JNCC Report

No. 332

Fair Isle Seabird Studies 2000

D N Shaw, C A Holt, H E Maggs & D de Palacio

Fair Isle Bird Observatory
Fair Isle
Shetland
ZE2 9JU

This document should be cited as:
Shaw, D N, Holt, C A, Maggs, H E & De Palacio, D 2002.
Fair Isle seabird studies 2000.
JNCC Report No. 332

For further information please contact:
Seabirds and Cetaceans
Joint Nature Conservation Committee
Dunnet House
7 Thistle Place
Aberdeen
AB10 1UZ

ISSN 0963-8091

Contents

1 Summary

1.1 Whole island census 2000

Population changes from 1999 were as follows:

Northern gannet:	+3.5%	to 1,162 apparently occupied nests (AON);
Arctic skua:	-5.8%	to 65 apparently occupied territories (AOT);
Great skua:	+2.3%	to 135 AOT;
Mew gull:	+33.3%	to 8 nests;
Common tern:	0.0%	3 pairs;
Arctic tern:	+122.6%	to 1,251 apparently incubating adults (AIA).

Whole island counts were carried out for four species, in conjunction with 'Seabird 2000':

The whole island census of black-legged kittiwakes revealed 8,175 AON, a decrease of 29.8% since the last complete island count in 1997.

The whole island census of northern fulmars revealed 20,424 apparently occupied sites (AOS), a decrease of 52.9% since the last complete island count in 1996.

The whole island census of razorbills revealed a total of 3,599 birds, an increase of 9.2% since the last complete island count in 1998.

The whole island census of Atlantic puffins produced an estimate of 80,000 birds. This would have represented a 100% increase on the 1995 estimate of 40,000 birds, but the 2000 figure may be an over-estimate as the regular presence of great skuas at the Roskilie colony almost certainly resulted in there being a low % of the population visible (see Results section 4.1.4).

1.2 Population changes at monitored plots

Northern fulmars, European shags, and black and common guillemots all increased at monitored plots in 2000 compared with 1999, the first three species bucking the trend of recent years. European shags showed a substantial increase of 61.4% at the five monitored beaches, while northern fulmars (contrary to the results of the whole island census), black and common guillemots all increased by approximately 20%. Black-legged kittiwakes continued their steady long-term decline; overall numbers at monitoring plots were 4.7% lower in 2000 compared with 1999, but four of the ten sites did show small (non-significant) increases.

1.3 Breeding productivity

The 2000 breeding season was generally productive, but affected by a storm on 13 June, which resulted in heavy losses on the exposed west coast. This meant that while plots on the sheltered east coast did well, those exposed to the storms did badly. As a result, northern gannet, razorbill and Atlantic puffin all had a below average season (razorbills had their lowest productivity since monitoring began and northern gannet their lowest

since 1991). Black-legged kittiwake, European shag, northern fulmar, black guillemot and Arctic terns all had an above average breeding season. However, the apparent overall success of European shags (highest productivity since monitoring began in 1986) may be misleading as the monitoring plot is on the east coast; European shags on the west coast were the hardest hit of all species during the June storms.

1.4 Adult survival

Black-legged kittiwakes showed an increased survival compared with recent years. From a total of 33 birds known to be alive in 1999, 26 were seen in 2000, an apparent over-winter survival from 1999-2000 of 78.8%. Ten new birds were ringed in 2000.

Atlantic puffins showed an uncharacteristically low survival; from a total of 104 birds known to be alive in 1999, just 75 were located in 2000, giving a survival estimate from 1999-2000 of 72.1%, the lowest since recording began in 1986. Fifteen new birds were colour-ringed in 2000.

1.5 Diet

Sandeels comprised the majority of food items for European shags, black-legged kittiwakes, common guillemots, razorbills and Atlantic puffins in 2000. The lengths of sandeels brought to common guillemot chicks, and load weights of Atlantic puffin feeds were about average.

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 one of the more important components 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 seabirds 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 a coverage as possible of British waters. Fair Isle is a very suitable site in North Britain, situated between the two important archipelagos of Orkney and Shetland.

Long-term studies on the numbers, breeding success, adult survival, chick growth and chick diet have been undertaken on up to eleven species on Fair Isle since 1986, with JNCC (formerly NCC CSD) support. Due to the long period of immaturity and high annual survival rates of seabirds, it is essential that continuity of long-term studies is maintained. As part of its Seabird Monitoring programme, the JNCC has contracted the Fair Isle Bird Observatory Trust (FIBOT) to:

(a) monitor numbers of northern fulmar *Fulmarus glacialis*, European shag *Phalacrocorax aristotelis*, Arctic skua *Stercorarius parasiticus*, great skua *Catharacta skua*, black-legged kittiwake *Rissa tridactyla*, Arctic tern *Sterna paradisaea*, common tern *Sterna hirundo*, common guillemot *Uria aalge*, razorbill *Alca torda*, black guillemot *Cepphus grylle* and Atlantic puffin *Fratercula arctica* nesting on Fair Isle.

(b) monitor breeding success of northern fulmar, northern gannet *Morus bassanus*, European shag, Arctic skua, great skua, black-legged kittiwake, common tern, Arctic tern, common guillemot, razorbill, black guillemot and Atlantic puffin.

(c) monitor adult survival of black-legged kittiwake and Atlantic puffin.

(d) assess feeding frequency of common guillemot and Atlantic puffin chicks through timed watches, and identify prey composition of food brought to the colonies during chick rearing period by collecting regurgitated samples or pellets for the following species: European shag, black-legged kittiwake, common guillemot, razorbill and Atlantic puffin.

(f) undertake special studies on species as agreed between the nominated officer and contractor e.g. weighing and measuring samples of chicks of all accessible species.

This report presents the results of seabird monitoring on Fair Isle in 2000, the fifteenth season of work. Some of the data collected in previous years have been re-analysed and therefore some of the results for the years 1986-99 published in this report may differ slightly from those in previous reports.

3 Methods

In addition to annual or regular total island counts, population changes of northern fulmar, European shag, black-legged kittiwake, common guillemot and black guillemot are monitored in plots. Full details of methods used are presented in Riddiford & Osborn (1986 & 1987), Riddiford & Silcocks (1988), Harvey *et al.* (1989, 1990, 1992), Harvey & Orsman (1991), Riddington *et al.* (1994, 1995, 1996, 1997), Baker *et al.* (1998) and Walsh *et al.* (1995).

4 Results

The results summarised below are presented in full in Tables 1-26 and Appendices 1-5.

4.1 Complete island census 2000

Species too numerous to count annually are censused every five years, or more regularly when in conjunction with projects such as Seabird 2000. The target species in 2000 were northern fulmar, black-legged kittiwake, razorbill and Atlantic puffin. To facilitate comparison with past (and future) counts, the island was split into twelve standard sectors for all the counts.

4.1.1 Northern fulmar (Table 1)

The island population of northern fulmars was counted during June. The final count of 20,424 AOS represents a 52.9% decrease on the 1996 count, which itself was the highest total count since records began in 1969. This population decrease was equally marked across all the count sectors of the island. Interestingly, there appears to have been a similar decrease on the island of Foula, 64 km to the north (Harvey, pers. comm.).

4.1.2 Black-legged kittiwake (Table 2)

The island population of black-legged kittiwakes was counted in June. The final count of 8,175 AON represents a 29.8% decrease on the (1997) count of 11,650 AON, and is a continuation of a long-term decline since 1988. A similar rate of decline was noted at the individual breeding productivity plots during the 1990s.

4.1.3 Razorbill (Table 3)

The island population of razorbills was counted on the evenings of 1-3 May, a period when a maximum number of birds are considered to be most visible. The final count of 3,599 individuals represents a 9.2% increase on the previous (1998) total of 3,296 birds.

4.1.4 Atlantic puffin (Table 4)

The whole island census of Atlantic puffins, done on the evenings of 29 April-3 May, revealed a total estimated population of 80,000 birds, double that estimated in 1995 and more in line with the estimated 70,000 birds in 1989, although the calculating method applied in 2000 may have been flawed. As only a percentage of the island population is visible at any one time, by using the colour-ringed population at Roskilie it is possible to estimate the percentage of birds ashore at any one time. However, this particular colony was subject to very persistent attack from great skuas in 2000, resulting in fewer birds ashore there than was usual. Therefore the ‘correction factor’ that was applied to the counts from the other colonies may well have led to an over-estimate of the percentage of

"non-visible" individuals at all other parts of the island and, hence, an over-estimate of the whole island population.

4.1.5 Northern gannet (Tables 5 & 6)

Northern gannets were counted on 13 June. The breeding population showed a small increase in the number of AON, up 3.5% from 1999, to 1,162 nests. Following the presence of single pairs in 1997 and 1999, four pairs nested on Sheep Rock in 2000. At the south end of the island, Fugli Stack continued to be a regular loafing site and may prove to be a potential breeding site.

4.1.6 Arctic skua (Table 5)

The number of AOT, counted between 28 May and 4 June, decreased from 69 to 65 (-5.8%). The distribution of territories was generally similar to 1999.

4.1.7 Great skua (Table 5)

Great skuas were censused between 28 May and 4 June. The population increased slightly (2.3%) from 132 territories in 1999, to 135 in 2000. The distribution of territories was similar to 1999.

4.1.8 Mew gull (Table 5)

Eight pairs of mew gull *Larus canus* were estimated to have attempted to breed in 2000, including five pairs on the favoured site at Byerwall above The Plantation. This total represented an increase of 33% on the six pairs in 1999.

4.1.9 Common tern (Table 5)

Three pairs were estimated to have bred in 2000 (all within the Arctic tern colony on Buness), the same number as in 1999 although precise estimates are difficult to achieve with this species due to their nesting habitat and their habit of nesting within the Arctic tern colonies.

4.1.10 Arctic tern (Table 5)

A large increase in the population of Arctic terns nesting on Fair Isle occurred in 2000. The total of 1,251 AIA was an increase of 122.6% compared with the 1999 total of 562. Buness and Tarryfield formed the core of the colony with smaller numbers on Eas Brecks, Horstibrekkers and Byerwall. In contrast to 1999, no birds were present at the small colonies at South Light and Brecks o' Busta. The islanders of Fair Isle continue to voice their concerns over the potential dangers to air traffic of loafing terns on the Airstrip, which lies adjacent to the Tarryfield colony.

4.2 Population changes as revealed by monitoring plots

4.2.1 Northern fulmar (Table 7)

Numbers of AOS increased at each of the five monitoring plots, with an overall increase (sites combined) of 19.2% compared to 1999. Three sites recorded particularly notable increases; South Ramnigeo (+37.3%), North Haven (+19.3%) and Heilli Stack/Linni Geo (+16.0%). However this rise in apparent occupied sites at the monitoring plots is contrary to the results of a whole island census in 2000, which indicated there had been a decrease of 52.8%, since the last complete count in 1996 (Table 1).

4.2.2 European shag (Table 8)

Nest counts in 2000 showed a notable increase at all five plots counted, compared to 1999, measured at +61.4% for all plots combined. The increase was particularly marked at North Ramnigeo (+109%) and Lericum (+96.7%). This represents a reversal of the trend of a long-term decline of the European shag population on the island, which reached an all-time low at the counted plots in 1999. A whole island count of this species is due to take place in the year 2001 as part of the Seabird 2000 Project.

4.2.3 Black-legged kittiwake (Table 9)

Numbers of black-legged kittiwakes at the ten monitoring plots showed an overall decline of 4.7% compared to 1999, continuing the long-term trend of decline. The greatest decreases were recorded at Da Swadin (-24.3%), South Gunnawark (-14.5%) and Trottie Kame (-14.0%). Four sites showed small increases, the largest of which was at Holms/Dog Geo (+6.9%).

4.2.4 Common guillemot (Table 10; Appendix 2)

Counts of attendant adults at monitoring plots increased in 2000, compared with 1999, with an overall increase of 19.4%. Counts increased at all of the five plots, though not statistically significantly at North Gunnawark and only significantly at one of the three sub-plots at both Shaldi Cliff and Da Swaddin. The increases were most marked at Kristal Kame and Guidicum, which experienced increases of over 15%. The mean count, at all five plots combined, was 3.3% lower than when consistent monitoring began in 1987.

4.2.5 Black guillemot (Tables 11a & 11b)

Numbers at Busta Geo (Table 11a) declined slightly between 1999 and 2000, continuing their steady decline there since 1989. Predation by domestic cats is thought to be responsible for the decline at this former island stronghold, with breeding no longer taking place on the boulder beach there. At the SOTEAG monitoring plot along the east coast (Table 11b), numbers rose compared with the previous year, the maximum count of 173 being an increase of 20.1% on the maximum 1999 count of 144 breeding plumaged birds. This may represent the reversal of the recent trend of decline.

4.3 Breeding success

4.3.1 Northern fulmar (Table 12)

In 2000, northern fulmar productivity was the highest recorded since 1995, an average of 0.45 chicks fledged per AOS. There was very little variation in success between the five monitoring plots, all sites recording productivities of between 0.43 and 0.47.

4.3.2 Northern gannet (Table 13)

As in the previous breeding season, northern gannet nests suffered in a storm in mid-June; from a sample of 196 occupied nests, 16 (8.2%) were lost. A total of 107 chicks reached fledging age, a productivity of just 0.55 which, although similar to that of 1999, was the worst since 1991.

4.3.3 European shag (Table 14)

In 2000, European shag productivity along the section of coast from Mavers Geo to Johnny's Peats was the second highest since monitoring began in 1986; 136 chicks fledged from 76 nests, a mean productivity of 1.79 chicks per nest. It should be noted that this sample site is on the east coast of the island, and hence was sheltered from the south-west gale on 13 June. The exposed west coast suffered estimated nest losses of 40-50%.

4.3.4 Arctic skua (Table 15)

1999 was a below average breeding season, with counts of fledged chicks on 27 July – 13 August revealing an estimated 24 chicks fledging from 65 AOT, a productivity 0.37. This represents a 42% decrease compared with the 0.64 estimated in 1999. At least 20 corpses of chicks were discovered, having been depredated by great skuas.

4.3.5 Great skua (Table 15)

A count on 13 August revealed 100 chicks fledged or near-fledged from 135 nests, a productivity of 0.74 chicks per nest. This is slightly lower than productivity estimates for recent seasons, yet still high.

4.3.6 Mew gull (Table 16)

In 2000, six chicks fledged from eight nests, an estimated productivity of 0.75 chicks per nest.

4.3.7 Black-legged kittiwake (Tables 17 & 18)

Following the record year in 1999, black-legged kittiwake breeding success on Fair Isle in 2000 was again high. An average of 1.15 chicks fledged per AON. Nine of the ten plots recorded above average productivities, ranging from 0.72 at Trottie Kame to 1.59 at Shaldi Cliff (one of the typically successful east coast sites). South and west coast sites suffered small losses during the gale on 13 June. The small colony at Da Swadin experienced a very poor year with a productivity of 0.04%, largely due to chick predation by herring gulls *Larus argentatus* and great skuas.

4.3.8 Common tern (Table 19)

Two common tern chicks were known to have fledged from three nests. Productivity was therefore estimated to be 0.67 chicks per nest.

4.3.9 Arctic tern (Table 19)

Arctic terns had a productive year on Fair Isle in 2000, with a count of approximately 1,000 fledged young during the third week of July (before most chicks had moved away from their breeding areas). Productivity was consequently estimated at 0.80 chicks per AIA, representing a record productivity for the Fair Isle colony and a significant increase on the productivity in 1999 (0.27).

4.3.10 Common guillemot (Table 20)

Common guillemots were fairly productive again in 2000, with productivity across the two monitoring sites averaging 0.77 chicks per AIA.

4.3.11 Razorbill (Table 21)

Breeding success at Easter Lother was estimated at 0.47 chicks assumed fledged per egg laid, similar to the 0.51 in 1999. Prior to 1999, the average productivity at this site since records began in 1990 was 0.65.

4.3.12 Black guillemot (Table 22)

Due to the continued difficulty in finding accessible nest sites, a small sample of fifteen black guillemot nests was used in 2000, an improvement on the sample of nine in 1999. The monitored nests were again relatively successful however, fledging an average of 1.07 chicks per active nest. For the third successive year, no sites were found in the boulder beaches in the south-east corner of the island, where domestic cats are thought to have been responsible for the desertion of several traditional sites. Consequently, the majority of nests were further north, including four in South Haven and three in Kirn o' Skroo.

4.3.13 Atlantic puffin (Table 23)

Breeding success of Atlantic puffins was again below average in 2000. A productivity value of 0.58 chicks fledged per occupied burrow represents a slight decrease on the 0.63 in 1999 and the same as in 1998.

4.4 Adult survival estimates

Breeding seabirds are fairly faithful to their breeding colony, returning to the same section of cliff and even the same nest site year after year. Therefore, by individually marking a sample of nesting adults, it is possible to estimate the year to year survival of that colony, i.e. the number of the marked birds returning in spring can give an approximation of the over-winter survival. In interpreting the results obtained with this method, it should be remembered that the survival estimates are likely to be under-estimates, since the non-appearance of a bird at a colony does not necessarily mean that the bird is dead. Table 24 presents two sets of calculations. Table 24a shows the return rate of colour-ringed birds seen at the breeding colony in the second of a two year pairing divided by the number seen at the colony in the first year of a pairing. It excludes sightings of birds from years subsequent to the two year pairing. Figure 24b includes such sightings and thus gives a better estimate of adult survival, which is updated each year if birds reappear after a period of absence.

4.4.1 Black-legged kittiwake (Table 24)

Sixteen visits were made to the colour-ringed population at Goorn in 2000. Table 24a shows that of the 21 colour-ringed birds present at the Goorn colony in 1999 14 were seen there again in 2000, a return rate of 66.7%. This is a substantial increase on the very low return rates of 21.7% and 29.2% recorded in 1997/98 and 1998/99. Table 24b shows that the very low return rates noted in 1997/98 and 1998/99 were not solely due to mortality, as some birds absent in those years were to return in subsequent years, giving estimated survival rates of 41.3% and 69.7% respectively and 78.8% for 1999/2000. These data, together with recent improved breeding success (Table 18), are an indication that there has at last been a change in fortune for this species. Ten new birds were colour-ringed in 2000.

4.4.2 Atlantic puffin (Tables 24)

Thirty visits were made to the colour-ringed population at Roskilie in 2000. Table 24a shows that of the 84 colour-ringed birds seen in the colony in 1999, 53 were observed in 2000, a return rate of 63.1% which is the lowest rate since recording began in 1986. Table 24b shows that re-sightings of birds in the years subsequent to 2000 reveal an estimated survival rate for 1999/2000 of 72.1%, still a comparatively very low figure, although with future re-sighting this may of course prove to be an underestimate. It is of note that the low return rate of 1997/98 (68.6%; Table 24a) related to an estimated survival rate for those years of 87.7% (which is near average), since many birds were seen subsequently. Fifteen new individuals were colour-ringed in 2000.

4.5 Diet

4.5.1 European shag (Appendix 3)

Thirty-five samples were collected from the colonies, between 20 June and 21 July. As in past years, sandeel *Ammodytes* sp. was the main species in European shag's diet, with 32 of the 35 samples (91.3%) being predominantly sandeel. Single other samples were predominantly clupeid and gadoid, with a further one remaining unidentified. The average weight of samples collected from pulli was 32.37g and that of pellets from adults was 1.77g.

4.5.2 Black-legged kittiwake (Appendix 3)

A total of 26 identifiable samples was collected from the colonies between 28 June and 19 July.
The majority of these were wholly sandeel (84.6%). Three of the remaining four samples were predominantly juvenile Gadoids. The mean ($\pm$ standard error) weight of samples from pulli was 8.15 $\pm$1.7g and from adults 18.26$\pm$ 2.95g.

4.5.3 Common guillemot (Table 25, Appendix 3)

A total of 303 food items was observed during 20 hours of feeding watches at the Peitron colony. The majority of these were between one and two times the length of an adult's bill. The feeding rates recorded were average for recent seasons, indicative of an adequate food supply.

Of 27 samples collected from the colonies (on various dates between 14 June and 11 July), 22 out of 27 (81.5%) were sandeels, with the remaining five comprising four Norway pout *Trisopterus esmarki* (a species not generally recorded in close inshore waters) and a single sprat *Sprattus sprattus*. Approximately half the sandeels were within the size range of 2 and 3 year olds (120-140mm), the remainder being younger fish. The mean ($\pm$ standard error) weight of sandeels was 5.74 $\pm$1.14g.

4.5.4 Razorbill (Appendix 3)

Eleven food samples, containing 16 individual fish, were collected from the colonies between 18 June and 4 July; all but one of these fish were sandeels. Unusually, these were generally similar sized fish to those brought in by common guillemots. In past years, common guillemot food samples have been somewhat larger. Mean ($\pm$ standard error) load weight was 4.4$\pm$ 1.16g.

4.5.5 Atlantic puffin (Table 26, Appendix 3)

Thirty-eight samples were collected from Atlantic puffins in 2000 (37 of these samples were collected on 9 July), which yielded a total of 231 individual fish. Of the fish

collected, 97% were sandeels, while 2.1% were sprats and 0.9% were Gadoids, which is similar to 1999 when sandeels represented 96% of fish collected. The mean weight (6.07$\pm$ 0.55g) was slightly below the previous 14 year average of 7.6g.

The feeding rates of adult Atlantic puffins was about average (5.2 feeds per burrow per day were recorded during the all-day feeding watch at Roskilie on 7th July). During the all-day watch, 98.7% of identified samples were sandeels.

4.6 Chick weights and wing-lengths (Appendix 4)

Data were collected on the weights and wing-lengths of chicks of northern fulmar (Table A4.1), European shag (Table A4.2), Arctic skua (Table A4.3), great skua (Table A4.4), herring gull (Table A4.5), lesser black-backed gull *Larus fuscus* (Table A4.6), black-legged kittiwake (Table A4.7), Arctic tern (Table A4.8), common guillemot (Table A4.9), razorbill (Table A4.10), black guillemot (Table A4.11) and Atlantic puffin (Table A4.12) chicks.

4.7 Adult weights and wing-lengths (Appendix 5)

Data were collected on weights and wing-lengths of adult northern fulmars (Table A5.1), black-legged kittiwakes (Table A5.2), common guillemots (Table A5.3), razorbills (Table A5.4), black guillemots (Table A5.5) and Atlantic puffins (Table A5.6).

5 Acknowledgements

Thanks go to Oliver Slessor and Basil Sansom, who proved to be valuable volunteers. Both made significant contributions to our data collection in the seabird colonies. Additional thanks to several Observatory visitors, who assisted in skua data collection. JNCC funded this contract. Matt Parsons of JNCC read a draft of the report and made many useful comments.

6 References

Baker, P E, Turner, S J, & Holt, C A 1998. Fair Isle seabird studies 1998. *JNCC Report,* No. 289.

Harvey, P V, & Orsman, C J 1991. Fair Isle seabird monitoring scheme: report to Joint Nature Conservation Committee of sixth season's work 1991. *JNCC Report,* No. 22.

Harvey, P V, Proctor, R, & Donald, C 1990. Fair Isle seabird monitoring scheme 1990. *Nature Conservancy Council, CSD Report,* No.1164.

Harvey, P V, Riddington, R, Votier, S C, & Taylor R 1992. Fair Isle seabird monitoring scheme: report to Joint Nature Conservation Committee of seventh season's work 1992. *JNCC Report,* No. 129.

Harvey, P V, Silcocks, A F, & Howlett, P 1989. Fair Isle seabird monitoring scheme: report to Nature Conservancy Council of fourth season's work 1989. *Nature Conservancy Council CSD Report,* No. 991.

Riddiford, N, & Osborn, K 1986. Fair Isle seabird monitoring scheme: report to Nature Conservancy Council of establishment and first season's work (1986). *Fair Isle Bird Observatory Trust.*

Riddiford, N, & Osborn, K 1987. Fair Isle seabird monitoring scheme: report to Nature Conservancy Council of second season's work 1987. *Nature Conservancy Council CSD Report,* No. 853.

Riddiford, N, & Silcocks, A F 1988. Fair Isle seabird monitoring scheme: report to Nature Conservancy Council of third season's work 1988. *Nature Conservancy Council CSD Report,* No. 879.

Riddington, R, Bull, J, Newell, M A, & Reid, J M 1997. Fair Isle seabird studies 1997. *JNCC Report*, No. 274.

Riddington, R, Hewson, C M, Wilson, K A & Newell, M 1995. Fair Isle seabird studies 1995. *JNCC Report*, No. 254.

Riddington, R, Newell, M A & Votier, S C 1996. Fair Isle seabird studies 1996. *JNCC Report*, No. 265.

Riddington, R, Thompson, G, Ward, N C, & Reid, J 1994. Fair Isle seabird monitoring scheme: report to Joint Nature Conservation Committee of ninth season's work 1994. *JNCC Report,* No. 214.

Shaw, D N, Holt, C A, Turner S J, & Bull, A J 2001. Fair Isle Seabird studies 1999. *JNCC Report*, No. 309.

Walsh, P M, Halley, D J, Harris, M P, del Nevo, A, Sim, I M W, & Tasker, M L 1995. *Seabird monitoring handbook for Britain and Ireland.* JNCC/RSPB/ITE/Seabird Group, Peterborough.

Tables: 1-26

Table 1. Northern fulmar - total island census counts 1969-2000.

Year	Count	% change since previous count
1969	16,264	-
1975	25,648	+57.7%
1986	26,995	+5.3%
1991	35,213	+30.4%
1996	43,317	+23.0%
2000	20,424	-52.8%

Figures refer to apparently occupied sites.
See also Appendix 1a, for a sector by sector breakdown of the 1996 and 2000 counts.

Table 2. Black-legged kittiwake – total island census counts 1969-2000

Year	Count	% change since previous count
1969	12,121	-
1975	17,000	+40.3%
1986	19,072	+12.2%
1988	19,340	+1.4%
1992	18,159	-6.1%
1997	11,650	-35.8%
2000	8,175	-29.8%

Figures refer to apparently occupied nests.
See also Appendix 1b, for a sector by sector breakdown of the 1997 and 2000 counts.

Table 3. Razorbill – total island census counts 1975-2000

Year	Count	% change since previous count
1975	2,500	-
1986	3,882	+55.3%
1988	5,114	+31.7%
1993	4,130	-19.6%
1998	3,296	-20.2%
2000	3,599	+9.2%

Figures refer to individuals.
See also Appendix 1c, for a sector by sector breakdown of the 2000 count.

Table 4. Atlantic puffin – total island estimated counts 1966-2000

Year	Count
1966	20,000 pairs
1986	20,000 birds
1989	70,000 birds
1995	40,000 birds
2000	80,000 birds

See also Appendix 1d, for a sector by sector breakdown of the 2000 count.

Table 5. Annual total island census counts of selected species for 1987-2000

	Northern gannet	Arctic skua	Great skua	Mew gull	Common tern	Arctic tern
1987	304	95	72	10	37	211
1988	488	78	78	9	59	345
1989	676	114	72	10	25	283
1990	643	105	75	9	7	400
1991	687	99	79	9	10	650
1992	781	109	110	10	17	1,100
1993	764	107	101	10	9	808
1994	825	93	101	7	3	615
1995	965	87	130	5	6	1,200
1996	1,090	86	120	6	5	1,250
1997	1,116	98	152	5	7	1,730
1998	1,118	67	79	5	3	1,249
1999	1,123	69	132	6	3	562
2000	1,162	65	135	8	3	1,251
% change '99-2000	+3.5%	-5.8%	+2.3%	+33.3%	+0%	+122.6%

Counting units: AON (Northern gannet), AOT (Arctic skua, great skua), number of nests (mew gull, terns 1986-1988), AIA (terns 1989-2000).

Table 6. Northern gannet counts by colony 2000, and comparison with 1999.

	1999	**2000**
Outer Stack	314	432
Inner Stack	98	100
Yellow Head	38	44
Dronger	66	76
North Felsigeo	346	212
Toor O' Da Ward Hill	140	130
Matchi Stack	36	50
Kame o' Guidicum	84	114
Sheep Rock	1	4
Total	**1,123**	**1,162**

Figures are counts of Apparently Occupied Nests (AON), i.e. nest material with adult(s) present.
The count for Inner Stack 2000 includes a boat count of 75 nests.

Table 7. Northern fulmar population change at five monitored plots 1986-2000.

	North Haven	**South Gunnawark**	**South Ramnigeo**	**Easter Lother**	**Heilli Stack/ Linni Geo**	**All Sites**
1986	118	90	125	90	87	510
1987	136	59	103	71	70	439
1988	72	66	121	68	71	398
1989	96	60	107	79	77	419
1990	104	67	107	72	73	423
1991	86	73	109	82	51	401
1992	95	62	134	102	76	469
1993	59	50	113	89	50	361
1994	65	50	109	86	63	373
1995	77	49	106	91	64	387
1996	78	54	110	118	71	431
1997	69	48	113	101	69	400
1998	41	53	112	108	65	379
1999	57	47	94	91	50	339
2000	68	48	129	101	58	404
% change 1999-2000	+19.3%	+2.2%	+37.3%	+9.9%	+16.0%	+19.2%
% change 1986-2000	NA	-46.7%	+3.2%	+12.2%	-33.4%	-20.1%

Figures refer to AOS (apparently incubating birds present at a suitable nest site on each of three visits to plots between 1 June and 10 June).
All sites % change for 1986-2000 excludes North Haven due to change in study site with construction of new pier and breakwater in 1992-93.

Table 8. European shag population change at five monitored plots 1986-2000.

	North Ramnigeo	South Ramnigeo	South Naaversgill	South Gunnawark	Lericum	All Sites
1986	27	38	52	64	36	217
1987	30	31	28	49	102	240
1988	24	53	45	48	51	221
1989	20	73	42	53	53	241
1990	20	60	25	43	54	202
1991	27	53	17	38	63	198
1992	21	49	16	26	63	175
1993	20	35	19	24	76	174
1994	26	46	17	24	58	171
1995	18	37	20	23	62	160
1996	26	51	24	33	72	206
1997	16	47	19	26	55	163
1998	13	32	20	25	45	135
1999	11	20	16	19	30	96
2000	23	30	18	25	59	155
% change 1999-2000	+109.0%	+50.0%	+12.5%	+31.5%	+96.7%	+61.4%
% change 1986-2000	-14.8%	-21.1%	-65.4%	-61.0%	+63.9%	-28.6%

Figures refer to number of nests (counted during a single visit to each plot between 14 June and 24 June).

Table 9. Black-legged kittiwake population change at ten monitored plots 1986-2000.

	SG	L	DN	HDG	JP	SH	SC	DS	TK	B	All Sites
1986	c.207	c.166	c.203	c.207	c.217	-	-	-	-	-	-
1987	c.217	c.165	c.188	c.205	c.208	c.93	c.93	c.91	c.94	c.92	1,446
1988	197	137	189	204	176	94	111	87	100	111	1,406
1989	196	155	184	218	177	92	124	85	97	99	1,427
1990	178	142	186	200	178	82	125	80	106	86	1,363
1991	162	140	182	169	154	76	120	72	100	78	1,253
1992	172	146	160	142	155	81	110	81	111	72	1,230
1993	139	106	139	130	127	71	83	54	97	51	997
1994	129	97	136	130	124	81	80	52	83	63	975
1995	127	92	130	134	109	78	68	51	67	61	917
1996	121	79	137	135	117	73	69	44	88	61	924
1997	115	78	138	126	110	62	63	47	87	59	885
1998	100	69	117	123	97	64	47	31	71	46	765
1999	97	69	96	116	95	66	57	33	79	43	751
2000	83	64	92	124	98	67	51	25	68	44	716
% change 1999-2000	-14.5	-7.3	-4.2	+6.9	+3.2	+1.5	-10.6	-24.3	-14.0	+2.4	-4.7
% change 1986-2000	-60.0	-61.5	-54.7	-40.1	-54.9	-28.0	-45.2	-72.6	-27.7	-52.2	-50.5

Figures refer to mapped AON, based on 15-20 visits to each plot between 15 May and 8 August.
Sites are SG: South Gunnawark; L: Lericum; DN: Da Nizz; HDG: Holms/Dog Geo; JP: Johnny's Peats; SH: Stroms Heelor; SC: Shaldi Cliff; DS: Da Swadin; TK: Trottle Kame; B: Bergaroo.

Table 10. Common guillemot population change at five monitored colonies 1986-2000.

	Shaldi Cliff	North Gunnawark	Guidicum	Da Swadin	Kristal Kame	All Sites
1986	496	306	506	243	-	-
1987	475	174	456	282	1,891	3,278
1988	365	165	432	254	1,172	2,388
1989	410	174	433	292	1,166	2,475
1990	313	130	288	219	807	1,757
1991	405	173	353	287	1,333	2,551
1992	461	185	456	357	1,702	3,161
1993	458	183	401	402	1,601	3,045
1994	437	352	338	367	1,440	2,934
1995	470	145	302	453	1,305	2,675
1996	483	158	344	439	1,279	2,703
1997	513	171	323	491	1,428	2,926
1998	-	170	347	-	1,377	-
1999	424	172	326	406	1,330	2,658
2000	492	188	376	422	1,696	3,174
% change 1999-2000	+16.1%	+9.3%	+15.4%	+4.0%	+27.6%	+19.4%
P value of 1999-2000 change in numbers	*/n.s./n.s.	n.s	***	*/n.s./n.s.	**/***	-
% change 1986-2000	-0.8%	-38.6%	-25.7 %	+73.7%	-10.3%	-3.3%

Data are based on eight counts between 3 and 22 June at each plot. Note that sample size was four in 1998 (for the sites shown), eight in 1994 and 1999, nine in 1988 and 1986, and ten in all other years. Also as no data was collected from Kristal Kame in 1986, the all sites comparison is from 1987-2000. Statistical significance of differences 1999-2000 as revealed by t-test on log-transformed counts: *P<0.05, ** P<0.01, ***P<0.001. Within each colony, from one to three plots were counted, and the statistical tests were done for each plot.

Table 11a. Black guillemot counts, Busta Geo, 1989-2000.

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
First count	41	39	30	32	26	24	23	22	13	6	6	3
Second count	40	33	35	32	25	25	14	21	19	5	3	4
% change in max. count from previous year	+2.4	-4.9	-10.3	-8.6	-18.8	-3.9	-8.0	-4.3	-13.6	-68.4	0.0	-33.3

Count dates were: 1988 (1/5, 12/5); 1989 (9/4, 27/4); 1990 (7/4, 21/4); 1991 (13/4, 22/4), 1992 (17/4, 29/4), 1993 (14/4, 25/4), 1994 (16/4, 22/4), 1995 (14/4, 21/4), 1996 (26/4, 30/4), 1997 (16/4, 20/4), 1998 (19/4, 30/4), 1999 (28/3, 20/4), 2000 [9/4, 17/4]

Counts are number of individuals in breeding plumage.

Table 11b. Black guillemot counts, North Light - South Light, east side, 1987-2000.

	1987	1989	1991	1993	1994	1995	1996	1997	1998	1999	2000
First count	220	281	230	183	238	214	189	254	153	144	173
Second count	209	286	241	190	240	216	224	230	160	135	132
% change in max. count from previous year	-13.4	+30.0	-15.7	-21.2	+26.3	-10.0	+3.7	+13.4	-37.0	-10.0	+20.1

Count dates were: 1987 (12/4, 23/4); 1988 (1/5, 12/5); 1989 (9/4, 27/4); 1990 (7/4, 21/4); 1991 (13/4, 22/4), 1992 (17/4, 29/4), 1993 (14/4, 25/4), 1994 (16/4, 22/4), 1995 (14/4, 21/4), 1996 (26/4, 30/4), 1997 (16/4, 20/4), 1998 (19/4, 30/4), 1999 (28/3, 20/4), 2000 [9/4, 17/4]

Counts are number of individuals in breeding plumage.

Table 12. Northern fulmar breeding success at five monitored plots 1990-2000.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NHV	0.25	0.24	0.37	0.46	0.28	0.33	0.32	0.26	0.43	0.28	0.43
SGU	0.21	0.52	0.58	0.51	0.48	0.47	0.31	0.29	0.23	0.38	0.44
SRA	0.36	0.60	0.55	0.51	0.53	0.54	0.55	0.42	0.30	0.29	0.43
ELO	0.29	0.49	0.59	0.71	0.53	0.55	0.51	0.40	0.31	0.32	0.47
H/L	0.23	0.73	0.64	0.66	0.70	0.56	0.48	0.42	0.37	0.48	0.45
mean	0.27	0.52	0.55	0.57	0.50	0.49	0.43	0.36	0.33	0.34	0.45
± SE	±.03	±.08	±.05	±.05	±.07	±.04	± .05	± .03	±.03	±.04	± .02

Site codes: NHV = North Haven; SGU = South Gunnawark; SRA = South Ramnigeo; ELO = Easter Lother; H/L = Heilli Stack/Linni Geo.

Northern fulmar productivity is expressed as number of chicks fledged per AOS. From 1986 to 1994, an AOS was defined as a site occupied on three consecutive visits in early June, plus any other site within the monitoring plot where a chick was subsequently present. However, estimates of productivity should strictly define AOS only as those sites found to be occupied on three consecutive checks in June (Walsh *et al.* 1995) as the addition of sites which were not found to be occupied in early June but in which a chick was subsequently seen will cause upward bias in productivity estimates. Productivity figures calculated by this more rigorous definition are given for 1995-99.

Table 13. Northern gannet breeding success 1989-2000.

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Occupied nests	147	159	150	129	152	141	166	222	222	187	165	196
Chicks fledged	114	95	78	94	117	109	125	149	157	149	96	107
Productivity	0.78	0.60	0.52	0.73	0.78	0.77	0.75	0.67	0.71	0.80	0.58	0.55

Note: Figures refer to whole island counts

Table 14. European shag breeding success 1989-2000.

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Occupied nests	59	62	95	74	72	79	71	85	89	71	60	76
Chicks fledged	84	60	112	122	130	130	94	117	115	102	65	136
Productivity	1.42	0.97	1.18	1.65	1.81	1.65	1.38	1.38	1.29	1.44	1.08	1.79

Note: Figures refer to counts from a plot on the east of the island.

Table 15. Breeding success of Arctic skua and great skua, 1991-2000.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Arctic skua										
Occupied territories	99	109	107	93	87	86	98	67	69	65
Chicks fledged	74	130	81-100	65	65-70	76	80	9	44	24
Productivity	0.75	1.2	0.8-0.9	0.70	0.75-0.80	0.88	0.82	0.13	0.64	0.37
Great skua										
Occupied territories	79	110	101	101	130	120	152	79	132	135
Chicks fledged	53-58	55-88	100-120	121	150	100	115	79	101	100
Productivity	0.70	0.5-0.8	1.0-1.2	1.20	1.15	0.83	0.76	1.00	0.76	0.74

Productivity = number of chicks fledged per AOT.

Table 16. Breeding success of Mew gull, 1992-2000.

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Nests	10	10	7	5	6	5	8	6	8
Chicks fledged	0	4	4	3	6	2	3	4	6
Productivity	0	0.40	0.57	0.60	1.00	0.40	0.60	0.67	0.75

Productivity = number of chicks fledged per nest

Table 17. Black-legged kittiwake breeding success, 2000.

	AON	Trace nest	Chicks fledged	Productivity
South Gunnawark	83	6	125	1.51
Lericum	64	5	82	1.28
Da Nizz	92	1	135	1.47
Holms/Dog Geo	124	6	114	0.92
Johnny's Peats	98	7	132	1.35
Stroms Heelor	67	1	97	1.45
Shaldi Cliff	51	5	81	1.59
Da Swadin	25	4	1	0.04
Trottie Kame	68	0	49	0.72
Bergaroo	44	0	51	1.16
Total				1.15

Productivity = number of chicks fledged per AON

Table 18. Black-legged kittiwake breeding success at monitored plots, 1989-2000.

	1989	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
S.Gunnawark	0.34	0	0.78	1.09	0.69	1.33	1.03	1.09	0.74	0.10	1.33	1.51
Lericum	0.39	0	0.90	1.42	1.04	1.00	0.60	1.15	0.55	0.07	1.03	1.28
Da Nizz	0.40	0	0.92	1.43	1.13	1.37	0.97	1.36	0.53	0.12	1.39	1.47
Holms/Dog geo	0.19	0	0.50	1.32	1.06	1.32	0.88	1.49	0.69	0.13	1.36	0.92
Johnny's Peats	0.36	0	0.74	1.20	0.93	1.30	1.04	1.38	0.75	0.17	1.37	1.35
Stroms Heelor	0.38	0	1.08	1.54	1.13	1.02	0.71	1.36	0.81	0.25	1.36	1.45
Shaldi Cliff	0.29	0	1.01	1.24	1.17	1.21	1.09	1.17	1.00	0.31	1.47	1.59
Da Swadin	0.32	0	1.00	1.15	1.02	1.06	0.14	0.59	0.21	0.03	1.18	0.04
Trottie Kame	0.59	0	1.10	1.34	1.30	1.43	1.10	1.35	0.75	0.23	1.34	0.72
Bergaroo	0.42	0	0.86	1.25	1.35	1.27	1.03	1.36	0.58	0.06	1.28	1.16
Mean (± se), all plots	0.37	0	0.89	1.30	1.08	1.23	0.87	1.23	0.66	0.15	1.33	1.15
	±0.01	-	±0.06	±0.04	±0.06	±0.05	±0.09	±0.08	±0.07	±0.03	±0.07	±0.15

Productivity = number of chicks fledged per AON

Table 19. Breeding success of Arctic tern and common tern, 1988-2000.

	Arctic tern			**Common tern**		
	AIA	Chicks fledged	Productivity	AIA	Chicks fledged	Productivity
1988	345	1	0.00	59	2	0.03
1989	283	36	0.13	25	1	0.04
1990	400	1	0.00	7	0	0
1991	650	650-845	1.0-1.3	10	2	0.20
1992	1100	1100+	1.0+	17	c.16	c.1.00
1993	808	50	0.06	9	1	0.11
1994	615	150	0.24	3	4	1.33
1995	1200	200	0.17	6	0	0
1996	1250	900+	0.75+	5	3	0.60
1997	1730	800	0.46	7	c. 7	c.1.00
1998	1249	1	0.00	2	0	0
1999	562	150	0.27	3	3	1.00
2000	1251	1000	0.80	3	2	0.67

Productivity = number of chicks fledged per pair AIA.
+ = Figure given is probably an underestimate

Table 20. Common guillemot breeding success at two monitored plots, 1988-2000.

	Peitron		**Da Swadin**		
	AIA	Productivity	AIA	Productivity	Mean productivity
1988	53	0.77	54	0.80	0.78
1989	57	0.79	60	0.78	0.78
1990	58	0.72	48	0.71	0.72
1991	136	0.79	57	0.61	0.70
1992	102	0.75	39	0.72	0.74
1993	148	0.86	50	0.84	0.85
1994	151	0.77	45	0.67	0.74
1995	117	0.68	48	0.65	0.67
1996	157	0.74	57	0.77	0.75
1997	106	0.69	55	0.84	0.74
1998	142	0.71	77	0.71	0.71
1999	112	0.77	56	0.82	0.79
2000	100	0.79	48	0.71	0.77

Productivity = number of chicks fledged per AIA.

Table 21. Razorbill breeding success, Easter Lother, 1991-2000.

	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
No. eggs laid	64	69	77	72	47	78	100	75	59	86
Productivity	0.58	0.55	0.77	0.64	0.49	0.72	0.61	0.80	0.51	0.47

Productivity = number of chicks assumed fledged per eggs laid

Table 22. Black guillemot breeding success at monitored nests, 1990-2000.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Nests with eggs	33	48	47	31	19	32	30	23	13	9	15
Chicks fledged	24	41	47	38	11	23	17	10	9	9	16
Productivity	0.73	0.85	1.00	1.23	0.58	0.72	0.57	0.43	0.69	1.00	1.07

Productivity = number of chicks assumed to have fledged per site with egg(s).

Table 23. Atlantic puffin breeding success at monitored burrows, 1990-2000.

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Sites with eggs	96	120	97	110	64	109	109	124	79	68	64
Chicks fledged	55	104	73	76	53	81	87	98	46	43	37
Productivity	0.57	0.87	0.75	0.69	0.83	0.74	0.80	0.79	0.58	0.63	0.58

Productivity = number of chicks assumed to have fledged per burrow with egg.

Table 24a. Year to year return rates of black-legged kittiwake and Atlantic puffin to Fair Isle, 1990-2000.

	90-91	**91-92**	**92-93**	**93-94**	**94-95**	**95-96**	**96-97**	**97-98**	**98-99**	**99-00**
Black-legged kittiwake	-	24/28 **85.7%**	17/24 **70.8%**	37/47 **78.7%**	30/37 **81.1%**	44/50 **88.0%**	42/48 **87.5%**	10/46 **21.7%**	7/24 **29.2%**	14/21 **66.7%**
Atlantic puffin	104/131 **79.4%**	101/127 **79.5%**	92/106 **86.8%**	75/99 **75.8%**	70/79 **88.6%**	80/86 **93.0%**	80/90 **88.9%**	59/86 **68.6%**	69/94 **73.4%**	53/84 **63.1%**

Note: This table shows the number of colour-ringed birds seen at a breeding colony in the second year of a two year pairing divided by the number seen at the breeding colony in the first year. Colonies studied: Goorn for black-legged kittiwakes, Roskillie for Atlantic puffins.

Table 24b Survival estimates of adult black-legged kittiwakes and Atlantic puffins on Fair Isle, 1990-2000.

	90-91	**91-92**	**92-93**	**93-94**	**94-95**	**95-96**	**96-97**	**97-98**	**98-99**	**99-00**
Black-legged kittiwake	-	25/28 **89.3%**	18/25 **72.0%**	40/47 **85.1%**	36/40 **90.0%**	52/56 **92.9%**	46/52 **88.5%**	19/46 **41.3%**	23/33 **69.7%**	26/33 **78.8%**
Atlantic puffin	114/145 **78.6%**	116/137 **84.7%**	109/120 **90.8%**	96/113 **85.0%**	97/100 **97.0%**	104/108 **96.3%**	102/104 **98.1%**	93/106 **87.7%**	104/119 **87.4%**	75/104 **72.1%**

Note: This table shows the number of birds known to be alive in the second year of a two year pairing divided by the number known to be alive in the first year. Unlike table 24a it includes birds that are seen at the breeding colony in years subsequent to the two year pairings, and so known to be alive even if not actually seen in the years in question. Survival estimates therefore continue to be updated as a small number of birds re-appear after a period of absence. This table includes birds re-sighted up to and including 2002.

Table 25. Numbers and lengths of fish fed to common guillemot chicks and feeding rate to chicks at Peitron colony 2000.

Size of fish; relative to length of adult bill	**Number of fish**	**Percentage of total**
Less than 1.0	33	10.9
1.0 – 1.5	124	40.9
1.5 – 2.0	115	37.9
2.0 – 2.5	16	5.4
Undetermined	15	4.9

NUMBER OF CHICKS OBSERVED - 89
AVERAGE FEEDING RATE – 3.41 feeds / chick / day
Counts made between 14.30 – 23.30 and 03.30 – 14.30 BST

Table 26. Weight and composition of Atlantic puffin food samples, Fair Isle, 1986 – 2000.

				Percentage total fish						
Year	**Sample dates**	**Mean weight ±s.e. (n)**	**Total no. fish**	**Sandeels**		**Gad.**	**Sprat**	**Rock.**	**Flatfish**	**Unid.**
				Large	Small					
1986	27/06-23/07	7.0 ± 0.8 (20)	44	26	70	2	0	2	0	0
1987	03/07-03/08	4.6 ± 0.4 (27)	32	25.0	75.0	0	0	0	0	0
1988	02/07-21/07	6.0 ± 0.6 (34)	159	5.2	37.1	50.9	5.0	1.2	0.6	0
1989	02/07-24/07	9.3 ± 0.6 (64)	428	4.2	76.6	16.1	1.6	1.4	0	0
1990	29/06-02/08	7.6 ± 0.4 (73)	613	0.7	44.5	41.6	0	13.1	0	0.1
1991	22/06-21/07	10.0 ± 0.5 (72)	384	17.7	75.5	3.9	0	2.9	0	0
1992	25/06-16/07	9.1 ± 0.4 (107)	520	11.9	16.9	61.0	0	6.7	0	3.5
1993	12/07	6.0 ± 0.9 (15)	52	5.8	38.5	0	3.8	51.9	0	0
1994	28/06-16/07	9.8 ± 1.3 (18)	99	9.1	73.7	16.2	0	0	0	1.0
1995	24/06-17/07	7.7 ± 1.0 (28)	143	13.3	42.6	35.6	7.7	0.7	0	0
1996	11/07-27/07	10.1 ± 0.9 (26)	163	2.5	85.8	6.1	5.5	0	0	0
1997	07/07-20/07	8.5 ± 0.8 (44)	449	0.2	40.5	37.4	1.3	13.8	0	6.7
1998	20/06-20/07	5.3 ± 0.45 (57)	264	3.8	14.0	77.3	0	0	0	4.9
1999	19/06-07/07	6.1 ± 1.08 (32)	193	1.6	94.3	3.1	1.0	0	0	0
2000	22/06-09/07	6.1 ± 0.55 (38)	231	0.9	96.1	0.9	2.1	0	0	0

Key: Gad = Gadoid; Rock = Rockling ; Unid = Unidentified; Large sandeels are > 100mm length
Note: In 2000, 37 of the 38 samples were collected on 9 July.

APPENDIX 1: Total island census 2000

1a. Sector by sector breakdown of northern fulmar total island census result, 2000 (with 1996 figures for comparison)

Sector	2000	1996	% change
1996-99			
1 Lericum - Biskam	1,228	2,340	-47.5%
2 Biskam – North Haven	2,011	3,853	-47.8%
3 N.Haven – South Haven	350	667	-47.5%
4 S.Haven – Goorn	517	1,545	-66.5%
5 Goorn – Shieldi	3,420	4,974	-31.3%
6 Shieldi – Whaleback	855	1,406	-39.2%
7 Whaleback – S.Hbr	547	827	-33.6%
8 S.Hbr – Fugli	410	629	-34.8%
9 Fugli – Hoini	1,720	4,136	-58.4%
10 Hoini – Lerness	2,266	8,376	-73.0%
11 Lerness – Dronger	4,684	9,305	-49.7%
12 Dronger – Lericum	2,416	5,120	-52.8%
Total	**20,424**	**43,317**	**-52.9%**

1b. Sector by sector breakdown of black-legged kittiwake total island census result, 2000 (with 1997 figures for comparison).

Sector	2000	1997	% change
1997-2000			
1 Lericum - Biskam	959	1,340	-28.4%
2 Biskam – North Haven	303	412	-26.5%
3 N.Haven – South Haven	88	144	-38.9%
4 S.Haven – Goorn	242	399	-39.4%
5 Goorn – Shieldi	1,245	2,069	-39.8%
6 Shieldi – Whaleback	42	38	+10.5%
7 Whaleback – S.Hbr	321	322	-0.1%
8 S.Hbr – Fugli	706	908	-22.3%
9 Fugli – Hoini	451	521	-13.4%
10 Hoini – Lerness	1,947	2,730	-28.7%
11 Lerness – Dronger	1,409	1,965	-28.3%
12 Dronger – Lericum	522	802	-34.9%
Total	**8,175**	**11,650**	**-29.8%**

1c. Sector by sector breakdown of razorbill total island census result, 2000

Sector	Birds at breeding sites	Loafers	Total
1 Lericum - Biskam	225	80	305
2 Biskam – North Haven	41	5	46
3 N.Haven – South Haven	25		25
4 S.Haven – Goorn	140	15	155
5 Goorn – Shieldi	410	17	427
6 Shieldi – Whaleback	42	82	124
7 Whaleback – S.Hbr	143	45	188
8 S.Hbr – Fugli	162	45	207
9 Fugli – Hoini	265	110	375
10 Hoini – Lerness	786	295	1,081
11 Lerness – Dronger	210	26	226
12 Dronger – Lericum	350	80	430
Total	**2,799**	**800**	**3,599**

1d. Sector by sector breakdown of Atlantic puffin total island census result, 2000

Sector	Ashore	Offshore	Wheeling	Total
1 Lericum - Biskam	710		66	776
2 Biskam – North Haven	340	1,255	222	1,817
3 N.Haven – South Haven	150	255		405
4 S.Haven – Goorn	70	430	10	510
5 Goorn – Shieldi	725	100		825
6 Shieldi – Whaleback	233	225		458
7 Whaleback – S.Hbr	42	51	26	119
8 S.Hbr – Fugli	265	640	245	1,150
9 Fugli – Hoini	748	185	100	1,033
10 Hoini – Lerness	3,625	500	140	4,265
11 Lerness – Dronger	1,500	500	100	2,100
12 Dronger – Lericum	1,310	350		1,660
Total	**9,718**	**4,491**	**909**	**15,118**

APPENDIX 2: Fair Isle common guillemot and razorbill census 2000

FAIR ISLE COMMON GUILLEMOT CENSUS COUNTS, JUNE 2000

COLONY: Shaldi Cliff OBSERVER: Deryk Shaw

DATE:	3	4	6	10	15	16	20	21	22
START TIME:	10.30	10.00	10.30	10.45	09.45	09.50	09.50	09.40	10.10
PLOT COUNT									
A	250	240	270	260	240	240	215	215	210
B	180	200	200	210	200	190	185	160	165
C	65	72	70	65	72	74	62	52	59
Loafers									
X	11	5	0	15	12	1	5	16	0
Y	96	18	0	89	105	41	15	25	17
Z	110	160	65	58	120	99	11	25	0
CLOUD	1	6	8	1	6	1	8	7	8
RAIN	1	1	1	1	2	1	1	1	2
SEA	2	2	1	2	1	1	2	2	2
SWELL	2	1	1	2	2	1	2	1	2-3
VISIBILITY, COLONY	1	1	1	1	1	1	1	1	1
VISIBILITY, SEA	1	1	1	1	1	1	2	2-3	2
WIND SPEED	2	2	0	2	3	1	2	1	1
WIND DIRECTION	N	N	NE	SW	W	W	NE	SE	S

KEY

Cloud cover in oktas. Wind speed is Beaufort scale.
Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy.
Sea: 1 = flat calm, 2 = small waves, 3 = large waves, 4 = white wave crests, 5 = waves breaking high onto rocks.
Swell: 1 = no swell, 2 = light swell, 3 = moderate swell, 4 = heavy swell.
Visibility: 1 = good, 2 = fair, 3 = poor.

FAIR ISLE COMMON GUILLEMOT CENSUS COUNTS, JUNE 2000

COLONY: North Gunnawark OBSERVER: Charlie Holt

DATE:	3	4	6	10	15	16	20	21	22
START TIME:	10.40	11.00	11.00	11.00	10.30	10.20	11.00	10.50	10.00
PLOT COUNT	195	187	182	197	206	204	183	167	167
Loafers	0	0	0	16	0	0	0	5	17
CLOUD	1	7	7	1	2	0	8	7	8
RAIN	1	1	1	1	1	1	1	1	1
SEA	2	2	1	2	3	1	2	1	1
SWELL	3	2	2	2	2	2	2	2	1
VISIBILITY, COLONY	1	1	1	1	1	1	1	1	1
VISIBILITY, SEA	1	1	1	1	1	1	1	2	2
WIND SPEED	3	3	1	3	4	1	3	2	1
WIND DIRECTION	N	NE	NE	SW	NW	NW	E	SE	S

KEY

Cloud cover in oktas. Wind speed is Beaufort scale.
Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy.
Sea: 1 = flat calm, 2 = small waves, 3 = large waves, 4 = white wave crests, 5 = waves breaking high onto rocks.
Swell: 1 = no swell, 2 = light swell, 3 = moderate swell, 4 = heavy swell.
Visibility: 1 = good, 2 = fair, 3 = poor.

FAIR ISLE COMMON GUILLEMOT CENSUS COUNTS, JUNE 2000

COLONY: Guidicum OBSERVER: Charlie Holt

DATE:	3	4	6	10	15	16	20	21	22
START TIME:	10.00	10.30	10.20	11.00	10.00	09.50	10.20	10.10	10.30
PLOT COUNT	385	386	366	390	393	404	367	340	350
Loafers	10	9	2	20	1	0	14	17	10
CLOUD	1	7	7	1	2	0	8	8	7
RAIN	1	1	1	1	2	1	1	1	1
SEA	2	2	1	2	3	1	2	1	1
SWELL	3	2	2	2	2	2	2	2	1
VISIBILITY, COLONY	1	1	1	1	1	1	1	1	1
VISIBILITY, SEA	1	1	1	1	1	1	1	2	2
WIND SPEED	3	3	1	4	4	1	3	2	1
WIND DIRECTION	N	NE	NE	SW	NW	NW	E	SE	SW

KEY

Cloud cover in oktas. Wind speed is Beaufort scale.
Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy.
Sea: 1 = flat calm, 2 = small waves, 3 = large waves, 4 = white wave crests, 5 = waves breaking high onto rocks.
Swell: 1 = no swell, 2 = light swell, 3 = moderate swell, 4 = heavy swell.
Visibility: 1 = good, 2 = fair, 3 = poor.

FAIR ISLE COMMON GUILLEMOT CENSUS COUNTS, JUNE 2000

COLONY: Da Swadin OBSERVER: Deryk Shaw

DATE:	3	4	6	10	15	16	20	21	22
START TIME:	09.50	10.30	09.40	10.05	10.30	09.50	10.40	10.40	10.45
PLOT COUNT									
A	140	135	115	125	115	115	135	100	105
B	150	170	140	135	150	130	130	110	100
C	185	172	152	161	179	180	164	153	152
Loafers	105	100	90	70	80	100	100	100	66
CLOUD	2	7	7	1	3	1	8	6	7
RAIN	1	1	1	1	1	1	1	1	1
SEA	2	2	1-2	2	2	1	2	2	2
SWELL	2	1	2	2	1	1	1	1	2-3
VISIBILITY, COLONY	1	1	1	1	1	1	1	1	1
VISIBILITY, SEA	1	1	2	1	1	1	2	2	2
WIND SPEED	2	2	0-1	2-3	3	1	2	0	1
WIND DIRECTION	N	NNE	NE	SW	W	W	NE	SE	S

KEY

Cloud cover in oktas. Wind speed is Beaufort scale.
Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy.
Sea: 1 = flat calm, 2 = small waves, 3 = large waves, 4 = white wave crests, 5 = waves breaking high onto rocks.
Swell: 1 = no swell, 2 = light swell, 3 = moderate swell, 4 = heavy swell.
Visibility: 1 = good, 2 = fair, 3 = poor.

FAIR ISLE COMMON GUILLEMOT CENSUS COUNTS, JUNE 2000

COLONY: Kristal Kame OBSERVER: Hywel Maggs

DATE:	3	4	6	10	15	16	20	21	22
START TIME:	10.15	10.00	09.00	11.00	09.00	10.00	10.00	10.00	10.00
PLOT COUNT									
A	1630	1200	1330	1500	1480	1370	1540	1340	1080
B	440	310	290	270	290	330	270	290	300
Loafers	30	40	30	50	70	45	100	55	30
CLOUD	1	6	7	3	3	2	8	7	7
RAIN	1	1	1	1	1	1	1	2	2
SEA	2	2	1	1	3	2	2	2	2
SWELL	3	3	2	2	3	2	3	2	2
VISIBILITY, COLONY	1	1	1	1	1	1	1	1	1
VISIBILITY, SEA	1	1	1	1	1	1	1	2	2
WIND SPEED	3	3	1	3	4	1	3	1	1
WIND DIRECTION	NE	NE	NE	SW	NW	NW	NE	E	SE

KEY

Cloud cover in oktas. Wind speed is Beaufort scale.
Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy.
Sea: 1 = flat calm, 2 = small waves, 3 = large waves, 4 = white wave crests, 5 = waves breaking high onto rocks.
Swell: 1 = no swell, 2 = light swell, 3 = moderate swell, 4 = heavy swell.
Visibility: 1 = good, 2 = fair, 3 = poor.

FAIR ISLE RAZORBILL CENSUS COUNTS, JUNE 2000

COLONY: Lericum OBSERVER: Hywel Maggs

DATE:	3	4	6	10	15	16	20	21	22
START TIME:	10.45	10.30	10.00	11.00	09.00	10.00	10.00	10.30	10.30
PLOT COUNT	100	70	60	54	42	63	85	83	67
CLOUD	1	7	7	1	8	2	8	7	7
RAIN	1	1	1	1	2	1	1	2	2
SEA	2	2	1	1	3	2	2	2	2
SWELL	3	2	1	1	3	3	2	1	1
VISIBILITY, COLONY	1	1	1	1	1	1	1	1	1
VISIBILITY, SEA	1	1	1	1	1	1	1	2	2
WIND SPEED	3	2	1	3	4	1	3	0-1	0-1
WIND DIRECTION	NE	NE	NE	SW	NW	NW	NE	E	SE

KEY

Cloud cover in oktas. Wind speed is Beaufort scale.
Rain: 1 = none, 2 = discontinuous light, 3 = discontinuous heavy, 4 = continuous light, 5 = continuous heavy.
Sea: 1 = flat calm, 2 = small waves, 3 = large waves, 4 = white wave crests, 5 = waves breaking high onto rocks.
Swell: 1 = no swell, 2 = light swell, 3 = moderate swell, 4 = heavy swell.
Visibility: 1 = good, 2 = fair, 3 = poor.

APPENDIX 3: Food sample collections and feeding watches in 2000.

Table A3.1. European shag food samples, 2000.

Sample no.	Date	Site	Mass (g)	Principal constituents
1	20.06	South Gunnawark	5.8	Gadoid
2	20.06	North Gunnawark	31.3	Sandeel
3	20.06	North Gunnawark	54.5	Sandeel
4	26.06	North Ramnigeo	44.5	Sandeel, Clupeid
5	26.06	North Ramnigeo	46.8	Sandeel
6	28.06	North Gunnawark	8.9	Sandeel
7	04.07	Lericum	10.0	Sandeel
8	04.07	Lericum	13.2	Sandeel
9	04.07	Lericum	13.9	Sandeel
10	04.07	Lericum	41.4	Sandeel
11	04.07	Lericum	26.0	Sandeel
12	04.07	Lericum	35.0	Sandeel
13	04.07	Lericum	32.0	Sandeel
14	04.07	Lericum	53.1	Sandeel
15	04.07	South Naaversgill	10.5	Sandeel
16	06.07	Skank	19.8	Sandeel
17	07.07	South Mila Hesslands	26.6	Sandeel
18	07.07	South Mila Hesslands	90.5	Sandeel
19	11.07	Wester Lother	58.0	Sandeel
20	19.07	Lericum	6.5	Sandeel
21	20.07	Jivvi Geo	23.3	Sandeel
22	20.07	Jivvi Geo	56.5	Sandeel
23	21.07	Da Soonds	36.5	Sandeel
24	20.06	North Gunnawark	0.5	Sandeel
25	20.06	North Gunnawark	0.8	Sandeel
26	20.06	North Gunnawark	0.8	Sandeel
27	28.06	North Gunnawark	2.5	Sandeel
28	28.06	North Gunnawark	2.4	Sandeel
29	28.06	North Gunnawark	1.5	Sandeel
30	04.07	Lericum	1.0	Sandeel
31	07.07	South Mila Hesslands	1.0	Sandeel
32	07.07	South Mila Hesslands	2.0	Sandeel
33	07.07	South Mila Hesslands	2.9	Sandeel
34	11.07	Wester Lother	2.0	Sandeel
35	19.07	Lericum	3.8	Unidentified

Number of samples: 35
Mean load weight of pulli regurgitates – samples 1-23 (g) = 32.4 $\pm$ 4.5 (SE)
Mean load weight of adult pellets – samples 24-35 (g) = 1.8 $\pm$ 0.3 (SE)

Load composition:	Species	% of loads of which principal constituent
	Sandeel	91.3
	Clupeid	2.9
	Gadoid	2.9
	Unidentified	2.9

Table A3.2. Black-legged kittiwake food samples, 2000.

Sample no.	Date	Site	Bird age	Wet mass (g)	Principal constituents
1	28.06	South Gunnawark	Pullus	9.6	Sandeel
2	28.06	South Gunnawark	Pullus	11.5	Sandeel
3	06.07	Skank	Pullus	5.5	Sandeel
4	07.07	South Mila Hesslands	Pullus	12.1	Sandeel
5	07.07	South Mila Hesslands	Pullus	10.2	Sandeel
6	07.07	South Mila Hesslands	Pullus	2.2	Sandeel
7	07.07	South Mila Hesslands	Pullus	5.8	Sandeel
8	07.07	South Mila Hesslands	Adult	11.8	Sandeel
9	07.07	South Mila Hesslands	Adult	7.1	Sandeel
10	07.07	South Mila Hesslands	Adult	5.5	Sandeel
11	07.07	South Mila Hesslands	Adult	13.4	Sandeel
12	07.07	South Mila Hesslands	Adult	34.5	Sandeel
13	07.07	South Mila Hesslands	Adult	33.6	Sandeel, Gadidae
14	12.07	Goorn	Pullus	1.1	Sandeel
15	12.07	Goorn	Pullus	8.4	Sandeel
16	12.07	Goorn	Pullus	22.8	Sandeel
17	12.07	Goorn	Pullus	3.6	Sandeel
18	12.07	Goorn	Adult	30.3	Sandeel, Gadidae
19	12.07	Goorn	Adult	21.9	Gadidae, Sandeel
20	12.07	Goorn	Adult	27.8	Gadidae
21	12.07	Goorn	Adult	28.8	Sandeel
22	12.07	Goorn	Adult	20.0	Sandeel
23	12.07	Goorn	Adult	6.2	Sandeel
24	12.07	Goorn	Adult	10.5	Sandeel
25	15.07	South Gunnawark	Adult	4.5	Gadidae
26	19.07	Lericum	Pullus	5.0	Unidentified

Number of samples: 26

Mean load weight = 13.60 g, $\pm$ 1.94 (SE); n=26
(pulli only) = 8.15 g, $\pm$ 1.70 (SE); n=12
(adults only) = 18.26 g, $\pm$ 2.95 (SE); n=14

Load composition:	Species	% of loads of which principal constituent
	Sandeel	22/26 = 84.6%
	Juv. Gadidae	3/26 = 11.6%
	Unidentified	1/26 = 3.8%

Table A3.3. Common guillemot food samples, 2000.

Sample no.	Date	Site	Weight (g)	Length (mm)	Principal constituents
1	14.06	Easter Lother	3.5	106	Sandeel
2	21.06	Kuthin	10.4	148	Sandeel
3	21.06	Kuthin	5.4	122	Sandeel
4	21.06	Kuthin	9.3	155	Sandeel
5	23.06	Wester Lother	21.9	143	Norway pout
6	04.07	South Naaversgill	4.7	117	Sandeel
7	04.07	South Naaversgill	13.0	126	Norway pout
8	04.07	Easter Lother	11.4	117	Sprat
9	04.07	Lericum	17.7	133	Norway pout
10	04.07	Lericum	10.0	143	Sandeel
11	04.07	Lericum	5.0	119	Sandeel
12	04.07	Lericum	1.6	79	Sandeel
13	04.07	Lericum	1.9	82	Sandeel
14	04.07	Lericum	1.6	79	Sandeel
15	04.07	Lericum	1.7	81	Sandeel
16	04.07	Lericum	2.3	85	Sandeel
17	04.07	Lericum	0.9	65	Sandeel
18	04.07	Lericum	1.6	83	Sandeel
19	04.07	Lericum	1.4	78	Sandeel
20	04.07	Lericum	1.3	75	Sandeel
21	04.07	Lericum	1.3	75	Sandeel
22	04.07	Lericum	1.0	70	Sandeel
23	04.07	Lericum	1.5	84	Sandeel
24	04.07	Lericum	2.3	87	Sandeel
25	04.07	Lericum	3.1	100	Sandeel
26	04.07	Lericum	1.6	80	Sandeel
27	11.07	Wester Lother	17.5	144	Norway pout

Number of samples: 27

Mean weight (all samples) = 5.74g $\pm$ 1.14 (SE); n=27

% Sandeel = 81.5%
Mean length (sandeels) = 96.1 mm

Table A3.4. Razorbill food samples, 2000.

Sample no.	Date	Site	Weight (g)	Length (mm)	Principal constituents
1	18.06	South Naaversgill	4.0	113	Sandeel
	″	″	4.5	116	Sandeel
2	20.06	North Gunnawark	5.5	120	Sandeel
3	20.06	North Gunnawark	7.0	129	Sandeel
4	23.06	Easter Lother	4.8	-	Sandeel
5	04.07	South Naaversgill	13.6	154	Sandeel
6	04.07	South Naaversgill	0.7	77	Sandeel
7	04.07	South Naaversgill	0.9	76	Sandeel
	″	″	0.5	56	Sandeel
	″	″	1.2	76	Sandeel
8	04.07	Lericum	2.6	-	Gadidae
9	04.07	Lericum	0.5	68	Sandeel
10	04.07	Easter Lother	0.5	60	Sandeel
11	04.07	Easter Lother	0.8	78	Sandeel
	″	″	0.4	61	Sandeel
	″	″	0.4	65	Sandeel
	″	″	0.5	66	Sandeel

Number of samples: 11

Mean load weight = 4.4 g $\pm$ 1.16 (SE); n=11
Mean length of sandeels = 87.7mm $\pm$ 7.9 (SE); n=15
Note: Each figure refers to one fish; samples 1 and 7 contained more than one fish

Table A3.5. Atlantic puffin food samples, 2000.

No. of samples	38
Dates collected	22 June & 09 July
Mean load weight	6.07g $\pm$ 0.55 (SE)

Species composition	No.	Mean length (mm) $\pm$ SE	% by no.
Sandeel (all)	224	71.5 $\pm$ 0.5 (n=224)	97.0%
Sandeel (< 100mm)	222	71.1 $\pm$ 0.4 (n=222)	96.1%
Sandeel (> 100mm)	2	121.5	0.9%
Gadidae	2	49.0	0.9%
Sprat	5	52.2 $\pm$ 2.4 (n=5)	2.1%

Table A3.6. Summary of Atlantic puffin feeding watch 8 July 2000, 03.00 - 23.00 hrs.

Burrow no.	No. feeds	Sandeel	Gadoid	Sprat	Unidentified
1	7	7	-	-	-
2	7	7	-	-	-
3	6	5	-	-	1
4	6	6	-	-	-
5	6	4	-	-	2
6	6	6	-	-	-
7	3	2	-	-	1
8	1	-	-	-	1
9	8	6	-	-	2
10	11	9	-	-	2
11	10	6	1	1	2
12	9	9	-	-	-
13	8	8	-	-	-
14	1	-	-	-	1
15	3	3	-	-	-
16	7	6	-	-	1
17	9	7	-	1	1
18	3	3	-	-	-
19	5	4	-	-	1
20	6	6	-	-	-
21	2	1	-	-	1
22	6	6	-	-	-
23	4	3	-	-	1
24	2	1	-	-	1
25	9	9	-	-	-
26	6	5	-	-	1
27	5	2	-	-	3
28	2	1	-	-	1
29	4	3	-	-	1
30	2	2	-	-	-
31	3	3	-	-	-
32	2	1	-	-	1
33	7	7	-	-	-
34	3	2	-	-	1
35	1	1	-	-	-
Total	**180**	**151**	**1**	**2**	**27**

Average no. feeds per burrow per day = 5.1
Of those specifically identified, 98.7% was sandeel

APPENDIX 4: Weights and wing-lengths of chicks in 2000.

Table A4.1. Northern fulmar: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)
11.07	48	350
22.07	59	360
22.07	75	640
22.07	90	630
22.07	90	550
22.07	78	500
22.07	70	430
22.07	65	390
22.07	64	460
22.07	95	495
22.07	66	420
22.07	70	440
22.07	66	420
22.07	82	720
22.07	85	540
22.07	90	530
22.07	50	330
22.07	104	560
27.07	104	560
27.07	66	420
27.07	121	830
27.07	180	810
27.07	95	850
27.07	141	1010
27.07	78	500
27.07	70	430
27.07	65	390
27.07	64	460
27.07	95	495
27.07	66	420
27.07	70	440
27.07	66	420
27.07	82	720
27.07	85	540
27.07	90	530
27.07	50	330

Table A4.2. European shag chicks weighed and measured once.

Date	Wing (mm)	Weight (g)	Brood Size
14.06	132	1380	1
16.06	61	660	3
16.06	61	690	3
16.06	62	650	3
16.06	94	1000	2
16.06	81	740	2
16.06	159	1460	2
16.06	161	1460	2
16.06	184	1410	3
16.06	159	1440	3
16.06	152	1440	3
16.06	110	1010	1
17.06	95	1090	2
17.06	59	635	2
19.06	79	750	3
19.06	79	850	3
19.06	63	710	3
23.06	190	1710	unknown
26.06	92	1100	unknown
26.06	96	975	3
26.06	94	820	3
26.06	97	800	3
26.06	154	1525	unknown
24.06	145	1760	unknown
26.06	105	1500	unknown
26.06	120	1100	unknown
26.06	132	1400	unknown
26.06	87	920	unknown
26.06	135	1500	unknown
28.06	82	900	3
28.06	70	725	3
28.06	103	1000	3
28.06	230	1850	1
04.07	137	1440	unknown
04.07	75	850	3
04.07	88	915	3
04.07	90	970	3
04.07	110	1000	2
04.07	115	1300	2
04.07	65	700	3
04.07	70	800	3
04.07	80	770	3
04.07	100	1140	1

Table A4.3a. Arctic skua: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)	Brood Size
26.06	43	105	unknown
26.06	124	290	unknown
02.07	161	360	2
02.07	177	380	2
05.07	166	400	unknown
05.07	76	180	unknown
05.07	174	340	2
05.07	160	340	2
05.07	160	310	unknown
05.07	238	375	2
05.07	153	250	1
05.07	185	310	1
05.07	192	340	unknown
05.07	165	345	2
05.07	167	290	2
05.07	170	350	unknown
06.07	198	375	unknown
06.07	175	250	2
06.07	208	400	2
06.07	225	375	unknown
06.07	159	270	unknown
06.07	105	230	2
06.07	145	325	2
06.07	179	340	2
06.07	153	310	2
06.07	169	355	2
06.07	201	440	2
06.07	211	430	unknown
06.07	183	380	unknown
06.07	171	295	unknown
10.07	239	410	unknown
10.07	150	340	unknown
10.07	169	370	unknown
10.07	50	135	unknown
10.07	154	325	unknown
10.07	247	450	unknown
10.07	201	370	unknown
11.07	150	345	2
11.07	134	325	2
17.07	245	460	unknown
17.07	36	83	unknown
17.07	203	460	unknown
18.07	123	280	unknown
18.07	233	390	unknown
18.07	151	320	unknown
22.07	155	293	unknown

Table A4.3b. Arctic skua: chicks weighed and measured twice.

Date i	Wing (mm)	Weight (g)	Brood size	Date ii	Wing (mm)	Weight (g)
02.07	120	250	2	10.07	191	355
05.07	178	330	1?	10.07	209	355
10.07	195	400	1?	17.07	236	420

Table A4.4a. Great skua: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)	Brood size
05.07	100	550	2
05.07	64	415	2
05.07	137	800	1?
05.07	176	960	1?
05.07	85	500	1?
05.07	93	710	1?
05.07	92	520	1?
05.07	105	690	1?
05.07	101	650	2
05.07	109	675	2
05.07	135	870	1?
05.07	115	730	1?
05.07	85	570	1?
05.07	80	500	2
05.07	64	480	2
05.07	108	620	2
05.07	114	690	2
05.07	52	390	1?
05.07	58	445	1?
05.07	142	840	1?
05.07	109	745	1?
05.07	86	630	2
05.07	120	650	1?
05.07	67	460	1?
05.07	90	500	2
05.07	75	450	2
05.07	129	770	1?
05.07	158	880	1?
05.07	123	750	1?
05.07	68	420	2
05.07	50	330	2
05.07	102	670	1?
05.07	137	720	1?
05.07	84	660	1?
05.07	135	760	1?
06.07	76	440	1?
06.07	40	240	1?
06.07	41	260	1?
06.07	97	620	1?
06.07	78	540	1?
06.07	97	660	1?
06.07	104	610	1?
06.07	113	720	1?
06.07	51	420	1?
06.07	57	390	1?
06.07	87	500	1?
06.07	73	500	2
06.07	64	400	2
06.07	75	500	1?
06.07	104	600	1?
06.07	52	420	1?
06.07	71	600	1?
06.07	108	715	1?
06.07	44	320	1?
06.07	125	780	1?
06.07	77	545	1?
06.07	63	505	1?
06.07	155	865	2

Date	Wing (mm)	Weight (g)	Brood size
06.07	177	990	2
06.07	115	705	2
06.07	119	690	2
06.07	70	450	1?
06.07	40	200	2
06.07	50	360	2
06.07	120	680	2
06.07	146	700	1?
06.07	45	275	1?
06.07	142	390	1?
06.07	56	370	1?
06.07	142	810	1?
06.07	165	875	1?
06.07	112	580	1?
06.07	116	710	1?
06.07	139	705	1?
06.07	85	590	1?
06.07	49	380	1?
06.07	79	515	1?
06.07	227	1200	1?
06.07	158	800	1?
06.07	157	880	2
06.07	167	990	2
06.07	60	420	1?
06.07	96	600	1?
06.07	111	660	1?
06.07	170	940	1?
06.07	147	780	1?
06.07	52	350	2
06.07	55	450	2
10.07	97	600	1?
10.07	172	1000	1?
10.07	150	910	1?
10.07	170	925	1?
10.07	169	950	1?
10.07	95	660	1?
10.07	47	300	1?
10.07	173	1010	1?
10.07	129	770	1?
10.07	107	730	1?
10.07	75	540	1?
10.07	138	850	1?
10.07	98	620	1?
10.07	210	1100	2
10.07	111	490	1?
10.07	154	800	1?
10.07	174	750	1?
10.07	192	860	1?
10.07	40	260	2
10.07	40	320	2
18.07	215	820	1?
18.07	190	1100	1?
18.07	229	1070	1?
18.07	52	400	1?
18.07	240	1200	1?
18.07	167	820	1?
18.07	285	1150	1?
18.07	220	1250	1?

Table A4.4b. Great skua: chicks weighed and measured twice.

Date i	Wing (mm)	Weight (g)	Brood Size	Date ii	Wing (mm)	Weight (g)
05.07	64	480	2	10.07	80	600
05.07	99	670	2	10.07	162	950
05.07	66	460	1?	10.07	112	600
05.07	88	625	1?	10.07	150	850
05.07	86	640	2	17.07	203	860
05.07	83	550	1?	10.07	114	780
05.07	70	400	1?	10.07	100	640
05.07	107	660	2	10.07	142	925
06.07	142	800	1?	10.07	170	950
06.07	65	420	1?	18.07	165	820
06.07	50	350	1?	18.07	145	875
06.07	113	620	1?	18.07	224	920
06.07	227	1030	1?	18.07	302	1170
10.07	200	950	2	18.07	260	1150

Table A4.5. Herring gull: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)
29.06	215	790
29.06	214	715
29.06	165	770
29.06	233	910
29.06	235	980
29.06	196	705
29.06	197	715
29.06	149	845
29.06	211	950
29.06	169	760
29.06	144	740
29.06	195	740
29.06	146	680
29.06	194	740
04.07	246	750
04.07	234	750
04.07	231	700
08.07	230	770

Date	Wing (mm)	Weight (g)
08.07	230	800
09.07	188	830
09.07	235	900
09.07	215	700
13.07	172	660
13.07	100	470
13.07	317	1050
13.07	168	600
13.07	118	450
13.07	330	990
13.07	260	900
13.07	273	1100
13.07	306	950
08.07	230	750
08.07	81	550
08.07	274	1050
08.07	219	850
08.07	221	920

Table A4.6. Lesser black-backed gull: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)
09.07	251	900
09.07	248	875
09.07	252	980
09.07	215	800
09.07	221	850
09.07	215	800
09.07	140	550
09.07	130	500
09.07	187	650
09.07	201	620

Table A4.7. Black-legged kittiwake: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)	Brood size
06.07	119	345	1
06.07	152	330	2
06.07	199	215	2
07.07	100	240	1
07.07	173	430	2
07.07	173	430	2
07.07	93	405	1
07.07	197	380	2
07.07	189	370	2
07.07	141	340	1
07.07	202	485	2
07.07	213	410	2
07.07	128	380	2
07.07	173	410	2
07.07	128	320	1
07.07	152	340	2
07.07	148	300	2
07.07	130	290	1
07.07	207	300	3
07.07	195	380	3
07.07	210	360	3
07.07	228	320	1
07.07	97	220	1
07.07	188	380	2
07.07	170	330	2
07.07	175	340	2
07.07	185	350	2
07.07	152	320	2
07.07	131	320	2
07.07	163	320	1
07.07	152	360	2
07.07	144	320	2
07.07	133	320	1

Table A4.8a. Arctic tern: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)
24.06	57	60
24.06	81	82
24.06	70	78
24.06	83	84
24.06	53	69
24.06	90	91
24.06	97	97
24.06	84	92
24.06	76	80
24.06	65	81
24.06	50	64
24.06	65	68
24.06	108	103
24.06	68	74
24.06	62	69
24.06	32	55
24.06	49	61
24.06	34	47
24.06	111	110
26.06	111	101
26.06	127	105
26.06	97	85
26.06	80	79
26.06	122	104
26.06	78	76
26.06	101	99
26.06	80	74
26.06	100	92
26.06	100	99
27.06	110	107
27.06	111	120
27.06	111	106
27.06	100	97
27.06	114	112
27.06	120	106
27.06	100	92
27.06	102	103
27.06	68	71
27.06	92	92
27.06	103	94
27.06	124	100

Date	Wing (mm)	Weight (g)
27.06	124	111
27.06	123	90
27.06	118	92
27.06	132	99
27.06	119	103
27.06	90	86
27.06	77	77
27.06	62	70
27.06	112	99
27.06	89	74
27.06	93	80
27.06	87	86
27.06	115	106
27.06	97	100
27.06	78	74
27.06	81	77
27.06	105	105
04.07	103	80
04.07	138	95
04.07	166	120
04.07	96	93
04.07	167	110
04.07	150	100
04.07	160	120
04.07	102	65
04.07	167	105
04.07	153	103
04.07	160	100
04.07	166	120
04.07	135	105
04.07	170	105
17.07	147	111
17.07	138	99
17.07	120	99
17.07	172	109
17.07	102	96
17.07	120	114
17.07	166	112
17.07	132	106
17.07	138	112
17.07	134	117

Table A4.8b. Arctic tern: chicks weighed and measured twice.

Date i	Wing (mm)	Weight (g)	Date ii	Wing (mm)	Weight (g)
24.06	57	72	04.07	92	153
27.06	109	86	02.07	133	71
27.06	85	89	02.07	128	100
27.06	103	105	02.07	144	95
27.06	135	107	02.07	160	90
27.06	109	95	02.07	144	91
27.06	113	98	02.07	139	80
27.06	82	86	02.07	127	95
27.06	72	72	02.07	116	92
28.06	100	94	04.07	151	110

Table A4.9 Common guillemot: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)	Date	Wing (mm)	Weight (g)
14.06	38	190	18.06	45	265
14.06	55	295	18.06	47	260
14.06	44	260	18.06	40	235
16.06	42	210	18.06	38	215
16.06	42	230	18.06	59	240
16.06	48	225	18.06	53	240
16.06	66	250	18.06	55	220
16.06	55	250	18.06	46	280
16.06	47	195	18.06	60	285
16.06	38	220	18.06	45	250
16.06	58	285	18.06	28	145
16.06	41	190	18.06	40	185
16.06	72	260	18.06	53	235
16.06	48	245	18.06	60	230
18.06	40	215	18.06	35	170
18.06	45	265	18.06	57	220
18.06	57	320	18.06	55	220
18.06	45	265	18.06	35	190
18.06	58	325	20.06	43	225

Table A4.10a Razorbill: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)
14.06	57	150
14.06	58	165
14.06	47	175
14.06	45	145
14.06	50	165
16.06	40	115
16.06	37	147
16.06	54	175
16.06	64	200
16.06	45	170
16.06	42	165
16.06	43	155
16.06	40	155
16.06	48	185
16.06	51	165
17.06	45	140
17.06	54	185
17.06	35	120
17.06	35	120
17.06	70	190
17.06	71	190
17.06	72	195
17.06	56	170
17.06	35	150
17.06	64	205
17.06	63	205
18.06	37	135
18.06	63	280
23.06	60	225
23.06	69	205
23.06	42	150
23.06	57	190
23.06	60	195
23.06	49	155
23.06	82	215
23.06	70	235
23.06	76	190
23.06	74	220
23.06	62	180
23.06	76	245
23.06	61	180
23.06	67	200
23.06	68	195
23.06	73	175
23.06	70	185
23.06	62	150
23.06	68	195
23.06	60	125
28.06	70	180
29.06	67	185
29.06	69	199
29.06	75	240
29.06	50	160
29.06	72	209
29.06	70	225
04.07	52	200
04.07	60	200

Table A4.10b Razorbill: chicks weighed and measured twice.

Date i	Wing (mm)	Weight (g)	Date ii	Wing (mm)	Weight (g)
14.06	47	150	23.06	79	245
14.06	54	150	23.06	78	200
14.06	45	150	23.06	73	165
14.06	52	190	23.06	82	215
14.06	54	180	23.06	75	225
14.06	55	150	23.06	81	170
23.06	53	170	29.06	74	190
23.06	60	175	29.06	81	240
23.06	56	180	29.06	78	220
23.06	58	190	29.06	78	215
23.06	75	225	29.06	88	230
23.06	70	225	29.06	87	235
23.06	67	200	29.06	81	215
23.06	60	225	29.06	79	200
23.06	58	165	29.06	76	202
29.06	56	180	04.07	72	180

Table A4.11a. Black guillemot: chicks measured once.

Date	Wing (mm)	Weight (g)	Brood size
03.07	51	185	2
03.07	42	145	2
19.07	57	230	1
19.07	38	185	1
19.07	79	290	1
19.07	37	105	1
21.07	119	410	2
21.07	33	95	2
21.07	33	95	2
02.08	67	235	2
02.08	38	140	1

Table A4.11b. Black guillemot: chicks measured twice.

Date i	wing, weight	Date ii	wing, weight
21.07	86, 280	02.08	125, 435
21.07	79, 275	02.08	122, 450

Table A4.12a. Atlantic puffin: chicks weighed and measured once.

Date	Wing (mm)	Weight (g)
29.06	45	160
29.06	60	244
29.06	27	80
29.06	60	205
04.07	65	250
04.07	76	315
04.07	64	240
04.07	49	180
04.07	102	300
08.07	105	310
08.07	114	330
08.07	58	175

Date	Wing (mm)	Weight (g)
08.07	112	330
08.07	124	330
08.07	140	390
08.07	71	215
08.07	109	340
08.07	75	250
08.07	125	350
08.07	116	370
08.07	136	310
08.07	105	310
08.07	127	330
08.07	106	310

Table A4.12b. Atlantic puffin: chicks weighed and measured twice.

Date i	Wing (mm)	Weight (g)	Date ii	Wing (mm)	Weight (g)
14.06	55	190	04.07	125	340
14.06	79	295	04.07	136	290

APPENDIX 5: Weights and wing-lengths of adults in 2000.

Table A5.1. Northern fulmar

Date	Wing (mm)	Weight (g)
04.07	315	600
04.07	340	850
11.07	335	800
11.07	328	720
13.07	320	750
13.07	330	875
13.07	327	800
13.07	330	750
13.07	330	1040
13.07	335	1050
13.07	347	970
13.07	315	740
13.07	325	930
13.07	325	800
13.07	328	950
13.07	330	1150
13.07	340	900
13.07	330	1000
13.07	348	800
13.07	312	850
13.07	345	950
13.07	345	1000
15.07	340	900
15.07	335	850
15.07	325	660
15.07	325	700
15.07	312	720
15.07	327	780
15.07	338	850
15.07	338	960
15.07	338	1100
15.07	335	660
15.07	336	820
15.07	332	920
15.07	340	950

Table A5.2. Black-legged kittiwake.

Date	Wing (mm)	Weight (g)
07.07	310	380
07.07	320	370
07.07	310	400
07.07	310	390
07.07	314	390
07.07	301	315
07.07	300	360
07.07	303	360
07.07	300	305
07.07	310	340
07.07	310	365
07.07	300	350
07.07	310	360
07.07	325	445
07.07	305	360
07.07	310	390
07.07	310	330
07.07	300	350
12.07	304	325
12.07	310	350
12.07	300	340
12.07	310	380
12.07	299	310
12.07	295	310
12.07	303	390
12.07	300	330
12.07	302	330
12.07	310	300
12.07	307	330
12.07	300	325
12.07	301	325
12.07	297	375
12.07	300	360
12.07	313	380
12.07	302	370
12.07	303	390
12.07	301	330
15.07	317	390
15.07	310	390
15.07	305	340
15.07	310	385
15.07	299	350
15.07	304	310
15.07	301	350
15.07	304	400
15.07	300	340

Table A5.3. Common guillemot.

Date	Wing (mm)	Weight (g)	Date	Wing (mm)	Weight (g)
16.06	210	1000	04.07	204	850
16.06	192	965	04.07	197	900
16.06	201	1025	04.07	196	850
19.06	198	1100	04.07	200	950
19.06	208	1100	04.07	200	920
23.06	200	910	04.07	213	900
28.06	195	975	04.07	218	900
28.06	196	925	04.07	200	800
28.06	198	900	04.07	205	940
28.06	205	920	04.07	192	880
28.06	205	920	04.07	197	850
29.06	205	940	04.07	185	760
04.07	202	870	04.07	195	900
04.07	202	885	04.07	198	890
04.07	203	925	04.07	199	925
04.07	201	850	04.07	198	890
04.07	199	925	04.07	210	900
04.07	203	840	04.07	200	910
04.07	195	900	04.07	203	975
04.07	195	860	04.07	203	900
04.07	194	900	04.07	196	850
04.07	200	910	04.07	199	910
04.07	200	900	04.07	205	940

Table A5.4. Razorbill.

Date	Wing (mm)	Weight (g)	Date	Wing (mm)	Weight (g)
14.06	199	650	29.06	194	600
14.06	200	660	29.06	200	580
14.06	190	565	29.06	190	600
14.06	197	600	29.06	187	540
16.06	200	665	29.06	190	620
16.06	197	645	29.06	191	620
16.06	191	615	29.06	198	580
16.06	198	615	29.06	192	600
16.06	188	590	29.06	194	580
16.06	203	640	04.07	187	500
16.06	200	565	04.07	190	540
16.06	193	600	04.07	189	610
23.06	188	570	04.07	190	590
23.06	196	585	17.06	190	580
28.06	190	650	17.06	194	600
28.06	186	520	17.06	200	580
28.06	190	570	17.06	190	600
28.06	193	650	17.06	187	540
28.06	195	570	17.06	190	620
28.06	181	600	17.06	191	620
28.06	195	620	17.06	198	580
28.06	200	620	17.06	192	600

Table A5.5. Black guillemot

Date	Wing (mm)	Weight (g)
25.06	159	385
19.07	159	395
20.07	157	420

Table A5.6. Atlantic puffin.

Date	Wing (mm)	Weight (g)
24.05	165	450
29.05	163	445
29.05	160	385
02.06	164	370
03.06	156	380
11.06	158	410
11.06	171	420
11.06	160	415
16.06	165	450
21.06	154	385
22.06	167	390
23.06	160	460
25.06	163	420
03.07	170	400
03.07	164	390
03.07	170	410
09.07	154	420
09.07	162	375
09.07	159	440
09.07	164	420
09.07	154	345
09.07	163	410
09.07	161	360
09.07	152	370
09.07	155	390
09.07	157	380
09.07	163	380
09.07	166	400
09.07	156	360
09.07	158	400
09.07	158	390
09.07	160	390
09.07	159	440
09.07	161	390
09.07	160	430

Date	Wing (mm)	Weight (g)
09.07	150	380
09.07	152	420
09.07	153	340
09.07	153	390
09.07	155	395
09.07	160	440
09.07	155	325
09.07	155	420
09.07	158	420
09.07	161	355
09.07	152	420
09.07	164	475
09.07	155	400
09.07	160	450
09.07	156	410
09.07	148	345
09.07	145	360
09.07	164	400
09.07	158	350
09.07	157	380
09.07	162	450
09.07	160	430
09.07	157	400
09.07	155	380
09.07	160	380
09.07	155	420
09.07	159	460
09.07	160	380
09.07	154	450
09.07	153	400
09.07	158	360
09.07	156	360
14.07	160	435
22.07	160	420
22.07	159	370