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Canna seabird studies 2003

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Contents

	Page
1. Summary	5
2. Introduction and objectives	6
3. Methods	7
4. Count results	10
5. Timing of breeding	15
6. Breeding success	16
7. Ringing studies	20
8. Return rates and age of first breeding	21
9. Feeding studies	22
10. Acknowledgements	23
11. References	23
Table 1	14
Table 2	16
Table 3	16
Table 4	17
Table 5	17
Table 6	18
Table 7	19
Table 8	20
Table 9	21
Figure 1	10
Figure 2	11
Figure 3	11
Figure 4	12
Figure 5	12
Figure 6	13
Figure 7	22
Appendix 1	24
Appendix 2	24

1. Summary

- 1.1 Three visits were made to Canna during 2003 to count and ring seabirds, monitor their breeding success and collect food samples.
- 1.2 The timing of the 2003 breeding season was slightly earlier than average for razorbills and European shags.
- 1.3 Counts showed that many seabird species are undergoing major declines on Canna. This trend continued in 2003 with European shag, herring gull and mew gull reaching record lows. Common guillemots and both lesser and great black-backed gulls also declined. Northern fulmar numbers showed a slight increase as did black-legged kittiwakes, which reached a new record high.
- 1.4 Breeding success was again exceptionally low in European shags, herring and great black-backed gulls, in which mass failures occurred; for northern fulmars and black-legged kittiwakes it was above average.
- 1.5 Totals of 451 fully grown and 2,664 pullus seabirds were ringed with BTO metal rings and 1,207 fully grown birds were retrapped in breeding colonies.
- 1.6 Retrapping of adult common guillemots resulted in 322 birds that were ringed as chicks being located back in colonies for the first time. Two 3-year olds, nine 4-year olds and 24 5-year olds were amongst those caught. The 1996 cohort, of which very few were reported as dead in their first year of life, showed high return rates. Thirty three razorbills and eight European shags that had been ringed as chicks were also retrapped in colonies for the first time.
- 1.7 Fifty-six fish were collected from adult common guillemots. Sprats *Sprattus sprattus* dominated in number (50%), followed by Gadidae (41%) and sandeels (9%). Sprats were not significantly different in size from the long-term average. The Gadidae were all whiting *Merlangius merlangus*, bar one *Trisopterus* sp.. European shags fed mostly on sandeels in early July, but on gadoids in late July. Black-legged kittiwake samples were dominated by 0-group sandeels, with a few gadoids and sprats.
- 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* were implicated in these declines, particularly with regard to the extinction of the Manx shearwater colony. This has led in the last few years to devastating declines in both numbers and breeding success in the mixed seabird colonies at the Nunnery, Lamasgor and Garrisdale. In 2003 there were signs that rat predation was beginning to effect 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. Birds were also involved in these high levels of predation: black-legged kittiwake breeding success on Sanday appeared to be affected by predation from great skuas and peregrine falcons, whilst gulls depredated shag nests and both young and adult auks at Geugasgor.

2. 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 2003, the 35th 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, and this is the first year of the current two-year contract with JNCC.

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

1. to continue seabird counts on the island;
2. to monitor the breeding success of selected seabird species (Northern fulmar *Fulmaris glacialis*, European shag *Phalacrocorax aristotelis*, herring gull *Larus argentatus*, great black-backed gull *Larus marinus* and black-legged kittiwake *Rissa tridactyla*);
3. 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;
4. to collect biometrics data from young common guillemots *Uria aalge*; and
5. to collect, identify and measure food samples from auks, black-legged kittiwakes, other gulls *Larus* spp. and European shags.

3. Methods

3.1 General

Three visits were made to Canna during 2003 to cover the seabird breeding season: 23-28 May, 4-12 July and 25 July-2 August.

Since 1997 we have been forced by circumstances beyond our control to arrange our second visit to the island 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 2003 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. The location of the study sites named in the text is shown in Figure 1.

3.2 Counts

Manx shearwater

In 1997, a full census of the Manx shearwater *Puffinus puffinus* colony indicated that fewer than 100 occupied burrows remained on Canna (Swann 1997). Subsequently, former core areas have been monitored annually using tape playback methods (Walsh *et al.* 1995) to provide an indication of colony status (Swann 1998). On the first visit to the island in 2003, two observers checked the known traditional shearwater areas between the Nunnery and Garrisdale, with tapes played at 100 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 *Cephus 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 4 July and 10 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.

3.3 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

There were 60 marked sites scattered throughout the large colony at Boro'osgor (or Garrisdale) and 12 at the Nunnery colony. These sites were checked in late May to see how many had been occupied and held nests in which eggs had been laid. The nests were checked a second time, in early July, to record the numbers and ages of young that had hatched. In late July the nests were again checked to count the number of large young and to record the remains of dead chicks, so that the number of young actually fledging could be calculated.

Herring gull

Nest counts were made in twelve 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 or 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 plastic coloured 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 67 nests, the second found 53 marked and 14 unmarked nests. In early July the colony was visited to ring the chicks, only two were found. A follow up visit was made in late July.

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.

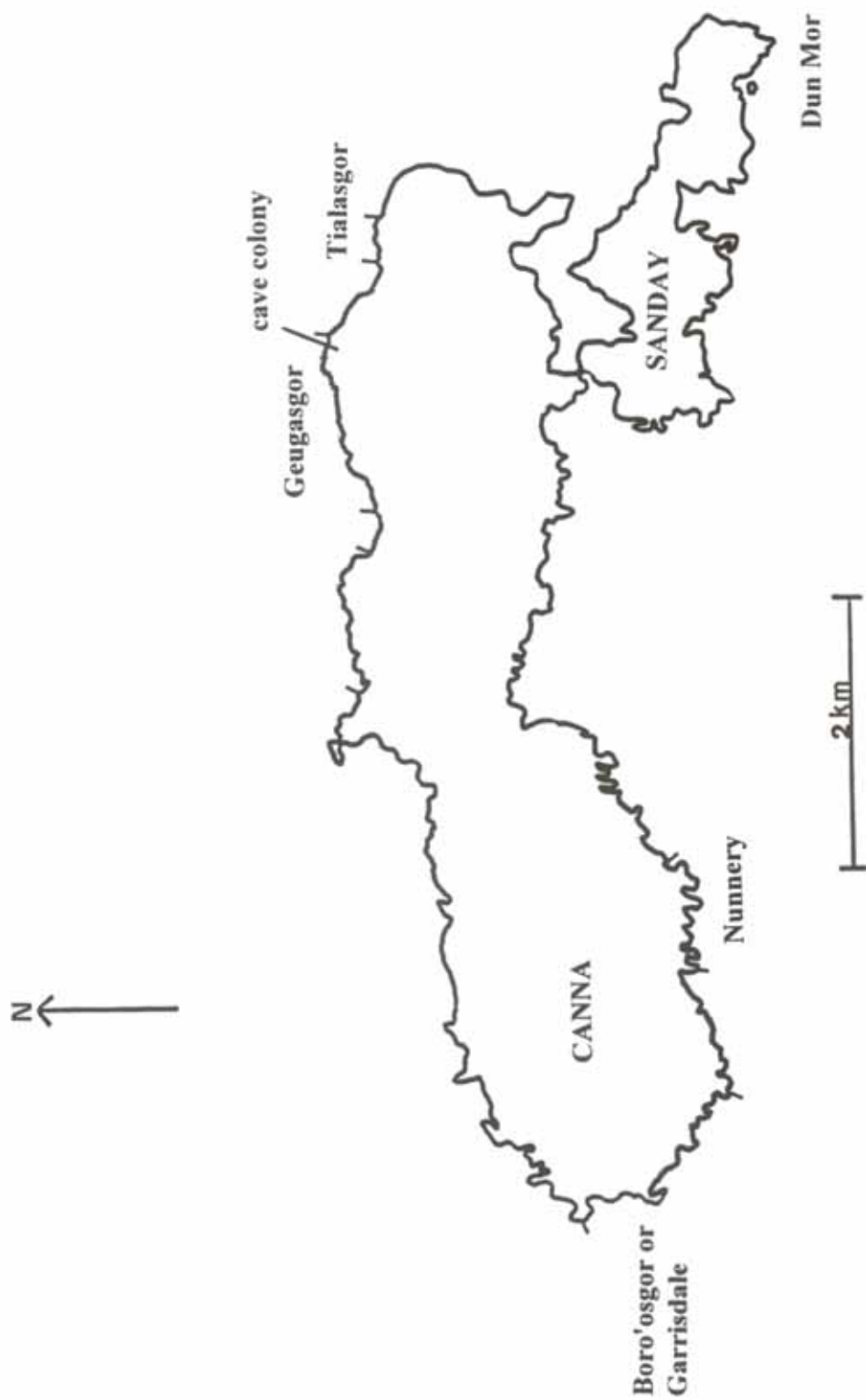


Figure 1 Outline map of Canna and Sanday showing study sites.

4. Count results

Details are given of the 2003 counts for each species and comparisons with past years are shown in Table 1. Further long-term analyses are detailed in Swann (2000).

Northern fulmar

A total of 434 apparently occupied sites was counted. This is slightly up on the 2002 count, but continues the trend of low numbers recorded since 1997 (Figure 2).

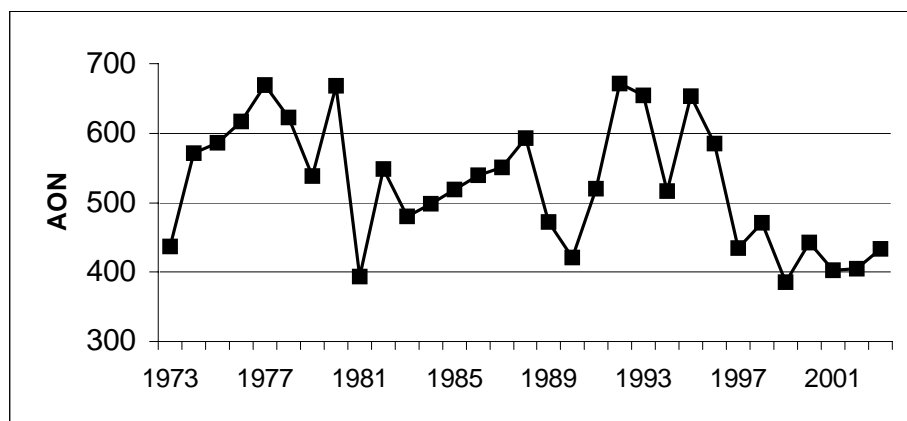


Figure 2. Number of apparently occupied northern fulmar sites on Canna 1973-2003.

Manx shearwater

Only one bird responded to taped calls from the 100 burrows checked between the Nunnery and Garrisdale. No other signs of Manx shearwaters (e.g. depredated adults) were noted on the island.

European shag

Numbers dropped further in 2003, to 603 apparently occupied nests, compared with 638 in 2002. Excluding two 'non-breeding' years this is the lowest figure recorded since 1974 (Figure 3).

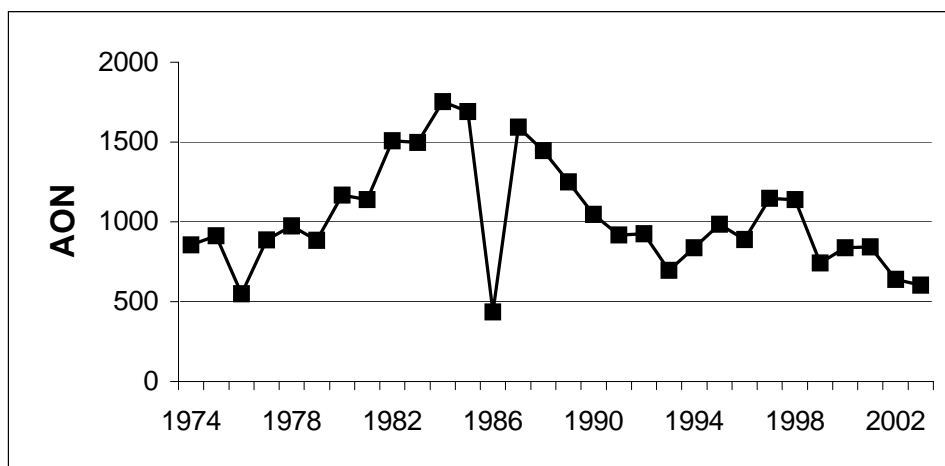


Figure 3. Number of apparently occupied European shag nests on Canna 1974-2003.

Great skua

Two pairs of great skua *Catharacta skua* were present in late May. In early July three pairs were present.

Mew gull

The number of mew gulls *Larus canus* was again very low in 2003, with only five 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* declined in 2003, with only 31 AOT, down from the 42 AOT recorded in 2002.

Herring gull

A total of only 587 apparently occupied territories was counted, and in the study colonies 292 nests were counted. This is a continuation of a long-term decline that started in 1989 (Figure 4). Several traditional herring gull sub-colonies on the island have now been abandoned and the population is now at the lowest level since monitoring started in 1971.

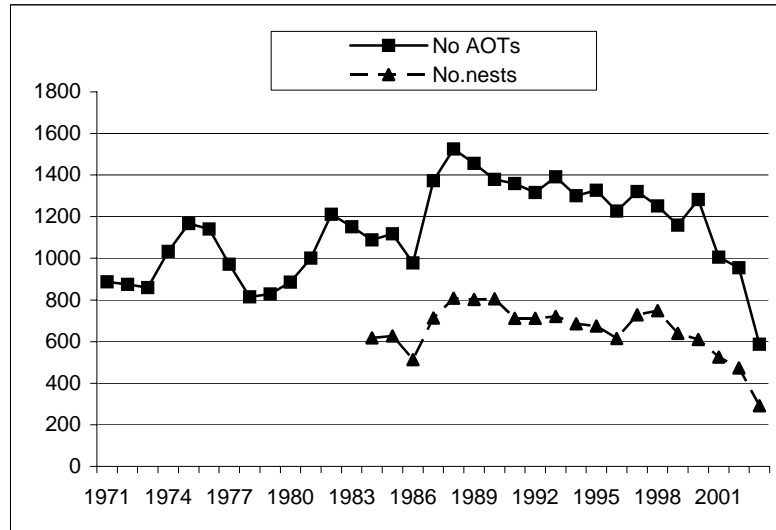


Figure 4. Number of apparently occupied herring gull territories on Canna and nest counts in sample study colonies.

Great black-backed gull

There was a further decrease in 2003 to 60 apparently occupied territories, compared with 68 in 2002 (Table 1).

Black-legged kittiwake

Numbers continued to remain very high, at 1,290 AON a new record count (Figure 5). These increases all occurred in the colonies on the north side of the island, whilst the colonies on Sanday have declined since 1997.

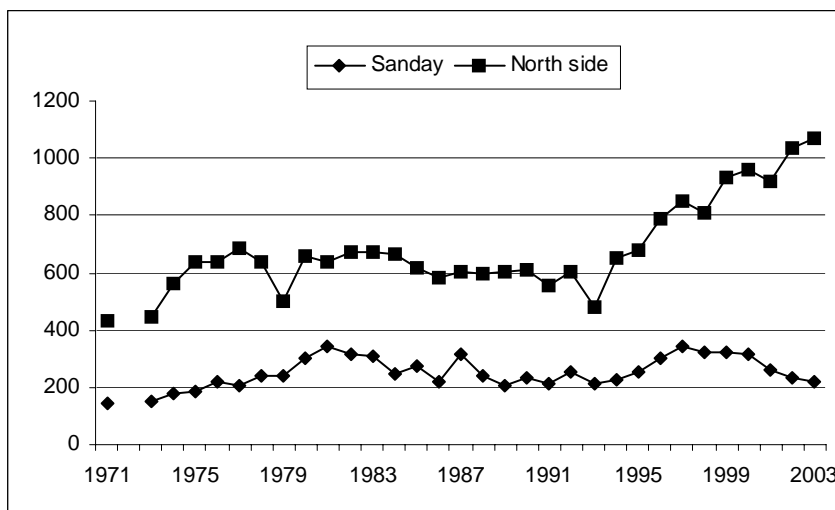


Figure 5. Number of apparently occupied black-legged kittiwake nests on Sanday and north side of Canna 1971-2003.

Common tern

Three pairs of common terns *Sterna hirundo* nested in 2003.

Common guillemot

Although some birds may have left the colony prior to our visit, many colonies (e.g. sections 1-4) appeared 'normal,' i.e. with mainly half grown chicks and eggs. The overall count in all our study areas was 881 (likely to be an underestimate), whereas in the core area (sections 1-4) it was 472. This suggests a possible real decrease in numbers since the 2001 peak count (Figure 6).

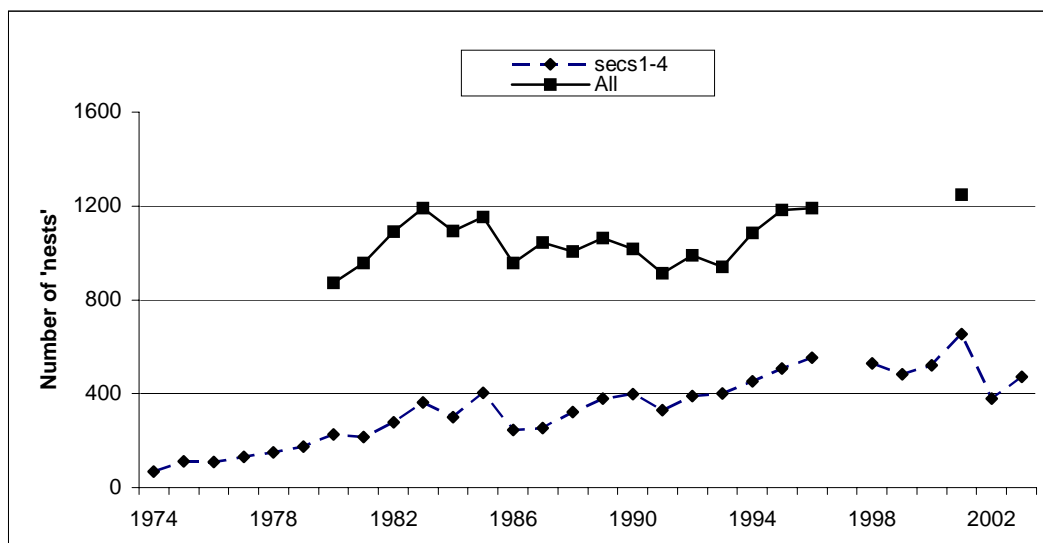


Figure 6. Number of common guillemot 'nests' in all study plots on Canna and in the section 1-4 plots only 1974-2003.

Razorbill

Too many birds had left the colonies prior to our July visits to give an accurate count in 2003.

Black guillemot

Only 36 individual adult birds were counted in 2003 (Table 1). As noted under Methods this under-estimates the true number present. It was, however, one of the lowest figures we have ever recorded on Canna and may suggest that this species is also declining on the island.

Table 1. Counts of breeding seabirds on Isle of Canna 1994-2003

	<i>1994</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>Peak (year)</i>
Northern fulmar ¹	517	653	585	435	471	386	443	402	406	434	669 (1977)
European shag ²	837	984	890	1,148	1,140	742	838	844	638	603	1,753 (1984)
Mew gull ⁴	8	17	14	13	18	14	15	10	8	5	18 (1983)
LBB gull ⁴	39	39	40	43	(33)	42	41	43	42	31	69 (1975)
Herring gull: pairs ⁴	1,301	1,326	1,226	1,320	(1,251)	1,159	1,282	1006	862	587	1,525 (1988)
Herring gull: nests ³	686	675	615	729	748	640	610	525	381	292	809 (1988)
GBB gull ⁴	91	85	72	93	86	80	89	72	68	60	93 (1997)
Black-legged kittiwake ²	875	932	1,087	1,193	1,133	1,252	1,274	1,179	1,264	1,290	1,290 (2003)
Common tern ³	6	3	0	1	1	7	3	0	0	3	18 (1992)
Common guillemot ⁵	1,084	1,184	1,190	-	(991)	(996)	(950)	1,249	-	(881)	1,191 (1983)
Razorbill ⁵	410	441	396	-	(355)	-	(274)	252	-	-	520 (1985)
Black guillemot ⁶	86	85	88	75	58	73	(54)	67	35	36	137 (1986)

Notes: Units used are as follows:

1. Apparently occupied site for northern 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
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.

5. Timing of breeding

The late winter and spring in north-west Scotland was unusually dry and bright. These conditions may have resulted in above average sea temperatures at the start of the breeding season. May to July was a cool and fairly unsettled period with much wind and rain. It was obvious that a large percentage of razorbills and even a few shags had already left the colonies by early July. Of the 334 occupied European shag nests 20% still contained eggs (compared with 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). It was reckoned however, that this was due to a large number of birds relaying, as most of the nests with chicks had very large youngsters, which were close to fledging.

6. Breeding success

Details are given of the 2003 results for each species and comparisons with past years are shown in Table 7. Further long-term analyses are given in Swann (2000).

Northern fulmar

Table 2 shows the breeding success from four study plots. This gives an overall success rate across all sites combined of 0.46 chicks per apparently occupied site and a mean rate of 0.49 (s.e. ± 0.13), close to the 2002 figure (0.45). There was great variability between plots, with success once again being highest on the north side of the island at Buidhe Sgor. The low level of success at Sanday A may have been due to predation by raptors as several ‘plucks’ were noted in the study area.

Table 2. Northern fulmar breeding success on Canna in 2002

<i>Study site</i>	<i>No. sites</i>	<i>No. young</i>	<i>Young per site</i>
Sanday A	28	4	0.14
Sanday B	17	9	0.53
Nunnery/Garrisdale	14	7	0.50
Buidhe Sgor	22	17	0.77
Total	81	37	0.46

Manx shearwater

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

European shag

On our first visit in late May many nests already contained very small chicks so we have no data on clutch size. The number of occupied study nests at the Nunnery is now very low. No birds were recorded nesting under boulders at this colony. All remaining nests are on open cliff ledges.

Table 3. European shag fledging success on Canna in 2003

<i>Young fledged per nest laid in</i>	<i>Number of nests</i>	
	<i>Nunnery</i>	<i>Garrisdale</i>
0	6	24
1	1	0
2	1	2
3	0	0

There were already signs of predated nests at the Nunnery and Garrisdale colonies in late May and by early July this was more marked. At the Nunnery all the study nests bar two had failed (Table 3), though sample sizes are now very low. At Garrisdale, of the 26 occupied study nests 24 had failed and only 4 young fledged from the surviving 2 nests (0.15 per study nest laid in). In the colony as a whole, we estimated only 40 young had been reared from 106 nests (*c.* 0.4 chicks per nest). Once again, successful nests were those located on cliff sites, although one small area of boulders in the centre of the colony also displayed ‘normal’ survival. At the Lamasgor colony we have no study nests but we estimated that 56 young

were reared from 43 nests (*c.*1.3 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. Here, we estimated that 460 young were reared from 329 nests (*c.*1.4 per nest), only slightly down on the 1.5 estimated in 2002.

Once again, the reasons for the high failure rate at Garrisdale and the Nunnery appeared to be linked with high levels of predation, with rats being the main suspects. Most nests failed at the egg or small chick stage. It was noticeable in all colonies that nests in more inaccessible locations survived and produced broods of 2 or 3 young, suggesting that food shortage was not the cause of the many failures. There was also further evidence of birds re-distributing within colonies, from under boulders to sites on narrow ledges on cliffs, where they could escape mammal predators. At one site at Geugasgor (Sec. 0) all traditional boulder areas had been abandoned and the birds were located either on the lip of the sea cliff or in the open at the top of a boulder slope at the base of the main cliff.

Great skua

A single large chick was produced from the three pairs present on Sanday.

Herring gull

The frequency distribution of clutch sizes recorded in six sub-colonies in late May is shown in Table 4 and information on hatching success in six sub-colonies observed in early July is shown in Table 5.

Table 4. Herring gull clutch size in late May at six study colonies on Canna in 2003 (excludes empty nests).

	<i>Sub-colony</i>					
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>
1 egg	19	3	3	8	0	2
2 eggs	21	8	0	23	2	3
3 eggs	22	21	0	34	4	5

Mean clutch size was slightly below average, at 2.3.

Table 5. Number of herring gull nests that showed signs of success or failure on Canna in 2003.

	<i>Sub-colony</i>					
	<i>A</i>	<i>D</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>
With chicks	1	0	0	3	1	1
Failed	77	77	16	31	92	51

Of the 350 nests checked only 1.7% produced chicks, indicating the least productive breeding season we have yet recorded. There was an almost total failure in all colonies on the island. At sub-colony A, the number of fledged chicks is usually estimated by capture-recapture (see Methods). Only two small chicks were found there from the one successful nest found in the only check of the colony in early July, but both had disappeared by late July, indicating a total failure in this colony. We estimate that the 587 pairs on the island produced about 30 chicks (0.05 chicks per pair). Most nests, again, appear to have failed at the egg or small chick stage.

Great black-backed gull

Thirty-four pairs of great black-backed gull were monitored, 28 of which failed, one produced a brood of three young, four produced broods of two young and one produced a

single young, giving an overall productivity of 0.35 young per pair. This was higher than in 2002 (0.09 young per pair) but still well below average (Table 7).

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 6.

Table 6. Number of occupied black-legged kittiwake nests in five study colonies and number of large young per nest in 2003.

	<i>Sanday, K1</i>	<i>Sanday, K2</i>	<i>Sanday, K3</i>	<i>Sanday, K4</i>	<i>Cave</i>
<i>No. nests</i>	54	47	43	26	186
empty	18	23	19	13	45
1 large young	17	11	19	9	61
2 large young	19	13	5	4	78
3 large young	0	0	0	0	2
av. young per nest	1.0	0.79	0.67	0.65	1.2

Overall in the Sanday study colony, 138 young were produced from 170 nests (0.8 chicks per nest). At the cave colony on the north side of the island success was higher with 223 young from 186 nests (1.2 chicks per nest). This gives an overall success rate across all sites combined of 1.01 chicks per AON. The mean across the five plots was 0.86 (s.e. \pm 0.10), much higher than the 2002 figure of 0.53 (s.e. \pm 0.07). The mean brood size of the successful nests on Sanday was 1.4, only slightly lower than the 1.6 recorded at the cave. The main difference in breeding output between the two areas was due to the fact that 43% of all nests on Sanday failed to produce any chicks, compared with only 24% at the cave. Nests on the periphery (e.g. K4 and the top of K3 and K2) were more likely to fail on Sanday and it was suspected that this may have been due to predation by great skuas and, possibly, peregrine falcons *Falco peregrinus*.

Common tern

Three pairs of common tern nested, but no young were fledged.

Auks

The mean weight of 50 common guillemot chicks with a wing length greater than 60 mm was 274.3g (see Appendix 1). This was significantly higher than chicks of a similar age in 2002 (Z-test: mean 258.0g n=54, z=3.29, p<0.01), but not significantly different from the overall mean (1983-2002) of 271g (Mann-Whitney U-test: n=803, U=17878.5, p>0.05). This suggests that, in 2003, the chicks were in good condition.

For the first time we came across significant levels of predation on auks at Geugasgor on the north side of Canna. At the main cave colony four large boulder areas, where up to 300 pairs of guillemots had bred in the past, were completely deserted. Stashes of predated eggs at the back of the boulders suggested rats were partly to blame. Birds continued to nests as usual on top of these boulders. 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. Many depredated eggs, particularly those of razorbills, were found under boulders. This species appears to prefer nesting in small, enclosed sites under boulders. There was much evidence of birds relaying, though most of these repeated breeding attempts ended in failure. Gulls also depredated both young and adult auks, possibly in response to food shortages.

Table 7. Breeding success of selected seabirds on Canna 1994-2003.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Northern fulmar	0.50	0.33	0.32	0.33	0.33	0.27	0.44	0.48	0.45	0.46
Manx shearwater	0.75	0.25	0.13	0.08	-	-	-	-	-	-
European shag	1.45	1.37	1.35	1.75	1.32	0.91	0.80	0.10	0.26	0.16
Herring gull ^a	67%	70%	32%	78%	53%	11%	63%	10%	4.5%	1.7%
Herring gull ^b	1.6	1.8	0.3	1.3	0.7	0.4	0.4	0.1	0	0
Great b-b gull	-	-	-	1.5	1.3	1.1	1.3	0.3	0.1	0.3
Blk-legged Kittiwake	0.86	0.86	0.97	0.95	0.95	0.64	0.51	0.83	0.61	1.01

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 0.05 in 2003.

7. Ringing studies

7.1 Ringing totals

Table 8 shows the number of adults and chicks ringed during 2003 and the number of fully-grown birds that were re-trapped.

Table 8. Number of birds ringed and adults re-trapped on Canna in 2003

	<i>Adults ringed</i>	<i>Chicks ringed</i>	<i>Full-grown re-trapped</i>
Northern fulmar	16	33	25
European shag	9	491	25
Great Skua	0	1	0
LBB gull	0	1	0
Herring gull	0	16	0
GBB gull	0	8	0
Black-legged kittiwake	35	119	24
Common guillemot	304	1,915	1,068
Razorbill	80	80	64
Atlantic puffin	7	0	1
Totals	451	2,664	1,207

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.

8. Return rates and age of first breeding

Common guillemot

Of the 1,068 adult guillemots that were retrapped in 2003, 322 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, nine 4-year olds, 24 5-year olds, 11 6-year olds, 67 7-year olds, 53 8-year olds, 61 9-year olds and 15 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 subsequent return rates of surviving birds to the colony. Data collected in 2003 illustrate this further (Table 9).

Table 9. Recovery rates and return rates of common guillemot chicks ringed on Canna.

<i>Year</i>	<i>No. ringed</i>	<i>% recovered in 1st year</i>	<i>% back by 5th year</i>	<i>% back by 6th year</i>	<i>% back by 7th year</i>
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	
1998	2,221	0.5	2.0		

The 1996 cohort, with its very low first year recovery rate, as expected showed very high return rates. It is not surprising, with these high return rates in recent years, that numbers on Canna showed increases up to 2002.

Razorbill

For the third 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. Thirty three razorbills that had been ringed as chicks were re-trapped on the island for the first time in 2003. These included two 2-year olds, seven 3-year olds, two 4-year olds, two 6-year olds, two 7-year olds, three 8-year olds, two 9-year olds and three 10-year olds.

European shag

Only eight shags that were ringed as chicks were retrapped on the island for the first time in 2003. All were breeders, being caught on nests, and comprised one 2-year old, two 3-year olds, three 6-year olds, one 11 year old and one 13-year old.

9. Feeding studies

Common guillemot

Fifty six fish were collected from adult common guillemots on their return to the colony from fishing trips, of which 28 (50%) were sprats *Sprattus sprattus*, 5 (9%) sandeels *Ammodytes* spp. and 23 (41%) Gadidae. Details of the fish sampled are given in Appendix 2. The mean length of the sprats was 114.6mm (s.e. 2.0), not significantly different from the 1991-2000 average (111.5 mm, s.e. 0.39, $z = 1.7$, $p > 0.05$). Of the Gadidae 22 were whiting *Merlangius merlangus* and the other a *Trisopterus* sp. The mean size of the whiting was 92.0mm (s.e. 2.15).

Figure 7 shows that since 1982 the percentage of sandeels taken by common guillemots has fluctuated but overall declined. Sprats, conversely, have increased in the diet, particularly since 1992 (with the exception of 1993 and 1998). In years when the number of sprats taken was low gadoids became more important (e.g. 1988-91, 1993 and 1998) and this was also the case in 2003.

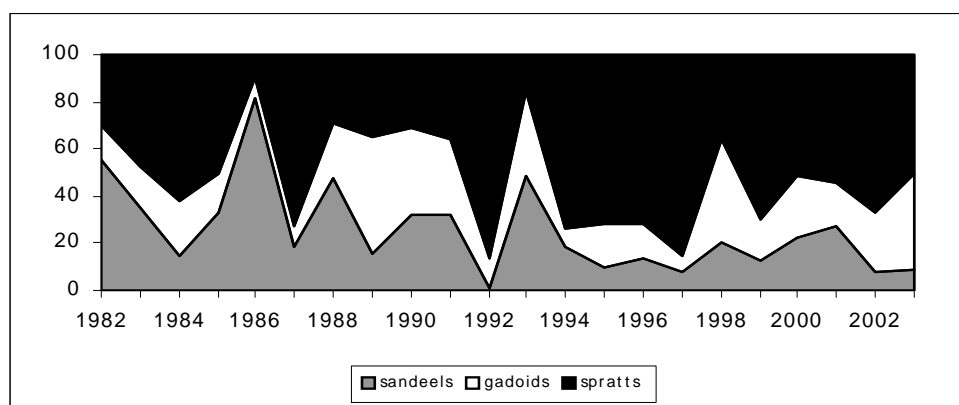


Figure 7. Fish species taken by common guillemots on Canna 1982-2003

Other seabirds

Eleven food samples were collected from regurgitations of both adult and chick kittiwakes, of which 8 mostly contained 0-group sandeels. One of these also contained a *Trisopterus* sp. and an older sandeel. Of the others one contained a small sprat (c.10cm) and c.10 small sandeels, one contained three small gadoids, and one contained a *Trisopterus* sp. and two other gadoid otoliths.

Six regurgitations were collected from young European shags in early July. Five of these contained large sandeels and the other a 10cm gadoid. Of five regurgitations in late July one contained 0-group and older sandeels, whilst the other four contained gadoids, mostly small whiting. European shag pellets mainly contained older sandeels and gadoids (see Appendix 2). It appeared that shags mainly fed on sandeels in early July but had switched to gadoids in late July.

Only three regurgitations from herring gull chicks were examined, all of which contained whitefish (considered to be discards from fishing boats). The great skua chick also regurgitated whitefish.

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Appendix 1 Common guillemot chick weights

Weights in grammes

305	252	262	314	282	316	310	210	273	298
291	310	260	280	300	278	286	264	293	278
298	237	274	272	210	297	286	252	276	238
244	274	231	276	228	274	272	278	247	284
256	290	315	280	272	267	278	289	302	258

Note: Weights taken only from chicks with a wing length of >60mm. Mean weight was 274.3g.

Appendix 2 Diet samples

Common guillemot

Details are given of the size (mm) of fish caught by adult guillemots on Canna in 2003.

Sprats: 28 measured

Length	78	98	104	105	107	109	110	111	112
No. of fish	1	1	1	1	1	1	1	2	1

Length	113	116	117	118	119	122	123	124	125
No. of fish	2	1	3	2	2	4	1	1	1

Length	136
No. of fish	1

Sandeels: 2 measured

Length	74	85	156	186	217
No. of fish	1	1	1	1	1

Whiting: 22 measured

Length	75	76	77	82	83	85	87	88	92
No. of fish	1	1	1	1	1	1	1	3	1

Length	94	96	99	100	102	103	105	108
No. of fish	2	1	1	1	2	2	1	1

European shag

The contents of European shag pellets collected in early and late July were as follows.

Month	Total no of pellets	No of pellets containing:					
		Sandeels	Gadidae	Trisopteru s	Rockling?	Dragonet	Flatfish
Early July	4	4	3	0	0	0	1
Total no. otoliths		137	67	0	0	0	1
Late July	16	2	15	12	3	1	0
Total no. otoliths		14	922	207	7	1	0

Note: The totals for Gadidae (mostly small whiting) exclude the totals for *Trisopterus sp.* and possible rockling.