SEABIRD RESEARCH AT PRINCE LEOPOLD ISLAND IN 2009

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Cover photo: From Blind G, Prince Leopold Island, July 2008 (AJG)

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SUMMARY

1. A field team of three people (AJG, Rob Rankin and Kevin Elner) visited Prince Leopold Island from 5-22 July 2009 to retrieve solar geolocator tags deployed on murres and kittiwakes in 2008 (International Polar Year project), to collect eggs for contaminant analysis and to make routine observations of marine birds as part of ongoing population monitoring.

2. Seventeen geolocator loggers were retrieved from Thick-billed Murres and four from Black-legged Kittiwakes. Unfortunately, owing to device failure, data could be obtained from only fourteen murres and two kittiwakes. The majority of murres wintered in southern Davis Strait. One kittiwake spent the entire winter close to Newfoundland.

2. The ice had broken up and mostly cleared from Barrow Strait by mid-June, so that by 25 June the edge of land fast ice in Parry Channel was 300 km west of Prince Leopold Island. The timing of breeding of Thick-billed Murres, with median hatching about 26 July, was the earliest yet observed and Black-legged Kittiwakes were similar to the earliest years observed previously (median hatch 23 July). Northern Fulmars, which vary little from year to year in their date of laying, began to hatch on 21 July suggesting that they bred a little earlier than usual. However, Glaucous Gulls appear to have lain later than in 2008, although the possibility that some first clutches were lost and that those hatching late were replacements could not be discounted.

3. Marine bird population trends in recent years at Prince Leopold Island have been highly variable: numbers of Thick-billed Murres on monitoring plots, after a 30% increase during 1976-2000, have shown little subsequent change; Northern Fulmar numbers on monitoring plots have gradually decreased since the 1970s; Black-legged Kittiwakes, which appeared fairly stable from 1976-1990 have shown a sharp increase subsequently, with numbers doubling since 1990; Glaucous Gulls, which declined sharply between 1970s and 2000 seem to have declined further, with numbers breeding along the East Cliffs in 2009 being the lowest recorded to date. However, numbers of Glaucous Gulls breeding on the south cliffs were slightly higher in 2009 than in 2001.

4. The cabin was found to be in good condition. All blinds were strengthened and shuttered on departure.

The hut, August 2008 (AJG)

Transport, July 2008 (AJG)

CONTENTS

1. Background

Research on marine bird populations and ecology at Prince Leopold Island has been ongoing irregularly since 1975. The island supports the most diverse assemblage of seabirds breeding together anywhere in the Canadian Arctic. Intensive baseline studies of Thick-billed Murres, Northern Fulmars, Black-legged Kittiwakes and Glaucous Gulls were carried out during 1975-1977 with observations extending over the entire breeding season. Subsequent observations have generally been made for shorter periods and, since 2000, have concentrated principally on collecting data relating to the potential effects of climate change on the birds and the marine ecosystems of which they form a part. The location is peculiarly appropriate for such studies, as the colony occupies a region close to the limit of breeding conditions for Thick-billed Murres and Black-legged Kittiwakes, such that we anticipate any climate amelioration should be beneficial to the population in the short-term.

In 2009, a team of biologists visited Prince Leopold Island, Nunavut, between 5-22 July. Primary objectives of the visit were the retrieval of solar geolocator tags deployed on Thick-billed Murres and Black-legged Kittiwakes in 2008 (a continuation of the International Polar Year project, “How Seabirds Can Help Detect Ecosystem Change in the Arctic”) and the collection of Northern Fulmar and Thick-billed Murre eggs (15 each) for contaminant analysis. The remainder of the work involved a repetition of the seabird population monitoring that has been carried out at this site since 1975. Observations were carried out on Thick-billed Murres, Black-legged Kittiwakes, Glaucous Gulls and Northern Fulmars. The following people took part in this year’s research: Tony Gaston (EC, National Wildlife Research Centre), Rob Rankin (Graduate Student, University of Lund, Sweden) and Kevin Elner (volunteer).

Accommodation consisted of a plywood cabin, erected in 2003 and used for sleeping and working and a Weatherhaven used for cooking and eating. A small outhouse is situated close to the airstrip. All of these facilities are scheduled for upgrade as part of the Arctic Research Infrastructure Fund initiative. Observations were conducted

from four plywood blinds (at D, G, S1 and U). All wooden structures were checked for soundness, renovated where necessary and left in place at the end of the season, suitably guyed down. The Weatherhaven was stored inside the hut.

Transportation to and from the site was by Polar Continental Shelf's Twin-otter from Resolute Bay. Apart from single arrival and departure flights, a small amount of additional food and equipment was delivered on 11 July by a flight bringing in the DIAND site inspector. At start-up we brought in three barrels of water, in case, as in 2008, the usual water source was dry. In the event the pond remained partially filled throughout our stay and additional water for cooking and cleaning was obtained from there.

Weather at camp was recorded at 0700-0800 and 1800-1900 h daily. The summer of 2009, like that of 2008, was exceptional for the amount of rainfall, with significant precipitation taking place on 7/17 days. Winds were generally moderate, with speeds >30 km/h recorded at 18.00 h on only 4 days in July. The maximum wind speed recorded was 60 km/h on 15 July. Conditions for observing birds were poor (visibility <0.5 km in morning and evening) on 7 days. Evening counts of murre study plots were impossible on 2 days. Maximum temperatures ranged from 1° C before 8 July to +12°C on 14 July.

A brief description of the field work carried out on the different study species and some preliminary results follow.

2. Thick-billed Murre *Uria lomvia*

Photo: T.J.F. Lash

2.1 Timing of breeding and reproductive success

Daily observations (weather permitting) were made of pairs breeding at plots S1 and U between 6 and 21 July. At plot U, 40 pairs and at plot S1, 157 pairs were known to have laid eggs. The first hatch occurred on 20 July on plot S1 and by 21 July a minimum of 14/167 (8%) permanently occupied sites had hatched; the earliest hatching on plot U was on 21 July. Among 56 eggs examined at Plot S2 on 21 July, one was hatched, four pipped and one starred. On the same date, at plots U and S1 combined, a minimum of 15/215 (7%) eggs were hatched on permanently occupied sites (eggs had not been observed on 18 of these sites). In 2008, when the first egg hatched on 22 July at plot S1, 7% hatching was recorded only on 27 July (Fig. 1). Although observations could not be extended to the median date of

hatching, the appearance of 7% of chicks six days before the same proportion was reached in 2008 suggests that median hatching would have been approximately 26 July, which would make this the earliest year on record for laying of Thick-billed Murres at Prince Leopold Island. This might be expected on the basis of the position of the ice edge relative to the colony on 25 June (Fig. 2).

Figure 1

Date of hatching (± 24 h) for nestling Thick-billed Murres at plots S1 and U in 2008 and 2009.

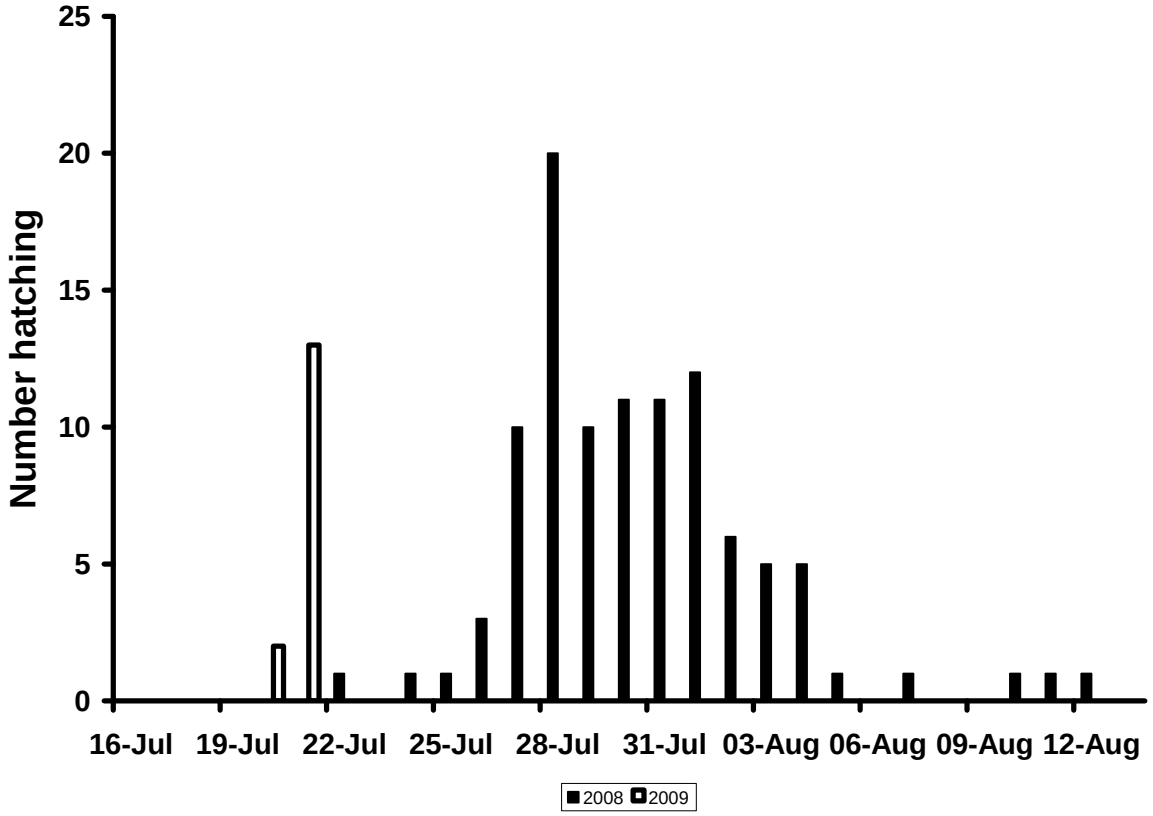
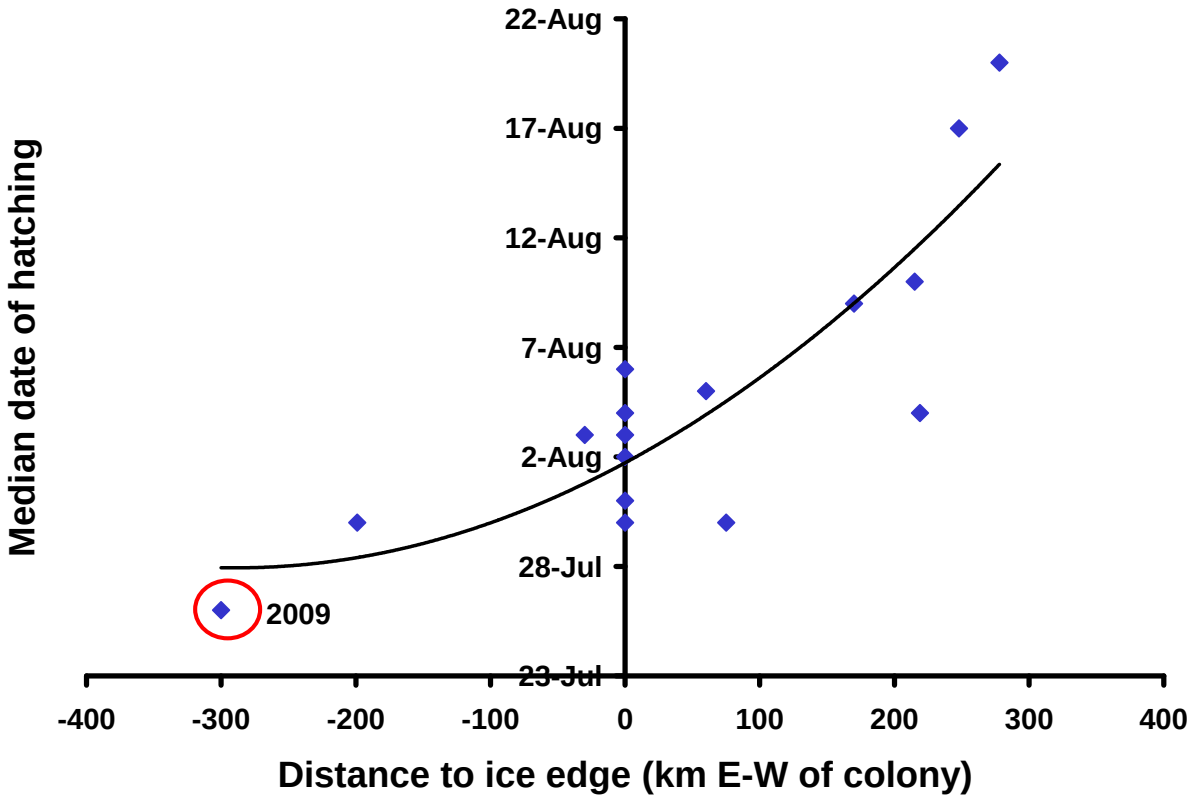


Figure 2

Timing of breeding (median date of hatching) in relation to the position of the ice edge in Parry Channel relative to Prince Leopold Island since 1975.



The estimate of 215 pairs laying on plots U and S1 in 2008 is lower than usual: 2000, 269 pairs; 2001, 249 pairs; 2002, 219 pairs; 2008, 230 pairs). A patch of steeply-sloping ice covered more than 30 sites on S1 when first observed and most previously occupied sites apparently unoccupied in 2009 were situated under the ice. It seems likely that birds which normally occupied sites in the ice-covered area of the plot abandoned breeding in 2009. Otherwise, the numbers breeding on plots S1 and U seem to have remained stable for the past decade. This result is concordant with the daily counts at the same and other plots (see below). Together, the evidence suggests no recent change in the breeding population.

2.2 Egg size

Fifty-three eggs were measured (length and maximum breadth) at plot S2 and nearby on 20 July (Appendix 1). The estimated mean length of these eggs was 77.3 mm ± 3.3 (range 69.9-83.7 mm), mean breadth was 49.5 mm ± 1.6 (range 45.0-53.3) and mean volume index (length * breadth^2) was 190.2 cm^3 + 18.0 (range 158.0-234.8). These volume indices are larger than in 2008 (mean 180.9 ± 16.2).

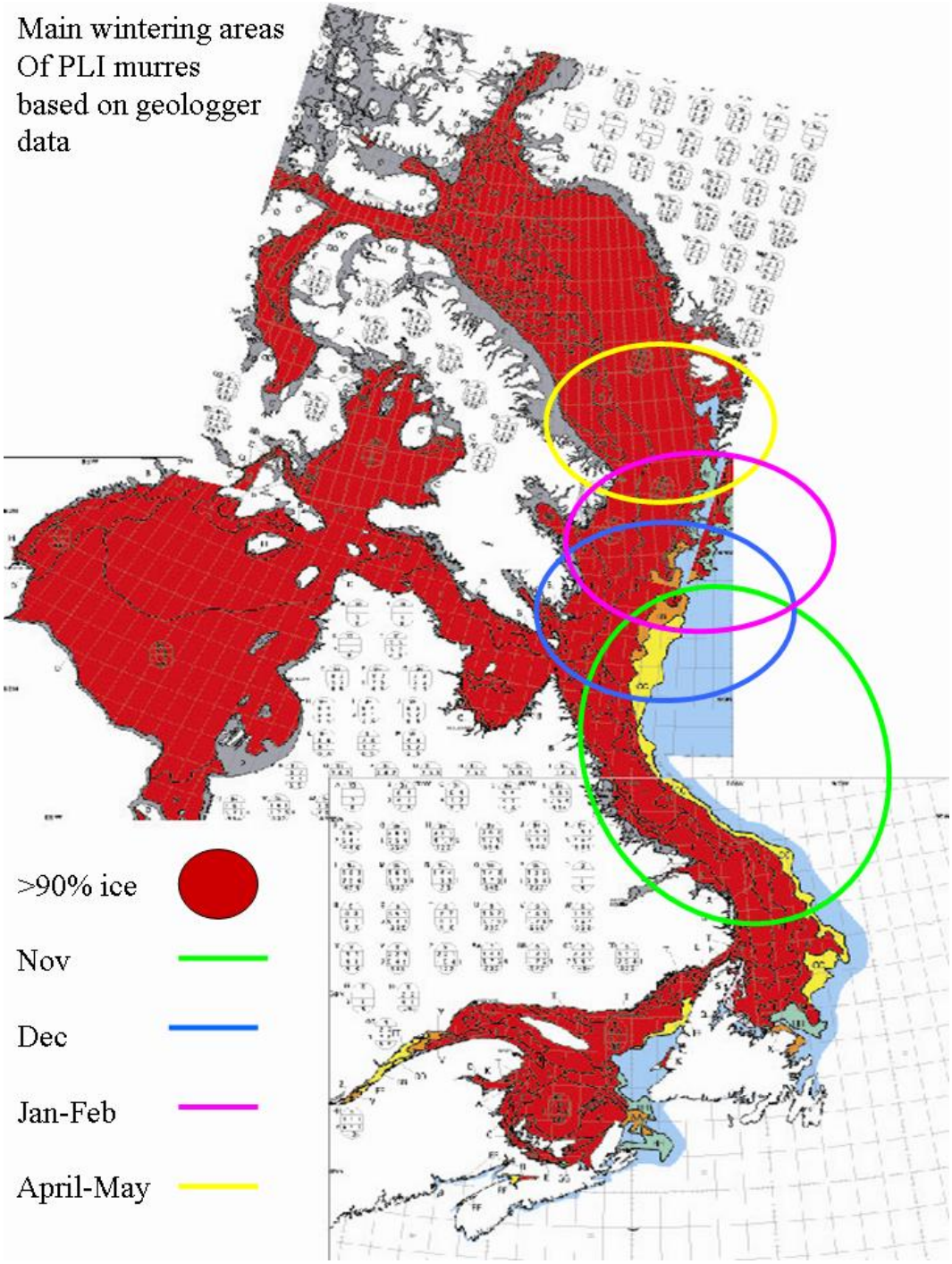
2.3 Geolocator results

Only preliminary results are available from the geolocators deployed on Thick-billed Murres. The data were mapped via the British Antarctic Survey software, *Birdtracker* (Bird tracking CSIDC project team, version 1.0). Latitude estimated by these devices is unreliable near the equinoxes and useless in summer where 24 h daylight prevails, but fixes in late August, November-February and from mid-April to the onset of 24 h daylight are generally accurate to within 150 km.

Most individuals moved rapidly southwards in late August to locations near the mouth of Hudson Strait by early September. By November, most birds were in the Labrador Sea, many close to the continental shelf. In December most had shifted northwards to the latitude of southern Baffin Island and in January and February most were centered in southern Davis Strait between southern Baffin Island and the west coast of Greenland. After the equinox the majority had shifted northward again to central Davis Strait between the Cumberland Peninsula and approximately Disk Bay, Greenland (Fig. 3). Birds usually arrive in the vicinity of Prince Leopold Island by mid-May (Gaston & Nettleship 1981).

Figure 3

Main wintering areas of Prince Leopold Island Thick-billed Murres, as determined from *Birdtracker* analysis of geologger data obtained during the winter of 2008-2009.



2.4 Adult capture

In addition to birds captured to retrieve geolocators, sixteen birds not carrying geolocators were captured and blood-sampled as controls (using noose poles). Just prior to departure a further 11 breeding Thick-billed Murres were captured on plots S1 and S2 and fitted with geolocators (LOTEK-type) attached to the leg band with adhesive tape and cable ties. One had been banded in a previous year. All were incubating eggs. Details are given in Appendix 2. These will need to be retrieved in 2010 to be downloaded. Fourteen time/depth/temperature loggers (Lotek LTD-1400 and 1500 series) were deployed, of which all but one were retrieved and successfully downloaded to give information on time budgets and dive depths over an approximately 54 h period.

Blood samples for sexing were collected from birds on which devices were deployed. All birds were captured between 11:00 – 16:00 h CDT and 12/13 were females. The sex ratio supports previous evidence from Prince Leopold Island that the majority of birds incubating or brooding in the middle of the day are females – the opposite arrangement to what has been observed at Coats Island.

The mean duration of incubation shifts during the period when depth loggers were deployed (11-20 July) was estimated from temperature records which show when birds were on the colony and when they were away foraging. The mean for all shifts was 12 h 42 min (± 5 h 36 min SD, Fig. 4), but those carried out during 13 July, a period of strong winds, averaged longer. Although females were mainly present during the middle of the day and males during the middle of the night, the synchrony of change-overs was low and the numbers of pairs changing over varied little with time of day (Fig. 5).

Figure 4

Duration of incubation shifts during 11-20 July, as determined from temperature logger data.

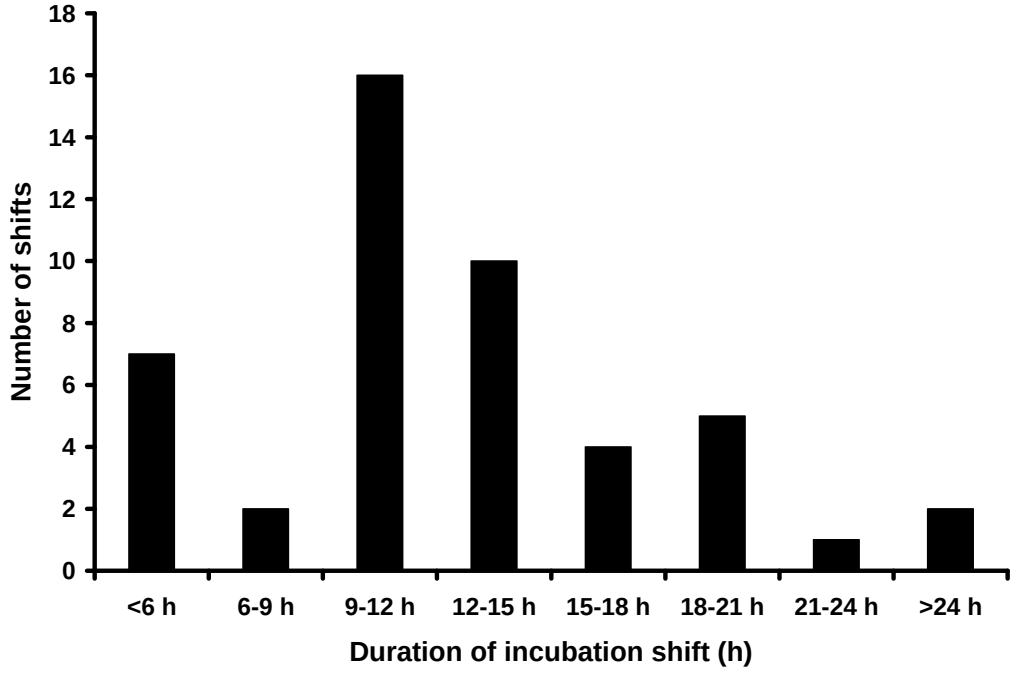
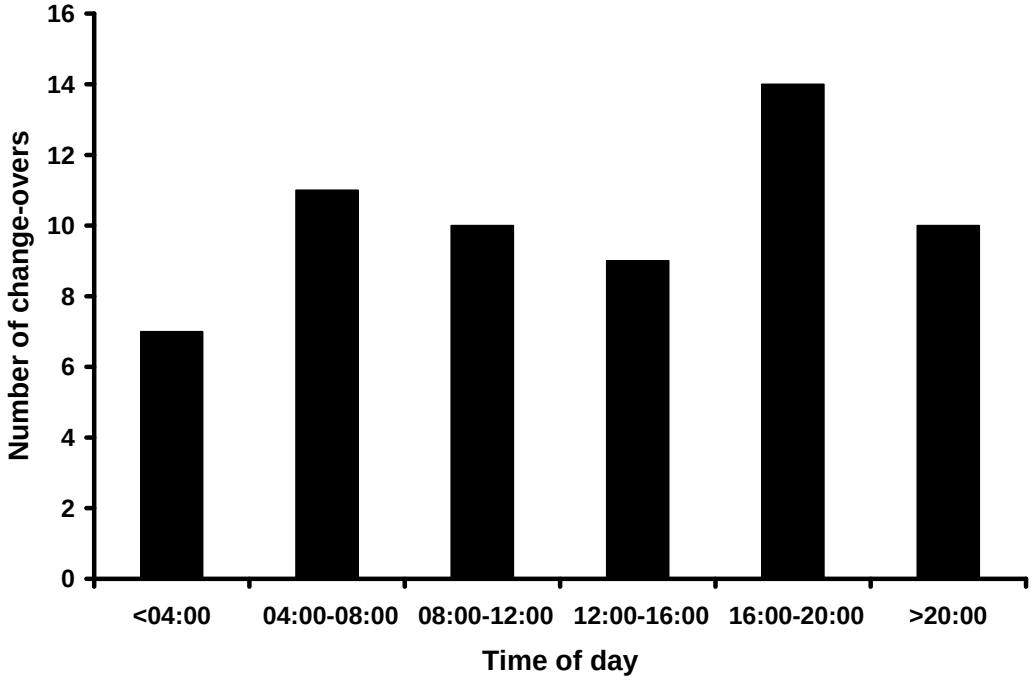


Figure 5

Timing of incubation shift change-overs during 11-20 July 2009.

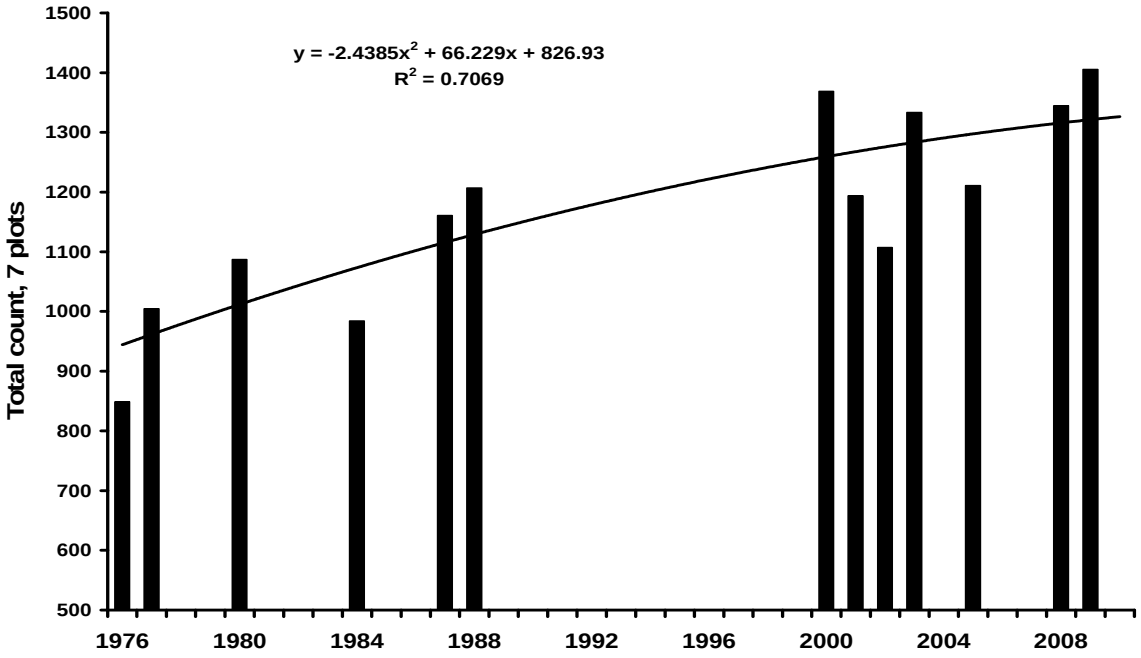


2.5 Attendance

Daily counts were carried out on seven Thick-billed Murre study plots between 17.00-18.00 h between 6-21 July, weather permitting (Appendix 3). The highest count recorded was on 14 July (1594) and the lowest on 11 July (980). There was little seasonal trend in numbers.

The mean of counts during 6-21 July (mid-late incubation period) was 1372 ± 161 (N=13). That is higher than mean counts in 2001 (1194) and 2002 (1107), but similar to those in 2000 (1369) and 2003 (1311). Comparison of counts made over similar periods in twelve years between 1976 and 2008 suggests an increase in numbers from 1976-2000, since when numbers appear to have been roughly stable (Fig. 6). Like 2008, the early breeding year suggests that feeding conditions were probably good, perhaps resulting in larger-than-usual numbers of prospecting birds attending the colony.

Figure 6
Trend in plot counts at Prince Leopold Island since 1976



3. Black-legged Kittiwake *Rissa tridactyla*

Photo: AJG

3.1 Timing of breeding

Timing of breeding, clutch size and attendance were measured by making daily observations at plots E and G between 6-21 July in 2009. Additional observations were made at plots M, $Q_{south(upper)}$, $Q_{south(lower)}$, S and T. Observations were not possible on some days because of thick fog.

First hatching was observed on 19 July and 7% of clutches had hatched at least one chick by 21 July, the same proportion as Thick-billed Murres. The level of hatching on 21 July corresponded to the level reached on 25 July 2008, suggesting that the timing of hatching was about 4 days earlier in 2009 (Fig) with median hatching likely about 24 July. In other years for which data are available (Table 4), median hatching ranged over 14 days, from 23 July (2000) to 5 August (2001), so this year's timing was towards the early end of the range for the species at Prince Leopold Island. The range in timing of breeding for Black-legged Kittiwakes at Prince Leopold Island appears similar to that for Thick-billed Murres, which showed median hatch ranging from 26 July – 10 August (11 days) over the same sample of

years. Both show similar trends in relation to ice break-up in Parry Channel although median hatching for kittiwakes occurs approximately 7 days earlier than for murres (Fig. 8).

Figure 7
Dates of hatching for Black-legged Kittiwakes at Prince Leopold Island in 2008 and 2009

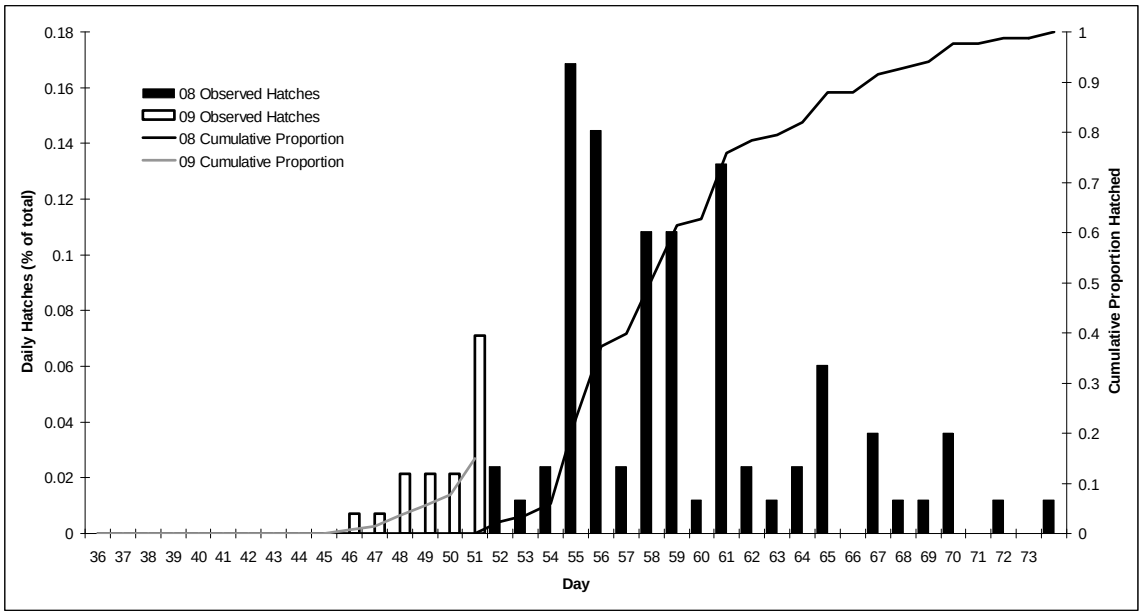
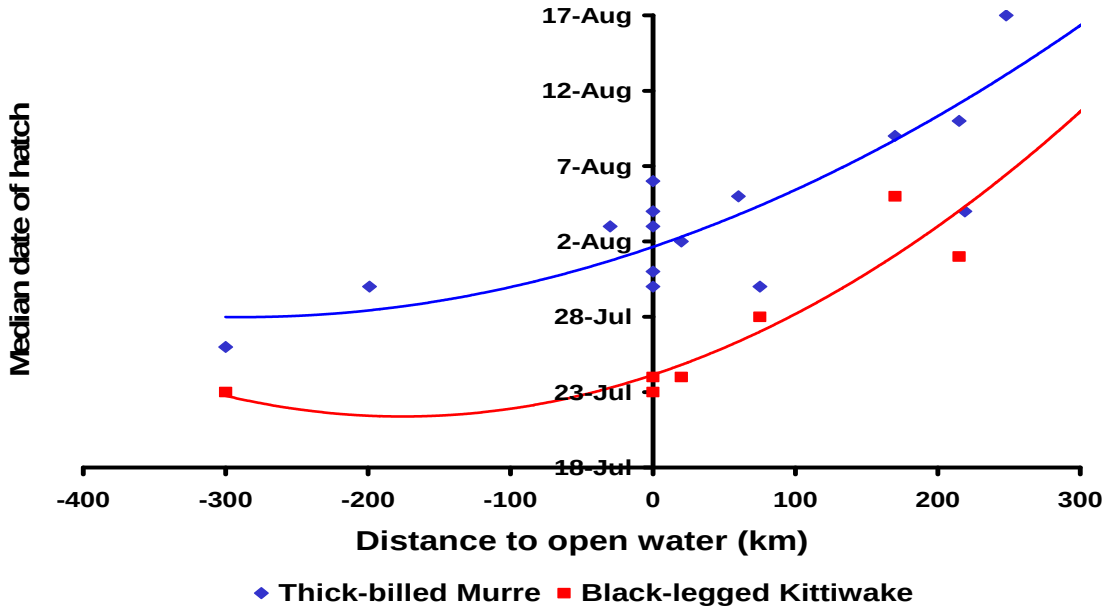


Figure 8
Timing of median hatching for Thick-billed Murres and Black-legged Kittiwakes at Prince Leopold Island in relation to the position of the ice edge on 25 June



3.2 Clutch size

Clutch size was observed at plots E and G. A total of 130 nests on plots E and G were occupied throughout the period of observation and all these pairs were assumed to have attempted to breed. Clutches of 1 egg made up 17% and 2-egg clutches made up 83% of the total (N = 116), giving a mean clutch size of 1.83 eggs. This is the highest mean clutch size recorded at Prince Leopold Island (Table 1). No three-egg clutches were seen in 2009. There is a strong effect of timing of breeding on clutch size (Figure 9).

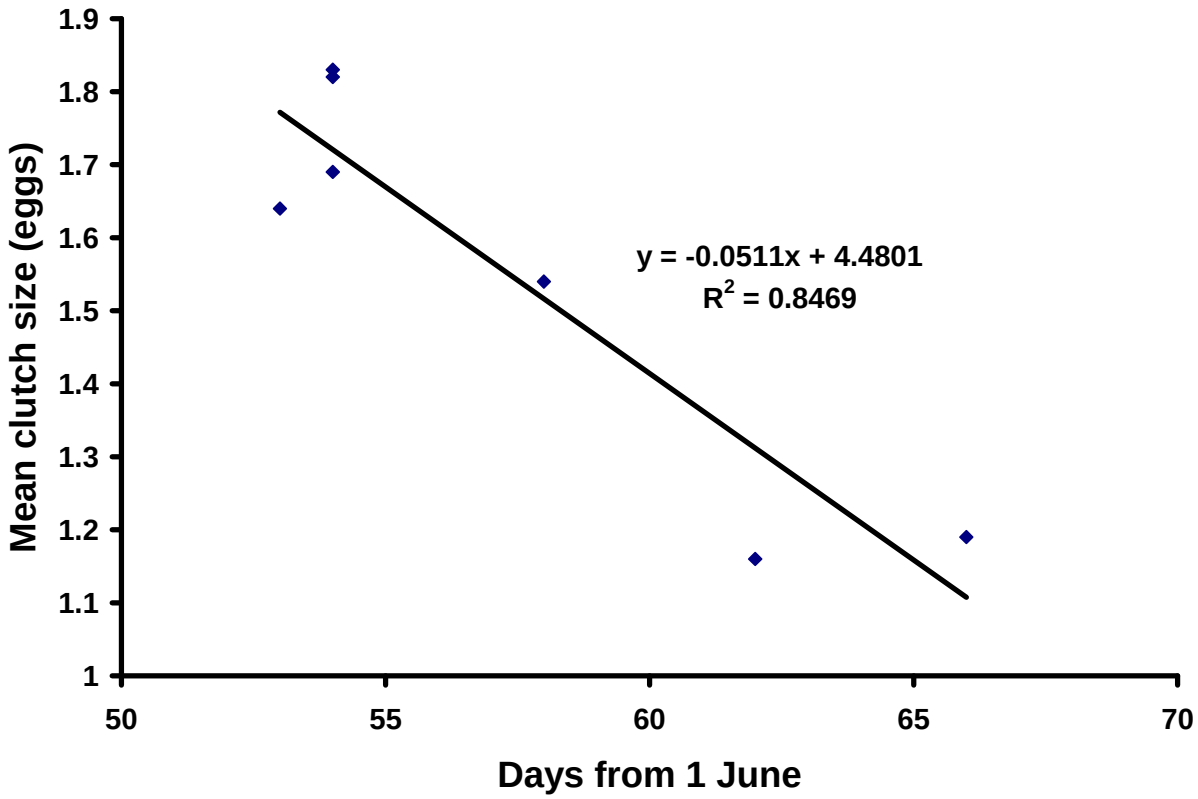
Table 1
Timing and success of breeding for Black-legged Kittiwakes at Prince Leopold Island, 2000-2008

	2000	2001		2002	2003	2005	2008	2009
	Plot G	Plot G	Other	Plot G	Plot G	Plot G+E	Plot G+E	Plot G+E
Sites occupied	?	102	275	119	107	115	130	116
Median hatching[1]	23-Jul	5-Aug		1-Aug	24-Jul	24-Jul	28-Jul	c. 24 Jul
Clutch % >1 egg[2]	62	19		9	69	82	54	83
Mean clutch size	1.64	1.19		1.16	1.69	1.82	1.54	1.83
Fledged chicks/pair	?	0.73	0.54	0.38	0.97		0.79	
Brood size at fledging (1+ = 1)	1.49	1.15	1.07	1.00	1.26		1.23	

[1] In 1988, 31 July at plot G (Nettleship et al. 1990)
[2] In 1988, 1.70 at plot G (Nettleship et al. 1990)

Figure 9

Clutch size in relation to timing of hatching at Prince Leopold Island in seven years during 2000-2009



3.3 Geolocators

Results were available at the time of writing for only one Black-legged Kittiwake. This bird was close to the mouth of Hudson Strait in late August and was found on the Newfoundland banks from November through to the spring Equinox.

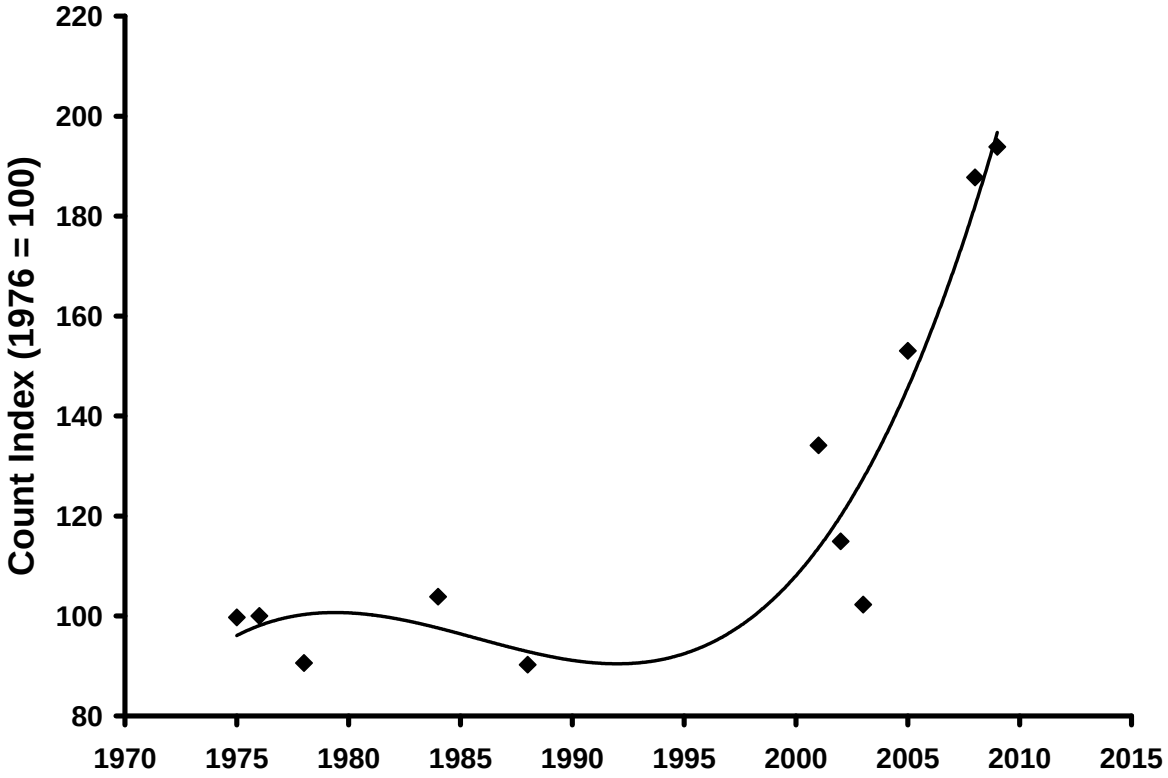
3.4 Population monitoring

Counts were made daily at 17:00 – 19:00 h at plots G, M, Q_{south} (upper and lower), $Q_{north,}$ S and T. Numbers counted remained stable over the period of observations, with the highest count (960) on 6 July and the lowest (739) on 17 July. Full details are given in Appendix 4. The mean total for the period 6-21 July was 857 ± 70 birds, a slight increase over the same period in 2008 and a 90% increase over 2003, giving an annual rate of increase since 2003 of 11%/annum. Counts since

1976 suggest a fairly static population up to some time between 1988-2000, followed by a rapid increase since then (Fig. 10).

Figure 10

Changes in monitoring counts of Black-legged Kittiwakes (10 July – 6 August) at Prince Leopold Island during 1975-2009.



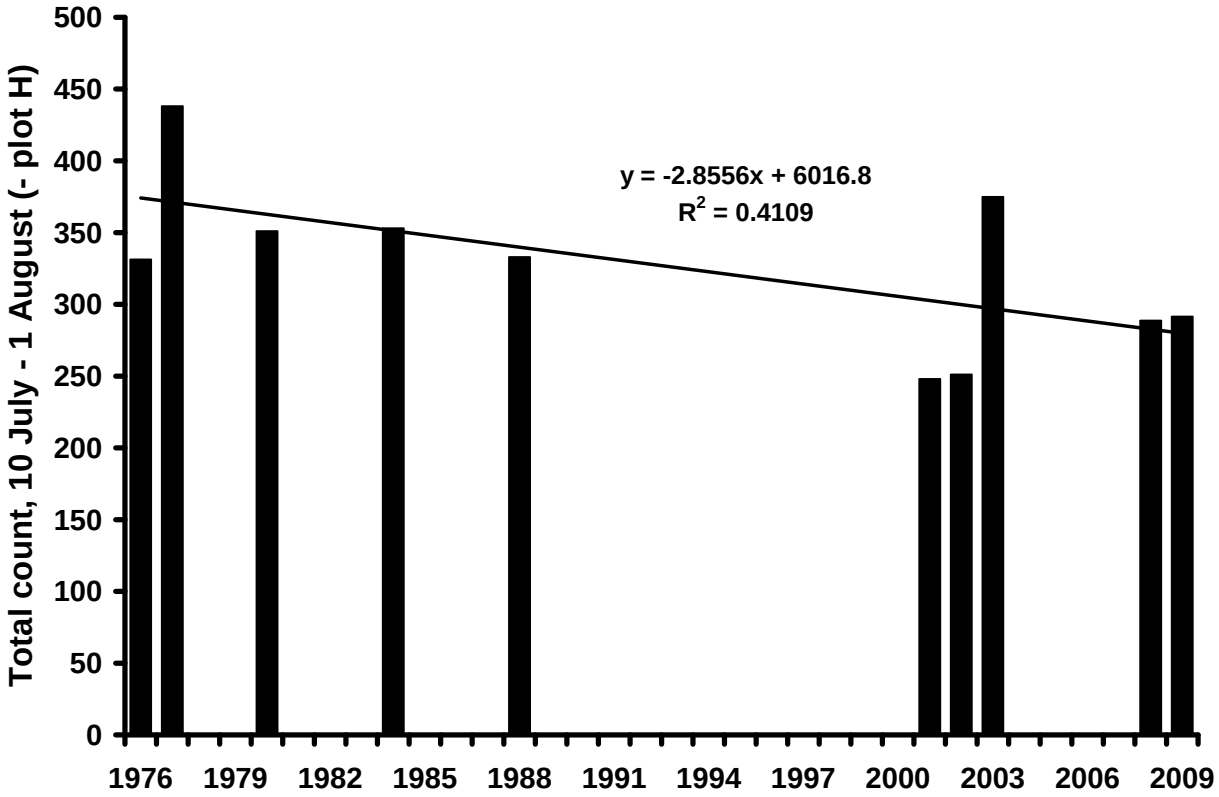
4. Northern Fulmar *Fulmarus glacialis*

Photo: T.J.F. Lash

4.1 Attendance

Counts were made daily at 17.00-19.00 h at study plots AA, A, C, D, G, H and J. Sites with single birds and with pairs present were counted separately. As in previous years, attendance was highly variable (Appendix 5). Numbers were generally lower than in 2003 and a comparison of counts during the period 10 July – 7 August suggests that there has been a small, but steady contraction in numbers visiting the study plots at Prince Leopold Island since the 1970s (Fig. 11).

Figure 11
Mean daily counts of Northern Fulmars present at plots AA, A, C, D, G and J during 6 July – 7 August, with linear trend fitted.



4.2 Timing of breeding

Two eggs had hatched by 21 July, a very early date compared with previous years. Success up to hatching appeared to be relatively high, with few eggs left unattended in 2009. No other information on fulmar reproduction was obtained.

5. Glaucous Gull

The number of Glaucous Gull nests found along the East cliff colony, and their contents, were recorded periodically throughout the study period. Altogether, 16 pairs were present on the upper half of the East Cliff colony, one pair on the cliffs immediately south of camp and two pairs on the lower cliffs just south of AA. Of the 16 pairs on the East Cliffs, at least 10 produced chicks and another three pairs were still sitting, presumably incubating eggs, on 21 July.

Table 7
Timing and success of breeding for Glaucous Gulls nesting along the east Cliff colony since 2000

	2000	*2001*	*2002*	*2003*	*2008*	*2009*
Number of pairs	25	26	21	19	19	16
First egg laid			8 Jun	5 June		
Median hatch		9 Jul	13 Jul	5 Jul	6 July	10 July
Final brood						
1	3	5	3	3	8	
2	3	4	2	8	7	
3	1	3	0	3	0	
Mean	1.71	1.83	1.4	2	1.47	
SD	0.48	0.85	0.33	1.47	1.16	

Seven broods had hatched at the first survey (10 July) and ten pairs were known to have hatched chicks by 22 July. On the last date nine pairs had a total of 19 chicks, meaning the final success would have been a maximum of 19/16 = 1.19 chicks/pair.

6. Black Guillemot *Cepphus grylle*

Only two Black Guillemots were seen on a walk along the base of the South Cliffs on 16 July. This colony needs to be re-examined because it appears to be contracting.

7. Observations of other species

8.1 Birds

Apart from the 5 species listed above, we recorded 6 other species of birds on the island. Snow Buntings *Plectrophenax nivalis* and Common Ravens *Corvus corax* were seen daily in areas adjacent to the East Cliff. Up to three ravens were seen. Two Golden Plovers *Pluvialis dominica* were seen on 5 July, one Baird's Sandpiper *Calidris bairdii* on 9 July, a single white morph Gyrfalcon *Falco rusticolus* on 10 July and eight Brant *Branta bernicla* on 14 July.

8.2 Mammals

A single polar bear *Ursus maritimus* was seen at the foot of the trail climbing up the scree from the SE Spit on 15 July One arctic fox *Alopex lagopus* was seen almost daily around camp and in the vicinity of the cliffs between G and AA.

On 6 July two bowhead whales *Balaena mysticetus*, the smaller probably a calf, as it kept close to the tail of the larger, swam slowly northwards about 0.5 km off the east cliffs. Beluga *Delphinapterus leucas* were seen on three dates between 10 - 17 July, all in pods of <10. We saw no narwal *Monodon monoceros* in 2009. One walrus was seen on 15 July.

8. Acknowledgements

I am very grateful to Rob Rankin and Kevin Elner for their excellent support in the field and to Tim Lash for permission to use his photographs. Everyone did an excellent job. Funding was partly provided by the Northern Contaminants Programme administered by Indian and Northern Affairs Canada via Birgit Braune (Research Scientist, NWRC). Additional funding was provided by the International Polar Year project "Using Seabirds to Detect Ecosystem Change in the High and Low Arctic". I also thank Polar Continental Shelf Project of Natural Resources Canada for outstanding logistical support while we were in Resolute and on the island. Thanks

to Christine Eberl for arranging supplies and shipping and for acting as our southern agent, to Mark Mallory for arranging permits and to Grant Gilchrist for expediting financial arrangements while I was in the field.

9. References

Gaston, A.J. and Nettleship, D.N. 1981. The Thick-billed Murres of Prince Leopold Island. Canadian Wildlife Service Monograph No. 6, CWS, Ottawa. 351 pp.

Appendix 1

Thick-billed Murre eggs measured at plot S(L) in 2009

	Measured from photo-image			Calibration	Calculated values		
Egg #	Line	Length	Breadth		Length (mm)	Breadth (mm)	Volume Index (mL)
76	11.81	6.76	4.68	1.08	72.82	50.39	184.92
77	11.08	6.41	4.20	1.15	73.65	48.25	171.48
78	10.90	6.79	4.16	1.17	79.24	48.60	187.13
79	10.84	6.68	4.31	1.17	78.46	50.57	200.63
80	10.87	6.11	4.38	1.17	71.59	51.26	188.11
82	10.93	6.24	4.13	1.16	72.63	48.05	167.72
83	10.79	5.98	4.10	1.18	70.49	48.31	164.54
85	10.81	6.82	4.02	1.18	80.33	47.30	179.75
86	10.77	6.45	3.95	1.18	76.24	46.75	166.59
87	10.31	6.59	4.15	1.23	81.36	51.20	213.30
89	16.98	10.20	6.37	0.75	76.49	47.74	174.36
90	16.18	10.06	6.43	0.79	79.11	50.59	202.47
91	14.35	8.51	5.51	0.89	75.53	48.84	180.13
92	14.03	8.56	5.74	0.91	77.64	52.03	210.22
94	14.03	8.22	5.45	0.91	74.62	49.47	182.59
95	14.30	8.67	5.69	0.89	77.19	50.65	198.05
96	14.31	8.37	5.38	0.89	74.51	47.83	170.47
97	14.24	8.52	5.40	0.89	76.21	48.29	177.71
98	14.15	8.44	5.43	0.90	75.94	48.80	180.87
99	14.39	9.13	5.69	0.88	80.71	50.36	204.69
100	14.36	8.85	5.60	0.89	78.43	49.64	193.25
101	14.27	8.01	5.05	0.89	71.44	45.03	144.84
102	12.74	8.18	5.11	1.00	81.70	51.03	212.79
103	13.11	7.56	5.04	0.97	73.48	48.99	176.32
104	13.05	8.46	5.22	0.98	82.53	50.88	213.61
105	13.23	8.57	5.21	0.96	82.40	50.14	207.11
106	12.83	7.70	4.88	0.99	76.42	48.38	178.86
107	11.92	7.19	4.84	1.07	76.77	51.63	204.63
108	11.45	7.05	4.79	1.11	78.39	53.28	222.52
109	11.59	6.98	4.50	1.10	76.60	49.42	187.11
110	11.48	6.91	4.53	1.11	76.65	50.24	193.49
111	11.53	7.23	4.53	1.10	79.83	49.99	199.50
112	10.82	6.83	4.40	1.18	80.38	51.80	215.68
113	11.18	7.02	4.39	1.14	79.89	50.01	199.78
114	10.81	7.07	4.51	1.18	83.24	53.11	234.82
115	10.69	7.03	4.35	1.19	83.70	51.76	224.23
116	10.71	6.62	4.15	1.19	78.77	49.31	191.56
117	10.51	6.38	4.10	1.21	77.25	49.65	190.42
118	9.96	5.91	3.81	1.28	75.54	48.70	179.12
121	12.79	7.65	4.74	1.00	76.15	47.22	169.84
122	12.77	7.33	4.95	1.00	73.04	49.38	178.14
124	13.68	8.10	5.12	0.93	75.38	47.64	171.10

126	13.59	8.10	5.13	0.94	75.87	48.07	175.34
127	13.61	8.20	5.03	0.94	76.68	47.03	169.62
129	13.39	8.44	5.09	0.95	80.23	48.44	188.25
130	13.23	7.26	4.94	0.96	69.86	47.55	157.97
132	13.36	8.38	5.13	0.95	79.87	48.89	190.91
133	13.27	7.58	5.24	0.96	72.69	50.25	183.57
134	13.21	8.33	5.24	0.96	80.27	50.47	204.45
136	12.47	7.47	4.90	1.02	76.24	50.01	190.67
137	12.74	7.72	4.91	1.00	77.17	49.09	185.97
138	11.15	7.08	4.44	1.14	80.86	50.71	207.93
139	11.61	7.08	4.61	1.10	77.65	50.53	198.30
140	11.11	6.99	4.51	1.15	80.01	51.69	213.78
141	10.95	6.71	4.36	1.16	78.02	50.69	200.45
142	11.61	7.14	4.46	1.10	78.24	48.90	187.12
Mean					77.26	49.55	190.16
					3.25	1.64	17.97

Appendix 2
Details of adult Thick-billed Murres trapped at Prince Leopold Island in 2009

Date	Time	Stat	Band number	Plot	Site	Breeding status	D-logger ##	Date recap	Time recap.	Geolocator	Notes
10-Jul		N	78535403	U	4	E					
10-Jul		N	78535404	U	5	E					
10-Jul		N	78535405	U	7	E					
10-Jul		N	78535406	U	8	E					
10-Jul		N	78535407	U-R		E					
10-Jul		N	78535408	U-R		E					
10-Jul		N	78535409	U-R		E					
10-Jul		N	78535410	U-R		E					
10-Jul		N	78535411	S2		E					
11-Jul	10.20	N	78535413	U-R	34	E	506	19-Jul	10:58		
11-Jul	11.12	N	78535414	S2-R		E	511	17-Jul	15:25		
11-Jul	11.20	N	78535415	S2-R		E	510	18-Jul	7:23		
11-Jul	11.26	N	78535416	S2-R		E	505	17-Jul	15:15		
11-Jul	11.32	N	78535417	S1	175	E	509	17-Jul	15:45		
11-Jul	12.55	N	78535418	S2-R		E	512	17-Jul	15:05		
11-Jul	13.01	N	78535419	S2-R		E	581	17-Jul	15:35		
11-Jul	13.09	N	78535420	S2		E	503	17-Jul	15:00		
11-Jul	11.01	R	78535412	S2		E	519	18-Jul	17:02		
13-Jul	14:45	N	78535421	U-R		E					
17-Jul	13:10	N	78535422	F		E	122	20-Jul	18:35		
17-Jul	13:31	N	78535423	F		E	120	20-Jul	13:29		
17-Jul	13:40	N	78535424	F		E	121	20-Jul	13:42		
17-Jul	13:49	N	78535425	F		E	129				
17-Jul	13:58	N	78535426	F		E					
17-Jul	16:12	N	78535427	S1	5	E	127	20-Jul	14:35	LOTEK1032	
17-Jul	16:17	N	78535428	S1	6	E	124				
17-Jul	17:20	N	78535429	S2		E					
17-Jul	17:25	N	78535430	S2		E					
17-Jul	17:35	N	78535431	S2		E					

19-Jul	10:55	N	78535432	U-R		E		
20-Jul	13:33	N	78535433	F		E		
20-Jul	14:45	N	78535434	S1	7	E	LOTEK1038	
20-Jul	14:52	N	78535435	S1	407	E	LOTEK1036	
20-Jul	15:06	N	78535436	S1	10	E	LOTEK1586	
20-Jul	15:15	N	78535437	S1	12	E	LOTEK1039	
20-Jul	15:21	N	78535438	S1	13	E	LOTEK1037	
20-Jul	15:30	N	78535439	S1	401	E	LOTEK1583	
20-Jul	15:38	N	78535440	S2®	4	E	LOTEK1582	
20-Jul	15:45	N	78535441	S1	16	E	LOTEK1581	
20-Jul	15:55	N	78535442	S1	16	E	LOTEK1030	Mate of -441
21-Jul		N	78535443	F		E		
10-Jul		N	78550997	S2		E		
10-Jul		N	78550998	S2		E		
10-Jul		N	78550999	U(L)		E		
18-Jul	15:00	R	78550965	U	34	E		
10-Jul		R	78550991	U®		E		
10-Jul		R	101500351	U®		E		
10-Jul		R	190520001	S2		E		
17-Jul	17:30	R	190520006	S2		E		
10-Jul		R	190520010			E		
10-Jul		R	190520053	S2		E		
10-Jul		R	240615051	U®		E		
18-Jul	14:30	R	240615059	U(L)		E		
10-Jul		R	240615063			E		
20-Jul	15:00	R	240606256	S1	5	E	LOTEK1024	
21-Jul	9:00	R	240615106	S1	5	E		

Appendix 3

Daily counts at Thick-billed Murre monitoring plots, 2009. Cell highlighted in yellow includes interpolated value for plot G4

Year	Date	G1	G4	N	N+	Q1	Q4	S1	S1+	U	Total (7plots)
2009	6-Jul	151	249	220	45	222	87	224	22	70	1290
2009	7-Jul	197	263	244	65	253	102	260	28	75	1487
2009	8-Jul	159	248	223	46	185	83	223	22	62	1251
2009	9-Jul	126	181	167	41			200	18	62	
2009	10-Jul	201	290	262	66	242	99	252	22	93	1527
2009	11-Jul	100	140	162	36	186	82	192	16	66	980
2009	12-Jul	156	237	233	56	218	97	215	20	69	1301
2009	13-Jul	155	229	248	60	235	102	240	27	81	1377
2009	14-Jul	200	262	273	72	275	102	296	25	89	1594
2009	15-Jul										
2009	16-Jul	190	254	245	59	243	90	240	20	80	1421
2009	17-Jul	154	227	203	49	233	88	228	20	67	1269
2009	18-Jul	165		260	61	240	90	278	26	89	1469
2009	19-Jul										
2009	20-Jul	170	237	241	51	215	95	237	21	87	1354
2009	21-Jul	201	269	265	62	251	97	256	27	87	1515
	Mean 6-21 Jul	166	237	232	55	231	93	239	22	77	1372
	St. Dev.	30	39	34	10	26	7	29	4	11	161

Appendix 4
Counts of Black-legged Kittiwake population monitoring plots at Prince Leopold Island in 2009

Date	G	M	QSU	QSL	S	QN	T	Totals
6-Jul	160	100	131	148	77	116	228	960
7-Jul	163	101	121	142	71	117	219	934
8-Jul	138	93	104	118	69	98	190	810
9-Jul	109	73			58		161	
10-Jul	167	97	115	146	75	113	161	874
11-Jul	114	79	108	119	72	87	213	792
12-Jul	143	85	108	121	68	102	152	779
13-Jul	162	95	117	153	74	109	206	916
14-Jul	167	94	119	140	72	111	223	926
15-Jul								
16-Jul	139	72	104	127	61	102	196	801
17-Jul	128	70	102	117	63	89	170	739
18-Jul	150	78	118	140	68	111	216	881
19-Jul	133							
20-Jul	154	86	117	140	81	113	215	906
21-Jul	139	74	109	125	66	108	201	822
Mean	144.4	85.5	113.3	133.5	69.6	105.8	196.5	856.9
SD	18.4	11.1	8.3	12.7	6.3	9.7	25.6	70.0
Apparently Occupied Sites								
21-Jul	95	49	76	88	50	69	133	560

Appendix 5

Daily counts of singles (s) and pairs (p) at Northern Fulmar monitoring plots, 2009. Cells highlighted grey were affected by fog

Date	AA		A		C		D		G		H		J		Total		Grand total	Plots AA, A, C, D, G, J		
	s	p	s	p	s	p	s	p	s	p	s	p	s	p	s	p		s	p	total
06-Jul	30	8	10	2	27	14	57	28	48	23	49	21	31	9	252	105	462	203	84	371
07-Jul	27	9	9	3	22	20	47	34	66	25	49	23	23	14	243	128	499	194	105	404
08-Jul	25	4	6	2	23	8	41	17	45	11	45	11	25	5	210	58	326	165	47	259
09-Jul	18	0	4	0	18	2	27	2	32	4	32	0	18	1	149	9	167	117	9	135
10-Jul	24	15	7	4	26	11	59	12	56	21	58	11	30	6	260	80	420	202	69	340
11-Jul	18	3	4	1	22	3	28	15	41	11	43	11	19	9	175	53	281	132	42	216
12-Jul	27	4	5	0	23	11	51	9	45	8	40	11	23	5	214	48	310	174	37	248
13-Jul	29	6	4	1	23	19	46	28	46	21	51	21	23	10	222	106	434	171	85	341
14-Jul	29	7	3	5	22	18	62	19	38	34	50	26	20	10	224	119	462	174	93	360
15-Jul																				
16-Jul	19	4	8	0	24	4	49	4	49	5	42	12	20	0	211	29	269	169	17	203
17-Jul	21	3	6	1	17	11	45	4	43	4	32	5	26	7	190	35	260	158	30	218
18-Jul	33	10	5	2	26	10			53	12	56	8	25	10	198	52	302	142	44	230
19-Jul	30	8	3	0					52	21			24	7	109	36				
20-Jul	21	6	6	2	25	18	55	19	67	31	56	21	25	9	255	106	467	199	85	369
21-Jul	21	3	5	1	24	15	61	18	55	30	56	22	23	15	245	104	453	189	82	353

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