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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 \pm 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.

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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 étre 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 \pm 3 131. À la même date, on estimait la population de canards plongeurs de la baie Hutchison à 17 756 \pm 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.

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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 <u>et al</u>. 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 .

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 <u>et al</u>. 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:

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$$t = \frac{\vec{Y}_1 - \vec{Y}_2}{S_{(\vec{Y}_1 - \vec{Y}_2)}}$$

where:

- 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

$$S_{(\vec{Y}_{1}-\vec{Y}_{2})} = \sqrt{\frac{S^{2}(n_{1}+n_{2})}{n_{1}(n_{2})}}$$

and

 $s^{2} = pooled variance = \frac{(n-1)s_{1}^{2} + (n_{2}-1)s_{1}^{2}}{(n_{1}-1) + (n_{2}-1)}$

 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 \pm 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 \pm 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.

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	McKinley Bay		Hutchison Bay	
Component	Total area (km²)	Area surveyed (km²)	Total area (km²)	Area surveyed (km²)
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 1.Size and aerial survey coverage of designated components of
the McKinley Bay and Hutchison Bay study areas.

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

Species	Location	Adjusted number ^a	Density (birds/km²)	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	McKinley Bay	3906	199.29	21623 ± 3131(S.E.) ^b
DUCKS	Hutchison Bay	31 45	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
Σ̄ ₁₉₈₁₋₈₅ ± S.D. ^b	1101 ± 113	976 ± 637	2219 ± 655
	· .		
1990	2397	2478	5040
1991	3666	1820	5707
1992	1419	2361	3906
Χ ₁₉₉₀₋₉₂ ± S.D.	2494 ± 1127	2220 ± 351	4884 ± 910
Test for difference ^c	t = -2.90	t = -3.05	t = -4.86
(X ₁₉₈₁₋₈₅ vs. X ₁₉₉₀₋₉₂)	*	*	*

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Adjusted number - from Appendix G S.D. = Standard Deviation. 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.

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Year	01dsquaw	Scoters	Total divers
1982	838	1246	2385
1983	617	1678	2415
1984	1717	1161	3066
1985	884	796	1801
x̄ ₁₉₈₂₋₈₅ ± S.D. ^b	1014 ± 392	1220 ± 362	2417 ± 517
1990	2733	1901	5064
1991	732	786	1968
1992	1516	875	3145
ًX ₁₉₉₀₋₉₂ ± S.D.	1660 ± 1008	1187 ± 620	3392 ± 1563
		·	
Test for difference ^c	t = -1.14	t = 0.09	t = -1.20
(X ₁₉₈₂₋₈₅ vs. X ₁₉₉₀₋₉₁)	ns	ns	ns

а Adjusted number - from Appendix G

i,

Þ S.D. = Standard Deviation.

с Compare to: $t_{0.05} = 2.571$. Not significant.

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	Mean number of birds ^a		
Species	1981-85	1990-92	
Pacific Loon Red-throated Loon Loon sp. ⁵ Total Loons	10 ± 9 24 ± 24 29 ± 17 64 ± 11	$ \begin{array}{r} 28 \pm 6 \\ 82 \pm 31 \\ 18 \pm 16 \\ 128 \pm 53 \end{array} $	
Tundra Swan	55 ± 19	67 ± 21	
Brant G. White-fronted Goose Dark Goose Snow Goose Total Geese	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	
Northern Pintail American Wigeon Dabbling duck Total Dabblers	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	
Scaup sp. Eider sp. Oldsquaw White-winged Scoter Surf Scoter Scoter sp. Total Scoters Red-breasted Merganser Diving duck ^c Total Divers	$153 \pm 134 \\ 4 \pm 8 \\ 1012 \pm 100 \\ 109 \pm 131 \\ 456 \pm 364 \\ 248 \pm 177 \\ 812 \pm 477 \\ 51 \pm 31 \\ 414 \pm 277 \\ 2447 \pm 684 \\ \end{cases}$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	
Sandhill Crane	5 ± 4	8 ± 5	
Shorebirds	123 ± 63	66 ± 110	
Glaucous Gull Sabine's Gull Total Gulls	76 ± 24 8 ± 6 83 ± 19	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	
Arctic Tern	44 ± 39	16 ± 14	

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

а ± standard deviation b

Table 5.

Includes Yellow-billed Loons and Common Loons Includes Common Merganser

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

	Mean number of birds ^a		
Species	1982-85	1990-92	
Pacific Loon Red-throated Loon Loon sp. ^b Total Loons	$ \begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$24 \pm 10 \\ 38 \pm 14 \\ 9 \pm 9 \\ 71 \pm 2$	
Tundra Swan	44 ± 24	74 ± 26	
Brant G. White-fronted Goose Dark Goose Snow Goose Total Geese	$51 \pm 35 \\ 16 \pm 18 \\ 30 \pm 25 \\ 10 \pm 10 \\ 106 \pm 49$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	
Northern Pintail American Wigeon Dabbling duck Total Dabblers	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	146 ± 78 26 ± 30 72 ± 25 244 ± 116	
Scaup sp. Eider sp. Oldsquaw White-winged Scoter Surf Scoter Scoter sp. Total Scoters Red-breasted Merganser Diving duck Total Divers	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	
Sandhill Crane	2 ± 3	6 ± 3	
Shorebirds	42 ± 30	53 ± 26	
Glaucous Gull Sabine's Gull Total Gulls	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	
Arctic Tern	14 ± 9	<u>1 ± 1</u>	

± standard deviation
 b Includes Vellow-bille

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 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 Al 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.

Year	Dredging activity(m ³) ¹	No. of ships in January ²	No. of ships mobilized ²	Annual no. <u>o</u> 1 person-days ³	f No. of flights June-Sept.	No. of offshore drillingoperations 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
19924	0	8	2	300	1 to 2/w	ık O

Appendix A1.	Level	of	industrial	activity	at	McKinley	Bay,	1979-1992.
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Sackmann <u>et al</u> 1991.

¹from: ²from: N. Vanderkooy, Canadian Marine Drilling Ltd., pers comm; John Ward, AMOCO, pers. comm; and Seakem Group Ltd. 1991. Seakem Group Ltd. 1991. N. Vanderkooy, pers. comm. Scott Edwards, Indian and Northern Affairs, Yellowknife, pers. comm.

³from: ⁴from: ⁵from:

	No. of		<u>Oil spill size (gallons)</u>								
Year	oil spills	<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	-									

Appendix A2. Oil spills reported in McKinley Bay, 1979-1992.¹

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.

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

· · · · · · · · · · · · · · · · · · ·					~			Total
			$\frac{1}{2}$	<u>ansect</u>	<u>number</u>	<u> </u>		on all
Species	<u> </u>	2	3	4	5	<u></u>	/	transects
Yellow-Dilled 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	2					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								
Gvrfalcon								
Willow Ptarmigan	,							
Ptarmigan sn								
Sandhill Crane								
Whimbrel								
Stilt Sandpiper								
Red-necked Phalarone								
Phalarone sn								
Pectoral Sandniner								
Sharehird	•							
Parasitic lagger								
lander en				•				
Glaucous Gull		Δ	6	1				11
Sahino's Gull	÷	т	. 0	1				11
Arctic Tern	2	2						4
Short-pared Owl	Ĺ	۲.						4
Desconing								
103511115								
All species	108	897	1427	923	347	221	52	2065
Km surveyed	2 F	12 0	12 25	925 Q K	575	5 0		
	0.0	16.0	13.23	0.0	5.75	5.0	<u>, , , , , , , , , , , , , , , , , , , </u>	

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

^aBlank denotes no birds seen.

Species 1 2 3 4 5 6 7 8 9 10 transects Pacific Loon 2 3 4 4 4 2 17 Pacific Loon 4 4 3 5 7 9 7 39 Common Loon 1 3 1 7 8 7 56 Donsp. 1 3 1 7 8 7 56 Brant 2 3 5 13 11 7 8 7 56 Brant 6 23 20 49 15 15 15 Mailard American Wigeon 7 7 12 27 2 16 7 78 Scaup sp. 4 60 7 83 8 45 100 1 237 White-winged Scater S 11 5 11 16 16 16						Tra	nsect	numbe	 r			Total on all
Pacific Loon 2 5 4 4 2 17 Red-throated Loon 4 4 3 5 7 9 7 39 Common Loon 1 3 1 7 7 75 Loon sp. 1 3 11 7 8 7 56 Brant 2 3 5 13 11 7 8 7 56 Mater 2 3 5 14 27 20 49 9 7 304 American Wigeon 6 23 20 49 460 7 78 78 56 56 23 20 49 304 305 304 305 305 305 305 305 305 305 305 306 306 306 306 306	Species	1	2	3	4	5	6	7	8	9	10	transects
Red-throated Loon 4 4 3 5 7 9 7 39 Common Loon 1 3 1 7 8 7 56 Brant 2 3 5 13 11 7 8 7 56 Brant 6 23 20 49 30 7 7 304 American Wigeon 7 7 12 27 2 16 7 78 Scaup sp. 4 60 7 71 12 27 2 16 7 78 Scaup sp. 4 60 7 71 22 2	Pacific Loon			2		5		4	4		2	17
Common Loon 1 3 1 7 8 7 56 Brant 2 3 5 13 11 7 8 7 56 Brant 6 23 20 49 Bark goose 6 23 20 49 Dark goose 6 23 20 49 Mathard 6 7 7 12 7 304 American Wigeon 7 7 12 27 2 16 7 78 Scaup sp. 4 60 7 78 52 2 2 Common Eider Eider sp. 6 20 1 237 White-winged Scoter Surf Scoter 5 11 5 11 16 Scoter sp. Cormon Merganser 142 142 142 142 Diving duck 11 54 10 101 176 Northern Harrier 8	Red-throated Loon				4	4	3	5	7	. 9	7	39
Loon sp. 1 3 1 5 Tundra Swan 2 3 5 13 11 7 8 7 56 Brant 6 23 20 49 15 15 15 Mallard Northern Pintail 69 71 14 27 20 84 12 7 304 American Wigeon 7 7 12 27 2 16 7 78 Scaup sp. 4 60	Common Loon											
Tundra Swan 2 3 5 13 11 7 8 7 56 Brant. G. White-fronted Goose 6 23 20 49 Dark goose 15 15 15 Mallard 7 7 12 27 2 16 7 Northern Pintail 69 71 14 27 20 84 12 7 304 American Wigeon 7 7 12 27 2 16 7 78 Scaup sp. 4 60 64 5 10 1 237 White-winged Scoter Surf Scoter 6 23 2 2 Common Merganser 2 2 2 2 2 Cade-breasted Merganser 142	Loon sp.					1		3	1			5
Brant 6 23 20 49 G. White-fronted Goose 15 15 Mallard Northern Pintail 69 71 14 27 20 84 12 7 304 Mareican Wigeon 7 7 12 27 2 16 7 78 Scaup sp. 4 60 60 64 64 64 64 Common Eider Eider sp. 6 23 83 8 45 100 1 237 White-winged Scoter 83 8 45 100 1 237 Surf Scoter sp. 2 2 2 2 2 2 2 Common Merganser 12 142	Tundra Swan			2	3	5	13	11	7	8	7	56
G. White-fronted Goose 6 23 20 49 Dark goose 15 15 Mallard 69 71 14 27 20 84 12 7 304 Northern Pintail 69 71 14 27 20 84 12 7 304 American Wigeon 7 7 12 27 2 16 7 78 Scaup sp. 4 60 6 23 20 49 Dabbling duck 7 7 12 27 2 16 7 78 Scaup sp. 4 60 6 23 20 10 1 237 White-winged Scoter Surf Scoter Surf Scoter 2	Brant			-	-	• .			•	•	•	
Dark goose 15 15 Mallard Northern Pintail 69 71 14 27 20 84 12 7 304 American Wigeon 7 7 12 27 2 16 7 78 Dabbling duck 7 7 12 27 2 16 7 78 Scaup sp. 4 60 60 64 64 64 Common Eider Eider 64 64 64 64 64 Common Merganser 4 60 1 237 Winte-winged Scoter 52 2 2 Surf Scoter sp. 2 10 10 17 </td <td>G. White-fronted Goose</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>. 6</td> <td>23</td> <td></td> <td>20</td> <td>49</td>	G. White-fronted Goose							. 6	23		20	49
Mailard 69 71 14 27 20 84 12 7 304 Northern Pintail 69 71 14 27 20 84 12 7 304 Dabbling duck 7 7 12 27 2 16 7 78 Scaup sp. 4 60 64 64 64 64 64 King Eider Common Eider Eider sp. 0 1 237 83 8 45 100 1 237 White-winged Scoter Surf Scoter Surf Scoter 2 2 2 Red-breasted Merganser 142 <td>Dark goose</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Ŭ</td> <td>20</td> <td></td> <td>15</td> <td>15</td>	Dark goose							Ŭ	20		15	15
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 64 64 King Eider 64 60 64 64 Common Eider Eider sp. 60 1 237 White-winged Scoter Souter sp. 2 2 2 Red-breasted Merganser 142 142 142 142 Unidentified duck 11 54 10 101 176 Unidentified duck 5 11 16 16 100 176 Unidentified duck 5 11 16 16 176 16 16 Northern Harrier 8 2 3 2 10 16 Northern Harrier 3 3 3 3 3 3 <t< td=""><td>Mallard</td><td>•</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>10</td><td>. 10</td></t<>	Mallard	•									10	. 10
American Wigeon 7 1	Northern Pintail		69		71	14	27	20	84	12	7	304
Nuclear 7 7 12 27 2 16 7 78 Scaup sp. 4 60 64 64 Common Eider Eider sp. 64 64 Common Eider Eider sp. 01 237 White-winged Scoter Surf Scoter 5 5 10 1 237 Scoter sp. 2 10	American Wigeon		05				C /	20	0.		,	001
Data String Guck 1	Dabbling duck				7	7	12	27	2	16	7	78
Stage Sp. 4 50 64 Common Eider Eider sp. 0 1 237 White-winged Scoter Surf Scoter Scoter sp. 2 2 Scoter sp. 142 142 142 142 Diving duck 11 54 10 101 176 Unidentified duck 5 11 16 16 Northern Harrier Rough-legged Hawk Gryfalcon 83 2 3 2 10 Willow Ptarmigan Sp. Sadhill Crane 3 3 3 3 3 3 3 Semipalmated Sandpiper 3 3 3 3 3 3 3 Pectoral Sandpiper 1 1 3 5 5 3 3 3 Sabine's Gull 2 2 13 11 6 4 38 3 Sabine's Gull 2 2 13 11 6 4 38 3 Sowy Owl 1 2 13 16 4 38 3 </td <td></td> <td></td> <td></td> <td></td> <td>'</td> <td>Λ</td> <td>60</td> <td>L7</td> <td>2</td> <td>10</td> <td>,</td> <td>64</td>					'	Λ	60	L7	2	10	,	64
King Lider Eider sp. Oldsquaw 83 8 45 100 1 237 White-winged Scoter Surf Scoter Surf Scoter 2 2 Surf Scoter Scoter sp. 2 142 142 142 Diving duck 11 54 10 101 176 Unidentified duck 5 11 16 16 Northern Harrier 83 2 3 2 10 Willow Ptarmigan 9 5 11 16 Northern Harrier 8 3 3 3 Red-necked Phalarope 9 3 3 3 Ptarmigan sp. 3 3 3 3 Semipalmated Sandpiper 3 3 3 3 Pectoral Sandpiper 1 1 3 5 Parasitic Jaeger 3 3 5 9 Jaeger sp. 1 1 3 7 7 Actic Tern 7 7 7 7 7	Ving Fidon					-	00					. 04
Common Fruer Cidsquaw 83 8 45 100 1 237 White-winged Scoter Surf Scoter 2 2 2 Scoter sp. 2 142 142 142 142 142 Diving duck 11 54 10 101 176 176 Unidentified duck 5 11 16 16 Northern Harrier 16 Northern Harrier 7 7 17 16 16 16 Northern Harrier 83 2 3 2 10 16 Willow Ptarmigan Ptarmigan sp. 3 3 3 3 3 Semipalmated Sandpiper 3 2 3 2 10 10 Whimbrel 3 3 3 3 3 3 3 Red-necked Phalarope 9 1 1 3 5 5 3 3 3 Red-necked Gull 1 2 13 11 6 4 38 Sabine's Gull 7	Common Fidon											
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OldSquaw 63 645 100 1 237 White-winged Scoter Surf Scoter Surf Scoter 2 2 Surf Scoter sp. 2 142 142 142 Scoter sp. 11 54 10 101 176 Common Merganser 142 142 142 142 Diving duck 511 10 101 176 Unidentified duck 511 16 16 Northern Harrier 8 11 16 16 Rough-legged Hawk Gryfalcon Willow Ptarmigan Ptarmigan sp. 9 Sandhill Crane 3 2 3 2 10 Whitherel 3 3 3 3 3 Red-necked Phalarope 3 3 3 3 3 Pactoral Sandpiper 3 3 5 9 3 3 Shorebird 1 1 3 5 1 1 1 3 5 Glaucous Gull 2 2 13 11	Cideguau					02	0	15	100		1	227
Wintle-Winged Scoter Surf Scoter sp. Common Merganser 142 Red-breasted Merganser 142 Diving duck 11 54 10 Unidentified duck 5 11 16 Northern Harrier 8 6 16 Rough-legged Hawk 6 6 16 Gryfalcon 8 10 10 Willow Ptarmigan 7 10 10 Ptarmigan sp. 3 2 2 10 Whimbrel 3 3 3 3 Semipalmated Sandpiper 3 3 3 Phalarope sp. 7 7 7 Phalarope sp. 7 7 7 Parasitic Jaeger 3 1 6 4 38 Sabine's Gull 2 13 1 6 4 38 Short-eared Owl 7 7 7 7 Snowy Owl 1 1 1 1 1 Passerine 1 1 1 1 <td>Ulusquaw</td> <td></td> <td></td> <td></td> <td></td> <td>03</td> <td>. 0</td> <td>40</td> <td>100</td> <td></td> <td>1</td> <td>237</td>	Ulusquaw					03	. 0	40	100		1	237
Suff Scoter 2 2 Red-breasted Merganser 142 142 Diving duck 11 54 10 101 176 Unidentified duck 5 11 16 16 16 Northern Harrier 8 11 54 10 11 16 Northern Harrier 8 11 5 11 16 16 Northern Harrier 8 7 10 176 16 Northern Harrier 8 8 16 10 176 Rough-legged Hawk 9 9 10 176 16 Willow Ptarmigan 9 3	white-winged Scoter											
Scoter sp. 2 2 Common Merganser 142 142 Diving duck 11 54 10 101 176 Unidentified duck 5 11 16 16 16 Northern Harrier 8 11 54 10 101 176 Rough-legged Hawk 5 11 16 16 16 16 Northern Harrier 8 5 11 16 16 16 Rough-legged Hawk 6 7 7 16 16 16 Sandhill Crane 3 2 2 10 16 16 16 Willow Ptarmigan 9 1 7 3	Surf Scoter											•
Common Merganser 2 2 Red-breasted Merganser 142 142 Diving duck 11 54 10 101 176 Unidentified duck 5 11 16 16 Northern Harrier 16 Rough-legged Hawk Gryfalcon 8 7 16 16 Willow Ptarmigan Sp. Sandhill Crane 3 2 2 10 Whimbrel Sandhill Crane 3 2 3 3 Semipalmated Sandpiper 3 3 3 3 Red-necked Phalarope Phalarope Sp. 9 9 1 3 5 Parasitic Jaeger 3 3 1 6 4 38 Sabine's Gull 2 13 11 6 4 38 Short-eared Owl 7 7 7 7 7 Snowy Owl 1 1 1 1 1 1 Passerine 1 1 1 1 1 1 Mil species 3 7	Scoter sp.									•		•
Red-breasted Merganser 142 142 Diving duck 11 54 10 101 176 Unidentified duck 5 11 16 16 16 Northern Harrier 8 11 54 10 101 176 Rough-legged Hawk Gryfalcon 8 11 54 10 16 Willow Ptarmigan 9 142 142 16 16 16 Ptarmigan sp. Sandhill Crane 3 2 2 10 1	Common Merganser									2		2
Diving duck 11 54 10 101 176 Unidentified duck 5 11 16 16 Northern Harrier Rough-legged Hawk Gryfalcon 16 Willow Ptarmigan Ptarmigan sp. 2 3 2 10 Winbrel Sandhill Crane 3 2 3 3 Semipalmated Sandpiper 3 3 3 3 Red-necked Phalarope Phalarope sp. Pectoral Sandpiper 3 3 Shorebird 1 1 3 5 Parasitic Jaeger Jaeger sp. Glaucous Gull 2 13 11 6 4 38 Sabine's Gull 7 7 7 7 7 7 7 Arctic Tern Short-eared Owl 1 1 1 1 1 1 Snowy Owl 1 1 1 1 1 1 1 Common Raven 3 7 6 88 136 199 154 489 54 66 1265	Red-breasted Merganser						<u> </u>		142			142
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 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 7 Arctic Tern Short-eared Owl Snowy Owl 1 1 Passerine 1 1 1 Shorebird 1 1 1 Shorebird 2 2 13 11 6 4 38 Sabine's Gull 7 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 <u>Km surveyed 0.25 1.0 2.25 6.75 10.75 10.25 15.5 12.0 10.0 10.0</u>	Diving duck					11	54	10	101			. 176
Northern Harrier Rough-legged Hawk Gryfalcon Willow Ptarmigan Ptarmigan sp. Sandhill Crane 3 Sandhill Crane 3 Semipalmated Sandpiper 3 Semipalmated Sandpiper 3 Red-necked Phalarope Phalarope sp. Pectoral Sandpiper Shorebird 1 Jaeger sp. Glaucous Gull 2 Sabine's Gull 7 Short-eared Owl Snowy Owl 1 Passerine 1 All species 3 Raven 3 All species 3 Grupt denotes no hirds seen	Unidentified duck						5	11				16
Rough-legged Hawk Gryfalcon Willow Ptarmigan Ptarmigan sp. Sandhill Crane 3 2 Sandhill Crane 3 2 Semipalmated Sandpiper 3 3 Red-necked Phalarope 3 3 Phalarope sp. Pectoral Sandpiper 3 5 Parasitic Jaeger 1 1 3 5 Jaeger sp. 6 2 2 13 11 6 4 38 Sabine's Gull 2 2 13 11 6 4 38 Short-eared Owl 7 7 7 7 7 Snowy Owl 1 1 1 1 1 Passerine 1 1 1 1 1 Common Raven 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 10.0 10.0	Northern Harrier											
Gryfalcon Willow Ptarmigan Ptarmigan sp. Sandhill Crane 3 2 10 Whimbrel 3 3 3 Semipalmated Sandpiper 3 3 3 Red-necked Phalarope 3 3 3 Phalarope sp. Pectoral Sandpiper 3 5 Shorebird 1 1 3 5 Parasitic Jaeger 3 3 5 Jaeger sp. 6 1 6 4 38 Sabine's Gull 2 2 13 11 6 4 38 Sabine's Gull 7 7 7 7 7 7 Arctic Tern 1 1 1 1 1 1 1 Snowy Owl 1 1 1 1 1 1 1 Common Raven 3 70 6 88 136 199 154 489 54 66 1265 Km surveyed 0.25 1.0 2.25 6.75 <td< td=""><td>Rough-legged Hawk</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Rough-legged Hawk											
Willow Ptarmigan Ptarmigan sp. Sandhill Crane 3 2 3 2 10 Whimbrel Semipalmated Sandpiper 3 3 3 3 Semipalmated Sandpiper 3 3 3 3 Red-necked Phalarope Phalarope sp. 7 7 Pectoral Sandpiper 1 1 3 5 Shorebird 1 1 3 5 Parasitic Jaeger Jaeger sp. 3 3 Jaeger sp. Glaucous Gull 2 2 13 11 6 4 38 Sabine's Gull 7 7 7 7 7 Arctic Tern Short-eared Owl 1 1 1 1 Snowy Owl 1 1 1 1 1 Passerine 1 1 1 1 1 Common Raven 3 70 6 88 136 199 154 489 54 66 1265 Km surveyed 0.25 1.0 <t< td=""><td>Gryfalcon</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td></t<>	Gryfalcon									-		
Ptarmigan sp. Sandhill Crane 3 2 3 2 10 Sandhill Crane 3 2 3 2 10 Whimbrel Semipalmated Sandpiper 3 3 3 Sed-necked Phalarope 3 3 3 Phalarope sp. Pectoral Sandpiper 3 5 Parasitic Jaeger 1 1 3 5 Jaeger sp. 6 1 1 3 5 Glaucous Gull 2 2 13 11 6 4 38 Sabine's Gull 7 7 7 7 7 Arctic Tern Short-eared Owl 1 1 1 1 Snowy Owl 1 1 1 1 1 1 Common Raven 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	Willow Ptarmigan											
Sandhill Crane 3 2 3 2 10 Whimbrel Semipalmated Sandpiper 3 3 3 Semipalmated Sandpiper 3 3 3 3 Phalarope sp. Pectoral Sandpiper 3 3 3 Phalarope sp. Pectoral Sandpiper 5 5 5 Shorebird 1 1 3 5 Parasitic Jaeger 3 3 6 Jaeger sp. 6 1 6 4 38 Sabine's Gull 2 2 13 11 6 4 38 Sabine's Gull 2 2 13 11 6 4 38 Short-eared Owl 7 7 7 7 7 1	Ptarmigan sp.											
Whimbrel 3 3 Semipalmated Sandpiper 3 3 Red-necked Phalarope Phalarope sp. Pectoral Sandpiper Shorebird 1 1 3 5 Pectoral Sandpiper Shorebird 1 1 3 5 Shorebird 1 1 3 5 5 Jaeger sp. 3 1 6 4 38 Sabine's Gull 2 2 13 11 6 4 38 Sabine's Gull 7 7 7 7 7 7 7 7 7 7 7 7 1	Sandhill Crane	3				2	3		2			10
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Appendix C2. Birds observed on the terrestrial component of the aerial surveys at McKinley Bay on August 3, 1992.^a

Species123456transectsYellow-billed Loon444Common Loon44Loon sp.3535Tundra Swan3535Brant3535G. White-fronted Goose3535Dark goose44American Wigeon44American Wigeon44Aberican Wigeon44Admerican Wigeon33Oldsquaw33White-winged Scoter33Surf Scoter sp.11Common Merganser11Red-breasted Merganser11Diving duck11Unidentified duckNorthern HarrierRough-legger HawkSpecies5Abillow Ptarmigan11Still Sandpiper8ed-necked PhalaropePhalarope sp.214Shorebird214Parasitic Jaeger214Shorebird214Passerine214All species56140All species56140All species56140All species56140All species56140All species501.51.75				Ту	ransect	t numbe	or.		To	otal all
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All species 5 6 1 40 52 Km surveyed 9.25 5.0 1.5 1.75 0.5 1.75	Passerine					- 10 - 10 -	-			
All species 5 6 1 40 52 Km surveyed 9.25 5.0 1.5 1.75 0.5 1.75	A 7 7			- ·		c		4.0		50
<u>Nii surveyed 9.25 5.0 1.5 1./5 0.5 1./5</u>	ATT Species		0.05	5	1 5	175		40		52
aplank denotes no hinde soon	^a Plank donatas na binda		9.25	5.0	1.5	1./5	0.5	1./5		

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

Appendix C4	Ap	pend	lix	C4
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. Birds observed on the bay component of aerial surveys at McKinley Bay on August 4, 1992^ª.

			Tr	ansect	number	r.		Total on all
Species	1	2	3	4	5	6	7	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	<u>5.75</u>	5.0	1.5	

^aBlank denotes no birds seen.

						Tra	insect	numbe	er			Total on all
Species	1	2	3	•	4	5	6	7	8	9	10	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	3	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					7.3
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							4					
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	5	7	148	113	143	586	100	56	1298
km surveyed 0	<u>. 25</u>	1.0	2.2	<u>56</u> .	<u>75</u> ·	10.75	10.25	15.5	12.0	10.0	10.0	
[•] Blank denotes no birds	see	en.										

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

probably immature Bald Eagle.

			T			Total
Spacios	1	2	<u>1rai</u> 3	<u>nsect</u> r	number 6	on all
Yellow-billed Loon		<u> </u>			0	<u>LI all'SECUS</u>
Pacific Loon						
Red-throated Loon				1		1
Common Loon				. 4		1
Loon sn						
Tundra Swan						
Brant						
Greater White-fronted Goose						
Dark goose						
Mallard						
Northern Pintail						
American Wigeon					•	
Dabbling duck						
Scaup sp.						
King Fider						
Common Fider						
Fider 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						
Gvrfalcon						
Willow Ptarmigan						
Ptarmigan sp.						
Sandhill Crane						
Whimbrel			۰.			
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	20
^a Blank denotes no birds seen.		<u> </u>				

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

			Transect	number	<u></u>	Total on all
Species	1	2	3	4	5	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	e Al an	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			X			
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		-	-			Ū.
Passerine						
· · · · · · · · · · · · · · · · · · ·						
All species	5	313	191	60	404	973
Km surveyed	10.5	13.5	15.5	6.5	3.5	

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

^aBlank denotes no birds seen.

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

· · · · · · · · · · · · · · · · · · ·			Trans	ect nu	mber		Total on all
Species	2	3	4	5	6	7	 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 Go	oose						
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 Lider							
Common Eider							
Eider sp.							10
Uldsquaw			•		18		18
white-winged Scoter							
Surf Scoter							
Scoter sp.							
Common Merganser				16			15
Red-breasted Merganser				15			15
Unidentified duck							
Nonthorn Hannion							
Rough loggod Howk							
Cuntal con							
Willow Ptarmigan							
Dtermigen en							
Sandhill Crane		З		2			5
Whimbrol		5		· L			5
Seminalmated Sandniner	3						З
Red-necked Phalarone							, J
Phalarone sn							
Pectoral Sandpiper							
Shorebird				5	1		6
Parasitic Jaeger				·	•.		Ū,
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	<u>1.</u> 75	<u>2.</u> 5	<u>11.</u> 5	7.5	<u>11.0</u>	<u>11.</u> 0	
aplank denotes no binds							

seen. DI ank aeno

Species	<u>Transect</u> 1	number 2	on all
Species Valley billed Lean	11	2	
Vollow billed Leen			<u>transects</u>
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	

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

Appen	di>	< D4
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4. Birds observed on the bay component of aerial surveys at Hutchison Bay on August 3, 1992^a.

						Total
		T	ransect	number		on all
<u>Species</u>	1	2	. 3	4	5	<u>transects</u>
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 Fider						
Common Fider						
Fider sp		•				
01dsquaw	15	296	621	82	248	1262
White-winged Scoter	10	230	011	01	2.0	2
Surf Scoter		267	49			316
Scoter sn	66	250	85	11		412
Common Merganser		200		••		126
Red-breasted Merganser		10	1	552		563
Diving Duck	30	190	67	152	88	527
Unidentified duck		150	07	102	00	027
Northern Harrier						
Rough_legged Hawk						
Gynfalcon		-				
Willow Ptarmigan						
Dtarmigan cn						
Sandhill Chang						
Whimhwo]						
Stilt Sandniner						
Pod_nockod Phalarone						
Phalarono sn						
Pactoral Sandninor						
Shawahind			. *	15		15
Damasitic Jacqon				10		15
lagger of						
Clauseus Cull	٨	1	· • •	E C	1	15
Glaucous Gull	4	1	3	0	1	15
Sabine S Guin						
Arctic Tern						
Snort-eared UWI						
rasserine					,	
All choose	110	1065	070	1000	260	2512
ATT SPECIES	10 E 110	10,E		1022) ンロン ロ	3513
^a Dlank denotes no binds soon	10.5		13.5	0.5	3.5	

Species 2 3 4 5 6 7 transect Yellow-billed Loon 3 1 2 15 21 Red-throated Loon 3 2 1 4 13 23 Common Loon 2 1 4 13 23 2 2 2 2 Tundra Swan 8 31 14 10 63 3			<u> </u>		Trar		umbor		Total
Yellow-billed Loon 3 1 2 15 21 Pacific Loon 3 1 2 15 21 Pacific Loon 3 2 1 4 13 23 Common Loon 2 2 2 2 2 Loon sp. 2 2 2 2 3 Granter White-fronted Goose 15 22 37 Dark goose 3 53 14 24 124 Mariand 33 53 14 24 124 American Wigeon 6 12 1 2 21 Dabbling duck 18 25 18 4 65 Scaup sp. King Eider Common Herganser 5 5 5 Scaup sp. 18 18 18 18 18 18 Super Scoter sp. Common Merganser 5 5 5 5 5 5 5 18 18 18 18 18 18 18 18 18 18 18 <th>Snecies</th> <th></th> <th>2</th> <th>3</th> <th><u> </u></th> <th><u>5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 </u></th> <th>6</th> <th></th> <th>ransects</th>	Snecies		2	3	<u> </u>	<u>5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 </u>	6		ransects
Pacific Loon 3 1 2 15 21 Red-throated Loon 3 2 1 4 13 23 Common Loon 3 2 1 4 13 23 Loon sp. 2 2 2 2 2 Tundra Swan 8 31 14 10 63 Brant 3 3 3 3 3 3 Greater White-fronted Goose 15 22 37 37 Dark goose 6 12 1 2 21 Mallard 33 53 14 24 124 American Wigeon 6 12 1 2 21 Dabbling duck 18 25 18 4 65 Scaup sp. 18 18 18 18 18 White-winged Scoter Socter sp. Common Merganser Red-breasted Merganser Red-breasted Merganser Red-breasted Merganser Red-breasted Merganser Red-breasted Merganser Socter sp. Socter sp. Socter sp	Yellow-billed Loon	h h	L			×			<u>uno e o o o</u>
Red-throated Loon32141323Common Loon2141323Loon sp.222Tundra Swan831141063Brant33333Greater White-fronted Goose152237Dark goose152237Mallard33531424124American Wigeon6121221Dabbling duck182518465Scaup sp.182518465Common EiderCommon Eider181818Eider sp.0dsquaw181818White-winged ScoterScoter sp.555Common MerganserRed-preasted Merganser1818Northern HarrierRough-legged Hawk6147Rough-legged HawkGyrfalconWillow Ptarmigan519Villow Ptarmigan sp.2244Stilt Sandpiper8303030Parasitic Jaeger220830Parasitic Jaeger220830Parasitic Jaeger2222Jaeger sp.2222Gelaucous Gull473519Short-eared Owl22222Passerine22 <td>Pacific Loon</td> <td></td> <td></td> <td></td> <td>3</td> <td>1</td> <td>2</td> <td>15</td> <td>21</td>	Pacific Loon				3	1	2	15	21
Common Loon22Loon sp.22Dundra Swan831Brant33Greater White-fronted Goose1522Mallard33531424Northern Pintail33531424American Wigeon61212Dabbling duck1825184Scaup sp.1825184King Eider1825184Common EiderEider Scoter55Surf ScoterScoter55Scoter sp.Common Merganser818Red-breasted MerganserNorthern Harrier8Rough-legged HawkGyrfalcon47Willow Ptarmigan224Whimbrel2208Stortil Sandpiper2208Red-necked Phalarope99Phalarope sp.96Parasitic Jaeger31Jaeger sp.611Arctic Tern222Short-eared Owl222Passerine222	Red-throated Loon		3		2	1	4	13	23
Loon sp.222Tundra Swan831141063Brant33152237Dark goose152237Mallard33531424124American Wigeon6121221Dabbling duck182518465Scaup sp.King EiderCommon Eider1825184Common EiderCommon Eider181818White-winged ScoterScater sp.Common Eider1818Surf ScoterScoter sp.Common Harrier830Red-breasted MerganserGyrfalconWillow Ptarmigan4735Ptarmigan sp.Sandhill Crane220830Practical Sandpiper22083030Shorebird22083030Parasitic Jaeger335193Sabine's Gull473519Sabine's Gull11111Arctic Tern2222Short-eared Owl2223Passerine33333	Common Loon		-		-	-	-		
Tundra Swan 8 31 14 10 63 Brant 3 3 3 Greater White-fronted Goose 15 22 37 Dark goose 4 Mallard 4 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 18 White-winged Scoter Scoter sp. Common Merganser Red-breasted Merganser Diving duck Unidentified duck Northern Harrier Rough-legged Hawk Gyrfalcon 4 Willow Ptarmigan Ptarmigan Sp. Sandhill Crane 2 2 4 Whimbrel 5 Still Sandpiper Shorebird 2 20 8 30 Parasitic Jaeger Jaeger Jaeger sp. Glaucous Gull 4 7 3 5 19 Sabine's Gull 1 1 1 Arctic Tern 2 2 2 Short-eared Owl Passerine						2			2
India SuchC311010Brant33311103Greater White-fronted Goose152237Dark gooseNorthern Pintail33531424124American Wigeon6121221Dabbling duck182518465Scaup sp.182518465King EiderCommon Eider181818Common EiderSocterScoter55Surf ScoterScoterScoter Sp.Common MerganserCommon MerganserCommon Merganser1818Diving duckUnidentified duckNorthern Harrier9Rough-legged HawkGyrfalconWillow Ptarmigan9Ptarmigan sp.Sandhill Crane224WhitmbrelShorebird2208Sandhill Crane220830Parasitic JaegerJaeger Sp.99Glaucous Gull4735Sabire's Gull111Arctic Tern222Short-eared Owl222Passerine322	Tundra Swan		8			31	14	10	63
Date152237Dark goose152237Dark goose33531424124American Wigeon6121221Dabbling duck182518465Scaup sp.182518465King Eider2181818Common Eider52181818Eider sp.0ldsquaw181818Surf ScoterScoter5555Scoter sp.Common Merganser886Diving duckUnidentified duckNorthern Harrier73Rough-legged HawkGyrfalcon999Willow PtarmiganPtarmigan sp.599Sandhill Crane220830Prassitic Jaeger220830Parasitic Jaeger3111Jaeger sp.1111Sandriper220830Parasitic Jaeger220830Passerine220830Passerine220830	Brant		Ũ			Ĩ	Å 1	10	3
OresterToFrorMallard33531424124Northern Pintail33531424124American Wigeon6121221Dabbling duck182518465Scaup sp.181825184King EiderCommon Eider181818Eider sp.Oldsquaw181818Oldsquaw18181818White-winged ScoterScoter sp.Scoter sp.5Common MerganserRed-breasted MerganserDiving duck18Unidentified duckNorthern HarrierRough-legged Hawk6Rough-legged HawkGyrfalcon224WhimbrelStill SandpiperSandhill Crane22Patarmigan sp.Saeder sp.Pectoral SandpiperShorebird220830Parasitic Jaeger3519Jaeger sp.6111Sabire's Gull111Arctic Tern222Short-eared Owl222Passerine1422	Greater White-fronted G	0056				15	22		37
Nailard Northern Pintail Northern Pintail American Wigeon Dabbling duck Scaup sp. King Eider Common Eider Eider sp. Oldsquaw 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 Ptarmigan sp. Sandhill Crane Ptarmigan sp. Sandhill Crane Ptarmigan sp. Sandhill Crane Ptarmigan sp. Sandhill Crane Shorebird Stilt Sandpiper Red-necked Phalarope Phalarope sp. Pectoral Sandpiper Shorebird Store Sull Aager Sp. Glaucous Gull Arctic Tern Sandhill Crane Short-eared Owl Passerine	Dark doose	0030				15	<u> </u>		57
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 1 1 Arctic Tern 2 2 Short-eared Owl Passerine	Mallard								
Northern Hindari American Wigeon 6 12 1 2 21 Dabbling duck 18 25 18 4 65 Scaup sp. 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 1 1 Arctic Tern 2 2 Short-eared Owl Passerine	Northorn Pintail				22	53	14	24	124
American wigeon101211214Dabbling duck182518465Scaup sp.Common EiderEider sp.01818Oldsquaw18181818White-winged ScoterSurf ScoterSurf Scoter5Surf ScoterScoter sp.Common Merganser818Red-breasted MerganserDiving duckUnidentified duck818Unidentified duckNorthern Harrier81818Rough-legged HawkGyrfalcon83018Ptarmigan sp.Sandhill Crane224WhimbrelStill Sandpiper83018Shorebird220830Parasitic Jaeger319319Sabine's Gull1111Arctic Tern2225Short-eared Owl22830Passerine3333	Amorican Wigoon				55	12	14.	2	21
Dabining dick102010400Scaup sp.King EiderCommon EiderEider sp.OldsquawSurf ScoterSurf Scoter sp.Common MerganserRed-breasted MerganserDiving duckUnidentified duckNorthern HarrierRough-legged HawkGyrfalconWillow PtarmiganPtarmigan sp.Sandhill Crane224WhimbrelShorebirdPectoral SandpiperShorebirdAgeger sp.Glaucous Gull473 519Sabine's Gull122Short-eared OwlPasserine	Dabbling duck				18	25	18	1	65
Stadp SD. King Eider1818Common Eider1818Eider sp.01dsquaw1818Surf ScoterSurf ScoterSurf ScoterSurf Scoter sp.Common MerganserRed-breasted MerganserDiving duckUnidentified duckNorthern HarrierNorthern HarrierRough-legged HawkGyrfalconWillow PtarmiganPtarmigan sp.Sandhill CranePtarmigan sp.224WhimbrelStilt SandpiperRed-necked PhalaropePhalarope sp.Pectoral SandpiperShorebirdShorebird2208Jaeger sp.11Sabne's Gull11Arctic Tern22Short-eared Owl22PasserineSaterine	Security Cuck				10	25	10	т	05
King ErderCommon EiderEider sp.OldsquawWhite-winged ScoterSurf ScoterScoter sp.Common MerganserRed-breasted MerganserDiving duckUnidentified duckNorthern HarrierRough-legged HawkGyrfalconWillow PtarmiganPtarmigan sp.Sandhill Crane224WhimbrelStilt SandpiperRed-necked PhalaropePhalarope sp.Pectoral SandpiperShorebird220830Parasitic JaegerJaeger sp.Glaucous Gull4735Sabine's Gull1Arctic Tern22ShorebirePasserine	Ving Eidon								
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 1 Arctic Tern 2 2 2	Common Eidon								
Elder Sp.1818Oldsquaw1818White-winged ScoterSurf ScoterScoter sp.Common MerganserDiving duckUnidentified duckNorthern HarrierRough-legged HawkGyrfalconWillow PtarmiganPtarmigan sp.Sandhill Crane2VMimbrelStilt SandpiperRed-necked PhalaropePhalarope sp.Pectoral SandpiperShorebird2Quality and the second s	Common Elder								
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Shorebird220830Parasitic JaegerJaeger sp.Jaeger sp.3519Glaucous Gull473519Sabine's Gull1111Arctic Tern222Short-eared OwlPasserine22	Pectoral Sandpiper								
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Jaeger sp. Glaucous Gull 4 7 3 5 19 Sabine's Gull 1 1 Arctic Tern 2 2 2 Short-eared Owl Passerine	Parasitic Jaeger								
Glaucous Gull473519Sabine's Gull1111Arctic Tern22Short-eared OwlPasserine22	Jaeger sp.								
Sabine's Gull11Arctic Tern22Short-eared Owl2Passerine2	Glaucous Gull		4			7	3	5	19
Arctic Tern 2 2 Short-eared Owl Passerine	Sabine's Gull		1						1
Short-eared Owl Passerine	Arctic Tern	· ·						2	2
Passerine	Short-eared Owl							•	
	Passerine								
				_					• ~ -
All species 18 0 84 152 96 83 43	All species			0_	, 84	152	96	83	433
<u>KM surveyed</u> <u>1./5 2.5 11.5 /.5 11.0 11.0</u>	ADlank denotes as hinds		1./5	2.5	11.5	1.5	11.0	11.0	

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

втапк

	Transe	act number	Total on all
Species	1	2	transects
Yellow-billed Loon		<u>►</u>	01 4110 00000
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	

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

"Blank denotes no birds seen.

_	Aug	ust 3	August 4
Species group	Number	Density (birds/km ²)	Density Number (birds/km²)
1	20	1 43	0 0 46
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

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

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

	Aug	ust 2	August 3				
Species group	Number	Density (birds/km²)	Number	Density (birds/km²)			
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			

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

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

	A	lugust 3	August 4				
Species group	Number	Density (birds/km²)	Number	Density (birds/km²)			
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			

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

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

	A	ugust 2	A	August 3				
Species group	Number	Density (birds/km²)	Number	Density (birds/km²)				
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				λ				
Passerines	9	0.55						
TOTAL BIRDS	381	23.37	433	26.56				

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

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

	010	<u>01dsquaw</u>		<u>Scoter</u>		Scaup		Red- Mer	Red-breasted <u>Merganser</u>			Eider	<u>r</u>	Identified 					
Year	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	Total	%	Unidentified divers	lotal 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

^aFrom best survey each year ^bIncludes 2 Common Mergansers

Appendix G1.

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.

	<u>Oldsquaw</u>		quaw Scoter			Scaup			Red- <u>Mer</u>	Red-breasted <u>Merganser</u>			Eider			ified ers			
Year	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	No.	%	Adj. no.	Total	%	Unidentifie divers	ed Total divers
1981	not s	surv	veyed						······ ···	-									
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	Q	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

^aFrom best survey each year.

	01ds	quaw	Scot	cers	Uniden div	tified ers	A11	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

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

^a McKinley Bay. ^b Hutchison Bay. ^c Includes scaup and merganser.