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Birds and marine mammals in southwestern Foxe Basin, Nunavut, Canada

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ABSTRACT. The southwestern part of Foxe Basin is a little known region of the Canadian Arctic, being difficult to access during the summer because of heavy and unpredictable ice conditions. Surveys of birds and marine mammals in the area were carried out by lightweight expeditions in the summers of 1994 and 1995, using sea-kayaks, as well as a Peterhead boat from the nearest community, at Repulse Bay. The area supports important populations of narwhal, bowhead whales and walrus, as well as significant concentrations of shorebirds, common eiders, black guillemots, and perhaps one third of the world's Thayer's gulls. New information was obtained on the status and abundance of these species and novel observations were made on the feeding ecology and breeding phenology of the gulls.

Contents

Introduction

Southwestern Foxe Basin has been rarely visited by biologists and little information on bird and marine mammal populations is available. To the north of the area, local accounts of bird populations are available for Igloolik (Ellis and Evans 1960; Forbes and others 1992) and Sarcpa Lake, Melville Peninsula (Montgomerie and others 1983), while to the south information is available for Southampton Island, especially the southern and eastern portions (Sutton 1932; Parker and Ross 1973; Abraham and Ankney 1986). In addition, a few aerial surveys have been carried out in the area to estimate numbers of larger birds (Reed and others 1980; Gaston and others 1986) and marine mammals (Richard 1991; Cosens and others 1997; Cosens and Innes 2000).

Waters in the vicinity of northern Southampton Island, Vansittart and White islands and Lyon Inlet (Fig. 1) maintain limited areas of open water throughout the winter and consequently form an important area for over-wintering marine mammals and seabirds (Heide-Jorgensen and Laidre 2004). In summer, the area supports the secondl largest population of narwhal (*Monodon monoceras*) in Canadian waters, possibly a distinct stock from those found in the eastern Canadian high Arctic (Richard 1991). In addition, being close to the boundary of low and high Arctic zones, the area is likely to be affected by global warming more immediately than comparable areas at higher and lower latitudes (Gaston and others 2005). Consequently, baseline information for the area may provide a valuable source for future comparisons.

The reason for the lack of previous attention to the area probably derives from ice conditions that, in most years, limit access by sea from the nearest communities, Repulse Bay and Igloolik, to the period from late July onwards (Figs. 2a, 2b). To improve knowledge of bird and mammal populations surveys were undertaken of coastal areas in this region in 1994 and 1995, concentrating mainly on shorebirds and breeding colonies of marine birds. Priority was given to the identification of significant breeding concentrations of common eiders (*Somateria mollissima*) and black guillemots (*Cepphus grylle*) and cliff-nesting Thayer's gulls (*Larus thayeri*) and glaucous gulls (*L. hyperboreus*). As well as providing new knowledge on distributions and abundance, these data should provide baseline information against which future climate driven changes in distribution can be compared. Further information on this research is available in two unpublished reports (Smith and others 1995, 1996).

Study area

The region between the northern tip of Southampton Island and the southern part of the Melville Peninsula is characterised by two large low-lying islands (White and Vansittart islands, separated by Frozen Strait) and numerous smaller ones (Fig. 1). Foxe Basin is generally shallow, but a broad channel >200 m deep extends from Hudson Strait along the north coast of Southampton Island and terminates in trenches passing both east and west of Vansittart Island. Cold, saline water moving south from Fury and Hecla Strait, offshore from the Melville Peninsula, turns westwards through Frozen Strait (Prinsenberg 1986).

The marine waters of the area, like most of Foxe Basin, are ice covered from October to June, or later (Markham 1981, 1986). Diurnal tides occur throughout the Frozen Strait area. During spring tides, we estimated the current in Comer Strait to reach 10 km/hr, and similar currents were

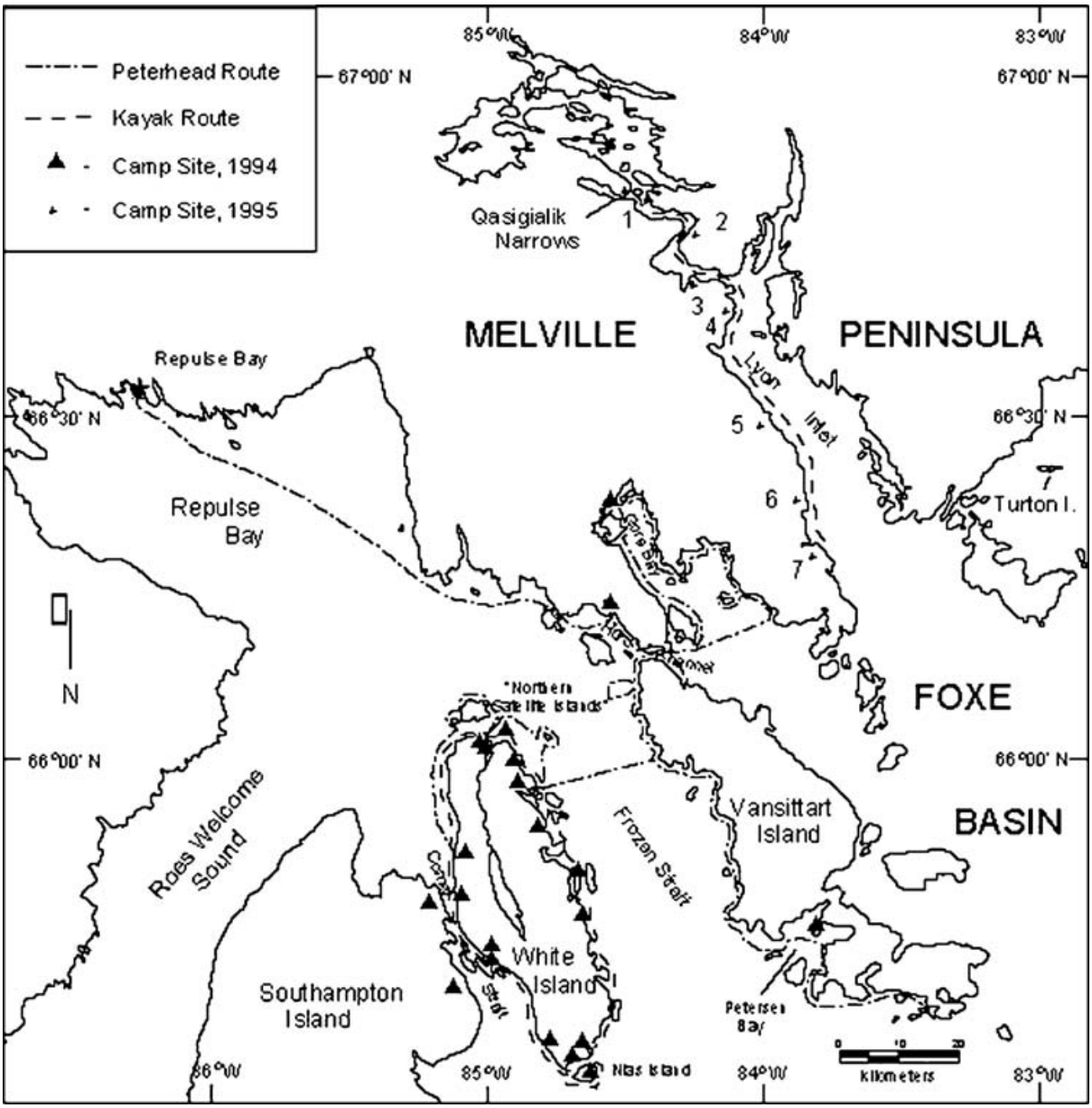

Fig. 1. Map of study area, showing location of camps and route of marine surveys.

encountered in the channels off the northern tip of White Island, around Passage Island, and inside Hurd Channel. With a flooding tide we observed a midstream northward setting current in Frozen Strait estimated to reach 6 km/hr. Tidal currents operating in the narrow straits and shallow waters among islands create the conditions for tidal polynyas, and the northern end of Frozen Strait, in particular, frequently provides extensive open water by July, in contrast with most of the rest of Foxe Basin.

Methods

Surveys were carried out during 11 July - 14 August 1994 and 5 July – 25 July 1995. Three people were involved in the 1994 surveys (SAS, JW and IS) and two in 1995 (SAS and RS). Survey routes and dates are shown in Fig. 1.

In 1994, surveys began on White Island, at the northern end of Comer Strait (65°47′N; 85°06′W). From 12 to 16 July, terrestrial birds, especially shorebirds, were surveyed over 20 km of the White Island coastal lowlands. On 19 July the party crossed to Southampton Island to survey 8 additional sample plots. Shorebird censuses ended on 23 July with the onset of flocking and numerous sightings of fledglings. From 24 July – 7 August, White Island was circumnavigated by kayak in order to record eiders, gull colonies and marine mammals. On 8 August, a Peterhead boat from Repulse Bay, met the team at the north end of Comer Strait (65°51′N, 85°08′W) and from 8 to 14 August it was used to survey Passage Island, the entire west coast of Vansittart Island, both sides of Hurd Channel and the perimeter of Gore Bay.

In 1995, surveys began on 5 July from the north end of Lyon Inlet, on the northwestern shore of Qasigialik Narrows (66°49.5′N; 84°29′W). From 7 July – 24 July, as sea ice conditions allowed, the survey team travelled by

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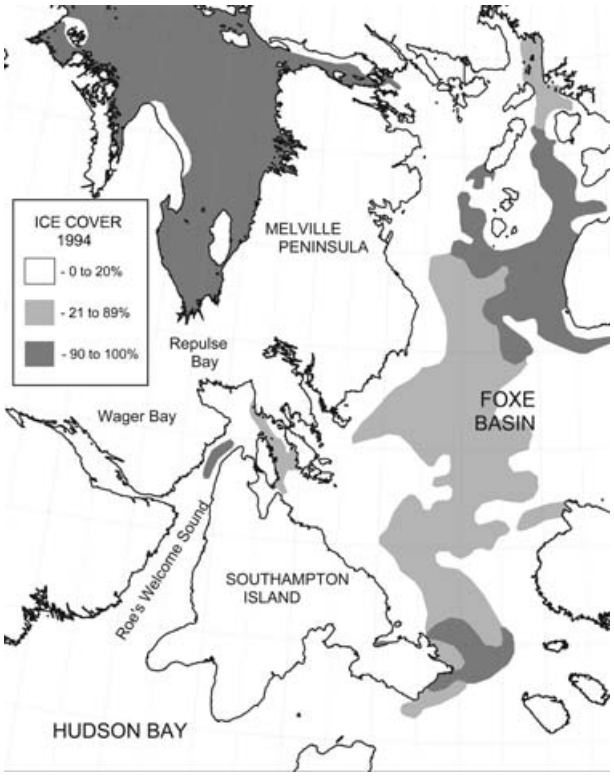

Fig. 2a. Ice conditions in southwestern Foxe Basin and adjacent waters in mid-July of 1994.

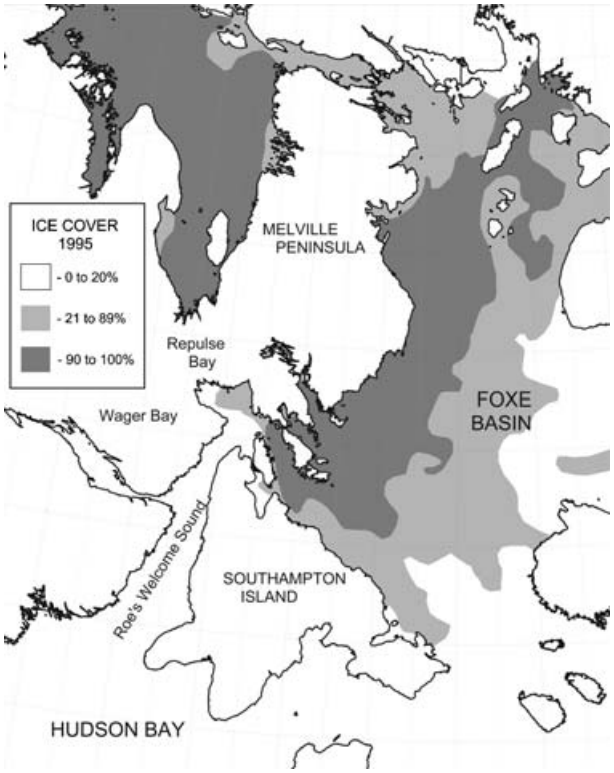

Fig. 2b. Ice conditions in southwestern Foxe Basin and adjacent waters in mid-July of 1995.

kayak along the west shore of Lyon Inlet, covering 85 km, surveying seabird colonies, and conducting overland foot surveys for inland-nesting birds. Concurrently, land- and

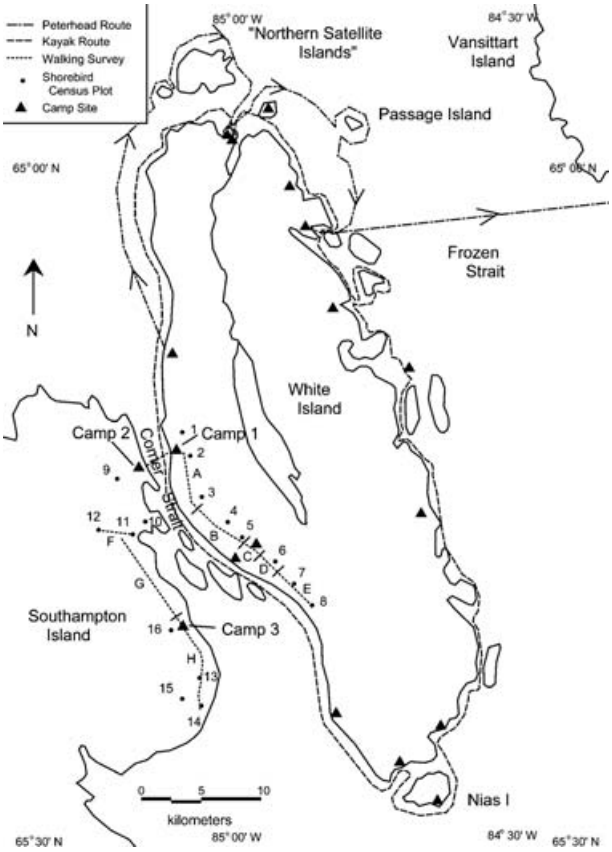

Fig. 3. Map of Comer Strait and White Island showing the position of shorebird census plots and transect routes covered in 1994.

sea-based observations of marine mammal presence and activity were maintained. On 25 July, the party travelled by helicopter to Turton Island to conduct a census of a common eider colony.

Terrestrial birds

Shorebird densities were determined in 1994 from foot surveys of 400 m × 400 m plots (with the exception of Plot 1 which was 200 m × 800 m). Aerial photographs were used to identify areas of uniform terrain type and plot locations were chosen to sample representative habitat types throughout the lowland region. Emphasis was given to habitat types known to be heavily utilised by shorebirds elsewhere in the low Arctic, for example, wet sedge habitats and areas near the coast (MacLaren and others 1977). The location of all plots was determined using a Global Positioning System (GPS) receiver (Fig. 3).

Surveys were conducted by three observers spaced 25 m apart, each walking side by side along parallel transects, established by compass bearing and working backwards and forwards until the entire plot was covered. Vegetation cover, moisture regimes, and a habitat description were recorded. All shorebirds seen, as well as their behaviour, and locations within the plot were recorded. Any other bird sightings were also recorded. When practical, additional surveys were conducted while travelling between plot locations: observers spaced themselves > 25 m apart and walked in parallel between

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known locations, recording all birds observed. 120 km were covered in transects between plots. In 1995, similar inland walking surveys were carried out for approximately 94 km of transects.

Gulls

All nesting locations were recorded by GPS and marked on aerial photographs. The general setting of each colony along with height of cliff, cliff aspect, height of occupied ledges, approximate ledge width, and distance to the sea, were described. Also, the availability of alternative cliff type habitats in the area was evaluated. The number of birds in attendance at the colony, and the species composition were recorded. In 1995, but not in 1994, the total number of apparently occupied nests was counted. Wherever possible, the contents of nests were recorded, including size of clutch or brood, and an estimate of nestling age. As time and accessibility allowed, observers visited nest sites to weigh and measure eggs and chicks. Eggs were checked for pipping, and chick wing lengths were measured from the carpus to the tip of the longest primary. Chicks were examined to determine the extent of remaining down and the state of feather tracts. Where nest sites were not accessible, size and plumage development were gauged by telescope. Wherever possible, gull counts were made in the evening, when breeders were thought likely to be close to their nests and overall colony attendance at its peak.

Eiders

Several small offshore islands were visited in 1994. We refer to a small group of un-named islands off the northern tip of White Island as the 'Satellite Island' group (Fig. 3). Each Satellite Island visited was surveyed by three observers on foot. All eider nests were counted on islands 1 and 2 (for details of island locations, see Smith and others 1995). On islands 3, 4 and 5 observers were spaced 100 m abreast moving parallel to the coastline, with each observer scanning a 10 m wide corridor. The outer transect followed the perimeter of the island along the 5 m elevation contour. Distinction was made between nests used that season and empty nest scrapes, and the contents of active nests were noted. The interiors of islands 4 and 5 were not surveyed.

Passage Island (Fig. 3) was visited on 9 August 1994 and a sample area in the northwest sector of the island, chosen on the basis of its representative topography and ground cover, was surveyed. Nine parallel transect lines were spaced 30 m apart on a bearing of 60°T. Observers walked three abreast for approximately 600 m across the eider colony, starting from the edge of the shoreline vegetation, counting all nest cups seen up to 5 m on either side of the transect line.

Turton Island (Fig. 1) was visited by helicopter on 25 July 1995. The island is a low-lying strip of land, 4 km long and averaging about 0.5 km wide, 5 km east of the Melville Peninsula (66°25′N, 82°59′W, Fig. 1). The surface is predominantly sandy, with prominent raised beach ridges and scattered outcrops of Canadian Shield rocks. It is dotted with more than a dozen small ponds. Vegetation is sparse and largely confined to the vicinity of the ponds, the troughs of raised beaches, and the rocky portions of the island.

Our survey focused on the western and central areas of Turton Island, representing approximately 65% of the island surface. This sample area was systematically scanned along a series of transect corridors by two observers on foot, with individual survey transects delineated by specific raised beach ridges and mapped out on an aerial photograph. It is believed that all occupied nests were counted within the area surveyed. Active nests were differentiated from empty nest scrapes: nest site characteristics and clutch or brood sizes were recorded.

Marine mammals

Species, location, group size, and behavioural data on marine mammals were recorded throughout the project. When travelling by kayak, all wildlife was recorded while transiting between known departure and arrival locations. Kayak speed generally ranged from 3–5 km/hr. Sightings were recorded using location points determined *en route* by GPS coordinates. Kayak travel covered 175 km in 1994 and 85 km in 1995. Coastal surveys by Peterhead boat in 1994 covered 440 km.

These were conducted approximately 100 m from shore at a speed of about 6 km/hr, although navigation was further offshore in shallow bays. Boat locations were determined from topographic (NTS) maps and GPS fixes. The locations and times of all wildlife sightings were recorded on NTS maps. Two or three observers were posted at any given time. A 25 power telescope was set up on the deck of the Peterhead for use in confirming distant sightings. 440 km were covered by this means.

Daily Log

General natural history notes were kept throughout both field seasons, including observations of breeding (nests found, young birds either pre- or post-fledging, adults carrying food, eggshells, down in nests, etc.), and information on marine mammal activities and concentration areas. A daily species list was maintained of all birds and mammals observed. Notes were also kept on ice conditions, tidal patterns and coastal habitats. Supplementary information was gathered from knowledgeable local Inuit who provided assistance.

Results

Ice conditions

Ice conditions differed between 1994 and 1995, with ice dispersing earlier in 1994 (Figs. 2a, 2b). On 11 July 1994, the only open water visible from the air between Repulse Bay and the Frozen Strait region was a 2 km segment of Comer Strait, and along the northeastern coast of White Island from the 'Satellite Island' group southward to Whale Sound. Constant north winds after mid-July probably facilitated break up, allowing the southward-setting current in Roe's Welcome Sound to clear the ice from Frozen and Comer straits. Ice decreased

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continuously during the period of our surveys, with Frozen Strait completely free of ice by 8 August. However, nine-tenths ice cover remained in southwestern Foxe Basin into August in 1994, preventing the circumnavigation of Vansittart Island and entrance of Lyon Inlet.

In 1995, ice cover in Lyon Inlet was complete on 11 July (Fig 2b), except for an area extending 5 km southeast from Qasigialik Narrows. Ice cover in southwestern Foxe Basin was also heavy at that date and continued to be until early August.

Terrestrial birds

233 birds of 16 species were identified in the census plots. A further nine species were seen on transects and one incidentally (Table 1). The most common species was white-rumped sandpiper (*Calidris fuscicollis*), comprising 26% (N = 620) of individuals recorded on plots and transects combined, followed by Lapland longspur (*Calcarius lapponicus*) 18%, Baird's sandpiper (*Calidris bairdii*) 9%, and long-tailed duck (*Clangula hyemalis*), grey plover [black-bellied plover] (*Pluvialis squatarola*) and dunlin (*Calidris alpina*) all 5%) (Table 1). Numbers of birds seen on plots were higher on Southampton Island (mean = 19 birds/plot, N = 9) than on White Island (mean = 9 birds/plot, N = 7) (Table 1). These are equivalent to densities of 59 and 27 pairs km^2, respectively.

Sandhill crane (*Grus canadensis*), Canada goose (*Branta canadensis*), snow goose (*Chen caerulescens*), and semi-palmated plover (*Charadrius semipalmatus*) were recorded on White Island plots and transects, but not on those on Southampton Island (both Canada geese and sandhill cranes were seen adjacent to the two southernmost Southampton Island sample plots). Species seen on Southampton Island but not on White Island were: Pacific loon (*Gavia pacifica*), tundra swan (*Cygnus columbianus*), common eider, grey plover [black-bellied plover], American golden plover (*Pluvialis dominica*), ruddy turnstone (*Arenaria interpres*) and red knot (*Calidris canutus*).

Seven habitat complexes were identified among the census plots (Table 2), of which six contained breeding shorebirds, while in the seventh, 'Dwarf Shrub Tundra/Beach Ridge' (Plot 4), only Lapland longspurs were observed. Half of the plots were classified as 'Wet Sedge/Moss Tundra with Beach Ridge/Limestone Barren' habitat (Plots 7–14). An average of 4.5 species averaging 19.6 individuals per plot in this habitat were observed. Corresponding numbers for all other habitat types were 9.5 individuals and 2.7 species per plot (Table 1). All but one of the 'Wet Sedge/Moss Tundra with Beach Ridge/Limestone Barren' plots were on Southampton Island, probably accounting for the difference in bird densities between the two islands. Appendix 1 provides detailed habitat descriptions for each plot.

In 1995, only three species of shorebirds were recorded in 84 km of walking surveys on largely dry upland tundra: two American golden plovers, 37 semipalmated

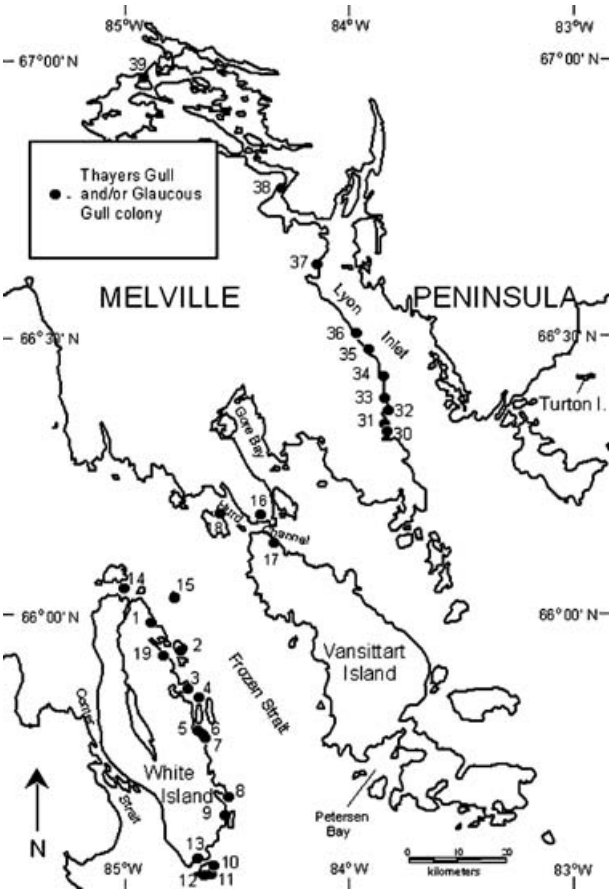

Fig. 4. Map of Thayer's and glaucous gull colonies visited in 1994 and 1995.

plovers (*Charadrius semipalmatus*) including 3 flightless chicks, and 92 Baird's sandpipers.

Five active peregrine falcon (*Falco peregrinus*) nests were located over the two years: two on White Island and one on Vansittart Island in 1994 and two at Lyon Inlet in 1995. In 1995, one nest contained 4 eggs on 8 July, while the other contained four 4–5 day old chicks on 22 July. No gyrfalcon (*Falco rusticolus*) nests were found, although one bird was seen on White Island.

Gulls

Populations and breeding sites

19 gull colonies were located in the Frozen Strait area in 1994, with a collective count of 1873 Thayer's gulls and 58 glaucous gulls (Table 3, Fig. 4). Counts of Thayer's gull colonies ranged from 15–475 birds (mean 102), while the largest number of glaucous gulls at a single site was 26. All colony sites were located either directly above, or in very close proximity to, the sea, except for Colony 16, which was located 1 km inland, and Colony 12 that was approximately 400 m from the coast (Table 3). In terms of the availability of cliff habitats for gull colonies, most of the coastal terrain in the region appeared to be occupied. Alternative cliff habitat was evident only in the vicinities of colonies 7 and 10.

Where nest sites were directly accessible by scrambling, signs of predation and unsuccessful breeding were

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Table 1. Details of plot surveys and transect counts made in the Comer Strait region between 12–23 July 1994.

	White Island					Southampton Island						
	Census plots			Transects		Census plots			Transects		Totals Plots & Transects	
	Present	Individuals	%	Individuals	%	Present	Individuals	%	Individuals	%		%
Gavia stellata				7	4.3	1	2	1.2	5	3.1	24	3.8
Gavia pacifica									1	0.6	2	0.3
Grus canadensis	1	1	1.7	4	2.5						6	1.0
Cygnus columbianus									2	1.2	3	0.5
Branta canadensis				18	11.0				2	1.2	32	5.2
Anser caerulscens				13	8.0						21	3.4
Somateria mollissima						1	1	0.6	8	4.9	15	2.5
Clangula hyemalis	2	4	6.7	16	9.8	1	1	0.6	10	6.1	45	7.2
Pluvialis squatarola						3	11	6.5	20	12.3	53	8.5
Pluvialis dominica						1	2	1.2	17	10.4	32	5.1
Charadrius semipalmatus				4	2.5						6	1.0
Phalaropus fulicaria	1	2	3.3			4	13	7.6	2	1.2	28	4.5
Arenaria interpres									11	6.7	18	2.9
Calidris canutus						1	2	1.2	4	2.5	11	1.7
Calidris alpina	1	2	3.3	7	4.3	7	20	11.8	4	2.5	57	9.1
Calidirs pusilla	(1)1										0	0.0
Calidiris fuscicollis	3	12	20.0	26	16.0	5	64	37.6	60	36.8	245	39.6
Calidris bairdii	4	11	18.3	28	17.2	3	8	4.7	7	4.3	72	11.6
Calidris melanotos	1	1	1.7	2	1.2	1	3	1.8	3	1.8	14	2.2
Calidris spp				2	1.2	1	5	2.9	12	7.4	32	5.1
Stercorarius parasiticus				6	3.7				3	1.8	15	2.3
Stercorarius longicaudus				1	0.6				3	1.8	6	1.0
Stercorarius spp.									1	0.6	2	0.3
Larus argentatus	1	2	3.3	9	5.5				14	8.6	37	6.0
Calcarius lapponicus	4	19	31.7	19	11.7	8	38	22.4	35	21.5	155	25.1
Plectrophenax nivalis	2	6	10.0	1	0.6				3	1.8	6	1.0
Totals	21	60		163		37	170		227		597	

Table 2. Descriptions of shorebird census plots. Key for Vegetative and Plot Cover: 1, < 10 %; 2, 11–49%; 3, 50–80%; 4, >80%.

Plot Date	Pin position end/bearing	Dominant vegetation	Soil moisture	Surficial expression	Veget. cover	Plot cover	Habitat description	Code
1	65°47′24″N	*Carex, Salix, moss*	mesic/hydric	flat and hummocky	4	3	Wet Sedge Tundra	1
12/7/1994	85°06′06″W	*Dryas, Cetraria, Salix*	xeric	raised beach ridges	2	1	Beach Ridge/Limestone Barren	
	SE 350°	unvegetated		ponds		2		
2	65°46′29″N	*Dryas, Cetraria, Cassiope*	mesic/xeric	5° to 25° slope	4	3	Dwarf Shrub Tundra	2
13/7/94	85°06′22″W	*Carex, Salix, Nostoc*	hydric/mesic	flat and hummocky	4	3	Wet Sedge Tundra	
	NW 160°							
3	65°44′46″N	*Carex*	hydric	flat	4	3	Wet Sedge Tundra	1
13/7/94	85°05′04″W	*Dryas, Cetraria,*	xeric	raised beach ridges	2	2	Beach Ridge/Limestone Barren	
	NE 122°							
4	65°44′02″N	*Dryas, S. reticulata, Cetraria*	xeric	flat raised beach	2	3	Beach Ridge/Limestone Barren	3
15/7/94	85°03′09″W	*Saxifraga, Stereocaulon, Carex*	xeric to mesic/hydric	flat	4	3	Dwarf Shrub Tundra	
	NE 120°							
5	65°43′07″N	*Carex*	mesic/hydric	flat	4	2	Wet Sedge Tundra	1
15/7/94	85°01′46″W	*Dryas, Cetraria,*	xeric	flat raised beach	2	3	Beach Ridge/Limestone Barren	
	NE 115°	unvegetated		ponds		2		
6	65°42′26″N	*Carex, Salix, moss*	mesic	flat/hummocky	4	3	Sedge/Dry Sedge Tundra	4
16/7/94	84°57′12″W	*Dryas, Cetraria, S. reticulata*	xeric	raised beach	3	2	Beach Ridge/Limestone Barren	
	NE 110°	unvegetated		ponds		2		
7	65°41′02″N	*Carex, mosses*	mesic/hydric	flat/hummocky	4	3	Wet Sedge/Moss Tundra	5
16/7/94	84°53′50″W	*Dryas, Cetraria, S. reticulata*	xeric	raised beach ridge	2	2	Beach Ridge/Limestone Barren	
	NE 125°	unvegetated		ponds		2		
8	65°39′45″N	*Carex, moss*	mesic/hydric	flat	4	3	Wet Sedge/Moss Tundra	5
16/7/94	84°51′41″W	*Dryas, Cetraria*	xeric	limestone barrens	1	1	Beach Ridge/Limestone Barren	
	NW 135°	mostly unvegetated		dry pond bottoms	1	1		
9	65°46′02″N	*Carex, moss, Nostoc*	mesic/hydric	flat	4	3	Wet Sedge/Moss Tundra	5
19/7/94	85°11′04″W	*Dryas, Cetraria, S. reticulata*	xeric	limestone barrens	2	2	Beach Ridge/Limestone Barren	
	NE 130°	unvegetated		ponds		1		
10	65°44′23″N	*Carex, moss, Nostoc*	mesic/hydric	studded with ponds	4	3	Wet Sedge/Moss Tundra	5
20/7/94	85°10′18″W	*Dryas, Cetraria*	xeric	limestone barrens	2	2	Beach Ridge/Limestone Barren	
	SE 00°	unvegetated		ponds		2		
11	65°44′01″N	*Carex, moss, Salix*	mesic/hydric		4	3	Wet Sedge/Moss Tundra	5
20/7/94	85°11′07″W	*Dryas, Cladina, Cetraria*	xeric	flat	2	2	Beach Ridge/Limestone Barren	
	SE 330°	unvegetated		ponds		2		
12	65°43′59″N	*Carex, moss, Nostoc*	mesic/hydric	flat	4	3	Wet Sedge/Moss Tundra	5
20/7/94	85°13′36″W	*Dryas, Cetraria, Salix*	xeric	flat	3	2	Beach Ridge/Limestone Barren	
	SE 305°	unvegetated		ponds		1		
13	65°37′21″N	*Carex, moss, Nostoc*	hydric		4	2	Wet Sedge/Moss Tundra	5
22/7/94	85°03′15″W	*Dryas, Cetraria*	xeric	flat raised beach	2	2	Beach Ridge/Limestone Barren	
	SW 320°	unvegetated		ponds		2		
14	65°36′05″N	*Carex, moss*	hydric	flat	4	2	Wet Sedge/Moss Tundra	5
22/7/94	85°02′15″W	*Dryas, Cetraria, Stereocaulon*	xeric	raised beach	2	3	Beach Ridge/Limestone Barren	
	NE 190°	unvegetated		ponds		2		
15	65°36′49″N	*Carex, S. glauca*	mesic	hummocky	4	3	Sedge/Dwarf Shrub Tundra	6
22/7/94	85°03′57″W	*Carex, moss*	hydric	flat	4	2	Wet Sedge/Moss Tundra	
	NE 230°	*Dryas, Cetraria*		flat	2	1	Beach Ridge/Limestone Barren	
		unvegetated		ponds		1		
16	65°36′49″N	*Carex, moss, S. glauca*	mesic	flat/hummocky	4	2	Wet Sedge/Moss Tundra	7
23/7/94	85°04′25″W	*Carex, Nostoc*	hydric	flat	4	2	Wet Sedge/Algae Tundra	
	NE 230°	*Dryas, Carex, Cetraria*	mesic/xeric			2	Beach Ridge/Limestone Barren	
		unvegetated		ponds		2		

Table 3. Gull colony counts and details of clutch and brood size and chick age. Clutches partially hatched are enumerated as chicks. Reference abbreviations: GEA = Gaston et al. 1986.

Colony #	Date	Species	Birds	Nests	Clutch/brood size 0	1	2	3	?	Chick age (d)	Previous reference	First hatch (est. from chick age)
Frozen Strait area (1994)												
1	29-Jul	THGU	85		31		7			5–20	Smith 1966	09-Jul
		GLGU	5					1		15		14-Jul
2	31-Jul	THGU	235			3	10		2	10–15	none	16-Jul
		GLGU	26		5							
3	31-Jul	THGU	58		8	2	2	2	4	7–15	none	16-Jul
4	31-Jul	THGU	140		9	4	3(2)	2		7–15	none	16-Jul
	01-Aug	GLGU	4			1		1		5		27-Jul
5	02-Aug	THGU	127			1	6	1	5	7–15	GEA, #23	18-Jul
6	02-Aug	THGU	60			1	5		11	7–10	none	23-Jul
			740									
			140 U,									
7	02-Aug	THGU	50 L		13	5	11	3	12	7–15	GEA, #22	18-Jul
			23 NE,									
8	02-Aug	THGU	40 S			2(1)	5	2	1	5–15	GEA, #20	18-Jul
9	02-Aug	THGU	22				1	2	1	15	none	18-Jul
		GLGU	1									
10	03-Aug	THGU	40		2	2	1		2	10–15	GEA, #17	19-Jul
11	03-Aug	THGU	50		6		1	2	3	10–15	none	19-Jul
		GLGU	2					1		15–20		14-Jul
12	03-Aug	THGU	475		21	20	61	8	38	3–20	GEA, #15?	14-Jul
	04-Aug	GLGU	2					1		15–20		15-Jul
13	04-Aug	THGU	15			2	4	1	1	15–20	none	15-Jul
		GLGU	1					1		20		15-Jul
14	09-Aug	THGU	60		59		1			< 5	Smith 1966	04-Aug
15	09-Aug	THGU	60		56		3			5	none	04-Aug
16	13-Aug	THGU	138			2				20–25	Bray 1943	19-Jul
17	13-Aug	THGU	18						9	?	none	
18	14-Aug	THGU	37							?	none	
19	30-Jul	GLGU	17		3		7	1		15	none	15-Jul
			938									
Lyon Inlet, 1995												
38	09-Jul	THGU	145	75		(8)	(11)	1(44)	11	20% hatch	GEA, #38	05-Jul
		GLGU	101	15					15	5–10		29-Jun
37	09-Jul	THGU	337	156					156		GEA, #37	
		GLGU	4	4			2		2	10–15		01-Jul
36	17-Jul	THGU	146	105					105		GEA, #36	
35	18-Jul	THGU	45	31		1			30	5	GEA, #35	13-Jul
34	18-Jul	THGU	45	24					24		GEA, #34	
33	19-Jul	THGU	253	151	2	5(6)	15(5)	12(1)	105	5	GEA, #33	14-Jul
32	20-Jul	THGU	25	10					10		GEA, #32	
31	20-Jul	THGU	100	60					60		GEA, #31	
30	20-Jul	THGU	55	40			2			5–7	GEA, #30	13-Jul
Totals		THGU	1151	652								
		GLGU	105	19								

usually encountered. Twenty out of 31 empty nests on colony 1 were on the west side of the colony where ledges were broad and easily approached. Faeces of both polar bear (*Ursus maritimus*) and fox (*Vulpes vulpes* or *Alopex lagopus*) were found near this colony. Colony 4 had 29 empty nests, all on accessible ledges: a depredated egg, fox scat, and bear scat full of feathers were found nearby. On Passage Island, both polar bear and fox scats were found near the Thayer's gull colony, and only the least accessible nests were occupied. On flat-lying colony 14, all but one of a total of 60 nest sites examined were unoccupied.

In 1995, nine Thayer's gulls colonies were visited that had been located in 1983 by Gaston and others (1986) in Lyon Inlet. 652 Thayer's gull and 19 glaucous gull nests were counted, with 1151 and 105 individuals present, respectively (mean size 72 Thayer's gull nests per colony for the nine colonies). Thayer's gull colonies varied in size from 10–158 nests (Table 3). The Kingmigjuak Narrows colony (38), situated on a flat-lying, rocky islet, was

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the only colony not on cliffs. Ninety nest sites were found on the islet (80% Thayer's and 20% glaucous); no herring gulls (*Larus argentatus*) were encountered, although Energy, Mines and Resources Canada (1984) reported this species at the site. All colonies were located either directly above or in very close proximity to the sea. Few suitable cliffs were seen that were unoccupied.

Timing of breeding

Estimated dates of first hatching for the 16 Thayer's gull colonies on Frozen Strait in 1994 ranged from 14 to 19 July, except for two colonies where estimates of 4 August presumably indicated replacement clutches laid after the loss of the first clutch (Table 3). For glaucous gulls, estimated dates of first hatching were 14 to 15 July at 4 colonies and 27 July at a fifth, the latter probably a replacement clutch. At Lyon Inlet in 1995, estimated first hatching ranged from 5 to 14 July (N = 4) for Thayer's gulls and 29 June to 1 July (N = 2) for glaucous gulls.

Feeding behaviour

In 1995, Thayer's gulls were observed feeding at close range in Qasigialik Narrows. At intervals spaced over three days, a flock of 25 Thayer's gulls was observed foraging for up to 1h at a time in a 100 to 150 m section of tidal rapids offshore of Camp 1 (Fig. 1). Birds in flight hovered for 2 to 3 s at 1 to 3 m above the water, then dived headfirst into the current, submerging the head and neck briefly. The bird would then sit on the water for a few seconds before lifting off to repeat the behaviour, sometimes several times in succession. The behaviour occurred only with an ebb tide. Once, a flock of 5 glaucous gulls joined in this activity. Similar foraging behaviour by Thayer's gulls was observed near the gull colony in Kingmigjuak Narrows, the birds seen hovering and diving in a riffle during full ebb current.

Both Thayer's and glaucous gulls were seen foraging on tidal flats at Camp 4 during low tide. For three consecutive days, flocks of up to 30 Thayer's gulls and 3 glaucous gulls were observed 'picking' invertebrates by walking along the beach and methodically dipping their bills into the mudflat shallows. The greatest numbers of birds were seen about low tide. A second group of up to 30 Thayer's gulls assembled along a small stream discharge during low tide periods. Feeding gulls stood in a slow running portion of the stream, actively stirring the bottom by moving their legs rapidly up and down and repeatedly dipping their bills into the current, pecking at estuarine invertebrates. When sampled with a kick net, the only organisms found in significant abundance at this marine foraging site were amphipods. Remains of these were found in gull faeces nearby.

Black guillemots (Cepphus grylle)

In 1994, 21 locations with black guillemots in groups larger than 20 individuals were found, totaling 2378 individuals. Locations where >100 individuals were counted were: the small islets off NW Vansittart Island (554 individuals), Bluhme Island (373), the chain of islets northwest of October Island (364), Passage Island (285), and 'Northern Satellite Islands 1' (411). Many of these concentrations were found in association with Thayer gull colonies (Fig. 4). Only two black guillemots were observed in the Lyon Inlet area in 1995.

Sea ducks

Only small numbers of common eiders were encountered on the 'Satellite Islands', with a total of 15 nests found, three with pipping eggs or ducklings. It was estrimated that there were about 100 nests on this island group. At Passage Island signs of past breeding activity were abundant. 102 empty nest cups were found distributed over the island. This count is conservative because nest cups were cryptic and many may have been overlooked. The survey scanned an area of 0.054 km^2, approximately 6% of the eider nesting habitat on the island, suggesting an estimated 1700 nest cups on the island. Only 6 nests contained definite evidence of use that year. The proportion of empty nests that had actually been occupied in 1994 could not be determined. Downy nest material was found scattered about the island. The region was subjected to two days of strong northwest winds two days prior to arrival, so wind may have cleared much of the evidence of recent breeding. Both fox and polar bear faeces were found on the island.

On Turton Island in 1995, 1061 common eider nests were found, of which 877 showed evidence of breeding activity in the 1995 season and 184 were empty. On the basis of helicopter observations, it was estimated that the survey area comprised 50–60% of breeding habitat. Accordingly, it was estimated that there were 1910 to 2122 common eider nests on the entire island. The proportion of empty nest cups that may have been occupied earlier that season is unknown, as downy nest material left on such exposed sites, is cleared away by even moderate winds. Among active nests, 59% contained eggs, and 41% either contained chicks or evidence that they had been recently vacated. Clutch sizes ranged from 1 to 8 eggs and/or chicks, with 4 eggs/chicks being the modal clutch size; 68% of all nests contained clutches of either 3 or 4 eggs/chicks.

Fresh fox tracks and faeces were encountered near the eider colony. During the course of the foot survey, six eider nests were found recently destroyed, possibly by foxes. Other bird species found breeding on Turton Island included arctic terns (*Sterna paradisaea*) ±60 adults, herring gulls (5 nest sites), Arctic skuas [parasitic jaegers] (*Stercorarius parasiticus*) 1 nest with young, snow buntings (*Plectrophenax nivalis*) 4 adults seen, and black guillemots (some heard).

Three crèches of eiders, totaling 22 ducklings, were seen on 6 August in southeast Comer Strait, but the main sightings of eider crèches in the Frozen Strait region were on 10 August along the west coast of Vansittart Island. The first, containing 6 ducklings, was seen near latitude 66°N; in Peterson Bay, 81 ducklings were seen in nine crèches; nine more crèches east of Sun Island contained 114 ducklings; while in the protected bays along

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Saglaarjuk Peninsula, at the south end of Vansittart Island, there were seven more crèches contained 121 young. On 11 August, 4 crèches, containing 32 ducklings, were encountered off the northwest coast of Vansittart Island at 66°03′N. The number of eiders seen along the west coast of Vansittart Island on 10 August totalled 640 individuals, which included a scattering of 200 males and one raft of c.200 females in Peterson Bay. On 13 August, 617 females were counted on the section of coastline from Moyle Bay southeast to 66°12′N; 83°58′W on the Melville Peninsula.

King eider (Somateria spectabilis)
The only sightings of king eiders in the Lyon Inlet region occurred on 22 July in the vicinity of Itiblikuluk Pass: two separate flocks of males (one flock of 60, and another of 400) were observed on a saltwater inlet immediately west of the pass.

Long-tailed duck (Clangula hyemalis)
In 1994, flocks of long-tailed ducks were observed on 12 July (60 females), 16 July (43 males) and 25 July (30 males). A raft of 115 long-tailed ducks, 55 of which were males, was observed along the Saglaarjuk Peninsula on Vansittart Island on 10 August. On 11 August, another 75 males flew along the northwest coastline of Vansittart Island. On 13 August, two rafts of >200 males were encountered off the Melville Peninsula.

In 1995, mixed flocks of up to 35 long-tailed ducks were observed regularly in the Lyon Inlet area. On 22 July, rafts of 180 males and 60 females were seen with king eiders on a saltwater inlet west of Itiblikuluk Pass and on 25 July, a mixed-sex flock of 200 was observed off Turton Island.

Marine mammals

Bowhead whale (Balaena mysticetus)
Three bowhead whales were seen near the mouth of Gore Bay on 13 August 1994: one in the Moyle Bay area at 66°17′N; 84°15′W, one at 66°16′N; 84°08′W, while the third was on the west side of Qikiqtaruluk Island at 66°14′N; 84°10′W (Fig. 5). All of them descended as the Peterhead passed within a few hundred metres. Local residents reported that 3 individuals appear near Repulse Bay each year. A single individual was observed on 12 July 1995 from Naujaarjuat Head at approximately 66°39.5′N; 84°05.5′W.

Narwhal (Monodon monoceros)
In 1994, 24 narwhals in 5 separate pods were observed (3, 4, 5 and 6 individuals seen at sea and 6 males seen from 'Satellite Island 2). In 1995, a pod of 4–8 animals was seen north of Cape Reid on 10 July (Fig. 5). On 12 July, pods of 3 and 17 were observed near Ingnit Islands and on 14 July scattered pods of 15–20 were sighted from 0.5 to 1 km off 'Killing Grounds' point. Ten were seen on 17 July scattered in 2/10s pack ice east of Camp 5. According to local sources, narwhal frequent the high current areas north of White Island earlier in the season before going to Lyon Inlet in the summer to give birth to their young.

Beluga (Delphinapterus leucas)
In 1994, pods of 5, 5 and 6 to 8 were seen in the Comer Strait area on 24–25 July. Only four sightings of 1 to 3 animals were obtained during the rest of the 1994 survey. None was seen in Lyon Inlet in 1995.

Atlantic walrus (Odobenus rosmarus)
Walrus were observed on six occasions in 1994, with the largest numbers in northern Duke of York Bay on 5 August, when 7 groups of 6 to 12 animals, totalling at least 50, were hauled out on ice floes. On 17 July 1995 five were seen feeding 200 m from shore near Camp 5: possibly the same individuals were observed the next day near Allison Bluff. A group of 10 to 12 individuals was sighted near mouth of Lyon Inlet on 23 July.

Bearded seal (Erignathus barbatus)
71 sightings of bearded seals were secured during the 1994 survey (Fig. 5). Two areas were particularly rich: the west coast of Gore Bay (23 individuals on 12 August), and along the coast of Melville Peninsula between Duckett Cove and the entrance to Repulse Bay (34 individuals on 14 August). Of the latter, 23 were on ice floes, with up to three seals hauled out together on the same floe. 22 were counted during the boat surveys of west coast of Vansittart Island on 10 and 11 August, and 10 were seen along the west coast of White Island on 25 July.

On 12 July 1995, 30 were hauled out on a 35 km^2 area of unbroken pack ice near Cape Reid. Groups of up to five were seen occasionally throughout the rest of the Lyon Inlet survey.

Ringed seal (Phoca hispida)
Ringed seals were less common than bearded seals during the 1994 survey. Seventeen were counted off the west coast of Vansittart Island on 10 August, and 25 along the shoreline of Gore Bay on 12 August. On 6 July 1995, a total of 64 ringed seals were seen hauled out on a 30 km^2 area of solid landfast ice near the mouth of Sherer Inlet. Only 3 were seen elsewhere in Lyon Inlet.

Harp seal (Phoca groenlandica)
A small group of seals that our Inuit companions identified as harp seals was seen in Frozen Strait on 10 August 1994. They were not seen in 1995.

Discussion

Kayaks made the field parties highly mobile and self-sufficient. Although their slow speed limited the distance that could be surveyed daily, they afforded the advantages of quietness and unobtrusiveness, allowing wildlife to be closely approached without disturbance. The use of kayaks, coupled with an expeditionary style approach, markedly reduced operational costs and streamlined logistics. The Peterhead boat chartered in 1994 was an ideal vehicle for observations, providing a stable viewing platform with the observer at a good height above the water for spotting birds.

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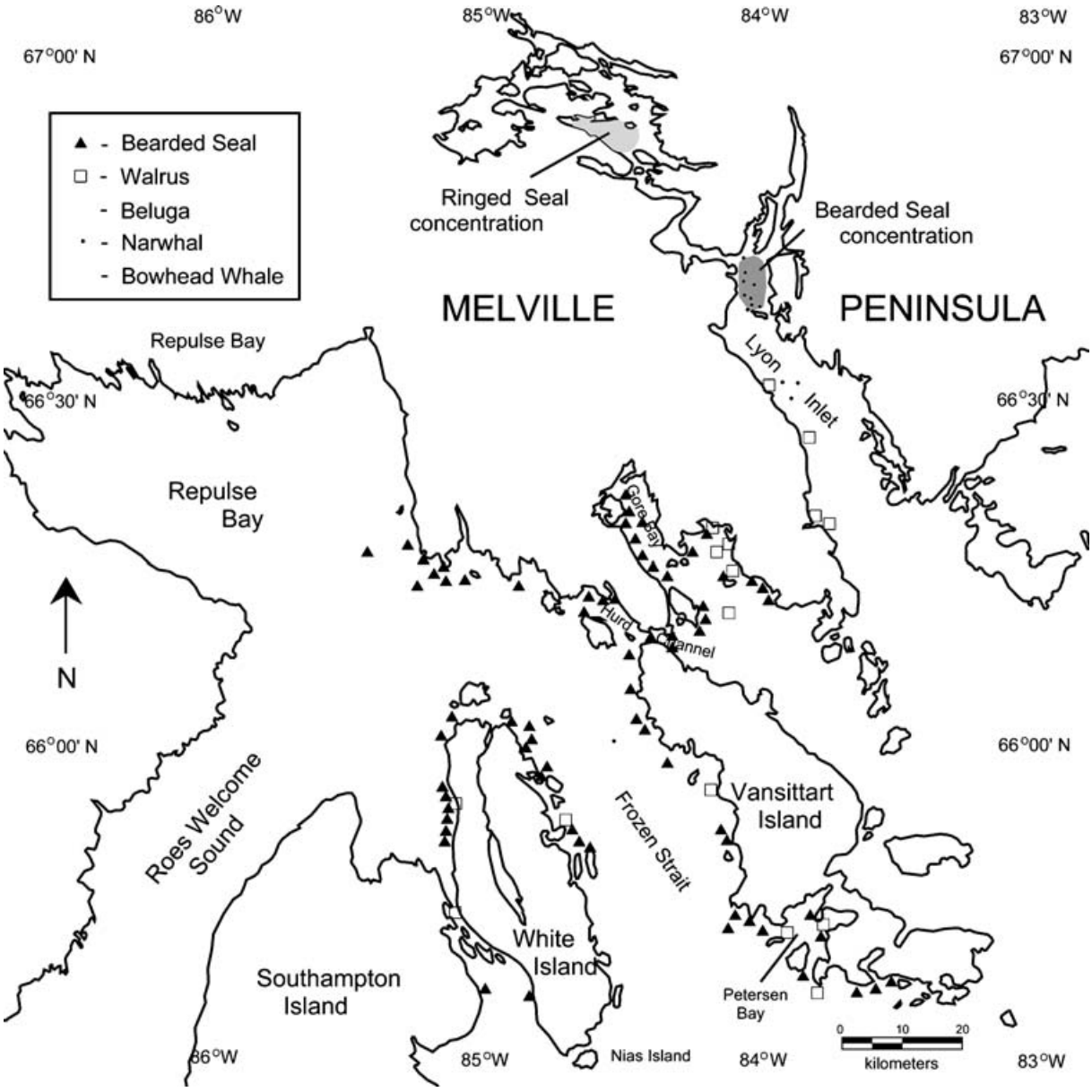

Fig. 5. Distribution of bearded seal, beluga, narwhal and bowhead whale sightings during the 1994 and 1995 surveys.

In 1994, summer ice conditions in the Frozen Strait/Gore Bay region were highly favourable for boating. Weather and sea conditions were ideal for boat travel between 8 and 14 August, with calm, ice-free waters offering consistent and unobstructed viewing conditions during the entire passage. Sea ice cover and distribution was considered to be 'much better than last year', and 'better than usual' according to local sources. The same informants indicated that Frozen Strait is typically icebound during August, with pack ice often persisting well into September. Ice conditions south and east of the Gore Bay area are such that summer boat travel northward beyond Vansittart Island is seldom possible.

The channels between the 'Satellite Islands', as well as Hurd Channel, include sections of open water through most of the year. The time and duration of open water and the availability of suitable breeding sites are some of the factors in determining the distribution of coastal and marine birds (Brown and Nettleship 1981; Morrison and Gaston 1986). In particular, year round open water may be responsible for the large numbers of Black Guillemots in the area, some of which may overwinter here (compare Gaston and McLaren 1990).

Terrestrial birds

The shorebird observations confirm that the Comer Strait area supports important populations of white-rumped sandpipers, Baird's sandpipers and dunlin. Densities of shorebirds in our intensively surveyed plots were high, compared to those observed elsewhere in the Foxe Basin/Northern Hudson Bay region (Forbes and others 1992; Morrison 1997 and references therein), but the plots were selected to include a high proportion of wet tundra and hence cannot be considered representative of

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the entire area. The paucity of red phalaropes, a very abundant species elsewhere on Southampton Island, at Igloolik and on Prince Charles Island (Morrison 1997; P. Smith personal communication) was striking and unlikely to have been caused by the timing of our surveys as the young of other species were in the process of hatching. At Lyon Inlet in 1995, the preponderance of Baird's sandpipers and semipalmated plovers probably relates to the generally dry, upland habitats characteristic of that area. Despite the apparent uniformity of raised beach and associated tundra habitats throughout coastal regions of northern Hudson Bay and Foxe Basin, there are substantial differences in the shorebird communities of different areas (Fig. 6).

Seabirds

Prior to our surveys, only two concentrations of more than 50 black guillemots had been reported for the Frozen Strait region (Gaston and others 1986). The counts made in 1994, totalling in the region of 2500 individuals are believed to represent >2% of the Canadian population and >1% of the total population of North America (Milko and others 2003).

Smith (1966) reported 10 gull colonies on the east side of White Island, two on northwestern Vansittart Island and two on the mainland just west of Hurd Channel. This study relocated with certainty only two of the colonies recorded by Smith (1966), possibly because some locations on his maps were misplaced. One (1994, 14), situated upon a flat-lying rocky islet, was the only Thayer's gull colony in the Frozen Strait area that was not on a cliff. Interestingly, this colony was reported by Smith (1966) to consist of both Herring and Thayer's gulls, but no Herring gulls were identified there.

The surveys placed particular emphasis on gull colonies, as aerial surveys in 1983 and 1984 suggested that the study area supported an important breeding concentration of the globally restricted and rather uncommon Thayer's Gull. The earlier surveys identified 11 gull colonies in the vicinity of White Island (Gaston and others 1986). Another colony was reported from Brooks Bluff on the Melville Peninsula (Bray 1943). The authors located 16 gull colonies in the Frozen Strait region, and obtained detailed information on all but four of the earlier known White Island colonies. The previous estimate for gulls in the White Island area was 600 to 700 pairs (Gaston and others 1986), a calculation that was based on a count that included four colonies that were not visited.

The counts for Lyon Inlet were similar to those obtained by Gaston and others (1986), who estimated 650–750 pairs in nine colonies: the present count was 671 nests, of which 652 were Thayer's gulls. If the ratio of individuals to nests that was found in Lyon Inlet in 1995 (671/1256 = 0.53) is applied to the counts of individuals at colonies in the Frozen Strait region in 1994 (1931), it provides an estimate of 1032 nests (32 glaucous gull, 1000 Thayer's gull) for 1994. In addition, if the size of the four colonies listed by Gaston and others. (1986) not visited in 1994 are estimated as the mean of Frozen Strait colonies (102 birds = 53 nests), then this yields an estimate for the entire regional population of approximately 2000 pairs of gulls, of which about 1950 were Thayer's gulls. This may represent more than one third of the estimated world population of 5,000 breeding pairs (Milko and others 2003). The timing of hatching estimated for Thayer's gulls in the Frozen Strait region in 1994 and in Lyon Inlet in 1995 suggested that laying began about 15 June, although perhaps 5d earlier at colony 38 in 1995, when 20% of clutches had hatched on 9 July (assuming a 3-egg clutch with 2d between eggs and a 26d incubation period (Gaston and others 1985). This is later than the timing of breeding reported by Macpherson (1961; earliest 5 June) and Gaston and others (1985; 6 June) for the ecologically and morphologically very similar and closely related Iceland gull *Larus glaucoides* in Hudson Strait, but similar to laying dates estimated for *L. thayeri* in the Frozen Strait region by Smith (1966). The present observations represent only the second observation of timing of breeding for the species (Snell 2002).

The timing of breeding observed for glaucous gulls in Frozen Strait in 1994, when most hatched in mid-July, appears much later than for most coastal glaucous gulls (Gaston and Gilchrist unpublished data), which generally hatch in late June or early July. Presumably the persistent ice in Frozen Strait reduces opportunities for feeding early in the season, delaying reproduction in this area, relative to areas further east, where ice breaks up earlier (compare Gaston and others 1985). Laying by glaucous gulls in Lyon Inlet in 1995 was considerably earlier, with most chicks hatched by 9 July.

Sea ducks

The estimates of 1700 common eider nests at Passage Island and 2000 at Turton Island, along with smaller numbers of nests seen elsewhere and several hundred ducklings seen in crèches along the west coast of Vansittart Island, suggest that the region supports at least 4000 breeding pairs. Turton Island represents one of the largest known common eider colonies in Foxe Basin, second only to the colony of 2800–3800 pairs in East Bay, Southampton Island (Gaston and others1986; H.G. Gilchrist, personal communication, 2005).

Marine mammals

The southwestern portion of Foxe Basin, and particularly Lyon Inlet, was an important area for the bowhead whale in the 19th century (Parry 1824; Lyon 1824; Comer 1906; Mansfield 1971; Reeves and others 1983). Aerial surveys in 1995 recorded 17 bowheads, with most concentrated in the mouth of Repulse Bay (Cosens and Innes 2000). The total population was estimated at 17–133 animals. Our observations support the finding that the region between Hoar Strait and Repulse Bay is a regular summer area for bowheads.

Aerial surveys of Lyon Inlet in July 1984 provided a mean estimate of 521 narwhal for the Lyon Inlet region, based upon a concentration of 0.25 individuals

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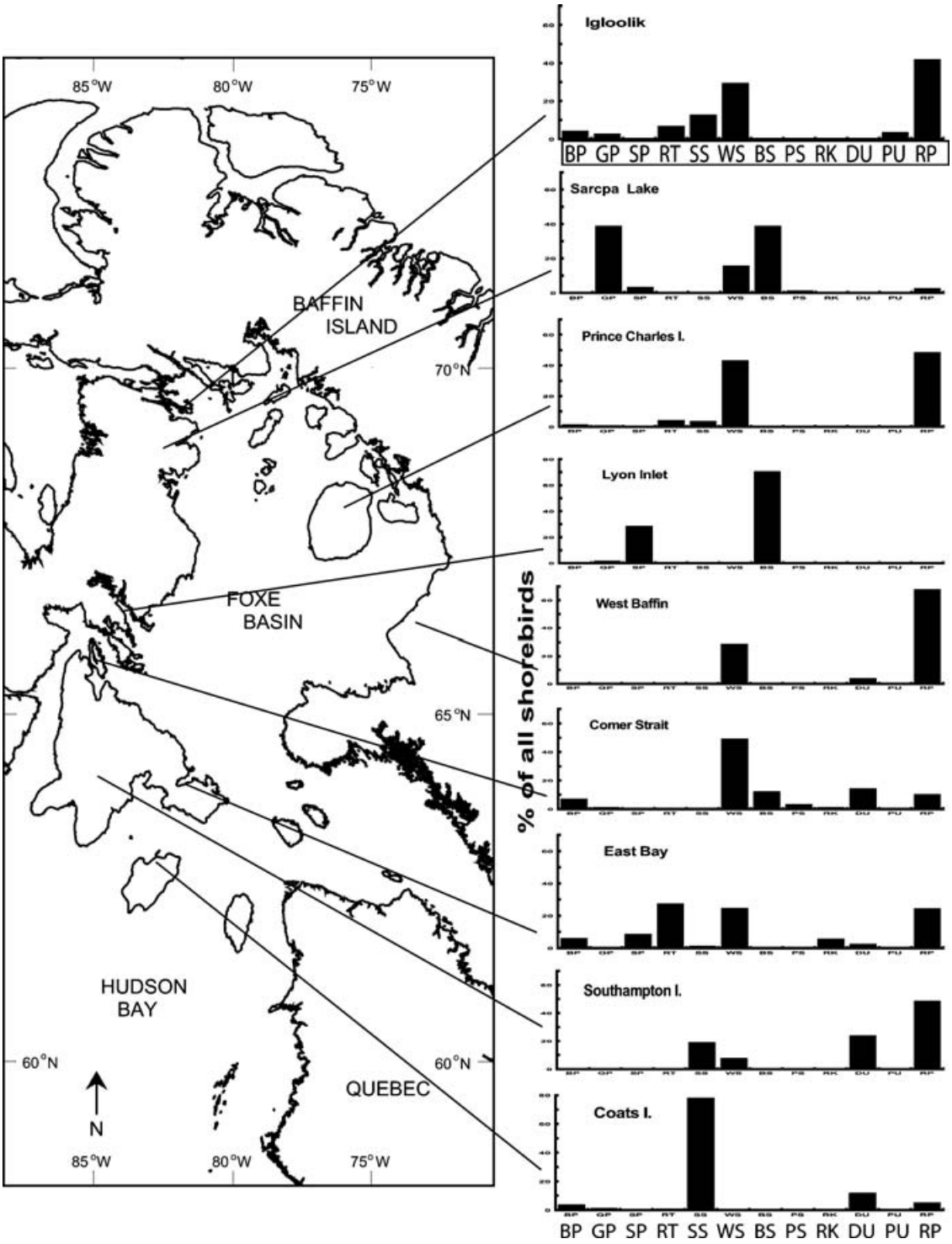

Fig. 6. Composition of shorebird communities in different coastal areas of northern Hudson Bay and Foxe Basin. References: Comer Strait and Lyon Inlet, this study; Sarcpa Lake, Montgomerie and others 1983; Igloolik, Forbes and others. 1992; Prince Charles Island, Morrison 1997; East Bay, and Coats Island, P. Smith, personal communication; Southampton Island and West Baffin Island, V. Johnston, personal communication. Key: BP grey plover [black-bellied plover], GP American golden plover, SP semipalmated plover, RT ruddy turnstone, SS semipalmated sandpiper, WS white-rumped sandpiper, BS Baird's sandpiper, PS pectoral sandpiper, RK red knot, DU dunlin, PU purple sandpiper, RP red phalarope.

per km^2 (Richard 1991). Mean estimates for the narwhal population in the northern Hudson Bay population are 1000 to 1500 individuals overall (Richard 1991). The present observations confirm that narwhal are common in the region, substantially outnumbering beluga. Although summer ice conditions severely restrict boat access into Lyon Inlet from the south, the inlet is well known to the residents of Repulse Bay. Moreover, although the distance

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involved is formidable (300–400 km one way), it is not unusual for residents of Igloolik and Hall Beach to journey to Lyon Inlet to hunt narwhal and beluga.

We encountered many archeological sites during our surveys and it is likely that early hunters took advantage of the region's waters rich with seal, walrus, whale, polar bear and marine birds. Residents of the Repulse Bay community carry on this tradition to the present day era and we benefited greatly from exchanges of information with the Putalik family of Repulse Bay during our week spent aboard their boat.

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References

Abraham, K.F., and C.D. Ankney. 1986. Summer birds of East Bay, Southampton Island, Northwest Territories. *Canadian Field Naturalist* 100: 180–185.

Bray, R.J. 1943. Notes on the birds of Southampton Island, Baffin Island and Melville Peninsula. *Auk* 60: 504–536.

Brown, R. G. B., and D.N. Nettleship. 1981. The biological significance of polynyas to arctic colonial seabirds. In: Stirling, I., and H. Cleator (editors). Polynyas in the Canadian Arctic. Ottawa: Canadian Wildlife Service (Canadian Wildlife Service Occasional Papers 45): 59–65.

Comer, G. 1906. Whaling in Hudson Bay, with notes upon Southampton Island. In: Laufer, B. (editor). Boas anniversary volume, Anthropological papers, written in honour of Franz Boas. New York: G.E. Stetchert and Co.: 475–484.

Cosens, S.E., and S. Innes. 2000. Distribution and numbers of bowhead whales (*Balaena mysticetus*) in northwestern Hudson Bay in August 1995. *Arctic* 53: 36–41.

Cosens, S.E., T. Qamukaq, B. Parker, L.P. Dueck, and B. Anardjuak. 1997. The distribution and numbers of Bowhead Whales, *Balaena mysticetus*, in northern Foxe Basin in 1994. *Canadian Field Naturalist* 111: 381–388.

Energy, Mines, and Resources Canada. 1984. Land use information series: maps 46 K and 46 I,J. Ottawa: Surveys and Mapping Branch.

Ellis, D.V., and J. Evans. 1960. Comments on the distribution and migration of birds in Foxe Basin, Northwest Territories. *Canadian Field Naturalist* 74: 59–70.

Forbes, G., K. Robertson, C. Ogilvie, and L. Seddon. 1992. Breeding densities, biogeography and nest depredation of birds on Igloolik Island, N.W.T. *Arctic* 45: 295–303.

Gaston, A.J., and P.L. McLaren. 1990. Winter observations of Black Guillemots *Cepphus grylle* in Hudson Bay and Davis Strait. *Studies in Avian Biology* 14: 67–70.

Gaston, A.J., R.D. Elliot, D.G. Noble, and D.K. Cairns. 1985. The natural history of Digges Sound. Ottawa: Canadian Wildlife Service (Canadian Wildlife Service Occasional Papers 46): 1–53.

Gaston, A.J., R. Decker, F.G. Cooch, and A. Reed. 1986. The distribution of larger species of birds breeding on the coasts of Foxe Basin and northern Hudson Bay, Canada. *Arctic* 36: 285–296.

Gaston, A.J., H.G. Gilchrist, and J.M. Hipfner. 2005. Climate change, ice conditions and reproduction in an Arctic nesting marine bird: the thick-billed murre (*Uria lomvia*, L.). *Journal of Animal Ecology* 74: 832–841.

Heide-Jorgensen, M.P., and K.L. Laidre. 2003. Declining extent of open-water refugia for top predators in Baffin Bay and adjacent waters. *Ambio: A Journal of the Human Environment* 33: 487–494.

Lyon, G.F. 1825. *A brief narrative of an unsuccessful attempt to reach Repulse Bay through Sir Thomas Rowe's 'Welcome' in His Majesty's Ship 'Griper' in the year MDCCCXXIV*. London: J. Murray.

MacPherson, A.H. 1961. Observations on Canadian Arctic *Larus* Gulls, and on the taxonomy of *L. thayeri* Brooks. Montreal: Arctic Institute of North America (Arctic Institute of North America Technical Paper 7): 1–40.

Mansfield, A.W. 1971. Occurrence of the bowhead or Greenland right whale (*Balaena mysticetus*) in Canadian Arctic waters. *Journal of the Fisheries Research Board of Canada* 28: 1873–1875.

Markham, W.E. 1981. Ice Atlas Canadian Arctic Waterways. Ottawa: Environment Canada (Atmospheric Environment Service).

Markham, W.E. 1986. The ice cover. In: I.P. Martini (editor). *Canadian inland seas*. Amsterdam: Elsevier SAcience Publishers(Elsevier Oceanography Series 44): 101–116.

McLaren, M.A., P.L. McLaren, and W.G. Alliston. 1977. *Bird populations in the Rasmussen Basin Lowland, NWT, June to September 1976*. Toronto: LGL Ltd. for Polar Gas Project.

Milko, R., L. Dickson, R. Elliot, and G. Donaldson. 2003. *Wings over water: Canada's Waterbird conservation plan*. Ottawa: Canadian Wildlife Service.

Montgomerie, R.D., R.V. Cartar, R.L. McLaughlin, and B. Lyon. 1983. Birds of Sarcpa Lake, Melville Peninsula, Northwest Territories: breeding phenologies, densities, and biogeography. *Arctic* 36: 65–75.

Morrison, R.I.G. 1997. The use of remote sensing to evaluate shorebird habitats and populations on Prince Charles Island, Foxe Basin, Canada. *Arctic* 50: 55–75.

Morrison, R.I.G., and A.J. Gaston. 1986. Marine and coastal birds of James Bay, Hudson Bay and Foxe Basin. In: I.P. Martini (editor). *Canadian inland seas*. Amsterdam: Elsevier Science Publishers (Elsevier Oceanography Series 44): 355–386.

Parker, G.R., and R.J. Ross. 1973. Notes of the birds of Southampton Island, Northwest Territories. *Arctic* 26: 123–129.

Parry, W.E. 1824. *Journal of a second voyage for the discovery of a North-West Passage from the Atlantic to the Pacific performed in the years 1821-22-23 in H. M. Ships 'Fury' and 'Hecla'*. London: John Murray.

Prinsenberg, S.J. 1986. On the physical oceanography of Foxe Basin. In: I.P. Martini (editor). *Canadian inland seas*. Amsterdam: Elsevier Science Publishers (Elsevier Oceanography Series 44): 217–236.

Reed, A., P. Dupuis, K. Fischer, and J. Moser. 1980. An aerial survey of breeding geese and other wildlife in Foxe Basin and northern Baffin Island, Northwest Territories, July 1979. Ottawa: Canadian Wildlife Service (Canadian Wildlife Service Technical Report 114): 1–21.

Reeves, R.R., E. Mitchell, A. Mansfield, and M. McLaughlin. 1983. Distribution and migration of the bowhead whale, *Balaena mysticetus*, in the eastern north American Arctic. *Arctic* 36: 5–64.

Richard, P. 1991. Abundance and distribution of narwhals (*Monodon monoceros*) in northern Hudson Bay. *Canadian Journal of Fisheries and Aquatic Science* 48: 276–283.

Smith, N.G. 1966. Evolution of some Arctic gulls (*Larus*): an experimental study of isolating mechanisms. Philadelphia: American Ornithologists' Union (American Ornithologists' Union Monograph 4).

Smith, S.A., J.A. Whitney, and G.I. Storm. 1995. Wildlife surveys in southwestern Foxe Basin – 1994. Banff: The Foxe Basin Project (Report to Canadian Parks Service, Ottawa): 1–42.

Smith, S.A., R.D. Saunders, and J.A. Whitney. 1996. Wildlife surveys in the Lyon Inlet region, Foxe Basin – 1995. Banff: The Foxe Basin Project (Report to Canadian Wildlife Service and Canadian Parks Service): 1–55.

Snell, R.R. 2002. Iceland Gull (*Larus glaucoides*) and Thayer's Gull (*Larus thayeri*). In: Poole, A., and F. Gill (editors). *The Birds of North America 669*. Philadelphia: The Birds of North America Inc.

Sutton, G.M. 1932. The exploration of Southampton Island, Hudson Bay. Part II, Zoology. Section 2. The birds of Southampton Island, Hudson Bay. *Memoirs of the Carnegie Museum* 12 (II 2): 1–275.