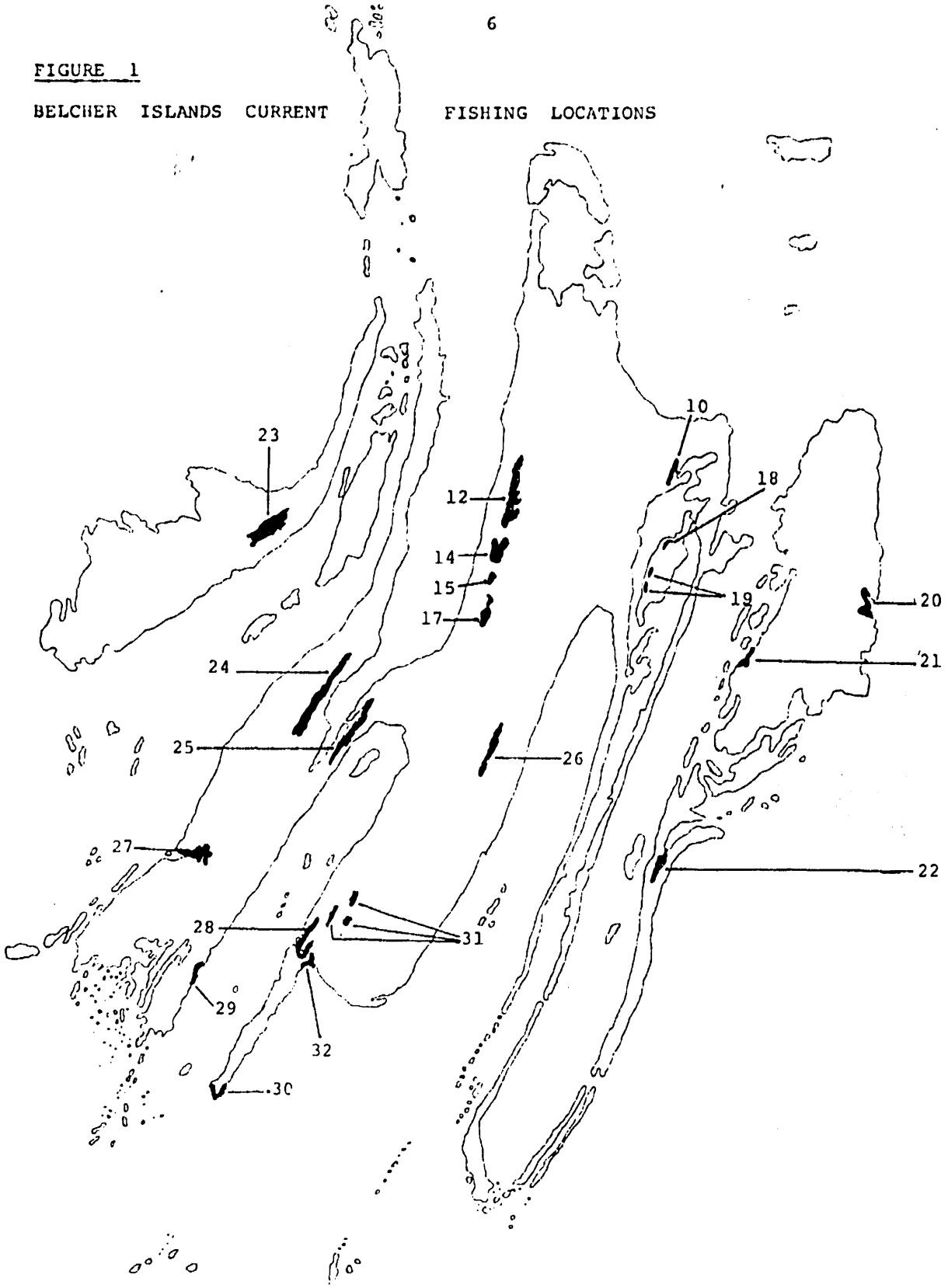


FIGURE 2 BELCHER ISLANDS CURRENT FISHING LOCATIONS

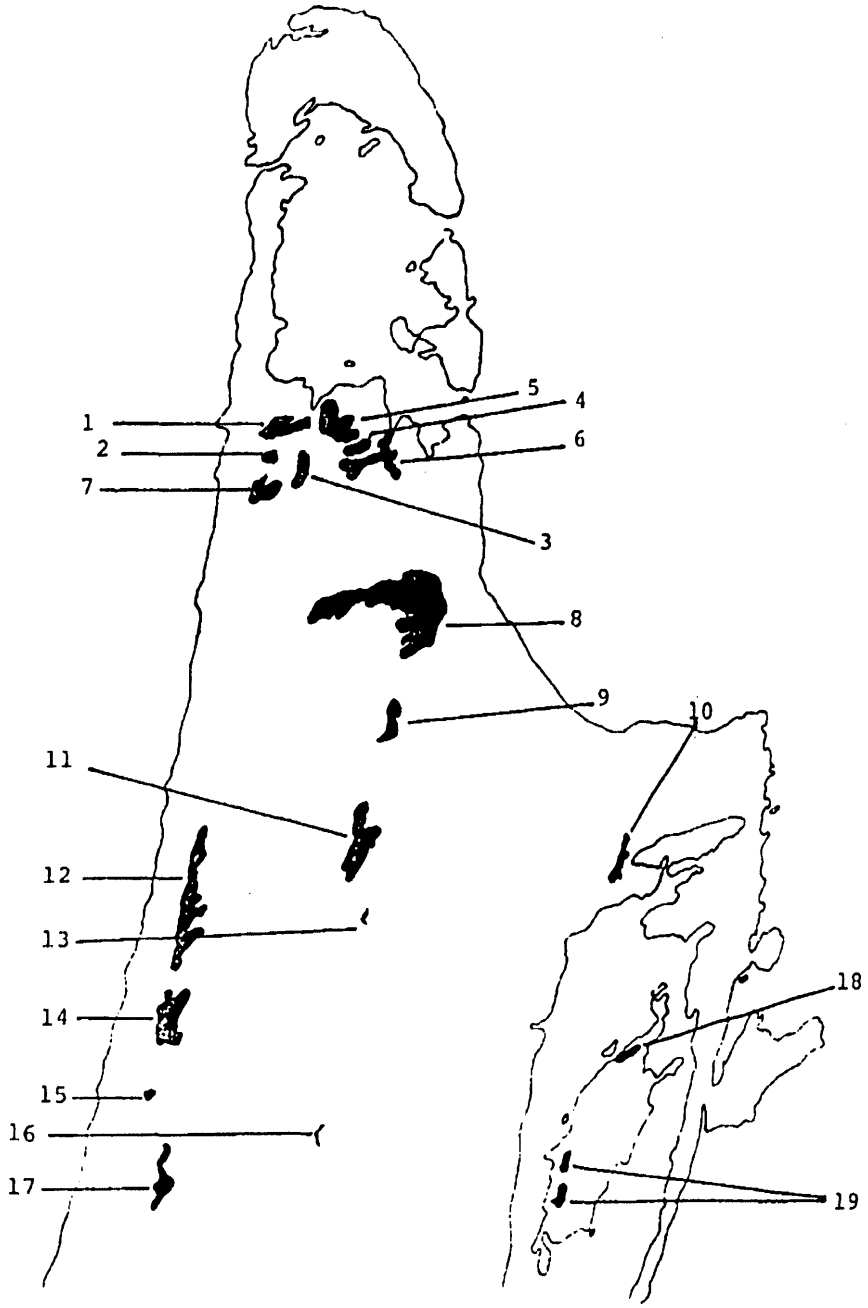


FIGURE 3 NORTH BELCHER ISLANDS CURRENT FISHING LOCATIONS

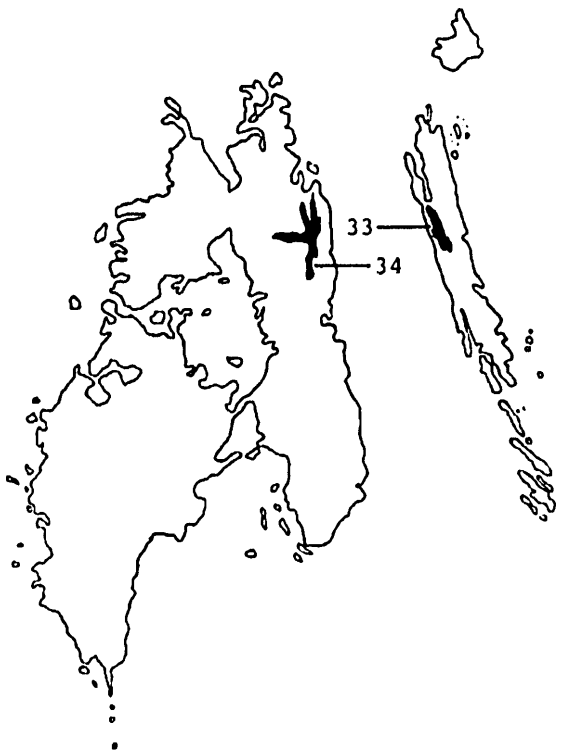
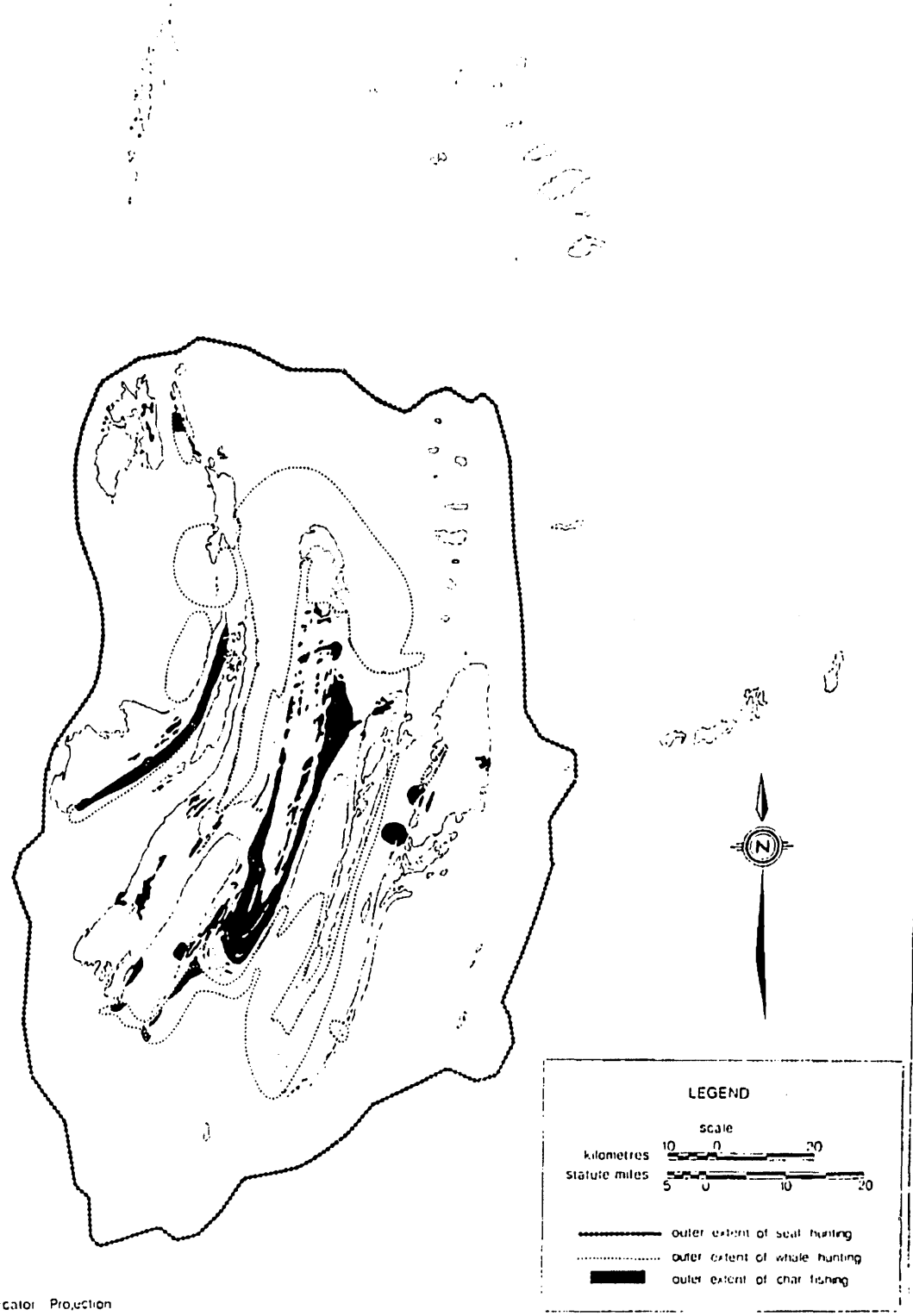


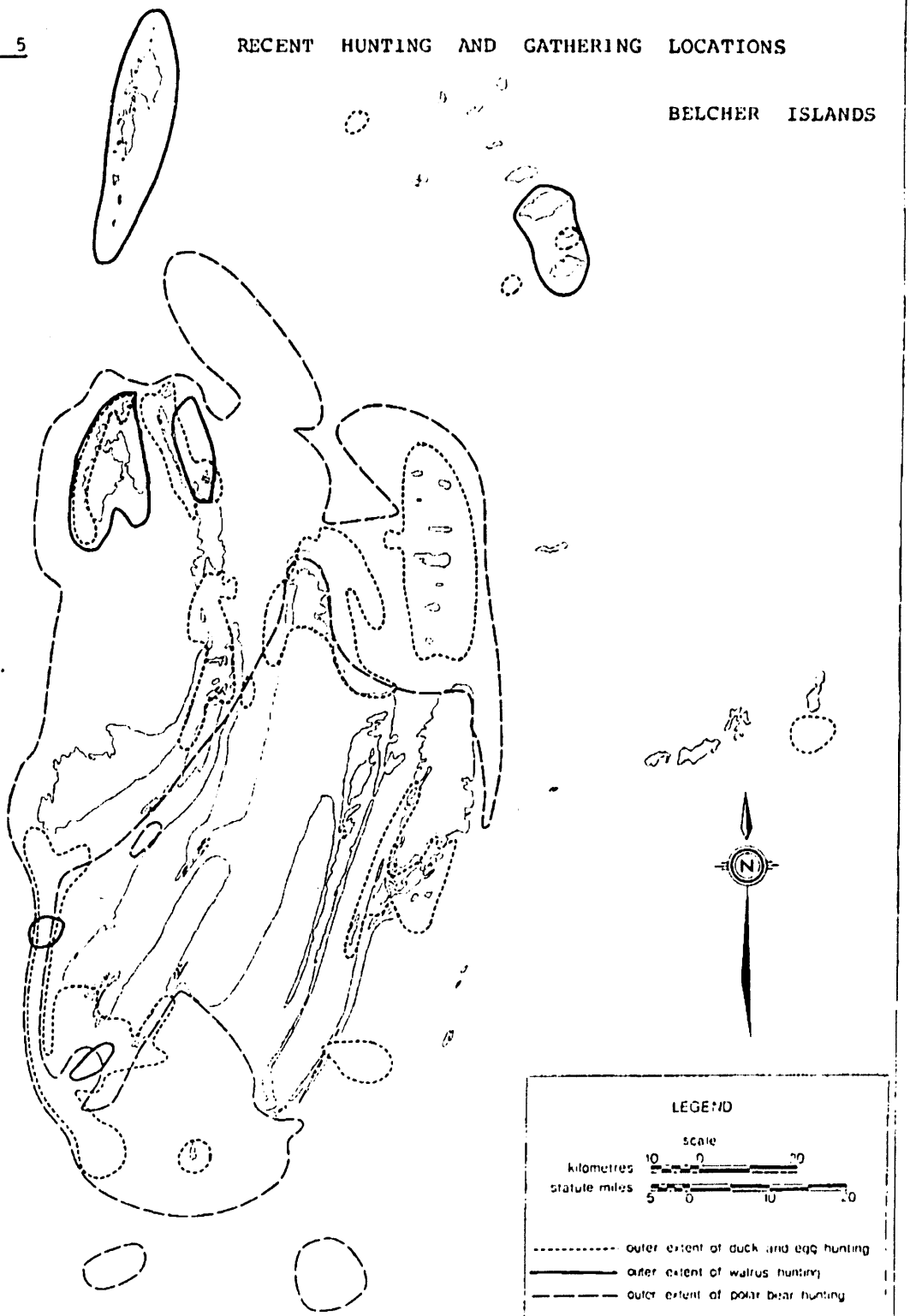
FIGURE 4 RECENT HUNTING AND FISHING AREAS, BELCHER ISLANDS



Transverse Mercator Projection

FIGURE 5 RECENT HUNTING AND GATHERING LOCATIONS

BELCHER ISLANDS



Transverse Mercator Projection

fishing locations will be discussed.

(c) Limited resources--other fish species in freshwater

When speaking of freshwater fishing on the Belcher Islands one is referring, overwhelmingly, to the harvesting of arctic char (Salvelinus alpinus; locally, igaluppik).

A limited fishery of lake herring, (Coregonus artedi, locally kapisilik) and brook trout (Salvelinus fontinalis, locally igaluk tasirsiutik) occurs at restricted locations and seasons. For example, herring are taken currently at two main locations (11 and 13 in Figure 2) though a small quantity (never more than 5% of the total yield) may be caught when netting char at some other locations in the spring. The main season for herring is early winter, when nets are set under the ice; herring are never taken by hook, either angling or jigging.

Several families regularly set nets under the ice in early winter, though all but one or two families lift them after two or three weeks as the ice progressively thickens. About half the fish in these winter nets are herring, the remainder are char, though nets set in these lakes before the ice forms may yield a higher proportion of herring. The proportion of herring in the nets decreases progressively throughout winter, so that by the spring only about 5% of the catch is herring. A fifty foot net, set at a favourable location under the ice, might yield about a dozen to fifteen

herring with an average individual weight of one pound. The largest herring would be ca. 2 pounds round weight.

Trout occur mainly in land-locked lakes, or lakes with small streams allowing only restricted access to the sea. Trout are always much less than half the total net catch (of trout and char), even in notable trouting lakes (locations 1 and 7 in Figure 2). Trout are taken in spring by jigging through the ice and by angling in summer. The average size of trout taken is ca. one pound, and a catch rate of one fish per hour would be considered good in summer, and perhaps average at a favourable jigging location in spring.

(d) Limited resources--other fish species in saltwater

Cod (Gadus ogac, locally ugak) are found at a number of special inshore locations, e.g. Kihl Bay at the head of Kipalu Inlet (with the local name ugassiuvik, literally, 'the cod fishing place') and the harbour on the south coast of Weigand Island called tungasittik. These locations are fished at specific times: e.g. ugassiuvik at the time of sea ice freeze-up in early December, and tungasittik from August till freeze-up. Cod can also be taken in the harbour at Sanikiluaq itself; in September and October they arrive there in large numbers and are readily taken by angling from shore or jigging from a boat, and in late November and early December when they are jigged through holes in the newly formed sea-ice for a period of about a week, after which they become

scarce at that location.

Cod is a popular food fish, and is especially sought when poor weather prevents seal hunting during the open water season. Fishing success at tungasittik appears to depend on the tides, but about ten cod per hour can usually be jigged from a canoe; the average size would be ca. one, to one and one-half, pounds per fish.

The same rate of fishing return could be expected at other favoured inshore locations, though the fish would be bigger and fatter at Sanikiluaq in September and October, averaging around two to two and one-half pounds. As many as two dozen people might be fishing on any suitable day on the harbour ice at Sanikiluaq immediately following freeze-up.

Sculpin (Myoxocephalus quadricornis and M. scorpio, locally kanajuk) may be taken inshore at any time, either when angling or jigging, or in nets set for char. There are two notable sculpin fishing locations near to Sanikiluaq, one a few miles to the east, the other to the west, in Coats Bay. Few people engage in deliberate sculpin fishing, and when they do, it is generally restricted to a few recreational day-trips in the spring extending over a three week period. Sculpins are rarely more than about one pound round weight.

Capelin (Mallotus villosus, locally qulilirraq) and halibut (Reinhardtius hippoglossoides, locally nipisarq) are even less important than sculpins in the local economy. The latter is very rarely encountered, and capelin are so localized in time and place during their onshore migrations

that no effort is made to deliberately exploit them. One spawning location is situated on the west coast of Tukarak Island (location 21 in Figure 1), and another is on Weigand Island (at tungasittik). Capelin, however, are preferred as food when taken from seal stomachs.

(e) Negative environmental effects

The pollution aspects of the sports fishing operation are of considerable concern locally and to government. Specifically, during the years of operation, raw sewage was discharged directly into the river from the camp living-quarters, untreated garbage was dumped on a small island in the river (which was swept by waves during story weather), unprotected gasoline and oil storage facilities were sited on the river bank, and aircraft were refueled in the main Kasegalik River.

These actual and potential pollution effects took place immediately proximate to a set of rapids at a narrow part of the Kasegalik River, past which point all the char returning to the Kasegalik Lake to spawn and overwinter migrated in early September. Thus a proportion of all fish caught at any of the fall char fishing locations (numbers 11, 12, 13, 14, 15, 17, in Figure 2, and 31 in Figure 1) had recently passed through an area containing fecal wastes, garbage, and other pollution. In addition it should be observed that other wildlife feeding in the river valley was hunted for food by

people frequenting the area in spring, summer, and fall. Specifically ranger seal, arctic fox and a total of 18 different bird species frequenting the Kasegalik River are potential food resources to people camping or travelling in this region (see Appendix 1).

Concern was also expressed about negative effects exerted on the migrating char by the continued use of motorized canoes and the presence of moored aircraft (being gassed up on the water) at the narrows in the river during the upstream char run.

(f) Lack of economic benefits

In the years from 1965 till 1970 the 'South Camp' settlement provided a small number of men each year to guide the tourists to fishing locations on the river.

Since 1970, however, there have been no Inuit employed at the sports camp, and in addition, no expenditure of any kind in Sanikiluaq by sports fishermen from the camp. The camp is a self-contained operation: personnel working there, and all food, fuel and other supplies are imported by the camp operator from outside the Northwest Territories.

The loss of employment opportunities is of limited significance: it is estimated that about $500-600 per week accrued from guiding activities, shared among two or three men, which constitutes scant compensation for the opportunity costs incurred by not engaging in alternative economic activities

(e.g. hunting, carving, casual employment in the settlement, etc.).

(g) Management problems

From the time the fishing lodge opened (in 1965) until 1970, about one third of the Belcher Island population resided near the Kasegalik River (at 'South Camp', or more properly itilliaruq). Since that settlement was closed down, and the population moved to Sanikiluaq in 1970, only short seasonal reoccupations of itilliaruq have occurred; consequently it has proved difficult for both government and the local people to monitor activities at the char fishing tourist lodge situated on the Kasegalik River.

The tourist lodge was inspected by a federal health official from Churchill in May 1975, and though a summer inspection was also planned that year it did not take place because of the expense (letter to Secretary, Hamlet Council from Mr. Richard Lawrence, May 20, 1976). In September 1976 a second inspection visit took place, on this occasion by the health officer and a territorial tourism development officer from Yellowknife. As a consequence of this visit it was recommended that the lodge be closed because of pollution problems and certain other contraventions (written report to Hamlet Council, from Mr. Mike Freeland, November 1976). During the 1976 summer fishing operation an inspection trip was also made by a territorial fish and wildlife officer

(Mr. Rick Letkeman, personal communication, August 22, 1978).

The license to operate this tourist lodge was withdrawn for the 1977 season and the suspension maintained through 1978, pending adequate environmental health and safety requirements being met (though fishing likely took place, by non-commercial visitors to the lodge, during those two seasons). Throughout the years 1965 through 1976 the camp operated for six or seven weeks each summer from early July till early September. No regular statistical (fishing) returns have been collected from this licensed operation during this twelve year period by either federal or territorial fishery management services. Consequently it has not been possible to determine how many sports anglers fished on the Belcher Islands, nor how many fish were removed from the river systems that were being fished, nor even which rivers and lakes were being fished during this lengthy period of time.

The fact is, that no effective regulation of sports fishermen visiting the Belcher Islands seems possible under the prevailing legislation, for a tourist may purchase a license from any number of outlets inside and outside the Northwest Territories and, following automatic issuance of this license, he/she may fish anywhere in the Territories. Fishermen having their own aircraft, or able to charter aircraft, are not required to individually report their fishing activities, and such regulations as the daily catch limit (4 arctic char) and maximum possession limit (7 arctic char) and regulations proscribing the use of certain equipment,

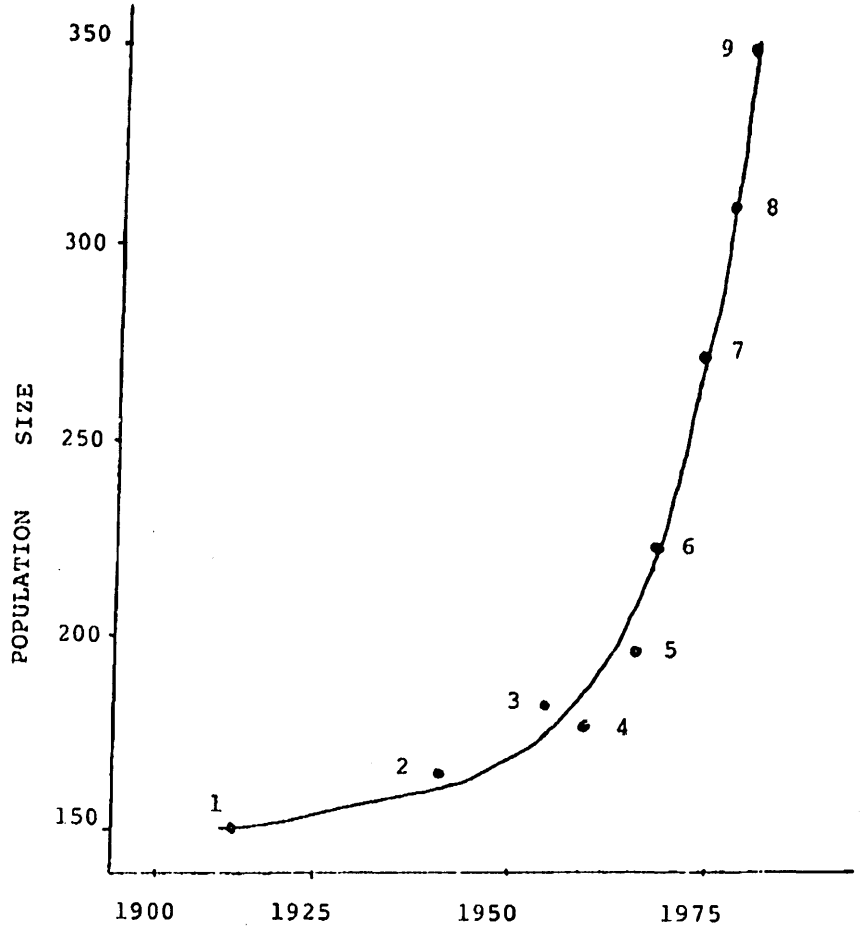
live bait, waste of fish, etc., are presently unenforceable under these conditions.

LOOKING TO THE FUTURE

The Belcher Islanders are acutely aware of two very vital facts concerning their collective future: (1) at present they exploit the resources of their limited territory very fully, and (2) their own population is growing in size. In combination these two realizations add up to understandable concern about their future wellbeing, a wellbeing that desires and requires a continued utilization of locally produced food supplies. It is important to stress (as others have done, e.g. Brody 1975:130, and Usher 1976:118) that food habits are not just culturally determined, they are both deep-rooted in the individual psyche and they are culture-sustaining. In a hunting and fishing society the distribution and consumption of food has a richness and significance of meaning that far outweighs the mere dietetic value of the food consumed. This concern of the Belcher Islanders, concerning their ability to husband and utilize their valued local renewable resources, is both rational and profound.

The population on the islands appears to have been around 150 at the time of first contact (Flaherty 1918). Various reports during the years from 1937 to 1960 show it to have remained more or less constantly between 165 and 185 (see Freeman 1967 for a brief demographic history of the

FIGURE 6: POPULATION OF THE BELCHER ISLANDS, 1910 - 1978



Sources: 1, Flaherty 1918; 2, Robinson 1944;
3, Desgoffe 1955; 4, Freeman, field notes 1959;
5, DIAND Disc List, November 1966;
6, DIAND Disc List, April 1968; 7, Schwartz 1976;
8, Hamlet Council Census 1977;
9, Freeman, field notes 1978.

islands until 1961). However, more recently the population has increased rapidly (see Figure 6): by 1968 the population was 220, and by the summer of 1978 it had grown to about 350. Three main factors account for this recent increase: (1) sedentarization, resulting in greater fertility; (2) increased immigration and (3) a continuing belief in the traditional high value placed on children. The first and third reasons are unlikely to change in the immediate future, but the influence of migration in the future is unpredictable. Some concern exists locally, that the recent decision to prohibit alcohol use on the Islands will lead to increased immigration of families from some large and less socially harmonious nearby communities.

Another recent development that may be expected to increase immigration, especially from Poste de la Baleine, P.Q., is the local decision, if taken, to restrict the export of high-quality soapstone from the Belcher Islands. Soapstone carving constitutes a major cash-producing activity, and together with locally available food resources on the islands, ensures a high degree of economic independence and hence the continued exercise of the individual autonomy that people value so highly.

DISCUSSION AND CONCLUSIONS

Kasegalik Lake constitutes the most extensive body of freshwater on the Belcher Island archipelago, covering an area of ca. 60,300 acres. Drainage into the lake is almost exclusively from surface water on the surrounding land area and from a number of small tributary lakes in close proximity. This lake system drains to the sea by the several mile long Kasegalik River, all but about half a mile of which is above tidal influence (see Appendix II for more information on this drainage system).

However, despite the low productivity of the arctic freshwater environment (referred to earlier) the huge area covered by the Kasegalik system (relative to any other system on the Belcher Islands) makes it of paramount importance locally as a fish producing system. This is especially so because the Kasegalik River--unlike many of the creeks draining other Belcher Islands lake systems--allows migratory char seasonal access to the more productive marine environment.

However, only some char migrate to sea in any year, for there are char that live permanently in freshwater (these are distinguished locally as ivitaaruk), and, furthermore, only a proportion of the migratory char population migrates to salt water in any year. The importance of the more productive salt water environment for the growth of char is evidenced by the fact that, normally, sexual maturity in female char on the Belcher Islands occurs when the char are about twelve

years of age and have grown to about 50 cm in length, whereas the stunted freshwater population, though also sexually mature at twelve years of age, may only be 10 cm in length at that same age. The importance of the Kasegalik system for local subsistence fishing purposes, relative to other freshwater systems on the Belcher Islands was assessed by asking a small sample of knowledgeable residents to rank, in terms of importance, each of several discrete drainage systems (shown in Figures 1,2 and 3) into one of four categories (see Appendix III for more details).

A high degree of consistency was obtained from these independently elicited responses. The summary result, shown in Table 3 below, indicates that fishing locations associated with the Kasegalik River and Lake cause that system to be ranked highest in importance at every season of the year, as well as placing it as pre-eminently important on an overall basis. It should also be noted that mere proximity (of lakes to the settlement, e.g. locations 1-8 in Figure 2) does not endow a fishing spot with great importance, for people are quite prepared to travel some distance to reach the most preferred locations and they do this at every season. The importance of the lakes near to the permanent settlement at Sanikiluaq derives from the use to which they are put by the small number of residents whose circumstances prevent their travelling to the better, more distant, fishing areas.

The relative importance, to the local residents, of

TABLE 3: Relative importance of fishing areas, by season, Belcher Islands, NWT

SEASON	VERY IMPORTANT	IMPORTANT	SOME IMPORTANCE	LITTLE OR NO IMPORTANCE
Spring (N = 12)	K	S, 23	8,10,18,22,24, 25,33,34	19,20,21,27,29 30,32
Summer (N = 11)	K	21,22,25,27	S,10,29,30,32	8,18,19,23,24, 33,34
Fall (N = 12)	K	10,27	S,8,20,21,25, 29	18,19,22,23,24, 30,32,33,34
Winter (N = 11)	K		10	2,3,5,6,7,8,9, 10,11,12,13,14, 15,16,17,18
All year (N = 46)	K		2,3,4,5,6,7,8, 9,11	10,12,13,14,15, 16,17,18

distant fishing areas makes the present collective concern more acute, for competition for these resources is exerted by a party (or parties) whose activities are perceived as even more threatening because they are so loosely 'controlled'. Indeed, it is true to say that the sports fisherman with his own transportation can take fish anywhere on the islands, with their individual conscience as the only control against abuse. People at Sanikiluaq recount instances where this honour system has been abused, where dead fish have been found at the tourists' abandoned camps, and where fly-in parties have fished on lakes they were requested, for good reason, not to visit. All this aggravates a feeling that only those who are deeply concerned about the resources in question, and who effectively demonstrate this concern, should control access to the resources, for infractions of the regulations apparently do take place without penalty.

Unfortunately we have little good data on char fishery activity, either from the sport fishery or from the domestic (subsistence) fishery. The N.W.T. Fish and Wildlife Service have incomplete recent data concerning the past four years spring domestic fishery that suggest that an average estimated spring take may be ca. 3,250 pounds of char (the estimated harvest ranges from ca. 2,400 to 4,200 pounds; see Appendix V for details). Even less data are available for other seasons; such reports as do exist suggest that the fall fishery may be of similar magnitude, witness the following reports on file (supplied by Mr. Richard Popko, Fish and

Wildlife Officer, September 18, 1978)

> November 1972: "Caught 500 char today by net"
> September 3-4, 1973: "The fishermen caught a lot of fish by net"
> October 8, 1973: "J. Cookie and Sampson Meeko caught 40 char today by net"
> October 14, 1973: "On the (Tukarak Island) camp we caught a lot of fish by net"
> October 4, 1973: The residents of Sanikiluaq Harbour have been fishing at several different locations on the islands. One group took 180 char...."

In comparison it is estimated that a yield of about the same magnitude is being taken each summer by the tourist lodge visitors, with the significant difference that it is taken from a single location and stock, not from the scattered areas as is the domestic practice. Thus data in Table 4 suggest that at least 2,500 pounds of char are sport fished each summer the lodge operates; this figure assumes strict compliance with Catch Limit regulations and does not take into account the activity of fly-in fishermen not resident at the tourist lodge. It is relevant at this point to point out that the Belcher Islands is the arctic char fishing area of the Northwest Territories closest to the two largest population centres of Canada (viz. Montreal and Toronto) and therefore in a relative sense very accessible to many tourists. The residents claim, with justification, that they have no other nearby areas with fish resources (the neighbouring mainland areas are outside of the Northwest Territories) so that their continued dependence upon local resources is great and becomes greater as their population grows progressively

Maximum			Probable
8 weeks	-	Length of Season -	7 weeks
9	-	Number of fishermen in residence per week -	8
6	-	Angling days/week -	5
4	-	Daily catch/fisherman	3
4 lb.	-	Average fish weight -	3 lb.
6,912 lbs.	-	Harvest -	2,520 lbs.

The above computation is based on the following verbal information obtained on August 22, 1978, from Mr. Rick Letkeman, Fish & Wildlife Officer, who visited Theriault's Camp in the 1976 season.

- Fishing season extends from mid-July till first week of September;
- 7-10 fishermen in residence each week;
- Generally anglers stay from 3 days to one week;
- Average char is around 3 lbs.; range up to 7-8 lbs.;
- Fishing in river regarded as "pretty good".

However, brochures published by Theriault Air Service advise that:

- Fishing extends from July 1st till August 31st;
- Accommodation exists for 8 guests and the resident camp manager.

TABLE 4: Estimate of Angler Harvest, Theriault's Camp

larger.

Though these local concerns have been repeatedly voiced by the Sanikiluaq Community and Hamlet councils, and the Sanikiluaq Hunters' and Trappers' Association over the past several years, they are being made explicit again on this occasion. It is hoped that this report, documenting the same concerns as earlier voiced, will materially assist in achieving a better and wider understanding of the situation that continues to be a major concern to the whole community at Sanikiluaq.

APPENDIX I: Wildlife (utilized as food) frequenting the Kasegalik River region.

Birds* frequenting the Kasegalik River and utilized for food:

Common Loon (Gavia immer), tulli
Red-throated Loon (G. stellata), qassauk
Canada Goose (Branta canadensis), nirliq
Snow Goose (Chen caeulescens), kanguk
Black Duck (Anas rubripes), ivugak qirnitak
Pintail (A. acuta), ivugak
American Goldeneye (Bucephala clangula americana), kutikkuuk
Old Squaw (Clangula hyemalis), aqarinnirq
Hudson Bay Eider (Somateria mollissima sedentaria), mittirq
King Eider (S. spectabilis), mittirluk
White-winged scoter (Melanitta deglandi), anigasik
American Scoter (Oidemia nigra americana), anigasik
American Merganser (Mergus merganser americanus), arpangijuraaluk
Red-breasted Merganser (M. serrator serrator), arpangijuk
Black Guillemot (Cepphus grylle), pissiulaak

Eggs of the following additional birds are utilized as food:

Glaucous Gull (Larus hyperboreus hyperboreus), naujak
Herring Gull (L. argentatus smithsonianus), naujak
Arctic Tern (Sterna parasiadea), imiqutailak

The following two mammals are also potential food species that feed on the river:

Harbour Seal (Phoca vitulina), qasiriak
Arctic Fox (Alopex lagopus), tiriranniak

*See Freeman 1970 for distributional data on birds in the region.

APPENDIX II: Limnological observations on Kasegalik Lake.

Morphometry

Occupying the central part of Flaherty Island, Kasegalik Lake extends forty miles in a generally northeast-southwest direction. A central landmass divides the lake into west and east arms, that become confluent at the south end of the lake.

Drainage is derived almost exclusively from surface water collecting on the surrounding hills, none of which are higher than about 350 feet. The few lakes that contribute to the Kasegalik Lake drainage are largely situated in the central divide between the west and east arms, this divide being nowhere more than five miles wide. There are no large rivers, glaciers, or large persistent snow patches draining into the lake, directly or indirectly.

The maximum width of the east arm is about five miles; that of the west arm slightly less. The average width of either arm, however, is about one mile. The outflow of the lake is by way of two small falls, each less than ten feet in height, but transporting a considerable volume of water through the narrow outlet gorges, six and ten feet in width.

The lake is usually ice-covered until the end of June, after which open water appears among the islands in the centre of the lake, elsewhere near the shoreline, and near the outflow area. Early in July open water may extend for several miles offshore, the location depending upon wind conditions.

The volume of water leaving the lake at this time of spring melting appears to be an estimated 15-25% greater than at the end of August. The water level does not appear to fluctuate during the summer.

Due to the very slight and local drainage effect from the outflow falls, all currents in the lake would probably be wind-generated, though temperature anomalies suggest sub-surface activity persists during calm weather.

A number of soundings were taken; the plotting of these and the use of aerial photographs showed the lake to be a deep basin, reflecting the various erosive processes that have left their mark on the islands' topography in such a characteristic fashion. The differential erosion of basalts, dolomites, and softer rock types, have resulted in deep scars on the landscape, forming Kasegalik Lake, the bays, fjords and sounds of the seacoast.

A maximum depth of 77 metres was recorded. Other soundings indicated that in the southern part at least, the west arm (maximum 58 metres) is slightly deeper than the east arm (maximum 41 metres). The outflow area, and the central island complex are considerably more shallow (averaging 10 and 15 metres respectively).

Physical and chemical parameters

One station was operated during August (1959) and certain characteristics determined. This station was situated

approximately 1000 yards from the lake outflow, and about 150 yards from the nearest shoreline in the west arm. The depth at this point was 29 meters, but the contours were descending rapidly here to a depth of 56 meters within a few yards.

The temperature of the surface waters rose from 7.4°C on August 4th, to 8.9° on August 22nd. Temperature fluctuations over a 48 hour period were never recorded as being more than 1.1°C. The minimum temperature recorded in August was 5.8°C at 40 meters depth on August 4th. Temperatures at all depths increased steadily throughout August. The following two profiles indicate the magnitude of the change, and also despite the surface warming, the absence of a thermocline.

	AUGUST 4th		AUGUST 22nd	
DEPTH	Uncorrected	Corrected	Uncorrected	Corrected
0 m.	7.4°C	7.39°C	-	-
5 m.	6.6	6.59	8.15	8.14
10 m.	6.35	6.34	7.55	7.53
15 m.	6.2	6.19	7.4	7.38
20 m.	6.1	6.09	7.27	7.26
25 m.	6.07	6.06	-	-
29 m.	-	-	6.5	6.48
35 m.	6.05	6.04	-	-
40 m.	5.8	5.785		

The temperature anomaly referred to previously was noted at 25 metres depth on August 7th, and the day following. It was impossible to obtain consistent readings on the reversing

thermometers, and for a total of six readings on August 8th, the following values were obtained:

Uncorrected: $6.94 \pm 0.31^{o}C$

Corrected: $6.93 \pm 0.305^{o}C$

No explanation is put forward for this, although a lake of this size would be expected to have internal seiches, and these anomalies may reflect this. Despite the fact that the lake bottom was probably on the average 40 metres depth below sea level, no salinity effect was found; this was so down to and including the maximum depth of 77 metres.

Oxygen determinations indicated that mixing was complete throughout the water column; dissolved oxygen ranged from 7.6 to 7.9 cc/litre.

Secchi disc extinction averaged 9 metres depth, at noon throughout August. A series of determinations made by Dr. E. H. Grainger, indicated that at the end of August, throughout the euphotic zone, phosphate and nitrate were at a very low concentration, and almost certainly limiting.

DEPTH	PO_4 (ugm at./l)	No_3 (ugm at./l)
1 m.	0.13	0.0
5 m.	0.04	0.0
10 m.	0.04	1.0
15 m.	0.08	0.1
20 m.	0.04	1.0
25 m.	0.04	0.5

Primary production cultures were set up, and an attempt made to measure production by the light and dark bottle method. However, production was at such a low level, that 48 hour periods were necessary to record any changes in oxygen concentration. The limitation of leaving cultures that length of time in oligotrophic waters are well known; however, qualitatively it can be stated that net production barely exceeds gross production in the euphotic zone (1% extinction at 24 metres depth).

(From: Milton M.R.Freeman, Reproduction and Distribution in Arctic Gasterosteus aculeatus L. (Teleostei:Gasterosteidae) Doctoral Dissertation, Marine Sciences Centre, McGill University, Montreal, 1965)

APPENDIX III: Methodology for obtaining rank ordering of fishing locations/systems

In order to assess the relative importance of each fishing location/system identified in Figures 1, 2 and 3, respondents were asked to categorize each of 18* fishing locations as either:

Very important

Important

Some more limited importance

Little or no importance

This ranking was to be applied to each location for each of four separate seasons:

Spring: Snow melting on the lake ice, open water appearing in rivers;

Summer: Open water season;

Fall: New ice forms on lakes, larger rivers still have some open water;

Winter: Rivers frozen, lake ice generally snow covered.

The qualitative categories were transformed into numerical data by scoring each assessment as follows: Very Important = 10 points, Important = 7 points, Some Importance = 4 points, Little/no importance = 1 point. Total point scores for each location were divided by the number of respondents to give an average computed score for each locality. To convert these numerical data back into qualitative assessments (as shown in Table 3) the following scale was used:

Very Important	9-10 points
Important	6-8 points
Some, more limited, importance	3-5 points
Little or no importance	1-2 points

It should be noted that Location 22 (Figure 1) was only discovered during spring 1978; therefore no assessment of fall or winter fishery importance could be made at the time of this study.

The locations marked on Figures 1, 2 & 3 do not constitute an exhaustive listing. There are, e.g., additional fishing locations in lakes near Desgoffe Point (tasirjuak), on Split Island (tasirruluq) and north of Freakly Point (inussualuit tasinga).

*Despite a total of 34 fishing locations entered on Figures 1, 2, and 3, only 18 locations were assessed. This is because locations 9, 11-17, 26 and 31 were all on the Kasegalik drainage and were therefore collectively treated as one fishing system, designated as K, and the locations 1-7 being proximate to the settlement of Sanikiluaq and each other were similarly collectively designated as S.

APPENDIX IV: Names of fishing locations shown in Figures 1,2 and 3

1 amittuaaluk
2 miluriasak
3 iparautak
4 kuulurtuk
5 tasiapik
6 tasiaaluk
7 ikarulik
8 nutarautik
9 tasirjuaak kinguani tasiapik
10 iqalussiuviaaluk
11 iqaluttuuk tulli
12 tasirkataaraaluk
13 iqaluttuuk
14 inni
15 inni
16 kapisilituq
17 tasikataaq iqaluliapik
18 iqaluppilik tarrasik
19 iqaluppilik siqinissik
20 sikuttak
21 illuruavinik
22 tasiujaraaluk
23 kugaak
24 takijukaaraaluk
25 kataruq
26 inuvinittalik
27 kutiaruk
28 tasiujak
29 upingaviaaluk
30 upingaviaruk
31 kurraaluup tasingit
32 itilliaruq
33 iqaluliaapik
34 qussutuup tasinga

APPENDIX V: Method of estimating spring domestic fishery harvest.

The only data available were abstracted from information compiled by Mr. Isaac Amitook and Mr. Lucassie Ekidlak (representing the Sanikiluaq Hunters' and Trappers' Association) and Mr. Rick Letkeman and Mr. Richard Popko (representing the Territorial Fish and Wildlife Service).

Year	Month	Hunters Interviewed	Numbers of Char	Pounds of Char
1975	April	8	--	712
1975	May	16	81	---
1975	June	10	--	---
1976	March	13	--	800
1976	April	13	--	24
1976	May	16	--	892
1977	March	16	--	---
1977	April	7	175	---
1977	May	26	81	---
1978	March	20	42	---
1978	April	31	287	---
1978	May	31	372	---

To facilitate comparisons being made these data were transformed by assuming an average fish weight of 3 pounds and a fishing population of ca. 40 people in the years 1976-78 and 32 people in 1975.

Thus the data become transformed as follows:

Year	Month	Pounds of Char	Seasonal Total
1975	April	2848	
1975	May	486	3334
1976	March	2400	
1976	April	72	
1976	May	1784	4250
1977	March		
1977	April	2625	
1977	May	365	2990
1978	March	252	
1978	April	947	
1978	May	1227	2426

Spring average estimated harvest

= 3250 pounds.

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THE BELCHER ISLAND CHAR FISHERY

A STATEMENT OF CONCERN

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ᓄᕕᒻᕙ 1978

Sanikiluaq Hamlet Council

November 1978

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INTRODUCTION

In the recent past, the residents of Sanikiluaq have been increasingly concerned about the presence of a sports fishing lodge on the Kasegalik River, Belcher Islands. This report outlines the basis of their concerns, provides background information relevant to these concerns, and draws some conclusions stemming from consideration of the foregoing.

The information and conclusions contained in this report are necessarily tentative, due both to the short time that has been available to research the problem, and the lack of information on the Belcher Island domestic and sport fishery. However, despite these limitations this report has been prepared in the hope that it will in some way assist those people most involved and concerned about the rational management of a valued resource on the Belcher Islands, N.W.T.

THE BASIS OF CONCERN

The reasons most strongly and frequently voiced related to the precarious nature of the renewable resource base on the Belcher Islands and the importance of these resources to the continued sense of well-being of the local residents, the particular importance of arctic char as a resource, the environmentally harmful effects of the tourist operation over the past several years, and the apparent inadequacy of

existing fish management practices. These issues will be addressed immediately below.

(a) Limited resources--general considerations

There are several studies and reports that comment on the biological resource base and subsistence activities of the Belcher Island Inuit (e.g. Burwash 1927; Freeman 1963; 1967; McLaren 1958; 1962; McLaren and Mansfield 1960; Schwartz 1976). These reports confirm the limited range of resources available, and the great extent to which the islanders exploit fully the resource potential available to them. McLaren's work, in particular, illustrates the critical nature of the resource situation, for despite the relative abundance of seals compared to immediately adjacent coastal areas, several (climatic) factors adversely afect successful local harvesting of seals.

A recent study has indicated the extensive land and sea areas covered by the local hunters, whereby all regions of the Belcher Island archipelago continue to be visited for specific resource harvesting activities (Schwartz, 1976). This activity, translated into actual land/sea areas is shown, for selected land use activities, in Figures 4 and 5, and is represented as actual 'square miles' used in Table 1. It is apparent from these data that even following concentration of the population into 'permanent' settlements (starting in 1961), resource harvesting still entails extensive use of the land

PRE-1960					1961-1974			
AREA IN SQUARE MILES			NUMBER OF INFORMANTS	RESOURCES	AREA IN SQUARE MILES			NUMBER OF INFORMANTS
Average	Minimum	Maximum			Average	Minimum	Maximum	
25	9	81	12	Marine Fish	29	9	81	9
51	9	172	26	Freshwater fish	60	9	172	20
58	9	172	19	Walrus	57	9	145	16
79	9	245	23	Beluga	91	9	436	19
120	9	509	10	Polar Bear	419	18	1410	15
153	18	618	27	Wildfowl/ eggs	109	18	309	20
218	27	1237	28	Eider ducks	117	27	309	23
256	18	1219	26	Foxtrapping	195	36	491	23
295	18	1319	28	Geese	264	18	1319	24
2264	100	5660	28	Bearded Seal	1018	45	3758	24
2303	136	5660	28	Ringed Seal	1041	45	3712	24

Table 1. Resource harvesting areas, Belcher Islands, N.W.T. (after Freeman et al 1976).

and surrounding marine areas: e.g. seal hunters range over areas greater than one thousand square miles of sea and sea ice on average, with the most mobile ranging over areas of about 3,700 square miles. Some resource harvesting activities (including fishing) occupy smaller areas, and reflect the highly discriminatory nature of skillful resource harvesting as well as the more restricted distribution of some resources.

(b) Limited resources--arctic char

Arctic char production is not that bountiful on the Belcher Islands. Biological studies in the arctic repeatedly confirm the low productivity of northern freshwater lakes: a recent review of the subject concluded that large arctic lakes are only about one-tenth as productive as lakes in more southerly locations, and that average production of fish in these cold water lakes may only average about from one half to one pound of fish per acre of lake surface (Peterson 1976: 95). Arctic rivers are more productive than lakes, and where fish spend part of the year in the sea (as arctic char do) production rates are higher than achieved in lakes alone. However, in the present context it should be remembered that (1) with the single exception of the Kasegalik River, all rivers and streams on the Belcher Islands are short and shallow, and so do not provide a productive environment for arctic char, and (2) only a proportion of the arctic char in

any lake make the journey to the sea or into rivers in any given year.

In 1959 the Fisheries Research Board of Canada conducted a study of the Kasegalik river and lake arctic char population. In a report on this investigation it is stated: "The growth rate for Arctic Char of Kasegalik Lake show that 16 years are required to produce the average maximum-sized fish. The slow growth rate evidenced indicates relatively low production" (Hunter and Perey, ms.). Furthermore, it must be remembered that (1) the Kasegalik drainage represents an overwhelmingly large proportion of the total arctic char habitat on the archipelago (see Figure 4); (2) that total fish production includes the growth of a large percentage of small fish, of uneatable/uncatchable size; and (3) the exploitation of the fish stock beyond a certain point likely results in a diminished capacity of that stock to sustain that ongoing level of exploitation.

Figures 1, 2 and 3 illustrate the location and extent of current char fishing areas on the archipelago. For purposes of clarity, Kasegalik Lake is omitted from Figures 1 and 2, though some actual locations on the lake (e.g., locations 13, 15, and 16 in Figure 2), and on other lakes associated with the Kasegalik drainage (e.g., locations 28, 31 on Figure 1) are indicated. It is also probable that inshore fishing areas in the sea (e.g., locations 29, 30, 32, on Figure 1) are supplying char originating from the Kasegalik drainage. Later in this report the relative importance of these different

FIGURE 1

BELCHER ISLANDS CURRENT FISHING LOCATIONS

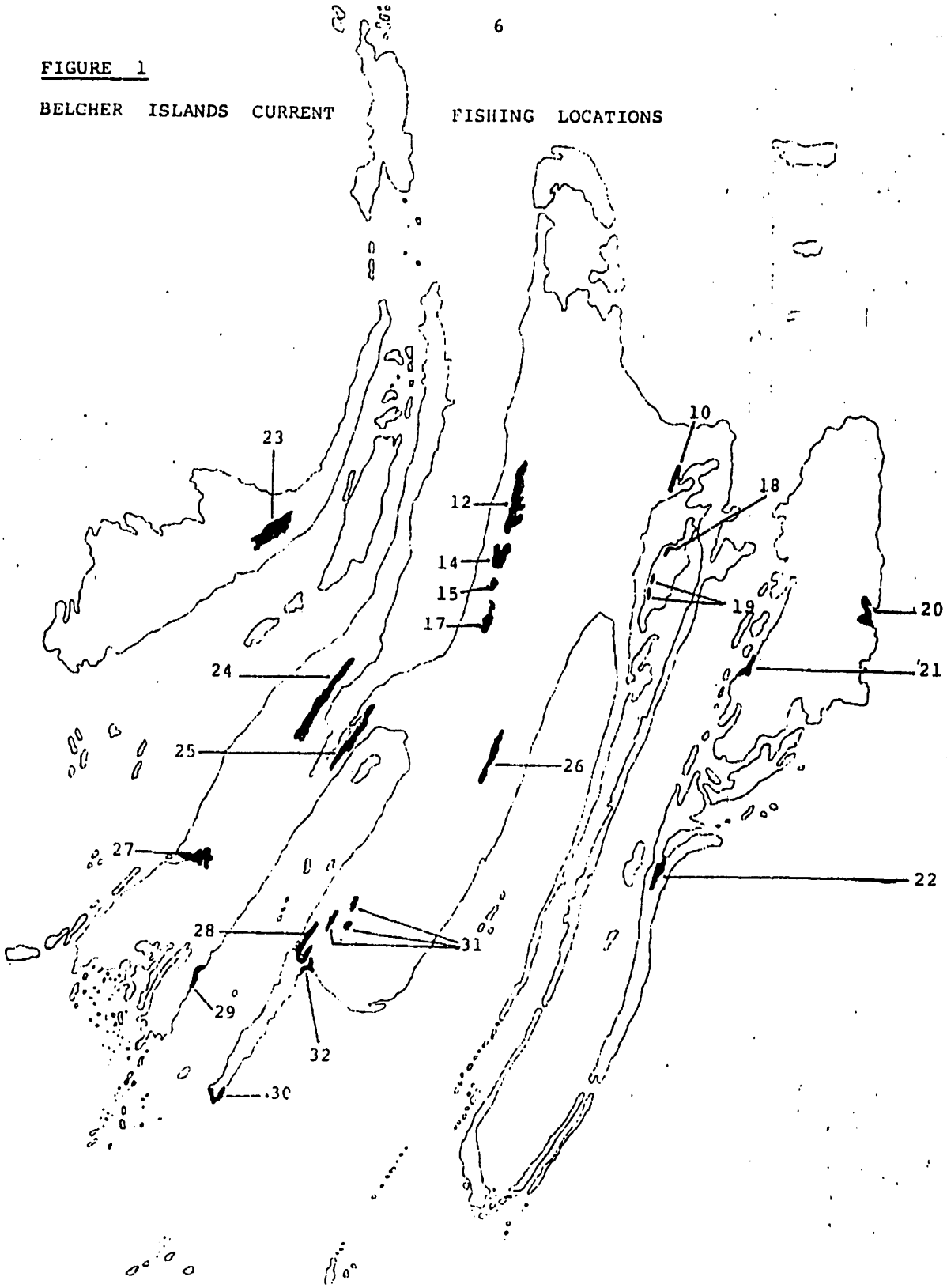


FIGURE 2 BELCHER ISLANDS CURRENT FISHING LOCATIONS

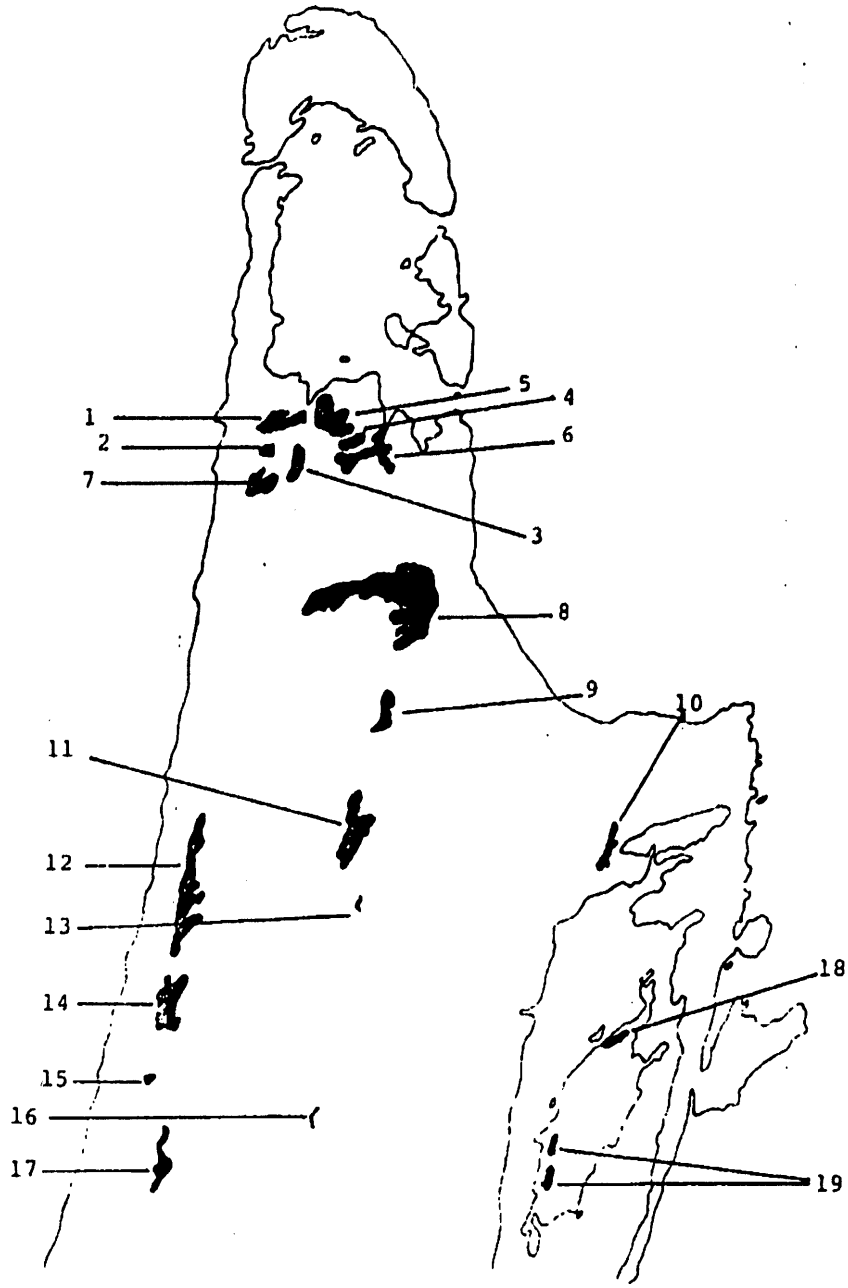


FIGURE 3 NORTH BELCHER ISLANDS CURRENT FISHING LOCATIONS

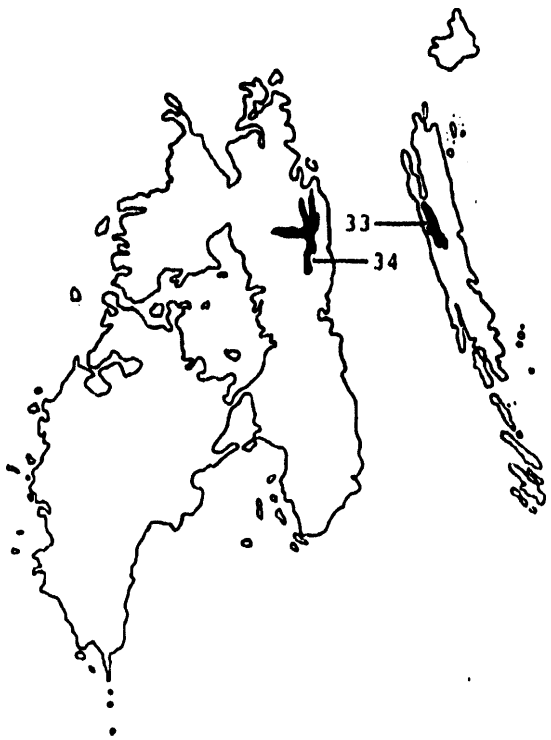
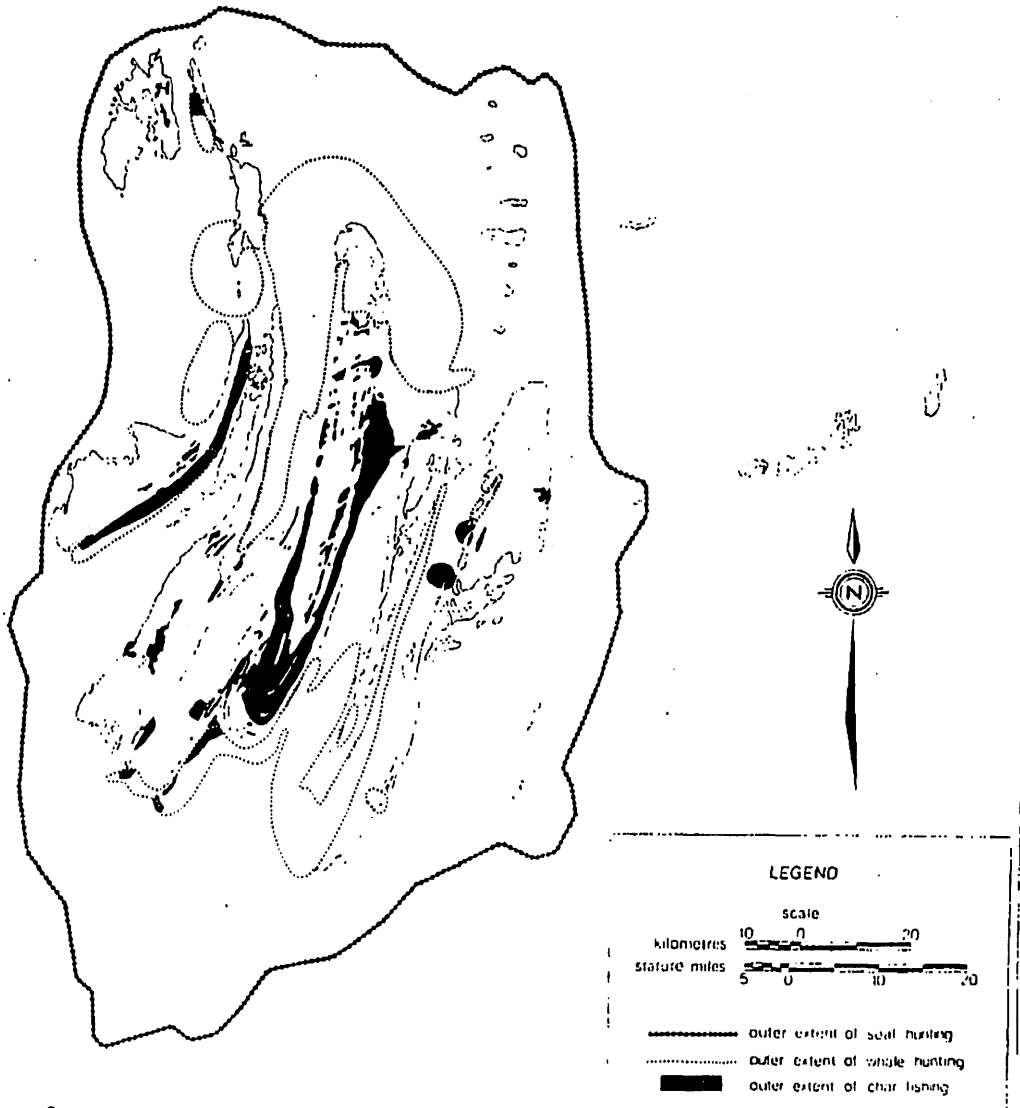


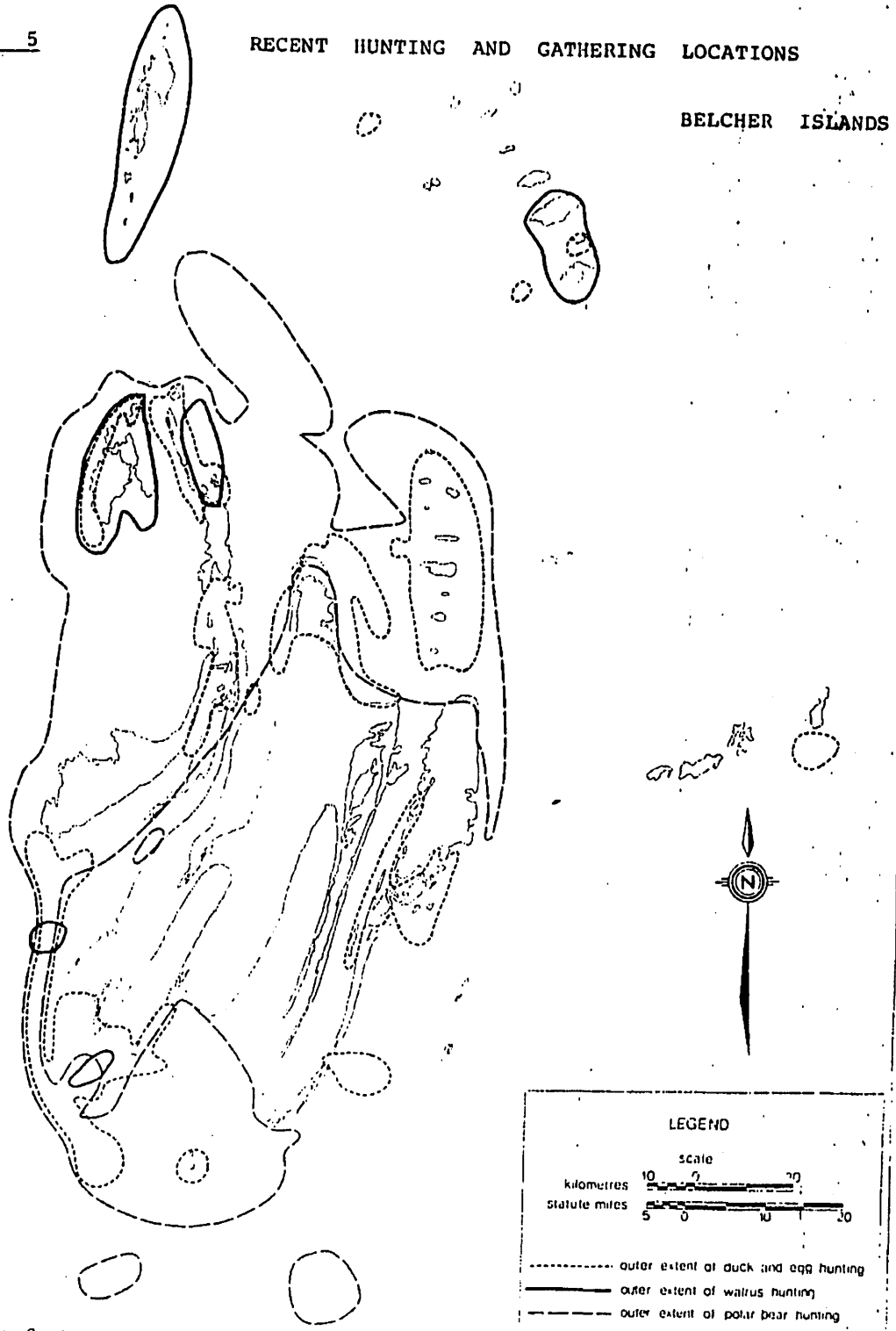
FIGURE 4 RECENT HUNTING AND FISHING AREAS, BELCHER ISLANDS



Transverse Mercator Projection

FIGURE 5 RECENT HUNTING AND GATHERING LOCATIONS

BELCHER ISLANDS



Transverse Mercator Projection

fishing locations will be discussed.

(c) Limited resources--other fish species in freshwater

When speaking of freshwater fishing on the Belcher Islands one is referring, overwhelmingly, to the harvesting of arctic char (Salvelinus alpinus; locally, iqaluppik).

A limited fishery of lake herring, (Coregonus artedi, locally kapisilik) and brook trout (Salvelinus fontinalis, locally iqaluk tasirsiutik) occurs at restricted locations and seasons. For example, herring are taken currently at two main locations (11 and 13 in Figure 2) though a small quantity (never more than 5% of the total yield) may be caught when netting char at some other locations in the spring. The main season for herring is early winter, when nets are set under the ice; herring are never taken by hook, either angling or jigging.

Several families regularly set nets under the ice in early winter, though all but one or two families lift them after two or three weeks as the ice progressively thickens. About half the fish in these winter nets are herring, the remainder are char, though nets set in these lakes before the ice forms may yield a higher proportion of herring. The proportion of herring in the nets decreases progressively throughout winter, so that by the spring only about 5% of the catch is herring. A fifty foot net, set at a favourable location under the ice, might yield about a dozen to fifteen

herring with an average individual weight of one pound. The largest herring would be ca. 2 pounds round weight.

Trout occur mainly in land-locked lakes, or lakes with small streams allowing only restricted access to the sea. Trout are always much less than half the total net catch (of trout and char), even in notable trouting lakes (locations 1 and 7 in Figure 2). Trout are taken in spring by jigging through the ice and by angling in summer. The average size of trout taken is ca. one pound, and a catch rate of one fish per hour would be considered good in summer, and perhaps average at a favourable jigging location in spring.

(d) Limited resources--other fish species in saltwater

Cod (Gadus ogac, locally ugak) are found at a number of special inshore locations, e.g. Kihl Bay at the head of Kipalu Inlet (with the local name ugassiuvik, literally, 'the cod fishing place') and the harbour on the south coast of Weigand Island called tungasittik. These locations are fished at specific times: e.g. ugassiuvik at the time of sea ice freeze-up in early December, and tungasittik from August till freeze-up. Cod can also be taken in the harbour at Sanikiluaq itself; in September and October they arrive there in large numbers and are readily taken by angling from shore or jigging from a boat, and in late November and early December when they are jigged through holes in the newly formed sea-ice for a period of about a week, after which they become

scarce at that location.

Cod is a popular food fish, and is especially sought when poor weather prevents seal hunting during the open water season. Fishing success at tungasittik appears to depend on the tides, but about ten cod per hour can usually be jigged from a canoe; the average size would be ca. one, to one and one-half, pounds per fish.

The same rate of fishing return could be expected at other favoured inshore locations, though the fish would be bigger and fatter at Sanikiluaq in September and October, averaging around two to two and one-half pounds. As many as two dozen people might be fishing on any suitable day on the harbour ice at Sanikiluaq immediately following freeze-up.

Sculpin (Myoxocephalus quadricornis and M. scorpio, locally kanajuk) may be taken inshore at any time, either when angling or jigging, or in nets set for char. There are two notable sculpin fishing locations near to Sanikiluaq, one a few miles to the east, the other to the west, in Coats Bay. Few people engage in deliberate sculpin fishing, and when they do, it is generally restricted to a few recreational day-trips in the spring extending over a three week period. Sculpins are rarely more than about one pound round weight.

Capelin (Mallotus villosus, locally qulilirraq) and halibut (Reinhardtius hippoglossoides, locally nipisarq) are even less important than sculpins in the local economy. The latter is very rarely encountered, and capelin are so localized in time and place during their onshore migrations

that no effort is made to deliberately exploit them. One spawning location is situated on the west coast of Tukarak Island (location 21 in Figure 1), and another is on Weigand Island (at tungasittik). Capelin, however, are preferred as food when taken from seal stomachs.

(e) Negative environmental effects

The pollution aspects of the sports fishing operation are of considerable concern locally and to government. Specifically, during the years of operation, raw sewage was discharged directly into the river from the camp living-quarters, untreated garbage was dumped on a small island in the river (which was swept by waves during story weather), unprotected gasoline and oil storage facilities were sited on the river bank, and aircraft were refueled in the main Kasegalik River.

These actual and potential pollution effects took place immediately proximate to a set of rapids at a narrow part of the Kasegalik River, past which point all the char returning to the Kasegalik Lake to spawn and overwinter migrated in early September. Thus a proportion of all fish caught at any of the fall char fishing locations (numbers 11, 12, 13, 14, 15, 17, in Figure 2, and 31 in Figure 1) had recently passed through an area containing fecal wastes, garbage, and other pollution. In addition it should be observed that other wildlife feeding in the river valley was hunted for food by

people frequenting the area in spring, summer, and fall. Specifically ranger seal, arctic fox and a total of 18 different bird species frequenting the Kasegalik River are potential food resources to people camping or travelling in this region (see Appendix 1).

Concern was also expressed about negative effects exerted on the migrating char by the continued use of motorized canoes and the presence of moored aircraft (being gassed up on the water) at the narrows in the river during the upstream char run.

(f) Lack of economic benefits

In the years from 1965 till 1970 the 'South Camp' settlement provided a small number of men each year to guide the tourists to fishing locations on the river.

Since 1970, however, there have been no Inuit employed at the sports camp, and in addition, no expenditure of any kind in Sanikiluaq by sports fishermen from the camp. The camp is a self-contained operation: personnel working there, and all food, fuel and other supplies are imported by the camp operator from outside the Northwest Territories.

The loss of employment opportunities is of limited significance: it is estimated that about $500-600 per week accrued from guiding activities, shared among two or three men, which constitutes scant compensation for the opportunity costs incurred by not engaging in alternative economic activities

(e.g. hunting, carving, casual employment in the settlement, etc.).

(g) Management problems

From the time the fishing lodge opened (in 1965) until 1970, about one third of the Belcher Island population resided near the Kasegalik River (at 'South Camp', or more properly itilliarug). Since that settlement was closed down, and the population moved to Sanikiluaq in 1970, only short seasonal reoccupations of itilliarug have occurred; consequently it has proved difficult for both government and the local people to monitor activities at the char fishing tourist lodge situated on the Kasegalik River.

The tourist lodge was inspected by a federal health official from Churchill in May 1975, and though a summer inspection was also planned that year it did not take place because of the expense (letter to Secretary, Hamlet Council from Mr. Richard Lawrence, May 20, 1976). In September 1976 a second inspection visit took place, on this occasion by the health officer and a territorial tourism development officer from Yellowknife. As a consequence of this visit it was recommended that the lodge be closed because of pollution problems and certain other contraventions (written report to Hamlet Council, from Mr. Mike Freeland, November 1976). During the 1976 summer fishing operation an inspection trip was also made by a territorial fish and wildlife officer

(Mr. Rick Letkeman, personal communication, August 22, 1978).

The license to operate this tourist lodge was withdrawn for the 1977 season and the suspension maintained through 1978, pending adequate environmental health and safety requirements being met (though fishing likely took place, by non-commercial visitors to the lodge, during those two seasons). Throughout the years 1965 through 1976 the camp operated for six or seven weeks each summer from early July till early September. No regular statistical (fishing) returns have been collected from this licensed operation during this twelve year period by either federal or territorial fishery management services. Consequently it has not been possible to determine how many sports anglers fished on the Belcher Islands, nor how many fish were removed from the river systems that were being fished, nor even which rivers and lakes were being fished during this lengthy period of time.

The fact is, that no effective regulation of sports fishermen visiting the Belcher Islands seems possible under the prevailing legislation, for a tourist may purchase a license from any number of outlets inside and outside the Northwest Territories and, following automatic issuance of this license, he/she may fish anywhere in the Territories. Fishermen having their own aircraft, or able to charter aircraft, are not required to individually report their fishing activities, and such regulations as the daily catch limit (4 arctic char) and maximum possession limit (7 arctic char) and regulations proscribing the use of certain equipment,

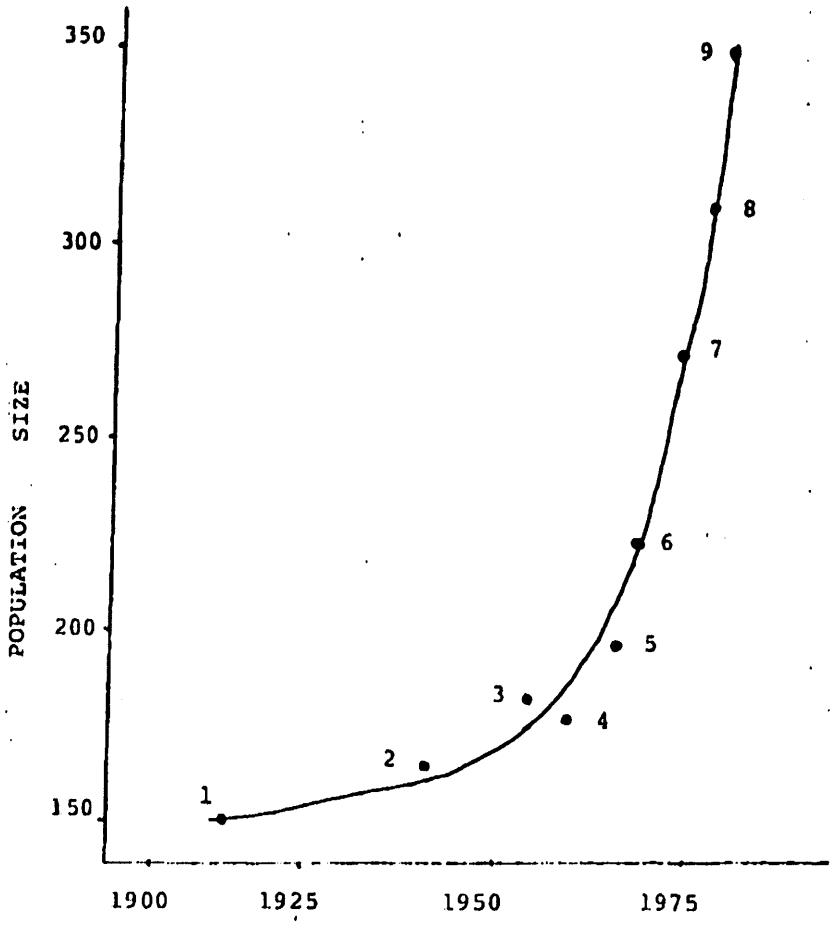
live bait, waste of fish, etc., are presently unenforceable under these conditions.

LOOKING TO THE FUTURE

The Belcher Islanders are acutely aware of two very vital facts concerning their collective future: (1) at present they exploit the resources of their limited territory very fully, and (2) their own population is growing in size. In combination these two realizations add up to understandable concern about their future wellbeing, a wellbeing that desires and requires a continued utilization of locally produced food supplies. It is important to stress (as others have done, e.g. Brody 1975:130, and Usher 1976:118) that food habits are not just culturally determined, they are both deep-rooted in the individual psyche and they are culture-sustaining. In a hunting and fishing society the distribution and consumption of food has a richness and significance of meaning that far outweighs the mere dietetic value of the food consumed. This concern of the Belcher Islanders, concerning their ability to husband and utilize their valued local renewable resources, is both rational and profound.

The population on the islands appears to have been around 150 at the time of first contact (Flaherty 1918). Various reports during the years from 1937 to 1960 show it to have remained more or less constantly between 165 and 185 (see Freeman 1967 for a brief demographic history of the

FIGURE 6: POPULATION OF THE BELCHER ISLANDS, 1910 - 1978



Sources: 1, Flaherty 1918; 2, Robinson 1944;
3, Desgoffe 1955; 4, Freeman, field notes 1959;
5, DIAND Disc List, November 1966;
6, DIAND Disc List, April 1968; 7, Schwartz 1976;
8, Hamlet Council Census 1977;
9, Freeman, field notes 1978.

islands until 1961). However, more recently the population has increased rapidly (see Figure 6): by 1968 the population was 220, and by the summer of 1978 it had grown to about 350. Three main factors account for this recent increase: (1) sedentarization, resulting in greater fertility; (2) increased immigration and (3) a continuing belief in the traditional high value placed on children. The first and third reasons are unlikely to change in the immediate future, but the influence of migration in the future is unpredictable. Some concern exists locally, that the recent decision to prohibit alcohol use on the Islands will lead to increased immigration of families from some large and less socially harmonious nearby communities.

Another recent development that may be expected to increase immigration, especially from Poste de la Baleine, P.Q., is the local decision, if taken, to restrict the export of high-quality soapstone from the Belcher Islands. Soapstone carving constitutes a major cash-producing activity, and together with locally available food resources on the islands, ensures a high degree of economic independence and hence the continued exercise of the individual autonomy that people value so highly.

DISCUSSION AND CONCLUSIONS

Kasegalik Lake constitutes the most extensive body of freshwater on the Belcher Island archipelago, covering an area of ca. 60,300 acres. Drainage into the lake is almost exclusively from surface water on the surrounding land area and from a number of small tributary lakes in close proximity. This lake system drains to the sea by the several mile long Kasegalik River, all but about half a mile of which is above tidal influence (see Appendix II for more information on this drainage system).

However, despite the low productivity of the arctic freshwater environment (referred to earlier) the huge area covered by the Kasegalik system (relative to any other system on the Belcher Islands) makes it of paramount importance locally as a fish producing system. This is especially so because the Kasegalik River--unlike many of the creeks draining other Belcher Islands lake systems--allows migratory char seasonal access to the more productive marine environment.

However, only some char migrate to sea in any year, for there are char that live permanently in freshwater (these are distinguished locally as ivitaaruk), and, furthermore, only a proportion of the migratory char population migrates to salt water in any year. The importance of the more productive salt water environment for the growth of char is evidenced by the fact that, normally, sexual maturity in female char on the Belcher Islands occurs when the char are about twelve

years of age and have grown to about 50 cm in length, whereas the stunted freshwater population, though also sexually mature at twelve years of age, may only be 10 cm in length at that same age. The importance of the Kasegalik system for local subsistence fishing purposes, relative to other freshwater systems on the Belcher Islands was assessed by asking a small sample of knowledgeable residents to rank, in terms of importance, each of several discrete drainage systems (shown in Figures 1,2 and 3) into one of four categories (see Appendix III for more details).

A high degree of consistency was obtained from these independently elicited responses. The summary result, shown in Table 3 below, indicates that fishing locations associated with the Kasegalik River and Lake cause that system to be ranked highest in importance at every season of the year, as well as placing it as pre-eminently important on an overall basis. It should also be noted that mere proximity (of lakes to the settlement, e.g. locations 1-8 in Figure 2) does not endow a fishing spot with great importance, for people are quite prepared to travel some distance to reach the most preferred locations and they do this at every season. The importance of the lakes near to the permanent settlement at Sanikiluaq derives from the use to which they are put by the small number of residents whose circumstances prevent their travelling to the better, more distant, fishing areas.

The relative importance, to the local residents, of

TABLE 3: Relative importance of fishing areas, by season, Belcher Islands, NWT

SEASON	VERY IMPORTANT	IMPORTANT	SOME IMPORTANCE	LITTLE OR NO IMPORTANCE
Spring (N = 12)	K	S, 23	8,10,18,22,24, 25,33,34	19,20,21,27,29 30,32
Summer (N = 11)	K	21,22,25,27	S,10,29,30,32	8,18,19,23,24, 33,34
Fall (N = 12)	K	10,27	S,8,20,21,25, 29	18,19,22,23,24, 30,32,33,34
Winter (N = 11)	K		10	2,3,5,6,7,8,9, 10,11,12,13,14, 15,16,17,18
All year (N = 46)	K		2,3,4,5,6,7,8, 9,11	10,12,13,14,15, 16,17,18

distant fishing areas makes the present collective concern more acute, for competition for these resources is exerted by a party (or parties) whose activities are perceived as even more threatening because they are so loosely 'controlled'. Indeed, it is true to say that the sports fisherman with his own transportation can take fish anywhere on the islands, with their individual conscience as the only control against abuse. People at Sanikiluaq recount instances where this honour system has been abused, where dead fish have been found at the tourists' abandoned camps, and where fly-in parties have fished on lakes they were requested, for good reason, not to visit. All this aggravates a feeling that only those who are deeply concerned about the resources in question, and who effectively demonstrate this concern, should control access to the resources, for infractions of the regulations apparently do take place without penalty.

Unfortunately we have little good data on char fishery activity, either from the sport fishery or from the domestic (subsistence) fishery. The N.W.T. Fish and Wildlife Service have incomplete recent data concerning the past four years spring domestic fishery that suggest that an average estimated spring take may be ca. 3,250 pounds of char (the estimated harvest ranges from ca. 2,400 to 4,200 pounds; see Appendix V for details). Even less data are available for other seasons; such reports as do exist suggest that the fall fishery may be of similar magnitude, witness the following reports on file (supplied by Mr. Richard Popko, Fish and

Wildlife Officer, September 18, 1978)

November 1972: "Caught 500 char today by net"
September 3-4, 1973: "The fishermen caught a lot of fish by net"
October 8, 1973: "J. Cookie and Sampson Meeko caught 40 char today by net"
October 14, 1973: "On the (Tukarak Island) camp we caught a lot of fish by net"
October 4, 1973: The residents of Sanikiluaq Harbour have been fishing at several different locations on the islands. One group took 180 char...."

In comparison it is estimated that a yield of about the same magnitude is being taken each summer by the tourist lodge visitors, with the significant difference that it is taken from a single location and stock, not from the scattered areas as is the domestic practice. Thus data in Table 4 suggest that at least 2,500 pounds of char are sport fished each summer the lodge operates; this figure assumes strict compliance with Catch Limit regulations and does not take into account the activity of fly-in fishermen not resident at the tourist lodge. It is relevant at this point to point out that the Belcher Islands is the arctic char fishing area of the Northwest Territories closest to the two largest population centres of Canada (viz. Montreal and Toronto) and therefore in a relative sense very accessible to many tourists. The residents claim, with justification, that they have no other nearby areas with fish resources (the neighbouring mainland areas are outside of the Northwest Territories) so that their continued dependence upon local resources is great and becomes greater as their population grows progressively

Maximum			Probable
8 weeks	-	Length of Season -	7 weeks
9	-	Number of fishermen in residence per week -	8
6	-	Angling days/week -	5
4	-	Daily catch/fisherman	3
4 lb.	-	Average fish weight -	3 lb.
6,912 lbs.	-	Harvest -	2,520 lbs.

The above computation is based on the following verbal information obtained on August 22, 1978, from Mr. Rick Letkeman, Fish & Wildlife Officer, who visited Theriault's Camp in the 1976 season.

- Fishing season extends from mid-July till first week of September;
- 7-10 fishermen in residence each week;
- Generally anglers stay from 3 days to one week;
- Average char is around 3 lbs.; range up to 7-8 lbs.;
- Fishing in river regarded as "pretty good".

However, brochures published by Theriault Air Service advise that:

- Fishing extends from July 1st till August 31st;
- Accommodation exists for 8 guests and the resident camp manager.

TABLE 4: Estimate of Angler Harvest, Theriault's Camp

larger.

Though these local concerns have been repeatedly voiced by the Sanikiluaq Community and Hamlet councils, and the Sanikiluaq Hunters' and Trappers' Association over the past several years, they are being made explicit again on this occasion. It is hoped that this report, documenting the same concerns as earlier voiced, will materially assist in achieving a better and wider understanding of the situation that continues to be a major concern to the whole community at Sanikiluaq.

APPENDIX I: Wildlife (utilized as food) frequenting the Kasegalik River region.

Birds* frequenting the Kasegalik River and utilized for food:

Common Loon (Gavia immer), tulli
Red-throated Loon (G. stellata), qassauk
Canada Goose (Branta canadensis), nirliq
Snow Goose (Chen caeulescens), kanguk
Black Duck (Anas rubripes), ivugak qirnitak
Pintail (A. acuta), ivugak
American Goldeneye (Bucephala clangula americana), kutikkuuk
Old Squaw (Clangula hyemalis), aqarinnirq
Hudson Bay Eider (Somateria mollissima sedentaria), mittirq
King Eider (S. spectabilis), mittirluk
White-winged scoter (Melanitta deglandi), anigasik
American Scoter (Oidemia nigra americana), anigasik
American Merganser (Mergus merganser americanus), arpangijuraaluk
Red-breasted Merganser (M. serrator serrator), arpangijuk
Black Guillemot (Cepphus grylle), pissiulaak

Eggs of the following additional birds are utilized as food:

Glaucous Gull (Larus hyperboreus hyperboreus), naujak
Herring Gull (L. argentatus smithsonianus), naujak
Arctic Tern (Sterna parasiadea), imiqutailak

The following two mammals are also potential food species that feed on the river:

Harbour Seal (Phoca vitulina), qasiriak
Arctic Fox (Alopex lagopus), tiriranniak

*See Freeman 1970 for distributional data on birds in the region.

APPENDIX II: Limnological observations on Kasegalik Lake.

Morphometry

Occupying the central part of Flaherty Island, Kasegalik Lake extends forty miles in a generally northeast-southwest direction. A central landmass divides the lake into west and east arms, that become confluent at the south end of the lake.

Drainage is derived almost exclusively from surface water collecting on the surrounding hills, none of which are higher than about 350 feet. The few lakes that contribute to the Kasegalik Lake drainage are largely situated in the central divide between the west and east arms, this divide being nowhere more than five miles wide. There are no large rivers, glaciers, or large persistent snow patches draining into the lake, directly or indirectly.

The maximum width of the east arm is about five miles; that of the west arm slightly less. The average width of either arm, however, is about one mile. The outflow of the lake is by way of two small falls, each less than ten feet in height, but transporting a considerable volume of water through the narrow outlet gorges, six and ten feet in width.

The lake is usually ice-covered until the end of June, after which open water appears among the islands in the centre of the lake, elsewhere near the shoreline, and near the outflow area. Early in July open water may extend for several miles offshore, the location depending upon wind conditions.

The volume of water leaving the lake at this time of spring melting appears to be an estimated 15-25% greater than at the end of August. The water level does not appear to fluctuate during the summer.

Due to the very slight and local drainage effect from the outflow falls, all currents in the lake would probably be wind-generated, though temperature anomalies suggest sub-surface activity persists during calm weather.

A number of soundings were taken; the plotting of these and the use of aerial photographs showed the lake to be a deep basin, reflecting the various erosive processes that have left their mark on the islands' topography in such a characteristic fashion. The differential erosion of basalts, dolomites, and softer rock types, have resulted in deep scars on the landscape, forming Kasegalik Lake, the bays, fjords and sounds of the seacoast.

A maximum depth of 77 metres was recorded. Other soundings indicated that in the southern part at least, the west arm (maximum 58 metres) is slightly deeper than the east arm (maximum 41 metres). The outflow area, and the central island complex are considerably more shallow (averaging 10 and 15 metres respectively).

Physical and chemical parameters

One station was operated during August (1959) and certain characteristics determined. This station was situated

approximately 1000 yards from the lake outflow, and about 150 yards from the nearest shoreline in the west arm. The depth at this point was 29 meters, but the contours were descending rapidly here to a depth of 56 meters within a few yards.

The temperature of the surface waters rose from 7.4°C on August 4th, to 8.9° on August 22nd. Temperature fluctuations over a 48 hour period were never recorded as being more than 1.1°C. The minimum temperature recorded in August was 5.8°C at 40 meters depth on August 4th. Temperatures at all depths increased steadily throughout August. The following two profiles indicate the magnitude of the change, and also despite the surface warming, the absence of a thermocline.

	AUGUST 4th		AUGUST 22nd	
DEPTH	Uncorrected	Corrected	Uncorrected	Corrected
0 m.	7.4°C	7.39°C	-	-
5 m.	6.6	6.59	8.15	8.14
10 m.	6.35	6.34	7.55	7.53
15 m.	6.2	6.19	7.4	7.38
20 m.	6.1	6.09	7.27	7.26
25 m.	6.07	6.06	-	-
29 m.	-	-	6.5	6.48
35 m.	6.05	6.04	-	-
40 m.	5.8	5.785		

The temperature anomaly referred to previously was noted at 25 metres depth on August 7th, and the day following. It was impossible to obtain consistent readings on the reversing

thermometers, and for a total of six readings on August 8th, the following values were obtained:

Uncorrected: $6.94 \pm 0.31^{o}C$

Corrected: $6.93 \pm 0.305^{o}C$

No explanation is put forward for this, although a lake of this size would be expected to have internal seiches, and these anomalies may reflect this. Despite the fact that the lake bottom was probably on the average 40 metres depth below sea level, no salinity effect was found; this was so down to and including the maximum depth of 77 metres.

Oxygen determinations indicated that mixing was complete throughout the water column; dissolved oxygen ranged from 7.6 to 7.9 cc/litre.

Secchi disc extinction averaged 9 metres depth, at noon throughout August. A series of determinations made by Dr. E. H. Grainger, indicated that at the end of August, throughout the euphotic zone, phosphate and nitrate were at a very low concentration, and almost certainly limiting.

DEPTH	PO_4 (ugm at./l)	No_3 (ugm at./l)
1 m.	0.13	0.0
5 m.	0.04	0.0
10 m.	0.04	1.0
15 m.	0.08	0.1
20 m.	0.04	1.0
25 m.	0.04	0.5

Primary production cultures were set up, and an attempt made to measure production by the light and dark bottle method. However, production was at such a low level, that 48 hour periods were necessary to record any changes in oxygen concentration. The limitation of leaving cultures that length of time in oligotrophic waters are well known; however, qualitatively it can be stated that net production barely exceeds gross production in the euphotic zone (1% extinction at 24 metres depth).

(From: Milton M.R.Freeman, Reproduction and Distribution in Arctic Gasterosteus aculeatus L. (Teleostei:Gasterosteidae) Doctoral Dissertation, Marine Sciences Centre, McGill University, Montreal, 1965)

APPENDIX III: Methodology for obtaining rank ordering of fishing locations/systems

In order to assess the relative importance of each fishing location/system identified in Figures 1, 2 and 3, respondents were asked to categorize each of 18* fishing locations as either:

Very important

Important

Some more limited importance

Little or no importance

This ranking was to be applied to each location for each of four separate seasons:

Spring: Snow melting on the lake ice, open water appearing in rivers;

Summer: Open water season;

Fall: New ice forms on lakes, larger rivers still have some open water;

Winter: Rivers frozen, lake ice generally snow covered.

The qualitative categories were transformed into numerical data by scoring each assessment as follows: Very Important = 10 points, Important = 7 points, Some Importance = 4 points, Little/no importance = 1 point. Total point scores for each location were divided by the number of respondents to give an average computed score for each locality. To convert these numerical data back into qualitative assessments (as shown in Table 3) the following scale was used:

Very Important	9-10 points
Important	6-8 points
Some, more limited, importance	3-5 points
Little or no importance	1-2 points

It should be noted that Location 22 (Figure 1) was only discovered during spring 1978; therefore no assessment of fall or winter fishery importance could be made at the time of this study.

The locations marked on Figures 1, 2 & 3 do not constitute an exhaustive listing. There are, e.g., additional fishing locations in lakes near Desgoffe Point (tasirjuak), on Split Island (tasirruluq) and north of Freakly Point (inussualuit tasinga).

*Despite a total of 34 fishing locations entered on Figures 1, 2, and 3, only 18 locations were assessed. This is because locations 9, 11-17, 26 and 31 were all on the Kasegalik drainage and were therefore collectively treated as one fishing system, designated as K, and the locations 1-7 being proximate to the settlement of Sanikiluaq and each other were similarly collectively designated as S.

APPENDIX IV: Names of fishing locations shown in Figures 1,2 and 3

1 amittuaaluk
2 miluriasak
3 iparautak
4 kuulurtuk
5 tasiapik
6 tasiaaluk
7 ikarulik
8 nutarautik
9 tasirjuaak kinguani tasiapik
10 iqalussiuviaaluk
11 iqaluttuuk tulli
12 tasirkataaraaluk
13 iqaluttuuk
14 inni
15 inni
16 kapisilituq
17 tasikataaq iqaluliapik
18 iqaluppilik tarrasik
19 iqaluppilik siqinissik
20 sikuttak
21 illuruavinik
22 tasiujaraaluk
23 kugaak
24 takijukaaraaluk
25 kataruq
26 inuvinittalik
27 kutiaruk
28 tasiujak
29 upingaviaaluk
30 upingaviaruk
31 kurraaluup tasingit
32 itilliaruq
33 iqaluliaapik
34 qussutuup tasinga

APPENDIX V: Method of estimating spring domestic fishery harvest.

The only data available were abstracted from information compiled by Mr. Isaac Amitook and Mr. Lucassie Ekidlak (representing the Sanikiluaq Hunters' and Trappers' Association) and Mr. Rick Letkeman and Mr. Richard Popko (representing the Territorial Fish and Wildlife Service).

Year	Month	Hunters Interviewed	Numbers of Char	Pounds of Char
1975	April	8	--	712
1975	May	16	81	---
1975	June	10	--	---
1976	March	13	--	800
1976	April	13	--	24
1976	May	16	--	892
1977	March	16	--	---
1977	April	7	175	---
1977	May	26	81	---
1978	March	20	42	---
1978	April	31	287	---
1978	May	31	372	---

To facilitate comparisons being made these data were transformed by assuming an average fish weight of 3 pounds and a fishing population of ca. 40 people in the years 1976-78 and 32 people in 1975.

Thus the data become transformed as follows:

Year	Month	Pounds of Char	Seasonal Total
1975	April	2848	
1975	May	486	3334
1976	March	2400	
1976	April	72	
1976	May	1784	4250
1977	March		
1977	April	2625	
1977	May	365	2990
1978	March	252	
1978	April	947	
1978	May	1227	2426

Spring average estimated harvest

= 3250 pounds.

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