WATERBIRD SURVEYS OF McKINLEY BAY, NORTHWEST TERRITORIES, 1982

by

Beth J. Cornish

and

D. Lynne Allen
Canadian Wildlife Service
Yellowknife, Northwest Territories

Prepared for:

CANADIAN WILDLIFE SERVICE

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

DOME PETROLEUM LIMITED

GULF CANADA RESOURCES INC.

January 1983

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SUMMARY

In anticipation of development of a medium draft harbour in McKinley Bay to support future oil and gas production in the Beaufort Sea, a study to monitor the abundance and distribution of birds in McKinley Bay was initiated in 1981 (Scott-Brown et al. 1981). In order to obtain information on the natural year to year fluctuations in the number of birds that use McKinley Bay, the three aerial surveys that were done in 1981 were repeated in 1982. Hutchison Bay was added to the study as a control. Additional surveys by helicopter, boat and foot were done in 1982 to facilitate interpretation of the results of the aerial surveys. More specifically, these additional surveys were intended to determine the species composition of birds in McKinley Bay, the timing of the moult of diving ducks in the bay, and the effect of tides, wind or time of day on the distribution of ducks in the bay.

The fixed-wing aerial surveys conducted in 1982 at both McKinley and Hutchison bays occurred on July 20, July 30 and August 10. The population of diving ducks at McKinley Bay on the marine component was estimated to be 6697 $\pm$ 2058 (standard error) on July 20, 6621 $\pm$ 1036 on July 30 and 12 433 $\pm$ 1639 on August 10. At Hutchison Bay the population estimates for these dates were 6311 $\pm$ 1658, 3944 $\pm$ 871 and 13 465 $\pm$ 3075 diving ducks respectively. When a statistical comparison was carried out for the August 10 surveys there was no significant difference in the number of diving ducks using McKinley Bay in 1982 compared to 1981 ($p<0.05$), with the exception of scaup

which were less common in 1982.

Oldsquaw and scoter were the most common species of diving duck observed in both bays in 1982. During most aerial and boat surveys, they accounted for more than 85 percent of the diving ducks. Numbers of Oldsquaw increased by a factor of eight between July 20 and August 10 at McKinley Bay and doubled at Hutchison Bay. This influx of Oldsquaw, which occurred primarily in early August, probably represented failed nesting females. During the same period scoters showed only a slight increase in number in McKinley Bay, although numbers doubled at Hutchison Bay.

At McKinley Bay, most eider were seen in the Atkinson Point area between July 24 and August 10. A peak number of 370 eider was observed on August 4. Most of the eider at McKinley Bay were females, and both King and Common eiders were identified. These eider were likely staging or resting while in migration westward to the Chukchi Sea to moult.

Large numbers of Greater Scaup moved into McKinley Bay after August 14. The highest count (238) occurred on August 24, the last day of surveys. The scaup were mostly male and it was speculated that they had already completed their wing-moult.

Brant and White-fronted Geese were identified at both bays, with Brant being the more common species. A density of 5.12 geese/km^2 was observed on the terrestrial component on August 10 at McKinley Bay. Fewer geese were observed at Hutchison Bay (2.33 geese/km^2). Increasing numbers of Brant (flocks of up to 250) moved into McKinley Bay after August 10 to rest and feed on the tide flats. Migrant flocks of Brant flying west were first noticed August 15, while

similar flocks of Snow Geese were not seen until August 22. About 30 Whistling Swans were seen in the lagoon south of McKinley Bay throughout the summer.

No consistent trends were found to relate the distribution of diving ducks in McKinley Bay to tidal phase. However, it was noted during surveys that Oldsquaw tended to form larger flocks in the evening. It was also noted that there were more diving ducks on the south side of the Atkinson Point spit when the winds were from the northwest and northeast than from the southeast.

Flocks of scoter were consistently found at the south end of McKinley Bay on aerial surveys. Concentrations of ducks, mainly Oldsquaw, were also observed south of the spit at Atkinson Point.

The peak period of wing-moult for Oldsquaw was from the last week in July to the third week in August. Scoter moulted later, for many were still apparently flightless when the study ended on August 24.

The effect of factors such as the weather, sea state and flock size on the detectability of ducks during aerial surveys is discussed.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

McKinley Bay on the Tuktoyaktuk Peninsula, N.W.T., is the site of a winter harbour used since 1979 by Dome Petroleum Limited to support oil and gas exploration in the Beaufort Sea. In 1981, 36 vessels including two with floating camps, four drillships and a dry dock were overwintered in McKinley Bay (Dome, Esso and Gulf 1982). Associated with the harbour are an artificial island, a dredged approach channel and mooring basin, and docking facilities.

McKinley Bay may become a major support base for Dome and Gulf in the future (Dome, Esso and Gulf 1982). Proposals for development of the harbour could include an airstrip, expanded accommodation for up to 500 personnel, a floating topping plant, power generators, a marine maintenance and repair facility, an expanded mooring basin, equipment storage and fuel storage to refuel the drillships.

The Canadian Wildlife Service was concerned that these developments could adversely affect the migratory bird usage of the area. A bird monitoring study involving aerial surveys with joint government and industry participation was therefore initiated in 1981 (Scott-Brown et al. 1981) to describe waterbird usage of McKinley Bay prior to extensive development. In order to detect possible changes in bird usage of the bay as a result of development, first the natural annual fluctuations in the number of birds in the bay must be established. To do this, several years of data are needed. Thus, the aerial surveys that were carried out in

1981 were repeated in 1982 to allow a comparison of data that would detect any change in numbers of each species. In 1982, the study was expanded to help interpret the aerial surveys. To gain information on the movements of waterbirds throughout the summer of 1982, a crew of researchers was based at McKinley Bay. Surveys by boat, helicopter and foot were conducted. Hutchison Bay, an undeveloped area on the Tuktoyaktuk Peninsula 45 km west of McKinley Bay, was added to the 1982 study as a control. As in 1981, emphasis was on documenting the number and distribution of moulting sea ducks due to their vulnerability to oil if spilled and their abundance in McKinley Bay.

Studies of bird populations in the McKinley Bay area have been undertaken in previous years by researchers associated with various projects. A summary of these studies is presented by Scott-Brown et al. (1981).

2. METHODS

2.1 Aerial Fixed-wing Surveys

In order to allow a statistical comparison of waterbird abundance for the years 1981 and 1982, the aerial fixed-wing surveys of McKinley Bay in 1982 followed the same design as in 1981 (Scott-Brown et al 1981). The object of the aerial surveys in both years was to describe bird species abundance and distribution. Surveys were flown on July 20, July 30 and August 10 in 1982. Ten east-west transects were flown 2 km apart (Fig. 1) in a Cessna 185 with floats at an elevation of 20 - 30 m above ground level (agl) at an average speed of 145 km/h. One observer on each side of the aircraft counted all birds seen within 180 m of that side, so that the total transect width was 360 m. When time permitted, "off transect" birds, more than 180 m from the plane, were also recorded, but were not included in calculations. Observations were recorded on tape so that observers never had to look away from the transect.

The study area at McKinley Bay was divided into three components: a marine component inside McKinley Bay, a terrestrial component, and a section of marine habitat outside of McKinley Bay called the outside component. The marine component encompassed all saltwater areas within McKinley Bay including exposed sandspits which are intermittently washed over by tides. The terrestrial component covered all land areas including inland lakes and the lagoon system at the south end of the bay. The area west of Atkinson Point, the small bay at the west end of transects 4 to 6,

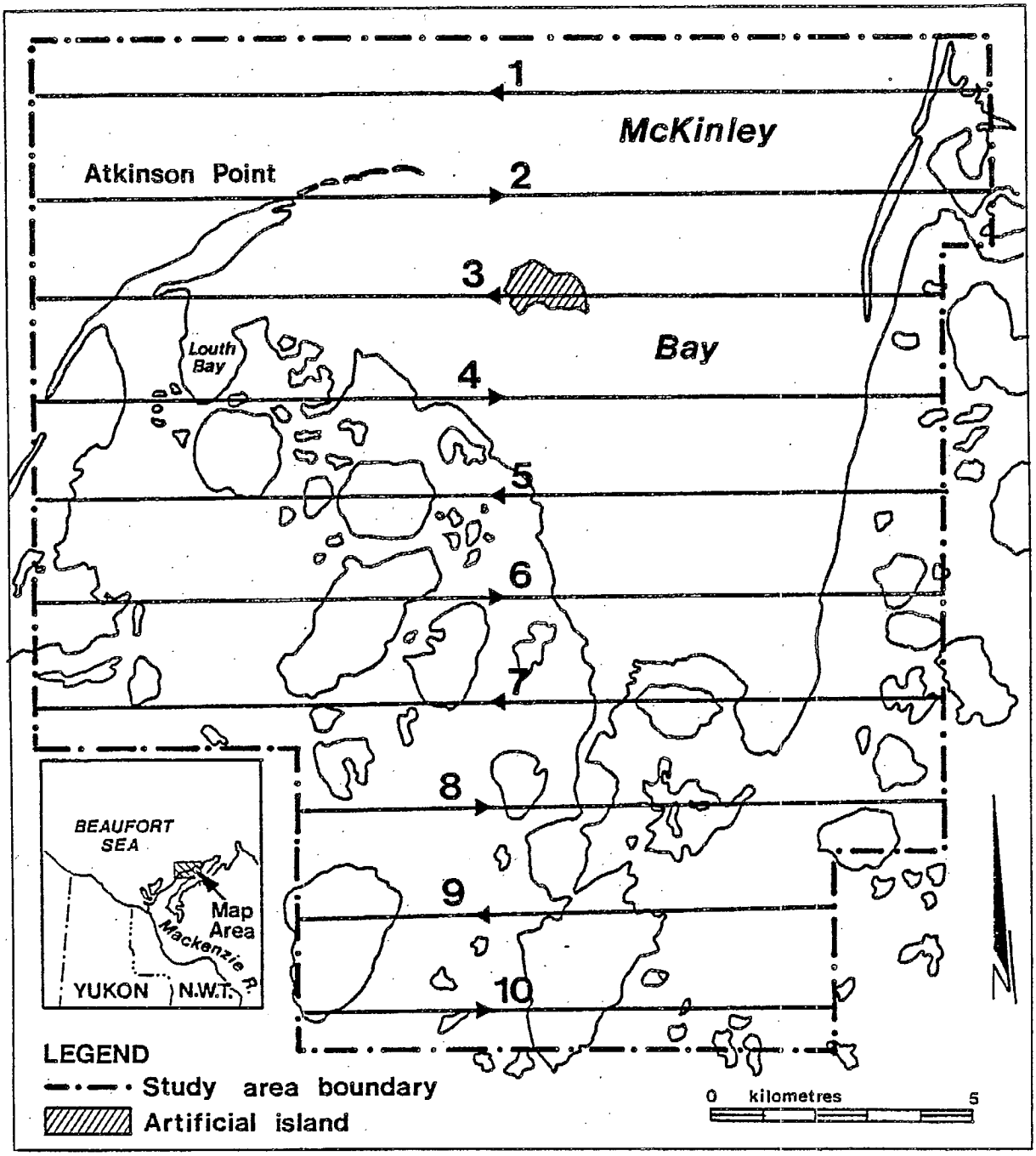

Fig. 1. Aerial transects flown by Cessna 185 at McKinley Bay, July 20, July 30 and August 10, 1982.

and the western half of transect 1 were considered the outside component and were omitted from the data analysis.

The areas of each component and the proportions surveyed are listed in Table 1. The total size of the study area was 305 km^2. The area of the marine section, 108.5 km^2, differed from the figure used by Scott-Brown et al (1981) as they included areas outside of McKinley Bay in the marine component. For the purpose of data comparison between 1981 and 1982, the 1981 results were recalculated with these outer areas excluded.

Using the same procedures as at McKinley Bay, aerial surveys were also conducted at Hutchison Bay in 1982. A series of seven east-west transects 2 km apart were flown on July 20, July 30 and August 10 (Fig. 2), the same days that equivalent surveys were carried out at McKinley Bay.

The study area at Hutchison Bay was divided into marine, terrestrial and outside components comparable to the McKinley Bay components. Warren Point sandspit was considered marine north of the area covered by transect 2, as were other sandspits intermittently washed over by tides. Other land areas and all inland lakes were part of the terrestrial component. The saltwater areas west of Warren Point, and the area covered by the western half of transect 1 were considered outside of Hutchison Bay.

Table 1 also presents the areas of the components at Hutchison Bay and proportions surveyed.

Table 1. The division of the McKinley Bay and Hutchison Bay study areas into three components for the 1982 aerial surveys.

Component	McKinley Bay		Hutchison Bay	
	Total Area (km^2)	Area Surveyed (km^2)	Total Area (km^2)	Area Surveyed (km^2)
Marine	108.5	19.6	100.5	17.8
Terrestrial	158.5	28.3	91.0	16.3
Outside	38.0	6.9	31.5	5.8
Total	305.0	54.8	223.0	39.9

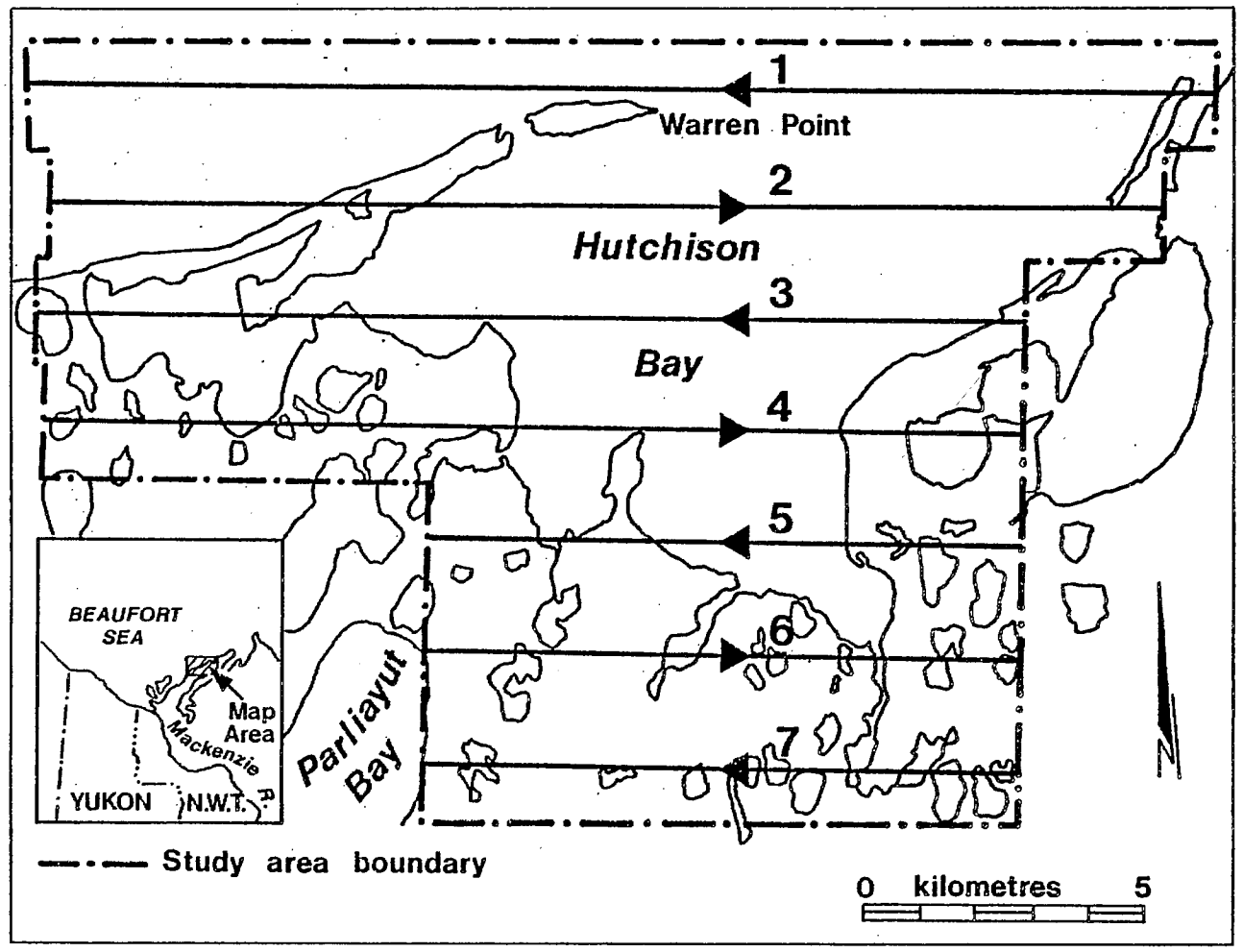

Fig. 2 Aerial Transects flown by Cessna 185 at Hutchison Bay, July 20, July 30 and August 10, 1982.

2.1.1 Analysis of Data

(1) Since transects were of varying length in the survey, the mean density $\hat{R}$ was found by using the ratio estimate:

$$\hat{R} = \bar{y}/\bar{x}$$

where $\bar{y}$ = average count of birds on the transects

$\bar{x}$ = average area of the transects

(2) Population estimates were calculated by multiplying the mean density of birds counted ($\hat{R}$) by the total area of the study component.

(3) Standard errors of the population estimates were calculated using the method by Kingsley and Smith (1980) for systematic surveys with transects of varying length. This method is based on examples that show that since systematic surveys are by design usually more efficient than random surveys, their precision is underestimated if the results are analyzed as though from a random survey.

$$\text{Standard error} = \sqrt{\text{Variance}} = \sqrt{S_1^2}$$

$$S_1^2 = \frac{(1-f) \sum_{i=1}^{n-1} (d_i - d_{i+1})^2}{2 \cdot (n-1) \cdot n \cdot \bar{x}^2}$$

where

d_i = modified count = $y_i - Rx_i$
R = density
y_i = count on the i^{th} transect
x_i = area of the i^{th} transect
f = the fraction of the entire study area sampled = $\frac{n}{N}$
n = number of transects samples
N = number of transects possible in the population

(4) Comparison of surveys, 1981 and 1982 at McKinley Bay:

The August 10 surveys of each year were chosen for comparisons because survey conditions were regarded as "good" during August 10 surveys in both years, whereas conditions were described as only "fair" on the survey dates in July for one or both of the two years.

To compute an increase or decrease in survey estimates, the differences between years of counts on each transect were used for the value y_i and to calculate $\bar{y}$. In other words, a set of y_i's was calculated by subtracting the value of y_i for 1982 from y_i for 1981. Then, a $\bar{y}$ was calculated using these differences. The standard error of the difference in counts on each transect between 1981 and 1982 was then calculated for each species.

By multiplying the standard error for each species by 1.96, the 95% confidence limits were calculated. The difference in population estimates between years was considered significant if the confidence interval did not include zero.

(5) The terms "diving ducks" or "divers" are used throughout this report in tables and discussions and refer to ducks belonging to both subfamilies Aythyinae and Merginae.

2.2 Boat Surveys Perpendicular to Shore

To determine distribution of waterfowl at McKinley Bay in relation to tidal phase, time of day and weather, surveys were conducted by boat throughout the summer in all kinds of tidal and weather conditions and times of day.

Two transects were drawn perpendicular to shore at McKinley Bay (Fig. 3). Transects were surveyed in a direction towards shore at trolling speed in a 10-foot Zodiac boat with a 9.8 horsepower motor. Two observers were involved, with one person driving the boat and observing birds on one side and another person observing on the other side and recording the data on tape. All birds that could be seen on either side of the boat were recorded, along with information about size of flock and behaviour. Transects were divided into 5-minute intervals.

Since it is difficult to estimate distances over water, no limit was set for the width of each transect. Hence, when survey conditions were good and ducks could be seen at greater distances from the boat, the counts were higher than when survey conditions were fair. However, these surveys were directed at investigating relative number of birds near shore compared to off shore. Total numbers of birds on each survey were used only in establishing percentages of ducks seen in each kilometre from shore.

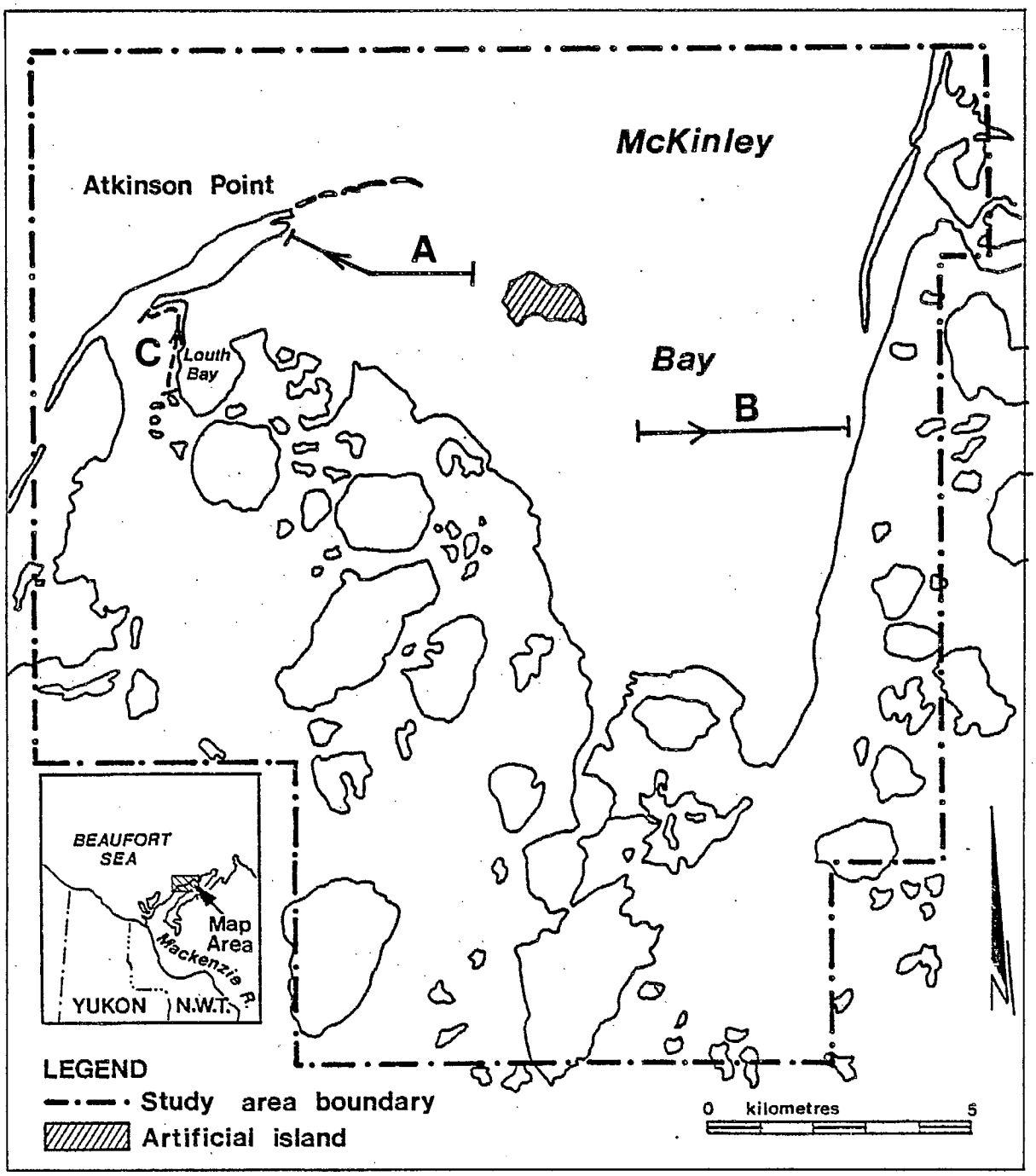

Fig. 3. Transects surveyed by boat perpendicular to shore (A and B) and by foot (C) at McKinley Bay, July and August, 1982.

2.3 Boat Surveys Parallel to Shore

To gain information on water bird usage of shoreline areas and data on the timing of the moult for species using these areas, boat surveys were carried out parallel to the shoreline every 10 days at each bay for a total of five surveys at McKinley Bay and three at Hutchison Bay. At McKinley Bay, these surveys were conducted on July 15, July 25, August 5, August 14 and August 24. A sixth survey planned for July 5 at McKinley Bay was impossible to complete due to ice conditions. At Hutchison Bay these boat surveys took place on July 20, July 31 and August 11.

Three transects at each bay were drawn parallel to shore at a distance of 500 m from shore (Figs. 4 and 5). Distances were estimated from the boat using a rangefinder and markers or the unassisted eye. Again, a 10-foot Zodiac with a 9.8 horsepower motor was used to carry out observations. One person operated the motor at trolling speed along each transect while the other person collected data. All birds seen between the boat and shore were recorded as "on transect". "Off transect" birds were used to gain information on the timing of the moult for the most common species at both bays. The transects were divided into 5-minute intervals.

2.4 Helicopter Surveys

Aerial surveys were flown in a Bell 206B helicopter on August 19, August 22 and August 23 at McKinley Bay to obtain further information on distribution of diving ducks as affected by tides, weather or time of day. A series of four east-west transects (Fig. 6) was surveyed four times per day at each tidal phase (high, ebb,

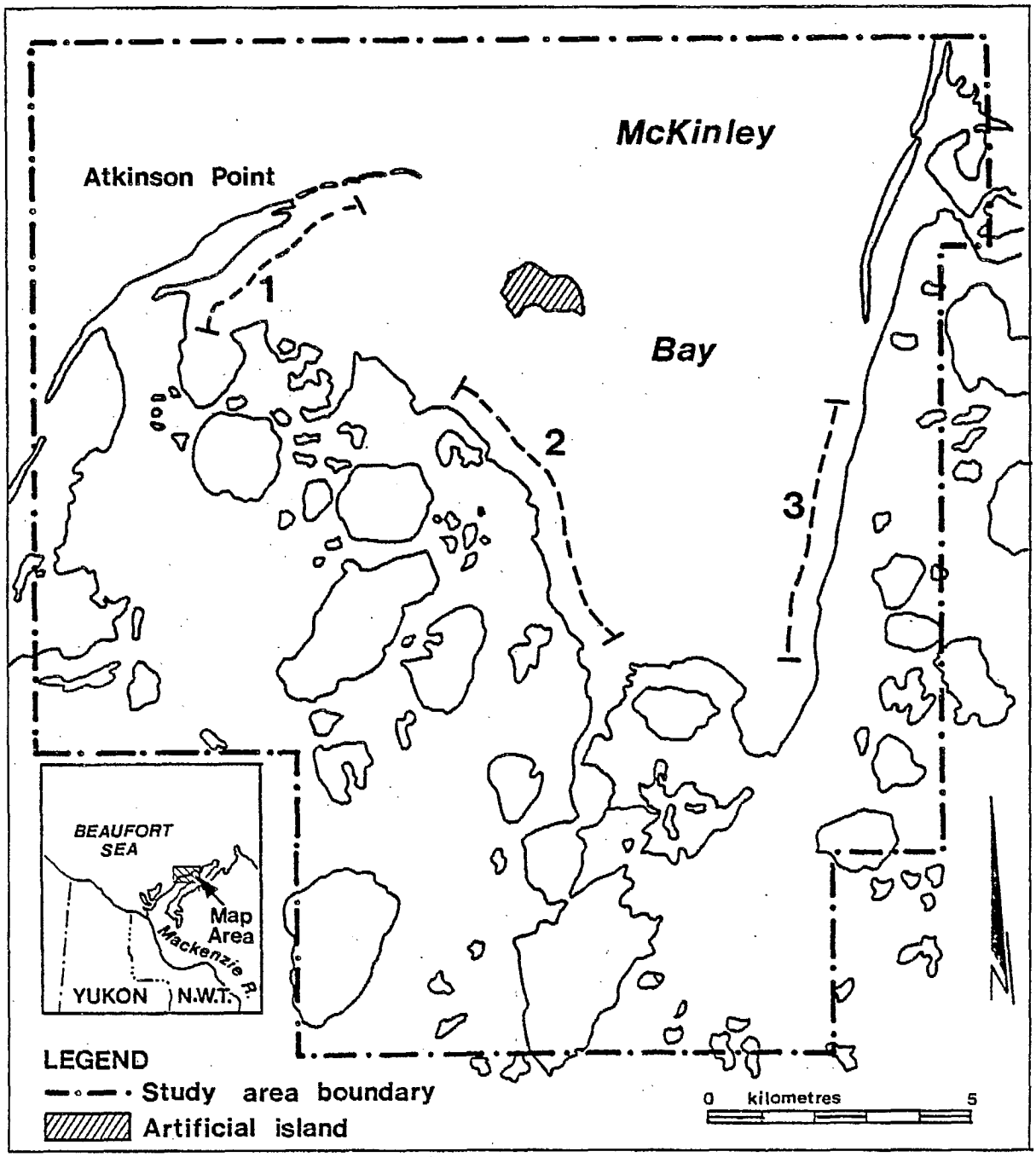

Fig. 4. Boat transects parallel to shore surveyed at McKinley Bay, July 15, July 25, August 5, August 14 and August 24, 1982.

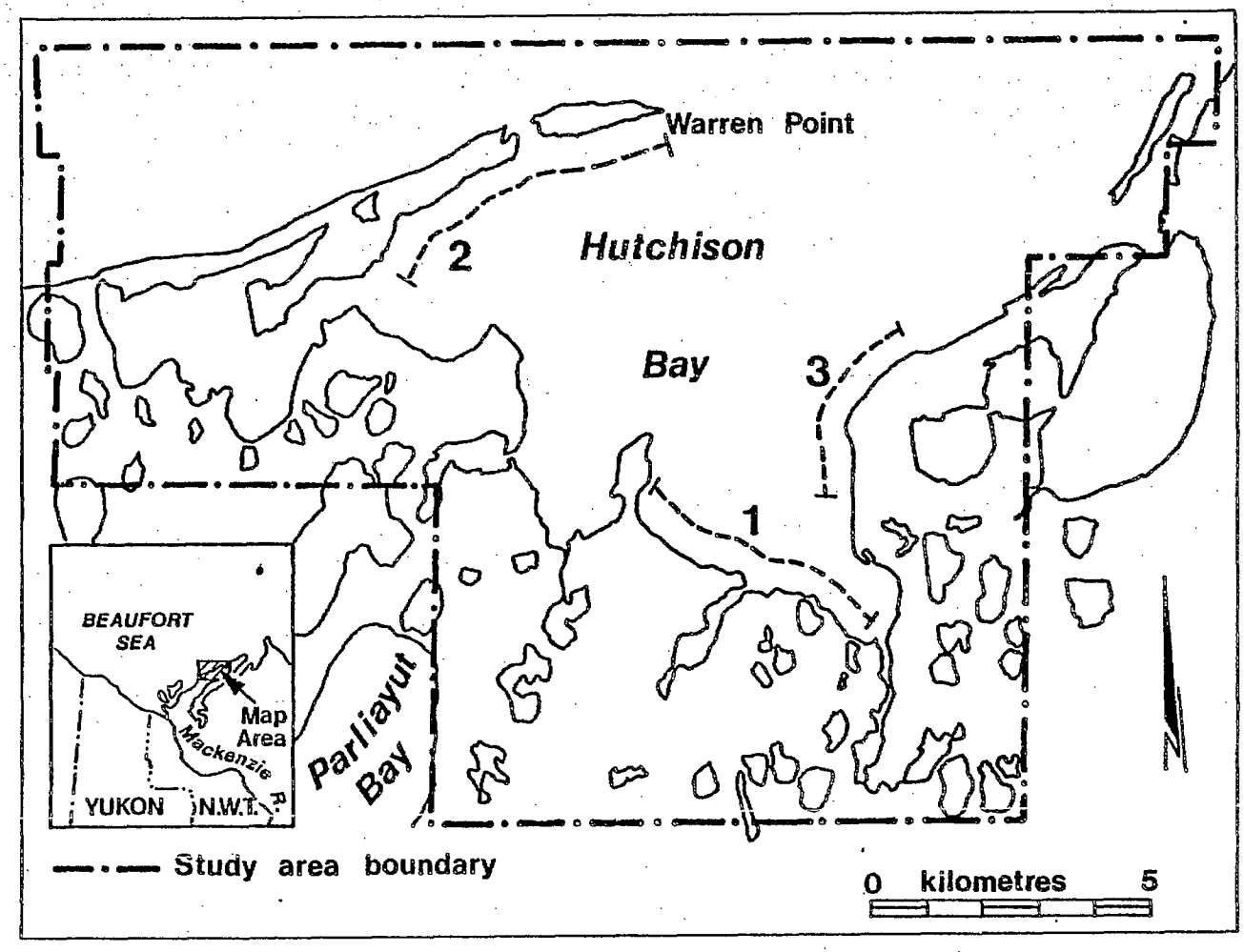

Fig. 5. Boat transects parallel to shore surveyed at Hutchison Bay, July 20, July 31 and August 11, 1982.

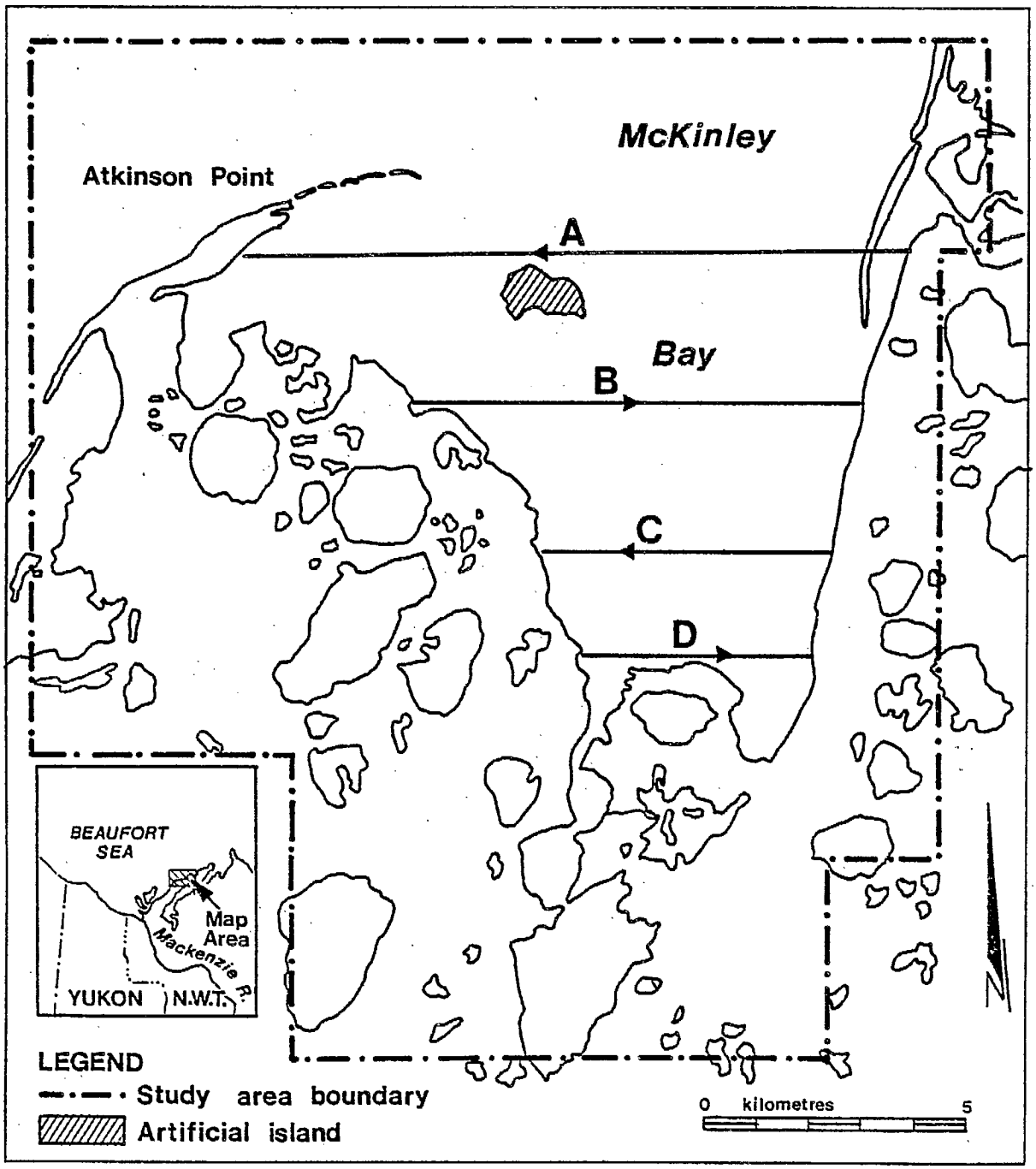

Fig. 6. Aerial transects flown by helicopter at McKinley Bay, August 18, 19 and 23, 1982.

low and flood) at an elevation of 30 m agl and an average speed of 145 km/h. Procedures were similar to the fixed-wing aerial surveys. One observer sat on each side of the aircraft and recorded numbers of birds seen and the sizes of flocks within 180 m of either side. If time permitted, the number of birds seen off transect was also recorded.

2.5 Shoreline Surveys by Foot

A shoreline transect was established at McKinley Bay which followed the western shoreline of Louth Bay, the small embayment south of Atkinson Point (Fig. 3). Observations were made along the transect by one observer on foot. Numbers and behaviour of birds on shore and near shore were recorded at each tidal phase and various times of day at 6-hour intervals. Shoreline surveys on foot at Louth Bay were designed to help determine the number of birds that use this area of the bay and how species behave in relation to tides, time of day and weather conditions.

3. RESULTS

3.1 Abundance

3.1.1 Aerial Fixed-wing Surveys

3.1.1.1 Survey Conditions

The aerial surveys on July 20 were conducted between the hours of 1430 and 1700. The weather was sunny with less than 10 percent cloud cover, the temperature was 10°C, the wind was west at 15 km/h and sea conditions were moderately rough with some swells and a few whitecaps. Glare from the sun was a problem that made identification of ducks impossible in some areas. Overall survey conditions on this day were considered "fair".

On July 30, the surveys were conducted from 1300 to 1535 hours. There was less than 10% cloud cover and no precipitation so that visibility was good in one direction but fair to poor looking into the sun due to glare off the water. Winds were moderate at 25-30 km/h from the southeast, and the temperature was 5°C. Survey conditions were again considered "fair", and the most serious problem was associated with the glare.

Survey conditions during the August 10 survey, conducted between 1345 and 1635 hours, were considered "good", with north winds 10-15 km/h, temperatures at 5°C and 100 percent cloud cover. There was no glare, and sea conditions were relatively calm, with no whitecaps although a swell was evident from earlier winds.

3.1.1.2 Marine Component

Numbers and densities of birds seen on the marine components of McKinley and Hutchison bays are presented in Tables 2 and 3 respectively. At both locations nearly twice as many diving ducks were observed on August 10 than on the two earlier surveys.

Estimates of the numbers of each species group using the marine component of each bay are given in Tables 4 and 5. No estimates are given for swans, dabbling ducks, shorebirds, jaegers or alcids because observations of these birds were rare on the marine component. The population of diving ducks at McKinley Bay on August 10, when the maximum number were counted, was estimated to be 12 433 1639 (standard error). The estimate at Hutchison Bay was 13 465 3075 diving ducks on August 10.

Standard errors of the population estimates were high for some groups due to the clumped distribution of birds in some areas of the bays, hence the high variation in numbers observed per transect.

A list of common and scientific names of all species observed on surveys in 1982 is presented in Appendix A. From the aerial surveys, it was found that Oldsquaw and scoter were the most common species of waterfowl using each bay. Tables 6 and 7 give the species composition and densities of diving ducks observed at each bay. Population estimates of diving duck species observed on the marine component at both bays are given in Table 8.

At McKinley Bay, more Oldsquaw were seen than other species on July 30 and on August 10, while more scoter than Oldsquaw were observed on the July 20 survey. Densities of both Oldsquaw and

Table 2. Number and density of birds observed on the marine component, McKinley Bay aerial surveys, 1982.
Area of marine component surveyed = 19.6 km^2.

Species	July 20		July 30		August 10	
	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)
Loons	11	0.56	7	0.36	10	0.51
Swans	0	-	0	-	0	-
Geese	6	0.31	0	-	0	-
Dabbling ducks	0	-	0	-	8	0.41
Diving ducks	1263	64.44	1196	61.02	2246	114.59
Unidentified ducks	10	0.51	0	-	54	2.76
Shorebirds	0	-	0	-	1	0.05
Jaegers	0	-	0	-	1	0.05
Gulls	117	5.97	42	2.14	46	2.34
Terns	6	0.31	2	0.10	7	0.36
TOTAL BIRDS	1413	72.09	1247	63.62	2373	121.07

Table 3. Number and density of birds observed on the marine component, Hutchison Bay aerial surveys, 1982.
Area of marine component surveyed = 17.8 km^2.

Species	July 20		July 30		August 10	
	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)
Loons	8	0.45	10	0.56	24	1.35
Swans	2	0.11	0	-	5	0.28
Geese	0	-	15	0.84	78	4.38
Dabbling ducks	0	-	0	-	0	-
Diving ducks	1118	62.81	699	39.27	2385	133.99
Unidentified ducks	0	-	85	4.78	24	1.35
Shorebirds	3	0.17	0	-	0	-
Jaegers	1	0.06	1	0.06	0	-
Gulls	107	6.01	43	2.42	36	2.02
Terns	0	-	13	0.73	1	0.06
Alcids	0	-	0	-	2	0.11
TOTAL BIRDS	1239	69.60	866	48.65	2555	143.54

Table 4. Estimated populations of birds on the marine component, McKinley Bay, 1982, based on aerial fixed-wing surveys. Area of marine component = 108.5 km^2.

	July 20		July 30		August 10	
Species	Population estimate	Standard error	Population estimate	Standard error	Population estimate	Standard error
Loons	61	18	39	16	55	27
Geese	33	31	0	-	0	-
Diving ducks	6697	2058	6621	1036	12 433	1639
Unidentified ducks	55	34	0	-	299	194
Gulls	648	322	232	96	255	97
Terns	34	31	11	7	39	29

Table 5. Estimated populations of birds on the marine component, Hutchison Bay, 1982, based on aerial fixed-wing surveys. Area of marine component = 100.5 km^2.

	July 20		July 30		August 10	
Species	Population estimate	Standard error	Population estimate	Standard error	Population estimate	Standard error
Loons	44	17	56	25	136	21
Geese	0	-	243	53	203	83
Diving ducks	6311	1658	3944	871	13 465	3075
Unidentified ducks	0	-	479	235	136	107
Gulls	604	170	243	53	203	83
Terns	0	-	73	39	6	4

Table 6. Species composition and density of diving ducks observed on the marine component during aerial surveys at McKinley Bay, 1982.

	July 20			July 30			August 10		
	Number	Percent	Density (birds/km^2)	Number	Percent	Density (birds/km^2)	Number	Percent	Density (birds/km^2)
Oldsquaw	130	15.8	6.63	449	49.4	22.91	1063	56.2	54.23
Scoter	669	81.5	34.13	377	41.5	19.23	785	41.5	40.04
Scaup	6	0.7	0.31	70	7.7	3.57	34	1.8	1.73
Merganser	3	0.4	0.15	12	1.3	0.61	8	0.4	0.41
Eider	14	1.7	0.71	0	0	0	0	0	0
TOTAL IDENTIFIED DIVING DUCKS	821	100.0	41.89	908	100.0	46.33	1890	100.0	96.43
Unidentified diving ducks	442	...	22.55	288	...	14.69	356	...	18.16

Table 7. Species composition and density of diving ducks observed on the marine component during aerial surveys at Hutchison Bay, 1982.

	July 20			July 30			August 10		
	Number	Percent	Density (birds/km^2)	Number	Percent	Density (birds/km^2)	Number	Percent	Density (birds/km^2)
Oldsquaw	281	31.5	15.79	274	41.7	15.39	778	35.2	43.71
Scoter	513	57.5	28.82	199	30.3	11.18	1156	52.3	64.94
Scaup	90	10.1	5.01	176	26.8	9.89	122	5.5	6.85
Merganser	8	0.9	0.45	7	1.1	0.39	157	7.0	8.82
Eider	0	0	0	1	0.1	0.06	0	0	0
TOTAL IDENTIFIED DUCKS	892	100.0	50.11	657	100.0	36.91	2210	100.0	124.16
Unidentified diving ducks	226	...	12.70	42	...	2.36	172	...	9.66

Table 8. Population estimates of the diving ducks on the marine component at McKinley Bay and Hutchison Bay, August 10, 1982, based on aerial survey data.

Species	Location	Total count on all transects	Density ($birds/km^2$)	Population estimate $\hat{Y}$	Standard error of $\hat{Y}$
Oldsquaw	McKinley Bay	1063	54.23	5884	2153
	Hutchison Bay	778	43.71	4393	419
Scoter	McKinley Bay	785	40.05	4346	1023
	Hutchison Bay	1156	64.89	6527	4143
Scaup	McKinley Bay	34	1.73	188	71
	Hutchison Bay	122	6.85	689	282
Merganser	McKinley Bay	8	0.41	44	24
	Hutchison Bay	157	8.82	886	665
Unidentified ducks	McKinley Bay	356	18.16	1971	1276
	Hutchison Bay	172	9.66	971	221
TOTAL DIVERS	McKinley Bay	2246	114.59	12 433	1639
	Hutchison Bay	2385	133.98	13 466	3075

scoter on the August 10 survey were more than double the densities calculated from the July 30 survey. The density of observed Oldsquaw increased by a factor of eight from the first aerial survey on July 20 to the last aerial survey on August 10, while scoter numbers were only slightly larger on August 10 than on July 20.

At Hutchison Bay, scoters were the most common species seen on July 20 and August 10, while on July 30 Oldsquaw were more abundant than scoters. Since the density of Oldsquaw did not increase from July 20 to July 30 at Hutchison Bay, this reflects a decrease in the number of scoter observed on the July 30 survey. Similar to McKinley Bay, on August 10 the densities of both Oldsquaw and scoter at Hutchison Bay were double the densities calculated from the July 30 survey.

Densities of scaup observed on aerial surveys in 1982 were highest at both bays on July 30, when 3.57 scaup/km^2 were recorded at McKinley Bay and 9.89 scaup/km^2 at Hutchison Bay. Merganser were much more abundant on the August 10 survey at Hutchison Bay than on the other two survey dates, although this dramatic increase was not observed at McKinley Bay.

All geese identified on the marine component at both bays were Brant, although on August 10, 65 dark geese were observed flying "off transect" at McKinley Bay and another 40 dark geese were counted "off transect" at Hutchison Bay. Two unidentified Alcidae were observed at Hutchison Bay on August 10.

Diving duck counts from the marine component of the aerial survey at McKinley Bay on August 10 in 1982 were compared to the data collected August 10, 1981 in order to estimate changes in population over the two years (Table 9). No significant change in population estimates were detected ($p < 0.05$) for any species except scaup. Standard errors of the population estimates were high, as the populations were clumped heavily on some transects.

According to aerial survey data, fewer scaup were present at McKinley Bay on August 10, 1982 than on August 10, 1981. This was supported by observations from a boat and on foot in 1982, where substantial numbers of scaup were noted only after August 15, 1982.

3.1.1.3 Terrestrial Component

The largest number of birds observed on the terrestrial components at both McKinley Bay and Hutchison Bay occurred on August 10 (Tables 10 and 11).

McKinley Bay

Loons, swans and geese were found in greater densities on the terrestrial component at McKinley Bay than at Hutchison Bay (Table 10). At McKinley Bay, loons were more abundant on the terrestrial component than on the marine component. The majority of loons sighted were Arctic and Red-throated, and there were infrequent observations of Yellow-billed Loons. Numbers of geese observed increased substantially from the July 20 survey, when 34 geese were observed, up to a total of 145 geese observed on the August 10 survey at McKinley Bay. Two species of geese were observed,

Table 9. Comparison of results of aerial surveys conducted August 10, 1981 and August 10, 1982 on the marine component at McKinley Bay.

Species	Year	Density birds/km^2	Population estimate $\hat{Y}$	Standard error (SE) of $\hat{Y}$	95% confidence limits of the population estimate
Oldsquaw	1981	46.43	5038	777	± 1554
	1982	54.23	5884	2153	± 4306
	Difference	7.81	846	2351	± 4702
Scoter	1981	31.22	3387	469	± 938
	1982	40.05	4345	1023	± 2046
	Difference	8.83	958	993	± 1986
Scaup	1981	18.77	2036	836	± 1642
	1982	1.73	188	71	± 142
	Difference	-17.04	-1849	864	± 1728
Merganser	1981	0	0	...	...
	1982	0.41	44	24	± 48
	Difference	0.41	44	24	± 48
Unidentified Divers	1981	14.39	1561	535	± 1070
	1982	18.16	1970	1276	± 2252
	Difference	3.77	409	1733	± 3466
TOTAL DIVERS	1981	110.82	12 024	959	± 1918
	1982	114.59	12 433	1639	± 3278
	Difference	3.77	409	1259	± 2518

Table 10. Numbers and densities of birds observed on the terrestrial component on aerial surveys at McKinley Bay, 1982. Area of terrestrial component surveyed = 28.3 km^2.

Species	July 20		July 30		August 10	
	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)
Loons	24	0.85	16	0.57	36	1.27
Swans	53	1.87	85	3.00	73	2.58
Geese	34	1.20	74	2.61	145	5.12
Dabbling ducks	13	0.46	35	1.24	195	6.89
Diving ducks	80	2.83	126	4.45	180	6.36
Unidentified ducks	28	0.99	75	2.65	45	1.59
Raptors	3	0.11	5	0.18	3	0.11
Ptarmigan	1	0.04	0	0	0	0
Cranes	0	0	1	0.04	1	0.04
Shorebirds	259	9.15	51	1.80	151	5.34
Jaegers	0	0	3	0.11	1	0.04
Gulls	73	2.58	45	1.59	35	1.24
Terns	3	0.11	6	0.21	1	0.04
Passerines	4	0.14	1	0.04	1	0.04
TOTAL BIRDS	575	20.32	523	18.48	867	30.64

Table 11. Numbers and densities of birds observed on the terrestrial component on aerial surveys at Hutchison Bay, 1982. Area of terrestrial component surveyed = 16.3 km^2.

Species	July 20		July 30		August 10	
	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)	Number	Density ($birds/km^2$)
Loons	8	0.49	4	0.24	36	2.21
Swans	9	0.55	25	1.53	30	1.84
Geese	0	0	0	0	38	2.33
Dabbling ducks	2	0.12	72	4.42	67	4.11
Diving ducks	41	2.52	85	5.21	33	2.02
Unidentified ducks	21	1.29	51	3.13	158	9.69
Raptors	5	0.31	5	0.31	3	0.18
Ptarmigan	0	0	7	0.43	1	0.06
Cranes	7	0.43	0	0	5	0.31
Shorebirds	74	4.54	22	1.35	14	0.86
Jaegers	0	0	1	0.06	0	0
Gulls	53	3.25	42	2.58	49	3.01
Terns	9	0.55	11	0.67	2	0.12
Passerines	2	0.12	2	0.12	1	0.06
TOTAL BIRDS	231	14.17	327	20.06	437	26.81

Brant and White-fronted Goose. Brant were the more common species. Where the two species were not distinguishable, they were classed as "dark geese". Density of Whistling Swans was greatest on July 30 at McKinley Bay, when 3.00 swans/km^2 were observed.

Diving ducks, especially scaup and less frequently Oldsquaw, utilized the terrestrial component in relatively large numbers. Divers accounted for 14 percent of the total birds observed on the terrestrial component at McKinley Bay on July 20, 24 percent on July 30 and 21 percent on August 10. A maximum density of 6.36 diving ducks/km^2 was observed on August 10.

Few dabbling ducks were observed on July 20 at McKinley Bay (0.46 birds/km^2 or less than 2 percent of total birds observed), but on August 10 the density of dabbling ducks had increased to 6.89 birds/km^2 and they accounted for 22 percent of total birds seen on the terrestrial component. Pintail and American Wigeon were the two species identified on aerial surveys.

Large numbers of shorebirds were observed at McKinley Bay on July 20, accounting for 45 percent of total birds seen on the terrestrial component. The maximum number of gulls observed on the three surveys was recorded on July 20, when a total of 73 gulls were observed. Raptors, jaegers, terns and other species were recorded on the surveys in relatively lower numbers (Table 10).

Hutchison Bay

Overall densities of waterfowl using the terrestrial component at Hutchison Bay were lower than at McKinley Bay (Table 11). No geese were observed on the terrestrial component at Hutchison Bay until the August 10 survey, when only White-fronted Geese were identified. The maximum density of Whistling Swans was 1.84 swans/km^2 on August 10, as compared to 2.58 swans/km^2 at McKinley Bay on August 10.

The largest number of shorebirds was observed on July 20 at Hutchison Bay, although the observed density, 4.54 birds/km^2, was much lower than that observed on the same date at McKinley Bay(9.15 birds/km^2). Densities of all the species groups are listed in Table 11.

3.2 Distribution

3.2.1 Aerial Fixed-wing Surveys

3.2.1.1 Marine Component

McKinley Bay

The distribution of waterfowl observed on the aerial surveys is presented in Figs. 7, 8 and 9 for McKinley Bay. On July 20, more than half of the total diving ducks were observed at the south end of the bay. More than 75 percent of the observed scoters were either in this area or in aggregations at the east end of transect 1 in the open northern section of the bay. Smaller concentrations of diving ducks were also observed south of Atkinson Point. On July 30, ducks were more widely scattered except for a concentration of Oldsquaw in the Atkinson Point area. It was again evident from the aerial surveys on August 10 that the area south of Atkinson Point was favoured by diving ducks, particularly Oldsquaw. About 50 percent of observed Oldsquaw were south of Atkinson Point. A concentration of over 200 scoters was again noted at the south end of the bay on August 10. Also, in the small section of the bay in the southeast corner, a dense aggregation of 100 scoters and 150 Oldsquaw was observed. On the marine component, no geese were observed on transect, although a flock of 65 dark geese was observed off transect flying along the east shore of the bay.

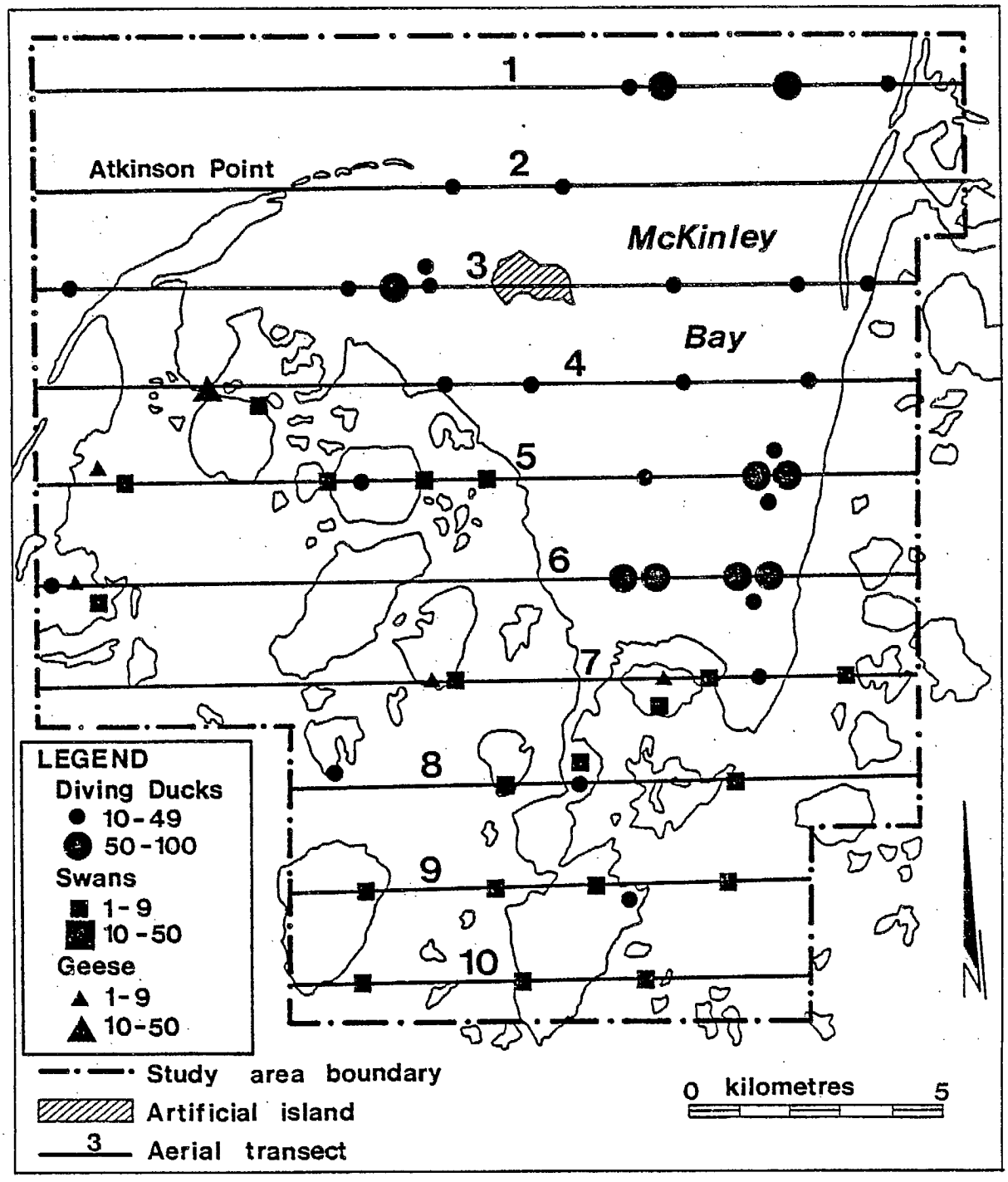

Fig. 7. Distribution of waterfowl observed on aerial transects from Cessna 185 at McKinley Bay, July 20, 1982.

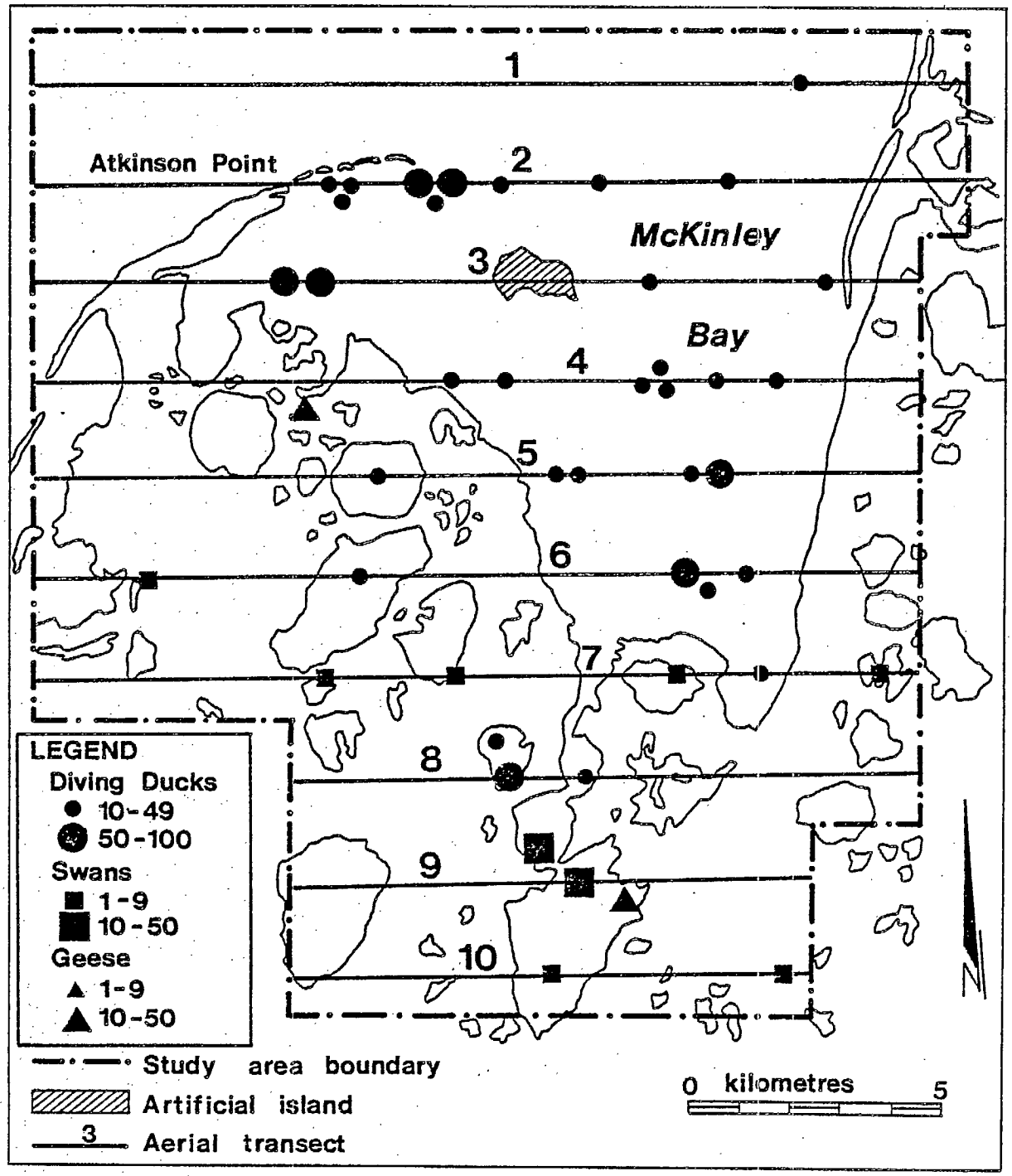

Fig. 8. Distribution of waterfowl observed on aerial transects from Cessna 185 at McKinley Bay, July 30, 1982.

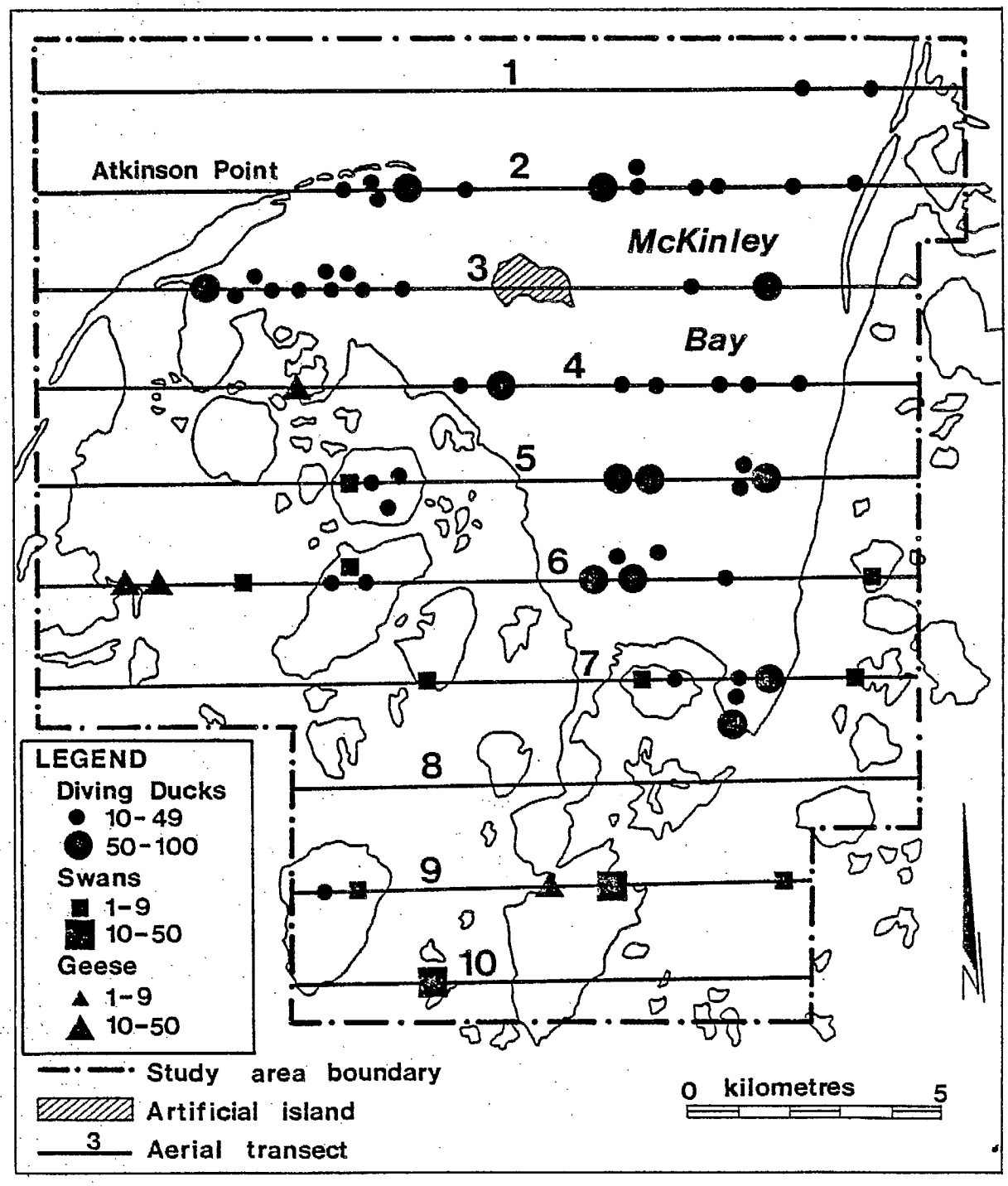

Fig. 9. Distribution of waterfowl observed on aerial transects from Cessna 185 at McKinley Bay, August 10, 1982.

Hutchison Bay

Figures 10, 11, and 12 show the distribution of waterfowl observed on the marine component during aerial surveys on July 20, July 30 and August 10 at Hutchison Bay. Almost half (46 percent) of the diving ducks observed on July 20 were on the east half of transect 1. These were mostly scoters, and represented over 60 percent of total scoters observed that day at Hutchison Bay. On July 30, more divers were concentrated in the west arm of the bay and just south of Warren Point, but in general ducks were fairly evenly distributed. On August 10, a raft of 730 Surf Scoters in the northeast section of the bay accounted for over 60 percent of scoters observed on that survey. Many diving ducks were seen near the Warren Point sandspit, especially at the narrows into the western arm of the bay. A large group of 130 Red-breasted Mergansers was recorded off the tip of a piece of land that juts into the northwestern part of the bay. Groups of Brant were sighted on the tip of the peninsula jutting from the south end of the bay on July 30 and on August 10. Another small group of Brant was observed near the western arm of the bay also on August 10.

Flock Size

From observations made during aerial surveys at McKinley and Hutchison bays, scoter were more heavily represented in large flocks (greater than 50 birds) than were Oldsquaw. On July 20 at McKinley Bay, 52 percent of total scoter observed were in flocks of more than 50 birds, as were 21 percent on July 30 and 43 percent on August 10. At Hutchison Bay, again 52 percent of total

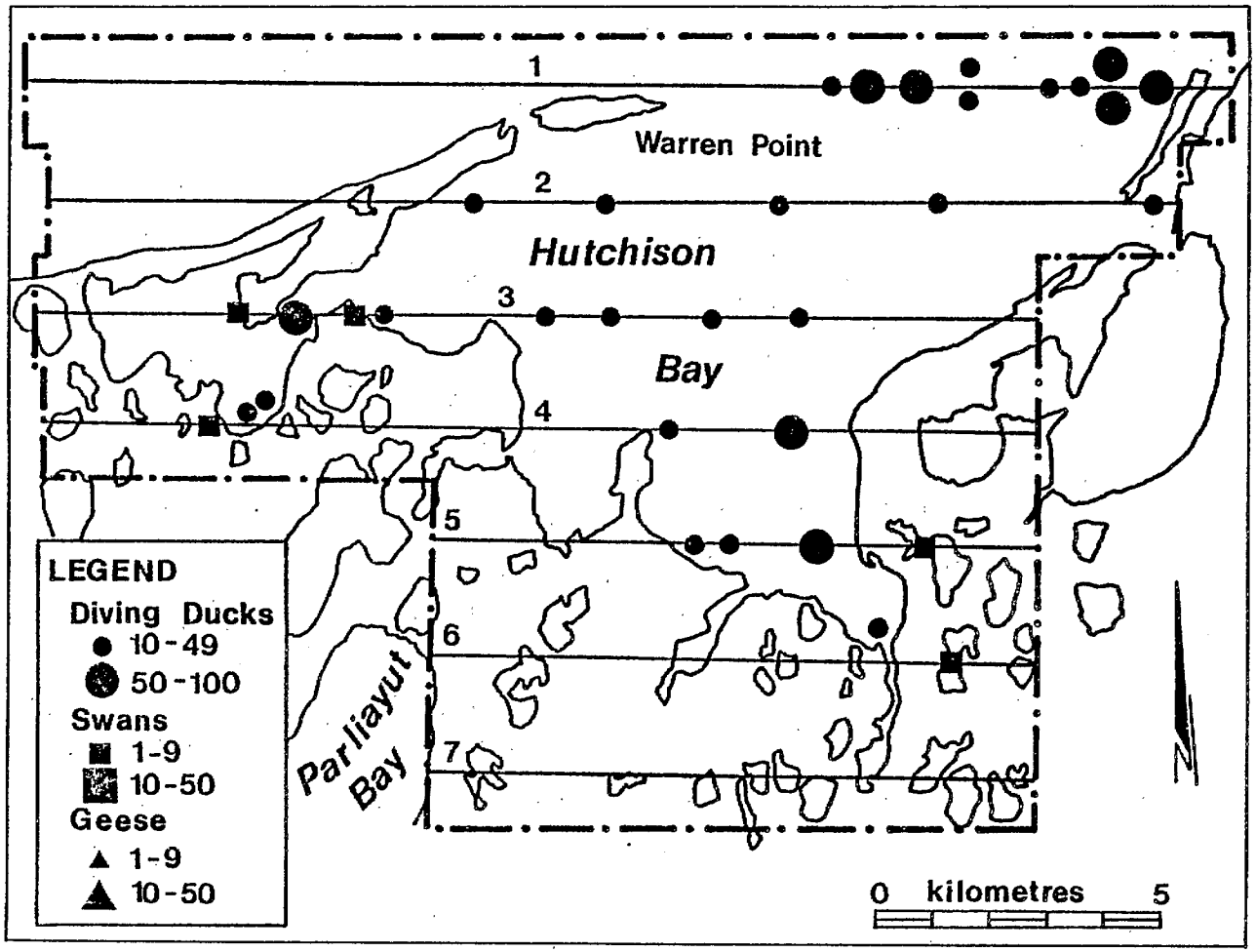

Fig. 10. Distribution of waterfowl observed on aerial transects from Cessna 185 at Hutchison Bay, July 20, 1982.

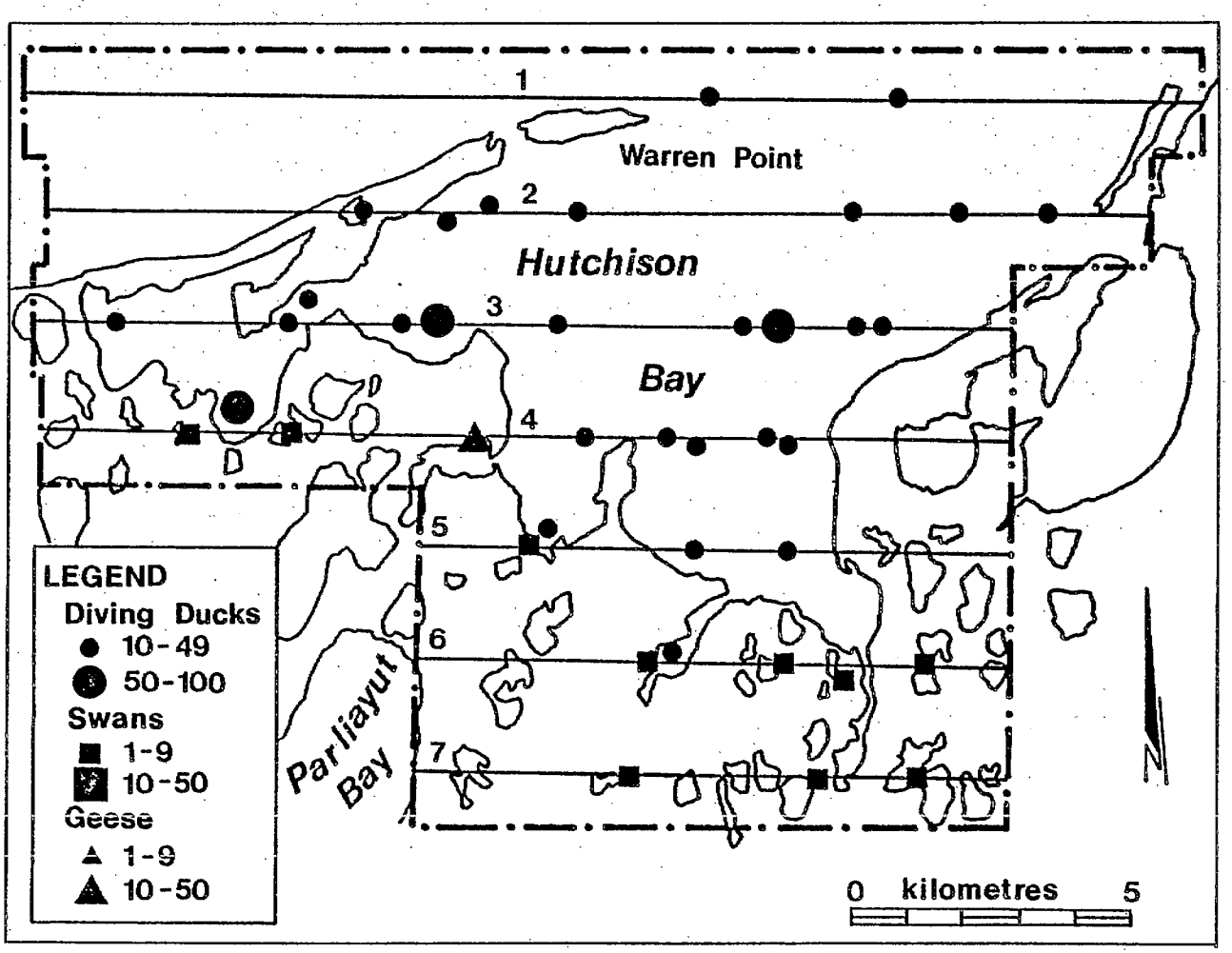

Fig. 11. Distribution of waterfowl observed on aerial transects from Cessna 185 at Hutchison Bay, July 30, 1982.

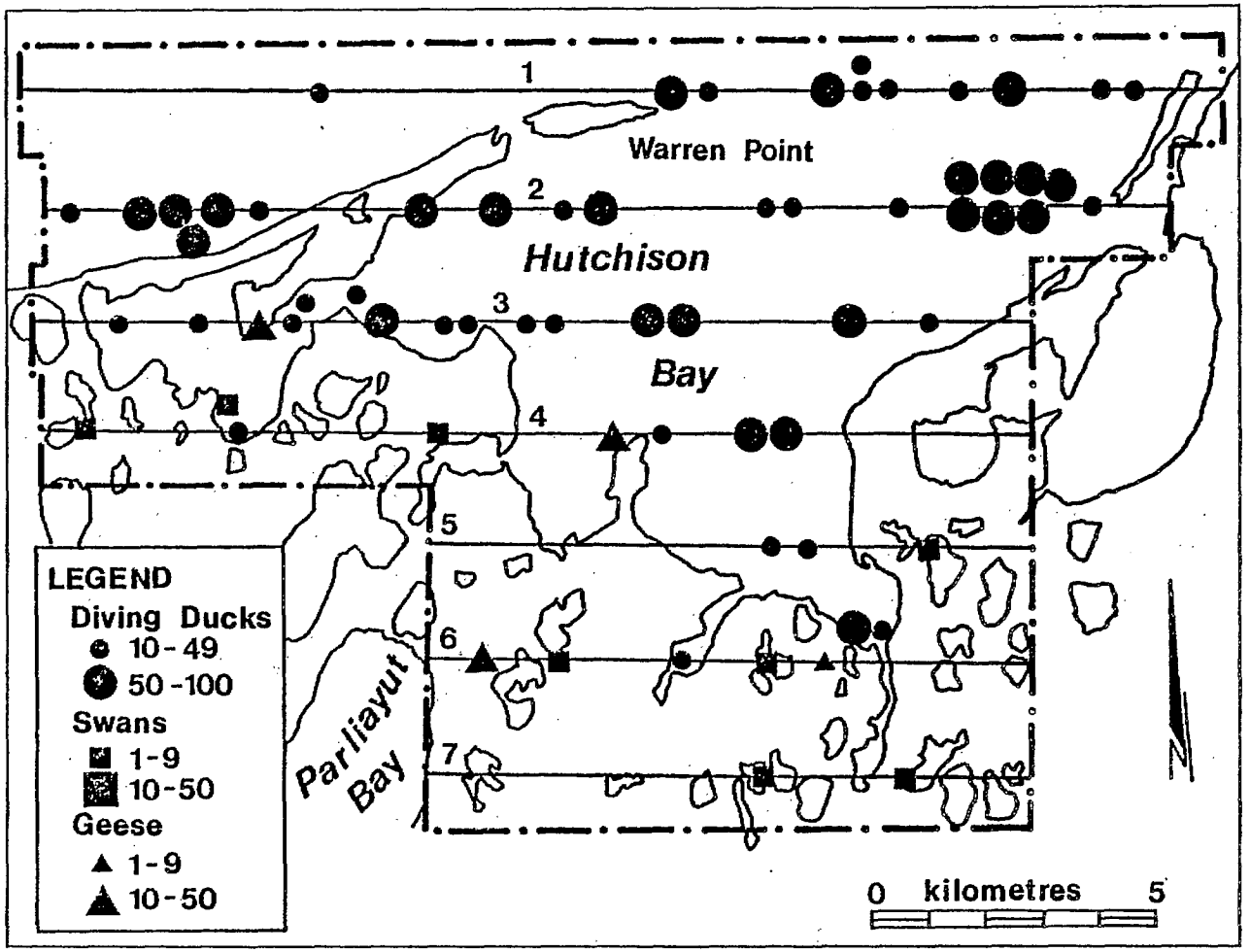

Fig. 12. Distribution of waterfowl observed on aerial transects from Cessna 185 at Hutchison Bay, August 10, 1982.

observed scoter on the July 20 survey were in flocks of more than 50 birds. Only 199 scoter were observed at Hutchison Bay on July 30, and no large groups were seen. However, on August 10, 93 percent of observed scoters were in large aggregations of over 50 birds. When only rafts of over 100 scoter are summed, the total still accounts for over 80 percent of scoter observed on that survey. All Oldsquaw observed during surveys on July 20 and July 30 at both McKinley Bay and Hutchison Bay were in flocks of less than 50 birds. On August 10 at McKinley Bay, the number of Oldsquaw observed in flocks of over 50 birds was only 20 percent of the total, and at Hutchison Bay on the same date, this ratio was 25 percent.

3.2.1.2 Terrestrial Component

McKinley Bay

Lakes south and west of McKinley Bay and the lagoon system to the south were utilized by diving ducks, dabbling ducks, geese and Whistling Swans. The distribution of divers, geese and swans is plotted for all three surveys at McKinley Bay on Figs. 7, 8 and 9.

Over the terrestrial component, diving ducks were recorded using the larger lakes. Concentrations of Brant were observed on all three surveys at the south end of Louth Bay (Fig.1) or in an area just east of Louth Bay. A total of 35 White-fronted Geese and 10 Brant were counted in the lagoon system on July 30. A large aggregation of 85 Brant was observed at the west end of transect 6 west of McKinley Bay, on August 10. Relatively large

numbers of Whistling Swans were sighted on the lagoon system, especially on July 30, when 64 swans were observed on transect 9 and 10. Many of the swans were observed after July 20 in family groups, usually consisting of two adults and two immature. On two occasions, multiple family groups were recorded: on July 30 a group of 10 adults and six immatures, and on August 10 a group of 21 adults and 12 immatures.

Hutchison Bay

There appeared to be fewer large lakes in the terrestrial component of the Hutchison Bay study area. Fewer diving ducks and swans were sighted, and no geese were seen until August 10. On this date, a group of 30 White-fronted Geese was observed near Parliayut Bay.

3.2.2 Boat Surveys Perpendicular to Shore

A total of 17 surveys were carried out in a boat at McKinley Bay on the two transects perpendicular to shore. A summary of conditions for each transect surveyed is presented in Table 12. Conditions were considered "good" for only six of the 17 surveys. The most common problems causing less than optimal conditions were choppy sea conditions, even though surveys were carried out only in winds less than 25 km/h. In choppy conditions it was more difficult to spot birds and to use binoculars when both the ducks and the observers' boat were rocking up and down.

Table 12. Observing conditions during 1982 McKinley Bay boat surveys perpendicular to shore.

Date	Time	Tide	Wind direction and speed (km/h)	Survey conditions	Transect surveyed A	Transect surveyed B
July 18	0900	Flood	NE 16	Fair-Poor	X	
	1200	High	NW 16	Fair		X
July 23	1200	Low	SE 16	Fair		X
	1800	High	SE 8	Good	X	
July 25	1500	Flood	N 16	Fair-Poor	X	
Aug. 7	0900	Ebb	SW 8	Good-Fair		X
	1200	Low	SW 8	Good	X	
	1800	High	NE 16	Good-Fair		X
	0000	Low	SW 16	Fair	X	
Aug. 8	0000	Low	Calm	Good		X
Aug. 15	1500	Ebb	NE 8	Good		X
	1800	Low	SW 16	Good	X	
Aug. 16	1200	High	SE 16	Fair		X
	1500	Ebb	SE 16	Fair	X	
	2100	Low	SE 16	Fair-Poor		X
Aug. 17	1200	Ebb	S 8	Good	X	
	1500	High	SW 16	Fair-Poor		X

In order to determine whether birds tended to be farther from shore at certain tides, times of day or weather conditions, each transect was divided into three sections to calculate the percentage of birds near shore and farther from shore. The results are compiled in Tables 13 and 14. Oldsquaw were seen within 1.2 km of shore more often than were scoter, especially near Atkinson Point on transect A. However, no behavioural trend which related movement of diving ducks away from shore to changes in tidal phases, times of day or wind direction, could be detected from the boat surveys.

Numbers of ducks observed varied considerably between surveys. In most cases, more ducks were seen on boat transect A than on transect B. With information from aerial surveys, this supports the observation that the area to the south and east of Atkinson Point is favoured by diving ducks.

Fewer scoters than Oldsquaw were observed during most surveys on both transects. Over all surveys on transect A, an average of 73 percent of identified divers were Oldsquaw and on transect B, 92 percent were Oldsquaw. However, on three occasions after transect B was completed, observers cruised in the boat to the south end of the bay and there observed large aggregations of scoters (on August 15, a raft of over 500 scoters in the south end of the bay).

Table 13. Distribution of Oldsquaw and scoter observed at McKinley Bay on boat transect A perpendicular to shore, expressed as a percentage.

Date	Time	Tidal phase	Species	Total observed	Percentage distribution 0-1.2 km from shore	1.2-2.4 km from shore	2.4-3.5 km from shore
July 18	0900	Flood	Oldsquaw	64	5	59	36
			Scoter	0	...	...	...
July 23	1800	High	Oldsquaw	316	64	18	18
			Scoter	403	1	47	52
July 25	1500	Flood	Oldsquaw	161	60	37	4
			Scoter	40	30	65	25
Aug. 7	1200	Low	Oldsquaw	401	33	29	38
			Scoter	44	48	52	0
Aug. 15	1800	Low	Oldsquaw	310	5	74	21
			Scoter	81	1	99	0
Aug. 16	1500	Ebb	Oldsquaw	86	43	6	51
			Scoter	0	0	0	0
Aug. 17	1200	Flood	Oldsquaw	252	22	68	14
			Scoter	0	0	0	0

Table 14. Distribution of Oldsquaw and scoter observed at McKinley Bay on boat transect B perpendicular to shore, expressed as a percentage.

Date	Time	Tidal phase	Species	Total observed	Percentage distribution		
					0-1.2 km from shore	1.2-2.4 km from shore	2.4-3.5 km from shore
July 18	1200	High	Oldsquaw	27	11	56	33
			Scoter	40	62	33	5
July 23	1200	Low	Oldsquaw	42	9	57	33
			Scoter	45	4	27	69
Aug. 7	0900	Ebb	Oldsquaw	262	13	17	69
			Scoter	23	30	52	18
Aug. 7	1800	High	Oldsquaw	220	18	70	12
			Scoter	0	...	...	...
Aug. 8	0000	Low	Oldsquaw	844	7	0	93
			Scoter	67	0	72	28
Aug. 15	1500	Ebb	Oldsquaw	396	0	11	89
			Scoter	0	...	...	...
Aug. 16	1200	High	Oldsquaw	48	4	44	52
			Scoter	0	...	...	...
Aug. 16	2100	Low	Oldsquaw	40	18	55	27
			Scoter	0	...	...	...
Aug. 17	1500	High	Oldsquaw	55	7	9	84
			Scoter	50	96	4	0

3.2.3 Boat Surveys Parallel to Shore

Results of these surveys are summarized for McKinley and Hutchison bays in Tables 15 and 16. Oldsquaw were the most common species seen within 500 m of shore at both bays. Many more scoters were observed off transect (more than 500 m from shore, Appendix F) than on transect. From a boat it was often possible to distinguish Surf Scoters from White-winged Scoters. When both "on transect" and "off transect" observations of scoters were combined, it was evident that White-winged Scoters were observed more often at McKinley Bay while Surf Scoters were more common at Hutchison Bay (Tables 15 and 16, Appendix F). The eider and scaup observed on the boat surveys were not identified to species.

Observations made during these surveys on the timing of the moult for the most common species are discussed in a separate section of this report.

McKinley Bay

Most Oldsquaw were observed on boat transect 1 near Atkinson Point. Although only three scoter were "on transect" on August 14, a large aggregation of over 500 scoters, in which 84 percent were White-winged Scoters, was sighted off transect, at the south end of the bay. Scoter were observed on transect 1 near Atkinson Point, and on transect 3 on the east side of the bay, but very rarely on transect 2 (Fig. 4).

Scaup also utilized the near shore areas. Numbers of scaup observed near shore increased substantially on the August 24 boat survey at McKinley Bay. Less than 10 scaup in total were observed

Table 15. Numbers of diving ducks observed near shore on boat transects parallel to shore at McKinley Bay, 1982.

Species	July 15	July 25	August 5	August 14	August 24
Oldsquaw	309	307	583	305	139
White-winged Scoter	82	101	2	3	63
Surf Scoter	17	50	0	0	96
Unidentified scoter	0	0	8	9	0
Scaup	0	0	7	2	239
Red-breasted Merganser	26	10	6	1	26
Eider	0	33	25	0	0
Unidentified diving ducks	29	0	8	0	53
TOTAL	463	501	639	320	616

Table 16. Numbers of diving ducks observed near shore on boat transects parallel to shore at Hutchison Bay, 1982.

Species	July 20	July 30	August 11
Oldsquaw	664	1862	360
White-winged Scoter	0	1	3
Surf Scoter	44	10	18
Unidentified Scoter	0	1	5
Scaup	8	0	8
Red-breasted Merganser	12	37	1
Eider	0	49	16
Unidentified diving ducks	0	0	5
TOTAL	728	1960	416

on any boat survey until August 24. On the August 24 survey, observed scaup (239) outnumbered Oldsquaw (139) in the near shore areas. As scaup were not frequently seen off shore during surveys throughout the summer, it appeared that this observation represented an influx of scaup into McKinley Bay after August 14.

A few eider were seen close to shore on July 25 and August 5, but none were seen on the other three surveys.

Red-breasted Mergansers were the only species of merganser identified and were seen consistently throughout the study period. At McKinley Bay they were more frequently seen along transect 1 in the Atkinson Point area than on the other boat transects.

Hutchison Bay

For all three boat surveys at Hutchison Bay, nearly all ducks observed within 500 m of shoreline were Oldsquaw. However, scoter were often recorded off transect (Appendix F). Most of the ducks seen were on transect 1 along the southwestern shoreline of the bay and on transect 2 south of Warren Point. Eider were most frequently seen near the base of Warren Point at the western arm of the bay (transect 2). Red-breasted Mergansers evidently preferred the western shore, for they were observed there (transect 1) on all surveys. A maximum of 37 Red-breasted Mergansers was observed on transect 1, on July 31.

3.2.4 Helicopter Surveys

Observing conditions were considered "fair to good" on August 18 and "good" on August 19 and August 23 with reference to weather and sea conditions affecting visibility. The surveys on August 18 occurred at 1200, 1500, 1800 and 2100 hours. On August 19 and 23, surveys were carried out at 0900, 1200, 1500 and 1800 hours.

Wind direction varied for each of the three survey dates. The surveys on August 18 were carried out in moderate northwest winds. On August 19, winds were light from the southwest until late afternoon; by the survey at 1800 hours, winds had veered to the northwest. Winds were light from the north for all surveys on August 23.

Large flocks of often more than 100 diving ducks were observed during all surveys on transects C and D at the south end of the bay. These were mainly scoters (Table 17). Oldsquaw were more commonly seen in small flocks south of Atkinson Point on the west end of transect A. For the five surveys when the wind was from the northwest, nearly all diving ducks were concentrated in these two areas. On all surveys, about 100 ducks were observed resting on or in the lee of a long spit on the east side of the bay, at the east end of transect A.

Although each tidal phase was investigated, no consistent trends of distribution of diving ducks in relation to tides were apparent (Table 18).

Table 17. The percentage of Oldsquaw and scoter observed at the south end of McKinley Bay at different times of day, based on the helicopter surveys in 1982.

Time	Date	Oldsquaw		Scoter	
		Total on all transects	Percent at south end	Total on all transects	Percent at south end
0900	Aug. 18	N.D.	...	N.D.	...
	Aug. 19	107	11	490	85
	Aug. 23	235	13	420	79
1200	Aug. 18	99	0	524	69
	Aug. 19	301	5	297	92
	Aug. 23	253	4	607	58
1500	Aug. 18	315	21	297	78
	Aug. 19	262	25	242	29
	Aug. 23	153	46	715	78
1800	Aug. 18	247	13	576	97
	Aug. 19	990	17	1156	90
	Aug. 23	268	15	459	66
2100	Aug. 18	676	13	404	71
	Aug. 19	N.D.	...	N.D.	...
	Aug. 23	N.D.	...	N.D.	...

N.D. Survey not carried out.

Table 18. Changes in flock sizes of Oldsquaw and scoter with the time of day, based on the helicopter surveys at McKinley Bay in 1982.

			Percent of total of each species							
			Oldsquaw				Scoter			
				Flock Size				Flock Size		
Time	Date	Tide	Total observed	< 5	5-50	> 50	Total observed	< 5	5-50	> 50
0900	Aug.18	...	N.D.	...	...	...	N.D.	...	...	...
	Aug.19	Low	107	43	57	0	490	6	43	51
	Aug.23	Ebb	235	35	65	0	420	9	51	40
1200	Aug.18	Flood	99	15	85	0	524	2	27	71
	Aug.19	Flood	301	29	71	0	297	6	47	47
	Aug.23	Low	253	21	79	0	607	5	41	54
1500	Aug.18	High	315	11	89	0	297	3	45	42
	Aug.19	High	262	22	78	0	242	13	58	29
	Aug.23	Flood	153	23	77	0	715	4	22	74
1800	Aug.18	Ebb	247	22	78	0	576	6	7	87
	Aug.19	Ebb	990	4	44	52	1156	2	33	65
	Aug.23	High	268	18	45	37	459	8	31	61
2100	Aug.18	Low	676	<1	47	52	404	<1	49	50
	Aug.19	...	N.D.	...	...	...	N.D.	...	...	...
	Aug.23	...	N.D.	...	...	...	N.D.	...	...	...

N.D. Survey not carried out.

It appeared from observations on these three days that Oldsquaw were in small groups until late afternoon or early evening, when they had a tendency to congregate in larger flocks. During the surveys before 1800 hours on all days, no Oldsquaw were observed in flocks greater than 50 birds. At 1800 hours on August 19, 52 percent of Oldsquaw were seen in aggregations of more than 50 birds, and at 1800 hours on August 23, 37 percent of Oldsquaw were in these large flocks (Table 18). On August 18, the shift to larger flocks was recorded on the survey at 2100 hours, when we observed 52 percent in flocks of more than 50.

In contrast to the Oldsquaw, scoters were observed in large aggregations at any of the surveyed time periods. Scoter were more frequently seen in large, tightly knit groups, often larger in number than 50 birds, and relatively few were observed in scattered loose groups of less than five (Table 18). This tendency for scoters to group into large aggregations was also observed during aerial fixed-wing surveys.

3.2.5 Shoreline Surveys by Foot

From a total of 39 surveys on foot along the shoreline, information was gained about seasonal usage of an area of McKinley Bay south of Atkinson Point (Fig. 3), including the small lagoon at the base of Atkinson Point and the small bay to the south of the lagoon called Louth Bay. Trends in numbers observed in relation to time of day, tides and weather were also noted.

Most of McKinley Bay was clear of ice by July 15. Ice was slow to leave the area near Atkinson Point and Louth Bay due to on shore winds blowing in broken sea ice.

In the period from July 3 to July 15, Oldsquaw, Surf Scoter, White-winged Scoter, eider, Red-breasted Merganser and scaup, listed in approximate order of abundance, were observed using open water leads near Atkinson Point and at the head of Louth Bay. Oldsquaw, eider and mergansers were often observed resting on the ice. Only 12 scaup in total were seen during this period. Also in early July, Oldsquaw and scoter were frequently observed flying over Atkinson Point. Oldsquaw in pairs were sometimes recorded flying over at this time. During a shoreline survey by one observer on July 11 that lasted 50 minutes, a total of 236 ducks were observed flying over, including a flock of 100 ducks and a flock of 50 ducks, both heading east. On July 12, many small flocks totalling 131 ducks were observed flying over during a 1-hour shoreline survey. On this day, 73 percent of the ducks counted flying over were heading eastwards. These observations of flying were made in the early evening, between 1800 and 2100 hours. There was much less flight activity in the morning or afternoon surveys (less than 10 birds flying, on any survey before 1800 hours).

After the ice was gone, diving ducks were scattered in loose mixed flocks at the head of Louth Bay and off Atkinson Point. Ducks were also observed resting on shore, along Atkinson Point and on the southeast shore of the small lagoon on Atkinson Point.

An average of 18 Oldsquaw were observed on or near shore on surveys in July. In early August, numbers of Oldsquaw resting in the vicinity of the lagoon south of Atkinson Point began to increase substantially to a peak of 610 observed on a survey on August 4. In this period, eider were seen in association with the Oldsquaw. From August 4 to the last survey conducted on August 22, an average of over 100 Oldsquaw rested on or near shore.

Eider were observed in numbers less than 10 from the day of the first shoreline survey on July 11 to July 23, resting on shore or near shore at the head of the lagoon south of Atkinson Point. After July 23, numbers of eider in this location began to increase. A peak number of 370 occurred on August 4. Eider were seen there almost daily until August 10. After this date there were only a few sightings of one or two birds. Over the summer, both King and Common eiders were identified, although King Eider were seen in larger numbers. All were females with the exception of five males of both species recorded on five separate occasions.

The first scaup sighting on the shoreline surveys was a group of four resting on shore among the other diving ducks. The number of scaup observed at this location began to increase after August 14 and reached a peak of 90 scaup on August 22. Whenever identified to species, they were Greater Scaup. Other notable scaup observations were 24 scaup sighted in the southeast corner of McKinley Bay during casual observation from a boat on August 15, and 238 scaup observed on boat transect 1 parallel to Atkinson Point on August 24.

Scoter were rarely observed resting on shore. On July 24, 23 scoter rested on Atkinson Point and on August 8, four White-winged Scoter rested with the Oldsquaw and eider.

Brant were observed on this shoreline transect on two occasions in July, but much more often in August. A total of 22 Brant were observed feeding on shore in the area of the lagoon on July 15. On July 16, seven Brant were observed on shore along the transect. Brant were not recorded on these surveys again until August 4, when a family group was sighted consisting of eight adults and 10 immatures. Numbers of Brant then began to increase steadily throughout the month of August. Brant on shore were observed feeding in tidal grasses (Puccinelia sp.) especially on the south shore of the lagoon. The maximum number of Brant seen on the transect was 300 at noon on August 22. Large flocks of Brant were frequently spotted flying in a westerly direction after the middle of August. Between 2030 and 2130 hours on August 22, one observer counted 890 Brant flying west over Atkinson Point.

Snow Geese were first recorded on August 22, when two flocks of 100 were counted flying west. On August 24, a total of 425 Snow Geese were counted flying west by one observer in the course of an hour.

Glaucous Gulls were most common along the shoreline transect in the first two weeks of July; over 100 gulls were noted along shore on one survey on July 12. More gulls were also observed off transect at this time resting on the Atkinson Point spit.

One or two Arctic Tern were seen on most surveys until August 10, when observers began to record groups of adult terns with immatures. On August 21, a group of 38 terns were observed on a shoreline survey.

Loons were observed throughout the summer on these surveys in fairly consistent low numbers, about three to five per survey. Three species of loon were identified, the Arctic, the Red-throated and the Yellow-billed loon. The Yellow-billed Loon was seen only in July and early August.

Eleven species of shorebirds were identified during the shoreline surveys, the most common species being the Northern Phalarope, Pectoral Sandpiper, Semipalmated Sandpiper, Stilt Sandpiper and Black-bellied Plover. Although there were never many shorebirds, numbers increased noticeably after August 12. Prior to that date we saw an average of three per survey, whereas during mid-August there were 23 sightings per survey. Five species were not seen until after August 12: the American Golden Plover, Buff-breasted Sandpiper, Lesser Yellowlegs, Pectoral Sandpiper and Dunlin. Appendix A contains a complete list of the shorebirds seen at McKinley Bay in 1982.

Table 19 charts the average numbers of Oldsquaw seen resting on shore or near shore on the shoreline surveys throughout the summer for each time of day and at high and low tidal phases. More Oldsquaw near shore and on shore were observed in the evening surveys than at other times of day. A consistent trend to correlate number of observations with tidal phase could not be

Table 19. The average number of Oldsquaw observed resting on shore or within 200 m of shore on shoreline surveys by foot during high and low tidal phases at McKinley Bay, 1982.

	High tide		Low tide	
Time	Oldsquaw	No. of surveys	Oldsquaw	No. of surveys
0600	...	(0)	51	(1)
0900	20	(4)	104	(2)
1200	65	(1)	63	(2)
1500	48	(2)	41	(2)
1800	45	(4)	3	(1)
2100	85	(2)	363	(2)
2400	...	(0)	...	(0)
0300	...	(0)	0	(1)

Table 20. Relationship between the wind direction and the number of Oldsquaw recorded on or near shore based on the shoreline surveys by foot. Only data for the three most frequent wind directions are presented. Surveys prior to July 15 are excluded due to the presence of ice in the study area.

	Average number of birds per survey					
	July			August		
Wind direction	On shore	Near shore	No. of surveys	On shore	Near shore	No. of surveys
SE	< 1	2	5	14	45	4
NE	3	16	5	104	46	4
NW	no surveys			150	55	8

proved.

The number of ducks using the shoreline area near Atkinson Point appeared to be associated with the direction of the winds. When winds were from the northeast or northwest, the average numbers of birds observed along this section of shoreline was greater than during surveys when winds were blowing from the southeast (Table 20). The data in Table 20 are presented separately for July and August because of the seasonal differences in abundance observed between July and August.

3.3 Flightless Period

During aerial surveys, very few diving ducks flushed when overflown by fixed-wing or helicopter; the birds tended to swim away or dive rather than flush. However, in the first two weeks of July before the wing-moult began, most ducks flushed from an approaching Zodiac motorboat, and observers became familiar with the "alarm distance" at which diving duck species would take off. On shoreline walks in early July, birds observed on or close to shore often took flight as the person on foot approached; also ducks were often observed flying over. These observations of flying became less common as the season progressed, and then began to increase again. Based on the assumption that there was a sufficiently alarming stimulus for birds to fly during boat surveys and shoreline surveys, the percentage of birds that flushed of the total count of each species was calculated for each survey and is presented graphically in Figs. 13, 14 and 15 for

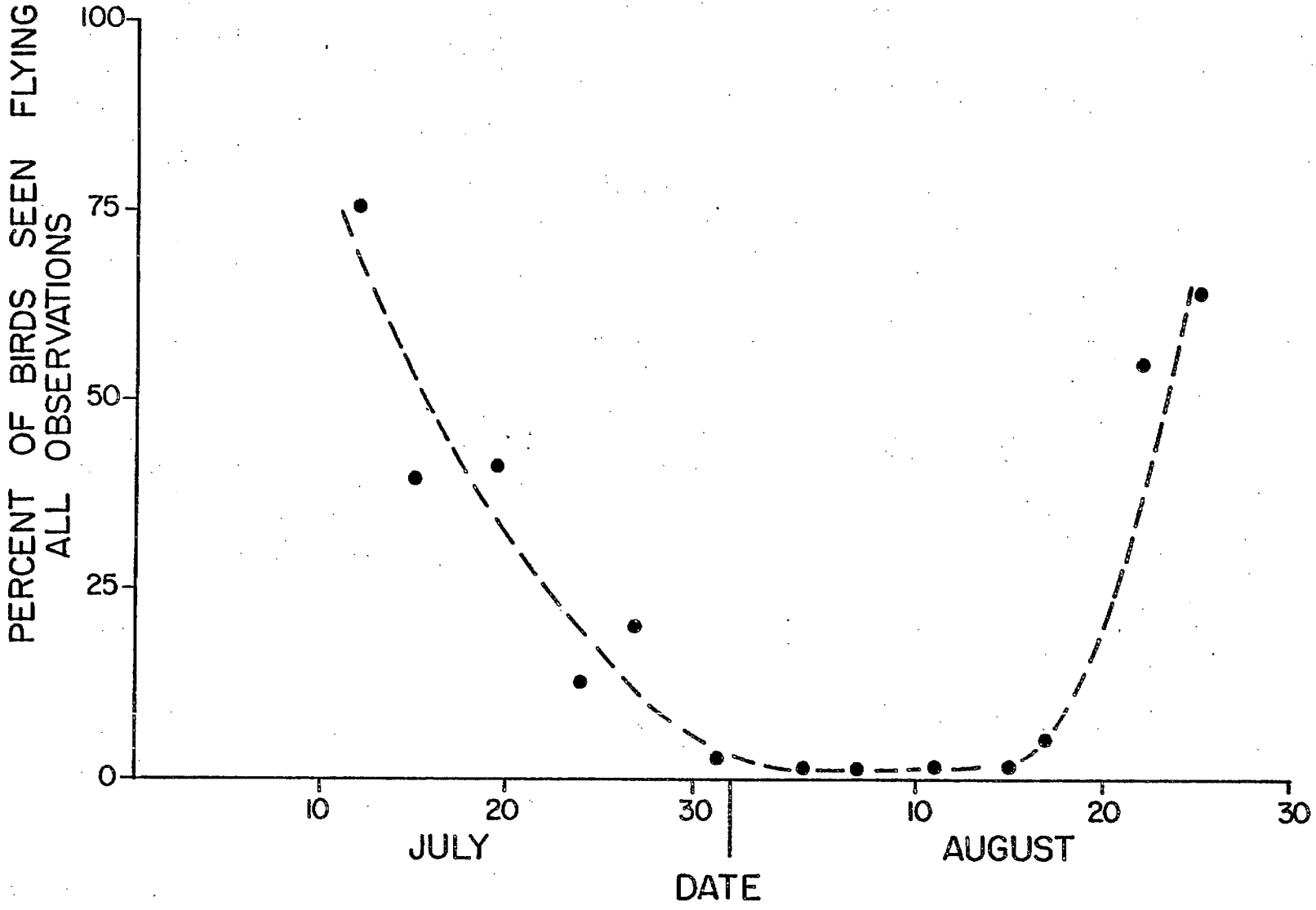

Fig. 13. Percentage of Oldsquaw that flushed of total seen on surveys on dates in July and August 1982, showing the period when most were apparently flightless.

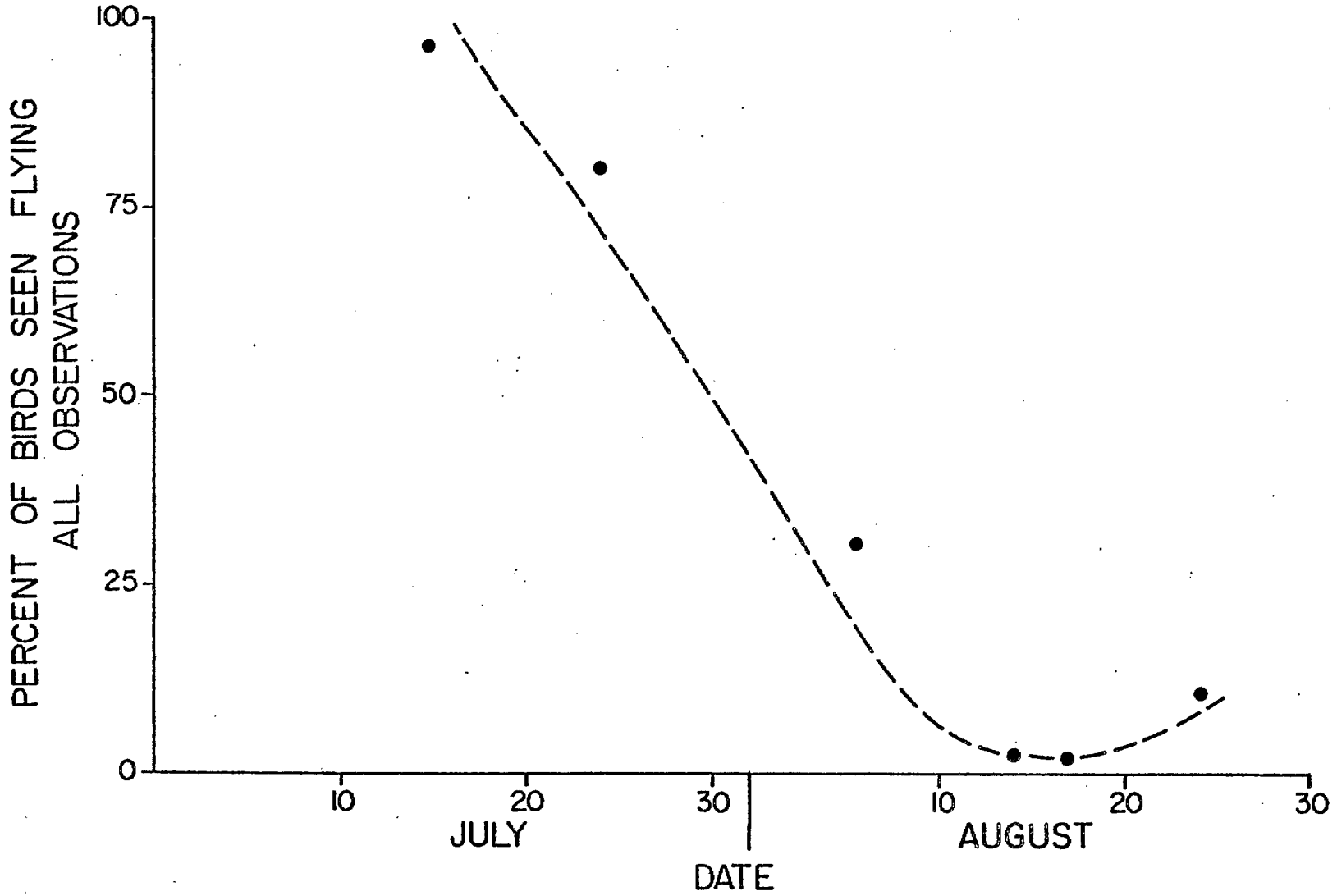

Fig. 14. Percentage of White-winged Scoter that flushed of total seen on surveys on dates in July and August 1982, showing the period when most were apparently flightless.

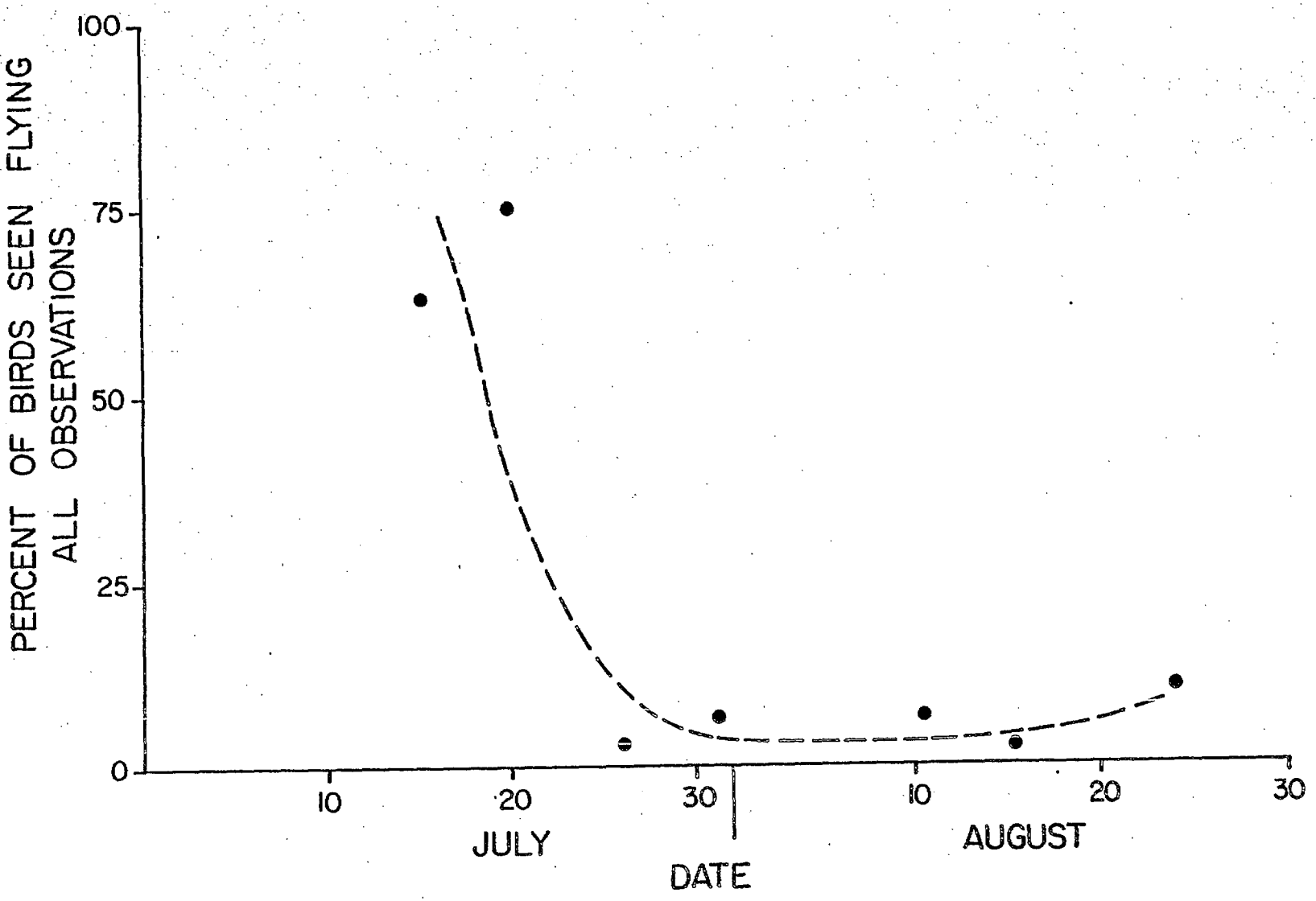

Fig. 15. Percentage of Surf Scoter that flushed of total seen on surveys on dates in July and August 1982, showing the period when most were apparently flightless.

Oldsquaw, White-winged Scoter, and Surf Scoter, respectively.

From all observations at both McKinley Bay and Hutchison Bay, it appeared that the flightless period for most Oldsquaw using these bays was between the last week of July and the third week of August. When birds were counted from the motorboat on a lead of open water south of Atkinson Point on July 5, all the Oldsquaw flushed out of a total of 116. On July 23, as an aggregation of 200 Oldsquaw at McKinley Bay was approached in the boat, 30 birds managed to fly. During boat surveys conducted at McKinley Bay on July 25, a total of 307 Oldsquaw were observed within 500 m of the moving boat, but only 5 percent of these flushed while the remainder dove underwater. On July 31 at Hutchison Bay, out of a total of 1862 Oldsquaw counted on transect from the boat, only 1 percent of them flew. From August 4 to August 16, less than 1 percent of all Oldsquaw observed on each survey at both bays attempted to fly. After August 17, the number of Oldsquaw seen flying began to increase. The large aggregations of Oldsquaw resting on shore of the lagoon south of Atkinson Point did not attempt to fly, however, until August 22 when a flock of 160 Oldsquaw resting there took flight. About two-thirds of Oldsquaw observed on transect flushed during the August 24 boat survey at McKinley Bay.

Fewer scoters were observed during boat surveys at McKinley Bay and Hutchison Bay on which to base suggested dates of moult. Also scoters were rarely observed on shoreline transects. However, data from boat transects combined with casual

observations from a boat give an approximate idea of the dates when the majority of scoters could not fly.

It appeared that the moult of White-winged Scoters using McKinley and Hutchison Bay occurred later in the season than for Oldsquaw, and that the flightless period for the majority of these White-winged Scoters began in August. At McKinley Bay on July 15 and July 23, over 90 percent of White-winged Scoters flushed out of observed totals of 82 and 203 respectively on each date. During the boat surveys at Hutchison Bay on July 31, only 30 scoters were observed on transect out of which 10 flew; however, some White-winged Scoters appeared to have difficulty getting airborne. In the first week of August, very few White-winged Scoters were observed. However, by August 14, only 6 percent of 118 White-winged Scoters flushed, while on August 15, 2 percent or 13 out of 574 White-winged Scoters flushed. On August 17, out of 45 White-winged Scoters observed, none flushed. During the final boat survey conducted on August 24, only 9 percent of White-winged Scoters flushed out of a total of 63.

Since no observations were carried out at either bay after August 24, it is unknown when most White-winged Scoters regained the ability to fly.

The dates that Surf Scoters appeared to be flightless also covered a larger time period and extended later into the season than for Oldsquaw. On July 20, out of 279 Surf Scoters sighted from the boat at Hutchison Bay, 87 percent flew. On July 31 at Hutchison Bay this percentage had dropped to 4 percent of a total

of 100. About 1 percent of observed Surf Scoters flushed from the boat during surveys at Hutchison Bay on August 11, when there were 73 Surf Scoters observed in total. At McKinley Bay, 86 Surf Scoters were observed on boat surveys on August 15, and none flushed. On the final survey conducted at McKinley Bay on August 24, 9 percent of a total of 96 Surf Scoters flushed.

Red-breasted Mergansers were not seen in sufficient numbers to tabulate. From the data, it appeared that the flightless period for most mergansers using these bays began between July 25 and July 31. A total of 51 Red-breasted Mergansers were seen on August 5, but none appeared able to fly. Most of the mergansers reacted when approached by the motorboat by flapping for some distance along the surface of the water. On August 22 and 24, four mergansers were observed flying; however, on the same date five other mergansers flapped along the surface of the water as if unable to get airborne. More observations are necessary to detect the end of the flightless period.

Scaup were not seen in substantial numbers until August 20. At this time, groups of 50 - 100 scaup were observed on shoreline walks and on boat surveys. Most of the scaup were males, and all that were identified to species were Greater Scaup. Between August 20 and August 24, an average of 75 percent of observed totals flushed when approached. It appeared that these groups of scaup had flown into McKinley Bay from some other location, and had already completed their moult.

Most eider were seen between the dates July 24 to August 10 at McKinley Bay. On July 26, more than one-third of the eiders seen flushed. On August 4, a group of 160 eider was flushed near Louth Bay. From the evidence, it seemed that those eider observed in McKinley Bay at this time were not flightless.

4. DISCUSSION

Numbers of observed Oldsquaw increased eight-fold from July 20 to August 10 on aerial surveys at McKinley Bay, and numbers doubled at Hutchison Bay. The results of the surveys by foot at McKinley Bay likewise showed an increase in the number of Oldsquaw as the season progressed. The average number of Oldsquaw observed on or near shore during the 16 shoreline surveys in July was 18 birds, while in August the average of 20 surveys was 145 Oldsquaw.

Barry et al. (1981) conducted three coastal seabird surveys between Herschel Island and Baillie Islands on July 13 - 17, July 29 - 31, and August 16 - 18, 1980. In the section of surveyed coastline from Tuktoyaktuk to Cape Dalhousie which includes both Hutchison and McKinley bays, numbers of Oldsquaw observed on the August survey were more than double the number observed on the other dates. In 1981, however, during corresponding aerial surveys of the coastline done on July 18, August 1 and August 11, Barry and Barry (1982) saw the most Oldsquaw on July 18 in the same section of shoreline. In the same year, Scott-Brown et al (1981) also recorded a decrease in numbers of Oldsquaw observed on aerial surveys after July 21. The results from 1980 and 1982 suggest a major influx of Oldsquaw into McKinley Bay and Hutchison Bay after July 31 to moult, which evidently did not occur in 1981.

According to Palmer (1972), pre-breeding yearlings or non-breeding birds of both sexes would be the earliest of the diving ducks to become flightless, followed by drakes of breeding pairs and then failed breeders. The breeding females may undergo their wing-moult on the breeding grounds or they may arrive in the moulting area later in the season (Salomonsen 1968). Johnson and Richardson (1980) differentiated sex class in their discussion of moult of Oldsquaw in 1977 and 1978 in Simpson Lagoon in the Alaskan Beaufort Sea. They estimated that for male Oldsquaw and to a lesser extent non-breeding female Oldsquaw, wing-moult occurs between July 15 and August 15 along the Beaufort coast. In both years, there was an influx of female Oldsquaw, apparently failed breeders, between August 7 and 18. Wing-lengths of collected females during this period showed that they had recently initiated wing-moult (Johnson and Richardson 1980).

During our study in 1982, most Oldsquaw in McKinley and Hutchison bays were apparently flightless between the last week in July and the third week in August. The large numbers of Oldsquaw that arrived in McKinley and Hutchison bays starting the first week in August were probably failed nesting females. The timing of this influx corresponds closely to the influx of females observed by Johnson and Richardson (1980). Thus, the size of the McKinley Bay population of moulting Oldsquaw in August of a given year may partly depend on nesting success in that year.

The timing of the moult for a species will vary from year to year depending on the timing of breeding and nest initiation (Salomonsen 1968). During the study at Simpson Lagoon, Johnson and Richardson (1980), based on measurements of wing-lengths, concluded that the moult for some male Oldsquaw occurred two weeks earlier in 1978 than in 1977. They suggested that this was due to an earlier spring break-up in 1978. Thus, timing of the moult at McKinley Bay may differ considerably in other years from what we found in 1982.

Oldsquaw were more commonly seen in the Atkinson Point area than in other parts of the bay, on boat surveys and aerial surveys throughout the summer. Scott-Brown et al. (1981), Sharp (1977) and Ward (1981) also observed large numbers of Oldsquaw in this area of the bay.

In this study, scoter showed a slight increase in number prior to the August 10 aerial survey in 1982 at McKinley Bay, while numbers at Hutchison Bay doubled between July 20 and August 10. Scoter were not observed in sufficient numbers on boat surveys and shoreline surveys by foot to provide supportive data for this observed seasonal change in abundance.

At McKinley Bay, scoter were most often observed at the south end of the bay. Karasiuk and Boothroyd (1982) and Scott-Brown et al. (1981) also saw large flocks of scoter at the south end of the bay.

During boat surveys conducted in 1982, White-winged Scoter were more frequently identified at McKinley Bay than Surf Scoter, while the reverse was true at Hutchison Bay. In 1980, Karasiuk and Boothroyd (1982) found on boat surveys on June 30 at McKinley Bay

that White-winged Scoter were more common than Surf Scoter. Barry et al. (1981) suggested that in the western Beaufort Sea area Surf Scoter outnumber White-winged Scoter, while eastwards the White-winged Scoter were more common.

It appeared that the moult for both species of scoter occurred later in the season in 1982 than for Oldsquaw. Many scoter were still apparently flightless when the study ended on August 24. Little is known of the moult of the scoter. It is likely that timing of moult for adult male scoter depends on the timing of breeding for each year. According to Bellrose (1980), the moult for most adult breeding female scoter occurs on the nesting grounds.

In eider, some females remain in the breeding areas to look after large flocks of ducklings including those of other pairs, a species trait called crèching. Other adult eider females, including failed breeders, will perform a separate moult migration after the males (Salomonsen 1968). In Scotland, Milne (1965), cited by Salomonsen (1968), found that breeding eider females undergo their wing-moult one month after the males. During a migration watch at Point Barrow, Alaska, Johnson (1971) noted that the peak period of migration of male eiders was the last week of July, whereas female eiders were not seen until after August 7. The eider females that were present at McKinley Bay between July 24 and August 10, 1982, were probably failed nesters staging or resting while in migration to the Chukchi Sea, where, according to Barry (1983) most of the eider in the Beaufort Sea area are thought to undergo the moult.

Most of the scaup recorded at McKinley Bay in 1982 were males. Whether the large number of scaup drakes that arrived in McKinley Bay after August 15 had completed their moult is unknown, but since no flightless scaup were observed from the time scaup were first recorded until the end of the study period on August 24, it is suspected that these males had completed their wing-moult somewhere else.

Evidence suggests that there is both seasonal and yearly variation in the densities of scaup observed at McKinley Bay. Significantly more scaup were observed on the marine component at McKinley Bay on August 10, 1981, than on the same date in 1982 ($p<0.05$). The data from the study by Scott-Brown et al. (1981) showed an influx of scaup before August 10, 1981; in 1982, this occurred after August 15. Similarly, there was an overall change in abundance of scaup along the eastern Beaufort Sea coastline between 1980 and 1981. Barry and Barry (1982) found that the average density of scaup between Tuktoyaktuk and Atkinson Point in July and August 1981 was about half the density recorded in 1980. At McKinley Bay, Scott-Brown et al. (1981) recorded densities of scaup on August 10-11, 1981, that were only one-third the densities recorded on the same date in 1980 (Karasiuk and Boothroyd 1982).

The scaup in McKinley Bay in 1982 were seen most often in the Atkinson Point area. They rested on shore frequently and were usually seen within 500 m of shore on all surveys.

Brant were observed in increasing numbers in August on the McKinley Bay study area in 1982. Scott-Brown et al. (1981) also noted an increase in numbers of geese prior to the August 10 aerial survey in 1981. In 1982, large numbers of migrating Brant were observed after August 16, with a peak in observed numbers occurring on August 22. Barry (pers. comm.) found that most Brant had left their nesting grounds at the Anderson River Delta by August 25 in 1982.

Brant utilized the shoreline areas east and west of Louth Bay in large numbers. The tidal flats at the edge of the small lagoon south of Atkinson Point were an important feeding area for Brant. Also, we suspect that Brant heavily use the tidal flats in the lagoon east of Louth Bay in late summer, as there were numerous sightings of flocks flushing from that area.

Snow Geese began migrating over McKinley Bay August 22 in 1982. During the remaining two days of the study, none were observed to land there. According to Barry (pers. comm.), Snow Geese usually overfly the Tuktoyaktuk Peninsula during the fall migration.

There were more than twice as many swans observed at McKinley Bay in 1982 than in 1981 (Scott-Brown et al. 1981). Both years, most were recorded on lakes and ponds rather than the bay itself. However, the brackish lagoon system south of McKinley Bay provided habitat for 20 to 30 swans. Hutchison Bay had fewer swans than McKinley Bay.

Results from aerial surveys of waterfowl must be reviewed critically, because varying weather conditions affect the visibility of the birds. Glare from the sun, choppy sea conditions and rain all create less than favourable survey conditions. Our total counts of divers on McKinley Bay on July 20 and 30 were both considerably lower than our total for August 10 (1263, 1196 and 2246 respectively). The difference is likely partly due to survey conditions. On July 20 and 30 which were both sunny days, there was glare off the water, and the winds were moderate causing choppy seas, whereas on August 10 the sky was overcast and winds were calm, so that survey conditions were good.

Weather conditions affect the detectability of some species more than others, according to Stott and Olson (1972). They found that aerial counts of scoters were most consistent with ground counts on cloudy days when the ocean surface was smooth. However, although they recorded a large variation in the percentage of Oldsquaw populations accurately counted by the aerial survey technique, they could not statistically attribute the variation in counts to amount of cloud cover or to sea conditions.

Another factor that affects the detectability of ducks is the tendency for them to aggregate into large flocks. This tendency, in turn, varies with the species and the time of day. Savard (1982) studied variability of waterfowl aerial surveys, and found that differences in estimates were larger for species that aggregated into flocks than for species with a more scattered distribution. We found that scoter were consistently, at any time of day, observed in

large rafts, often over 100 birds and sometimes over 500 birds in one group. Gollop et al. (1974) recorded similar observations of flocking of scoter. In our study, Oldsquaw were found less often in large flocks until later afternoon or evening. It has been acknowledged that large flocks of birds are more visible on aerial surveys than small groups, especially when conditions are less than favourable (Stott and Olson 1972). Results from the 1982 helicopter surveys at McKinley Bay demonstrated how flocking behaviour may affect the variability of total counts on all surveys. Four helicopter surveys were flown, three hours apart, on each of three days in August, between 0900 and 2100 hours. When the percentage of Oldsquaw that were in large flocks increased, the total count of that species also increased. That is, more Oldsquaw were observed on the evening surveys than at any other time of day and this may be attributable to the increased chances of seeing larger flocks.

Other studies have also noted that the number of sea ducks observed is related to the time of day. Ward and Sharp (1974) on their helicopter surveys in protected bays at Herschel Island, counted more Oldsquaw and Surf Scoter per hour in the later afternoon and early evening than during the rest of the day. The numbers of Oldsquaw near and on shore increased in early evening at Herschel Island (Ward and Sharp 1974), an observation that was also recorded at McKinley Bay in this study.

More birds used the area south of Atkinson Point when winds were from the northwest or northeast than when winds were from the southeast. Concentrations of sea ducks on the lee sides of barrier

islands and reefs, with respect to wind, were also observed by Johnson and Richardson (1980), and Vermeer and Anweiler (1975) in Beaufort Sea waterfowl studies. Johnson and Richardson (1980) suggested that the observed distribution of birds on the leeward sides of barrier islands was a factor of food availability. Barrier reefs and spits may also provide physical protection from wind for moulting ducks (Vermeer and Anweiler 1975).

When birds are aggregated in one section of a study area, the standard error of the population estimate is increased. The size of the standard error is directly dependent on the variation in density throughout the study area (Caughley 1977). On our aerial fixed-wing surveys in 1982, we noted a generally clumped distribution of birds in the south end of McKinley Bay and in the Atkinson Point area. The standard error could be decreased by dividing the study area into zones of high and low bird densities.

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APPENDIX A. Scienfic names of species of birds observed at McKinley Bay and Hutchison Bay in July and August 1982, with a checklist of species recorded nesting.

Common name	Scientific name	Recorded nesting locally (X)
Arctic Loon	Gavia arctica	x
Red-throated Loon	Gavia stellata	x
Yellow-billed Loon	Gavia adamsii	-
Whistling Swan	Olor columbianus	x
Brant	Branta bernicla	x
White-fronted Goose	Anser albifrons	x
Snow Goose	Chen caerulescens	-
Pintail	Anas acuta	x
Mallard	Anas platyrhynchos	-
Green-winged Teal	Anas crecca	-
American Wigeon	Anas americana	-
Greater Scaup	Aythya marila	-
Common Pacific Eider	Somateria mollissima v. nigra	-
King Eider	Somateria spectabilis	-
Oldsquaw	Clangula hyemalis	x
White-winged Scoter	Melanitta deglandi	-
Surf Scoter	Melanitta perspicillata	-
Red-breasted Merganser	Mergus serrator	-
Rough-legged Hawk	Buteo lagopus	-
Peregrine Falcon	Falco peregrinus	-
Willow Ptarmigan	Lagopus lagopus	x
Rock Ptarmigan	Lagopus mutus	-
Sandhill Crane	Grus canadensis	x
American Golden Plover	Pluvialis dominica	-

APPENDIX A. (cont'd)

Common name	Scientific name	Recorded nesting locally (X)
Black-bellied Plover	Pluvialis squatarola	-
Semipalmated Plover	Charadrius semipalmatus	x
Eskimo Curlew *	Numenius borealis	-
Whimbrel	Numenius phaeopus	-
Hudsonian Godwit	Limosa haemastica	-
Buff-breasted Sandpiper	Tryngites subruficollis	x
Lesser Yellowlegs	Tringa flavipes	-
Stilt Sandpiper	Micropalama himantopus	x
Long-billed Dowitcher	Limnodromus scolopaceus	-
Ruddy Turnstone	Arenaria interpres	-
Pectoral Sandpiper	Calidris melanotos	-
Dunlin	Calidris alpina	-
Sanderling	Calidris alba	-
Baird's Sandpiper	Calidris bairdii	x
Semipalmated Sandpiper	Calidris pusilla	x
Red Phalarope	Phalaropus fulicarius	x
Northern Phalarope	Lobipes lobatus	x
Parasitic Jaeger	Stercorarius parasiticus	-
Glaucous Gull	Larus hyperboreus	x
Herring/Thayer's Gull	Larus sp.	-
Sabine's Gull	Xema sabini	-
Arctic Tern	Sterna paradisaea	x
Short-eared Owl	Asio flammeus	-
Snowy Owl	Nyctea scandiaca	-

APPENDIX A. (cont'd)

Common name	Scientific name	Recorded nesting locally (X)
Horned Lark	Eremophila alpestris	-
Barn Swallow	Hirundo rustica	x
Common Raven	Corvus corax	-
Redpoll spp.	Carduelis spp.	-
Savannah Sparrow	Passerculus sandwichensis	x
Lapland Longspur	Calcarius lapponicus	x
Smith's Longspur	Calcarius pictus	-
Snow Bunting	Plectrophenax nivalis	x

* unconfirmed sighting on August 15 just south of the lagoon at Atkinson Point.

APPENDIX B. Birds observed on aerial fixed-wing transects at McKinley Bay, 1982.

TABLE B1. Birds observed on marine component of aerial transects at McKinley Bay on July 20, 1982.

Species	Transect number 1	2	3	4	5	6	7	8	9	10	Total on all transects
Yellow-billed Loon											
Arctic Loon			1								1
Red-throated Loon							1				1
Loon sp.		4	1	2		1	1				9
Whistling Swan											
Brant						6					6
White-fronted Goose											
Dark goose											
Pintail											
American Wigeon											
Dabbling duck											
Eider sp.			4	3	7						14
Scaup sp.		2	2		2						6
Oldsquaw	1		30	15	70	12	2				130
Scoter sp.	37	24	35	2	2	246	4				350
White-winged Scoter	13	1	7	5	27						53
Surf Scoter	180	1	25		6	52					264
Red-breasted Merganser						3					3
Diving duck	10	4	156	50	177	46					443
Duck						1	9				10
Raptor											
Ptarmigan sp.											
Sandhill Crane											
Shorebird											
Jaeger sp.											
Glaucous Gull		58	15	5	1	38					117
Sabine's Gull											
Arctic Tern						6					6
Common Raven											
Passerine											
Alcid											
TOTAL	242	94	276	82	292	411	17				1413

TABLE B2. Birds observed on marine component of aerial transects at McKinley Bay on July 30, 1982.

Species	Transect number										Total on all transects
	1	2	3	4	5	6	7	8	9	10	
Yellow-billed Loon						1					1
Arctic Loon		1		1	1						3
Red-throated Loon											
Loon sp.	1			2							3
Whistling Swan											
Brant											
White-fronted Goose											
Dark goose											
Pintail											
American Wigeon											
Dabbling duck											
Eider sp.											
Scaup sp.		27	13	14	6	10					70
Oldsquaw	2	65	207	66	88	15	6				449
Scoter sp.		75	12	53	37						177
White-winged Scoter		4			23						27
Surf Scoter		102	40	6	22	3					173
Red-breasted Merganser		9	1			2					12
Diving duck	22	60	2	82		76	46				288
Duck											
Raptor											
Ptarmigan sp.											
Sandhill Crane											
Shorebird											
Jaeger sp.											
Glaucous Gull	1	24	12	2	1	2					42
Sabine's Gull											
Arctic Tern			1		1						2
Common Raven											
Passerine											
Alcid											
TOTAL	26	367	288	226	179	109	52				1247

TABLE B3. Birds observed on marine component of aerial transects at McKinley Bay on August 10, 1982.

Species	Transect number										Total on all transects
	1	2	3	4	5	6	7	8	9	10	
Yellow-billed Loon											
Arctic Loon											
Red-throated Loon		2									2
Loon sp.	1	4	1	1		1					8
Whistling Swan											
Brant											
White-fronted Goose											
Dark goose											
Pintail		8									8
American Wigeon											
Dabbling duck											
Eider sp.											
Scaup sp.		2	15	8		9					34
Oldsquaw	32	114	517	99	137	14	158				1071
Scoter sp.	44	44	18	3	30	200	4				343
White-winged Scoter					40	43					83
Surf Scoter	10	18	42	44	102	56	100				372
Red-breasted Merganser		1	5			2					8
Diving duck	2	239	8	50	53	4					356
Duck			50		4						54
Raptor											
Ptarmigan sp.											
Sandhill Crane											
Shorebird						1					1
Jaeger sp.				1							1
Glaucous Gull	6	9	25	1	1	4					46
Sabine's Gull											
Arctic Tern		5		2							7
Common Raven											
Passerine											
Alcid											
TOTAL	95	446	681	209	367	334	262				2394

TABLE B4. Birds observed on terrestrial component of aerial transects at McKinley Bay on July 20, 1982.

Species	Transect number										Total on all transects
	1	2	3	4	5	6	7	8	9	10	
Yellow-billed Loon											
Arctic Loon											
Red-throated Loon											
Loon sp.				1	2	7	6	4	1	3	24
Whistling Swan				6	7	3	7	11	11	8	53
Brant				24	2		8				34
White-fronted Goose											
Dark goose											
Pintail							11			2	13
American Wigeon											
Dabbling duck											
Eider sp.									2		2
Scaup sp.				6		25					31
Oldsquaw				1	11	4					16
Scoter sp.											
White-winged Scoter											
Surf Scoter					6						6
Red-breasted Merganser								24	1		25
Diving duck											
Duck					7	1		17	10		28
Raptor							1	1	1		3
Ptarmigan sp.									1		1
Sandhill Crane											
Shorebird			2	4	132	15	24	5	77		259
Jaeger sp.											
Glaucous Gull			2	26	8	13	22		1	1	73
Sabine's Gull											
Arctic Tern			1	1		1					3
Common Raven											
Passerine				1		1			2		4
Alcid											
TOTAL			4	69	170	68	81	62	107	14	575

TABLE B5. Birds observed on terrestrial component of aerial transects at McKinley Bay on July 30, 1982.

Species	Transect number										Total on all transects
	1	2	3	4	5	6	7	8	9	10	
Yellow-billed Loon											
Arctic Loon											
Red-throated Loon											
Loon sp.				2	6	1	4	3			16
Whistling Swan						3	18		34	30	85
Brant				29					10		39
White-fronted Goose									35		35
Dark goose											
Pintail		8			6		4		25		43
American Wigeon											
Dabbling duck											
Eider sp.											
Scaup sp.					4			75			79
Oldsquaw					4			1			5
Scoter sp.	3					16					19
White-winged Scoter											
Surf Scoter											
Red-breasted Merganser								15			15
Diving duck											
Duck				9	5	31		30			75
Raptor					1	1	1			2	6
Ptarmigan sp.											
Sandhill Crane						1					1
Shorebird				26		14	3	8			51
Jaeger sp.				1				2			3
Glaucous Gull					1	10	24	6	2	2	45
Sabine's Gull											
Arctic Tern				1	1		1	3			6
Common Raven											
Passerine										1	1
Alcid											
TOTAL	3	8		68	28	77	55	143	106	35	523

TABLE B6. Birds observed on terrestrial component of aerial transects at McKinley Bay on August 10, 1982.

Species	Transect number										Total on all transects
	1	2	3	4	5	6	7	8	9	10	
Yellow-billed Loon											
Arctic Loon											
Red-throated Loon											
Loon sp.				2	5	5	15	2	6	1	36
Whistling Swan					2	7	15		16	33	73
Brant				15		85					100
White-fronted Goose											
Dark goose									45		45
Pintail	3	8		10	26	5	52	8	10		122
American Wigeon							30				30
Dabbling duck						10	31			2	43
Eider sp.											
Scaup sp.					60	21	5				86
Oldsquaw					51	3				3	57
Scoter sp.											
White-winged Scoter											
Surf Scoter					20						20
Red-breasted Merganser								2	12	3	17
Diving duck											
Duck						37	8		1		45
Raptor	1			1		1					3
Ptarmigan sp.											
Sandhill Crane					1						1
Shorebird		2	20		2	4	121	2			151
Jaeger sp.					1						1
Glaucous Gull		3		5	3	3	8	8	3	2	35
Sabine's Gull											
Arctic Tern						1					1
Common Raven											
Passerine										1	1
Alcid											
TOTAL	4	13	20	33	171	182	285	22	93	45	868

APPENDIX C. Birds observed on aerial fixed-wing transects at Hutchison Bay, 1982.

TABLE C1. Birds observed on marine component of aerial transects at Hutchison Bay on July 20, 1982.

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon								
Arctic Loon								
Red-throated Loon					1			1
Loon sp.		2	3		2			7
Whistling Swan			2					2
Brant								
White-fronted Goose								
Dark goose								
Pintail								
American Wigeon								
Dabbling duck								
Eider sp.								
Scaup sp.		20	70					90
Oldsquaw	54	16	114	14	83			281
Scoter sp.	59	49	3	7				118
White-winged Scoter	9							9
Surf Scoter	295	9	8	50	24			386
Red-breasted Merganser	2		1	5				8
Diving duck	80	88	5	53				226
Duck								
Raptor								
Ptarmigan sp.								
Sandhill Crane								
Shorebird	1	1		1	31			34
Jaeger sp.	1							1
Glaucous Gull	9	17	14	36				76
Sabine's Gull								
Arctic Tern								
Common Raven								
Passerine								
Alcid								
TOTAL	510	202	220	166	141			1239

TABLE C2. Birds observed on marine component of aerial transects at Hutchison Bay on July 30, 1982.

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon								
Arctic Loon								
Red-throated Loon								
Loon sp.	3		5	2				10
Whistling Swan								
Brant				15				15
White-fronted Goose								
Dark goose								
Pintail								
American Wigeon								
Dabbling duck								
Eider sp.			1					1
Scaup sp.		23	102	14	37			176
Oldsquaw	31	39	143	34	27			274
Scoter sp.		12	5					17
White-winged Scoter	6		13	6	5			30
Surf Scoter	17	27	60	47	1			152
Red-breasted Merganser	2		2	3				7
Diving duck	5	14	11	12				42
Duck			40	45				85
Raptor								
Ptarmigan sp.								
Sandhill Crane								
Shorebird								
Jaeger sp.	1							1
Glaucous Gull	12	6	17	6	2			43
Sabine's Gull								
Arctic Tern			8	1	4			13
Common Raven								
Passerine								
Alcid								
TOTAL	77	121	407	185	76			866

TABLE C3. Birds observed on marine component of aerial transects at Hutchison Bay on August 10, 1982.

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon								
Arctic Loon	1							1
Red-throated Loon			2					2
Loon sp.	2	4	5	7	4			21
Whistling Swan				5				5
Brant			45	33				78
White-fronted Goose								
Dark goose								
Pintail								
American Wigeon								
Dabbling duck								
Eider sp.								
Scaup sp.	58	6	26	30	2			122
Oldsquaw	136	181	302	110	49			778
Scoter sp.	108	80	58	15				261
White-winged Scoter		1	3					4
Surf Scoter	37	751	22	55	26			891
Red-breasted Merganser		13	141	2	1			157
Diving duck	66	40	66					172
Duck				19	5			24
Raptor								
Ptarmigan sp.								
Sandhill Crane								
Shorebird								
Jaeger sp.								
Glaucous Gull	3	6	23	3	1			36
Sabine's Gull								
Arctic Tern	1							1
Common Raven								
Passerine								
Alcid	2							2
TOTAL	411	1085	693	279	88			2555

TABLE C4. Birds observed on terrestrial component of aerial transects at Hutchison Bay on July 20, 1982.

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon								
Arctic Loon							2	2
Red-throated Loon							1	1
Loon sp.			2			1	2	5
Whistling Swan								9
Brant								
White-fronted Goose								
Dark goose								
Pintail								
American Wigeon								
Dabbling duck					2			2
Eider sp.								
Scaup sp.				10				10
Oldsquaw				1			1	2
Scoter sp.						13		13
White-winged Scoter								
Surf Scoter								
Red-breasted Merganser				15			1	16
Diving duck								
Duck				20			1	21
Raptor			1	3		1		5
Ptarmigan sp.								
Sandhill Crane						5	2	7
Shorebird			1	1	11	61		74
Jaeger sp.								
Glaucous Gull		19	6	4	2	7	8	46
Sabine's Gull		7						7
Arctic Tern		5		1	1		2	9
Common Raven								
Passerine							2	2
Alcid								
TOTAL		31	11	57	22	88	22	231

TABLE C5. Birds observed on terrestrial component of aerial transects at Hutchison Bay on July 30, 1982.

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon								
Arctic Loon								
Red-throated Loon								
Loon sp.				2		2		4
Whistling Swan				4	2	14	5	25
Brant								
White-fronted Goose								
Dark goose								
Pintail		15		57				72
American Wigeon								
Dabbling duck								
Eider sp.								
Scaup sp.								
Oldsquaw				55				55
Scoter sp.						30		30
White-winged Scoter								
Surf Scoter								
Red-breasted Merganser								
Diving duck								
Duck		50				1		51
Raptor				2		2	1	5
Ptarmigan sp.				7				7
Sandhill Crane								
Shorebird		1		7		10	4	22
Jaeger sp.							1	1
Glaucous Gull		10		5	18	3	6	42
Sabine's Gull								
Arctic Tern						2	9	11
Common Raven								
Passerine					1	1		2
Alcid								
TOTAL		76		139	21	65	26	327

TABLE C6. Birds observed on terrestrial component of aerial transects at Hutchison Bay on August 10, 1982.

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon								
Arctic Loon							3	3
Red-throated Loon								
Loon sp.		1		5	10		17	33
Whistling Swan				10	1	10	9	30
Brant								
White-fronted Goose						32		32
Dark goose						6		6
Pintail				53		6	2	61
American Wigeon					1			1
Dabbling duck							5	5
Eider sp.								
Scaup sp.								
Oldsquaw						2		2
Scoter sp.						10		10
White-winged Scoter								
Surf Scoter						13		13
Red-breasted Merganser				2	1			3
Diving duck							5	5
Duck		57			2	99		158
Raptor				1		2		3
Ptarmigan sp.					1			1
Sandhill Crane				1	2	2		5
Shorebird				4	7	1	2	14
Jaeger sp.								
Glaucous Gull		19			20	3	7	49
Sabine's Gull								
Arctic Tern				1	1	1		3
Common Raven								
Passerine								
Alcid								
TOTAL		77		77	46	187	50	437

APPENDIX D. Birds observed on boat transects parallel to shore at McKinley Bay, 1982.

TABLE D1. Birds observed on boat transects parallel to shore at McKinley Bay on July 15, 1982.

Species	Transect number 1	2	3	Total on all transects
Yellow-billed Loon				
Arctic Loon	7		2	9
Red-throated Loon				
Loon sp.	1		6	7
Whistling Swan		2		2
Brant				
White-fronted Goose				
Snow Goose				
Eider sp.				
Scaup sp.				
Oldsquaw	251	17	41	309
White-winged Scoter	45		37	82
Surf Scoter	6		11	17
Scoter sp.				
Red-breasted Merganser	1	18	7	26
Diving duck				
Dabbling duck	10		19	29
Glaucous Gull	55	35	15	105
Arctic Tern		1		1
TOTAL	376	73	138	587

TABLE D2. Birds observed on boat transects parallel to shore at McKinley Bay on July 25, 1982.

Species	Transect number 1	2	3	Total on all transects
Yellow-billed Loon				
Arctic Loon		3	2	5
Red-throated Loon				
Loon sp.		2	2	4
Whistling Swan				
Brant				
White-fronted Goose				
Snow Goose				
Eider sp.	30		3	33
Scaup sp.				
Oldsquaw	149	15	143	307
White-winged Scoter	17		84	101
Surf Scoter			50	50
Scoter sp.				
Red-breasted Merganser	9		1	10
Diving duck				
Dabbling duck				
Glaucous Gull	15	13	33	61
Arctic Tern				
TOTAL	220	33	318	571

TABLE D3. Birds observed on boat transects parallel to shore at McKinley Bay on August 5, 1982.

Species	Transect number 1	2	3	Total on all transects
Yellow-billed Loon				
Arctic Loon	3	1		4
Red-throated Loon				
Loon sp.	2			2
Whistling Swan				
Brant				
White-fronted Goose				
Snow Goose				
Eider sp.	25			25
Scaup sp.	5	2		7
Oldsquaw	392	156	35	583
White-winged Scoter	2			2
Surf Scoter				
Scoter sp.			8	8
Red-breasted Merganser	6			6
Diving duck		8		8
Dabbling duck				
Glaucous Gull	6		1	7
Arctic Tern	6			6
TOTAL	447	167	44	658

TABLE D4. Birds observed on boat transects parallel to shore at McKinley Bay on August 14, 1982.

Species	Transect number 1	2	3*	Total on all transects
Yellow-billed Loon		1		1
Arctic Loon		4	1	5
Red-throated Loon			1	1
Loon sp.	3		10	13
Whistling Swan				
Brant	35			35
White-fronted Goose				
Snow Goose				
Eider sp.	2			2
Scaup sp.	2			2
Oldsquaw	262	9	34	305
White-winged Scoter	3			3
Surf Scoter				
Scoter sp.	1		8	9
Red-breasted Merganser	1			1
Diving duck				
Dabbling duck	2			2
Glaucous Gull	76	5	3	84
Arctic Tern	16	2	6	24
TOTAL	403	21	63	487

* boat transect 3 surveyed on August 15.

TABLE D5. Birds observed on boat transects parallel to shore at McKinley Bay on August 24, 1982.

Species	Transect number 1	2	3	Total all transects
Yellow-billed Loon				
Arctic Loon			2	2
Red-throated Loon				
Loon sp.	4	7	2	13
Whistling Swan				
Brant	50			50
White-fronted Goose				
Snow Goose				
Eider sp.				
Scaup sp.	238		1	239
Oldsquaw	103	21	15	139
White-winged Scoter	36	18	9	63
Surf Scoter	96			96
Scoter sp.				
Red-breasted Merganser	26			26
Diving duck	53			53
Dabbling duck				
Glaucous Gull	11	4	4	19
Arctic Tern	1			1
TOTAL	618	50	33	701

TABLE D6. Extra species composition data from 8 km boat survey across south end of McKinley Bay and then northwards to artificial island, August 15, 1982.

Species	Transect number W
Yellow-billed Loon	
Arctic Loon	
Red-throated Loon	
Loon sp.	2
Whistling Swan	
Brant	8
White-fronted Goose	
Snow Goose	
Eider sp.	
Scaup sp.	24
Oldsquaw	207
White-winged Scoter	456
Surf Scoter	86
Scoter sp.	
Red-breasted Merganser	45
Diving duck	
Dabbling duck	
Glaucous Gull	
Arctic Tern	
TOTAL	828

APPENDIX E. Birds observed on boat transects parallel to shore at Hutchison Bay, 1982.

TABLE E1. Birds observed on boat transects parallel to shore at Hutchison Bay on July 20, 1982.

Species	Transect number 1	2	3	Total on all transects
Yellow-billed Loon				
Arctic Loon	2	5	1	8
Red-throated Loon				
Loon sp.	2	2		4
Whistling Swan				
Brant		10		10
White-fronted Goose				
Snow Goose				
Eider sp.				
Scaup sp.		8		8
Oldsquaw	8	656		664
White-winged Scoter				
Surf Scoter	43	1		44
Scoter sp.				
Red-breasted Merganser		12		12
Diving duck				
Dabbling duck				
Glaucous Gull	2	4		6
Arctic Tern		5	2	7
TOTAL	57	703	3	763

TABLE E2. Birds observed on boat transects parallel to shore at Hutchison Bay on July 31, 1982.

Species	Transect number 1	2	3	Total on all transects
Yellow-billed Loon				
Arctic Loon				
Red-throated Loon				
Loon sp.				
Whistling Swan				
Brant				
White-fronted Goose				
Snow Goose				
Eider sp.	6	31	12	49
Scaup sp.				
Oldsquaw	1223	469	170	1862
White-winged Scoter	1			1
Surf Scoter		4	6	10
Scoter sp.		1		1
Red-breasted Merganser	27	5	5	37
Diving duck				
Dabbling duck	2	11		13
Glaucous Gull	10	13	13	36
Arctic Tern		2	2	4
TOTAL	1269	536	208	2013

TABLE E3. Birds observed on boat transects parallel to shore at Hutchison Bay on August 11, 1982.

Species	Transect number 1	2	3	Total on all transects
Yellow-billed Loon				
Arctic Loon	1			1
Red-throated Loon				
Loon sp.			2	2
Whistling Swan				
Brant				
White-fronted Goose				
Snow Goose				
Eider sp.			16	16
Scaup sp.	5	3		8
Oldsquaw	86	258	16	360
White-winged Scoter	1		2	3
Surf Scoter			18	18
Scoter sp.			5	5
Red-breasted Merganser	1			1
Diving duck			5	5
Dabbling duck		5		5
Glaucous Gull	3	17	2	22
Arctic Tern	5	3	3	11
TOTAL	102	302	53	457

APPENDIX F. Number of White-winged and Surf Scoters identified off transect on boat surveys parallel to shore at McKinley and Hutchison bays, 1982.

Table F1. Number of White-winged and Surf scoters identified off transect on boat surveys parallel to shore at McKinley Bay.

Species	July 15	July 25	August 5	August 14/15	August 24
White-winged Scoter	90	0	6	565	225
Surf Scoter	2	0	0	80	0

Table F2. Number of White-winged and Surf scoters identified off transect on boat surveys papallel to shore at Hutchison Bay.

Species	July 20	July 31	August 11
White-winged Scoter	0	0	0
Surf Scoter	235	87	55

APPENDIX G. Birds observed on helicopter transects at McKinley Bay, August, 1982.

TABLE G1. Birds observed on helicopter transects at McKinley Bay on August 18, 1982.

	Transect A				Transect B				Transect C				Transect D			
	Time (hrs)				Time (hrs)				Time (hrs)				Time (hrs)			
Species	1200	1500	1800	2100	1200	1500	1800	2100	1200	1500	1800	2100	1200	1500	1800	2100
Oldsquaw	80	222	116	517	19	28	98	68		65	31	80			3	11
White-winged Scoter	101	5	5	23	20	30	3		107	80	409	187		75		
Surf Scoter	20						3		10	22		50	16			
Scoter sp.	20	30		84			7	10	165	55	149	50	65			
Scaup sp.				25			4	4								
Red-breasted Merganser																
Diving duck	33	77	118	272	67	2	20		171	167			15	110		35
TOTAL	254	334	239	921	106	60	135	82	453	389	589	367	96	185	2	46

TABLE G2. Birds observed on helicopter transects at McKinley Bay on August 19, 1982.

	Transect A				Transect B				Transect C				Transect D			
	Time (hrs)				Time (hrs)				Time (hrs)				Time (hrs)			
Species	0900	1200	1500	1800	0900	1200	1500	1800	0900	1200	1500	1800	0900	1200	1500	1800
Oldsquaw	72	195	132	712	23	92	65	109	6	13	60	159	6	1	5	10
White-winged Scoter	3	4	19	80	8	1	5	1	247	51	36	236				
Surf Scoter		4			10	8		21	32	10		70				
Scoter sp.	54		96	5		5	52	7	135	211	18	730	1	3	16	6
Scaup Sp.		6	83				4	20				15				
Red-breasted Merganser																
Diving duck	7	125	57	174	4	8	57	60	3	10	10	3		2		1
TOTAL	136	333	397	971	45	114	183	218	423	295	124	1213	7	6	21	17

TABLE G3. Birds observed on helicopter transects at McKinley Bay on August 23, 1982.

Species	Transect A Time (hrs)				Transect B Time (hrs)				Transect C Time (hrs)				Transect D Time (hrs)			
	0900	1200	1500	1800	0900	1200	1500	1800	0900	1200	1500	1800	0900	1200	1500	1800
Oldsquaw	164	218	81	196	40	26	1	32	13	9	71	31	18			9
White-winged Scoter	4	51	23	9	22	62	26	100	295	285	59	104	4			1
Surf Scoter		2		4		16	7	40	32	62	7					
Scoter sp.	58	15	5	5	5	110	95				113	66		4	380	130
Scaup sp.	13	2	15					5								
Red-breasted Merganser					3											
Diving duck	130	98	63	243		14	15	2	15	1	80	50		1		
TOTAL	369	386	187	457	70	228	144	179	355	357	330	251	22	5	380	140

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