Monitoring Black Guillemot population and nesting success at Herschel Island, Yukon Territory – 2005

Cameron D. Eckert, Dorothy Cooley, and Richard R. Gordon

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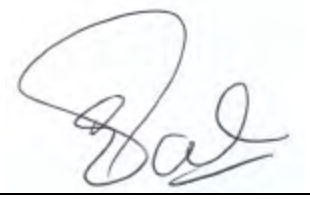
Cameron D. Eckert [1], Parks Branch

Dorothy Cooley, Fish & Wildlife Branch

Richard R. Gordon, Parks Branch



Director, Parks Branch

Director, Fish & Wildlife Branch

[1] Author to whom correspondence should be addressed: Government of the Yukon, Box 2703, Whitehorse, Yukon, Canada, Y1A 2C6

Cover photo: Pauline Cove settlement on Herschel Island, Yukon Territory. 24 July 2005. Photo by C. D. Eckert

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Dr. George Divoky provided valuable information and suggestions based on research on the Black Guillemot colony at Cooper Island near Point Barrow, Alaska. This collaborative approach is essential in gaining an understanding of changes in the environment and wildlife populations in the Arctic.

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Executive summary

The Black Guillemot colony at Pauline Cove on Herschel Island is the only one in the Yukon Territory, and one of the few in the western Arctic. This colony has been monitored for population and nesting success since about 1984. The nearest Black Guillemot nesting colony to Herschel Island, and the largest in the western Arctic is located at Point Barrow, Alaska. Researchers there have monitored that colony since the early 1970s and have explored links between population declines, poor nesting productivity, changes in the physical environment, and climate change. The monitoring of Black Guillemot population and nesting success at Herschel Island Territorial Park can provide valuable information for understanding changes across the Beaufort Sea region.

The key findings from nest checks and population counts during June–August 2005 with more intensive surveys during 21–28 July are:

- the nesting colony at Pauline Cove is comprised of a total of about 60 adult Black Guillemots;
- a high of 19 nests dwindled to 12 surviving nests with 22 chicks by the final nest check on 22 August;
- Black Guillemots are not nesting elsewhere on Herschel Island;
- Black Guillemots were observed consuming very small silver fish in nearshore waters, and were also observed making feeding forays towards offshore waters.

Here we outline our plans for field surveys in 2006, as well as long-term objectives for monitoring Black Guillemots at Herschel Island.

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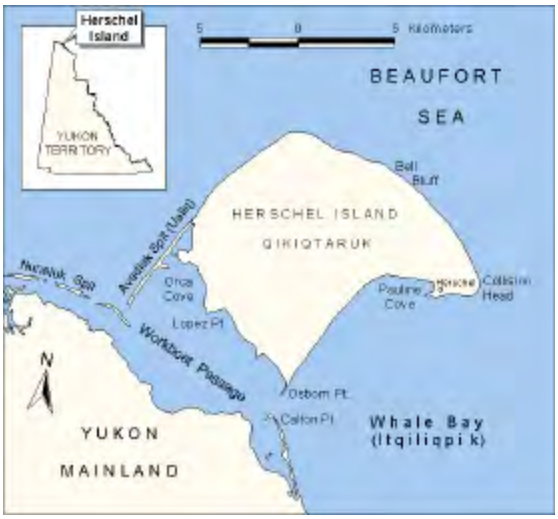
1. Introduction

The Black Guillemot (*Cepphus grylle*) is a seabird of the alcid family with a circumpolar distribution (Butler and Buckley 2002). It breeds from the eastern Canadian Arctic south to the coast of Maine, then eastward along the southern Arctic across Eurasia, just reaching North America again in isolated colonies in northern Alaska and the Yukon Territory (Butler and Buckley 2002).

In the Yukon, the only known nesting colony (one of very few in the western Arctic) is on Herschel Island, a Yukon Territorial Park off the Yukon's North Coast (Sinclair *et al.* 2003). The historic Anglican mission house at Pauline Cove on Herschel Island is the main nesting site; the guillemots occupy nest boxes and crevices in the house. The colony has been monitored for population and nesting productivity since about 1984 (Ward *et al.* 1986, Cooley 2005). At that time, the guillemots nested in both natural and artificial sites. Currently, the colony numbers about 60 birds and all birds nest in artificial sites.

Concern about the nesting success of the Herschel Island colony arose after very poor productivity in 2003 (2 chicks) and 2004 (no chicks) (Cooley 2005; Appendix A). The nearest Black Guillemot colony (150 breeding pairs), located at Point Barrow, Alaska (650 km northwest of Herschel) also had very poor productivity in 2003 and 2004 (Divoky *et al.* 1974; Divoky 1994, 2005). The 2003 results from Point Barrow found that brood reduction occurred in all two-nestling nests and only 24



of the 143 breeding pairs were able to fledge young (Divoky 2005). As well, fledging weights were among the lowest in the 28 years of the study (Divoky 2005). Nesting productivity at Point Barrow is influenced by nearshore sea ice conditions with poor nesting success recorded when the ice moves out early (Divoky 2005). Thus there is a potential link between climate change and long-term nesting productivity by Black Guillemots.

Movement of Black Guillemots between Herschel Island and Point Barrow has been documented. An adult caught in 1984 at Barrow bred in 1986 on Herschel (Divoky 1998). This may well be the longest distance recorded for an alcid between prospecting and breeding (Divoky 1998).

Adult Black Guillemots on the nearshore waters at Pauline Cove, Herschel Island. 25 July 2005. Photo by C. D. Eckert

2. Objectives & Methods

At Herschel Island, the objectives of the population and nesting monitoring are to

- track changes in the population through annual total population counts of adult Black Guillemots; and
- monitor annual nesting success through nest checks during July and August.

Monitoring to date has been conducted by Herschel Island Territorial Park rangers. Counts of adult guillemots have been done opportunistically. Nest checks at the mission house have been done once or twice per season between late June and late August. Nest boxes are cleaned each season prior to nesting and material removed includes rocks (carried there by guillemots), dead chicks or eggs, or nesting material from Snow Buntings (*Plectrophenax nivalis*). The contents of nests are recorded on each check and may include adult birds, eggs, live or dead chicks, presence of another species (i.e. Snow Bunting), or nesting material. All nest sites are numbered, and data are recorded specifically for each site. In 2005, the nests were checked four times, and on one check eggs without adults sitting on them were felt briefly to determine temperature (i.e. warm or cold).

In 2005, additional objectives were to

- work with rangers to refine protocols for population counts and nest checks to add detail and fill data gaps;
- survey other parts of Herschel Island for any additional nesting Black Guillemots; and
- investigate prey species consumed by adult guillemots.

These objectives were investigated during field surveys conducted by C. D. Eckert on the island during 21–28 July, 2005.

The mission house at Pauline Cove:

In early June 2005 the guillemot nest boxes were removed for the replacement of the tar paper on the historic Anglican mission house roof. These photos on 22–25 July 2005 show the boxes neatly back in place, with at least a few occupied by nesting guillemots, one of which is shown making a foray out to the open waters of the Beaufort Sea.

Photos by C. D. Eckert

3. Results – 2005 surveys

How many active Black Guillemot nests were at Herschel Island in 2005?

Table 1: Black Guillemot nest check results at the mission house on four dates in 2005.

	20 June	23 July	7 August	22 August
Nest with eggs unknown	0	6	0	0
Nests with 1 egg	0	6	6	5
Nests with 2 eggs	4	5	0	0
Nests with 3 eggs	0	1	0	0
Nests with 1 chick	0	0	5	2
Nests with 2 chicks	0	0	7	10
Nests with 2 chicks & 1 egg	0	0	1	0
Total number of nests	4	18	19	17
Total number of adults on nests	0	13	7	0
Total number of eggs	8	19	7	5
Total number of chicks	0	0	21	22
Cavities with Snow Bunting nests	1	2	-	2

How many adult Black Guillemots were seen at the colony in 2005?

In 2005, counts were done opportunistically through the season. We found that there are currently about 60 adult Black Guillemots at the colony on Herschel Island. High counts included 43 (all on the water) on 22 June; 33 (21 on the water, 13 on nests) on 23 July; 47 (all on the water) on 27 July; 60 (53 on the water, 7 on nests) on 22 August.

What did a check of egg temperature indicate?

On 23 July, all eggs without an adult sitting on them were checked for temperature (i.e. warm or cold). Five single egg clutches (i.e. 5 nests each with one egg) were found to be cold; one was obviously dead (i.e. it looked spoiled). None of the cold eggs had hatched by 22 August and were thus confirmed to be moribund. A record of egg temperature on each nest check is thus a good way to track individual nest success through the season.

What are the guillemots feeding on?

Daily observations of adult guillemots loafing and feeding on the water and flying out to sea were conducted by C. D. Eckert during 21–28 July. The eggs had not yet hatched so no adults were seen travelling to nest sites carrying food. The Black Guillemots were frequently seen feeding in the nearshore waters around Pauline Cove. They would often surface with a small, thin, silver fish just a little longer than their bill, which they quickly swallowed. While the species could not be positively identified during the brief view, they were not Arctic Cod or Four-horned Sculpin which are prey species of Black Guillemots at Point Barrow, Alaska (see photos page 6). Adult guillemots consume both invertebrates and fish (Butler and Buckley 2002) so a lack of observations of adults with fish does not mean that they are not feeding.

Black Guillemots were often seen flying from Pauline Cove northeast out to the Beaufort Sea and disappearing in the distance. These forays appeared to be foraging trips, although birds were not seen returning with fish so it is not known what they were eating.

Do Black Guillemots nest elsewhere on Herschel Island?

On 24 July 2005, C. D. Eckert conducted a land-based survey of Workboat Passage from Osborn Point to Avadlek Spit, including a check of a couple of old cabins and drift logs at Lopez Point on the south side of the island. No guillemots were seen. On 25 July 2005, C. D. Eckert conducted a boat-based survey from Pauline Cove south to Workboat Passage, and north along Avadlek Spit to the northwest point of the island. The only Black Guillemot seen was a single adult flying along the northwest side of the island.

Notes on other birds observed at Herschel Island, Yukon during 21–28 July 2005

A total of 32 bird species was observed by C. D. Eckert at Herschel Island, Yukon during 21–28 July 2005 (Appendix B). All but two of these were expected and recorded in apparently normal numbers (Talarico and Mossop 1986, Eckert *et al*. 2000). The two rarities were the Yukon's first McKay's Bunting and Herschel Island's first well-documented Glaucous-winged Gull (Appendix C).

In general, there was little visible movement of birds at Pauline Cove during this time even though fall migration for shorebirds and songbirds is well underway by mid to late July. A few pairs of local breeding shorebirds and songbirds such as Semipalmated Sandpiper, Baird's Sandpiper, American Pipit, Savannah Sparrow, and Snow Bunting were still tending to dependant fledglings on the island. Small numbers of migrant shorebirds, mostly juveniles, and a few juvenile American Pipits (still showing pink legs) stopped in at the island each day. The lack of movement seen at Pauline Cove may have been due to strong northeast winds which prevented mainland or nearshore migrants from straying to the island. In 2004, strong southerly winds corresponded with the appearance of a Rusty Blackbird on the island. It seems notable that no Ruddy Turnstones were seen at Herschel during 21–28 July as it has been described as a fairly common summer resident (Talarico and Mossop 1986). In 1996, an early-August survey of the birds at Herschel Island recorded a much higher diversity and higher numbers of migrant shorebirds (Eckert 1996).

Flocks of Surf and White-winged scoters and Long-tailed Ducks in their summer moult were noted at Pauline Cove and in the sheltered coves along Workboat Passage. An adult Long-tailed Duck, lacking in its ability to produce dark pigments (leucistic) was seen at Workboat Passage by C. D. Eckert on 24 July 2005. A flock of Common Eiders at Pauline Cove included about 4 adult females with up to 14 still fairly small ducklings in tow. On 27 July, we observed a flock of about 40 flightless (moulting) Canada Geese on the water west of Avadlek Spit. The geese, which could not take flight, surprised us by diving deep and out of sight, staying under for 30 seconds or more.

Herschel Island is known for a high density of nesting Rough-legged Hawks. For example, 22 and 24 nests were recorded on the island in 1985 and 1986 respectively (Talarico and Mossop 1986). While we did not survey the island for hawks in 2005, C. D. Eckert observed a pair nesting on top of a tall navigational marker along workboat passage on the south side of the island on 24 July. A pair of Common Ravens seen on the same day also appeared to have used a navigational marker for nesting. A pair of nesting Peregrine Falcons was seen on the bluffs along the west side of the island on 27 July. The only other raptor seen was a Short-eared Owl on 22 July. Although Snowy Owls can be abundant on Herschel Island in some years (Cooley 2005), none were seen during our surveys.

There was no indication that the Glaucous Gulls hanging around Pauline Cove had successfully bred there, rather they appeared to be post-breeders or failed breeders. One pair mobbed anybody who wandered too close, although there was no nest or young present. The pair of breeding Long-tailed Jaegers usually seen at Pauline Cove was not present, although C. Kennedy and B. Bell observed a juvenile still at its nest site in the Herschel uplands on 24 July.

The pale luminescence of a leucistic Long-tailed Duck stands out among the flock at Workboat Passage along the south side of Herschel Island on 24 July 2005. Photo by C. D. Eckert

4. Discussion

What is the current status of the Black Guillemot colony on Herschel Island?

The Black Guillemot colony at Herschel Island now numbers about 60 adults with all breeders occupying artificial nest sites. This shows a decline from the high counts recorded by Ward and co-workers (1986) nearly two decades ago (e.g. 107 in 1984, 83 in 1985, and 90 in 1986). Surveys in 2005 indicate fewer active nests than one would expect based on a population of 60 adults (i.e. expect about 30 nests) (Table 1). The high count of 19 nests was down to 12 surviving nests with 22 chicks by the final nest check on 22 August. While this is similar to the nesting rates observed at Herschel in 1985 (83 adults initiated 23 nests) and 1986 (90 adults initiated 31 nests) (Ward *et al.* 1986), there are now many more artificial nest boxes at the mission house. In 1984–1986, guillemots nested in both natural and constructed crevices at Pauline Cove; now they nest exclusively at the mission house. We note here that the repair of the roof on the mission house in June 2005 did not appear to have a negative impact on the nesting guillemots. The nest boxes were removed, cleaned, and repaired while the roofing material was being replaced.

Annual Black Guillemot reproductive success (chicks fledged compared to eggs laid) varies with geographic location and year with a range of 12–79% (Butler and Buckley 2002). Fledging success rates are not known for the Herschel Island colony since the chicks leave the nest after the rangers have departed for the season. However, by the final nest check (22 August) 56% of the nests were still surviving, which accounted for 65.8% of the total number of eggs laid. This was very close to the hatching success (66.7%) recorded here in 1985 (Ward *et al.* 1986). These numbers seem promising, although events such as storms prior to fledging can have a dramatic impact on chick survival. In 2003, a storm at Point Barrow blew the ice offshore and took with it the Arctic cod that is the diet staple of Cooper Island guillemot chicks. As a result, only 26 of 196 chicks were able to fledge (George Divoky, Institute of Arctic Biology, University of Alaska Fairbanks, personal communication).

What can we learn from monitoring Black Guillemots?

Monitoring Black Guillemot population and nesting success at Herschel Island is a priority for the North Slope (Wildlife Management Advisory Council–North Slope 2000); this work contributes to understanding changes to the health and functioning of coastal and marine ecosystems. The link between climate change, changes in the physical environment and guillemot nesting productivity has been made by researchers at Point Barrow, Alaska (Divoky 2005). The continuation of Black Guillemot monitoring at Herschel Island in conjunction with work at Point Barrow will improve our understanding of factors affecting nesting productivity and the relationship to climate change across the North Slope and Beaufort Sea region. The Inuvialuit are especially concerned about changes to the physical environment and ecosystems associated with climate change and the resulting impact on biodiversity (Wildlife Management Advisory Council–North Slope and the Aklavik Hunters and Trappers Committee 2003). The Black Guillemot colony at Herschel Island provides a window to monitoring, measuring, and understanding these changes.

Our surveys underscore that Herschel Island Territorial Park is an exceptional place for Arctic birds, both during migration and the breeding season. While birds are an important element of biodiversity that can benefit from the protection afforded by the park, they are also a key resource of the park in attracting visitors and in offering interpretive opportunities. Herschel Island is a busy place in the summer; during our visit we observed the passage of private and commercial ships and barges, the Canadian Coast Guard, guided tours, and numerous aircraft, along with the massive oil drilling platform moored in Pauline Cove. It is clear that the management of Herschel Island Territorial Park and the protection of its abundant natural values rely heavily on the diligence of the park rangers and their ongoing communication and interaction with the many operators and visitors to the Beaufort region.

5. Future field studies

Herschel Island Territorial Park rangers – integral to Black Guillemot monitoring: The Herschel Island rangers have a wide range of responsibilities for myriad activities on the island. We will continue to rely on the rangers to conduct the guillemot counts and nest checks, and work with them on refining protocols and planning additional monitoring work to ensure that the required capacity and training is in place.

Cooperative research: The field surveys and monitoring being conducted at Herschel Island have benefited from sharing ideas, data, and methodology with Dr. George Divoky (Institute of Arctic Biology, University of Alaska - Fairbanks) at Point Barrow, Alaska. Continuing this cooperative and collaborative approach will improve our understanding of populations, environmental dynamics, and climate change across the Beaufort Sea region.

2006 objectives

Identification of Black Guillemot prey species: In 2006, we will use high-resolution digital photographs to identify prey species at Herschel Island. Researchers at Point Barrow, Alaska identify prey species by photographing guillemots as they return to nest sites carrying fish (G. Divoky personal communication). High-resolution photographs taken with a 400mm lens are of sufficient quality to distinguish between species such as Arctic Cod and sculpin.

Colour-banding of guillemot chicks: In 2006, we will initiate colour-banding of guillemot chicks at Herschel Island. Colour-banding is a safe means of individually marking birds whereby a small aluminum band and a small coloured plastic band are attached to a bird's leg. Colour-banding provides information on yearly survival and dispersal of individuals and can considerably enhance our understanding of population fluctuations. Most of the guillemots at Point Barrow, Alaska are banded.

Long-term objectives

Continue monitoring Black Guillemots at Herschel Island: The guillemot colony at Pauline Cove is a unique natural feature of Herschel Island Territorial Park, and is a window to environmental changes in the Arctic. Long-term population and nesting information on the guillemot colony has been established, and the continuation of that monitoring is of the highest long-term priority.

Factors affecting prey availability: The short-term objective of identifying Black Guillemot prey species will enable studies to investigate factors affecting prey availability. This will require local and traditional knowledge together with a range of scientific disciplines. Researchers at Point Barrow are investigating factors such as pack ice characteristics, sea surface and atmospheric temperatures, storm frequency and dominant modes of long-term atmospheric variability in the region. Information from Herschel Island will be an important part of the regional picture.

Photographs of colour-banded Black Guillemot are used to identify prey species at Point Barrow, Alaska. Photos by G. Divoky

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7. Appendix A: Herschel Island Black Guillemot nesting data: 1988–2004

Black Guillemot nesting data for nest cavities on the mission house at Pauline Cove, Herschel Island, Yukon: 1988–2004 (from Cooley 2005).

Year	Survey date	# sites available	# sites occupied	# adults	# eggs	# live chicks	# dead chicks	# sites abandoned
1988	29 Jun	71	26		45			
1992	30 Jun	72	36		62		1	31
1993	13 Jul	61	31	2	53	4	1	23
1994	29 Jul	71	36		19	43	2	
1996	19 Jul	71	21		21	13		3
1997	14 Jul	75	22	9	30			9
1998	1 Aug	71	26		10	34	2	4
1999	23 Jul	71	34	9	33	6	4	37
2001	27 Jul	71	30		30	11	1	
2002	7 Jul	76	22	10	24		1	
	14 Jul	76	20	9	15			
2003	20 Jun	76	9	0	8	0	1	0
	21 Aug	76	11	0	11	2	2	2
2004	7 Aug	76	8	2	13	0	0	
	21 Aug	76	8	0	13	0	1	0

This photo taken 3 July 1984 shows 48 Black Guillemots flying and landing on the historic Anglican mission house at Pauline Cove. This was prior to the installation of the nest boxes and shingle paper on the roof. Photo by J. S. Hawkings

8. Appendix B: Bird species observed at Herschel Island, 21–28 July 2005

Daily totals for 32 bird species observed by C. D. Eckert at Herschel Island Territorial Park, Yukon 21–28 July 2005.

July	21	22	23	24	25	26	27	28
Greater White-fronted Goose							4	
Canada Goose	1			17	1		40	
Tundra Swan				1			1	
Common Eider	19	15	32	10	20		40	25
Surf Scoter		10	100	560	80	20	140	80
White-winged Scoter	10		2		60		20	1
Long-tailed Duck	6		60	300	80	10	190	40
Red-breasted Merganser	1			1				
Pacific Loon				1		2	4	
Red-throated Loon	1	6	4	4	6	4	8	
Rough-legged Hawk			1	2			4	
Peregrine Falcon							6	
Semipalmated Plover				1	1			
Semipalmated Sandpiper	15	15	15		15	16	15	12
Baird's Sandpiper			1		4		5	4
Pectoral Sandpiper	2		1		5	8	6	4
Red-necked Phalarope				1		1		
Parasitic Jaeger		1						
Long-tailed Jaeger			1				1	
Herring Gull						1		
Glaucous-winged Gull		1	1					
Glaucous Gull	4	10	10	8	6	10	40	6
Glaucous x Herring hybrid gull			1					
Black Guillemot	8	6	33	1	21	20	48	30
Short-eared Owl		1						
Common Raven		5	4	2				
American Pipit	3	6	15	7	10	10	4	10
Savannah Sparrow	1				3		6	
Lapland Longspur			6	10		6	4	
McKay's Bunting	1	1	1	1	1	1	1	1
Snow Bunting	13	12	12	8	14	15	15	8
Common Redpoll				1			1	
Hoary Redpoll		2	2					
redpoll sp.			2		6			1

9. Appendix C: Rare birds observed at Herschel Island, 21–28 July 2005

McKay's Bunting (*Plectrophenax hyperboreus*)

The rarest bird species seen at Herschel Island in 2005, and one of the rarest ever recorded in the Yukon, was a male McKay's Bunting in breeding plumage. It was first seen by Lee John Meyook on 16 July and was seen every day by C. D. Eckert during 21–28 July. During that time many visitors to the island were very keen to see this rarity, and with a bit of guiding everyone who wanted to see it was rewarded with a good view. The McKay's Bunting spent most of its time feeding and roosting among the driftwood on the gravel spit at Pauline Cove. It was usually by itself and did not associate with the closely related Snow Buntings common at Pauline Cove.

The McKay's Bunting is one of North America's rarest songbirds, with a total population of less than 6,000 birds; it breeds on just two small isolated islands (Hall and St. Matthew) in the middle of the Bering Sea (Lyon and Montgomerie 1995). This is about 1800 km west of Herschel Island. There is limited hybridization between Snow Bunting and McKay's Bunting on St. Lawrence Island in the Bering Sea where the latter occurs rarely (Lyon and Montgomerie 1995).

The breeding male McKay's Bunting is distinguished by its white head, nape, breast, belly, rump, and back, with black on tips of primaries, posterior scapulars, and central tail feathers; and is distinguishable in all plumages from Snow Bunting by extensive white on third tail feather from centre (Lyon and Montgomerie 1995). The McKay's Bunting on Herschel Island showed no trace of hybridization and a good flight photograph shows that its third tail feather from the centre was virtually completely white.

Very little has been written about the songs or calls of the McKay's Bunting (Lyon and Montgomerie 1995). The McKay's Bunting on Herschel Island would frequently call in flight – a rolling twitter like that of a Snow Bunting. After listening to the flight call for a few days, it became fairly easy to pick it out as being slightly higher and sweeter than that of a Snow Bunting.

McKay's Bunting at Herschel Island, Yukon on 22 July and 24 July 2005. Note its extensively white plumage, including a white back, and white tail with black tips on just the central tail feathers. Photos by C. D. Eckert

The McKay's Bunting at Herschel Island provided the first record for the Yukon Territory (Eckert *et al.* 2005, Sinclair *et al.* 2003), and perhaps the first for the Beaufort Sea region (Johnson and Herter 1989). It further enshrines Herschel Island as northern Yukon's premier birding hotspot, having hosted numerous outstanding rarities such as Wood Sandpiper, Ross's Gull, and Yellow-headed Blackbird (Sinclair *et al.* 2003).

Glaucous-winged Gull (*Larus glaucescens*)

An adult Glaucous-winged Gull feeding on fish scraps at Pauline Cove was photographed (top and middle) by C. D. Eckert on 22–23 July 2005. It was about the same size and shape as a Glaucous Gull (*Larus hyperboreus)*, which is common at Pauline Cove, but was readily distinguished by its dark eye, pink orbital ring, slightly darker grey mantle, and grey wing tips which were the same shade as its mantle. It also had a slightly bulkier bill than the average Glaucous Gull.

This was apparently the first documented record for Herschel Island and the Yukon's Arctic coast (Sinclair *et al.* 2003), although the Herschel Island sightings log has entries for Glaucous-winged Gull in 1990 and 2004 (Cooley 2005). Glaucous-winged Gull is a rare wanderer to the Beaufort Sea region (Johnson and Herter 1989), and is occasionally seen at the Inuvik dump (e.g. Mactavish 2002), and along the Peel River (Sinclair *et al.* 2003).

Glaucous x Herring Gull hybrid (*Larus hyberboreus* x *Larus argentatus*)

An adult Glaucous Gull x Herring Gull hybrid was photographed (bottom right) by C. D. Eckert at Pauline Cove on 22 July 2005. Hybridization between Glaucous and Herring gulls is well known where their ranges overlap (Gilchrist 2001), and is common in the Mackenzie Delta region (Spear 1987). Careful study is required in the identification of Herring, Glaucous-winged, and especially Thayer's gulls in the Beaufort Sea region as hybrids look superficially similar to these species (Sinclair *et al.* 2003). A survey of gulls at Kay Point, Escape Reef, Pauline Cove, and Tuktoyaktuk, NWT, found that Glaucous Gull x Herring Gull hybrids outnumbered pure Herring Gulls by a ratio of 51:8 (Spear 1987); the only Thayer's Gulls (2) seen were north of Tuktoyaktuk (Spear 1987).

The photograph (right) shows the pale yellow iris and yellow orbital ring typical of both Glaucous and Herring gulls (Pierotti and Good 1994, Gilchrist 2001). A pure Glaucous Gull has white wing tips, while a pure Herring Gull has extensively black wing tips (with white spots). Thus the limited black in the outer primaries on this gull indicates its hybrid origin.

Top and middle: Adult Glaucous-winged Gull at Pauline Cove, Herschel Island, Yukon. 22 July 2005.

Bottom: Adult Glaucous x Herring Gull hybrid at Pauline Cove, Herschel Island. 22 July 2005. Photos by C. D. Eckert

10. Appendix D: Common summer birds at Herschel Island, 21–28 July 2005

Juvenile shorebirds on migration

Three common shorebirds (counter-clockwise from top left) seen at Pauline Cove were Semipalmated Sandpiper (here 28 July), Baird's Sandpiper (here 28 July), and Pectoral Sandpiper (here 25 July). Most adult shorebirds had already departed.

Common Eiders along the beach

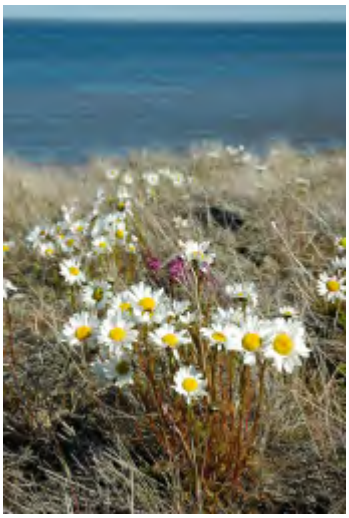
A flock of up to 40 female Common Eiders (bottom) and their small young were seen most days at Pauline Cove. This photo was taken 24 July.

Photos by C. D. Eckert

Counter-clockwise from top right:

- juvenile Snow Bunting on 28 July (C. D. Eckert);
- adult Glaucous Gull on 22 July (C. D. Eckert);
- female Rough-legged Hawk on 24 July (C. D. Eckert);
- juvenile American Pipit on 23 July (C. D. Eckert);
- adult Red-throated Loon on 24 July (B. Bell).

11. Appendix E: Herschel Island ecosystems and habitats – 2005

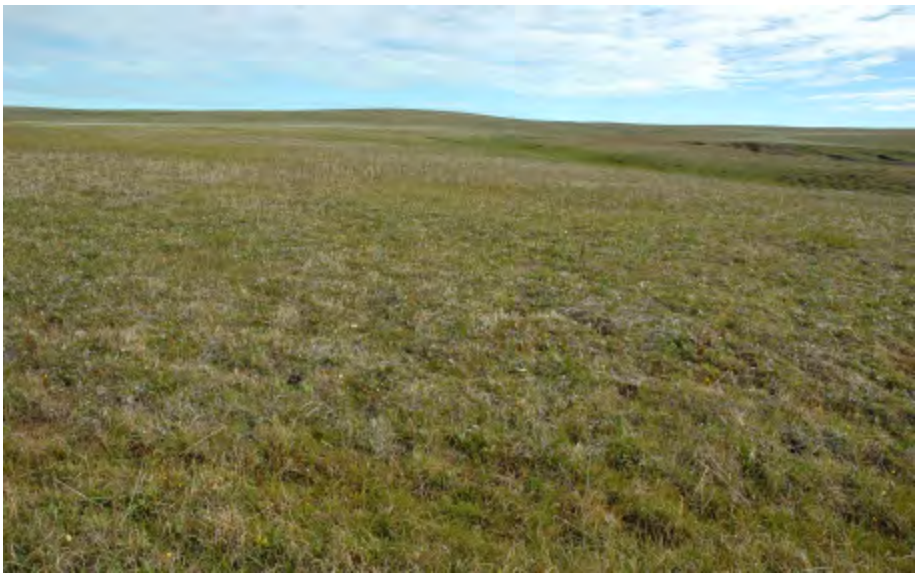


Diverse Arctic ecosystems

Top: A view over Pauline Cove, looking east to the open waters and sea ice of the Beaufort Sea on 24 July. Photo by C. D. Eckert

Middle: In summer, a rich flora blooms over Herschel Island. The diverse mix includes Arctic species such as Seashore Chamomile *Matricaria ambigua* (left, 27 July), and Elegant Paintbrush *Castilleja elegans* (right, 15 July). Photos by C. D. Eckert and Herschel ranger L. J. Meyook

Bottom: Dramatic seasonal changes to the Arctic landscape are evident in these photos of the historic reindeer herders' cabins at Lopez Point on the south-west shore of Herschel Island. Only the roof tops are visible above the snow pack on 19 April (left); on 24 July (right), the sod roofs have turned green. Photos by Herschel rangers P. Foisy & J. Meyook; and C. D. Eckert



A changing landscape

Top left: The view west across Workboat Passage to the Coastal Plain of Ivvavik National Park on 24 July 2005. Photo by C. D. Eckert

Top right: Disappearing sea ice and the opening of the Northwest Passage means that Herschel Island can expect to see more sea-borne traffic. *Idlewild* of Edmonton, Alberta, seen here 22 July 2005, spent a few days at Pauline Cove en route to the eastern Arctic. Photo by C. D. Eckert

Middle: A Polar Bear in its element off Bell Bluff on the north side of Herschel Island, 12 May 2005. This Arctic predator is entirely dependent on sea ice for survival. Warming trends and the loss of sea ice in the southern Beaufort have led to concerns about the status of Polar Bear populations. Declines in cub survival have already been detected (Regehr *et al*. 2006). Photo by Herschel rangers P. Ross & L. J. Meyook

Bottom: The last two decades have seen pronounced vegetation changes on Herschel Island. Most notably, an explosion of Polargrass *Arctagrostis latifolia* has occurred on stable, undisturbed uplands (Kennedy *et al.* 2001). This photo (24 July 2005) shows rolling tundra with patches of Polargrass (light beige in colour) on the south side of Herschel. Photo by C. D. Eckert