NORTHWEST PROJECT WILDLIFE STUDIES

AN ORNITHOLOGICAL STUDY OF ALTERNATE GAS PIPELINE ROUTES IN ALASKA, YUKON TERRITORY AND THE NORTHWEST TERRITORIES

VOLUME I

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INTRODUCTION

The following Report is the result of ornithological field studies undertaken in the summer of 1971 for Williams Brothers Canada Limited, who are acting on behalf of the Northwest Project Study Group. Our instructions were to survey proposed gas pipeline routes between Prudhoe Bay, Alaska, and Emerson, Manitoba. Because of the constraints of time and the vast distances involved, we decided to devote the first season's work to those areas which we considered most critical and concerning which there is relatively little published information. Thus, our work was concentrated along two proposed routes - the Inshore Route and the Mountain route - between Prudhoe Bay and Arctic Red River.

The North American arctic region is one of the world's last remaining great wilderness areas. No component of arctic wildlife is more important than the birds, especially waterfowl, which in high latitudes number in hundreds of thousands, perhaps millions. The region is the last significant waterfowl-producing area in North America.

The study was an attempt to describe and estimate the numbers of species and relative densities of birds along the two alternate pipeline routes, and to arrive at certain

conclusions and recommendations. Volume I contains the detailed objectives of the study, describes study areas and methodology and presents complete results. Volume II contains an analysis and discussion of the results, together with our conclusions.

OBJECTIVES

The objectives of the field work undertaken in 1971 were:

1) To survey the bird populations along the two proposed alternative gas pipeline routes between Prudhoe Bay and Arctic Red River, using sampling techniques to:
   (a) determine the bird species to be found in each major habitat found along the routes;
   (b) estimate the abundance of each species;
   (c) designate areas of major importance to birds during migration, nesting, moulting and pre-migration concentration.
2) To make an evaluation as to which of the two alternate routes is likely to be less damaging to existing bird populations.
3) To designate areas that could be used as experimental and control test-sites for subsequent "impact" studies of human disturbance on bird populations.
4) To formulate recommendations designed to eliminate or minimize disturbance to birds during the construction and subsequent maintenance of a gas pipeline.
5) During the course of the bird surveys, to make note of other wildlife, such as mammals and fishes, and to consider the implications of human disturbance on the habits of these forms.

6) To make one survey flight along the remainder of the route, from Fort McPherson to Emerson, Man., as a preliminary step to preparation of a detailed programme of ornithological investigations in 1972.

STUDY AREA

General Description

The area selected for study in 1971 lies north of the Arctic Circle and is bounded on the east by the Mackenzie River, on the north by the Beaufort Sea, on the west and south by a line drawn roughly from Prudhoe Bay to Arctic Village, Alaska, and then east through Old Crow, Yukon Territories, ending on the Mackenzie River south of Arctic Red River, Northwest Territories.

General geographic, physiographic, climatic and vegetative descriptions of the study area are given in Brooks et al. (1971), Naysmith (1971), Klein (1970), Weedin and Klein (1970), Irving (1960), Kessel and Scholler (1960), Kessel and Cade (1958), Sage (no date), Wiggins and Thomas (1962), Porsild (1943), and Porsild (1935), and will not be added to here.

Within the general area, studies were confined to areas on or near the two proposed alternate gas pipeline routes extending from Prudhoe Bay to Arctic Red River.

The Inshore Route

The first alternate proposed route (which will hereafter be called the Inshore Route) follows the Arctic Slope

eastward to the west side of the Mackenzie Delta where it turns south down the narrow corridor between the Delta and Richardson Mountains. In this area it roughly follows the transition between the foothills of the Sadlerochit, Romanzof, British, Barn and Richardson Mountains and the Arctic Coastal Plain and the Mackenzie Delta. From Prudhoe Bay to Arctic Red River, this route measures approximately 433 miles (Figure 1). It is generally an area of relatively smooth surface features varying from the rounded knolls and isolated knobs of the outer foothills to the gently undulating expanse of the coastal tundra. The lakes are relatively small and shallow. The streams, all of which drain into the Beaufort Sea, tend to meander in the eastern section, but become swift and braided in the better drained Alaskan portions. Permafrost is continuous with ice ridge polygons in the flatter areas.

The Mountain Route

The second alternate proposed route (which will hereafter be referred to as the Mountain Route) runs from Prudhoe Bay across the Arctic Slope, up the Canning River and through the Brooks Range, skirting the western and southern boundaries of the Arctic National Wildlife Range, to the Alaskan-Canadian boundary. From there it continues eastward, swerving to avoid the Old Crow Flats while staying

north of the Porcupine River, crossing the Bell River at Lapierre House and joining the North Route at a point approximately seventeen miles south of Arctic Red River. From Prudhoe Bay to Arctic Red River, this route measures approximately 500 miles (Figure 1).

The Mountain Route differs from the Inshore Route in that it traverses several different physiographic and vegetative zones. Starting at the Arctic Slope, a relatively smooth, tundra area, it enters and crosses the rugged Brooks Range via the access route provided by the valleys of the Canning River on the north side and Cane Creek on the south. From here to the Old Crow Flats, it remains in the foothills of the Brooks Range – latitudinally and altitudinally an ecotonal area between tundra and taiga. At the Old Crow Flats it descends into the boreal forest of the Porcupine Valley and is separated from a similar forest in the Mackenzie Valley by the tundra areas of the Richardson Mountains.

Areas Regularly Surveyed by Air

Regular aerial transects were flown (a) on the Arctic Slope from the Malcolm River to the Babbage River, and (b), on the Old Crow Flats north of the Porcupine and the smaller pothole area due south of Old Crow.

Ground Survey Sites

A total of 24 sites were examined along the two routes for quantitative information about the birds contained on them (Figure 1 and Table 1). Eight of these sites are on the Mountain Route, (sites 20, 19, 21, 22, 5, 4, 3, and 2 from west to east), eight on the Inshore Route (sites 18, 17, 15, 14, 11, 8, 7 and 6 from west to east), and seven on the North coast (sites 16, 13, 12, 10, 9, 24 and 23 from west to east), and one lying between the North and South route (site 1) near the eastern junction.

The sites were located along the two routes at intervals which varied from approximately 15 to 55 miles in order to cover typical habitats. The Richardson Mountains and Brooks Range were not examined because adequate transportation was not available. Detailed descriptions of each site are given in Appendix 1.

Transects

At each site, five to nine transects were set up, each approximately half-mile by two chains wide (descriptions in Figures 4 to 27).

METHODS OF STUDY

Aerial Surveys

Aerial Surveys were important in: (a) locating critical areas used by birds; (b) providing information on seasonal use of these areas, and, (c) providing a means of estimating numbers. They gave a general overall picture of bird usage (at least by larger birds) of the two routes throughout the season. Aerial surveys were also essential for planning ground work.

Periodic Route Surveys

Route surveys were flown to locate concentrations of the birds and the areas they were using, and to plan the logistics of getting into the various sites. They were also used to give a rough idea of the numbers of birds in a certain area, e.g., sea ducks along the barrier beaches and snow geese on the North Slope. Some of these latter surveys were incomplete because of poor weather or lack of fuel (See Table 2).

As emphasis was on qualitative not quantitative information, no special course was followed on the route surveys. Nevertheless, all birds seen were classified as to species and number, and all mammals seen were also reported.

Two observers were used on all route surveys, except those during September when only one was used.

Regular Aerial Transect Surveys

From the information gained on route surveys, regular aerial transect surveys were set up and flown to provide quantitative information throughout the summer season on those areas that were thought to be particularly important to birds. Four such areas exist along the Inshore and Mountain Routes; (1) the Old Crow Flats; (2) the pothole area around Prudhoe Bay; (3) the coastline, by the Malcolm, Firth and Babbage Deltas and, (4), the Mackenzie Delta. Aerial transects were set up and flown on only two of these areas, the Old Crow Flats and the Malcolm, Firth and Babbage Deltas areas. Aerial transects were not set up on the Mackenzie Delta and the area around Prudhoe Bay because of coverage of these areas by the Canadian Wildlife Service and United States Fish and Wildlife Service. It was understood that this information would subsequently be made available to us, so we concentrated on the relatively unstudied areas.

Information on the regular transect surveys of the two areas are given in Table 3. Two observers were used on all of the surveys (except those done in June when one was used) and each observer covered the standard one-eighth mile strip. Species, numbers and the relevant transect were

recorded, as were all mammals. All transects were flown at an elevation of one hundred feet, at an airspeed of ninety miles per hour, in a Cessna 185 aircraft.

The Old Crow Flats transects followed the Universal Transversal Mercator grid zones, starting at the north end at 75800 M.N, (Blow River Map) and flying east to west on first transect, then back and forth. Eight transect were set up north of the Porcupine River and two south at each consecutive grid zone (Figure 3).

The Malcolm, Firth and Babbage River transects started at the west end at 540,000 m.E, (Herschel Island maps) and ending 610000 m.E, flying first south to north and ending at 610000m.E. No transects extended more than ten miles inland from the coast line. Fifteen transects were flown (Figure 2).

Review Survey from Mackenzie Delta to Manitoba-North Dakota Border

The route from the Mackenzie Delta to the North Dakota boundary was surveyed at the end of September to look for concentrations of birds and to plan next year's work. Only one observer was used and all birds seen were recorded as to species, numbers and location. A Piper Aztec was used.

Ground Surveys

To give a more quantitative, detailed assessment of the birdlife along the two routes, ground surveys were undertaken at selected sites.

Site Selection

Our first approach was to set up a method whereby sites were selected randomly from stratified blocks (dictated by habitat). This was soon rejected because of (a) a lack of habitat maps for the area, and, (b) limitations imposed by available transportation. Therefore, sites were selected for the best compromise between habitat type, obvious critical areas, and aircraft landing feasibility. A Cessna 185 STOL modified float-plane was used in Canada, so unfrozen lakes and deep rivers dictated site selection. In Alaska, a Cessna 185 with big wheels was used to land on gravel bars and flat tundra. These were usually found in association with large rivers.

Transect selection

At each site, transects were set up to sample the area. As was the case with the sites themselves, random selection of transects was found to be impractical because of the difficulty of walking over the terrain and because of limited manpower. Consequently, transects were selected

close to each landing area to cover the various types of habitat occurring at that site.

Transects were set up by determining a starting point and moving from that point on a fixed compass bearing. Beginnings and endings of transects were marked by coloured flags, stakes, rocks or prominent land-marks, such as lake edges. These were also described graphically (see Figures 4 to 27).

Two or three men moved abreast down the transects recording birds seen; notes were made as to species, number, sex, habitat and behaviour; birds flying directly over the transect were counted as on the transect. All birds seen off the transects were also recorded, and classified separately, including those seen around camp or while walking to transects. In dense cover, birds heard but not seen were also recorded.

Most of the transects were read twice during the summer. The first reading extended from June 4, 1971 to July 5, 1971, and the second took from July 8, 1971 to August 18, 1971. Table 4 gives the dates and transects read at each site. Sites 23 and 24 were included in the second reading to give better coverage of the Mackenzie Delta. Site 21, and half of site 22, had to be skipped on the second reading because of high water. At several sites, transects were added to the original ones from the first

reading, in an attempt to make up the discrepancy between species on and off transect. These new transects differed from the others in terms of minor vegetational differences.

RESULTS

Aerial Surveys

Results of Periodic Route Surveys

Even though there was little standardization of time and routes flown and methods of surveying on the periodic route surveys, some interesting trends are revealed.

On the Inshore Route there was a great increase in numbers of waterfowl using the barrier beaches during July and August, (Table 5). These were mostly sea ducks with oldsquaws being the most common species, followed by scoters (both surf and whitewinged) and quite a few scaup. Eiders were not as common as the others, and most of these were probably breeding females. For the remaining species, both aerial and ground observations revealed a preponderance of males with few females, the latter probably being non-breeders.

There was a large increase in numbers of shorebirds occurring around the barrier beach lagoons during the first week of August. They were usually in flocks of fifty or more, and apparently were feeding preparatory to migration. The mudflats of the river delta were especially attractive to these flocks, as were the barrier beaches themselves.

Another very noticeable increase in numbers during early August occurred in the loon population along the coast.

Most of them appeared to be red-throated loons, but specific identification from the air was difficult. They were scattered from Komakuk to Prudhoe Bay, usually just one or two birds together. While a few were on the lagoon side of the barrier beaches, most were on the sea side and it was felt that numbers were not seen because of being further out away from land amongst the ice floes.

Perhaps the most spectacular increase in bird numbers happened in late August and early September, when snow geese and brant flocked to the north slope preparatory to and during migration. The largest numbers of brant were recorded during late August, while the peak numbers of snow geese probably occurred a week later. Both species came from the east but, while the brant apparently continued west, the snow geese turned back to the Delta and eventually migrated up the Mackenzie Valley. For more details on the coastal movements of birds see the sections on the ground surveys we ran to count the waterfowl flight.

A final trend noticed on the periodic route surveys was the absence of jaegers after the first week in August. They apparently were finished nesting by this time and had moved away from the North Slope.

Results of Regular Aerial Transect Surveys

Some interesting seasonal trends in bird usage were

revealed on the regular aerial transect surveys of the Old Crow Flats and the Malcolm, Firth and Babbage Deltas (Tables 6 and 7). There were relatively few birds present in early June of the Old Crow Flats. Only the edges of the large lakes and a few of the smaller ones were open to provide water for arriving birds. There was a large increase in numbers from June to July, both in waterfowl and shorebirds, but only waterfowl increased in number during the August count, while shorebirds began to decline. The September count showed a decline in waterfowl numbers and shorebirds were virtually absent.

Loons followed the same trend in numbers as the ducks and are here included with waterfowl. The numbers shown do not reflect true numbers of these birds as most of them would dive at the approach of the plane, and could not be counted. This was also true of oldsquaws, and to a lesser degree of scoters and scaups.

Identification of all species of ducks was very difficult during the middle of the summer and many of the puddle ducks are doubtless included in unidentified waterfowl.

A similar build-up of birds occurred on the Malcolm, Firth and Babbage Deltas. Very few birds were there when the June survey was flown. Most of the lakes on the North Slope were still frozen and ice was continuous along the

coastline, except where rivers emptied into the sea. Of course, most of the birds were found around open water.

A large number of sea ducks moved onto the barrier beaches during July and stayed until the end of August. Around Herschel Island alone (from Osborn Point to Avadlek Spit) there were between 5,000 and 10,000 sea ducks, mostly surf scoters and whitewinged scoters with some oldsquaw and scaup. This differed from the Alaskan barrier beaches which contained mostly oldsquaws. Later on, in August, these ducks drifted away from Herschel Island toward Phillip's Bay where they could be seen offshore in flocks of various sizes. We do not know when these birds migrated, but they were not seen from the ground camp at Nunaluk Spit August 24-September 6; numbers were seen during the second week of September between Phillip's Bay and Herschel Island.

Loons were not as common in this area as they were on the Old Crow Flats and probably few of them were breeders. Many of them were part of the sudden influx of red-throated loons as described in Results of Route Surveys. However, ground and air observations showed that at least a few of these loons were the rarer yellow-billed loon, a species not seen on the Old Crow Flats. The other two species, arctic loon and common loon, were also seen in the lagoons along Nunaluk Spit.

In July, shorebirds flocked into the coastal area,

especially the river deltas, but they were mostly gone by the first of September. Gulls and terns, together with a few eiders, nested on the islands just east of Nunaluk Spit. The terns completed nesting and were gone by September, but gull numbers increased as migrants appeared from the east and moved west along the barrier beaches.

Whistling swans were never plentiful in this area; most of them occurred on the delta of the Babbage River where a few pairs raised broods amongst a larger number of non-breeders (approximately fifty). The great influx of geese along the North Slope was evident during the September survey. Few geese were seen on previous surveys, but white-fronted geese, Canada geese, snow geese and brant were all seen on the last survey; snow geese were by far the most numerous. Except for geese and gulls, the September survey showed few birds remaining on the North Slope.

Jaegers showed the same decline in numbers during August on this survey, as they did on the route surveys. Apparently they use the North Slope for a relatively short time.

Results of Review Survey from Mackenzie Delta to Manitoba-North Dakota Border

The survey of Ellice Island on September 19, 1971 showed that a large number of snow geese had moved out to

the Delta after being driven from the North Slope by bad weather, (Table 8). Our ground observations at Moose Channel support this. The survey of Ellice Island, which was by no means complete, revealed 48,000 snow geese that had not yet started the southerly migration. We did not ascertain how long they stayed after the survey.

The route survey from the Mackenzie Delta to High Level, Alta., recorded 26,315 birds (Table 9). There were few surprises except for the large flocks of loons (arctic?) at Stewart Lake, N.W.T., west of the Mackenzie River. One flock contained about 1,000 birds. Many flocks of ducks, geese and swans were seen in the air or resting on the sandbars of the Mackenzie River, all the way south to Fort Providence. The Wrigley Air Traffic centre told us on September 23, 1971, that many birds had gone by for the past two days at an elevation of 1,500 to 2,500 feet. They further estimated that, 90 percent of the time, the flocks follow the river. The operator stated the birds were snow geese, although it is not known how he determined this.

Other than the above, there were no notable concentrations of birds along this section of the pipeline route to High Level and there appeared little basis for choice between the two alternate routes. This condition changed, however, from High Level to North Dakota as the forest gave way to farmland and prairie and almost every

pond and lake contained birds. Of the two alternate routes in this section, the northeastern one contained more birds (Table 9). The southwestern alternate route appeared to traverse less productive areas, i.e., sand hills, rocky areas and dense forest. Other than those that appeared on the lakes, however, no concentrations of birds were seen.

Ground Surveys

Site Results (species seen and relative abundance)

A total of 110 species of 11 orders and 25 families of birds were seen on the ground sites (Table 10). Species seen both on and off transects are included in this list. Passeriformes (songbirds) was the best represented order with 39 species, followed by Charadriiformes (shore birds, gulls, terns), with 30 species, and Anseriformes (ducks, geese, swans) with 22. These three orders comprised most of the birdlife seen on the sites, although such orders as Gaviiformes (loons), Falconiformes, (hawks), and Galliformes (grouse) were widespread and of more or less frequent occurrence and low numbers.

In comparing the routes (Table 11) from a species standpoint, there were 37 species at site 1 (this site can be considered on either the Inshore or Mountain Route), 73 species on the Mountain Route sites, 68 species on the Inshore Route sites, 69 species on the North Coast site,

and 88 species on the Inshore Route combined with the North Coast site. So there was little difference in numbers of species on each route if considered separately, but when the North Slope is considered as a whole, the gap widens (Table 12).

On the Mountain Route, Passeriformes (songbirds) were the most important group with 32 species, more than double the next important groups, shorebirds and waterfowl, which each had 15 species. Songbirds were also represented by the most species, 27, on the Inshore Route. They were followed by shorebirds with 19, and waterfowl with only nine. On the North Coast, shorebirds were the best represented with 24 species, followed by songbirds with 17, then waterfowl with 15. The total North Slope picture, however, again has songbirds on top with 27 species, followed by shorebirds with 26, and waterfowl with 15 (Table 12).

It should be noted that loons were common on both Inshore and Mountain Routes, but the yellow-billed loon was only seen on the Inshore Route and North Coast. Only one red-necked grebe was seen during the entire summer and that was at site 1.

The numbers of species and numbers of birds seen at the various sites differed to some extent between the first and second reading. This was due both to seasonal changes

in the bird populations, and to the addition of transects on the second reading to cover micro-habitat situations missed on the first reading. For purposes of analysis, we are using the sum of both readings for our species-number composition in Tables 13, 14, 15 and 16. Table 13 includes the numbers of birds seen at site 1 and their relative densities computed from the total area covered on the two readings. Table 14 includes the same information for the Mountain Route (sites 20, 19, 21, 22, 5, 4, 3 and 2), Table 15 for the Inshore Route (sites 18, 17, 15, 14, 11, 8, 7 and 6), and Table 16 for the North Coast (sites 16, 13, 12, 10, 9, 24 and 23).

Birds Seen on Lakes

Most birds seen on lakes were considered off transect, (exceptions are birds seen on or close to shore before swimming out). Figures 4 through 27 show the positions of these lakes. Table 17 gives the results of these observations. Almost all of the small thaw lakes supported some waterfowl during the summer and many pairs produced young.

The edges of these small lakes are also important to breeding and foraging shorebirds, but only waterfowl are included in Table 17 because of the difficulty in deciding how shorebirds were using the lakes.

There was a total of approximately 411 waterfowl seen

on 24 lakes, for an average of 17 waterfowl per lake.

Description of Vegetative and Habitat Types

Since the birdlife of an area is a reflection of the type of vegetation (habitat) available, it was considered desirable to define the vegetative types that occurred at each site. This was done by first describing the plant communities that occurred at each site and then grouping them into thirteen vegetation types (Table 18). Estimates were made of the frequency of occurrence of the main plant species that occurred in the plant communities and these were converted to a percentage. Rough estimates were made of the smallest, largest and average ground cover of each species and assigned a value from 1 to 100. From these figures, vegetative types were defined by the characteristic plants and a comparison of the main species. Data are incomplete on three of the vegetative types: sphagnum bog, brackish sedge-willow and barren lichenous rock, in Table 18. Table 19 shows the vegetative types that occurred on each transect.

In addition to the thirteen vegetative types, there were four habitat types that were not described vegetatively. These are: gravel beaches, flowing water, still water, and the ocean.

Spruce Heath (Type 1)

The most prominent plants in this type are spruce (Picea spp.), and Ledum palustre. Willow (Salix spp.), birch (Betula glandulosa), alder (Alnus crispa), Vaccinium uliginosum are also common in this type. This was the only vegetative type in which Ledum groenlandicum regularly occurred. This is a dense habitat, with the spruce growing from twenty to fifty feet high and the other species forming a dense understory. Dense stands of willow and alder occur where sloughs, slides, burns, streambeds or other openings occur.

This vegetative type grows in large homogeneous stands and comprises a major habitat of the Mackenzie Delta and the protruding fingers of the river systems that drain the southern slope of the Brooks Range.

Birds commonly found in this vegetative type are: gray jay, robin, varied thrush, hermit thrush, gray-cheeked thrush, Bohemian waxing, blackpoll warbler, tree sparrow and white-crowned sparrow. Less common species are: solitary sandpiper, mew gull, yellow-shafted flicker, northern three-toed woodpecker, olive-sided flycatcher, raven, ruby-crowned kinglet, orange-crowned warbler, myrtle warbler, rusty blackbird, pine grosbeak, pine siskin and slate-coloured junco.

Sedge-Grass Marsh (Type 2)

Various species of sedge (Carex, spp.), are the most prominant plants in this type. Prostrate or low shrubby willows and Eriophoruma angustifolium also occurred in scattered clumps. This vegetative type is found on low, poorly drained areas, such as around lakes and streams, or on polygonal ground. It varies from very wet (covered with several inches of water) to dry and hard (usually in polygonal areas). Potentilla palustris and Ranunculus pallassii are indicator species for the wet form. Sedge-grass marsh covers extensive areas, but sometimes is found in isolated smaller areas in association with other vegetative types, especially tussock-heath tundra.

Birds usually found in this type are: marsh hawk, roughlegged hawk, golden plover, buff-breasted sandpiper, lesser yellow-legs, long-billed dowitcher, pectoral sandpiper, least sandpiper, semipalmated sandpiper, common snipe, red phalarope, northern phalarope, parasitic jaeger, snowy owl, raven, Lapland longspur and Smith's longspur.

Tussock-Heath Tundra (Type 3)

The dominant plant in this vegetative type is cotton grass (Eriophorum vaginatum), growing in characteristic tussock form. Among the tussocks, Betula glandulosa and mosses (Musci spp.), frequently grow. This is the

vegetative type of the better-drained coastal plain and foothill areas and usually graded into sedge-grass marsh in poorly drained areas. Its hummocky appearance is very characteristic from the ground or air.

As with Type 2, characteristic birds tend to be shorebirds, but the Lapland longspur is probably the most characteristic species. Others are: marsh hawk, rouglegged hawk, rock ptarmigan, golden plover, buff-breasted sandpiper, stilt sandpiper, least sandpiper, parasitic jaeger, long-tailed jaeger, cliff swallow, common plover and Savannah sparrow.

Shrubby Lichen Tundra (Type 4)

Spruce is again a dominant plant of this vegetative type, but it is less dense and tends to be scattered. Otherwise, the distinguishing feature of this type, as opposed to spruce heath, is the occurrence of lichens.

This vegetative type is actually an ecotonal area between the spruce forest and tundra areas, appearing on the fringes of the boreal forest. Birds found in this type are: yellow-shafted flicker, gray jay, common raven, robin, gray-cheeked thrush, water pipit, redpoll, tree sparrow and white-crowned sparrow.

Willow-Alder Brush (Type 5)

The dominant plants of this vegetative type are willow and alder (Alnus crispa), which grow from two to ten feet in height. The understory varies from a Carex spp., substratum in wet situations to mosses (Musci spp.), and horsetail (Equisetum spp.), in drier areas. Sometimes, pure stands of Alnus formed almost impenetrable thickets.

Typical locations for this habitat were creek, river and lake borders. Characteristic birds are: willow ptarmigan, Traill's flycatcher, olive-sided flycatcher, gray jay, robin, varied thrush, gray-cheeked thrush, yellow wagtail, yellow warbler, myrtle warbler, northern waterthrush, Wilson's warbler, hoary and common redpoll, tree sparrow, white-crowned sparrow and fox sparrow.

Willow-Birch Brush (Type 6)

The dominant plants in this type are again willows, but alder is replaced with Betula glandulosa. Heaths of various species regularly occur in the understory of this type.

It occurs along stream and lake shores, and ravines, but usually in drier, more tundra-like situations than Type 5. Nor is it usually as dense as Type 5. Birds that regularly occur in this habitat are similar to Type 5, leaning heavily to insectivorous perching birds.

Dry-River Tundra (Type 7)

The dominant plants of this type are willows, Dryas integrifoli , Carex spp., Musci spp., and lichens. The willow is rarely more than five feet tall and usually much lower.

This type occurs on the gravelly, stream-bed terraces of swift North Slope rivers and is continuous with the next type, Gravel-River Tundra.

Characteristic birds are: black-bellied plover, dunlin and water pipit.

Gravel-River Tundra (Type 8)

The dominant plants of this type are similar to Type 7, with willows, Dryas, sedges and mosses, but are more scattered with patches of naked gravel between sparse tufts of vegetation. Potentilla biflora and Saxifraga spp., are also present, but less abundant than the above genera.

The location of this vegetative type is on the extensive, flat flood plains and islands of the braided rivers on the North Slope.

Characteristic birds are: semipalmated plover, ruddy turnstone, rock ptarmigan and common redpoll.

Tall Brush (Type 9)

The dominant plants of the tall brush vegetative type are willows, ten to fifteen feet in height. Poplars (Populus sp.), also occur in several areas. At shrub and herb level are Shepherdia, Rosa acicularis, Hedysarum alpinum, Arctostaphylos alpina, Equisetum spp., and Musci spp.

This vegetative type occurs in disturbed areas within a typical spruce forest such as mud slides, dry oxbows of old meanders, and is apparently a seral stage in the development of the boreal forest.

Birds likely to be found in this habitat are: olive-sided flycatcher, gray jay, robin, varied thrush, Swainson's thrush, gray-cheeked thrush, ruby-crowned kinglet, Bohemian waxwing, orange-crowned warbler, yellow warbler, myrtle warbler, blackpoll warbler, northern waterthrush, Wilson's warbler, rusty blackbird, white-crowned sparrow, and fox sparrow.

Sphagnum Bog (Type 10)

Sphagnum bog occurs only on Site 5 in the Old Crow Flats. The dominant plants are sphagnum spp., which covers 40 to 70 per cent of the ground. Other species there are Andromeda polifolia, Ledum palustre, Rubus chamaemorus, Alnus crispa, Betula glandulosa and Picea mariana.

This is a poorly drained open area occurring in the spruce forest of the Old Crow Flats, probably too wet to be spruce forest.

Birds found there are: whitewinged scoter, old-squaw, herring gull, northern phalarope, least sandpiper, red-throated loon and tree sparrow.

Brackish Sedge-Willow (Type 11)

The dominant plants of this type are sedges and willows. The Carex grows in a dense carpet on the alluvial floodplains of deltas. Low prostrate willows occasionally appear in the flat, sedge surface.

This vegetation type occurs in the deltas of the North Slope rivers where they meet the sea. The flat sedge-willow plains and islands are bordered by meander streams and dotted with potholes.

Characteristic birds found here are: whistling swan, sandhill crane, northern phalarope, pintail, arctic loon, semipalmated sandpiper, oldsquaw. In August and September, black brant and snow geese feed extensively on these sedge flats.

Barren Lichenous Rock (Type 12)

We found this type, barren lichenous rock, only on a rocky bluff at Site 7. The dominant plant forms are lichens

covering the rocks and exposed soil; willows, Saxifraga spp., and Cassiope tetragona grow on the small patches of soil between the rocks. The wheatear and the Lapland longspur were the only birds seen on this rocky outcrop.

Alluvial Willow Shrub (Type 13)

Willows are the dominant plants of this vegetation type, growing two to three feet high in a gravelly situation, and up to ten or fifteen feet high in deep-silt deposits. In the more exposed gravel areas, Graminae, Leguminosae and Artemisia spp., grow among the willows. In the silt areas, horsetails (Equisetum spp.,) form the understory.

This type of willow brush grows wherever alluvial deposits occur along streams, especially on those that drain the south face of the Brooks Range.

Characteristic birds are: willow ptarmigan, rock ptarmigan, semipalmated plover, least sandpiper, yellow wagtail, northern shrike, yellow warbler, myrtle warbler, common redpoll and tree sparrow.

Gravel Beaches (Type 14)

In addition to the vegetative types noted above, four other habitats occur which are not described according to the vegetation occurring there, but because of some other

more outstanding characteristic. The first of these types, gravel beaches, is a good example. While one or two species of grasses and/or sedge grew on some of the higher barrier beaches, they are mainly characterized by broad expanses of gravel.

Gravel beaches occur at the mouths of the North Slope rivers where outworked gravel has been scooped up in windrows by the force of waves and ice.

Terns, eiders, Sabine's gulls and glaucous gulls, and snow buntings nest on these beaches. Oldsquaws, eiders, scoters and scaups moulted there. Semipalmated sandpipers, red phalaropes, northern phalaropes, black brant, red-breasted mergansers and snow geese used these beaches for migratory rest-stops or pre-migratory feeding.

Fluviatile Waters (Type 15)

Fluviatile (flowing) waters provided bird habitat mostly in the quieter meander-type stream of the Old Crow Flats, Mackenzie Delta, or North Slope deltas. Most of the waterfowl species of the area could be found on the less swift areas at one time or another. One species that was not seen, preferring the swifter mountain streams, is the harlequin duck. The wandering tattler, ruddy turnstone, semipalmated plover, belted kingfisher and arctic tern are other species seen feeding in streams and rivers.

Lacustrine Waters (Type 16)

Lakes, ponds, pools and puddles constitute an important habitat for all waterfowl and most of the shorebirds. They occur in all of the main vegetative types and seem to influence the type of waterfowl found there, at least during the breeding season. For instance, whistling swans prefer the brackish sedge willow flats of outer delta areas for breeding, but non-breeders could be found in lakes surrounded by spruce forest or tall brush.

Ocean (Type 17)

The last type, the Arctic Ocean, includes the brackish lagoons on the land side of barrier beaches as well as the ocean itself. These waters are used by waterfowl, loons and shorebirds for feeding, resting, and moulting.

Birds in Relation to Vegetative and Habitat Type

Species found at each site, and the most numerous species seen on transect, with an idea of their relative abundance, have been set forth in preceding sections. This section deals with the species of birds found in each vegetative and habitat type, and will necessarily deal with birds seen both on and off transect. The thirteen vegetative types and four additional habitat types are included in Table 20.

Because more than one vegetative type occurs at each site, a species is recorded as occurring in each vegetative type in which it was found, (as the intent is to show the species found in a general vegetative picture). Waterfowl are included under the types of water bodies in which they occur, as well as within the vegetative type found surrounding that water. If the species was seen off transect but not on transect, it is recorded in all of the vegetative types included at that site (except for the gravel beaches that were separate from the alluvial deltas).

From Table 20, it can be seen that spruce-heath, sedge-grass marsh and tussock heath tundra, and barrier beaches form the four most important habitat types. However, the intergrades and micro-habitat situations occurring within these macro-habitat types confuse the picture. For this reason the important types in which a particular species occurred are differentiated from the general community. For instance, the wheatear was seen only at site 7. This site had an overall aspect of tussock heath tundra with sedge-grass marsh and low brush occurring in ravines and swales. The wheatear nested on a rocky outcrop that was sparsely vegetated, so this was considered their preferred habitat, not tussock-heath tundra.

Records of Nests and Fledglings

Table 21 gives the list of nest and fledglings sighted on both readings. Forty-five species were verified as breeding through the finding of nests, young, or fledglings, but all of the species that occurred regularly were probably breeding.

The onset of the breeding season was very quick, with the nests built and eggs laid by the middle of June. A few young were seen even at this early date. By the first of July, there was little territorial singing and some fledglings were already appearing. By the end of July and early August, many birds were flocking. This was especially true of some of the shorebirds, noticeably northern phalaropes which gathered in large flocks. Other shorebirds were noticeably absent from the tundra breeding grounds by the first of August. Some passeriformes (songbirds) such as redpolls, tree sparrows and Lapland longspurs appeared in large numbers, substantially biasing the second reading. These flocks appeared to be composed largely of juveniles, especially those of tree sparrows and redpolls, so perhaps the adults had already migrated.

Waterfowl appeared to develop later than other species. Some, such as swans, were still not flying by the first of September, although by that time juvenile geese of several species were common in the flocks migrating and staging along the north coast.

Some interesting associations occurred among the species that nested on the barrier beach islands. Three species nested on the island east of Nunaluk Spit: arctic tern, glaucous gull, (and possibly a pair of herring gulls and another of Sabine's gulls) and common eider. However, each species seemed to nest on a separate part of the island. The tern colony was separate, although adjacent to the gull colony and similarly the gull nests were adjacent to, but not among, the eider nests. However, one gull nest had two typical gull eggs and two typical common eider eggs.

On the first reading, there were nineteen common eider nests containing 71 eggs, eighteen glaucous gull nests containing 20 eggs, and seven arctic tern nests containing 10 eggs. However, the tern nests were difficult to find. We estimated there were approximately fifty terns diving at sea when we intruded on their nesting territory.

On the second reading, there were thirty adult common eider and fifteen young; forty-six adult glaucous gulls and eight young; and approximately fifty adult terns with twenty-two young, and approximately twenty-five fledglings.

Ground Observations of Fall Migration along the North Coast

Ground observations at Nunaluk Spit and Moose Channel monitored the bird migrations along the North Coast in conjunction with aerial surveys. There was a sudden increase in snow geese on the North Slope during the latter part of August. (The first flocks were seen on August 15, at Cambden Bay, Alaska). Ground observations at Nunaluk Spit showed that they came from the east (Table 22) — undoubtedly from the breeding grounds — and appeared to be migrating to the west. Large flocks were seen to stop and feed on the sedge-marsh flats, but there was a steady movement to the west. Aerial surveys showed that they went westward as far as the Canning River, Alaska. Not many were seen beyond. The preferred flight route at Nunaluk Spit seemed to be inland two to five miles, although they were spread out from the coast to the foothills.

From August 25 to September 2, approximately 80,000 snow geese were seen travelling west for an average of 8,000 birds a day. Using this average for the twenty days that the birds were known to have been on the North Slope, gives a figure of at least 160,000 geese. This is undoubtedly low as poor weather limited visibility and many geese passed in the dark. For the same reason, it is difficult to coordinate weather with geese movements because many of the birds undoubtedly were not seen (Table 23).

On September 3, the westward movement stopped completely and the eastward movement began ahead of a rain storm from the northwest, that turned to snow. Aerial surveys in ensuing days confirmed that the geese preferred to stay ahead of the advancing snow line. They spread out into the upper valley and foothill region of the Blow and Babbage rivers.

The bad weather forced us to move our camp to Moose Channel on the Mackenzie Delta, and Tables 24 and 25 give the results from that camp. Most of the geese were observed flying east, southeast or south. This represented the main migratory movement so the east and south columns for geese should probably be combined. Similarly, there was a great deal of back and forth movement of large flocks (associated with feeding and disturbance by aircraft), and it is felt for this reason that the north and west movements should also be combined.

The following field-notes are of interest:

September 13, 1971: Between 1900 and 2200 hours, approximately 6000 geese passed overhead, moving east. Most of them settled on the delta one mile east of camp. Geese could be heard passing throughout the night.

September 14, 1971: Several thousand snow geese (not included in table) were observed moving southeast along the hills southwest of camp, at 07:40 hours.

12:00 hours. Few birds moving, probably feeding.

17:40 hours. Airplane flew over - about 1000 snow geese feeding one mile east of camp. They flew about one mile and landed on delta.

September 15, 1971: 06:30 hours. Snow geese rising from delta west of camp and flying to an area two to three miles south of camp. Estimated 10,000 to 15,000 snow geese.

07:00. More flocks of snow geese moving southeast toward the large congregation.

September 16, 1971: 07:30 hours. Snow geese shifting around and calling in every direction; general movement east.

09:30 hours. Few geese moving, but three large flocks of snow geese are feeding within view of camp.

11:00 hours. An airplane went over and approximately 2,500 snow geese feeding to the east got up and flew west, landing on tundra just across the river channel.

12:00 hours. Several thousand snow geese flushed by airplane are milling around.

September 17, 1971: Several large groups of snow geese seen rising and settling in distance. Many of these geese undoubtedly started migration up the Mackenzie, while others moved over to the Ellice and Richards Island areas of the Mackenzie Delta for more pre-migratory feeding. Only a few geese were left around Shingle Point during the last week of September.

Brant formed the second largest component of the migration. They almost invariably travelled west, and approximately 15,000 were seen during thirteen days of observation at Nunaluk; for a daily average of 1,150 brant travelling west. During this period, only 40 were seen travelling east. It is not known for how long the brant migration continued.

Brant seemed to prefer the barrier beach lagoons and the ocean as a migration route. They frequently landed on the lagoons and alluvial sedge-flats bordering the land side of the lagoons, and these were undoubtedly important as pre-migratory and migratory feeding areas.

White-fronted geese, Canada geese and whistling swans all seemed to come from Alaska to migrate up the Mackenzie, but in relatively small numbers, although large flocks flew by Phillip's Bay on September 8th. Some dark geese were seen feeding among snow geese around Blow River, but most preferred sedge flats closer to the ocean. They also seemed to begin the southerly migration before the snow geese.

Species of ducks migrated in different directions; pintails headed east to the Mackenzie, while mengansers and sea ducks mostly headed west, apparently following the same route as the brant. Large sea duck movements had still not occurred by the third week in September unless they occurred out of sight of land. Most of the loons also went west following the shoreline.

Most of the shorebirds were seen going east and apparently migrate through the Mackenzie corridor. Glaucous gulls followed the barrier beaches westward. Most of those seen heading east were probably on local feeding movements.

Records of Hawks and Eagles Seen

Surprisingly few raptors were seen either from the ground or air. Sightings are shown in Figures 28, 29 and 30. Because of their rarity, peregines were especially looked for, but few were seen and no nests were found although one was reported on the Old Crow River a few miles above where it joins the Porcupine, (Donald Dabbs, pers. comm.) and another in the foothills of the Rapid River (Frank Hansen, pers. comm.). Neither of these was confirmed. Raptor sightings are given below:

Gyrfalcon

(1) One seen on August 18, 1971, at Site 13, transect 3.

(2) One seen on June 6, 1971, on the Malcolm, Firth and Babbage aerial survey, transect 4.

(3) One seen on June 18, 1971, while surveying the pipeline (North Route) near the Alaska border.

(4) One seen on August 6, 1971, on the Malcolm, Firth and Babbage aerial survey (Herschel Island transect).

(5) One seen several times from August 26 to September 2 at Nunaluk Spit. A dark one, it was probably the same bird each time.

(6) One seen on September 16, 1971, perched on a tower south of the camp at Moose Channel. On September 17, 1971, an unconfirmed sighting of one flying east at the same location.

Peregrine Falcon

(1) One seen on the Malcolm, Firth, Babbage aerial survey on June 6, 1971, sitting on a hummock on the tundra (transect 5). Flushed at airplane's approach.

(2) One seen on July 18, 1971, on the Old Crow Flats aerial survey, (transect 4), sitting in a spruce on the bluff above the Old Crow River.

(3) Several were reported around Komakuk Dew Line Site by Dan Pope, stationmaster, but these were unconfirmed.

Unidentified Falcons

(1) One seen on July 22, 1971, at site 6 on transect 3.

(2) One seen on July 2, 1971, at site 9.

(3) One seen on June 6, 1971, possibly a peregrine, on the Firth Delta.

(4) Two seen on June 4, 1971, on the Old Crow Flats.

(5) One seen on August 8, 1971, at Moose Channel.

(6) One seen on September 9, 1971, on the Old Crow Survey, transect 3.

All falcon sightings are given in Figure 28. In addition to these, a few unidentified hawk sightings that could have been falcons appear in Figure 29 under Hawk Sightings.

Marsh Hawk

(1) One seen on June 16, 1971, at site 6.

(2) One seen on June 22, 1971, at site 9.

(3) One seen on August 14, 1971, at site 19.

(4) One seen on July 26, 1971, at site 24.

(5) One seen on June 4, 1971, on the Old Crow Flats aerial survey, transect 5. Not a positive identification.

(6) One seen on July 18, 1971, on the Old Crow Flats aerial survey, transect 1.

(7) Three seen on August 8, 1971, on the Old Crow Flats aerial survey, transects 8 and 5.

(8) One seen on September 9, 1971, on the Malcolm, Firth and Babbage aerial survey, transect 1.

(9) Two seen on September 11, 1971, on the Old Crow Flats survey, transects 1 and 6.

(10) Two seen at Nunaluk Spit, one seen on August 28, 1971, flying east and another on August 29, 1971, flying west.

Rough-legged Hawk

(1) One seen on June 21, 1971, at site 8.

(2) One seen on June 22, 1971, at site 9.

(3) One seen on June 20, 1971, by the Sadleroclit River.

(4) One seen on July 5, 1971, at Strangle Woman Creek.

(5) One seen on July 8, 1971, on the edge of the Delta, west of Aklavik.

(6) One seen on July 8, 1971, at Komakuk.

(7) One seen on August 8, 1971, on the Old Crow Flats aerial survey, transect 7.

(8) One seen on September 3, 1971, at Nunaluk Spit.

Unidentified Hawks

(1) One seen on June 16, 1971, at site 6.

(2) One seen on July 7, 1971, at site 6.

(3) One seen on July 31, 1971 at Site 11.

(4) One seen on July 2, 1971, at Site 18.

(5) One seen on June 2, 1971, at the Lower Firth River.

(6) One seen on June 4, 1971, on the Old Crow Flats aerial survey, transect 8. Possibly a falcon.

(7) One seen on June 4, 1971, on the Old Crow Flats aerial survey, transect 7.

(8) One seen on June 2, 1971, near the pipeline route on the Blow River.

(9) One seen on July 18, 1971, on the Old Crow Flats aerial survey. It was small, possibly a pigeon hawk.

(10) One seen on August 8, 1971, on the Old Crow Flats aerial survey, transect 3.

Swainson's Hawk

(1) One seen on August 16, 1971, at site 15.

Golden Eagle

Golden eagles were relatively common, although how many were repeated sightings is unknown.

(1) One seen on June 6, 1971, at site 2.

(2) One seen on June 16, 1971, at site 6.

(3) One seen on July 7, 1971, at site 6.

(4) One seen on August 16, 1971, at site 15.

(5) One seen on June 16, 1971, at site 6.

(6) One seen on July 23, 1971, at site 7. It was an immature.

(7) Two seen on June 30, 1971, at site 14.

(8) One seen on July 4, 1971, at site 20. Possibly an immature.

(9) One seen on July 24, 1971, at site 23.

(10) One seen on June 8, 1971, at Mt. Goodenough. Perched on a cliff, but flew at our approach. No nest.

(11) Two seen on June 9, 1971, at the mouth of Blow River.

(12) One seen on June 18, 1971, at Cache Creek, two miles north of site 7.

(13) One seen on June 18, 1971, ten miles south of White Fish Station.

(14) One seen on June 18, 1971, at Petacook Creek.

(15) Three seen on June 20, 1971; one at Komakuk (on pipeline site), one at Buckhouse Creek also on pipeline, and the third at Turner River. This last one was sitting on a dead caribou.

(16) Two more on June 20, 1971, at Aichilik River and Sadlerochit River, also on the pipeline route. The relatively large number of eagles seen this day may be related to the caribou migration and calving occuring here at this time.

(17) One seen on July 5, 1971, on the Old Woman Creek.

(18) One seen on July 8, 1971, on the Mackenzie Delta west of Aklavik.

(19) One seen on July 9, 1971, at Fish River.

(20) Two seen on August 24, 1971, at Shingle Point. One was sitting on the end of the Shingle Point runway. The other was one mile further west.

(21) Two seen on September 6, 1971, at Shingle Point. No nests of golden eagles were seen.

Bald Eagle

(1) One seen on June 9, 1971, at Reindeer Station, Mackenzie Delta.

(2) Two seen on June 6, 1971, at Husky Channel. This pair was subsequently seen again on several occasions and probably had a nest but we could not find it.

(3) One seen on June 20, 1971, on the pipeline by the Itkilyarak River.

(4) A pair and nest with 2 young located four miles southwest of end of Shallow Bay, Mackenzie Delta. Seen on August 5, 1971.

(5) One seen on August 30, 1971, at Moose Channel.

(6) One seen on September 9, 1971, at Middle Channel.

Unidentified Eagles

(1) Two immature eagles were seen on September 11, 1971, on the Old Crow Flats aerial survey, transect 4.

Records of Mammals Seen

Caribou

The most common ungulates were, of course, caribou, and sightings of them are given in Table 26. Caribou were migrating through the Old Crow Flats and the Firth and Malcolm Rivers when we surveyed in early June. They then passed along the coastal plain into Alaska, many of them spreading out around the mouth of the Canning River. Flying the pipeline route on June 20, 1971, we counted 13,790 caribou. There were many more toward the ocean which went uncounted.

Calves were seen all the way from the Old Crow Flats to the North Slope. Caribou were too numerous to attempt classification, although it did seem that bulls stayed in some groups and cows and calves in others. Later on in the summer, they left the Alaskan North Slope and filtered back into Canada. Many were seen in the Blow and Fish River drainages, and even through to MacDougall Pass. There was also a significant number in the Chandalar River-Sheejek River area on our second reading.

Moose

Most moose were seen on the Old Crow Flats aerial transects. Sightings are listed in Table 27 and shown in

Figure 31. How many were repeats is unknown. Quite a few cows and calves were seen between Blow River and Phillip's Bay and the occasional bull was seen on the North Slope.

Dall Sheep

Enough Dall sheep were seen in the Richardson Mountains to indicate a viable population (see Figure 31).

(1) On June 6, 1971, ten large rams were seen five miles southwest of Mt. Goodenough. They ran at the approach of the airplane.

(2) On June 16, 1971, about fifty ewes and lambs were seen approximately ten miles east of White Mountain (local name not on map). They ran at approach of the airplane.

(3) On September 11, 1971, twenty-two ewes and lambs were seen on Mt. Goodenough. They ran at the approach of the airplane.

Musk-ox

Four musk-oxen were seen at site 15 on the Jago River on July 1, 1971, and were undoubtedly Nunivak transplants. Three of the four were tagged with ear streamers thus: 1 white left, 1 red left, and 1 white right. The fourth had no visible tags or streamers. They were not very afraid of man or the airplane. Sightings of musk-oxen are given in Figure 31.

Several species of carnivores were also seen and these sightings are given below.

Grizzly Bear

(1) One adult, chocolate-brown, was seen on June 27, 1971, at site 12 near the coast. It was foraging on the tundra.

(2) A small, chocolate-brown adult was seen on June 2, 1971, on the Firth Delta. It ran at the approach of the airplane.

(3) A small, chocolate-brown adult was seen on June 6, 1971, on the Malcolm, Firth, Babbage aerial survey, transect 1. Could be same as above. Ran at approach of airplane.

(4) A white (almost as white as a polar bear) sow and two chocolate cubs (50 lbs. est.) were seen on June 6, 1971, on the Malcolm, Firth and Babbage aerial survey, transect 3. Ran at approach of plane.

(5) Two, one blonde and the other chocolate-brown, were seen on the Old Crow Survey, transect 7, on July 18, 1971. Ran at approach of plane.

(6) One chocolate-brown was seen on August 8, 1971, on the Old Crow Survey, transect 6. Ran at approach of the airplane.

(7) Three, a sow and two large cubs (150 lbs. est.) were seen on September 2, 1971, on the Hula Hula River. Ran at the approach of airplane, but sow inclined to fight.

(8) One chocolate-brown seen on September 7, 1971, one mile south of Phillip's Bay. Ran at approach of airplane.

(9) Two chocolate-brown, one very large, seen on September 10, 1971, one mile east of Demarcation Bay. They were foraging right along the coastline, and ran at the approach of airplane.

(10) One seen on August 15, 1971, at Old Woman Creek.

Polar Bear

Only four polar bears were seen, all at Nunaluk Spit. During the night of September 3-4, 1971, a sow and two large cubs came into camp in search of garbage. The next day, a large adult was seen foraging Nunaluk Spit.

Wolf

Only four wolves were seen. All appeared panic-stricken by the airplane.

(1) A gray was seen on August 4, 1971, one mile west of Komakuk.

(2) A gray was seen on August 8, 1971, on the Old Crow aerial survey, transect 1.

(3) A gray was seen on August 24, 1971, by the Babbage River, near the coast.

(4) A gray was seen on August 30, 1971, at Clarence Lagoon.

(5) One was seen above Old Crow Village, but it may have been a dog as it was not alarmed as the airplane passed.

Coloured Fox

Only red foxes were seen in addition to arctic foxes and they were not seen as often as the white ones, although fox tracks were seen at many of the sites.

(1) One was seen on August 13, 1971, at site 20, trotting along the river gravel.

(2) One seen on September 11, 1971, on the Old Crow Flats aerial survey.

(3) Two seen on August 8, 1971, on the Old Crow Flats aerial survey, transect 1; they ran at approach of the airplane.

Arctic Fox

Arctic foxes were very common along the North Coast and barrier beaches. They also were frequently seen on the

North Slope itself. All were moulting and were a combination of black and white.

(1) One was seen on June 24, 1971, in a driftwood pile at site 10. Possibly sick.

(2) One was seen on June 25, 1971, at site 10 foraging in the gravel beach.

(3) One was seen on June 29, 1971, at site 22, foraging on the gravel spit.

(4) Two seen on June 30, 1971, at site 13, at Silver Point.

(5) One seen on July 2, 1971, at site 18. Possibly a den near, but we could not investigate as we were reading a transect.

(6) One seen on August 8, 1971, at site 12. Sunning in driftwood by lagoon.

(7) One seen on August 18, 1971, at Nogavapuk Point at the abandoned Dew Line site there. It came in camp to scavenge for garbage. Very tame.

(8) One seen on August 18, 1971, at Silver Point.

(9) Two seen on August 24, 1971, at Nunaluk Spit. They had a den at the west end of the lagoon.

(10) One seen on August 4, 1971, on the Malcolm, Firth, Babbage aerial survey, transect 6.

(11) Two seen on June 20, 1971, on a bluff above the Katakturok River, playing around den. Vicinity of proposed pipeline.

(12) One seen on June 20, 1971, by the Canning River in the vicinity of the pipeline. Disappeared into den. Figure 37 gives the sightings of grizzlies, wolves, foxes and polar bears.

Seals and Whales

In addition to the described mammals, many seals and whales were seen along the North Coast. One walrus was killed at Herschel Island at the end of August by seal hunters there. The marine mammals seen are listed below:

(1) One ringed seal seen on July 1, 1971, at site 16, on ice floe.

(2) One seal seen on August 8, 1971, at site 10, swimming 100 yards offshore.

(3) Two seals seen on August 5, 1971, at site 12, swimming in the sea.

(4) One seal seen on August 6, 1971, at site 12, swimming in the sea.

(5) One seal seen on August 7, 1971, at Nunaluk Spit, swimming in the sea.

(6) Three seals (bearded) seen on August 18, 1971, at Silver Point. Diving at end of spit.

(7) One seal seen on September 9, 1971, on Malcolm, Firth, Babbage survey in the sea.

(8) Four white whales seen on September 9, 1971, off King Point.

(9) Four seals seen on June 2, 1971, at Herschel Island in sea.

(10) One seal seen on August 8, 1971, between Barter Island and Camden Bay.

(11) Fifty white whales seen on August 6, 1971, west of Komakuk.

(12) Eight white whales seen on August 28, 1971, between Blow and Babbage Rivers close to shore.

(13) One seal seen on June 30, 1971, at Clarence Lagoon.

(14) Twelve seals seen on August 4, 1971, at Nunaluk Spit.

(15) One ringed seal seen on August 6, 1971, at Komakuk.

(16) One bearded seal seen on August 6, 1971, at Komakuk.

(17) Two seals seen on August 6, 1971, one at Cobden Bay and the other at Brow Low Point.

(18) Three seals seen on August 24, 1971, at Komakuk.

Besides these mammals, tracks, signs and smaller fur-bearers and rodents were also seen and are given in Table 28. No small mammals were collected, so it is not known what species occurred at the various sites.

Records of Fish Seen

Fish occurred in almost all of the streams and many of the lakes we visited. Grayling were especially prevalent in the streams running from the Brooks Range. The most spectacular fish concentration occurred on August 18, 1971, from Demarcation Bay to Komakuk. Thousands of fish in schools of varying size were clustered right along the shore. These could have been char preparing to spawn, or herring. All fish sightings are given in Table 29.

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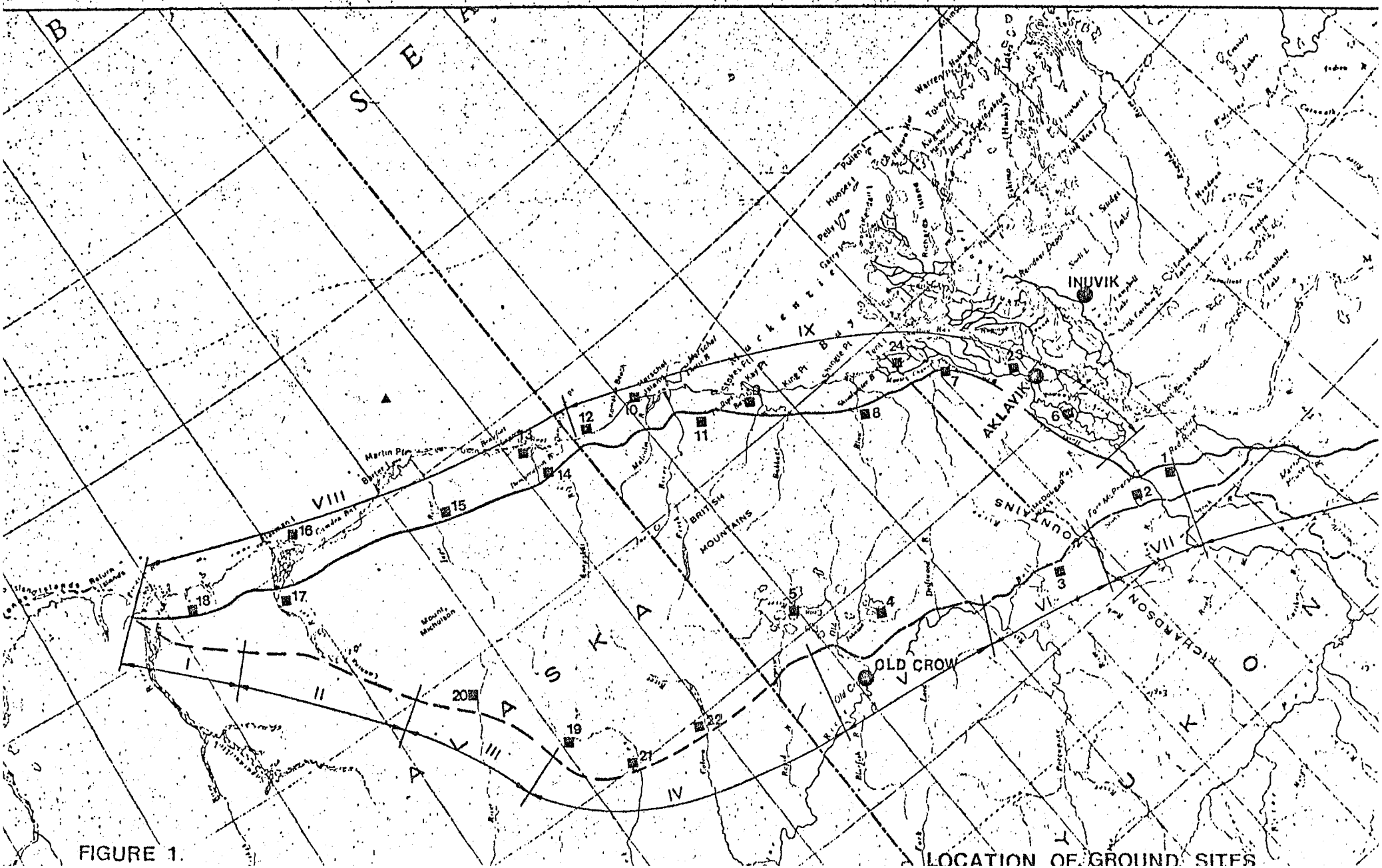


FIGURE 1. LOCATION OF GROUND SITES

FIG: 2

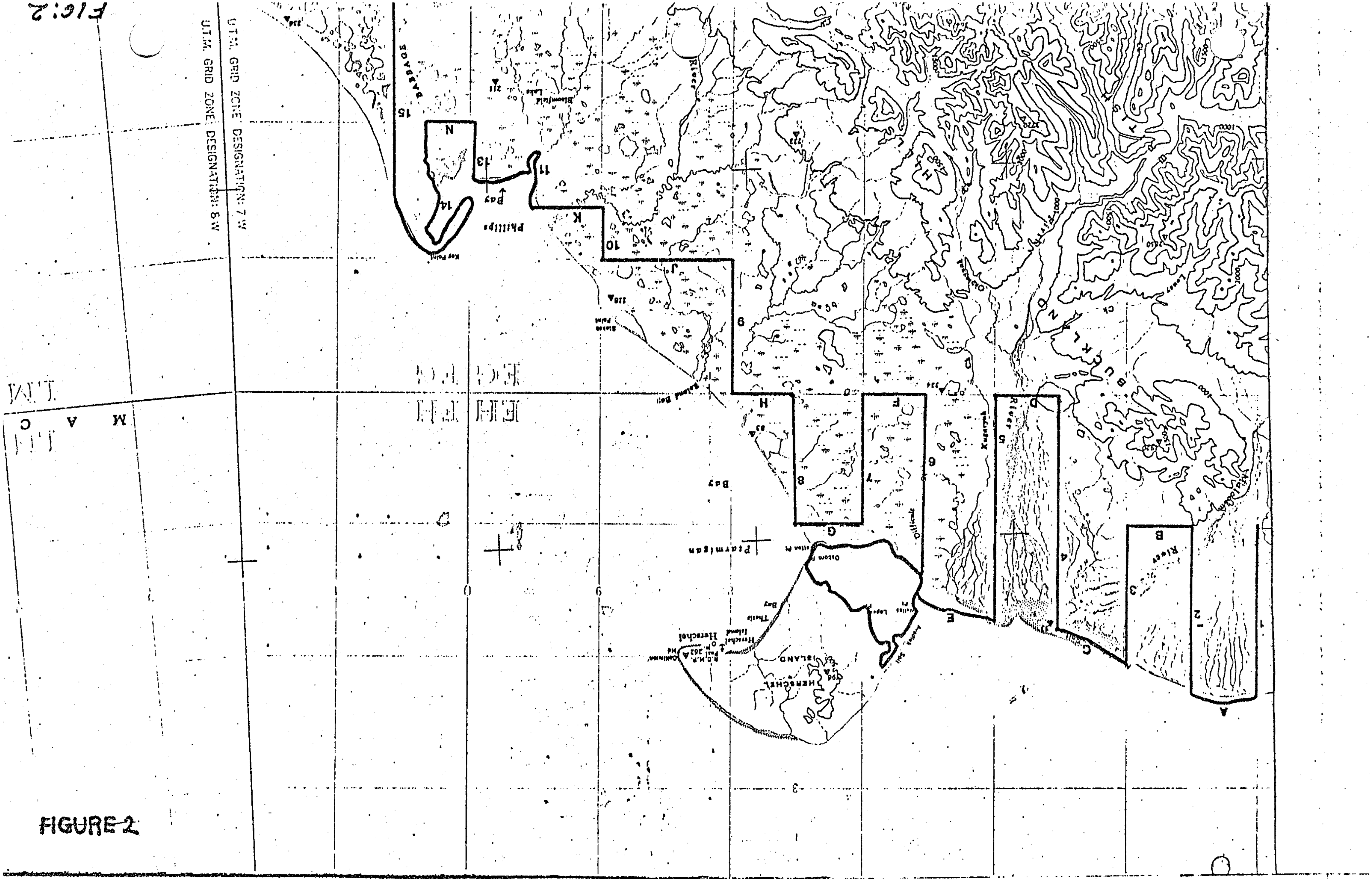
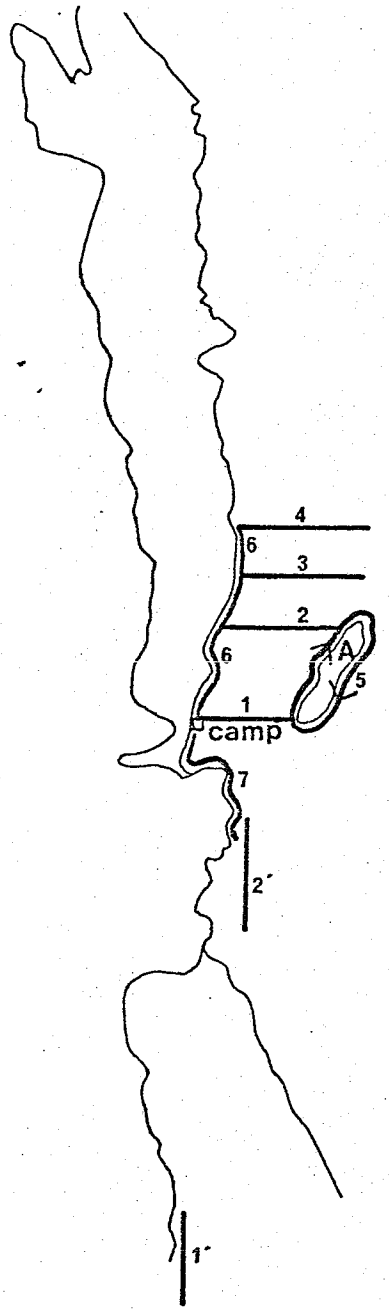


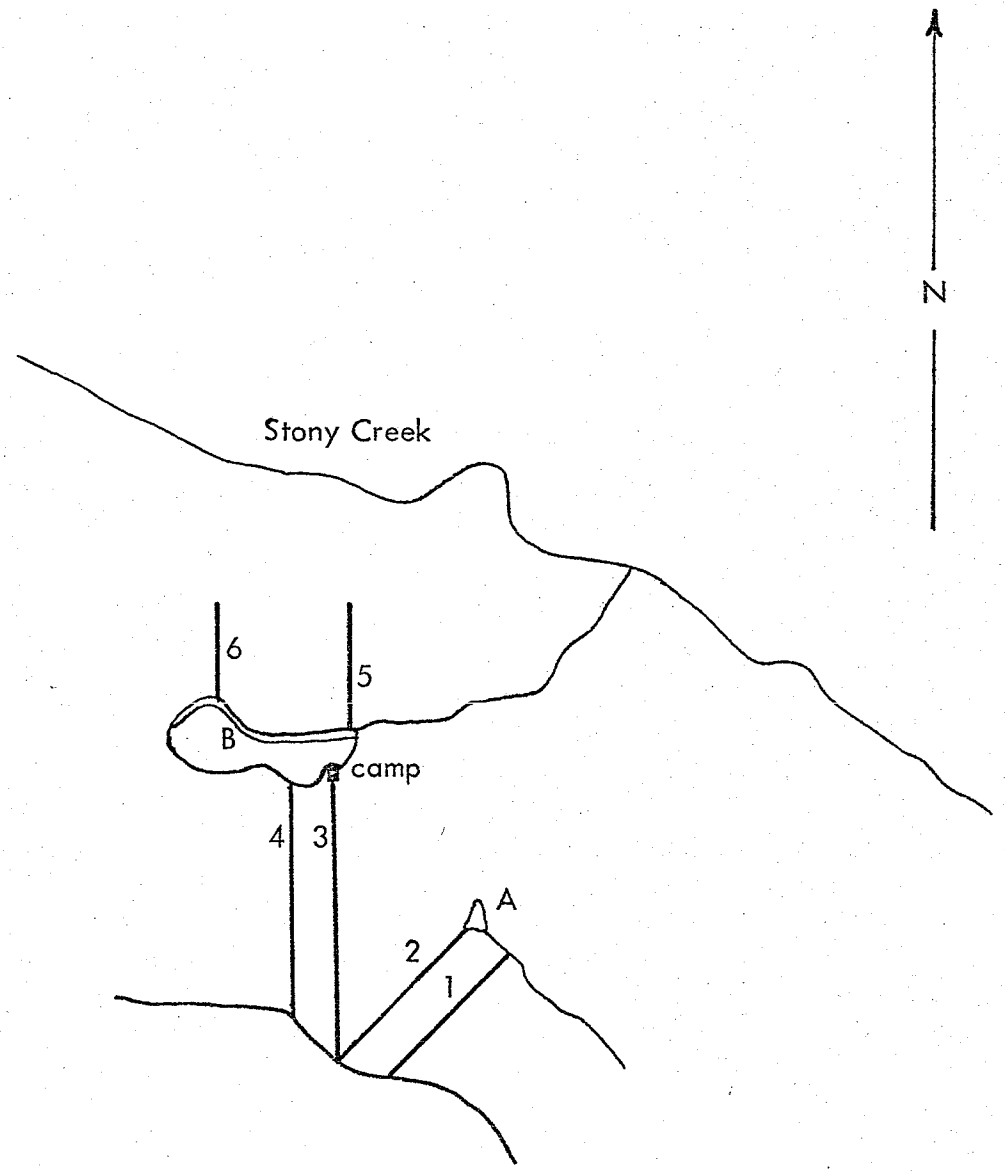
FIGURE 2

FIG 3



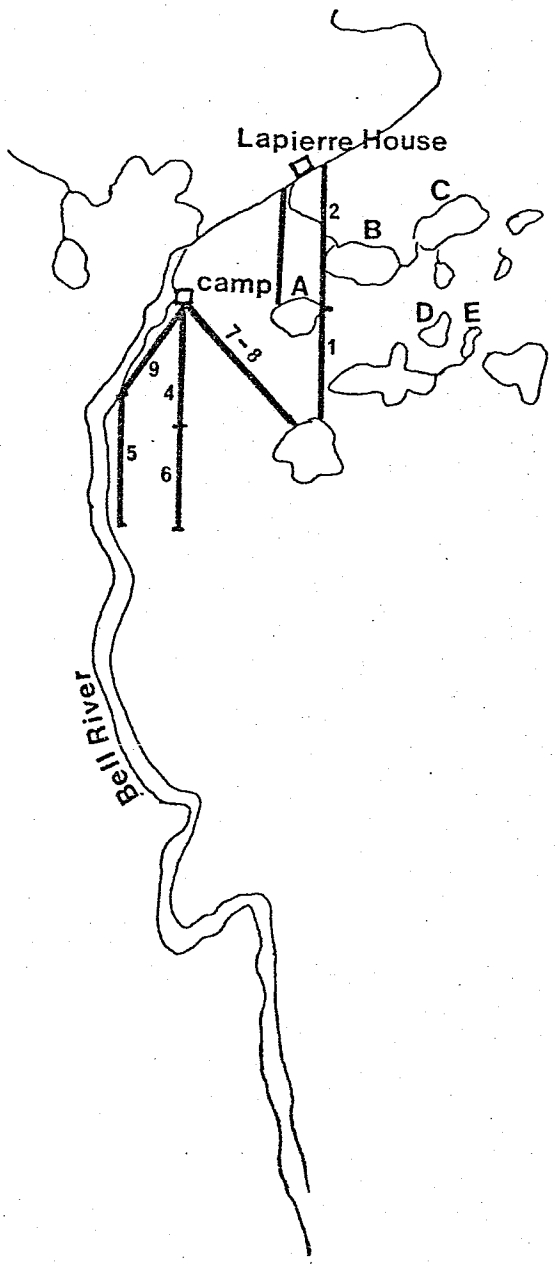
SITE 1

FIG: 4



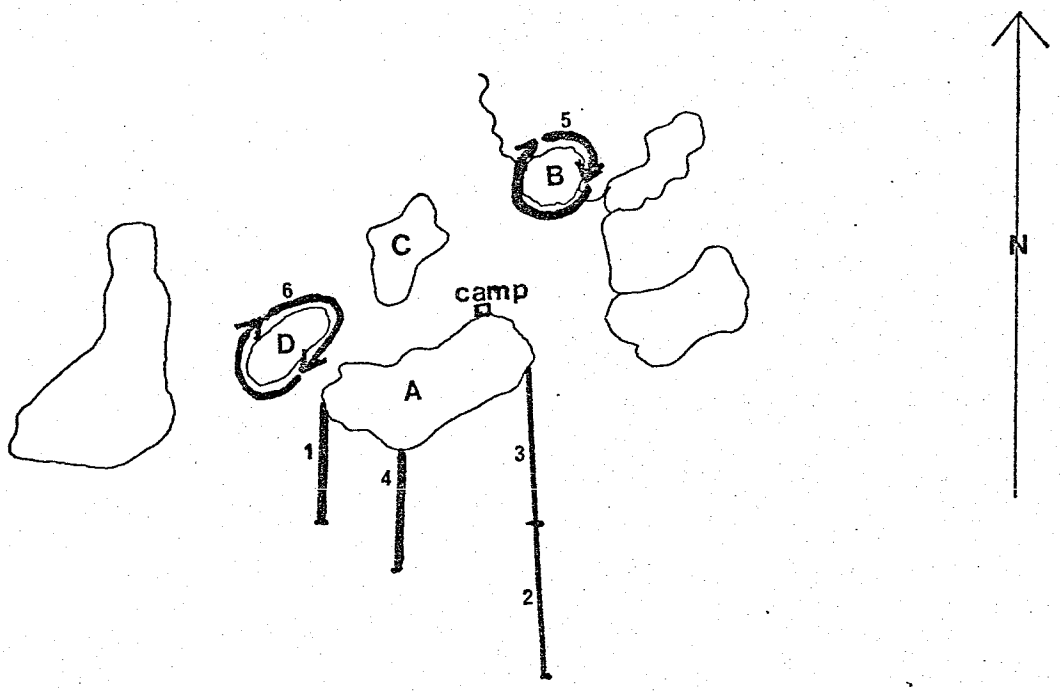
SITE 2

FIG; 5



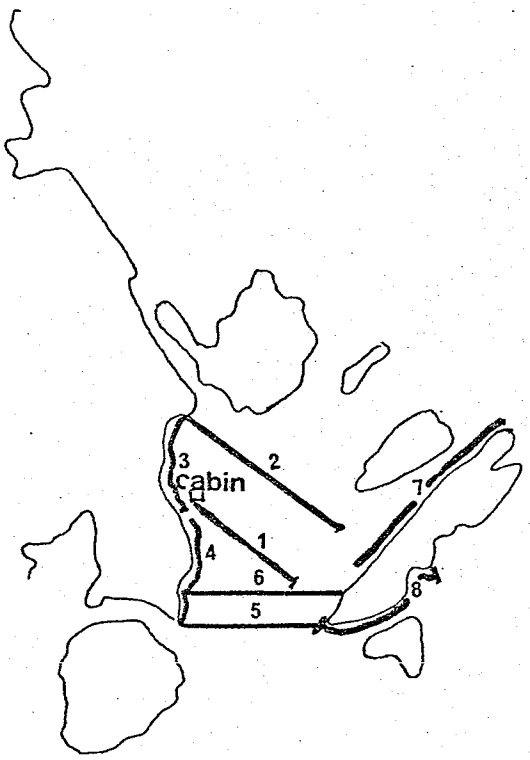
SITE 3

FIG 6



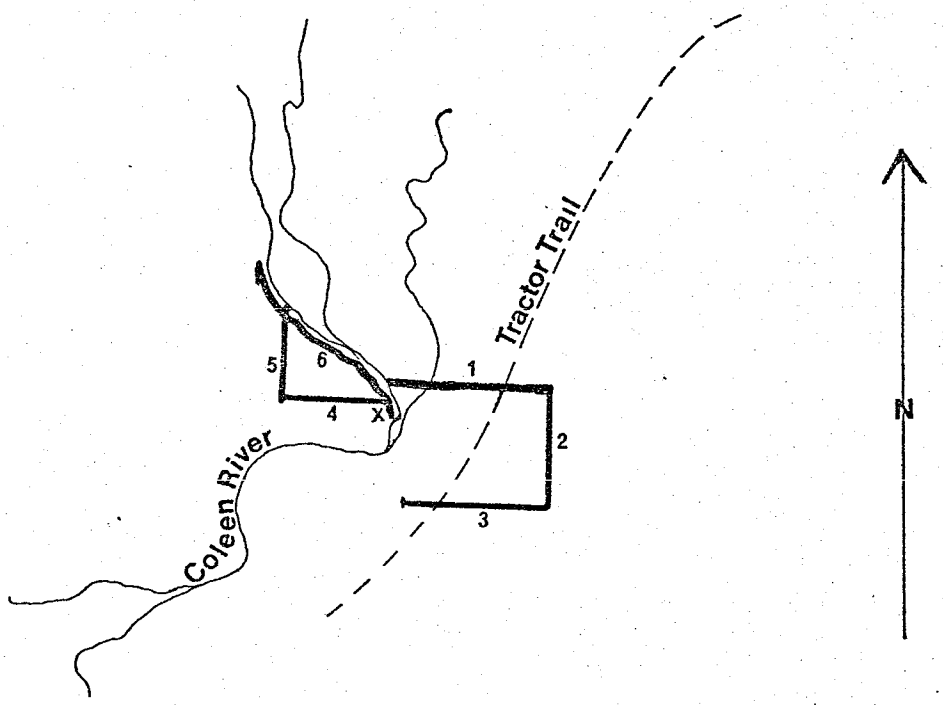
SITE 4

FIG: 7



SITE 5

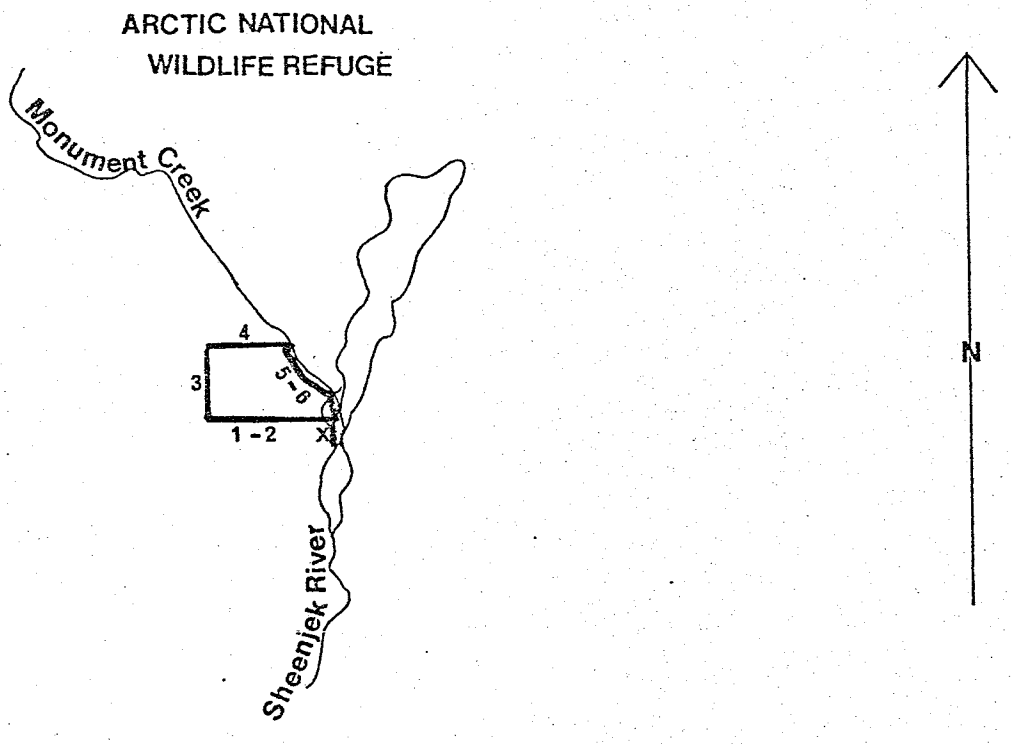
FIG: 8



SITE 22

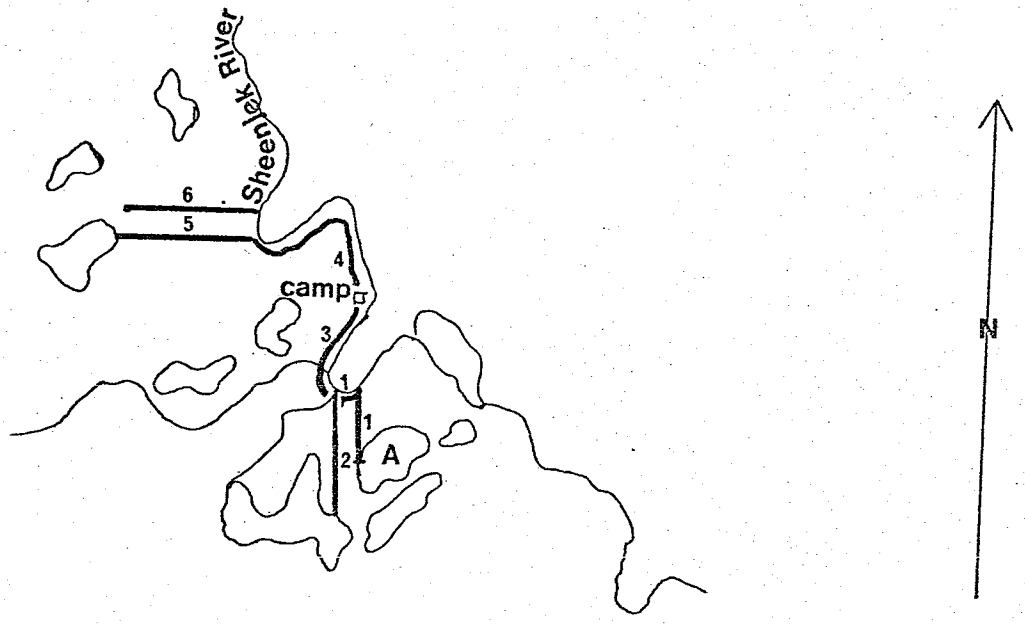
X = Landing Site

FIG: 9



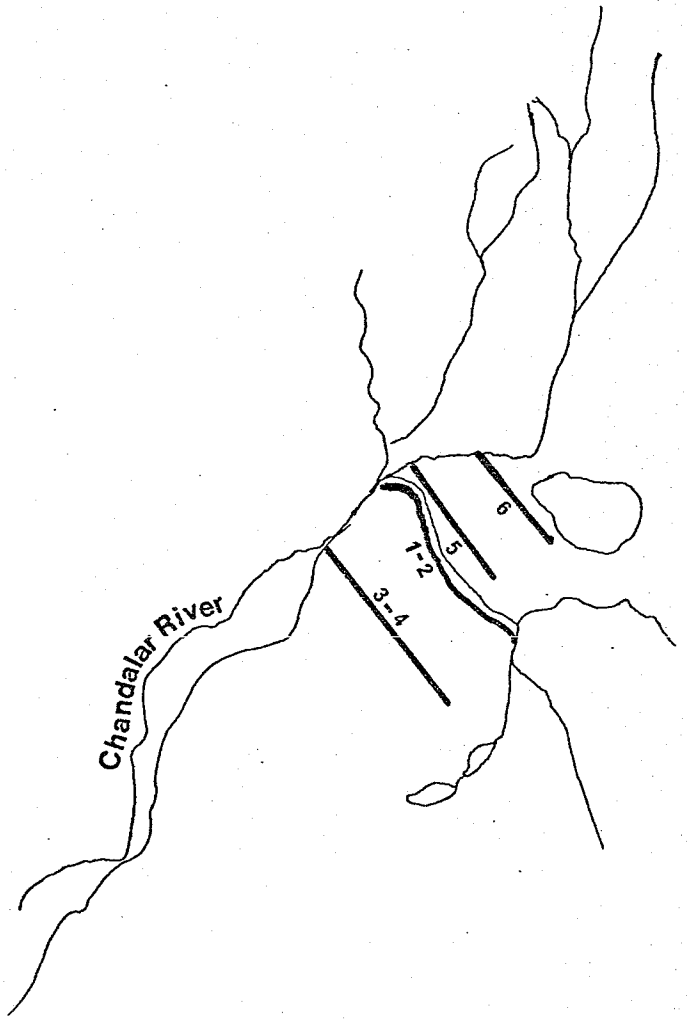
SITE 21
X= Landing Site

FIG: 10



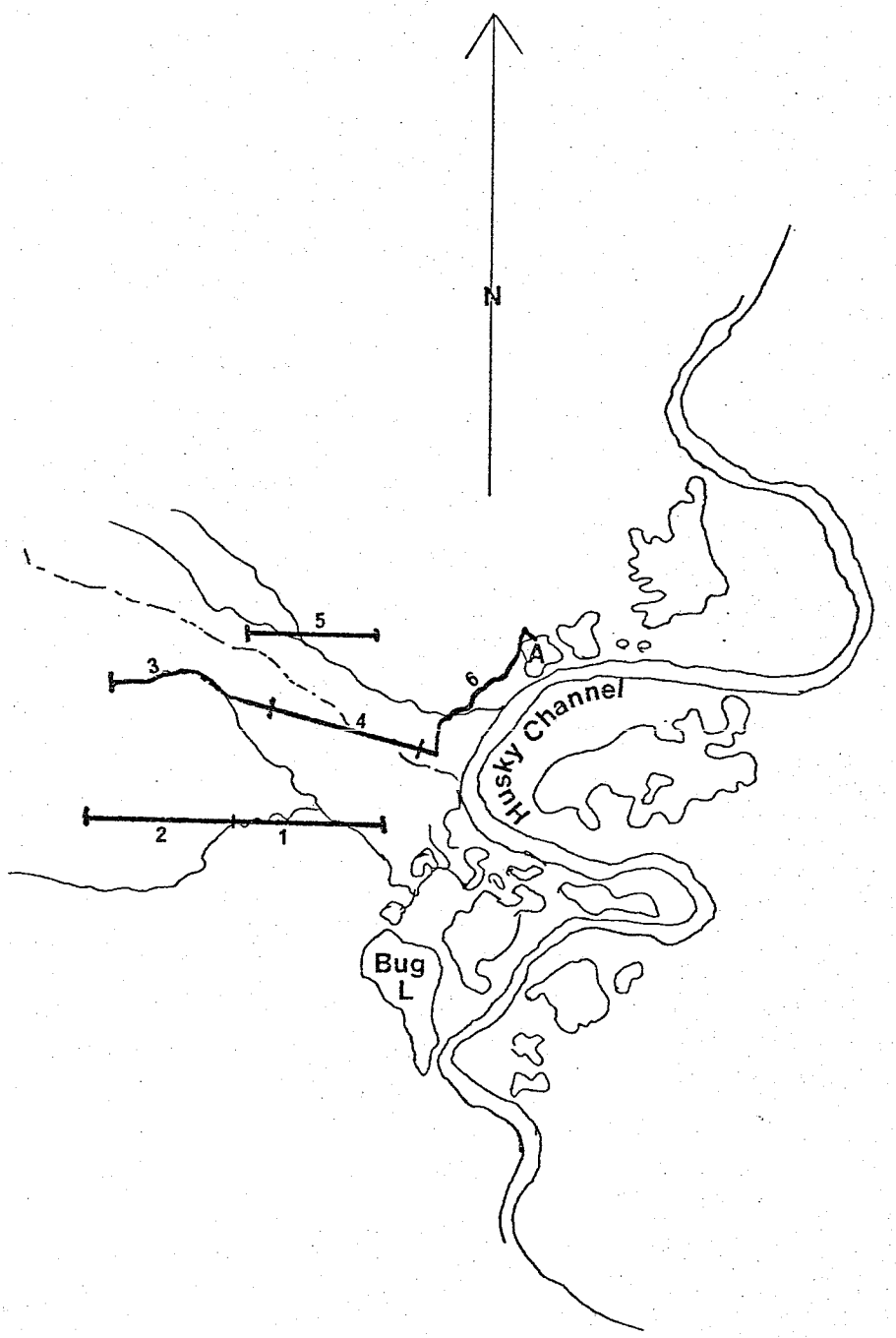
SITE 19

FIG: 11



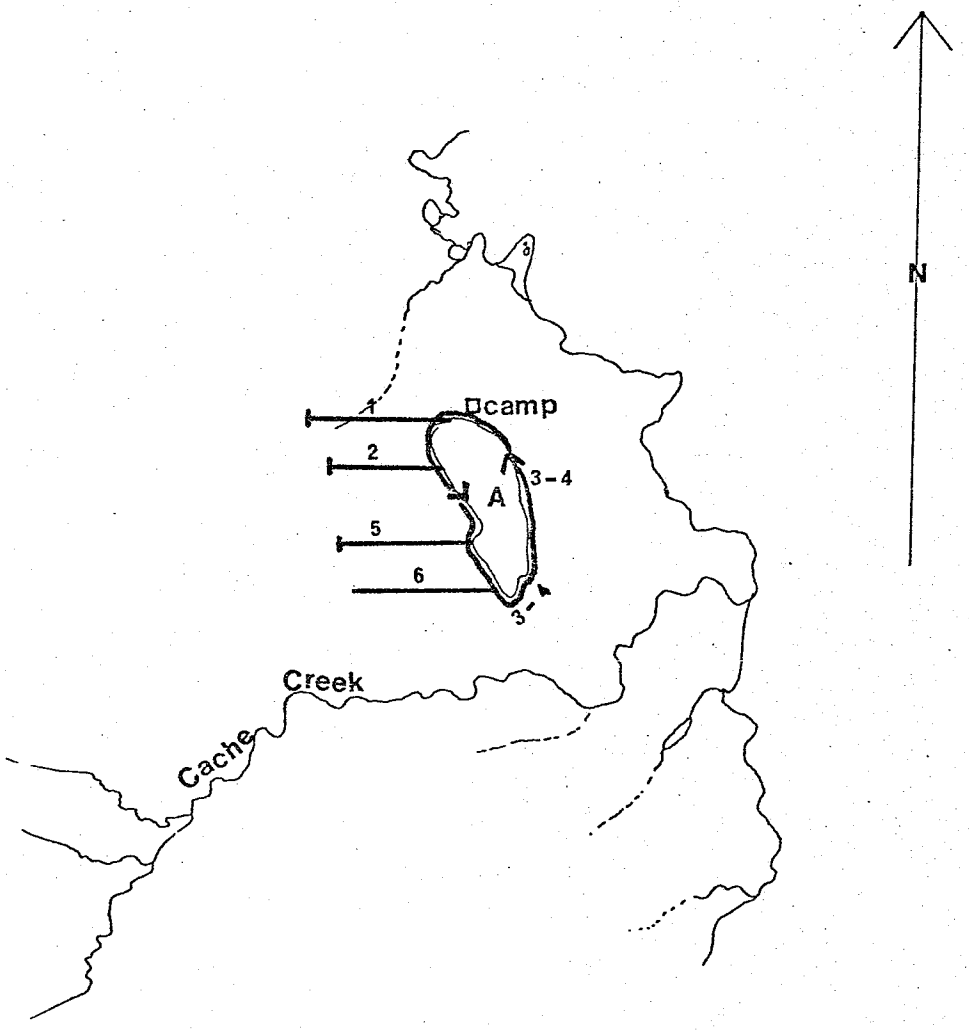
SITE 20

FIG! 12



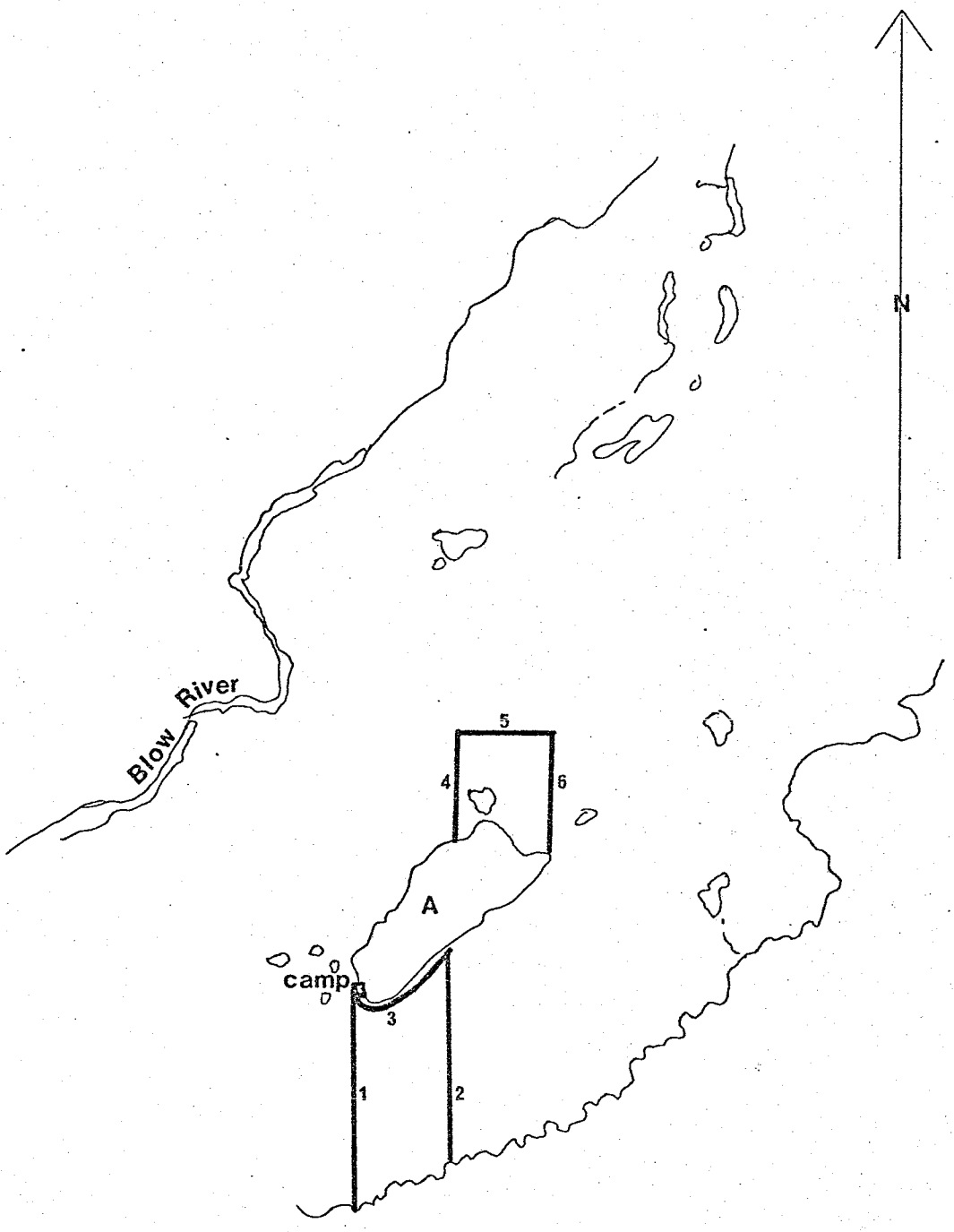
SITE 6

FIG: 13



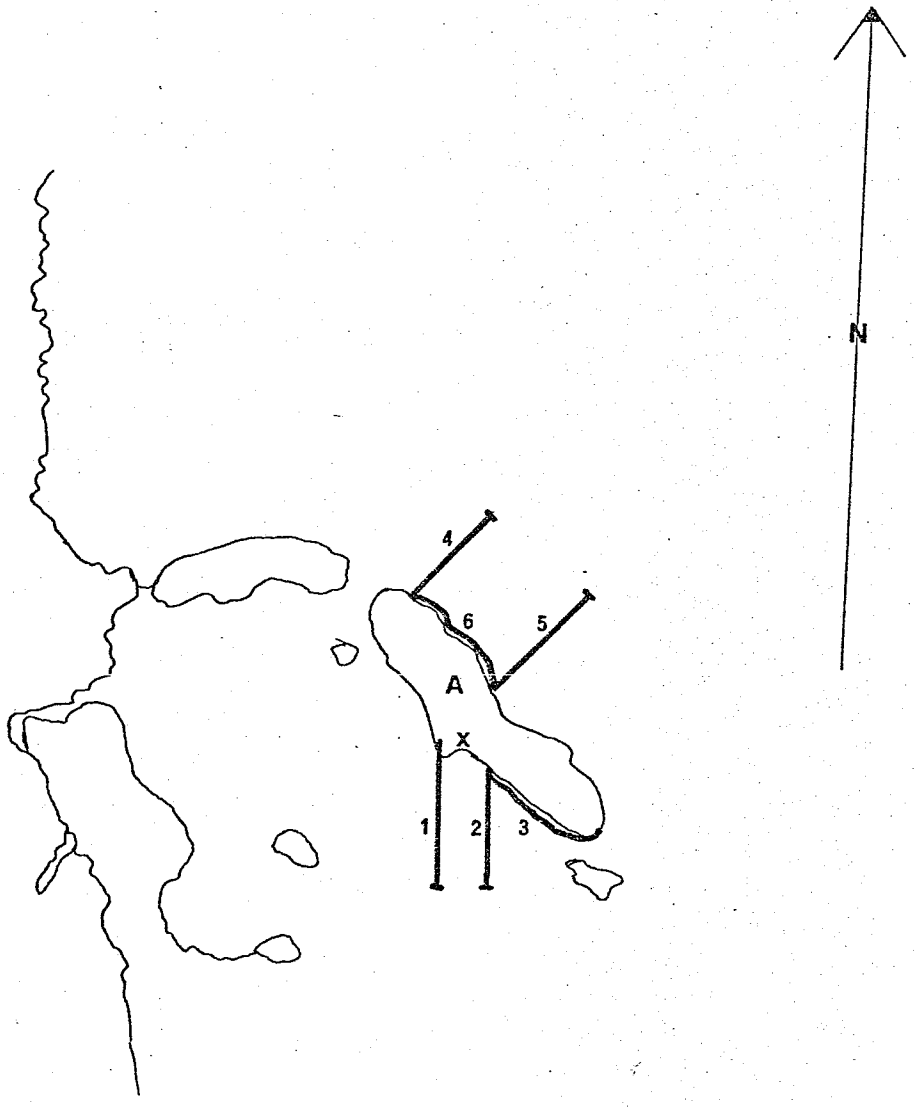
SITE 7

FIG: 14



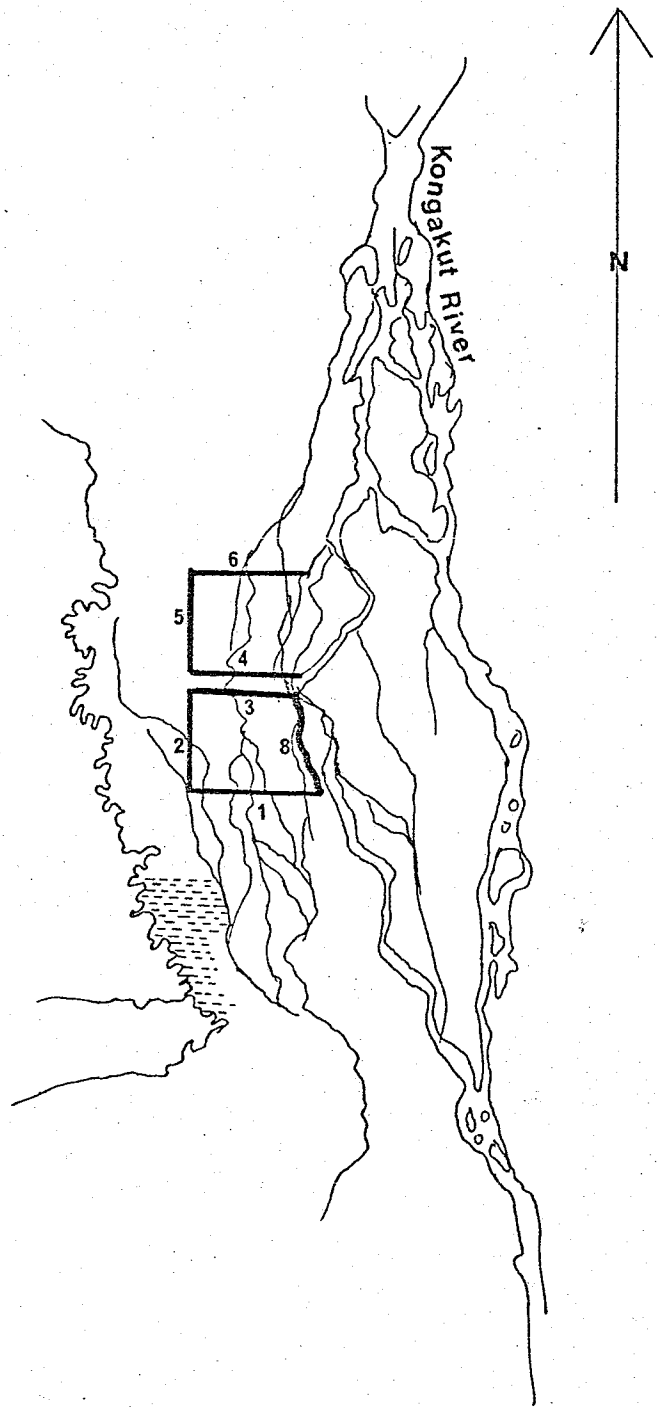
SITE 8

FIGI 15



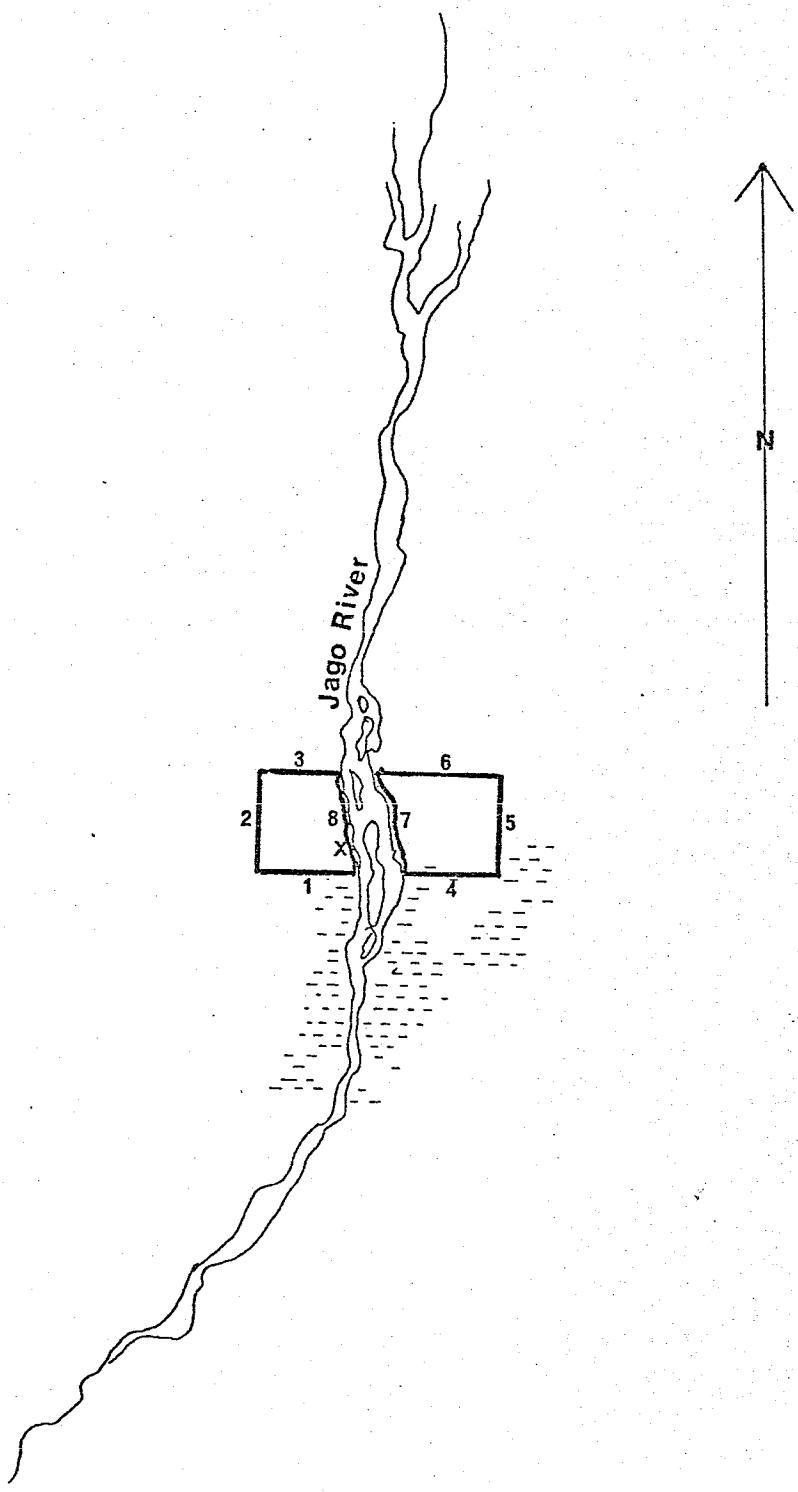
SITE 11
X= Landing Site

FIG: 16



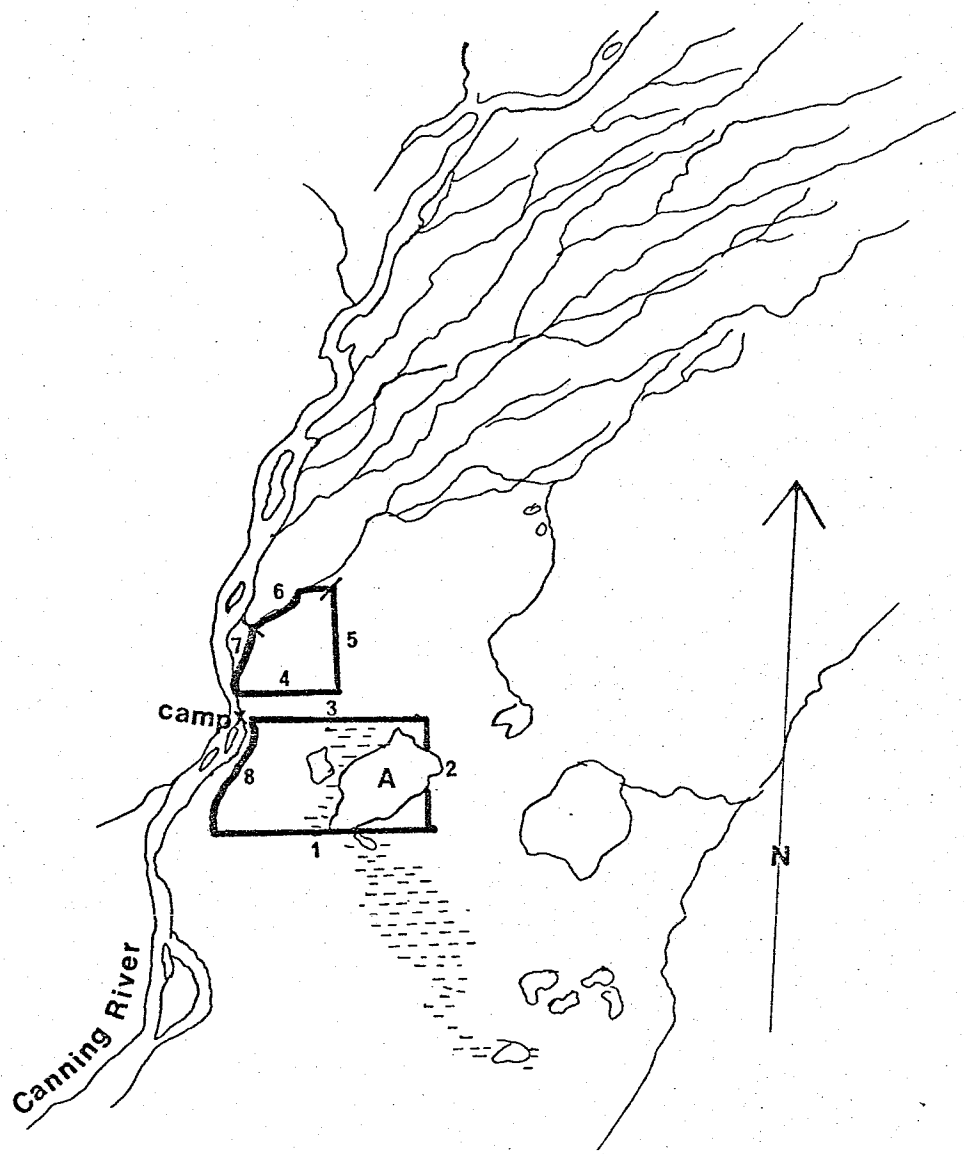
SITE 14

FIGURE 17



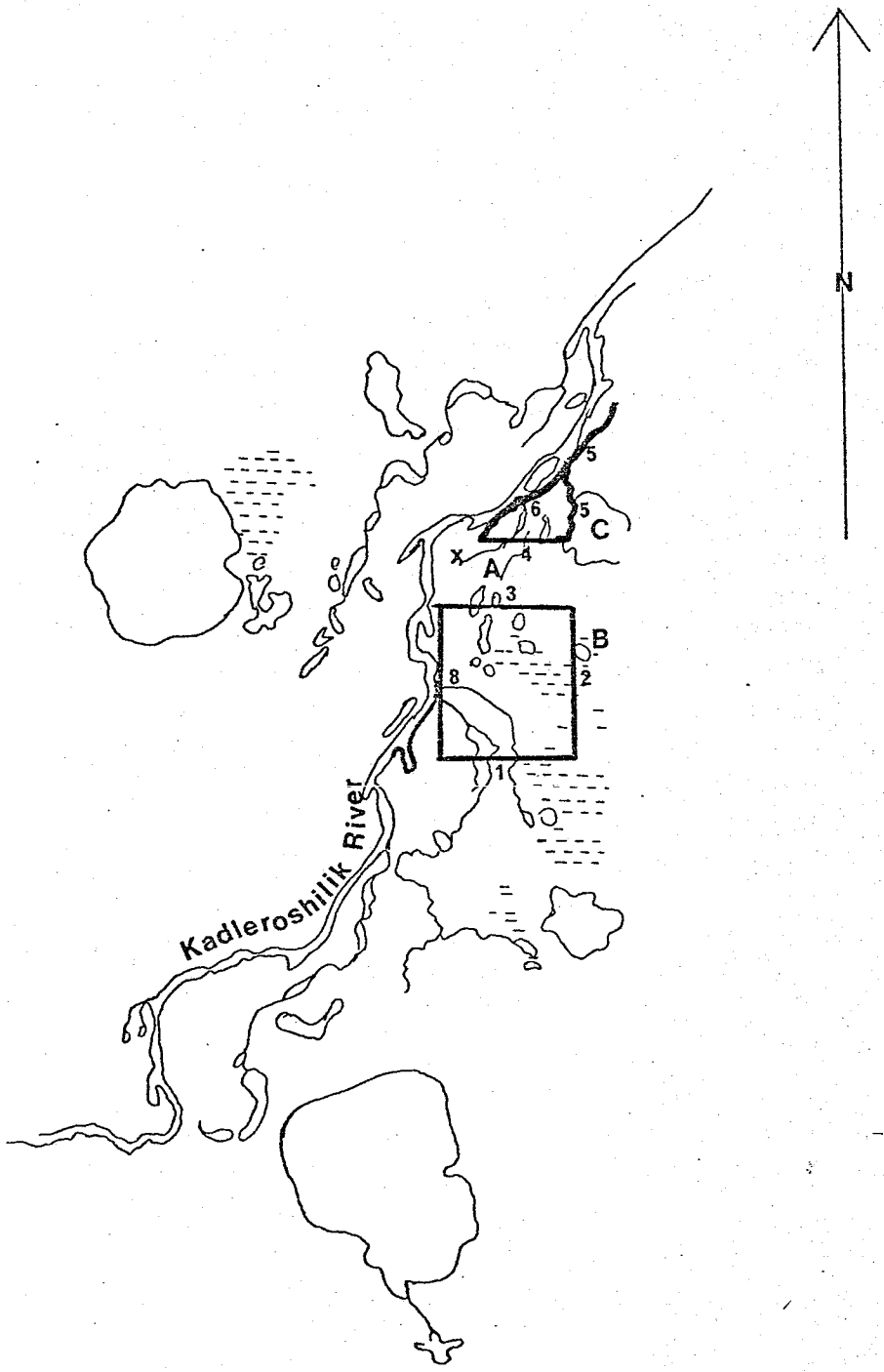
SITE 15

FIG: 18



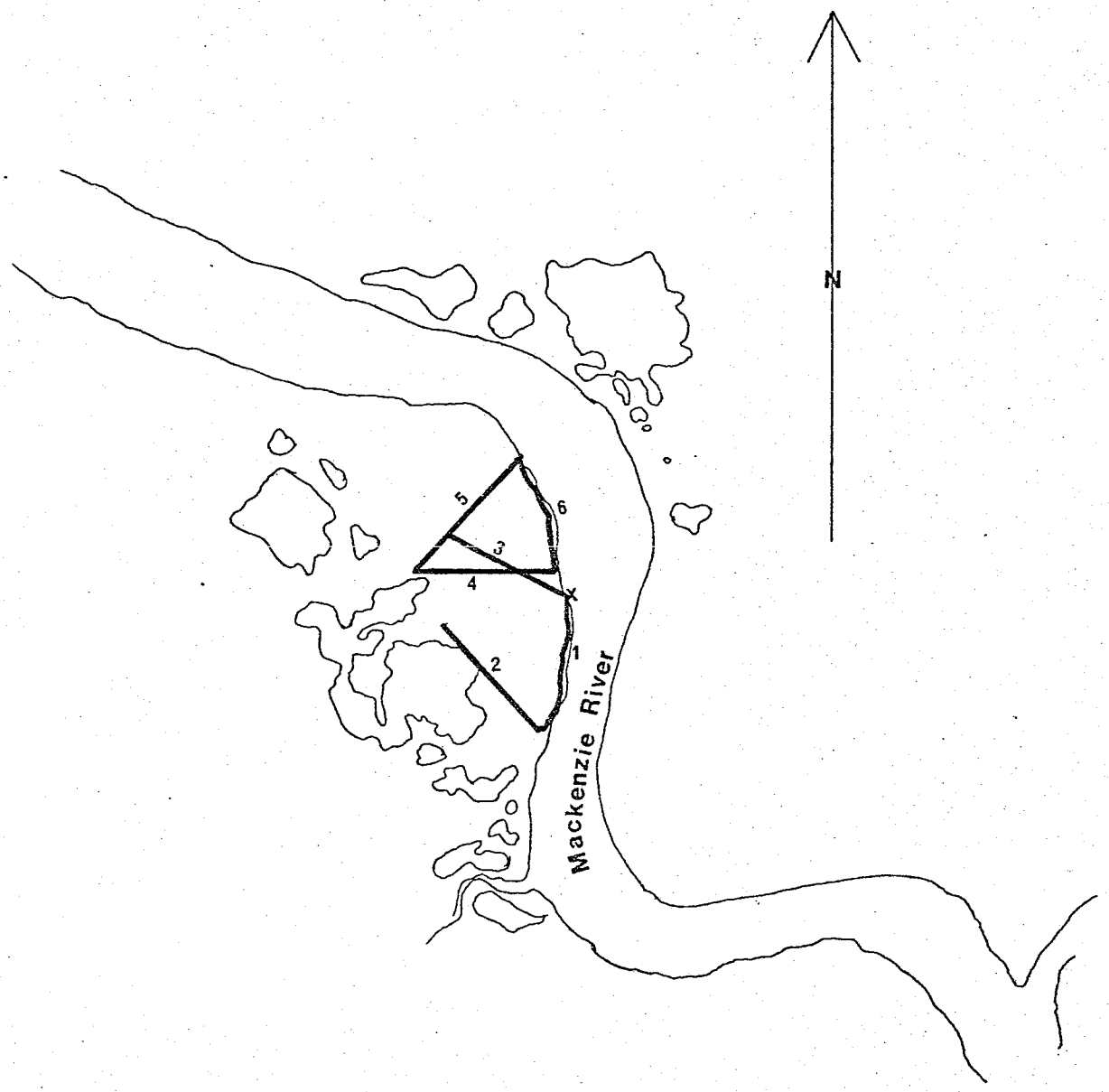
SITE 17

FIG: 19



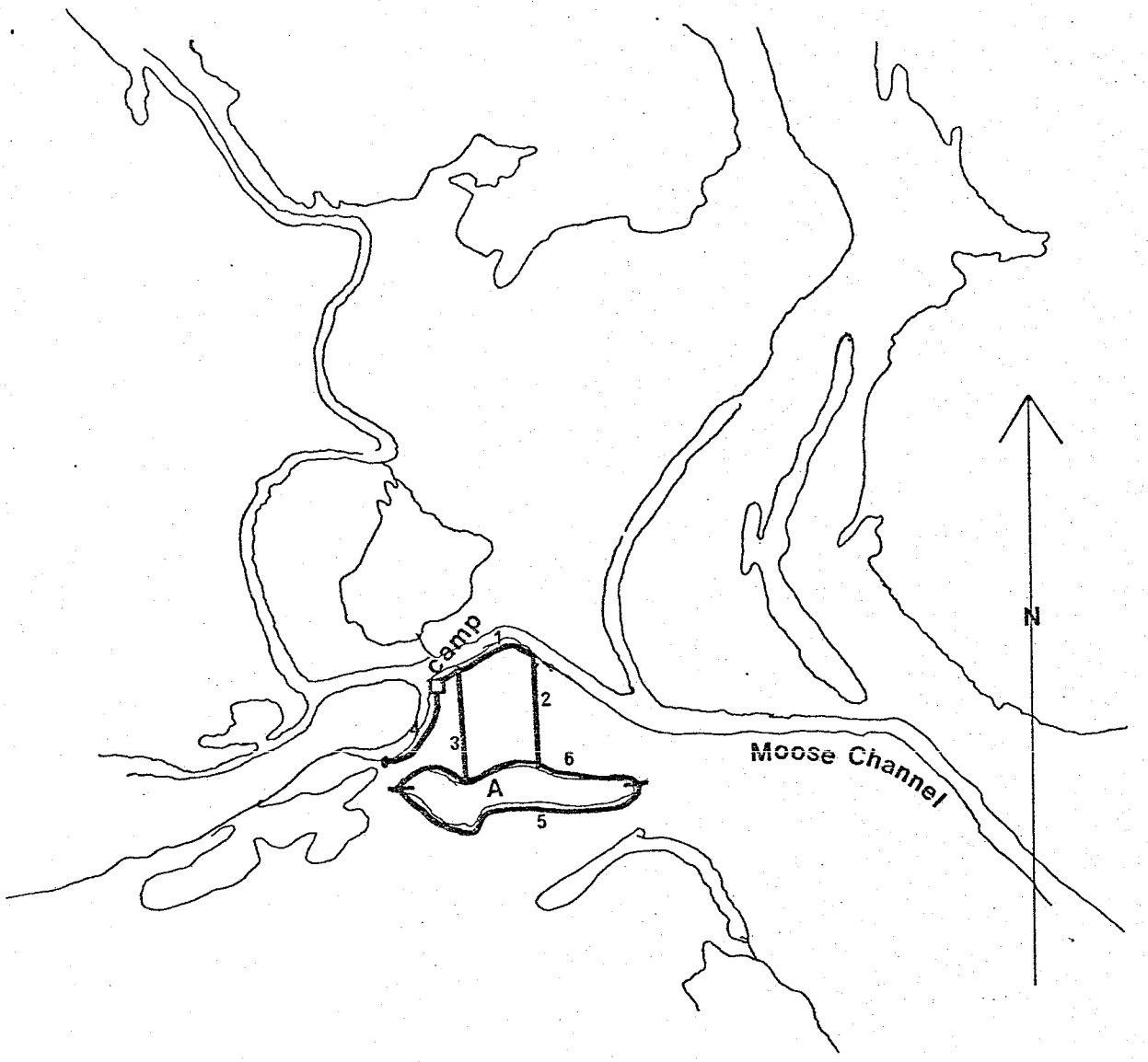
SITE 18
x = Starting Point

FIGI 20



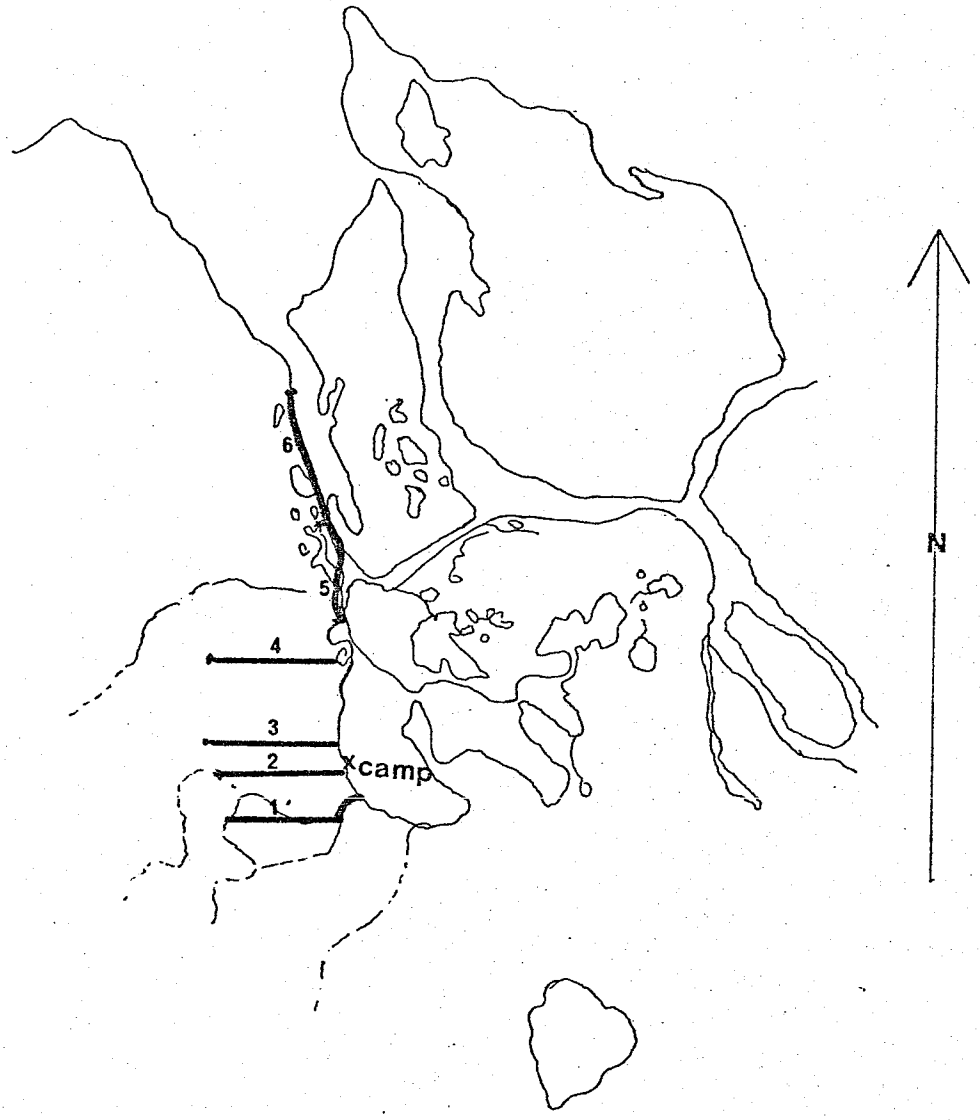
SITE 23
x= Landing Site

FIG: 21



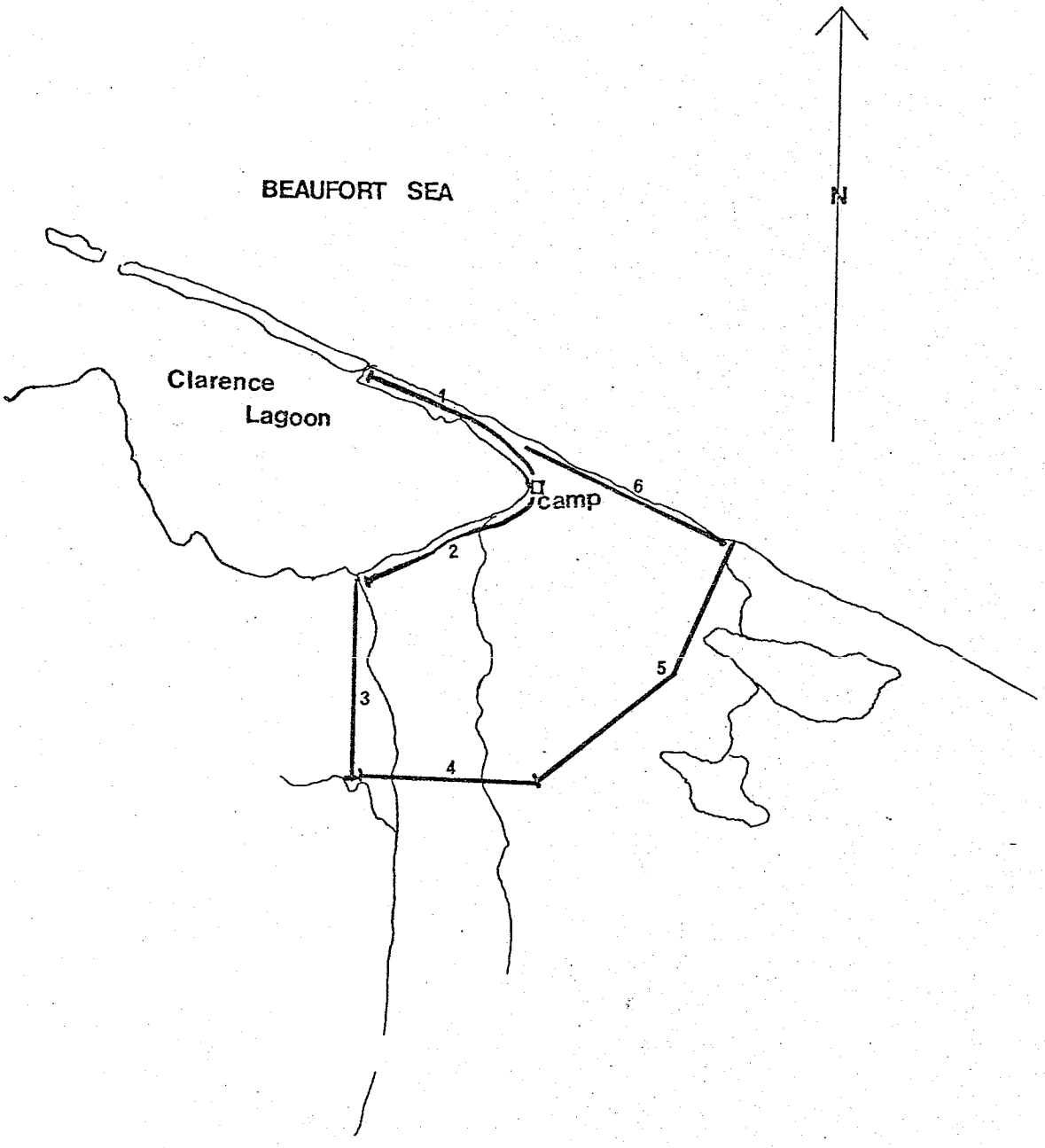
SITE 24

FIGI 22



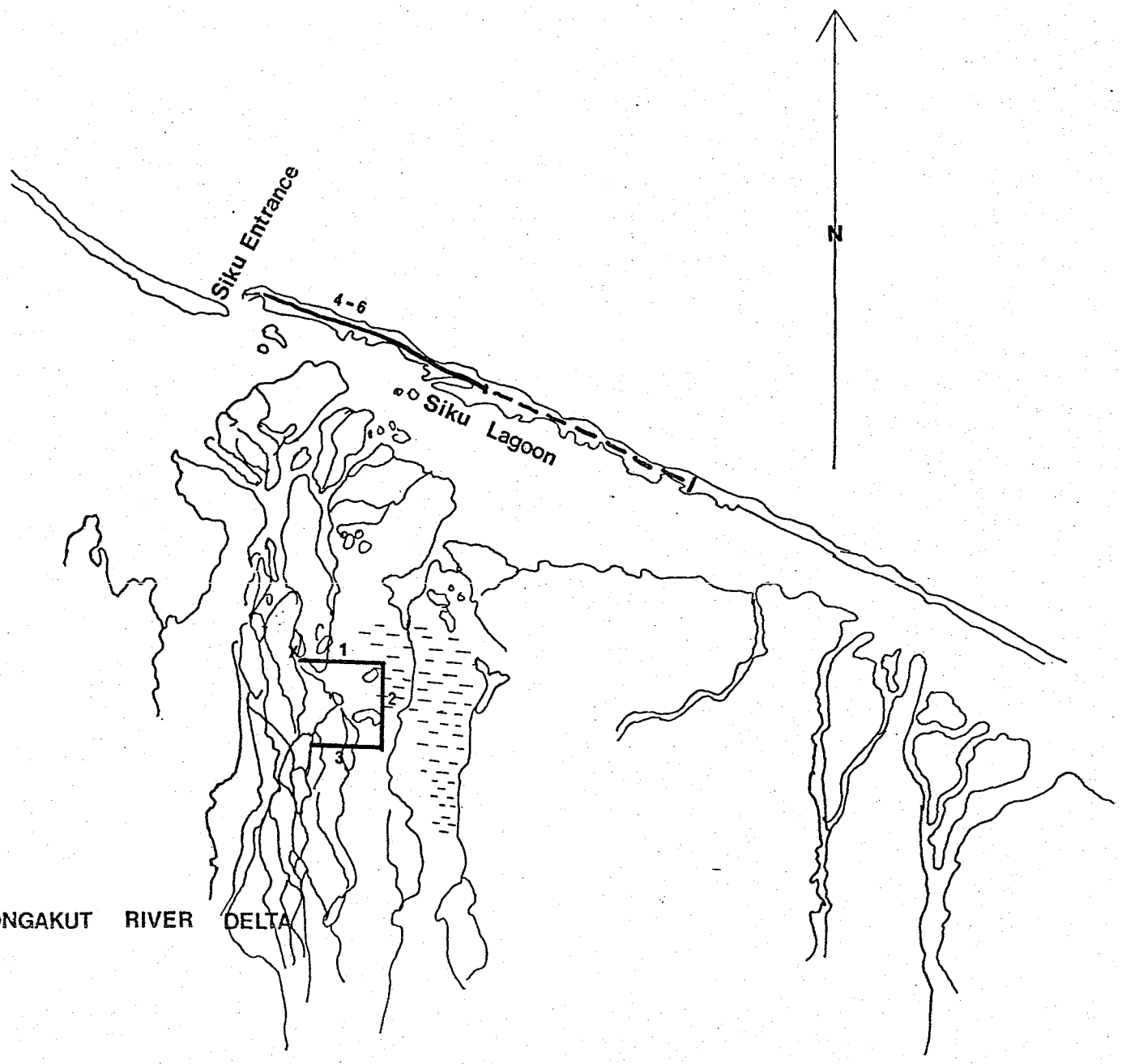
SITE 9

FIG: 23



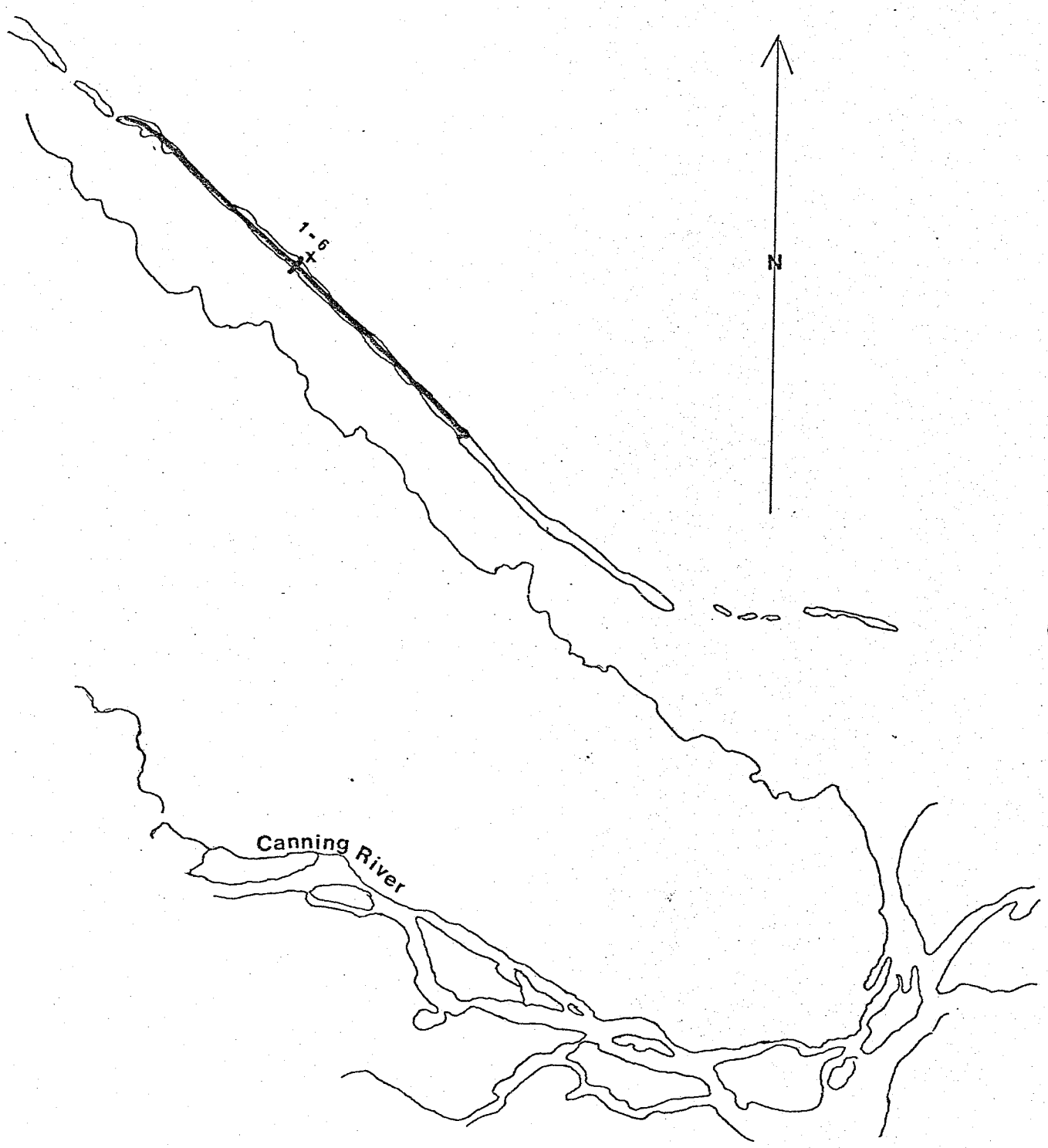
SITE I2

FIGI 25



SITE 13
x- Landing Point

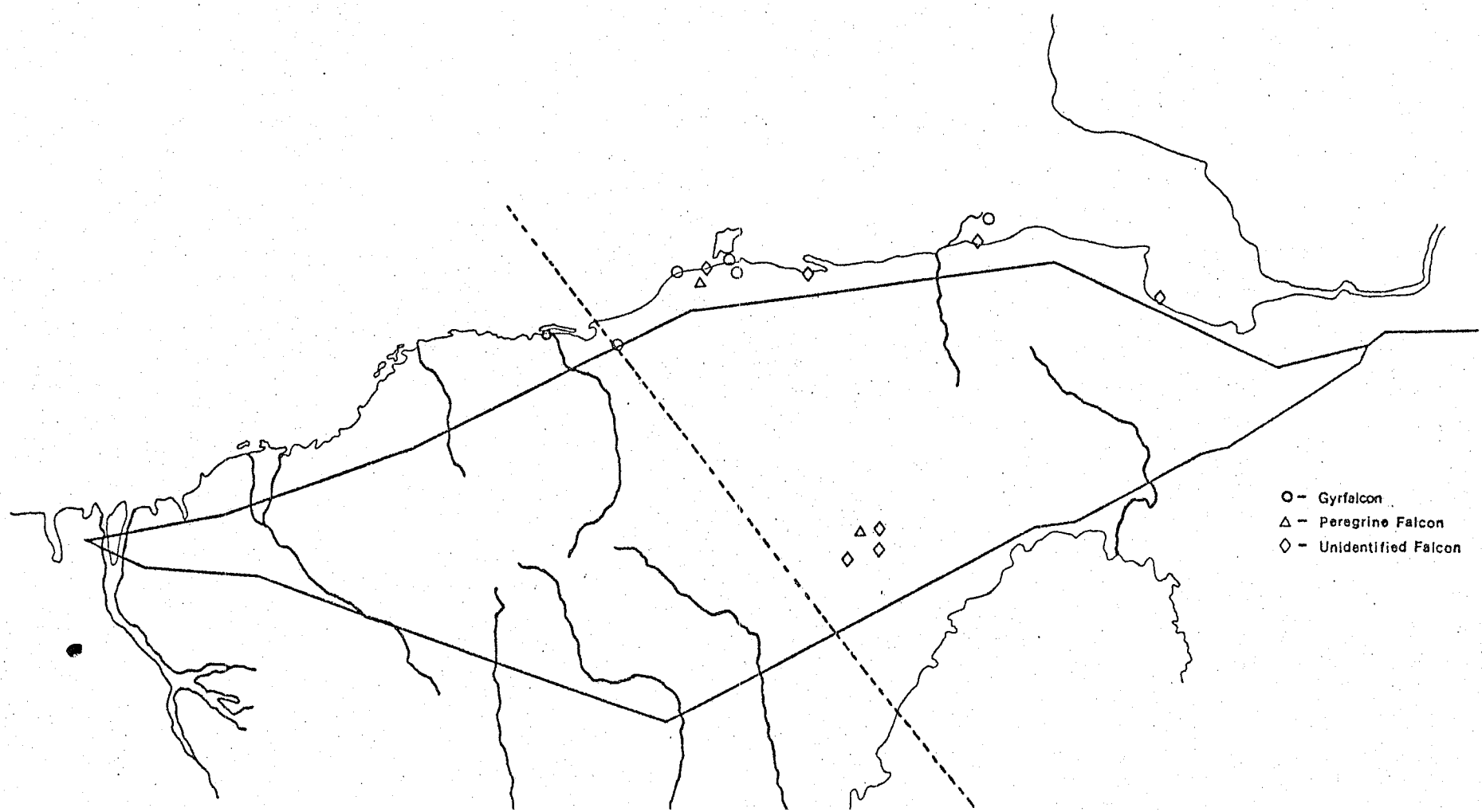
FIGI 26



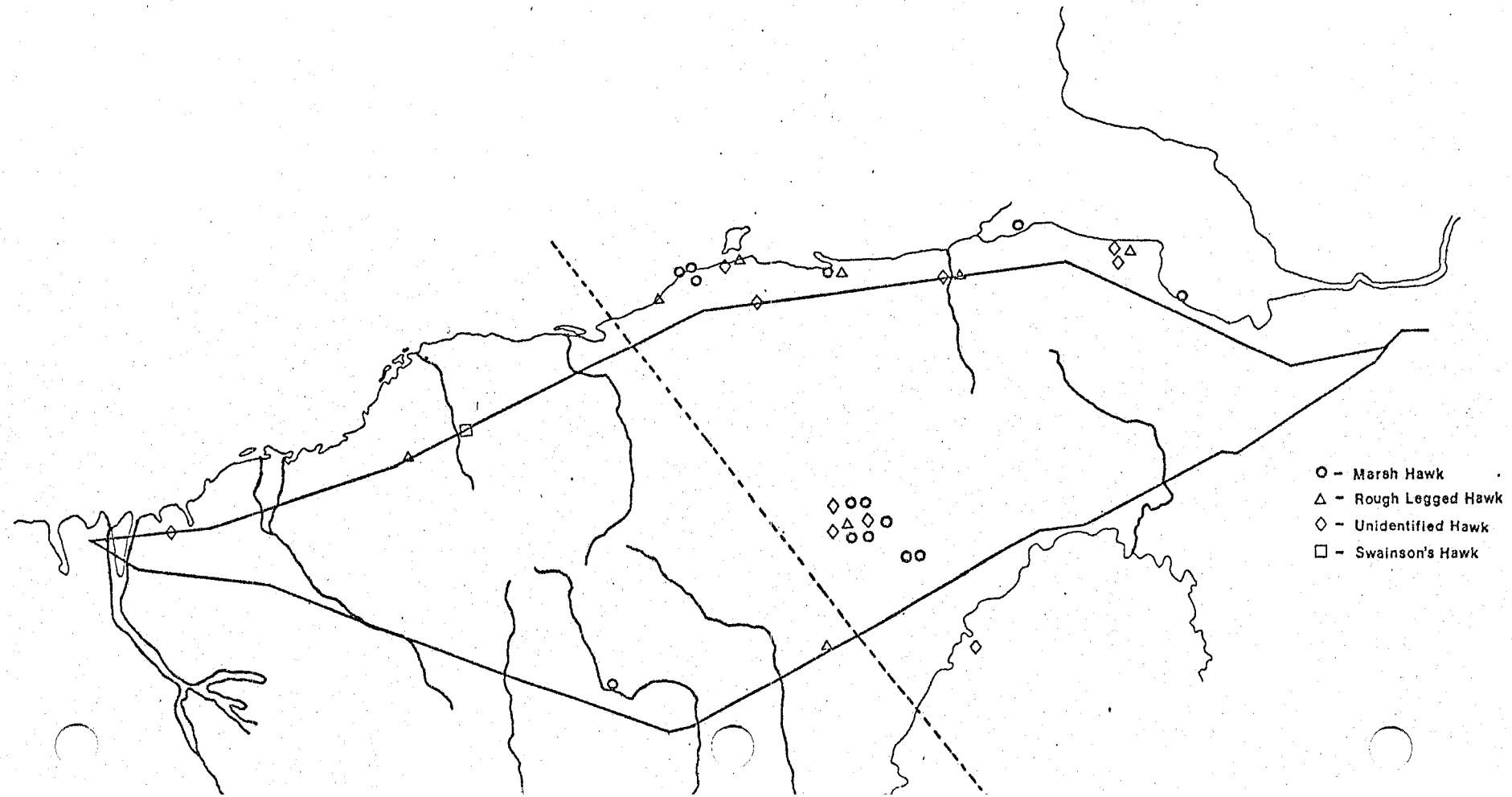
SITE 16
x=Midpoint

FIG; 27

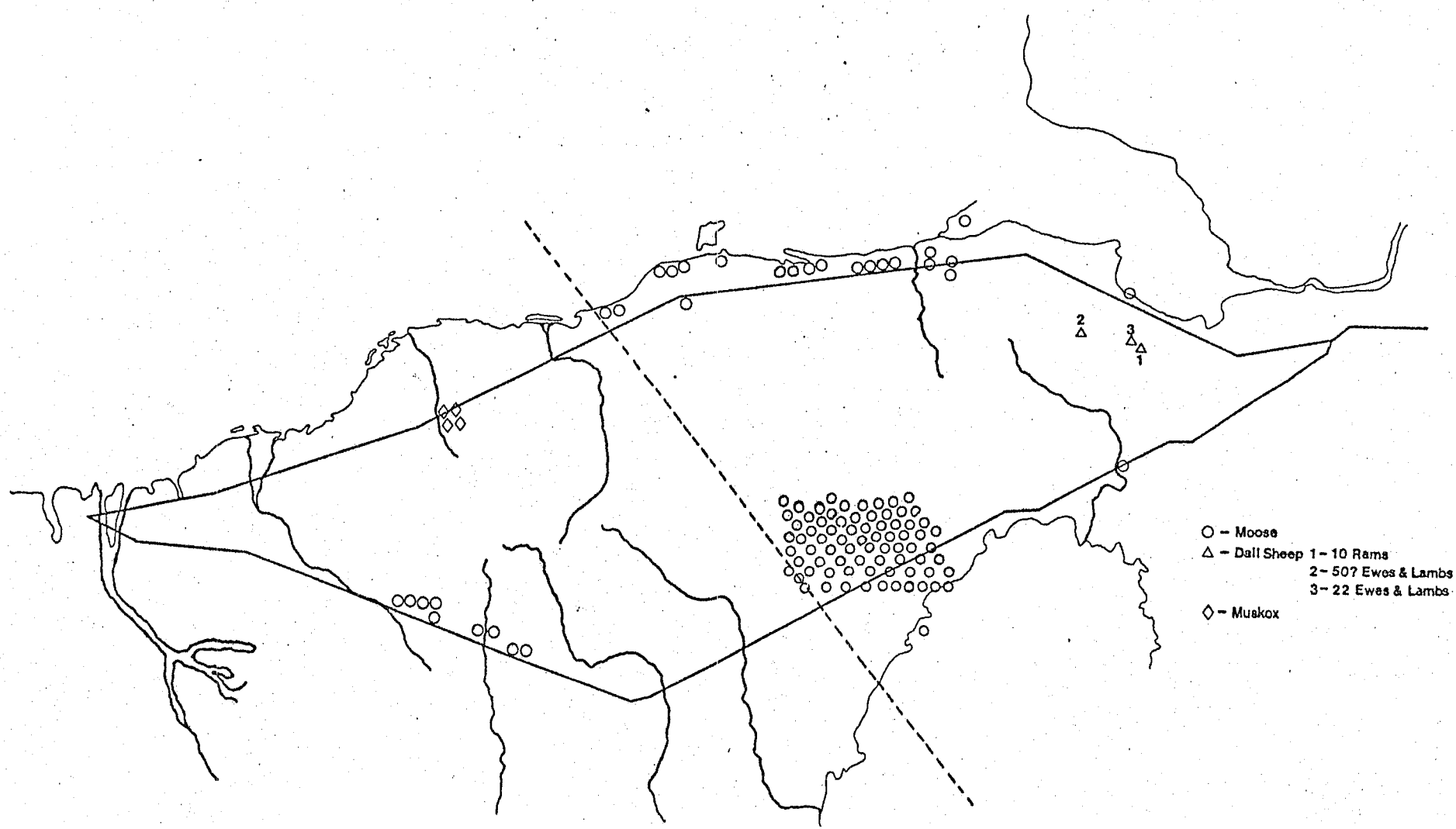
Falcon (Figure 28)



Hawk (Figure 29)



Moose, Dall Sheep and Muskox (Fig.31)



Bears, Wolves and Foxes (Figure 32)

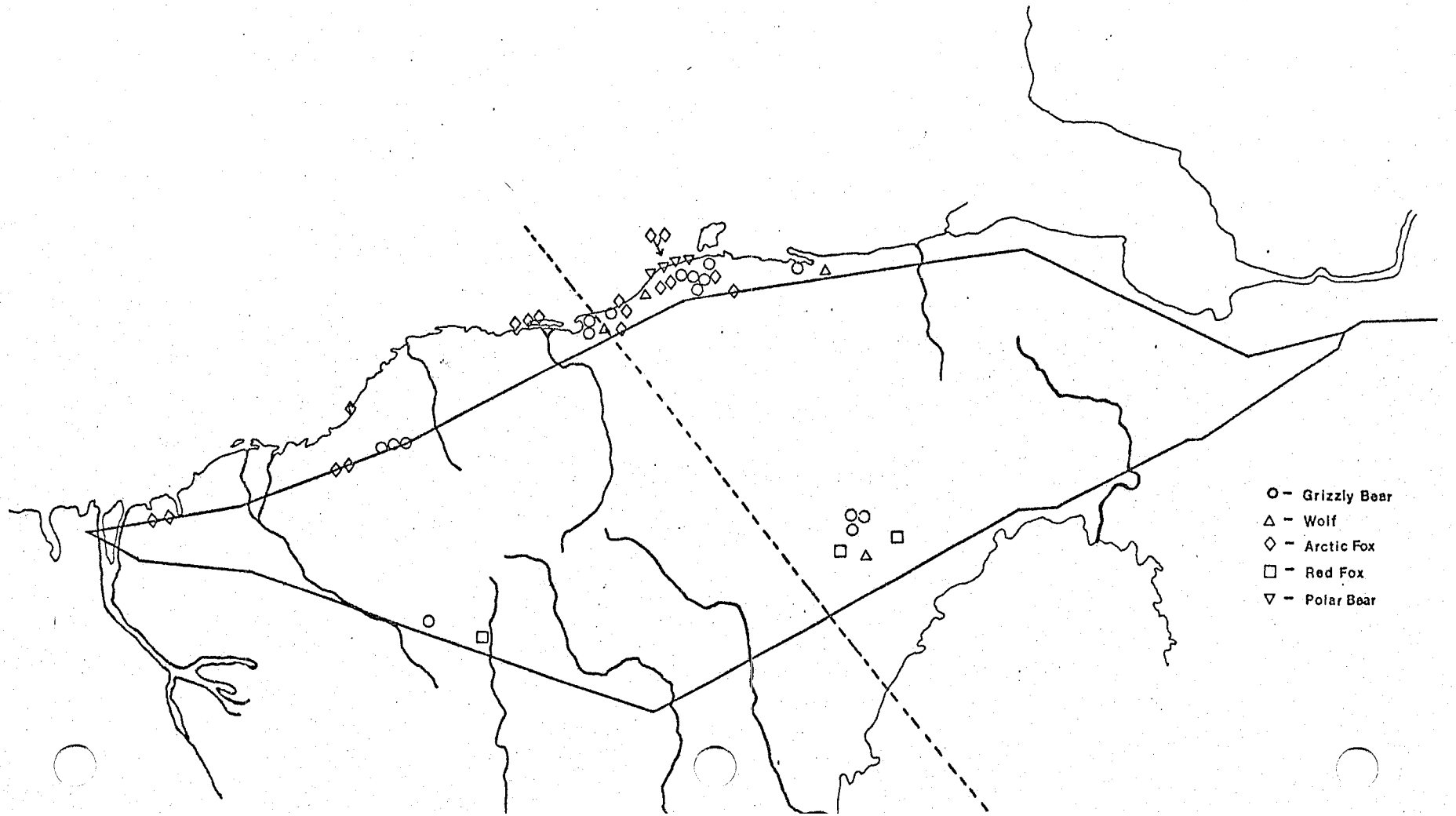


TABLE 1

Position of ground survey sites

Site #	Site Name	Longitude	Latitude	Position described
1	Fort McPherson	134°41'42"	67°12'36"	Camp site
2	Stoney Lake	135°14'48"	67°19'48"	Camp site
3	Bell River (Lapierre House)	136°59'30"	67°22'30"	Camp site
4	Old Crow Flats	138°58'12"	67°38'42"	Camp site
5	Old Crow Flats (T. Barry's Cabin)	140° 2'6"	68° 5'42"	Camp site
6	Husky Channel (MacKenzie Delta)	135°23'6"	68° 4'42"	Camp site
7	Cache Creek	135°49'24"	68°30'24"	Camp site
8	Blow River	137°10'42"	68°46'48"	Camp site
9	Phillip's Bay	138°26'54"	69°11'48"	Camp site
10	Nunaluk Spit	139°47'12"	69°36'00"	Camp site
11	Firth River	139°21'42"	69°21'48"	Landing site
12	Clarence Lagoon	140°47'00"	69°37'00"	Camp site
13	Siku Point	141°51'18"	69°48'42"	(Trans 4-4) Landing Site
13	Lower Kongakut River	141°54'12"	69°47'12"	(Trans 1-3) Landing Site
14	Upper Kongakut River	141°55'12"	69°35'24"	Starting Point (Trans 3&4)
15	Jago River	143°37' 6"	69°39'48"	Landing Site
16	Brown Low Pt. Spit	145°43'30"	70° 7'48"	Midpoint of Transects
17	Canning River	146°22' 6"	69°53'48"	Starting Point (Trans 3)
18	Kadleroshilik River	147°38' 6"	70° 4'30"	Starting Point (between 3 & 4)
19	Sheenjek River (Old Woman Creek)	143°52'54"	68°20'48"	Camp site
20	Chandular River	144°51'24"	68°37'42"	Starting Point (Trans 1 & 2)
21	Sheenjek River	143°16'48"	67°58'30"	Landing Site
22	Coleen River	142° 5'42"	67°53'54"	Landing Site
23	West Channel (Aklavik)	135°13' 6"	68°19'30"	Landing Site
24	Moose Channel (MacKenzie Delta)	136°36'54"	68°47'36"	

TABLE 2

Periodic route survey information in 1971

Date Flown	Aircraft Used	Area Flown
June 2	Cessna 185	Inuvik - Old Crow - Firth River - Inuvik
June 19	Cessna 185	Komakuk - Coast - Hula Hula - Coast - Komakuk
June 20	Cessna 185	Komakuk - Pipeline - Prudhoe Bay - Coast - Komakuk
June 24	Piper Aztec	Inuvik - Old Crow - Canning River - Inuvik
July 8	Piper Aztec	Inuvik - Komakuk - Prudhoe Bay - Old Crow - Inuvik
Aug. 4	Cessna 185	Komakuk - Coast - Prudhoe Bay - Pipeline - Komakuk
Aug. 24	Cessna 185	Komakuk - Coast - Humphrey Pt. - Pipeline - Komakuk
Aug. 30	Cessna 185	Komakuk - Coast - Humphrey Pt. - Pipeline - Komakuk
Sept. 2	Cessna 185	Komakuk - Coast - Prudhoe Bay - Pipeline - Komakuk
Sept. 10	Cessna 185	Komakuk - Coast - Hula Hula - Pipeline - Komakuk
Sept. 19	Cessna 185	MacKenzie Delta - Ellice Island Area
Sept. 22 - Sept. 30	Piper Aztec	MacKenzie Delta - North Dakota - Edmonton

TABLE 3

Regular aerial transect survey information in 1971

Date Flown	Aircraft Used	Survey
June 4	Cessna 185	Old Crow Flats
June 6	Cessna 185	Malcolm, Firth, Babbage Deltas
July 17	Cessna 185	Malcolm, Firth, Babbage Deltas
July 18	Cessna 185	Old Crow Flats
Aug. 6	Cessna 185	Malcolm, Firth, Babbage Deltas
Aug. 8	Cessna 185	Old Crow Flats
Sept. 9	Cessna 185	Malcolm, Firth, Babbage Deltas
Sept. 11	Cessna 185	Old Crow Flats

TABLE 4

Dates of transects run at each site in 1971

Site-Transect No.	Reading 1 Date Month/Day	Reading 2 Date Month/Day
Site 1		
Trans 1'	6/4	
2'	6/4	
1	6/5	7/19
2	6/5	7/19
3	6/5	7/19
4	6/5	7/19
5		7/19
6		7/20
7		7/20
Site 2		
Trans 1	6/6	7/17
2	6/6	7/17
3	6/7	7/17
4	6/7	7/17
5	6/7	7/18
6	6/7	7/18
7	6/8	7/18
Site 3		
Trans 1	6/9	7/16
2	6/9	7/16
3	6/9	7/16
4	6/9	7/16
5	6/9	7/16
6		7/16
7-8		7/16
9		7/16
Site 4		
Trans 1	6/11	7/12
2	6/11	7/12
3	6/11	7/12
4	6/12	7/12
5	6/12	7/12
6	6/13	7/12

Site - Transect No.	Reading 1 Date Month/Day	Reading 2 Date Month/Day
Site 5		
Trans 1	6/14	7/9
2	6/14	7/9
3	6/14	7/9
4	6/15	7/9
5	6/15	7/9
6	6/15	7/9
7		7/9
8		7/9
Site 6		
Trans 1	6/16	7/21
2	6/16	7/21
3	6/17	7/21
4	6/17	7/21
5	6/17	7/22
6	6/17	7/22
Site 7		
Trans 1	6/18	7/23
2	6/18	7/23
3-4	6/19	7/23
5	6/19	7/23
6	6/19	7/23
Site 8		
Trans 1	6/21	7/25
2	6/21	7/25
3	6/21	7/25
4	6/21	7/25
5	6/21	7/25
6	6/21	7/25
Site 9		
Trans 1	6/22	7/29
2	6/22	7/29
3	6/22	7/28
4	6/22	7/28
5	6/23	7/28
6	6/23	7/28

TABLE 4 (Cont'd)

Site - Transect No.	Reading 1 Date Month/Day	Reading 2 Date Month/Day
Site 10		
Trans 1	6/24	8/7
2	6/24	8/7
3	6/24	8/7
4	6/24	8/7
5	6/24	8/7
6	6/24	8/7
7	6/25	8/8
Site 11		
Trans 1	6/26	7/31
2	6/26	7/31
3	6/26	7/30
4	6/26	7/30
5	6/26	7/30
6	6/26	7/30
Site 12		
Trans 1	6/26	8/5
2	6/27	8/5
3	6/27	8/5
4	6/27	8/5
5	6/27	8/5
6	6/27	8/5
Site 13		
Trans 1	6/30	8/18
2	6/30	8/18
3	6/30	8/18
4-6	6/30	8/18
Site 14		
Trans 1	6/30	8/17
2	6/30	8/17
3	6/30	8/17
4	6/30	8/17
5	6/30	8/17
6	6/30	8/17
8		8/17

Site - Transect No.	Reading 1 Date Month/Day	Reading 2 Date Month/Day
Site 15		
Trans 1	7/1	8/16
2	7/1	8/16
3	7/1	8/16
4	7/1	8/16
5	7/1	8/16
6	7/1	8/16
7	7/1	8/16
8	7/1	8/16
Site 16		
Trans 1-3	7/1	8/15
4-6	7/1	8/15
Site 17		
Trans 1	7/2	8/16
2	7/2	8/16
3	7/2	8/16
4	7/2	8/16
5	7/2	8/16
6	7/2	8/16
7	7/2	8/16
8	7/2	8/16
Site 18		
Trans 1	7/2	8/15
2	7/2	8/15
3	7/2	8/15
4	7/2	8/15
5	7/2	8/15
6	7/2	8/15
8	7/2	8/15
Site 19		
Trans 1	7/3	8/14
2	7/3	8/14
3	7/3	8/14
4	7/3	8/14
5	7/3	8/14
6	7/3	8/14

TABLE 4 (Cont'd)

Site - Transect No.	Reading 1 Date Month/Day	Reading 2 Date Month/Day
Site 20		
Trans 1-2	7/4	8/13
3-4	7/4	8/13
5	7/4	8/13
6	7/4	8/13
Site 21		
Trans 1-2	7/4	
3	7/4	
4	7/4	
5-6	7/4	
Site 22		
Trans 1	7/5	
2	7/5	
3	7/5	
4	7/5	8/14
5	7/5	8/14
6	7/5	8/14
Site 23		
Trans 1		7/24
2		7/24
3		7/24
4		7/24
5		7/24
6		7/24
Site 24		
Trans 1		7/26
2		7/26
3		7/26
4		7/27
5		7/27
6		7/27

TABLE 5

Birds seen on periodic route surveys in 1971

Route:	M	I	I	MrI	IM	I	I	I	I	I
Species	June2	June18	June20	June24	July8	Aug6	Aug24	Aug30	Sept2	Sept10
Snow Goose	24	-	-		-	-	13120	17863	114930	52500
Canada Goose	-	-	2		-	20	-	-	275	-
White-fronted Goose	20	-	32		-	-	-	-	25	5000 - 150
Black Brant	15	6	74		-	23	3430	2175	555	125
Whistling Swan	158	1	21		31	26	8	12	10	5
Oldsquaw	40	66	130		983	8404	40	-	7788	25
Scoters (spp.)	44	431	259		486	368	5000	-	74	-
Scaups (spp.)	96	-	-		51	1200	-	-	300	-
Eiders (spp.)	10	56	249		92	370	1000	-	-	93
Teal	4	-	-		-	-	-	-	-	-
Pintail	1	-	1		-	-	-	-	3	-
American Widgeon	1	-	-		-	-	-	-	-	-
Goldeneye (spp.)	-	-	-		-	-	-	-	5	-
Unidentified Waterfowl	92	20	234		419	8052	200	80	250	-
Unidentified Shorebirds	3	6	22		58	811	-	-	-	-
Unidentified Gulls (spp.)	29	14	122		179	232	-	-	376	-
Arctic Tern	2	13	106		53	154	-	-	-	-
Ptarmigan (spp.)	10	3	4		-	-	-	-	-	-
Unidentified Hawks	4	1	1(rL)		2(rL)	-	-	-	-	-
Common Raven	22	1	3		2	-	-	-	-	-
Jaegers (spp.)	15	1	31		13	1	-	-	1	-
Short-eared Owl	1	-	-		-	-	-	-	-	-
Snowy Owl	1	-	1		-	-	-	-	-	-
Golden Eagle	-	1	5		3	-	-	-	-	-
Bald Eagle	-	-	1		-	-	-	-	-	-
Unidentified Songbirds	-	2	-		1	1	-	-	25	-
Unidentified Loons	-	16	32		18	122	-	-	8	-

Reconnaisance Only

TABLE 6

Results of regular aerial transect surveys of the Old Crow Flats

Species	June	July	August	September	Birds per square mile June	July	August	September
Scoter (white-winged & surf)	694	1314	370	36	13.5	12.8	3.6	.4
Scaups spp.	647	2489	1038	1319	12.6	24.3	10.1	12.9
Oldsquaw	84	326	49	269	1.6	3.2	.5	2.6
American Widgeon	60	60	457	359	1.2	.6	4.5	3.5
Pintail	57	67	51	124	1.1	.7	.5	1.2
Whistling Swan	25	67	64	37	.5	.7	.6	.4
Redhead	20	5	5	-	.4	.1	.1	-
Canvasback	-	82	426	673	-	.8	4.2	6.6
Shoveler	16	-	-	-	.3	-	-	-
Mallard	4	-	-	5	.1	-	-	.1
White-fronted Goose	19	150	190	60	.4	1.5	1.9	.6
Canada Goose	2	100	-	100	.04	1.0	-	1.0
Red-breasted Merganser	-	-	-	9	-	-	-	.1
Unidentified Loons	60	160	136	47	1.2	1.6	1.3	.5
Unidentified Waterfowl	109	2886	7609	3135	2.1	28.2	74.2	30.6
Total Waterfowl	1797	7706	10395	6173	35	74.6	101.5	59.6
Unidentified Gulls	33	411	52	8	.6	4.1	.5	.1
Arctic Tern	20	39	28	-	.4	.4	.3	-
Common Raven	6	22	9	2	.1	.2	.1	.02
Ptarmigan spp.	3	-	-	16	.1	-	-	.2
Unidentified Hawks	3	5	8	3	.1	.1	.1	.03
Jaegers spp.	-	-	4	-	-	-	.04	-
Unidentified Owls	-	-	2	-	-	-	.02	-
Sand hill Crane	-	-	4	3	-	-	.04	.03
Unidentified Shorebirds	81	395	283	-	1.6	3.6	2.8	-
Unidentified Songbirds	-	30	321	45	-	.3	3.1	.5
Bald Eagle	-	-	2	4	-	-	.02	.04
Golden Eagle	-	-	1	-	-	-	.01	-
Total Non-Waterfowl	146	902	714	81	2.9	8.7	7.03	.92
Total Birds	1943	8608	11109	6254				

TABLE 7

Results of regular aerial transect surveys of Malcolm, Firth, Babbage Deltas

Species	June	July	August	September	Birds per square mile June	July	August	September
Scoter (white-winged & surf)	-	7533	3760	21	-	185.3	92.5	.5
Scaups spp.	-	390	310	119	-	9.6	7.6	2.9
Oldsquaw	8	1579	3273	571	.4	38.8	80.5	14.0
Eiders spp.	-	4	7	15	-	.1	.2	.4
Pintail	7	-	5	17	.3	-	.1	.4
Red-breasted Merganser	-	5	-	13	-	.1	-	.3
Whistling Swan	15	51	43	15	.7	1.3	1.1	.4
Canada Goose	-	-	-	125	-	-	-	3.1
Snow Goose	-	-	-	8552	-	-	-	210.4
Black Brant	55	-	-	186	2.7	-	-	4.6
Unidentified Waterfowl	-	92	2232	835	-	2.3	54.9	20.5
Unidentified Loons	-	12	45	22	-	.3	1.1	.5
Total Waterfowl	85	9666	9675	10491	4.1	237.8	238	258
Unidentified Gulls	13	180	111	208	.6	4.4	2.7	5.1
Arctic Tern	-	75	18	-	-	1.8	.4	-
Ptarmigan spp.	12	-	9	-	.6	-	.2	-
Common Raven	-	2	-	-	-	.1	-	-
Unidentified Hawks	1	-	1	1	.1	-	.02	.02
Jaegers spp.	7	10	3	-	.3	.3	.1	-
Sandhill Crane	2	-	-	2	.1	-	-	.1
Unidentified Shorebirds	33	85	159	1	1.6	2.1	3.9	.02
Unidentified Songbirds	1	-	19	-	.1	-	.5	-
Total Non-Waterfowl	69	352	320	212	3.4	8.7	7.8	5.6
Total Birds	154	10018	9995	10703				

TABLE 8

Results of review survey from Mackenzie Delta to High Level, Alberta

ELLICE ISLAND SURVEY

September 19, 1971

Snow Goose	48,021
Whistling Swan	109
TOTAL	48,130

SOUTHERN SURVEY (Mackenzie Delta to High Level)

September 22 to 25, 1971

Unidentified Waterfowl	10,906
Snow Goose	9,365
Unidentified Loon	1,310
Whistling Swan	1,112
Scaups spp.	1,005
Canada Goose	832
Red-breasted Merganser	541
Oldsquaw	375
Pintail	265
Unidentified Gull	175
Goldeneye	169
Mallard	118
Black Brant	75
American Widgeon	27
Scoters (spp.)	24
Bald Eagle	16
Unidentified Hawk	1
TOTAL	26,315

TABLE 9

Results of review survey from High Level, Alberta

to Manitoba-North Dakota border

September 25 to 30, 1971

Species	Northeastern Alternate Route	Southwestern Alternate Route	Convergence to North Dakota
Scaups (spp.)	22,265	510	-
Mallard	10,000	1,100	26,775
Canvasback	7,000	-	-
Unidentified Waterfowl	3,530	1,800	2,340
American Widgeon	510	-	-
Unidentified Gulls	175	-	150
White-fronted Goose	125	-	-
Goldeneye	90	25	-
Mergansers (spp.)	75	5	-
Bufflehead	20	10	1,000
Teals (spp.)	5	-	-
Unidentified Loons	4	-	-
Bald Eagle	2	-	-
Marsh Hawk	-	-	-
Canada Goose	-	600	1,475
American Coot	-	340	2,900
Great Blue Heron	-	6	-
Whistling Swan	-	2	35
Pintail	-	-	15,000
Snow Goose	-	-	1
TOTAL	43,801	4,398	49,676

TABLE 10

Species seen from ground sites both on and off transect

1. Order Gaviiformes
    1. Family Gaviidae
        1. Common Loon (Gavia immer)
        2. Yellow-billed Loon (Gavia adamsii)
        3. Arctic Loon (Gavia arctica)
        4. Red-throated Loon (Gavia stellata)

2. Order Podicipediformes
    2. Family Podicipedidae
        5. Red-necked Grebe (Podiceps grisegena)

3. Order Anseriformes
    3. Family Anatidae
        6. Whistling Swan (Olor columbianus)
        7. Canada Goose (Branta canadensis)
        8. Black Brant (Branta nigricans)
        9. White-fronted Goose (Anser albifrons)
        10. Snow Goose (Chen hyperborea)
        11. Mallard (Anas platyrhynchos)
        12. Pintail (Anas acuta)
        13. American Widgeon (Mareca americana)
        14. Shoveler (Spatula clypeata)
        15. Blue-winged Teal (Anas discors)
        16. Green-winged Teal (Anas carolinensis)
        17. Canvasback (Aythya valisineria)
        18. Greater Scaup (Aythya marila)
        19. Lesser Scaup (Aythya affinis)
        20. Common Goldeneye (Bucephala clangula)
        21. Barrow's Goldeneye (Bucephala islandica)
        22. Common Eider (Somateria mollissima)
        23. King Eider (Somateria spectabilis)
        24. Oldsquaw (Clangula hyemalis)
        25. White-winged Scoter (Melanitta deglandi)
        26. Surf Scoter (Melanitta perspicillata)
        27. Red-breasted Merganser (Mergus serrator)

4. Order Falconiformes
    4. Family Accipitridae
        28. Goshawk (Accipiter gentilis)
        29. Marsh Hawk (Circus cyaneus)
        30. Rough-legged Hawk (Buteo lagopus)
        31. Swainson's Hawk (Buteo swainsoni)
        32. Golden Eagle (Aquila chrysaëtos)
    5. Family Falconidae
        33. Gyrfalcon (Falco rusticolus)

5. Order Galliformes
    6. Family Tetraonidae
        34. Willow Ptarmigan (Lagopus lagopus)
        35. Rock Ptarmigan (Lagopus mutus)

6. Order Gruiformes
    7. Family Gruidae
        36. Sandhill Crane (Grus canadensis)

7. Order Charadriiformes
    8. Family Charadriidae
        37. American Golden Plover (Pluvialis dominica)
        38. Black-bellied Plover (Squatarola squatarola)
        39. Semipalmated Plover (Charadrius semipalmatus)
    9. Family Scolopacidae
        40. Upland Plover (Bartramia longicauda)
        41. Buff-breasted Sandpiper (Tryngites subruficollis)
        42. Solitary Sandpiper (Tringa solitaria)
        43. Spotted Sandpiper (Actitis macularia)
        44. Wandering Tattler (Heteroscelus incanum)
        45. Lesser Yellowlegs Totanus flavipes)
        46. Stilt Sandpiper (Micropalama himantopus)
        47. Long-billed Dowitcher (Limnodromus scolopaceus)
        48. Ruddy Turnstone (Arenaria interpres)
        49. Pectoral Sandpiper (Erolia melanotos)
        50. Dunlin (Erolia alpina)
        51. Sanderling (Crocethia alba)
        52. Baird's Sandpiper (Erolia bairdii)
        53. Least Sandpiper (Erolia minutilla)
        54. Semipalmated Sandpiper (Ereunetes pusillus)
        55. Common Snipe (Capella gallinago)
    10. Family Phalaropodidae
        56. Red Phalarope (Phalaropus fulicarius)
        57. Northern Phalarope (Lobipes lobatus)
    11. Family Stercorariidae
        58. Parasitic Jaeger (Stercorarius parasiticus)
        59. Pomarine Jaeger (Stercorarius pomarinus)
        60. Long-tailed Jaeger (Stercorarius longicaudus)
    12. Family Laridae
        61. Glaucous Gull (Larus hyperboreus)
        62. Herring Gull (Larus argentatus)
        63. Mew Gull (Larus canus)
        64. Bonaparte's Gull (Larus philadelphia)
        65. Sabine's Gull (Xema sabini)
        66. Arctic Tern (Sterna paradisaea)

8. Order Strigiformes
    13. Family Strigidae
        67. Short-eared Owl (Asio flammeus)
        68. Snowy Owl (Nyctea scandiaca)

9. Order Coraciiformes
    14. Family Alcedinidae
        69. Belted Kingfisher (Megaceryle alcyon)

10. Order Piciformes
    15. Family Picidae
        70. Yellow-shafted Flicker (Colaptes auratus)
        71. Northern Three-toed Woodpecker (Picoides tridactylus)

11. Order Passeriformes
    16. Family Tyrannidae
        72. Say's Phoebe (Sayornis saya)
        73. Traill's Flycatcher (Empidonax trailli)
        74. Olive-sided Flycatcher (Nuttallornis borealis)
    17. Family Hirundinidae
        75. Cliff Swallow (Petrochelidon pyrrhonota)
        76. Tree Swallow (Iridoprocne bicolor)
    18. Family Corvidae
        77. Gray Jay (Perisoreus canadensis)
        78. Common Raven (Corvus corax)
    19. Family Turdidae
        79. Robin (Turdus migratorius)
        80. Varied Thrush (Ixoreus naevius)
        81. Wheatear (Oenanthe oenanthe)
        82. Hermit Thrush (Hylocichla guttata)
        83. Swainson's Thrush (Hylocichla ustulata)
        84. Gray-cheeked Thrush (Hylocichla minima)
    20. Family Sylviidae
        85. Ruby-crowned Kinglet (Regulus satrapa)
    21. Family Motacillidae
        86. Water Pipit (Anthus spinoletta)
        87. Yellow Wagtail (Motacilla flava)
    22. Family Bombycillidae
        88. Bohemian Waxwing (Bombycilla garrulus)
    23. Family Laniidae
        89. Northern Shrike (Lanius excubitor)
    24. Family Parulidae
        90. Orange-crowned Warbler (Vermivora celata)
        91. Yellow Warbler (Dendroica petechia)
        92. Myrtle Warbler (Dendroica coronata)
        93. Blackpoll Warbler (Dendroica striata)
        94. Northern Waterthrush (Seiurus noveboracensis)
        95. Wilson's Warbler (Wilsonia pusilla)
    25. Family Icteridae
        96. Red-winged Blackbird (Agelaius phoeniceus)
        97. Rusty Blackbird (Euphagus carolinus)
        98. Brewer's Blackbird (Euphagus cyanocephalus)
    26. Family Fringillidae
        99. Pine Grosbeak (Pinicola enucleator)
        100. Hoary Redpoll (Acanthis hornemanni)
        101. Common Redpoll (Acanthis flammea)
        102. Pine Siskin (Spinus pinus)
        103. Savannah Sparrow (Passerculus sandwichensis)
        104. Slate-coloured Junco (Junco hyemalis)
        105. Tree Sparrow (Spizella arborea)
        106. White-crowned Sparrow (Zonotrichia leucophrys)
        107. Fox Sparrow (Passerella iliaca)
        108. Lapland Longspur (Calcarius lapponicus)
        109. Smith's Longspur (Calcarius pictus)
        110. Snow Bunting (Plectrophenax nivalis)

TABLE 11

Species and the sites at which they occurred on first and second readings

both on and off transects

x = first reading
y = second reading

	South									North Coast							North								No. sites each species occurred on
Site No:	1	2	3	4	5	19	20	21	22	9	10	12	13	16	23	24	6	7	8	11	14	15	17	18	
Common Loon	y				x						xy	y			y										5
Yellow-billed Loon											x	y	x										xy		4
Arctic Loon	xy	xy	xy	xy	x	xy				xy	y	xy	xy	x		y		xy	xy	xy				y	16
Red-throated Loon					xy					xy	xy	xy	y	xy			xy						y		8
Red-necked Greve	x																								1
Whistling Swan	xy			x	x					xy	x	y	xy	x				y							9
Canada Goose					x																				1
Black Brant											xy														1
White-fronted Goose											xy	y		y	y										4
Snow Goose											x		y												2
Mallard	x		x	xy	y												x								5
Pintail		xy	x	xy	xy	xy				xy		y	xy	x	y			x	xy	xy			x	xy	15
American Widgeon	xy	xy	x	xy	xy	y				x							x		y						9
Shoveler				x																					1
Blue-winged Teal			x																						1
Green-winged Teal	x	x	xy	xy	x	x	y		y	x															9
Canvasback		x																	y						2
Greater Scaup												x													1
Lesser Scaup	xy	xy	xy	xy	x	xy				x		xy				y		x	xy						11
Common Goldeneye			x		y																				2
Barrow's Goldeneye																			y						1
Common Eider											xy	xy	x	xy											4
King Eider												y													1
Oldsquaw	x	xy	x	xy	xy					x	xy	xy	xy	xy		y		xy	xy	xy			x	x	16
White-winged Scoter	xy	xy		xy	xy						x		x												6
Surf Scoter		x	xy	xy							x	x													5
Red-breasted Merganser		x				x			x	xy		xy	xy							xy					7
Goshawk								x																	1
Marsh Hawk						y				x						y	x								4

TABLE 11 (Cont'd)

Site No:	South 1	2	3	4	5	19	20	21	22	North Coast 9	10	12	13	16	23	24	North 6	7	8	11	14	15	17	18	No. sites each species occurred at
Rough-legged Hawk										x									x						2
Swainson's Hawk																						y			1
Golden Eagle		xy				x									y		xy	y			x	y			7
Gyrfalcon													y												1
Willow Ptarmigan	y	xy	x	xy	xy	xy	x				y	xy				y	xy	x	xy			y		x	15
Rock Ptarmigan											x	x	x					xy	x		xy	xy	xy	x	9
Sandhill Crane										xy	x		y	x		y									5
American Golden Plover										xy	xy	xy		y	y	y		xy	x	xy	x	x	xy	xy	13
Black-bellied Plover													y											x	2
Semipalmated Plover															y							x			2
Upland Plover							xy										xy								2
Buff-breasted Sandpiper											xy		x	y							x			x	5
Solitary Sandpiper	y							x	x						y										4
Spotted Sandpiper	xy	x					y	x	xy						y										6
Wandering Tattler							x																		1
Lesser Yellowlegs	y	xy	x	xy	xy	xy			x							y	xy								9
Stilt Sandpiper																				x					1
Long-billed Dowitcher													y												1
Ruddy Turnstone												y	x											x	3
Pectoral Sandpiper						y						y	y						xy	xy	xy	x	xy	xy	9
Dunlin													y											xy	2
Sanderling													y												1
Baird's Sandpiper										y															1
Least Sandpiper					xy	xy	x		x																4
Semipalmated Sandpiper						xy				xy	x	xy	xy		y			y	xy	xy	x	x	x	x	13
Common Snipe		xy	xy	xy		y	xy		x	y						y	x			y					10
Red Phalarope											x			y	xy									x	4
Northern Phalarope	y		x	xy	xy	xy				xy	y	y	xy	y	y		y		xy	xy				x	15
Parasitic Jaeger					x					xy	y	xy		y		y			xy	y	xy	y	xy	xy	12
Pomarine Jaeger													x	x											2
Long-tailed Jaeger										x	x	xy	x			y		xy	x	x	x	x		x	11
Glaucous Gull										xy	xy	xy	xy	xy	y	y					x			x	9
Herring Gull	y		x		x		x				x				y										6
Mew Gull	y		xy	xy	xy	x		y		x															7
Bonaparte's Gull				xy	x																				2
Sabine's Gull											y			x										x	3
Arctic Tern	xy			x	x		y	x	x	xy	xy	xy	xy	xy	y	y		x		xy			xy	x	17
Short-eared Owl	y	x	xy	xy							x						xy					xy		x	8

TABLE 11 (Cont'd)

	South								North Coast							North								No. sites each species occurred at
Site No:	1	2	3	4	5	19	20	21	22	9	10	12	13	16	23	24	6	7	8	11	14	15	17	18	
Snowy Owl												xy													1
Belted Kingfisher			xy					x									y								3
Yellow-shafted Flicker							x										y								2
Northern 3-toed Woodpecker									x								y								2
Say's Phoebe							x																		1
Traill's Flycatcher																	xy								1
Olive-sided Flycatcher								x																	1
Cliff Swallow				x													xy	xy							3
Tree Swallow	x			y																					2
Gray Jay	xy	xy	y	xy	xy		xy	x	xy						y		xy								10
Common Raven		xy	x	xy	xy		xy			xy	x				y	y	xy	x	x	x	x		x	x	16
Robin	xy	xy	xy	xy	xy	xy	xy		x						y		xy	xy							11
Varied Thrush		y	y												y		xy								4
Wheatear																		xy							1
Hermit Thrush				xy	y																				2
Swainson's Thrush		y			y				x																3
Gray-cheeked Thrush	xy		x	xy	xy		xy	x	xy								x	y							9
Ruby-crowned Kinglet									xy																1
Water Pipit							y														y				2
Yellow Wagtail							y			x								y			x	x			5
Bohemian Waxwing	xy			xy		y	xy	x	x																6
Northern Shrike																					y				1
Orange-crowned Warbler								x									x								2
Yellow Warbler	x	xy	xy	xy	xy				xy						y		x	xy							9
Myrtle Warbler	xy	xy		xy			xy		xy								x								6
Blackpoll Warbler	xy	x		xy	xy				x						y		x								7
Northern Waterthrush	y		x	xy	xy				xy						y		x								7
Wilson's Warbler	y	y	y						x						y		xy	x							7
Red-winged Blackbird	x																								1
Rusty Blackbird			xy	xy	xy	y		x	x								x								7
Brewer's Blackbird	x				xy																				2
Pine Grosbeak	xy	x		xy			xy		y																5
Hoary Redpoll																		x							1
Common Redpoll	xy	y	xy	xy	xy	xy	xy	x	x						y	y	xy	xy	xy	xy	xy	xy	y		18
Pine Siskin								x																	1
Savannah Sparrow			xy	xy	xy	x		x	x	x						y	x	x	x	xy		xy			13
Slate-coloured Junco	xy	y	xy						x						y		x								6
Tree sparrow	xy	xy	xy	xy	xy	xy	y	x	xy						y	y	xy	xy	y	y	y	y			17
White-crowned Sparrow	xy	xy	xy	xy	y	xy	x	x	x						y		xy	xy							12
Fox Sparrow	xy	y	y	y	xy		xy								y		xy	xy							9
Lapland Longspur										xy	xy	xy	xy			y		xy	xy	xy	xy	xy	xy	xy	12
Smith's Longspur						xy																			1
Snow Bunting											xy		x							xy					3

TABLE 12

Comparison of numbers of species seen on the Mountain Route, Inshore Route, the North Coast, and the Inshore Route and North Coast considered together.

Order	Inshore-Mountain (Site 1)	Mountain Route	Inshore Route	North Coast	Inshore & North Coast
Gaviiformes (Loons)	2	3	3	4	4
Podecipediformes (Grebes)	1	-	-	-	-
Anseriformes (Waterfowl)	7	15	9	15	18
Falconiformes (Hawks)	-	3	4	4	5
Galliformes (Ptarmigan)	1	1	2	2	2
Gruiiformes (Cranes)	-	-	-	1	1
Charadriiformes (Shorebirds, Gulls)	7	15	19	24	26
Strigiformes (Owls)	1	1	1	2	2
Caraciiformes (Kingfishers)	-	1	1	-	1
Piciformes (Woodpeckers)	-	2	2	-	2
Passeriformes (Perching Birds)	18	32	27	17	27
	37	73	68	69	88

Note: Site 1 can be considered on either Inshore or Mountain Route.

TABLE 13

Numbers and relative densities of birds seen at Site 1

Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.Mile
1 & 2	American Widgeon	-	-	1	1	1	1	5.6
	Scaups (spp.)	-	-	1	1	1	1	5.6
	Willow Ptarmigan	-	-	2	2	2	2	11.2
	Solitary Sandpiper	-	-	1	1	1	1	5.6
	Spotted Sandpiper	-	-	3	3	3	2	16.8
	Lesser Yellowlegs	-	-	8	8	8	6	44.8
	Northern Phalarope	-	-	4	4	4	3	22.4
	Herring Gull	-	-	1	1	1	1	5.6
	Arctic Tern	-	-	1	1	1	1	5.6
	Gray Jay	-	-	1	1	1	1	5.6
	Robin	1	3	7	7	8	6	44.8
	Bohemian Waxwing	-	-	7	7	7	6	39.2
	Yellow Warbler	1	3	-	-	1	1	5.6
	Myrtle Warbler	1	3	1	1	2	2	11.2
	Wilson's Warbler	-	-	1	1	1	1	5.6
	Gray-cheeked Thrush	7	23	2	2	9	7	50.4
	Pine Grosbeak	1	3	-	-	1	1	5.6
	Blackpoll Warbler	8	27	4	4	12	10	67.2
	Common Redpoll	1	3	29	29	30	24	168.0
	Slate-coloured Junco	-	-	8	8	8	6	44.8
	Tree Sparrow	3	10	7	7	10	8	56.0
	Fox Sparrow	1	3	2	2	3	2	16.8
	White-crowned Sparrow	-	-	1	1	1	1	5.6
	Northern Waterthrush	-	-	5	5	5	4	5.6
	Unidentified Song Birds	1	3	-	-	1	1	5.6
	Unidentified Shorebirds	-	-	2	2	2	2	11.2
	Unidentified Gulls	1	3	-	-	1	1	5.6
		26		99		125		

.1775 sq. miles

TABLE 14

Numbers and relative densities of birds seen

at sites on the Mountain Route

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
20	2-4-6 7-9	Willow Ptarmigan	1	5	-	-	1	2	7.7
		Least Sandpiper	2	10	-	-	2	3	15.4
		Upland Plover	1	5	1	2	2	3	15.4
		Mew Gull	-	-	1	2	1	2	7.7
		Gray Jay	-	-	1	2	1	2	7.7
		Robin	5	25	3	8	8	9	61.6
		Gray-cheeked Thrush	2	10	1	2	3	5	23.1
		Bohemian Waxwing	1	5	-	-	1	2	7.7
		Water Pipit	-	-	14	36	14	32	107.8
		Yellow Wagtail	-	-	2	5	2	3	15.4
		Yellow-shafted Flicker	2	10	-	-	2	3	15.4
		Common Redpoll	1	5	9	24	10	16	77.0
		Tree Sparrow	-	-	2	5	2	3	15.4
		Fox Sparrow	1	5	1	2	2	3	15.4
		White-crowned Sparrow	2	5	-	-	2	3	15.4
		Myrtle Warbler	-	-	1	2	1	2	7.7
		Pine Grosbeak	-	-	1	2	1	2	7.7
		Unidentified Song Birds	3	15	1	2	4	6	30.8
		Unidentified Ptarmigans	-	-	1	2	1	2	7.7
			21		39		60		
									.1300 sq.miles
19	2-3-5-6 13	Pintail	-	-	2	4	2		12.2
		Willow Ptarmigan	4	5	10	18	14		85.4
		Least Sandpiper	2	1	-	-	2		12.2
		Lesser Yellowlegs	11	13	1	2	12		73.2
		Pectoral Sandpiper	-	-	1	2	1		6.1
		Semipalmated Sandpiper	3	4	1	2	4		24.4
		Northern Phalarope	3	4	6	11	9		54.9
		Common Snipe	2	1	2	4	4		24.4
		Arctic Tern	-	-	2	4	2		12.2
		Mew Gull	1	1	-	-	1		6.1
		Robin	1	1	1	2	2		12.2
		Rusty Blackbird	-	-	1	2	1		6.1
		Common Redpoll	41	49	-	-	41		250.1
		Tree Sparrow	10	12	9	17	19		115.9
		White-crowned Sparrow	1	1	6	11	7		42.7
		Savannah Sparrow	1	1	-	-	1		6.1
		Smith's Longspur	3	-	4	7	7		24.4
		Unidentified Shorebirds	1	1	1	2	2		12.2
		Unidentified Song Birds	3	4	7	12	10		61.0
			84		54		141		
									.1650 sq.miles

TABLE 14 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
	1-2-3-5-9	Goshawk	1	2					26.7
	13	Solitary Sandpiper	1	2					26.7
		Spotted Sandpiper	1	2					26.7
		Olive-sided Flycatcher	2	5					53.4
		Gray-cheeked Thrush	3	8					80.1
		Arctic Tern	2	5					53.4
		Bohemian Waxwing	4	10					106.8
		Rusty Blackbird	1	2					26.7
		Pine Siskin	1	2					26.7
		Common Redpoll	3	8					80.1
		Tree Sparrow	11	28					293.7
		Gray Jay	2	5					53.4
		White-crowned Sparrow	5	13					133.5
		Savannah Sparrow	1	2					26.7
		Unidentified Accipiter	1	2					26.7
		Unidentified Song Birds	1	2					26.7
			40						.0375 sq.miles
22	1-3-5-9	Least Sandpiper	1	1	-	-	1	1	10
		Solitary Sandpiper	1	1	-	-	1	1	10
		Lesser Yellowlegs	6	8	-	-	6	5	60
		Common Snipe	3	4	-	-	3	3	30
		Northern 3-toed Woodpecker	1	1	3	9	4	4	40
		Gray Jay	1	1	1	3	2	2	20
		Robin	2	3	-	-	2	2	20
		Swainson's Thrush	3	4	-	-	3	3	30
		Gray-cheeked Thrush	1	1	1	3	2	2	20
		Bohemian Waxwing	4	5	-	-	4	4	40
		Yellow Warbler	-	-	8	25	8	7	80
		Myrtle Warbler	5	6	4	13	9	8	90
		Blackpoll Warbler	7	9	-	-	7	6	70
		Wilson's Warbler	3	4	-	-	3	3	30
		Northern Waterthrush	2	3	2	6	4	4	40
		Ruby-crowned Kinglet	6	8	-	-	6	5	60
		Pine Grosbeak	-	-	3	9	3	3	30
		Common Redpoll	4	5	-	-	4	4	40
		Tree Sparrow	11	14	5	16	16	14	160
		Savannah Sparrow	1	1	-	-	1	1	10
		Slate-coloured Junco	2	3	-	-	2	2	20
		White-crowned Sparrow	3	4	-	-	3	3	30
		Unidentified Song Birds	11	14	5	16	16	14	160
			78		32		110		.1000 sq.miles

TABLE 14 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
5	1-2-5-6	Red-throated Loon	1	1	-	-	1	<1	4.2
		Canada Goose	2	2	-	-	2	1	8.4
		Oldsquaw	2	2	-	-	2	1	8.4
		Pintail	1	1	-	-	1	<1	4.2
		White-winged Scoter	7	8	-	-	7	3	29.4
		Surf Scoter	1	1	-	-	1	<1	4.2
		Willow Ptarmigan	1	1	5	3	6	2	25.2
		Least Sandpiper	1	1	-	-	1	1	4.2
		Northern Phalarope	5	5	1	1	6	2	25.2
		Lesser Yellowlegs	2	2	2	1	4	2	16.8
		Common Snipe	-	-	1	1	1	<1	4.2
		Herring Gull	4	4	-	-	4	2	16.8
		Mew Gull	2	2	2	1	4	2	16.8
		Gray Jay	1	1	-	-	1	<1	4.2
		Common Raven	1	1	-	-	1	<1	4.2
		Robin	-	-	2	1	2	1	8.4
		Hermit Thrush	-	-	1	1	1	1	4.2
		Gray-cheeked Thrush	4	4	11	7	15	6	63.0
		Yellow Warbler	2	2	5	3	7	4	29.4
		Blackpoll Warbler	2	2	10	6	12	5	50.4
		Northern Waterthrush	1	1	11	7	12	5	50.4
		Rusty Blackbird	11	12	3	2	14	6	58.8
		Brewer's Blackbird	2	2	3	2	5	3	21.0
		Common Redpoll	4	4	21	14	25	10	105.0
		Savannah Sparrow	2	2	5	3	7	3	29.4
		Tree Sparrow	17	18	45	29	62	25	260.4
		White-crowned Sparrow	-	-	3	2	3	1	12.6
		Fox Sparrow	4	4	6	4	10	4	42.0
		Unidentified Song Birds	2	2	15	10	17	7	71.4
		Unidentified Gulls	1	1	1	-	2	1	8.4
		Unidentified Shorebirds	2	2	1	1	3	1	12.6
		Unidentified Waterfowl	9	10	-	-	9	4	37.8
			94		154		248		

.2400 sq.miles

TABLE 14 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
	1-2-6	Arctic Loon	-	-	1	-	1	1	5
		Mallard	2	2	1	-	3	1	15
		Pintail	3	2	1	-	4	1	20
		Shoveler	1	1	-	-	1	1	5
		Green-winged Teal	1	1	1	-	1	1	5
		Scaups spp.	3	2	4	2	7	2	35
		American Widgeon	9	7	17	7	26	7	130
		Oldsquaw	1	1	-	-	1	1	5
		Surf Scoter	2	2	-	-	2	1	10
		Lesser Yellowlegs	3	2	8	3	11	3	55
		Common Snipe	2	2	4	2	6	2	30
		Northern Phalarope	11	9	8	3	19	5	95
		Mew Gull	1	1	1	-	2	1	10
		Bonaparte's Gull	3	2	22	9	25	7	125
		Arctic Tern	3	2	-	-	3	1	15
		Short-eared Owl	-	-	1	-	1	1	5
		Gray Jay	1	1	3	1	4	1	20
		Common Raven	1	1	2	1	3	1	15
		Robin	5	3	2	1	7	2	35
		Hermit Thrush	1	1	6	2	7	2	35
		Gray-cheeked Thrush	10	8	4	2	14	4	70
		Bohemian Waxwing	2	2	13	5	15	4	75
		Yellow Warbler	4	3	5	2	9	2	45
		Myrtle Warbler	1	1	3	1	4	1	20
		Blackpoll Warbler	5	3	11	4	16	4	80
		Northern Waterthrush	1	1	3	1	4	1	20
		Rusty Blackbird	10	8	19	8	29	8	145
		Common Redpoll	2	2	24	10	26	7	130
		Savannah Sparrow	3	2	2	1	5	1	25
		Tree Sparrow	24	19	50	20	74	19	370
		White-crowned Sparrow	8	6	23	9	31	9	155
		Fox Sparrow	-	-	3	1	3	1	15
		Unidentified Song Birds	2	2	8	3	10	3	50
		Unidentified Accipiter	1	1	-	-	1	1	5
		Unidentified Waterfowl	-	-	-	1	1	1	5
			126		250		376		

.2000 sq.miles

TABLE 14 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mil
3	1-2-3-9	Willow Ptarmigan	1	6	-	-	1	1	5.8
		Common Snipe	-	-	3	4	3	3	17.4
		Mew Gull	-	-	3	4	3	3	17.4
		Short-eared Owl	-	-	1	1	1	1	5.8
		Gray Jay	-	-	3	4	3	3	17.4
		Robin	2	13	1	1	3	3	17.4
		Varied Thrush	-	-	2	3	2	2	11.6
		Yellow Warbler	-	-	1	1	1	1	5.8
		Wilson's Warbler	-	-	2	3	2	2	11.6
		Rusty Blackbird	-	-	5	7	5	6	29.0
		Common Redpoll	-	-	2	3	2	2	11.6
		Slate-Coloured Junco	-	-	6	8	6	7	34.8
		Tree Sparrow	4	27	26	36	30	33	174.0
		White-crowned Sparrow	3	20	7	10	10	11	58.0
		Savannah Sparrow	1	6	1	1	2	2	11.6
		Fox Sparrow	-	-	6	8	6	7	34.8
		Unidentified Song Birds	3	20	4	6	7	8	40.6
		Unidentified Loons	1	6	-	-	1	1	5.8
			15		73		88		
									.1725 sq.miles
2	1-2-3	Willow Ptarmigan	1	2	4	4	5	3	13.5
	4-5-9	Golden Eagle	1	2	-	-	1	<1	2.7
		Lesser Yellowlegs	5	6	4	4	9	5	24.3
		Common Snipe	1	2	2	2	3	2	8.1
		Gray Jay	4	5	2	2	6	4	16.2
		Common Raven	-	-	2	1	2	1	5.4
		Robin	11	14	7	8	18	10	48.6
		Yellow Warbler	12	15	6	7	18	10	48.6
		Myrtle Warbler	2	2	5	6	7	4	18.9
		Wilson's Warbler	-	-	6	7	6	4	16.2
		Blackpoll Warbler	2	2	-	-	2	1	5.4
		Pine Grosbeak	1	2	-	-	1	<1	2.7
		Common Redpoll	-	-	12	13	12	7	32.4
		Tree Sparrow	21	27	12	13	33	20	89.1
		Fox Sparrow	-	-	3	3	3	2	8.1
		White-crowned Sparrow	5	6	10	11	15	9	40.5
		Unidentified Song Birds	10	13	17	19	27	16	72.9
		Unidentified Gulls	1	2	-	-	1	<1	2.7
			77		92		169		
									.3650 sq.miles

TABLE 15

Numbers and relative densities of birds seen

at sites on the Inshore Route

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
18	2-3-7	Oldsquaw	2	2	-	-	2	1	10.6
		Willow Ptarmigan	1	1	-	-	1	<1	5.3
		Rock Ptarmigan	2	2	-	-	2	1	10.6
		Golden Plover	7	6	5	5	12	6	63.6
		Black-bellied Plover	3	3	-	-	3	2	15.9
		Dunlin	2	2	1	1	3	2	15.9
		Ruddy Turnstone	5	4	-	-	5	3	26.5
		Northern Phalarope	14	13	-	-	14	7	74.2
		Red Phalarope	4	4	-	-	4	2	21.2
		Buff-breasted Sandpiper	6	6	-	-	6	3	31.8
		Pectoral Sandpiper	5	4	25	24	30	15	159.0
		Semipalmated Sandpiper	19	18	-	-	19	9	100.7
		Long-tailed Jaeger	5	4	-	-	5	3	26.5
		Parasitic Jaeger	3	3	2	2	5	3	26.5
		Arctic Tern	1	1	-	-	1	<1	5.3
		Short-eared Owl	1	1	-	-	1	<1	5.3
		Lapland Longspur	25	23	70	68	95	47	503.5
		Unidentified Song Birds	1	1	-	-	1	<1	5.3
		Unidentified Shorebirds	1	1	-	-	1	<1	5.3
		Unidentified Jaegers	1	1	-	-	1	<1	5.3
			108		103		211		
									.1900 sq.miles
17	2-3-7-13	Rock Ptarmigan	7	17	1	2	8	8	40
		Pintail	6	15	-	-	6	6	30
		American Golden Plover	1	3	18	30	19	19	95
		Semipalmated Sandpiper	7	17	-	-	7	7	35
		Pectoral Sandpiper	1	3	1	2	2	2	10
		Parasitic Jaeger	3	8	1	2	4	4	20
		Arctic Tern	1	3	1	2	2	2	10
		Raven	1	3	-	-	1	1	5
		Lapland Longspur	11	28	36	60	47	47	235
		Unidentified Shorebirds	1	3	1	2	2	2	10
			39		59		98		
									.2000 sq.miles

TABLE 15 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
15	2-3-13	Swainson's Hawk	-	-	1	-	1	<1	6.1
		Golden Eagle	-	-	1	-	1	1	6.1
		Willow Ptarmigan	-	-	4	2	4	1	24.4
		Rock Ptarmigan	3	5	4	2	7	2	42.7
		Golden Plover	1	1	-	-	1	1	6.1
		Semipalmated Plover	3	5	-	-	4	3	24.3
		Pectoral Sandpiper	3	5	-	-	3	2	18.3
		Long-tailed Jaeger	2	3	-	-	2	<1	12.2
		Parasitic Jaeger	-	-	1	-	1	<1	6.1
		Short-eared Owl	1	1	1	-	2	<1	12.2
		Tree Sparrow	-	-	1	-	1	<1	6.1
		Savannah Sparrow	6	9	1	-	7	2	42.7
		Redpoll	11	17	38	14	49	15	298.9
		Yellow Wagtail	2	3	-	-	2	<1	12.2
		Lapland Longspur	30	45	203	77	233	70	1421.3
		Unidentified Song Birds	2	3	1	-	3	1	18.3
		Unidentified Shorebirds	1	1	-	-	1	<1	6.1
		Unidentified Ptarmigans	-	-	8	3	8	2	48.8
			66		264		331		
									.1650 sq.miles
14	2-3-6-7 13	Rock Ptarmigan	4	7	-	-	4	2	25.2
		Golden Plover	15	27	-	-	15	9	94.5
		Semipalmated Sandpiper	2	4	-	-	2	1	12.6
		Pectoral Sandpiper	1	2	8	7	9	5	56.7
		Buff-breasted Sandpiper	1	2	-	-	1	1	6.3
		Long-tailed Jaeger	1	2	-	-	1	1	6.3
		Parasitic Jaeger	3	5	-	-	3	2	18.9
		Glaucous Gull	1	2	-	-	1	1	6.3
		Tree Sparrow	-	-	5	5	5	3	31.5
		Redpoll	9	17	59	53	68	41	428.4
		Water Pipit	-	-	1	1	1	1	6.3
		Lapland Longspur	15	27	33	30	48	29	302.4
		Unidentified Song Birds	-	-	4	4	4	2	25.2
		Unidentified Jaegers	3	5	-	-	3	2	18.9
			55		110		165		
									.1600 sq.miles

TABLE 15 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
11	2-3-5-7	Willow Ptarmigan	2	2	2	-	4	3	26.8
		Rock Ptarmigan	2	2	-	-	2	1	13.4
		Golden Plover	1	1	1	-	2	1	13.4
		Northern Phalarope	7	8	-	-	7	5	46.9
		Semipalmated Sandpiper	5	5	1	-	6	4	40.2
		Pectoral Sandpiper	8	9	-	-	8	5	53.6
		Stilt Sandpiper	5	5	-	-	5	3	33.5
		Arctic Tern	1	1	1	-	2	1	13.4
		Long-tailed Jaeger	3	3	-	-	3	2	20.1
		Tree Sparrow	-	-	2	-	2	1	13.4
		Savannah Sparrow	17	19	9	-	26	17	174.2
		Redpoll	8	9	13	-	21	14	140.7
		Unidentified Song Birds	-	-	6	-	6	4	40.2
		Lapland Longspur	31	35	20	-	51	33	341.7
		Unidentified Shorebird	1	1	7	-	8	5	53.6
			91		62		153		
									.1500 sq.miles
8	2-3	Oldsquaw	2	2	-	-	2	1	10
		Rock Ptarmigan	1	1	-	-	1	1	5
		Semipalmated Sandpiper	5	6	-	-	5	4	25
		Pectoral Sandpiper	3	4	2	4	5	4	25
		Common Snipe	-	-	1	2	1	1	5
		Northern Phalarope	12	14	4	8	16	11	80
		Long-tailed Jaeger	2	2	-	-	2	1	10
		Parasitic Jaeger	-	-	5	9	5	4	25
		Tree Sparrow	-	-	1	2	1	1	5
		White-crowned Sparrow	5	6	-	-	5	4	25
		Savannah Sparrow	-	-	4	8	4	3	20
		Redpoll	4	5	4	8	8	6	40
		Lapland Longspur	43	51	25	49	68	48	340
		Unidentified Song Birds	2	2	1	2	3	2	15
		Unidentified Jaegers	1	1	-	-	1	1	5
		Unidentified Shorebirds	5	6	4	8	9	6	45
			85		51		136		
									.200 sq.miles

TABLE 15 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
7	2-3-4-5	Arctic Loon	2	2	-	-	2	1	10.2
	12	Scaups (spp.)	8	9	-	-	8	3	40.8
		Pintail	1	1	-	-	1	<1	5.1
		Oldsquaw	-	-	8	5	8	3	40.8
		Willow Ptarmigan	1	1	-	-	1	<1	5.1
		Rock Ptarmigan	2	2	5	3	7	3	35.7
		Golden Plover	3	3	4	2	7	3	35.7
		Semipalmated Sandpiper	-	-	1	1	1	<1	5.1
		Arctic Tern	1	1	-	-	1	<1	5.1
		Long-tailed Jaeger	2	2	1	1	3	1	15.3
		Cliff Swallow	2	2	1	1	3	1	15.3
		Common Raven	1	1	-	-	1	<1	5.1
		Robin	1	1	2	1	3	1	15.3
		Wheatear	2	2	5	3	7	3	35.7
		Gray-cheeked Thrush	-	-	1	1	1	<1	5.1
		Yellow Wagtail	-	-	8	5	8	3	40.8
		Hoary Redpoll	2	2	-	-	2	1	10.2
		Common Redpoll	8	9	64	41	72	29	367.2
		Savanaah Sparrow	3	3	-	-	3	1	15.3
		Tree Sparrow	9	10	15	9	24	10	122.4
		White-crowned Sparrow	1	1	5	3	6	2	30.6
		Fox Sparrow	1	1	1	1	2	1	10.2
		Lapland Longspur	32	35	35	22	67	27	341.7
		Wilson's Warbler	2	1	-	-	2	1	10.2
		Unidentified Song Birds	6	7	2	1	8	3	40.8
		Unidentified Jaegers	1	1	-	-	1	<1	5.1
		Unidentified Shorebirds	2	2	-	-	2	1	10.2
			93		158		251		

.19 sq.miles

TABLE 15 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
6	1-2-3-4-5	Red-throated Loon	-	-	1	1	1	<1	5.4
		Willow Ptarmigan	3	4	9	6	12	6	64.8
		Golden Eagle	1	2	-	-	1	<1	5.4
		Yellowlegs	-	-	1	1	1	<1	5.4
		Northern Phalarope	-	-	2	1	2	1	10.8
		Upland Plover	-	-	4	3	4	2	21.6
		Short-eared Owl	-	-	1	1	1	<1	5.4
		Traill's Flycatcher	2	3	3	2	5	3	27.0
		Gray Jay	-	-	8	5	8	4	43.2
		Common Raven	-	-	1	1	1	<1	5.4
		Robin	6	9	2	1	8	4	43.2
		Varied Thrush	-	-	1	1	1	<1	5.4
		Cliff Swallow	-	-	7	5	7	4	37.8
		Orange-crowned Warbler	2	3	-	-	2	1	10.8
		Yellow Warbler	1	2	-	-	1	<1	5.4
		Blackpoll Warbler	3	4	-	-	3	2	16.2
		Myrtle Warbler	1	2	-	-	1	<1	5.4
		Northern Waterthrush	1	2	-	-	1	<1	5.4
		Wilson's Warbler	5	8	8	5	13	6	70.2
		Redpoll	-	-	21	13	21	10	113.4
		Tree Sparrow	11	17	16	11	27	13	145.8
		White-crowned Sparrow	6	9	9	6	15	7	81.0
		Savannah Sparrow	4	6	-	-	4	2	21.6
		Slate-coloured Junco	1	2	-	-	1	<1	5.4
		Fox Sparrow	9	13	10	7	19	9	102.6
		Yellow-shafted Flicker	-	-	5	3	5	3	27.0
		Northern 3-toed Woodpecker	-	-	1	1	1	<1	5.4
		Unidentified Waterfowl	-	-	1	1	1	<1	5.4
		Unidentified Song Birds	8	12	31	21	39	19	210.6
		Unidentified Hawks	1	2	1	1	2	1	10.8
			65		143		208		
		Totals:	602		950		1552		

.1850 sq.miles

TABLE 16

Numbers and relative densities of birds seen

at sites on the North Coast

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
16	gravel spit	Red-throated Loon	1	1	1	1	2	1	16.6
		Pintail	3	4	-	-	3	1	24.9
		Oldsquaw	35	45	-	-	35	14	290.5
		White-winged Scoter	-	-	1	1	1	1	8.3
		American Golden Plover	-	-	9	5	9	4	74.7
		Semipalmated Sandpiper	-	-	3	2	3	1	24.9
		Buff-breasted Sandpiper	-	-	9	5	9	4	74.7
		Northern Phalarope	-	-	100	63	100	40	830.0
		Red Phalarope	17	22	-	-	17	7	141.1
		Glaucous Gull	2	2	5	3	7	3	58.1
		Arctic Tern	13	17	22	14	35	14	290.5
		Sabine's Gull	4	5	-	-	4	2	33.2
		Parasitic Jaeger	-	-	2	1	2	1	16.6
		Pomarine Haeger	2	2	-	-	2	1	16.6
		Unidentified Shorebirds	-	-	8	5	8	3	66.4
		Unidentified Loons	1	1	-	-	1	1	8.3
			78		160		238		

.1200 sq.miles

TABLE 16 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
13	2-13 gravel beach	Arctic Loon	2	2	-	-	2	<1	13.4
		Red-throated Loon	-	-	5	1	5	1	33.5
		Pintail	16	17	32	7	48	10	321.6
		Oldsquaw	10	11	-	-	10	2	67.0
		Red-breasted Merganser	17	18	-	-	17	3	113.9
		White-winged Scoter	4	4	-	-	4	1	26.8
		Common Eider	2	2	-	-	2	<1	13.4
		Whistling Swan	2	2	-	-	2	<1	13.4
		Snow Goose	-	-	200	45	200	40	1340.0
		Gyrfalcon	-	-	1	.05	1	<1	6.7
		American Golden Plover	-	-	78	17	78	16	522.6
		Semipalmated Sandpiper	-	-	10	2	10	2	67.0
		Ruddy Turnstone	1	1	-	-	1	<1	6.7
		Pectoral Sandpiper	-	-	19	4	19	4	127.3
		Long-billed Dowitcher	-	-	3	1	3	<1	20.1
		Dunlin	-	-	7	2	7	1	46.9
		Semipalmated Plover	-	-	2	.05	2	<1	13.4
		Sanderling	-	-	6	1	6	1	40.2
		Northern Phalarope	2	2	11	2	13	3	87.1
		Red Phalarope	-	-	3	1	3	<1	20.1
		Arctic Tern	8	9	2	.05	10	2	67.0
		Glaucous Gull	7	8	9	2	16	3	107.2
		Parasitic Jaeger	2	2	2	.05	4	1	26.8
		Pomarine Jaeger	9	10	-	-	9	2	60.3
		Lapland Longspur	6	7	8	2	14	3	93.8
		Snow Bunting	2	2	-	-	2	<1	13.4
		Unidentified Shorebirds	3	3	51	11	54	11	361.8
			93		449		542		

.1500 sq.miles

TABLE 16 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mil
12	2-8 gravel spit	Red-throated Loon	3	10	-	-	3	3	10.5
		Pintail	-	-	9	15	9	10	31.5
		Oldsquaw	1	-	-	-	1	1	3.5
		Rock Ptarmigan	1	-	-	-	1	1	3.5
		Sandhill Crane	-	-	2	3	2	2	7.0
		American Golden Plover	2	7	-	-	2	2	7.0
		Semipalmated Sandpiper	3	9	3	5	6	7	21.0
		Ruddy Turnstone	-	-	1	2	1	1	3.5
		Pectoral Sandpiper	-	-	8	14	8	9	28.0
		Glaucous Gull	2	7	3	5	5	6	17.5
		Long-tailed Jaeger	-	-	1	2	1	1	3.5
		Snowy Owl	-	-	1	2	1	1	3.5
		Lapland Longspur	13	37	3	5	16	17	56.0
		Snow Bunting	10	29	-	-	10	11	35.0
		Unidentified Shorebirds	-	-	26	45	26	26	91.0
		Unidentified Loons	-	-	1	2	1	1	3.5
			35		58		93		
									.2850 sq.miles
10	7-8 gravel spit	Arctic Loon	-	-	2	1	2	<1	8.8
		Red-throated Loon	2	1	-	-	2	<1	8.8
		Oldsquaw	3	2	148	33	151	30	664.4
		Black Brant	2	1	2	1	4	1	17.6
		Common Eider	27	19	30	7	57	11	250.8
		Whistling Swan	2	1	-	-	2	<1	17.6
		Rock Ptarmigan	2	1	-	-	2	<1	17.6
		American Golden Plover	2	1	1	-	3	<1	13.2
		Semipalmated Sandpiper	2	1	-	-	2	<1	17.6
		Buff-breasted Sandpiper	5	3	16	4	21	4	92.4
		Northern Phalarope	-	-	56	12	56	11	246.4
		Red Phalarope	-	-	2	1	2	<1	17.6
		Glaucous Gull	17	12	60	13	77	15	338.8
		Sabine's Gull	-	-	1	-	1	<1	4.4
		Arctic Tern	64	44	100	22	164	33	721.6
		Long-tailed Jaeger	4	3	-	-	4	1	17.6
		Lapland Longspur	5	3	27	6	32	6	140.8
		Snow Bunting	1	1	-	-	1	<1	4.4
		Unidentified Song Birds	6	4	-	-	6	1	26.4
		Unidentified Shorebirds	-	-	6	1	6	1	26.4
			144		451		595		
									.2250 sq.miles

TABLE 16 (Cont'd)

Site	Vegetation Types	Species	First Reading #	First Reading %	Second Reading #	Second Reading %	Total #	Total %	Density Birds per sq.mile
9	2-3-4-11	Arctic Loon	5	5	-	-	5	2	33.5
		Scaups spp.	2	2	-	-	2	<1	13.4
		Pintail	4	4	-	-	4	1	26.8
		Oldsquaw	10	9	-	-	10	4	67.0
		Green-winged Teal	2	2	-	-	2	<1	13.4
		Red-breasted Merganser	-	-	2	1	2	<1	13.4
		American Golden Plover	9	8	1	1	10	4	67.0
		Semipalmated Sandpiper	12	11	8	5	20	7	134.0
		Baird's Sandpiper	-	-	4	2	4	1	26.8
		Northern Phalarope	5	5	-	-	5	2	33.5
		Glaucous Gull	2	2	-	-	2	<1	13.4
		Arctic Tern	2	2	-	-	2	<1	13.4
		Parasitic Jaeger	2	2	5	3	7	2	46.9
		Common Raven	1	1	-	-	1	<1	6.7
		Savannah Sparrow	1	1	-	-	1	<1	6.7
		Yellow Wagtail	1	1	-	-	1	<1	6.7
		Lapland Longspur	39	38	142	82	181	63	1212.7
		Unidentified Song Birds	1	1	-	-	1	<1	6.7
		Unidentified Shorebirds	5	5	20	6	25	9	167.5
		Unidentified Jaegers	1	1	-	-	1	<1	6.7
			104		182		286		
									.1500 sq.miles
23	2-5-13	Common Loon	1	1					10.5
		Semipalmated Plover	2	2					21.0
		Lesser Yellowlegs	1	1					10.5
		Solitary Sandpiper	1	1					10.5
		Common Snipe	1	1					10.5
		Spotted Sandpiper	1	1					10.5
		Northern Phalarope	1	1					10.5
		Arctic Tern	4	4					42.0
		Robin	1	1					10.5
		Varied Thrush	4	4					42.0
		Gray Jay	7	6					73.
		Wilson's Warbler	1	1					10.5
		Blackpoll Warbler	2	2					21.0
		Yellow Warbler	1	1					10.5
		Northern Waterthrush	4	4					42.0
		Fox Sparrow	7	6					73.5
		Tree Sparrow	12	11					126.0
		Redpoll	27	24					283.5
		White-crowned Sparrow	2	2					21.0
		Unidentified Waterfowl	12	11					126.0
		Unidentified Shorebirds	1	1					10.5
		Unidentified Song Birds	16	14					168.0
			109						
									.0950 sq.miles

TABLE 16 (Cont'd)

Site	Vegetation Types		First Reading #	First Reading %	Density Birds per square mile
24	2-3-4-5	Willow Ptarmigan	2	1	20
	13	Glaucous Gull	1	-	10
		Arctic Tern	3	1	30
		Parasitic Jaeger	4	1	40
		Common Raven	1	-	10
		Tree Sparrow	26	7	260
		Common Redpoll	323	83	3230
		Savannah Sparrow	1	-	10
		Lapland Longspur	4	1	40
		Unidentified Song Birds	17	4	170
		Unidentified Shorebirds	1	-	10
		Unidentified Ptarmigans	7	2	70
			390		

.1000 sq.miles

TABLE 17

Waterfowl seen on lakes

Site	Lake	Species	Reading 1				Reading 2			
			♂	♀	imm	T	♂	♀	imm	T
1	A	Scaups (spp.)	1	1		2				
		Mallard	3			3				
		American Widgeon	2	2		4		3	7	10
		Green-winged Teal	1			1				
		Unidentified Waterfowl	1	1		2				
		Arctic Loon	1	1		2	1	1		2
2	A	American Widgeon-Scaups (spp.)	1	1		2		1	10	11
		Oldsquaw					1	1		2
	B	Oldsquaw	5	5						
		White-winged Scoter	5	5		10	3	1		4
		Scaups (spp.)	3	2		5		1	7	8
		Pintail	1	1		2		2	1	3
		American Widgeon	2			2		1	5	6
		Green-winged Teal	1	1		2				
		Surf Scoter	1	1		2				
		Arctic Loon	1	1		2	1	1		2
		Unidentified Waterfowl							3	3
		Canvasback	1			1				
3	A	Scaups (spp.)	8	4		12	2	4		6
		Common Goldeneye	3	2		5				
		Surf Scoter	1	1		2		3		3
		Green-winged Teal	1			1		1	2	3
		American Widgeon	1			1				
	B	Oldsquaw	1	1		2				
		Pintail	4	2		6				
		Mallard	2			2				
		Surf Scoter	2			2				
		Blue-winged Teal	1			1				
		Green-winged Teal	1			1				
		Scaups (spp.)	11	4		15				
		American Widgeon	1	1		2				
	C	Scaups spp.	2	2		4				
		Surf Scoter	1	1		2				
		Common Goldeneye		1		1				
		American Loon				1				
	D	Mallard		1		1				
		Green-winged Teal	1			1				
		American Widgeon	1			1				
		Arctic Loon	2	2		4				
	E	Green-winged Teal	1			1				

TABLE 17 (Cont'd)

Site	Lake	Species	Reading 1 ♂	♀	imm	T	Reading 2 ♂	♀	imm	T
4	A	Oldsquaw	3	1		4		1	4	14
		Pintail				6		1	7	8
		American Widgeon	2	2		4			13	20
		Surf Scoter	5	4		9				2
		Green-winged Teal	2			2				
		White-winged Scoter	8	5		13				15
		Scaup	40	30		70			6	38
		Whistling Swan				4				
		Arctic Loon	1	1		2				4
		Mallard						1	4	5
	B	Green-winged Teal	1			1				
		American Widgeon	1			1				2
		Arctic Loon				1				1
		Scaups spp.						1		1
		Unidentified Waterfowl								1
	C	White-winged Scoter	4	4		8		1		1
		Scaups spp.	7	7		14		1	10	13
		Pintail	1	1		2				
		American Widgeon	1	1		2		1	8	10
		Oldsquaw	2	2		4		1		1
		Arctic Loon	1	1		2				3
		Surf Scoter						4	9	13
	D	Oldsquaw	1			1				
		American Widgeon	2	2		4		2	12	15
		Scaups spp.	1	1		2				
		Surf Scoter	1	1		2				
		Pintail	2	1		3				
		Arctic Loon	1	1		2				
6	A	Red-throated Loon	1	1		2				1
		Unidentified Waterfowl								1
7	A	Scaup	4	2		6				
		Pintail		1		1				
		Arctic Loon				2	1	1	1	3
		Oldsquaw				2		1	7	8
8	A	Oldsquaw	14	11		32			18	58
		Scaups spp.				10			18	68
		Scoters spp.				5				
		Pintail		1		1			8	10
		Unidentified Waterfowl				2				
		Arctic Loon				1				5
		Whistling Swan								2
		Barrow's Goldeneye					1			1
		Canvasback								5
		American Widgeon								1

TABLE 17 (Cont'd)

Site	Lake	Species	Reading 1 ♂	Reading 1 ♀	Reading 1 imm	Reading 1 T	Reading 2 ♂	Reading 2 ♀	Reading 2 imm	Reading 2 T
11	A	Red-breasted Merganser	1	1		2		1	2	3
		Oldsquaw	6	1		7		1	8	11
		Arctic Loon				6	1	1	2	5
		Pintail						1		1
17	A	Yellow-billed Loon				1				1
		Oldsquaw				13				
18	A (Trans 3)	Oldsquaw				3				
	B (Trans 2)	Oldsquaw		1		1				
	C	Oldsquaw	1	1		2				
		Arctic Loon								2
	D (Trans 5)	Oldsquaw (not on map)	1	1		2				
19	A&B	Green-winged Teal	3			3				
		Arctic Loon				2	1	1		2
		American Widgeon								6
		Scaup spp.								1
		Pintail				2				
24	A	Oldsquaw		1		1				
		Arctic Loon				2				

TABLE 18

Comparison of the quantitative differences of the major species found in the vegetative types

Columns I Number of times the plant occurred in the vegetation type (frequency of occurrence)
II Frequency of occurrence converted into percentage
III Smallest and largest groundcover value of the plant (1-100 scale)

	Sedge Grass Marsh			Tussock Heath			Spruce Heath			Shrubby Lichen Tundra			Brush (SA)		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Picea spp.	1	2	3	4	9	1-10	16	46	1-30	9	37	1-10	10	30	1-10
Salix spp.	33	66	1-20	22	50	5-15	15	42	3-30	13	54	1-30	29	88	5-60
Betula gland.	13	26	1-10	36	89	1-25	25	71	3-40	24	100	1-30	3	10	1-30
Alnus crispa	4	8	1-25	6	13	1-10	26	76	1-40	15	62	1-15	32	96	5-70
Erioph. vag.	7	14	5	45	100	1-50	17	47	1-20	10	40	1-25	1	3	25
Vaccinium uli.	1	2	1	4	9	1-10	10	29	1-20	13	54	1-25	1	3	1
Vaccinium v-i.	1	2	1	17	38	1-5	27	78	1-30	10	42	1-5	4	12	1-10
Ledum palustre	2	4	1-3	29	66	1-20	35	100	1-50	20	84	1-25	3	9	1-25
Cassiope tetr.	1	2	1	11	24	2-15	1	2	1	2	8	1-5			
Empetrum nigr.				16	35	1-10	16	46	1-20	14	58	1-10	8	24	1-10
Arctostaphylos				2	4	1-5	3	8	1-3	13	54	1-5	3	9	1-10
Andromeda poli.							2	6	1-15						
Shepherdia can.															
Dryas spp.	5	10	1-5	4	9	5-10				3	12	1-15	1	2	1
Rubus cham.	3	3	1-5	6	13	1-5	9	26	1-10	4	16	1-3	2	5	1-5
Lichens	1	2	1	13	29	1-10	12	34	5-30	24	100	5-40			
Graminae	4	8	5-20	3	7	1-5				1	4	1	10	30	5-40
Erioph. angust.	37	74	1-40	4	9	1-5	4	11	1-2	5	21	1-15	13	39	1-20
Carex spp.	50	100	20-80	18	40	1-40	9	26	5-20	19	79	1-10	12	36	1-50
Musci	34	68	5-80	44	98	5-40	27	78	5-60	20	83	5-40	18	54	1-70
Equisetum spp.				1	2	5				2	8	1-40	14	42	1-60
Juniperus comm.															
Rosa acicalaris															
Ericacaea sp.?							1	2	10						
Pyrola spp.													2	6	5
Spireae veauv.							2	6	1-20				2	6	1-10
Populus sp.													1	2	1
Artemisia spp.	1	2	5										1	2	1
Ranunculus spp.															
Saxifraga spp.															
Geum glacial															
Potentilla bifl.	2	4	1												
Leguminosae													4	12	1-5
Petasites frig.	1	2	3	2	4	1-10							1	3	1
Potentilla pal.	5	10	5-10				1	2	6				4	12	1
Lycopodium ann.							1	2	1						

Columns I Number of times the plant occurred in the vegetation type (Frequency of occurrence)
II Frequency of occurrence converted into percentage
III Smallest and largest groundcover value of the plant (1-100 scale)

	Willow-Birch Brush			Tall Brush			Alluvial Willowshrub			Dry River Tundra			Gravel River Tundra		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Picea spp.										1	5	1			
Salix spp.	10	100	20-50	11	100	5-25				17	85	5-25	9	54	1-10
Betula gland.	10	100	10-40	11	100	2-50	13	92	5-60	6	30	1-5			
Alnus crispa	2	20	1-5												
Erioph. vag.	1	10	1							1	5	5			
Vaccinium uli.	7	70	1-10	3	27	1-30				3	15	1-10			
Vaccinium v.i.	4	40	1-30							1	5	25			
Ledum palustre	6	60	2-10							1	5	2			
Cassiope tetr.										10	50	5-40	1	6	5
Empetrum nigr.	2	20	1							1	5	1			
Arctostaphylos	1	10	5	8	72	1-10	3	21	1-10	5	25	1-25			
Andromeda poli.															
Shepherdia can.				6	54	1-10									
Dryas spp.				3	27	1	4	28	10-30	17	85	1-50	12	72	5-40
Rubus cham.															
Lichens										7	35	1-15	7	42	1-15
Graminae							9	64	1-50	4	20	2-5	4	24	3-40
Erioph. angust.	1	10	1				3	21	1-20	1	5	1	4	24	5-10
Carex spp.	9	90	1-40	5	45	5-10	4	28	1-40	19	95	2-20	17	100	2-60
Musci	10	100	15-60	9	82	10-70	5	36	1-30	16	80	1-30	8	54	5-40
Equisetum spp.	2	20	1-30	7	63	5-50	2	24	1	4	5	1-30	2	12	1-5
Juniperus comm.				2	18	2-3									
Rosa acicularis				5	45	1-5									
Ericaceae sp?	4	40	1-5												
Pyrola spp.															
Spiraea beauv.															
Populus sp.				7	63	1-10									
Artemisia spp.							2	14	3-5						
Ranunculus sp.															
Saxifraga spp.										1	5	5	3	18	1-2
Geum glaciale													1	6	5
Potentilla bifl.										2	10	1-5	7	42	1-5
Leguminosae				10	91	1-10	6	43	5-10	9	30	1-10			
Petasites frig.															
Potentilla pal.	1	10	1												
Lycopodium ann.															

TABLE 18 (Cont'd)

	Sphagnum Bog	Brackish Sedge-willow	Barren Lichenous Rock
Picea spp.	X		
Salix spp.		X	X
Betula gland.	X		
Alnus crispa	X		
Erioph. Vag.			
Vaccinium uli.			
Vaccinium v.l.			
Ledum palustre	X		
Cassiope tetr.			X
Empetrum nigr.			
Arctostaphylos			
Andromeda poli.	X		
Shepherdia can.			
Dryas spp.			
Rubus cham.	X		
Lichens			X
Graminae			
Erioph. angust.			
Carex spp.		X	
Musci			
Equisetum spp.			
Juniperus comm.			
Rosa acicularis			
Ericaceae			
Pyrola spp.			
Spireae beauv.			
Populus sp.			
Artemisia spp.			
Ranunculus sp.			
Saxifraga spp.			X
Geum glaciale			
Potentilla bifl.			
Leguminosae			
Petasites frig.			
Potentilla pal.			
Lycopodium ann.			

TABLE 19

List of transects and their vegetative types

Site	Transect	Spruce-Heath	Sedge Grass Marsh	Tussock-Heath Tundra	Shrubby-Lichen Tundra	Brush (Willow, Alder)	Brush (Willow, Birch)	Dry River Tundra	Gravel River Tundra	Tall Brush	Sphagnum Bog	Brackish Sedge-Willow	Barren Lichenous Rock	Alluvial Willow-shrub	Remarks
1	1	x													
	2	x													
	3	x													
	4	x													
	5	x	x												
	6	x	x												along lake
															around lake
2	1	x			x										
	2	x		x		x									
	3				x					x					
	4	x			x										
	5	x		x	x										
	6	x			x										
	7	x			x	x									
3	1	x		x											along lake
	2	x		x											
	3	x								x					
	4	x	x	x											
	5	x	x												
	6	x		x											
	7&8			x		x									
	9	x				x									
4	1	x					x								
	2						x								
	3						x								
	4						x								
	5	x													
	6	x				x									
															around lake
5	1	x													
	2	x									x				
	3	x					x				x				
	4	x				x									
	5	x	x												
	6	x													
	7	x	x			x									
	8					x									around lake

TABLE 19 (Cont'd)

Site	Transect	Spruce-Heath	Sedge Grass Marsh	Tussock-Heath Tundra	Shrubby-Lichen Tundra	Brush (Willow, Alder)	Brush (Willow, Birch)	Dry River Tundra	Gravel River Tundra	Tall Brush	Sphagnum Bog	Brackish Sedge-Willow	Barren Lichenous Rock	Alluvial Willow-shrub	Remarks
6	1					x									
	2	x	x	x	x										
	3	x				x									
	4	x		x		x									
	5	x	x	x											
	6	x	x			x									
7	1			x	x	x									
	2				x										
	3+4		x		x	x									
	5				x	x									
	6			x	x								x		
8	1		x	x											
	2		x	x											
	3			x											along lake
	4		x	x											
	5		x	x											
	6		x	x											
9	1		x	x		x									
	2		x	x											
	3		x	x											
	4		x	x											
	5											x			along channel
	6											x			along channel
10	1+2+3	No vegetation													spit
	4								x						
	5							x							
	6	No vegetation													spit
11	1		x	x											
	2		x	x				x							some tarns
	3		x	x											
	4		x	x											
	5		x	x				x							
	6					x									
12	1+6	No vegetation													gravel beach
	2								x						
	3								x						
	4								x						
	5		x						x						

Site	Transect	Spruce-Heath	Sedge Grass Marsh	Tussock-Heath Tundra	Shrubby-Lichen Tundra	Brush (Willow, Alder)	Brush (Willow, Birch)	Dry River Tundra	Gravel River Tundra	Tall Brush	Sphagnum Bog	Brackish Sedge-Willow	Barren Lichenous Rock	Alluvial Willow-shrub	Remarks
13	1		x											x	
	2		x												
	3		x											x	
	4,5,6	No vegetation													spit
14	1		x	x											
	2		x												
	3		x					x							
	4		x					x						x	
	5		x												
	6		x					x							
	8						x	x							riverbedding
15	1		x	x											
	2			x											
	3		x	x											
	4			x											
	5		x	x											
	6		x	x											
	7													x	
	8		x												
16	1 to 6 inclusive - No vegetation														sandspit
17	1		x	x				x							
	2			x				x							
	3		x	x				x							
	4		x	x				x							
	5		x	x				x							
	6		x					x						x	
	7							x							
	8							x							
18	1		x					x							
	2		x	x											
	3		x	x				x							
	4		x					x							
	5		x	x											
	6		x	x											
	7		x					x							
	8		x					x							

TABLE 19 (Cont'd)

Site	Transect	Spruce-Heath	Sedge Grass Marsh	Tussock-Heath Tundra	Shrubby-Lichen Tundra	Brush (Willow, Alder)	Brush (Willow, Birch)	Dry River Tundra	Gravel River Tundra	Tall Brush	Sphagnum Bog	Brackish Sedge-Willow	Barren Lichenous Rock	Alluvial Willow-shrub	Remarks
19	1		x				x x								
	2						x								
	3													x	
	4					x								x	
	5		x			x									
	6			x			x								
20	1+2				x			x		x					
	3+4		x		x			x							
	5		x x		x										
	6		x				x								
21	1+2		x							x					
	3	x		x											
	4	x													
	5+6					x								x	riverbedding
22	1	x				x				x					
	2			x		x x									
	3			x		x				x					
	4									x					
	5									x					
	6									x					
23	1					x									6 parallel zones
	2	x	x			x									
	3	x x	x			x									
	4	x			x	x									
	5		x		x	x									
	6														
24	1					x									
	2					x									
	3		x			x									
	4					x									
	5		x			x								x	
	6					x								x	

TABLE 20

Bird species and the vegetative and habitat types they occur in

x - on transect

y - off transect

Species	Spruce-Heath	Sedge-Grass Marsh	Tussock-Heath Tundra	Shrubby-Lichen Tundra	Brush (Willow-Alder)	Brush (Willow-Birch)	Dry River Tundra	Gravel River Tundra	Tall Brush	Sphagnum Bog	Brackish Sedge-Willow	Barren Lichenous Rock	Alluvial Willow-Shrub	Gravel Beaches	Fluviatile Waters	Lacustrine Waters	Ocean
Common Loon	x	x		x	x	x										y	y
Yellow-Billed Loon		x					x	x								y	y
Arctic Loon	x	y	y	x	x	x	x		x	x	x	x	x			y	y
Red-throated Loon	y	x	x	x	x		x	x			x		x		x	y	y
Red-necked Grebe	x	x														y	
Whistling Swan	x	x	x		x	x	x	x		x	y		x	x	x	y	y
Canada Goose	x	y			x										x	y	
Black Brant							x	x			y			y			y
White-fronted Goose	x	x			x	x	x	x								y	y
Snow Goose		y					x	x			y			x			
Mallard	y	x	x	x	x				x	x	x					y	
Pintail	y	y	x	x	x	x	x	x	x	x	y		x		x	y	
American Widgeon	y	x	x	x	x				x	x	x				x	y	
Shoveler	x	x			x	x										y	
Blue-winged Teal	x	x	x		x											y	
Green-winged Teal	x	y	x	x	x	x	x		x	x	x		x			y	
Canvasback	x	x	x	x	x				x							y	
Greater Scaup		y						x						x			
Lesser Scaup	x	x	x	x	x	x		x			x		x	x		y	y
Common Goldeneye	x	x	x		x				x	x						y	
Barrow's Goldeneye		x	x													y	
Common Eider		x					x	x					x	y			y
King Eider		x						x						y			y
Oldsquaw	x	y	y	x	x		x	x			x	x	x	y		y	y
White-winged Scoter	x	y	y	x	x	x	x	x	x				x	y		y	y
Surf Scoter	x	x	x	x	x	x	x	x	x					y		y	y
Red-breasted Merganser	x	x	x	x	x			x	x	x	x		x	y		y	y
Goshawk		x		x	x	x			x								
Marsh Hawk	x	y	y	x	x						x		x				
Rough-legged Hawk		y	y		x												
Swainson's Hawk		x	x										x				
Golden Eagle	x	x	y	x	x	x	x		x	x		x		x			
Gyrfalcon		x	y										x	x			
Willow Ptarmigan	x	x	y	x	y	y	x	x				x	y				
Rock Ptarmigan		x	y	x	x	x	x	y				x	y				
Sandhill Crane		x	y		x		x	x			y		x				
American Golden Plover		y	y	x	x		x	x				x	x	x			
Black-bellied Plover		x	x				y						x	x			
Semipalmated Plover	x	x	x	x	x			y					y				
Upland Plover	x	x	x	y	x	x							x				

TABLE 20 (Cont'd)

Species	Spruce-Heath	Sedge-grass Marsh	Tussock-Heath Tundra	Shrubby-Lichen Tundra	Brush (Willow-Alder)	Brush (Willow-Birch)	Dry River Tundra	Gravel River Tundra	Tall Brush	Sphagnum Bog	Brackish Sedge-Willow	Barren Lichenous Rock	Alluvial Willow-Shrub	Gravel Beaches	Fluviatile Waters	Lacustrine Waters	Ocean
Buff-breasted Sandpiper		y	y			x	x	x					x	x			
Solitary Sandpiper	y	x	x	x	x				x				x				
Spotted Sandpiper	x	x	x	x	x	x	x		x				x		y		
Wandering Tattler																	
Lesser Yellowlegs	x	y	x	x	x												
Stilt Sandpiper		x	y				x										
Long-billed Dowitcher	y												x				
Ruddy Turnstone		x	x				x	y					x				
Pectoral Sandpiper		y	y		x	x	x	x					x				
Dunlin		x	x				y						x				
Sanderling														x			
Baird's Sandpiper		x	x		x						x						
Least Sandpiper	x	y	y		x	x			x	x			y				
Semipalmated Sandpiper	x	y	x	x	x	x	x	x			x	x	x	y			
mmon Snipe	x	y	x	x	x	x	x	x	x	x			x				
Red Phalarope		y	x				x						x	y			y
Northern Phalarope	x	y	x	x	x	x	x	x			y	x	x	y		y	
Parasitic Jaeger	x	y	y	x	x	x	x	x					x	x			
Pomarine Jaeger		x	x		x			x			x		x	x			x
Long-tailed Jaeger		y	y	x	x		x	x			x		x	x			
Glaucous Gull	x	x	x	x	x	x	x	x					x	y			
Herring Gull	x	x	x	x	x	x	x		x	x							
Mew Gull	y	x	x	x	x	x			x	x			x				
Bonaparte's Gull	y	x			x	x				x							
Sabine's Gull		x	x				x							y			
Arctic Tern	x	x	x	x	x	x	x	x	x	x	x		x	y	x	y	y
Short-eared Owl	x	x	x	x	x	x	x	x	x	x			x				
Snowy Owl		y						x						y			
Belted Kingfisher	x	x	x	x	x				x				x		y		
Yellow-shafted Flicker	y	x	x	y	x	x	x		x								
Northern 3-toed Woodpecker	y	x	x	x	x				x				x				
Say's Phoebe		x		x		x	x			y							
Traill's Flycatcher	x	x	x	x	y												
Olive-sided Flycatcher	y	x	x		y				y				x				
Cliff Swallow	x	x	y	x	x	x											
Tree Swallow	x	x			x	x											
Gray Jay	y	x	x	x	y	y	x		y				x				
Common Raven	y	y	y	y	x	x	x	x	x	x	x	x	x	x			
Robin	y	x	x	y	y	y	x	x	y	x		x	x				
ried Thrush	y	x	x	x	y	y			y								
Wheatear		x	x	x	x							y					

TABLE 20 (Cont'd)

Species	Spruce-Heath	Sedge-Grass Marsh	Tuccosk-Heath Tundra	Shrubby-Lichen Tundra	Brush (Willow-Alder)	Brush (WillowOBirch)	Dry River Tundra	Gravel River Tundra	Tall Brush	Sphagnum Bog	Brackish Sedge-Willow	Barren Lichenous Rock	Alluvial Willow-Shrub	Gravel Beaches	Fluviatile Waters	Lacustrine Waters	Ocean
Hermit Thrush	y	x			x	x				x							
Swainson's Thrush	y	x	x	x	x	x			y	x			x				
Gray-cheeked Thrush	y	x	x	y	y	x	x		y	x			x				
Ruby-crowned Kinglet	y		x		x				y								
Water Pipit		x	x	y		x	y		x				x				
Yellow Wagtail		x	x	x	y	y	x		x			x	y				
Bohemian Waxwing	y	x	x	x	x	x	x		y				x				
Northern Shrike		x	x			x	x						y				
Orange-crowned Warbler	y	x	x	x	x				y				x				
Yellow Warbler	x	x	x	x	y	y			y	x		x	y				
Myrtle Warbler	y	x	x	x	y	y	x		y				y				
Blackpoll Warbler	y	x	x	x	x				y	x			x				
Northern Waterthrush	x	x	x	x	y	y	x		y	x			x				
Wilson's Warbler	x	x	x	x	y				y			x					
Red-winged Blackbird	x	x															
Brewer's Blackbird	x	x			x	x				x							
Pine Grosbeak	y	x	x	x	x	x	x		x				x				
Hoary Redpoll		x	x	x	y							x					
Common Redpoll	x	x	x	y	y	y	x	y	x				y				
Ring Siskin	y	x	x		x				x				x				
Savannah Sparrow	x	y	y	x	x	y			x	x			x				
Slate-coloured Junco	y	x	x	x	x				x				x				
Tree Sparrow	y	x	x	y	y	y			y	x	x	x	y				
White-crowned Sparrow	y	x	x	y	y	y			y	x		x	x				
Fox Sparrow	x	x	x	x	y	y			y	x			x				
Lapland Longspur		y	y	x	x		x	x			x	x	x				
Smith's Longspur		y	y		x	x							x				
Snow Bunting		x	x				x	x					x	y			
*Rusty Blackbird	y	x	x	x	x	x			y	x			x				

TABLE 21

List of the nests and fledglings

seen on the first and second readings of the 24 sites

Date 1971	Site	Species	Eggs	Young	Fledglings
June 4	1	Slate-coloured junco	4	-	-
8	2	Tree sparrow	5	-	-
8	2	Tree sparrow	5	-	-
8	2	White-crowned sparrow	5	-	-
9	3	Tree sparrow	5	-	-
12	4	Yellow warbler	4	-	-
13	4	Bonaparte's gull	-	-	-
13	4	American widgeon	8	-	-
13	4	Tree sparrow	1	4	-
13	4	Bonaparte's gull	-	-	-
13	4	Northern phalarope	4	-	-
13	4	Yellow warbler	5	-	-
14	5	Red-throated loon	1	-	-
14	5	Northern waterthrush	5	-	-
15	5	Gray-cheeked thrush	4	-	-
17	6	Red-throated loon	1	-	-
17	Old Crow Flats	Red throated loon	1	-	-
17	Old Crow Flats	Arctic loon	2	-	-
17	Old Crow Flats	Red-throated loon	1	-	-
18	7	Tree sparrow	3	2	-
19	7	Wheatear	7	-	-
22	9	Whistling swan	4	-	-
24	10	Lapland longspur	-	4	-
25	10	Common eider	3	-	-
25	10	Common eider	3	-	-
25	10	Common eider	3	-	-
25	10	Common eider	0	-	-
25	10	Common eider	1	-	-
25	10	Common eider	5	-	-
25	10	Common eider	6	-	-
25	10	Common eider	4	-	-
25	10	Common eider	3	-	-
25	10	Common eider	8	-	-
25	10	Common eider	6	-	-
25	10	Common eider	4	-	-
25	10	Common eider	4	-	-
25	10	Common eider	1	-	-
25	10	Common eider	5	-	-
25	10	Common eider	1	-	-
25	10	Common eider	2	-	-
25	10	Common eider	4	-	-
25	10	Common eider	4	-	-
25	10	Common eider	4	-	-

TABLE 21 (Cont'd)

Date 1971	Site	Species	Eggs	Young	Fledglings
June 25	10	Gull (probably glaucous - possibly herring)	4	-	-
25	10	Gull " "	2	-	-
25	10	Gull " "	-	-	-
25	10	Gull " "	1	-	-
25	10	Gull " "	2	-	-
25	10	Gull " "	0	-	-
25	10	Gull " "	0	-	-
25	10	Gull " "	3	-	-
25	10	Gull " "	0	-	-
25	10	Gull " "	3	-	-
25	10	Gull " "	1	-	-
25	10	Gull " "	2	-	-
25	10	Gull " "	0	-	-
25	10	Gull " "	0	-	-
25	10	Gull " "	0	-	-
25	10	Gull " "	2	-	-
25	10	Gull " "	1	-	-
25	10	Gull " "	0	-	-
25	10	Gull " "	3	-	-
25	10	Arctic Tern	2	-	-
25	10	Arctic tern	0	-	-
25	10	Arctic tern	0	-	-
25	10	Arctic tern	2	-	-
25	10	Arctic tern	2	-	-
25	10	Arctic tern	2	-	-
25	10	Arctic tern	2	-	-
26	24	Willow ptarmigan	-	-	11
26	24	Tree sparrow	-	-	5
26	24	Redpoll	-	-	200?
26	24	Lapland longspur	-	-	4
30	14	Lapland longspur	-	4	-
30	14	Rock ptarmigan	4	-	-
July 1	15	Lapland longspur	-	-	7
3	19	Smith's longspur	-	-	1
3	19	Tree sparrow	3	-	-
4	20	Fox sparrow?	3	-	-
4	20	Say's phoebe	5	-	-
5	22	Ruby-crowned kinglet	-	-	1
5	22	Myrtle warbler	-	-	2
9	5	Gray-cheeked thrush	-	4	-
11	4	Arctic loon	2	-	-
16	3	Robin	-	-	2
16	3	Green-winged teal	-	2	-
16	3	Common redpoll	-	-	1
16	3	White-crowned sparrow	-	-	3
16	3	Tree sparrow	-	-	16
16	3	Fox sparrow	-	-	4
16	3	Slate-coloured junco	-	-	2
16	3	Short-eared owl	-	1	-

TABLE 21 (Cont'd)

Date 1971	Site	Species	Eggs	Young	Fledglings	
July 16	3	Varied thrush	-	-	1	
16	3	Gray Jay	-	-	1	
17	2	White-crowned sparrow	-	-	1	
17	2	Robin	-	-	1	
18	2	White-winged scoter	-	3	-	
18	2	Golden eagle	-	-	1	(probably 1 y
18	2	Pintail	-	1	-	o
18	2	American widgeon	-	5	-	
18	2	Common redpoll	-	-	1	
18	2	Varied thrush	-	-	1	
18	2	Willow ptarmigan	-	-	5	
18	2	Tree sparrow	-	-	8	
18	2	Scaups spp.	-	-	10	
18	2	Gray jay	-	-	1	
18	2	Fox sparrow	-	-	2	
18	2	White-crowned sparrow	-	-	4	
18	2	Yellow warbler	-	-	1	
18	2	Wilson's warbler	-	-	2	
18	2	Robin	-	-	4	
18	2	Myrtle warbler	-	-	2	
19	1	Robin	-	-	2	
19	1	Gray-cheeked thrush	-	-	2	
19	1	Yellowlegs	-	-	5	
19	1	Northern waterthrush	-	-	1	
19	1	Northern phalarope	-	-	3	
19	1	Common redpoll	-	-	2	
19	1	Pine grosbeak	-	-	1	
19	1	White-crowned sparrow	-	-	1	
19	1	Myrtle warbler	-	-	1	
19	1	Willow ptarmigan	-	-	1	
19	1	Tree sparrow	-	-	1	
19	1	Spotted sandpiper	-	-	1	
19	1	Bohemian waxwing	-	-	3	
19	1	American widgeon	-	-	7	
21	6	Tree sparrow	-	-	5	
21	6	Fox sparrow	-	-	7	
21	6	Wilson's warbler	-	-	3	
21	6	Robin	-	-	1	
21	6	Golden eagle	-	-	1	
21	6	White-crowned sparrow	-	-	4	
21	6	Gray jay	-	-	4	
21	6	Common redpoll	-	-	2	
21	6	Willow ptarmigan	-	-	8	
23	7	Tree sparrow	-	-	13	
23	7	Lapland longspur	-	-	9	
23	7	Common redpoll	-	-	16	
23	7	Yellow warbler	-	-	3	
23	7	Robin	-	-	1	
23	7	Wheatear	-	-	3	
23	7	Gray-cheeked thrush	-	-	1	
23	7	Oldsquaw	-	-	7	
23	7	Arctic loon	-	1	-	

TABLE 21 (Cont'd)

Date 1971	Site	Species	Eggs	Young	Fledglings
July 23	7	Yellow wagtail	-	-	4
23	7	Bald eagle	-	-	1
23	7	White-crowned sparrow	-	-	1
23	7	Fox sparrow	-	-	1
24	23	Gray jay	-	-	3
24	23	Tree sparrow	-	-	6
24	23	White-crowned sparrow	-	-	1
24	23	Blackpoll warbler	-	-	1
24	23	Varied thrush	-	-	1
24	23	Pintail	-	-	-
25	8	Lapland longspur	-	-	8
25	8	Common redpoll	-	-	2
25	8	Tree sparrow	-	-	1
25	8	Savannah (?) sparrow	-	-	2
25	8	Pintail	-	-	12
25	8	Scaups spp.	-	-	18
28	9	Oldsquaw	-	-	18
28	9	Lapland longspur	-	-	3
30	9	Whistling swan	-	8	-
30	9	Lapland longspur	-	-	5
30	9	Savannah (?) sparrow	-	-	1
30	9	Tree sparrow	-	-	1
30	9	American golden plover	-	-	4
30	9	Oldsquaw	-	8	-
30	9	Arctic loon	-	2	-
August 5	12	Red-breasted merganser	-	2	-
7	10	Ruddy turnstone	-	-	-
7	11	Glaucous gull	-	21	-
7	10	Arctic tern	-	22	25
7	10	Lapland longspur	-	-	1
13	20	Common eider	-	15	-
14	19	Fox sparrow	-	-	1
14	19	Rusty blackbird	-	-	1
14	19	Tree sparrow	-	-	2
14	11	White-crowned sparrow	-	-	1
14	22	White-crowned sparrow	-	-	5
14	11	Pine grosbeak	-	-	4
14	22	Spotted sandpiper	-	-	2
14	22	Myrtle warbler	-	-	1
14	22	Yellow warbler	-	-	3
14	22	Tree sparrow	-	-	1
15	16	Tree sparrow	-	-	1
15	16	Arctic tern	-	2	25
16	15	Glaucous gull	-	-	1
17	14	Unidentified ptarmigan	-	-	8
17	14	Common redpoll	-	-	6
17	14	Tree sparrow	-	-	1
		Water pipit	-	-	1

TABLE 22

Birds and their flight directions observed from Nunalak Spit, August 24 - September 6, 1971 during daily 12-hour observation periods, 07:00 to 19:00

(Note: Aug. 24 and Sept. 6 were half-days only)

Number of birds seen travelling east

	Snow Goose	Black Brant	White-fronted Goose	Canada Goose	Unidentified Geese	Blue Goose	Pintail	Oldsquaw	Unidentified Ducks	Common Loon	Arctic Loon	Red-throated Loon	Unidentified Loons	Swan
Aug. 24	-	-	-	-	-	-	4	-	-	-	-	5	-	-
Aug. 25	-	-	-	-	-	-	7	5	-	2	-	4	11	-
Aug. 26	-	-	-	-	-	-	11	10	25	-	-	8	2	2
Aug. 27	-	-	-	-	-	-	96	-	91	-	1	11	9	-
Aug. 28	-	40	8	-	-	1	186	-	43	-	-	1	6	35
Aug. 29	400	-	1550	59	100	-	18	-	22	2	-	3	8	8
Aug. 30	4	-	255	-	128	-	51	-	-	-	-	3	2	-
Aug. 31	106	-	-	-	40	-	15	-	-	-	-	2	2	-
Sept. 1	50	-	-	-	50	-	-	-	-	1	-	-	1	-
Sept. 2	10	-	-	-	-	-	-	-	20	-	-	-	4	2
Sept. 3	-	-	-	-	-	-	-	13	17	5	-	-	16	-
Sept. 4	370	-	-	-	-	-	2	-	10	-	-	-	-	6
Sept. 5	842	-	286	60	325	-	6	-	25	-	-	-	-	26
Sept. 6	200	-	110	-	64	-	-	-	-	-	-	-	-	23
Total	1982	40	2209	119	707	1	396	28	253	10	1	37	61	2

TABLE 22 (Cont'd)

Number of birds seen travelling east (cont'd)

	Unidentified Waterfowl	American Golden Plover	Pectoral Sandpiper	Long-billed Dowitcher	Unidentified Shorebirds	Glaucous Gull	Golden Eagle	Rough-legged Hawk	Marsh Hawk	Gyrfalcon	Common Raven	Parasitic Jaeger	Lapland Longspur	Unidentified Swallows
Aug. 24	-	-	16	-	-	-	-	-	-	-	-	-	-	-
Aug. 25	-	3	104	33	704	12	-	-	-	-	-	-	23	-
Aug. 26	-	7	24	10	628	17	-	-	-	-	-	-	59	-
Aug. 27	-	17	11	10	92	4	-	-	-	-	1	2	10	-
Aug. 28	-	4	11	12	135	19	-	-	1(?)	-	1	1	1	-
Aug. 29	-	12	-	22	185	25	-	-	-	-	-	-	9	-
Aug. 30	-	9	-	7	4	19	-	-	-	-	-	-	4	-
Aug. 31	-	-	-	-	-	12	-	-	-	-	2	-	-	3
Sept. 1	-	-	-	-	-	?	-	-	-	-	-	6	2	-
Sept. 2	-	-	-	-	-	?	1	-	-	-	-	-	-	-
Sept. 3	-	-	-	-	-	32	-	1	-	-	-	-	-	-
Sept. 4	-	1	-	-	2	14	-	-	-	-	-	-	-	-
Sept. 5	31	-	-	-	-	32	-	-	-	-	-	15	-	-
Sept. 6	-	-	-	-	-	11	-	-	-	-	-	-	-	-
Total	31	53	166	94	1750	196	1*	1	1	**	***	24	108	3

*Eagle circling, direction uncertain
**Several sightings (probably) same bird (ONE)
***Ravens apparently local birds, others seen perched. Minimum of 5 Ravens in area.

TABLE 22 (Cont'd)

Number of birds seen travelling west

	Snow Goose	Black Brant	White-fronted Goose	Unidentified Geese	Pintail	Oldsquaw	Common Eider	Red-breasted Merganser	Unidentified Ducks	Common Loon	Yellow-billed Loon	Arctic Loon	Red-throated Loon	Unidentified Loons	Sum
ug. 24	-	-	-	-	-	-	9	-	-	-	-	-	8	-	-
ug. 25	1984	1299	-	-	-	-	-	-	23	8	-	-	4	20	-
ug. 26	3461	2910	-	-	-	-	1	-	-	5	1	-	1	33	4
ug. 27	862	1849	-	-	1	-	-	-	-	-	-	2	4	16	-
ug. 28	75	1005	-	-	2	-	-	-	-	-	-	-	6	27	-
g. 29	4276	1275	-	-	3	1	-	-	-	1	-	-	8		-
ug. 30	431	100	-	-	-	-	-	-	-	-	-	16	36	39	-
ug. 31	14698	3301	-	550	5	-	-	-	-	-	-	-	-	13	-
ept. 1	22467	1249	-	-	5	-	-	-	-	1	-	-	-	2	-
ept. 2	20912	175	6	-	-	-	-	-	-	1	-	-	-	-	2
ept. 3	1723	1195	-	-	-	106	-	15	73	-	-	1	1	2	-
ept. 4	-	90	-	-	-	685	-	-	120	-	-	-	-	5	-
ept. 5	-	278	-	-	-	144	-	30	55	-	-	-	1	1	-
ept. 6	-	80	-	-	-	61	-	34	60	-	-	1	1	-	-
otal	70889	14806	6	550	16	997	10	79	331	16	1	20	70	160	6

TABLE 22 (Cont'd)

Number of birds seen travelling west (cont'd)

	Unidentified Waterfowl	American Golden Plover	Black-bellied Plover	Pectoral Sandpiper	Long-billed Dowitcher	Unidentified Shorebirds	Glaucous Gull	Marsh Hawk	Gyrfalcon	Snowy Owl	Common Raven	Parasitic Jaeger	Lapland Longspur	Common Redpoll	Snow Bunting
Aug. 24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aug. 25	-	-	-	-	3	35	4	-	-	-	1	-	10	1	-
Aug. 26	-	-	-	1	-	25	15	-	-	-	-	-	-	-	21
Aug. 27	-	-	-	-	-	2	1	-	-	-	3	-	1	-	-
Aug. 28	-	-	-	-	-	16	28	-	-	-	-	4	3	-	-
Aug. 29	-	1	-	-	-	5	14	1	-	-	-	4	-	-	21
Aug. 30	-	-	2	-	-	1	285	-	-	-	-	8	2	-	-
Aug. 31	-	-	-	-	-	7	57	-	-	-	-	-	20	-	5
Sept. 1	-	-	-	-	-	-	?	-	-	-	-	4	-	-	1
Sept. 2	-	-	-	-	-	-	?	-	-	1	-	-	-	-	-
Sept. 3	-	-	-	-	-	-	27	-	-	-	-	-	-	-	-
Sept. 4	-	1	-	-	-	1	4	-	-	-	-	-	-	-	-
Sept. 5	10	-	-	-	-	-	52	-	-	-	1	-	-	-	-
Sept. 6	27	-	-	-	-	-	22	-	-	-	-	-	-	-	-
Total	37	2	2	1	3	92	509	1	*	1	**	20	36	1	48

*Several sightings, probably same bird (ONE).

**Ravens apparently local birds, others seen perched. Minimum of 5 Ravens in area.

TABLE 23

Weather data for Nunalak Spit, August 24 - September 6, 1971

Date		Cloud cover	Direction of wind	Wind speed	Temperature (Approx)	Other
Aug. 24	Morning					
	Afternoon	95%	NW	slight	38°	
Aug. 25	Morning	Intermittent fog Clouds. 90%	NW	moderate	45°	
	Afternoon	95%	NW	slight	40°	
Aug. 26	Morning	80%	W	slight	32°-40°	
	Afternoon	30%	NE	moderate	40°	
Aug. 27	Morning	Fogged in. Visibility ¼ mile	No wind	No wind	55°	
	Afternoon	Fogged in. Visibility ½ mile	No wind	No wind	50°	
Aug. 28	Morning	95-100%	NW	moderate	40°	
	Afternoon	95-100%	NW-W	moderate	45°-50°	
Aug. 29	Morning	95-100%	NW-W	moderate	45°	
	Afternoon	100%	W	moderate-hard	45°	
Aug. 30	Morning	100%	NW-W	moderate-hard	32°	Intermittent light snow
	Afternoon	100%	NW-W	moderate-hard	36°	
Aug. 31	Morning	95%	SE	moderate	35°-40°	
	Afternoon	75%	E	moderate	35°	
Sept. 1	Morning	80%	E	moderate	35°	Foggy towards mountains south
	Afternoon	70%	E	moderate-strong	35°-40°	
Sept.3	Morning	100%	E	slight	35°-40°	Light rain at times, fog in south around mountain
	Afternoon	100%	NW	slight	35°-40°	Fogged in. Visibility ¼-½ mile. Some rain
Sept. 4	Morning	100%	NW-W	strong	35°	Snowing, some snow on ground. Visibility ½ mile
	Afternoon	100%	NW-W	strong	35°	Snowing. Vis. ½ mi
Sept. 5	Morning	100%	NW-W	strong	30°-35°	Snowing. Visibil ½-1 mile. Snow on gr
	Afternoon	100%	NW-W	strong	30°-35°	" "
Sept. 6	Morning	100%	NW-W	strong	30°-50°	" "
	Afternoon	100%	NW-W	strong	30°-50°	" "

TABLE 24

Birds and their flight directions observed from Moose Channel,

September 13-17, 1971 during daily 12-hour observation periods (700 hrs - 1900 hrs)
(Sept. 17 observations made for half-day only: 700-1300 hrs)

	Snow Goose	White-front Goose	Canada Goose	Unidentified Geese	Whistling Swan	Pintail	Red-breasted Merganser	Unidentified Ducks	Unidentified Loons	Arctic Loon	Snow Bunting	Redpoll	Raven
Number of birds seen travelling east													
Sept. 13	11026	463	45	30	9	-	-	-	2	-	-	-	3
Sept. 14	1392	105	51	163	6	-	-	-	-	-	-	-	2
Sept. 15	696	38	68	75	14	3	-	-	-	5	-	14	-
Sept. 16	5298	67	-	210	5	-	-	-	2	-	40	-	10
Sept. 17	56	50	-	85	-	-	-	-	-	-	-	1	2
Total	18468	723	164	563	34	3	-	-	4	5	40	15	17
Number of birds seen travelling south													
Sept. 13	-	-	-	-	-	2	-	-	2	-	60	-	7
Sept. 14	220	-	-	-	-	-	-	-	-	-	25	-	-
Sept. 15	-	-	-	-	-	-	6	-	-	-	10	20	-
Sept. 16	205	20	-	-	-	-	9	-	2	-	1	-	7
Sept. 17	1019	-	-	-	-	1	-	-	-	-	-	-	-
Total	1444	20	-	-	-	3	15	-	4	-	96	20	14

TABLE 24 (Cont'd)

	Snow Goose	White-front Goose	Canada Goose	Unidentified Geese	Whistling Swan	Pintail	Red-breasted Merganser	Unidentified Ducks	Unidentified Loons	Arctic Loon	Snow Bunting	Redpoll	Raven
Number of birds seen travelling west													
Sept. 13	485	5	-	45	-	2	-	-	-	-	-	-	-
Sept. 14	57	1	-	-	-	-	-	-	-	-	-	-	-
Sept. 15	1401	10	-	13	-	-	-	-	2	3	2	-	4
Sept. 16	1505	20	-	-	-	-	-	10	2	-	-	-	3
Sept. 17	39	-	-	-	-	1	-	-	3	-	-	-	-
Total	3487	36	-	58	-	3	-	10	7	3	2	-	7
Number of birds seen travelling north													
Sept. 13	10	10	-	-	-	-	-	-	2	-	-	-	4
Sept. 14	6	-	-	-	-	-	-	-	-	-	-	-	2
Sept. 15	-	-	-	-	-	2	-	-	-	-	-	-	3
Sept. 16	1	-	-	-	-	-	-	-	-	1	-	-	2
Sept. 17	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	17	10	-	-	-	2	-	-	2	1	-	-	12

TABLE 25

WEATHER DATA FOR MOOSE CHANNEL, SEPTEMBER 13-17, 1971

Date		Cover Cloud	Wind From	Wind Speed	Estimated Temperature	Other
Sept. 13th.	7-13:00 Hrs. Morning	100%	W	Slight	30°F	Intermittent Snow
	13-19:00 Hrs Afternoon	90%	O- SE	Slight	30°-36°	Clearing off
Sept. 14th.	Morning	5%	S-SW-W	Med. strong	30°-45°	
	Afternoon	5%-40%	SW- W	Med. strong	43°-35°	
Sept. 15th.	Morning	5%-10%	N.W.	Slight	25°-40°	Sun shining, fair
	Afternoon	30%	N.	Slight	35°	Hazy
Sept. 17th.	Morning	30%-75%	E	Slight	25°-30°	
	Afternoon	---------no observations----------				

TABLE 26

Records of Caribou Seen

Date	Number	Sex & Age	Location	Remarks
1971				
June 2	28	Bulls	Old Crow Flats	Moving North
"	959	Mostly cows and calves	Firth River	" ,grazing
"	94	33 adults,3 calves	Clarence Lagoon	Moving west, 1 calf being born
"	13	-	Between Herschel & Phillip's Bay	-
"	5	-	Between Phillip's Bay and Blow River	-
" 4	18	-	Old Crow survey, Transect 7	Ran at 'plane's approach
"	1	-	-do- " 6	"
"	636	-	-do- " 5	"
"	25	-	-do- " 4	"
"	55	-	-do- " 3	"
"	4	-	-do- " 2	"
"	8	-	-do- " A	"
"	12	-	-do- " B	"
" 6	68	-	Malcolm,Firth, Babbage, Transect 1	"
"	57	-	-do- " 3	"
"	60	5 calves	-do- " B	"
"	21	-	-do- " 4	"
"	10	-	-do- " 10	"
"	40	-	-do- " 5	"
"	94	14 calves	-do- " 6	"
"	13	3 calves	-do- " F	"
"	26	1 calf	-do- " 7	"
"	17	-	-do- " 4	"
"	13	-	-do- " 13	"
"	3	-	-do- " J	"
"	17	-	-do- " 11	"
"	2	-	-do- " L	"
"	15	-	-do- " 13	"
June 18	2759	-	Between Konkagut & Hula Hula River	"
" 11	392	-	Hula Hula cost & Komakuk	"
" 18	758	-	Between Blow & Firth rivers on pipeline	Walking west
"	1045	-	Between Firth & Malcolm Rivers	"
"	1317	-	Between Malcolm River & Komakuk	"
"	803	-	Between Kumakuk & Alaska Line	"
"	2750	-	Between Alaska Line & Kongakut River	"
: 20	6620	-	Between Komakuk & Kangakut River	-

Date	Number	Sex and Age	+	Location	Remarks
June 20	7095	-		Between Kangakut & Jago rivers	-
"	75	-		Between Jago & Sagaranicktok Rivers	-
" 22	12	-		Site 9	-
" 24	2	-		Site 10	-
" 27	1	Adult		Site 12	Lame
"	3	1 adult female, 1 fawn, 1 yearling		Site 12	-
" 29	2	-		"	-
" 30	1000	-		Site 14	Moving out of foot hills
"	3000	-		Mouth of Sadlerachit River	-
"	5000	-		Mouth of Canning River	-
July 4	1	-		Head of Old Woman Creek	-
" 8	4325	-		Nunaluk Spit	Crowded on Spit
" 2	1	Yearling		Site 18	-
" 8	2	-		Jago River	-
" 14	2	-		Malcolm,Firth,Babbage survey, Transect 8	-
" 17	1	Calf		Babbage river	-
Aug. 1	1	Adult		Site 12	Lame
" 3	3	Bulls		NW of Blow River,on coast	-
" 6	17	-		Between Brown Low Point & Flax Man Island	-
"	14	-		Between Flaxman Island & Prudhoe Bay	-
"	2880	-		South of Shingle Point	-
"	2	-		Malcolm,Firth,Babbage survey, Transect 14	-
"	1	-		Malcolm,Firth,Babbage survey, Transect 15	-
" 8	2	-		Old Crow Survey,Transect 7	-
"	3	2 Cows, & 1 Calf		" " " 2	-
" 13	13	1 C 2 Calves		Site 20	Ran from willows in Chandalar
" 14	25	-		East Old John Lake	Moving west
"	320	-		Between Konese River & Monument Creek	Moving west
" 15	3	Adult, 1 male		Site 18	On gravel bay
" 16	1	-		Site 15	-
" 16	3	-		"	Feeding
" 16	3	-		"	"
" 17	1	-		Site 14	-
" 24	11	-		Babbage River	-
Sept.12	12	-		10 miles east of Prudhoe Bay	-
"	9	-		Canning River	-
"	29	-		Inland from Flaxman Island	Feeding
" 7	27	-		1 mile S.E. King Point	-
" 9	40	1 calf		Malcolm,Firth, Babbage survey	-
" 11	36	-		Old Crow survey,Transect 8	-
"	14	-		" " " 7	-
"	15	-		" " " 6	-
"	42	-		" " " B	-

TABLE 27

Records of Moose Seen

Date	Number	Sex and Age	Location	Remarks
1971				
June 4	1	Bull	Transect 7	Stood at plane's approa
"	15	"	Transect 6	" "
"	1	Cow	Transect 5	" "
"	1	Bull	Transect 13	" "
" 8	1	Bull	Lapierre House	Browsing
" 16	2	Bulls	Site 6	
" 24	1	Cow	Crayling Lake	Feeding in lake
"	1	Bull	Old Woman Creek	Feeding in willows
" 29	1	Bull	Malcolm Delta	
July 4	4	Bull	Old Woman Creek	
" 4	2		Site 20	
July 7	2	Bull	Phillip's Bay	
" 8	2	Cow and Calf	Blow River	
"	3	Cow & 2 calves	Blow River	
"	4	2 Cows & 2 calves	West Blow River on North Slope	
"	2	Cow and Calf	Babbage River	
" 18	11	Bulls	Old Crow Flats	
"	2	Cow	Old Crow Flats	
"	4	Cow	" "	
"	1	Calf	" "	
"	1	Bull	Old Crow,Survey Transect 8	
"	3	Bulls	Old Crow Survey Transect 7	
"	1	Bull	-do- Transect 5	
"	1	Cow	-do- Transect 4	
"	2	Cow and Calf	-do- Transect 2	
"	2	Cow and Calf	-do- Transect 2	
"	2	Cow and Calf	-do- " 1	
" 21	1	Bull	Edge Delta NW of Aklavik	
" 28	2	Adult & Calf	Site 9	
Aug. 6	1	Bull	Malcolm,Firth, Babbage transect	
" 8	2	Cow and Calf	Site 10	
"	10	6 Bulls,4 Cows	Old Crow survey, Transect 8	
"	7	6 Bulls,1 Cow	-do- " 7	
"	1	Cow	-do- " 3	
" 14	1	Cow	Grayling Lake	Feeding in lake
" 24	2	Bull	Clarence Lagoon	
" 28	1	Bull	Sans Sault	
"	1	Bull	Malcolm River	Browsing in willows
Sept.11	16	8 Bulls,6 Cows, 2 calves	Old Crow Flats, Transect 7	
"	3		-do- " 6	
	2		-do- " 4	
" 23	3	Cow,Calf & Bull	Tarton Lake	
"	3	Cows	Mills Lake	
" 25	2	Bull & Cow	Slave Lake	

TABLE 28

Incidental Mammal Observations

Date	Species	Number	Sex and Age	Location	Remarks
June 5	Muskrat	2	Adult	Site 1, in pond	Swimming in lake
"	Red squirrel	1	"	" in tree	Sitting in tree
"	Snowshoe hare	1	"	"	Flushed
"	Beaver house	1	-	" in pond edge	
" 7	Snowshoe hare	3		Site 2	
"	Red squirrel	1 (heard)		"	
" 8	Muskrat			" in lake	
"	Moose tracks & droppings			"	
"	Bear sign in ravine			"	
"	Beaver cuttings (old)			near lake	
" 9	Beaver	3	Adult	Site 3	
"	Snowshoe hare	1		"	
"	Red squirrel	2		"	
" 11	Beaver	2	Adult	" 4	
"	Muskrat	1	"	" 4	
" 12	Mouse(dead)	1	"	" 4	
"	Beaver lodge & evidence of recent cuttings			" 4	
" 14	Muskrat	3	Adult	Site 5, in lake	
" 15	"	3	"	" "	Swimming in lake
	Muskrat entrails in lake			" "	
" 16	Muskrat	3	Adult	" "	Swimming in lake
" 17	Snowshoe hare	1	Adult	" 6	
"	Wolf Tracks by Stream				
" 18	Weasel	1	Adult	" 7	
"	Muskrat	1	"	" "	
" 21	Muskrat	2	"	" 8	Swimming in lake
"	Caribou trails besides lake				
" 26	Golden mouse-like creature	1	?	" 11	In sedge
" 30	Fox tracks on gravel spit			" 13	
"	Arctic ground squirrel	1		" 13	Running over plain
"	Fox tracks on spit			" 16	
July 1	Dead caribou - remains covered by bear			" 17	
" 3	Ground Squirrel tracks			" 19	
"	Fox Tracks			" "	

Table 28 (continued)

Date	Species	Number	Sex and Age	Location	Remarks
July 3	Lynx tracks			Site 19	
"	Moose tracks			"	
"	Wolf tracks			"	
" 4	Moose tracks, droppings			Site 20	
"	Old Caribou tracks			"	
"	Snowshoe hare	1	?	"	
"	Wolf tracks			"	
"	Porcupine	1	Immature	"	Hidden under spruce
"	Red squirrel- heard cattering			Site 21	
"	Red squirrel	1	Adult(?)	"	On fallen spruce
"	Ar.ground squirrel	1		Site 20	
" 5	Red Squirrel		?	Site 22	
"	Mouse	1	?	"	
"	Moose tracks	-	-	"	
"	Caribou tracks	-	-	"	
" 9	Muskrat	2	Adult	Site 5	Swimming in lake
" 10	Beaver	2	Adult	Site 4	" "
" 13	Snowshoe hare	2	Young	"	In alders
" 16	Muskrat	1	Adult	Site 3	Swimming in lake
"	Vole	1	?	"	Tall grass by river
"	Red Squirrel	1	Adult	"	In spruce by river
"	Red Squirrel- heard only			"	By river
"	Moose tracks & droppings - fresh	-	-	"	"
"	Bear tracks	--	-	In mud by river	"
" 17	Snowshoe hare	1	Young	Site 2	Running through spruce
"	" "	1	Adult	"	On ground in spruce wood
" 17	Snowshoe hare	1	-	Babbage River	Hopping over tundra
" 18	Beaver lodge	1	-	Transect 4	
" 18	Beaver lodge	1	-	" 3	
"	Muskrat	1	Adult	"	Swimming in lake
" 19	Beaver lodge	1	-	In lake,Sitel	
"	Snowshoe hare	1	Young	Site 1	Flushed; sedges by lake
" 20	Red squirrel	1	"	"	
" 20	"	1	?	"	Heard chattering in spruce
" 20	Snowshore hare	1	?	"	In grass along shor
" 21	"	6	2 Adult, 4 Juvenile	Site 6	Flushed from hiding
" 21	"	1	Baby - 8" long	"	
" 21	"		2 skulls (fresh)	"	
"	"	1	-	"	
"	"	2	Immature	"	
"	"	2	Immature		
"	" (skulls)	2		"	
"	"	1	Adult	"	
" 22	"	2	"	"	

Date	Species	No.	Sex & Age	Location	Remarks
July 23	Arctic Ground Squirrel	2	Adult	Site 7	Under rock
"	" "	1	Young	"	
"	" "	4	Adult	"	Sitting near holes on rocky ridge
"	" ""	5	"	"	" " "
"	" "	2	Adult(?)	"	Sitting, chattering
"	" "	4	"	"	Standing near hole, on tundra
"	" "	7	"	"	On hillside
"	Weasel or ermine	1	Adult	"	Flitting along rocky outc
" 24	Snowshoe hare	2	1 Adult, 1 Young	Site 23	In alders
"	Red squirrel	1	?	"	In spruce
"	Snowshore hare	1	Adult (?)	"	Running through spruce
"	"	3	Adult (?)	"	In willows, alders
"	Lemming	1	?	"	In spruce-alder-willow
" 28	Arctic ground squirrel	2	?	Site 9	Sitting by hole
"	" "	2	Adult (?)	"	" " on hillside
" 30	" "	1	Adult	"	" on rise in ground
"	" "	1	Adult (?)	Site 11	Sitting; tussocky hummock
Aug. 8	Beaver lodge	1		Transect 1	
"	Muskrat	1		" 7	
" 13	Arctic Ground Squirrel	4	Adult	Site 20	Sitting by holes
" 14	Bear tracks	-	-	Site 19	Ground
"	Wolf tracks	-	-	"	"
"	Caribou tracks	-	-	"	"
"	Moose tracks	-	-	"	"
"	Fox tracks	-	-	"	"
"	Muskrat tracks	-	-	"	"
"	Arctic Ground Squirrel	1	Adult	Arctic Village, Alaska	Foraging in tent
"	" "	1	?	"	Ground
"	Bear digging sign	--	-	"	"
" 15	Arctic Ground Squirrel	2	?	"	" - on tundra
"	Caribou	2	Adult	Site 18	Running across tundra
"	Arctic Ground Squirrel	2	Adult	"	Sitting on tundra
"	Ground Squirrel	1	"	"	On tundra
"	" "	3	?	Site 14	Sitting on tundra
.22.	Beaver	1	-	Beaver River	
"	"	2	-	Ramparts	
" 27	Beaver Lodge	4	-	Ramparts	

TABLE 29

Records of fish seen

Date	Species	Number	Sex and Age	Location	Remarks
June 6	White fish	1	12"long; had been stabbed by loon	Site 1	-
" 14	Pike	Number of small ones in lake		Site 5	-
July 3	Grayling	Many	1lb.-2lbs.	Sheenjek River	In river
" 4	Unidentified	Many	-	Site 19	Rising in river
" 5	Grayling	Many	2 lbs.approx.	Coleen River	-
" 9	Pike	Several	12" - 18" long	Site 5	In shall
" 19	Pike	Several	One 10lbs; Several 1 lb.	Site 1	-
Aug. 1	Unidentified minnows	Many	Very small	Site 11	In lake shallows
" 13	Grayling	Several	1-2lbs.	Upper Chandalar	In r r
" 14	"	"	"	Sheenjek River	In river
" 14	"	"	"	Coleen River	"
" 17	"	"	"	Upper Kongakut river	"
" 18	Char or herring	Many thousands	?	Along seashore west of Koma-kuk	Saw many schools am shallows sea
" 28	Arctic Char	Several	2-3lbs	In shallow lagoon, Nunaluk Spit	Caught several in net
" 28	Herring	Several	1-2lbs.	"	"
" 28	Unidentified minnows	Several	2" - 4" long	Nunaluk Spit in lagoon	Dead in shallows
Sept. 12	Unidentified minnows	Many	2" long	Moose channel, Barry's camp	Swimming i shall

APPENDIX I

LOCATION AND VEGETATIVE DESCRIPTION OF GROUND SITES 1 to 24.

Site 1

Site 1 lies in dense spruce forest 16.5 miles southeast of Fort McPherson near the south end of a lake, approximately five miles long by one-quarter mile wide. The low hills surrounding the lake are covered with dense to fairly open stands of spruce. The spruce is quite variable in size. In some burnt-over areas, trees are only 6 to 8 feet high. Other areas have trees 20 to 30 feet high. The dry hilltips are almost pure stands of spruce with Eriophorum, Ledum and moss as a ground cover. Slopes nearer lakes have a mixture of spruce, birch (dwarf and paper). Dense alders and sometimes willows, border the lakes and streams and the mudbanks near the water are covered by Carex and Equisetum.

Site 2

This is on the tundra plateau above Stoney Creek, fifteen miles southwest of Fort McPherson. It was on a small lake, three-quarters of a mile long by one-eight mile wide, at an elevation of approximately one thousand feet. The surface rose gradually around the lake and then dropped into Stoney Creek to the north and an unnamed tributary of Stoney

Creek to the south. The vegetation was generally lichen tundra grading into tussock-heath tundra on the uplands. The scattered spruce and dwarf birch rapidly changed into spruce forest on the steep slopes above the creeks. Dwarf birch and alder surrounded the lake and a heavy belt of spruce-birch occurred on the north bank.

Site 3

Site 3 was located three-quarters of a mile south-west of Lapierre House on the east bank of the Bell River at an elevation of one thousand feet. The river was from fifty to seventy-five yards wide at this point, with a narrow belt of alder and spruce growing on the alluvial plain near the river. Further back, the surrounding area was open spruce sphagnum bog dotted with small lakes and sloughs.

Site 4

Site 4 was located 20.5 miles east-northeast of Old Crow on a lake approximately one half mile long by one-quarter mile wide at an elevation of one thousand feet. The area was generally flat and poorly drained to the north, but rose into heavy spruce forest to the south with alder and willow understory. Part of the spruce forest was apparently an old burn. The lakes were surrounded by alder, willow and spruce growing in dense clumps in some places.

Site 5

Site 5 was located at Dr. Thomas Barry's cabin on the Old Crow Flats at an elevation of one thousand feet. The cabin is situated on an arm of a large lake. The area was generally poorly drained with open spruce forest and a willow-birch-alder understory that grew in dense stands along the lakes.

Site 6

Site 6 was fourteen miles southwest of Aklavik on Husky Channel of the Mackenzie Delta at an elevation below one hundred feet. The land sloped gradually across a narrow tundra plain, to the foothills of the Richardson Mountains where it rose steeply. The alluvial area along Husky Channel was dense spruce, alder, and willow, but quickly graded into dense brush, then tussock-heath tundra, as the land rose.

Site 7

Site 7 was located twenty-eight miles northwest of Aklavik at an elevation of about one hundred feet. It was situated on a small lake approximately two-thirds of a mile long. The land rose gradually around the lake with the exception of a steep rocky outcrop on each side at the south

end of the lake. Several small streams drained northeastward into Cache Creek. The general vegetation type was tussock-heath tundra with dwarf birch and willow growing along the lake and stream edges. Barren lichenous rock occurred on the two outcrops.

Site 8

Site 8 was located eleven miles south-southeast of Shingle Point on a lake one mile long by half-mile wide, at an elevation of two hundred feet. The lake was situated approximately one and a half miles east of Blow River on a relatively flat area of tussock-heath tundra. The lower areas around the lake were sedge-grass marsh; sparse dwarf birch and willow grew along the lake edge.

Site 9

Site 9 was located twenty-eight miles south-southeast of Herschel Island on the delta of the Babbage River. It was on an irregularly shaped lake about one mile long and wide, with a peninsula protruding nearly across it in the middle. The lake is about two miles south of the Babbage River's exit into Phillip's Bay. The upper areas were tussock-heath tundra with sedge-grass marsh in the poorly drained areas. The delta flats were alluvial-sedge willow grading into brackish-sedge willow.

Site 10

Site 10 was split into two parts: one was Nunaluk Spit, twenty-one miles west of Herschel Island, and the other part was on a barrier beach island approximately eight miles southeast of there. The first part, Nunalak Spit, was connected to land at its western end at the mouth of the Malcolm River. The delta area of the Malcolm was brackish sedge-willow. The second part was completely surrounded by water and had little vegetation. Both the Spit and the island had a large amount of driftwood deposited upon them.

Site 11

Site 11 was located eighteen miles southwest of Herschel east of the Firth River, on a lake one mile long by one-third mile wide. The area around the lake was undulating tussock-heath tundra with sedge-grass marsh in the lower poorly drained areas. Dwarf birch grew in sparse clumps around the lake edge.

Site 12

Site 12 was located sixteen miles west of Komakuk Beach at Clarence Lagoon. Clarence Lagoon has a vegetated spit starting at the northeast corner and extending northwest. The vegetation along the edge of the lagoon is brackish sedge-willow and sedge-grass marsh.

Site 13

Site 13 was split into two parts, the first part was Siku Point, on the twenty-mile barrier beach that extends from the Kongakut River to Demarcation Bay. It has a little grass on it, but is mostly gravel and much driftwood. The second part was on the mainland on the left channel of the Kongakut River. It was alluvial willow-shrub.

Site 14

Site 14 was located twenty-four miles southeast of Nuvagapak Point Tower, on the Kongakut River at an elevation of approximately four hundred feet. The transects are on the west side of the river in tussock-heath tundra mixed with sedge-grass marsh. Stunted willows grow along the river bank and in depressions of small streambeds.

Site 15

Site 15 was located thirty-four miles southwest of Nuvagapak Point Tower on the Jago River at an elevation of approximately six hundred feet. The transects were run on both sides of the Jago River in tussock-heath tundra and sedge-grass marsh.

Site 16

Site 16 was two and a half miles souteast of Brown Low Point Tower on a gravel bar about eight miles long. The transects were run on the most westward three miles of the strip that was not connected to land. There was no vegetation and very little driftwood.

Site 17

Site 17 was located seven miles southwest of VABM 238 (May) on the east bank of the Canning River at an elevation of approximately four hundred feet. The transects were run on tussock-heath tundra, mixed with sedge-grass marsh. Dwarf birch and willow occurred in scattered clumps.

Site 18

Site 18 was twenty-file miles southeast of VABM 37 on the Kadleroshilik River at an elevation of approximately sixty feet. We ran our transects on the east side of the Kadleroshilik River directly across from the gravel airstrip there. The area was sedge-grass marsh and river-tundra with sloughs at the edge of succeeding steppes in the river terrace. Frost polygonal ridges were evident in some areas, as well as a few potholes and lakes.

Site 19

Site 19 was located on the Old Woman Creek six miles west of Table Mountain at an elevation of 2,200 feet. The transects were run on the south bank which was willow on the alluvial plain grading into tundra and sedge-grass marsh. Several small lakes were in the area.

Site 20

Site 20 was on the east bank of the Chandalar River across from the mouth of Cane Creek. There was dense willow and scattered spruce along the stream banks, quickly giving way to scattered spruce on the dry tundra uplands.

Site 21

Site 21 was located on the Sheenjek River at the mouth of Monument Creek, four miles west-northwest of Grayling Lake at an elevation of approximately 1,500 feet. The vegetation was heavy spruce forest with moss and occasionally horsetails and dense willows and alders along the streams with a large open marshy area that was sedge-grass marsh with Eriophorum hummocks.

Site 22

Site 22 was located on the Coleen River, five miles

upriver of its junction with Strangle Woman Creek at an elevation of about 1200 feet. Transects were run on the east and west sides of the river. The east side was dense willow along the stream, giving way to sedge-grass marsh and tussock-heath tundra away from the river. The west side was dense spruce-willow forest.

Site 23

Site 23 was on the west bank of the west channel of the Mackenzie River approximately 850 miles northwest of Aklakvik. The vegetation here was of three main types, depending on the wetness of the ground: (1) spruce-alder forest, composed of spruces 30 to 50 feet tall with an understory of alder, mosses and Vaccinium; (2) dense alder thickets, occurring in wetter areas than the first type, and composed almost entirely of dense alders 8 to 15 feet high; (3) alder-willow-sedge openings, composed of low-growing (3 to 4 feet tall) alders and willows interspersed with sedges; this was marshy in places and the wettest of the three types. The river channels were bordered by dense willows.

Site 24

Site 24 was on Moose Channel of the Mackenzie Delta, nineteen miles southeast of Shingle Point. It had two types

of vegetation: (1) alder thickets, mainly along the river channels, were generally composed of dense alder (3 to 5 feet tall), occasionally mixed with birch or willow; (2) the tundra areas characterized by scattered alder bushes (1 to 2 feet tall) growing on Eriophorum. Sedges grew at margins of lakes and channels.

NORTHWEST PROJECT WILDLIFE STUDIES

AN ORNITHOLOGICAL STUDY OF ALTERNATE GAS PIPELINE ROUTES IN ALASKA, YUKON TERRITORY AND THE NORTHWEST TERRITORIES

VOLUME II

Prepared for:

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DISCUSSION

Aerial Surveys

Aerial survey has long been used to estimate numbers of waterfowl and other large birds because it is possible to cover large areas in a relatively short time. However, because of variations in visibility caused by changes in sun angle, cloud cover, wind, and vegetative cover, gross trends in population are usually the most that can be gleaned from such surveys. On our own aerial surveys, noticeable trends (increases and decreases) in bird populations were seen (a) in the Old Crow Flats, (b) along the barrier beaches, and (c) on the North Slope, as the summer progressed.

The largest build-up was noticed on the Old Crow Flats between June and July. Many lakes were only open around the edges by the first of June and many of the birds had not reached the Flats by then. Irving (1960) reports bird arrivals there from early May to the middle of June. Another large increase in waterfowl was observed between the July and August surveys. This may have been due to moulting birds moving to larger, safer bodies of water during their flightless period and thus becoming more conspicuous, or to the limitations of aerial survey, or

to a movement into the Flats from outside the area. It is not inconceivable that some of the male sea ducks returning from the eastern breeding grounds filter down to moult in the Old Crow Flats. Irving (1960) thought that the eastward trend of ducks up the Porcupine Valley would lead them to the Mackenzie Valley. The reverse could also be true. Many waterfowl had evidently left by the September survey. Shorebirds were conspicuously absent after August on Old Crow Flats.

Along the North Coast, we were too late this year to observe the spring migration of sea ducks, but it apparently occurred farther out than usual because of a large lead that developed from Barter Island to Cape Parry. This migration begins in late April and moves from west to east along the coast from lead to lead (Barry, 1967), (Livingston, 1970) and involves hundreds of thousands, perhaps millions of birds (Leffingwell, 1919), (Brooks et al., 1971).

The summer build-up of sea ducks along the North Coast occurs after the males have left the breeding grounds (Barry pers. comm.,) and (Brooks, 1915). They flock to the barrier beaches where they find protection from the waves behind the beaches and feed in the shallow lagoons. Here they stay to moult. Oldsquaws were the most common species, except at Herschel Island where they were outnumbered by

thousands of scoters (both surf and white-winged scoters). During heavy seas, the scoters were found in close to the southerly edge of Herschel, but on calm days they were scattered from there to the Firth Delta and Ptarmigan Bay. Later on in the season (probably after gaining flight), they again moved seaward and drifted away from Herschel Island toward Phillips Bay. We did not learn when they made their fall migration. Many oldsquaws were still on the barrier beaches at the time of the September 2 aerial survey, but were gone by September 10. Beginning on September 3 and continuing until camp was removed on the 6th, ground observations at Nunaluk Spit showed a large increase in the numbers of oldsquaws, red-breasted mergansers and unidentified ducks travelling west.

Little is known about sea duck migration along the coast; it involves enormous numbers of birds. Inevitably, this movement will be directly affected by oil or gas exploration, production or shipping. From this summer's work, we know that the barrier beaches from Herschel Island to Prudhoe Bay are used by moulting sea ducks during July and August. They are also used during fall migration in September and during spring migration in May and June.

As on the Old Crow Flats, shorebirds were scarce on the North Coast after the middle of August. Flocks of shorebirds were noticed during the August aerial census,

especially along the barrier beaches and the mud flats of the river deltas. Apparently these were pre-migratory feeding areas for shorebirds after the tundra breeding areas were abandoned. Jaegers also disappeared but there was no evidence of flocking before their departure.

The most spectacular build-up of bird populations in the region was that of snow geese and brant in the fall. Snow geese suddenly appeared on the North Slope on the 15th of August (there was a severe snow storm at Banks Island at this time), and built up to large numbers in the ensuing weeks. More than 100,000 were counted on September 2nd, but this was only the basis of a straight-line survey and no attempt was made to get a complete count. Doubtless they numbered two or three times that figure.

Apparently snow geese travelled to the North Slope to take advantage of ungrazed sedges and berries; they were distributed from the coast to the foothills, some getting as far up the Blow River as Bonnett Lake and others as far west as the Canning River. As the season progressed, numbers of geese decreased; they appeared to retreat back to the Delta. Finally, the geese were driven off the slope by the weather, and those that had not already migrated flocked to the outer Mackenzie Delta. We found them in large numbers from Ellice Island to Richards Island, the majority being around Ellice.

Black brant restricted their feeding activities to the sedge flats bordering the barrier beach lagoons. When they migrated, they followed these lagoons and were never seen very far inland. Unlike snow geese, they did not reverse direction and go up the Mackenzie, but continued westward instead.

The North Slope, from the Canning River to Cache Creek and from the barrier beaches to the mountain foothills, is therefore especially important to snow geese and brant from the middle of August to the middle or end of September.

The Mackenzie valley is an important migration corridor for ducks, geese, swans, shorebirds and songbirds because it forms a natural pathway between the Arctic breeding grounds.

Most of the southern part of the Mackenzie route is heavily forested and, as such, provides its own sound-insulation against human activities in the form of a muffling and a visual-screening effect. Furthermore, because the forest has a higher vegetative productivity than the tundra, the recovery rate from disturbance should be more rapid, particularly if serious attempts are made towards regeneration or vegetation.

Farther south, where the evergreen forest blends into aspen parkland and prairie farmlands, the destruction of wildlife habitat is already conspicuous with the clearing of brush and the building of highways, railroads and pipelines.

GROUND SURVEYS

Information developed by aerial surveys revealed large areas of special importance to concentrations of birds and gave an indication of the periods in which they were most heavily used. However, it was also necessary to do ground survey work in order to identify the smaller and/or less concentrated species that probably compose the majority of the avifauna.

Data from ground surveys are also useful in relating species to their characteristic habitats, and in giving some relative idea of the sizes of populations within the habitats. This information can be used later as baseline material against experimental work to determine the degree of change after some human activity occurs.

Several systems of censusing birds from sample counts taken on the ground have been devised and these are reviewed by Emlen (1971), but none is perfect, and the results from all are subject to some degree of error.

Our censusing method suffered from many of the known difficulties but also had certain advantages: the procedures are simple, the area covered is delineated, the need to guess distances to birds is eliminated, and two observers are able to check each other.

Variables such as weather, time of day, behavior of different species, light conditions, and visibility factors could not be avoided because of the large amount of ground that had to be covered in a relatively short time. They undoubtedly influenced results.

In the first reading of the sites, we found we were encountering many additional species outside our transects that were not on transect. This was because our transects were set up to cover the main types of macro-habitats whereas most of the birds occurred in micro-habitat situations.

An example of this was at Site 2, which was at a small lake surrounded by tussock-heath and shrubby lichen tundra falling off to spruce forest in the deep ravines draining into Stoney Creek. Our first six transects were set up in the tundra and forest areas and only 22 birds of nine identified species were seen. However, it was obvious that the brush surrounding the lake was alive with birds; another transect around the lake roughly comparable in length to two standard transects revealed 55 birds of nine identified species in addition to the waterfowl on the lake.

This was not unique. Again and again it was found that most of the birds in large homogeneous blocks of habitat occur in small pockets or areas where the micro-

habitat changes (the well-known "edge effect"). Ravines, sloughs, burns and mudslides, or any area that suddenly produces a bush in the middle of the tundra or sedges in a forest, is likely to contain more birds of more species than the surrounding homogeneous habitat. This is especially true along water edges. Streams, rivers, lakes, ponds and sloughs all provide conditions along their margins that are attractive to birds. Birds of almost all species appear to be encouraged by diversity of habitats in which to nest especially those related to the water.

This brings us to one of the main problems involved in our site selections. We had to choose areas near water because of the limitations of fixed wing aircraft. If bird populations within one to two miles of water are greater than those farther away, then our figures are biased accordingly. A helicopter would be necessary to reach areas where there are no rivers or lakes.

Quantitative Data in the Ornithological Literature

There are several work reports and publications pertaining in part or whole to the avifauna within our study area. Besides those already mentioned, Sage (1971), Reed (1956), Seale (1958), Dixon (1943), Leffingwell (1919), Anderson (1913), (1915) and (1917), and Bartonek (1969) all contain pertinent information about the avifauna of the

North Slope. Clarke (1944), Hahn and Robinson (1951), Porsild (1943), Stevens and Hahn (1958), Ross (1862), and Godfrey (1965) all contain check-lists and information pertaining to the birdlife found in the Mackenzie Delta, and Smith and Sutton (1955), Williams (1925) and Grinnell (1909) give similar information about birds of the upper Yukon. These publications generally give an annotated check-list of the birds seen, location, behavior, and perhaps references to the type of habitat, but, except from aerial surveys, there is little quantitative information on the comparative densities of species. Sage described the relative densities of nine species of birds in the Ribdon and Lupine Valleys, but most workers referred to various species as "common", "uncommon" or "rare".

RESULTS OF GROUND SURVEYS

As might be expected, the physiographic divisions described by Mollard and Associates (see Fig. 1) for the proposed alternate pipeline routes in the north also reflect broad-scale differences in the vegetative cover and, hence, the character of bird populations. In brief, the ground cover and the birds associated with it, are in large part a reflection of the land forms.

For this reason, in attempting to make a meaningful comparison between the kinds and quantities of birds found along the two alternate routes between Prudhoe Bay and Arctic Red River, we have assembled data from our ground sites into groupings representing the physiographic and vegetative divisions in which they occur.

THE INSHORE ROUTE

The Inshore Route is readily separable into three portions -

(1) Arctic North Slope: Prudhoe Bay east to Alaska/Yukon boundary (Mollard Division VIII).

In this division, we have four sites (18, 17, 15 & 14) that are near, or on the proposed pipeline route. All of these sites are along rivers which are swift and braided

with gravel bars and islands between the channels. The vegetation varies from dwarfed willow and birch on the river banks to tussock-heath tundra on the higher areas. Polygonal ridges and sedge-grass marsh occur in pockets in the less well-drained area. In general, the tundra in this division is better drained than it is in the division to the east.

(2) Arctic North Slope: Alaska/Yukon boundary east to the Mackenzie Delta and south along its western side to the edge of the spruce forest (Mollard Division IX).

In this division we have sites 11, 8, 7 and 6. Sites 11, 8 and 7 are similar in that they occur near lakes situated in tussock-heath tundra and sedge-grass marsh. In general, these sites are wetter than those in Alaska. Dwarf birch and willow grow in patches on the lakeshores, in ravines and other wet areas. Site 6, located on the narrow strip between the Richardson Mountains and the Mackenzie Delta, represents a transition between the spruce and willow of the Delta and the tussock-heath tundra of sites 11, 8 and 7. The spruce forest along Husky Channel grades into dense willow-alder brush and then tussock-heath tundra with dwarf birch and willow in the ravines on the slopes.

(3) Forested region along western margin of Mackenzie Delta south to include the Peel River basin (part of Mollard Divisions VII and X).

In this division we have Site 1 as a representative sample. Site 1 is at a long narrow lake in the dense spruce forest south of Fort McPherson. It lies close to both the Mountain and Inshore Routes near their junction at Arctic Red River. The lakeshore is covered with dense willows and part of the spruce forest is an old burn with smaller trees than on the unburned forest.

Table 30 provides a figure for the number of birds per square mile of each species identified on transects at the sites located on or near the proposed pipeline right-of-way within each of the three physiographic divisions. Bird species identified off transect but not on transect are indicated in the appropriate columns of the Table by the symbol "T" (for "trace"). The final column in Table 30 gives a calculation of the average number of birds per square mile for the full length of the Inshore Route for each species. These figures are obtained for each species by weighting the average number of birds per square mile for that species in each of the three physiographic divisions in relation to the number of linear pipeline miles within that division and then calculating an average for the total length of the Inshore Route, based on a summation of these three weighted averages.

Taking the length of the Inshore Route line to be approximately 433 miles, a multiplication by 433 of the figures given in column 4 of Table 30 will give a rough approximation of the number of birds of each species living for all or part of the summer within half a mile on either side of the Inshore Route - roughly 450,000 birds in all, according to our calculations. This does not include, however, late summer visitors such as flocks of snow geese.

Table 30 indicates that the Inshore Route can be assumed to have a quite high density of summering birds, most of them breeding in the area. This density is about 1050 birds per square mile. Songbirds make up 74% of the total, with one abundant species, Lapland longspur, accounting for 35% of all birds and common redpolls another 16%. Four species of sparrow (savannah, tree, white-crowned and fox) contribute about 11%, and other songbirds (including "unidentified") about 12%.

Shorebirds (4 species of plovers, 10 species of sandpipers and 2 species of phalaropes) nest extensively on the tundra at a density of about 166 birds per square mile. They account for 16% of all birds and are, therefore, an important component of the total bird population.

Ptarmigan, resident through most or all of the year, average 40 per square mile in summer (3.8%) and form an important food source for man and other predators, such as gyrfalcons.

Gulls and terns are scarce along the Inshore Route, but jaegers (25 per square mile, 2.4%) are conspicuous during the summer nesting season.

Nine species of ducks were recorded, mostly off transect on adjacent lakes. Pintail, (lesser) scamp and oldsquaw were the commonest. Density on transect was 21 ducks per square mile (2%).

No geese were found on transects, but a few whistling swans were seen in the vicinity of two sites.

Owls, hawks and eagles were scarce in 1971.

Loons (2 per square mile on transect) indicated the presence of a nesting pair on most suitable lakes in the summer.

In terms of numbers, species that would bear the brunt of disturbance caused by the construction and operation of a gas pipeline would be the Lapland Longspur (375 per square mile), common redpoll (167 per square mile) and the various shorebirds, particularly American golden plover, pectoral and semipalmated sandpiper, buff-breasted sandpiper and northern phalarope, and willow ptarmigan.

The Lapland Longspur is a common bird, widely distributed on a circumpolar basis. One might guess, however, that on the basis of our calculations, the north slope might be the heart of the breeding range, with greater densities than elsewhere. Certain it is that the snow bunting, a more northern breeder but often found in association with the Lapland Longspur elsewhere, is present only in very small numbers along the coastal plain of the North Slope.

American golden plovers and pectoral sandpipers do not exist in large numbers anywhere; the western portion of the plain (Division 8) may be of particular importance to them and to the buff-breasted sandpiper, a comparatively rare bird, as nesting territory.

The status of the common redpoll is uncertain, but there may be other areas across the north where it is equally common. The same can be said more certainly for willow ptarmigan, northern phalarope and semipalmated sandpiper, all of which are quite numerous and well distributed through the arctic and sub-arctic.

The Mountain Route

The Mountain Route crosses much more varied terrain. This is reflected in the increase in number of physiographic divisions from three to eight (Mollard Division I to VII and part of X).

(I) Lower Coastal Plain, from Prudhoe southeast to vicinity of Shaviovik River. Poorly drained tundra. We established no sites in this division in 1971, but expect it to be similar in birdlife to site 18, somewhat nearer to the coast.

(II) North Slope Foothills, from Shaviovik River (at 300 feet) to beyond the Canning River exit from the Brooks Range (about 2,500 feet). The foothills are much better drained and somewhat more severe climatically and hence the birdlife can be expected to differ. We established no camp in this division in 1971 and require a survey in 1972, as existing data are very scanty.

(III) Brooks Range, from Canning River canyon across the height of land to beyond the east fork of the Chandalar River. Vegetation is sparse up to the south slope, where tundra blends into brush. In the vicinity of the Chandalar River, the valley supports an extension of spruce forest. Site 20 is situated on the Chandalar River.

(IV) Foothills south of Brooks Range, from a point east of the Chandalar River to the Alaska/Yukon border. Each of our three sites in this division (19, 21, and 22) is similar in that each occurs near a river that drains the southern slopes of the Brooks Range into the Porcupine River. These sites were established by using a light aircraft with oversize wheels, as was site 20 in the previous division; this tended to limit our choice of habitats. The river valleys support an extension of the spruce forest protruding into the surrounding higher tundra. High, dense willows grow on the flood plains near the rivers, grading into dense spruce forest, and then brush and tundra as the land rises from the rivers. Most of our transects were confined to the brush and spruce forest and to circuits around small lakes.

(V) Old Crow Basin, from the Alaska/Yukon border to the junction of the Bell and Porcupine Rivers. Sites 5 and 4 are within the olf Crow Flats, an area of many lakes, sloughs and bogs. The proposed pipeline right-of-way lies south of the Flats, in somewhat drier terrain, closer to the Porcupine River.

(VI) Richardson Mountains, from the Bell River to the Yukon/NWT boundary. Site 3 is on the Bell River. Dense willow-alder brush grows on its banks, behind which is a narrow belt of spruce giving way to the upper tundra areas. Several small lakes are also at this site. We were not able to establish a site in the upper tundra of the Richardson Mountains, and this remains to be done, although there is some qualitative information about birds of the area in Stirling (1966), Stevens and Hahn (1958), and Godfrey (1965).

(VII) Glaciated Peel Plateau, from the Yukon/NWT boundary to the west side of the Peel River. Site 2 is on the tundra plateau 15 miles southwest of Fort McPherson, at a small lake. The vegetation is largely shrubby lichen tundra grading into tussock-heath on the uplands. Scattered spruce and swarf birch on the upper slopes grade into spruce forest along the creek systems.

(X) Northern Section of the Mackenzie Plain. The vegetation for Site 1, close to the convergence of the two proposed pipeline routes, was described under "Inshore Route" above.

In Table 31 we have set forth in statistical form our data from ground sites established on or near the

Mountain Route in 1971. As in Table 30, these are grouped according to the physiographic divisions in which they fall.

We have no site in Division I, but for the time being have entered data from Site 18 (also used in Table 30) as being representative.

We have no data as yet for Division II, the north-facing foothills. Site 20 on the Chandalar River falls within Division III, but there is a need for information from the upper section of the Brooks Range. From Irving's (1960) report from the Anaktuvik Pass and Kessel and Schaller's (1960) notes on the Upper Sheenjek, a qualitative picture of species likely to be found in this habitat can be assembled. Species in Table 31 likely to be found in this division but not represented from site 20 are indicated by the symbol "p" (for "probable"); in addition, the following four species, not listed in the table, should also be considered as "probables": Baird's sandpiper, horned lark, Townsend's solitaire, and gray-crowned rosy finch.

In Division IV, Sites 19, 21 and 22 cover similar river-bottom situations but fail to give coverage of the plateaux in between, a deficiency that should be made good in 1972.

Division V is represented for the time being by Sites

5 and 4 in the Old Crow Flats, in areas reflecting a much richer and more varied waterfowl population than would be expected at sites established directly on the route to the south. It was highly important to obtain data from the Old Crow Flats but one or two new sites in the Division are needed to provide a more specific reflection of bird populations along the right-of-way.

Division VI requires additional data from the tundra uplands of the Richardson Mountains. Stirling (1966), Stevens and Hahn (1958), and Godfrey (1965) report sharp-tailed grouse, spruce grouse, horned lark, Townsend's solitaire, tree sparrow, golden-crowned sparrow, sharp-shinned hawk, and wheatear as occurring in the upper area of the Porcupine Valley and Richardson Mountains. Probably water pipit should be added to this list.

The following are comments on the data presented in Table 31.

1. Songbirds comprise 34 out of 80 (42%) species identified along the Mountain Route to date and hold a wide margin in terms of numbers over all other species. Sparrows (4 spp.) and juncos are common; in the wooded and brushy areas warblers (6 spp.) are also common and thrushes are quite prominent, with robins and gray-cheeked thrushes the most numerous. On the south slope. the Lapland longspur, so abundant on the Inshore Route, is notably absent, though we may find it on the high tundra not yet examined. Gray jays are present in numbers (5.6 to 17.4 per sq. mile) on the south slope.

2. Ducks are abundant on the Old Crow Flats but scarce elsewhere.

3. Among the sandpipers, lesser yellowlegs (24.3 to 60 per sq. mile) and common snipe (15.9 to 23 per sq. mile) are common south of the Brooks Range, and solitary, spotted and semipalmated sandpipers present here and there in smaller numbers.

4. Willow ptarmigan are quite plentiful (5.8 to 46.7 per square mile), but hawks, eagles, and owls were very scarce in the areas checked to date.

5. Loons are present in small numbers in the Old Crow Flats but rather scarce elsewhere.

6. Jaegers are virtually absent on the south slope exept perhaps on the high tundra; mew gulls and Bonaparte's gulls occur in the Porcupine valley and are quite common in the Old Crow Flats.

In composite, the following bird species might be considered as most representative of the Mountain Route south and southeast of the Brooks Range. Figures in parentheses represent a range of birds per square mile. Willow ptarmigan (5.8 to 46.7), lesser yellowlegs (24 to 60), least (10-15) and semipalmated (13) sandpipers, common snipe (8-23), northern phalarope (30), mew gull (6-17), arctic tern (5-13), gray jay (7-17), robin (13-61), gray-cheeked thrush (16-66), water pipit (103 at Site 20), yellow wagtail (15 at Site 20). Bohemian waxwing (8-39), 5 species of warblers: yellow (27-36), myrtle (7-33), blackpoll (5-60), northern waterthrush (13-35), Wilson's (10); pine grosbeak (7-10). Common redpolls (32-147) and tree sparrows (15-174) are common; white-crowned sparrows (6-58) are well distributed; Smith's longspur 23 at Site 19 was rather a surprise.

A check of the high country will undoubtedly add several species as yet unrecorded by us but, because of the low vegetative productivity of this upper tundra, population levels are likely to be lower or at least no higher than at sites already established at somewhat lower

levels. Perhaps most significant would be the finding of eyries of golden eagles, gyrfalcons, and the now critically endangered peragrine falcon. It is possible that a small number of these species nest close to the route at the upper levels of the Brooks Range and also possibly in the Richardson Mountains.

The North Coast

No comparison of the bird populations along the alternate pipeline routes between Prudhoe Bay and the Mackenzie Delta can be valid in itself without a review of the bird populations that make use of the North Coast for a variety of reasons from late spring to late fall. In our opinion, they are of far greater economic, scientific and aesthetic importance than the combined bird populations of the two routes under consideration. Therefore any activity resulting from the construction and operation of a gas pipeline on either of the proposed routes that may react unfavorably on them must be given very serious attention.

The North Coast is a two-way flyway for migrating birds, especially for waterfowl and shorebirds, and their continued existence depends on its preservation in a form that will continue to support and shelter them. It is also a sanctuary for many birds that nest or moult there during the summer.

The chief physiographic features of the coastline that make it so important to birds are: the barrier beaches, the lagoons, the river deltas (fed by a regular flow of fresh water from the mountains) and the flat tundra plain beyond the shoreline. The barriers beaches provide safe places for nesting and resting during the moulting period; the lagoons provide sheltered, ice-free feeding areas for adults and young; the river deltas are vital feeding areas; and the tundra provides nest-sites close to the shore. Portions of the coast that do not have barrier beaches, peninsulas, lagoons, and deltas are therefore not as important to birdlife as those that have.

In 1971, we established ground sites at five locations along the North Coast and at two locations on the western side of the lower Mackenzie Delta. Summarized results, in terms of birds per square mile for each species identified on transect, are presented in Table 32 for these two types of habitat. In general terms the table is organized in the same manner as Tables 30 and 31. The period covered ranged from early June to the middle of August. Subsequent camps recorded movement of waterfowl along the shoreline (Table 22).

Table 32 shows that, according to our calculations, bird populations along the coast from Prudhoe Bay to the Blow River are estimated at about 1900 per square mile.

In actual fact, the coastal area heavily used by birds ranged from some distance out to sea from the barrier beaches to half a mile or so inland, so that a square-mile rather than a linear measurement is acceptable if not conservative.

Our estimate of coastal mileage for the above distance (329 miles) did not attempt to follow minor convolutions of the shoreline, so that an estimate of total bird numbers based in the figure 329 might be low (329 x 1929 = 634,641). On the other hand, however, our camp sites tended to be located in places well frequented by birds and were probably above average for the coast as a whole in this respect.

Grouping the birds into certain categories, we obtained:

waterfowl	32%
shorebirds	31%
gulls and terns	18%
Lapland longspurs	14%
others	5%

Naturally enough, waterfowl are a very important part of the coastal bird population in summer. Ducks (20%) at 394 per square mile, consisted largely of oldsquaw, pintail, and eiders. There was a large representation of snow geese (11%, 220 per square mile), probably non-breeders

and moulters. There was also a small number of Brant and whistling swans.

Shorebirds are an equally important component, at 593 per square mile. (American golden plover, 114 per square mile; sandpipers, 132 p.s.m.; phalaropes, 215 p.s.m.; unidentified shorebirds, 131 p.s.m.).

The nesting colonies of glaucous gulls (6%) and arctic terns (12%) are reflected in the figures of 118 p.s.m. and 232 p.s.m. respectively. Together, they represent about 18% of the birdlife along the coast at this period. Jaegers (33 p.s.m.) are slightly more common than along the inshore route (25 p.s.m.).

In contrast to the pipeline routes, songbirds comprise only 15% of the bird population along the coast, and are represented almost entirely by just one species, the Lapland longspur, at 267 p.s.m. (13.9%). Snow buntings are relatively scarce (0.7%) and other songbirds rare.

Loons, chiefly red-throated (13 p.s.m.) and arctic (10 p.s.m.), were relatively common compared to inland.

ADDITIONAL OBSERVATIONS

The breeding season is short; there was no evidence that birds renested or even had time to raise more than one brood. It is clear that the period of June and July is especially critical to breeding birds. Waterfowl take longer to raise their broods than do shorebirds and songbirds.

Brood counts from aerial surveys are difficult for many birds (1), ducklings dive or hide in the reeds at the approach of a plane or cluster in a tight compact group, and (2), some species such as scoters tend to form nurseries of several broods in one group.

The tendency of eiders, gulls and terns to nest on barrier beaches is an interesting phenomenon discussed by Koskimes (1957). Certainly, more attention should be paid to the characteristics of those beaches that attract both nesting and moulting birds. For instance, we noticed that, along the shores, birds tended to nest on small islands. Peninsulas had few or no nesting birds. This is probably a response to fox predation. Furthermore, eiders seemed to prefer driftwood to nest around, while gulls and terns appeared to prefer the lower, wave-swept beaches unused by eiders.

Effects of Disturbance on Birds

Noticeable disturbance of birds was from two main sources:

1. The mere human presence.
2. Operation of machinery.

Most of the smaller species of birds paid little attention to us as we walked the transects, flying only far enough to stay out of the way. Larger birds, however, were more wary: we drove every swan ahead of us on the Babbage River Delta. Ducks and loons would not come near our lakeshore camps until everyone was quiet inside the tents. Cranes were especially wary and difficult to approach, as were flightless ducks. Moulting sea ducks along the barrier beaches swam away long before a man approached closely. We do not know how our disturbance to the eider, gull and tern colonies affected their breeding success. More has to be learned about the degree of human presence that birds tolerate.

In terms of mechanical devices, airplanes seem to cause the most noticeable effects on birds, but these were difficult to measure. Almost all large birds would take to wing and dive at a plane's approach. Nesting swans and geese sometimes make interspecific aggressive displays against airplanes; gulls and terns would dive at aircraft when the breeding territory was invaded. We have not yet

determined what repeated exposure to airplane disturbance would do to breeding birds. Moulting birds along the barrier beaches would scurry and dive into the water as a plane approached, in obvious panic. We do not know what long-term effect a repetitive disturbance of this sort would have on the birds. Perhaps the most spectacular effect of airplanes occurred on the flocks of snow geese feeding on the north slope in early fall. Planes flying low several miles away caused them to take to the air. Once we followed a helicopter flying at approximately 1,000 feet along the north coast shoreline. Our combined noise was enough to cause snow geese to fly at a distance of two to three miles. With the increase in air traffic which is likely to accompany the construction and maintenance of a pipeline, it is conceivable that the North Slope could lose its attractiveness to snow geese as a pre-migratory feeding area. Because of cloudy conditions we were unable to fly high enough (above 2,000 feet) not to disturb these geese so we do not know what the acceptable altitude limits are for this species. At all heights below 2,000 feet, we disturbed geese ½ to three miles away. Wind direction and speed probably affect the disturbance distance of aircraft.

Effects of Disturbance on Mammals

All grizzlies seen always appeared to be afraid of airplanes. They either ran at the approach of the plane or were already running when first seen. They seemed to be in panic although they did not usually run far after we left. Several (undoubtedly the same animals) were seen not far from their original location several hours later. Others would be gone when we returned. Two sows with cubs turned and tried to fend off the plane with their paws. Whether increased air traffic and "buzzing" of grizzlies will force them to abandon much of the range covered by the pipelines is not known, but the animals have clearly been severely harassed already. Minimum height regulations for aircraft should be enforced until it can be shown that aircraft do not disrupt their normal activities. The same applies to wolves - every wolf spotted from the air was already running when first seen.

Caribou reacted differently to airplanes as the season advanced. It was easy to force them to run when they were migrating in June, but later on they paid little attention, even to "buzzing". On one occasion some lying down were "buzzed" three times without causing them to rise. This was in early September.

Moose were very phlegmatic about airplanes and paid little attention to a landing on the same lake. They seemed more inclined to run from the airplane's approach later in the summer, but this was only an impression.

Dall sheep would stare in curiosity as an airplane approached and then scatter in every direction. Continued harassment of this species would probably cause disruption of bands and abandonment of portions of their range. The animals do not appear to receive protection from molestation.

Four musk-oxen seen on the Jago River showed little fear of airplanes, although they did bunch up as the plane approached. They also showed little fear of man, and ran only a few hundred yards when approached, then continued eating.

CONCLUSIONS

On the Mountain Route, although the Brooks Range and Richardson Mountains have not yet been ground-surveyed, it appears that the Old Crow Flats may be the only major area which is critical to large populations of birds. It is an important breeding area for songbirds, shorebirds, and great numbers of waterfowl. It is used as a moulting area by many waterfowl; some ducks move there for that express purpose. The Flats may also be a connecting link between the Mackenzie Valley and the Porcupine Valley migration corridors. Situated as it is in a 'bowl' between the surrounding mountain ranges, and sustained as it is by water originating in these ranges, the Flats environment may be expected to be influenced to at least some extent by construction activities on the Mountain Route.

The entire North Coast is of extreme importance at various times of the season to very great numbers of birds. Only the autumn goose concentrations are directly on the proposed pipeline route, with heaviest bird densities concentrated along the coast. As far as birds nesting on the pipeline right-of-way are concerned, much would depend on how construction activity was programmed. It seems clear, however, that a pipeline along the Inshore Route can be expected to have more or less profound effects on coastal

waterfowl habitat if construction should alter the flow of the several rivers draining northward into the Arctic Ocean, and which to such a great extent sustain that habitat.

Aerial surveys confirmed that the North Coast shoreline is a spring and fall migration route for large numbers of waterfowl (probably millions), loons, and shorebirds. The coastal barrier beaches and lagoons are used in the summer as moulting areas for large numbers of sea ducks, and in the fall as staging areas for ducks, geese, loons and shorebirds; the North Slope from the Blow River to the Canning River is used as a staging area in the fall by several hundred thousand snow geese and lesser numbers of white-fronted and Canada geese.

In summary:

1. From the ornithological point of view, the Mountain Route would be the less hazardous. No route should be chosen which could impair the North Coast habitat.

2. Construction and other activities north of the Arctic Circle should be curtailed between May and September. Especially critical are the nesting months of June and July, along both proposed routes, and on the North Slope from mid-August to mid-September when snow geese are grazing preparatory to migration.

3. "Buzzing" of birds and other wildlife should be prohibited.

4. The route selected should run as much as possible through large, homogenous blocks of habitat. Where the crossing of transitional zones is unavoidable, such crossings should be minimal (eg. crossing a stream at right angles rather than following its course).

5. Open water, marshy areas and other soft ground should be avoided.

6. Transportation routes should detour around such critical areas as the Old Crow Flats, which must be off-limites to everyone save the native people. Also off-limits should be such critical sites as Phillips Bay, Herschel Island, Nunaluk Spit, Clarence Lagoon, Demarcation Bay, Beaufort Lagoon, Clarence Bay, Flaxman Island, and the barrier beaches to the west.

7. Studies should be undertaken to determine the possible effects of various types of disturbance on arctic wildlife, on sites between the Babbage and Malcolm Rivers and south of and adjacent to the Old Crow Flats.

8. Areas of the Mountain Route not studied in 1971 should be examined in 1972.

TABLES

TABLE 30

DENSITY OF BIRD POPULATIONS ALONG INSHORE ROUTE

(1) Division VIII, Prudhoe Bay to Alaska/Yukon border

(2) Division IX, Alaska/Yukon border to 135° W. Long.

(3) Division X, 135° W. Long. to convergence, Artic Red River

(4) Inshore Route to convergence

Site distribution: VIII, 18, 17, 15, 14;

IX; 11, 8, 7, 6;

X; 1.

Est'd. Pipeline mileage: VIII, 175 miles, IX, 225 miles; X, 33 miles; total, Inshore Route, 433 miles.

"T" (for "trace") indicates species seen at one or more sites but not on transects.

TABLE 30

	Division VIII Birds per square mile	Division IX Birds per square mile	Division X Birds per square mile	Inshore Route Birds per square mile
1. Common Loon			T	T
2. Yellow-billed Loon	T			T
3. Arctic Loon		2.8	T	1.5
4. Red-throated Loon	T	1.4		0.7
5. Unidentified Loons	T	T		T
6. Red-necked Grebe			T	T
7. Whistling Swan		T	T	T
8. Canada Goose				
9. Black Brant				
0. White-fronted Goose				
1. Snow Goose				
2. Mallard		T	T	T
Pintail	8.4	1.4		4.1
4. American Widgeon		T	5.6	0.5
5. Shoveler				
6. Blue-winged Teal				
7. Green-winged Teal			T	T
8. Canvasback		T		T
9. Greater Scaup				
0. Lesser Scaup				
1. Scaups, spp.		11.2	5.6	6.3
2. Common Goldeneye				
3. Barrow's Goldeneye		T		T
4. Common Eider				
King Eider				

TABLE 30

		VIII	IX	X	Insho Route
26.	Oldsquaw	2.8	14.0	T	8.4
27.	White-winged Scoter			T	T
28.	Surf Scoter				
29.	Red-breasted Merganser				
30.	Unidentified Waterfowl		1.4		0.7
31.	Goshawk				
32.	Marsh Hawk		T		T
33.	Rough-legged Hawk		T		T
34.	Swainson's Hawk	1.4			0.6
35.	Unidentified Hawks		2.8		1.5
36.	Golden Eagle	1.4	1.4		1.3
37.	Gyrfalcon				
38.	Unidentified Falcons		T		T
39.	Willow Ptarmigan	7.0	23.8	11.2	16.1
40.	Rock Ptarmigan	29.5	14.0		19.3
41.	Unidentified Ptarmigan	11.2			4.5
42.	Sandhill Crane				
43.	American Golden Plover	65.7	12.6		33.2
44.	Black-bellied Plover	4.2			1.7
45.	Semipamated Plover	5.6			2.3
46.	Ruddy Turnstone	7.0			2.8
47.	Upland Plover		5.6		2.9
48.	Buff-breasted Sandpiper	9.8			4.0
49.	Solitary Sandpiper			5.6	0.7
50.	Spotted Sandpiper			16.8	1.3

TABLE 30

		VIII	IX	X	Inshore Route
51.	Wandering Tattler				
52.	Lesser Yellowlegs		1.4	44.8	4.3
53.	Stilt Sandpiper		7.0		3.6
54.	Long-billed Dowitcher				
55.	Pectoral Sandpiper	61.6	18.2		34.5
56.	Dunlin	4.2			1.7
57.	Sanderling				
58.	Baird's Sandpiper				
59.	Least Sandpiper				
60.	Semipalmated Sandpiper	40.7	16.8		25.2
61.	Common Snipe		1.4		0.7
62.	Red Phalarope	5.6			2.3
63.	Northern Phalarope	19.6	35.0	22.4	27.9
64.	Unidentified Shorebirds	5.6	26.6	11.2	17.0
65.	Parasite Jaeger	18.2	7.0		11.0
66.	Pomarine Jaeger				
67.	Long-tailed Jaeger	11.2	11.2		10.3
68.	Unidentified Jaegers	5.6	2.8		3.8
69.	Glaucous Gull	1.4			0.6
70.	Herring Gull			5.6	0.5
71.	Mew Gull			T	T
72.	Bonaparte's Gull				
73.	Sabine's Gull	T			T
74.	Unidentified Gulls			5.6	0.5
75.	Arctic Tern	4.2	4.2	5.6	3.9

TABLE 30

		VIII	IX	X	Inshore Route
76.	Short-eared Owl	4.2	1.4	T	2.4
77.	Snowy Owl				
78.	Belted Kingfisher		T		T
79.	Yellow-shafted Flicker		7.0		3.6
80.	Northern Three-toed Woodpecker		1.4		0.7
81.	Say's Phoebe				
82.	Traill's Flycatcher		7.0		3.6
83.	Olive-sided Flycatcher				
84.	Cliff Swallow		14.0		7.3
85.	Tree Swallow			T	T
86.	Gray Jay		11.2	5.6	6.2
87.	Common Raven	1.4	2.8		7
88.	Robin		15.4	44.8	12.4
89.	Varied Thrush		1.4		0.7
90.	Wheatear		9.8		5.1
91.	Hermit Thrush				
92.	Swainson's Thrush				
93.	Gray-checked Thrush		1.4	50.4	4.8
94.	Ruby-crowned Kinglet				
95.	Water Pipit	1.4			0.6
96.	Yellow Wagtail	2.8	11.2		6.9
97.	Bohemian Waxwing			39.2	3.1
98.	Northern Shrike	T			T
99.	Orange-crowned Warbler		2.8		1.5
100.	Yellow Warbler		1.4	5.6	1.2

TABLE 30

		VIII	IX	X	Inshore Route
101.	Myrtle Warbler		1.4	11.2	1.6
102.	Blackpoll Warbler		4.2	67.2	7.6
103.	Northern Waterthrush		1.4	28.0	3.0
104.	Wilson's Warbler		21.0	5.6	11.4
105.	Red-winged Blackbird			T	T
106.	Rusty Blackbird		T	T	T
107.	Brewer's Blackbird			T	T
108.	Pine Grosbeak			5.6	0.5
109.	Hoary Redpoll		2.8		1.5
110.	Common Redpoll	164.0	170.8	168.0	168.6
111.	Pine Siskin				
112.	Savannah Sparrow	9.8	51.8		30.9
113.	Slate-colored Junco		1.4	44.8	4.3
114.	Tree Sparrow	8.4	75.6	56.0	47.2
115.	White-crowned Sparrow		36.4	5.6	19.4
116.	Fox Sparrow		28.9	16.8	16.4
117.	Lapland Longspur	592.0	260.4		375.0
118.	Smith's Longspur				
119.	Snow Bunting				
120.	Unidentified Songbirds	11.2	78.4	5.6	45.7
	Total Birds per square mile	1127	1047	694.4	1057

TABLE 31

DENSITY OF BIRD POPULATIONS ALONG MOUNTAIN ROUTE

Physiographic Division	I	II	III	IV	V	VI	VII	X	Total
Est'd pipeline mileage	48	70	58	114	72	53	40	32	487
Ground site #	18	-	20	19,21,22	5,4	3	2	1	

"T" (for "trace") indicates species seen at one or more sites but not on transects

"P" (for "probable") indicates probably occurs, according to the literature.

TABLE 31

	I	II	III	IV	V	VI	VII	X	Total Mountain Route
1. Common Loon					T			T	
2. Yellow-billed Loon									
3. Arctic Loon	T		P	T	2.3	T	T		
4. Red-throated Loon					2.3				
5. Unidentified Loons	T				2.3	5.8			
6. Red-necked Grebe								T	
7. Whistling Swan					T			T	
8. Canada Goose					4.6				
9. Black Brant									
10. White-fronted Goose									
11. Snow Goose									
12. Mallard					6.8	T		T	
13. Pintail	T			6.7	11.4	T	T		
14. American Widgeon				T	59.0	T	T	5.6	
15. Shoveler					2.3				
16. Blue-winged Teal						T			
17. Green-winged Teal				T	2.3	T	T	T	
18. Canvasback							T		

Table 31

	I	II	III	IV	V	VI	VII	X	Total Mountain Route
19. Greater Scaup									
20. Lesser Scaup									
21. Scaups, spp.				T	15.9	T	T	5.6	
22. Common Goldeneye						T			
23. Barrow's Goldeneye									
24. Common Eider									
25. King Eider									
26. Oldsquaw	10.5				6.8	T	T	T	
27. White-winged Scoter					15.9		T	T	
28. Surf Scoter					6.8	T	T		
29. Red-breasted Merganser			P	T			T		
30. Unidentified Waterfowl					22.8				
31. Goshawk			P	3.4					
32. Unidentified Accipiters	T			3.4	2.3				
33. Marsh Hawk			P	T					
34. Rough-legged Hawk			P						
35. Swainson's Hawk									
36. Golden Eagle			T				2.7		

Table 31

		I	II	III	IV	V	VI	VII	X	Total Mountain Route
37.	Gyrfalcon			P						
38.	Willow Ptarmigan	5.3		7.7	46.7	13.6	5.8	13.5	11.2	
39.	Rock Ptarmigan	10.5								
40.	Unidentified Ptarmigan			7.7						
41.	Sandhill Crane									
42.	American Golden Plover	63.2		P						
43.	Black-bellied Plover	15.7								
44.	Semipalmated Plover									
45.	Ruddy Turnstone									
46.	Upland Plover			15.3						
47.	Buff-breasted Sandpiper	31.6								
48.	Solitary Sandpiper				6.7				5.6	
49.	Spotted Sandpiper				3.4			T	16.8	
50.	Wandering Tattler			T						
51.	Lesser Yellowlegs				60.0	34.2	T	24.3	44.8	
52.	Stilt Sandpiper									
53.	Long-billed Dowitcher									
54.	Pectoral Sandpiper	157.0			3.4					

Table 31

		I	II	III	IV	V	VI	VII	X	Total Mountain Route
55.	Dunlin	15.7								
56.	Sanderling									
57.	Baird's Sandpiper									
58.	Least Sandpiper			15.3	10.0	2.3				
59.	Semipalmated Sandpiper	100.0			13.3					
60.	Common Snipe				23.3	15.9	17.4	8.1		
61.	Red Phalarope	21.3								
62.	Northern Phalarope	73.8			30.0	56.9	T		22.4	
63.	Unidentified Shorebirds	5.3			6.7	6.8			11.2	
64.	Parasite Jaeger	26.4				T				
65.	Pomarine Jaeger									
66.	Long-tailed Jaeger	26.4								
67.	Unidentified Jaegers	5.3								
68.	Glaucous Gull	T								
69.	Herring Gull			T			T		5.6	
70.	Mew Gull			7.7	6.7	13.6	17.4	T		
71.	Bonaparte's Gull					56.7				
72.	Sabine's Gull	T								

Table 31

	I	II	III	IV	V	VI	VII	X	Total Mountain Route
73. Unidentified Gulls	T				4.6				
74. Arctic Tern	5.3		T	13.3	6.8			5.6	
75. Short-eared Owl	5.3		P		2.3	5.8	T	T	
76. Snowy Owl									
77. Belted Kingfisher				T		T			
78. Yellow-shafted Flicker			15.3						
79. Northern Three-toed Woodpecker				13.3					
80. Say's Phoebe			T						
81. Traill's Flycatcher									
82. Olive-sided Flycatcher				6.7					
83. Cliff Swallow					T				
84. Tree Swallow								T	
85. Gray Jay			7.7	13.3	11.4	17.4	16.2	5.6	
86. Common Raven	T		T		9.2	T	5.4		
87. Robin			61.5	13.3	20.4	17.4	48.6	44.8	
88. Varied Thrush						1.6	T		
89. Wheatear			P						
90. Hermit Thrush				18.2					

Table 31

		I	II	III	IV	V	VI	VII	X	Total Mountain Route
91.	Swainson's Thrush				10.0			T		
92.	Gray-cheeked Thrush			23.1	16.6	66.0	T		50.4	
93.	Ruby-crowned Kinglet				20.0					
94.	Water Pipit			108.0						
95.	Yellow Wagtail			15.3						
96.	Bohemian Waxwing			7.7	27.6	34.5			39.2	
97.	Northern Shrike									
98.	Orange-crowned Warbler				T					
99.	Yellow Warbler				27.6	36.4	5.8	48.6	5.6	
100.	Myrtle Warbler			7.7	33.2	9.2		18.9	11.2	
101.	Blackpoll Warbler				23.3	63.6		5.4	67.2	
102.	Northern Waterthrush				13.3	36.4	T	T	28.0	
103.	Wilson's Warbler				10.0		11.6	16.2	5.6	
104.	Red-winged Blackbird								T	
105.	Rusty Blackbird				6.7	98.0	29.0		T	
106.	Brewer's Blackbird					11.4			T	
107.	Pine Grosbeak			7.7	10.0	T		2.7	5.6	
108.	Hoary Redpoll									

Table 31

		I	II	III	IV	V	VI	VII	X	Total Mountain Route
109.	Common Redpoll			77.0	147.0	116.0	11.6	32.4	168.0	
110.	Pine Siskin				3.4					
111.	Savannah Sparrow			P	10.0	27.2	11.6			
112.	Slate-colored Junco				6.7		34.8	T	44.8	
113.	Tree Sparrow			15.3	153.0	309.0	174.0	89.1	56.0	
114.	White-crowned Sparrow			15.3	50.0	77.3	58.0	40.5	5.6	
115.	Fox Sparrow			15.3		29.5	34.8	8.1	16.8	
116.	Lapland Longspur	473.0		P						
117.	Smith's Longspur				23.3					
118.	Snow Bunting									
119.	Unidentified songbirds	5.3		30.7	90.0	61.3	40.6	72.9	5.6	
	Total Birds per sq. mile	1083.3	-	392.0	965.3	1412.5	510.4	453.6	694.4	848.7*

*No data for Division II

TABLE 32

BIRD POPULATION DENSITIES

(1) Along North Coast, Prudhoe Bay to Blow River;

(2) The West side of the Lower Mackenzie Delta.

Based on site transects, June to Mid-August, 1971.

North Coast sites 16, 13, 12, 10, 9: Delta sites 23, 24.

"T" (for "trace") indicates species seen at one or more sites but not on transects.

Table 32

		NORTH COAST 329 miles Birds per square mile	LOWER DELTA 65 miles Birds per mile
1.	Common Loon	T	5.1
2.	Yellow-billed Loon	T	
3.	Arctic Loon	9.9	T
4.	Red-throated Loon	13.2	
5.	Unidentified Loons	2.2	
6.	Red-necked Grebe		
7.	Whistling Swan	4.4	
8.	Canada Goose		
9.	Black Brant	4.4	
10.	White-fronted Goose	T	
11.	Snow Goose	220.0	
12.	Mallard		
13.	Pintail	70.4	T
14.	American Widgeon		
15.	Shoveler		
16.	Blue-winged Teal		
17.	Green-winged Teal	2.2	
18.	Canvasback		
19.	Greater Scaup	T	
20.	Lesser Scaup	T	
1.	Scaups, spp.	2.2	

Table 32

	NORTH COAST	LOWER DELTA
22. Common Goldeneye		
23. Barrow's Goldeneye		
24. Common Eider	64.9	
25. King Eider	T	
26. Oldsquaw	227.7	T
27. White-winged Scoter	5.5	
28. Surf Scoter	T	
29. Red-breasted Merganser	20.9	
30. Unidentified waterfowl		61.2
31. Goshawk		
32. Marsh Hawk	T	T
33. Rough-legged Hawk	T	
34. Swainson's Hawk		
35. Unidentified Hawks		
36. Golden Eagle		T
37. Gyrfalcon	1.1	
38. Willow Ptarmigan		10.2
39. Rock Ptarmigan	3.3	
40. Unidentified Ptarmigan		35.7
41. Sandhill Crane	2.2	T
42. American Golden Plover	112.2	
43. Black-bellied Plover	T	
44. Semipalmated Plover	2.2	10.2
45. Ruddy Turnstone	2.2.	
46. Upland Plover		
47. Buff-breasted Sandpiper	33.0	

Table 32

	NORTH COAST	LOWER DELTA
48. Solitary Sandpiper		5.1
49. Spotted Sandpiper		5.1
50. Wandering Tattler		
51. Lesser Yellowlegs		5.1
52. Stilt Sandpiper		
53. Long-billed Dowitcher	3.3	
54. Ruddy Turnstone	2.2	
55. Pectoral Sandpiper	29.7	
56. Dunlin	7.7	
57. Sanderling	6.6	
58. Baird's Sandpiper	4.4	
59. Least Sandpiper		
60. Semipalmated Sandpiper	45.1	
61. Common Snipe		5.1
62. Red Phalarope	24.2	
63. Northern Phalarope	191.4	5.1
64. Unidentified shorebirds	130.9	10.2
65. Parasite Jaeger	14.3	20.4
66. Pomarine Jaeger	12.1	
67. Long-tailed Jaeger	5.5	
68. Unidentified jaegers	1.1	
69. Glaucous Gull	117.7	5.1
70. Herring Gull		T
71. Mew Gull		
72. Bonaparte's Gull		

Table 32

		NORTH COAST	LOWER DELTA
73.	Sabine's Gull	5.5	
74.	Unidentified Gulls		
75.	Arctic Tern	232.1	35.7
76.	Short-eared Owl	T	
77.	Snowy Owl	1.1	
78.	Belted Kingfisher		
79.	Yellow-shafted Flicker		
80.	Northern Three-toed Woodpecker		
81.	Say's Phoebe		
82.	Traill's Flycatcher		
83.	Olive-sided Flycatcher		
84.	Cliff Swallow		
85.	Tree Swallow		
86.	Gray Jay		35.7
87.	Common Raven	1.1	5.1
88.	Robin		5.1
89.	Varied Thrush		20.4
90.	Wheatear		
91.	Hermit Thrush		
92.	Swainson's Thrush		
93.	Gray-cheeked Thrush		
94.	Ruby-crowned Kinglet		
95.	Water Pipit		
96.	Yellow Wagtail	1.1	
97.	Bohemian Waxwing		

		NORTH COAST	LOWER DELTA
98.	Northern Shrike		
99.	Orange-crowned Warbler		
100.	Yellow Warbler		5.1
101.	Myrtle Warbler		
102.	Blackpoll Warbler		10.2
103.	Northern Waterthrush		20.4
104.	Wilson's Warbler		5.1
105.	Red-winged Blackbird		
106.	Rusty Blackbird		
107.	Brewer's Blackbird		
108.	Pine Grosbeak		
109.	Hoary Redpoll		
110.	Common Redpoll		1785.0
111.	Pine Siskin		
112.	Savannah Sparrow	1.1	5.1
113.	Slate-colored Junco		
114.	Tree Sparrow		193.8
115.	White-crowned Sparrow		10.2
116.	Fox Sparrow		35.7
117.	Lapland Longspur	267.3	20.4
118.	Smith's Longspur		
119.	Snow Bunting	14.3	
	Unidentified songbirds	7.7	168.3
	Total birds per square mile	1929.4	2544.9
			less redpolls 1785.0
			759.9