BIRD SURVEYS AT MCKINLEY BAY AND HUTCHISON BAY, NORTHWEST TERRITORIES, IN 1992

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ABSTRACT

Aerial surveys for bird abundance and distribution were conducted in August 1992 at McKinley Bay, Northwest Territories. This bay is the site of a winter harbour for drillships and proposed location for a major year-round support base for oil and gas exploration in the Beaufort Sea. The 1992 surveys represented the continuation of a long-term monitoring study of birds in McKinley Bay and Hutchison Bay, a nearby area used as a control. The primary objectives of the 1992 surveys were to expand the set of baseline data on natural annual fluctuations in diving duck numbers, and to determine if numbers of diving ducks had changed since the initial set of surveys from 1981 to 1985.

Survey techniques were identical to previous years. A series of east-west transects 2 km apart was flown across each bay, and all birds within 180 m of the aircraft flightline were counted.

The best survey conditions in 1992 occurred on August 3. Based on the survey data from that day, the estimated population of diving ducks in McKinley Bay was 21 623 ± 3131. At Hutchison Bay on the same day, there were an estimated 17 756 + 4077 diving ducks.

On average, more diving ducks utilized McKinley Bay in the years from 1990 to 1992 than from 1981 to 1985 ($p<0.05$). Both scoters and Oldsquaw had more than doubled in number between the two survey periods. At Hutchison Bay, however, the number of diving ducks had not changed significantly since the early 1980's ($p>0.05$). The increase in the use of McKinley Bay by diving ducks relative to Hutchison Bay coincided with a decrease in the amount of human activity in McKinley Bay.

RÉSUMÉ

En août 1992, on a effectué des relevés aériens afin de déterminer l'abondance et la distribution des oiseaux dans la baie McKinley dans les Territoires du Nord-Ouest. Cette baie sert de port d'hivernage pour les navires de forage et pourrait être le lieu d'une importante infrastructure de soutien à l'année pour les activités d'exploration pétrolière et gazière dans la mer de Beaufort. Les relevés affectués en 1992 s'inscrivent dans le cadre d'une étude de contrôle à long terme des oiseaux de la baie McKinley et de la baie Hutchinson, zone de contrôle située à proximité. L'évaluation de 1992 visait principalement à accroitre les données de base relatives aux fluctuations annuelles naturelles de la population de canards plongeurs et à établir si ce nombre a varié depuis les premiers relevés effectués de 1981 à 1985.

On a utilisé les mémes méthodes que pour les années précédentes. On a survolé une série de transects est-ouest, séparés par une distance de 2 km, dans chaque baie et on a dénombré tous les oiseaux situés à l'intérieur d'une distance de 180 m de l'axe de passage de l'avion.

Les meilleures conditions d'évaluation ont été enregistrées le 3 août 1992. Selon le relevé enregistré à cette date, la population estimative des canards plongeurs de la baie McKinley s'établissait à 21 623 ± 3 131. À la même date, on estimait la population de canards plongeurs de la baie Hutchison à 17 756 ± 4 077.

En moyenne, on a observé un plus grand nombre de canards plongeurs dans la baie McKinley de 1990 à 1992 que de 1981 à 1985 ($p.<0,05$). La population de macreuses et de canards kakawi a plus que doublé entre les deux périodes de relevés. Toutefois, dans la baie Hutchinson, le nombre de canards plongeurs est demeuré sensiblement le même depuis le début des années 1980 ($p.>0,05$). L'augmentation du nombre de canards observés dans la baie McKinley comparé à celui de la baie Hutchinson coincide avec une diminution de l'activité humaine dans la baie McKinley.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

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1.0 INTRODUCTION

McKinley Bay is a shallow protected bay along the eastern Beaufort Sea coastline in the Northwest Territories. Each year, it provides important habitat for tens of thousands of diving ducks which migrate there in summer to moult.

Since 1979, McKinley Bay has been the site of a winter harbour and support base for oil and gas exploration in the Beaufort Sea. A brief history of the industrial development of the bay, and a summary of recent industrial activity, are included in Appendix A. Major activities such as dredging operations directed towards the continued development of the bay have not occurred since 1981. Although the support base at McKinley Bay remains active, there has been very little offshore drilling in the Canadian Beaufort Sea since 1985. However, in the future, this bay may become a major year-round support base for Beaufort Sea oil and gas drilling activity.

The Canadian Wildlife Service initiated a study in 1981 to monitor the effects of industrial development and activity on bird populations using the bay. The objective of the study was to collect baseline information on natural annual fluctuations in numbers of birds, for use in detecting potential changes in bird use of the bay due to harbour development. Hutchison Bay, an undeveloped bay of similar size about 45 km to the west, was also surveyed, starting in 1982, as a control. Emphasis throughout the study has been placed on moulting diving ducks, due to their abundance. Results of the 5-year initial phase of the study were presented in an earlier report (Cornish and Dickson 1986).

Annual aerial surveys from 1981 to 1985 determined that, on the average, over 12 000 diving ducks, primarily Oldsquaw and scoters, occurred in McKinley Bay in early August each year, while an average of over 13 000 diving ducks utilized Hutchison Bay (Cornish and Dickson 1986). Numbers of scoters and Oldsquaw using McKinley Bay varied significantly in some years, although numbers of Oldsquaw were less variable than scoters (Cornish and Dickson 1986).

In order to collect a second data set for comparison with the earlier set of surveys, aerial surveys were resumed in 1990 at McKinley and Hutchison bays (Cornish et al. 1991), and repeated in 1991 and 1992. The primary objective of the second set of surveys was to determine whether diving duck numbers had changed significantly in the five years since completion of the initial phase of the study. This report summarizes the findings of surveys conducted in 1992, and compares the data from 1990 and 1992 to those from the first five years of surveys.

2.0 METHODS

2.1 Aerial Surveys

To allow comparisons between sets of data, the same survey methods were used during the 1992 surveys as in the previous seven years of survey. East-west transects were flown 2 km apart (Figs. 1 and 2), in a Cessna 185 at an elevation of 30 m above ground level and 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. Observations were dictated into tape recorders so that observers never had to look away from the transect. Counting bias due to differences in observer skill was reduced since observers during the 1992 surveys were the same individuals as throughout the rest of the study (with the exception of one of the observers in 1981).

It became apparent from surveys conducted in 1982 that the peak period of moult for diving ducks in the bay was the first two weeks of August (Cornish and Allen 1983), and that good survey conditions (calm sea and light cloud) were imperative for accurate survey results. Accordingly, each year surveys were conducted between August 1 and 10 on whatever days the survey conditions were expected to be suitable. The data from the survey with the best conditions, in terms of visibility of birds, were then used for the calculations.

The study area at McKinley Bay was divided into three components: the area inside McKinley Bay called the bay component, a terrestrial component, and a section of marine habitat outside McKinley Bay called the outside component (Fig. 1). The bay component encompassed saltwater areas within McKinley Bay, including exposed sandspits which were intermittently washed over by tides. Protected shallow lagoon areas, such as the small branching lagoon system east of Louth Bay and the long narrow lagoon extending about 7 km south of McKinley Bay, were considered terrestrial, as were all inland lakes. The area west of Atkinson Point, the small bay at the west end of transects 4 to 6, and the western half of transect 1 were considered the outside component. The areas of each component and the proportions surveyed are listed in Table 1. The total size of the study area was 306 km^2. The area of the bay component of the McKinley Bay study area was 108.5 km^2. and the terrestrial component was 158.5 km^2.

At Hutchison Bay, the study area was also divided into three components (Fig. 2). Again, marine areas within the bay, and sandspits intermittently washed over by tides, were considered bay component. The isolated lagoon at the east end of transect 4, the narrow, shallow channels of the bay along transects 6 and 7, and all inland lakes were included in the terrestrial component. The saltwater areas west of Warren Point and the area covered by the western half of transect 1 were considered outside component. Table 1 presents the areas of the components at Hutchison Bay and proportions surveyed.

The terms diving ducks and divers refer to ducks belonging to either Aythyinae or Merginae. References in the text to dabbling ducks or dabblers refer to surface-feeding ducks classed as Anatinae. Appendix B lists the common and scientific names of species discussed in this report.

2.2 Analysis of Data

During the eight years of the study, anywhere from 1 to 41% of the diving ducks were not identified to species, depending on such factors as flock size and survey conditions. To avoid underestimating species densities and population estimates on the bay component, it was necessary to include all observations of diving ducks in calculations of these parameters. Thus, for each of the major species, the adjusted number of birds was calculated by multiplying the observed proportion of that species among the identified diving ducks by the total number of diving ducks on all transects.

The mean densities for each species were then calculated by the standard ratio estimator, or the adjusted number of birds on all transects divided by the total area surveyed. Population estimates were found by multiplying the estimated mean density of birds by the total area of the study component (Table 1). The standard error of the population estimate for total diving ducks was calculated using the method by Kingsley and Smith (1980). This equation is described in earlier reports (Cornish et al. 1991).

Numbers of Oldsquaw, scoters and total divers from 1990 to 1992 were compared to values from the initial data set collected from 1981 to 1985 by calculating the t statistic (Steel and Torrie 1980). The mean for each data set was calculated using the adjusted numbers of Oldsquaw, scoters and total divers. The formula for comparison of two sample means where $n_1 \neq n_2$, is as follows:

$$t = \frac{\bar{Y}_1 - \bar{Y}_2}{s_{(\bar{Y}_1 - \bar{Y}_2)}}$$

where:

$\bar{Y}_1$ = the mean of adjusted numbers of diving ducks observed from 1981 to 1985 (for Hutchison Bay, from 1982 to 1985)

$\bar{Y}_2$ = the mean of adjusted numbers of diving ducks observed at each bay from 1990 to 1992

$$s_{(\bar{Y}_1 - \bar{Y}_2)} = \sqrt{\frac{s^2 (n_1 + n_2)}{n_1 (n_2)}}$$

and

$$s^2 = \text{pooled variance} = \frac{(n_1 - 1) s_1^2 + (n_2 - 1) s_2^2}{(n_1 - 1) + (n_2 - 1)}$$

n_1 = first sample size (1981 to 1985) = 5 years for McKinley Bay
(1982 to 1985) = 4 years for Hutchison Bay

n_2 = second sample size which was 3 years for both bays (1990 to 1992)

For each year, only the results from the survey with the best weather and sea conditions were included for data comparisons. Significant differences were accepted at $p < 0.05$.

3.0 RESULTS AND DISCUSSION

3.1 Survey Conditions

The best survey conditions in 1992 occurred on August 3. At McKinley Bay, there was a light wind at 5 to 8 kph from the southeast creating nearly calm sea conditions. Cloud cover was 100% with the occasional rain shower and periods of dark lighting. Overall survey conditions were rated as good. At Hutchison Bay conditions were excellent. The winds were from the southeast at <5 kph, so that sea conditions were virtually calm. Cloud cover was 100%, but lighting was brighter than at McKinley Bay making it easier to identify birds to species. The surveys on August 3 were conducted at McKinley Bay between 1150 and 1310, then at Hutchison Bay between 1320 and 1425.

3.2 Abundance and Distribution of Birds

The results of the 1992 surveys are presented in detail in Appendices C and D. Bird densities observed in 1992 are presented in Appendices E and F.

There were an estimated 21 623 ± 3131 diving ducks moulting in McKinley Bay in 1992 based on the count obtained on August 3 (Table 2). At Hutchison Bay on the same day there were an estimated 17 756 ± 4077 diving ducks in the Bay.

The divers were distributed fairly evenly throughout each of the bays on August 3, although at McKinley Bay densities were higher south of Atkinson Point (Figs. 3 and 4). The divers tended to be in larger flocks at Hutchison Bay than at McKinley Bay (Appendix H). About 78% of the divers seen at McKinley Bay were in flocks of <100, compared to only 56% of the divers at Hutchison Bay.

3.3 Comparison of Bird Abundance Between 1981-85 and 1990-92

The number of diving ducks moulting in McKinley Bay from 1990 to 1992 has increased since the earlier set of surveys from 1981 to 1985 ($P<0.05$) (Table 3; Figs. 5, 6 and 7). Both Oldsquaw and scoters in the Bay have more than doubled in number. At Hutchison Bay, however, there has been no significant change in either Oldsquaw or scoter numbers ($p> 0.05$) (Table 4; Figs. 5, 6 and 7).

To examine changes in abundance of species other than diving ducks, the counts from both the bay and terrestrial components were combined (Tables 5 and 6; Fig. 8). The number of both Pacific and Red-throated loons more than doubled at McKinley Bay from the first set of surveys in the early 1980's to the second set in 1990-92. Loon numbers increased at Hutchison Bay as well, but not to the same extent (Fig. 8). Likewise, the number of dabblers, primarily Northern Pintail, more than doubled at McKinley Bay with a smaller increase occurring at Hutchison Bay. On the other hand, Tundra Swans and Greater White-fronted Geese showed a greater increase at Hutchison Bay than McKinley Bay. The number of Brant and Arctic Terns declined at both study sites over the years, while the number of Glaucous Gulls remained about the same.

From 1982 to 1985, diving duck densities were always higher in Hutchison Bay than McKinley Bay. This was the case again in 1990. However, during the past two years of surveys, diving duck densities have been highest at McKinley Bay.

Furthermore, the number of divers at McKinley Bay was significantly higher ($p<0.05$) during the 1990-92 period compared to earlier surveys, whereas no change in numbers could be detected at Hutchison Bay. The increase in the use of McKinley Bay by diving ducks relative to Hutchison Bay coincides with a decrease in the level of human activity in McKinley Bay. Oil and gas related activity at McKinley Bay has declined considerably since the 1981 to 1985 period (Appendix A). Sixteen to 20 ships were mobilized for offshore oil and gas exploration between 1981 and 1985, compared to only 2 to 6 ships from 1990 to 1992. Consequently the number of people stationed at McKinley Bay, and boat and aircraft traffic to and from the Bay, have declined. Another year of survey data will help to clarify whether duck numbers at McKinley Bay have increased in recent years.

Table 1. Size and aerial survey coverage of designated components of the McKinley Bay and Hutchison Bay study areas.

Component	McKinley Bay		Hutchison Bay	
	Total area (km^2)	Area surveyed (km^2)	Total area (km^2)	Area surveyed (km^2)
Bay	108.5	19.6	100.5	17.8
Terrestrial	158.5	28.3	91.0	16.3
Outside	39.0	7.1	30.5	5.8
TOTAL	306.0	55.0	222.0	39.9

Table 2. Population estimates of the diving ducks on the bay component at McKinley Bay and Hutchison Bay on August 3, 1992.

Species	Location	Adjusted number[a]	Density (birds/km^2)	Population estimate
Oldsquaw	McKinley Bay	1419	72.40	7855
	Hutchison Bay	1516	85.17	8560
Scoter sp.	McKinley Bay	2361	120.46	13070
	Hutchison Bay	875	49.16	4941
Scaup sp.	McKinley Bay	96	4.90	532
	Hutchison Bay	78	4.38	440
Merganser sp.	McKinley Bay	30	1.53	166
	Hutchison Bay	676	37.98	3817
TOTAL DIVING DUCKS	McKinley Bay	3906	199.29	21623 ± 3131(S.E.)[b]
	Hutchison Bay	3145	176.68	17756 ± 4077(S.E.)

[a] From Appendix G

[b] S.E. = Standard Error. Not calculated for individual species since the adjusted number includes an uneven proportion of unidentified divers on each transect.

Table 3. Comparison of adjusted numbers[a] of diving ducks on the bay component at McKinley Bay during two sets of aerial surveys, 1981 to 1985 and 1990 to 1992.

Year	Oldsquaw	Scoters	Total divers
1981	1046	705	2175
1982	1263	934	2246
1983	992	1207	2312
1984	1171	1880	3104
1985	1031	153	1258
$\bar{X}_{1981-85} \pm$ S.D.[b]	1101 ± 113	976 ± 637	2219 ± 655
1990	2397	2478	5040
1991	3666	1820	5707
1992	1419	2361	3906
$\bar{X}_{1990-92} \pm$ S.D.	2494 ± 1127	2220 ± 351	4884 ± 910
Test for difference[c] ($\bar{X}_{1981-85}$ vs. $\bar{X}_{1990-92}$)	t = -2.90 *	t = -3.05 *	t = -4.86 *

[a] Adjusted number - from Appendix G
[b] S.D. = Standard Deviation.
[c] Compare to: $t_{0.05} = 2.447$.
* Significant difference, $p < 0.05$.

Table 4. Comparison of adjusted numbers[a] of diving ducks on the bay component at Hutchison Bay during two sets of aerial surveys, 1982 to 1985, and 1990 to 1992.

Year	Oldsquaw	Scoters	Total divers
1982	838	1246	2385
1983	617	1678	2415
1984	1717	1161	3066
1985	884	796	1801
$\bar{X}_{1982-85} \pm$ S.D.[b]	1014 ± 392	1220 ± 362	2417 ± 517
1990	2733	1901	5064
1991	732	786	1968
1992	1516	875	3145
$\bar{X}_{1990-92} \pm$ S.D.	1660 ± 1008	1187 ± 620	3392 ± 1563
Test for difference[c] ($\bar{X}_{1982-85}$ vs. $\bar{X}_{1990-91}$)	t = -1.14 ns	t = 0.09 ns	t = -1.20 ns

[a] Adjusted number - from Appendix G
[b] S.D. = Standard Deviation.
[c] Compare to: $t_{0.05} = 2.571$.
ns Not significant.

Table 5. Number of birds observed at McKinley Bay from 1990-92 compared to 1981-85 (bay and terrestrial components combined).

Species	Mean number of birds[a] 1981-85	1990-92
Pacific Loon	10 ± 9	28 ± 6
Red-throated Loon	24 ± 24	82 ± 31
Loon sp.[b]	29 ± 17	18 ± 16
Total Loons	64 ± 11	128 ± 53
Tundra Swan	55 ± 19	67 ± 21
Brant	61 ± 36	32 ± 63
G. White-fronted Goose	24 ± 26	48 ± 28
Dark Goose	50 ± 34	8 ± 7
Snow Goose	<1 ± <1	0 ± 0
Total Geese	136 ± 52	88 ± 35
Northern Pintail	113 ± 44	344 ± 206
American Wigeon	12 ± 11	28 ± 45
Dabbling duck	43 ± 30	108 ± 120
Total Dabblers	168 ± 57	480 ± 104
Scaup sp.	153 ± 134	132 ± 24
Eider sp.	4 ± 8	0 ± 0
Oldsquaw	1012 ± 100	2189 ± 1064
White-winged Scoter	109 ± 131	157 ± 221
Surf Scoter	456 ± 364	464 ± 313
Scoter sp.	248 ± 177	919 ± 197
Total Scoters	812 ± 477	1541 ± 450
Red-breasted Merganser	51 ± 31	142 ± 20
Diving duck[c]	414 ± 277	1730 ± 783
Total Divers	2447 ± 684	5733 ± 1400
Sandhill Crane	5 ± 4	8 ± 5
Shorebirds	123 ± 63	66 ± 110
Glaucous Gull	76 ± 24	89 ± 44
Sabine's Gull	8 ± 6	5 ± 5
Total Gulls	83 ± 19	95 ± 40
Arctic Tern	44 ± 39	16 ± 14

[a] ± standard deviation
[b] Includes Yellow-billed Loons and Common Loons
[c] Includes Common Merganser

Table 6. Number of birds observed at Hutchison Bay from 1990-92 compared to 1981-85 (bay and terrestrial components combine).

Species	Mean number of birds[a] 1982-85	1990-92
Pacific Loon	16 ± 10	24 ± 10
Red-throated Loon	24 ± 20	38 ± 14
Loon sp.[b]	26 ± 19	9 ± 9
Total Loons	65 ± 20	71 ± 2
Tundra Swan	44 ± 24	74 ± 26
Brant	51 ± 35	33 ± 56
G. White-fronted Goose	16 ± 18	80 ± 76
Dark Goose	30 ± 25	107 ± 102
Snow Goose	10 ± 10	<1 ± <1
Total Geese	106 ± 49	220 ± 74
Northern Pintail	109 ± 115	146 ± 78
American Wigeon	2 ± 2	26 ± 30
Dabbling duck	26 ± 24	72 ± 25
Total Dabblers	136 ± 140	244 ± 116
Scaup sp.	156 ± 53	248 ± 226
Eider sp.	3 ± 6	0 ± 0
Oldsquaw	939 ± 390	1425 ± 1113
White-winged Scoter	90 ± 89	20 ± 35
Surf Scoter	722 ± 226	485 ± 530
Scoter sp.	328 ± 192	499 ± 140
Total Scoters	1140 ± 326	1004 ± 698
Red-breasted Merganser	53 ± 72	308 ± 259
Diving duck	203 ± 158	581 ± 59
Total Divers	2495 ± 488	3565 ± 1896
Sandhill Crane	2 ± 3	6 ± 3
Shorebirds	42 ± 30	53 ± 26
Glaucous Gull	62 ± 16	62 ± 38
Sabine's Gull	0 ± 0	1 ± 1
Total Gulls	62 ± 16	63 ± 38
Arctic Tern	14 ± 9	1 ± 1

[a] ± standard deviation
[b] Includes Yellow-billed Loons and Common Loons
[c] Includes Common Merganser

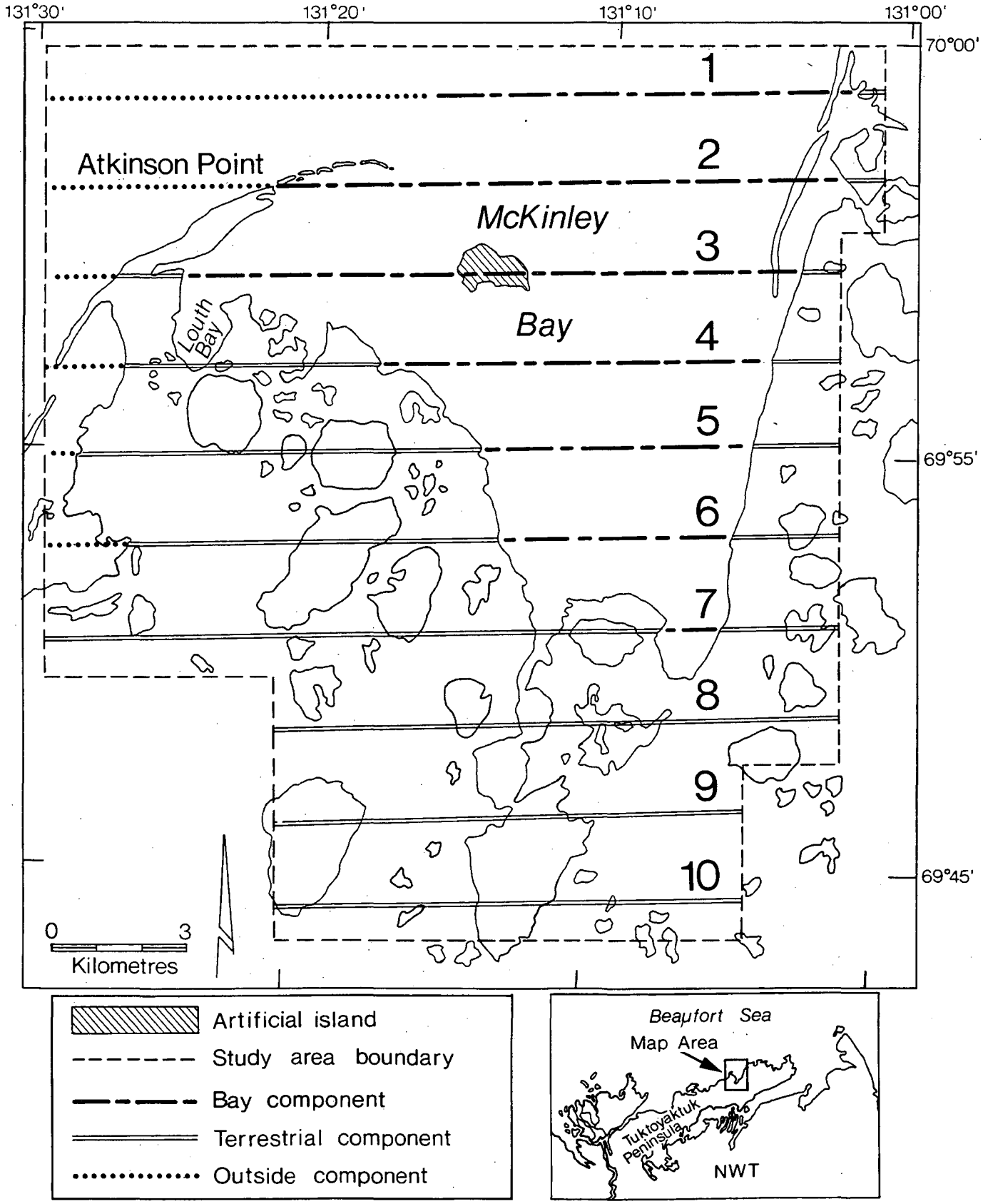

Figure 1. Aerial transects flown at McKinley Bay on August 3 and 4, 1992 showing the bay, terrestrial and outside components of the study area.

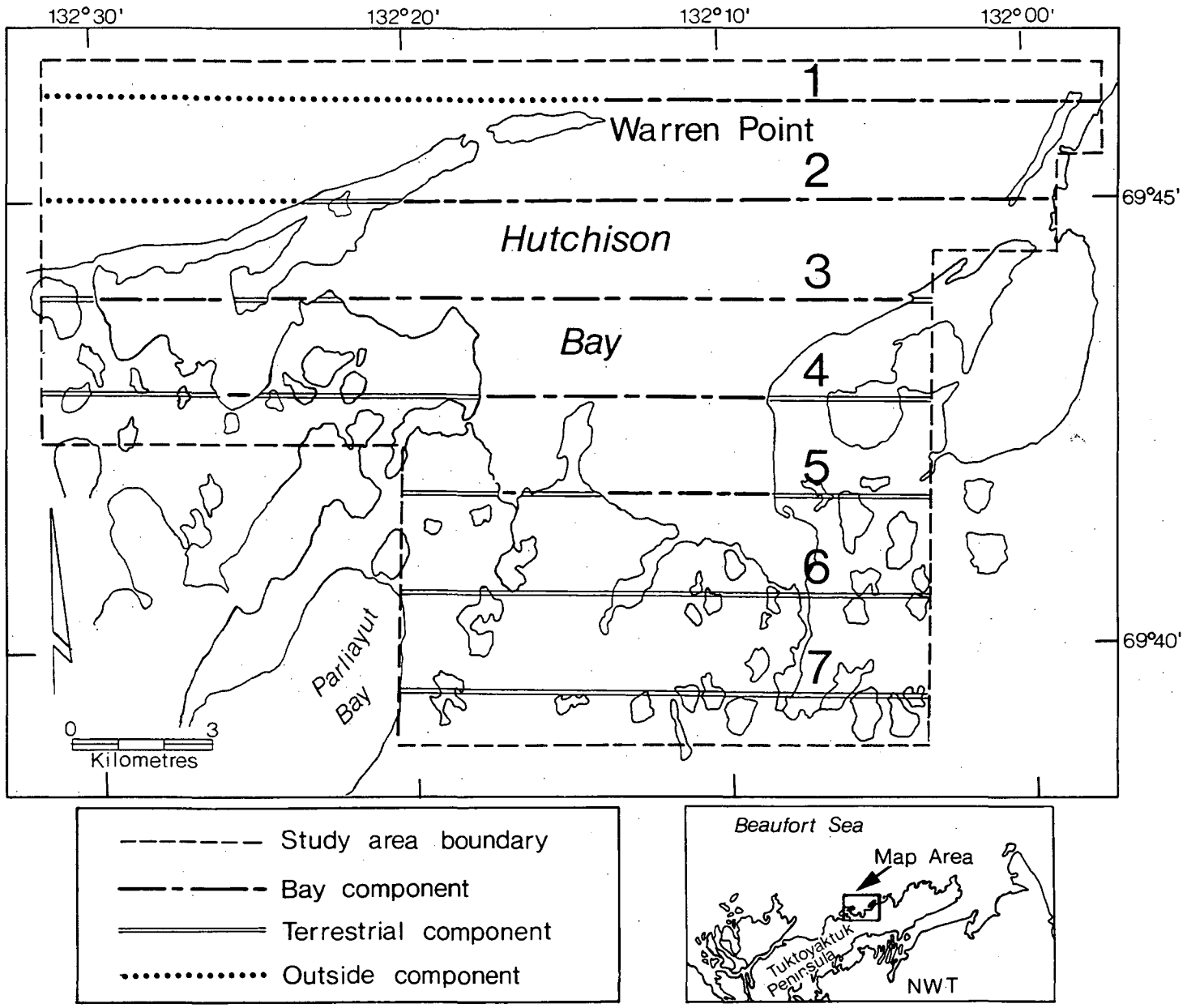

Figure 2. Aerial transects flown at Hutchison Bay on August 2, and 3, 1992 showing the bay, terrestrial and outside components of the study area.

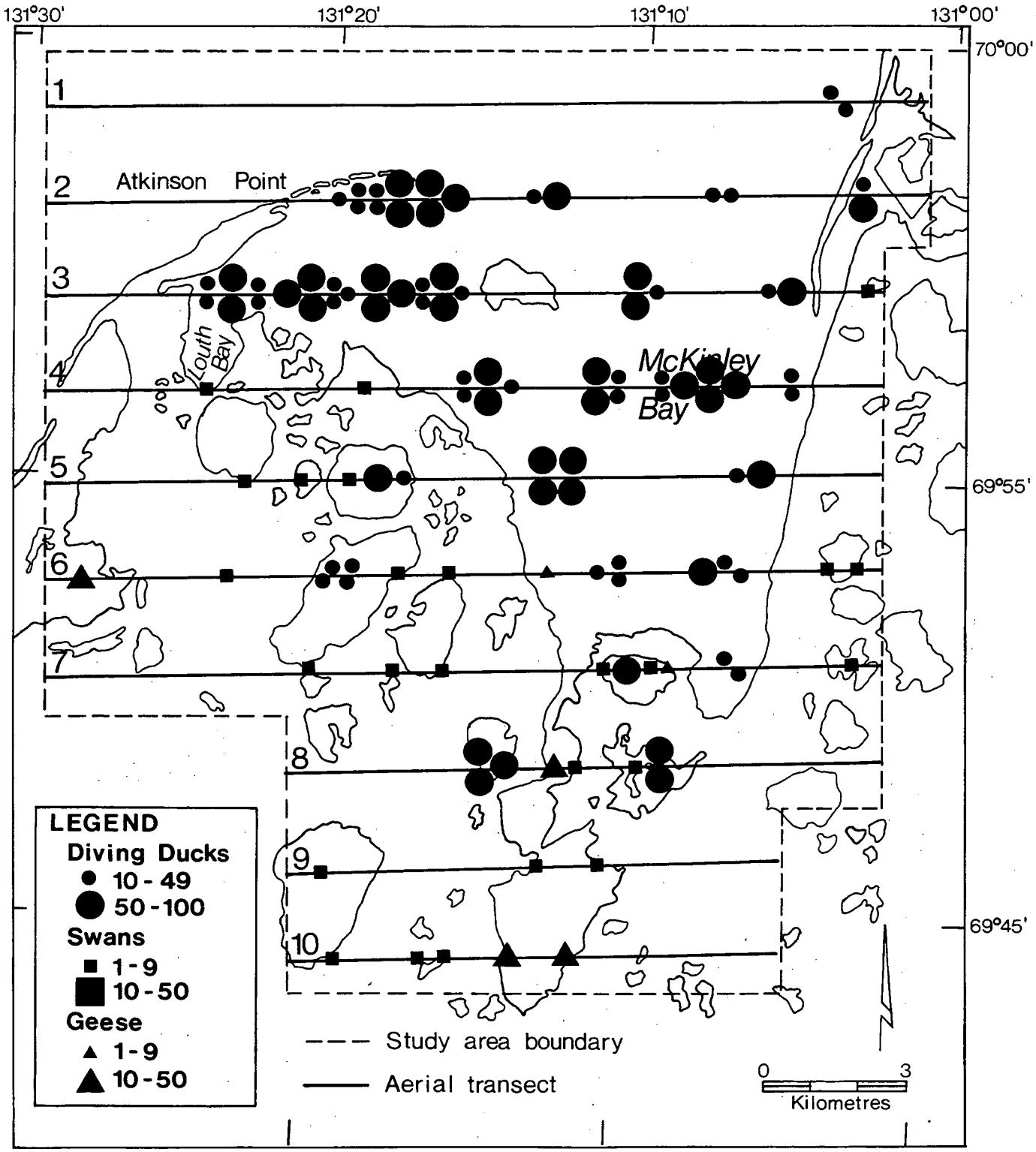

Figure 3. Distribution of waterfowl observed during the aerial survey at McKinley Bay on August 3, 1992.

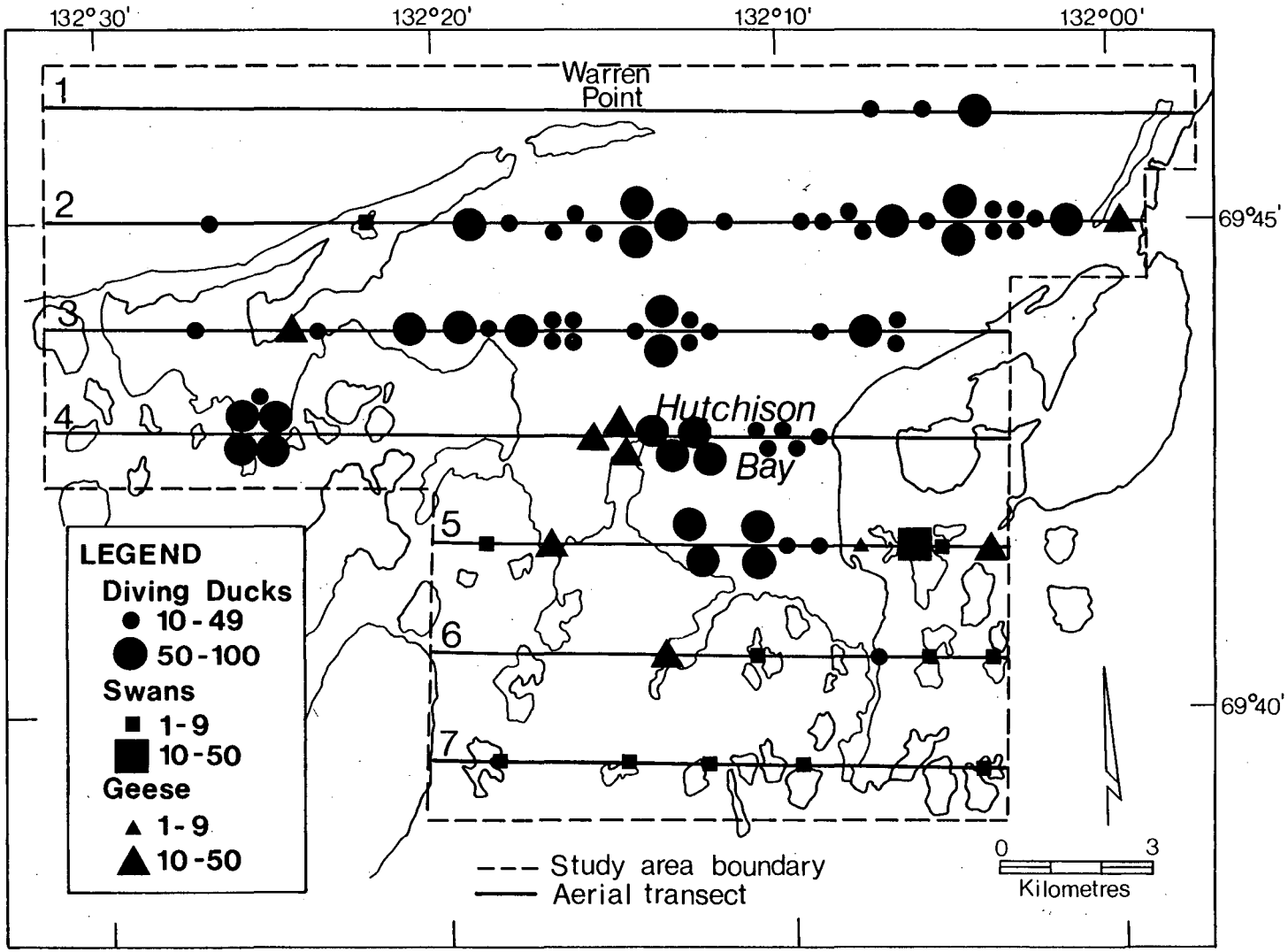

Figure 4. Distribution of waterfowl observed during the aerial survey at Hutchison Bay on August 3, 1992.

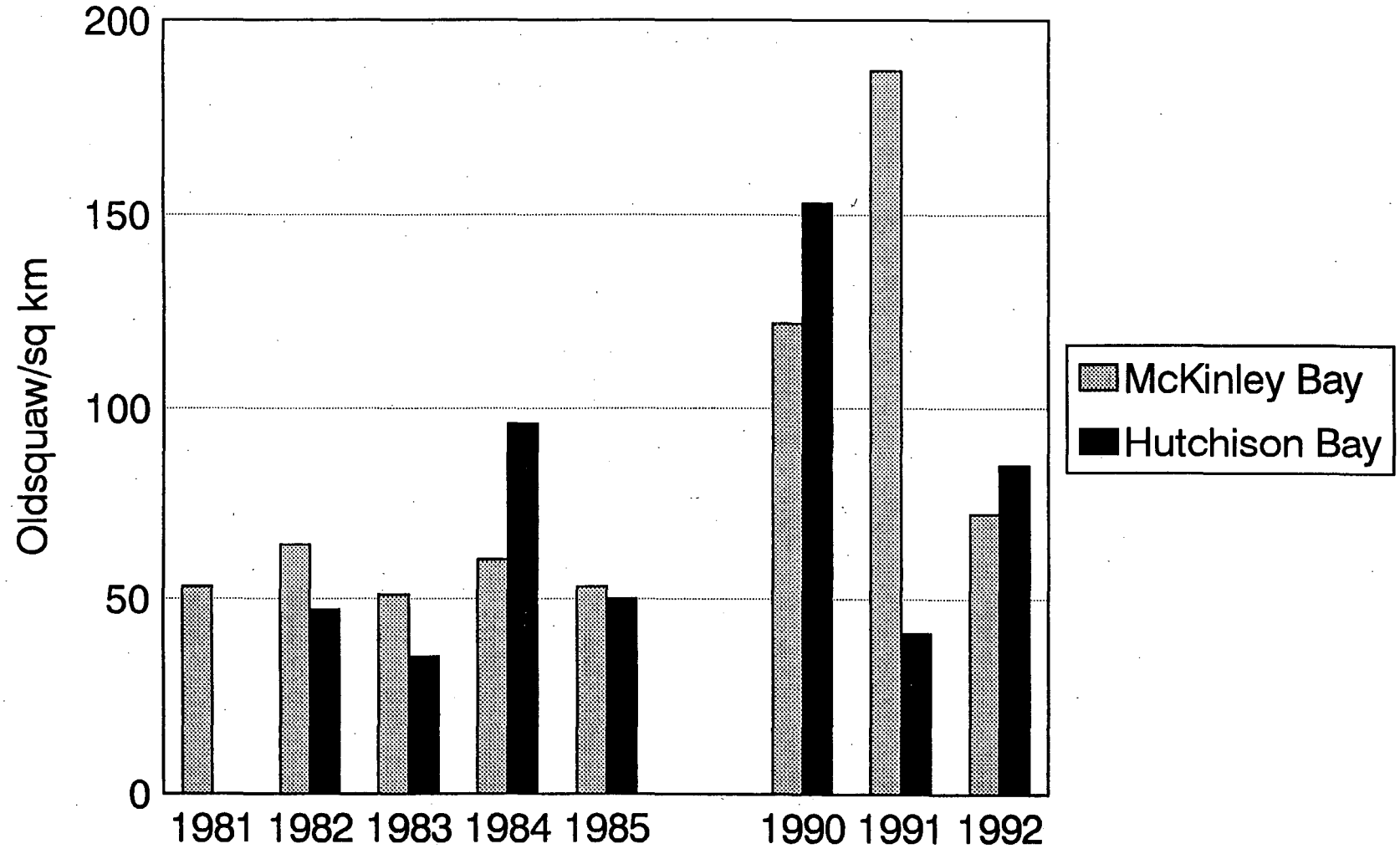

Figure 5. Density of Oldsquaw observed on the bay component at McKinley Bay and Hutchison Bay, 1981 to 1985 and 1990 to 1992.

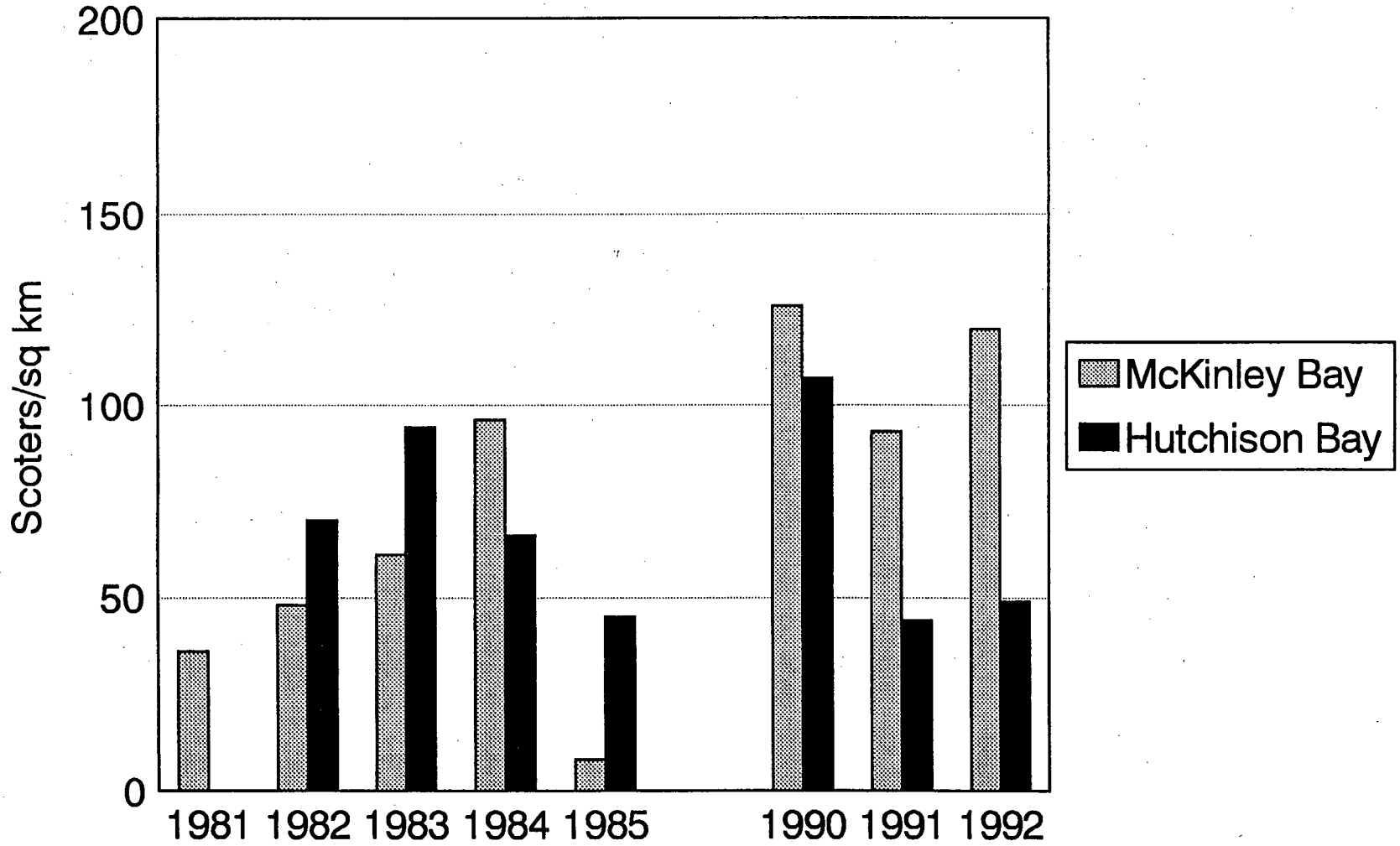

Figure 6. Density of scoters observed on the bay component at McKinley Bay and Hutchison Bay, 1981 to 1985 and 1990 to 1992.

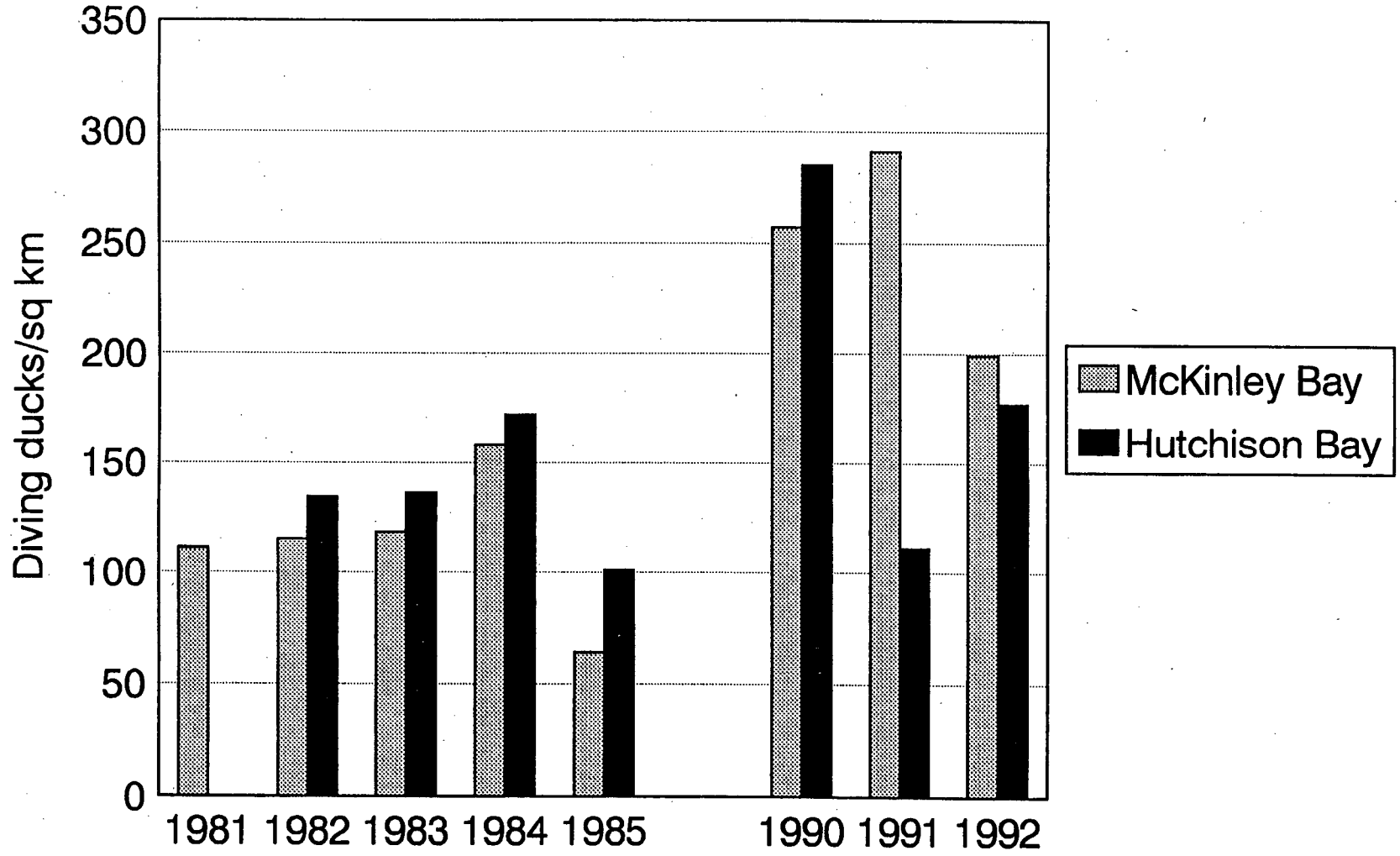

Figure 7. Density of diving ducks observed on the bay component at McKinley Bay and Hutchison Bay, 1981 to 1985 and 1990 to 1992.

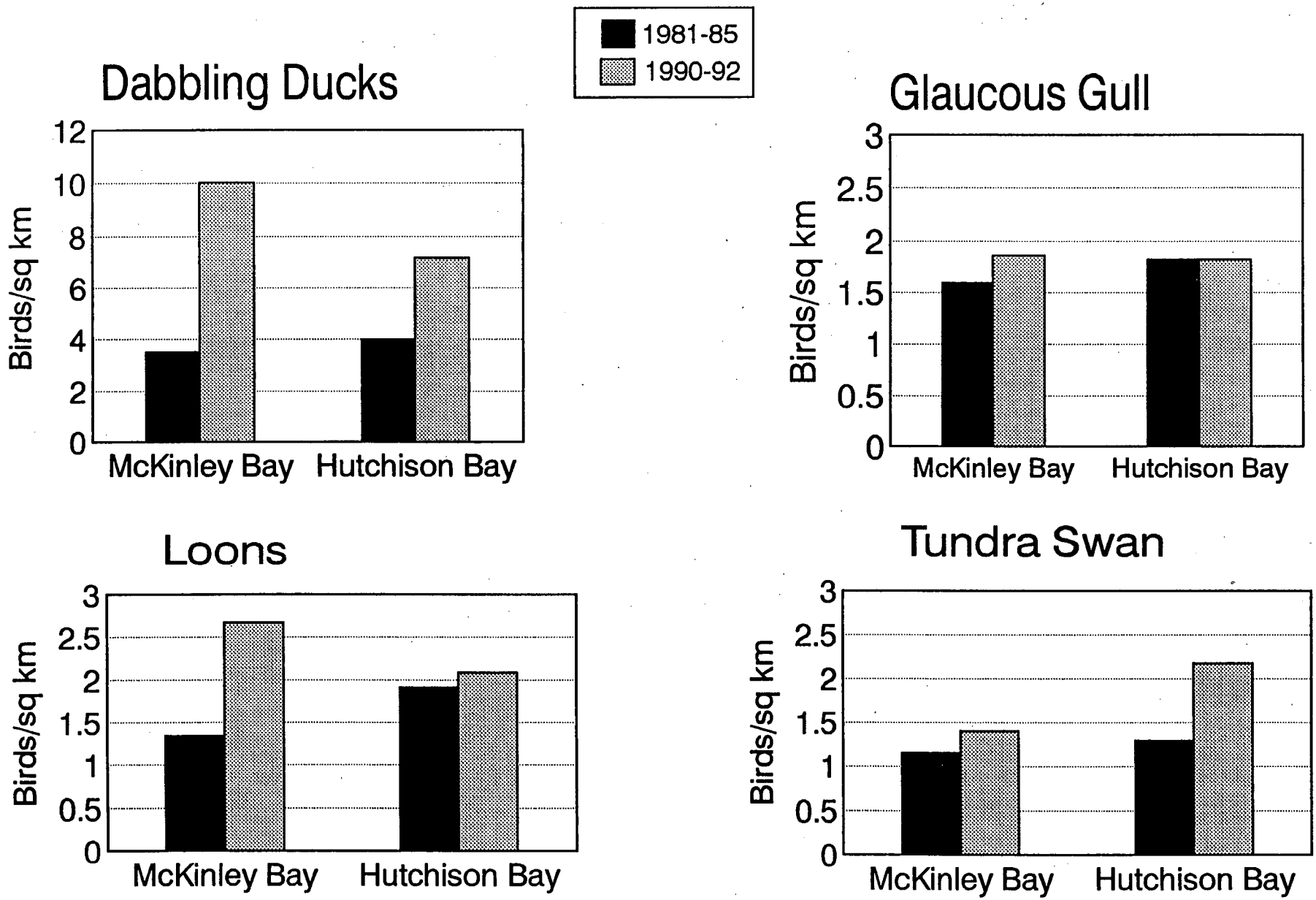

Figure 8. Density of birds observed on the bay and terrestrial components at McKinley Bay and Hutchison Bay, 1981 to 1985 and 1990 to 1992.

APPENDIX A. INDUSTRIAL ACTIVITY IN MCKINLEY BAY

Development and use of McKinley Bay as a Winter Harbour

An entrance channel and mooring basin were dredged in the northeast section of McKinley Bay in September of 1979. This was followed in 1980 by construction of a more sheltered mooring area, southwest of the original location. An artificial island was created to the north of the new location with the dredged spoils, to further protect the moored ships from storms and ice movement. In 1981, docking facilities were constructed, and the artificial island and mooring basin were expanded. In 1982 and 1983, an airstrip and accommodation for 130 people were put on the island. The island also became a storage area for fuel and materials to support the offshore drilling operation.

Use of McKinley Bay as a harbour peaked from 1982 to 1985. Since then there has been very little offshore drilling activity in the Canadian Beaufort Sea. Appendix A1 summarizes the activities associated with industrial use of McKinley Bay from 1979 to 1992.

Most of the oil spills at McKinley Bay occurred between 1979 and 1984 (Appendix A2). The two largest spills which were 500 gal in 1980 and 1100 gal in 1982 both occurred after freeze-up. There was another large spill of 7000 gal at Atkinson Point in February in 1983, but the oil did not enter the water. Since 1985, there have been only two small spills of less than 25 gal within McKinley Bay.

Two oil spill clean-up experiments were permitted in McKinley Bay under the Ocean Dumping Control Act (Seakem Group Ltd. 1991). The first experiment involved dumping about 4000 gal of crude oil under the ice in three releases from December, 1979 to April, 1980. In the second experiment which occurred in February, 1982, about 75 gal of emulsified crude oil were released under the ice.

There have been no oil spills in Hutchison Bay from 1979 to present.

Appendix A1. Level of industrial activity at McKinley Bay, 1979-1992.

Year	Dredging activity(m^3)[1]	No. of ships in January[2]	No. of ships mobilized[2]	Annual no. of person-days[3]	No. of flights June-Sept.	No. of offshore drilling operations[5]
1979	3 427 000			21 900	?	3-4
1980	5 860 015	16	16	48 300	?	3-4
1981	3 486 400	16	16	41 250	?	3-4
1982	42 669	19	19	45 700	?	3
1983	0	20	20	42 750	?	4
1984	0	20	20	42 750	2/day	6
1985	0	17	17	27 750	daily	5
1986	0	17	13	14 550	daily	1
1987	0	11	7	14 550	3/wk	0
1988	0	8	6	14 550	3/wk	0
1989	0	11	5	14 550	daily	1
1990	0	9	4	14 500	3/wk	0
1991[4]	0	7	6	2 850	daily	0
1992[4]	0	8	2	300	1 to 2/wk	0

[1]from: Sackmann et al 1991.
[2]from: N. Vanderkooy, Canadian Marine Drilling Ltd., pers comm; John Ward, AMOCO, pers. comm; and Seakem Group Ltd. 1991.
[3]from: Seakem Group Ltd. 1991.
[4]from: N. Vanderkooy, pers. comm.
[5]from: Scott Edwards, Indian and Northern Affairs, Yellowknife, pers. comm.

Appendix A2. Oil spills reported in McKinley Bay, 1979-1992.[1]

Year	No. of oil spills	Oil spill size (gallons) <50	51 - 200	201 - 400	>400
1979	2		2		
1980	16	13	2		1
1981	3	1	1	1	
1982	10	5	2	2	1
1983	2		2		
1984	1		1		
1985	0				
1986	1	1			
1987	1	1			
1988	0				
1989	1	1			
1990	0				
1991	0				
1992	0				

[1]Data from NWT Spill Reports, Government of NWT.
No oil spills occurred in Hutchison Bay from 1979 to 1992.
Spill of 6995 gal of fuel oil on land at Atkinson Point on 9 February, 1983 and two spills <1 gal at McKinley Bay not included in above.

Appendix B. Scientific names of species of birds observed at McKinley Bay and Hutchison Bay.

Common name	Scientific name
Red-throated Loon	*Gavia stellata*
Pacific Loon	*Gavia pacifica*
Common Loon	*Gavia immer*
Tundra Swan	*Cygnus columbianus*
Greater White-fronted Goose	*Anser albifrons*
Brant	*Branta bernicla*
Canada Goose	*Branta canadensis*
Snow Goose	*Chen caerulescens*
Mallard	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
American Wigeon	*Anas americana*
Canvasback	*Aythya valisineria*
Scaup sp.	*Aythya sp.*
King Eider	*Somateria spectabilis*
Common Eider	*Somateria mollissima*
Oldsquaw	*Clangula hyemalis*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Red-breasted Merganser	*Mergus serrator*
Northern Harrier	*Circus cyaneus*
Rough-legged Hawk	*Buteo lagopus*
Gyrfalcon	*Falco rusticolus*
Willow Ptarmigan	*Lagopus lagopus*
Ptarmigan sp.	*Lagopus sp.*
Sandhill Crane	*Grus canadensis*
Whimbrel	*Numenius phaeopus*
Stilt Sandpiper	*Calidris himantopus*
Red-necked Phalarope	*Phalaropus lobatus*
Phalarope sp.	*Phalaropus sp.*
Pectoral Sandpiper	*Calidris melanotos*
Parasitic Jaeger	*Stercorarius parasiticus*
Jaeger sp.	*Stercorarius sp.*
Glaucous Gull	*Larus hyperboreus*
Sabine's Gull	*Xema sabini*
Arctic Tern	*Sterna paradisaea*
Short-eared Owl	*Asio flammeus*
Common Raven	*Corvus corax*

Appendix C1. Birds observed on the bay component of aerial surveys at McKinley Bay on August 3, 1992.[a].

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon						1		1
Pacific Loon	3	4	1					8
Red-throated Loon	6	3	3	4		1		17
Common Loon		1						1
Loon sp.				1				1
Tundra Swan								
Brant								
Greater White-fronted Goose						1		1
Dark goose								
Mallard								
Northern Pintail	7							7
American Wigeon								
Dabbling duck								
Scaup sp.	3	2	5	55			6	71
King Eider								
Common Eider								
Eider sp.								
Oldsquaw		453	357	156	18	48	17	1049
White-winged Scoter	3		4	95				102
Surf Scoter	8	98	223	137		94	2	562
Scoter sp.	3	213	678	167	19	2		1082
Common Merganser							2	2
Red-breasted Merganser		20						20
Diving duck	70	82	150	307	310	74	25	1018
Unidentified duck	3	5						8
Northern Harrier								
Rough-legged Hawk								
Gyrfalcon								
Willow Ptarmigan								
Ptarmigan sp.								
Sandhill Crane								
Whimbrel								
Stilt Sandpiper								
Red-necked Phalarope								
Phalarope sp.								
Pectoral Sandpiper								
Shorebird								
Parasitic Jaeger								
Jaeger sp.								
Glaucous Gull		4	6	1				11
Sabine's Gull								
Arctic Tern	2	2						4
Short-eared Owl								
Passerine								
All species	108	887	1427	923	347	221	52	3965
Km surveyed	8.5	12.0	13.25	8.5	5.75	5.0	1.5	

[a]Blank denotes no birds seen.

Appendix C2. Birds observed on the terrestrial component of the aerial surveys at McKinley Bay on August 3, 1992.[a]

Species	Transect number 1	2	3	4	5	6	7	8	9	10	Total on all transects
Pacific Loon			2		5		4	4		2	17
Red-throated Loon				4	4	3	5	7	9	7	39
Common Loon											
Loon sp.					1		3	1			5
Tundra Swan			2	3	5	13	11	7	8	7	56
Brant											
G. White-fronted Goose							6	23		20	49
Dark goose										15	15
Mallard											
Northern Pintail		69		71	14	27	20	84	12	7	304
American Wigeon											
Dabbling duck				7	7	12	27	2	16	7	78
Scaup sp.					4	60					64
King Eider											
Common Eider											
Eider sp.											
Oldsquaw					83	8	45	100		1	237
White-winged Scoter											
Surf Scoter											
Scoter sp.											
Common Merganser									2		2
Red-breasted Merganser								142			142
Diving duck					11	54	10	101			176
Unidentified duck						5	11				16
Northern Harrier											
Rough-legged Hawk											
Gryfalcon											
Willow Ptarmigan											
Ptarmigan sp.											
Sandhill Crane	3				2	3		2			10
Whimbrel											
Semipalmated Sandpiper									3		3
Red-necked Phalarope											
Phalarope sp.											
Pectoral Sandpiper											
Shorebird				1			1	3			5
Parasitic Jaeger											
Jaeger sp.											
Glaucous Gull			2	2		13	11	6	4		38
Sabine's Gull								7			7
Arctic Tern											
Short-eared Owl											
Snowy Owl		1									1
Passerine						1					1
Common Raven											
All species	3	70	6	88	136	199	154	489	54	66	1265
Km surveyed	0.25	1.0	2.25	6.75	10.75	10.25	15.5	12.0	10.0	10.0	

[a]Blank denotes no birds seen.

Appendix C3. Birds observed on the outside component of aerial surveys at McKinley Bay on August 3, 1992[a].

Species	Transect number 1	2	3	4	5	6	Total on all transects
Yellow-billed Loon							
Pacific Loon							
Red-throated Loon		4					4
Common Loon							
Loon sp.							
Tundra Swan							
Brant						35	35
G. White-fronted Goose							
Dark goose							
Mallard							
Northern Pintail						4	4
American Wigeon							
Dabbling duck							
Scaup sp.							
King Eider							
Common Eider							
Eider sp.							
Oldsquaw				3			3
White-winged Scoter							
Surf Scoter							
Scoter sp.		1					1
Common Merganser							
Red-breasted Merganser							
Diving duck							
Unidentified duck							
Northern Harrier							
Rough-legged Hawk							
Gyrfalcon							
Willow Ptarmigan							
Ptarmigan sp.							
Sandhill Crane							
Whimbrel							
Stilt Sandpiper							
Red-necked Phalarope							
Phalarope sp.							
Pectoral Sandpiper							
Shorebird							
Parasitic Jaeger							
Jaeger sp.							
Glaucous Gull				1			1
Sabine's Gull							
Arctic Tern				2	1	1	4
Short-eared Owl							
Passerine							
All species		5		6	1	40	52
Km surveyed	9.25	5.0	1.5	1.75	0.5	1.75	

[a]Blank denotes no birds seen.

Appendix C4. Birds observed on the bay component of aerial surveys at McKinley Bay on August 4, 1992[a].

Species	Transect number 1	2	3	4	5	6	7	Total on all transects
Yellow-billed Loon								
Pacific Loon		1			1			2
Red-throated Loon	3				1		3	7
Common Loon								
Loon sp.								
Tundra Swan								
Brant								
Greater White-fronted Goose								
Dark goose								
Mallard								
Northern Pintail	17							17
American Wigeon								
Dabbling duck	8							8
Scaup sp.		40					15	55
King Eider								
Common Eider								
Eider sp.								
Oldsquaw		225	186	204	55	161	11	842
White-winged Scoter		1	16	15	1	2		35
Surf Scoter	1	44	150	158	82	11		446
Scoter sp.		78	36	93	5	32	97	341
Common Merganser								
Red-breasted Merganser								
Diving duck		2			20			22
Unidentified duck	2							2
Northern Harrier								
Rough-legged Hawk								
Gyrfalcon								
Willow Ptarmigan								
Ptarmigan sp.								
Sandhill Crane								
Whimbrel								
Stilt Sandpiper								
Red-necked Phalarope								
Phalarope sp.								
Pectoral Sandpiper								
Shorebird								
Parasitic Jaeger								
Jaeger sp.								
Glaucous Gull		3	1	1		1	4	10
Sabine's Gull								
Arctic Tern						1		1
Short-eared Owl								
Passerine								
All species	31	394	389	471	165	208	130	1788
Km surveyed	8.5	12.0	13.25	8.5	5.75	5.0	1.5	

[a]Blank denotes no birds seen.

Appendix C5. Birds observed on the terrestrial component of aerial surveys at McKinley Bay on August 4, 1992[a].

Species	Transect number 1	2	3	4	5	6	7	8	9	10	Total on all transects
Pacific Loon				1	3	2	3	4	2		15
Red-throated Loon				9	5	5	7	5	9		40
Common Loon											
Loon sp.										1	1
Tundra Swan				1	5	6	24	10	3	25	74
Snow Goose							1				1
Brant								33			33
G. White-fronted Goose						5	16		25		46
Dark goose								20		11	31
Northern Pintail		90	2	39	41	16	32	46	35	7	308
American Wigeon			3				1	4	5		13
Dabbling duck					18	2	30	34		10	94
Scaup sp.					48	25					73
King Eider											
Common Eider											
Eider sp.											
Oldsquaw					18	7		425			450
White-winged Scoter											
Surf Scoter											
Scoter sp.											
Red-breasted Merganser							7		2		9
Diving duck									1		1
Unidentified duck											
Northern Harrier											
Rough-legged Hawk											
Eagle									1*		1
Willow Ptarmigan											
Ptarmigan sp.											
Sandhill Crane					2	2	3		2		9
Whimbrel											
Semipalmated Sandpiper									8		8
Red-necked Phalarope											
Phalarope sp.											
Pectoral Sandpiper											
Shorebird				2		20	2				24
Parasitic Jaeger											
Jaeger sp.											
Glaucous Gull				5	8	21	15	5	4	2	60
Sabine's Gull						2	1				3
Arctic Tern							1		3		4
Short-eared Owl											
Passerine											
All species		90	5	57	148	113	143	586	100	56	1298
km surveyed	0.25	1.0	2.25	6.75	10.75	10.25	15.5	12.0	10.0	10.0	

[a]Blank denotes no birds seen.
*probably immature Bald Eagle.

Appendix C6. Birds observed on the outside component of aerial surveys at McKinley Bay on August 4, 1992[a].

Species	Transect number 1	2	3	4	5	6	Total on all transects
Yellow-billed Loon							
Pacific Loon							
Red-throated Loon				1			1
Common Loon							
Loon sp.							
Tundra Swan							
Brant							
Greater White-fronted Goose							
Dark goose							
Mallard							
Northern Pintail							
American Wigeon							
Dabbling duck							
Scaup sp.							
King Eider							
Common Eider							
Eider sp.							
Oldsquaw						2	2
White-winged Scoter							
Surf Scoter							
Scoter sp.				12			12
Common Merganser							
Red-breasted Merganser							
Diving duck							
Unidentified duck							
Northern Harrier							
Rough-legged Hawk							
Gyrfalcon							
Willow Ptarmigan							
Ptarmigan sp.							
Sandhill Crane							
Whimbrel							
Stilt Sandpiper							
Red-necked Phalarope							
Phalarope sp.							
Pectoral Sandpiper							
Shorebird							
Parasitic Jaeger							
Jaeger sp.							
Glaucous Gull				2		2	4
Sabine's Gull							
Arctic Tern				1			1
Short-eared Owl							
Passerine							
All species				16		4	20
Km surveyed	9.25	5.0	1.5	1.75	0.5	1.75	

[a]Blank denotes no birds seen.

Appendix D1. Birds observed on the bay component of aerial surveys at Hutchison Bay on August 2, 1992[a].

Species	Transect number 1	2	3	4	5	Total on all transects
Yellow-billed Loon						
Pacific Loon		2				2
Red-throated Loon	1					1
Common Loon						
Loon sp.						
Tundra Swan						
Brant						
Greater White-fronted Goose					100	100
Dark goose						
Mallard						
Northern Pintail				4		4
American Wigeon				12		12
Dabbling duck		8	3		1	12
Scaup sp.					11	11
King Eider						
Common Eider						
Eider sp.						
Oldsquaw		94	77		204	375
White-winged Scoter	3	42				45
Surf Scoter		17	84			101
Scoter sp.		138			11	149
Common Merganser						
Red-breasted Merganser			8	30	75	113
Diving duck			7			7
Unidentified duck		10				10
Northern Harrier						
Rough-legged Hawk						
Gyrfalcon						
Willow Ptarmigan						
Ptarmigan sp.						
Sandhill Crane						
Whimbrel						
Stilt Sandpiper						
Red-necked Phalarope						
Phalarope sp.						
Pectoral Sandpiper						
Shorebird				7		7
Parasitic Jaeger						
Jaeger sp.						
Glaucous Gull	1	1	10	7	2	21
Sabine's Gull						
Arctic Tern		1	2			3
Short-eared Owl						
Passerine						
All species	5	313	191	60	404	973
Km surveyed	10.5	13.5	15.5	6.5	3.5	

[a]Blank denotes no birds seen.

Appendix D2. Birds observed on the terrestrial component of aerial surveys at Hutchison Bay on August 2, 1992[a].

Species	Transect number 2	3	4	5	6	7	Total on all transects
Yellow-billed Loon							
Pacific Loon			4	1	4	7	16
Red-throated Loon		2		5		7	14
Common Loon							
Loon sp.							
Tundra Swan	6		3	4	28	9	50
Brant							
Greater White-fronted Goose							
Dark goose			34		15		49
Mallard							
Northern Pintail	13		9	11	47	1	81
American Wigeon							
Dabbling duck	1		3	60	2		66
Scaup sp.							
King Eider							
Common Eider							
Eider sp.							
Oldsquaw					18		18
White-winged Scoter							
Surf Scoter							
Scoter sp.							
Common Merganser							
Red-breasted Merganser				15			15
Diving duck							
Unidentified duck							
Northern Harrier							
Rough-legged Hawk							
Gyrfalcon							
Willow Ptarmigan							
Ptarmigan sp.							
Sandhill Crane		3		2			5
Whimbrel							
Semipalmated Sandpiper	3						3
Red-necked Phalarope							
Phalarope sp.							
Pectoral Sandpiper							
Shorebird				5	1		6
Parasitic Jaeger							
Jaeger sp.							
Glaucous Gull	4			23	6	7	40
Sabine's Gull							
Arctic Tern	3					6	9
Short-eared Owl							
Passerine				6	2	1	9
All species	30	5	53	132	123	38	381
Km surveyed	1.75	2.5	11.5	7.5	11.0	11.0	

[a]Blank denotes no birds seen.

Appendix D3. Birds observed on the outside component of aerial surveys at Hutchison Bay on August 2, 1992[a].

Species	Transect number 1	Transect number 2	Total on all transects
Yellow-billed Loon			
Pacific Loon			
Red-throated Loon	1		1
Common Loon			
Loon sp.			
Tundra Swan			
Brant			
Greater White-fronted Goose			
Dark goose			
Mallard			
Northern Pintail			
American Wigeon			
Dabbling duck			
Scaup sp.			
King Eider			
Common Eider			
Eider sp.			
Oldsquaw			
White-winged Scoter			
Surf Scoter		1	1
Scoter sp.			
Common Merganser			
Red-breasted Merganser			
Diving duck			
Unidentified duck			
Northern Harrier			
Rough-legged Hawk			
Gyrfalcon			
Willow Ptarmigan			
Ptarmigan sp.			
Sandhill Crane			
Whimbrel			
Stilt Sandpiper			
Red-necked Phalarope			
Phalarope sp.			
Pectoral Sandpiper			
Shorebird			
Parasitic Jaeger			
Jaeger sp.			
Glaucous Gull	2	1	3
Sabine's Gull			
Arctic Tern	4		4
Short-eared Owl			
Passerine			
All species	7	2	9
Km surveyed	11.0	5.25	

[a]Blank denotes no birds seen.

Appendix D4. Birds observed on the bay component of aerial surveys at Hutchison Bay on August 3, 1992[a].

Species	Transect number 1	2	3	4	5	Total on all transects
Yellow-billed Loon						
Pacific Loon	3	1	1		1	6
Red-throated Loon		6	6	1	5	18
Common Loon						
Loon sp.						
Tundra Swan						
Snow goose					1	1
Brant						
Greater White-fronted Goose					25	25
Dark Goose		40	15	150		205
Mallard						
Northern Pintail			3	25		28
American Wigeon				35		35
Dabbling duck				20		20
Scaup sp.		4	21	40		65
King Eider						
Common Eider						
Eider sp.						
Oldsquaw	15	296	621	82	248	1262
White-winged Scoter						
Surf Scoter		267	49			316
Scoter sp.	66	250	85	11		412
Common Merganser						
Red-breasted Merganser		10	1	552		563
Diving Duck	30	190	67	152	88	527
Unidentified duck						
Northern Harrier						
Rough-legged Hawk						
Gyrfalcon						
Willow Ptarmigan						
Ptarmigan sp.						
Sandhill Crane						
Whimbrel						
Stilt Sandpiper						
Red-necked Phalarope						
Phalarope sp.						
Pectoral Sandpiper						
Shorebird				15		15
Parasitic Jaeger						
Jaeger sp.						
Glaucous Gull	4	1	3	6	1	15
Sabine's Gull						
Arctic Tern						
Short-eared Owl						
Passerine						
All species	118	1065	872	1089	369	3513
Km surveyed	10.5	13.5	15.5	6.5	3.5	

[a]Blank denotes no birds seen.

Appendix D5. Birds observed on the terrestrial component of aerial surveys at Hutchison Bay on August 3, 1992[a].

Species	Transect number 2	3	4	5	6	7	Total on all transects
Yellow-billed Loon							
Pacific Loon			3	1	2	15	21
Red-throated Loon	3		2	1	4	13	23
Common Loon							
Loon sp.				2			2
Tundra Swan	8			31	14	10	63
Brant				3			3
Greater White-fronted Goose				15	22		37
Dark goose							
Mallard							
Northern Pintail			33	53	14	24	124
American Wigeon			6	12	1	2	21
Dabbling duck			18	25	18	4	65
Scaup sp.							
King Eider							
Common Eider							
Eider sp.							
Oldsquaw					18		18
White-winged Scoter							
Surf Scoter							
Scoter sp.							
Common Merganser							
Red-breasted Merganser							
Diving duck							
Unidentified duck							
Northern Harrier							
Rough-legged Hawk							
Gyrfalcon							
Willow Ptarmigan							
Ptarmigan sp.							
Sandhill Crane			2	2			4
Whimbrel							
Stilt Sandpiper							
Red-necked Phalarope							
Phalarope sp.							
Pectoral Sandpiper							
Shorebird	2		20			8	30
Parasitic Jaeger							
Jaeger sp.							
Glaucous Gull	4			7	3	5	19
Sabine's Gull	1						1
Arctic Tern						2	2
Short-eared Owl							
Passerine							
All species	18	0	84	152	96	83	433
Km surveyed	1.75	2.5	11.5	7.5	11.0	11.0	

[a]Blank denotes no birds seen.

Appendix D6. Birds observed on the outside component of aerial surveys at Hutchison Bay on August 3, 1992[a].

Species	Transect number 1	Transect number 2	Total on all transects
Yellow-billed Loon			
Pacific Loon			
Red-throated Loon	1	2	3
Common Loon			
Loon sp.			
Tundra Swan			
Brant			
Greater White-fronted Goose			
Dark goose			
Mallard			
Northern Pintail			
American Wigeon			
Dabbling duck			
Scaup sp.			
King Eider			
Common Eider			
Eider sp.			
Oldsquaw		12	12
White-winged Scoter			
Surf Scoter			
Scoter sp.			
Common Merganser			
Red-breasted Merganser	9		9
Diving duck	2	22	24
Unidentified duck			
Northern Harrier			
Rough-legged Hawk			
Gyrfalcon			
Willow Ptarmigan			
Ptarmigan sp.			
Sandhill Crane			
Whimbrel			
Stilt Sandpiper			
Red-necked Phalarope			
Phalarope sp.			
Pectoral Sandpiper			
Shorebird			
Parasitic Jaeger			
Jaeger sp.			
Glaucous Gull	12	2	14
Sabine's Gull			
Arctic Tern		2	2
Short-eared Owl			
Passerine			
All species	24	40	64
Km surveyed	11.0	5.25	

[a]Blank denotes no birds seen.

Appendix E1. Number and density of birds observed on the bay component at McKinley Bay in August 1992[a].

Species group	August 3 Number	August 3 Density (birds/km^2)	August 4 Number	August 4 Density (birds/km^2)
Loons	28	1.43	9	0.46
Geese	1	0.05		
Dabbling ducks	7	0.36	25	1.27
Diving ducks	3906	199.29	1741	88.83
Unidentified ducks	8	0.41	2	0.10
Shorebirds				
Gulls	11	0.56	10	0.51
Terns	4	0.20	1	0.05
TOTAL BIRDS	3965	202.30	1788	91.22

[a] Area surveyed = 19.6 km^2. Blanks denote no birds seen.

Appendix E2. Number and density of birds observed on the bay component at Hutchison Bay in August 1992[a].

Species group	August 2 Number	August 2 Density (birds/km^2)	August 3 Number	August 3 Density (birds/km^2)
Loons	3	0.17	24	1.35
Geese	100	5.62	231	12.98
Dabbling ducks	28	1.57	83	4.66
Diving ducks	801	45.00	3145	176.68
Unidentified ducks	10	0.56		
Shorebirds	7	0.39	15	0.84
Gulls	21	1.18	15	0.84
Terns	3	0.17		
TOTAL BIRDS	973	54.66	3513	197.36

[a] Area surveyed = 17.8 km^2. Blanks denote no birds seen.

Appendix F1. Number and density of birds observed on the terrestrial component at McKinley Bay in August 1992[a].

Species group	August 3 Number	August 3 Density (birds/km^2)	August 4 Number	August 4 Density (birds/km^2)
Loons	61	2.16	56	1.98
Swans	56	1.98	74	2.61
Geese	64	2.26	111	3.92
Dabbling ducks	382	13.50	415	14.66
Diving ducks	621	21.94	533	18.83
Unidentified ducks	16	0.56		
Raptors			1	0.04
Sandhill Cranes	10	0.35	9	0.32
Shorebirds	8	0.28	32	1.13
Gulls	45	1.59	63	2.23
Terns			4	0.14
Owls	1	0.04		
Passerines	1	0.04		
TOTAL BIRDS	1265	44.70	1298	45.86

[a] Area surveyed = 28.3 km^2. Blanks denote no birds seen.

Appendix F2. Number and density of birds observed on the terrestrial component at Hutchison Bay in August, 1992[a].

Species group	August 2		August 3	
	Number	Density (birds/km^2)	Number	Density (birds/km^2)
Loons	30	1.84	46	2.82
Swans	50	3.07	63	3.86
Geese	49	3.01	40	2.45
Dabbling ducks	147	9.02	210	12.88
Diving ducks	33	2.02	18	1.10
Unidentified ducks				
Raptors				
Sandhill Cranes	5	0.31	4	0.24
Shorebirds	9	0.55	30	1.84
Gulls	40	2.45	20	1.23
Terns	9	0.55	2	0.12
Owls				
Passerines	9	0.55		
TOTAL BIRDS	381	23.37	433	26.56

[a] Area surveyed = 16.3 km^2. Blanks denote no birds seen.

Appendix G1. Adjusted number of each species of diver seen on the bay component at McKinley Bay each year based on the species composition of the identified divers[a].

	Oldsquaw			Scoter			Scaup			Red-breasted Merganser			Eider			Identified divers			
Year	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	Total	%	Unidentified divers	Total divers
1981	910	48	1046	613	32	705	369	20	424	0	0	0	0	0	0	1892	87	283	2175
1982	1063	56	1263	785	41	934	34	2	40	8	<1	9	0	0	0	1890	84	356	2246
1983	814	43	992	990	52	1207	93	5	113	0	0	0	0	0	0	1897	82	415	2312
1984	913	38	1171	1466	61	1880	20	<1	26	20	<1	26	1	<1	1	2420	77	684	3104
1985	996	82	1031	148	12	153	70	6	72	0	0	0	1	<1	1	1215	96	43	1258
1990	1713	48	2397	1771	49	2478	87	2	122	31	1	43	0	0	0	3602	71	1438	5040
1991	2179	64	3666	1082	32	1820	30	1	51	101	3	170	0	0	0	3392	59	2315	5707
1992	1049	36	1419	1746	60	2361	71	2	96	22[b]	1	30	0	0	0	2888	74	1018	3906

[a]From best survey each year
[b]Includes 2 Common Mergansers

Appendix G2. Adjusted number of each species of diver seen on the bay component at Hutchison Bay each year based on the species composition of the identified divers[a].

	Oldsquaw			Scoter			Scaup			Red-breasted Merganser			Eider			Identified divers			
Year	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	Total	%	Unidentified divers	Total divers
1981	not surveyed																		
1982	778	35	838	1156	52	1246	122	5	132	157	7	169	0	0	0	2213	93	172	2385
1983	578	26	617	1571	69	1678	99	4	106	13	<1	14	0	0	0	2261	94	154	2415
1984	1488	56	1717	1006	38	1161	159	6	183	4	<1	5	0	0	0	2657	87	409	3066
1985	872	49	884	785	44	796	102	6	104	6	<1	6	11	1	11	1776	99	25	1801
1990	2436	54	2733	1694	38	1901	252	6	283	131	3	147	0	0	0	4513	89	551	5064
1991	541	37	732	581	40	786	109	7	147	224	15	303	0	0	0	1455	74	513	1968
1992	1262	48	1516	728	28	875	65	2	78	563	22	676	0	0	0	2168	83	527	3145

[a]From best survey each year.

Appendix H Distribution of diving ducks in flocks of different sizes on the bay component at McKinley Bay and Hutchison Bay, August 3, 1992.

	Percent of total observed							
	Oldsquaw		Scoters		Unidentified divers		All divers[c]	
Flock size	MB[a]	HB[b]	MB	HB	MB	HB	MB	HB
< 10 birds	11	5	5	8	2	2	6	4
10-49 birds	54	25	28	35	31	38	37	27
50-99 birds	34	39	47	11	18	39	35	25
100-199 birds	1	19	19	20	10	21	12	20
200-399 birds	0	12	0	25	39	0	10	11
≥ 400 birds	0	0	0	0	0	0	0	13
TOTAL OBSERVED	1049	1262	1746	728	1018	527	3906	3145

[a] McKinley Bay.
[b] Hutchison Bay.
[c] Includes scaup and merganser.