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Canna seabird studies 2004

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Summary

1.1 Three visits were made to Canna during 2004 to count and ring seabirds, monitor their breeding success and collect food samples.

1.2 The timing of the 2004 breeding season was slightly later than average for all species.

1.3 Counts showed that many seabird species were still undergoing major declines on Canna. This trend continued in 2004 with European shag, lesser black-backed gull, herring gull and great black-backed gull reaching record low breeding numbers. Common guillemots and razorbills continued to decline. Northern fulmar numbers remained stable whereas black-legged kittiwakes reached another new record high.

1.4 Breeding success was again exceptionally low in herring gull and great black-backed gull, in which mass failures occurred; for northern fulmars it was above average, and for black-legged kittiwakes it was average. European shags nesting on cliff ledges had average success, whilst those nesting under boulders at Garrisdale all failed.

1.5 Totals of 479 fully grown and 2,665 pullus seabirds were ringed with BTO metal rings and 1,576 fully grown birds were retrapped in breeding colonies.

1.6 Retrapping of adult common guillemots resulted in 412 birds ringed as chicks being located back in colonies for the first time. Two 3-year olds, four 4-year olds and 21 5-year olds were amongst those caught. The 1996 and 1998 cohorts, of which very few were reported as dead in their first year of life, showed high return rates. Sixteen razorbills and 17 European shags that had been ringed as chicks were also retrapped in colonies for the first time.

1.7 One hundred and nineteen fish were collected from adult common guillemots. Gadidae dominated in number (45%), followed by Sprats *Sprattus sprattus* (35%) and sandeels (19%). Sprats were significantly smaller in size compared with the long-term average. The Gadidae were all whiting *Merlangius merlangus*, bar one *Trisopterus* sp. European shag samples contained sandeels and gadoids, whereas black-legged kittiwake samples were dominated by clupeids.

1.8 Predation continued to be a major phenomenon in seabird colonies on Canna, affecting breeding success and overall numbers attempting to breed. Brown rats *Rattus norvegicus* are strongly implicated in these declines. This has led to devastating and rapid declines in both numbers and breeding success in the mixed seabird colonies at the Nunnery, Lamasgor and Garrisdale. In 2004 there were further signs that rat predation had adversely affected the large colony at Geugasgor, on the north side of the island. Depredated auk and shag eggs were found under boulders and there was much evidence of seabirds switching nest sites from below boulders to more open sites. This is a feature we have noted at all colonies on the island affected by predation and appears to be a response to reduce the effect of predation by mammals. The movement of birds to more open sites on the cliff makes them more vulnerable to predation from birds like common raven and gulls.

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1 Introduction and objectives

The Joint Nature Conservation Committee (JNCC) has a responsibility to advise on the condition of the natural marine environment. Seabirds are an important component of this environment and Britain has internationally important populations of several species. The JNCC's Seabird Monitoring Programme has been designed to assess population changes and breeding success of selected species of seabird at a range of colonies. In addition, selected 'key site' colonies have been targeted for more detailed monitoring of breeding performance, annual survival rates and feeding ecology. These sites are geographically spread in order to give as full coverage as possible of British waters. Canna is a very suitable site off north-west Britain, situated in the Sea of the Hebrides.

This report covers seabird monitoring work on Canna during 2004, the 36th year of the Highland Ringing Group's long-term seabird studies on the island. Since 1986, the Group has received funding support from JNCC (formerly NCC) for its seabird monitoring work on Canna.

During the period covered by this report the main aims were as follows:

- to continue seabird counts on the island;
- to monitor the breeding success of selected seabird species (northern fulmar *Fulmarus glacialis*, European shag *Phalacrocorax aristotelis*, herring gull *Larus argentatus*, great black-backed gull *Larus marinus* and black-legged kittiwake *Rissa tridactyla*);
- to continue the ringing programme in order to establish dispersal patterns from the island, rates and causes of mortality, and ages of return to the island and of first breeding;
- to collect biometrics data from young common guillemots *Uria aalge*; and
- to collect, identify and measure food samples from auks, black-legged kittiwakes, other gulls *Larus* spp. and European shags.

2 Methods

2.1 General

Three visits were made to Canna during 2004 to cover the seabird breeding season: 21-24 May, 2-10 July and 28 July-4 August.

Since 1997, due to circumstances beyond our control, the second visit to the island was a few days later than normal (i.e. from late June into early July). This, combined with a series of earlier than average breeding seasons, meant that in some years many razorbills and a few common guillemots had left the island prior to our arrival, thus affecting the validity of our counts for these two species. In 2004 we were quite confident that no young auks had fledged prior to our early July visit to the island. The location of the study sites named in the text is shown in Figure 1.

2.2 Counts

Manx shearwaters

On the first visit to the island in 2004, using tape playback methods (Walsh *et al* 1995) two observers checked the known traditional shearwater areas between the Nunnery and Garrisdale, with tapes played at 50 burrow entrances.

Common guillemot and razorbill

Counts were made of the number of occupied sites in accessible colonies at Geugasgor and other smaller colonies. Occupied guillemot sites were recognised by the presence of an egg or chick. Occupied razorbill sites were recognised by an egg or eggshell, chick or dense mass of droppings in a crack or under a boulder.

Black guillemot

Black guillemots *Cepphus grylle* were counted on various sections of the island on different days during the second visit. Counts were made in the late afternoon or evening. All birds seen on land or adjacent areas of sea were counted. This method is known to underestimate the true number of birds present.

Other seabirds

Whole island counts were conducted between 2 July and 9 July. All counts were made from land, with the exception of fulmars at Tialasgor and Geugasgor and kittiwakes at Geugasgor, which were made by boat. The units used differ from species to species and are indicated in the results section.

2.3 Monitoring breeding success

Northern fulmar

At the Sanday study plots the position of apparently occupied sites (AOS) were marked on a photograph in late May and the number of large chicks at these sites noted in early August. At Buidhe Sgor, Nunnery and Garrisdale, the number of birds that had laid was noted in late May and the number of large chicks produced from these eggs was recorded in early August.

European shag

Due to the dramatic decline in numbers of this species on Canna most of our original study nests are now abandoned. We therefore altered our methodology to monitor breeding success of European shag. At Garrisdale, where some birds still nest under boulders all active nests located in May were marked using paint. At the Nunnery, Dun Mor area of Sanday and Rubha Langanais, where birds have shifted to nesting on narrow ledges on the present sea cliff the position of all nests was mapped on a sketch map. All marked nests were checked a second time, in early July, to record nest contents including the number and ages of young that had hatched. In late July the nests were again checked so that the number of young actually fledging could be calculated.

Herring gull

Nest counts were made in 12 sub-colonies scattered throughout the island. Six were counted in late May to provide details of clutch size. The remainder was counted in early July. Nests in six of these were checked for signs of hatching (e.g. copious droppings, food remains, chicks). Nests with no such signs were classed as having failed. In order to estimate breeding success in colony A, nests were counted in late May. On the first sweep through the colony all nests were marked with a coloured plastic tag. On the second sweep each nest found with a tag was given a second tag and those without were given a different coloured tag. Using the information from the second sweep we can calculate our efficiency in finding nests and estimate the total number of nests in the colony. The first sweep found 52 nests, the second found 26 marked and 7 unmarked nests. In early July the colony was visited twice to ring the chicks. The first visit found 16 chicks, the second found 8 marked and 6 unmarked chicks.

Great black-backed gull

Accessible pairs were plotted on a map in late May. The sites were revisited in early July to count the number of large young present.

Black-legged kittiwake

In late May, apparently occupied nests (AON) at the study plots were marked on photographs. These were checked again in early July and late July to see how many had eggs or chicks. The size and number of chicks was also noted.

3 Count results

A summary of the 2004 counts for each species and comparisons with past years are shown in Table 1. Further long-term analyses are detailed in Swann (2000).

Table 1. Counts of breeding seabirds on Isle of Canna 1995-2004.

	1995	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*Peak (year)*
Northern fulmar [1]	653	585	435	471	386	443	402	406	434	436	669 (1977)
European shag [2]	984	890	1,148	1,140	742	838	844	638	603	495	1,753 (1984)
Mew gull [4]	17	14	13	18	14	15	10	8	5	6	18 (1983)
LBB gull [4]	39	40	43	(33)	42	41	43	42	31	13	69 (1975)
Herring gull: pairs [4]	1,326	1,226	1,320	(1,251)	1,159	1,282	1006	862	587	372	1,525 (1988)
Herring gull: nests [3]	675	615	729	748	640	610	525	381	292	182	809 (1988)
GBB gull [4]	85	72	93	86	80	89	72	68	60	44	93 (1997)
Kittiwake [2]	932	1,087	1,193	1,133	1,252	1,274	1,179	1,264	1,290	1,340	1,340 (2004)
Common tern [3]	3	0	1	1	7	3	0	0	3	1	18 (1992)
Guillemot [5]	1,184	1,190	-	(991)	(996)	(950)	1,249	-	(881)	906	1,249 (2001)
Razorbill [5]	441	396	-	(355)	-	(274)	252	-	-	169	520 (1985)
Black guillemot [6]	85	88	75	58	73	(54)	67	35	36	44	137 (1986)

Notes: Units used are as follows:
1. Apparently occupied site for norther fulmar
2. Apparently occupied nests for European shag and black-legged kittiwake
3. Nest with egg or chick for common tern or herring gull (nest)
4. Apparently occupied territory for gulls and skuas
5. Egg or chick in study plot for common guillemot and razorbill
6. Individual bird for black guillemot

Counts in brackets are known to be underestimates.

Northern fulmar

A total of 436 apparently occupied sites was counted. This is very similar to the 2003 count, but continues the trend of low numbers recorded since 1997 (Figure 1).

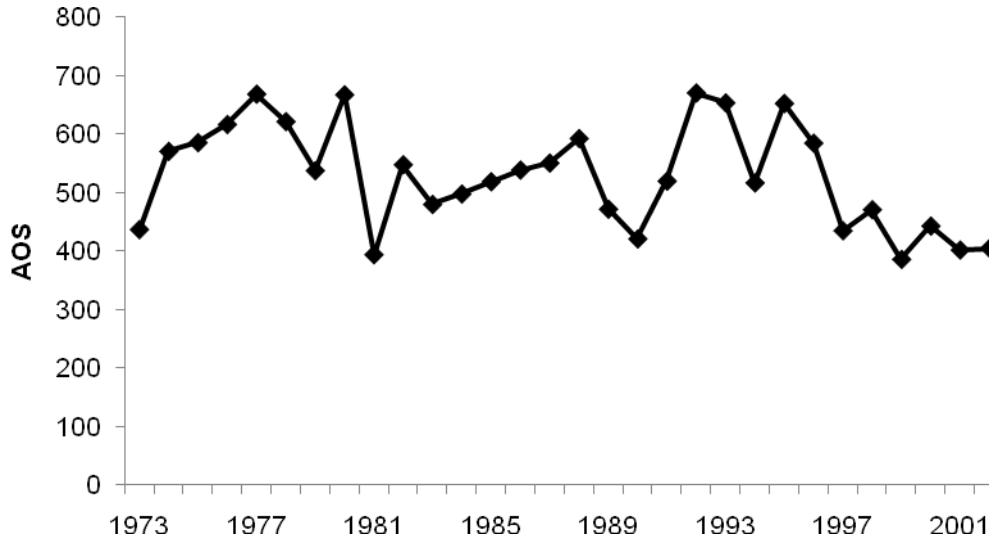

Figure 1. Number of apparently occupied Northern fulmar sites on Canna 1973-2004.

Manx shearwater

No birds responded to taped calls from the 50 burrows checked between the Nunnery and Garrisdale. No other signs of Manx shearwater (e.g. depredated adults) were noted on the island.

European shag

Numbers dropped further in 2004, to 495 apparently occupied nests, compared with the 602 in 2003. Excluding the 1986 ‘non-breeding’ year this is the lowest figure recorded since 1974 (Figure 2). Much redistribution continues with birds moving away from boulder sites and relocating on narrow cliff ledges. This is assumed to be a strategy to avoid mammal predators. No birds now nest under boulders at the former Nunnery colony. The numbers nesting under boulders at Lamasgor and Garrisdale are now exceptionally low. Figure 3 shows how rapid the declines have been at these colonies. Large decreases are also taking place at the Geugasgor colony with many birds moving to nest on the cliff edge.

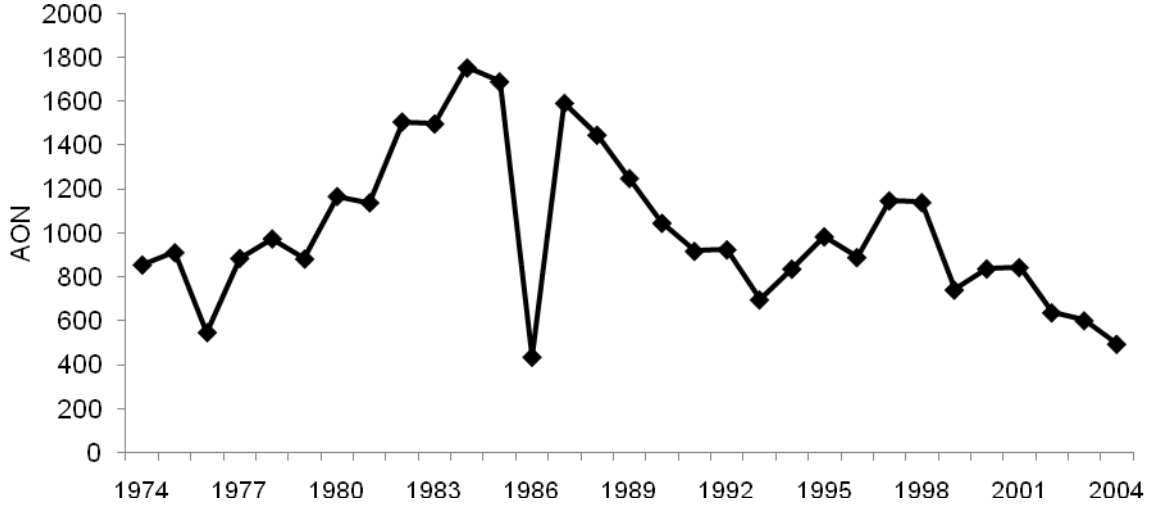

Figure 2. Number of apparently occupied European shag nests on Canna 1974-2004.

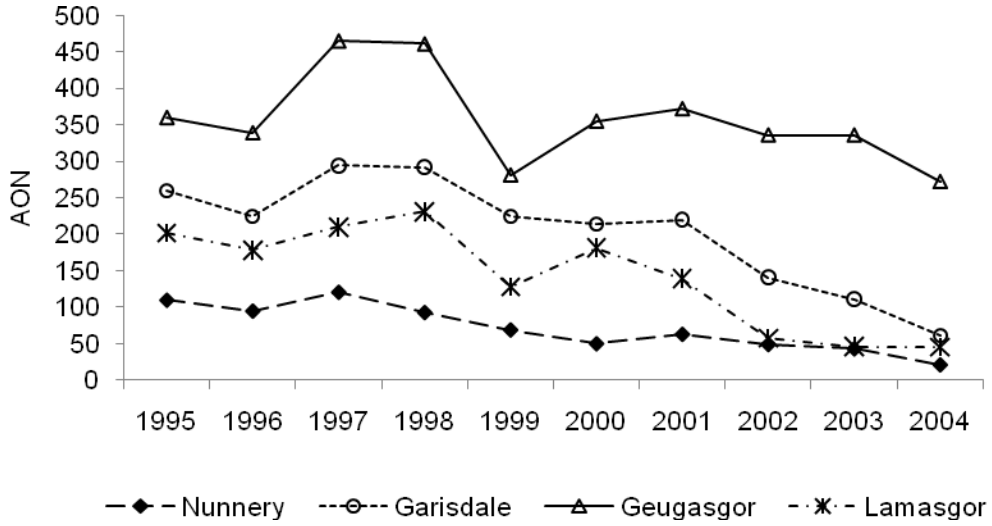

Figure 3. The recent changes in the number of apparently occupied European shag nests at the main sub-colonies on Canna.

Great skua

Two pairs of great skua Catharacta skua were present and both pairs bred.

Mew gull

The number of mew gulls Larus canus was again very low in 2004, with only six Apparently Occupied Territories (AOT) counted, continuing a long term decline of this species on Canna (Table 1).

Lesser black-backed gull

The number of lesser black-backed gulls Larus fuscus has declined substantially in the last two years with 31 AOTs in 2003 dropping to only 13 in 2004 (Figure 4).

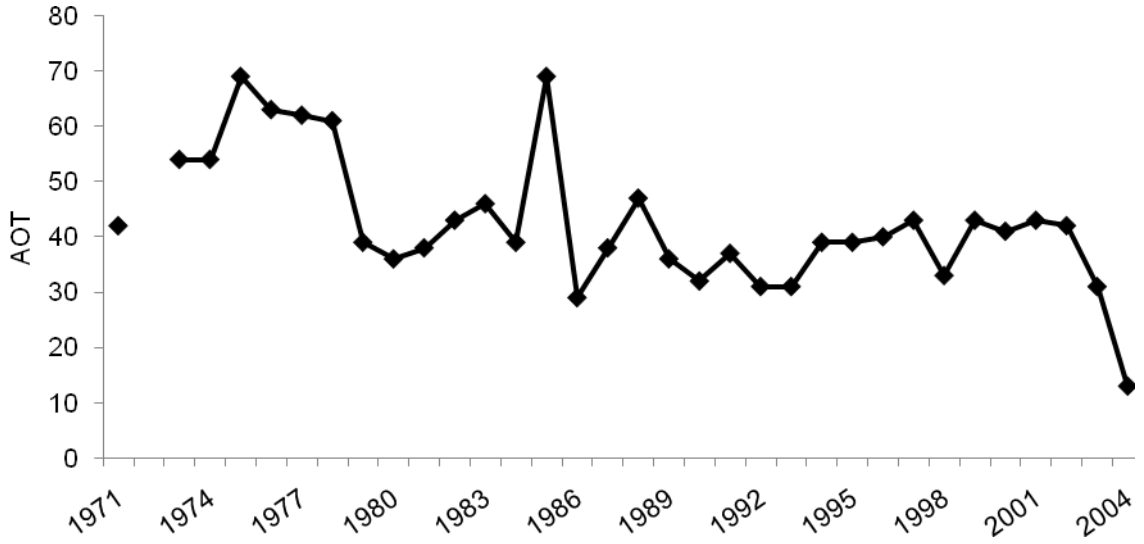

Figure 4. Number of apparently occupied Lesser Black-backed Gull territories on Canna 1971-2004.

Herring gull

A total of only 372 apparently occupied territories was counted, and in the study colonies 182 nests were counted. This is a continuation of a long-term decline that started in 1989 (Figure 5). Several traditional herring gull sub-colonies on the island have been abandoned and the population is now at the lowest level since monitoring started in 1971.

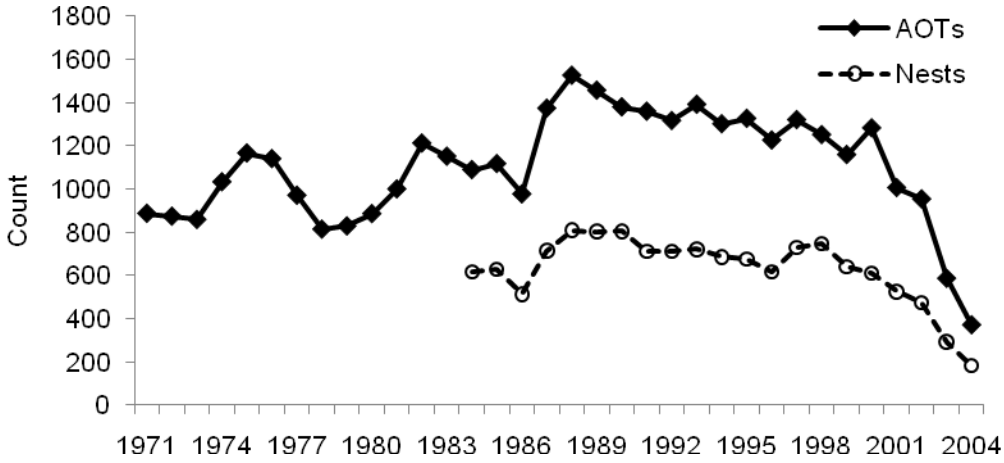

Figure 5. Number of apparently occupied herring gull territories on Canna and nest counts in sample study colonies 1970-2004.

Great black-backed gull

There was a further substantial decrease in 2004 to 44 apparently occupied territories (AOTs), compared with 60 in 2003 (Table 1).

Black-legged kittiwake

Numbers continued to remain very high, at 1,340 AONs a new record count (Figure 6). These increases all occurred in the colonies on the north side of the island, whilst the colonies on Sanday have declined since 1997.

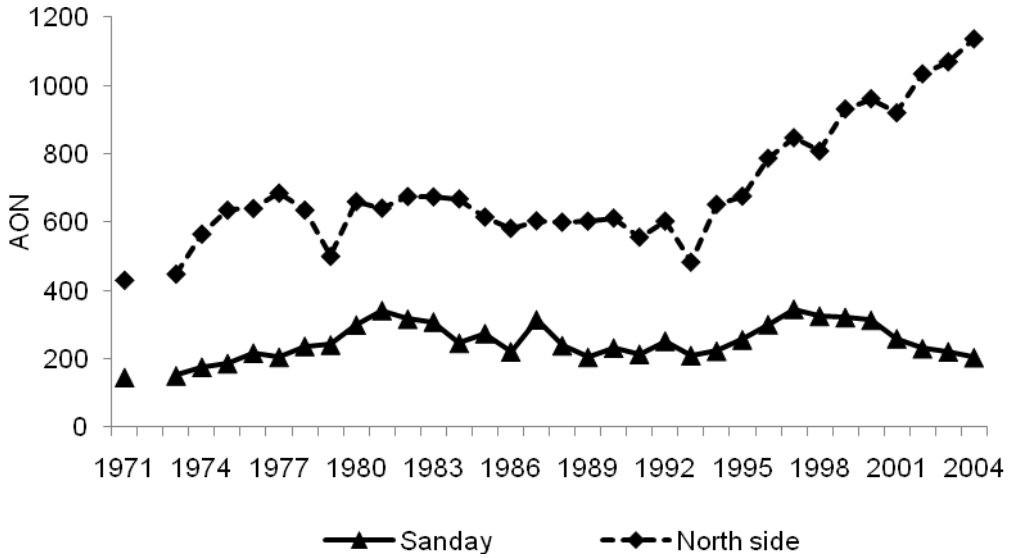

Figure 6. Number of apparently occupied black-legged kittiwake nests on Sanday and north side of Canna 1971-2004.

Common tern

One pair of common tern Sterna hirundo nested in 2004.

Common guillemot

The overall count of all nests in all our study areas was 906, whereas in the core area it was 414. This suggests a real decrease in numbers since the 2001 peak count (Figure 7). This appears to be linked to high levels of rat predation affecting the main colony at Geugasgor. Many depredated eggs were found under boulders and many birds had re-distributed, moving out of traditional boulder sites and nesting on the bare rock at the lip of the present day sea cliff.

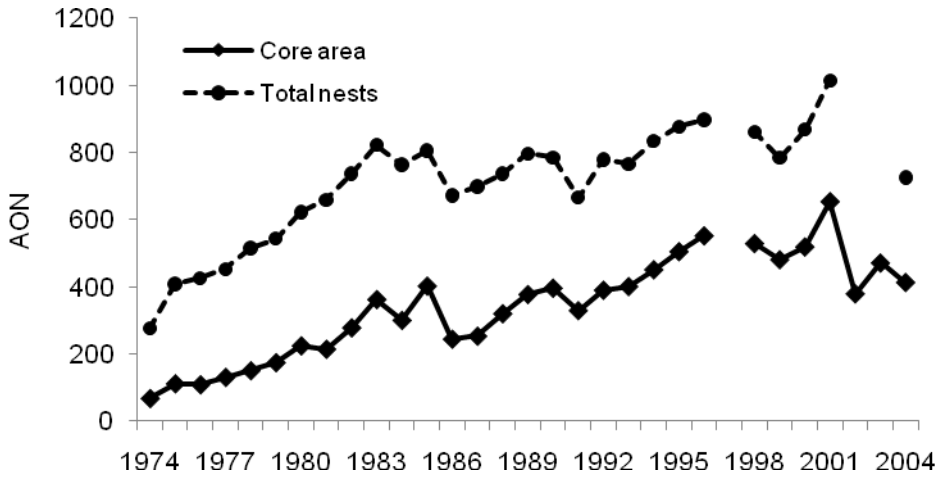

Figure 7. Number of common guillemot ‘nests’ in all study plots on Canna and in the section 1-4 plots only 1974-2004.

Razorbill

The total island count was only 169 ‘nests’ with 162 at Geugasgor, 5 at Buidhe Sgor and only two at Lamasgor. This is the continuation of a major decline that started in the early 1990s (Figure 8). Razorbills on Canna nest mainly under boulders on the raised wave cut platform that surrounds much of the island. This makes them very vulnerable to predation by rats. Large numbers of depredated eggs were noticed this year at Geugasgor. Many previously occupied colonies like Garrisdale and Nunnery are now totally abandoned by Razorbills.

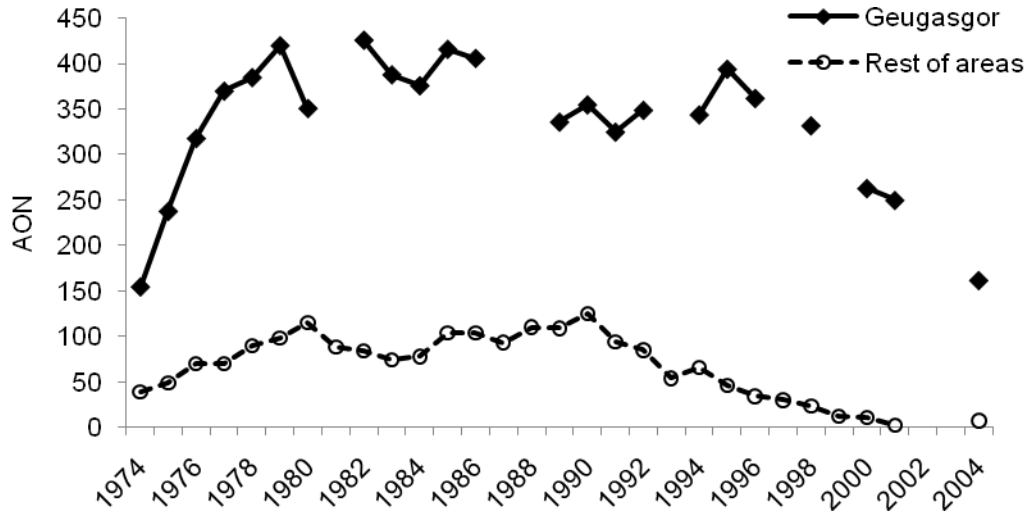

Figure 8. Number of razorbill ‘nests’ at Geugasgor and at all other sites on the island 1974-2004.

Black guillemot

Only 44 individual adult birds were counted in 2004 (Table 1). As noted under Methods this under-estimates the true number present. It was, however, another low figure and may suggest that this species is also declining on the island.

4 Timing of breeding results

March and April were dominated by cool, northerly and easterly winds. May to July was cool but dry. Many of the seabirds appeared to have nested later than normal: for example, in early July kittiwake nests contained small chicks or eggs, most auk chicks were only half grown and there was a high percentage of eggs in some sub-colonies. There was no evidence of chicks having left prior to our visits. Of the 236 occupied European shag nests 27% still contained eggs (compared with 20% 2003, 7% in 2002, 11% in 2001, 14% in 2000, 12% in 1999, 19% in 1998, 24% in 1997, 68% in 1996 and 50% in 1995).

5 Breeding success results

A summary of the 2004 results for each species and comparisons with past years are shown in Table 2. Further long-term analyses are given in Swann (2000).

Table 2. Breeding success of selected seabirds on Canna 1995-2004.

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Northern fulmar	0.33	0.32	0.33	0.33	0.27	0.44	0.48	0.45	0.46	0.56
Manx shearwater	0.25	0.13	0.08	-	-	-	-	-	-	-
European shag a	1.37	1.35	1.75	1.32	0.91	0.80	0.10	0.26	0.16	0.01
European shag b										1.39
Herring gull (%) a	70	32	78	53	11	63	10	4.5	1.7	3.1
Herring gull b	1.8	0.3	1.3	0.7	0.4	0.4	0.1	0	0	0.4
Great b-b gull	-	-	1.5	1.3	1.1	1.3	0.3	0.1	0.3	0.3
Black-legged Kittiwake	0.86	0.97	0.95	0.95	0 64	0 51	0.83	0.61	1.01	0.78

Notes:

1. For northern fulmar and black-legged kittiwake, figures are overall breeding success across all plots, rather than means of individual plot figures.
2. Figures are large young per apparently occupied site or egg for fulmars, chicks fledged per egg laid for Manx shearwaters, chicks fledged per nest in which eggs were laid for shags, large chicks per occupied territory for great black-backed gulls and chicks fledged per apparently occupied nest for black-legged kittiwakes.
3. For herring gull [a] refers to percentage of nests which produced chicks and [b] refers to young fledged per nest based on capture-recapture at sub-colony A. An all-island estimate of chicks per nest was 0.16 in 2004.
4. For shag [a] refers to number of young fledged per marked nest in the boulder colony at Garrisdale and [b] refers to number of young fledged per marked nest on sub-colonies on cliff ledges.

Northern fulmar

Table 3 shows the breeding success from four study plots. This gives an overall success rate across all sites combined of 0.56 chicks per apparently occupied site and a mean rate of 0.53 (s.e. 0.10), higher than the 2003 figure (0.46). There was great variability between plots, with success once again being highest on cliff sites.

Table 3. Northern fulmar breeding success on Canna in 2004.

Study site	*No. sites*	*No. young*	*Young per site*
Sanday A	27	14	0.51
Sanday B	13	9	0.69
Nunnery/Garrisdale	16	4	0.25
Buidhe Sgor	35	24	0.68
Total	91	51	0.56

Manx shearwater

There are now too few occupied burrows to monitor this species adequately on Canna.

European shag

Note that, as stated in the methods section, we have been forced to alter our methods of monitoring European shag breeding performance.

Table 4. European shag fledging success on Canna in 2004.

Young fledged per nest laid in	*Garrisdale*	*Nunnery**	*Rubha Langanais**	*Dun Mor area, Sanday**
0	54	12	2	2
1	0	2	6	3
2	3	5	7	5
3	0	2	2	6
n	57	21	17	16
Av young/AON	0.1	0.9	1.5	1.9

* = nests located on narrow cliff ledges.

At Garrisdale most birds were nesting under boulders on the raised wave-cut platform; all of these nests failed and the remains of depredated shells suggested rats were the main culprits. The three nests that produced chicks were all located on inaccessible narrow cliff ledges. The success rate for this colony was 0.1 chicks per nest. At the other monitored sites the birds nested on cliff ledges. These were inaccessible to rats but at some sites, like the Nunnery, were more accessible to avian predators, particularly common ravens. Many depredated shag eggs were found around a successful common raven nest at the Nunnery.

At the Lamasgor colony we have no study nests but we estimated that 67 young were reared from 43 nests (c.1.6 chicks per nest). These successful nests were all located in the highest parts of the colony, well up the tallus slopes and away from the shore; most of the rest of this colony is now abandoned. The large colony at Geugasgor on the north side of the island was much as normal. Although we have no actual study nests, we estimated that 330 young were reared from 223 nests (c. 1.5 per nest), similar to the 2002 and 2003 figures.

Great skua

Of the two pairs present on Sanday one pair reared a single chick and the other pair reared two chicks.

Herring gull

The frequency distribution of clutch sizes recorded in six sub-colonies in late May is shown in Table 5 and information on hatching success in six sub-colonies observed in early July is shown in Table 6.

Table 5. Herring gull clutch size in late May at six study colonies on Canna in 2004 (excludes empty nests).

	Sub-colony					
	A	B	C	D	E	F
1 egg	2	3	2	5	0	0
2 eggs	9	4	0	6	0	1
3 eggs	43	6	3	33	7	3

Mean clutch size was slightly above average, at 2.65.

Table 6. Number of herring gull nests that showed signs of success or failure on Canna in 2004.

	Sub-colony					
	D	G	H	I	J	K
With chicks	2	0	3	1	0	0
Failed	42	15	23	62	30	17

Of the 195 nests checked, only 3.1% produced chicks, indicating the second least productive breeding season we have yet recorded. There was an almost total failure in all colonies on the island, with no chicks being reared at all in the western half of the island, where many of the colonies were almost totally deserted. At sub-colony A, the number of fledged chicks is estimated by capture-recapture (see Methods). We estimated 28 chicks were present in this colony in early July, giving an average of 0.42 chicks per nest, making it the most successful colony on the island. We estimate that the 372 pairs on the island produced about 60 chicks (0.16 chicks per pair), with most nests, again, appearing to have failed at the egg or small chick stage.

Great black-backed gull

Thirty pairs of great black-backed gull were monitored, 24 of which failed, two produced broods of two young and four produced a single young, giving an overall productivity of 0.26 young per pair.

Black-legged kittiwake

The results obtained from the four Sanday sub colonies and the cave on the north side of Canna are detailed in Table 7.

Table 7. Number of occupied black-legged kittiwake nests and number of large young per nest in study plots in 2004.

	Sanday,K1	*Sanday,K2*	*Sanday,K3*	*Sanday,K4*	*Cave*
No. nests	*38*	*42*	*37*	*26*	*188*
empty	17	10	16	20	99
1 large young	11	13	9	4	42
2 large young	10	19	12	2	46
3 large young	0	0	0	0	1
av. young per nest	0.8	1.2	0.9	0.3	0.7

Overall in the Sanday study colony, 123 young were produced from 143 nests (0.86 chicks per nest). At the cave colony, on the north side of the island, success was lower with 137 young from 188 nests (0.73 chicks per nest). This gives an overall success rate across all sites combined of 0.78 chicks per AON. The mean across the five plots was also 0.78 (s.e. + 0.15), lower than the 2003 figure of 0.86 (s.e. + 0.10). The mean brood size of the successful nests on Sanday and the Cave was 1.54. The main difference in breeding output between the two areas was due to the fact that 44% of all nests on Sanday failed to produce any chicks, compared with 53% at the cave.

Common tern

One pair of common terns nested, producing a single chick.

Common guillemot

The mean weight of 50 common guillemot chicks with a wing length greater than 60 mm was 270.1g (see Appendix 1). This was not significantly different than chicks of a similar age in 2003 (mean 274.3.0g, n=50, z= -0.93, p>0.05), nor significantly different from the overall mean (1983-2002) of 272g (n=853, U=21052, p>0.05). This suggests that, in 2004, the chicks were in good condition.

Once again there was much evidence of significant levels of predation on guillemots at Geugasgor, on the north side of Canna. In sections 1-4 it was evident that many traditional, boulder sites had been abandoned by the guillemots, which were now nesting out on the bare rock on the lip of the present sea cliff. Stashes of depredated eggs at the back of boulders suggested rats were partly to blame (see photos 1-4). There was significant variation in the number of birds on eggs in the different sub-colonies (Table 8).

Table 8. Percentage of common guillemots still on eggs in early July 2004 according to sub colony.

Sub-colony	*No. 'nests'*	*No. still on eggs*	*% on eggs*
Cave	1713	307	17
Sec 1-4	414	153	40
Sec 5 main	134	102	76
rest sec 5	178	61	34
Buidhe Sgor area	179	38	21

Normally in early July we would expect around 20% of birds to still be on eggs. In sections 1-4 the figure was twice as high as normal. We suppose that this was due to birds re-laying after their eggs had been depredated; in the Cave and Buidhe Sgor (colonies that had lower proportions still on eggs) there was little sign, this year, of depredated eggs. Conversely, the colony at section 5 main showed a large decrease in the number of 'nests' and a very high percentage of birds still on eggs.

Photo 1. A stash of depredated eggs.

Photo 2. A depredated egg, containing embryo.

Photo 3. A depredated egg.

Photo 4. A depredated chick.

Razorbill

Many depredated razorbill eggs were found under boulders in 2004. This species appears to prefer nesting in small, enclosed sites under boulders, making it particularly susceptible to predation by rats. Of 169 razorbill nests sites that we located, 88 contained an egg or youngster, whilst 81 were empty or contained depredated eggshells. This suggests that almost half the breeding razorbills failed, and this could be an underestimate as it is easier to overlook failed sites than occupied sites.

6 Ringing studies

6.1 Ringing totals

Table 9 shows the number of adults and chicks ringed during 2004 and the number of fully-grown birds that were re-trapped.

Table 9. Number of birds ringed and adults retrapped on Canna in 2004.

	Adults ringed	*Chicks ringed*	*Full-grown retrapped*
Northern fulmar	9	34	27
European shag	18	407	23
Great skua	0	3	0
LBB Gull	0	0	0
Herring gull	0	37	0
GBB gull	0	6	0
Black-legged kittiwake	39	99	22
Common guillemot	354	1,997	1,465
Razorbill	52	80	39
Atlantic puffin	7	1	0
Total	**479**	**2,665**	**1,576**

Due to high rates of breeding failure, fewer than normal gull and shag chicks were ringed. The use of a fleyg net once again increased the number of razorbills that could be ringed and re-trapped.

6.2 Ringing recoveries

During late August and into September 2004 Scotland was affected by some very deep depressions, which produced very unsettled weather with periods of strong to gale force south westerly winds and heavy rain. Following this, large numbers of auks were reported to be in distress in sea lochs in north-west Scotland. Beached bird surveys were organised by RSPB staff and 2,115 beached seabirds were counted including 1,793 guillemots (Swann 2004). These figures will greatly underestimate the number of birds affected, and only a small percentage of the coastline was covered. In addition, corpses were removed quickly by scavengers and others were buried under tangles thrown up by the large waves.

The wreck was apparently caused by a combination of low availability of suitable fish and stormy weather. Five corpses sent to the Scottish Agricultural College laboratory at Achincruive in Ayrshire were underweight (range 619-780g) and showed typical signs of having died of starvation.

Ring recoveries showed that most of the guillemots were of local origin, with 24 originating from the Isle of Canna. Of these birds six were youngsters less than three months old, two were immatures, but the majority, 16 of them, were adults of breeding age, many of which were in heavy wing moult. The loss of such a high number of experienced breeders may impact on colony size on Canna in the coming years.

7 Return and survival rates results

Common guillemot

Of the 1,471 adult guillemots that were retrapped in 2004, 412 were birds that had been ringed as chicks on Canna and were retrapped on the island for the first time. These included: two 3-year olds, four 4-year olds, 21 5-year olds, 44 6-year olds, 13 7-year olds, 55 8-year olds, 67 9-year olds and 65 10-year olds. Swann (2000) showed a negative correlation between the recovery rate of pullus guillemots ringed on Canna and found dead in their first year of life, and the subsequent return rates of surviving birds to the colony. Data collected in 2004 illustrate this further (Table 10).

Table 10. Recovery rates and return rates of common guillemot chicks ringed on Canna.

Year	*No. ringed*	*% recovered in 1st year*	*% back by 5th year*	*% back by 6th year*	*% back by 7th year*
1984	1,843	2.5	1.5	2.6	4.6
1985	2,224	3.6	0.6	1.3	2.1
1986	1,913	0.3	2.4	5.0	6.7
1987	1,080	2.4	0.7	1.2	2.6
1988	2,423	1.9	0.8	1.8	2.8
1989	2,392	2.8	0.6	1.0	1.4
1990	2,334	1.7	1.4	2.4	3.3
1991	2,299	0.3	2.0	3.1	6.0
1992	2,458	0.9	1.9	3.8	5.9
1993	1,947	0.7	1.8	3.7	7.0
1994	2,671	0.7	1.8	4.4	6.6
1995	2,843	1.4	1.3	2.5	3.9
1996	2,423	0.6	2.3	3.9	6.6
1997	819	1.0	1.0	2.3	3.9
1998	2,221	0.5	2.0	4.0	
1999	2,157	1.3	1.5		

The 1996 and 1998 cohorts, with their very low first year recovery rates, as expected showed high return rates in their fifth and subsequent years, whilst the 1997 cohort, which had a higher first year recovery rate is showing a relatively low return rate.

Razorbill

For the fourth year running a fleyg net was used to capture adult razorbills. This results in the capture of both breeders and non-breeders so the results are not entirely comparable with figures prior to 2001. Sixteen razorbills that had been ringed as chicks were re-trapped on the island for the first time in 2004. These included three 3-year olds, one 4-year olds, one 5-year old, one 6-year old, two 8-year olds, three 10-year olds, two 12-year olds, one 13-year old and two 14-year olds.

European shag

Seventeen shags that were ringed as chicks were retrapped on the island for the first time in 2004. All were breeders, being caught on nests, and comprised one 2-year old, two 3-year olds, three 4-year olds, one 5-year old, two 6-year olds, three 7-year olds, three 8-year olds, one 9-year old and one 12-year old. Of these 17, 14 had switched colony so were no longer breeding in their natal sub-colony. This is a much higher percentage than previously recorded and is in line with the redistribution of breeding shags that is taking place on the island. Similarly, three out of seven birds retrapped that had originally been ringed as breeding adults had also shifted colony.

Common guillemot

Of the 119 fish that were collected from adult common guillemots on their return to the colony from fishing trips 42 (35%) were Clupeids Sprattus sprattus, 23 (19%) sandeels Ammodytes spp. and 53 (45%) Gadidae. Details of the fish sampled are given in Appendix 2. The mean length of the sprats was 101mm (s.d. 13.7), significantly smaller than the 2001-03 average (109.1 mm, sd 9.08, z = 3.50, p<0.01). The mean length of sandeels was 123.5mm (sd 37.4), not significantly different from the 2001-03 average (110.1mm, sd 39.51, z = 1.258, ns). Of the Gadidae 52 were whiting Merlangius merlangus and one a Trisopterus sp. The mean size of the whiting was 88.7mm (sd 12.9), not significantly different from the 2001-03 average (91.91mm, sd 10.51, z = 1.27, ns).

Figure 9 shows that since 1982 the percentage of sandeels taken by common guillemots has fluctuated, but overall declined. Sprats, conversely, increased in the diet, particularly between 1992 and 2002. In years when the number of sprats taken was low gadoids became more important e.g. 1988-91, 1993, 1998 and since 2002.

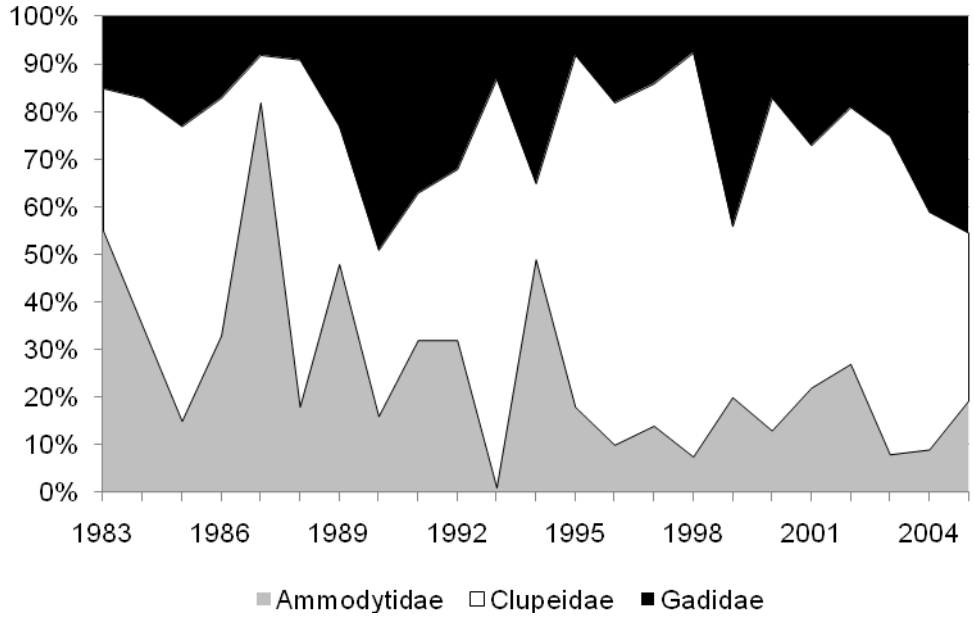

Figure 9. Proportion of fish species taken by common guillemots on Canna 1982-2004.

Other seabirds

Twenty one food samples were collected from regurgitations of both adult and chick kittiwakes, of which 20 contained 1- 45 very small clupeid otoliths but, surprisingly, only one contained a single 0-group sandeel otolith. The remaining sample contained gadoid bones.

Three regurgitations were collected from young European shags, all of which contained otoliths of 0-group sandeels. Of nine European shag pellets collected in late July/early August, 8 contained gadoid remains, 4 Trisopterus sp and 2 contained 1+ group sandeel otoliths (see Appendix 2).

8 References

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9 Appendices

Appendix 1. Common guillemot chick weights

Weights in grammes									
295	264	284	290	265	288	285	286	252	233
236	254	295	287	274	222	310	274	234	240
280	282	246	254	268	280	279	270	279	274
265	264	270	290	289	260	273	296	246	300
284	240	266	254	254	242	276	283	295	276

Note: Weights taken only from chicks with a wing length of >60mm. Mean weight was 270.1g.

Appendix 2. Diet samples

Common guillemot

Details are given of the size (mm) of fish caught by adult guillemots on Canna in 2004.

Sprats: 42 measured

Length	74	82	84	87	88	89	95	96	97
No. of fish	1	1	1	1	1	1	3	1	2

Length	98	99	100	101	103	104	105	106	107
No. of fish	2	1	1	1	2	2	3	3	2

Length	108	110	111	112	113	116	129
No.of fish	3	2	2	1	2	2	1

Sandeels: 23 measured

Length	75	78	88	93	105	117	122	125	127
No. of fish	1	1	2	1	1	2	1	1	1

Length	128	132	134	150	153	155	161	166	200
No. of fish	2	2	1	1	1	1	1	2	1

Whiting: 52 measured

Length	66	67	68	72	73	74	*76*	*78*	*79*
No. of fish	1	2	1	2	1	1	1	2	1

Length	80	82	83	84	85	86	87	88	91
No. of fish	3	2	1	3	2	2	2	3	1

Length	93	94	95	96	97	98	100	103	104
No. of fish	2	2	1	2	1	2	1	1	2

Length	105	106	107	112	125
No. of fish	1	3	1	1	1

European shag

The contents of European shag pellets were as follows.

Month	*Total no of pellets*	*No of pellets containing:* *Sandeels*	*Gadidae*	*Trisopterus*	*Rockling?*
Late July/early August	9	2	8	4	2
Total no. otoliths	766	32	682	48	4

Note: The totals for Gadidae exclude the totals for *Trisopterus sp*. and possible rockling.