

**Birds and mammals
of the Belcher,
Sleepers, Ottawa and
King George Islands,
and Northwest
Territories**

by T. H. Manning

**Occasional Paper
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**Canadian
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Abstract

On Kugong Island, the westernmost of the Belcher Islands, 49 species of birds were recorded between May 5 and July 14, and between September 2 and 22, 1971. Of these, 26 species were thought to nest or to have nested on Kugong Island and four were new records for the Belcher Islands. Arrival dates, nesting data, numbers seen and, where practicable, population estimates are given. The North Belcher, Sleeper, Ottawa and King George islands were visited between July 31 and September 2 and, as far as time and season permitted, similar observations were made. A table listing 1971 and earlier records (71 species) for the five groups of islands is given. In all, 202 specimens of birds were collected; weights and fat estimates are given for most of these. Reasons for referring eastern North American specimens of *Calcarius lapponicus* (Lapland Longspur) to *C. l. subcalcaratus* are given. There are notes on 10 species of mammals which now occupy or have occupied the islands or surrounding seas. Lemmings were at a cyclic high on Kugong Island in the spring and early summer, but they had virtually disappeared by September. Examples of cyclic synchrony across water and ice barriers are discussed. Trapped lemmings were predominantly females (39% males), whereas 67% of those caught by a retriever were males. The difference is significant ($P < 0.005$). Two hundred and sixty four mammals were collected.

Résumé

On a relevé, du 5 mai au 14 juillet 1971 et du 2 au 22 septembre de la même année, la présence de 49 espèces d'oiseaux dans l'île Kugong, la plus occidentale de l'archipel Belcher. On estimait que 26 de ces espèces nichaient à l'île Kugong ou l'avaient déjà fait et qu'il s'en trouvait quatre dont la présence dans l'archipel était relevée pour la première fois. Le présent rapport énonce les dates d'arrivée et de nidification, le nombre d'oiseaux observés ainsi que, dans la mesure du possible, le nombre estimatif de la population. En autant que le temps et la saison le permettaient, de semblables observations ont été effectuées lors de visites des îles Belcher-Nord, Dormeuses, Ottawa et du Roi-Georges effectuées entre le 31 juillet et le 2 septembre. Le rapport comporte aussi un tableau des données obtenues en 1971 et auparavant, portant sur 71 espèces, en fonction des cinq sous-ensembles d'îles qui constituent l'archipel. On a recueilli en tout 202 spécimens ornithologiques dont pour la plupart on énonce ici le poids et la teneur estimative en graisse. L'auteur s'explique par ailleurs de ses raisons d'attribuer à la sous-espèce *C. l. subcalcaratus* les spécimens de l'espèce *Calcarius lapponicus* (Bruant lapon) de l'est nord-américain. Des notes sur 10 espèces de mammifères actuellement ou antérieurement présentes dans les parages figurent également dans ce rapport. Les lemmings en étaient au point culminant de leur cycle à l'île Kugong au printemps et au début de l'été, mais ils étaient à peu près disparus septembre venu. Il est fait état de considération à propos de faits pertinents à la question du synchronisme en présence de barrières d'eau et de glace. Quelque 61% des lemmings pris au piège étaient femelles alors qu'étaient des mâles 67% de ceux qu'avait pris un chien d'arrêt. La différence est significative: ($P < 0.005$). On a recueilli 264 mammifères en tout.

Introduction

In 1971 I was on the islands off the east coast of Hudson Bay from May 3 to September 23. The main purpose of the trip was to snare and tag polar bears, under a contract from the Canadian Wildlife Service (CWS). A subsidiary purpose was to make a general biological survey of the places visited. I was accompanied by Brenda Carter, a wildlife and landscape artist.

In the early spring of 1973 we visited the Belcher Islands for 5 days, March 28 to April 1, and flew 25 hours by helicopter in search of bears. The purpose of this paper is to summarise our observations of birds and mammals and to amplify the meagre information hitherto available on these little-studied islands.

The first zoological expedition to the Belcher Islands was that of O. J. Murie on behalf of the Carnegie Museum. Between August 14 and 30, 1915, he visited Tukarak Island, the north end of Flaherty Island and Moore Island (Todd 1963). In 1938 J. K. Douitt and A. C. Twomey, also from the Carnegie Museum, spent from April 13 to near the end of August based at the Hudson's Bay Co. post on Tukarak Island. Most of their collecting was done on that island but they made brief trips to Flaherty Island. On August 17 they visited the north end of Johnson Island, one of the North Belcher Islands, and between August 18 and 22 the Sleeper Islands (Douitt 1939, Twomey and Herrick 1942, Todd 1963). Todd (1963) evidently considered that the latter period was spent at the 'North Sleepers' which he equated with the Marcopeet Islands. These islands are, however, little more than raised shoals of rock and pebbles, with scarcely any vegetation and it seems unlikely that the birds recorded would have been seen there. There is no good harbour and I could not persuade the Eskimos to remain there overnight on either of my earlier visits in 1944 or 1971. The Marcopeet Islands are, moreover, about 30 km north

of the north end of the Sleeper Islands, and Twomey (Twomey and Herrick 1942) neither mentions this crossing nor indicates it on his route map. Also the termination of their voyage is clearly shown on the map in Douitt (1939) to be at the north end of Kidney Island. There can therefore be no doubt that the records which Todd (1963) attributes to the Marcopeet Islands refer to the north end of the Sleeper Islands. The ornithological results of both the above Carnegie Museum expeditions were recorded for the first time by Todd (1963). Freeman (1970*a, b*), who spent the summers of 1959 and 1960 and the late winter of 1961 on the Belcher Islands, mostly between the southwest corner of Kasegalik Lake and Kasegalik River mouth, includes a summary of previous observations on the birds, together with his own records. I have not repeated this in the text, but I have provided a list (App. 1) of the species previously recorded. This includes nine species listed by Todd (1963) but omitted by Freeman (1970*a*).

We selected Kugong Island for our base camp because its westerly position, near the main Hudson Bay pack ice, made it a likely place for bears. It was also interesting because it had not been visited by Murie, Douitt or Twomey (Todd 1963), or in summer by Freeman (1970*a*). Our visit to the Sleeper, Ottawa and King George Islands was brief and rather late in the season. As far as I know these islands have not been visited by an ornithologist since I was there in 1944. In this paper I have referred only occasionally to my earlier records (Manning 1946, 1949).

Two hundred and two specimens of birds were collected for the Royal Ontario Museum and 264 specimens of mammals for the Royal Ontario Museum and the National Museum of Natural Sciences.

Itinerary

We arrived at Sanikiluaq (Belcher Islands settlement) on May 3 and left for Kugong Island by skidoo the following day. On May 6 we established our camp ($56^{\circ}12'N$, $80^{\circ}00'W$) near a small brook about 5 km from the south point of the island (Fig. 1). We remained there until June 19 working within a radius of about 6 km of our camp. On that date we went about 16 km north along the coast by canoe but were stopped by ice and returned on June 21. The period from June 27 to July 1 was spent on the southwest coast ($56^{\circ}11'N$, $80^{\circ}05'W$). On July 9 we left for Sanikiluaq by canoe, but were held up by ice and weather until July 14 at $56^{\circ}19'N$, $79^{\circ}39'W$ near the mouth of a small brook which flows from the only known fish lake on Kugong Island. We were again blocked by ice for two days at Howard Point on Flaherty Island. From July 16 to 20 we camped on the west side of Eskimo Harbour at latitude $56^{\circ}36'N$. On July 20 we were picked up by a Peterhead boat, the *Tudlik*. During the next two weeks we visited various places on the Belcher and North Belcher Islands looking for bears. The overnight stops are shown on the map.

We arrived on the Sleeper Islands on August 4, and camped near the southwest point of Kidney Island until August 10 when we moved to the northeast end of the island (Fig. 2). There we were held up by weather until August 16. The southeastern part of Kidney Island was visited several times on foot and by boat, and on August 5 we went to Digit Point and landed on two of the small islands between it and Kidney Island. We reached the Ottawa Islands via Port Harrison on August 18 and camped at Murray Harbour on Gilmore Island until August 24, then sailed south along the west side of the Ottawa Islands and back to Port Harrison. We camped at my 1944 campsite on Driftwood Island, one of the King George Islands, from August 28

until September 2 when we were picked up by the longliner *Joan Ryan* from the Belcher Islands. Next day we reached our base camp on Kugong Island and remained there until September 22 when we returned to Sanikiluaq by canoe.

Figure 1
The Belcher Islands

- Peterhead boat route
- Canoe route
- - - - - Peterhead boat and canoe route
- Overnight stops
- Other stops: 1, Base camp; 2, Kasegalik River mouth; 3, Samikiluaq Settlement; 4, Fish Lake; 5, The Bluff; 6, South Camp; 7, Site of old Hudson's Bay Co. Post

Figure 1

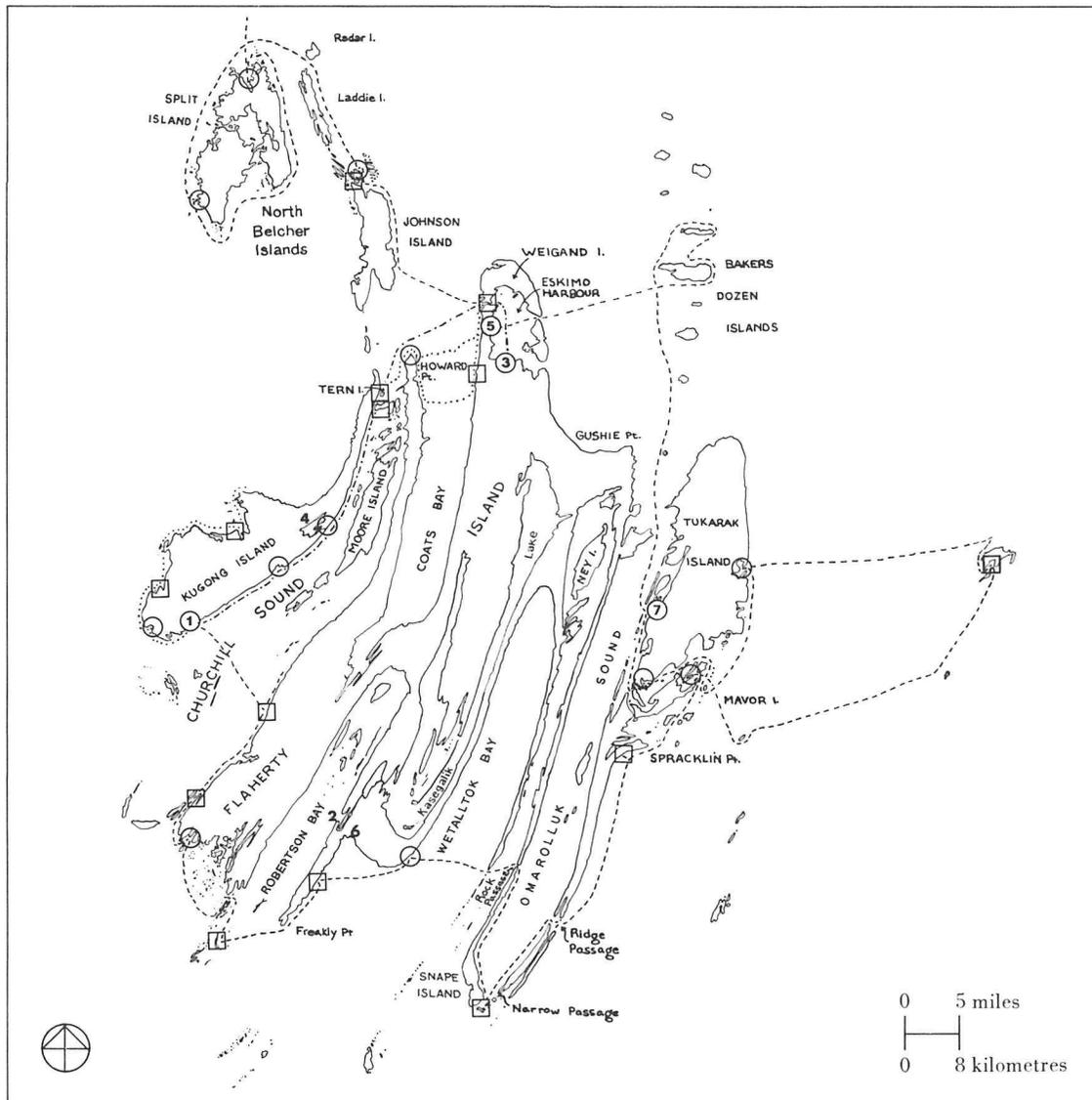
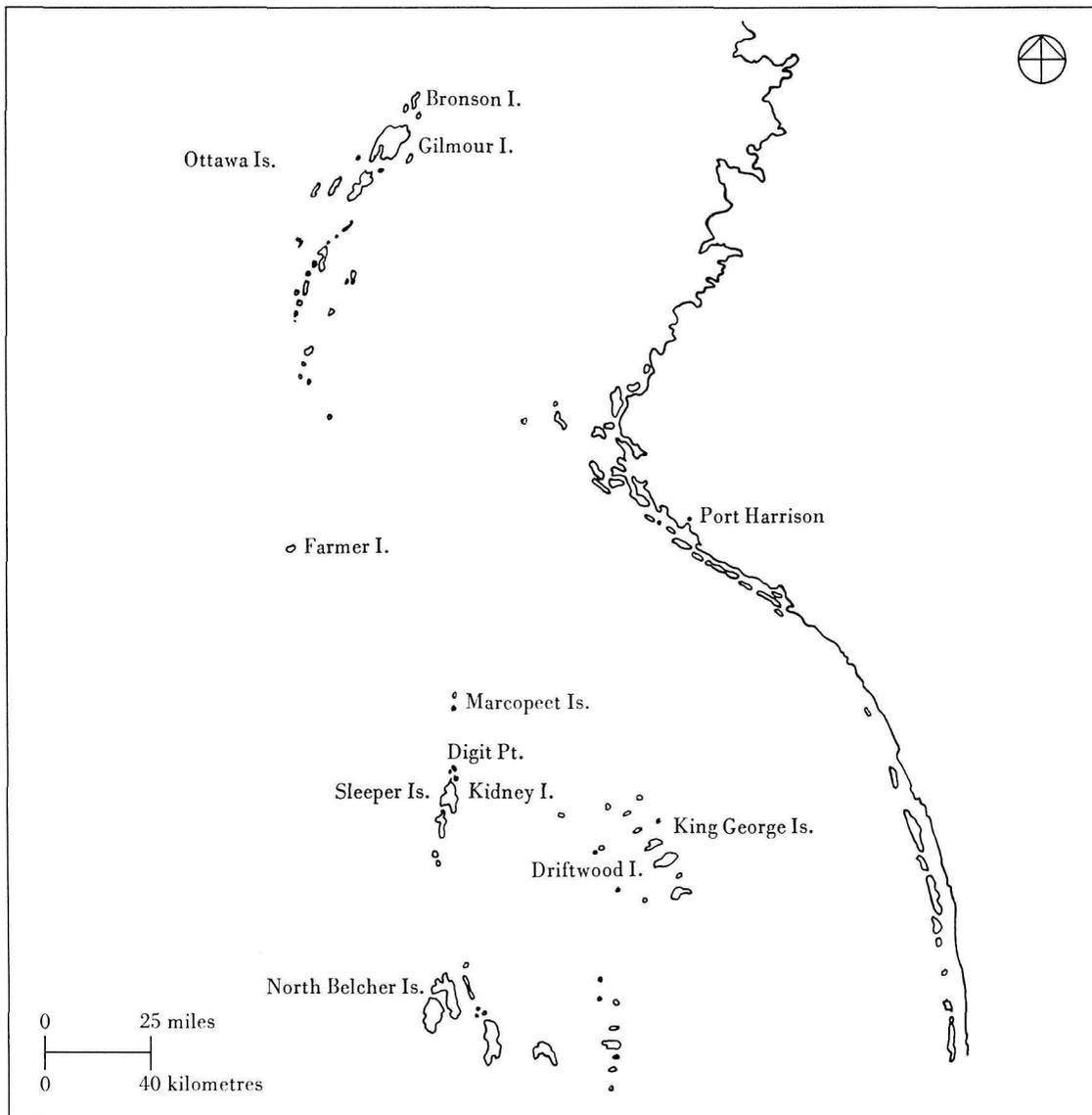


Figure 2
The Ottawa, Marcopect, Sleeper and King George islands

Figure 2



Phenology

The last few days of April and the first week of May were exceptionally warm and fine on the Belcher Islands. On May 4 the flat ice between the islands was bare of snow and there was standing water in places. On May 6 Kugong Island was two-thirds to three-quarters snow free. The brooks were then at their deepest, but some tundra areas were drier than at any other time during the summer. Thereafter the weather turned cold, and with very few exceptions remained cold, wet, windy and foggy throughout the summer. I believe the bad weather had an adverse effect on nesting success, and may have delayed or prevented some individuals of several species from breeding. According to Doult and Twomey (Todd 1963), in 1938 the shore birds and passerines arrived suddenly after the middle of May. This was also our experience in 1971. They did not, however, as in 1938, immediately start nesting or even singing. Indeed nesting seemed late even by much more northerly standards; for instance, the flight song of the Lapland Longspur (*Calcarius lapponicus*) was not heard until June 5, and that of the Purple Sandpiper (*Erolia maritima*) not until June 6. No Lapland Longspur nests were found, and the Purple Sandpiper apparently did not start nesting until well into the latter half of June. On the other hand, our dates (Table 1) for the events listed by Freeman (1970b, Table 2) are in several instances earlier than his. Except for the evenings of the two days mentioned in Table 1, mosquitoes were never troublesome and seldom seen.

Table 1

Phenological data for Kugong Island	
Running water on tundra	Before May 3
First <i>Saxifraga oppositifolia</i> flower seen	May 18
First Canada Goose nest (three eggs)	May 19
New ice still on rock pools at midday	May 20
Snow cover less than one tenth	May 25
<i>Saxifraga oppositifolia</i> flowers plentiful	May 28
First night without frost	May 28
Last snow fell	June 8
Fine warm day, first blowflies seen, and many birds singing for first time	June 12
Ice moved out of Churchill Sound opposite camp	June 15
First mosquitoes	June 16
First Semipalmated Plover nest (three eggs)	June 18
Mosquitoes troublesome for first time	July 3
Mosquitoes troublesome for second and last time	July 28

Islands visited

Kugong Island: 330 km². May 5 to July 14, September 3 to 22. Timed walks; 173 hours. Time in canoe; about 40 hours. The island consists almost entirely of pillow lava which forms low, rounded, heavily glaciated hills and ridges running parallel with the main axis of the island. Lakes cover about 15% of the island, and another 35% is bare rock, or in a few places pebble ridges. The remaining 50% is vegetated: dry slopes and uplands, with caribou lichen and dryas dominant, occupy about 20%; slightly wetter areas with low creeping willows dominant, 5%; large tussocks of peat- or turf-covered rocks with sedges dominant and mosses and lichens abundant, 12%; smaller tussocks with sedges, bilberry, willow and dryas, 8%; wet to very wet marsh with sedges, willows and mosses, and sedges and mosses alone in the wettest places, 5%.

North Belcher Islands: August 1 to 4. Ashore 6 hours on Split Island. Its eastern half appears rocky but the western half is low and flat and probably rather marshy, with raised beaches, mainly of pebbles, in some areas. Large heaps of kelp along the west coast make attractive feeding places for shore birds. Johnson and Laddie Islands are barren and rocky. **Kidney Island:** 39 km². August 4 to 16. Timed walks; 18 hours. **Gilmore Island:** 65 km². August 18 to 24. Timed walks; 15 hours. **Driftwood Island:** 30 km². August 28 to September 2. Timed walks; 6 hours.

For descriptions of Kidney, Gilmore and Driftwood Islands see Manning (1946).

Method of estimating bird populations

Population estimates were made in the manner described by Manning, Höhn and Macpherson (1956, pp. 6-7), with some allowance for the difficulty of seeing small birds, particularly passerines, in bad weather.

Daily records were kept of the numbers of birds seen and the hours spent observing and walking. To obtain the number of birds of each species per square mile (2.6 km²), and hence the population of an island, the number seen was multiplied by an index figure, varying from 1 to 10, listed by Manning *et al.* (1956, Table I) and the result divided by the hours of observation. Manning *et al.* stated "To arrive at the estimates it was necessary to assume that the time spent observing was divided proportionately to the area of the different biomes at each station, and also to consider the different distances at which the various species can be seen, as well as the proportion which actually were seen." I have used this method consistently in a variety of localities across the northern mainland and in the arctic islands. Any census technique, and particularly any method using only a single visit to a site, must include some subjective elements. Although this one was no exception, it has the merit of simplicity and a fair degree of reproducibility.

Weights and fat grades

Most specimens up to 1500 g were weighed on a triple beam balance; those over that weight on a spring balance. Fatness was estimated on a scale which I have used since 1957 (Macpherson and Manning 1959). It is graded from 1 (very thin) to 6 (very fat), though in practice grades 1 and 6 were seldom used. A similar scale with grades 0–5 was proposed by McCabe (1943). The main difference appears to be that I have attempted to adjust the scale for each species, so that the amount of fat on a grade 5 Lapland Longspur would not be the same as that on a grade 5 Rock Ptarmigan (*Lagopus mutus*) or even a grade 5 Water Pipit (*Anthus spinoletta*). McCabe, on the other hand, apparently only made allowances in extreme cases. Any such scale is, of course, subjective and mine depends on memory of how fat each species may get. Nonetheless, there appears to be a reasonably high correlation between fat grade and weight so that weights may be reduced to a standard fatness (see Horned Lark p. 26, and Lapland Longspur p. 27).

Birds

Loon, *Gavia* sp.

All loons were rather scarce in the vicinity of base camp but apparently commoner further north, particularly near the fish lake.

Common Loon, *Gavia immer* (Brünnich)

Kugong Island. Estimated population 20. Nests on Flaherty Island (Freeman 1970a) and presumably on Kugong Island. First seen on June 3, on open water at mouth of brook. Last heard on September 18. Female collected June 9 (3.5 kg, fat 2, largest ovum 7 mm). **Split Island.** One seen on August 3. **Kidney Island.** One heard on August 8.

Arctic Loon, *Gavia arctica pacifica* (Lawrence)

Kugong Island. Estimated population 30. First seen on June 9. First pair (?) on June 14 at sea. Nest with one egg was found 16 km northeast of base camp on June 20. **Kidney Island.** Estimated population 12. A pair on August 6 behaved as though they had young.

Red-throated Loon, *Gavia stellata* (Pontoppidan)

Kugong Island. Estimated population 50. Nests on Tukarak and Flaherty islands (Todd 1963) and almost certainly on Kugong Island. First seen May 27. On June 8 two flocks of about eight were seen flying over Kugong Island. Last seen on September 14, on west side of Kugong Island. **Kidney Island.** Estimated population 30. Two three-quarters grown young seen with their parents on August 8. **Driftwood Island.** An occasional Red-throated Loon flew over our camp between August 28 and September 2.

Whistling Swan, *Olor columbianus* (Ord)

Kugong Island. One flew west over camp on May 27. The Eskimos we asked knew of no swans

having nested anywhere on the Belcher Islands in recent years (*cf.* Freeman 1970*a*) but they do appear to have nested on Kugong Island and/or the North Belcher Islands as recently as 1938 (Todd 1963).

Canada Goose, *Branta canadensis* interior Todd

Kugong Island. Estimated population 1200. Nests throughout the island. Nests were particularly numerous near our base camp where there was less bare rock than in most other parts of the island, and where hummocks formed by peat or by rocks covered by vegetation were plentiful. Except for one nest near the shore, built on top of what appeared to be an old eider nest, all nests found were on such hummocks.

According to the Eskimos, few Canada Geese had been seen before our arrival on May 4. Twenty-five were seen in small groups on our way south along Kugong Island on May 5 and the next day they were plentiful in the vicinity of our base camp. There was a slight increase between that date and May 10, when the main migration appeared to be over. By May 12, several pairs seemed to be occupying territories, though some of these were later abandoned. By May 22, four-fifths of the geese were in pairs, the remainder in small flocks. The first nest (three eggs) was found on May 19. Next day two more nests, each with three eggs, were found. On May 28 the parents were collected from a nest containing five slightly incubated eggs. The first young, five downies still in the nest, were seen on June 20 (male collected, 94.7 g), and most eggs were hatched by June 27. The last unhatched egg (pipped) was seen on July 4. This was in a nest which contained one egg on May 28 and one on June 1, but three (one pipped) on July 3. The only other nest visited more than once while laying was in progress had three eggs on May 25,

four on May 28, and five on May 29 and June 1. Both nests suggest rather erratic laying unless eggs had been removed by predators. A goose collected on June 13 had three empty follicles, but only two eggs in the nest. Twenty nests were checked on or after June 5, by which date most original clutches should have been complete. Six nests had two eggs, two nests had three eggs, seven nests four eggs and five nests five eggs. The mean, 3.55 eggs per nest, is actually lower than the mean, 4.2 eggs per nest, for 11 nests found before June 5, though some of these were probably not full clutches. Possibly some of the smaller clutches, found after June 5, were second nesting attempts, made after the original nests had been destroyed by predators. MacInnes (1962) did not detect any re-nesting of Canada Geese at MacConnell River on the west side of Hudson Bay, but it appears to be quite common in more southerly regions (Brakhage 1965). Throughout the nesting season, there were more pairs apparently without nests than there were with nests and I found at least 20 destroyed nests. The Eskimos also remarked on the poor nesting success on other parts of the Belcher Islands and believed it was due to the large fox population. The bad weather may also have contributed. The mean length and breadth of 58 eggs from 15 nests, calculated from the unweighted means of 15 clutches was 84.27 ± 0.537 and 56.26 ± 0.329 mm respectively.

After July 4, geese became much less numerous near our camp. Perhaps they had moved to the other side of the island, where during a brief visit on September 14, I noticed an abundance of droppings. Between September 4 and 15 two or three small flocks were seen each day, after which Sightings became less frequent, and by the time we left on September 22 most of the geese seemed to have departed. The specimens collected are listed in Table 2.

Table 2
Weight, fat grade and breeding condition of adult Canada Geese (*B. c. interior*) collected on Kugong Island

Males				Females			
Date	Weight (kg)	Fat grade	Testis (mm)	Date	Weight (kg)	Fat grade	Remarks
May 19	3.8	3	—	May 11	—	5	Ovary granular
May 23	3.7	1	18	May 23	3.3	4	Nesting
May 31	3.7	2	27	June 1	3.6	3	4 empty follicles
June 13	3.5	1	20	June 1	3.2	3	Nesting
				June 13	2.8	2	Nesting

Split Island. There were no young in the two flocks (20 geese) seen, but the low, apparently well-vegetated terrain of the western part of the island appeared suitable for nesting, and the large quantity of droppings indicated a high goose density at times. **Kidney Island.** Estimated population 200. Probably breeds, but no nests or young seen. **Gilmore Island.** Sixty seen in three flocks, perhaps migrants. **Driftwood Island.** One hundred seen in three flocks. Probably nests.

Canada Goose, *Branta canadensis hutchinsii* (Richardson)

Kugong Island. Apparently fairly common during the fall migration. First definitely identified on September 17, when an adult female (1.60 kg, fat 3) was collected from a flock of 15. On September 19 an adult male (2.0 kg, fat 4) and female (1.77 kg, fat 4) were collected, a third goose with them was probably a juvenile. A flock of 15 was seen on September 22.

Brant, *Branta bernicla hrota* (Müller)

Kugong Island. Apparently occurs irregularly in migration. Four flocks of from 12 to 30 were seen between June 12 and 17. On the latter date, a male (1.19 kg, testis 15 mm, fat 3) was collected. On September 21, a 20-year old Eskimo shot a young brant, apparently the first he had ever seen.

Snow Goose, *Chen caerulescens caerulescens* (Linnaeus)

Kugong Island. An abundant spring and fall migrant, though in spring most flocks may not land. First recorded on May 20, when one white- and three blue-phase birds were feeding on the tundra. The last spring record was June 12, when one blue and one white were seen flying west-southwest. Between those dates the following numbers were counted in flight: May 25, 25; May 27, 40 (four also seen on ground); May 28, 20; June 2, 400; June 5, 20; June 8, 1800. All those seen on June 8 were flying north-northeast and passed between 0830 and 1000 hours. There was a very light south wind at the time and snow flurries later in the day. On June 7 a very thin (1.93 kg) immature white female was collected while standing with a flock of Canada Geese.

Some Snow Geese may have passed Kugong Island before our return on September 3. I saw a flock of 15 on September 4 and between that date and September 15 a few small flocks flew over. On September 16 about 20 flocks passed, flying south-southwest to southwest. The largest flock consisted of about 30 geese. We saw two flocks land, and next day we saw 300 geese on the tundra during a 2-hour walk (blue juv. female collected, 1.67 kg, fat 2). Most had left by the following morning (white juv. female collected, 1.325 kg, fat 1) and none was seen after that. In the spring, about two-thirds of the geese seen

were blue, but in the fall that proportion was reversed. **Gilmore Island.** A flock of five flew over on August 21. **Driftwood Island.** Three flocks of about 25 were seen on August 29 and 30.

Black Duck, *Anas rubripes* Brewster
Kugong Island. Scarce. According to the Eskimos does not breed on the Belcher Islands (Freeman 1970a). Two seen together by Carter on June 3. **Split Island.** Two males (testes 12 mm in both), shot near north end by Eskimos on August 3, were collected. **Kidney Island.** Two seen flying near Digit Point on August 5.

Pintail, *Anas acuta* Linnaeus
Kugong Island. Estimated population 50. Nests on Flaherty Island (Freeman 1970a) and probably on Kugong Island. First seen (two pairs) on May 8 (male collected, 0.80 kg, testis 45 mm). Thirty three recorded on walks between that date and our departure on July 14. A pair collected on June 1 (male, 0.84 kg, testis 42 mm, fat 3; female, 0.75 kg, largest ovum 7 mm, fat 4). None seen after our return on September 3. **Split Island.** Seven seen. **Kidney Island.** Five seen, female collected on August 8 (0.73 kg, largest ovum 1 mm, fat 4). **Driftwood Island.** Nested in 1944 (Manning 1946). None seen in 1971.

Scaup, *Aythya* sp.
Kugong Island. A pair was seen in open water in front of our camp in early June. The only other record for the Belcher Islands appears to be three identified as Greater Scaups, *A. marila*, by A. C. Twomey on May 30, 1938 (Todd 1963).

Common Goldeneye, *Bucephala clangula americana* (Bonaparte)
Kugong Island. Not known to breed on the Belcher Islands (Todd 1963, Freeman 1970a) and

not seen inland on Kugong Island by us. Fairly common on the sea near our camp and around the south coast, also probably on the west coast where about 200 were seen on September 14. First seen on June 11, when there was a flock of eight on a patch of open water near camp and 200 on open water 3 km to the south. **Kidney Island.** Twenty seen (male collected, 1.00 kg, testes 8 mm, fat 4) at sea near the northeast point on August 13.

Oldsquaw, *Clangula hyemalis* (Linnaeus)
Kugong Island. Estimated population 500 (excluding offshore islands). This figure, based on the number seen inland during the last half of July, appears low in relation to the number seen on the sea in the fall, even when allowance is made for young.

The first Oldsquaws were recorded on May 16, when two were heard flying over our tent. On May 25 a pair landed on the open water near camp and after May 27 there were usually about 25 there. After breakup on June 15, there were about 10 per square kilometre of sea near the southeast point of the island. Later in the month the number gradually decreased both there and further north along the east coast. By July 1 there were only scattered individuals, perhaps not more than 0.75 per square kilometre.

After June 2, pairs were regularly seen flying inland. The testis length of a male collected on June 7 was 24 mm (fat 3) and the largest ovum of a female taken the same day was 4 mm (fat 3). A female shot on June 18 had no empty follicles, the largest ovum was 24 mm and most of the females seen inland as late as July 4 were accompanied by males. No nests were found inland and perhaps fewer than usual nested successfully owing to the bad weather and high fox population (*cf.* Kidney Island p. 16, and Canada Goose, p. 13). On July 14 two nests were found on

'Tern' Island and on July 29, 15 females were counted there and two more nests seen. A careful search would probably have located other nests.

When we returned to Kugong Island on September 3, there was a flock of 150 Oldsquaws on the bay near base camp, and from then until we left on September 22 a flock of about 50 was frequently seen near camp. On September 14 a flock of 200 as well as smaller flocks totalling about 300 were seen along the southern half of the west coast, and on September 22 we saw many large flocks as we went north along the east coast, so that the total coastal population of Kugong Island at that time was probably about 2500.

Kidney Island. In 1944 I recorded 165 Oldsquaws during 8½ hours walking between August 18 and 21 (Manning 1946). In 1971 only six were seen between August 4 and 16 in 18 hours walking. Also, whereas a large number of flightless young were seen on the sea near Kidney Island in 1944, no young were seen in 1971.

Driftwood Island. Nested in 1944 (Manning 1946). Not seen in 1971 between August 28 and September 2.

Common Eider, *Somateria mollissima sedentaria* Snyder

Kugong Island. Nests abundantly on small offshore islands, less frequently on islands in lakes. Winters in open water about the Belcher Islands (Freeman 1970*b*). The first eiders (four males, one female) were seen in open water near camp on May 24. By May 27 this pool was 150 m in diameter and usually occupied by about 30 eiders. At first they were mostly males, but the proportion of females gradually increased until June 11 when the sexes were about equal. On June 3, 150 were seen in a pool 300 m across off the point 3 km to the south; by June 11 they

numbered 300. On June 15 and 19 there were about 40 eiders per square kilometre of coastal water along the southern half of the east coast. After that their number decreased to about eight per square kilometre (*cf.* Freeman 1970*b*).

In 1971 the nesting season appeared to be at least a week later at Kugong Island than at the Robertson Bay colonies in 1960 (Freeman 1970*b*) or at the small island east of Gushie Point in 1938 (Todd 1963). On June 19 two nests, one with one egg and one with two eggs, were found on a small island 16 km north of our base camp. There were also another eight nests in preparation, and judging by the number of eiders at least 25 nests were expected on the island. When visited on July 9, however, there was no sign of eiders. Probably a fox had been able to cross to the island on the pack ice. On June 21 there were four nests, containing four, three, two and one eggs respectively, on the island a mile east of base camp. On June 23, 35 nests, mostly with less than four eggs, were found on the island 1.5 km south of base camp. A more thorough search would probably have located a further 20 nests. On July 14 there were about 150 nesting females and about 40 males on 'Tern' Island. On July 29 most of the nests still contained eggs. There were young in three nests, but no family groups could be seen nearby although a few may have moved off. We saw only three males and from other observations it appeared that males remained with nesting females for about the first half of the incubation period (*cf.* Freeman 1970*b*). Egg counts were made of a random sample of nests from which it was believed no young had hatched: two nests had six eggs, 11 nests five eggs, 11 nests four eggs, one nest three eggs and two nests two eggs, giving a mean of 4.37 eggs per nest. This figure is similar to those recorded by Freeman (1970*b*). The only nests found inland were on islands in lakes. On June 28 I saw about

Table 3

Weight, fat grade and breeding condition of adult Common Eiders. The female collected on July 26 was found near the southeast end of Flaherty Island, unable to fly or walk. The remainder were collected on or near Kugong Island

Males			Females				
Date	Weight (kg)	Fat grade	Testis (mm)	Date	Weight (kg)	Fat grade	Remarks
June 15	2.9	4	36	June 15	3.0	5	Egg in oviduct, 2 empty follicles
June 15	2.8	3	40	June 27	2.4	4	Incubating patch
June 15	2.5	2	24	July 6	2.0	2	Incubating patch
June 27	2.5	4	37	July 6	2.2	3	Incubating patch
July 6	2.1	1	28	July 26	1.35	1	—
July 6	2.5	1	25				
Sept. 14	2.5	2	10				
Sept. 14	2.8	2	10				

25 males on an island in a deep lake near the southwest point of Kugong Island. No females were seen but some may have been concealed on their nests. On July 7 there were seven nesting females and a similar number of males on a small island in a shallow lake about 3 km northwest of base camp. I saw 15 males and a similar number of females on July 11, some or perhaps all of the latter with nests, on an island in the fish lake. As islands are fairly numerous in some of the large lakes which were not visited, it is possible that a significant proportion of the eiders seen near Kugong Island nest inland. Others may nest on the islands 8 km to the south. We saw few eiders and no evidence of nests on July 27 when passing by boat through the numerous islands off the southwest peninsula of Flaherty Island. Probably these islands are too rocky and barren (*cf.* Freeman 1970b).

I measured 68 eggs from 20 nests on small islands near Kugong Island. The mean lengths and breadths derived from the unweighted clutch means were 77.21 ± 0.546 and 50.85 ± 0.25 mm respectively.

Eiders were scarce along the east coast of Kugong Island on September 3 and 22. They were also scarce about our base camp between those dates. However, on September 14, 700 were seen in small scattered groups or large flocks between the southwest point of Kugong Island and the point on the west coast about 27 km to the north-

east. Males appeared to outnumber females and two flocks of about 100 each were all males. Only about 50 recognizable young were seen. The specimens collected are listed in Table 3.

Split Island. About 400 Common Eiders were seen on the north and west side of Split Island on August 1, and a similar number near the southeast and southwest points on August 3. Females considerably outnumbered males.

Kidney Island. Three hundred adults, but only 12 families were seen while circumnavigating Kidney Island and the small islands to the northwest on August 4 and 5. On two small islands where we landed there were a few old nests.

Marcopect Islands. Probably nests. About 200 females and 20 young but no males were seen.

Ottawa and Driftwood Islands. Very few eiders seen.

1973 observations

On March 29, 1973, I saw 200-300 Common Eiders from the air. They were mostly in flocks of about 50 near the Bakers Dozen Islands. Next day I estimated that we passed over 2000 in flocks of 50 to 100 between Radar Island and the Sleeper Islands. They were densely packed on small patches of open water between the floes. On April 1 there were 30 on the floe edge south of the Belcher Islands. No eiders were seen in James Bay until April 9 when there were 20 towards the northeast corner of the bay.

**King Eider, *Somateria spectabilis*
(Linnaeus)**

Kugong Island. Rather uncommon, presumably nests, probably on islands in lakes. Perhaps even less common on Tukarak and Flaherty Islands (*cf.* Todd 1963, Freeman 1970*a*). First seen (a pair) on the open water by base camp on June 4. Thereafter about one in 50 of the eiders seen there were King Eiders. On June 9 seven males and three females were seen. On June 18 a pair was seen inland and next day a pair was collected on the coast 16 km northeast (male, 1.67 kg, fat 2; female, 1.90 kg, fat 5). The female had four empty follicles and an egg in the oviduct.

Split Island. About 100 males were seen off north and west coasts, but no females identified.

Kidney Island. Six adult female eiders with 20 young, seen by Carter on a lake on August 7, were thought to be King Eiders.

**White-winged Scoter, *Melanitta deglandi*
(Bonaparte)**

Kugong Island. Common in June and July off the southeast coast. Most of the 100 scoters seen on June 11 in an open pool 3 km south of base camp were White-winged Scoters, as were most of the 200 seen near the south point on June 27. About 700 scoters were seen on canoe trips between the south point and the fish lake, and again most appeared to be White-winged Scoters.

Kidney Island. A male (1.77 kg, testis 15 mm, fat 2) shot by an Eskimo was collected on August 8.

**Surf Scoter, *Melanitta perspicillata*
(Linnaeus)**

**Black Scoter, *Melanitta nigra americana*
Swainson**

Kugong Island. Most scoters were seen too far away for these two species to be satisfactorily distinguished. Some dark winged scoters were

seen on June 11 and 27, and probably 100 or 200 of those seen from the canoe between June 15 and July 14 were also dark winged. A male Black Scoter (0.95 kg, testis 22 mm, fat 2) accompanied by a female was collected near the south shore on June 29. An Eskimo shot a Surf Scoter on July 24 near the south end of Tukarak Island.

American Merganser, *Mergus merganser americanus* Cassin

Red-breasted Merganser, *Mergus serrator serrator* Linnaeus

Kugong Island. There is no evidence that either species nests on Kugong Island though the American Merganser is known to do so on Flaherty Island (Freeman 1970*a*). Most of the mergansers seen were at sea and conditions were seldom satisfactory for specific identification. The first mergansers recorded were a pair of Red-breasted on a patch of open water near base camp on June 2. This species was not identified again until July 9 when one was seen at sea near the fish lake. Ten American Mergansers were seen on our first visit to the southwest coast on June 15, and 26 on our second, between June 27 and July 1. Four of these, all males, were on lakes (male collected, 1.60 kg, testis 19 mm, fat 2). On September 3, 20 mergansers were scattered along the eastern side of Kugong Island and a Red-breasted Merganser (testis 11 mm, fat 2) was collected. Five to 10 mergansers were usually recorded on visits to the south point between September 4 and 21, and 100 were seen on the south and west coasts on September 14, but none could be specifically identified. **Split Island.** Ten unidentified mergansers were seen near the north end on August 1. **Kidney Island.** Eight mergansers seen at sea between August 4 and 16. **Gilmore Island.** Twenty mergansers in Murray Harbour on August 18 were believed to be Red-breasted Mergansers.

Rough-legged Hawk, *Buteo lagopus scantijohannis* (Gmelin)

Kugong Island. A pair was occupying a cliff on the east coast about 20 km northeast of base camp on May 5. There was an occupied nest there on June 19 and two others between there and base camp. On June 15 an occupied nest was seen near the extreme west point, and another on June 27 about 3 km inland of there. Two single birds were also occasionally seen near cliffs, one of them 3 km east of base camp, the other on the southwest coast. There may have been two or three other nests near the northern part of the southwest coast, which was not visited during the breeding season, but apart from these the above records probably represent the total population. A Rough-legged Hawk seen on September 14 was the only one recorded after our return to Kugong Island on September 3.

Peregrine Falcon, *Falco peregrinus anatum* Bonaparte

In 1969 Ernie Sieber (pers. comm.) saw a nesting pair at the cliffs bordering the narrows at the north end of Johnson Island. We examined the area on July 31, but saw no sign of Peregrine Falcons. In 1975 Brian Yorga (pers. comm.) saw what he believed to be a nesting Peregrine Falcon near a hill, probably Salty Bill Hill, 16 km north of the old Hudson's Bay Co. post on Tukarak Island. This is probably 'Cruikshank Hill' where Twomey found a nest in 1938 (Todd 1963). Freeman (1970a) records several sightings.

Rock Ptarmigan, *Lagopus mutus rupestris* (Gmelin)

Kugong Island. Estimated population 400. Most of those seen in early May were already in pairs, though all were still pure white until May 10 (cf. Todd 1963), after which most females showed a few dark feathers. After May 10 pairs

Table 4
Weight, fat grade and breeding condition of adult Rock Ptarmigan collected on Kugong and Gilmore Islands

Males				Females			
Date	Weight (g)	Fat grade	Testis (mm)	Date	Weight (g)	Fat grade	Largest ovum (mm)
Kugong Island							
May 21	538	3	13	May 25	553	5	13
May 25	512	2	14	June 5	637	6	—†
May 25	531	—	—	*June 5	613	5	18§
*June 5	513	1	—	†June 16	618	—	—
†June 16	526	—	—	June 22	516	4	20¶
June 22	538	2	10	July 2	490	2	2¶
July 4	—	2	9	Sept. 17	541	2	Granular
Sept. 15	535	2	—	Sept. 17	537	2	Granular
Gilmore Island							
Aug. 22	—	3	5				
Aug. 22	500	3	5				

* † Pairs.

‡ Egg in oviduct, one empty follicle.

§ No empty follicles.

|| Egg in oviduct, 4 empty follicles.

¶ Incubating patch.

were often seen in the same areas, and may have been holding territories. Only one nest was found: it contained two eggs on June 26, six eggs on July 1 and seven on July 6. It was destroyed, probably by a fox, a few days later. At least until July 11 some males were regularly displaying, though they appeared to have left the females. About that date two or three males were often seen together. An occasional lone male displayed as late as September 15. Between September 3 and 22 about 100 ptarmigan were seen; 60 of these were in two flocks on the west coast and not observed closely. Fifteen were in one flock near the south coast, the remainder were single or in small groups near camp. No young birds were distinguished and the three specimens collected were all adults. I suspect that it had been a poor nesting season. **Split Island.** Three seen on August 1. **Kidney Island.** Very scarce, one seen. **Gilmore Island.** Four seen. The adult specimens collected are listed in Table 4.

The Kugong Island females are very grey, typical of *L. m. rupestris* and easily distinguishable from specimens of *L. m. saturatus* from Prince of Wales Island and Adelaide Peninsula. The males as usual were more variable. The mean straight-

ened wing lengths for eight males and eight females were 195.0 ± 1.34 and 187.9 ± 1.74 mm respectively. These figures do not differ appreciably from the means of comparable specimens (in the National Museum of Natural Sciences and the Royal Ontario Museum) from Baffin Island and the Labrador Peninsula (21 males, 194.0 ± 1.35 mm, 28 females, 186.7 ± 0.97), but the bills of the Kugong Island specimens were unusually large and heavy. The mean lengths, from the anterior edge of the nostril, of the eight males and eight females were 9.81 ± 0.193 and 9.25 ± 0.135 mm respectively. These means are significantly greater ($P < 0.05$) than those for the 12 males and 18 females from Baffin Island (9.25 ± 0.154 and 8.87 ± 0.100). The difference between the Kugong Island males and the 12 Ungava males is not significant but that between the Kugong Island females and the 19 Ungava females (8.78 ± 0.08 mm) is highly significant ($P < 0.005$). The evidence is a little conflicting but it certainly suggests that at least in the females there are differences between the Belcher Island and mainland ptarmigan, in which case the Belcher Island population is probably isolated and non-migratory. Since there is no reason to expect any direct contact between the populations of the Belcher Islands and Ottawa Islands the two male specimens from Gilmore Island have been kept separate. Their bill measurements were 9.8 and 9.7 mm.

Semipalmated Plover, *Charadrius semipalmatus* Bonaparte

Kugong Island. Estimated population 3000. One of the commonest birds. First seen May 26 after which they rapidly became plentiful along the shore. A nest which had three eggs on June 18 and four the next day was destroyed on June 23. A new nest, made about 10 m away, presumably by the same pair, contained one egg on July 1,

two eggs on July 3 and three eggs on July 6. No Semipalmated Plovers were seen after our return on September 3. The weights of a male and female collected on June 1 were 38.3 g (fat 2) and 46.1 g (fat 3) respectively. **Split Island.** Twenty seen in 400 m along west coast on August 2. **Kidney Island.** Eight seen between August 4 and 16. **Driftwood Island.** In 1944, 64 Semipalmated Plovers were seen between August 9 and 14. Since none were seen in 1971 they had probably migrated before August 28.

Smith (1969) reported finding mixed pairs of *C. hiaticula* and *C. semipalmatus* breeding in the Home Bay region of Baffin Island and concluded that they were morphs of a single species. His observations are so startling and at such variance with earlier reports (Kumlien 1879; Wynne-Edwards 1952) that they can hardly be accepted without confirmation. Prior to Smith's paper it was generally accepted that where the two forms overlapped in Baffin Island they behaved as full species (A.O.U. 1956). In the Bering Strait region the situation is less clear (Bock 1959), though evidence for intergradation is lacking (Vaurie 1964). Although Bock (1959) does not mention it, his figures for combined males and females show that specimens of *semipalmatus* from western North America have shorter wings ($P < 0.001$) and longer bills ($P \approx 0.001$) than those from the east. A similar difference between eastern and western *semipalmatus* is indicated by the measurements in Manning *et al.* (1956). The latter measurements also indicate that males have shorter wings than females ($P < 0.01$), though there is no significant difference in bill length.

Golden Plover, *Pluvialis dominica* dominica (Müller)

Kugong Island. A spring and fall migrant. First seen May 31 (male collected, 128.6 g, testis 12 mm, fat 3). Eight seen between that date and

June 6 inclusive. Between September 6 and 22, 25 plovers were seen, of which 8 were identified as Golden Plovers (female collected Sept. 17, 105.5 g, fat 2). **Kidney Island.** One or more flocks of about 10 large plovers were often seen near the north end August 10–13, though identification as Golden Plovers was not certain.

Driftwood Island. One or two frequently seen near camp. One shot on August 30 weighed 137.0 g (fat 3).

Black-bellied Plover, *Pluvialis squatarola* (Linnaeus)

Kugong Island. Apparently a fall migrant only. Not previously recorded from the Belcher Islands. Of the 25 plovers seen between September 6 and 22, 10 were identified as Black-bellied Plovers. A male (181.1 g, fat 3) and a female (172.5 g, fat 2) were collected on September 16.

Ruddy Turnstone, *Arenaria interpres morinella* (Linnaeus)

Kugong Island. Apparently a fall migrant only (*cf.* Todd 1963). Four or five regularly seen near base camp between September 3 and 18 (female (?) collected Sept. 13, 110.5 g, fat 4). **Split**

Island. On August 2 a male (fat 5) was collected from a flock of 20. **Kidney Island.** Between August 18 and 23, 1944, 86 were seen on Kidney Island and the small islands at Digit Point (Manning 1946), but none was seen at either place between August 4 and 16, 1971. I was therefore probably incorrect in thinking that they nested on the Sleeper and King George islands.

Driftwood Island. Several were frequently seen near camp between August 28 and September 2.

Greater Yellowlegs, *Tringa melanoluca* (Gmelin)

Kidney Island. A yellowlegs, tentatively identified as a Greater Yellowlegs was seen near

the north point on August 8. I saw a Greater Yellowlegs at the same place in 1944 (Manning 1946).

Purple Sandpiper, *Calidris maritima* (Brünnich)

Kugong Island. Estimated population 4000. Probably the commonest shorebird (*cf.* Freeman 1970a). First seen May 28, rapidly became numerous along the shore (female collected May 30, 70.8 g, fat 2). A few, mostly females, were seen inland at the beginning of June (female collected June 5, 75 g, fat 3), but during the first 10 days of that month most of those seen and collected on the shore were males (weights: 60.4 g, 62.8 g, 61.1 g, 63.1 g, 57.3 g; fat grades: 2, 3, 3, 3, 2). Flight songs were first heard on June 6, but not regularly until June 12. On June 15 a female was collected (fat 2) with a yolk in its oviduct and two empty follicles. On June 25, three females were collected: the first with largest ovum 15 mm and no empty follicles (90.5 g, fat 4), the second with three or four empty follicles (fat 2), and the third with an egg in the oviduct and two empty follicles (90.0 g, fat 2). A nest with four eggs was found on June 26, another with four eggs on June 27 and one with three eggs on July 13. Purple Sandpipers were very numerous near the fish lake between July 10 and 12, when 80 were seen in 8 hours walking inland. Many were nesting but there were also small groups of three and four, and one of eight. None was seen inland after our return on September 3, but there was often a group of three or four on the shore until September 8. **Split Island.** About 150 (female collected, ovary granular, fat 3) in flocks seen on the west coast on August 2. On August 3, 50 were seen near the north point and an adult male (fat 3) and four downy young were collected inland. The male was tending the young

and repeatedly returned to them. The female was not seen. **Kidney Island.** Twelve were seen between August 4 and 16. **Driftwood Island.** Fifteen seen on August 31 in 2 hours walk along mud flats.

White-rumped Sandpiper, *Calidris fuscicollis* (Vieillot)

Kugong Island. Apparently a fall migrant only (*cf.* Todd 1963 and Freeman 1970*a*). Small groups were occasionally seen along the shore after our return on September 3 and an adult male (46.0 g, fat 4) and adult female (62.5 g, fat 5) were collected on September 8. Observations on other islands suggest that they may have been more numerous in August, particularly on the kelp beds along the west coast. **Split Island.** Four hundred seen August 2 on west coast (male, fat 5 and female, fat 3, collected), and 200 seen next day near the north point. **Kidney Island.** Thirty seen on the beaches August 4–16. **Driftwood Island.** Two hundred (female collected, 51.5 g, fat 5) seen in 2 hours walking over mud flats on August 31.

Baird Sandpiper, *Calidris bairdii* (Coues)

Gilmore Island. Occasionally seen between August 18 and 24 along the shore of Murray Harbour, singly or in groups of up to eight (one collected August 23, fat 4).

Least Sandpiper, *Calidris minutilla* (Vieillot)

Kugong Island. Male (22.9 g, fat 4) collected on June 7 is perhaps the only record for the Belcher Islands. Freeman (1970*a*) states that Twomey and Herrick (1942) recorded Least Sandpipers breeding on Tukarak Island, but Todd (1963) does not mention this and I have not been able to find the reference in Twomey and Herrick (1942).

Dunlin, *Calidris alpina hudsonia* Todd

Kugong Island. A juvenile male (55.5 g, fat 2) was collected on the west coast on September 14. Although this is the only definite record of the Dunlin (*cf.* Freeman 1970*a*) for the main Belcher Island group, it appears likely in view of the Split Island observations that they may be common on the west coast of Kugong Island in August. **Split Island.** A hundred (two females collected, fat 3) were seen on August 2 on the west coast and three next day near the north point.

The recovery in Siberia of two Dunlins banded by Worth (Norton 1971) in Alaska leaves little doubt that MacLean and Holmes (1971) were correct in suggesting that the breeding population of northern Alaska migrates to Siberia and is referable to *C.a. sakhalina*. Judging by the means given in their Table 1 for culmen length and by standard deviations derived from the measurements of 18 male and 20 female *C.a. hudsonia* in the National Museum of Canada, about 84% of *C.a. sakhalina* and *C.a. hudsonia*, and 88% of *C.a. sakhalina* and *C.a. pacifica* are separable by this character. Culmen length is of little value for separating *hudsonia* and *pacifica* but as Todd (1953) points out, they can be distinguished in breeding plumage by the more heavily streaked throat of *hudsonia*.

Semipalmated Sandpiper, *Calidris pusilla* ssp.

Kugong Island. Estimated population 2000. First seen June 3 and regularly thereafter. Appeared to move inland at once, but flight song seldom heard before June 12. Female collected on July 2 had one empty follicle and its largest ovum was 13 mm. Nest with 4 eggs found on July 4. Most appeared to have departed before our return on September 3, the only record after this date being two juveniles seen on the west coast on September 14. **Split Island.** Two hundred

Table 5

Weight, fat grade, culmen length, bill breadth, and culmen length/bill breadth ratio of Semipalmated Sandpipers collected on Kugong Island. All are adults except the September female

Date	Weight (g)	Fat grade	Culmen (mm)	Bill breadth (mm)	Ratio
<i>Males</i>					
June 4	26.7	5	19.1	1.6	11.94
June 6	26.7	2	19.2	1.65	11.64
June 11	25.2	2	20.9	1.75	11.94
June 11	21.1	3	20.6	1.7	12.12
June 19	23.3	2	19.1	1.65	11.58
July 2	25.3	4	20.1	1.6	12.56
July 7	26.6	2	19.9	1.5	13.27
Mean	25.0	2.9	19.8	1.64	12.15
<i>Females</i>					
June 3	25.7	4	21.3	1.70	12.53
July 2	26.4	5	20.6	1.75	11.77
Sept. 14	28.4	5	18.9	1.95	9.69

seen on the west coast on August 2, and 30 next day near the north point. There were also a few inland. **Kidney Island.** Ten seen August 4–16. **Driftwood Island.** One hundred seen in 2 hours walk over mud flats on August 31.

The mean ratio of exposed culmen/bill breadth for the combined male and female series of June and July adult specimens (Table 5) is 12.15, which agrees closely with the ratio obtained previously for eastern specimens (Manning *et al.* 1956). The single September specimen, a juvenile, is closer to *C. p. pusilla* from the western arctic and may be a western migrant (*cf.* Ouellet *et al.* 1973). No name has been assigned to the eastern race because of difficulty in obtaining measurements of the type of *Hemipalmata minor* Lembeye.

Sanderling, *Crocethia alba* (Pallas)

Kugong Island. Four (female collected, 77.7 g, fat 5) seen on southwest coast on September 12. This is the only record for the Belcher Islands. In 1944 I thought I saw one on Kidney Island.

Northern Phalarope, *Lobipes lobatus* (Linnaeus)

Kugong Island. Estimated population 300. First seen (four together on a lake) by Carter on

June 5. Not seen again until June 13 when a pair was collected (male, 33.6 g, fat 3; female, 46.8 g, fat 4, one empty follicle, yolk in oviduct).

None seen after our return on September 3.

Split Island. One seen on west coast on August 1.

Kidney Island. Two seen on August 9.

Long-tailed Jaeger, *Stercorarius longicaudus pallescens* Løppenthin

Kugong Island. One seen on July 6. Seen by A. C. Twomey at the north end of Ney Island on May 28, 1937 (Todd 1963) and at the King George Islands by Manning (1946) in mid-August, 1944. Manning (1964) gives reasons for considering the nearctic population to be racially distinct from the palearctic.

Glaucous Gull, *Larus hyperboreus hyperboreus* Gunnerus

Kugong Island. Estimated population 300. Nests on islands in lakes and on rocky offshore islands. No cliff colonies known. May winter on open water near the Belcher Islands (*cf.* Todd 1963). First seen on May 5, but not common until May 19. Nest with three eggs (79 x 55, 77 x 54, 82 x 55 mm) found on June 21 on a small island 3 km east of base camp. The parents were collected (male, 1.77 g; female, 1.40 g) on July 9, at which time the eggs appeared to be about 5 days from hatching. Two days later a nest with three eggs (80 x 55, 75 x 55, 78 x 54 mm) was found on an island about 1.5 km south of base camp. The young, one barely able to fly, were still near the nest on September 3. On July 3 Carter found a nest with one pipped and one unpipped egg on a flat island in a lake. There was no change in the condition next day, and the pipped egg was collected and the downy young (80 g) hatched out and preserved. On July 7, three young (293, 254, 154 g), the smallest about 3 days old, and their parents

(male, 2.00 kg, fat 2; female, 1.45 kg, fat 2) were collected from a lake where they had nested. On July 11 four nests were seen on islands in the fish lake.

Glaucous Gulls comprised half of a loose flock of 30 to 70 gulls (10% young) which was usually seen near the south point between September 3 and 21.

Other Belcher Islands. The gulls at a small colony on an island cliff (56° 18' N, 78° 03' W) 23 miles east of Tukarak Island were almost certainly Glaucous Gulls. There was also a colony of about 20 pairs of Glaucous Gulls on an island cliff (55° 45' N, 79° 56' W) south of Flaherty Island. Half-grown young could be seen in one nest. **Split Island.** Fifteen seen while circumnavigating the island August 2–3. **Kidney Island.** Estimated population 20, including small islands offshore and to the north. **Gilmore Island.** Rather scarce, five seen while circumnavigating the island on August 23. **Driftwood Island.** Scarce, four seen.

Herring Gull, *Larus argentatus smithsonianus* Coues

Kugong Island. Estimated population 300. Nests on islands in lakes. First identified May 11 and regularly seen after May 17. Carter found a nest with one egg (77 x 48 mm) on June 21, and I saw another nest on June 26. Both were on small islands in lakes (female collected, July 1, 1.00 kg, fat 3). A loose flock of 100 was seen on the southwest coast on September 14, and about half of a flock of 30 to 70 gulls (10% young) often seen near the south point between September 3 and 21 were Herring Gulls. **Other Belcher Islands.** Appeared commoner than Glaucous Gulls on the more easterly Belcher Islands. A hundred seen on a small island about 5 km east of Gushie Point were probably nesting. **Split Island.** Thirty seen while circumnavigating the

island, August 1–3. **Kidney Island.** Estimated population 35, including small islands offshore and to the north. **Gilmore Island.** Moderately common but seldom seen in Murray Harbour. Ten seen while circumnavigating the island as well as 30 (50% young) in a flock on the north coast. Groups of 20, 25 and 30 gulls seen on August 24 on the Ottawa Islands south of Gilmore Island were almost certainly this species.

Arctic Tern, *Sterna paradisaea* Pontoppidan

Common only near their nesting colonies. First seen June 19 and occasionally thereafter at base camp. A few were often seen near shore at the fish lake July 9–14. On July 14 there were an estimated 500 at 'Tern' Island and a smaller island south of it. Most appeared to be nesting. Five nests were seen with two eggs, and three nests with one egg. One egg was broken and contained an embryo about four days from hatching. The colony was revisited on July 29 and 10 downies were seen on land. On that date four nests had one egg, one nest two eggs, and one nest one egg and one downy. Terns were not seen after our return on September 3. **Other Belcher Islands.** There was a group of 100 terns at Howard Point from July 14 to 16 apparently feeding at the tide rip and not nesting. Three hundred which flew up from the island 4.5 km east of Gushie Point may have been nesting. **Split Island.** Probably nests in fair numbers on the small gravel and pebble islands along the west side and off the southwest point. One hundred were seen flying over one such island on August 1, as well as scattered birds along the coast. **Kidney Island.** On August 5 about 100 were seen during a trip round Kidney Island and the small islands towards Digit Point. Frequently seen at other times, but nothing to compare with the 400 seen at Digit Point in 1944 (Manning 1946). **Driftwood Island.** Frequent-

ly seen near camp between August 28 and September 2, but not in large numbers, probably most had already left.

Thick-billed Murre, *Uria lomvia lomvia* (Linnaeus)

Ottawa Islands. One seen 32 km southeast of Pearly Island, and one near the northeast point of Bronson Island. Wanderers occasionally go as far south as the Belcher Islands (Todd 1963).

Black Guillemot, *Cephus grylle ultimus* Salomonsen

Kugong Island. Said to winter in open water near the Belcher Islands (Todd 1963). We saw none there between March 28 and April 1, 1973, although on April 9 we recorded 25 near the northeast corner of James Bay. A few may nest among the boulders on the southwest coast of Kugong Island and perhaps on the islands near the west coast but we saw no evidence that they nested on the east coast. First seen (200, mostly in large flocks) on June 15 when the ice moved out sufficiently for us to canoe to the south point. On similar trips on June 27 and July 1 only four were seen. None was seen north of base camp during canoe trips on June 19 or 21 and only six on July 9. Ten were seen north of the fish lake on July 14. A few guillemots were regularly seen south of base camp after our return on September 3 (adult collected, September 5, 453 g) and there were about 50 near the islands 16 km up the west coast on September 14. **Other Belcher Islands.** Scattered guillemots were seen on our boat trip through the islands, but they were numerous only about the islands south of Snape Island. There, 300 were seen on the water or flying in and out of the crevices between the boulders where they presumably had nests. **North Belcher Islands.** There were scattered guillemots along the coasts of Johnson

and Laddie Islands on July 31 and August 1. Only one was seen near Split Island, but we were never close to the rocky east coast. **Kidney Island.** About 40 seen while we were circumnavigating Kidney Island and the small islands to the north (Digit Point) on August 5. Most were among the small islands at the south end of Kidney Island. The large numbers, some of which were nesting, recorded at Digit Point in 1944 (Manning 1946), were not seen in 1971. **Ottawa Islands.** Five hundred were seen at the northeast point of Bronson Island on August 23. Many were flying in and out of crevices among the boulders below a cliff and undoubtedly had young. Elsewhere amongst the Ottawa Islands they were scarcer than at the Sleeper Islands, an average of a little over one per kilometre being seen.

Snowy Owl, *Nyctea scandiaca* (Linnaeus)

Estimated population 50. First seen May 13. Gradually became more numerous toward the end of May. On May 13, Carter watched a very white owl displaying in an apparent attempt to attract her away from a nest. This display was again observed by us both on May 21 and on May 25 Carter found a nest with eight eggs. The white owl, which was the only one that displayed, proved to be the male. The female was very dark and easily distinguished. On June 26 there were only three young left in the nest, and we were not sure whether the older ones had left or the younger had died, probably the latter. On June 20 I found another nest with six eggs, measuring 56.1 x 45.3, 54.8 x 45.2, 55.5 x 45.3, 57.4 x 45.5, 57.8 x 44.4, 55.8 x 44.9 mm. A third nest with two young nearby was found on July 11.

Snowy Owls were almost twice as plentiful near our base camp after our return on September 3, but only one young was seen (September 16). Apparently either the young had left or had

not survived the reduction in the lemming population which occurred in August.

On September 12 a Snowy Owl and an arctic hare were seen about 3 m apart sheltering from a light wind under a cliff (see arctic hare).

Snowy Owls were not seen on the North Belcher, Sleeper, Ottawa, or King George Islands. Pellets found on Kidney Island contained bones of fox or hare, presumably the former since there are no hares (or lemming) on the Sleeper Islands.

Short-eared Owl, *Asio flammeus flammeus* (Pontoppidan)

Kugong Island. Two seen on May 28 and one on June 5. These appear to be the only records for the Belcher Islands.

Horned Lark, *Eremophila alpestris alpestris* (Linnaeus)

Kugong Island. Estimated population 2000. First seen May 8. Became numerous, at first mostly males, on suitable terrain after May 19. Only occasionally seen after our return on September 3. Last seen September 17.

The mean weights and fat grades for the specimens are given by months in Table 6. The weighted mean of the male and female correlation coefficients r is 0.77 and the weighted mean of the male and female regressions of weight on fat grade is 2.65 ± 0.48 g. The weights of males and females adjusted by this regression to a standard fat grade of 2 (no obvious fat) are 39.1 ± 0.71 and 35.0 ± 1.01 g respectively.

Table 6
Mean weights and fat grades by months of adult Horned Larks collected on Kugong Island

Date	Males			Females		
	No.	Weight (g)	Fat grades	No.	Weight (g)	Fat grades
May	5	44.0	4.0	3	33.5	2.0
June	7	37.8	2.0	3	40.7	4.0
July	4	42.3	2.5	2	39.0	3.0
All months	16	40.9 ± 0.86	2.7 ± 0.28	8	37.6 ± 1.61	3.0 ± 0.38

The largest ovum in the three females collected between May 21 and 31 measured 1, 1 and 2 mm respectively, and that of the female collected on June 10, 5 mm. None had empty follicles. The four females taken between June 19 and July 1 all had incubating patches. **Kidney Island.** Estimated population 100, mostly on the southern part of the island which was not visited in 1944 (Manning 1946). **Driftwood Island.** Two seen near shore on August 31.

Common Raven, *Corvus corax principalis* Ridgway

Kugong Island. One seen on June 15 near the cliffs along the southwest coast, where it may have nested, and one near camp on September 4 and 5. **Other Belcher Islands.** One, which had been caught in a fox trap during the preceding winter, was picked up at Howard Point. One seen near Mavor Island on July 24, and two at the high, steep cliffs near Spracklin Point on July 25. **Gilmore Island.** One seen at north end on August 20, and five including four together on August 23 at Murray Harbour.

Brown Thrasher, *Toxostoma rufum rufum* (Linnaeus)

Kugong Island. An emaciated male Brown Thrasher (53.2 g, wing chord 101 mm, tail 118 mm), too weak to fly, was found sitting by the tent after 3 days of south and west winds and snow squalls. Freeman (1970a) also records a Brown Thrasher from the Belcher Islands.

Water Pipit, *Anthus spinoletta rubescens* (Tunstall)

Kugong Island. Estimated population 500. Common only in the more rocky areas. First seen about June 1 by Carter, next seen (one collected, 20.1 g, fat 3) on June 7. A nest with six eggs, well sheltered under an over-hanging ledge, was found

on June 27. Several pipits were seen after our return on September 3, but none after September 12. **Kidney Island.** Three pairs seen by Carter on August 9. **Gilmore Island.** Six seen August 19-23.

Black-throated Blue Warbler, *Dendroica caerulescens caerulescens* (Gmelin)

Zazalenchuk (1967) collected a Black-throated Blue Warbler at South Camp on October 20, 1966. The specimen was intended for the National Museum but is not in the collection.

Yellowthroat, *Geothlypis trichas trichas* (Linnaeus)

Kugong Island. A mummified specimen, probably from the preceding fall, was found near camp on May 16.

Redpoll, *Acanthis* sp.

Kugong Island. One seen near southwest coast on June 29.

Savannah Sparrow, *Passerculus sandwichensis labradorius* Howe

Kugong Island. Scarce. Probably nests in a few localities. On July 29, one was seen 16 km north of our base camp and on July 14, a pair appeared to have a nest in a patch of *Elymus arenarius* on 'Tern' Island. They were collected (male, fat 2; female, fat 2, incubating patch). Two other Savannah Sparrows were seen at the same place on July 29 and an apparent pair near The Bluff on Flaherty Island on July 17 (male collected) may also have had a nest in *Elymus*. **Split Island.** One seen on west coast on August 2.

Tree Sparrow, *Spizella arborea arborea* (Wilson)

Kugong Island. A Tree Sparrow, in rather exhausted condition, was seen sheltering from a

strong west wind on June 3. A. C. Twomey saw a few on Tukarak Island in May and June 1938 (Todd 1963).

Lapland Longspur, *Calcarius lapponicus subcalcaratus* (Brehm)

Kugong Island. Estimated population 6000. The commonest bird. First seen May 15, next May 20. Became common after May 24. First flight song heard June 5 but not frequently until June 12, perhaps because of the bad weather. Flight songs seemed to be less frequent than I remember from other years. No nests were found, and in early July a rather large number of females appeared to be without nests. A few males were still singing as late as July 5. Few Lapland Longspurs were seen between September 3 and 12, but after that their numbers increased until September 16, when 120 were seen in 3 hours walking. They were very wild and most had left by September 18. The comparatively small numbers remaining until we left on September 22 were, however, quite tame.

The mean weights and fat grades for the specimens are given by months in Table 7. The weighted mean of the male and female correlation coefficients r is 0.66 and the weighted mean of the male and female regressions of weight on fat grade is 1.65 ± 0.38 g. The weights of males and females adjusted by this regression to a standard fat grade of 2 (no obvious fat) are 28.3 ± 0.71 and 23.6 ± 1.10 g respectively. The largest ovum of five females collected before

Table 7
Mean weights and fat grades by months of adult and full-grown juvenile Lapland Longspurs collected on Kugong Island

Date	Males			Females		
	No.	Weight (g)	Fat grades	No.	Weight (g)	Fat grades
May	1	28.6	4.0	1	32.5	6.0
June	5	27.6	2.4	6	25.4	4.0
July	2	27.9	3.5	—	—	—
Sept.	5	29.1	3.8	7	29.3	4.9
All months	13	28.3 ± 0.59	3.2 ± 0.28	14	27.9 ± 0.76	4.6 ± 0.27

June 11 was 1 mm or less. The largest ovum of a female taken on that date was 8 mm and that of another with no empty follicles, taken on June 19, was 7 mm. A female taken on June 26 was the only one with an incubating patch. **Split Island.** Scarce. Two seen. **Kidney Island.** Estimated population 100. **Gilmour Island.** Fifteen seen, August 28–September 2.

From geographical considerations alone it appears unlikely that the European and eastern North American populations of *C. lapponicus* originated from a common gene pool separate from the Asiatic and western North American races. Furthermore, in a species as plastic as *C. lapponicus* morphological differences between populations on different sides of the Atlantic are to be expected. Some years ago I planned a detailed study of the races of *C. lapponicus* and examined and measured material in the Copenhagen Museum of Zoology and in the British Museum as well as in several museums in North America. I have not yet had an opportunity to bring representative material together or to analyse the measurements, but I have no hesitation in saying that I now (*cf.* Manning *et al.* 1956) agree with Salomonsen (1951) in recognising *C. l. subcalcaratus* as a race distinct from *C. l. lapponicus* of the palaearctic, and including in it all the nearctic populations, which were previously assigned to *C. l. lapponicus*. Salomonsen's statement (p. 523) that Greenland birds are slightly paler than the typical race, however, is rather misleading since although the feather edges may be lighter, they are, as he points out (p. 524), also narrower and the dark mesial portions are wider and blacker causing the specimen as a whole to appear darker. I have not been able to compare a good fresh fall series of *C. l. alascensis* directly with topotypical *C. l. lapponicus*, but I believe it resembles that race more closely in both colour and size than it does *C. l. subcalcaratus*, or than

C. l. subcalcaratus resembles *C. l. lapponicus*. Perhaps that is why Salomonsen considered *C. l. alascensis* a poorly marked race.

Snow Bunting, *Plectrophenax nivalis nivalis* (Linnaeus)

Kugong Island. Estimated population 2000. A few males present when we arrived on May 6. First female not definitely identified until May 16. First flock seen May 25. A nest with six young about 1 week old was found on July 9. The first flying young were seen on July 24, near Mavor Island. Snow Buntings were rather scarce from September 3 to 16 but more numerous between September 16 and 22, when we left Kugong Island. The mean weights and fat grades of the four males and three females collected were 36.4 g, fat 3.8 and 31.7 g, fat 3.0 respectively. The specimens collected are listed in Table 8. **Split Island.** Twenty seen along shore August 2–3. **Kidney Island.** Estimated population 600. **Gilmore Island.** Five seen August 19–23. **Driftwood Island.** Thirty seen August 27–September 1.

Table 8
Weight, fat grade and breeding condition of the Snow Buntings collected on Kugong Island. All are adults except the September specimen

Date	Males			Females		
	Weight (g)	Fat grade	Testis length (mm)	Weight (g)	Fat grade	Largest ovum (mm)
May 26	—	—	—	33.2	3	1
May 27	37.2	4	7	31.7	3	1
May 27	31.4	3	5	—	—	—
June 2	—	2	8	—	3	1.5
June 11	40.3	5	8	30.3	2	1.3
Sept. 14	36.8	3	—	—	—	—

Mammals

Arctic hare, *Lepus arcticus* ssp.

The arctic hare occurs in moderate numbers throughout the southern Belcher Islands. I am not sure of its status on the North Belcher Islands. On Kugong Island it was commonest near the rugged south coast, where the population averaged about 0.5 to the square kilometre. Droppings were extremely plentiful on the small, high island (55°45'N, 79°56'W) 10 km southwest of Freakly Point. The first five hares collected were males (3.5, 3.5, 3.5, 3.5, 3.6 kg), and no young were seen, but there was a remnant of mammary tissue on the female (4.4 kg) taken on September 22.

On September 12 Carter and I saw an arctic hare and a Snowy Owl sheltering below a small cliff within about 3 m of each other. The owl flew as soon as it saw us come around a rock some 15 m distant, and a minute later the hare also saw us and bounded away. The hare, which was not protected in any way by the terrain, was in near-white pelage and very conspicuous against the snow-free land. Manniche (1910) writes, "I often observed owls and hares sitting close to each other showing no sign of hostility", but goes on to give one instance where two hares had apparently been attacked by a Snowy Owl and frightened into a cave. Unless the owl had designs on the hare and was waiting for it to move before attacking, it is difficult to see what had brought the two so close together. Lemmings, which had been abundant earlier in the summer, were then very scarce, yet owls, at least in that particular part of Kugong Island, were even more abundant and presumably utilizing some other prey (*cf.* Bent 1961). If, however, Snowy Owls are able to kill uninjured adult arctic hares it is difficult to see how any hares would survive, since they were certainly outnumbered by the owls and, in spring and fall, very conspicuous in their white pelage. Possibly their habit of lying

close to a rock (*cf.* Manniche 1910) and sometimes between two rocks is for protection from the air rather than concealment from ground enemies.

I saw no evidence of arctic hares on the Sleeper, Ottawa, or King George islands in 1944 or 1971, and it seems unlikely that they occur there.

Labrador varying lemming, *Dicrostonyx hudsonius* (Pallas)

Between May 7 and June 12, 1550 trap nights produced 186 lemmings, or 0.12 lemmings per trap night. All were preserved. Traps were set at likely holes and moved irregularly, but on average each trap was moved about twice. Undoubtedly more lemmings would have been caught if the traps had been moved more frequently. On May 15 lemming tracks were clearly visible in the snow which had fallen the previous evening. That day 12 lemmings were caught in 70 traps, but many had ignored the bait (peanut butter, rolled oats and raisins) and had run close by at least 40 traps, often two or three times. During the whole trapping period about one-third of the lemmings caught had been running through the traps rather than taking the bait. Except for a brief period, July 16 to 18, at the north end of Flaherty Island, no traps were set after June 12 as my Labrador retriever was catching all the lemmings I had time to skin.

Using the curve given by Hansen (1957) for the age-weight relationship of captive varying lemmings, it appears that 25 of the 392 lemmings taken between May 7 and June 8 had been born between April 6 and May 8. As pregnant females were also regularly taken in May and June, breeding had evidently been continuous through the spring thaw and apparently with little change in pace. The absence of the marked spring breeding hiatus observed on Prince of

Wales Island in 1958 (Manning and Macpherson 1961), or of a sudden increase in breeding activity with the disappearance of the snow as recorded by Krebs (1964) at Baker Lake between 1959 and 1962, may have resulted from two factors. One was the very ridged, broken and rather dry terrain of Kugong Island and the other Belcher Islands, with innumerable boulders under which lemmings could shelter and nest without danger from flooding. The other was the comparatively long, drawn-out spring thaw which had uncovered two-thirds of the land by May 5 but left one-tenth still covered on May 25. This long thaw period may be characteristic of the Belcher Islands where the surrounding sea moderates the winter climate and pack-ice prevents a rapid spring warm up (*cf.* Freeman 1970*b*). In 1971 the thaw period was further lengthened by exceptionally fine warm weather at the end of April and beginning of May, and unusually cold, wet and windy weather thereafter.

I have little doubt that there had also been some winter breeding of lemming, although at present the age of specimens over 35 g cannot be determined with any accuracy. Certainly the wintering population had been high. Winter nests left on the ground as the snow melted were plentiful and in some places, usually in the vicinity of peat tussocks or sheltering rocks, the sedges had been clipped down to the ground and the willow debarked. Between May 12 and 29 about 35 lemmings were found dead either by myself or my dog. All but five were in spring pelage and appeared recently dead. Eighteen (10 males, 8 females) were skinned and all showed some injury, usually to the back near the shoulders, though the skulls were intact. The first dead lemming with no obvious injury was found on June 1; after that fewer dead were found and none were skinned.

There may have been a slight decline in lemming numbers during May and a slight increase in June. Towards the end of May and the beginning of June there was some new digging in peat hummocks, probably due to lemmings moving back off the ridges as the land dried out. Fresh droppings and worn burrow entrances were plentiful until we left Kugong Island on July 14. When we returned on September 3 the lemmings had vanished and vegetation had started to grow up in the runways and at the entrances to burrows. My retriever found a few holes where there was still scent, but investigation invariably showed only an old nest, and the only lemming seen was a small one under our food cache.

In the latter half of July the lemming density on Flaherty and Tukarak Islands was similar to that on Kugong Island. The situation in September is unknown. At our two landing places on Split Island there were practically no lemming signs and no owls at the beginning of August. I think lemmings must have been scarce there for at least 10 months. On Driftwood Island there was abundant old sign with about the same amount of new growth on runways and burrow entrances as on Kugong Island in September. Certainly lemmings must have been numerous at least until early summer.

We saw no evidence of lemmings on the ice between the Belcher Islands in the spring of 1971. Under normal conditions there is probably little contact between the lemmings of Kugong, Flaherty and Tukarak Islands, or at least insufficient to account for continued cyclic synchrony, unless the few lemmings which may cross, carry disease. Contact between lemmings of the Belcher and King George Islands must be very rare indeed, since the Sleeper Islands have not been colonized and the three island groups are about equidistant. Likewise, it must be only in

exceptional circumstances that any lemmings from the mainland reach the King George Islands. Yet in 1944 there was an identical build-up of the populations at both places (Manning 1946). Similar cases of synchronous peak populations on apparently isolated islands were recorded by Manning and Macpherson (1950) in 1949, when either varying lemmings or fresh sign were abundant along the coasts of Hudson Bay and Foxe Basin from Long Island to Igloodik and from Igloodik to Churchill. Evidently desynchrony such as observed on Split Island is more unusual than synchrony (*cf.* Krebs 1964). Leslie (1959) has shown how similar weather conditions may bring divergent cycles into phase, but the actual conditions that may affect the lemmings is unknown. Island studies would seem to be one of the best ways to attack this problem (*cf.* Pruitt 1972).

An unusual proportion of the lemmings trapped during the May 7–20 period were very large. This shows clearly in the histogram for total length (Fig. 3) where the 150–159 mm class predominates. The first part of the trapping period, June 10–30, on Prince of Wales Island in 1958 was phenologically similar and lemmings (*D. torquatus*) were as abundant, but the 150–159 mm class was represented by only three individuals, and the 140–149 mm class was also not particularly large (Manning and Macpherson 1961, Fig. 11). Krebs (1964) considered that his 1960 Baker Lake series of *D. torquatus* was composed of particularly large individuals associated with a cyclic population high, but the mean weight of the 43 specimens taken by him between May 16 and June 15 was only 55.1 g compared to 71.3 g for the 97 specimens taken by me in the May 7–20 period on Kugong Island in 1971. The latter is more nearly comparable to the mean (73.4 g) of 27 Baker Lake adults. The largest Kugong Island lemming taken weighed 116.5 g and had

a total length of 165 mm. It was therefore heavier than the largest (106 g) from Baker Lake (Krebs 1964, Tables 41 and 46) and 3 mm longer than the longest of 200 taken at Adelaide Peninsula, King William Island and Victoria Island in 1957, and also of 133 taken on Prince of Wales Island in 1958.

There appear to be six possible causes of the relatively large size of the individuals in the May 7–20 Kugong Island catch:

- 1) *D. hudsonius* averages larger than the closely related *D. torquatus* from the western side of Hudson Bay.
- 2) Most other large collections have been made later in the spring when perhaps fewer old individuals survived.
- 3) The low arctic environment permits better winter survival of old individuals, and longer growth of the preceding summer's young.
- 4) The larger lemmings were the first to move out from below the snow and occupy the most desirable shelter under boulders and ridges where much of the early trapping was done.
- 5) At this particular time and place the largest lemmings were more trap-prone than the others.
- 6) The particular events that caused and led up to the sudden population decline that occurred later in the summer.

All these factors may have been operative. The above figures certainly suggest that *D. hudsonius* is larger than *D. torquatus* but this can only be proved by the comparison of large series collected over one or more full cycles. The second and third possible causes need further investigation; the fourth if true would probably also be true of other early spring collections; and the fifth is related to the sixth, which seems most likely to have been the chief cause.

It appears to be well established that large size is associated with cyclic peaks of both lemmings and voles. At Baker Lake, Krebs (1964) had

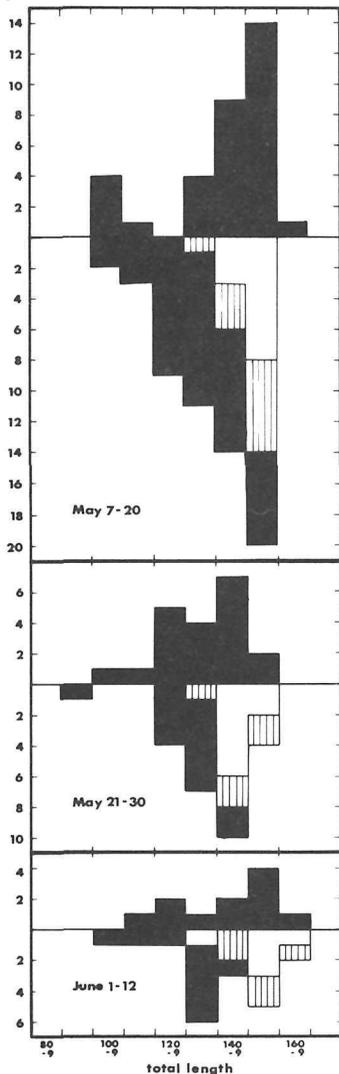
Figure 3

Histograms of total length of *D. hudsonius*. The histograms on the left show all specimens trapped on Kugong Island during the periods indicated. Those on the right are mostly of lemmings caught by my retriever or found dead. Some, usually the smaller ones, obtained by the retriever were not preserved. The June 13 to July 22 period includes a few specimens from the other Belcher Islands. Seven of these specimens were trapped. Males are plotted above the line, females below

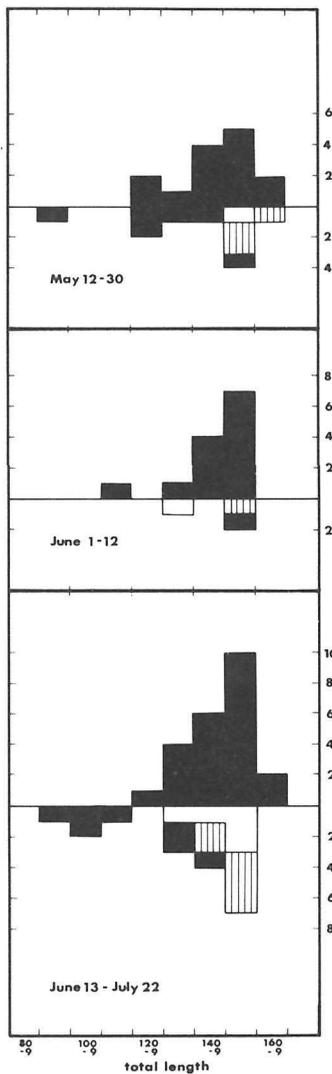
- Pregnant females
- ▨ Non-pregnant females with uterine scars
- Males or non-pregnant females without uterine scars

Figure 3

No. of lemmings



No. of lemmings



evidence that large size was caused by a change in growth rate rather than by a difference in the age structure of the population, such as was found by Zejda (1961) in the bank vole (*Clethrionomys glareolus*). On Kugong Island, however, most of the lemmings in the 150–159 mm class and a few of the 140–149 mm class were clearly very old; their flesh was tough, their legs, particularly the front ones, were very muscular, and their tail vertebrae almost impossible to pull out of the skin. I think these lemmings must have been born at least as early as the preceding summer or perhaps spring.

It is possible that the high proportion of old adults in the population in some way affected the survival of the young. Unfortunately complete records were not kept, but about 10 females with recent uterine scars had no active mammary tissue, and I suspect that either prenatal or early postnatal mortality, perhaps both, was high. The final disappearance of the lemmings during August may therefore have been caused by heavy predation on a population in which few young survived the nestling stage. The embryo count for 20 females taken May 12–27 was 5.40 ± 0.222 . For 10 females taken June 6–July 17 it was 4.70 ± 0.300 .

More females than males were caught in each trapping period (Fig. 3). When the three periods were pooled, they totalled 104 females and 67 males, or 39% male. On the other hand, of 45 lemmings caught by my retriever 30 (67%) were males. The adjusted chi-squares based on the hypothesis of random selection from a population of equal sexes are 7.6 ($P < 0.01$) for the traps and 4.4 ($P < 0.05$) for the retriever. The adjusted chi-square based on the hypothesis of homogeneity of the two samples is 9.9 ($P < 0.005$). The large proportion of males in the retriever's catch was presumably caused by their stronger scent or by some behaviour

characteristic. In either case males may be more prone to natural predation. The low proportion of males in the trapped sample could then have been caused by the unequal predation as well as by intra-specific strife between males in a declining population. In late August and early September 1949 there also appeared to be a declining population in northeastern Foxe Basin where we (Manning and Macpherson 1950) caught 34 females but only 15 males (adjusted $\chi^2 = 6.6$, $P = 0.01$).

Bowhead Whale, *Balaena mysticetus* Linnaeus

The spouts from one or more whales, presumably this species, were seen in the distance on August 18, when we were 30 km east of the centre of the Ottawa Islands.

White Whale, *Delphinapterus leucas* (Pallas)

We only saw white whales on September 22, when a school of about 12 passed our base camp on Kugong Island.

Arctic Fox, *Alopex lagopus* ssp.

The arctic fox population had been very high the previous winter and the Belcher Island Eskimos had made a record catch. Foxes remained numerous throughout our stay on Kugong Island and undoubtedly destroyed a large number of goose nests there and, according to the Eskimos, elsewhere on the Belcher Islands. In spite of a high lemming population in spring, few foxes appeared to breed. A similar situation was observed on Prince of Wales Island in 1958 (Manning and Macpherson 1961). In May, one or two foxes were often seen at a den near base camp, but only five on timed walks of 85.5 hours (0.06 per hour). In June, 10 were seen in 59 hours (0.17 per hour), and in

July three in 29 hours (0.10 per hour). Seven dens were found on Kugong Island, and two on the other Belcher Islands. Foxes were seen at four of the Kugong Island dens in the spring, but only at one may there have been young. Only two foxes were seen after our return to Kugong Island on September 22.

In spite of a difference of 17° in latitude and over a month difference in the time of spring thaw, the Belcher Island foxes changed into summer pelage only slightly, if any, earlier than those on Prince of Wales Island (Manning and Macpherson 1961). Thus although the first all-summer pelaged fox was seen on June 16, another seen on June 20 was all white except for the head. Two seen on June 26 and two on June 27 were dark, but a third seen on the latter date was still half white.

Polar Bear, *Ursus maritimus maritimus* (Phipps)

About 10 polar bears were killed by the Eskimos on the Belcher Islands during the winter of 1970–71, and several others seen, mostly in March. None was seen on the Belcher Islands either by us or the Eskimos during the summer, and we had no definite evidence that any of our snares were visited, although droppings only a few days old were seen on September 10 near the south point of Kugong Island. Pebble hills and ridges are scarce on Kugong Island, and we only visited four outstanding ones. Several dug out sleeping places, all many years old, were seen at each of these hills, perhaps an indication that bears were once more numerous there in summer, possibly at a time when walrus also were more numerous.

The Eskimos did not appear to have found any maternity dens in recent years but they thought that the ridges on the west side of the southwest peninsula of Flaherty Island and at the southern

end of Kugong Island were likely places. We visited these areas by helicopter between March 27 and April 1, 1973. We saw no sign of bears on Flaherty Island but at the southern end of Kugong Island there were tracks of one or two females with cubs. During 25 hours flying between the above dates in the vicinity of the Belcher, North Belcher, Sleeper, and the Bakers Dozen islands, we saw eight bears. Seven males and one female without a cub were tagged. We saw no tracks on land except when the land was close to the floe edge, notably on the northwest island of the Bakers Dozen, on Radar Island and on the extreme south of Kugong Island. No tracks were seen on the smooth ice of the bays or sounds between the islands or on the ice east of Tukarak Island and it seems unlikely that bears often visit the eastern side of the Belcher Islands. Along the floe edge from about halfway down the east side of the Bakers Dozen, north around the Bakers Dozen and westward to Radar and Split Island then south to southern Kugong Island and southwest from there, bear tracks were numerous and one or more tracks were in sight from the helicopter about half the time. Tracks were most plentiful along the floe edge north of Weigand Island where the Eskimos were seal hunting. Perhaps the bears were attracted by the abandoned seal fat although we found no evidence that they had been eating it. We did see several places where they had themselves killed and eaten seals. Out on the main pack tracks were less numerous than they were along the floe edge, although I think slightly more numerous than they were on the James Bay ice.

No bears were seen on the Sleeper or King George Islands in August 1944 (Manning 1946) or in August 1971. However, our Eskimo crew, who frequently used to visit the Sleeper Islands in late fall to hunt walrus, told us that they

often saw a bear there, but had never seen one on the King George Islands.

No bears were seen by C. J. Jonkel during an aerial survey of Gilmore Island on August 18, but on August 22 Johnny Inukpuk saw a bear sleeping among some large boulders in the hills, and reported plentiful tracks in a nearby gully. Next day I saw a mother and two cubs or yearlings on the north shore of Gilmore Island. Probably bears are very difficult to see from the air in such hilly, boulder strewn country. We saw no bears on the Ottawa Islands in late August 1944 (Manning 1946). In late August 1966 bears were troublesome around G. Falconer's camp and three were shot by Eskimos (pers. comm.).

Ermine, *Mustela erminea richardsonii* Bonaparte

According to the Eskimos, ermine are uncommon on the Belcher Islands. Hugh Brody saw one in his house at Sanikiluaq on September 20, 1971 (pers. comm.).

Walrus, *Odobenus rosmarus rosmarus* (Linnaeus)

On July 16 a young walrus was killed on the ice off the west side of Weigand Island. However, at the present time they are apparently seldom seen around the Belcher Islands, and the Eskimos were considering going to the Sleeper Islands to hunt in the fall. We found two skulls buried in mud near the south end of Kugong Island, and bones, including broken skulls, were numerous about some of the old tent rings. Apparently as late as 1944 Eskimos from Port Harrison went to the Belcher Islands to hunt walrus (Manning 1946). On August 4 we saw about 75 walrus near the south end of the Sleeper Islands and next day about 25 off the west coast of Kidney Island. We saw several skulls almost covered by

turf at each of three groups of old turf houses, probably at least 300 years old. A dead walrus was seen on Driftwood Island in 1944 (Manning 1946) and in 1971 I saw skulls near two old turf houses.

Harbour Seal, *Phoca vitulina concolor* DeKay

Kasegalik means the place of harbour seals and according to the Eskimos these seals are still found in Kasegalik Lake in summer. Three were apparently obtained from there for the Carnegie Museum in 1938 and an afterbirth was seen on a rock (Twomey and Herrick 1942).

Ringed Seal, *Phoca hispida hispida* Schreber

Using a spotting scope from base camp at 1400 EST on May 24, a fine sunny day with a 25 km/h wind and a temperature of about 4°C, I counted 51 seals on about 30 km² of ice (1.7/km²) in Churchill Sound. At the same time on May 28, a cloudy day with a wind of about 20 km/h and a temperature of 4°C I counted 87 seals in the same area (2.9/km²). Occasionally, on slightly warmer days, they seemed to be more numerous. Sixteen kilometres north of base camp, at 0800 EST on June 20, a fine sunny morning, I counted 40 seals on a single flat floe of about 2.6 km². There were none on surrounding smaller floes. After break-up, seals were rather scarce along the southeast and south coast of Kugong Island, but more numerous 2 or 3 km out in Churchill Sound. We did not see many seals even on fine days on our boat trip around the Bakers Dozen and eastern Belcher Islands, until we got to the southern end of the latter. There I counted 30 in Omarolluk Sound between Ridged Passage and Narrow Passage, and 35 between Rock Passage and the point southeast of Kasegalik Lake. Seals did not seem very

plentiful about the Sleeper, Ottawa and King George islands, but for the most part the weather was unsuitable for sighting.

In 1973 we saw a few seals on the ice near the Belcher Islands between March 27 and 29 despite temperatures around -18°C . On March 30, a fine calm day (-12°C), we saw about 50 seals on the ice north of Weigand Island, including 15 along a single crack. Comparatively few were seen in James Bay despite warmer weather.

Bearded Seal, *Erignathus barbatus barbatus* (Erxleben)

On June 15 three bearded seals were seen on ice pans during an 8 km canoe trip southwest from our base camp and several were seen at other times in this region. There was a bearded seal on the sandy point at the entrance to the inner part of Murray Harbour on Gilmore Island on August 18.

Caribou, *Rangifer tarandus* ssp.

Caribou disappeared from the Belcher Islands about 1880 (Flaherty 1918). Although this happened 90 years ago I was surprised to find neither bones nor antlers even in old caches and tent rings. Twomey (Twomey and Herrick 1942, p. 269) also found no bones that definitely belonged to caribou. It is possible that the population was small or migratory. The latter seems to be suggested by Flaherty (1918).

The only evidence that there may once have been caribou on the Sleeper, Ottawa or King George islands was a small piece of caribou antler found by Carter in a crack in the turf of a Thule house ruin on Kidney Island. It could of course have been carried from the mainland or the Belcher Islands.

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Appendix

Appendix 1

Species recorded in 1971 and previous years. The islands include the surrounding sea and small islands near their coasts. 'Other Belcher islands' include all the Belcher Islands except Kugong Island and the North Belcher Islands. The records given in Todd (1963) for the North Belcher Islands all refer to Johnson Island. The records taken from Todd (1963) for the Marcopeet Islands should be credited to the Sleeper Islands (see Introduction)

Species	Kugong I.	Other Belcher is.	North Belcher Is.	Sleeper Is.	Marcopeet Is.	Ottawa Is.	King George Is.
Common Loon	N?(M)*	N(TF)	R(TM)	R(M)	R(T)		
Arctic Loon	N(M)	N(T)R(F)	R(T)	R(T)N?(M)			
Red-throated Loon	N?(M)	N(T)N?(F)		R(44)N(M)			R(44M)
Whistling Swan	N(T)R(M)	N(T)R(F)	N?(TF)				
Canada Goose (<i>interior</i>)	N(M)	N(TF)	N?(M)	R(44)N?(M)		R(M)	N?(M)(44)
Canada Goose (<i>hutchinsii</i>)	M(M)	M(F)					
Brant	M(M)	M(TF)					
White-fronted Goose†		M(T)					
Snow Goose	M(M)	M(TF)					
Black Duck	R(M)	R(F)	R(M)	R(M)			
Pintail	N?(M)	N?(T)N(F)	R(M)	R(44M)			N(44)
Green-winged Teal		R(F)					
Scaup‡	R(M)	R(T)					
American Goldeneye	R(M)	R(TF)		R(M)	R(T)		
Oldsquaw	N(M)	N(TF)	R(T)	N?(44M)	R(T)		N(44)
Harlequin Duck		S(B)					
Common Eider	N(M)	N(TF)	N?(M)	R(44)N(M)	R(44)N?(M)	R?(44)R(M)	N(44)R(M)
King Eider	N?(M)	R(F)	N?(F)R(M)	N?(M)		R(44)	
White-winged Scoter	R(M)	R(TF)	R(T)	R(TM)	R(T)		
Surf Scoter		R(T)	R(T)	R(T)	R(T)		
Black Scoter	R(M)	R(TF)					
American Merganser	R(M)	R(T)N(F)	R?(M)	R?(M)			R(44)
Red-breasted Merganser	R(M)	R(TF)	R?(M)	R?(M)		R?(M)	
Rough-legged Hawk	N(M)	R(T)N(F)					
Peregrine Falcon		N(T)R(F)	N?(M)				R(44)
Rock Ptarmigan	N(M)	N(TF)	N?(M)	N?(M)		N?(M)	
Sandhill Crane		S(F)					
Semipalmated Plover	N(M)	N(TF)	R(M)	N?(44)RM			N?(44)
Golden Plover	M(M)	R(TF)	R(T)	R?(M)	R(T)		R?(44)R(M)
Black-bellied Plover†	M(M)						R?(44)
Ruddy Turnstone‡	M(M)	R(T)	R(TM)	N?(44)	R(T)	R(44)	N?(44)RM
Whimbrel							R?(44)
Greater Yellowlegs		R(T)	R(T)	R(44)R?(M)	R(T)	R?(44)	R(44)
Knot				R(44)			R(44)
Purple Sandpiper	N(M)	N(TF)	R(T)N(M)	N?(44)R(M)	R(T)		N?(44)R(M)
Pectoral Sandpiper		R(T)	N?(T)	R(44)			
White-rumped Sandpiper	M(M)	M(T)	R(TM)	R(44M)	R(T)	R(44)	R(44)
Baird's Sandpiper		R?(F)				R(M)	
Least Sandpiper†	R(M)						
Dunlin	M(M)	R?(F)	R(M)				R(44)
Semipalmated Sandpiper‡	N(M)	N(T)	R(T)N?(M)	R(44M)	R(T)	R(44)	R(44M)
Sanderling†	M(M)			R?(44)			
Northern Phalarope	N(M)	N(TF)	R(TM)	R(44M)	R(T)	R?(44)	R(44)
Parasitic Jaeger		N(T)	R(T)	R?(44)	R(T)		R(44)
Long-tailed Jaeger	R(M)	R(T)					R(44)
Glaucous Gull	N(M)	N(TF)	R(M)	R(44M)		R(44M)	R(44M)
Herring Gull	N(M)	N(TF)	R(TM)	R(44M)	R(T44M)	R(44M)	R(44)
Arctic Tern	N(M)	N(T)R(F)	R(T)N?(M)	N(44)R(M)	R(T44)		N(44)R(M)
Thick-billed Murre‡		S(T)				S(M)	
Black Guillemot	N?(M)	N(TF)	R(TM)	N(44)N?(M)	R(44)	R(44)N(M)	R(44)

Continued on next page

Appendix I cont'd.

Species	Kugong I.	Other Belcher is.	North Belcher Is.	Sleeper Is.	Marcopet Is.	Ottawa Is.	King George Is.
Snowy Owl	N(M)	N(T)R(F)		R?(M)			
Short-eared Owl†	R(M)						
Horned Lark	N(M)	N(T)N?(F)		R(44)N?(M)	R(T)		R(44M)
Purple Martin		S?(F)					
Raven	N?(M)	N(T)R(F)				R(44M)	
Brown Thrasher	S(M)	S(F)					
Water Pipit	N(M)	N(TF)	R(T)	N?(M)	R(T)	R?(44)N?(M)	R(44)
Tennessee Warbler		S(T)					
Orange-crowned Warbler		S(F)					
Black-throated Blue Warbler		S(Z)					
Yellow-rumped Warbler		S(T)					
Bay-breasted Warbler		S(T)					
Yellowthroat†	S(M)						
Redpoll sp.	R(M)	R(F)					
Common Redpoll		N?(T)					
Savannah Sparrow‡	N?(M)	N(T)	R(M)				R(44)
Tree Sparrow‡	S(M)	S(T)					
White-crowned Sparrow‡		N?(T)					
White-throated Sparrow‡		S(T)					
Lincoln's Sparrow‡		R(T)					
Lapland Longspur	N(M)	N(TF)	R(TM)	R(44)N?(M)	R(T)	N?(M)	R(44)
Snow Bunting	N(M)	N(TF)	R(TM)	R(44)N?(M)	R(T)	R?(44)N?(M)	R(44M)

*The following abbreviations are used:

- N, Nests.
- N?, Probably nests.
- R, Recorded. Summering but not breeding or status uncertain.
- R?, Record uncertain.
- M, Recorded only during migration.
- S, Straggler.
- (B), L. T. Burwash (see Manning 1949)
- (F), Freeman (1970a)
- (44), 1944 observation (Manning 1946)
- (M), This study
- (T), Todd (1963)
- (Z), Zazalenchuk (1967)

† Recorded on the Belcher Islands for the first time in 1970.

‡ Listed by Todd (1963) but omitted by Freeman (1970a).

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