PRELIMINARY ENVIRONMENTAL ASSESSMENT OF PROPOSED HARBOUR SITES AT McKINLEY BAY AND BAILLIE ISLANDS, NORTHWEST TERRITORIES

VOLUME 1:

MIGRATORY BIRD HABITAT AND BIRD USE, 1980

by

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Yellowknife, N.W.T.

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January 1982

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CANADIAN WILDLIFE SERVICE

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ABSTRACT

Aerial and ground observations of migratory bird use of McKinley Bay and Baillie Islands, N.W.T., were made during the summer of 1980. Vegetation and ecological land classifications were developed for the two areas through aerial photo interpretation, ground reconnaissance and consideration of classifications assembled by other researchers.

ACKNOWLEDGEMENTS

We thank John Ostrick, of the Inuvik Research Laboratory and Eddie Chapman, of the Polar Continental Shelf Project, Tuktoyaktuk, for gracious hospitality and indispensable logistic support.

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John Ward of Dome Petroleum Ltd. kindly supplied us with data on aircraft traffic in McKinley Bay in 1980, associated with Dome/Canmar's activities, and unpublished observations of wildlife in McKinley Bay, and D. Reid of Hardy Associates (1978) Ltd. provided aerial photography, land and vegetation data for the McKinley Bay area. We thank Dave Tilden of the Environmental Protection Service, Yellowknife, for compiling information on oilspills occurring in the Beaufort Sea area in 1980.

We are grateful to Tom Barry of the Canadian Wildlife Service for sharing his many years of experience in the Beaufort Sea area. He gave us many useful insights that were essential to the design, execution and writing-up of our work.

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1. INTRODUCTION

1.1 Background

Dome Petroleum Limited (Dome) began exploratory oil and gas drilling operations in the Beaufort Sea (Figure 1) in 1976 through its subsidiary Canadian Marine Drilling Ltd. (Canmar). Since that time, two substantial oil discoveries have been made, Nektoralik and Kopanoar, and two gas discoveries were confirmed, Ukalerk and Tingmiark (Figure 2). Another hydrocarbon structure, referred to as the Nerlerk structure, is Dome's largest in the Beaufort Sea and the company regards the presence of oil in the Nerlerk well as highly significant (Dome 1980). Dome is presently developing concepts for year-round drilling operations and, on the basis of exploratory drilling results to date, the year 1986 is projected as the target date for the initial production and movement of Beaufort Sea oil to southern markets.

Initially, Pauline Cove on Herschel Island appeared to fulfill the requirement for suitable overwintering facilities and consequently, during the winter of 1976-77, Canmar's drillships were wintered there. However, several disadvantages of this location became apparent: water depth within the harbour was too shallow; icebreakup did not occur until after ice had cleared from the drillsites; and a breakwater would be required to provide protection from southeast winds and moving ice (Canmar 1979). During the following two winters (1977-78 and 1978-79), the drilling fleet overwintered at Summers Harbour on Booth Island west of Cape Parry. Although the suitability of Summers Harbour as an eastern Beaufort deepwater overwintering area was confirmed, it had the disadvantages of a considerable distance of ice to be traversed each spring and fall and the remoteness of the Cape Parry region to the exploratory drilling locations.

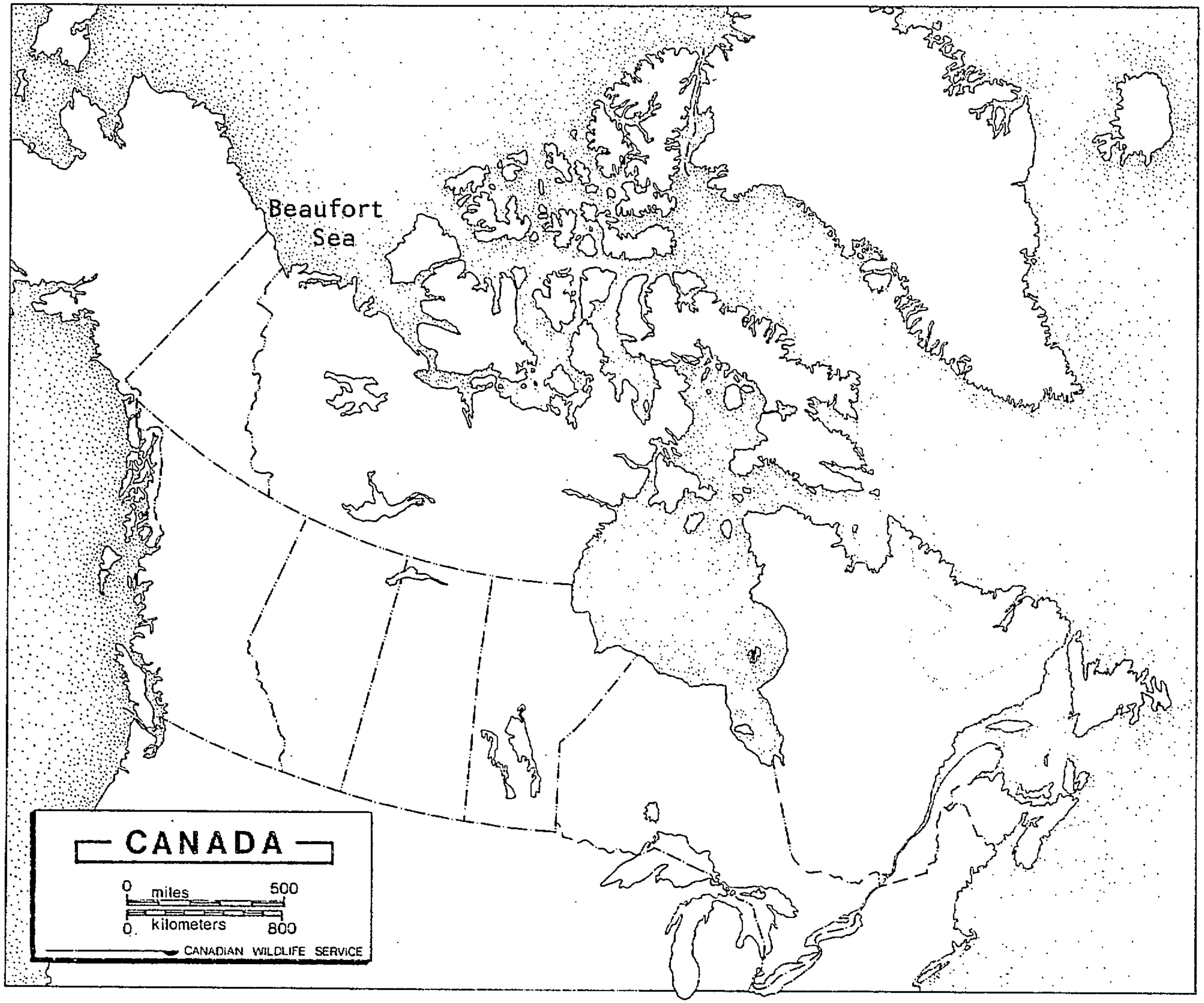


Figure 1. Location of Beaufort Sea.

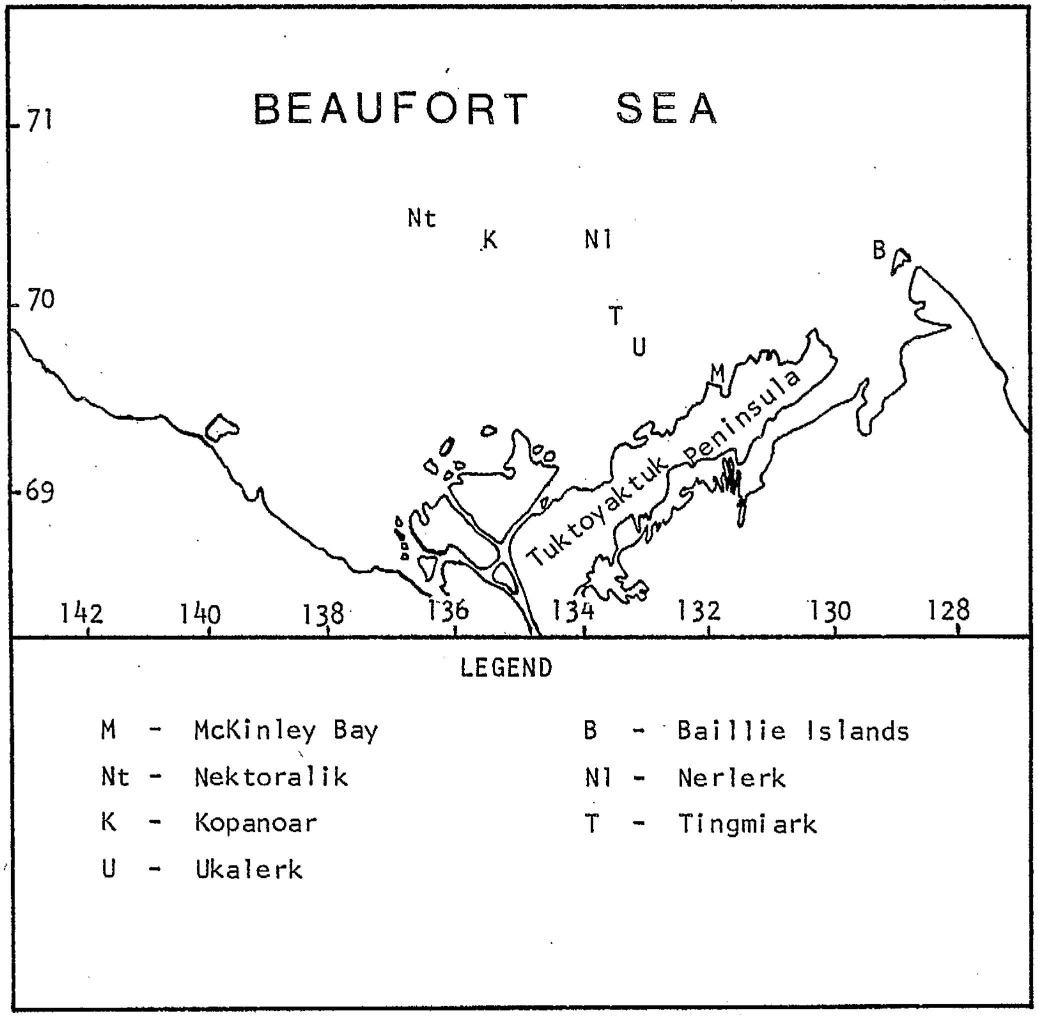


Figure 2. Location of significant hydrocarbon discoveries in the Beaufort Sea in relation to McKinley Bay and Baillie Islands.

Dome became interested in McKinley Bay because of its more central location and because a dredge had become available that was capable of doing the necessary dredging in an economically acceptable manner. An application for an ocean dumping permit was made in the summer of 1979 that would permit dredging of an approach channel and mooring basin in McKinley Bay and provide overwintering facilities for the drilling fleet and the icebreaker Kigoriak. Despite opposition by representatives of the Canadian Wildlife Service and other agencies about the long-term environmental consequences of use of McKinley Bay as a harbour site, a dredging permit under the Ocean Dumping Control Act could not be denied under the terms of reference of the Act for permit processing. Consequently, a permit was granted, dredging took place and the ships were overwintered in McKinley Bay during the winter of 1979-80.

At the time the present study was being planned in early 1980, Dome's long-term plans for McKinley Bay were uncertain. Dome was considering a number of other alternative locations for a deepwater harbour (17 m draft) including: King Point on the Yukon coast; Tuktoyaktuk; Baillie Islands at the tip of the Bathurst Peninsula; and Wise Bay on the Parry Peninsula. These alternatives influenced the design of the present study.

1.2 Purpose of Study

The Canadian Wildlife Service opposed dredging in McKinley Bay for several reasons. First, it appeared obvious that once development was permitted in McKinley Bay, it would not end with dredging. Because Dome was searching for a suitable deepwater harbour, it was perceived that additional developments, including land-based facilities, would follow the dredging. CWS felt strongly that such facilities and various support activities, such as aircraft flights, would conflict with migratory bird use of the area.

Second, CWS objected to the fact that development activity had been permitted to take place in McKinley Bay prior to the collection of site-specific environmental data and a comprehensive review of the environmental implications of Beaufort Sea development through the federal Environmental Assessment and Review Process (EARP).

Barry (1976) referred to McKinley Bay as a critical coastal area for nesting whistling swans and moulting white-fronted geese, oldsquaw, scaup and scoters. As many as several hundred brant have nested at McKinley Bay and several thousand have used the area for staging (T. Barry, pers. comm.). The bay has received use as a fall staging area by thousands of eiders in some years. Use of the bay by snow geese during spring migration is erratic; the geese are absent in some years, while in others, numbers may be as high as 20 to 30,000 (T. Barry, pers. comm.). In addition, glaucous gulls have been seen nesting and spending the summer on the barrier beaches near Atkinson Point[a/] (T. Barry, pers. comm.).

Since it did not appear likely that site-specific project-related information on migratory bird use of McKinley Bay, and distribution of important habitat, would be collected by Dome, the present study was conceived. Funds were available to investigate one other site on the Beaufort Sea coast proposed for possible harbour development, in addition to McKinley. Therefore, it was decided that bird use and habitat information would also be collected for

[a/] geographic locations in the McKinley Bay and Baillie Islands study areas, referred to in the text, are shown in Figures 3 and 4 respectively.

Baillie Islands because:

(1) information on their importance to migratory birds was sketchy;

(2) fairly good site-specific information was available for the Wise Bay area;

(3) King Point was of lesser importance to migratory birds than other areas along the Beaufort Sea coast; and

(4) the Tuktoyaktuk area was considered to be already fairly well-developed.

More specifically the study was designed to provide:

(1) a description of the use of the two areas by migratory birds;

(2) a description of migratory bird habitat which could be affected by harbour development;

(3) an analysis of the potential effects of harbour and associated development on migratory birds; and

(4) recommendations concerning measures that should be taken to protect migratory birds and their habitat, should further development proceed.

The first two aspects of the study are covered in this report (Volume I). Volume II contains the analysis of potential effects and recommended protection measures. Subsequent to the initiation of this study, the Department of Indian Affairs and Northern Development announced on July 23, 1980, that oil and gas production in the Beaufort Sea had been referred to EARP for formal review. This report should therefore be useful in the preparation of an Environmental Impact Statement and for preparing CWS or DOE position papers concerning proposed development in the Beaufort Sea area.

2. THE STUDY AREAS

2.1 Geographic Location

Figure 2 shows the geographic locations of the McKinley Bay and Baillie Islands study areas. Both areas occur on the southeast coast of the Beaufort Sea in the District of Mackenzie, N.W.T. Locations of places in each study area referred to in the text are shown in Figures 3 and 4.

McKinley Bay is an indentation in the Tuktoyaktuk Peninsula, and is approximately 85 km from the Hamlet of Tuktoyaktuk, N.W.T. Formerly, a radar site operated at nearby Atkinson Point as part of the Distant Early Warning system (DEW line). The DEW line site has since been abandoned, but McKinley Bay is now used by Inuit reindeer ranchers during the spring reindeer roundup. A sand airstrip receives some use and a DECCA radio navigation base operates at Atkinson Point during the summer months.

Baillie Islands (one large and one small) lie approximately 5 km north of the Cape Bathurst Peninsula. Once a major winter harbour for the Beaufort Sea whaling fleet during 1890-1910, there are now no permanently occupied installations except for a DECCA radio base that is manned during the summer months through the Polar Continental Shelf Project.

2.2 Oceanography and Climate

The physical oceanography of the Beaufort Sea is strongly influenced by the Beaufort Gyre, a major clockwise circulation of surface water in the Canada Basin of the Arctic Ocean, and the inflow of the Mackenzie River. These factors were discussed by Herlinveaux and de Lange Boom (1975).

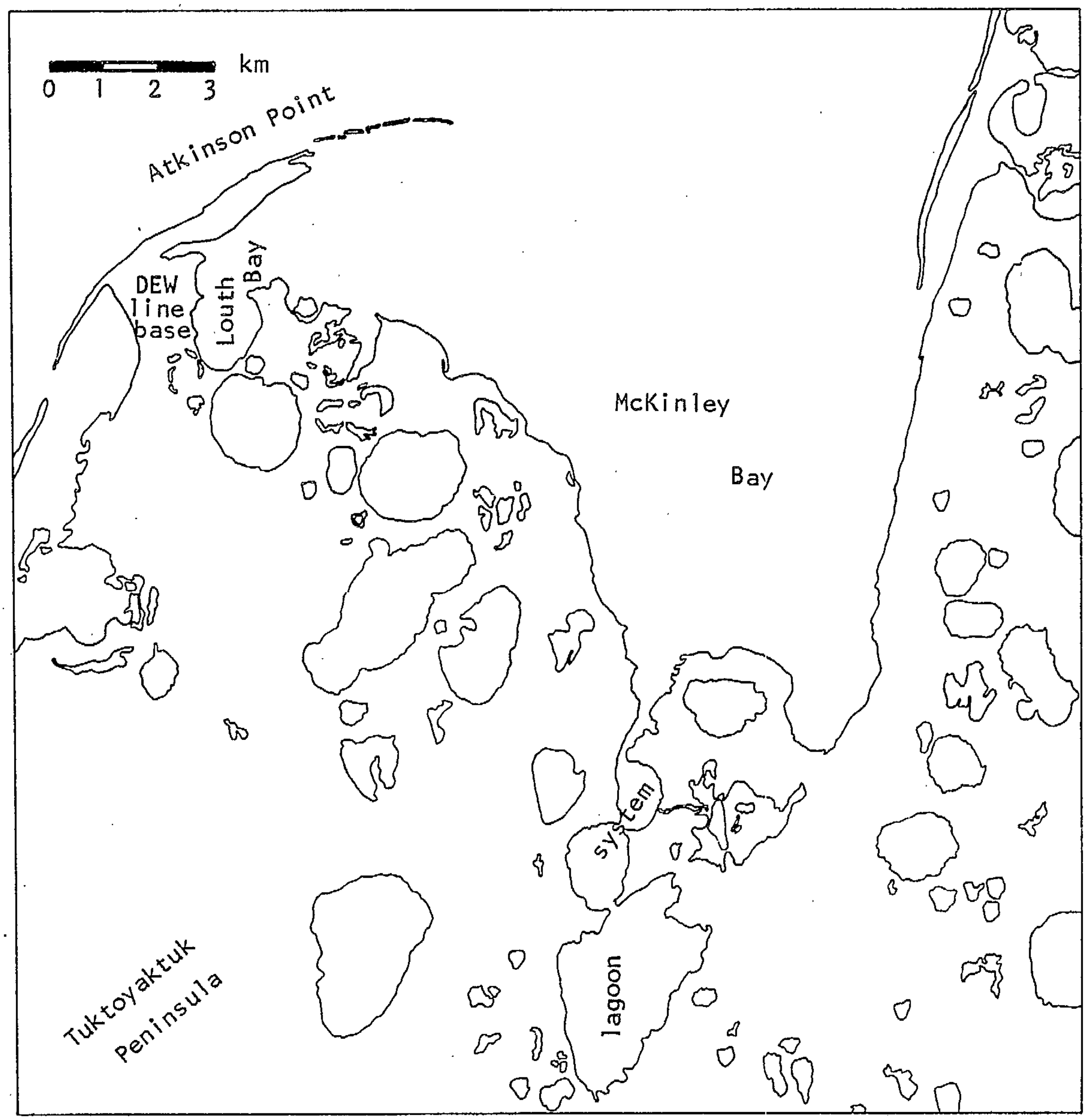


Figure 3. Geographic locations in the McKinley Bay study area.

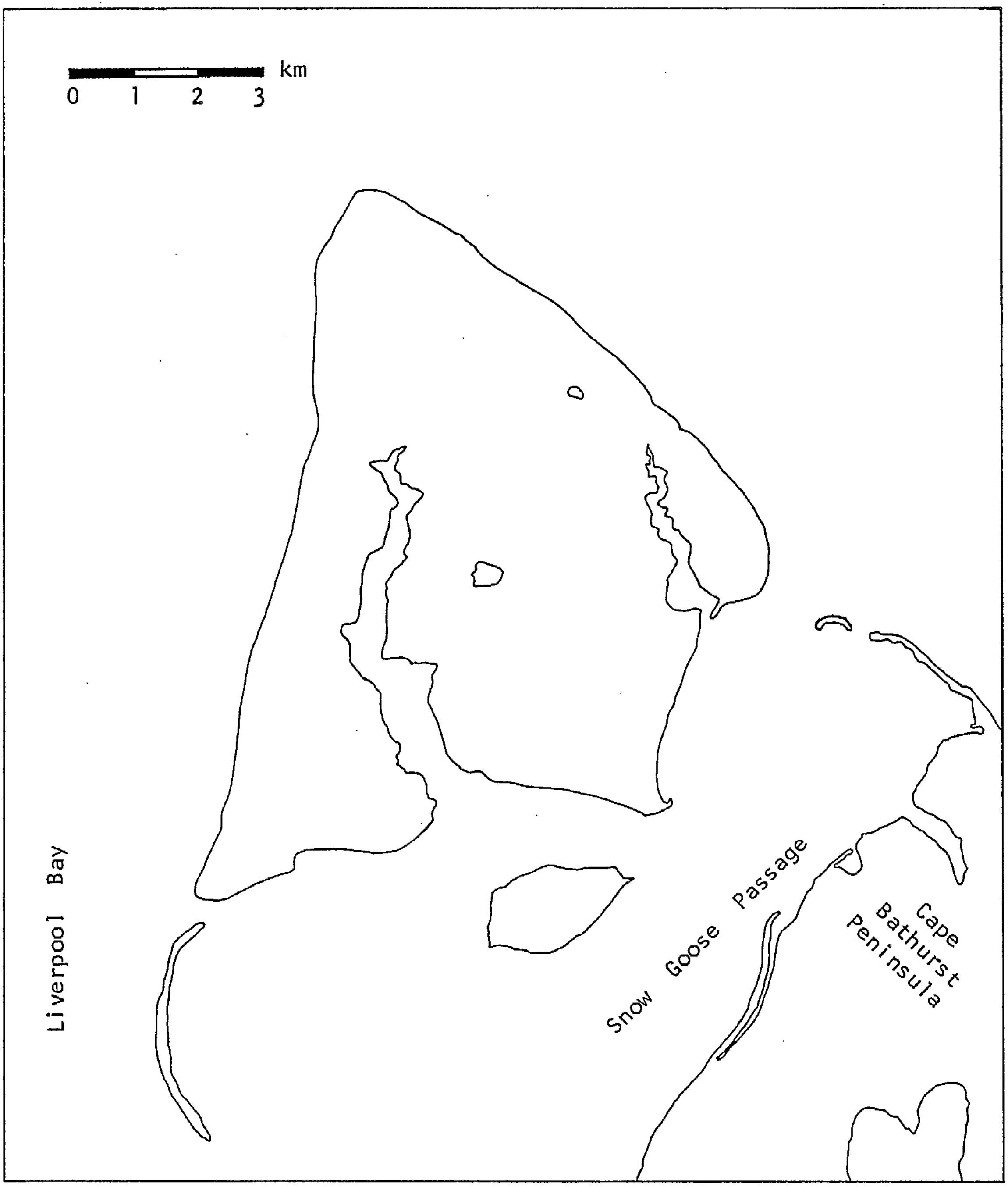


Figure 4. Geographic locations in the Baillie Islands study area.

A major feature that affects the distribution of wildlife in the south-eastern Beaufort Sea is the Cape Bathurst polynya which occurs in the zone of shifting pack ice situated between Baillie Islands and Banks Island. This recurrent polynya is usually one of the first areas to open in spring, and among the last areas of the Beaufort Sea to freeze over in winter. It becomes part of a lead system that extends north along the west coast of Banks Island and along the coast of the Tuktoyaktuk Peninsula. Baillie Islands are situated advantageously with respect to the Cape Bathurst polynya; by early June 1980, only 3 km separated the northern tip of the larger island from open water (Figure 5). The importance of this and other polynyas to wildlife is discussed by Stirling and Cleator (1981).

Three major zones of sea ice have been recognized in the southern Beaufort Sea; shorefast ice, transition zone ice and gyral polar pack ice (Kovacs and Mellor 1974, Marko 1975). Both proposed harbour sites are within the shorefast ice zone.

To date, there have been no site-specific studies of the marine biology of either McKinley Bay or Baiilie Islands. Grainger (1975) performed a regional analysis of the chemical oceanography and primary productivity of the southern Beaufort Sea. His data are supplemented by those of Hsiao (1975) on phytoplankton and Wacasey (1975) on zoobenthos. Although the Mackenzie River contributes huge amounts of nutrients to the Beaufort Sea annually and moderates water temperature, primary productivity is low in the Beaufort Sea compared with other arctic marine locations at the same latitude (Grainger 1975, Hsiao 1975). Zoobenthic species diversity and biomass are similarly low (Wacasey 1975).

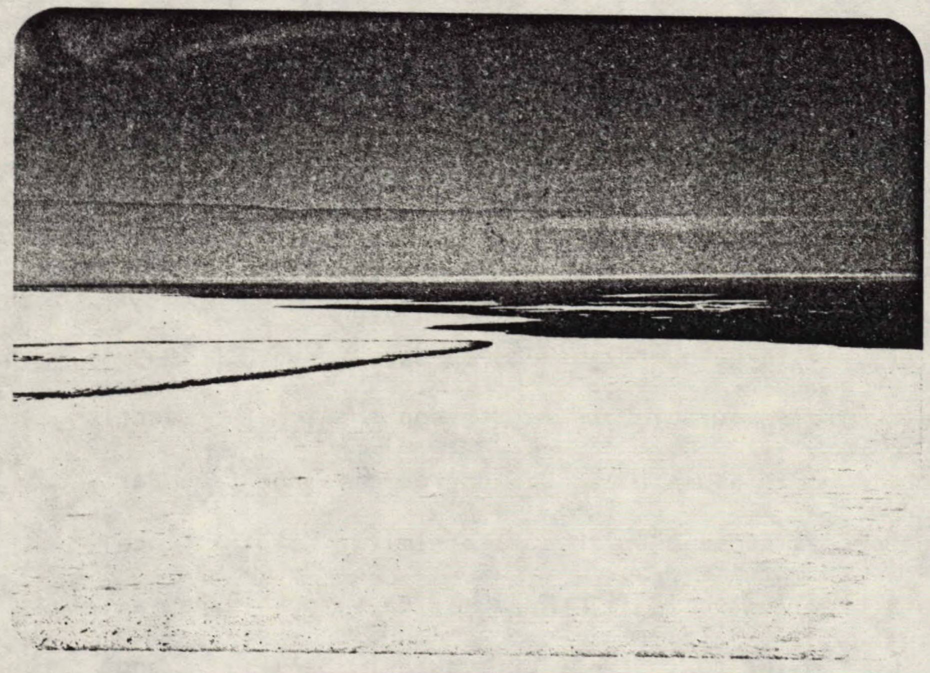


Figure 5. Proximity of the Cape Bathurst polynya to the larger Baillie Island, June 5, 1980.

There are no long-term, year-round climatic data for either McKinley Bay or Baillie Island. However, data from Tuktoyaktuk, Nicholson Peninsula and Cape Parry are comparable, because all are coastal localities, and because there are minor local topographic variation in this part of the Beaufort Sea coast.

Table 1 presents temperature data for Tuktoyaktuk, Nicholson Peninsula, and Cape Parry. There is an east-west temperature gradient, in which Tuktoyaktuk has the mildest temperature regime and Cape Parry the coolest. In an average year, Tuktoyaktuk has 277 days with frost, Nicholson Peninsula 298, and Cape Parry 295. Frost may occur in any month of the year (Atmospheric Environment Service 1975a). Tuktoyaktuk has a relatively large number of degree-days above 0°C (849.5), and hence has a more favourable growing season than most of arctic Canada. Nicholson Peninsula has 628.5 degree-days and Cape Parry has 462.2 degree-days above 0°C; these are similar to other localities in the low Arctic (Aston 1977). McKinley Bay probably has a temperature regime similar to that of Tuktoyaktuk. Baillie Islands probably has a climate like that of Cape Parry because both occur at the tips of long peninsulas and are near the Cape Bathurst polynya.

Table 2 shows the precipitation regime for Cape Parry, Nicholson Peninsula, and Tuktoyaktuk (Atmospheric Environment Service 1975b). McKinley Bay probably has a similar precipitation regime to that of Tuktoyaktuk, while Baillie Islands is probably more similar to Cape Parry or Nicholson Peninsula. The southeastern Beaufort Sea receives less precipitation than

Table 1. Mean daily temperatures (^{o}C) for Tuktoyaktuk, Nicholson Peninsula and Cape Parry, N.W.T.

	J	F	M	A	M	J	J	A	S	O	N	D	Annual
Tuktoyaktuk	-27.2	-29.2	-24.9	-16.9	-4.6	4.7	10.3	8.7	2.3	-6.9	-19.3	-25.2	-10.7
Nicholson Peninsula	-27.7	-29.3	-25.1	-17.6	-5.5	4.1	7.8	6.8	0.8	-7.3	-19.4	-25.6	-11.5
Cape Parry A	-28.5	-30.4	-26.1	-17.4	-6.1	1.7	5.7	5.3	0.8	-6.5	-18.2	-24.5	-12.0

Source: Atmospheric Environment Service (1975a)

Table 2. Mean monthly precipitation (mm) and mean monthly rainfall (mm) for Tuktoyaktuk, Nicholson Peninsula and Cape Parry, N.W.T.

a. Mean monthly precipitation, mm	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
Tuktoyaktuk	5.1	5.3	3.6	4.8	7.1	13.5	22.1	28.7	14.0	12.7	5.1	7.6	129.6
Nicholson Peninsula	2.3	2.3	3.3	3.6	4.6	10.7	20.8	31.8	15.0	10.9	4.1	3.0	112.4
Cape Parry A	4.6	5.3	6.4	10.2	7.9	14.2	18.0	31.0	26.2	21.3	8.1	6.4	159.6
b. Mean monthly rainfall, mm													
Tuktoyaktuk	0.0	0.0	0.0	0.0	3.0	10.2	21.6	28.2	9.9	0.5	T[a/]	0.0	73.4
Nicholson Peninsula	0.0	0.0	0.0	0.0	1.8	8.1	20.6	31.0	10.7	0.8	0.0	0.0	73.0
Cape Parry A	T	T	T	T	0.8	11.7	17.3	29.7	11.9	1.0	T	T	72.4

Source: Atmospheric Environment Service (1975 b)

[a/] T=trace

the forested parts of the Northwest Territories, and less than arctic localities near Hudson Bay or Davis Strait. Between 45 and 65 percent of mean total precipitation falls as rain; August is the month with highest precipitation (Atmospheric Environment Service 1975b).

There are no published data on winds at McKinley Bay and Baillie Islands. Burns (1973) presents analysis of wind data from Cape Parry in his regional treatment of the climate of northwestern Canada, while Berry et al. (1975) also used data from ship observations in the Beaufort Sea. The prevailing direction is from the NE to SE quadrants or from the W to NW quadrants; at Cape Parry, strong winds come from the ENE to ESE quadrants and from the W to WNW quadrants. If these wind patterns are representative of McKinley Bay and Baillie Islands, then McKinley Bay is well sheltered from strong prevailing winds, but Baillie Islands are open to a strong eastward fetch.

Burns (1974) presents information on fog incidence at Cape Parry to describe impairment of visibility on the Beaufort Sea coast generally. Fogs often result when warm moist air is saturated by cooling as it passes over an ice-water surface and by evaporation of water from open leads.

Storm surges are wind-induced increases in sea level. Although the increases are ordinarily up to 1 m above tide level, in embayments such as Tuktoyaktuk harbour they may exceed 2 m. Storm surges are particularly a concern at McKinley Bay, because much of its coastline has little topographic relief, and driftwood from storm surges can be seen up to several hundred metres inland from the usual high tide strandline.

Spilled oil and floating garbage can also be carried ashore by storm surges (Henry 1975). Because Baillie Islands have relatively high (10-20 m) coastal bluffs, a lesser area is vulnerable to pollution carried by surges.

A forecasting system for frequency of storm surges is not complete, because of the relatively short period of tidal and climatic record (Henry 1975). Two unusual kinds of surges have also been described by Henry (1975). Negative surges are decreases in sea level generated by strong offshore winds. Decreases as great as 1 m have been recorded at Tuktoyaktuk. These may present hazards to navigation. Winter surges of about 1 m have occurred beneath the frozen sea ice at Tuktoyaktuk. Such surges may imperil any installation placed too close to shore. Figure 6 shows the minimum extent of the McKinley Bay area likely to be affected by storm surges. Driftwood wrack (Figure 7) was used as an indicator.

2.3 Landforms and Vegetation

Both McKinley Bay and Baillie Islands are within the Mackenzie Delta Section of the Arctic Coastal Plain Province (Bostock 1964). Craig and Fyles (1960) note that the coastal plain between Cape Bathurst and the Alaska boundary has deposits of unconsolidated sediments of clays, silts, sands, and gravels to a depth of a hundred or so metres. Much of the material comprising the Tuktoyaktuk Peninsula may have been deposited in a delta or deltas of the Mackenzie River in late Tertiary or Quaternary time. Bedrock does not occur at the ground surface in either the McKinley Bay or Baillie Islands study areas (Yorath and Balkwill 1970, Yorath et al. 1969). The McKinley Bay area may not have glaciated

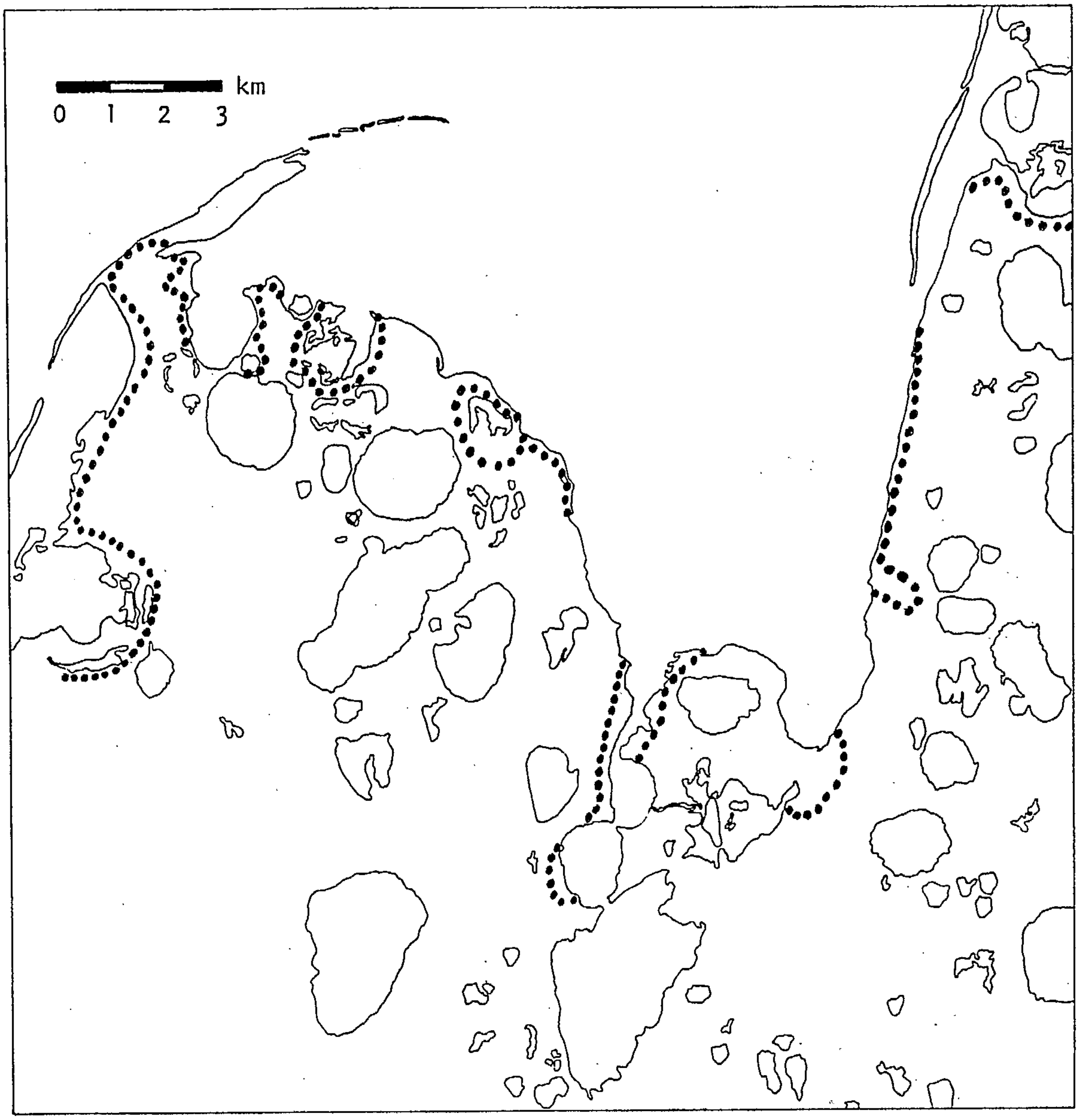


Figure 6. Distribution of driftwood wrack at McKinley Bay.

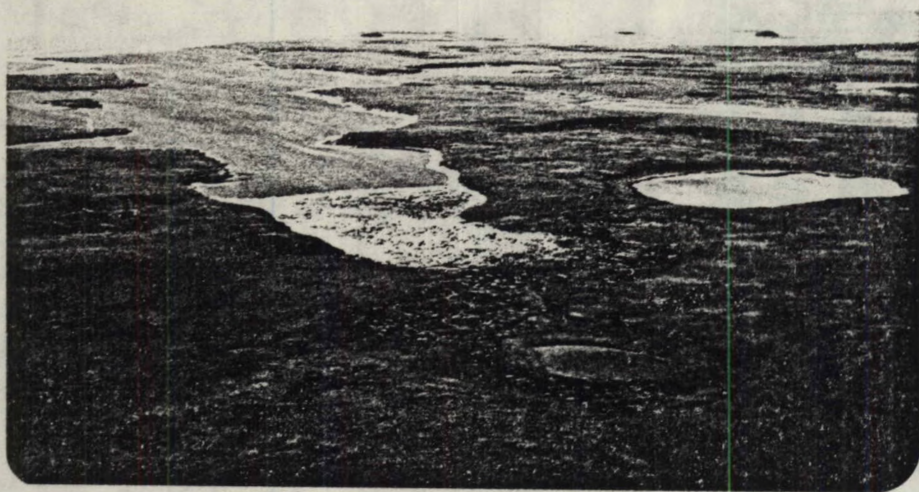


Figure 7. Driftwood wrack along the Tuktoyaktuk Peninsula.

during the Wisconsinan advance. McKinley Bay used to be part of a meltwater channel from the Mackenzie River (Mackay 1963).

The McKinley Bay study area is a complex of fluvial, aeolian, lacustrine and marine land forms (Rampton 1972, Monroe 1972). Its landscape has been extensively modified by permafrost phenomena. Thermokarst ponds are numerous south and west of the bay; according to Washburn (1973), such ponds occupy basins that are formed or enlarged by the thawing of frozen ground. Both high and low-centered polygons occur extensively throughout the study area. Three pingos occupy former lake beds near McKinley Bay. McKinley Bay is separated from the Beaufort Sea by a large spit extending from Atkinson Point, and there are barrier beaches on the east side of the bay and southwest of Atkinson Point. Active sand dunes occur at the south end of McKinley Bay and at Atkinson Point.

The materials in the Baillie Islands study area were derived from marine and lacustrine silts and clays (Rampton 1972). Baillie Islands are also modified by permafrost. Most marine sediments have non-sorted circles that are approximately 0.3 to 0.7 m across; the centers of the circles are unvegetated, but *Dryas* vegetation occurs at the periphery of the circles. On slopes, the circles become somewhat elongated. Low-centered polygons and a few thermokarst ponds have developed on lacustrine sediments. Marine erosional landforms include coastal bluffs, which occur on all sides of the large Baillie Island. Spits extending from the large Baillie Island and from Cape Bathurst, and tidal mudflats at Cape Bathurst are depositional landforms.

Corns (1972) recognized five major vegetation types in the Mackenzie Delta and the Tuktoyaktuk Peninsula areas:

(1) dwarf shrub-heath, absent at Atkinson Point;

(2) tall shrub-herb, absent at Atkinson Point;

(3) alder-heath, not sampled at Atkinson Point and probably absent there;

(4) herb-dwarf shrub-heath; and

(5) herb.

Baillie Islands are a part of the Horton-Anderson study area described by Zoltai et al. (1979). Much of Baillie Islands has the *Dryas* subtype of the dwarf shrub-herb-lichen type that Zoltai et al. recognized, but which did not occur in Corns' (1972) study area. Neither Zoltai et al. nor Corns treated littoral or tidal marsh vegetation. Although a distinctive flora occurs, its areal extent is limited. Later sections of this report describe this flora and other vegetation types identified at the two study areas.

3. METHODS

3.1 Ground Investigations

3.1.1 Birds

Ground and boat investigations were conducted between June 28 and July 1 at McKinley Bay and from July 2 to July 4 at Baillie Islands. Access to ground study sites in each study area was obtained using a Zodiac powered by a 9.9 hp motor. All birds observed were recorded and these observations supplemented the aerial observations and were used to develop preliminary bird checklists for each study area. As with the aerial observations, notes were made of habitat and ice conditions and other environmental factors which may have influenced bird distribution. Incidental observations were also made at the study sites and campsites. Locations of study sites and approximate boat routes are shown in Figures 8 and 9.

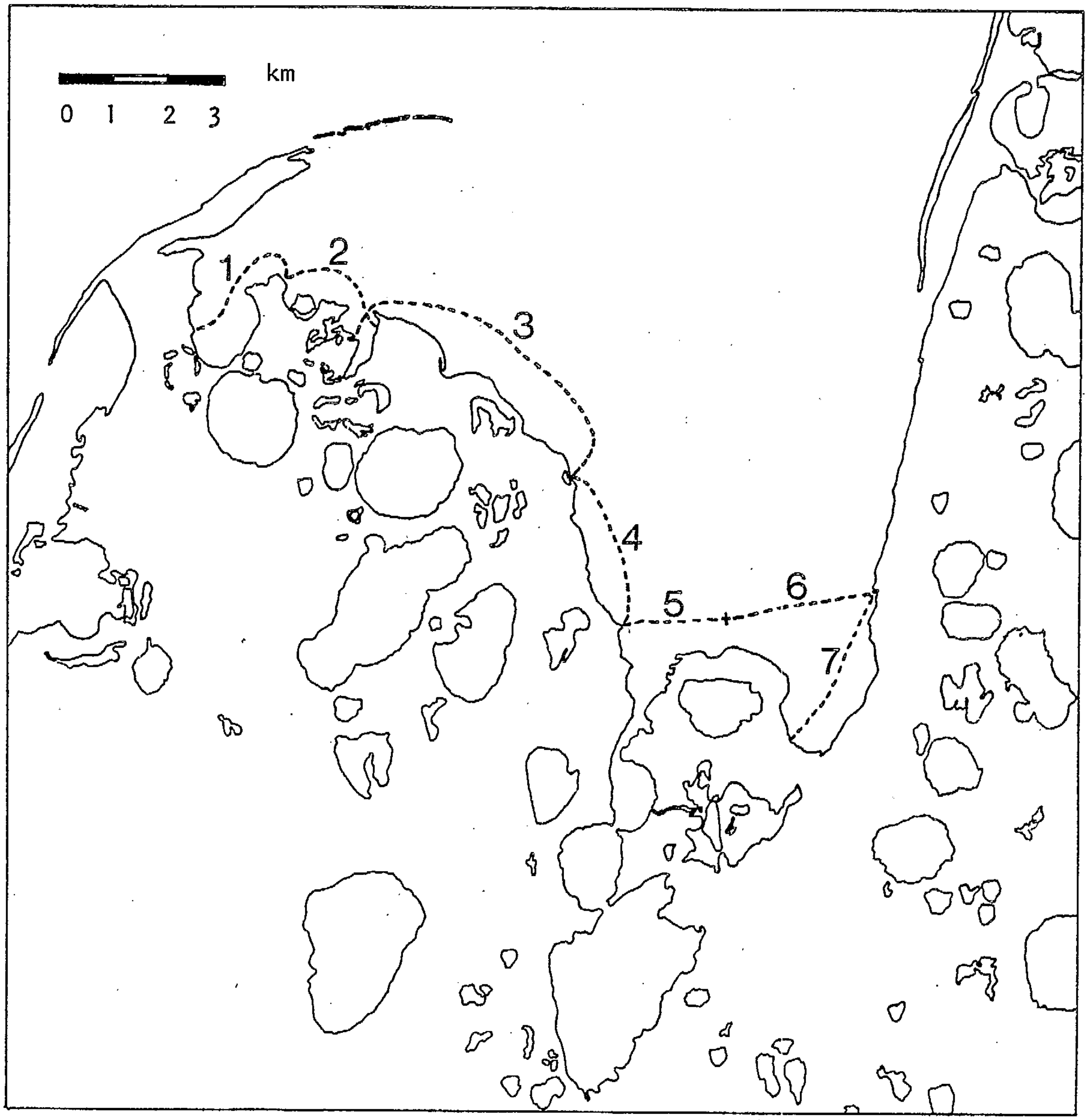
3.1.2 Vegetation and Landforms

3.1.2.1 Vegetation Classification

We collected plants at five locations at McKinley Bay and ten locations at Baillie Islands, to enable us to classify the vegetation of these study areas. We collected specimens of the dominant species only. The specimens were pressed, then identified with the aid of diagnostic keys of Hultén (1968) and Porsild (1964). The pressed specimens are stored in the collections of the Canadian Wildlife Service in Yellowknife, N.W.T.

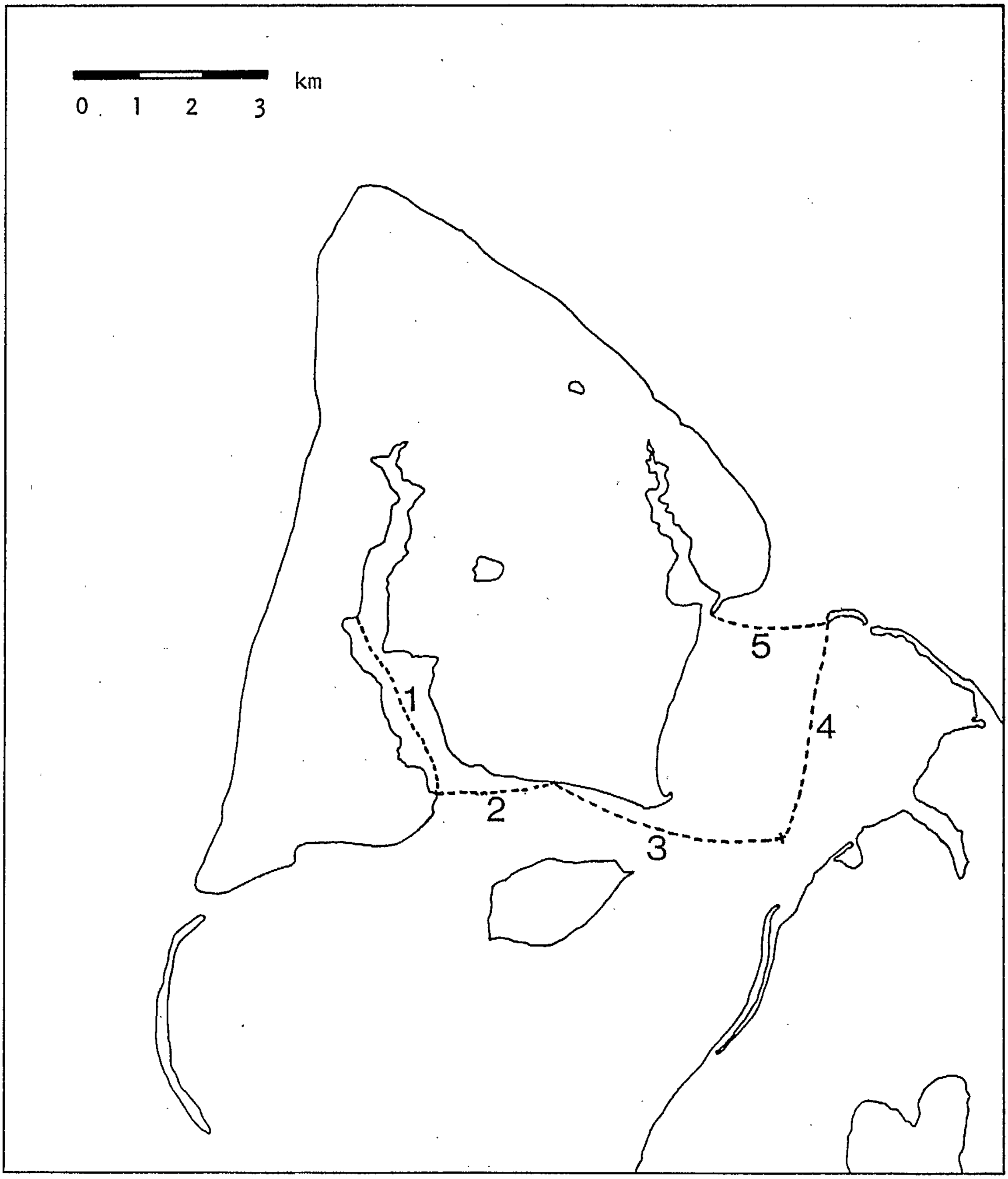
3.1.2.2 Ecological Land Classification

In deriving our land classification, we have modified the terrain classifications of Rampton (1972) and of Monroe (1972) for landforms and



3 - location of survey segments referred to in Table 12.

Figure 8. Route of boat census conducted at McKinley Bay, June 30, 1980.



4 - location of survey segments referred to in Table 13.

Figure 9. Route of boat census conducted at Baillie Islands, July 3, 1980.

terrain sensitivity respectively. We used the vegetation classification systems of Corns (1972), Hardy Associates Ltd. (1979), Zoltai et al. (1979), the Lacate (1969) ecological land classification principles and our own ground truthing to establish ecological land classifications for McKinley Bay and Baillie Islands. Wildlife use was derived exclusively from our own field data.

The purpose of our land classification was to identify areas that have similar biological characteristics and would respond similarly to given environmental stresses. Our classification is weak because we lack the information that would allow us to classify marine areas.

3.2 Aerial Observations

Aerial surveys were initially planned to determine migratory bird use of McKinley Bay and Baillie Islands (1) upon arrival in spring, (2) for breeding, (3) for moulting, and (4) during staging prior to migration south. At McKinley Bay, the surveys were flown June 4, June 27, August 11 and August 27. We were not able to conduct the last two surveys at Baillie Islands due to poor weather conditions; the first two surveys were flown June 5 and June 28. The surveys were flown in good weather at elevations between 15 and 35 m above ground level and at ground speeds between 120 and 195 kph using a Cessna 185. We recorded all birds within 0.18 km of each side of the aircraft. Birds were recorded as being on or off transect with the assistance of marker tape placed on the wing struts of the aircraft. The struts were calibrated prior to the surveys by flying perpendicular to the airport runway at Inuvik, N.W.T., at survey altitude (approximately 30 m), and noting the positions of runway lights, known to be 0.18 km apart.

Except for the June 4 McKinley Bay survey, which was flown as a reconnaissance only, each survey at each study area consisted of two parts: (1) a set of 10 east-west (E-W) transects flown 2 km apart; and (2) a survey of shoreline areas, referred to hereafter as a "shoreline cruise" (Figures 10, 11, 12, and 13). The purpose of the E-W transects was to locate areas of high bird use in each study area, and to derive densities of bird species located within the study areas at the time of each survey. Birds occurring further than 0.18 km from the aircraft (off transect) were excluded from calculations of bird density, but were considered in identifying those areas most important to birds. The shoreline cruises were flown to supplement the transect observations in identifying important shoreline areas as indicated by comparatively high bird use. Both on and off transect observations were used in these determinations. Ice and terrain conditions, associated with locations of birds, and other information considered relevant, was recorded on tape with the bird observations. Because the transects and shoreline cruises were always flown consecutively at each study area, some movement of birds may have occurred between the two surveys due to disturbance by the survey aircraft. The degree to which this possible source of error affected the survey results is not known.

Each study area was divided into marine and terrestrial components. At McKinley Bay the marine component included all salt water embayments off the bay itself with the exception of the lagoon system south of the bay, which was arbitrarily included in the terrestrial component due to its freshwater inflows. The marine component was considered to terminate just north of the area covered by transect 7 at the head of the lagoon system (Figure 10). All inland lakes, and sandspits and islands located in the bay, were considered to be part of the terrestrial component for simplicity

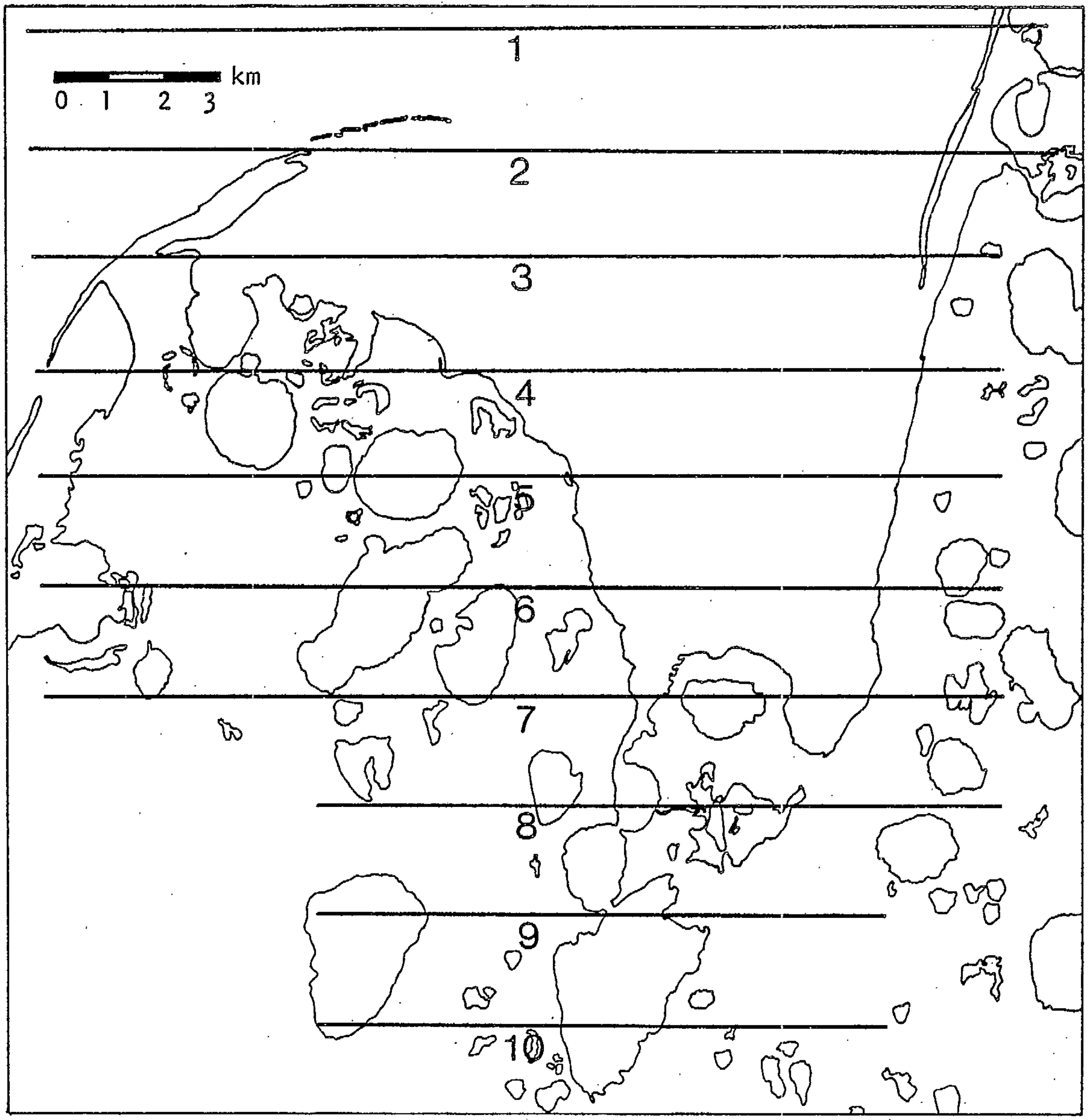
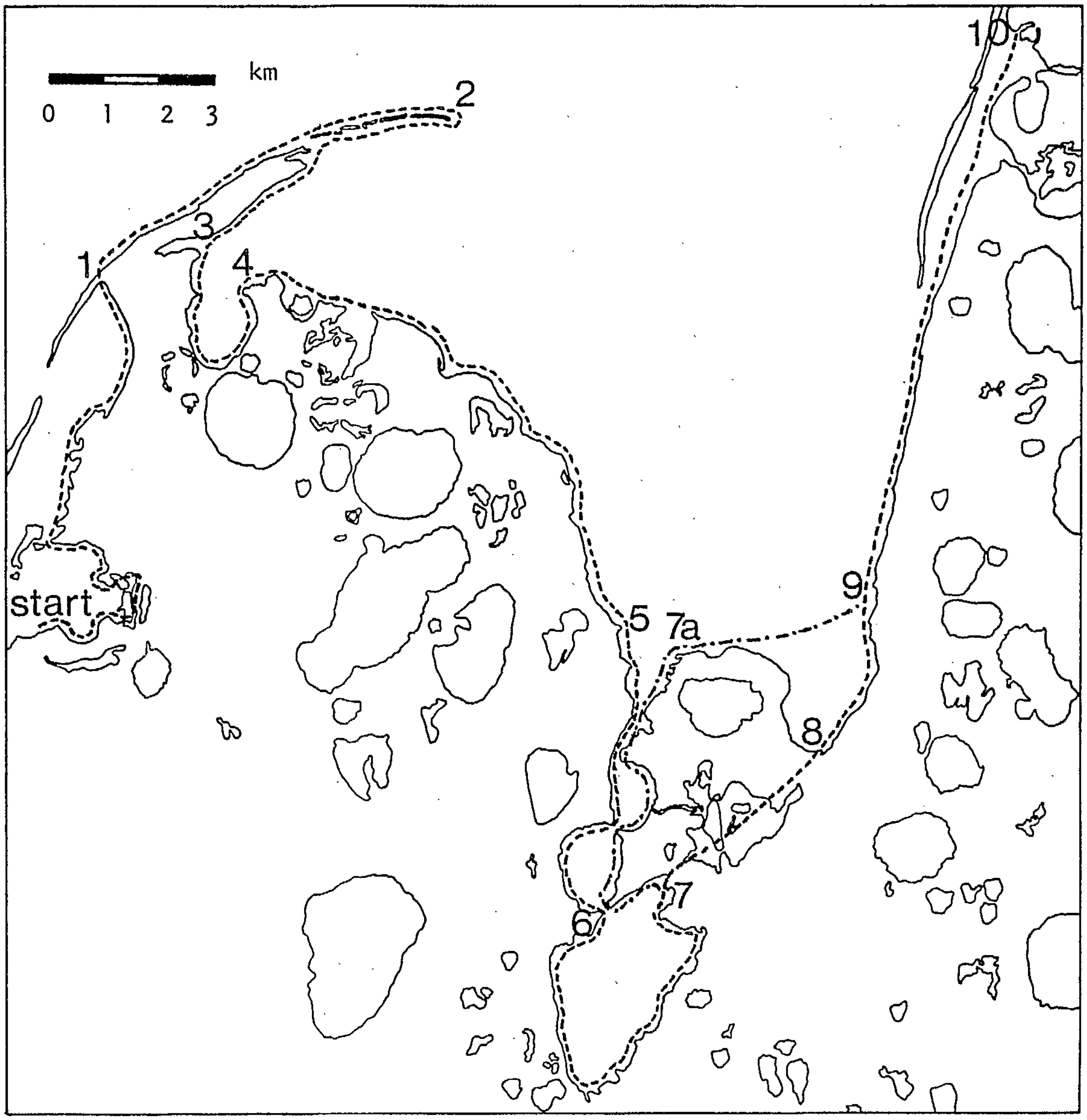


Figure 10. Aerial transects flown at McKinley Bay, June 27, August 11 and 27, 1980.



2 - Locations of stations referred to in Appendices 3,6,9

Note: On June 27, cruise proceeded via station 7a.
On August 11 and 27, cruise proceeded via station 8.

Figure 11. Routes of shoreline cruises flown at McKenzie Bay, June 27 August 11 and 27, 1980.

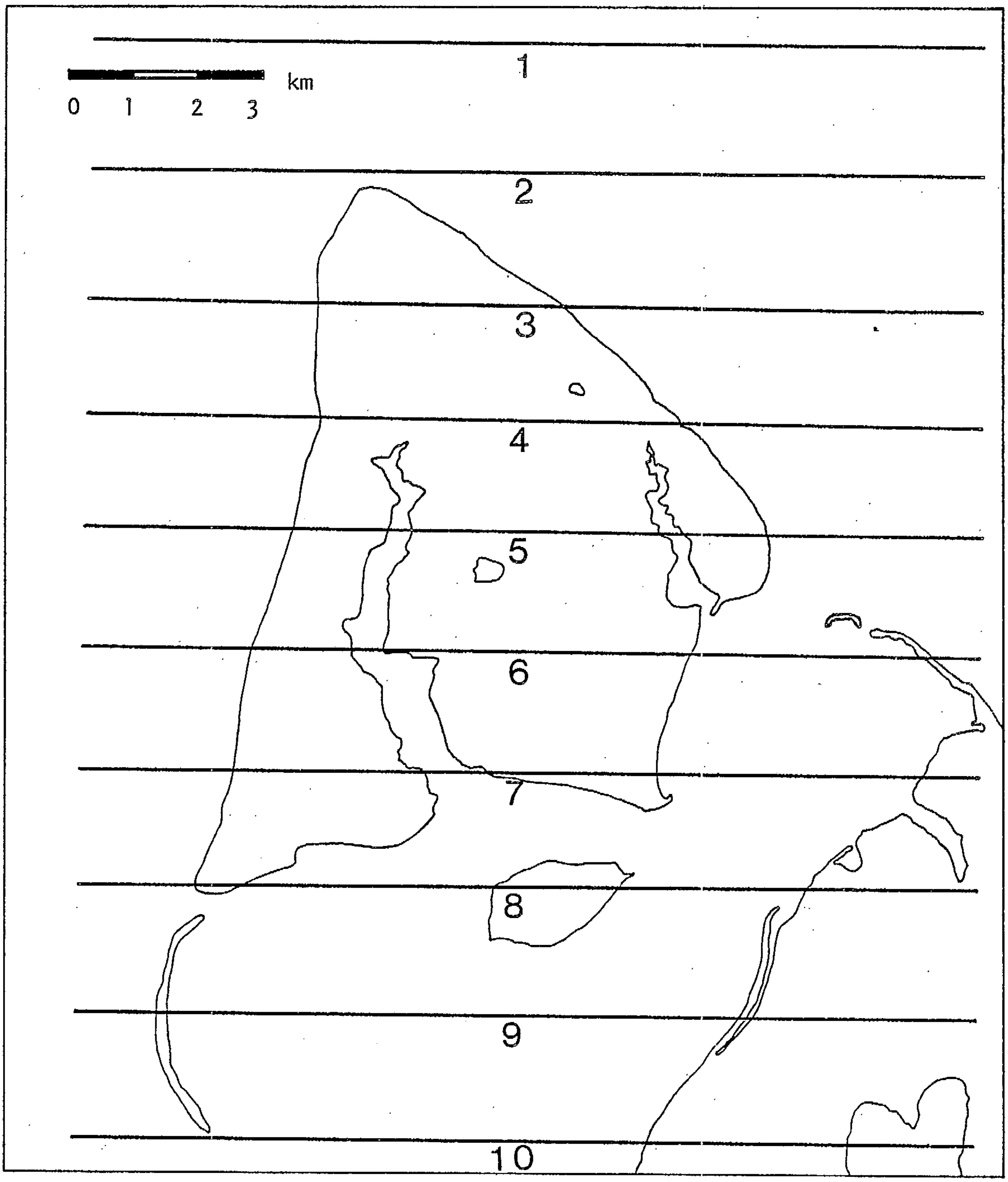


Figure 12. Aerial transects flown at Baillie Islands, June 5 and 28, 1980.

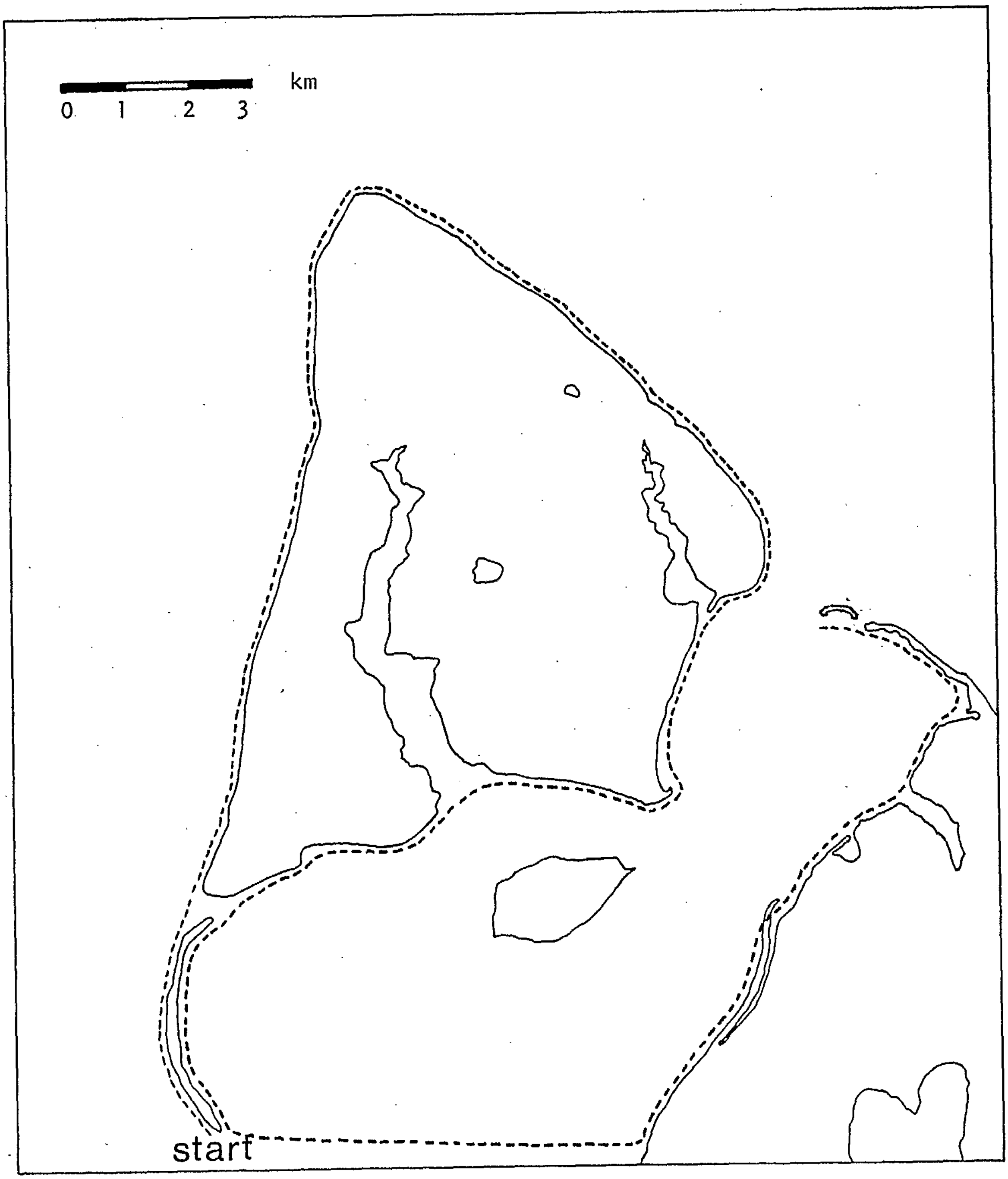


Figure 13. Route of shoreline cruises flown at Baillie Islands, June 5 and 28, 1980.

of analysis. Table 3 shows the extent to which each component of the study area was sampled during the aerial transects. These data made it possible to estimate the total number of birds using each component of the study area at the times the surveys were conducted.

Because much of the bay was covered with ice on June 27, total numbers of birds using the bay itself could not be estimated for that survey. However, estimates were made for the marine component of the other two surveys and for the terrestrial component of all three surveys.

For Baillie Islands, the marine component included all marine embayments and the two inlets of the large island. All islands and sandspits were included in the terrestrial component. The area of each component surveyed in relation to the total area of each component in the study area is indicated in Table 3. Because of the extensive sea ice cover, it was not possible to estimate total numbers of birds using the marine component at the time of the surveys. However, such extrapolations were made for the terrestrial component.

The validity of stratifying each study area into two "macro" components is severely limited. Such stratification assumes that each component is homogeneous with respect to habitat and other environmental conditions and that, therefore, it is equally likely that a certain species will occur in one area as in any other area within the component. Results of the surveys showed that, for most species, this was not the case (see section 4.3). For example, the distribution of diving ducks at McKinley Bay when the August 11 survey was conducted was significantly clumped with most of the ducks occurring in large flocks in limited areas. Use of clumped data to estimate total

Table 3. Percentages of marine and terrestrial components of the study areas surveyed by aerial transects.

Study area	Area of study area (km^2)	Total area surveyed[a] (km^2)	% of study area surveyed	Area of marine component surveyed[a] (km^2)	% of marine component surveyed	Area of terrestrial component surveyed[a] (km^2)	% of terrestrial component surveyed
McKinley Bay	380	55.1	14.5	26.8	18.3[b]	28.3	12.1[c]
Baillie Islands	304	54.0	17.8	39.1	17.8[d]	14.9	17.7[e]

a/ based on transect lengths and assuming transect width of 0.18 km
b/ total area of marine component of study area = 146.5 km^2
c/ total area of terrestrial component of study area = 233.5 km^2
d/ total area of marine component of study area = 219.7 km^2
e/ total area of terrestrial component of study area = 84.3 km^2

numbers of birds in the study area could result in an overestimation. However, this may be offset somewhat by the fact that other flocks occurring off transect would not have been observed or recorded. In any event, the reliability of these estimates is questionable and interpretation of the extrapolated data must be made with caution.

To illustrate distribution of birds observed in the study areas, simplified maps were prepared. Data from both the transects and the shoreline cruises was used in generating these maps. The maps are not intended to indicate the exact location of every bird observation made. Rather, they summarize locations of groups of 10 or more diving ducks and sightings of geese and swans where the locations were known with reasonable accuracy. Therefore, these maps indicate which areas of the study areas were most important to waterfowl.

4. RESULTS AND DISCUSSION

4.1 Vegetation Classification

Plant communities occurring in the McKinley Bay and Baillie Islands study areas were classified into the following vegetation types.

4.1.1 Herb - Dwarf Shrub - Heath Vegetation Type

This type is diverse and variable. Eleven of the twelve sites sampled by Corns (1972) at Atkinson Point belonged to this type. Most of the upland vegetation we sampled in the McKinley Bay area agreed with Corns' descriptions.

4.1.1.1 Raised Center Polygon Subtype (Corns 1972)

This is tundra vegetation that occurs on mesic sites with relatively flat relief. According to Corns, approximately 26 percent of the Atkinson Point area has this vegetation. Labrador tea[a/], lowbush cranberry and cloudberry are characteristic of polygon tops (Corns 1972). We found polygon tops also had dwarf birch, white heather, crowberry, white avens, blue-green willow and bilberry. The shrub vegetation was generally 0.2 to 0.3 m high. The wetter depressions between the polygons had Bigelow sedge, bilberry, broadleaved cottongrass, and aquatic sedge (Corns 1972). Hardy Associates Ltd. (1979) recognized a dwarf shrub-heath association that is probably identical to this subtype.

4.1.1.2 Sedge - Heath Subtype (Corns 1972)

This subtype develops on nearly level mineral soils at the bases of slopes, or on uplands with impeded drainage. There is a high cover of Bigelow

[a/] Scientific names of plants mentioned in this report are given in Appendix I.

sedge and varying amounts of hare's tail cottongrass, together with low-bush cranberry, Labrador tea, and bilberry. One of Corns' sample sites at Atkinson Point was of this subtype. This is the same as Hardy Associates Ltd. (1979) sedge-heath or *Carex bigelowii - Empetrum nigrum* association. Hardy Associates reported that white heather, dwarf birch, cassandra, and netted willow were characteristic. In a similar association, we found that blue-green and Arctic willow were also common.

4.1.2 Herb Vegetation Type (Corns 1972)

4.1.2.1 Sedge Subtype (Corns 1972) (*Carex stans* Subtype)

Corns found that this was the predominant vegetation at Atkinson Point, occupying 61 percent of the study area. It occurred in the depressions of low-center polygons and other poorly drained locations. Corns found that sedges were the dominant species but did not name the species. In our 1980 collections, aquatic sedge was by far the most common species, but we also collected specimens that we tentatively identified as *C. podocarpa* and *C. rariflora*. Broad-leaved and hare's tail cottongrasses and Arctic willow were also common in our collections. Hardy Associates Ltd. (1979) characterized this as the *Carex limosa - Carex amblyorhyncha* association. We did not obtain either of these species in our collections at McKinley Bay, perhaps because we collected early in the season.

A variant of the sedge subtype occurs on lacustrine sediments at Baillie Islands. Aquatic sedge is a dominant species in wet to moist sites. Other constant to dominant species are grasses: these include cottongrasses, oatgrass, foxtail and bluegrass. Blue-green willow is a constant shrub. The aquatic moss *Drepanocladus uncinatus* dominates the bottoms of tundra ponds.

4.1.2.2 White Avens Subtype

Zoltai et al. (1979) described this subtype from the Horton-Anderson study area. This type is rare or absent at McKinley Bay, but is widespread on the marine sediments at Baillie Islands. Blue-green willow and white avens are constant and dominant. Other common species include rock saxifrage, mountain sorrel, *Draba bellii*, an unidentified bluegrass, and short-leaved fescue. A primrose (*Primula stricta*), Vahl cinquefoil, and Richardson phlox are frequent. At Baillie Islands, this vegetation occurs on mudboils in fine silts and clays.

4.1.3 Dune Vegetation Type

4.1.3.1 Stabilized Dune Subtype

This vegetation has not been described by Corns (1972), Zoltai et al. (1979) or Hardy Associates Ltd. (1979). It occupies a stabilized deposit of aeolian soils east of McKinley Bay. It has a diverse assemblage of herbs and graminoids on mesic soils. The dominant graminoids are Bigelow sedge, *Kobresia myosuroides*, and the bluegrass *Poa alpigena*. Arctic willow, white avens, *Oxytropis arctica*, Labrador tea, crowberry, and *Potentilla rubricaulis* are frequent shrubs and herbs.

4.1.3.2 Active Dune Subtype (*Elymus arenarius* Subtype)

Very active dunes occur on the backshores of McKinley Bay commonly, and the smaller Baillie Island has one active dune complex. Lyme grass is the dominant species, and either Arctic willow or blue-green willow are also common. White avens, shortleaf fescue, mountain sorrel, and red bearberry occur on slightly less active sites. Hardy Associates Ltd. (1979) note that *Arctagrostis latifolia* occurs also.

Hardy Associates Ltd. (1979) describes a more mature assemblage in which *Carex limosa* is co-dominant with lyme grass. Though not studied by us this sedge-grass meadow is probably intermediate between the active and stabilized dunes described earlier in this section.

4.1.4 Littoral Vegetation Type

4.1.4.1 Tidal Marsh (*Puccinellia phryganodes* Subtype)

At both McKinley Bay and Baillie Islands, tidal shorelines that are protected from ice scour sometimes develop a tidal marsh vegetation as a result of extremes in high tide levels. The dominant species is goose grass which sometimes develops an extensive, lawnlike turf. On slightly higher beaches, *Arenaria peploides, Stellaria humifusa, Cochlearia officinalis*, and shortleaf fescue may also be present.

4.1.4.2 Sandspits and Barrier Beaches (*Arenaria peploides* Subtype)

Arenaria peploides, Cochlearia officinalis and shortleaf fescue are the characteristic species on sandy to pebbly beaches that are subject to regular wave and ice disturbance. Vegetative cover may be much less than one percent, and it is patchy and discontinuous. Examples occur at both McKinley Bay and Baillie Islands. Hardy Associates Ltd. (1979), Zoltai et al. (1979) and Corns (1972) did not describe this minor vegetation type. Schamel (1978) briefly describes similar vegetation at Egg Island, Alaska (70°26'N, 148°43'W).

4.2 Ecological Land Classification

By the Lacate system, all of the McKinley Bay study area is within a single ecodistrict, because it originated as deltaic deposits derived from the Mackenzie River during Wisconsinan and Recent times, and now has a low arctic climate. The McKinley Bay area is subdivided into four ecosections that reflect distinct land formational processes related to marine deposition, the action of wind, and the deposition of sediments in freshwater lakes. At the lowest level of the hierarchy, we have recognized ecotypes that differ in their vegetation cover and their use by wildlife.

The Baillie Islands study area is probably within a different ecodistrict from the McKinley Bay study area, because Baillie Islands and nearby parts of the Cape Bathurst Peninsula were formed from fine textured marine sediments that were lifted up from the sea floor during Wisconsinan or Recent times. Further, Baillie Islands may have a slightly cooler, drier climate than does McKinley Bay.

Within the Baillie Islands ecodistrict, we have recognized four ecosections that reflect differing processes of land formation. Each ecosection is further subdivided into one or more ecotypes that differ from each other by vegetation and wildlife use. Within this report, we have used a unified nomenclature for the Baillie Islands and McKinley Bay study areas.

Tables 4 and 5 are preliminary biophysical legends for McKinley Bay, and Baillie Islands, respectively. Figures 14 and 15 are maps that show the distributions of ecotypes within each study area.

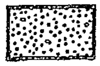
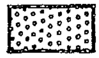
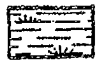
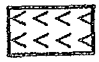
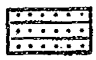
Table 4. Preliminary biophysical legend for the McKinley Bay study area.

Ecosection	Ecotype	Landform	Soil texture	Predominating vegetation	Wildlife characteristics
Atkinson Point	AT 1	spit, bay mouth bar, barrier beach	sandy to gravelly	*Arenaria peploides* subtype	1. loafing areas for sea ducks, gulls. 2. potential nest sites for glaucous gull, Arctic tern
	AT 2	active sand dunes	sandy	*Elymus arenarius* subtype	1. limited use due to small areal extent.
Louth Bay	LB 1	tidal marsh, lacustrine sediments invaded by sea	marine silts, clays	*Puccinellia phryganoides* subtype	1. important grazing area for brant. 2. loafing area for oldsquaw and other sea ducks.
	LB 2	tidal mudflat	marine silts, clays	no vegetation	1. no major uses, minor use as loafing area for sea ducks and gulls.
Airstrip	AS 1	aeolian-veneered fluvial plain, many thermokarst ponds, low-centered polygons predominate	sands, clays	*Carex stans* subtype	1. high densities of nesting shorebirds and songbirds. 2. important nesting area for oldsquaw, pintail, white-fronted goose, whistling swan.
	AS 2	aeolian-veneered fluvial plain, low-centered polygons predominate, many thermokarst ponds	sands, clays	Raised-center polygon subtype	1. grazing area for reindeer. 2. moderate densities of nesting shorebirds and songbirds.
Corral	CO 1	deep aeolian veneer over fluvial plain, aeolian deposits stabilized by vegetation	sands	stabilized dunes subtype	1. grazing area for reindeer. 2. low to moderate densities of nesting songbirds.
Pingo	PG 1	lacustrine sediments sometimes with low-centered polygons	silts, clays	mesic: sedge-heath subtype wet: *Carex stans* subtype	1. moderate to high numbers of nesting songbirds and shorebirds 2. sometimes high use by non-breeding and moulting swans. 3. possibly important to other nesting waterfowl.

Table 5. Preliminary biophysical legend for the Baillie Islands study area.

Ecosection	Ecotype	Landform	Soil texture	Predominating vegetation	Wildlife characteristics
Atkinson Point	AT 1	spit, bay mouth bar, barrier beach	sandy to gravelly	*Arenaria peploides* subtype	1. loafing area for sea ducks, gulls. 2. potential nesting area for glaucous gull, Arctic tern.
	AT 2	active sand dunes	sand	*Elymus arenarius* subtype	None. Limited area on smaller Baillie Is.
Baillie	BA 1	marine sediments, mudboils are predominant pattern. Mesic to xeric	silts, clays	White avens subtype	1. grazing area for caribou. 2. low to moderate densities of nesting shorebirds and songbirds.
Pingo	PG 2	lacustrine sediments, occasional low-centered polygons. Mesic to hydric	silts, clays	*Carex stans* subtype	1. moderate densities of nesting shorebirds and songbirds. 2. low densities of nesting swans and jaegers.
Louth Bay	LB 2	tidal mudflat	marine silts, clays	mostly without vegetation, occasional *Puccinellia phryganoides* at upper limit of tide	1. loafing area for sea ducks.

Legend for Ecotype Distribution Maps [a/]

Ecosection	Ecotype	Designation
Atkinson Point	AT1	
	AT2	
Louth Bay	LB1	
	LB2	(same as LB1)
Airstrip	AS1	
	AS2	
Corral	CO1	
Pingo	PG1	
	PG2	
Baillie	BA1	

 coastal mud cliffs

[a/] see Tables 4 and 5 for biophysical legends

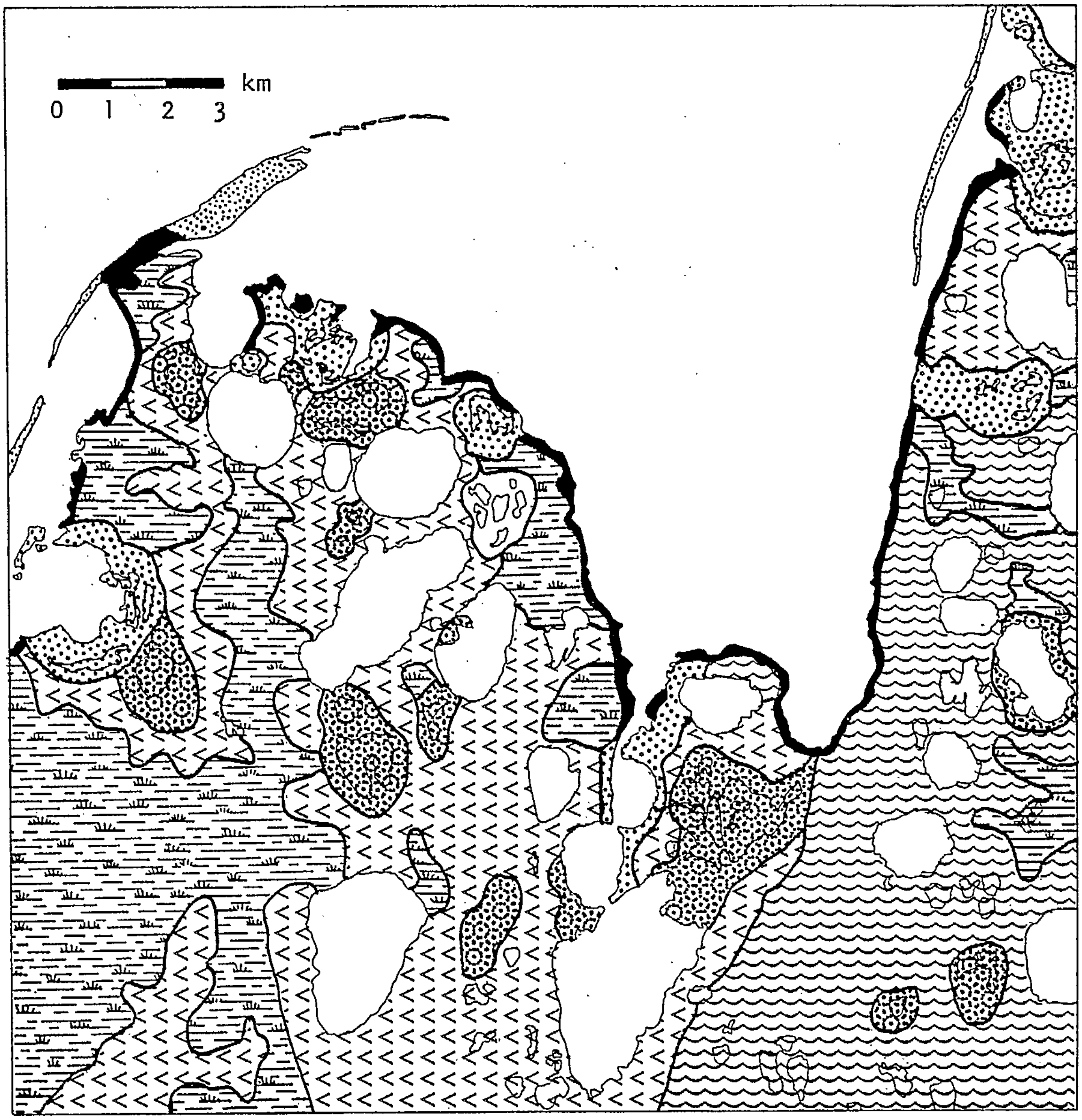


Figure 14. Distribution of ecotypes within the McKinley Bay study area.

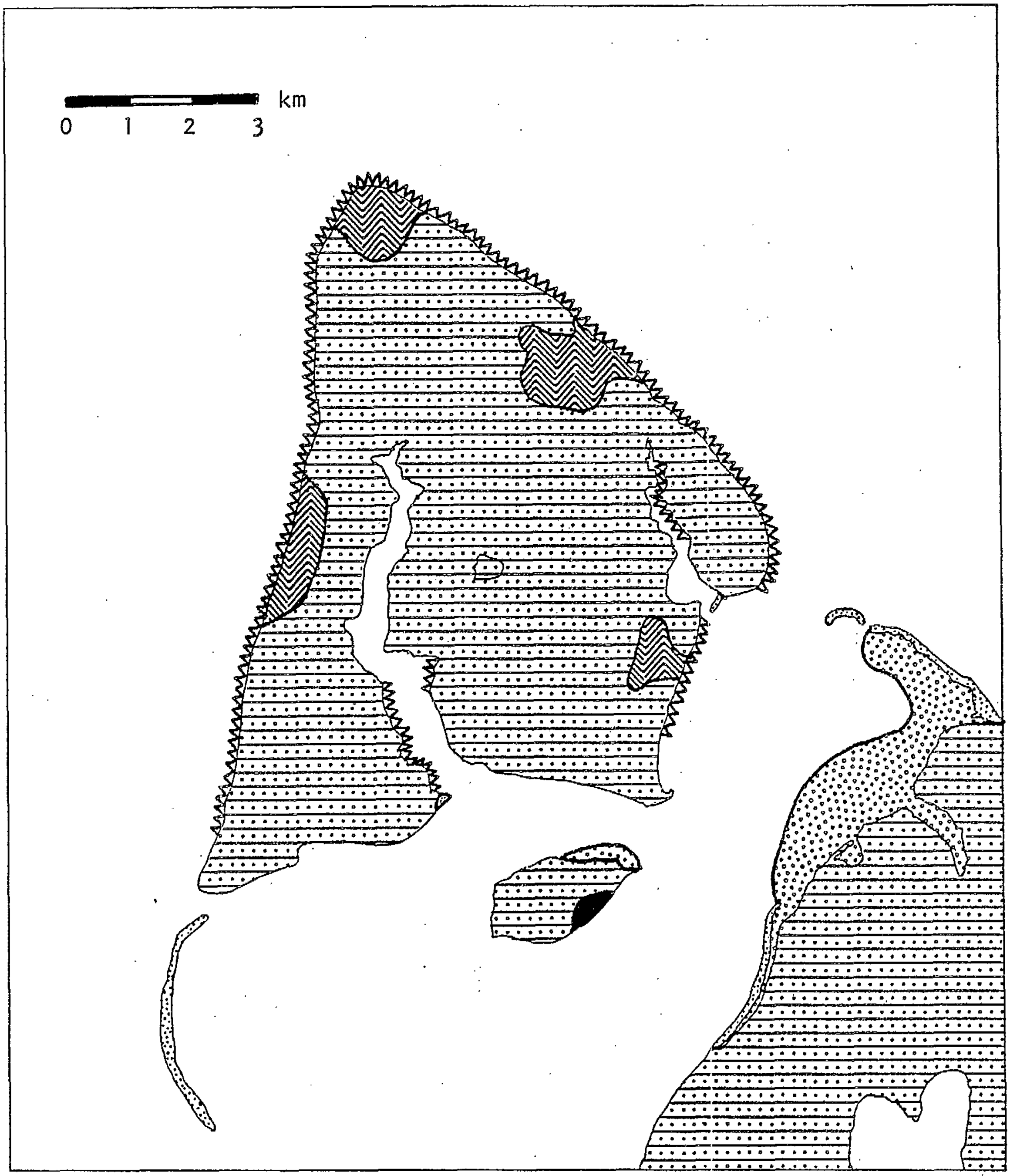


Figure 15. Distribution of ecotypes within the Baillie Islands study area.

4.3 Aerial Surveys

4.3.1 McKinley Bay

The first survey of McKinley Bay had been initially scheduled for June 4. However, on arrival we discovered that, except for a few small shallow leads along the shoreline, the entire bay was covered with ice. The adjacent land surface and lakes were also covered with snow and ice. As a result, few birds were observed and the June 4 flight served only to familiarize us with the geography of the area.

On June 27, much of the bay was still ice covered. However, a shoreline lead, approximately 0.5 to 1.5 km wide, was present and the tidal lagoon system at the south end of the bay and inland lakes were largely free of ice. Diving ducks were the most commonly observed birds (Tables 6 and 7).

Except for occasional birds seen in flight, most diving ducks were observed concentrated in the shoreline lead on the east side of the bay (Figure 16). These flocks consisted mainly of oldsquaws[a/] and scoters; oldsquaws were more numerous than scoters along the shoreline (Appendix 2), whereas at the ice edge white-winged and surf scoters predominated (Appendix 3). Dabblers and loons were present in low numbers and geese were not numerous (Appendix 4). Most of the swans observed occurred in pairs and were associated with the deeper lakes located southeast of the bay (Figure 16). Glaucous gulls were quite numerous throughout the study area. Total number of birds in the terrestrial portion of the study area was estimated to be about 1200 (Table 8).

[a/] scientific names of all birds observed at McKinley Bay and Baillie Islands are given in Appendices 16 and 17 respectively.

Table 6. Birds observed along aerial transects at McKinley Bay.

Survey date	Marine component[a]									Terrestrial component[b]												
	divers	dabblers	unidentified ducks	geese	loons	gulls	terns	shorebirds	Total Birds	divers	dabblers	unidentified ducks	geese	swans	loons	jaegers	gulls	terns	shorebirds	passerines	Total Birds	TOTAL BIRDS MARINE AND TERRESTRIAL[c]
June 27	292	2	0	15	1	27	5	0	342	28	5	0	27	18	3	6	54	0	6	0	147	489
	(10.8)[d]	(0.1)	(-)	(0.6)	(Tr.)[e]	(1.1)	(0.3)	(-)	(12.8)	(1.1)	(0.3)	(-)	(0.8)	(0.6)	(0.1)	(0.3)	(1.9)	(-)	(0.3)	(-)	(5.3)	(8.9)
August 11	970	14	81	12	7	44	2	32	1162	65	182	21	23	67	4	3	103	64	76	10	618	1780
	(36.4)	(0.6)	(3.1)	(0.6)	(0.3)	(1.7)	(0.1)	(1.1)	(43.3)	(2.2)	(6.4)	(0.8)	(0.8)	(2.5)	(0.3)	(0.1)	(3.6)	(2.2)	(2.8)	(0.3)	(21.9)	(32.2)
August 27	113	0	21	29	6	116	0	23	308	71	51	38	158	6	2	1	63	0	16	2	408	716
	(4.2)	(-)	(0.8)	(1.1)	(0.3)	(4.4)	(-)	(0.8)	(11.7)	(2.5)	(1.9)	(1.4)	(5.6)	(0.3)	(0.1)	(Tr.)	(2.2)	(-)	(0.6)	(-)	(14.4)	(13.0)

[a] 74.3 km surveyed

[b] 78.7 km surveyed

[c] total distance surveyed = 153.0 km

[d] birds/km^2

[e] Tr. indicates density is non-zero but less than 0.1

Table 7. Birds observed along shoreline cruises at McKinley Bay.

Survey date	divers	dabblers	unidentified ducks	geese	swans	loons	gulls	terns	shorebirds	TOTAL BIRDS
June 27[a/]	550 (20.8)[b/]	4 (0.3)	8 (0.3)	60 (2.2)	3 (0.1)	5 (0.3)	69 (2.5)	18 (0.6)	3 (0.1)	720 (27.2)
August 11[c/]	1981 (76.9)	15 (0.6)	251 (9.7)	58 (2.2)	26 (1.1)	9 (0.3)	109 (4.2)	35 (1.4)	4 (0.3)	2488 (96.7)
August 27[c/]	38 (1.4)	4 (0.3)	205 (8.1)	502 (19.4)	0 (-)	2 (0.1)	200 (7.9)	7 (0.3)	127 (5.0)	1085 (42.2)

[a/] length of cruise = 73.8 km

[b/] birds/km^2

[c/] length of cruise = 71.4 km

Key to Symbols Used in Bird Distribution Maps.

		Density
Diving ducks	●	10 - 49
	⬤	50 - 100
Geese	△	1 - 9
	▲	10 - 49
	▲ (large)	50 - 100
Swans	□	1 - 9
	■	10 - 50
	■ (large)	50 - 100

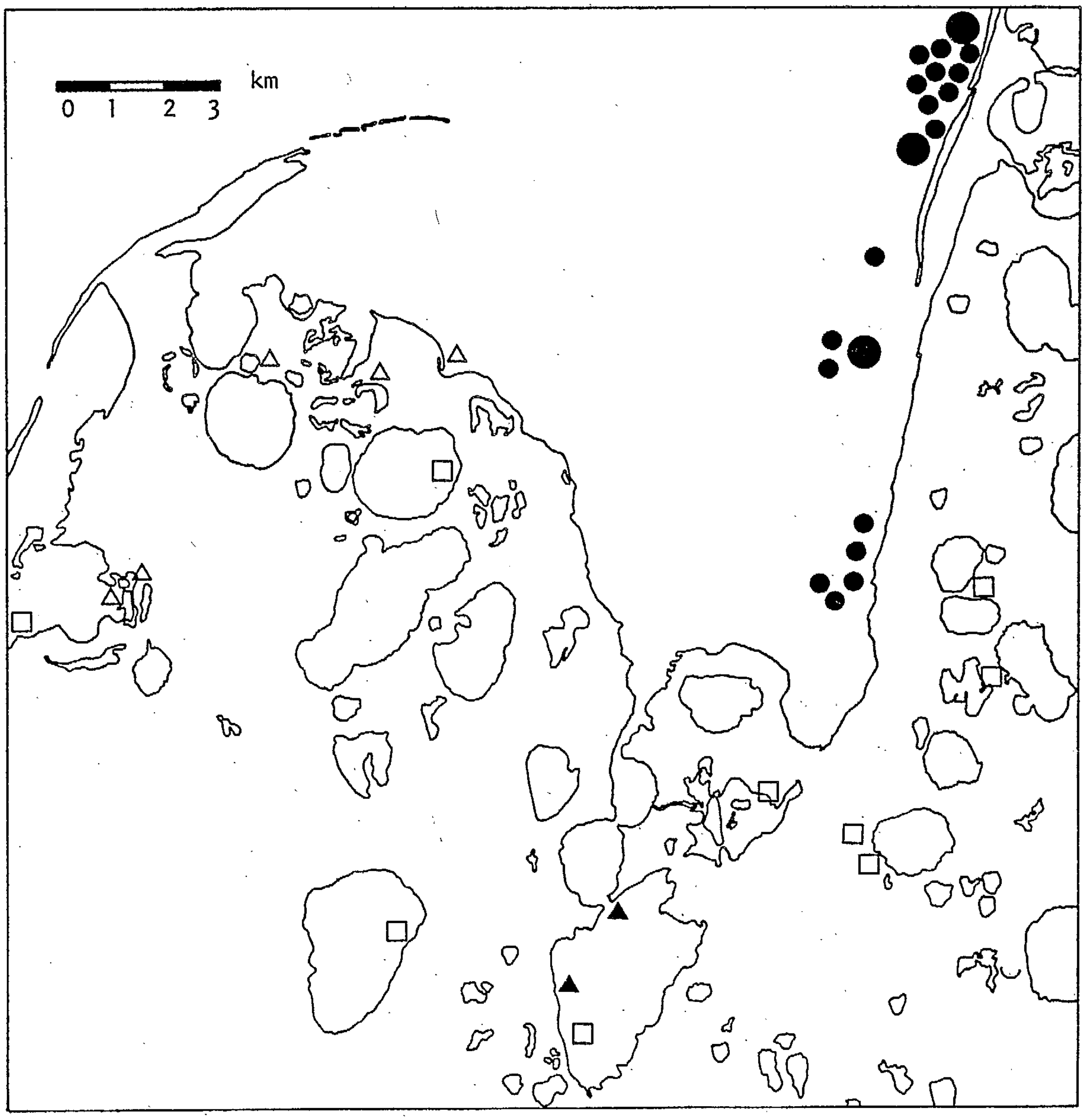


Figure 16. Distribution of waterfowl at McKinley Bay, June 27, 1980.

Table 8. Estimated numbers of birds present at McKinley Bay.

	Marine component									Terrestrial component											
	divers	dabblers	unidentified ducks	geese	loons	gulls	terns	shorebirds	TOTAL BIRDS	divers	dabblers	unidentified ducks	geese	swans	loons	jaegers	gulls	terns	shorebirds	TOTAL BIRDS [a]	TOTAL BIRDS - MARINE AND TERRESTRIAL
June 27	. [b]	.	.	.	.	.	.	.	.	231	41	0	223	149	25	50	446	0	50	1214	.
August 11	5301	77	443	66	38	240	11	175	6351	537	1503	174	190	553	33	24	851	529	628	5111	11462
August 27	618	0	115	159	33	634	0	126	1685	587	421	314	1305	50	17	8	520	0	132	3370	5055

[a] not including passerines

[b] . indicates no extrapolation made from raw data (see section 3).

By August 11, many more birds were present in the study area (Table 6, Appendices 5 and 6). Moulting diving ducks, primarily scoters, occurred in large flocks south of the protective spit at Atkinson Point and in the extreme southern portion of the bay (Figure 17). Numbers observed were similar to those reported by Sharp (1978). The number of loons observed per km^2 by T. Barry (pers. comm.) between August 16 and 18 was equivalent to the number we observed. However, T. Barry recorded higher densities of oldsquaws and scoters during that period. Approximately 5300 diving ducks were estimated to be present in the marine component of the study area at this time (Table 8). This is similar to the number observed from Canmar's dredge southeast of Atkinson Point in early August (J. Ward, pers. comm.) and suggests that 5300 is an underestimate of the total number of divers present in the entire bay. Dabblers, mostly wigeon, had increased in number and occurred mainly in the poorly drained polygon area west of the bay (Appendix 7). Geese were again not numerous throughout the study area; largest numbers occurred in the lagoon system south of the bay. Swans were also present in significant numbers in the lagoon system and pairs, many with young, were again observed in the lake area southeast of the bay. Swans were estimated to number about 550 throughout the terrestrial portion of the study area (Table 8). The apparent attraction of swans to the lagoon system was also evident from the data collected by Searing _et al_. (1975). Glaucous gulls occurred throughout the study area and Sabine's gulls and Arctic terns were numerous in localized areas.

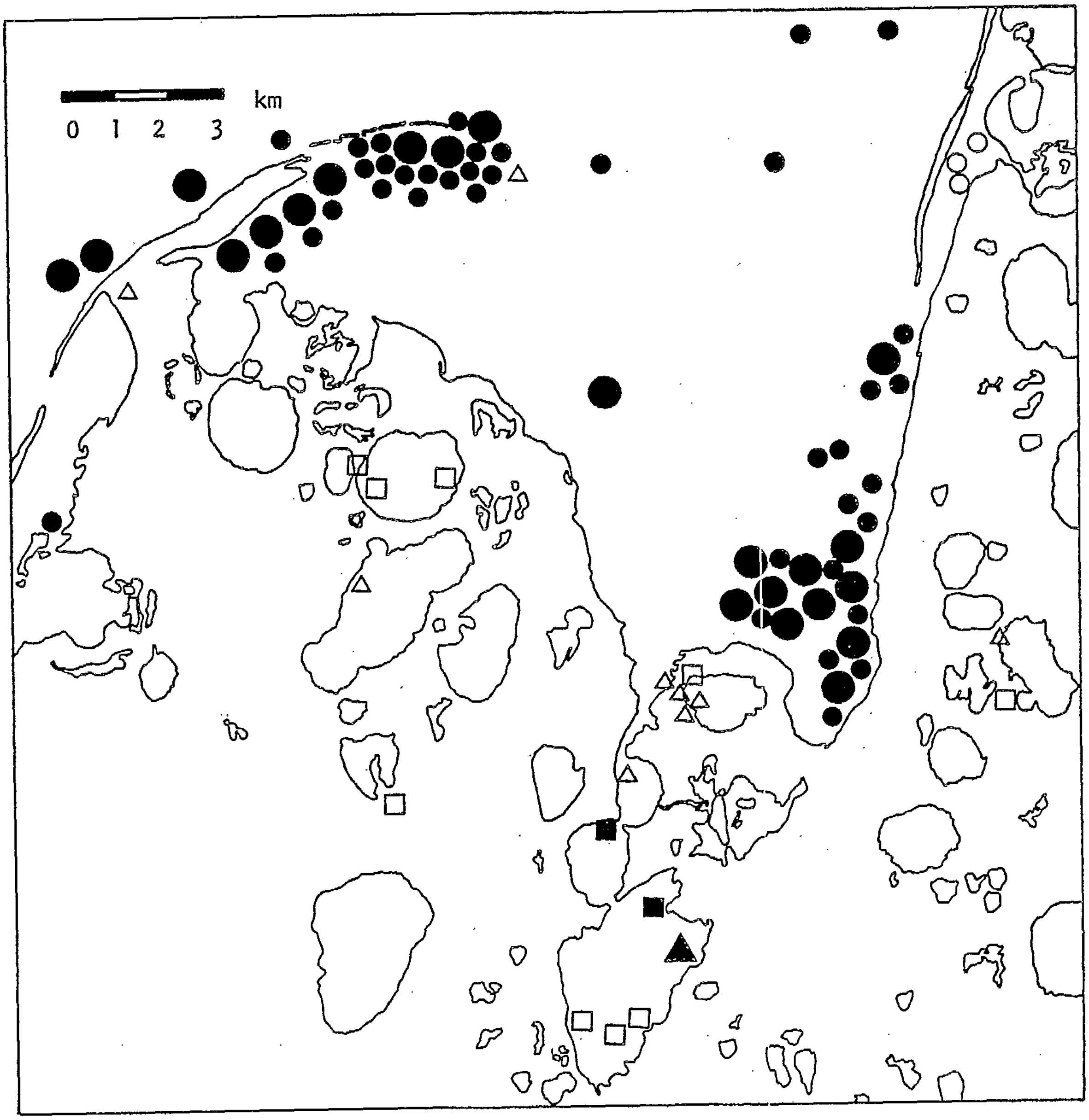


Figure 17. Distribution of waterfowl at McKinley Bay, August 11, 1980.

By August 27, there were much fewer diving ducks in the study area (Table 6, Appendices 8 and 9), and large concentrations were absent from the Atkinson Point and extreme southeastern areas of the bay (Figure 18). The total number of diving ducks estimated present in the marine component had dropped to just over 600. A few large flocks were present at the southern end of the lagoon system. The large reduction in diving ducks between the beginning and end of August was also noted by T. Barry (pers. comm.) and reflected the departure of the birds following the moult. However, J. Ward (pers. comm.) reported several thousand divers in the northeastern portion of the bay at the end of August. Geese were more numerous (Table 6, Appendix 10), occurring in moderate concentrations in the lagoon system and on the eastern side of the bay (Figure 18). Approximately 1300 geese were estimated to be present throughout the terrestrial portion of the study area. Swans were observed in only small numbers and immature individuals were again present. Glaucous gulls were abundant and observed in larger numbers than during the previous two surveys (Appendices 8,9 and 10). Over 1000 gulls were estimated to be present in the entire study area. At least 70 gulls were observed on the artificial island formed through disposal of dredge spoils during the summer by Canmar.

In summary, at the end of June, diving ducks occurred in concentrations in the lead adjacent to the eastern shoreline of the bay. Following melt of the ice cover in the bay, moulting concentrations of divers were most numerous just south of the spit at Atkinson Point and in the extreme south end of the bay. By the end of August, most divers had apparently departed from the bay following the moult, although some

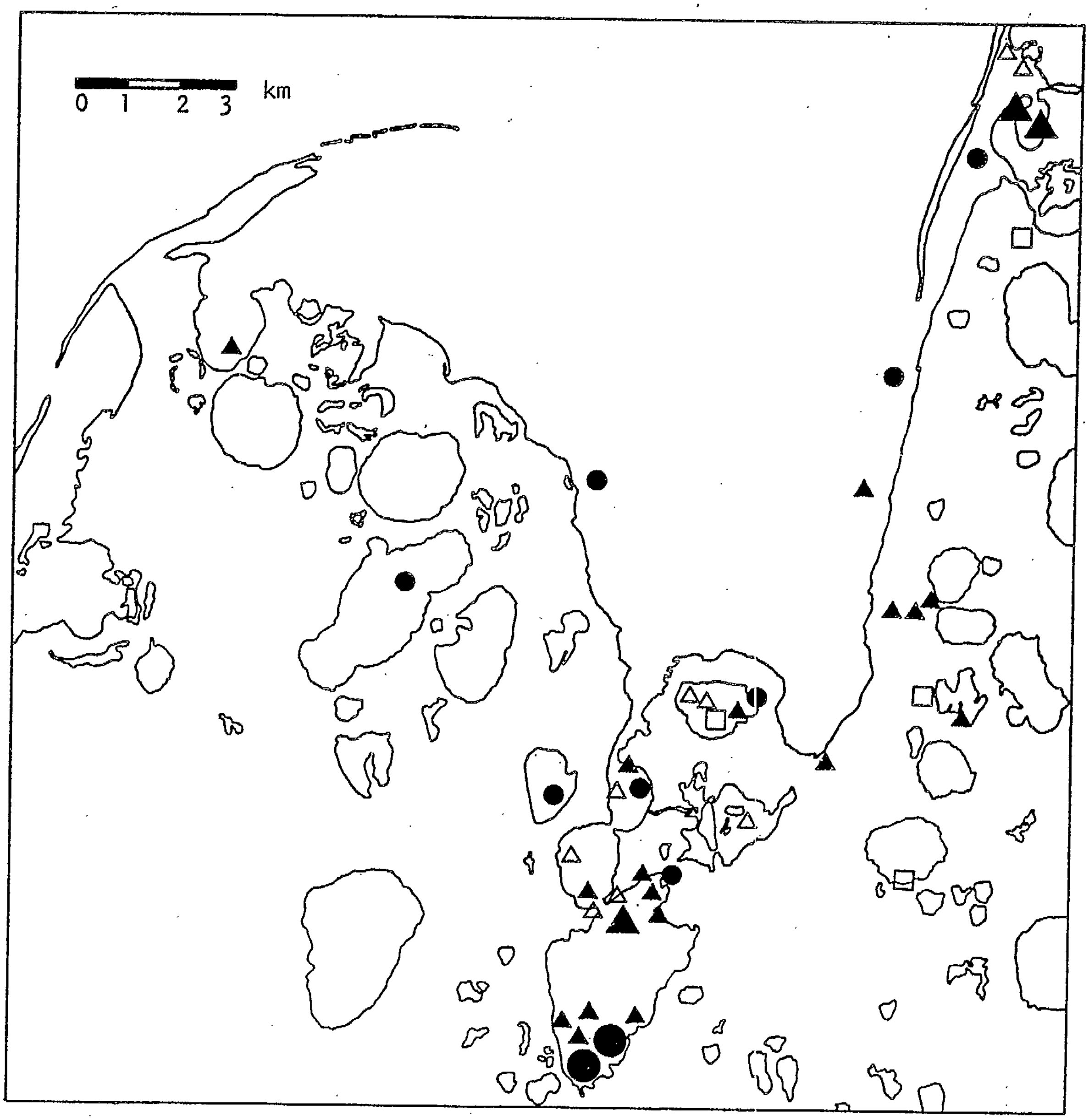


Figure 18. Distribution of waterfowl at McKinley Bay, August 27, 1980.

flocks still remained in the lagoon system south of the bay. Dabblers were common at the beginning of August in the low-lying polygonal area west of the bay. Geese were most commonly associated with the lagoon system and were most numerous at the end of August. Most of the swans were in the deeper lakes located in the more elevated terrain southeast of the bay. Swans also occurred in the lagoon system. Glaucous gulls were numerous in the study area particularly at the end of August.

4.3.2 Baillie Islands

At the time of the first survey on June 5, shorefast ice covered most of the marine portion of the study area. A small area of shallow water over mudflats occurred at the base of the spit at Cape Bathurst. An extensive area of open sea existed in a large lead extending in a roughly northwest to southeast direction north of the larger island. This was the Cape Bathurst polynya. Almost 300 common eiders and a few oldsquaws were observed at the ice edge bordering the lead (Table 9, Appendix 11, Figure 19). The use of this polynya by several thousand eiders and oldsquaws in 1974 was documented by Searing et al. (1975). Small flocks of snow geese were seen flying over the northern part of the large island and a larger flock of 150 was noted on the mainland (Appendix 12). Snowy owls were fairly common on the large island. A total of 1300 geese and 45 snowy owls were estimated to be present in the terrestrial portion of the study area (Table 10). Large numbers of snowy owls and jaegers have been observed on the large island in years of high lemming (*Lemmus sibiricus*) populations (T. Barry, pers. comm.).

Table 9. Birds observed along aerial transects at Baillie Islands.

Survey date	Marine component[a]							Terrestrial component[b]									
	divers	geese	swans	loons	jaegers	gulls	Total Birds	divers	dabblers	geese	swans	jaegers	gulls	shorebirds	snowy owls	Total Birds	TOTAL BIRDS - MARINE AND TERRESTRIAL[c]
June 5	291	40	0	0	0	42	373	0	0	230	0	0	0	11	8	249	622
	(7.5)[d]	(1.1)	(-)	(-)	(-)	(1.1)	(9.4)	(-)	(-)	(15.6)	(-)	(-)	(-)	(0.3)	(0.3)	(16.7)	(11.7)
June 28	544	8	4	1	3	4	564	1	1	10	2	11	15	1	2	43	607
	(13.9)	(0.3)	(0.1)	(Tr.)[e]	(0.1)	(0.1)	(14.4)	(Tr.)	(Tr.)	(0.6)	(0.3)	(0.8)	(1.1)	(Tr.)	(0.3)	(2.8)	(11.4)

[a] 108.6 km surveyed

[b] 41.4 km surveyed

[c] total distance surveyed = 150.0 km

[d] birds/km^2

[e] Tr. indicates density is non-zero but less than 0.1

Figure 19. Distribution of waterfowl at Baillie Islands, June 5, 1980.

Table 10. Estimated numbers of birds present at Baillie Islands. [a/]

Survey date	divers	dabblers	geese	swans	jaegers	gulls	shorebirds	snowy owls	TOTAL BIRDS
June 5	0	0	1300	0	0	0	62	45	1407
June 28	6	6	57	11	62	85	6	11	243

[a/] terrestrial component only (see 3. METHODS)

Ice was still present in the study area at the time of the June 28 survey. However, a narrow shoreline lead now surrounded the large island and open water also occurred between the island and the mainland west of Cape Bathurst. Diving ducks were now almost twice as numerous as they were on June 5 (Tables 9 and 11). Oldsquaws occurred in greater numbers than eiders or scoters (Appendices 13 and 14). The largest concentrations were present in the extensive lead north of the islands (Figure 20). During the shoreline cruise, over 400 oldsquaw were found concentrated in the sheltered area just west of Cape Bathurst with eiders and scoters (Figure 20, Appendix 14). A few single swans occurred on the larger island and in the westernmost inlet of the island indicating some breeding in this area. Geese, jaegers and other birds occurred in small numbers in the study area (Appendix 15).

Due to poor weather conditions, we were unable to conduct the two surveys originally planned for August. Therefore we were unable to record numbers and species of migratory birds using the Baillie Islands area during the latter part of the brief summer period. T. Barry (pers. comm.) reports that several hundred eiders were present in the area adjacent to the sandspit southwest of the large island. The large concentrations of ducks observed west of Cape Bathurst on June 28 were no longer present. Searing et al. (1975) noted the presence of eider flocks in the Baillie Islands area in late summer of 1974.

In summary, in early June, open water was present only in the polynya to the north of the islands. Eiders were the most common birds present in this open water area. Snowy owls were quite common on land. Small

Table 11. Birds observed during shoreline cruise at Baillie Islands.[a]

Survey date	divers	unidentified ducks	geese	swans	loons	gulls
June 28	569 (28.6)[b]	75 (3.9)	4 (0.3)	4 (0.3)	5 (0.3)	41 (1.9)

[a] length of cruise = 55.1 km

[b] birds/km^2

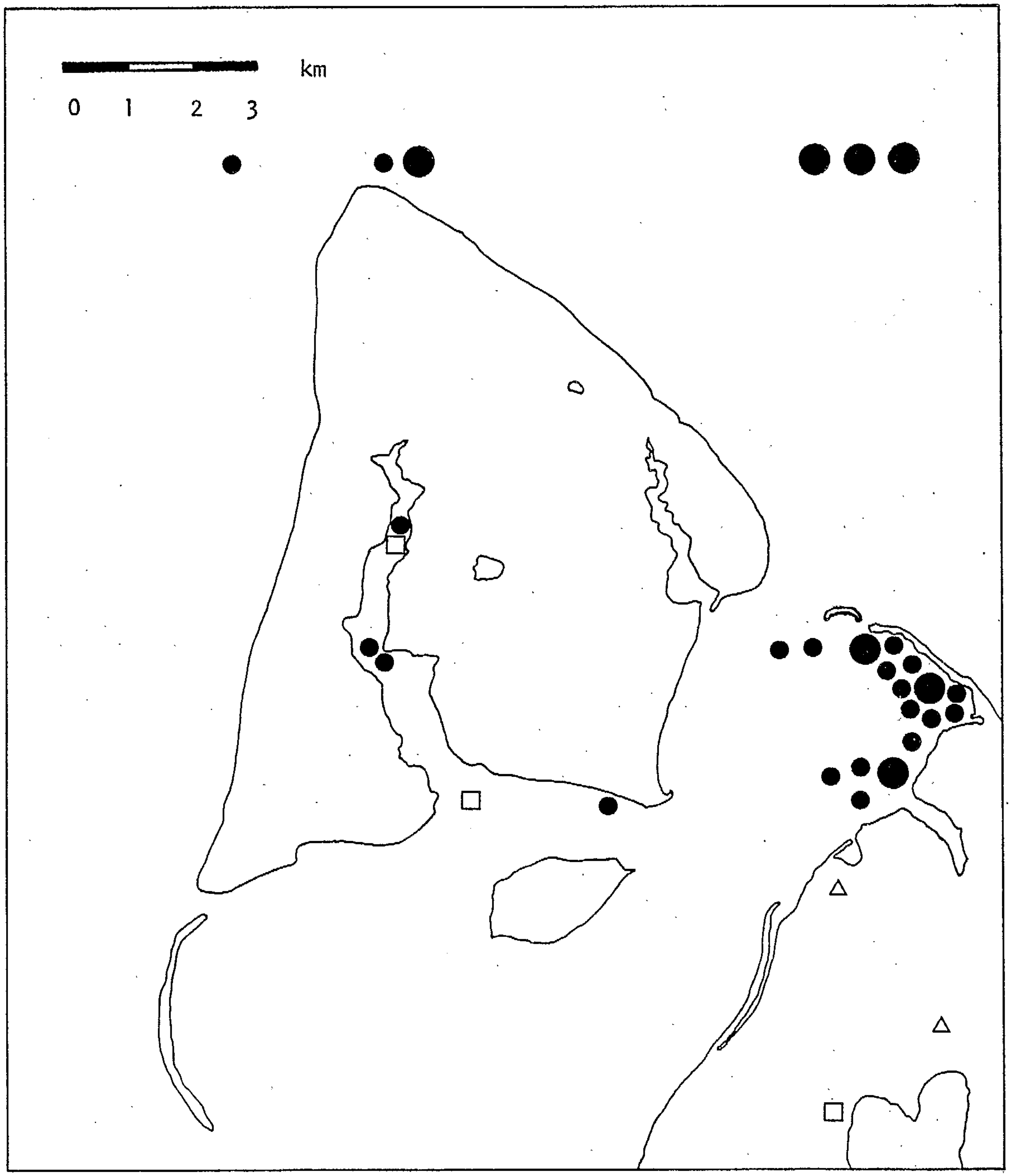


Figure 20. Distribution of waterfowl at Baillie Islands, June 28, 1980.

flocks of snow geese were also present. By late June, oldsquaws outnumbered the eiders and scoters in the polynya and in the open water area which had appeared west of Cape Bathurst. Small numbers of other birds including swans, geese and jaegers also occurred in the study area. Migratory bird use of the Baillie Islands area later in the summer was not documented due to poor weather.

4.4 Boat Surveys

4.4.1 McKinley Bay

On June 30, 1980, we performed a boat census of birds in McKinley Bay. The census was incomplete, because high waves and drifting ice floes prevented us from surveying the eastern shore of the bay. That day, most of the bay deeper than 1 m was covered by a continuous sheet of melting ice; there was open water in the shallows near shore and in Louth Bay. Our boat census route was 19.5 km long (Figure 8). Table 12 summarizes the data from this census; "roll-ups" of birds flying ahead of the boat were excluded to provide an unduplicated count.

In descending order, the most numerous species were: white-winged scoter, surf scoter, glaucous gull, oldsquaw, red-breasted merganser, and common merganser. The remaining species were less frequent than one individual per kilometer of the total survey. More than 80 percent of the white-winged scoters, surf scoters and oldsquaws were males. These birds had either completed breeding activities and had moved to McKinley Bay to moult, or had not bred. Almost all glaucous gulls were in adult plumage, but we could not determine whether these birds were all breeding.

Table 12. Birds observed during boat census of McKinley Bay during spring breakup, June 30, 1980.

Survey segment (length in kilometers)	yellow-billed loon	arctic loon	red-throated loon	loon	pintail	oldsquaw	king eider	white-winged scoter	surf scoter	common merganser	red-breasted merganser	merganser	jaeger	glaucous gull	arctic tern	TOTAL BIRDS
1[a] (2.0)	0	0	2 (1.0)[b]	0	0	12	0	18 (9.0)	1 (0.5)	5 (2.5)	0	0	0	0	0	38 (19.0)
2 (2.0)	0	0	1 (0.5)	0	0	0	0	7 (3.5)	1 (0.5)	0	0	0	1 (0.5)	9 (4.5)	0	19 (9.5)
3 (5.0)	1 (0.2)	4 (0.8)	0	0	2 (0.4)	60 (12.0)	0	4 (0.8)	1 (0.2)	24 (4.8)	13 (2.6)	2 (0.4)	0	10 (2.0)	0	121 (24.2)
4 (3.0)	1 (0.3)	2 (0.7)	2 (0.7)	0	0	9 (3.0)	6 (2.0)	8 (2.7)	0	0	21 (7.0)	0	0	8 (2.7)	0	57 (19.0)
5 (2.0)	1 (0.5)	0	0	2 (1.0)	0	10 (5.0)	3 (1.5)	339 (169.5)	182 (91.0)	1 (0.5)	11 (5.5)	0	0	29 (14.5)	1 (0.5)	579 (289.5)
6 (2.5)	0	0	0	0	0	0	0	59 (21.6)	50 (20.0)	0	5 (2.0)	0	0	5 (2.0)	0	114 (45.6)
7 (3.0)	0	3 (1.0)	6 (2.0)	2 (0.7)	0	1 (0.3)	0	19 (6.3)	12 (4.0)	0	5 (1.7)	0	0	6 (2.0)	0	54 (18.0)
Total (19.5)	3 (0.2)	9 (0.5)	11 (0.6)	4 (0.2)	2 (0.1)	92 (4.8)	9 (0.5)	449 (23.0)	247 (12.7)	30 (1.5)	55 (2.8)	2 (0.1)	1 (0.1)	67 (3.4)	1 (0.1)	982 (50.4)

a/ locations of survey segments are shown in Figure 8

b/ birds per kilometer of survey segment

The relatively large numbers of common mergansers surprised us, because the range maps of Godfrey (1966) show that the normal breeding range is many hundred kilometers south of McKinley Bay. We did not observe this species during the aerial surveys. Because these birds were mostly males, we believe that common mergansers make a moult migration similar to that of the scoters.

During our boat census, there was a marked concentration of birds at the ice edge as was observed during the aerial surveys. Many birds used the ice edge as a loafing area and fed in the adjacent shallow water. Also the greatest numbers of birds were at the southern end of McKinley Bay. This last result differs somewhat from the observations made during the aerial surveys. Very few ducks were seen along the 7a-9 segment of the June 27, 1980 shoreline cruise (Appendix 3). Greater numbers of birds were observed in the bay on transect 6 of the June 27 aerial survey. However, the number of birds seen from the boat was far greater. Probably, fewer birds were seen from the air because the aerial surveys were perpendicular to the ice edge instead of parallel to it. Certain concentrations of birds located along the ice edge would therefore have gone undetected.

Appendix 16 is a preliminary checklist of birds observed in the McKinley Bay study area.

Interpretation of the boat census data is difficult because spring breakup of the sea ice is a changeable, short term phenomenon. Distribution of seabirds in the spring is therefore also short term.

However, present oil spill cleanup technology requires that oil be allowed to migrate to the ice surface where it can be burned off once the ice begins to melt in the spring and the oil is released. Thus, our boat census data indicate the species which are most likely to be affected by winter oil spills which cannot be cleaned up successfully.

4.4.2 Baillie Islands

On July 3, 1980 we performed a 14.5 km boat survey of birds using the marine waters of Baillie Islands (Figure 9). There were extensive areas of melting ice, but the pans were discontinuous. Much of the open water had developed during the previous week. Only the shorefast ice zone was surveyed. Table 13 summarizes data from this survey. "Roll-ups" of birds flying ahead of the boat were excluded.

There were half as many individuals per kilometer of survey at Baillie Islands than there were at McKinley Bay. The only common species were oldsquaw, glaucous gull and Arctic tern. The remaining species occurred less frequently than one individual per kilometer of the total survey.

More than 90 percent of the oldsquaws we saw were clearly males; many birds appeared to be moulting. Oldsquaws were most numerous in the large western inlet of the larger Baillie Island. Smaller numbers were also seen west of the sandspit projecting north from Cape Bathurst but there were fewer oldsquaws than were observed during the June 28 shoreline cruise (Appendix 14). The rapid melt of shorefast ice in Snow Goose Passage since the June 28 aerial surveys had presumably reduced moulting bird density near Cape Bathurst vicinity because more open water was

Table 13. Birds observed during boat census of Baillie Islands during spring breakup, July 3, 1980.

Survey segment (distance in kilometers)	yellow-billed loon	arctic loon	red-throated loon	oldsquaw	eider	common merganser	pomarine jaeger	parasitic jaeger	long-tailed jaeger	glaucous gull	arctic tern	TOTAL BIRDS
1[a] (3.0)	0	0	0	179 (59.7)[b]	0	0	0	0	0	0	0	179 (59.7)
2 (2.5)	0	0	0	0	0	0	8 (3.2)	2 (0.8)	2 (0.8)	6 (2.4)	0	18 (7.2)
3 (3.0)	1 (0.3)	4 (1.3)	0	8 (2.7)	1 (0.3)	0	0	0	0	4 (1.3)	0	18 (6.0)
4 (4.0)	0	0	2 (0.5)	39 (9.8)	0	0	1 (0.3)	0	0	60 (15.0)	20 (5.0)	122 (30.5)
5 (2.0)	0	0	0	0	0	4 (2.0)	0	0	0	2 (1.0)	0	6 (3.0)
Total (14.5)	1 (0.1)	4 (0.3)	2 (0.1)	226 (15.6)	1 (0.1)	4 (0.3)	9 (0.6)	2 (0.1)	2 (0.1)	72 (5.0)	20 (1.4)	343 (23.7)

a/ locations of survey segments are shown in Figure 9
b/ birds per kilometer of survey segment

available. Glaucous gulls and arctic terns occurred in large flocks near the sandspit projecting north from Cape Bathurst. Although we searched extensively, we found no nests of either species. However, the spit appears to be an important loafing area for these seabirds.

Although they did not occur in large numbers, all three jaeger species occurred in the Baillie Islands study area. Although all three species do not commonly occur together, this is not unusual for Baillie Islands (T. Barry, pers. comm.). On one occasion, a flock of approximately 50 pomarine jaegers (all light phase) flew overhead.

Appendix 17 is a preliminary checklist of birds observed in the Baillie Islands study area.

Again, any spills which had occurred during the winter at Snow Goose Passage, in connection with a harbour facility, and which could not be successfully cleaned up, would reappear following melting and dispersal of the ice pans thus creating a hazard for marine birds before cleanup could be continued. Therefore, our information indicates which species are likely to be most affected by such spills.

5. SUMMARY AND CONCLUSIONS

In 1980 we performed four aerial surveys of McKinley Bay and two aerial surveys of Baillie Islands, N.W.T., to determine migratory bird use of the two areas. The aerial survey data were supplemented with observations made during boat surveys of both locations. We also spent four days performing ground reconnaissance at McKinley Bay, and three at Baillie Islands, between June 28 and July 5, 1980. During this work, we collected information on the birds, mammals, vegetation, and landscape of the study areas to evaluate the effects of harbour and marine terminal development at each site. We made plant collections to supplement existing vegetation classifications of the study area. We developed an ecological land classification that integrates the vegetation, landform, soils, and wildlife attributes for both Baillie Islands and McKinley Bay.

At McKinley Bay, at the end of June, diving ducks concentrated in the shoreline lead adjacent to the bay's eastern shoreline. Further concentrations were associated with the ice edge in the southern portion of the bay. Following melt of the ice cover, moulting concentrations of divers were most numerous south of the sandspit at Atkinson Point and in the extreme south end of the bay. By the end of August, most divers had apparently left the bay following the moult, although some flocks remained in the lagoon system south of the bay.

Dabblers were common at the beginning of August in the low-lying polygon and poorly drained areas to the west of the bay. Geese were most commonly associated with the lagoon system and were most numerous at the end of August. Greatest numbers of swans were present in the deeper lakes located in the more elevated terrain southeast of the bay. Swans also occurred in the lagoon system. Glaucous gulls were numerous throughout the area, particularly at the end of August.

In early June, in the Baillie Islands area, open water was present only in the polynya lying to the north of the islands. Eiders were the most common birds here. Snowy owls were quite common on land and small flocks of snow geese were also noted. By late June, oldsquaws outnumbered the eiders and scoters in the polynya and in the open water area which occurred west of the Cape Bathurst spit. By early July, many of the oldsquaws previously observed in the Cape Bathurst area had apparently dispersed to other areas of Snow Goose Passage following rapid ice melt, particularly to the western inlet of the larger island.

Small numbers of other birds including swans, geese and jaegers also occurred in the area. Migratory bird use of Baillie Islands later in the summer was not documented due to poor weather.

An analysis of the potential effects of harbour and marine terminal development on the use of McKinley Bay and Baillie Islands by migratory birds and other wildlife is contained in a separate volume (Volume II). Volume II also lists recommended measures for protecting wildlife from adverse effects of development activities.

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Appendix 1. Common names of plants mentioned in this report, and their scientific equivalents.

Aquatic sedge	*Carex aquatilis* var *stans*
Arctic willow	*Salix arctica*
Bigelow sedge	*Carex bigelowii*
Bilberry	*Vaccinium uliginosum*
Bluegrass	*Poa* spp.
Blue-green willow	*Salix glauca*
Broad-leaved cottongrass	*Eriophorum angustifolium*
Cassandra	*Chamaedaphne calyculata*
Cloudberry	*Rubus chamaemorus*
Cottongrass	*Eriophorum* spp.
Crowberry	*Empetrum nigrum*
Dwarf birch	*Betula nana*
Foxtail	*Alopecurus alpinus*
Goose grass	*Puccinellia phryganodes*
Harestail cottongrass	*Eriophorum scheuchzeri*
Labrador tea	*Ledum decumbens*
Lowbush cranberry	*Vaccinium vitis-idaea*
Lyme grass	*Elymus arenarius* ssp. *mollis*
Mountain sorrel	*Oxyria digyna*
Netted willow	*Salix reticulata*
Oatgrass	*Dupontia fisheri*
Red bearberry	*Arctostaphylos rubra*
Richardson phlox	*Phlox richardsonii*
Rock saxifrage	*Saxifraga oppositifolia*
Short-leaved fescue	*Festuca brachyphylla*
Vahl cinquefoil	*Potentilla vahliana*
White avens	*Dryas integrifolia*
White heather	*Cassiope tetragona*

Appendix 2. Birds and mammals observed on marine component of aerial transects at McKinley Bay - June 27, 1980.

	Birds																Mammals
Transect	loon	brant	white-fronted goose	American wigeon	scaup	oldsquaw	common eider	white-winged scoter	surf scoter	scoter	red-breasted merganser	diver	glaucous gull	herring gull	gull	Arctic tern	ringed seal
1	. a/	.	.	.	.	.	.	.	.	.	.	2	2	1	.	.	.
2	1	.	.	2	.	2	.	.	.	.	.	.	12	.	1	.	.
3	.	12	.	.	40	.	.	.	8	3	.	2	.	.	.	.	.
4	.	.	.	.	.	17	.	100	15	.	.	.	2	.	.	3	.
5	.	.	.	.	.	.	.	.	14	.	.	.	2	.	2	.	1
6	.	1	2	.	.	26	.	.	58	.	.	.	3	.	.	2	.
7	.	.	.	.	.	.	1	.	.	1	2	1	.	.	.	.	.
8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Total	1	13	2	2	40	45	1	100	95	4	2	5	23	1	3	5	1

a/ . indicates no observations

Appendix 3. Birds and mammals observed during shoreline cruise at McKinley Bay, June 27, 1980.

Cruise segment[a/]	Birds																						Mammals
	yellow-billed loon	Arctic loon	red-throated loon	loon	whistling swan	Canada goose	brant	dark goose	pintail	scaup	oldsquaw	common eider	white-winged scoter	surf scoter	scoter	red-breasted merganser	diver	unidentified duck	American golden plover	glaucous gull	herring gull	Arctic tern	reindeer
0 - 1	.[b/]	.	.	.	.	2	.	40	.	.	12	6	.	.	.	.	3	.	.	.	6	2	.
1 - 2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	6	3	.	.
2 - 3	.	.	.	.	.	.	.	.	.	1	.	.	5	.	.	.	.	.	.	1	.	.	.
3 - 4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
4 - 5	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	3	.	.	.	4	3	.	.
5 - 7a[c/]	.	.	.	.	1	.	.	15	.	.	5	.	.	2	.	.	10	.	.	32	1	13	.
7a - 9	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	3	.	1	.	3	50
9 - 10	.	2	.	1	2	2	.	.	.	.	309	2	.	130	61	.	.	5	3	8	3	.	.
Total	1	2	1	1	3	4	1	55	4	1	326	8	5	132	61	4	13	8	3	53	16	18	50

a/ each segment is that portion of the cruise between specified stations (see Figure 9. for station locations and cruise routes)
b/ . indicates no observations
c/ station 5 through 6 and 7 to 7a inclusive

Appendix 4. Birds and mammals observed on terrestrial component of aerial transects at McKinley Bay - June 27, 1980

Transects	Birds																				Mammals
	Arctic loon	loon	whistling swan	brant	white-fronted goose	dark goose	pintail	northern shoveler	oldsquaw	common eider	king eider	red-breasted merganser	diver	ptarmigan	shorebird	jaeger	glaucous gull	herring gull	Thayer's gull	passerine	reindeer
1	. a/	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4	.	.	1	.	6	5	.	.	2	.	.	.	.	.	1	1	.	.	.	.	5
5	.	.	1	.	.	.	3	.	.	.	.	.	.	.	.	.	1	.	.	1	1
6	.	2	2	.	.	.	.	.	.	.	.	.	.	.	1	1	1	.	1	.	72
7	.	.	4	.	1	.	.	.	.	.	2	5	.	.	.	3	9	.	.	.	58
8	1	.	5	.	.	1	.	2	3	7	1	.	2	.	.	.	35	1	.	.	150
9	.	.	.	12	.	.	.	.	.	.	.	.	3	.	4	1	5	.	.	.	.
10	.	.	5	.	.	7	.	.	.	.	.	.	3	1	.	.	1	.	.	.	27
Total	1	2	18	12	7	8	3	2	5	7	3	5	8	1	6	6	52	1	1	1	313

a/ . indicates no observations

Appendix 5. Birds observed on marine component of aerial transects at McKinley Bay, August 11, 1980

	Arctic loon	red-throated loon	loon	brant	mallard	pintail	American wigeon	oldsquaw	eider	surf scoter	scoter	diver	unidentified duck	sandpiper	shorebird	glacous gull	Thayer's gull	Arctic tern
1	. [a/]	1	.	.	.	.	.	2	19	.	25	.	6	.	.	2	.	.
2	.	1	.	.	.	.	.	44	2	250	29	.	.	.	5	6	1	1
3	.	.	1	12	.	.	.	7	1	.	.	.	75	.	.	16 [b/]	.	.
4	1	.	.	.	.	.	.	14	9	.	9	.	.	.	17	8	.	1
5	.	1	.	.	.	.	.	1	.	4	14	27	.	.	.	9	.	.
6	.	.	2	.	7	2	5	.	.	350	160	.	.	10	.	1	.	.
7	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	1	.	.
8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Total	1	3	3	12	7	2	5	71	31	604	237	27	81	10	22	43	1	2

a/ indicates no observations
b/ 12 glaucous gulls observed on artificial island newly created from dredge spoils

Appendix 6. Birds and mammals observed during shoreline cruise at McKinley Bay, August 11, 1980. August 11, 1980.

Cruise segment[a/]	Birds																					Mammals
	yellow-billed loon	Arctic loon	red-throated loon	whistling swan	brant	white-fronted goose	pintail	American wigeon	dabbler	scaup	oldsquaw	eider	scoter	red-breasted merganser	diver	unidentified duck	shorebird	glaucous gull	Thayer's gull	Sabine's gull	Arctic tern	reindeer
0 - 1	.[b/]	2	1	.	.	.	.	.	.	.	20	.	2	.	.	.	.	4	.	.	19	.
1 - 2	2	.	.	.	.	.	.	.	.	155	45	6	.	.	.	40	.	10	.	60	.	10
2 - 3	.	2	.	.	3	.	.	.	.	.	886	.	220	.	.	.	.	.	.	.	1	.
3 - 4	.	.	.	.	.	.	.	.	.	.	7	.	.	.	.	.	.	1	.	.	.	.
4 - 5	.	1	.	.	.	.	.	.	.	.	.	.	102	14	.	41	4	4	.	.	1	5
5 - 6	.	.	.	.	5	.	4	.	2	.	.	.	.	.	.	.	.	5	.	.	14	1
6 - 7	.	.	.	26	.	50	.	3	.	.	.	.	.	.	.	2	.	.	1	15	.	1
7 - 8	.	.	.	.	.	.	.	.	6	.	.	.	.	.	.	.	.	4	.	.	.	.
8 - 9	.	.	.	.	.	.	.	.	.	45	.	.	65	.	60	25	.	1	.	.	.	.
9 - 10	1	.	.	.	.	.	.	.	.	39	130	4	191	.	.	143	.	4	.	.	.	1
Total	3	5	1	26	8	50	4	3	8	239	1088	10	580	14	60	251	4	33	1	75	35	18

a/ . indicates no observations

b/ see footnote a/, Appendix 3.

Appendix 7. Birds and mammals observed on terrestrial component of aerial transects at McKinley Bay - August 11, 1980.

	Birds																									Mammals
Transect	Arctic loon	loon	whistling swan	brant	white-fronted goose	pintail	American wigeon	dabbler	scaup	oldsquaw	eider	scoter	unidentified duck	sandhill crane	American golden plover	shorebird	parasitic jaeger	jaeger	glaucous gull	herring gull	Sabine's gull	Arctic tern	common raven	lapland longspur	passerine	reindeer
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	.	.	1	.	.	.	.	.	.	.
4	.	.	.	.	.	.	2	.	.	.	.	.	2	.	.	.	.	.	71	.	.	.	.	.	.	.
5	.	.	8	.	.	.	6	.	.	.	5	.	5	.	.	60	2	.	1	1	.	.	.	.	.	1
6	1	1	2	2	.	.	.	4	25	7	.	2	.	.	.	.	.	.	1	.	.	.	.	.	3	.
7	.	2	10	2	19	4	69	42	.	5	.	.	5	2	.	.	.	.	7	.	.	2	.	.	.	3
8	.	.	4	.	.	1	.	1	.	21	.	.	9	.	3	6	.	.	7	.	13	40	.	4	1	.
9	.	.	40	.	.	3	28	5	.	.	.	.	.	.	.	.	.	.	.	.	.	22	.	.	.	.
10	.	.	3	.	.	5	.	7	.	.	.	.	.	.	.	.	.	1	1	.	.	.	2	.	.	.
Total	1	3	67	4	19	13	110	59	25	33	5	2	21	2	3	73	2	1	89	1	13	64	2	4	4	4

a/ . indicates no observations

Appendix 8. Birds observed on marine component of aerial transects at McKinley Bay - August 27, 1980.

Transect	loon	brant	dark goose	oldsquaw	common eider	surf scoter	scoter	unidentified duck	glaucous gull	shorebird
1	.[a/]	.	7	1	.	.	.	.	2	.
2	.	.	.	35	.	.	.	.	35	.
3	6	.	.	10	.	.	8	.	76[b/]	20[c/]
4	.	22	.	4	.	8	.	20	1	2
5	.	.	.	3	4	31	9	1	1	.
6	.	.	.	.	.	.	.	.	1	1
7	.	.	.	.	.	.	.	.	.	.
8	.	.	.	.	.	.	.	.	.	.
9	.	.	.	.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.	.	.
Total	6	22	7	53	4	39	17	21	116	23

a/ . indicates no observations
b/ 70 glaucous gulls observed on artificial island created from dredge spoils
c/ all observed on artificial island created from dredge spoils.

Appendix 9. Birds and mammals observed during shoreline cruise at McKinley Bay - August 27, 1980.

Cruise segment[a]	Birds: loon	Canada goose	brant	white-fronted goose	dark geese	dabbler	oldsquaw	white-winged scoter	scoter	merganser	unidentified duck	raptor	sandpiper	shorebird	glaucous gull	herring gull	Arctic tern	Mammals: reindeer
0 - 1	1	.[b]	.	2	.	.	1	.	.	.	1	.	.	12	7	.	.	.
1 - 2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33	.	3	.
2 - 3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	71	.	.	.
3 - 4	.	.	.	.	.	.	.	.	.	.	.	.	.	55	34	.	3	.
4 - 5	.	.	.	.	.	.	.	.	.	.	4	.	.	.	7	.	.	1
5 - 6	.	35	16	.	.	.	15	.	6	2	.	.	.	59	11	.	1	.
6 - 7	1	17	.	126	40	4	.	.	.	.	200	.	.	.	1	.	.	140
7 - 8	.	.	7	.	.	.	.	14	.	.	.	.	.	1	5	.	.	.
8 - 9	.	.	.	17	.	.	.	.	.	.	.	.	.	.	1	1	.	50
9 - 10	.	.	.	22	220	.	.	.	.	.	.	1	4	.	29	.	.	7
Total	2	52	23	167	260	4	16	14	6	2	205	1	4	127	199	1	7	198

a/ . indicates no observations

b/ see footnote a/, Appendix 3.

Appendix 10. Birds and mammals observed on terrestrial component of aerial transects at McKinley Bay - August 27, 1980.

Transect	Birds																		Mammals
	loon	whistling swan	brant	white-fronted goose	dark geese	mallard	pintail	American wigeon	dabbler	scaup	oldsquaw	unidentified duck	sandhill crane	shorebird	jaeger	glaucous gull	herring gull	common raven	reindeer
1	.[a/]	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	16	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.
4	.	.	.	.	.	.	3	.	.	.	.	.	.	.	1	18	.	.	150
5	1	.	.	.	.	.	.	.	4	.	30	.	.	1	.	3	.	1	7
6	.	.	.	.	.	.	.	6	5	22	.	.	.	3	.	7	.	.	.
7	.	6	.	10	16	6	.	.	9	.	.	.	.	6	.	12	1	.	.
8	.	.	4	.	.	.	.	.	7	.	19	.	.	.	.	3	.	.	.
9	1	.	9	12	107	.	9	.	.	.	.	.	.	.	.	1	.	1	130
10	.	.	.	.	.	.	.	.	2	.	.	38	.	.	.	.	.	.	556
Total	2	6	13	22	123	6	12	6	27	22	49	38	2	16	1	62	1	2	843

a/ . indicates no observations

Appendix 11. Birds and mammals observed on marine component of aerial transects at Baillie Islands - June 5, 1980.

Transect	Birds						Mammals	
	snow goose	oldsquaw	common eider	king eider	glaucous gull	short-earred owl	ringed seal	bearded seal
1	. a/	2	18	3	4	.	2	.
2	.	1	269	.	37	.	4	.
3	40	.	.	.	.	.	.	.
4	.	.	.	.	.	.	.	2
5	.	.	.	.	.	.	.	.
6	.	.	.	.	.	1	.	.
7	.	.	.	.	.	.	1	.
8	.	.	.	.	1	.	.	.
9	.	.	.	.	.	.	.	.
10	.	.	.	.	.	.	.	.
Total	40	3	287	3	42	1	7	2

a/ . indicates no observations

Appendix 12. Birds and mammals observed on terrestrial component of aerial transects at Baillie Islands - June 5, 1980.

Transect	Birds				Mammals
	snow goose	American golden plover	shorebird	snowy owl	caribou
1	. [a/]	.	.	.	.
2	80	.	.	.	.
3	.	.	.	4	7
4	.	.	2	2	.
5	.	1	2	.	.
6	.	.	2	2	.
7	.	.	.	.	.
8	.	.	4	.	.
9	.	.	.	.	.
10	150	.	.	.	.
Total	230	1	10	8	7

[a/] . indicates no observations

Appendix 13. Birds and mammals observed on marine component of aerial transects at Baillie Islands - June 28, 1980.

Transect	Birds											Mammals			
	loon	whistling swan	dark geese	oldsquaw	common eider	eider	white-winged scoter	scoter	pomarine jaeger	jaeger	glaucous gull	ringed seal	bearded seal	seal	beluga whale
1	.[a/]	.	.	1	.	.	.	3	1	.	.	.	.	.	30
2	.	.	8	202	71	15	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.
4	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
5	.	2	.	23	.	.	.	2	.	.	1	2	.	3	.
6	.	.	.	71	5	.	.	15	.	2	.	1	1	1	.
7	1	2	.	99	.	.	.	5	.	.	3	.	.	.	.
8	.	.	.	9	1	.	7	.	.	.	.	1	.	.	.
9	.	.	.	6	.	2	3	1	.	.	.	.	.	.	.
10	.	.	.	1	.	.	2	.	.	.	.	.	.	3	.
Total	1	4	8	412	77	17	12	26	1	2	4	9	1	7	30

[a/] . indicates no observations

Appendix 14. Birds and mammals observed during shoreline cruise at Baillie Islands - June 28, 1980.

Cruise segment[a/]	Birds															Mammals	
	yellow-billed loon	red-throated loon	whistling swan	brant	oldsquaw	common eider	king eider	eider	white-winged scoter	scoter	common merganser	diver	duck	glaucous gull	herring gull	caribou	ringed seal
0 - 1	.[b/]	.	.	.	1	.	.	.	.	3	.	30	5	8	.	9	1
1 - 2	.	.	.	.	.	.	.	.	.	.	.	.	40	.	.	.	.
2 - 1	.	3	4	.	79	20	.	1	.	.	5	1	.	7	1	1	.
3 - 4	1	1	.	4	340	6	13	.	9	41	.	20	20	25	.	.	.
Total	1	4	4	4	420	26	13	1	9	44	5	51	65	40	1	10	1

[a/] each segment is that portion of the cruise between specified stations (see Figure 11 for station locations and cruise routes.

[b/] . indicates no observations

Appendix 15. Birds and mammals observed on terrestrial component of aerial transects at Baillie Islands - June 28, 1980.

Transect	Birds										Mammals
	whistling swan	brant	white-fronted goose	pintail	scoter	willow ptarmigan	American golden plover	parasitic jaeger	glaucous gull	snowy owl	caribou
1	. [a]	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	1	1	.	1	.	.
4	.	.	.	.	.	.	.	.	.	1	.
5	.	.	.	.	.	.	.	.	.	.	3
6	2	.	.	.	.	.	.	.	.	.	.
7	.	.	.	.	.	.	.	11	.	.	.
8	.	7	.	.	1	.	.	.	.	1	3
9	.	.	3	.	.	.	.	.	.	.	2
10	.	.	.	1	.	.	.	.	14	.	.
Total	2	7	3	1	1	1	1	11	15	2	8

[a] . indicates no observations

Appendix 16. Preliminary checklist of the birds of the McKinley Bay study area.

The sources of information for the following table are: Kevan (1970) (Kev); Sharp (1978) (Sh); Ward (1979) (Wa79); Ward (1980) (Wa80); this study (KB).

Comments on abundance are provisional, because of the short duration of field studies in the area. The abundance rating is based on the numbers of individuals likely to be seen per day by qualified observers duirng the breeding season:

(1) rare - one or two seen per season,
(2) uncommon - one to five seen per day,
(3) fairly common - six to 25 seen per day,
(4) common - 26 to 100 seen per day,
(5) very common - 101 to 500 seen per day,
(6) abundant - 501 or more seen per day.

Accidental species are those that are beyond the known breeding range, and are unlikely to be seen more often than once in ten years. Migrants are seen in spring and fall en route between breeding and wintering grounds, but do not breed in the study area. Summer residents occur during the breeding season, but their nests or dependent young have not been reported by observers. Breeders (denoted by "B") are species for which nests or dependent flightless young have been reported.

Appendix 16. Preliminary checklist of the birds of the McKinley Bay study area.

Species	Sources of information					Provisional status	Remarks
	Kev	Sh	Wa79	Wa80	KB		
Common loon (*Gavia immer*)		X				Accidental or hypothetical	
Yellow-billed loon (*Gavia adamsii*)		X	X	X	X	Uncommon summer resident	Marine; vulnerable to oil spills
Arctic loon (*Gavia arctica*)		X	B	X	X	Uncommon breeder	Marine feeder; vulnerable to oil spills
Red-throated loon (*Gavia stellata*)		X	B	X	X	Fairly common breeder	Marine feeder; vulnerable to oil spills
Whistling swan (*Olor columbianus*)			B	X	X	Fairly common breeder; fairly common summer resident	
Black brant (*Branta bernicla nigricans*)	B	X	X	X	B	Common breeder	Small colonies noted in study area. Feeds on tidal flats; vulnerable to oil spills.
White-fronted goose (*Anser albifrons*)				X	B	Uncommon breeder	Non-breeders make use of lagoon system (T.Barry, pers.comm.)
Snow goose (*Anser caerulescens*)	X			X	B	Rare breeder, more common in migration	Up to 200,000 pass through region during migration (T.Barry pers.comm.)
Mallard (*Anas platyrhynchos*)					X	Uncommon summer resident	Only one record
Pintail (*Anas acuta*)	X	X	X	X	X	Fairly common summer resident	
Green-winged teal (*Anas crecca*)					X	Uncommon summer resident	
American widgeon (*Anas americana*)					X	Uncommon summer resident	
Scaup ssp. (*Aythya marila* and *A. affinis*)		X			X	Uncommon summer resident	Local population is probably composed of non-breeding moulters
Oldsquaw (*Clangula hyemalis*)	B	X	B	X	B	Common breeder and summer resident	Large flocks of moulting males on bay; vulnerable to oil spills
Common eider (*Somateria mollissima*)		X		X	X	Uncommon summer resident	
King eider (*Somateria spectabilis*)	B?	X		X	B?	Fairly common summer resident	Probably breeds in the area
White-winged scoter (*Melanitta deglandi*)		X		X	X	Very common summer resident	Resident population consists of non-breeding moulting males; vulnerable to oil spills
Surf scoter (*Melanitta perspicillata*)		X	X	X	X	Very common summer resident	Resident population consists of non-breeding moulting males; vulnerable to oil spills
Common merganser (*Mergus merganser*)					X	Fairly common summer resident	Vulnerable to oil spills
Red-breasted merganser (*Mergus serrator*)		X		X	X	Fairly common summer resident	Vulnerable to oil spills
Gyrfalcon (*Falco rusticolus*)			X	X		Rare summer resident	
American kestrel (*Falco sparverius*)				X		Accidental	
Willow ptarmigan (*Lagopus lagopus*)	B?				X	Uncommon permanent resident	
Rock ptarmigan (*Lagopus mutus*)					B	Uncommon permanent resident	

Appendix 16. (cont'd)

Species	Sources of information Kev	Sh	Wa79	Wa80	KB	Provisional status	Remarks
Sandhill crane (*Grus canadensis*)	X		B		X	Uncommon breeder	
Semipalmated plover (*Charadrius semipalmatus*)					X	Uncommon summer resident	
American golden plover (*Pluvialis dominica*)	X		X		X	Uncommon summer resident	
Black-bellied plover (*Pluvialis squatarola*)	X			X		Rare migrant	
Hudsonian godwit (*Limosa haemastica*)			X			Rare summer resident	
Whimbrel (*Numenius phaeopus*)				X		Rare summer resident	
Lesser yellowlegs (*Tringa flavipes*)			X			Rare summer resident	
Ruddy turnstone (*Arenaria interpres*)				X		Rare migrant	
Northern phalarope (*Lobipes lobatus*)	B		X	X	X	Fairly common summer resident; uncommon breeder	
Red phalarope (*Phalaropus fulicarius*)	B?					Rare, may breed	
Sanderling (*Calidris alba*)	X		X			Fairly common migrant	
Semipalmated sandpiper (*Calidris pusilla*)	X		X			Fairly common migrant	
Bairds' sandpiper (*Calidris bairdii*)	X					Uncertain	
Pectoral sandpiper (*Calidris melanotos*)	B		X		X	Uncommon breeder	
Stilt sandpiper (*Micropalama himantopus*)	B					Rare to uncommon breeder	
Long-billed dowitcher (*Limnodromus scolopaceus*)					X	Uncommon summer resident	
Pomarine jaeger (*Stercorarius pomarinus*)	X					Uncertain; probably rare summer resident	Vulnerable to oil spills
Parasitic jaeger (*Stercorarius parasiticus*)	X			X	X	Uncommon summer resident	Vulnerable to oil spills
Long-tailed jaeger (*Stercorarius longicaudus*)	X			X		Uncertain; probably uncommon	Vulnerable to oil spills
Glaucous gull (*Larus hyperboreus*)	B		X	X	B	Common breeder	Breeding colony on small lake southeast of Louth Bay; other colonies presumed; vulnerable to oil spills at sea.
Thayer's gull (*Larus thayeri*)	B		X	X	B	Common breeder	

Appendix 16. (cont'd)

Species	Sources of Information Kev	Sh	Wa79	Wa80	KB	Provisional status	Remarks
Mew gull (*Larus canus*)	B					Rare breeder	Reported only by Kevan (1970)
Sabine's gull (*Xema sabini*)					B	Uncommon breeder	Small breeding colony near DEW line site; vulnerable to oil spills at sea
Arctic tern (*Sterna paradisaea*)	B		B?	X	X	Uncommon breeder	Vulnerable to oil spills at sea
Thick-billed murre (*Uria lomvia*)				X		Rare transient	Reported only by Ward (1980)
Black guillemot (*Cepphus grylle*)				X		Rare transient	Reported only by Ward (1980)
Short-eared owl (*Asio flammeus*)					X	Uncommon summer resident	
Horned lark (*Eremophila alpestris*)					X	Uncommon summer resident	
Common raven (*Corvus corax*)			X		X	Uncommon permanent resident	
Water pipit (*Anthus spinoletta*)			X			Uncommon summer resident	
Common redpoll (*Carduelis flammea*)				X	B	Uncommon breeder	
Savannah sparrow (*Passerculus sandwichensis*)			X	X	B	Uncommon breeder	
Lapland longspur (*Calcarius lapponicus*)	B?		X	X	B?	Uncommon summer resident	Probably breeds
Snow bunting (*Plectrophenax nivalis*)	B			X		Uncommon breeder	

Appendix 17. Preliminary checklist of the birds of the Baillie Islands study area.

There is little published data that relates specifically to birds of Baillie Islands. Our own ground reconnaissance lasted only three days, from July 2 to 5, 1980. Thus comments on abundance and breeding status are preliminary.

The remarks on abundance are based on the numbers of birds seen during aerial and ground surveys conducted during this study. The scale of abundance is the same as that used in Appendix 16. The terms used to describe breeding status are the same as those used in Appendix 16 .

Appendix 17. Preliminary checklist of the birds of the Baillie Islands study area.

Species	Provisional status	Remarks
Yellow-billed loon (*Gavia adamsii*)	Uncommon summer resident	Vulnerable to oil spills at sea
Arctic loon (*Gavia arctica*)	Uncommon summer resident	Vulnerable to oil spills at sea
Red-throated loon (*Gavia stellata*)	Uncommon summer resident	Vulnerable to oil spills at sea
Whistling swan (*Olor columbianus*)	Fairly common breeder	
Black brant (*Branta bernicla nigricans*)	Uncommon summer resident	Vulnerable to oil spills on tidal flats
Snow goose (*Anser caerulescens*)	Common migrant	
Mallard (*Anas platyrhynchos*)	Uncommon summer resident	
Oldsquaw (*Clangula hyemalis*)	Very common summer resident and migrant	Summer residents mostly moulting males Large numbers migrate north of Baillie Is; vulnerable to oil spills at sea
Common eider (*Somateria mollissima*)	Very common migrant	Large numbers migrate north of Baillie Is.; vulnerable to oil spills at sea
King eider (*Somateria spectabilis*)	Common migrant	Large numbers migrate north of Baillie Is.; vulnerable to oil spills at sea
White-winged scoter (*Melanitta deglandii*)	Uncommon summer resident	Summer population probably non-breeders in moult migration; vulnerable to oil spills at sea
Rough-legged hawk (*Buteo lagopus*)	Uncommon summer resident	
Rock ptarmigan (*Lagopus mutus*)	Uncommon summer resident	
American golden plover (*Pluvialis dominica*)	Fairly common summer resident	
Semipalmated sandpiper (*Calidris pusillus*)	Uncommon summer resident	
Pectoral sandpiper (*Calidris melanotos*)	Uncommon summer resident	
Pomarine jaeger (*Stercorarius pomarinus*)	Fairly common summer resident	Vulnerable to oil spills at sea
Parasitic jaeger (*Stercorarius parasiticus*)	Fairly common summer resident	May breed in study area (adults showed nest- defense behaviour); vulnerable to oil spills at sea
Long-tailed jaeger (*Stercorarius longicaudus*)	Uncommon summer resident	Vulnerable to oil spills at sea
Glaucous gull (*Larus hyperboreus*)	Common breeder	Vulnerable to oil spills at sea
Arctic tern (*Sterna paradisaea*)	Fairly common summer resident	Vulnerable to oil spills at sea
Snowy owl (*Nyctea scandiaca*)	Uncommon permanent resident	
Short-eared owl (*Asio flammeus*)	Uncommon summer resident	
Horned lark (*Eremophila alpestris*)	Uncommon summer resident	
Lapland longspur (*Calcarius lapponicus*)	Common summer resident	
Snow bunting (*Plectrophenax nivalis*)	Uncommon summer resident	

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