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**Seabird numbers and breeding success  
in Britain and Ireland, 1997**

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## Summary

This report presents the results of monitoring of seabird populations and breeding success throughout Britain and Ireland in 1997 and makes comparisons with previous years. The report is produced annually as part of the JNCC's Seabird Monitoring Programme, in collaboration with the Royal Society for the Protection of Birds and the Shetland Oil Terminal Environmental Advisory Group.

The 1997 breeding season was dominated by the adverse effects of unusually wet and windy weather conditions across much of Britain. Colonies exposed to the easterly gales in late June were particularly severely affected. In Shetland, the effects of the weather were exacerbated by apparent shortages of 0-group sandeels in early July. Some results of particular note from 1997 are summarised below.

- In Shetland, with the exception of Fair Isle, average breeding success of Arctic skuas, great skuas, Arctic terns and kittiwakes was the lowest recorded since the sandeel shortages of the late 1980s and early 1990s.
- Numbers of breeding kittiwakes at Fair Isle, the largest colony in Shetland, have decreased by 36% since 1992. A total estimated decrease of 50% since 1981 in the Shetland kittiwake population is attributed to poor recruitment following sandeel shortages and to predation by great skuas (Heubeck *et al.* in press).
- Breeding success of shags, kittiwakes and guillemots was below average in 1997, particularly at east coast colonies. Average kittiwake breeding success at colonies in eastern England was the lowest recorded in twelve years, but still above the 1986-96 average for colonies bordering the southern Irish sea.
- Changes in numbers of breeding fulmars at monitored colonies from 1996 to 1997 were in line with longer term regional patterns of population stability or increase. However, average breeding success was the third lowest recorded in twelve years of monitoring and significantly lower than in 1996.
- High tides, in some instances exacerbated by gales, again washed out some tern and gull colonies, and poor weather increased chick mortality at many sites. Little terns were particularly badly affected and fledged few young, although breeding numbers increased. Foxes, mink and other predators also reduced tern breeding success at a number of colonies.
- The UK roseate tern population decreased further, to 50 pairs, and total numbers in the Irish Republic also fell slightly from 1996. However, productivity was generally moderate to good.
- Heavy rain led to flooding of burrows and reduced breeding success at most monitored puffin colonies.
- In Orkney, triennial monitoring of Mainland colonies found further increases in numbers of fulmars, guillemots and razorbills since 1994, in line with longer-term population trends. However, kittiwake numbers fell by 10% from 1994, with proportionately larger declines at the smallest colonies.
- In western Scotland, a mink control programme is proving effective in safeguarding breeding black-headed gulls, common gulls, common terns and Arctic terns at selected breeding sites.
- A census of the Manx shearwater colony on Canna (Lochaber), revealed fewer than 100 occupied burrows, compared with over 1000 in the mid 1970s. Breeding success at this colony was again very low.
- A census of lesser black-backed gulls in the Isles of Scilly found a total of just over 3040 pairs, some 20% lower than recorded in 1987. However, on Skomer there was evidence of a halt to the recent population decline, and breeding success was markedly higher than in any of the previous five years.
- A census of Britain's largest razorbill colony, on Handa, found 15,600 birds, little changed since 1987.
- A census of black guillemots at North Ronaldsay, Orkney, found 369 birds, similar to the 1984 total. In Shetland, numbers of black guillemots at monitoring sites affected by the *Braer* oil spill, have now almost recovered to pre-spill levels.

## 1 Introduction

This is the ninth annual report on the results of seabird monitoring at colonies throughout Britain and Ireland, produced jointly by JNCC, RSPB and SOTEAG, as part of JNCC's Seabird Monitoring Programme. Available data on seabird breeding numbers and breeding success at seabird colonies in 1997 are summarised and compared with results from previous years, primarily 1996.

The information contained in this report has been collated from many sources. These include: research staff and wardens from a variety of organisations including RSPB, SOTEAG, JNCC, Scottish Natural Heritage, English Nature, Countryside Council for Wales, Irish National Parks and Wildlife Service, The Wildlife Trusts, Bird Observatories, National Trust and National Trust for Scotland, the Institute of Terrestrial Ecology and BirdWatch Ireland. Many dedicated fieldwork volunteers also contribute valuable data to the Seabird Monitoring Programme. Please refer to the acknowledgements for details.

One aim of the annual report is to draw attention to notable changes in seabird numbers or breeding success which may merit direct conservation action or further research. It is also intended to provide feedback and, we hope, encouragement for future work, to the many individuals and organisations contributing data, by placing results for individual colonies or regions in a wider context. The results presented refer mainly to coastal or island populations of seabirds, but reference is also made to inland populations of cormorants, gulls and terns where data are available.

Any comments on this report, or offers of help for future seasons, would be greatly appreciated by the authors. We are also keen to receive any existing additional information on numbers or breeding success for any seabird species, whether at coastal or inland colonies, not previously submitted to the Seabird Monitoring Programme. Any such data will be added to the long-term seabird databases maintained by JNCC and RSPB, including the JNCC/Seabird Group's Seabird Colony Register.

Details of recommended methods for assessing seabird numbers and breeding success are given in the *Seabird monitoring handbook for Britain and Ireland* (Walsh *et al.* 1995). Copies of the *Handbook*, or other advice on seabird monitoring methodology, may be obtained from the Seabirds and Cetaceans Team of JNCC at the address given on the title page.

### 1.1 The Seabird Monitoring Programme and Seabird Colony Register

The JNCC's Seabird Monitoring Programme facilitates the co-ordination of seabird monitoring on a UK-wide basis. The aim of the programme is to ensure that sufficient data on breeding numbers and breeding performance of seabirds are collected both regionally and nationally to enable their conservation status to be assessed. The programme assists JNCC, RSPB and partner organisations, including the statutory country agencies, to monitor aspects of the health of the wider marine environment and to provide sound advice relevant to the conservation needs of breeding seabirds.

Seabird monitoring directly funded by JNCC focuses particularly on species such as fulmar, shag, kittiwake and auks, for which changes in breeding populations, breeding success or other parameters may provide evidence of changes in the marine environment as a whole. The most detailed monitoring is undertaken, through external contracts, at several geographically dispersed 'key sites': Isle of May (south-east Scotland), Fair Isle (Shetland), Canna (north-west Scotland) and Skomer (Wales). Long-term monitoring of numbers and breeding success is also undertaken on Orkney Mainland, on St Kilda (north-west Scotland) and in Grampian (north-east Scotland). Monitoring of breeding success of cliff-breeding species is also encouraged by JNCC at many other colonies, partly by contributing to fieldwork costs of volunteers via the Seabird Group.

The RSPB monitors the numbers and breeding success of a range of seabird species throughout the UK through their network of reserves. The monitoring of terns in Britain is also largely co-ordinated by RSPB. Further RSPB monitoring or survey effort is directed at petrels and skuas.

In Shetland, Aberdeen University, under contract to SOTEAG, carries out extensive population-monitoring of cliff-nesting species and black guillemots. This work is funded by the Sullom Voe Association Ltd., and forms part of a wider scheme of biological monitoring in Shetland. For fulmar, guillemot and razorbill, annual counts are carried out in sample plots, while for shag, kittiwake and black guillemot, counts are made of longer stretches of coastline at intervals of two or more years. Breeding success has also been assessed annually at many colonies since the mid-1980s.

Available data for Irish colonies are also collated by JNCC and RSPB, helping to place patterns or trends for British colonies in a wider context. Contacts are maintained with a number of bodies, including the National Parks and Wildlife Service and BirdWatch Ireland. Fieldwork at some Irish colonies is grant-aided by the Seabird Group.

The JNCC and Seabird Group also collaborate on the Seabird Colony Register, a database of colony counts for Britain and Ireland, which is maintained as part of the Seabird Monitoring Programme. Many observers and organisations (including SOTEAG and RSPB) contribute to the Register annually and data are also abstracted from sources such as research reports and county bird reports. Nearly all coastal colonies in Britain and Ireland were censused for the Register in 1985-87, providing a baseline for seabird populations. Population changes since the previous full survey (the Seabird Group's Operation Seafarer in 1969-70) are summarised in Table 1.1. A repeat census of British and Irish seabird colonies, Seabird 2000, will take place from 1998 to 2002.

## 1.2 Data presentation and methods

Some potential limitations of the information presented in this report are outlined below. Further discussion of methodological considerations and details of analyses are given in the *Seabird monitoring handbook* (Walsh *et al.* 1995) and in previous annual reports.

### 1.2.1 Population changes: use of regional samples

In order to allow concise and standardised presentation of population data, individual colonies are generally not considered in detail in this report. Details of the original counts used in assessing population changes are held by JNCC, RSPB and SOTEAG.

For most species, with the exception of some terns, it is neither practicable nor valid to assess year-to-year changes for the breeding population as a whole, because such changes are known to vary markedly between different parts of the British Isles and monitoring effort is uneven. Instead, the coastline has been subdivided into 14 'regions', as defined in Figure 1.1 and Table 1.2. Within each region, valid counts of whole colonies (excluding very small colonies and colonies where counting error is known or suspected to exceed 5%), or of sample plots within colonies, are summed for year-to-year population comparisons. The aim of this approach is to draw attention to any common patterns shown by a number of regions, as well as to highlight any notable changes shown by colonies in particular regions.

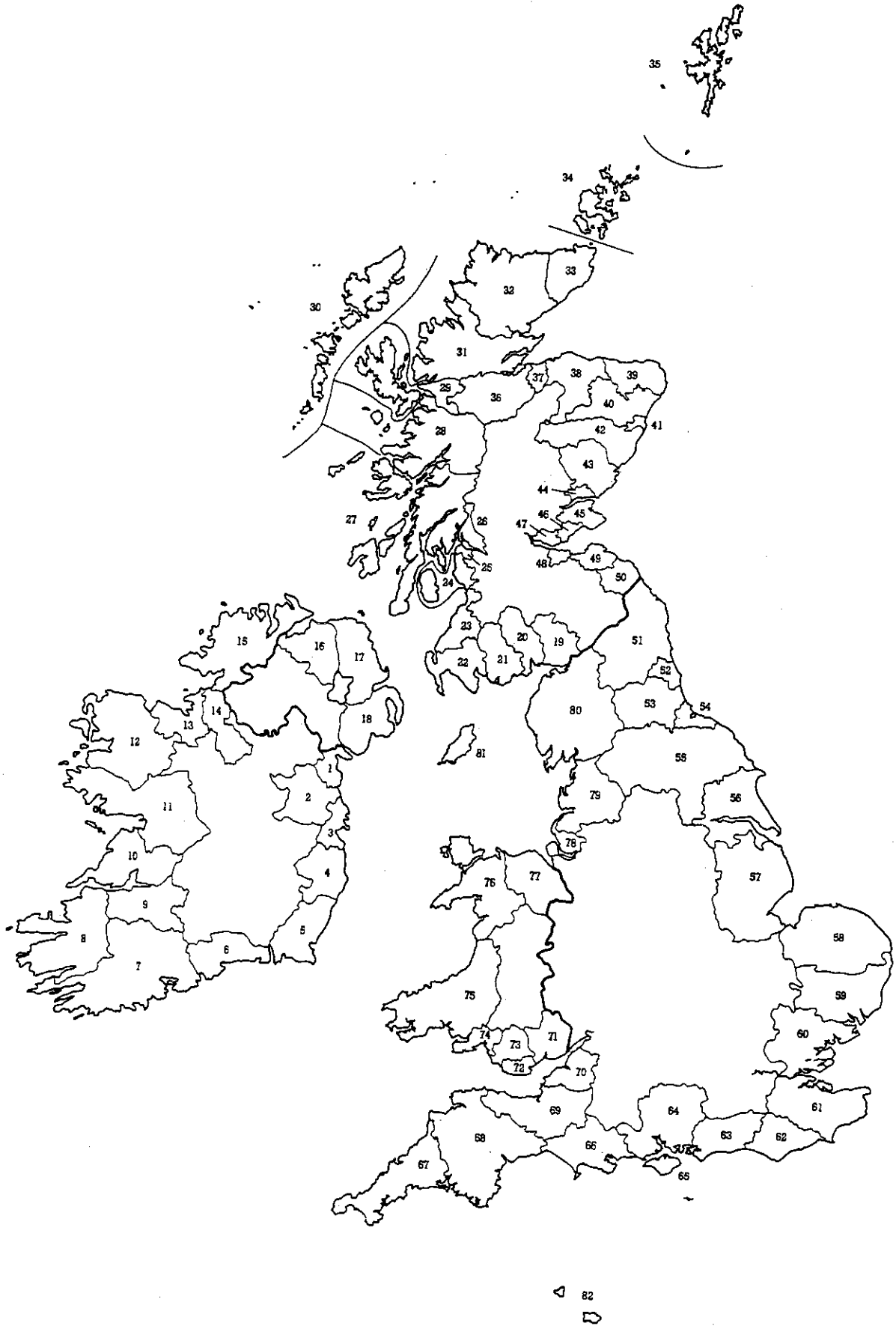
Regional population changes for most species are tabulated for 1996 and 1997. It should be noted that some of the changes indicated by these counts may be of a short-term nature, not necessarily consistent with longer-term trends, e.g. year-to-year changes in species such as kittiwake or shag may in some instances reflect fluctuations in the proportion of the adult population attempting to breed. Movements of breeding birds to or from unmonitored colonies, notably in the case of terns, cormorants, and black-headed gulls, may also contribute to apparent changes. Even where inter-colony movements do not occur, changes shown by sample populations are not necessarily representative of wider populations.

**Table 1.1** Counts or estimates of total breeding populations of seabirds in Britain and Ireland. Most figures are for 1985-87 (Lloyd, Tasker & Partridge 1991) but those for gannets, skuas, roseate terns and Arctic terns include more recent updates. Figures for Britain exclude the Isle of Man and the Channel Islands (included under Britain & Ireland). For population estimates for Great Britain (excluding the Isle of Man) and UK (GB plus Northern Ireland) see Stone *et al.* (1997). Units are 'pairs' for most species (apparently occupied nests/sites or, for skuas, territories), with the exception of auks for which units are individual birds.

	Coastal population		% change <sup>2</sup> 1969-87 B & I coast	Total population <sup>3</sup>	
	Britain	Britain & Ireland <sup>1</sup>		Britain	Britain & Ireland <sup>1</sup>
Fulmar	537,000	571,000	+85%	537,000	571,000
Manx shearwater <sup>4</sup>	c. 235,000	c. 275,000	?	c. 235,000	c. 275,000
Storm petrel	41+ colonies	72+ colonies	?	41+ cols.	72+ cols.
Leach's petrel	6+ colonies	7+ colonies	?	6+ cols.	7+ cols.
Gannet <sup>5</sup>	196,500	232,500	+36%	196,300	232,500
Cormorant	6,000	10,400	+30%	6,800	11,700
Shag	36,400	47,300	+40%	36,400	47,300
Arctic skua <sup>6</sup>	3,100	3,100	≤ +220%	3,100	3,100
Great skua <sup>6</sup>	8,800	8,800	≤ +150%	8,800	8,800
Black-headed gull	77,300	84,200	+13%	167,000	233,000
Common gull	14,800	15,700	+21%	67,800	71,400
Lesser black-backed gull	62,300	65,700	+31%	82,300	88,700
Herring gull	135,000	191,000	-43%	150,000	206,000
Great black-backed gull	18,300	23,300	+3%	18,400	23,400
Kittiwake	492,000	544,000	+22%	492,000	544,000
Sandwich tern	14,000	18,400	+53%	14,000	18,600
Roseate tern <sup>7</sup>	41+	701+	-80%	41+	701+
Common tern	11,800	14,700	-1%	12,700	16,000
Arctic tern <sup>8</sup>	42,400	44,900	-14%	42,900	45,500
Little tern	2,400	2,800	+40%	2,400	2,800
Guillemot	1,047,000i	1,203,000i	+118%	1,047,000i	1,203,000i
Razorbill	147,000i	182,000i	probably +	147,000i	182,000i
Black guillemot	37,500i	40,500i	probably +	37,500i	40,500i
Puffin	898,000i	940,000i	slightly +?	898,000i	940,000i

## Notes:

- Irish figures include some estimates (mainly for fulmar, shag and gulls) for coastal sections which had not been surveyed by 1988.
- Net change based on comparison with total recorded during the 1969-70 'Operation Seafarer' survey (reanalysis of counts summarised by Cramp, Bourne & Saunders (1974)); differences in count methods prevent direct comparison for some species.
- British & Irish totals for some species include estimates of inland populations.
- Manx shearwater figures are very approximate (midpoints of population estimates).
- Gannet figures are from a complete survey of North Atlantic colonies carried out in 1994 and 1995 (Murray & Wanless 1997) with updates for colonies also counted in 1997.
- Skua figures are from the 1992 survey of Orkney & Shetland, with a 1996 update for Hoy, otherwise 1985-87 with updates to 1996 for Handa and St. Kilda. Although some nest inland in mainland Scotland, all are treated as coastal here.
- Roseate tern figures are from 1997 (this report), allowing for small numbers at uncounted colonies. Note that the figure published in the 1996 report (Thompson, Brindley & Heubeck 1997) for Britain was in error as it included Northern Ireland. The correct total for Britain in 1996 was 52+, not 65+ as published.
- Arctic tern figures include Shetland and Orkney counts from the 1989 RSPB survey (Avery *et al.* 1993), with counts of individuals divided by 1.5 to give an estimate of pairs.
- Puffin figures are very approximate, and include a high proportion of counts of pairs multiplied by two to give estimates of numbers of individuals.



**Figure 1.1** Coastal counties and districts of Britain and Ireland. See table 1.2 for details of the coastal regions (combinations of counties or districts) used in this report. Reproduced, with permission, from Lloyd, Tasker & Partridge (1991).



**Table 1.2** Groupings of coastal counties and districts used in assessing regional population changes. These regions are based on Figure 2 of Lloyd, Tasker & Partridge (1991), except that Shetland and Orkney are each treated separately from 'NE Scotland' and the Inverness-to-Caithness coastline is treated separately ('N Scotland') from 'NW Scotland'.

County or district name (numbers refer to figure 1.1)	Region
Louth (1), Meath (2), Dublin (3), Wicklow (4), Wexford (5), Waterford (6)	SE Ireland
Cork (7), Kerry (8), Limerick (9), Clare (10)	SW Ireland
Galway (11), Mayo (12), Sligo (13), Leitrim (14), Donegal (15)	NW Ireland
Londonderry (16), Antrim (17), Down (18)	NE Ireland
Annandale & Eskdale (19), Nithsdale (20), Stewartry (21), Wigtown (22), Kyle & Carrick (23), Cunninghame (24), Inverclyde (25), Dunbarton (26), Argyll & Bute (27)	SW Scotland
Lochaber (28), Skye & Lochalsh (29), Western Isles (30), west coast of Ross & Cromarty (31), north-west coast of Sutherland (32)	NW Scotland
Orkney (34)	Orkney
Shetland (35)	Shetland
Caithness (33), east coast of Sutherland (32), east coast of Ross & Cromarty (31), Inverness (32)	N Scotland
Nairn (37), Moray (38), Banff & Buchan (39), Gordon (40), City of Aberdeen (41), Kincardine & Deeside (42)	NE Scotland
Angus (43), City of Dundee (44), north-east Fife (45), Kirkcaldy (46), Dunfermline (47), West Lothian, City of Edinburgh (48), East Lothian (49), Berwickshire (50)	SE Scotland
Northumberland (51), Tyne & Wear (52), Durham (53), Cleveland (54), North Yorkshire (55), Humberside (56), Lincolnshire (57)	NE England
Norfolk (58), Suffolk (59), Essex (60)	E England
Kent (61), East Sussex (62), West Sussex (63), Hampshire (64), Isle of Wight (65)	SE England
Dorset (66), Cornwall & Isles of Scilly (67), Devon (68), Somerset (69), Avon (70), Gloucestershire, Channel Islands (82)	SW England and Channel Islands
Gwent (71), South Glamorgan (72), Mid Glamorgan (73), West Glamorgan (74), Dyfed (75), Gwynedd (76), Clwyd (77)	Wales
Merseyside (78), Lancashire (79), Cumbria (80), Isle of Man (81)	NW England and Isle of Man

### *1.2.2 Calculation of population trends*

Regional population trends are assessed using population indices, rather than sums of actual colony counts, because different combinations of colonies may be counted in different years. The population index in a baseline year (1986 unless otherwise noted), is set at 100, subsequent population changes being expressed relative to this value. Further details of the derivation of these population indices are given in Walsh, Avery & Heubeck (1990) and in Thompson, Brindley & Heubeck (1997).

Average annual rates of population change are calculated by linear regression of the logarithms of index values on year. The significance of the slope of the regression, equivalent to the average annual rate of increase or decrease in the population, is then assessed using the t-test (Wilkinson 1990). Population trends are not presented in this report for some mobile species, such as gulls, Arctic terns and common terns, for which the numbers of colonies and/or breeding pairs monitored each year are considered too small to enable wider population trends to be confidently assessed.

### *1.2.3 Accuracy and representativeness of counts*

In comprehensive assessments of long-term changes in seabird numbers e.g. between 1969-70 and 1985-87 (Lloyd, Tasker & Partridge 1991), there is inevitably some loss of count accuracy at the expense of obtaining complete geographical coverage. However, stricter criteria, covering factors such as census unit, timing, frequency and apparent accuracy of counts, need to be applied when selecting counts for assessment of short-term changes, as in this report. For most species, single, well-timed counts of apparently occupied nests are sufficient. However, the possibility of undetected variations in count accuracy, count coverage or timing of breeding season should be borne in mind.

For fulmar, guillemot and razorbill, numbers of adults attending colonies can fluctuate markedly from day to day. Given this source of variation, assessment of population change for these species ideally requires five to ten counts of adults (auks) or apparently occupied nest-sites (fulmars) in June each year. The statistical significance of changes shown by such counts can be assessed using t-tests. Where such replication of counts is necessary, it is rarely possible to count the whole of a large colony. Therefore, counts are normally of sample plots within a colony, but these plots, even where randomly selected, will not necessarily be representative of the colony as a whole.

The seabird colonies regularly monitored may not be representative of British or Irish populations as a whole. Representativeness is more likely to be achieved within particular regions, but cannot be assumed, especially if few colonies or small population samples are monitored. In particular, if efforts are concentrated on individual colonies, the formation of new colonies elsewhere may be missed. Coverage of extensive stretches of coastline is a more satisfactory approach for species not requiring replicate counts. This approach is used, for example, in SOTEAG's monitoring of shags, kittiwakes and black guillemots in Shetland.

### *1.2.4 Breeding success: use of 'low-input' methods*

For general monitoring purposes, the number of chicks fledged per breeding pair is the most useful parameter for gauging breeding success. Productivity of species other than terns is usually assessed for sample plots, ideally randomly selected, within colonies. For such species, the figures presented here have generally been averaged (rather than combined) across plots. For terns, whole-colony assessments of productivity are usually made. Full details of breeding success monitoring methods are given in Walsh *et al.* (1995). For some species or regions where few colonies are currently monitored, the results presented may not be fully representative. Also, in many cases, 'low-input' methods of assessing breeding success are used and these will tend to overestimate the productivity of breeding pairs slightly (Walsh *et al.* 1995). However, this is considered acceptable, as major geographical or year-to-year changes will still be obvious.

### 1.3 General features of the 1997 breeding season

The 1997 breeding season was dominated by abnormal spring and summer weather conditions. Temperatures in April and May were close to, or slightly above average, although eastern Scotland had an exceptionally wet May, with rainfall amounts almost double the monthly average (Eden 1997a & b). In most regions there was no evidence of a delayed seabird breeding season, as was seen following the cold spring of 1996 (Thompson, Brindley & Heubeck 1997). Indeed, on the Isle of May in south-east Scotland, shags and auks bred early (Harris 1997), as did auks and gulls on Canna in north-west Scotland (Swann 1997). The exception to the normal or early breeding season was Shetland, where red-throated divers, skuas, Arctic terns and, at some colonies also shags, were reported as having an exceptionally late breeding season (Furness 1997b, Farrell & Fisher 1997, Croft & Suddaby 1997, Okill 1997b). At Sumburgh Head (Shetland) and at North Sutor (Easter Ross), high tides in combination with gales at the end of May resulted in losses of eggs from low guillemot ledges and few chicks fledged from the replacement eggs laid subsequently (Heubeck 1998, R. Swann *in litt.*).

In June, the wettest conditions were recorded in England and Wales, where rainfall was the highest recorded in over a century, and double the long-term average. The June depressions also brought some unusually cold weather and gales, with the east coast of Britain being particularly severely affected by easterly gales and heavy rain towards the end of the month. However, northern and western areas of Scotland, together with Northern Ireland, had an unusually dry June (Eden 1997c). The wet and windy June weather over most of Britain was responsible for abnormally high chick mortality in many species and colonies (see species accounts).

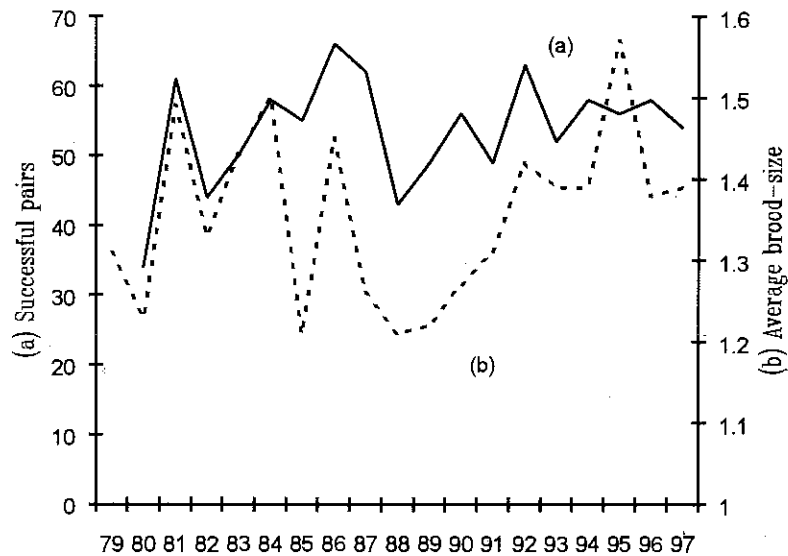
July began with severe downpours in Scotland and northern England, and monthly rainfall totals were above average in northern Scotland and Northern Ireland. Elsewhere, although overall monthly rainfall was below average, there was considerable local variability arising from heavy thundery downpours (Eden 1997d). In Shetland, a marked improvement in the weather from that experienced earlier in the season was noted after early July (Lewis 1997, Okill 1997b, Farrell & Fisher 1997).

The limited data available, suggest that in most areas feeding conditions were good throughout the breeding season. For example, at the Isle of May, sandeels predominated in shag, kittiwake, and auk food samples, with no evidence of any shortages (Harris 1997). On Canna, kittiwakes and shags also fed on sandeels, which appeared unusually abundant in 1997, although, as in previous years, guillemots fed mainly on sprats (Swann 1997). However, in Shetland, although 0-group sandeels appeared readily available early in the season (e.g. Martin 1998), there was evidence of temporary shortages in early July. During this period, puffins at Fair Isle and great skuas at Foula showed evidence of diet switching from sandeels to other fish (Riddington *et al.* 1997, Furness 1997b), and increased mortality of small kittiwake chicks was observed at many colonies (Heubeck 1998, Farrell & Fisher 1997).

## 2.1 Red-throated diver *Gavia stellata*

*Breeding numbers and breeding success* (Figure 2.1.1, Table 2.1.1)

Despite a very late breeding season in Shetland, the Shetland Ringing Group reported an average season for this species in terms of breeding numbers and success. In four annually monitored study areas, there were 54 pairs with chicks in mid-July, close to the mean for the period 1980 to 1996 (53.8, s.e.  $\pm 2.00$ ). The mean brood size of 1.39 was also close to the average of 1.35 (s.e.  $\pm 0.03$ ) for the period 1979-1996.



**Figure 2.1.1** Annual variation in (a) numbers of 'successful' pairs (with chicks in mid-July) and (b) average brood-size near fledging at red-throated diver study areas in Shetland (parts of Unst, Eshaness, North Roe and Bressay), 1979-97. Data are from Okill (1997a).

At Hermaness NNR, eight breeding pairs reared an average of just 0.75 chicks per pair, well below the 1986-1996 average of 1.07 (s.e.  $\pm 0.12$ ), and the lowest figure recorded since 1990, although still relatively high for Shetland. In contrast to this result, breeding success at the RSPB study sites on Yell (Lumbister and South Yell quadrat) was substantially higher than average, with 26 chicks fledged by 27 breeding pairs. On Fetlar, 21 pairs reared an average of 0.43 chicks per pair, similar to the 1986-96 average of 0.47 (s.e.  $\pm 0.06$ ), but well below the levels recorded in both 1995 and 1996. On Foula, several chicks were taken by great skuas, and only four or five were fledged by the thirteen breeding pairs.

At fifteen occupied sites monitored on Mainland Orkney, breeding success increased substantially to an average of 0.73 chicks per breeding pair, compared with an average for 1989 to 1996 of 0.45 (s.e.  $\pm 0.08$ ). However on Hoy, average breeding success was only moderate, at 0.45 chicks fledged per pair, compared with an eight-year mean of 0.54 (s.e.  $\pm 0.03$ ). Again, there was complete breeding failure on Rousay.

In north-west Scotland, nine pairs on Rum reared a total of five chicks, close to the 1980-1996 average of 0.57 (s.e.  $\pm 0.06$ ) per pair. However, the three pairs on neighbouring Eigg had a very poor season, rearing just one young, apparently because of predation of eggs, a chick and an adult by an otter (*Lutra lutra*). On Handa (Sutherland) four pairs bred and raised a total of three to four chicks.

**Table 2.1.1** Red-throated diver breeding success, 1986-96, 1996 and 1997: figures are estimated number of chicks fledged per breeding pair or occupied site (Orkney). Note that numbers of pairs do not necessarily indicate total populations in study areas.

	1986-96 mean		1996		1997	
	No. years	Fldg/pr ( $\pm$ s.e.)	Pairs	Fldg/pr	Pairs	Fldg/pr
Hermaness	11	1.07 ( $\pm$ 0.12)	8	0.88	8	0.75
Fetlar	11	0.47 ( $\pm$ 0.06)	19	0.68	21	0.43
Yell	9	0.59 ( $\pm$ 0.11)	23	0.43	27	0.96
Foula	11	0.52 ( $\pm$ 0.09)	13	0.38-0.46	13	0.31-0.38
Shetland sample total	9	0.60 ( $\pm$ 0.06)	63	0.56-0.57	69	0.67
Hoy	8	0.54 ( $\pm$ 0.03)	66	0.47	64	0.45
Rousay	7	0.18 ( $\pm$ 0.05)	-	-	7	0.00
Mainland	8	0.45 ( $\pm$ 0.08)	14	0.21	15	0.73
Orkney sample total	8	0.48 ( $\pm$ 0.03)	80	0.43	86	0.47
Handa	11	1.19 ( $\pm$ 0.11)	3	1.33	4	0.75-1.00
Eigg	11	1.14 ( $\pm$ 0.15)	3	0.67	3	0.33
Rum	11	0.63 ( $\pm$ 0.08)	11	0.55	9	0.56

## 2.2 Fulmar *Fulmarus glacialis*

### *Breeding numbers* (Table 2.2.1, Figure 2.2.1)

There were no major changes in numbers of breeding fulmars at monitored colonies from 1996 to 1997. The 10% decline in south-west Scotland was within the range of previous fluctuations at the colonies monitored in this region since 1993, while the similar decline in north-west Scotland was entirely attributable to local predation on Canna.

In Shetland, none of the changes in monitoring plots at individual sites was significant and there was correspondingly little overall change in this region. On Orkney Mainland, fulmar numbers continued to increase, although the only statistically significant change in average numbers of birds at the five colonies monitored triennially was a 20% increase at Costa Head.

The further increases recorded in south-east Scotland and north-east England were in line with longer-term population trends in these regions. Further north, at Sands of Forvie NNR in Grampian, breeding numbers increased to 350 apparently occupied sites (AOS) in 1997 from 238 AOS in 1994.

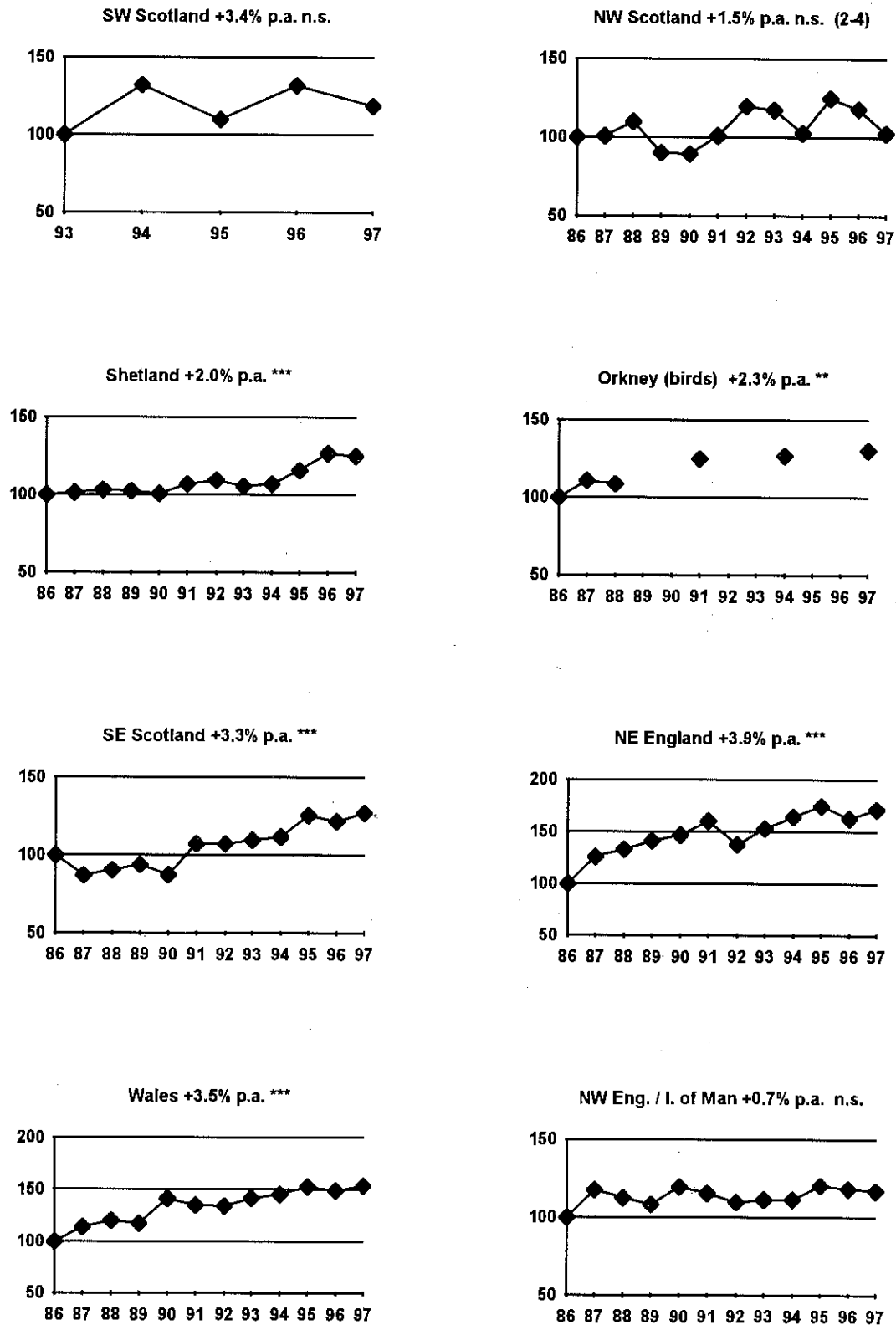
In Wales, a sample of 69 colonies was monitored in both 1996 and 1997 as part of the *Sea Empress* oil spill environmental impact evaluation programme. Overall numbers at these colonies increased by 10% from 1996, in line with the longer term regional trend.

Few fulmar colonies in Ireland are counted regularly, but numbers in sample plots on Rathlin Island (Antrim) showed little change from 1996. In south-east Ireland, numbers on Little Saltee increased to 292 AOS from 259 in 1993 and 233 in 1988, while in the west, an early July count on Great Skellig found 863 AOS, the highest total in the past four years.

**Table 2.2.1** Population changes at monitored fulmar colonies, 1996-97 (apparently occupied sites in late May or June). Counts with a reported inaccuracy of  $> \pm 5\%$ , and regional samples  $< 100$  AOS, are excluded. Except where otherwise indicated, regional totals are derived from single complete counts of the colonies listed below.

	SW Scotland	NW Scotland	Shetland	SE Scotland	NE England	Wales	NW England / Isle of Man
1996	1417	1188	2714	2253	319	2529	1427
1997	1276	1057	2674	2353	337	2791	1419
1996-97 % change	-10.0 <sup>a</sup>	-11.0 <sup>b</sup>	-1.5 <sup>c</sup>	+4.4 <sup>d</sup>	+5.6 <sup>e</sup>	+10.4 <sup>f</sup>	-0.6 <sup>g</sup>

Colonies: <sup>a</sup> Mull of Galloway, Lunga (Treshnish islands), Colonsay (sample areas); <sup>b</sup> Canna, Rum (SE coast), Handa (plot counts); <sup>c</sup> Hermaness (productivity plot), Eshaness (plot counts), Burravoe (plot counts), Troswick Ness (plot counts), Sumburgh Head (plot counts), Fair Isle (productivity plots); <sup>d</sup> Isle of May, Fidra, Lamb, St. Abb's Head, Inchkeith, Inchgarvie, Inchmickery, Inchcolm, Craigleith, Bass Rock; <sup>e</sup> Farne Islands, Coquet Island; <sup>f</sup> 69 colonies in SW Wales; <sup>g</sup> Calf of Man, Traie Vane - Gob yn Ushtey, Cass Strooan - Peel Headlands, Peel Hill, Glen Maye, Stroin Vuigh - Eairmyerey, Eairmyerey - Fleshwick, Contrary Head - Traie Cronkan, Marine Drive Douglas, Lynague - Will's Strand, Bradda, Glen Mooar - Gob y Deigan, St. Bee's Head.



**Figure 2.2.1** Regional population indices for breeding fulmars, 1986-1997 (apparently occupied sites in June except for Orkney, where counts are of individual birds). Average annual rates of change for the period 1986-97 were calculated by regression of natural log of index against year (see section 1.2.2. for details). Unless otherwise indicated, three or more colonies were counted in each year. Statistical significance of trends (t-test) indicated as: n.s. not significant, \*  $P < 0.05$ ; \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ .

*Breeding success* (Table 2.2.2)

In 1997, breeding success averaged 0.39 (s.e.  $\pm 0.02$ ) chicks fledged per site at 36 colonies. This was the third lowest mean recorded in the past twelve years although not significantly different from the 1986-96 average (0.43, s.e.  $\pm 0.01$ ). Breeding success declined at 25 of 35 colonies where it was measured by comparable methods in both years, and the average change across all 35 colonies was a very highly significant decrease of 0.09 chicks fledged per AOS.

In some instances, for example at Gultak on Orkney where feral cats (*Felis domesticus*) were active, poor breeding performance was attributed to predators. However, the scale of the general reduction in breeding success suggests that a more general factor, presumably the poor weather experienced in many areas (see section 1.3), adversely affected fulmars in 1997. In this context, it is interesting to note that the only region where breeding success increased from 1996 to 1997 was north-west Scotland, where weather conditions were generally good. However, despite this increase, fulmar breeding success in this region was again amongst the lowest regional averages recorded. At one unmonitored colony in this region, Eigg, chicks were noted as suffering severe heat stress in early July (J. Chester *in litt.*)

In Wales, the reduced breeding success at both Skokholm (0.45 chicks per AOS) and Skomer (0.60 chicks per AOS) in 1997 reflects a return to more typical productivity levels following an exceptionally productive season in 1996, rather than an unusually poor breeding season in 1997.

**Table 2.2.2** Fulmar breeding success, 1996-97: estimated number of chicks fledged per apparently occupied site (AOS) at sample colonies (n = number of colonies). Figures are based on regularly occupied sites or on the average numbers of occupied sites in June, and are presented as the means and standard errors of figures for individual colonies. Changes in breeding success are indicated for colonies where similar methods have been used in both years (significant changes, assessed by t-tests, are indicated as \*P < 0.05, \*\*P < 0.01, \*\*\* P < 0.001).

Region	1996 chicks fledged/site				1997 chicks fledged/site				1996-97 change	
	AOS <sup>n</sup>	range	mean	$\pm$ s.e.	AOS <sup>n</sup>	range	mean	$\pm$ s.e.	mean <sup>n</sup>	$\pm$ s.e.
SW Scotland <sup>a</sup>	19 <sup>1</sup>		0.79		12 <sup>1</sup>		0.67		-0.12 <sup>1</sup>	
NW Scotland <sup>b</sup>	324 <sup>3</sup>	0.29-0.39	0.36	$\pm 0.04$	561 <sup>3</sup>	0.33-0.45	0.39	$\pm 0.04$	+0.03 <sup>3</sup>	$\pm 0.02$
Shetland <sup>c</sup>	>3449 <sup>8</sup>	0.36-0.71	0.48	$\pm 0.04$	3337 <sup>8</sup>	0.31-0.67	0.45	$\pm 0.04$	-0.04 <sup>8</sup>	$\pm 0.02^*$
Orkney <sup>d</sup>	1158 <sup>8</sup>	0.10-0.77	0.48	$\pm 0.07$	951 <sup>7</sup>	0.16-0.54	0.36	$\pm 0.06$	-0.10 <sup>7</sup>	$\pm 0.06$
N Scotland <sup>e</sup>	289 <sup>4</sup>	0.15-0.90	0.53	$\pm 0.15$	302 <sup>4</sup>	0.13-0.39	0.30	$\pm 0.06$	-0.23 <sup>4</sup>	$\pm 0.12$
SE Scotland <sup>f</sup>	393 <sup>4</sup>	0.31-0.53	0.43	$\pm 0.05$	334 <sup>3</sup>	0.13-0.49	0.33	$\pm 0.11$	-0.07 <sup>3</sup>	$\pm 0.06$
NE England <sup>g</sup>	261 <sup>2</sup>	0.58-0.65	0.62	$\pm 0.04$	234 <sup>1</sup>		0.49		-0.09 <sup>1</sup>	
SW England <sup>h</sup>	49 <sup>2</sup>	0.32-0.54	0.43	$\pm 0.11$	22 <sup>1</sup>		0.54		0.00 <sup>1</sup>	
Wales <sup>i</sup>	274 <sup>3</sup>	0.18-0.73	0.51	$\pm 0.17$	285 <sup>2</sup>	0.45-0.60	0.53	$\pm 0.08$	-0.13 <sup>2</sup>	$\pm 0.06$
Isle of Man <sup>j</sup>	495 <sup>6</sup>	0.36-0.60	0.44	$\pm 0.04$	739 <sup>6</sup>	0.21-0.48	0.33	$\pm 0.04$	-0.09 <sup>5</sup>	$\pm 0.06$
Total	>6711 <sup>41</sup>	0.10-0.90	0.48	$\pm 0.03$	6777 <sup>36</sup>	0.13-0.67	0.39	$\pm 0.02$	-0.09 <sup>35</sup>	$\pm 0.02^{***}$

Colonies: <sup>a</sup> Ailsa Craig; <sup>b</sup> Canna, Handa, St Kilda; <sup>c</sup> Hermaness, Eshaness, Noss, Westerwick, Troswick Ness, Sumburgh Head, Fair Isle, Fetlar; <sup>d</sup> Papa Westray, Costa Head, Mull Head, Gultak, Hoy, Rousay, North Ronaldsay; <sup>e</sup> Easter Ross, St. John's Head, Sandside Head, Wilkhaven; <sup>f</sup> Isle of May, Fidra (1996 only), Tantallon, St. Abb's Head; <sup>g</sup> Farne Islands, Coquet Island (1996 only); <sup>h</sup> West Bay-Burton Bradstock, Annet (1996 only); <sup>i</sup> Skomer, Skokholm, Bardsey (1996 only); <sup>j</sup> Traie Vane-Gob yn Ushtey, Will's Strand-Gob y Deigan (1997 only), Peel Hill, Glen Maye, Bradda, Douglas, Cass Strooan-Peel headlands (1996 only).



### 2.3 Manx shearwater *Puffinus puffinus*

In 1997, a systematic census of the Manx shearwater colony on Canna (Lochaber), using the tape playback methods recommended by Walsh *et al.* (1995) to assess burrow occupancy, suggested that only 65 out of a total of 952 potential shearwater burrows were occupied. This confirms that there has been a major decline in this colony since the mid-1970s, when a census indicated a total of 1,000 - 1,500 breeding pairs (Swann & Ramsey 1976). Such a decline had previously been indicated by falling occupancy rates in study burrows noted since the mid-1980s (Swann 1997). Brown rats (*Rattus norvegicus*) are known predators of Manx shearwaters on Canna, and feral cats (*Felis domesticus*) may also take birds. However, it is unknown whether the decline of this colony, which is much smaller than that on the neighbouring island of Rum, is solely attributable to predators. Breeding success on Canna was again very low, with just one chick fledging from thirteen burrows in which eggs were laid. On nearby Rum, where the breeding season was noted as being very early, 63% of 145 study burrows were occupied by breeding pairs. In these burrows, an average of 0.88 chicks per egg laid fledged, the highest figure recorded since monitoring of this colony resumed in 1994.

On the Isle of May, in the Firth of Forth, Manx shearwaters were heard calling from burrows on a number of nights in late July and early August (D. Hemsley *in litt.*). It is intended to use tape playback methods in 1998 to check for the presence of birds in burrows during the day. There has been only one proven breeding record for the Manx shearwater along the east coast of mainland Britain, at Marsden Rock (Durham) in 1939 (Brooke 1990).

In Wales, many chicks on Skokholm drowned or were eaten by predators when their burrows flooded in exceptionally heavy rain. However, average breeding success in a sample of 82 occupied burrows on Skomer was 0.64, higher than the 1991-1996 average of 0.49 (s.e.  $\pm 0.08$ ). Breeding success was also good on Bardsey, where an average of 0.80 chicks per burrow fledged from 50 burrows. In Northern Ireland, 680 fledglings were ringed on Lighthouse Island in the Copeland Group, the second highest total yet recorded and suggestive of a breeding population in excess of 1000 pairs.

## 2.4 Storm Petrel *Hydrobates pelagicus*

### *Breeding Numbers*

Very little new information was reported for storm petrels in 1997. At Bearasaidh, Loch Roag (Western Isles), 91 birds were caught over two nights in July, but there was no evidence of breeding. On Sanda (Argyll) an occupied burrow, with a newly hatched chick on 29 July, was found away from the main colony area around the lighthouse. Night visits to the main Sanda colony in recent years, together with retrap data, suggest that this colony is of the order of 150 pairs.

A project to develop storm petrel census techniques further, and to investigate variation in timing of breeding, continued at the Isles of Scilly in 1997. It is hoped to expand this study to include other breeding areas in 1998.

On Mousa, Shetland, checks of established nest sites on 9 September found that the breeding season was later than usual, with most chicks well over two weeks from fledging (Okill 1997b).

## 2.5 Leach's Petrel *Oceanodroma leucorhoa*

### *Breeding numbers*

Only six to seven islands or island groups are currently known to be occupied in Britain and Ireland, although mist-netting studies have indicated that there could be others.

At the annually monitored colony at Ramna Stacks on Gruney in Shetland, twelve occupied burrows were found. However, because of a combination of late visit dates and equipment failure, additional occupied burrows may have been missed. Elsewhere, nineteen birds were caught, using tape lures, over two nights in July at Bearasaidh, Loch Roag (Western Isles). However, none of the birds caught had full brood patches and burrows on the island showed no evidence of having been occupied that year. One to three birds were observed on Great Skellig in south-west Ireland in early July.

## 2.6 Gannet *Morus bassanus*

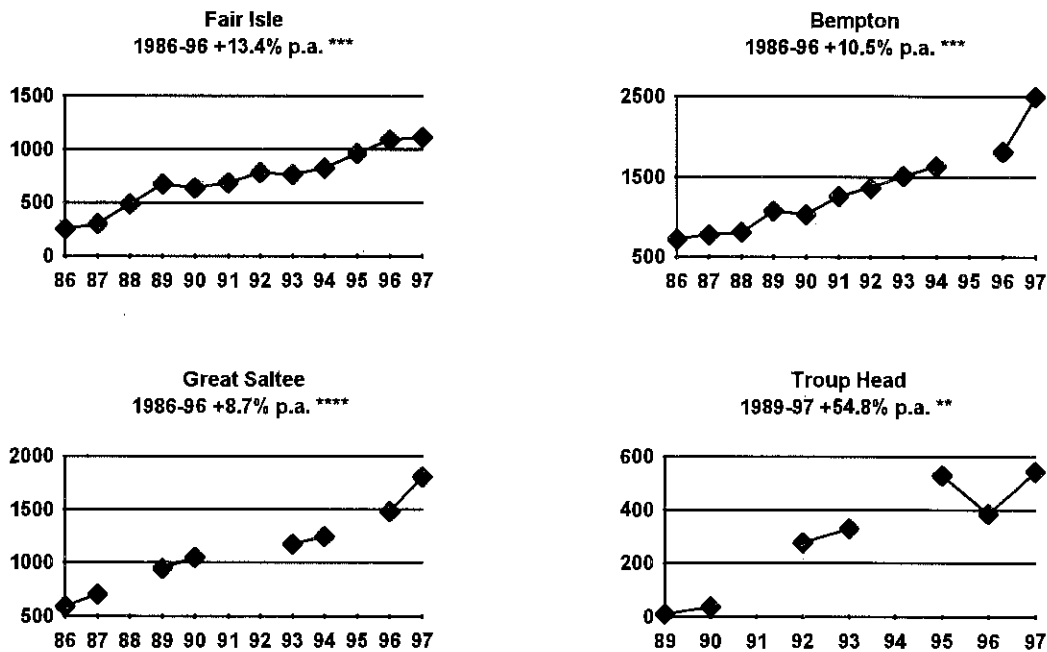
### Breeding numbers (Table 2.6.1, Figure 2.6.1)

The numbers of gannets breeding at the three established colonies routinely monitored each year continued to increase in 1997, in line with recent trends. However, while the rate of increase at Fair Isle appears to be slowing, both Bempton and Great Saltee showed larger increases in numbers between 1996 and 1997 than in recent years.

At the Troup Head colony in Grampian, a minimum of 347 out of a total of 545 well-built nests contained chicks or brooding/incubating adults in late July. This represents a further expansion of this recently established colony (Wanless, Matthews & Bourne 1996), and the presence of large numbers of non-breeders suggests that numbers will continue to increase rapidly in coming years. The small colony on Ireland's Eye, County Dublin, which formed in 1989, also showed a further increase in numbers of nests, from 106 in 1996 to between 111 and 115 in 1997.

**Table 2.6.1** Population changes at individual gannet colonies 1996-97 (peak or single counts of apparently occupied nests in June-July).

	Fair Isle (Shetland)	Bempton (NE England)	Great Saltee (SE Ireland)
1996	1090	1820+	1480
1997	1116	2501	1805
% change 1996-97	+2.4	+ ≤ 37.4	+22.0



**Figure 2.6.1** Gannet colony population trends, 1986-97. Figures are counts of apparently occupied nests. Trends for the periods indicated are average annual rates of change. Significance of trends indicated as: \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Further details of calculation of trends are given in section 1.2.2.

*Breeding success* (Table 2.6.2)

Unlike some smaller species, there was no evidence that gannets were adversely affected by the unusual summer weather conditions in 1997. Indeed, the greatest increase in productivity from 1996 and the highest figure for any colony, 0.80 chicks fledged per occupied nest, was recorded at the east coast colony of Bempton, where the breeding success of kittiwakes and guillemots was significantly reduced in the wake of the summer gales. Mean breeding success across the five colonies monitored in detail was 0.71 (s.e.  $\pm$  0.01) chicks fledged per occupied nest, not significantly different from the 1986-1996 average of 0.69 (s.e.  $\pm$  0.01). On Grassholm, average hatching success was 83%, compared with 71% in 1996 and 57 - 67% between 1993 and 1995 (SEEEC 1998).

**Table 2.6.2** Gannet breeding success, 1986-96, 1996 and 1997: estimated number of chicks fledged per occupied nest. In 1996 and 1997, productivity is shown as the mean and standard error of figures from superscript n sample plots; \* = whole colony.

Colony	1986-96 fledged/nest			1996 fledged/nest			1997 fledged/nest		
	years	mean	s.e.	AON <sup>n</sup>	mean	s.e.	AON <sup>n</sup>	mean	s.e.
Ailsa Craig (SW Scotland)	6	0.67	0.03	92 <sup>1</sup>	0.73	-	90 <sup>1</sup>	0.70	-
Hermaness (Shetland)	8	0.67	0.02	702 <sup>3</sup>	0.64	0.02	692 <sup>3</sup>	0.65	0.02
Noss (Shetland)	11	0.68	0.01	429 <sup>4</sup>	0.70	0.02	447 <sup>4</sup>	0.67	0.02
Fair Isle (Shetland)	11	0.69	0.03	222 <sup>1</sup>	0.67	-	222 <sup>1</sup>	0.71	-
Troup Head (NE Scotland)	4	0.53	0.05	$\geq 385^*$	( $\leq 0.75$ )	-	$\geq 545^*$	( $\leq 0.64$ )	-
Bempton (NE England)	9	0.77	0.03	122 <sup>1</sup>	0.73	-	151 <sup>1</sup>	0.80	-
All colonies	-	0.69	0.01	1567	0.69	0.02	1602	0.71	0.03

Note: figures for Troup Head are approximations based on a single July count of nests and chicks and are excluded from the calculation of overall mean breeding success.

## 2.7 Cormorant *Phalacrocorax carbo*

*Breeding numbers* (Table 2.7.1, Figure 2.7.1)

Most of the data summarised here were compiled from various sources by Dr. R.M. Sellers who runs the Cormorant Breeding Colony Survey. It should be noted that counts of breeding pairs of cormorants can be difficult to interpret, particularly where regional coverage is incomplete, as birds may move between colonies and variable proportions of adults breed each year.

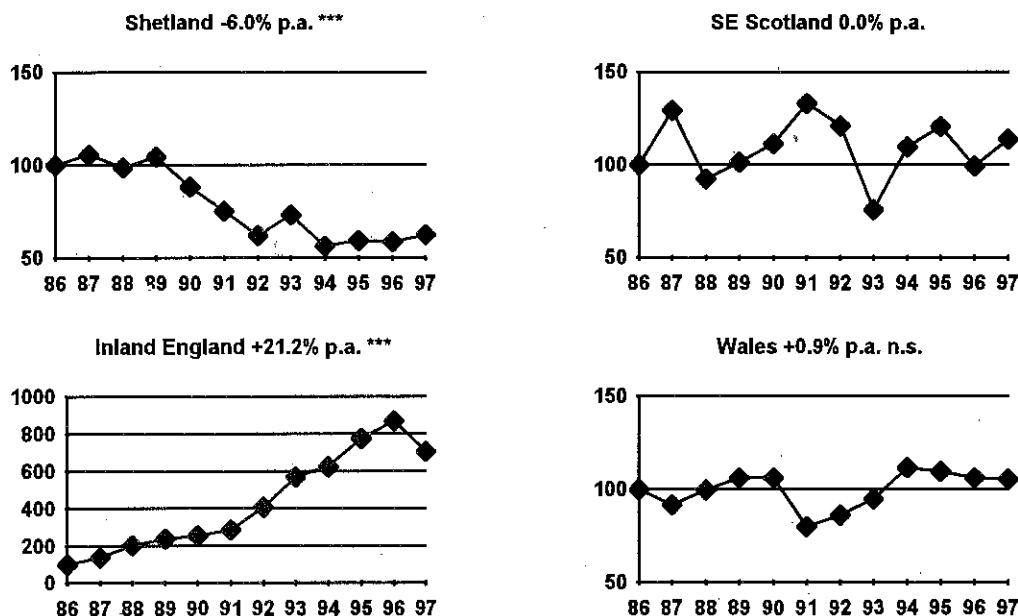
In regions such as Wales and south-east Scotland (Figure 2.7.1), breeding numbers of cormorants have shown considerable fluctuations since 1986, with no significant underlying trend. In Wales, there was little overall change in numbers between 1996 and 1997, although this masks considerable variation between individual colonies. In both south-west and south-east Scotland, and also in north-east England, numbers of pairs breeding increased in 1997, following declines between 1995 and 1996 that were attributed to cold spring weather in 1996. In northern Scotland, numbers at North Sutor (Easter Ross) declined for the second successive year, to 177 pairs, although there was a slight increase, to a total of 122 pairs, at colonies in east Caithness.

In Shetland, the 6.7% increase in numbers at those colonies counted in 1997 suggests some initial recovery from the significant decline between 1989 and 1994, during which the breeding population almost halved. More recently, the Shetland population seems to have levelled out (Figure 2.7.1). In the Western Isles, a breeding site at Loch an Tomain which had not been censused in recent years, held 44 pairs, and a new site, holding two pairs, was reported from Loch Moidart in the north-west Highlands.

**Table 2.7.1** Population changes at monitored cormorant colonies, 1996-97 (apparently occupied nests in May-June). Regional samples of under 50 AONs are excluded. Trends for 1986-96 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, \*  $P < 0.05$ , \*\*\*  $P < 0.001$ ). Further details of calculation of trends are given in section 1.2.2.

	SW Scotland	Shetland	N Scotland	SE Scotland	NE England	Inland England
1986-96 annual % change	+4.2*	-6.8***	-1.6 n.s.	-0.3 n.s.	+0.6 n.s.	+23.5***
1996	506	150	314	434	194	634
1997	586	160	299	496	227	549
1996-97 % change	+15.8 <sup>a</sup>	+6.7 <sup>b</sup>	-4.8 <sup>c</sup>	+14.3 <sup>d</sup>	+17.0 <sup>e</sup>	-13.4 <sup>f</sup>
	SW England	NW England & Isle of Man	Wales	NE Ireland	SE Ireland	
1986-96 annual % change	-0.3 n.s.	+4.6***	+0.9 n.s.	+6.1***	-	
1996	264	72	1082	199	250	
1997	249	69	1076	209	265	
1996-97 % change	-5.7 <sup>g</sup>	-4.2 <sup>h</sup>	-0.6 <sup>i</sup>	+5.0 <sup>j</sup>	+6.0 <sup>k</sup>	

Colonies: <sup>a</sup> Lady Isle, Port O' Warren, Rigg Bay, Currarie-Portandea, Eilean na Cille, Carraig an Daimh, Eilean Buidhe; <sup>b</sup> High Holm, Clett Stacks, Ramna Stacks; <sup>c</sup> Stack O' Brough, Stack of Ulbster, Stacks of Occumster, Ceann Leathad, Neuk Mhor, Ord Point, North Sutor, Eathie; <sup>d</sup> Craigleith, Carr Craig, Haystack, Lamb, Long Craig & Inchkeith, Fast Castle Head; <sup>e</sup> Farn Islands; <sup>f</sup> Rutland Water (Leics.), Abberton Res. (Essex), Aldermaston (Berks), Stodmarsh (Kent); <sup>g</sup> Gad Cliff, Ballard Cliff, Carswell Cove, Thatcher Rock, Parson & Clerk, Burgh Island; <sup>h</sup> Grune Point, Wills Strand; <sup>i</sup> total of 18 colonies, including St. Margaret's Island, Penderi & Pen Glog, New Quay Head, Green Scar, Ynys Gwylan, Rhoscolyn Beacon, Great Orme's Head, Little Orme's Head; <sup>j</sup> Bird Island, Black Rock; <sup>k</sup> Ireland's Eye.



**Figure 2.7.1** Regional population indices for breeding cormorant, 1986-1997 (occupied nests) Trends for 1986-97 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, \*\*\*  $P < 0.001$ . Further details of calculation of trends are given in section 1.2.2.

The most dramatic change in cormorant populations over the past decade has been the very rapid expansion of inland breeding sites in England (Figure 2.7.1). In 1997, counts at four of these inland colonies suggested that this rising trend may now be starting to level off. In particular, the number of pairs breeding at Abberton reservoir (Essex), the largest inland colony, declined to the lowest total (396) recorded since 1991, apparently because of habitat destruction and food depletion caused by the birds themselves.

In south-west England, there was a slight decline in numbers of breeding birds at monitored colonies between 1996 and 1997. In Cumbria and the Isle of Man, numbers at monitored colonies also fell slightly, contrary to the overall trend since 1986. At monitored colonies in County Down, cormorant numbers again increased in 1997, in line with the longer-term trend, and in south-east Ireland, numbers at Ireland's Eye continued to increase, to a record total of 265 pairs. However, in Sligo, a count on Ardboline Island found just 96 pairs, compared with 205 pairs in 1985.

### Breeding success

Breeding success of cormorants in most colonies monitored in 1997 was close to the norm for this species in Britain, that is between two and three chicks fledged per successful nest. The most notable exception to this was at North Sutor, where breeding success in a sample of 119 nests, was just 1.0 chick per pair, much lower than the 1991 to 1996 mean for this colony of 2.24 (s.e.  $\pm 0.15$ ). The poor breeding performance at this colony was apparently caused by periods of torrential rain and easterly winds. However, at Ceann Leathad in Caithness, mean brood size in 19 nests was 2.26, within the range recorded in the preceding four years. In Shetland, average brood size was 2.7 chicks per nest, similar to the 1990-96 average of 2.8 (s.e.  $\pm 0.11$ ). In western Scotland, between 188 and 206 young fledged from 137 nests at six colonies, equivalent to an average of 1.4 per pair. However, one of the monitored colonies was affected by mink (*Mustela vison*), and fledged a maximum of just 0.64 chicks per nest.

At Gob ny Skeddan on the Isle of Man, 27 occupied nests held an average of 2.4 large young per nest. Several cormorant colonies were monitored in Dyfed in 1996 and 1997 as part of the *Sea Empress* environmental impact assessment. In 1996, an average of 2.03 (s.e.  $\pm$  0.11) chicks fledged per successful nest at six colonies, while at seven colonies in 1997 the mean was 2.10 (s.e.  $\pm$  0.13). These figures include St. Margaret's Island, the largest colony in the area, where fledging success in 41 nests in 1997 averaged 2.29 chicks per nest, compared with 2.28 in 1995 and 2.05 in 1996. Further north, in Gwynedd, average brood sizes in late July were 1.96 and 2.03 at Craig yr Aderyn and Little Orme respectively, while in Devon in May, there were 2.30 chicks per nest at Burgh Island and 2.33 per nest at Carswell Cove.

## 2.8 Shag *Phalacrocorax aristotelis*

### *Breeding numbers* (Table 2.8.1, Figure 2.8.1)

Numbers of breeding shags at monitored colonies in south-east Scotland and north-east England again increased slightly, but populations in these areas are still well below the levels seen in the early 1990s, prior to the winter wreck of 1993-94. In Shetland, total numbers of apparently occupied nests (AONs) at three colonies monitored in both 1996 and 1997 decreased by 8%. This was attributable to a marked decline in the numbers of nests in sample plots on Fair Isle, where there had been a similar increase between 1995 and 1996. However, counts over larger areas last surveyed between 1993 and 1996, indicate that the Shetland population is now slowly increasing after prolonged decline. In northern Scotland, numbers of breeding pairs at North Sutor fell back to 209, following an increase to 242 in the previous year.

In both north-west and south-west Scotland, overall numbers of breeding pairs at monitored colonies increased between 1996 and 1997. In the north, 1148 AONs were found on Canna, the highest figure recorded since 1989, while in the south the number of pairs breeding on the Mull of Galloway almost trebled, to a record 123 AONs. Longer term population trends in south-west Scotland are unclear, but figures derived from two different sets of colonies suggest a recent reversal to an apparent population decline in the late 1980s.

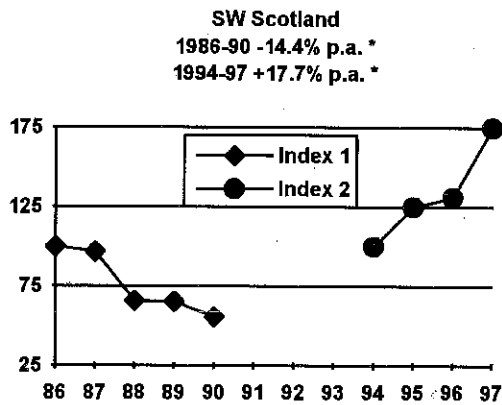
In south-west Wales, a total of 28 colonies, holding 146 AONs in 1996, was surveyed in both 1996 and 1997 as part of the *Sea Empress* environmental impact assessment. Total numbers of AONs at these sites increased by 6.8% in 1997. However, numbers at the three largest colonies, Middleholm, Cardigan Island and Bishops and Clerks/Ramsey, fell by 11%, to 70 AONs, following a 7.5% increase between 1995 and 1996. In the Isle of Man, there was a substantial increase in the numbers of breeding pairs recorded at the Calf of Man (to c. 236 AONs), although numbers at this colony remain below those, in excess of 300 pairs, found in the early 1990s. At other smaller Manx colonies, and also in south-east Ireland, there was no evidence of any major change between 1996 and 1997.

**Table 2.8.1** Population changes at monitored shag colonies, 1996-97 (apparently occupied nests in May-June). Counts with a reported inaccuracy of  $> \pm 5\%$ , and regional samples  $< 100$  AONs, are excluded.

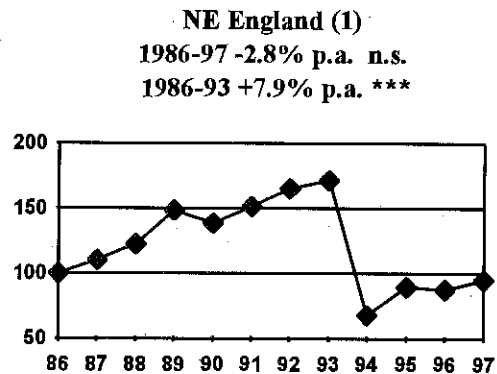
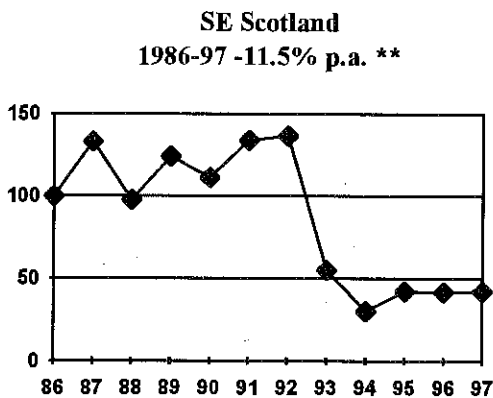
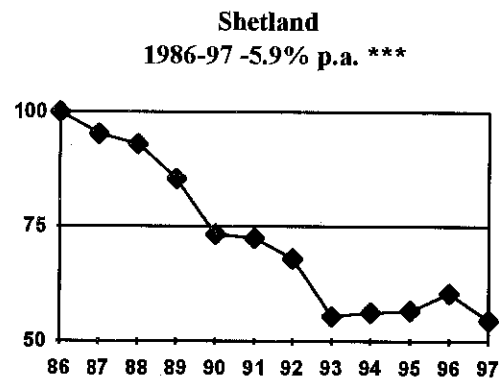
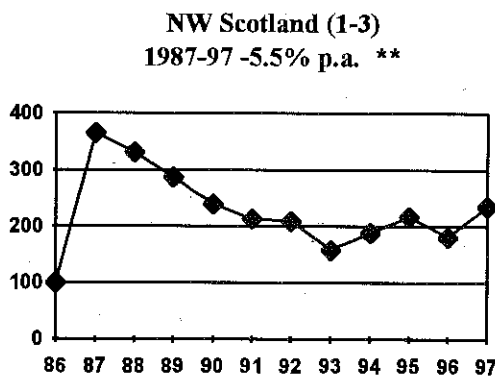
	SW Scotland	NW Scotland	Shetland	SE Scotland	NE England	Wales
1996	1059	984	586	1097	994	146
1997	1223	1273	547	1114	1060	156
1996-97 % change	+15.5 <sup>a</sup>	+29.4 <sup>b</sup>	-6.7 <sup>c</sup>	+1.5 <sup>d</sup>	+6.6 <sup>e</sup>	+6.8 <sup>f</sup>

Colonies: <sup>a</sup> Mull of Galloway, Sanda Island, Eileanan Glasa, Carraig an Daimh, Eilean Fraoich, Eilean Buidhe, Ruadh Sgeir, Eilean na Cille, Dubh Feith, Lunga; <sup>b</sup> Eigg, Canna, An Glas Eilean, Handa (plot); <sup>c</sup> Fair Isle (plots), Noss, Sumburgh Head; <sup>d</sup> Isle of May, Inchkeith, Craigleith, Lamb, Fidra, Inchmickery, Inchcolm, Haystack, Carr Craig, Bass Rock, St. Abb's Head; <sup>e</sup> Farne Islands; <sup>f</sup> 28 colonies including Middleholm, Cardigan island, Bishops & Clerks, Ramsey.

Seabird numbers and breeding success, 1997



Notes to SW Scotland figure: the index values for 1986-90 and 1994-97 are derived from counts of different groupings of colonies and therefore are not directly comparable.



**Figure 2.8.1** Population indices for breeding shags, 1986-97 (apparently occupied nests in late May or June). Three or more colonies are counted in each region in each year unless otherwise indicated. Trends for 1986-97 are average annual rates of change shown by sample populations, but note that overall trends may mask shorter term population fluctuations. Significance of trends (t-test) indicated as: n.s. not significant, \*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Further details of calculation of trends are given in section 1.2.2.

*Breeding success* (Table 2.8.2)

Across eight colonies where productivity was assessed by monitoring sample nests throughout the breeding season in 1997, an average of 1.06 chicks fledged per active nest, rather lower than the 1986-96 mean of 1.35 (s.e.  $\pm 0.06$ ) averaged over between three and twenty colonies annually. The mean difference in breeding success across seven of these colonies monitored in both years was not statistically significant, but there were marked differences between 1996 and 1997 in some regions. In



particular, breeding success declined at all four colonies monitored along the east coast of Britain, with the most marked decline, of 1.36 young fledged per active nest, being recorded at St. Abb's Head Breeding success at St. Abb's, and also at the Farne Islands and North Sutor, was the lowest recorded since monitoring began between 1987 and 1992, apparently because of poor weather. However, on the Isle of May, where the breeding season was the earliest ever recorded, breeding success declined only slightly from 1996 and was above the 1986-96 average.

Breeding success at regularly monitored colonies in Shetland was slightly above, although not significantly different from, average. In Wales, a mean brood size of 2.45 large chicks per nest in 31 nests on Midland Island during a June ringing visit suggests a productive season, but only 1.66 chicks per active nest fledged from a small sample of nine monitored nests on Bardsey. At the Isle of Man, checks of two colonies indicated a fledging rate in excess of two chicks per active nest.

In Argyll, south-west Scotland, average estimated minimum productivity at six colonies from which American mink (*Mustela vison*) were absent was moderate, at 1.05 chicks per pair. In five of these colonies, monitored in both years, the best or maximum productivity estimates for 1997 were significantly lower than the minimum estimates for 1996. However, on Canna (north-west Scotland), breeding success of 1.75 chicks fledged per active nest was the highest recorded since 1988. In the same region, fledging success at the An Glas Eilean colony was estimated to be in the order of one chick per pair, following successful mink control efforts.

**Table 2.8.2** Shag breeding success, 1996-97: estimated number of chicks fledged per occupied nest at sample colonies (superscript n = number of colonies). Figures are based on nests where eggs or apparent incubation were recorded, and are presented as the mean and standard error of figures for individual colonies. Only colonies where ten or more nests were monitored in 1997 are included. Figures for colonies in SW Scotland and for An Glas Eilean in NW Scotland are approximate minima or best estimates based on one or more visits; those for other regions are based on regular checks of sample nests. Changes in breeding success are indicated for colonies where similar methods have been used in both years (significant changes, assessed by t-tests, are indicated as \*P < 0.05).

Region	1996 chicks fledged/nest				1997 chicks fledged/nest				1996-97 change	
	nests <sup>n</sup>	range	mean	±s.e.	nests <sup>n</sup>	range	mean	±s.e.	mean <sup>n</sup>	±s.e.
SW Scotland <sup>a</sup>	195 <sup>6</sup>	1.16-2.00	≥1.70	±0.14	271 <sup>6</sup>	0.19-1.65	≥1.05	±0.24	-0.61 <sup>5</sup>	±0.20 *
NW Scotland <sup>b</sup>	64 <sup>2</sup>	0.00-1.35	0.68	±0.68	102 <sup>2</sup>	0.98-1.75	≥1.37	±0.39	+0.69 <sup>2</sup>	±0.29
Shetland <sup>c</sup>	393 <sup>4</sup>	1.34-1.49	1.39	±0.03	272 <sup>3</sup>	1.19-1.43	1.35	±0.08	+0.06 <sup>2</sup>	±0.01
N Scotland <sup>d</sup>	80 <sup>1</sup>		1.84		68 <sup>1</sup>		0.65		-1.19 <sup>1</sup>	
SE Scotland <sup>e</sup>	173 <sup>3</sup>	0.99-1.76	1.44	±0.23	194 <sup>2</sup>	0.40-0.96	0.68	±0.28	-0.70 <sup>2</sup>	±0.67
NE England <sup>f</sup>	260 <sup>1</sup>		0.86		395 <sup>1</sup>		0.66		-0.20 <sup>1</sup>	
Total	1165 <sup>17</sup>	0.00-2.00	≥1.42	±0.12	1302 <sup>15</sup>	0.19-1.75	≥1.05	±0.13	-	±0.19
Detailed only	957 <sup>10</sup>	0.86-1.84	1.39	±0.10	990 <sup>8</sup>	0.40-1.75	1.06	±0.17	-0.32 <sup>7</sup>	±0.26
									0.33 <sup>13</sup>	

Colonies: <sup>a</sup> Ruadh Sgeir, Eilean Buidhe, Eilean Dubh (1996 only), Eilean na Cille, Carraig an Daimh, Eileanan Glasa, Craro (1997 only); <sup>b</sup> Canna, An Glas Eilean; <sup>c</sup> Noness (1996 only), Westerwick (1996 only), Sumburgh Head, Fair Isle, Foula (1997 only); <sup>d</sup> North Sutor; <sup>e</sup> Isle of May, Fidra (1996 only), St. Abb's Head; <sup>f</sup> Farne Islands.

## 2.9 Arctic Skua *Stercorarius parasiticus*

### *Breeding numbers* (Table 2.9.1)

On Foula, the start of breeding was late in 1997, and breeding numbers continued to fall, to 117 apparently occupied territories (AOTs). Annual adult survival has been consistently high since 1992 (85-90%), and there are now many fewer immature birds present on club sites than there were in the late 1980s. On Hermaness, breeding numbers remained at eleven AOTs as in 1996, but only eight AOTs were found on Noss in 1997, the lowest number ever recorded. The overall number of AOTs on Fair Isle, however, increased by 14% to 98 in 1997, the first recorded increase since 1992. At the nine remaining annually monitored study sites in Shetland, there was a total of 92 AOTs.

At the five study sites on Orkney, there were 129 AOTs, similar to the 127 AOTs at the same sites in 1996. On Handa, in north-west Scotland, the population has been relatively stable over the past ten years and in 1997, 30 AOTs were found, similar to the 1996 figure

**Table 2.9.1** Population changes at monitored Arctic skua colonies, 1996-1997 (apparently occupied territories). Superscript = number of colonies counted in both years.

	Foula	Fair Isle	other Shetland	total Shetland	Orkney	Handa
1996	120	86	115	321	127	29
1997	117	98	111	326	129	30
1996-1997 % change	-2.5	+14.0	-3.5 <sup>11</sup>	+1.6 <sup>13</sup>	+1.6 <sup>5</sup>	+3.4

### *Breeding success* (Table 2.9.2)

On Foula, breeding success appeared to be poor, with only 88 chicks being ringed despite intensive searching. Feeding opportunities were considered to be poor, with sandeels apparently in limited supply. Four young fledged from eight AOTs on Noss, one of the lowest figures since 1990, while at Hermaness, productivity fell to 0.73 young per AOT, the lowest figure since 1991.

Elsewhere in Shetland, productivity was also very low. At eight sites, only nineteen chicks fledged successfully from 72 AOTs, an overall productivity of 0.21 young per pair. As with Arctic terns and kittiwakes in this region, this was the poorest year since 1990. Many of the failures occurred at the egg or early chick stage and observers noted lower adult attendance than in previous years. On Fair Isle, an estimated 80 chicks fledged from 98 AOTs (0.82 per AOT), which is higher than in recent years. However, post-fledging mortality at this colony may have been quite high.

The overall productivity figure on Orkney was 1.17 chicks per pair, which is higher than the previous two years (0.89 and 0.87). The most marked improvement was at Gallo Hill on Westray, at which 44 young fledged from 24 AOTs. Binga Fea, which frequently suffers heavy predation by great skuas, appeared to have fledged young early in the season, but two of these were found dead in neighbouring great skua territories later in the season.

**Table 2.9.2** Arctic skua breeding success 1996 and 1997: number of chicks fledged per apparently occupied territory (AOT).

Colony	AOTs	1996 overall numbers fledged per AOT	AOTs	1997 overall numbers fledged per AOT
<i>Shetland</i>				
Unst (2 cols)	28	0.79	25	0.52
Fetlar	18	0.72	20	0.25
Yell (2 cols)	15	0.80	17	0.24
Noss	12	0.58	8	0.50
Mousa	19	1.26	18	0.17
Mainland (4 cols)	23	1.00	23	0.30
Fair Isle	86	0.88	98	0.82
<i>Orkney</i>				
Papa Westray	139	1.00	29	1.03
Westray	28	0.71	24	1.83
Rousay	33	1.30	33	1.09
Mainland	23	0.65	32	1.19
Hoy	6	0.00	11	0.27

## 2.10 Great Skua *Stercorarius skua*

### *Breeding numbers* (Table 2.10.1)

Great skuas on Foula were unusually late in breeding in 1997, and overall numbers breeding were higher than in the previous two years. Pellets suggested that sandeels were available in June, but by early July had been replaced largely by whitefish and herring *Clupeidae* in the diet (Furness 1997b). The numbers of birds at club sites increased markedly and was the highest since the late 1980s, with 850 on 3 July. It seems likely that this reflects the improved breeding success in the 1990s.

At Hermaness, a full census was carried out in 1997, giving a total of 631 apparently occupied territories (AOTs), compared with 854 at the last full count in 1992. A whole-island count was also carried out on Noss, where a total of 414 AOTs were found. This was little changed on the 423 AOTs found at the last count in 1992, although the distribution of AOTs had expanded into more peripheral areas (Farrell & Fisher 1997). On Fair Isle, the number of AOTs increased, by 27% to 152, the highest recorded density on Fair Isle. At a further five annually monitored colonies in Shetland, there were 80 AOTs, lower than the 91 AOTs at these sites in 1996.

Estimates were also made of the St Kilda population in 1997. On Hirta, there were 233 AOTs, an increase on the 213 recorded in 1996. There were two AOTs on Boreray, but none on Dun. On Soay, there were an estimated 36 pairs, nineteen of the nests being found.

In Orkney, a survey of the three main study colonies revealed a total of 101 AOTs, slightly lower than the 112 AOTs found in 1996. On Papa Westray, the North Hill colony held thirteen pairs, a large increase on the eight AOTs there in 1996.

**Table 2.10.1** Population changes at monitored great skua colonies, 1996-1997 (apparently occupied territories). Superscript = number of colonies counted in both years.

	Fair Isle	other Shetland	total Shetland	Orkney
1996	120	246	366	112
1997	152	235	387	101
% change	+26.7	-4.5 <sup>8</sup>	+5.7 <sup>9</sup>	-9.8 <sup>3</sup>

*Breeding success* (Table 2.10.2)

On Foula, chick survival appeared to have been good, with over one chick per pair being ringed. Productivity on Noss was the lowest recorded since 1992, at 0.37 chicks per AOT. However, productivity estimates were made at a later date than normal in 1997, which may have affected the chick counts. At Hermaness, productivity was monitored at 32 AOTs from which ten chicks fledged (0.31 per AOT). This again is the lowest recorded productivity since 1989. Circumstantial evidence suggested high chick mortality (Lewis 1997). At the remaining five study colonies which are monitored annually in Shetland, 19 chicks fledged from a total of 80 AOTs, giving an overall productivity value of 0.23 young per pair. As was the case with Arctic skua and Arctic tern in Shetland in 1997, this is the lowest value recorded in seven years of annual monitoring. Adult attendance was noted by observers to be low and many chicks were predated by adult birds. Birds on Fair Isle were unusually late in breeding and a count on 22 August revealed 105 fledged or near-fledged chicks. The final productivity estimate there was 0.76 young per AOT, a similar figure to previous seasons.

At three colonies on Hoy, Orkney, productivity exceeded that in 1996, with an estimated 84 young fledged from 101 AOTs (0.83 young per AOT). This figure includes a very successful season at Lyrawa Hill, at which an estimated 1.60 chicks fledged per AOT. At three other study colonies in Orkney, productivity reached 1.07 chicks per AOT.

**Table 2.10.2** Great Skua breeding success, 1996-1997: number of chicks fledged per apparently occupied territory (AOT). (n = number of AOTs)

Colony	1996		1997	
	n	overall nos. fledged/AOT	n	overall nos. fledged/AOT
Hermaness	38	1.11	32	0.31
Fetlar	53	1.13	58	0.69
Mainland (2 cols)	51	0.71	41	1.15
Yell (2 cols)	29	0.79	28	0.25
Mousa	11	1.09	11	0.55
Noss	63	0.68	65	0.37
Fair Isle	120	0.83	152	0.76
NW Hoy	36	1.11	45	0.56
S Hoy	34	0.41	31	0.61
E Hoy	42	0.83	25	1.60

## 2.11 Black-headed gull *Larus ridibundus*

### *Breeding numbers and breeding success* (Table 2.11.1)

Black-headed gulls are highly mobile between breeding sites; hence, year to year changes in numbers at the relatively few locations that are counted regularly are not necessarily representative of broader regional trends.

**Table 2.11.1** Population changes at monitored black-headed gull colonies, 1996-97 (breeding pairs or apparently occupied nests in May-June). Regional samples of less than 200 pairs are excluded.

	W Scotland	NE England	SE England	NE Ireland
1996	267	2286	10911	5055
1997	288	c. 2191	12483	5351
1996-97 % change	+7.9 <sup>a</sup>	-4.2 <sup>b</sup>	+14.4 <sup>c</sup>	+5.9 <sup>d</sup>

Colonies: <sup>a</sup> Eilean Inshaig, Sgeir na Caillich, Aird's Islet, Dubh Sgeir, Eilean Fada, Whitehouse Bay islet, Eilean nan Gall, Duncuan; <sup>b</sup> Coquet Island, Farnes; <sup>c</sup> Rye and Langstone Harbours, North Solent NNR, Newtown Estuary, Flanders Mare; <sup>d</sup> Strangford Lough (several colonies), Swan & Blue Circle Islands (Larne Lough), Green Island (Carlingford Lough).

In western Scotland, overall breeding numbers at eight colonies visited in both 1996 and 1997 increased slightly in 1997. However, three sites that had held a total of fifty pairs in 1995 were deserted by 1997, in line with the general decline in black-headed gull numbers in this area over the past decade. This decline has been attributed to repeated breeding failures caused by American mink (*Mustela vison*). A mink control programme is now in place and is proving effective in protecting terns and other species at selected sites (Craik 1997). In 1997, at three black-headed gull colonies where mink were removed, between 69 and 74 young fledged from 122 pairs, equivalent to roughly 0.59 per pair. At four colonies with no mink control, 64 young fledged from 168 pairs, an average of 0.38 per pair.

On Fetlar in Shetland, 24 pairs of black-headed gulls bred in 1997 and fledged an average of 0.88 chicks per pair. In north-east England, there was a further slight decline in breeding numbers at Coquet Island, to c. 2100 pairs. On the Farne Islands, where 91 pairs bred, an average of 1.83 chicks per pair fledged from a sample of eighteen nests. However, in Norfolk, breeding success was reported to be poor at Scott Head and at Brancaster, which together held in excess of 320 pairs. In Essex, at least 1786 pairs bred at the Blackwater Estuary, but no information is available on their breeding success.

In south-east England, numbers increased by 14.4% from 1996 across five sites, to a total of nearly 12,500 pairs. This included a record 1415 pairs at Langstone Harbour (Hampshire), where a large increase in numbers in 1996 coincided with the desertion of a former colony site at Chichester Harbour. Breeding success in 1997 was very variable between sites in this region. At Langstone Harbour, 0.97 chicks fledged per pair, the same average as in 1996. At Newtown Estuary (Isle of Wight), breeding success was much higher than in the previous three seasons, at an average of 1.29 chicks per pair (n = 550 pairs). However, at North Solent (Hampshire), the largest colony in this region, only approximately one quarter of the almost 6750 pairs present reared young, compared with an average of more than two young per pair in 1996. Wet, windy and cold weather in June was thought to be responsible. At Rye Harbour (East Sussex), a total of 350 pairs fledged approximately 60 young, an average of 0.17 per pair, compared with 0.40 to 0.50 chicks per pair in the preceding three seasons.

At the Ribble Estuary in Cumbria, where nearly 12,000 pairs bred in 1996, high tides in May washed out the colony and only a few pairs apparently relaid. In north-east Ireland, there was little overall change in breeding numbers in 1997, but a notable increase from under 300 pairs between 1994 and 1996 to c. 600 pairs at the artificial Blue Circle Island in Larne Lough.

## 2.12 Common gull *Larus canus*

### *Breeding numbers and breeding success (Table 2.12.1)*

Information on this species in 1997 is very limited, with virtually no data available for the Northern Isles and Grampian, which together hold the bulk of the British breeding population. However, coastal colonies in western Scotland are monitored annually, and in this area annual counts at 20 breeding sites from 1994 to 1997 (Table 2.12.1) suggest some stabilisation of numbers in 1997, following efforts in recent years to reduce predation of eggs and chicks by introduced American mink (*Mustela vison*) (Craik 1997). Mink were controlled at ten sites used by common gulls in 1997, and at these colonies between 326 and 430 chicks fledged from a total of 547 pairs, an average of 0.60 to 0.79 per pair. However, at the largest colony, of 344 pairs at Kilmaronag in Loch Etive, many chicks died, apparently of starvation. At a further twenty colonies where there was no mink control, an average of 0.38 to 0.42 chicks per pair fledged from a total of 577 pairs. This includes a colony of 75 pairs at Ban Eileanan which failed completely because of mink predation. The overall breeding success at the 30 colonies monitored was between 0.49 and 0.60 chicks fledged per pair.

**Table 2.12.1** Numbers of common gulls in study colonies on the west coast of Scotland 1994-97. Figures are sums of counts of pairs at 20 colonies in Argyll & Bute and southern Lochaber.

Year	1994	1995	1996	1997	1996-97 % change
No. of pairs	1086	1020	826	811	-1.8

In Shetland, five pairs on Fair Isle fledged only two young and several other colonies were also noted as having a poor breeding season. The colony at Wornadale failed completely because of predation of chicks, apparently by feral polecats. However, some Shetland colonies, including Out Skerries, fledged high numbers of chicks. On Papa Westray in Orkney, a colony of 75 pairs fledged *c.* 100 chicks, an average of 1.33 per pair. The colony at Nigg (Ross and Cromarty), established in 1990, increased further, to 69 pairs, and had a moderately successful breeding season, with an average of 1.06 chicks per pair fledging from the 35 pairs monitored. In the same area, a colony of approximately 100 pairs at Alness Point produced *c.* 0.75 chicks per pair, compared with 0.44 young per pair in 1996, while at Invergordon, a colony of 180 pairs fledged between 150 and 200 young.

In north-east Ireland, breeding numbers of common gulls in Strangford Lough increased to a record 135 pairs, and at Rathlin Island a total of 182 pairs were recorded, compared with the previous count of 64 pairs in 1985.

## 2.13 Lesser black-backed gull *Larus fuscus*

### *Breeding numbers and breeding success (Table 2.13.1)*

No data were obtained from any of the large English lesser black-backed gull colonies in 1997. However, a complete census of the Isles of Scilly recorded in excess of 3042 breeding pairs, nearly 20% lower than in 1987. In Wales, 37 colonies, including Britain's second largest colony on Skomer, were counted in both 1996 and 1997. Total numbers at these colonies changed little, decreasing by 1.4%. The rapid decline seen at Skomer over the preceding three years, from a peak in excess of 20,000 pairs in 1993, appears to have slowed, with a decrease of just 0.5% between 1996 and 1997 to an estimated total of 14,343 breeding pairs. Breeding success on Skomer was higher than in recent years, with an estimated average of between 0.4 and 0.8 chicks fledged per breeding pair, compared with a mean of 0.14-0.19 in the preceding eight years. However, productivity remained low on Skokholm, with an estimated 600 fledglings produced from 2937 nests, an average of 0.20. On

Bardsey, an average of 0.49 chicks per pair fledged from a sample of 70 nests, compared with 0.56 in 1996.

The annual census of the mixed herring and lesser black-backed gull colony on the Isle of May in south-east Scotland indicated a decline in the lesser black-backed gull population following a period of rapid expansion in recent years since a culling programme ceased. Breeding success at this colony in 1997, using different methods from previous seasons, was estimated at 0.72 chicks fledged per pair.

**Table 2.13.1** Population changes at monitored lesser black-backed gull colonies, 1995-97. Figures are breeding pairs or apparently occupied nests in May-June. Regional samples < 200 pairs are excluded.

	SE Scotland <sup>a</sup>	Wales <sup>b</sup>
1995	1635	19526
1996	≥1641	18830
1997	1540	18483
1996-97 % change	-16.2	-1.8

Colonies: <sup>a</sup> Isle of May, <sup>b</sup> Skomer, Skokholm, Bardsey, Caldey, Ramsey.

In Argyll, estimated numbers of lesser black-backed gulls at eight monitored colonies, holding roughly 800-1000 pairs, changed little overall between 1996 and 1997, although Eilean Fraoich, which held between 40 and 100 pairs between 1994 and 1996, was abandoned in 1997. At five colonies in this area holding an estimated 542 pairs, breeding success was estimated at *c.* 0.66 young per pair, rather higher than in the previous three seasons. In Orkney, two colonies holding 31 pairs on Papa Westray fledged an average of 1.23 young per pair.

In north-east Ireland, numbers of lesser black-backed gulls increased at monitored colonies in 1997. A total of between 570 and 775 pairs was estimated to breed on the Copeland Islands, compared with 315 to 580 in 1996. Similarly, in Strangford Lough, a record total of 241 pairs bred, compared with 161 in 1996.

## 2.14 Herring gull *Larus argentatus*

### *Breeding numbers and breeding success* (Table 2.14.1)

Few herring gull colonies are counted regularly, but the available data indicate that coastal populations have been roughly stable or declining in the past decade, following major declines from the early 1970s to mid-1980s (Walsh & Gordon 1994; Lloyd, Tasker & Partridge 1991). However, there can be considerable differences within regions in population trends at individual colonies, so data for small samples of colonies may not be indicative of more widespread changes.

In western Scotland, overall numbers of herring gulls breeding at monitored sites increased from 1996 to 1997, following declines in the previous year (Table 2.14.1). Across a larger sample of fifteen colonies in south-west Scotland, where accurate counts of herring gulls were made in both 1996 and 1997, there was an overall increase of 19%, to a total of 1523 pairs. In north-west Scotland, accurate counts at three colonies (Table 2.14.1) plus estimates at a further ten colonies holding *c.* 870 pairs in 1997, both indicated an increase in numbers of breeding pairs. At nine colonies in western Scotland, holding a total of 1032 nests, from which mink (*Mustela vison*) were absent, breeding success averaged 0.96 chicks per pair. In ten colonies where there was evidence of mink activity, an average of just 0.23 chicks fledged per pair from 996 nests, with the seven smallest colonies (of 243 nests) failing completely. On Canna (Lochaber), an estimated 1.3 chicks fledged per breeding pair in a study area.

**Table 2.14.1** Population changes at monitored herring gull colonies, 1995-97 (breeding pairs or apparently occupied nests in May-June). Regional samples < 200 pairs are excluded.

	NW Scotland <sup>a</sup>	SW Scotland <sup>b</sup>	SE Scotland <sup>c</sup>	NE England <sup>d</sup>	Wales <sup>e</sup>	NW England <sup>f</sup>	NE Ireland <sup>g</sup>
1995	1518	1131	3019	c. 670	3513	495	1216
1996	1455	896	3410	c. 485	3927	540	799
1997	1548	1123	3279	c. 508	3840	583	711
1996-97 % change	+6.4	+25.3	-3.8	+4.7	-2.2	+8.0	-11.0

Colonies: <sup>a</sup> Canna, Eilean MhicNeill, Sligneath Mor; <sup>b</sup> Sgeir nan Gobhar, Eilean Beag, Eilean Loch Oscair, Eilean nan Caorach, Ruadh Sgeir, Eilean Eoghainn, Lunga; <sup>c</sup> Isle of May, Eyebroughty, Carr Craig, Haystack, St. Abb's Head; <sup>d</sup> Huntcliff, Boulby - Cowbar Nab; <sup>e</sup> Stackpole Head, New Quay to Broadhaven, Cardigan, Skomer, Skokholm, Ramsey, Caldey, Bardsey, Ynys Gwylan; <sup>f</sup> St. Bee's Head; <sup>g</sup> Strangford Lough (several colonies), Gun's Island.

Two small herring gull colonies, of 64 and 48 pairs, on Papa Westray, Orkney, had a moderately successful breeding season in 1997, fledging 1.40 and 1.25 young per pair respectively. In north-east Scotland, a total of 489 pairs of herring gulls bred at Sands of Forvie NNR, fewer than 50% of the numbers recorded at this site in the mid-1980s.

In south-east Scotland, there was a slight decrease in overall numbers at monitored colonies, following recent increases, notably on the Isle of May, where a culling program ceased in 1986. Breeding success on the Isle of May in 1997 was estimated at 0.65 chicks fledged per pair, but this estimate may have been artificially low following a change in monitoring methods. At two colonies in north-east England, numbers increased slightly in 1997 following a much larger percentage decline in the previous year. In Essex, recently colonised by herring gulls, seven pairs bred at Old Hall Marshes in the Blackwater Estuary.

At Burton Bradstock in Dorset, a small colony of 48 pairs fledged an average of 2.27 chicks per nest, in line with previous estimates from this colony. In Wales, there was little overall change in numbers of breeding pairs at regularly monitored colonies (Table 2.14.1). Across a larger sample of 48 colonies in south-west Wales, censused as part of the *Sea Empress* environmental impact assessment, numbers increased overall by 1.4% between 1996 and 1997, but there was considerable variation between colonies. At Skomer, numbers declined further, to 361 pairs, the lowest total recorded since monitoring began in 1961 and approximately only one eighth of the 1981 peak. Numbers also decreased from 1996 at Caldey, although the total of 1334 pairs was the third highest in the past decade. However, there was a slight increase on Skokholm, to 336 nests, and numbers also increased at Cardigan Island, to 720 pairs, the highest total recorded there since 1985. Breeding success at monitored herring gull colonies in Wales was generally average to high in 1997; fledglings per breeding pair averaged 1.57 at Needle Rock, 1.8 at Ynys Meicel, 1.24 at Skomer and 0.93 at Elegug Stacks. However, on Skokholm, only 0.44 chicks per pair fledged from 124 nests in a sample colony where some nests were washed away by heavy seas in mid-season.

Along northern Irish Sea coasts, numbers increased at both St. Bee's Head, by 8.0% to 583 pairs, and at the Calf of Man, by 11.1% to 671 pairs, but it should be noted that these colonies are very small compared with that at South Walney, which was not counted in 1997. Numbers also increased, by 23.8% to 656 pairs, at Strangford Lough (Co. Down), the highest total in six years, but well below the figures of around 2000 pairs recorded in the mid-1980s. However, at Gun's Island, where foxes (*Vulpes vulpes*) were active, there was a further decline to just 55 pairs, compared with a peak of nearly 2000 pairs in 1990 and with 269 pairs in 1996.



## 2.15 Great black-backed gull *Larus marinus*

### *Breeding numbers and breeding success* (Table 2.15.1)

A review of the limited amount of available data suggests that coastal populations of great black-backed gulls in the UK have generally increased or been roughly stable since 1986 (Walsh & Gordon 1994). However, a survey of the largest British colonies on Hoy (Orkney) in 1996 found that these had declined markedly since 1984 (Furness 1997a).

The fall in overall numbers across several colonies in south-west Scotland from 1996 to 1997 was almost entirely attributable to a decline on Lunga from the record numbers recorded there in 1996. On Canna (north-west Scotland), great black-backed gull numbers increased to a record 93 pairs, and breeding success across 29 monitored pairs averaged 1.52 young fledged per pair. Across nineteen colonies monitored by Clive Craik in Argyll and Lochaber, a total of between 164 and 187 chicks fledged from 198 apparently occupied nests, equivalent to between 0.83 and 0.94 per breeding pair. Mink (*Mustela vison*) took eggs and chicks at a number of these sites.

In Shetland, there were indications of a poor breeding season at several colonies where only small numbers of chicks were present in relation to numbers of adults. However, on Papa Westray in Orkney, two colonies of 85 and 24 pairs fledged averages of *c.* 1.4 and 1.0 plus chicks per pair respectively. In northern Scotland, the colony at Nigg continued its expansion, to 110 pairs from just four in 1990, but breeding success, at 1.15 chicks per pair, was the lowest since monitoring began in 1992 (1992-96 mean 1.90, *s.e.*  $\pm$  0.09). Numbers on the Forth islands in south-east Scotland remained stable, at 25 pairs.

On Annet, Isles of Scilly, 105 pairs bred in 1997, the lowest total recorded since 1991. The increase in numbers recorded at routinely monitored colonies in Wales was largely attributable to a doubling of numbers on Middleholm, to 69 pairs, with the overall increase at the remaining colonies amounting to under 5%. Across a larger sample of 28 sites in south-west Wales, monitored in the wake of the *Sea Empress* oil spill, overall numbers increased by 20.4%, to 324 pairs. However, if Middleholm is excluded the increase was a smaller 8.5%. On Skokholm, breeding success averaged 1.51 chicks per pair, the highest figure recorded in recent years, while on Skomer, 30 monitored pairs reared an average of 1.17 chicks per pair, similar to 1996.

On the Calf of Man, breeding numbers increased to *c.* 110 pairs after two years in which numbers had declined to around 50 pairs. Numbers in Northern Ireland decreased further, but in south-east Ireland, estimated numbers were similar to recent years.

**Table 2.15.1** Population changes at monitored great black-backed gull colonies, 1995-97 (breeding pairs or apparently occupied nests in May-June). Regional samples < 50 pairs are excluded.

	SW Scotland <sup>a</sup>	NW Scotland <sup>b</sup>	Shetland <sup>c</sup>	N Scotland <sup>d</sup>	Wales <sup>e</sup>	NE Ireland <sup>f</sup>
1995	147	93	<i>c.</i> 75	99	256	78
1996	173	83	67	104	257	76
1997	154	109	68	110	302	60
1996-97 % change	-11.0	+31.3	+1.5	+5.8	+17.5	-21.1

Colonies: <sup>a</sup> Sanda, Lunga, Eilean Gainimh, Abbot's Isle, Ruadh Sgeir; <sup>b</sup> Canna, Sligneath Mor; <sup>c</sup> Noss; <sup>d</sup> Nigg oil terminal; <sup>e</sup> Grassholm, Skomer, Skokholm, Middleholm, Ramsey, Caldey, Eileag Stacks, Bishops & Clerks, Cardigan Island, Ynys Gwylan, Bardsey; <sup>f</sup> Strangford Lough (several colonies), Gun's Island.

### 2.16 Kittiwake *Rissa tridactyla*

*Breeding numbers* (Table 2.16.1, Figure 2.16.1)

In interpreting year to year changes in counts of kittiwakes at sample colonies, it should be noted that, because of movements of birds between colonies, such counts may not necessarily reflect larger scale population changes. A recent example from eastern England is the formation, since 1995, of two new colonies on artificial structures associated with Sizewell power station, coincident with a decline in the established colony at Lowestoft. Further south, at the South Foreland cliffs in Kent, a colony that had been declining since 1992, but which still held 501 apparently occupied nests (AONs) in 1996 was abandoned in 1997.

The available data suggest that kittiwake populations in most regions have remained relatively stable over the past decade, with no significant overall changes in numbers since 1986 at monitored colonies, despite fluctuations over shorter periods. The data for south-east Scotland, where the majority of colonies are monitored each year, provide one example of this type of pattern (Figure 2.16.1). However, in a few regions, most notably Shetland, there have been significant population changes over this period. The 13% decline seen in colonies in Shetland counted in both 1996 and 1997 is in line with an estimated average annual decline of 6.9% in sample colonies since 1985/86 (Figure 2.16.1) and an apparent overall decline in the Shetland kittiwake population of 50% since 1981 (Heubeck *et al.* in press). A 1997 count of Fair Isle, the largest Shetland colony, found that it had declined by 35.8% since 1992, to 11,650 breeding pairs. The decline of kittiwake populations in Shetland is attributed to reduced recruitment following several years of poor breeding success caused by sandeel shortages and to recent increases in predation by great skuas (*Stercorarius skua*) (Heubeck *et al.* in press).

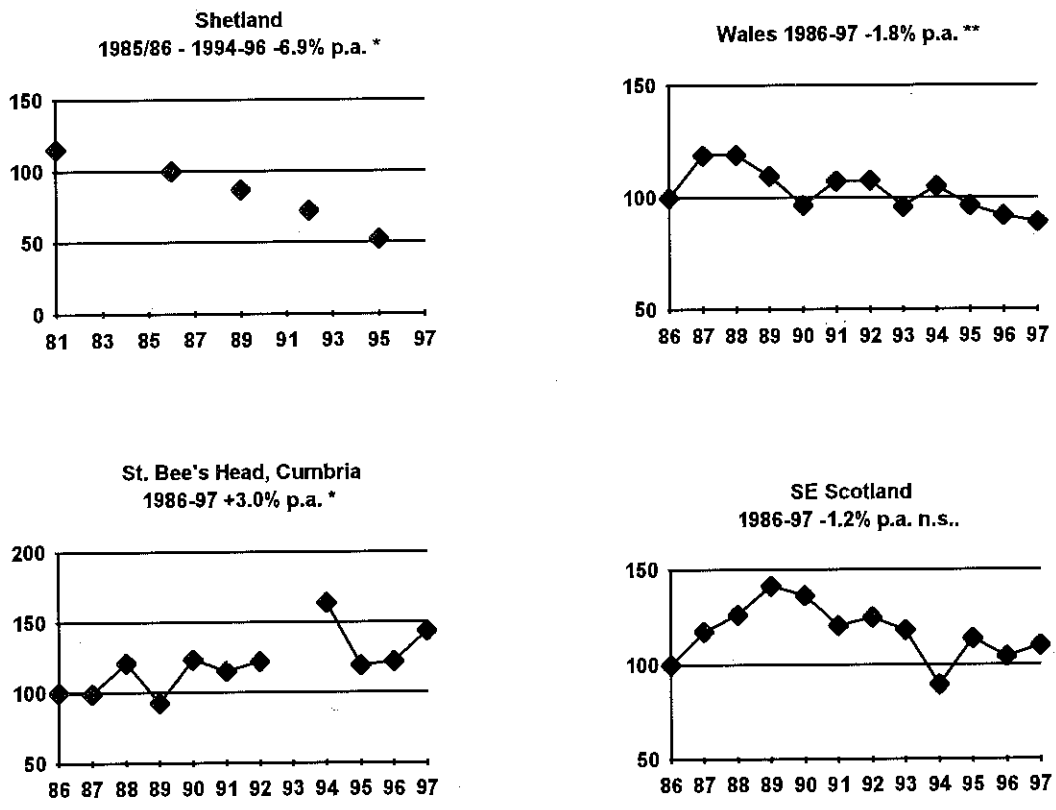


Figure 2.16.1 Sample population indices for breeding kittiwakes, 1986-1997. Average annual rates of change as shown were calculated by regression of natural log of index against year (see section 1.2.2. for details). Statistical significance of trends (t-test) indicated as: n.s. not significant, \* P < 0.05; \*\* P < 0.01. For Shetland, chain indices are presented for 1981, 1985-87 (plotted as 1986), 1988-90, 1991-93 and 1994-96.

**Table 2.16.1** Population changes at monitored kittiwake colonies, 1995-97 (apparently occupied nests in late May or June) and 1986-96 population trends. Data for 1995 are shown only where all colonies counted in both 1996 and 1997 were also counted in 1995. Counts with a reported inaccuracy of  $> \pm 5\%$  and regional samples  $< 100$  AONs are excluded. Average annual rates of change for 1986-96 were calculated by regression of natural log of index against year (see section 1.2.2. for details). Statistical significance of trends (t-test) indicated as: n.s. not significant, \*  $P < 0.05$ .

	SW Scotland	NW Scotland	Shetland	NE Scotland 1986-95	SE Scotland	NE England
1986-96 % annual change	+2.2 n.s.	+1.1 n.s.	-6.9 *	+6.0% n.s.	-1.3 n.s.	+1.5 n.s.
1995	1085	-	-	1125	-	18363
1996	1003	2553	4608	805	24147	14088
1997	1183	2694	4128	807	25514	13746
1996-97 % change	+18.2 <sup>a</sup>	+5.5 <sup>b</sup>	-11.8 <sup>c</sup>	+0.2 <sup>d</sup>	+5.7 <sup>e</sup>	-2.4 <sup>f</sup>

	E England	SE England	Wales	NW England	NE Ireland	SE Ireland
1986-96 % annual change	-	+0.1 n.s.	-1.6 *	+2.9 *	+3.0 n.s.	+1.1 n.s.
1995	281	2822	-	1189	788	2150
1996	233	2266	5557	1213	746	1988
1997	236	1978	5221	1427	809	2109
1996-97 % change	+1.3% <sup>g</sup>	-12.7 <sup>h</sup>	-6.0 <sup>i</sup>	+17.6 <sup>j</sup>	+8.4 <sup>k</sup>	+6.1 <sup>l</sup>

Colonies: <sup>a</sup> Mull of Galloway, Lunga; <sup>b</sup> Canna, SE Rum; <sup>c</sup> Hermaness, Sumburgh Head, Ness, Ramna Geo, Westerwick, Eshaness & Fair Isle (productivity plots), Foula; <sup>d</sup> Fowlsheugh (plots), Covesea, Portknockie; <sup>e</sup> Isle of May, Inchkeith, Craigleith, Lamb, Fidra, Inchcolm, Bass Rock, St. Abb's Head, Dunbar; <sup>f</sup> Farne Islands, Gateshead, Coquet, Saltburn, Huntcliff; <sup>g</sup> Lowestoft, Sizewell; <sup>h</sup> Fan Bay-West Langdon Cliffs (3 colonies); <sup>i</sup> New Quay Head, Llangrannog, Ramsey, Elegug Stacks, Grassholm, Skomer, Stackpole NNR, St. Margaret's, Bardsey, Great Orme, Little Orme; <sup>j</sup> St. Bees Head; <sup>k</sup> Rathlin (plots), Guns Island; <sup>l</sup> Dunmore East, Portally, Ireland's Eye.

There has also been a significant decline since 1986 in numbers of kittiwakes breeding in sample colonies in Wales. However, the further apparent decline seen in 1997 may be at least partly attributable to early losses of nests in May gales on Skomer, the largest colony. In north-west England, there was a further increase in breeding pairs at St. Bees Head, in line with the overall trend since 1986 (Figure 2.16.1).

In Orkney, counts of five Mainland colonies in 1997 indicated an overall decline of 10.2% since these colonies were last surveyed in 1994. However, the extent of the decline varied inversely with colony size, ranging from just 1.0% at the largest (holding nearly 5000 pairs) to 37.3% at the smallest (holding under 500 pairs). In south-west Ireland, counts at four colonies in County Cork, holding a total of 1983 pairs, were little changed (+2.3%) since the previous count in 1993, although numbers remain well below those recorded at the same colonies in 1985 (2688 pairs).

#### *Breeding success* (Table 2.16.2, Figure 2.16.2)

Kittiwake breeding success in 1997 averaged 0.61 (s.e.  $\pm 0.06$ ) chicks fledged per breeding pair at 47 colonies, compared with the 1986-96 mean of 0.74 (s.e.  $\pm 0.03$ ) across 30 to 61 colonies annually, and 0.74 (s.e.  $\pm 0.06$ ) at 49 colonies monitored in 1996. Across a total of 44 colonies monitored in both

seasons, there was a highly significant average reduction in breeding success of -0.17 (s.e.  $\pm$  0.06) chicks fledged per breeding pair. However, this figure masks marked regional differences, as detailed below.

**Table 2.16.2** Kittiwake breeding success, 1996-97: estimated number of chicks fledged per occupied, well-built nest at sample colonies (superscript n = number of colonies). Figures are presented as the mean and standard error of figures for individual colonies. Changes in breeding success are indicated for colonies studied in both years (significant changes, as indicated by *t*-test: \*  $P < 0.05$ , \*\*  $P < 0.01$ ).

Region	1996 chicks fledged/nest				1997 chicks fledged/nest				1996-97 change	
	nests <sup>n</sup>	range	mean	$\pm$ s.e.	nests <sup>n</sup>	range	mean	$\pm$ s.e.	mean <sup>n</sup>	$\pm$ s.e.
SW Scotland <sup>a</sup>	125 <sup>1</sup>		0.86		91 <sup>1</sup>		0.74		-0.12 <sup>1</sup>	
NW Scotland <sup>b</sup>	1077 <sup>3</sup>	0.62-1.59	1.05	$\pm$ 0.28	1358 <sup>3</sup>	0.01-1.38	0.78	$\pm$ 0.41	-0.27 <sup>3</sup>	$\pm$ 0.18
Shetland <sup>c</sup>	2731 <sup>9</sup>	0.00-1.23	0.61	$\pm$ 0.13	2739 <sup>9</sup>	0.00-0.75	0.28	$\pm$ 0.09	-0.33 <sup>9</sup>	$\pm$ 0.11 *
Orkney <sup>d</sup>	1125 <sup>6</sup>	0.98-1.23	1.14	$\pm$ 0.04	1128 <sup>6</sup>	0.54-1.53	1.05	$\pm$ 0.15	-0.09 <sup>6</sup>	$\pm$ 0.12
N Scotland <sup>e</sup>	221 <sup>1</sup>		0.50		238 <sup>1</sup>		0.26		-0.24 <sup>1</sup>	
NE Scotland <sup>f</sup>	768 <sup>3</sup>	0.10-0.53	0.26	$\pm$ 0.13	690 <sup>3</sup>	0.16-0.37	0.23	$\pm$ 0.07	-0.08 <sup>2</sup>	$\pm$ 0.08
SE Scotland <sup>g</sup>	1988 <sup>4</sup>	0.24-1.06	0.65	$\pm$ 0.17	1882 <sup>3</sup>	0.40-0.95	0.68	$\pm$ 0.16	-0.11 <sup>3</sup>	$\pm$ 0.18
NE England <sup>h</sup>	1536 <sup>5</sup>	1.14-1.28	1.22	$\pm$ 0.02	1683 <sup>5</sup>	0.20-0.87	0.59	$\pm$ 0.12	-0.62 <sup>5</sup>	$\pm$ 0.11 **
E England <sup>i</sup>	192 <sup>1</sup>		1.13		152 <sup>1</sup>		0.81		-0.32 <sup>1</sup>	
SE England <sup>j</sup>	88 <sup>1</sup>		1.12		96 <sup>1</sup>		1.18		+0.06 <sup>1</sup>	
SW England <sup>k</sup>	598 <sup>5</sup>	0.18-1.06	0.72	$\pm$ 0.16	206 <sup>3</sup>	1.17-1.29	1.21	$\pm$ 0.04	+0.62 <sup>2</sup>	$\pm$ 0.50
I. of Man <sup>l</sup>	101 <sup>1</sup>		0.00		54 <sup>1</sup>		0.15		+0.15 <sup>1</sup>	
Wales <sup>m</sup>	2151 <sup>6</sup>	0.00-1.22	0.56	$\pm$ 0.19	2079 <sup>6</sup>	0.22-0.85	0.55	$\pm$ 0.10	-0.01 <sup>6</sup>	$\pm$ 0.16
NE Ireland <sup>n</sup>					144 <sup>1</sup>		1.11			
SE Ireland <sup>p</sup>	1483 <sup>3</sup>	0.02-0.48	0.24	$\pm$ 0.13	1516 <sup>3</sup>	0.05-0.38	0.23	$\pm$ 0.10	0.003 <sup>3</sup>	$\pm$ 0.05
Total	14184 <sup>49</sup>	0.00-1.59	0.74	$\pm$ 0.06	13696 <sup>47</sup>	0.00-1.53	0.61	$\pm$ 0.06	-0.17 <sup>44</sup>	$\pm$ 0.06 **

Colonies: <sup>a</sup> Ailsa Craig; <sup>b</sup> Canna, Handa, St. Kilda; <sup>c</sup> Ness, Hermaness, Eshaness, Westerwick, Foula, Noss, Ramna Geo, Sumburgh Head, Fair Isle; <sup>d</sup> Papa Westray, Rousay, Marwick Head, Row Head, Mull Head, Gultak; <sup>e</sup> North Sutor; <sup>f</sup> Bullers of Buchan, Sands of Forvie, Fowlsheugh; <sup>g</sup> Isle of May, Fidra (1996 only), Dunbar, St. Abb's Head; <sup>h</sup> Farn Islands, Coquet Island, Gateshead, Saltburn, Bempton; <sup>i</sup> Lowestoft; <sup>j</sup> South Foreland; <sup>k</sup> Durlston Head-St. Albans Head, North Hallsands, Lundy (1996 only), Dollar Cove (1996 only), Isles of Scilly; <sup>l</sup> Contrary Head-Traie Cronkan; <sup>m</sup> Elegug Stacks, Skomer, Bardsey, Great Orme, Ramsey, St. Margaret's; <sup>n</sup> Rathlin (1997 only); <sup>p</sup> Dunmore, Portally, Ram Head.

In Shetland, kittiwakes had their worst breeding season since 1990, fledging an average of just 0.28 (s.e.  $\pm$  0.09) chicks per AON, compared with the 1991-96 mean of 0.68 (s.e.  $\pm$  0.05). Predation by great skuas again contributed to the poor performance at some colonies, notably Sumburgh Head and Eshaness, but another factor appeared to be low availability of sandeels during early July. Many small chicks died in this period and adult attendance of broods declined. However, this food shortage appeared relatively short-lived, and breeding performance, although very low, was not reduced by as much as was seen during the peak years of the sandeel crisis of the late 1980s and early 1990s (Figure 2.16.2). In Orkney, there was no evidence of food shortages and average breeding success again exceeded one chick per breeding pair. The colony at Marwick Head was the most successful of all those monitored in 1997, fledging a colony record average of 1.53 young per AON.

Along the east coast of Britain, severe north-easterly gales with associated rain and heavy seas destroyed large numbers of kittiwake nests at exposed colonies in late June, resulting in a considerable reduction in breeding success at the majority of colonies monitored. Across thirteen east coast colonies monitored in both 1996 and 1997, the mean decline in breeding success was a statistically highly significant 0.32 (s.e.  $\pm$  0.09) chicks fledged per breeding pair. This is in marked contrast with west coast and Irish colonies, which showed no significant mean change (+0.02, s.e.  $\pm$  0.10). Colonies in north-east England were particularly severely affected by the gales, with average breeding success falling from 1.22 (s.e.  $\pm$  0.02) chicks fledged per pair in 1996 to 0.59 (s.e.  $\pm$  0.12) in 1997. Across eastern England as a whole, average breeding success (0.71, s.e.  $\pm$  0.12) was the lowest recorded in twelve years of monitoring (1986-96 mean 1.10, s.e.  $\pm$  0.03). However, it should be noted that, despite some of the more dramatic press reports at the time of the gales, even this reduced level of productivity is higher than the averages recorded in all but one of the previous eleven years at colonies bordering the southern Irish Sea (Figure 2.16.2). In eastern Scotland, the picture was more mixed, with no significant overall change in breeding performance from 1996, although average numbers of chicks fledged per pair at both North Sutor (0.26) and at Fowlsheugh (0.37) were well below average for these colonies.

In western Scotland, Wales and south-east Ireland, breeding success at most colonies was within the ranges recorded in recent years. One notable exception to this was St. Kilda, where there was almost complete breeding failure (0.01 chicks fledged per pair) following desertion of the colonies by breeding adults in July. This was in marked contrast to the two other monitored colonies in north-west Scotland, Canna (0.95 chicks fledged per pair) and Handa (1.38 chicks fledged per pair). The reason for the failure at St. Kilda is unknown. On the Isle of Man, kittiwakes at the Contrary Head - Traie Cronkan colony fledged a few young (0.15 per pair) after two years of complete breeding failure.

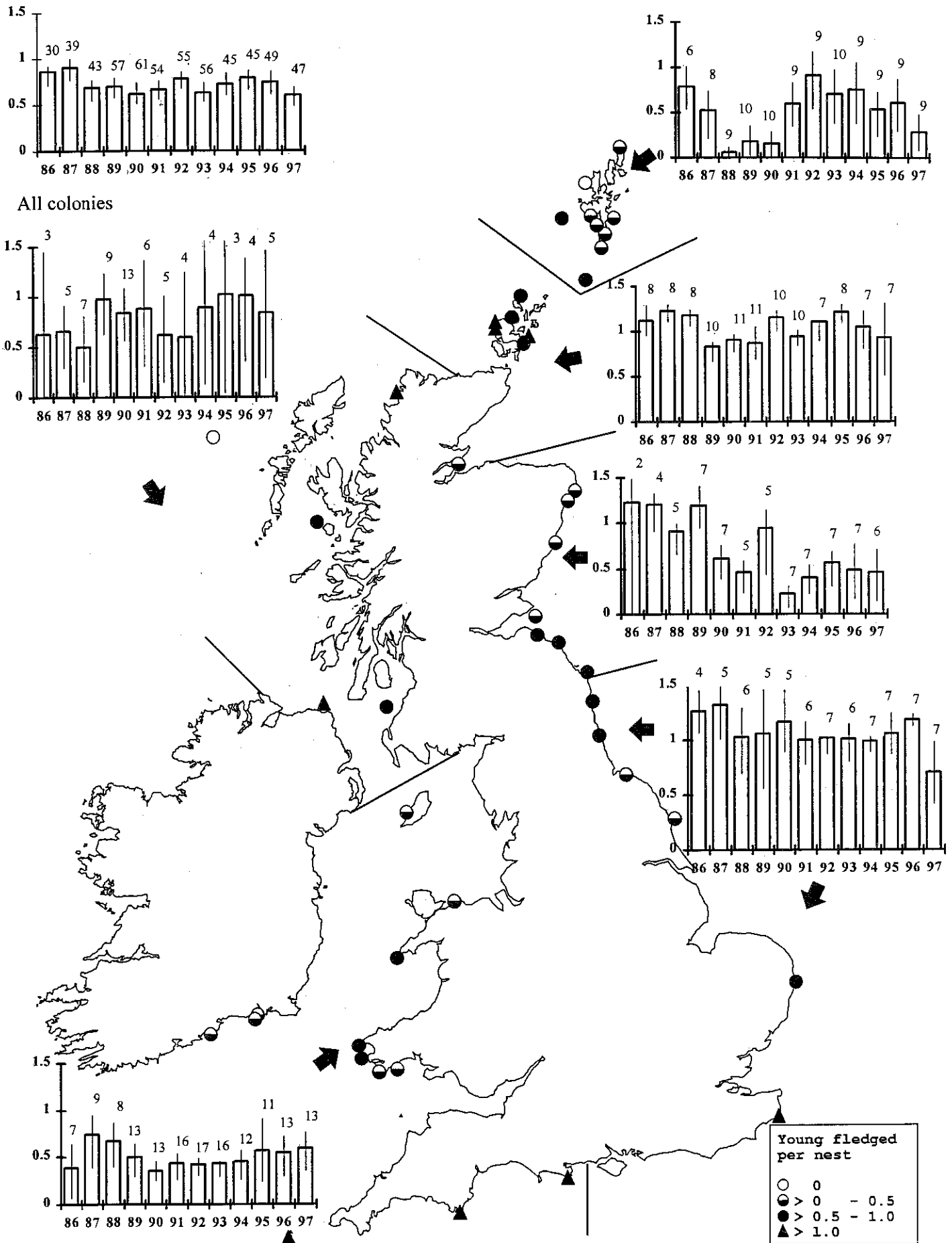


Figure 2.16.2 Breeding productivity (chicks fledged per well-built nest) at kittiwake colonies during 1986-96, showing regional and annual variation. Symbols on map represent 1996 figures for individual colonies; histograms show annual averages for each region (with 95% confidence limits and numbers of colonies).

## 2.17 Sandwich Tern *Sterna sandvicensis*

### Breeding numbers (Tables 2.17.1 & 2.17.2)

Overall numbers of Sandwich terns at monitored colonies in Britain and Ireland declined by 5.5% in 1997, following some increase in the previous year.

In Scotland, the decline was similar to that seen between 1995 and 1996. No breeding pairs settled at Loch Ryan in south-west Scotland in 1997. In north-east Scotland, numbers at Strathbeg remained similar to 1996 (375 pairs), at 355 pairs, while four pairs nested at Sands of Forvie. In south-east Scotland, no pairs settled to breed.

In north-east England, however, numbers increased substantially at the Farnes, by 14% to 2484 pairs in 1997. Numbers also increased at Coquet, to 1659 nests. At two colonies monitored in east England, numbers declined from 3950 pairs in 1996 to 3220 pairs in 1997. In south-east England, numbers increased at four colonies, from 317 pairs to 386 pairs, with a large increase from 12 to 91 pairs at Langstone Harbour. At Dungeness, all 110 apparently occupied nests (AONs) present at the end of May failed. At Brownsea, in south-west England, numbers continued to increase, to 165 pairs. However on Anglesey, numbers dropped by 33% to 450 pairs, a reversal of the trend seen in previous years and only the second time in ten years that breeding numbers have fallen below 500 pairs.

Breeding numbers dropped at Inch Island, north-west Ireland, from 240 to approximately 149 pairs. Flooding in mid-May led to the loss of many nests. A habitat creation scheme had allowed the build-up of a raised platform that was used by relaying birds, and the figure of 149 probably includes relays. At Lady's Island Lake (Co. Wexford), breeding numbers were the lowest for eight years (1050 pairs). In north-east Ireland, breeding numbers increased overall, with numbers at Green Island almost doubling, perhaps as a result of birds moving from Swan Island.

**Table 2.17.1** Population changes at monitored Sandwich tern colonies, 1996-1997 (breeding pairs). Trends for 1986-96 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, \*  $P < 0.05$ , \*\*  $P < 0.01$ . Further details of calculation of trends are given in section 1.2.2. Superscript = number of colonies counted in both years.

	SW Scotland	NE Scotland	SE Scotland	NE England	E England	SE England
1986-96 annual % change	-	-10.4*	-36.9**	-3.1**	+1.0 n.s.	-4.7**
1996	19	376	2	3690	3950	317
1997	0	359	0	4143	3220	386
1996-97 % change	-100.0 <sup>1</sup>	-4.5 <sup>2</sup>	-100.0 <sup>2</sup>	+12.3 <sup>2</sup>	-18.5 <sup>2</sup>	+21.8 <sup>4</sup>
	SW England	NW England	Wales	NE Ireland	NW Ireland	SE Ireland
1986-96 annual % change	+7.7 n.s.	-6.2 n.s.	-2.0 n.s.	-6.0 n.s.	+0.1 n.s.	+9.6*
1996	140	360	c650-700	1468	240	1358
1997	165	230	450	1728	149	1050
1996-97 % change	+17.9 <sup>1</sup>	-36.1 <sup>1</sup>	-33.3 <sup>1</sup>	+17.8 <sup>3</sup>	-37.9 <sup>1</sup>	-22.7 <sup>1</sup>

**Table 2.17.2** Numbers of Sandwich tern breeding pairs at regularly counted colonies in Britain and Ireland, 1987-1996. (- indicates that no data were available)

Colony	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Loch of Strathbeg	130	404	239	121	283	304	515	923	481	375	355
Sands of Forvie	1082	664	744	1126	1115	29	0	0	0	1	4
Inchmickery	656	383	272	418	473	112	9	98	1	0	0
Coquet Island	1586	1616	1164	1203	1736	2131	1469	1611	1543	1511	1659
Farne Islands	2870	3408	3445	2846	2126	2730	2349	c1750	1837	2179	2484
Scolt Head	3089	2775	1052	0	320	280	853	2406	1588	450	220
Blakeney Point	475	1000	1500	3000	3000	4000	3000	1000	1450	3500	3000
Minsmere	0	0	0	5	20	0	0	0	23	0	0
Havergate	200	63	50	60	84	70	125	300	250	104	-
Foulness/Maplin	243	350	300	280	280	548	275	405	330	53	-
Dungeness	3	125	220	240	250	250	40	0	0	120	110
Rye Harbour	155	0	3	25	2	0	90	c125	c100	12	c30
Pagham Harbour	0	0	0	26	2	0	0	0	0	0	0
Chichester Harbour	27	0	15	22	5	27	45	9	0	0	0
Langstone Harbour	0	3	2	0	0	0	0	0	0	12	91
North West Solent	220	305	198	150	151	150	85	148	233	173	155
Pitts Deep-Hurst	50	70	-	25	0	90	103	150	-	-	-
Brownsea Island	25	72	90	64	75	82	120	70	107	140	165
Anglesey	700	1080	830	517	601	500	564	400	650	650	450
South Walney	180	0	0	0	0	450	0	0	0	0	-
Foulney	550	700	770	720	332	0	253	380	343	0	-
Hodbarrow	0	0	50	120	520	360	100	0	59	360	230
Swan Island	74	117	138	130	135	132	c64	152	234	255	4
Green Island	286	78	36	59	172	108	c721	449	270	502	935
Strangford Lough	2127	2228	962	1482	879	657	587	346	532	711	789
Lady's Island Lake	708	412	1317	1395	1469	1129	1254	1447	1130	1358	1050
Lough Swilly	102	73	76	109	99	116	119	220	222	240	149
Mulroy Bay	98	225	240	79	76	107	117	23	0	0	0
Total	15639	16150	13763+	14122	14205	14333	12857	12412	11183	12706	11880

*Breeding success* (Table 2.17.3)

Breeding success at Loch of Strathbeg was again low in 1997, with a minimum of 0.18 chicks fledged per pair. This was the only colony in Scotland to record fledged young in 1997. The only other extant colony to attempt breeding was Forvie, where no young fledged from the four nests.

In north-east England, at Coquet, approximately 0.5 young fledged per pair, lower than in the previous two years when productivity was over 0.7 per pair. At the two monitored colonies in eastern England, high tides washed out all 220 pairs at Scolt Head, while 3000 pairs at Blakeney fledged 1500 young (0.5 per pair). In south-east England, all 110 nests at Dungeness failed at the end of May with evidence of mink (*Mustela vison*) predation and disturbance by badgers (*Meles meles*). Badgers were also suspected at Rye, where 36 pairs failed to raise any young. However, Sandwich terns had a better season at Langstone Harbour, with 41 fledged from 91 pairs, and also at North Solent, where at least 100 young fledged from 155 pairs. Although breeding numbers declined at Cemlyn (Wales), breeding success was high, with over 600 young thought to have fledged from the 450 pairs (1.3 young/pair).

At Hodbarrow in Cumbria, a successful season resulted in more than 200 young fledging from 230 pairs (0.87 per pair), much improved on the previous two years, when productivity ranged from 0.0 to 0.28 fledged young per pair.

A total of 131 young was ringed at the colony at Inch Island, north-west Ireland, giving a maximum productivity figure of 0.88 per pair.



**Table 2.17.3** Sandwich tern breeding success, 1996-1997: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). Note that the same colonies have not necessarily been monitored in each region each year and that the numbers of pairs given here are sample sizes (and do not necessarily indicate population changes between years).

Region	1996 fledged/pair			1997 fledged/pair		
	prs <sup>n</sup>	range	total	prs <sup>n</sup>	range	total
NE Scotland	376 <sup>2</sup>		0.21	359 <sup>2</sup>	0.00-0.18	≥0.18
SE Scotland	2 <sup>1</sup>		0.00			
NE England	1511 <sup>1</sup>		c. 0.70	1659 <sup>1</sup>		c. 0.5
E England	4054 <sup>3</sup>	0.04-0.86	0.75	3220 <sup>2</sup>	0.00-0.50	0.47
SE England	320 <sup>5</sup>	0.00-1.88	1.43	386 <sup>4</sup>	0.00-0.64	0.36
SW England	140 <sup>1</sup>		0.87	165 <sup>1</sup>		0.70-1.30
Wales	650 <sup>1</sup>		≤1.18	450 <sup>1</sup>		1.33
NW England	360 <sup>1</sup>		0.28	230 <sup>1</sup>		0.87
NW Ireland	240 <sup>1</sup>		≤ 1.37	149 <sup>1</sup>		<0.88
SE Ireland	1358 <sup>1</sup>	0.00-1.88	≤ 0.89			
TOTAL	9011 <sup>17</sup>	0.00-1.88	0.68	6618 <sup>13</sup>	0.00-1.33	0.55

## 2.18 Roseate Tern *Sterna dougalli*

### Breeding numbers (Table 2.18.1)

In 1997, overall breeding numbers in the UK continued to decline to 50 pairs, which is the lowest total ever recorded. Breeding numbers were also lower than in 1996 in the Republic of Ireland.

**Table 2.18.1** Roseate tern numbers (breeding pairs) at major colonies (those holding at least 20 pairs in at least one year) during 1986-1997, and breeding success (chicks fledged/pair) in 1997.

Region: Colony	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Chicks per pair 1997
<b>SE Scotland:</b>													
Inchnickery	18	20	21	5	0	0	0	0	2	0	0	0	0.00
Forth B	-	2	12	-	15	23	17	17	7	11	7	8	1.00
<b>NE England:</b>													
Farne Islands	9	14	21	12	4	3	4	3	2-3	2	2	3	1.66
Coquet Island	20	17	21	25	23	20	29	c30	c38	38	24	25	0.68
New colony	0	0	0	0	0	0	0	0	0	1	14	2	1.00
<b>Wales</b>													
Anglesey A	200	40	45	70	35	1	0	16	18	0	0	2	1.00
Anglesey B	0	21	0	19	7	0	0	0	0	0	0	0	0.00
<b>NE Ireland:</b>													
Larne Lough	21	25	23	37	19	4	3	0	4	7	13	7	0.70
Carlingford	34	40	7	25	3	0	0	0	0	0	0	2	-
<b>SE Ireland</b>													
Rockabill	177	250	332	194	321	366	378	427	394	554	557	602	1.06
Lady's Island	0	8	0	76	60	56	76	76	140	60	120	48	1.22
TOTAL*	490	450	480	470	490	450	520	578	614	686	744	701	

\* includes pairs noted at other sites in the UK and Republic of Ireland.

In eastern Scotland, birds bred at only one colony, in the Firth of Forth, where they increased from seven to eight pairs. In north-east England, overall numbers at three colonies fell from 43 to 30 pairs, with 25 pairs at Coquet, three pairs on the Farnes and only two pairs at Sunderland Docks. No birds bred on the Isles of Scilly. Two sites were occupied in Anglesey in 1997, with one pair on the Skerries for the first time in many years.

A total of nine pairs bred at two sites in Northern Ireland, seven pairs at Larne Lough and two pairs at Carlingford Lough for the first time since 1990. The numbers of roseate terns in the Republic of Ireland also declined slightly in 1997. At Lady's Island Lake, Co. Wexford, overall breeding numbers were 61% lower than in 1996, at 48 nests. All tern species at Lady's Island bred in lower numbers than in recent years, probably due to a combination of weather, disturbance from black-headed gulls (*Larus ridibundus*) and greylag geese (*Anser anser*), and lush vegetation growth early in the season (Aspey *et al.* 1997). At Rockabill, however, 602 nests were found by the end of June, an increase on the 1996 figure of 563.

#### *Breeding success* (Table 2.18.1)

The one colony in Scotland fledged one chick per pair in 1997. At Coquet, north-east England, gales in June led to high chick mortality and an overall productivity of only 0.68 chicks per pair. Productivity was higher, however, at the Farne Islands and Sunderland Docks, where 1.66 chicks per pair and 1.00 chick per pair fledged respectively. While two pairs at one of the occupied sites in Anglesey fledged two chicks (1.00 per pair), the pair nesting on the Skerries was unsuccessful.

In Northern Ireland, 0.7 chicks per pair fledged at Larne Lough. In south-east Ireland, productivity at Lady's Island Lake was estimated at 1.22 chicks per pair, slightly higher than the 1.07 per pair in 1996, although monitoring methods were slightly different between years. Rockabill also had another good season, with productivity (assessed from a study plot) of 1.06 chicks per pair. However, poor weather played a large role in increased egg and chick mortality in 1997, with eggs and chicks being blown and washed off the island, as well as being buried under debris (Mundy & Millet 1997). Feeding observations at Rockabill indicated that the main prey in the pre-laying period was sandeel (*Ammodytes* spp.); during the chick rearing period, however, sprats (*Sprattus sprattus*) were more frequently brought back to chicks than sandeels. In contrast, at Lady's Island Lake, sandeels formed the largest part of the chick diet.

## 2.19 Common Tern *Sterna hirundo*

### *Breeding Numbers* (Table 2.19.1)

At eleven study colonies in western Scotland, there was a total of 1029 clutches in 1997. Over the past two years, former breeding areas have been recolonised following an intensive programme of mink (*Mustela vison*) trapping in the area (Craik 1997).

In north Scotland, overall numbers remained little changed at five monitored colonies, with a total of 324 pairs (345 pairs in 1996), although this masked a large increase at Alness Point from 105 to 200 pairs, and a decline at Nigg from 175 to 104 pairs. In north-east Scotland, breeding numbers continued to increase at St. Fergus, bringing the total recorded at five colonies in this area to 403 pairs, from 317 pairs in 1996. At ten colonies in south-east Scotland that were occupied in both 1996 and 1997, overall breeding numbers also increased, from 963 pairs to 1057 pairs.

At four colonies monitored in both years in north-east England, overall breeding numbers also increased, from 631 to 828 pairs, with a large increase at Coquet from 611 pairs in 1996 to 806 pairs in 1997. Numbers declined slightly at eight colonies in east England between 1996 and 1997, from 733 pairs to 669 pairs. However, an increase was evident at seven colonies in south-east England, where numbers rose from 488 pairs to 609 pairs. At Brownsea, south-west England, 184 pairs bred.

The six regularly occupied colonies in Wales also increased, by 19.7% to 553 pairs, in 1997, with most of this increase taking place at Shotton, which had declined in numbers between 1995 and 1996. By contrast, in north-west England, there was a decline in overall numbers at four regularly occupied colonies, from 318 pairs to 255 pairs in 1997. This is largely explained by a decline at the Ribble Estuary.

In north-east Ireland, breeding numbers declined at Swan Island, from 253 pairs to 135 pairs, but remained stable at Strangford Lough with 562 pairs (563 in 1997). There were also 352 pairs at Green Island in Carlingford Lough. In south-east Ireland, numbers at Rockabill continued to increase, to 479 pairs in 1997, while falling slightly at Lady's Island Lake, to 351 pairs. Two sites were occupied in Dublin port, holding a total of 114 pairs.

**Table 2.19.1** Population changes at monitored common tern colonies, 1996-1997 (breeding pairs).  
Superscript = number of colonies counted in both years.

	NW & SW Scotland	N Scotland	NE Scotland	SE Scotland	NE England	E England
1996	1003	345	317	963	631	733
1997	966	324	403	1057	828	669
1996-97 % change	-3.7 <sup>7</sup>	-6.1 <sup>5</sup>	+27.1 <sup>5</sup>	+9.8 <sup>10</sup>	+31.2 <sup>4</sup>	-8.7 <sup>8</sup>
	SE England	SW England	NW England	Wales	NE Ireland	SE Ireland
1996	488	166	318	462	816	773
1997	609	184	255	553	697	830
1996-97 % change	+24.8 <sup>7</sup>	+10.8 <sup>1</sup>	-19.8 <sup>4</sup>	+19.7 <sup>6</sup>	-14.6 <sup>2</sup>	+7.4 <sup>2</sup>

*Breeding success* (Table 2.19.2)

Eleven colonies were monitored on the west coast of Scotland in 1997 and a mink control programme was continued, with mink killed at five colonies in the spring. At these five colonies, a total of 873 pairs fledged 722-942 young (0.83-1.08 per pair). However, at the remaining six colonies, mink took many young and only 13-23 young fledged from 156 pairs. Peregrine (*Falco peregrinus*) and otter (*Lutra lutra*) predation was also evident at several of the eleven colonies. Overall breeding success at the two colonies monitored in north Scotland was slightly improved on 1996, although still very low, at 0.19 chicks fledged per pair. In north-east Scotland, the situation was little better, with an average of 0.22 chicks fledged per pair at four colonies. At one of the largest colonies, St Fergus, only 24 chicks fledged from 246 pairs due to a combination of poor weather, disturbance and lack of food. Productivity was higher at two colonies in south-east Scotland, with one colony in the Firth of Forth fledging over 1.4 chicks per pair.

In north-east England, 142 young fledged from 221 pairs at seven monitored colonies (0.64 per pair). In east England, high tides in June washed out the majority of nests, with only 190 young fledging from 636 pairs at six colonies (0.30 young per pair). In south-east England, overall productivity at six colonies reached only 0.36 per pair, the largest colonies at Dungeness and Rye Harbour exhibiting signs of disturbance and predation by badgers (*Meles meles*) and foxes (*Vulpes vulpes*), and also by mink at Dungeness. Colonies in Wales had a varied season, with productivity at six colonies ranging from 0.00 to 1.22 young per pair (overall 1.00 young per pair). Three colonies in north-west England similarly had reasonable success, with 0.68 young fledged per pair overall

**Table 2.19.2** Common tern breeding success, 1996-97: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). Note that the same colonies have not necessarily been monitored in each region in each year. Numbers of pairs given here are sample sizes and are not necessarily indicative of population changes between years.

Region	1996 fledged per pair			1997 fledged per pair		
	prs <sup>n</sup>	range	total	prs <sup>n</sup>	range	total
SW Scotland	874 <sup>11</sup>	0.00-1.80	0.33-0.38	880 <sup>5</sup>	0.50-2.00	0.79-1.04
NW Scotland	275 <sup>7</sup>	0.00-2.13	0.29-0.37	149 <sup>6</sup>	0.00-1.88	0.32
N Scotland	457 <sup>7</sup>	0.00-0.24	0.08	204 <sup>2</sup>	0.15-0.26	0.19
NE Scotland	383 <sup>7</sup>	0.00-0.18	0.07	403 <sup>4</sup>	0.00-0.46	0.22
SE Scotland	608 <sup>7</sup>	0.00-0.66	0.02	197 <sup>3</sup>	0.37-1.50	0.76
SCOTLAND	2597 <sup>39</sup>	0.00-2.13	0.17-0.20	1833 <sup>20</sup>	0.00-2.00	c0.61
NE England	-	-	-	221 <sup>7</sup>	0.36-1.50	0.64
E England	860 <sup>8</sup>	0.00-0.73	0.50	636 <sup>6</sup>	0.00-0.85	0.30
SE England	518 <sup>7</sup>	0.25-1.00	0.46	499 <sup>6</sup>	0.00-1.00	0.36
SW England	166 <sup>1</sup>		0.57	184 <sup>1</sup>		0.16 max
NW England	150 <sup>4</sup>	0.00-0.38	0.26	155 <sup>3</sup>	0.00-1.25	0.68
ENGLAND	1694 <sup>20</sup>	0.00-1.00	0.47	1695 <sup>23</sup>	0.00-1.50	0.38
WALES	406 <sup>5</sup>	0.10-2.27	1.79	553 <sup>6</sup>	0.00-1.92	1.00
GREAT BRITAIN	4697 <sup>64</sup>	0.00-2.27	0.43	4081 <sup>49</sup>	0.00-2.00	0.57
SE Ireland	387 <sup>1</sup>		2.01	479 <sup>1</sup>		0.82

## 2.20 Arctic Tern *Sterna paradise*

### *Breeding numbers* (Table 2.20.1)

In western Scotland, 273 pairs of Arctic terns were monitored at thirteen sites in Argyll. Reports were received from three colonies in north Scotland, where numbers fell from 65 pairs in 1996 to 44 pairs in 1997. At St Fergus, in north-east Scotland, breeding numbers were also lower than in 1996, at 327 pairs (423 pairs in 1996). At four of five colonies monitored in both years in south-east Scotland, numbers were little changed, but at the Isle of May breeding pairs increased from 531 in 1996 to 630 in 1997.

In north-east England, numbers increased at Coquet, to 749 pairs, with 2459 pairs on the Farnes, while approximately 662 pairs bred at Long Nanny. In east England, fifteen to twenty pairs bred again at Blakeney and one pair at Scolt Head, similar to 1996. Breeding numbers at three colonies in Wales also increased, to 1247 pairs from 1202 pairs in 1996, with an increase of 24% (40 pairs) at one of the Anglesey colonies.

At Strangford Lough, Northern Ireland, 642 pairs of 'commic' tern were reported, plus an additional 80 pairs of Arctic tern and there were again *c.* 300 pairs at Big Copeland Island. In south-east Ireland, breeding numbers remained virtually unchanged at both Rockabill, where there were 66 pairs (67 pairs in 1996), and at Lady's Island Lake, which held 135 pairs (143 pairs in 1996).

**Table 2.20.1** Population change at monitored Arctic tern colonies, 1996-1997 (breeding pairs).  
Superscript = number of colonies counted in both years (including known colonies not occupied in 1996-97).  
Regional samples <100 pairs not included.

	NE Scotland	SE Scotland	NE England	Wales	SE Ireland
1996	423	565	3078	1202	210
1997	327	<i>c.</i> 660	3208	1247	201
1996-97 % change	-22.7 <sup>1</sup>	+16.8 <sup>5</sup>	+4.2 <sup>2</sup>	+3.7 <sup>3</sup>	-4.3 <sup>2</sup>

### *Breeding success* (Table 2.20.2)

Twenty-one colonies were monitored in Shetland in 1997. At these colonies, overall productivity was very low, at 0.14 young fledged per pair (range 0.00-0.52). This is the lowest figure since 1990, when no young survived to fledge from the study colonies. The reasons for failure at many colonies were unclear, although there was some evidence to suggest that the availability of suitably sized sandeels may have been poor for short periods in some areas (*cf* kittiwake species account). At twenty-one colonies studied throughout Orkney, overall productivity was much higher, at 0.51 young per pair. However, fledging success was mixed on different islands; while sites on Mainland, Rousay and Westray fared well, and appeared to have had a good supply of suitably sized sandeels throughout chick rearing, colonies on Westray, Papa Westray and Shapinsay suffered badly from north-easterly gales in early July. On Sanday, the majority of study colonies failed and feeding watches suggested that this was due to poor food availability.

In Argyll and Lochaber, mink (*Mustela vison*) were controlled at two Arctic tern colonies at which 70 pairs fledged approximately 63 young (0.89 young per pair). At eight colonies where there was no mink control, only 48 young fledged from 196 pairs (0.24 young per pair). At two small colonies in north Scotland, only three to four young fledged from 44 pairs (0.07 to 0.09 per pair), only marginally

better than in 1996, and at St Fergus, productivity was similarly low again, with only 15 young fledging from 327 pairs (0.05 per pair). It is thought that a combination of poor weather, disturbance and food shortages contributed to failure there. In south-east Scotland, the smaller colonies failed completely in 1997, due to predation by stoats (*Mustela erminea*), foxes (*Vulpes vulpes*) and gulls (*Larus* spp.), disturbance and tidal flooding. However, productivity on the Isle of May was reasonable, with a minimum of 0.53 young fledged per pair.

Surprisingly, the poor June weather did not appear to have affected Arctic tern productivity in north-east England. On Coquet, productivity at a sample of nests was 0.83 young per pair and on the Farnes, 2044 young were estimated to have fledged from 2459 pairs (0.83 per pair). Long Nanny saw lower productivity, with a maximum of 0.38 young per pair. However, at Blakeney in Norfolk, only two chicks fledged from fifteen to twenty pairs. The largest colony in Wales, Skerries, reported continued high productivity with 1.7 young per pair estimated to have fledged.

**Table 2.20.2** Arctic tern breeding success, 1996-1997: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). Note that the same colonies have not necessarily been monitored in each region each year and that numbers of pairs given here are sample sizes (and do not necessarily indicate population change between years). < = figures which may be substantial overestimates (mainly based on number of chicks ringed).

Region	1996 chicks fledged/pair			1997 chicks fledged/pair		
	prs <sup>n</sup>	range	total	prs <sup>n</sup>	range	total
SW Scotland	102 <sup>8</sup>	0.00-1.80	0.61	231 <sup>8</sup>	0.00-1.00	0.39
NW Scotland	8 <sup>3</sup>	0.00-1.66	0.75	35 <sup>3</sup>	0.00-0.63	0.57
Shetland	3624 <sup>22</sup>	0.00-0.62	0.25	3117 <sup>21</sup>	0.00-0.52	0.14
Orkney	2070 <sup>12</sup>	0.00-0.72	0.17	6740 <sup>21</sup>	0.00-1.56	0.51
N Scotland	110 <sup>4</sup>	0.00-0.08	0.03	44 <sup>2</sup>	0.05-0.20	0.09
NE Scotland	995 <sup>5</sup>	0.00-0.01	0.00	327 <sup>1</sup>		0.05
SE Scotland	34 <sup>4</sup>	0.00-2.20	0.97	661 <sup>5</sup>	0.00-0.53	0.51
NE England	-	-	-	3121 <sup>2</sup>	0.38-0.83	0.74
Wales	1202 <sup>3</sup>	0.09-1.20	1.00	1257 <sup>4</sup>	0.00-1.77	1.56
NW England	61 <sup>2</sup>	0.00-0.05	0.05	59 <sup>1</sup>		0.22
SE Ireland	67 <sup>1</sup>		<1.28			

## 2.21 Little Tern *Sterna albifrons*

### Breeding numbers (Table 2.21.1)

Overall breeding numbers at colonies in Scotland were lower than in 1996. Only 22 pairs bred at Forvie, the only colony at which birds were reported to breed in north-east Scotland. In south-east Scotland, a minimum of 46 pairs nested at three colonies, the largest of which was at the Eden Estuary which held 27-38 pairs, a decline from the 42-45 pairs that nested there in 1996.

In north-east England, eight occupied colonies held slightly higher numbers (206 pairs) of breeding pairs than in 1996 (187 pairs), the main increases being seen at Gibraltar Point and at Crimdon Dene, to where colour ringing has shown that birds have moved from Coatham. In east England, at fifteen colonies occupied in both years, breeding numbers also increased, by 33% to 602 pairs.

Six colonies were occupied in south-east England, and held similar numbers (168 pairs) to 1996 (149 pairs), although some of the smaller colonies in Kent (e.g. Sandwich Bay) were completely deserted. Langstone Harbour is now the largest colony in south-east England, birds perhaps having moved in from Chichester Harbour, which appears to have been abandoned as a breeding site. At Chesil (Dorset), breeding numbers remained high, at 100 pairs.

At the single colony in Wales, Gronant, numbers increased slightly again to 80+ pairs. At four colonies in north-west England, 36 pairs bred, a decline on the 1996 figures, with the main decline seen at Allonby, from 20 pairs in 1996 to eight pairs in 1997. At Kilcoole in south-east Ireland, 21-27 pairs bred in 1997.

**Table 2.21.1** Population changes at monitored little tern colonies, 1996-1997 (breeding pairs).  
Superscript = number of colonies counted in both years (including known colonies not occupied in 1996-1997).  
Regional samples <50 pairs are excluded.

	Scotland	NE England	E England	SE England	SW England	Wales	NW England	Britain
1996	86	187	454	149	95	78	54	1103
1997	73	206	602	168	100	80	36	1265
1996-97 % change	-15.1 <sup>6</sup>	+10.2 <sup>8</sup>	+32.6 <sup>15</sup>	+12.8 <sup>6</sup>	+5.3 <sup>1</sup>	+2.6 <sup>1</sup>	-33.3 <sup>4</sup>	+14.7 <sup>41</sup>

### Breeding success (Table 2.21.2)

Although overall breeding numbers at monitored colonies in Britain increased by 15% between 1996 and 1997, little terns generally had a very poor year in terms of breeding success. Many colonies were badly affected by storms and high tides at the end of June with many pairs suffering either nest or chick losses. Colonies on the east coast were particularly badly affected, electric fences at some sites being destroyed and enabling predators to enter. There appears to have been quite a bit of movement of birds between colonies after the storms.

Breeding success was very low in Scotland in 1997, due mainly to tidal flooding and storms in June. The only colony reported to have produced any young was Forvie where eight young fledged from 22 pairs, which were protected against foxes *Vulpes vulpes* by an electric fence. All three remaining colonies (in south-east Scotland) failed, for various reasons including human disturbance, tidal flooding and predation by foxes and stoats (*Mustela erminea*).

In north-east England, productivity was little better, with a minimum of 23 young fledging from 206 pairs (0.11 per pair) at eight colonies. Tidal flooding resulted in high chick mortality. The colony at Coatham has become progressively smaller over the past few years, probably largely due to the encroachment of marram grass and persistent fox predation. A colour-ringing programme at Coatham has established that birds have moved to a new site at Crimdon Sands, where 65 pairs bred in 1997. However, fox predation was severe at Crimdon Sands in 1997 and relay clutches were taken by magpies *Pica pica* and badly affected by the poor weather. In all, eleven chicks are thought to have fledged from a total of 129 clutches laid at Crimdon.

The main East Anglian colony, at Great Yarmouth, had a much more successful year in 1997 than in 1996. The provision of extra wardening staff enabled better protection from foxes. Over the twelve years that this colony has been wardened, breeding success has averaged 0.63 young per pair. Elsewhere in east England, 535 pairs at twelve monitored colonies fledged only 140 young, (0.26 young per pair) with ten of these colonies failing completely mainly as a consequence of high tides and storms at the end of June. Productivity data were recorded from five colonies in south-east England, and a total of 233 pairs fledged 70 young. In south-west England, productivity was very low at Chesil where only six young fledged from 100 pairs. At Gronant in Wales, productivity was similarly low at 0.11 per pair. Again, fox predation and poor weather accounted for most of the losses. Only 13 young fledged from 36 pairs at four monitored colonies in north-west England.

In south-east Ireland, the little tern colony at Kilcoole was protected for the first time by an electric fence that appears to have been successful in keeping out foxes; when the fence was damaged by storms, foxes immediately entered the colony. A sparrowhawk *Accipiter nisus* took several adults which is thought to have led to several further desertions. The little tern population in Ireland as a whole has declined considerably over the past ten years and Kilcoole is now the largest and most regularly used site on the Irish east coast.

**Table 2.21.2** Little tern breeding success, 1996-97: estimated number of chicks fledged per breeding pair at sample colonies (superscript = number of colonies). Note that the same colonies may not necessarily have been counted in each region each year and that numbers of pairs given here are sample sizes (and do not necessarily indicate population changes between years).

Region	1996 fledged/pair			1997 fledged/pair		
	pairs <sup>a</sup>	range	overall success	pairs <sup>a</sup>	range	overall success
N Scotland	5 <sup>1</sup>	-	0.00	-	-	-
NE Scotland	30 <sup>2</sup>	0.00-1.00	0.07	22 <sup>1</sup>		0.36
SE Scotland	55 <sup>3</sup>	0.75-1.49	≥1.19	c50 <sup>3</sup>		0.00
Scotland	90 <sup>6</sup>	0.00-1.49	≥0.73	c72 <sup>4</sup>	0.00-0.36	0.11
NE England	187 <sup>9</sup>	0.00-1.58	0.52	206 <sup>8</sup>	0.00-0.17	0.11
E England	671 <sup>20</sup>	0.00-0.61	0.27	535 <sup>12</sup>	0.00-0.68	0.26
SE England	184 <sup>6</sup>	0.00-0.77	0.62	233 <sup>5</sup>	0.00-0.53	0.30
SW England	90 <sup>1</sup>	-	0.41	100 <sup>1</sup>		0.06
Wales	78 <sup>1</sup>	-	1.41	80+ <sup>1</sup>		0.11
NW England	54 <sup>4</sup>	0.00-1.00	0.41	36 <sup>4</sup>	0.00-0.80	0.36
England & Wales	1269 <sup>41</sup>	0.00-1.58	0.42	1190 <sup>31</sup>	0.00-0.80	0.20
Total (GB)	1359 <sup>47</sup>	0.00-1.58	0.45	1262 <sup>35</sup>	0.00-0.80	0.19



## 2.22 Guillemot *Uria aalge*

### Breeding numbers (Table 2.22.1, Figure 2.22.1)

Guillemots on Canna (north-west Scotland) were noted as breeding much earlier than usual in 1997, and, in marked contrast to 1996, the breeding season on the Isle of May (south-east Scotland) was also earlier than normal, with the first chicks fledging on the night of 15-16 June. An early breeding season may result in underestimates of numbers of breeding birds, as some chicks and adults will have left the cliffs within the normal recommended counting period.

Little change in numbers was evident at monitored colonies in western Scotland in 1997. However, at colonies in eastern Scotland and north-east England, numbers of adults on the cliffs increased, in line with longer-term trends (Figure 2.22.1). The increases in numbers in sample plots at Fowlsheugh (10.0%), Isle of May (13.5%) and St. Abb's (24.1%) were all statistically significant. There was also an overall increase from 1996 to 1997, of 10%, in numbers of guillemots attending monitoring plots in Shetland, with the increases at Hermaness (8.1%), Noss (16.5%), Troswick Ness (17.5%) and Fair Isle (8.2%) being statistically significant. However, there has been no overall change in guillemot numbers in Shetland since 1986 (Figure 2.22.1).

**Table 2.22.1** Population changes at monitored guillemot colonies, 1996-97 (adults attending colony in first three weeks of June). Trends for 1986-96 are average annual rates of change shown by sample populations. Significance of trends (t-test) indicated as: n.s. not significant, \*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Further details of calculation of trends are given in section 1.2.2.

**2.22.1a** Counts of birds in study plots. Figures are summed means of 5-10 annual counts of study plots.

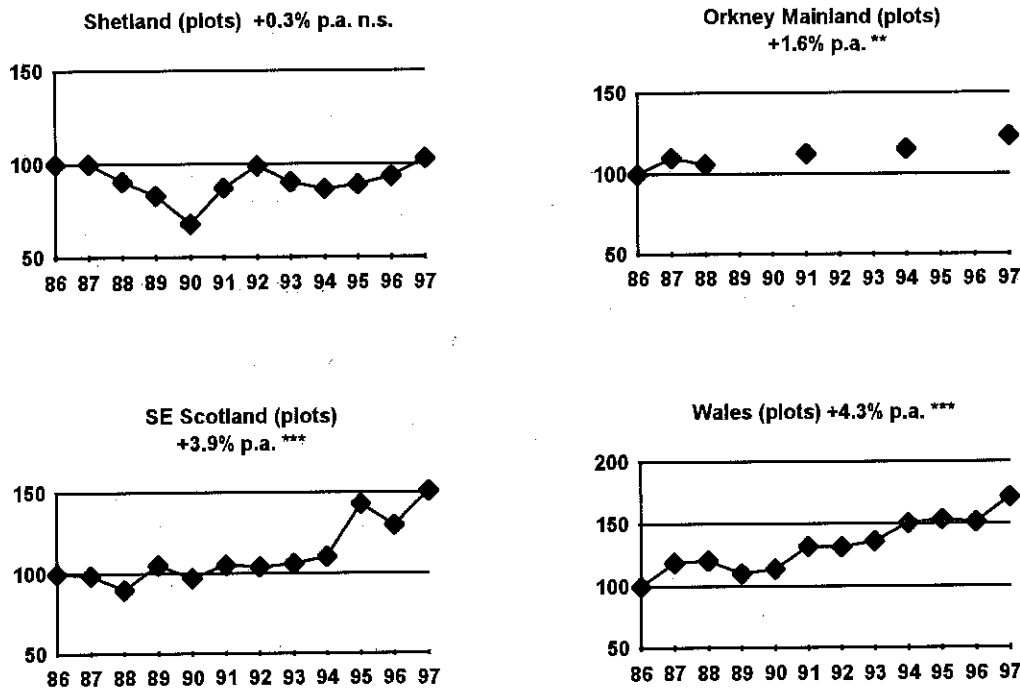
	NW Scotland		Orkney	NE Scotland	SE Scotland	Wales	NE Ireland
1986-96 annual % change	+0.9 n.s.	-0.4 n.s.	+3.8 n.s.	+5.4***	+3.3**	+4.0***	+0.9 n.s.
1996	2057	11441	264	3206	5390	4777	(2946)
1997	2065	12592	303	3528	6274	5414	(3283)
1996-97 % change	+0.4 <sup>a</sup>	+10.1 <sup>b</sup>	+14.8 <sup>c</sup>	+10.0 <sup>d</sup>	+16.4 <sup>e</sup>	+13.3 <sup>f</sup>	+11.4 <sup>g</sup>

Colonies: <sup>a</sup> Handa; <sup>b</sup> Hermaness, Sumburgh Head, Burrae, Eshaness, Noss, Troswick Ness, Fair Isle; <sup>c</sup> Papa Westray; <sup>d</sup> Fowlsheugh; <sup>e</sup> Isle of May, St. Abb's Head; <sup>f</sup> Skomer, Skokholm, Stackpole NNR, Elegug Stacks; <sup>g</sup> Rathlin Island (figures are sum of mean counts for three individual plots).

**2.22.1b** Counts of whole colonies. Note that whole-colony counts should be treated with some caution as the numbers of birds attending colonies may vary markedly from day to day. Replicate study plot counts are better indicators of population change. Trends given for SW and SE Scotland are whole-colony counts for the Mull of Galloway and Isle of May respectively, those for NE England are whole-colony counts at the Farne Islands plus plot counts at Bempton, and those for NW England are whole-colony counts at St. Bee's Head.

	SW Scotland	SE Scotland	NE England	Wales	SW England	NW England/ I. of Man	SE Ireland
1986-96 annual % change	+4.9*	+2.8*	+3.7**	-	-	-1.1	-
1996	9840	33301	28650	24511	1336	5321	2468
1997	10121	36117	35073	27462	1373	6678	2268
1996-97 % change	+2.9 <sup>a</sup>	+8.5 <sup>b</sup>	+22.4 <sup>c</sup>	+12.0 <sup>d</sup>	+2.8 <sup>e</sup>	+25.5 <sup>f</sup>	-8.1 <sup>g</sup>

Colonies: <sup>a</sup> Mull of Galloway, Lunga (late June); <sup>b</sup> Isle of May, Inchkeith, Craigleith, Lamb, Bass Rock; <sup>c</sup> Farne Islands; <sup>d</sup> total of 33 colonies; <sup>e</sup> St. Alban's - Durlston, Berry Head (peak June count); <sup>f</sup> St. Bee's Head, Peel Hill; <sup>g</sup> Ireland's Eye.



**Figure 2.22.1** Population indices for breeding guillemots in various regions, 1986-97. Indices are derived from mean counts of adults in study plots in June. Trends for 1986-97 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, \*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Further details of calculation of trends are given in section 1.2.2.

In Orkney, a series of monitoring plots at five mainland colonies was counted in 1997 as part of a triennial monitoring scheme. Numbers of birds in these plots were 6.8% higher overall than in 1994 (Figure 2.22.1), and the increases at Row Head (12.1%), Gultak (26.8%) and Mull Head (15.7%) were all statistically significant. Numbers had also increased rapidly at Mull Head between 1988 and 1994, but have remained virtually stable at the largest colony, Marwick Head, over the past ten years. The Mainland data were mirrored by counts at Papa Westray, where numbers of birds in sample plots have increased steadily since 1994, with a significant increase of 14.8% from 1996 to 1997.

In Wales, sample plot counts at four colonies and whole-colony counts of over 30 colonies monitored in the wake of the *Sea Empress* oil spill, indicated an increase of between 12% and 13% in numbers of guillemots on breeding ledges. This is in line with the general trend since 1986, and follows some reduction in numbers in 1996 (Figure 2.22.1). There were statistically significant increases in guillemot numbers from 1996 to 1997 in sample plots at Elegug Stacks (+21.3%), Stackpole NNR (+27.9%), Skomer (+6.5%) and Skokholm (+18.8%).

In south-west England, there was little change in numbers of guillemots at the two colonies counted, but on Lundy a limited number of counts of sample plots suggested some increase since 1996 and in Cumbria, numbers at St. Bee's Head increased by over 25%. In western Ireland, a number of colonies last censused in the 1980s were counted in 1997. Numbers at Aughris Head (Sligo) were little changed from the mid-1980s, with 1211 birds present, but at Downpatrick Head (Mayo) numbers had more than doubled, to 1069 birds, since counts in 1985 and 1990. At Creevagh Head (Mayo), the count of 535 birds was some 20% below the numbers recorded in the mid 1980s.

*Breeding success (Table 2.22.2)*

Guillemots at many colonies were adversely affected by poor weather conditions in 1997. Mean breeding success was reduced from 0.79 (s.e.  $\pm 0.013$ ) chicks fledged per breeding pair across fifteen colonies in 1996, to 0.62 (s.e.  $\pm 0.06$ ) across fourteen colonies in 1997, significantly below the 1986-96 average of 0.75 (s.e.  $\pm 0.01$ ). Across thirteen colonies monitored in both years, there was a significant average change in mean breeding success of -0.16 chicks per pair.

At Sumburgh Head in Shetland, a freak wave washed many eggs off part of the study plot. Although most of the affected birds relaid, no chicks fledged from these second eggs. However, at Fair Isle, guillemots had a successful season. In Orkney, lower than average numbers of chicks fledged at two colonies, but good numbers at a third. At Bempton in Humberside, the severe gales at the end of June severely disrupted monitoring and guillemots had the worst breeding season ever recorded at this site. Only 0.18 chicks per breeding pair remained after the storm, compared with 0.49 previously. Many chicks were seen dead in the water, with others dying shortly after hatching. Major losses of guillemot eggs and chicks during the same storms were also reported from the Farne Islands. However, on the Scottish east coast, guillemots at North Sutor and at the Isle of May, had a successful breeding season

Although English east coast colonies were the worst hit, some Welsh colonies were also adversely affected by poor weather conditions. At Needle Rock, northerly gales in June washed most of the study chicks off the breeding ledges. Breeding performance was also lower than normal at Elegug Stacks, but guillemots on both Skokholm and Skomer fledged good numbers of chicks.

**Table 2.22.2** Guillemot breeding success, 1996-97 and colony averages: estimated number of chicks fledged per site regularly occupied by a pair or per pair laying. Superscript figures for individual colonies are numbers of study plots; colony figures are mean and standard error across all plots.

Colony	Colony average			1996 chicks fledged/pair			1997 chicks fledged/pair			1996-97 change
	years	mean	$\pm$ s.e.	sites <sup>n</sup>	mean	$\pm$ s.e.	sites <sup>n</sup>	mean	$\pm$ s.e.	
Handa	9	0.72	$\pm 0.02$	188 <sup>3</sup>	0.80	$\pm 0.02$	231 <sup>3</sup>	0.65	$\pm 0.02$	-0.15
Sumburgh Head	8	0.69	$\pm 0.03$	110 <sup>1</sup>	0.75		122 <sup>1</sup>	0.50		-0.25
Fair Isle	10	0.75	$\pm 0.02$	214 <sup>2</sup>	0.76	$\pm 0.02$	161 <sup>2</sup>	0.77	$\pm 0.08$	+0.01
Papa Westray	8	0.74	$\pm 0.05$	127 <sup>1</sup>	0.87		193 <sup>1</sup>	0.63		-0.24
Marwick Head	10	0.73	$\pm 0.02$	96 <sup>1</sup>	0.75		72 <sup>1</sup>	0.72		-0.03
Mull Head	7	0.73	$\pm 0.02$	93 <sup>1</sup>	0.74		85 <sup>1</sup>	0.61		-0.13
North Sutor	3	0.74	$\pm 0.01$	88 <sup>1</sup>	0.74		120 <sup>1</sup>	0.78		+0.04
Isle of May	11	0.81	$\pm 0.01$	786 <sup>5</sup>	0.82	$\pm 0.02$	842 <sup>5</sup>	0.77	$\pm 0.01$	-0.05
Bempton	6	0.78	$\pm 0.02$	112 <sup>1</sup>	0.77		152 <sup>1</sup>	0.18-0.49		$\leq 0.59$
Durlston	4	0.82	$\pm 0.02$	$\leq 76$ <sup>1</sup>	0.85		-	-		-
Berry Head	-	-	-	-	-		31 <sup>1</sup>	0.65		-
Skokholm	2	0.79	$\pm 0.01$	88 <sup>1</sup>	0.80		66 <sup>1</sup>	0.95		+0.15
Skomer	8	0.74	$\pm 0.01$	210 <sup>6</sup>	0.77	$\pm 0.02$	226 <sup>6</sup>	0.77	$\pm 0.04$	0.00
Needle Rock	-	-	-	51 <sup>6</sup>	0.89	$\pm 0.07$	46 <sup>6</sup>	0.13	$\pm 0.06$	-0.76
Elegug Stacks	-	-	-	262 <sup>8</sup>	0.75	$\pm 0.04$	294 <sup>8</sup>	0.62	$\pm 0.07$	-0.13
St. Margaret's Is.	-	-	-	52 <sup>?</sup>	0.72	$\pm 0.09$	-	-		-
Total	-	-	-	2553 <sup>15</sup>	0.79	$\pm 0.01$	2641 <sup>14</sup>	0.62	$\pm 0.06$	-0.16 <sup>13</sup>

## 2.23 Razorbill *Alca torda*

*Breeding numbers* (Table 2.23.1, Figure 2.23.1)

Tables 2.23.1a and 2.23.1b show regional changes in razorbill numbers in sample plots (summed means of five or more counts) and at whole colonies (single counts) respectively from 1996 to 1997. Generally, multiple plot counts are preferred for assessing population change as they smooth out day to day fluctuations in numbers of birds attending breeding colonies.

**Table 2.23.1** Population changes at monitored razorbill colonies, 1996-97 (adults attending colony in first three weeks of June). Regional totals of under 50 birds are excluded. Trends for 1986-96 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, \*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Further details of calculation of trends are given in section 1.2.2.

**2.23.1a** Counts of birds in study plots. Figures are based on the means of 5-10 annual counts of study plots within each colony.

	NW Scotland	Shetland	NE Scotland	SE Scotland	Wales	NE Ireland
1986-96 annual % change	-	+1.3 n.s.	+0.5 n.s.	+5.3***	+4.0***	+0.8 n.s.
1996	252	404	152	862	1294	838
1997	236	415	215	980	1452	924
1996-97 % change	-6.4 <sup>a</sup>	+2.7 <sup>b</sup>	+41.5 <sup>c</sup>	+13.6 <sup>d</sup>	+12.2 <sup>e</sup>	+10.3 <sup>f</sup>

Colonies: <sup>a</sup>Handa; <sup>b</sup>Sumburgh Head, Eshaness, Noss, Troswick Ness, Burravoe; <sup>c</sup>Fowlsheugh; <sup>d</sup>Isle of May, St. Abb's Head; <sup>e</sup>Skomer, Skokholm, Elegug Stacks, Stackpole NNR; <sup>f</sup>Rathlin Island.

**2.23.1b** Single counts of whole colonies

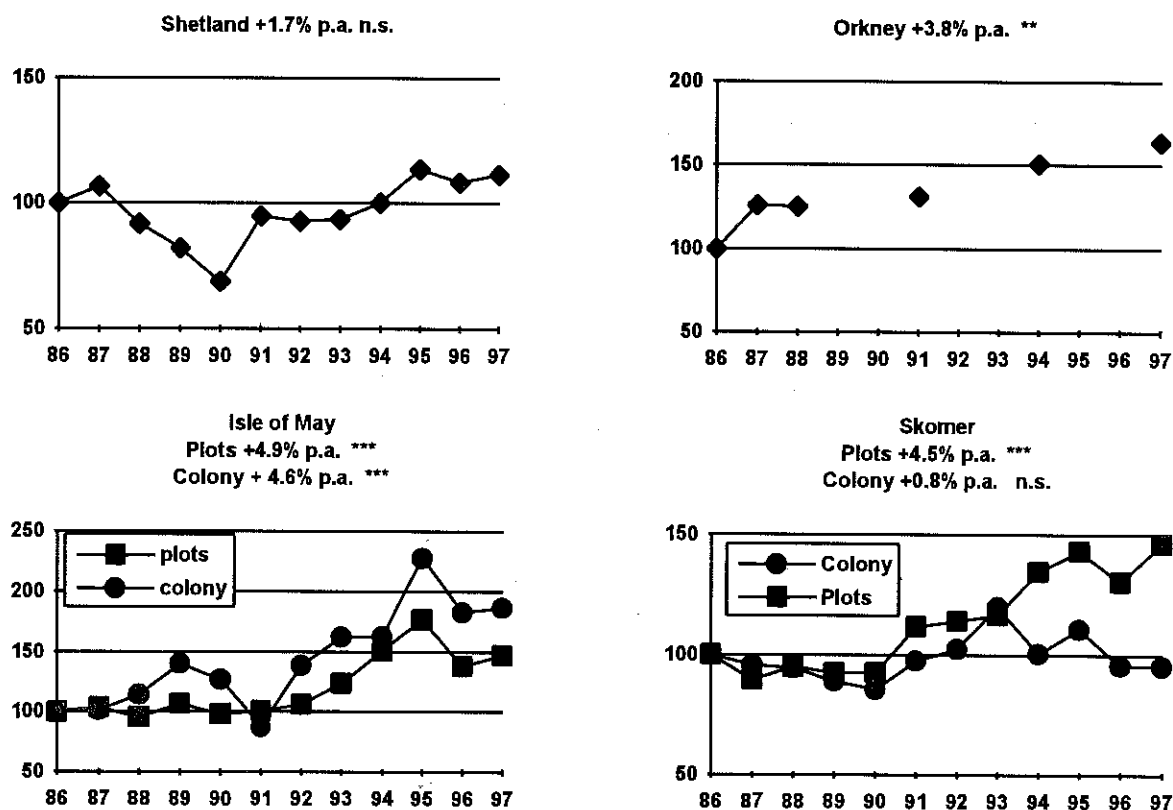
	SW Scotland	Isle of May (birds)	Other SE Scotland (sites)	NE England	Wales	NW England & Isle of Man
1986-96 annual % change	+4.3 n.s.	+4.8 **	-	-	-	+0.4 n.s.
1996	1308	3405	479	141	7947	238
1997	1699	3478	448	150	8364	348
1996-97 % change	+29.9 <sup>a</sup>	+2.1	-6.5 <sup>b</sup>	+6.4 <sup>c</sup>	+5.2 <sup>d</sup>	+46.2 <sup>e</sup>

Colonies: <sup>a</sup>Mull of Galloway, Lunga; <sup>b</sup>Inchcolm, Inchkeith, Craighleith, Lamb, Fidra, Bass Rock; <sup>c</sup>Farne Islands; <sup>d</sup>total of 38 colonies in SW Wales; <sup>e</sup>St. Bee's Head, Peel Hill.

On Handa in north-west Scotland, the largest razorbill colony in Britain, a total of 15,573 birds was counted in 1997, 5% lower than the previous count in 1987. This suggests little change in numbers over the past decade, although no data are available for the years 1988-1996. However, it should be noted that the 1997 count may be an underestimate as observations on Canna indicated that razorbills in this region bred unusually early. This means that breeding adults may have already left the breeding ledges prior to some sections on Handa being counted. As of 1996, the Handa razorbill population is also being monitored through counts of sample plots, and in these mean numbers did not change significantly between 1996 and 1997.

Numbers increased slightly overall at monitored colonies in Shetland, but only at Noss, where numbers increased by 19.6%, was the change from 1996 to 1997 statistically significant. There has been no significant overall trend in razorbill numbers at monitoring plots in Shetland from 1986 (Figure 2.23.1). This contrasts with Orkney, where razorbill plots were counted at five Mainland colonies in 1997 as-

part of a triennial monitoring programme. Overall numbers in these plots increased from 1994, continuing a rising trend (Figure 2.23.1). The increases seen at two colonies, Costa Head (+17.9%) and Mull Head (+20.8%) were statistically significant.



**Figure 2.23.1** Population indices for breeding razorbills in various colonies and regions, 1986-97. Trends for 1986-97 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, \*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ . Further details of calculation of trends are given in section 1.2.2.

In north-east Scotland, numbers of razorbills increased significantly in sample plots at Fowlsheugh (+41.5%). A similar increase was also recorded at St. Abb's in south-east Scotland following a large decrease in the preceding year, but there was no significant change in plot counts at the Isle of May. Both plot counts and colony counts on the Isle of May have shown a significant upward trend since 1986 (Figure 2.23.1).

In Wales too there was an increase in razorbill numbers at monitored colonies in 1997, in line with the trend since 1986, following a slight decrease in the previous year. The increases recorded in sample plots at Stackpole (+17.7%), Skokholm (+37.3%) and Skomer (+12.2%) were statistically significant. However, the whole-colony count on Skomer was unchanged from 1996, and there has been divergence between plot and whole colony counts at this site in recent years (Figure 2.23.1). More razorbill colonies than usual in south-west Wales were counted in both 1996 and 1997 as part of the *Sea Empress* environmental assessment exercise, and overall numbers in these also increased, by 5.2%. However, there was considerable variation between colonies.

Few data are available for England. However, on Lundy Island (south-west England), a limited number of plot counts in 1997 suggested a continuing increase in the population. On the Farnes (north-east England), there was little change in numbers of razorbills from 1996 to 1997, following a large decrease in the previous year.

*Breeding success* (Table 2.23.2)

Mean breeding success in six colonies monitored in 1997 was 0.73 (s.e.  $\pm 0.04$ ) chicks fledged per breeding pair, not significantly different from the 1986-96 mean of 0.70 (s.e.  $\pm 0.01$ ) measured in between one and five colonies annually. There was no significant change in mean breeding success in five colonies that were monitored in both 1996 and 1997.

Breeding success was lowest on Fair Isle in Shetland (0.61 chicks per pair), although not significantly different from the mean for this site (1991-1996: 0.63, s.e.  $\pm 0.04$ ). A small sample of razorbills monitored for the first time at North Sutor (Ross and Cromarty) produced a very high average of 0.88 chicks fledged per egg laid. On the Isle of May in the Firth of Forth, razorbills bred earlier than normal in 1997, as was also noted on Canna in north-west Scotland, and productivity, at 0.71 chicks per pair, was average.

In Wales, breeding success on Skomer (0.68 chicks per pair) was the second highest recorded in five years of monitoring and razorbills on neighbouring Skokholm also had a good season. In north-east England, breeding success on the Farnes declined slightly in 1997, the second year of monitoring at this site.

**Table 2.23.2** Razorbill breeding success, 1996-97: estimated number of chicks fledged per site regularly occupied by a pair or per pair laying. Superscript figures for individual colonies are numbers of study plots. Where three or more study plots are monitored, colony figures are mean and standard error across all plots.

Colony	1996 chicks fledged/pair			1997 chicks fledged/pair			1996-97 change	
	sites <sup>n</sup>	mean	$\pm$ s.e.	sites <sup>n</sup>	mean	$\pm$ s.e.	mean	$\pm$ s.e.
Fair Isle	78 <sup>1</sup>	$\leq 0.72$		100 <sup>1</sup>	$\leq 0.61$		-0.11	
North Sutor				16 <sup>1</sup>	0.88			
Isle of May	140 <sup>4</sup>	0.63	$\pm 0.11$	132 <sup>4</sup>	0.71	$\pm 0.04$	+0.08	
Farnes	23 <sup>1</sup>	0.70		60 <sup>3</sup>	0.66	$\pm 0.17$	-0.04	
Skokholm	52 <sup>1</sup>	0.75		49 <sup>1</sup>	0.84		+0.09	
Skomer	201 <sup>5</sup>	0.64	$\pm 0.02$	208 <sup>5</sup>	0.68	$\pm 0.03$	+0.04	
Total no. colonies	494 <sup>5</sup>	0.69	$\pm 0.02$	565 <sup>6</sup>	0.73	$\pm 0.04$	+0.01 <sup>5</sup>	$\pm 0.04$

## 2.24 Black guillemot *Cepphus grylle*

### *Breeding numbers* (Table 2.24.1)

In Shetland, there was an overall increase of 3% from 1996 to 1997 in numbers of black guillemots recorded in pre-breeding season surveys across thirteen study areas, excluding Yell Sound which was not surveyed in 1997. In those sample areas directly affected by the *Braer* oil spill, where black guillemot numbers fell by almost 30% between 1992 and 1993, populations have now recovered to almost 90% of 1992 levels. A similar recovery in numbers has been evident on the east coast of Fair Isle, with a further rise of 13.4%, to 254 birds, in 1997. Along the east Mainland coast, excluding one study area impacted by the *Braer* incident, numbers increased by just over 5% in 1997. This increase follows a 10% decline in the previous year, which may have been linked to unusually high oil-related mortality in the 1995/96 winter. Similarly, there was a 7% increase in numbers along the east coast of Fetlar.

In Orkney, a census of North Ronaldsay found 369 birds, comparable with the total of 374 found in 1984 (Tasker & Webb 1984). At Rathlin Island (Northern Ireland), numbers in five study areas decreased slightly from 1996 to 1997, by 4.2% to 184 birds.

**Table 2.24.1** Population changes at monitored black guillemot colonies, 1995-97 (adults in breeding habitat in early morning, late March-early May). Trends for 1985/86-96 are average annual rates of change shown by sample populations. None of these trends are statistically significant. For further details of the calculation of these trends see section 1.2.2.

	Fair Isle (east coast)	Fetlar (east coast)	Braer coast Shetland	Other coasts, Shetland East	Other coasts, Shetland West	Isle of Man
1985/86-96 annual % change	-1.5	+2.1	-1.4	-1.5	+1.4	+2.5
1995	216	-	324	635	-	106
1996	224	258	320	572	510	121
1997	254	276	330	601	521	101
1996-97 % change	+13.4	+7.0	+3.1 <sup>a</sup>	+5.1 <sup>b</sup>	+2.1 <sup>c</sup>	-16.5 <sup>d</sup>

Colonies: <sup>a</sup> Kettlaness, West Burra, Boddam-Virkie, <sup>b</sup> Lunning, Levaneap, Kirkabister, Aithsetter, <sup>c</sup> Muness, Watsness-Dale, Hillswick Ness; <sup>d</sup> Peel Hill.

### *Breeding success*

On Fair Isle, 23 monitored sites fledged an average of only 0.43 young per site, compared with an average for 1986-96 of 0.79 (s.e.  $\pm 0.08$ ). This is the lowest productivity recorded at Fair Isle since 1987 and follows a very poor breeding season in 1996. In Orkney, 1.48 chicks per site fledged from 69 sites monitored on North Ronaldsay, and up to 1.07 chicks per site fledged from 30 accessible nests checked on Auskerry in July. In western Scotland, at least eight young were judged to have fledged from eleven nests at five sites, but there was evidence of mink (*Mustela vison*) taking black guillemot eggs and adults at several locations.

## 2.25 Puffin *Fratercula arctica*

### *Breeding numbers*

Relatively little information was collected on puffin numbers in 1997. At Hermaness, a series of permanent monitoring transects was surveyed after a gap of one year. The number of occupied burrows was the lowest recorded since the transects were established in 1974, continuing a decline that began in 1988. However, the rate of decline appears to have slowed and there was no significant change from the 1995 count (Martin 1997). An estimate was also made of the total number of occupied burrows in the Hermaness colony. This was based on simultaneous dusk counts of adult loafing birds in the main section of the colony and in a sample plot holding a known number of occupied burrows, from which time-specific correction factors were obtained. Allowing for peripheral areas of the colony not visited, the best estimate was 28,300 breeding pairs, some 30% higher than the previous best estimate in 1995. However, given the uncertain biases introduced by the count method used, this result should not be taken as being necessarily indicative of any real change in numbers over this period (Martin 1997).

On Lunga (Argyll), 1866 AOBs were counted, an increase of *c.* 14% on the previous three years. In Wales, peak spring counts of individual puffins on land on Skomer (8610 and 9049 birds) were within the ranges recorded in the previous three years, and a single spring count of 3250 birds on Skokholm also suggested no major changes there.

### *Breeding success* (Table 2.25.1)

Flooding of puffin burrows following heavy rain in June and July, and consequent loss of chicks, were reported from a number of colonies in 1997. On the Isle of May, an average of just 0.65 chicks fledged per egg laid, the lowest figure since records began and well below the average of 0.82 (s.e.  $\pm$  0.02) for the period 1986-1996. Similarly, on the Farnes, 0.74 chicks fledged per egg laid, compared with an average of 0.85 (s.e.  $\pm$  0.03) from 1994 to 1996.

In Wales, only 0.64 chicks fledged per occupied burrow on Skomer, compared with a nine year average of 0.79 (s.e.  $\pm$  0.02). A similarly low level of breeding success was recorded on Skokholm. In contrast to more southern colonies, puffins on Fair Isle (Shetland), had a productive season, fledging 0.79 chicks per egg laid, close to the 1987-96 mean of 0.75 (s.e.  $\pm$  0.03)

**Table 2.25.1** Puffin breeding success, 1996-97: estimated number of chicks fledged per egg or occupied burrow (Welsh colonies). Superscript indicates number of colonies.

Colony	1996 chicks fledged/pair				1997 chicks fledged/pair				1996-97 change	
	burrows	range	mean	$\pm$ s.e.	burrows	range	mean	$\pm$ s.e.		
Fair Isle	109		0.80		124		0.79		-0.01	
Isle of May	173		0.79		166		0.65		-0.14	
Farne Islands	100		0.85		151		0.74		-0.11	
Coquet Island	142		0.82							
Skokholm	-		-		70		0.63		-	
Skomer	83		0.83		77		0.64		-0.19	
Total	607 <sup>5</sup>	0.79-0.85	0.82	$\pm$ 0.01	588 <sup>5</sup>	0.63-0.79	0.69	$\pm$ 0.03	-0.11 <sup>4</sup>	$\pm$ 0.04



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