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Seabird numbers and breeding success in Britain and Ireland, 1999

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Contents

Summary

This report presents the results of monitoring of seabird populations and breeding success throughout Britain and Ireland in 1999 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 (RSPB) and the Shetland Oil Terminal Environmental Advisory Group (SOTEAG). Some findings of particular note in 1999 are summarised below:

- In Shetland, seabirds generally had a more successful breeding season than in 1998, when several species experienced near breeding failure associated with severe weather and poor availability of sandeels. In particular, kittiwake breeding success in 1999 was well above the regional average. However, there was some evidence that reduced sandeel availability late in the season adversely affected both Arctic skuas and Arctic terns. Storms in May also reduced breeding success of guillemots, shags and gannets at some sites.

- Spring gales also caused many shags to abandon their nests at colonies in north-west Scotland, while in south-east Scotland, breeding numbers on the Isle of May more than halved from 1998. Shag breeding success was well below average in most regions, with the notable exception of Wales.

- Numbers of breeding cormorants in Shetland declined markedly, following some recovery in populations between 1994 and 1998, but mean brood sizes were average.

- The kittiwake colony at Fowlsheugh - Dunnottar Castle in north-east Scotland has more than halved since 1992, to just under 24,000 pairs, which is in line with decreases recorded at other colonies in this region.

- Kittiwakes at colonies in north-west Scotland and along North Sea and Channel coasts had generally below average breeding success, but those in Orkney and along Irish Sea coasts had a very productive season.

- Terns in Wales and on Rockabill (south-east Ireland) also had a very productive breeding season, but those on the Farnes (north-east England) experienced severe, localised, food shortages. Breeding numbers of Sandwich terns reached their highest level in the UK since 1992 and little tern numbers also increased substantially in 1999. However, breeding success of both species was very variable.

- Mink control measures in western Scotland are improving breeding success and assisting population recovery in a number of gull and tern species.

- Fulmars had an average breeding season overall, although productivity was again low at a number of Scottish colonies.

- Guillemot numbers continued to increase at Welsh colonies, but declined for a second year in eastern Scotland and north-east England, contrary to a rising trend since the mid-1980's. However, razorbill numbers declined at Welsh colonies, contrary to the long-term trend, while populations in Shetland and eastern Scotland increased following dips in 1998.

- Breeding success of auks was below long-term averages at most monitored colonies throughout Britain.

- In Ireland, surveys of the major seabird colonies at Rathlin Island and the Cliffs of Moher found substantial increases in numbers of fulmars, kittiwakes, guillemots and razorbills from the mid-1980's.

- Numbers of breeding black-headed gulls increased at several major coastal colonies in England and breeding success was generally high. However, there was a marked decline in Northern Ireland.

- A survey of the mixed colony at Walney, Cumbria found no change in numbers since 1995, with *c.* 19,500 pairs of lesser black-backed gulls and *c.* 10,000 pairs of herring gulls.

- Monitored colonies of Arctic skuas have declined by 30% on Shetland and by 54% on Orkney since 1990.

- In Shetland, gannet numbers have increased by 37% at Hermaness and by 10% at Noss since 1994.

1 Introduction

This is the eleventh 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 1999 are summarised and compared with results from previous years, primarily 1998.

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; refer to the Acknowledgements section 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, that may not have been 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 Unit 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 SCR 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 SCR in 1985-87, providing a baseline for seabird populations. Population changes since the previous complete 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, is currently under way.

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 may vary markedly between different areas 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 1998 and 1999. Some of the changes indicated by these counts may be of a short-term nature, not necessarily indicative of 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 *et al.* 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 ('i' in table).

	Coastal population		% change[2]	Total population[3]	
	Britain	Britain & Ireland[1]	1969-87 B & I coast	Britain	Britain & Ireland[1]
Fulmar	537,000	571,000	+85%	537,000	571,000
Manx shearwater[4]	*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[5]	202,100	238,300	+36%	202,100	238,300
Cormorant	6,000	10,400	+30%	6,800	11,700
Shag	36,400	47,300	+40%	36,400	47,300
Arctic skua[6]	3,100	3,100	≤+220%	3,100	3,100
Great skua[6]	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[7]	61	788	-80%	61	788
Common tern	11,800	14,700	-1%	12,700	16,000
Arctic tern[8]	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[9]	898,000i	940,000i	Slightly +?	898,000i	940,000I

Notes:

1. Irish figures include some estimates (mainly for fulmar, shag and gulls) for coastal sections which had not been surveyed by 1988.
2. Net change based on comparison with total recorded during the 1969-70 'Operation Seafarer' survey (reanalysis of counts summarised by Cramp *et al.* 1974); differences in count methods prevent direct comparison for some species.
3. British & Irish totals for some species include estimates of inland populations.
4. Manx shearwater figures are very approximate (midpoints of population estimates).
5. Gannet figures are from a complete survey of North Atlantic colonies carried out in 1994 and 1995 (Murray & Wanless 1997) with updates for colonies counted subsequently.
6. Skua figures are from the 1992 surveys of Orkney and Shetland (Meek *et al.* 1994; Sears *et al.* 1995), with a 1996 update for Hoy (Furness 1997), 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.
7. Roseate tern figures are from 1999 (this report).
8. 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.
9. Puffin figures are very approximate, and include a high proportion of counts of pairs multiplied by two to give estimates of numbers of individuals.

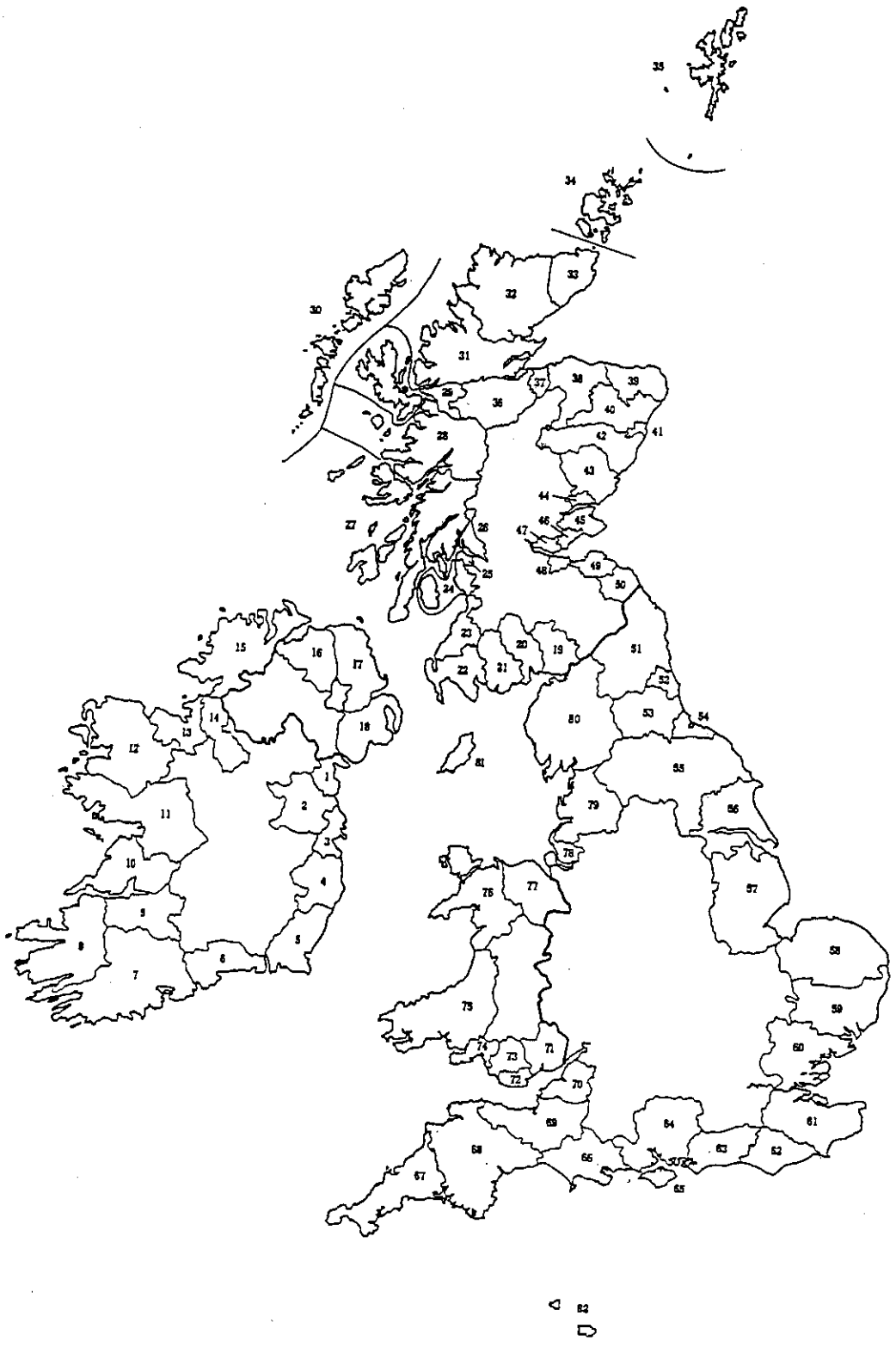

Figure 1.1 Coastal counties and districts of Britain and Ireland. See Table 1.2 for details of the coastal regions (combinations of counties or districts) used in this report. Reproduced, with permission, from Lloyd *et al.* (1991).

Table 1.2 Groupings of coastal counties and districts used in assessing regional population changes. These regions are based on Figure 2 of Lloyd *et al.* (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 *et al.* (1990) and in Thompson *et al.* (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 *et al.* 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 usually 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 go undetected. 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.

2 General features of the 1999 breeding season

As in 1998 (Thompson *et al.* 1999), adverse weather conditions, in some areas combined with apparent difficulties in finding preferred prey, were major factors in determining the fortunes of seabirds during the 1999 breeding season.

April 1999 was the fourth warmest in the last 50 years, but it was a wet month with rainfall 35% above average in England and Wales. Two vigorous depressions travelled eastwards close to northern Scotland on the 10th and 11th, bringing gales to northern Britain. An Arctic airstream brought wintry showers to many areas between the 13th and 20th. A series of Atlantic depressions then brought wet and windy weather to all regions between 20th and 27th (Eden 1999a). Fieldworkers reported an early breeding season for shags and auks at a number of colonies. However, south-easterly gales during the third week, washed away some early shag nests at Sumburgh Head, Shetland (Heubeck 1999).

May 1999 was a warm month with frequent thunderstorms. Much of Scotland had a particularly wet month and a severe gale swept across northern parts on the 21st and 22nd (Eden 1999b). On Eigg in north-west Scotland, seabird numbers were low as a result of seven to ten days of gale force westerly winds in mid to late May, with shags been particularly affected (J. Chester, pers. comm.). In Shetland, gales on the 22nd washed thousands of incubating guillemots off cliffs and destroyed many shag nests at Sumburgh Head (Heubeck 1999).

Temperatures in June 1999 were about normal and rainfall was about 25% above average in England and Wales, although it was nowhere near as wet as the previous two Junes. There were widespread thunderstorms on the 2nd, with unsettled weather for the next few days and north-east England was particularly wet on the 6th. High pressure dominated during the latter half of the month and much of the UK was affected by overnight thunderstorms on the 26th and 27th (Eden 1999c). At the Bullers of Buchan in north-east Scotland, heavy rain washed away many kittiwake nests (A. Crawford, pers. comm.). Kittiwakes also experienced low productivity at Lowestoft in East Anglia, due to heavy rainfall and occasional thunderstorms (T. Brown, pers. comm.). Strong winds and wet weather in the Northern Isles during May and June adversely affected Arctic tern colonies (Croft & Marks 1999). Manx shearwater burrows on Copeland Island in Northern Ireland were affected by flooding and breeding success was poor (N. McKee, pers. comm.). July 1999 was a warm, sunny and very dry month, particularly in England and Wales, although there were severe thunderstorms on the 5th and 6th (Eden 1999d).

Limited data are available on feeding conditions. In Shetland, there appeared to be greater availability of sandeels *Ammodytes* spp. than in 1998 (Heubeck 1999). However, the sandeel fishery in Mousa Sound closed two weeks early, due to a lack of fish by mid-July. High chick mortality was evident in South Mainland Arctic tern colonies at this time, and the most likely explanation was that 0-group sandeels moved from the water column and into the sediment, thus becoming unavailable to surface-feeding species (Croft & Marks 1999). It was a similar situation on Foula, where great skua pellets contained very few sandeels by mid-July, being replaced by herring *Clupea harengus* and whitefish (Furness 1999). On the Farnes in north-east England, the tern colony experienced severe difficulties in locating food, although this appeared to be localised as the nearby colony on Coquet Island had no such problems (J. Walton, pers. comm.). On the Isle of May in the Firth of Forth, sandeels predominated in the diets of shag, kittiwake, razorbill and puffin. However, guillemots fed on young sprats *Sprattus sprattus* and unusual numbers of gadoids. There was evidence that guillemots and puffins were having problems raising chicks in 1999, with fledging weights well below the long-term average for both species (Bull *et al.* 1999). On Canna in north-west Scotland, guillemot chick weights were again high and the diet was a typical mixture of sprats, sandeels and Gadidae (Swann 1999a).

3. Species accounts

3.1 Red-throated diver *Gavia stellata*

Breeding numbers and breeding success (Figure 3.1.1, Table 3.1.1)

The timing of the breeding season in Shetland was about average after the late seasons in 1997 and 1998. In four areas monitored annually by the Shetland Ringing Group (Okill 1999a), there was a slight improvement in the number of successful pairs, from 44 to 48, but this is still below the average for the period 1980 to 1998 (53.3, s.e. ± 1.88). As in recent years, the weather during the incubation period was poor and a number of nests failed due to heavy rain and storms in late May. The mean brood size at fledging in the study area was 1.33, which is slightly below the mean for the period 1979 to 1998 (1.36, s.e. ± 0.02).

Elsewhere in Shetland, mean breeding success was above the levels recorded in 1998 for all the study areas except Yell, where an otter *Lutra lutra* killed young at five sites. However, breeding success was below the 1986-1998 mean for all study areas except Fetlar, where 22 monitored pairs reared an average of 0.91 chicks per pair with eggs, the highest figure recorded since 1986 (Smith 1999). It was another poor breeding season on Foula, with only three chicks fledging from 13 nesting pairs (Furness 1999).

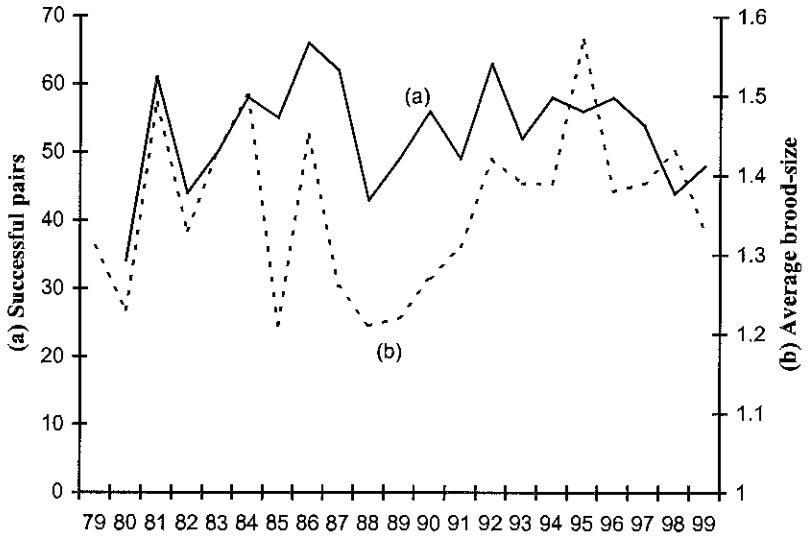

Figure 3.1.1 Annual variation in (a) numbers of 'successful' pairs (with chicks in mid-July) and (b) average brood-size near fledging at red-throated diver study areas in Shetland (parts of Unst, Eshaness, North Roe and Bressay), 1979-99. Data are from Okill (1999a).

In Orkney, 1999 was the most successful breeding season since 1989, with 92 monitored sites fledging an average of 0.75 chicks per site, well above the 1989-98 mean (0.49, s.e. ± 0.03). On Hoy, the improvement in breeding success was thought to be due to better summer weather and improved food supply during 1999 (E.J. & S.J. Williams, pers. comm.). At four monitored sites on Rousay, 1.25 chicks per site were reared, following complete failure in 1997 and 1998 (Meek 1999).

Outside the Northern Isles, few data are available for 1999. On Rum (Lochaber), eight pairs reared only three young, well below the 1986-98 average, and on the neighbouring island of Eigg, breeding success was also poor, with two pairs fledging only one young. On Handa (Sutherland), four pairs each fledged two young, the highest figure recorded since 1986.

Table 3.1.1 Red-throated diver breeding success, 1986-98, 1998 and 1999: 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.

	1986-98 mean		1998		1999	
	No. years	Fldg/pr (±s.e.)	Pairs	Fldg/pr	Pairs	Fldg/pr
Hermaness	13	1.02 (±0.10)	8	0.75	7	0.86
Fetlar	13	0.43 (±0.05)	23	0.39	22	0.91
Yell	11	0.63 (±0.09)	20	0.75	28	0.43
Foula	13	0.48 (±0.07)	12	0.17	13	0.23
Shetland sample total	11	0.60 (±0.05)	63	0.51	70	0.59
Hoy	10	0.53 (±0.03)	68	0.59	63	0.73
Rousay	9	0.14 (±0.04)	5	0.00	4	1.25
Mainland	10	0.51 (±0.07)	20	0.80	25	0.72
Orkney sample total	10	0.49 (±0.03)	93	0.60	92	0.75
Handa	13	1.20 (±0.10)	2-3	1.00-1.50	4	2.00
Eigg	13	1.06 (±0.14)	3	1.00	2	0.50
Rum	12	0.62 (±0.07)	-	-	8	0.37

3.2 Fulmar *Fulmarus glacialis*

Breeding numbers (Table 3.2.1, Figure 3.2.1)

Overall numbers of fulmars breeding at monitored colonies decreased across most regions between 1998 and 1999. In Shetland, south-east Scotland and Wales, this decline was in contrast to upward population trends recorded between 1986 and 1997 (Thompson *et al.* 1999).

In Shetland, the only significant change in the four SOTEAG monitoring plots, was a 17% increase at Burravoe. A whole-colony count at Hermaness found a total of 13,956 apparently occupied sites (AOS), a 4.3% decrease since the last survey in 1989. In north-west Scotland, a complete survey of St. Kilda indicated that numbers had increased by 3.3% to 64,842 AOS, since the last count in 1987. However, there was a 71% decline in numbers on Boreray, due to the spread of the gannetry (P.I. Mitchell, pers comm.). There was little change in the five monitoring plots on Hirta between 1996 and 1999. The long-term decline continued on Canna, with numbers down by 18% since 1998 to 386 AOS. A complete census of the Shiant Isles found 4,387 AOS, compared with 5,239 in 1995 and 6,816 in 1986.

In south-east Scotland, numbers declined from 1998 on the Isle of May by 14% and at St. Abb's Head by 6.5%. A complete survey along the Easter Ross coast in north Scotland found 1,312 AOS, down by nearly 20% since 1991. In Wales, numbers declined for the third successive year on Skomer, down by 9% to 581 AOS. The overall increase in numbers on the Isle of Man was largely due to a rise in the Calf of Man population, up from 186 to 270 AOS between 1998 and 1999.

In Northern Ireland, a whole colony count of Rathlin Island found 2,032 AOS, a 66% increase since 1985. Elsewhere in Ireland, complete surveys of Clare Island found 4,029 AOS (1,898 in 1990) and 3,560 AOS at the Cliffs of Moher (3,097 in 1987).

Table 3.2.1 Population changes at monitored fulmar colonies, 1998-99 (apparently occupied sites in late May or June). Counts with a reported inaccuracy of > ± 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	NE Scotland	SE Scotland	NE England	Wales	NW England / Isle of Man
1998	1,242	792	2,756	314	1,614	529	1,033	1,291
1999	1,095	644	2,656	294	1,569	537	1,005	1,389
1998-99 % change	-11.8[a]	-18.7[b]	-3.6[c]	-6.4[d]	-2.8[e]	+1.5[f]	-2.7[g]	+7.6[h]

Colonies: [a] Mull of Galloway, Lunga (Treshnish islands), Colonsay (sample areas); [b] Canna, Eigg, Handa (plot counts); [c] Hermaness (productivity plot), Eshaness (plot counts), Burravoe (plot counts), Troswick Ness (plot counts), Sumburgh Head (plot counts), Fair Isle (productivity plots); [d] Sands of Forvie; [e] Isle of May, Fidra, St. Abb's Head, Inchkeith, Inchgarvie, Inchmickery, Inchcolm; [f] Farne Islands, Coquet Island, Huntcliff, Boulby-Cowbar Nab; [g] Stackpole Head plus Elegug Stacks & adjacent coastline, St. Margaret's Island, Caldey, Skomer, Skokholm, Bardsey; [h] Calf of Man, Traie Vane - Gob yn Ushtey, Cass Strooan - Peel Headlands, Peel Hill, Glen Maye, Contrary Head - Traie Cronkan, Marine Drive Douglas, Lynague - Will's Strand, Glen Mooar - Gob y Deigan, St. Bee's Head.

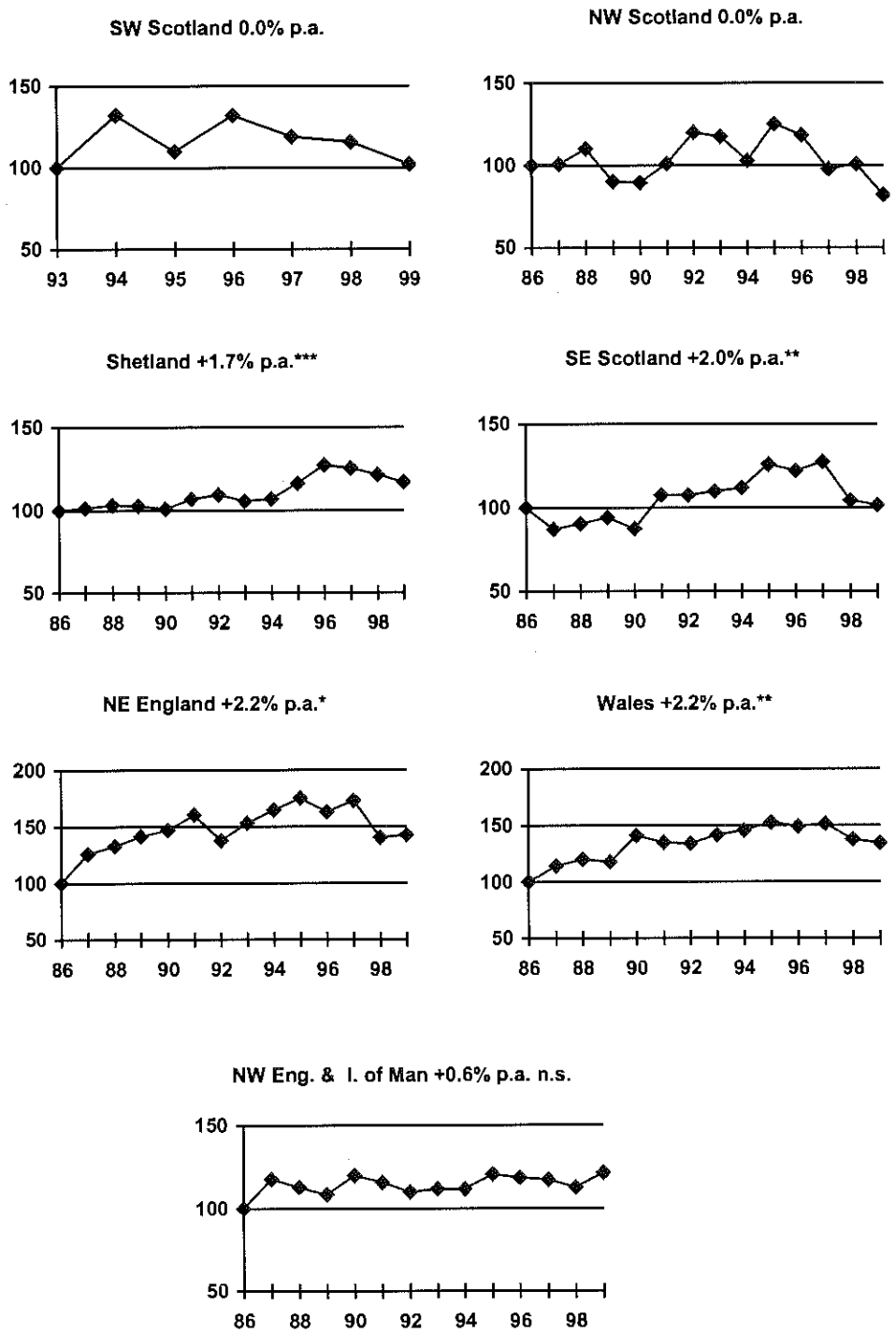

Figure 3.2.1 Regional population indices for breeding fulmars, 1986-1999 (apparently occupied sites in June). Average annual rates of change were calculated by regression of natural log of index against year (see section 1.2.2. for details). Unless otherwise indicated, three or more colonies were counted 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 3.2.2)

In 1999, fulmars generally had an average breeding season, although there were variations between regions. Breeding success averaged 0.43 (s.e. ± 0.06) chicks fledged per AOS across 36 colonies, similar to the 1986-98 mean of 0.42 (s.e. ± 0.01).

Several colonies along the Scottish east coast again experienced poor breeding success. At St. Abb's Head, only 0.11 chicks fledged per AOS, although this was an improvement on 1998 when the colony failed almost completely. Most failures in 1999 occurred during incubation, but there was no evidence of disturbance or predation. Five downy chicks were also found dead, which may indicate poor food availability (Rideout & McCafferty 1999). Breeding success was also poor at Tantallon (0.18), North Sutor (0.12) and Wilkhaven (0.11). However, it was a successful year on the Isle of May, with 0.47 chicks fledged per AOS, above the 1986-98 average of 0.43 (s.e. ± 0.03). In north-east England, success improved on the Farnes to 0.46 chicks fledged per AOS, compared with only 0.36 in 1998.

In Shetland, there was little change in breeding success across eight monitored colonies from 1998, with 0.39 chicks fledged per AOS. Overall success across five Orkney colonies monitored in both 1998 and 1999 increased by 0.16 chicks per AOS. On the west coast of Scotland, only 0.25 chicks fledged per AOS on Canna, well below the 1986-98 average of 0.38 (s.e. ± 0.03). It was once again a very productive season on Ailsa Craig, with 0.83 chicks per AOS. In Wales, it was another successful breeding season. However, success decreased by 0.14 chicks per AOS across three colonies monitored in both 1998 and 1999 on the Isle of Man.

Table 3.2.2 Fulmar breeding success, 1998-99: 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).

Region	1998 chicks fledged/site				1999 chicks fledged/site				1998-99 change	
	AOS[n]	Range	Mean	±s.e.	AOS[n]	Range	Mean	±s.e.	Mean[n]	±s.e.
SW Scotland[a]	18[1]	-	0.72	-	23[1]	-	0.83	-	+0.11[1]	-
NW Scotland[b]	539[3]	0.30-0.50	0.43	±0.06	481[3]	0.25-0.37	0.33	±0.04	-0.10[3]	±0.02*
Shetland[c]	3110[8]	0.33-0.51	0.39	±0.03	3041[8]	0.33-0.55	0.39	±0.02	-0.00[8]	±0.01
Orkney[d]	594[5]	0.00-0.50	0.34	±0.09	745[6]	0.44-0.62	0.49	±0.03	+0.16[5]	±0.06
N Scotland[e]	411[4]	0.07-0.45	0.20	±0.09	112[2]	0.11-0.12	0.11	±0.00	+0.03[2]	±0.01
SE Scotland[f]	160[2]	0.00-0.35	0.18	±0.18	289[3]	0.11-0.47	0.25	±0.11	+0.11[2]	±0.00
NE England[g]	224[2]	0.24-0.36	0.30	±0.06	158[1]	-	0.46	-	+0.10[1]	-
SW England[h]	26[1]	-	0.50	-	25[1]	-	0.56	-	+0.06[1]	-
Wales[i]	257[3]	0.54-0.86	0.71	±0.09	263[3]	0.50-0.93	0.67	±0.13	-0.04[3]	±0.04
Isle of Man[j]	187[3]	0.28-0.53	0.39	±0.07	459[7]	0.08-0.39	0.26	±0.04	-0.14[3]	±0.01**
NE Ireland[k]	14[1]	-	0.21	-	15[1]	-	0.40	-	+0.19[1]	-
Total	5540[33]	0.00-0.86	0.38	±0.03	5611[36]	0.08-0.93	0.43	±0.06	+0.03[30]	±0.01**

Colonies: [a] Ailsa Craig; [b] Canna, Handa, St Kilda; [c] Hermaness, Eshaness, Noss, Westerwick, Troswick Ness, Sumburgh Head, Fair Isle, Fetlar; [d] Costa Head, Mull Head, Gultak, Rousay, North Ronaldsay, Papa Westray (1999 only); [e] Easter Ross, Wilkhaven; [f] Isle of May, Tantallon (1999 only), St. Abb's Head; [g] Farne Islands, Coquet Island (1998 only); [h] West Bay-Burton Bradstock; [i] Skomer, Skokholm, Bardsey; [j] Traie Vane-Gob yn Ushtey (1999 only), Peel Hill (1999 only), Glen Maye (1999 only), Bradda, Marine Drive Douglas, north of Peel, Contrary Head-Traie Cronkan (1999 only); [k] Old Lighthouse Island.

3.3 Manx shearwater *Puffinus puffinus*

On Canna (Lochaber), there was no response to tape playback from *c.* 100 burrows checked. In addition, none of the 40 study burrows previously used to monitor breeding success were occupied by breeding pairs in 1999. This species is probably now close to extinction on Canna (Swann 1999). In an attempt to reduce predation, the National Trust for Scotland continued using rat boxes containing poisoned bait. On nearby Rum, one of the largest colonies in the world, it was another poor breeding season due largely to predation by brown rats *Rattus norvegicus* (A.D.K. Ramsay, pers. comm.). Occupancy was 63% in a sample of 123 monitored burrows, but breeding success was only 0.56 chicks fledged per occupied burrow, below the 1994-98 average (0.71, s.e. $\pm$ 0.09).

Breeding success was again good on Skomer, with between 0.58 and 0.67 chicks fledged per pair laying from 84 study burrows (Perrins 1999), which is above the 1991-98 average (0.55, s.e. $\pm$ 0.07). It was another productive breeding season on Bardsey, with 0.84 chicks fledged per pair from a sample of 50 occupied burrows, which is above the range (0.78-0.80) recorded during 1996-98. However, on Lighthouse Island (Co. Down), it was another poor season with only 337 fledglings ringed, due to wet weather chilling eggs or drowning young in burrows (N. McKee, pers. comm.). This compares with 314 fledglings in 1998 and is below the 1994-97 mean of 675 (s.e. $\pm$17.7), although the variation between years is not necessarily indicative of a change in breeding output and may reflect ringing effort.

3.4 Storm petrel *Hydrobates pelagicus*

Nest sites on Mousa were checked on 12 September. As in 1998, 1999 was another very late season, and the 38 chicks ringed were still at least two weeks from fledging. Four other sites had dead chicks, and nine sites had failed. However, sites were not as wet as in 1998 (Okill 1999b).

The number of storm petrels on Sanda was estimated at 200 pairs, compared with 150 pairs in 1998. This estimate was arrived at by using extensive retrap data, and from being in the colony while birds were singing in potential nest sites. There was no response from a known colony of ten nesting birds in July to tape playback (Morton 1999).

A diurnal playback method was used in July 1999 for preliminary studies to determine the number of storm petrels around Yell. It was noted that response rate declined in strong winds and during rain, and was highest during the hour before dusk (i.e. 21:00-22:00 hours) (Fowler 2000). Twenty nine sites were checked, and responses were obtained from 15 of them. There are plans to undertake more extensive surveys in 2000 (Fowler 2000). A diurnal playback method was also used on Priest Island in 1999, and numbers were estimated at 4,500 apparently occupied sites (95% C.L, 3,300 - 6,200) (Mayhew *et al, in prep.*).

No monitoring was undertaken on Skomer or Skokholm (Pembrokeshire) in 1999.

3.5 Leach's petrel *Oceanodroma leucorhoa*

No data on breeding numbers or breeding success are available for 1999.

3.6 Gannet *Morus bassanus*

Breeding numbers (Table 3.6.1, Figure 3.6.1)

At three colonies counted in both 1998 and 1999, there were further increases in the numbers of breeding gannets. However, the rates of increase at all three colonies now appears to be slowing. In Shetland, land and sea counts at Hermaness located 16,386 apparently occupied nests (AON), a 37% increase since the last survey in 1994, and on Noss, a total of 8,017 AON were identified, a 9.7% increase over the same period. In Ireland, the recently established colony on Clare Island (Co. Mayo) numbered three pairs, compared with four pairs in 1998.

Table 3.6.1 Population changes at individual gannet colonies 1998-99 (peak or single counts of apparently occupied nests in June-July). The 1998 figure for Fair Isle differs from that in Thompson *et al.* 1999.

	Fair Isle (Shetland)	Great Saltee (SE Ireland)	Irelands Eye (SE Ireland)
1998	1,118	1,860	136-146
1999	1,123	1,930	142-152
% change 1998-99	+0.4	+3.8	+4.3

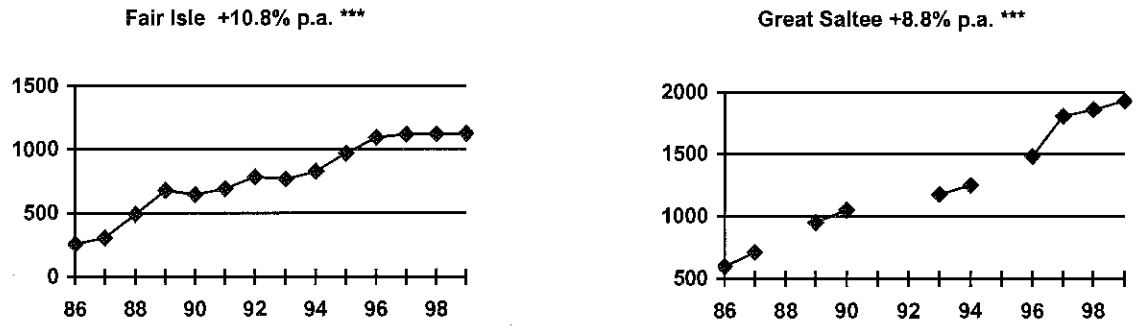

Figure 3.6.1 Gannet colony population trends, 1986-99. Figures are counts of apparently occupied nests. Note different scales. Trends are average annual rates of change. Significance of trends indicated as: *** $P < 0.001$. Further details of calculation of trends are given in section 1.2.2.

Breeding success (Table 3.6.2)

Mean breeding success across four colonies monitored in 1999 was 0.66 chicks fledged per occupied nest, similar to the 1986-98 mean of 0.67 (based on between three and six colonies). At Hermaness and Noss, breeding success was higher than 1998, with levels above the colony means. However, productivity on Fair Isle was the lowest recorded since 1991 due to many nests being washed out in May storms (Shaw *et al.* 1999), and breeding success on Ailsa Craig was the lowest recorded since 1993 as a result of disturbance by helicopters (B. Zonfrillo, pers. comm.).

Table 3.6.2 Gannet breeding success, 1986-98, 1998 and 1999: estimated number of chicks fledged per occupied nest. In 1998 and 1999, with the exception of Fair Isle, productivity is shown as the mean and standard error of figures from superscript n sample plots. The 1998 and 1999 figures for Fair Isle, plus the 1998 figures for Bempton are for all nests totalled across sample plots.

Colony	1986-98 fledged /nest			1998 fledged/nest			1999 fledged/nest		
	Years	mean	± s.e.	AON^n	mean	± s.e.	AON^n	mean	± s.e.
Ailsa Craig (SW Scotland)	8	0.68	±0.03	64^1	0.75	-	110^1	0.61	-
Hermaness (Shetland)	10	0.66	±0.02	733^3	0.64	±0.04	713^3	0.69	±0.02
Noss (Shetland)	13	0.68	±0.01	454^4	0.64	±0.03	454^4	0.74	±0.02
Fair Isle (Shetland)	I3	0.70	±0.03	187	0.80	-	160	0.59	-
Troup Head (NE Scotland)	5	0.54	±0.04	643	≥0.59	-	-	-	-
Bempton (NE England)	I1	0.77	±0.02	254	0.73	-	-	-	-
All colonies	-	0.67	±0.03	2335	0.69	±0.03	1437	0.66	±0.03

Note: The 1998 figure for Troup Head is shown as a minimum as some chicks in more distant sections of the colony may have been missed. However, the level of potential error is not thought to be large and this figure has been included in the calculation for all colonies combined.

3.7 Cormorant *Phalacrocorax carbo*

Breeding numbers (Table 3.7.1, Figure 3.7.1)

Most of the data summarised here were compiled from various sources by Dr. R.M. Sellers, organiser of 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; birds may move between colonies and variable proportions of adults breed each year.

There was a slight decline recorded in a sample of inland colonies in England between 1998 and 1999, with the number of apparently occupied nests (AON) at Abberton Reservoir, down from 457 to 423. In north-west England and the Isle of Man, there was a 13% increase in numbers at colonies counted in both 1998 and 1999. The Colony at Maughold Head (Isle of Man) continued to increase, with 84 AON (71 in 1998) and numbers increased at Grune Point (Cumbria) to 54 AON (38 in 1998). There was a 31% decline at regularly monitored colonies in south-west England, with numbers at Ballard Cliff (Dorset) down to 65 AON, compared to 96 in 1998. On the Isles of Scilly, a complete survey found 56 AON, similar to the last count in 1993. In north-east England, breeding numbers on the Farnes fell for a second year, with only 167 AON in 1999, the lowest recorded since 1986.

Table 3.7.1 Population changes at monitored cormorant colonies, 1998-99 (apparently occupied nests in May-June). Regional samples of fewer than 50 AON or of only one colony are excluded. Trends for 1986-98 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, ** $P < 0.01$, *** $P < 0.001$). Further details of calculation of trends are given in section 1.2.2.

	SW Scotland	Shetland	N Scotland	SE Scotland	NE England
1986-98 annual % change	+2.7 n.s.	-5.4***	-2.7 n.s.	0.0.	-0.2 n.s.
1998	388	225	349	314	239
1999	377	192	312	319	226
1998-99 % change	-2.8[a]	-14.7[b]	-10.6[c]	+1.6[d]	-5.4e

	Inland England	SW England	NW England & Isle of Man	Wales	NE Ireland
1986-98 annual % change	+19.4***	-0.8 n.s.	+3.4**	+1.2 n.s.	+5.4***
1998	781	177	I70	856	207
1999	737	139	I93	739	271
1998-99 % change	-5.6[f]	-21.5[g]	+13.5[h]	-13.7[i]	+30.9[j]

Colonies: [a] Horse Island, Port O' Warren, Rigg Bay, Currarie-Portandea, Balkenna, Sanda, Eilean na Cille, Carraig an Daimh, Eilean Dubh; [b] High Holm, Clett Stacks, Muckle Roe, Heads of Grocken; [c] Stack of Ulbster, Stacks of Occumster, Ceann Leathad, Neuk Mhor, Ord Point, North Sutor; [d] Carr Craig, Lamb, Long Craig & Inchkeith; [e] Farne Islands, Huntcliff, Boulby Cliff; [f] Abberton Res. (Essex), Stodmarsh & Dungeness (Kent), Besthorpe (Notts.); [g] Ballard Cliff, Carswell Cove, Great Mewstone; [h] Grune Point, St. Bee's Head, Wills Strand, Pistol Castle, Maughold Head, Howstrake; [i] Skomer, St. Margaret's Island, Penderi, Thorn Island, Gwynedd A, Rhoscolyn Beacon, Craig yr Aderyn, Little Orme; [j] Bird Island, Black Rock.

In Wales, there was considerable variation between colonies in changes in numbers between 1998 and 1999. The largest change was at the Little Orme, where the colony declined by 36% to 171 AON. Numbers on St. Margaret's Island fell to only 172 AON, the lowest recorded in the period since 1986. However, colony "A" in Gwynedd increased again, by 13.5% to 210 AON. In Ireland, the colony in Strangford Lough (Co. Down) increased by 31% to 271 AON, which is the highest figure recorded since 1986, and on Lambay (Co. Dublin), numbers increased to 675 AON, compared with 605 AON during the last survey in 1995.

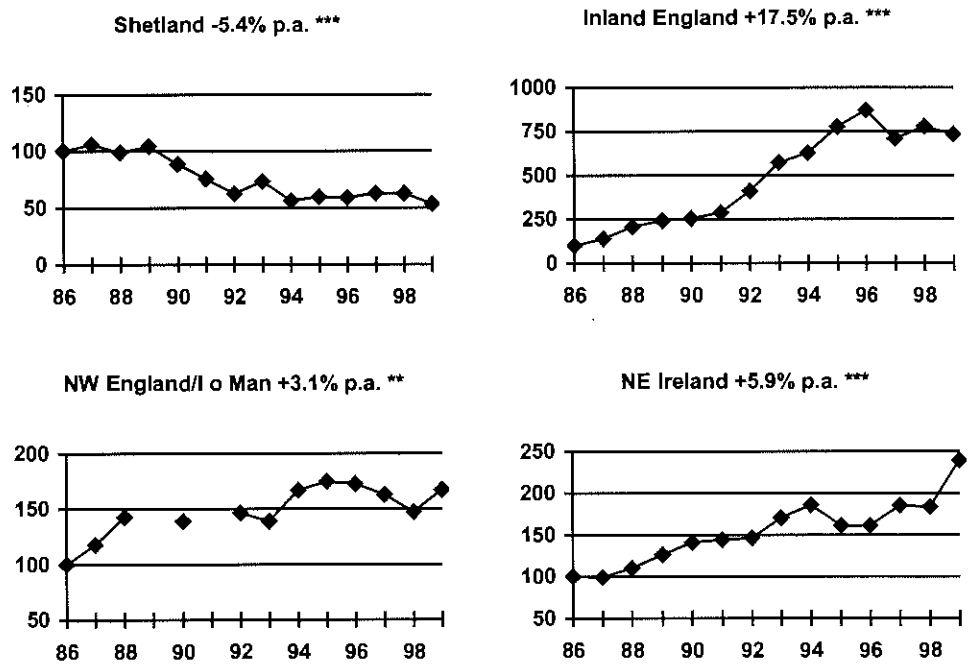

Figure 3.7.1 Regional population indices for breeding cormorant, 1986-1999 (apparently occupied nests). Trends are average annual rates of change shown by sample populations. Significance of trends indicated as: ** P<0.01, *** P < 0.001. Further details of calculation of trends are given in section 1.2.2.

In Shetland, where numbers had levelled off in recent years (Fig 3.7.1) following a steep decline, the total population declined from 225 AON in 1998 to only 192 in 1999, and Ramna Stacks was deserted for the second consecutive year (Okill 1999b). In Orkney, numbers on Boray Holm, the largest colony, increased from 1998 by 12% to 169 AON, while the second largest colony on Little Green Holm held 55 AON, 31% below the 1998 figure. In northern Scotland, numbers in Caithness fell from 128 AON in 1998 to only 114 in 1999, while the colony at North Sutor declined by 9% to 201 AON. In south-west Scotland, the colony at Port O'Warren declined by 29% to 96 AON, and numbers fell at Currarie-Portandea by 26% to 106 AON. In south-east Scotland, only 56 AON were found on Craigleith, compared with 130 in 1997.

Breeding success

Breeding success in most of the few colonies monitored in 1999 was below or close to the norm for this species in Britain, with broods of between two and three chicks fledged per successful nest. In Shetland, average brood size at ringing was 2.8 chicks per nest, identical to the 1990-98 average. Mean brood size in two colonies in Caithness was 1.66 chicks, well below the range recorded in previous years (2.20-2.93). At North Sutor (Easter Ross), breeding success in a sample of 114 nests was 1.79 chicks per nest, below the 1991-98 mean for this colony (2.07, s.e. $\pm$ 0.19). In western Scotland, a minimum of 197 young fledged from 146 nests at six colonies, equivalent to a minimum of 1.35 per pair (Craik 1999a). In Wales, the colony on Ynysoedd Gwylan fledged an average of 1.98 chicks per pair. On the Isle of Man, the colony at Wills Strand produced 2.65 chicks per pair from 17 nests. In Ireland, average brood size at ringing was 3.4 chicks per nest on Lambay (Co. Dublin) from a sample of 30 nests.

3.8 Shag *Phalacrocorax aristotelis*

Breeding numbers (Table 3.8.1, Figure 3.8.1)

Changes in numbers of breeding shags between 1998 and 1999 varied between regions. In south-east Scotland, the number of apparently occupied nests (AON) on the Isle of May declined by 58% between 1998 and 1999, from 621 to 259 AON (Hemsley 1999). The number of adults present was much lower than in recent years and many of those present showed little nesting activity. In the usual study area on the Isle of May, only 58 AON were located, the lowest figure recorded in the period since 1986 (Bull *et al.* 1999). In north-east England numbers fell on the Farnes for the second consecutive year, declining from 1,000 to 940 pairs.

In Shetland, where the population had recently been increasing following a long-term decline, numbers declined by 19.6% across 13 colonies counted in both 1998 and 1999. This was due to gales in April and May, which caused many birds to abandon nests (M. Heubeck, pers. comm.). On Fair Isle, the long-term decline in numbers at the five monitoring plots continued, down by 29% between 1998 and 1999 (Shaw *et al.* 1999). At North Sutor in northern Scotland, numbers increased by 19% from 1998 to 266 AON.

Numbers at monitored colonies in north-western Scotland declined overall in 1999 by 33%. After a prolonged increase since 1993, the population on Canna fell from 1,140 to 742 AON between 1998 and 1999. On Eigg, gale-force westerly winds in the latter half of May caused many birds to give up nesting and desert eggs (J. Chester, pers. comm.). A survey of the Shiant Isles found only 506 AON, a 71.5% decline since the last count in 1986 (D. Maclennan, pers. comm.). There was little change in overall numbers at monitored colonies in south-western Scotland.

A complete survey of the Isles of Scilly found a total of 1,109 pairs, similar to the count of 1,100-1,300 in 1987 (P. Robinson, pers. comm.). In Wales, there was variation between colonies, but numbers at Ynys Gwylan Fawr, the largest colony monitored, increased from 92 to 125 AON. In Ireland, a survey of Lambay (Co. Dublin) located 1,124 AON, which is slightly lower than the last count in 1995, when 1,164 AON were found.

Table 3.8.1 Population changes at monitored shag colonies, 1998-99 (apparently occupied nests in May-June). Counts with a reported inaccuracy of > ±5%, and regional samples < 100 AON, are excluded.

	SW Scotland	NW Scotland	Shetland	N Scotland	SE Scotland	NE England	SW England	Wales
1998	1,022	1,344	1,286	224	960	1,000	154	131
1999	1,030	924	1,034	266	546	940	209	182
1998-99 % change	+0.8[a]	-31.3[b]	-19.6[c]	+18.8[d]	-43.1[e]	-6.0[f]	+35.7[g]	+38.9[h]

Colonies: [a] Colonsay (sample plots), Sanda Island, Lunga, Carraig an Daimh, Eilean Buidhe, Ruadh Sgeir, Eilean na Cille; [b] Eigg, Canna, An Glas Eilean, Handa (plot); [c] Fair Isle (plots), Noss, Sumburgh Head, Skelda Ness to Burga Stacks, Kettlaness, Noness, West Burra, Reawick Ness, Vaila, south-east Yell, Mousa, Troswick Ness, Boddam-Virkie; [d] North Sutor; [e] Isle of May, Inchkeith, Fidra, Inchmickery, Inchcolm, Haystack, Carr Craig, St. Abb's Head; [f] Farne Islands; [g] Annet (Isles of Scilly); [h] Ynys Gwylan Fawr, Bardsey, St. Margaret's Island, Caldey Island, Skomer, Stackpole Head & nearby coast.

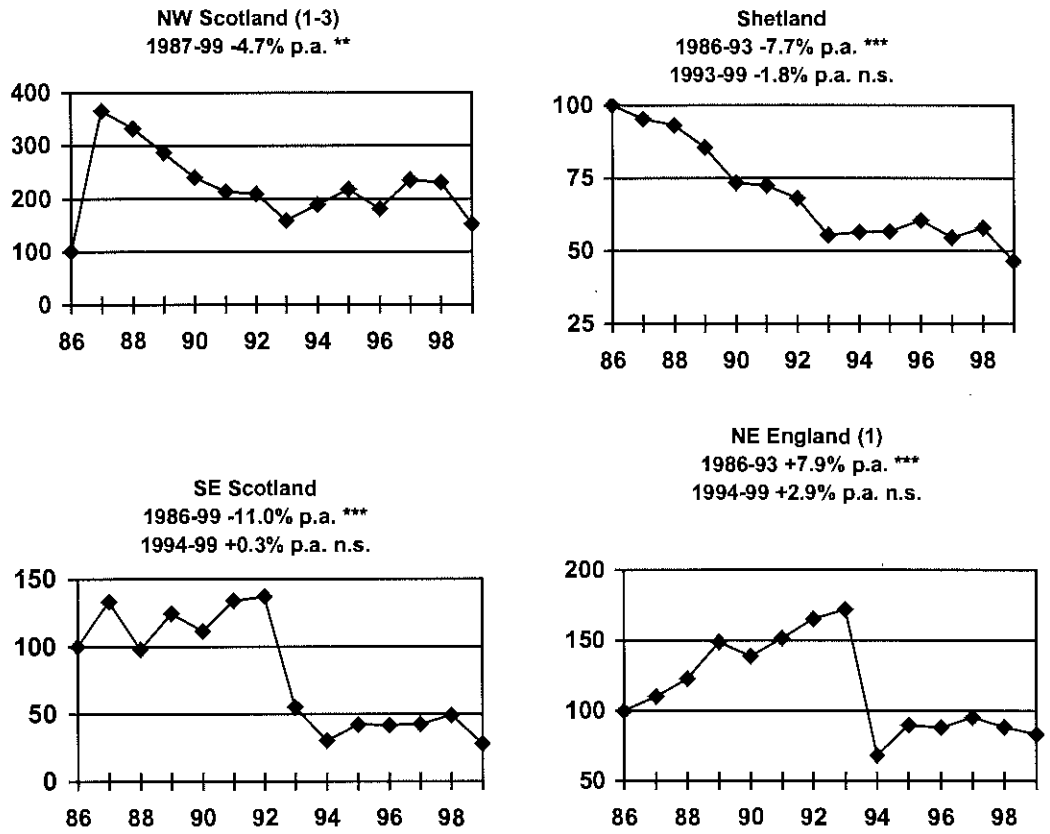

Figure 3.8.1 Population indices for breeding shags, 1986-99 (apparently occupied nests in late May or June). Three or more colonies are counted in each region in each year unless otherwise indicated. Trends for 1986-99 are average annual rates of change shown by sample populations for the periods indicated, but note that overall trends may mask shorter term population fluctuations. Significance of trends (t-test) indicated as: n.s. not significant, ** $P < 0.01$, *** $P < 0.001$. Further details of calculation of trends are given in section 1.2.2. Note that for SW Scotland, the index values for 1986-90 and 1994-99 are derived from counts of different groupings of colonies and are not directly comparable.

Breeding Success (Table 3.8.2)

Across 14 colonies where productivity was assessed by monitoring sample nests throughout the breeding season, an average of 1.06 chicks fledged per active nest in 1999, below the 1986-98 mean of 1.32 (s.e. $\pm$ 0.06) averaged over between three and 20 colonies annually. This was lower than the 1998 average of 1.26 chicks fledged per pair and across the 11 colonies monitored in both years, breeding success decreased by an average of 0.34 chicks per pair.

In south-east Scotland, breeding success at St. Abb's Head was 0.93 chicks fledged per pair, lower than the 1990-98 mean of 1.26 (s.e $\pm$ 0.17). On the Isle of May, many of the adults present showed little nesting activity and only 0.33 chicks fledged per pair overall, well below the 1986-98 average (0.81, s.e. $\pm$ 0.08) (Bull *et al.* 1999). In north-east England, breeding success on the Farnes was 0.59 chicks per pair, the lowest figure recorded in the period since 1987.

At North Sutor in northern Scotland, success was lower than average at 1.36 chicks per pair (mean 1992-98, 1.52, s.e. $\pm$ 0.15). In Shetland, breeding success at Sumburgh Head was 0.98 chicks per pair, the lowest recorded figure since 1990, which was largely due to spring gales washing out nests, and heavy seas at the end of August again washing away unfledged chicks hatched from re-laid clutches

(Heubeck 1999). Productivity at Fair Isle was also the lowest recorded since 1990 at 1.13 chicks per pair, below the 1986-98 mean of 1.41 (s.e. ± 0.06).

In western Scotland, American mink *Mustela vison* were responsible for severe predation of shag chicks at An Glas-eilean. Seven other colonies containing 350 nests monitored by Clive Craik fledged a minimum of 0.92 chicks per AON, below the estimate of 1.30 for mink-free colonies in 1998. Breeding success on Canna was the lowest recorded in the period since 1986 at 0.91 chicks per pair. Breeding success continued to be high in Wales and averaged 1.94 chicks per AON across three monitored colonies.

Table 3.8.2 Shag breeding success, 1998-99: 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 are included. The figures used for some colonies in both years in SW Scotland as well as for An Glas Eilean in NW Scotland and for Middleholm in Wales are based on just one or a few visits and are hence approximate, those for other colonies and regions are based on regular checks of sample nests. Changes in breeding success are indicated for colonies studied in both years (significant changes, as indicated by t-test: *** P<0.001).

Regions	1998 chicks fledged/nest				1999 chicks fledged/nest				1998-99 change	
	Nests[n]	Range	Mean	±s.e.	Nests[n]	Range	Mean	±s.e.	Mean[n]	±s.e.
SW Scotland[a]	269[6]	0.00-2.14	≥1.09	±0.30	300[6]	0.37-1.63	≥1.20	±0.24	+≥0.07[5]	±0.07
NW Scotland[b]	70[2]	≤0.12-1.32	≤0.72	±0.60	74[2]	≤0.35-0.91	≤0.63	±0.28	-≤0.09[2]	±0.32
Shetland[c]	290[3]	1.14-1.71	1.43	±0.16	288[3]	1.01-1.13	≥ 1.06	±0.04	-≤0.37[3]	±0.12
N Scotland[d]	63[1]	-	1.68	-	78[1]	-	1.36	-	-0.32[1]	-
SE Scotland[e]	188[2]	0.85-1.10	0.97	±0.12	103[2]	0.33-0.93	0.63	±0.30	-0.34[2]	±0.18
NE England[f]	327[1]	-	0.78	-	369[1]	-	0.59	-	-0.19[1]	-
Wales[g]	44[2]	≤1.68-2.10	≤1.89	±0.21	195[3]	1.81-2.00	≤1.94	±0.06	+≤0.11[1]	-
Total	1,251[17]	0.00-2.14	*c* 1.20	±0.15	1,407[18]	0.33-2.00	1.14	±0.13	-0.08[16]	±0.00***
Detailed only	1,093[12]	0.12-2.14	1.26	±0.17	1,274[14]	0.33-2.00	1.06	+0.13	-0.34[11]	±0.01***

Colonies: [a] Ruadh Sgeir, Eilean Aoghainn (1998 only), Eilean Buidhe, Eilean na Cille, Carraig an Daimh, Eileanan Glasa (1999 only), Corr Eilean; [b] Canna, An Glas Eilean; [c] Sumburgh Head, Fair Isle, Foula; [d] North Sutor; [e] Isle of May, St. Abb's Head; [f] Farne Islands; [g] Bardsey, Ynys Gwylan (1999 only), Middleholm.

3.9 Arctic skua *Stercorarius parasiticus*

Breeding numbers (Table 3.9.1)

Overall, numbers of breeding pairs on Shetland in 1999 continued to fall, down by 1.6% compared with 1998 levels. The number of breeding pairs continued to decline on Foula, with only 106 counted in 1999, the lowest recorded for at least 11 years. There continues to be little recruitment into the colony and adult survival was also reportedly not as high as in recent years; there was however a higher proportion than usual of non-breeders present on club sites (Furness 1999). On Fair Isle, the number of apparently occupied territories (AOT) remained at similar levels to 1998, but this is still relatively low compared with recent years (Shaw *et al.* 1999). Study plots at 11 other colonies monitored annually in Shetland, also retained a similar number of AOT to 1998. However, since 1990, the population of Arctic skuas at these sites has declined by 30.3% in total (Croft and Marks 1999).

At five annually monitored plots on Orkney, there has been a 54.1% decline in numbers since 1990. This includes the 3% decline recorded between 1998 and 1999 (Croft and Marks 1999). Study plots on Rousay, Westray and Hoy lost a total of ten AOTs in 1999, and although the plot on Papa Westray increased by six AOT to 35, on the Reserve as a whole, numbers declined slightly to 129 AOTs (Meek 1999).

Table 3.9.1 Population changes at monitored Arctic skua colonies, 1997-1999 (apparently occupied territories). Superscript = number of colonies counted in both years.

	Foula	Fair Isle	Other Shetland	Total Shetland	Orkney	Handa
1997	117	98	111	326	129	30
1998	114	67	132	313	127	32
1999	106	69	133	308	123	35
1998-1999 % change	-7.0	+3.0	$+0.8^{11}$	-1.6^{13}	-3.1^{5}	$+9.4^{1}$

Breeding success (Table 3.9.2)

Although productivity in Shetland (excluding Foula) in 1999 was higher than in 1998, it remained below the 1991-98 average of 0.79 (s.e. ± 0.11), with 0.46 young fledged per AOT overall (range 0.00-2.00). In addition, on Foula, 0.6 chicks per pair were estimated to have fledged from 106 pairs (Furness 1999). Reports from Foula and elsewhere in Shetland indicate that food availability in 1999 seemed poor, and chicks and fledglings again suffered from considerable predation by great skuas (Furness 1999; Croft & Marks 1999).

A good supply of food provided by guillemots and kittiwakes meant Arctic skuas in Orkney had a better than average year in 1999 (1991-98 mean = 0.72, s.e.± 0.11), fledging an average of 0.83 chicks per AOT (range 0.00-1.49) (Croft & Marks 1999). The most successful site was on Papa Westray, where 52 chicks fledged from 35 AOTs in the study plot, and a further 110 chicks fledged from the remaining 94 AOTs on the Reserve (1.26 fledged per AOT overall) (Meek 1999).

Table 3.9.2 Arctic skua breeding success in 1998 and 1999: number of chicks fledged per apparently occupied territory (AOT).

Colony	1998		1999	
	AOT	Overall numbers fledged per AOT	AOT	Overall numbers fledged per AOT
Shetland				
Unst (2 colonies)	34	0.12	35	0.26
Fetlar	19	0.00	20	0.20
Yell (2 colonies)	21	0.19	23	0.13
Noss	10	0.20	10	0.30
Mousa	21	0.14	18	0.33
Mainland (4 colonies)	27	0.30	27	0.85
Fair Isle	67	0.13	69	0.64
Shetland total	199	0.15	202	0.46
Orkney				
Papa Westray	29	0.17	35	1.49
Westray	28	0.21	24	0.71
Rousay	35	0.43	31	0.39
Mainland	29	0.14	29	0.72
Hoy	6	0.00	4	0.00
Orkney total	127	0.24	123	0.83

3.10 Great skua *Stercorarius skua*

Breeding numbers (Table 3.10.1)

There was an increase of almost 15% in the total number of apparently occupied territories (AOT) recorded in Shetland in 1999, compared with 1998. However, the number of AOT counted on Fair Isle in 1998 is thought to have been an underestimate (Shaw *et al.* 1999), and hence, the 1998-1999 percentage increase there, and in Shetland as a whole, is likely to be higher than reported. At nine other annually monitored plots on Shetland, the number of AOT fell by ten, to 199 in 1999 (Croft & Marks 1999). This was mainly attributable to a decline on Noss, from 56 AOT in 1998 to 43 AOT in 1999, although the 1999 figure is possibly an underestimate (Upton *et al.* 1999). A larger study plot than usual (94 AOTs) was monitored at Hermaness (Unst) in 1999, and so a direct comparison with 1998 figures cannot be made. On Foula, adult survival rate remained high, at about 93% (Furness 1999).

Table 3.10.1 Population changes at monitored great skua colonies, 1997-1999 (apparently occupied territories). * Fair Isle count from 1998 thought to be an underestimate. Superscript = number of colonies counted in both years.

	Fair Isle	Other Shetland	Total Shetland	Orkney	Handa
1997	152	203	355	121	-
1998	79*	209	288*	133	165
1999	132	199	331	105	168
1998-1999 % change	+67.1	-4.8^{9}	$+14.9^{10}$	-21.1^{6}	$+1.8^{1}$

In Orkney, the total number of AOT recorded in six study plots fell by over 20% between 1998 and 1999, to the lowest level for five years. Most of this decline occurred at North Hoy, where only 35 AOT were monitored in 1999, compared with 61 in 1998 (Croft & Marks 1999).

Breeding success (Table 3.10.2)

Overall, great skuas in Shetland experienced a slightly lower than average productivity for the island group in 1999 (1991-98 mean = 0.79, s.e. ± 0.06). However, there were marked differences between sites. Birds on Foula had the best productivity for 15 years (1.10 chicks fledged per nest), despite evidence of food shortages from mid-July. As with the previous two years, pellets indicated that by mid-July, sandeels had become very scarce, and fewer predated birds were again represented in the chick diet (Furness 1999). Elsewhere in Shetland, the colony at Hermaness (Unst) was equally successful. On Fair Isle, 101 chicks were counted as fledged or near-fledged on 15 August (0.77 chicks fledged per AOT), slightly lower than estimates for previous seasons (Shaw *et al.* 1999).

While great skuas in Orkney also fledged a below average number of chicks in 1999 (1991-98 mean = 0.63, s.e. ± 0.09), they had a more productive season compared to 1998 at all sites monitored (range 0.33-0.82 chicks per AOT), with the exception of the Mainland colony which fledged only 0.40 young per AOT. The most productive sites were on Papa Westray and Westray, with 0.82 and 0.80 chicks fledged per AOT respectively. As in Shetland, reasons for failure included poor weather early on in the breeding season, reduced food availabiity and predation by conspecifics (Croft and Marks 1999).

Table 3.10.2 Great skua breeding success in 1998 and 1999: number of chicks fledged per apparently occupied territory (AOT).

Colony	1998		1999	
	AOT	Overall numbers fledged per AOT	AOT	Overall numbers fledged per AOT
Shetland				
Unst	30	0.73	94	1.10
Fetlar (3 colonies)	59	0.71	60	0.48
Mainland (2 colonies)	46	0.30	46	0.39
Yell (2 colonies)	31	0.26	32	0.31
Mousa	17	0.53	18	0.56
Noss	56	0.32	43	0.70
Fair Isle	79	1.00	132	0.77
Shetland total	318	0.60	425	0.71
Orkney				
NW Hoy	61	0.20	35	0.49
S Hoy	29	0.10	27	0.33
E Hoy	31	0.23	30	0.53
Westray	6	0.33	5	0.80
Mainland	3	1.00	5	0.40
Rousay	3	0.33	3	0.67
Papa Westray	10	0.60	11	0.82
Orkney total	143	0.24	116	0.51

3.11 Black-headed gull *Larus ridibundus*

Breeding numbers and breeding success (Table 3.11.1)

Black-headed gulls are highly mobile between breeding sites; hence, the changes in numbers at sample colonies shown in Table 3.11.1 are not necessarily representative of broader regional trends.

Table 3.11.1 Population changes at monitored black-headed gull colonies, 1998-99 (breeding pairs, apparently incubating adults or apparently occupied nests in May-June).

	W Scotland	NE Scotland	NE England	SE England	NE Ireland
1998	311	1,068	2,167	9,892	5,911
1999	243	505	2,290	12,922	4,851
1998-99 % change	-21.9[a]	-52.7[b]	+5.7[c]	+30.6[d]	-17.9[e]

Colonies: [a] Eilean Inshaig, Sgeir na Caillich, Dubh Sgeir, Eilean Fada, Airds Islet, Torinturk, Duncuan, Eilean Choinneich; [b] Kirkhill, Sands of Forvie; [c] Coquet Island, Farnes; [d] Rye Harbour, North Solent NNR, Newtown Estuary, Flanders Mare, Dungeness, Langstone Harbour; [e] Strangford Lough, Copeland Islands, Swan & Blue Circle Islands (Larne L.), Green Island (Carlingford L.).

In western Scotland, overall numbers at monitored colonies declined by 22%. There was a marked contrast in success between five colonies where mink were controlled (156 pairs, 0.53 fledglings per pair) and two colonies with no mink control measures (81 pairs, failed completely) (Craik 1999a). Breeding success in this region has averaged only *c.* 0.25 chicks per pair (s.e. ± 0.05) from 1992-98.

In Shetland, 102 pairs on Fetlar fledged only 0.09 chicks per nest, due largely to predation of chicks by great skuas (Smith 1999). Breeding numbers in the Tingwall area continue to fall and productivity was again low, while the colony at Walls produced a reasonable number of chicks despite purposeful disturbance (Okill 1999b). In Orkney, *c.* 65 pairs on Rousay fledged an average of 0.25 chicks per nest. In north-east Scotland, a colony in an Aberdeen industrial estate, which held 1,050 pairs in 1998, declined to only 450 pairs due to deliberate human disturbance (R. Duncan, pers. comm.). At Sands of Forvie, 55 pairs fledged an average of 0.51 chicks per nest. In north-east England, 2,210 pairs bred on Coquet Island, compared with 2,100 in 1997 and 1998. On the Farnes, a sample of 12 pairs fledged an average of 1.75 chicks per nest (0.27 in 1998 and 1.83 in 1997). In East Anglia, the colony at Blakeney Point was estimated at 3,000 pairs.

In south-east England, numbers at North Solent recovered to 4,977 apparently occupied nests from the record low figure of 2,230 in 1998 (1986-98 mean 6,478, s.e. ± 460). Breeding success was again good, with two chicks fledged per pair. At Langstone Harbour, numbers continue to increase with a record 2,711 pairs (2,628 in 1998) and breeding success averaged 1.17 chicks per pair (0.89 in 1998 and 0.97 in 1997). At Rye Harbour, 180 pairs failed completely and at Dungeness, 350 pairs fledged only 0.09 chicks per nest, partly due to fox *Vulpes vulpes* or badger *Meles meles* predation. A record 853 pairs nested at Newtown Estuary and fledged *c.* 1.8 chicks per pair (1.4 in 1998). In south-west England, poor breeding success on Brownsea Island was attributed to disturbance by deer (K. Cook, pers. comm.).

A maximum of 14,500 pairs bred at the Ribble Estuary in north-west England, compared with only 8,550 in 1998, and breeding success appeared to be better than in recent years (R. Lambert, pers. comm.). In Ireland, only 3,349 pairs nested at Strangford Lough (Co. Down), compared to 4,729 in 1998, and well below the 1990-98 mean (5,298, s.e. ± 379). At Big Copeland (Co. Down), it was reported to have been a very successful breeding season (N. McKee, pers. comm.).

3.12 Common gull *Larus canus*

Breeding numbers and breeding success (Table 3.12.1)

In western Scotland, accurate counts have been undertaken annually at 20 breeding sites since 1994 (Table 3.12.1) (Craik 1999b). At these sites, there was little change in overall numbers between 1998 and 1999. Mink control efforts were noticeable in enhancing breeding success again. In 1999, in 18 colonies holding a total of 828 nests at which mink were controlled, a total of 510 chicks fledged (0.62 per pair). This contrasts with 18 colonies with no mink control, where a total of 482 pairs fledged just 129 chicks (0.27 per pair). Five of these colonies, holding 72 pairs, failed completely. At eight smaller colonies with no mink control, 24 pairs fledged only three chicks (0.12 per pair) (Craik 1999b).

Table 3.12.1 Numbers of common gulls in study colonies on the west coast of Scotland 1994-99. Figures are sums of counts of pairs at 20 colonies in Argyll & Bute and southern Lochaber. Data supplied by Clive Craik.

Year	1994	1995	1996	1997	1998	1999	1998-99 % change
No. of pairs	1,081	1,015	821	805	929	913	-1.7

Colonies: Glas Eileanan, Eilean Inshaig, Tucker's Island, Sgeir na Caillich, Eilean an Ruisg, Eilean Mor, Glas Eilean, Kilmaronag, Aird's Point Islet, Bonawe Island, McCormaig Island, Eilean Fada, Ardrishaig, Sanda, Eilean Dubh, Eilean Gainimh, Sgeir Sallachain, Eilean Choinneich, Coruanan, Eilean Nan Gall.

In Shetland, the Tingwall colony continued to decline, and breeding success was poor due to predation by ferret-polecats *Mustela putorius x M. furo*. However, colonies in the Dalsetter area and on Hildasay appeared to have a good breeding season (Okill 1999b). On Fair Isle, six pairs fledged an average of 0.67 chicks per pair (D. Shaw, pers. comm.). In Orkney, 28 pairs at Fowlcraig produced 1.32 chicks per nest.

The colony at Nigg in north Scotland, increased further to 104 pairs, compared to 73 pairs in 1998. Breeding success averaged 0.67 chicks per pair from a sample of 54 monitored nests (compared with 1.19 in 1998 and 1.06 in 1997) (Swann 1999b). In the same area, the colony at Alness Point increased to 102 pairs (*c.* 75 in 1998) and productivity averaged 1.08 chicks per pair, compared to 1.50 in 1998 and 0.75 in 1997. In south-east England, 11 pairs at Dungeness failed completely.

In north-east Ireland, breeding numbers in Strangford Lough increased to 138 pairs, the highest figure recorded since 1986 (Andrews *et al.* 1999). At Big Copeland Island, a sample of 100 pairs fledged *c.* 1.5 chicks per pair and on Old Lighthouse Island, 14 pairs fledged 1.21 chicks per pair (N. McKee, pers. comm.).

3.13 Lesser black-backed gull *Larus fuscus*

Breeding numbers and breeding success (Table 3.13.1)

In north-west England, the South Walney colony was estimated to be *c.* 19,500 pairs, similar to the last count in 1995 (N. Littlewood, pers. comm.). The inland colony at Tarnbrook Fell (Lancashire) continues to expand, and was estimated at just over 24,000 pairs (Sowter 1999). In the Isles of Scilly, a complete survey found 3,608 pairs, compared to 3,042 in 1997 and 3,778 in 1987. In east England, breeding numbers at Orford Ness increased between 1998 and 1999, by 3.7% to 22,500 pairs, although 16% of nests failed due to fox predation (D. Cormack, pers. comm.). At Blakeney Point, *c.* 120 pairs nested, compared to just two pairs in 1989.

Table 3.13.1 Population changes at monitored lesser black-backed gull colonies, 1997-99. Figures are breeding pairs, apparently incubating adults or apparently occupied nests in May-June.

	SW Scotland[a]	SE Scotland[b]	E England[c]	Wales[d]
1997	960 - 1,090	1,540	20,216	18,250
1998	840 - 1,070	1,533	21,700	16,391
1999	859 - 879	1,519	22,500	16,064
1998-99 % change	-	-0.9	+3.7	-2.0

Colonies: [a] Reisa Mhic Phaidean, Eilean Gamha, Bach Island, Eilean Mor, Eilean Dubh, Eilean na Cille, Eilean Aoghainn, Glas Eilean, Sanda; [b] Isle of May; [c] Orford Ness; [d] Skomer, Skokholm, Middleholm, Bardsey, Caldey.

In Wales, the annual census of breeding numbers on Skomer resulted in an estimated 12,028 pairs, similar to the 1998 figure (Smith *et al.* 1999). Breeding success was 0.41 chicks per pair, above the 1989-98 average (0.19, s.e. $\pm$ 0.06), but well below the number needed for the population to maintain itself (Perrins 1999). On Skokholm, numbers declined from 1998 by 20% to 2,894 pairs and productivity remained poor at 0.14 chicks fledged per pair. On Bardsey, 478 pairs fledged an average of 0.26 chicks per pair, below the range recorded during 1996-98 (0.45-0.56).

In Argyll, south-west Scotland, between 859 and 879 pairs were estimated to have bred at nine colonies monitored in both 1998 and 1999. At some of these colonies the 1998 and 1999 population estimates overlapped, but declines were apparent at four colonies that together held 576-676 pairs in 1998, compared to 431 in 1999. However, there were increases at two colonies which held 120-130 pairs in 1998, compared to 200 in 1999. At 12 monitored colonies containing 916 pairs, breeding success averaged 0.52 chicks per pair. At two of these colonies containing 80 pairs, mink predation was responsible for total failure (Craik 1999a). In south-east Scotland, the annual census of the gull colony on the Isle of May found an estimated 1,519 nests, similar to the 1998 figure. Breeding success was 0.44 chicks per pair, well below the 1989-98 average (0.85, s.e. $\pm$ 0.07) (Hemsley 1999). In Shetland, a colony of 50 pairs on Hildasay was completely abandoned by early July (Okill 1999b). Two small colonies on Papa Westray in Orkney totalling 35 pairs, fledged an average of 1.03 chicks per nest.

In north-east Ireland, a total of 179 pairs were found at Strangford Lough, compared with 199 pairs in 1998 (Andrews *et al.*1999). At Old Lighthouse Island (Co. Down), 250 pairs fledged an average of 0.48-0.60 chicks per pair. A total of 50 adults died of botulism at this site during the season (N. McKee, pers. comm.).

3.14 Herring gull *Larus argentatus*

Breeding numbers and breeding success (Table 3.14.1)

Few herring gull colonies are counted regularly, but the limited data available suggest that coastal populations have been roughly stable or declining over the past decade, following major declines from the early 1970s to mid-1980s (Walsh & Gordon 1994; Lloyd *et al.* 1991). However, population trends at individual colonies may vary within regions, so that data for small samples of colonies are not necessarily indicative of more widespread changes.

In western Scotland, overall numbers at regularly monitored colonies declined from 1998 by 14% at sites counted accurately (Table 3.14.1). On Eigg, (Lochaber), only 296 territories were found, well below the 1986-98 average (421, s.e. ± 33). In Argyll and Lochaber, breeding success across seven colonies at which mink were controlled, averaged 0.81 fledglings per pair from *c.* 1,700 nests, compared with just 0.38 fledglings per pair for *c.* 6,492 nests in 42 colonies of ten or more pairs in which mink were not controlled. At 19 of these latter colonies, where mink were known to be active, only 0.11 chicks fledged per nest from 2,815 pairs. Thirteen of these colonies completely failed (Craik 1999a). On Canna (Lochaber), it was a very poor breeding season with only 0.38 chicks fledged per pair from 165 nests in the study area (Swann 1999a).

Table 3.14.1 Population changes at monitored herring gull colonies, 1997-99 (breeding pairs or apparently occupied nests in May-June). Regional samples < 200 pairs are excluded.

	W Scotland[a]	NE Scotland[b]	SE Scotland[c]	NE England[d]	E England[e]	Wales[f]	NW England[g]	NE Ireland[h]
1997	2,972	509	4,527	*c.* 536	*c.* 5,250	3,143	583	656
1998	3,007	595	4,440	*c.* 492	*c.* 6,050	3,473	638	575
1999	2,588	490	4,817	*c.* 459	*c.* 6,250	3,583	602	435
1998-99 % change	-13.9	-17.6	+8.5	-6.7	+3.3	+3.2	-5.6	-24.3

Colonies: [a] Canna, Eilean MhicNeill, Sligneach Mor, Sgeir nan Gobhar, Eilean Beag, Eilean Loch Oscair, Sgeir nan Tom, Inn Island & islet, Abbott's Isle, Eilean nan Caorach, Ruadh Sgeir, Eilean Eoghainn, Lunga; [b] Sands of Forvie NNR, Kirkhill; [c] Isle of May, Carr Craig, Fidra, St. Abb's Head; [d] Huntcliff, Boulby - Cowbar Nab, Longnewton Reservoir; [e] Orford Ness; [f] Stackpole Head plus Elegug Stacks and nearby, Skomer, Skokholm, Middleholm, St. Margarets, Caldey, Bardsey; [g] St. Bee's Head; [h] Strangford Lough (several colonies).

In Shetland, a colony of 40 pairs on the west side of Hildasay fledged only two chicks, but colonies at Gulberwick and Cunningsburgh both produced good numbers of chicks. It was a successful breeding season in Lerwick despite egg pricking of roof-nesting pairs by the local council (Okill 1998b). Two small colonies on Papa Westray in Orkney totalling 60 pairs, fledged an average of 1.44 chicks per nest. In north-east Scotland, there was a decline in numbers breeding at Sands of Forvie NNR, to 445 pairs (575 in 1998). A small rooftop study colony of 17 pairs in Aberdeen fledged an average of 1.18 chicks per nest, only half the figure recorded in the previous two years, and at a second rooftop colony only 0.98 chicks fledged from 48 nests. The colony at Craigleith has declined by 52% since 1994 to only 1,146 pairs. Breeding numbers remained low at St. Abb's Head with 253 pairs, only one third of the colony size in the late 1980s, and success was again poor on the Isle of May, at 0.57 chicks fledged per pair.

The mixed colony at Orford Ness in Suffolk continues to expand and held 6,250 breeding pairs of herring gulls, compared to 6,050 in 1998. In Sussex, a small sample of eight pairs at Rye Harbour reared only two chicks and at Burton Bradstock (Dorset), 40 pairs fledged an average of 2.15 chicks per nest, equal to the 1992-98 colony mean. In Wales, numbers on Skomer increased to 374 pairs, compared with 299 in 1998 and 361 in 1997, suggesting intermittent breeding by some birds (Smith *et al.* 1999). Breeding success on Skokholm was similar to 1998, with 0.80 chicks fledged per pair from

86 nests. The colony on Caldey Island increased by 11% to 1,638 pairs, but there was a substantial decline at South Stack, from 468 pairs in 1998 to only 245 in 1999. Productivity on Bardsey averaged 0.95 chicks per nest from 508 pairs, compared to 0.70 in 1998 and 1.80 in 1997.

Elsewhere along Irish Sea coasts, the large mixed colony at South Walney was estimated to hold just over 10,000 pairs of herring gulls, similar to the last count in 1995 (N. Littlewood, pers. comm.). There was a slight decline at St. Bees Head, from 638 pairs in 1998 to 602 in 1999. In Ireland, numbers at Strangford Lough (Co. Down) declined by 24% to 435 pairs, the lowest figure recorded in the period since 1986 (Andrews *et al.* 1999). This colony was affected by Botulism in 1998 (Thompson *et al.* 1999). At Old Lighthouse Island (Co. Down), 90 pairs fledged an average of *c.* 0.67 chicks per pair. A survey of Clare Island (Co. Mayo) found only 23 pairs, compared to 460 in 1982 (Cussen *et al.* 1999).

3.15 Great black-backed gull *Larus marinus*

Breeding numbers and breeding success (Table 3.15.1)

A review of the limited 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 1997).

Table 3.15.1 Population changes at monitored great black-backed gull colonies, 1997-99 (breeding pairs or apparently occupied nests in May-June). Regional samples of < 50 pairs are excluded.

	SW Scotland[a]	NW Scotland[b]	Shetland[c]	N Scotland[d]	SW England[e]	Wales[f]	NE Ireland[g]
1997	160	109	68	110	105	285	59
1998	168	108	55	104	128	283	67
1999	196	95	51	134	137	283	53
1998-99 % change	+16.7	-12.0	-7.3	+28.8	+7.0	0.0	-20.9

Colonies: [a] Sanda, Lunga, Eilean Gainimh, Abbot's Isle, Dubh Sgeir, Ruadh Sgeir; [b] Canna, Sligneach Mor; [c] Noss; [d] Nigg oil terminal; [e] Annet; [f] Skomer, Skokholm, Middleholm, Stackpole Head plus Elegug Stacks and nearby, Caldey, St. Margarets, Bardsey, Ynys Gwylan; [g] Strangford Lough (several colonies).

At monitored colonies in western Scotland, there was a 17% increase in breeding numbers from 1998 to 1999 (Table 3.15.1). Within Clive Craik's study area in Argyll and Lochaber, breeding success averaged 0.85 chicks per pair across *c.* 525 nests at 61 sites. These figures include single breeding pairs at 25 sites, which fledged between 0.28 and 0.32 chicks per pair. There was complete breeding failure at 30 of the monitored sites; mink were responsible in 17 cases, and may have been involved at a further six (Craik 1999a). On Canna, breeding success averaged 1.15 young fledged per pair from 34 nests (Swann 1999a). A survey of the Shiant Isles found 310 pairs, a substantial increase since the last count in 1995, when 164 pairs were located (Maclennan 1999).

In Shetland, numbers of pairs breeding on Noss were the lowest recorded in the period since 1986, and productivity was low due to poor weather in late May and early June (Upton *et al.* 1999). However, it was a reasonable breeding season on South Havra and High Holm (Okill 1998b). In Orkney, breeding success was reported to have been very poor, with only four young reared on Eynhallow (compared with the usual 120-150) and at three other colonies, the number of fledged young was down by 90% compared to 1998 (Meek 1999). However, two colonies on Papa Westray totalling 142 pairs, fledged an average of 1.73 chicks per nest. In northern Scotland, the colony at Nigg reached its highest level

since its formation in 1990, but breeding success was low at 1.0 chicks per pair (1992-98 mean 1.83, s.e. $\pm$ 0.12). Pre-fledging mortality was high with 57 ringed chicks been found dead (Swann 1998b).

On the Isles of Scilly, a full survey found 808 pairs, compared to *c.* 1,000 in 1987. There was no overall change in numbers at regularly monitored colonies in Wales. Breeding success in 1999 was lower than the previous three years on both Skokholm, at 0.96 chicks per pair from 49 nests, and on Skomer, at 0.96 chicks per pair from 25 nests (Smith *et al.* 1999). On Ynys Gwylan Fawr, 54 pairs fledged an average of 1.59 chicks per pair, similar to the 1998 figure.

In north-west England, *c.* 100 pairs nested at South Walney, a reduction from 120 in 1998. On the Calf of Man, breeding numbers recovered to 101 pairs from a low of 45 in 1998. In Northern Ireland, numbers declined at Strangford Lough, from 67 pairs in 1998 to 53 in 1999 (Andrews *et al.* 1999).

3.16 Kittiwake *Rissa tridactyla*

Breeding numbers (Table 3.16.1, Figure 3.16.1)

Kittiwakes may move between colonies and hence, year to year changes in counts of kittiwakes at sample colonies may not always necessarily reflect larger scale regional population changes.

In 1999, the Shetland population (excluding Fair Isle) was estimated at only *c.* 10,481 apparently occupied nests (AON), a 71% decrease since 1981 (Heubeck 1999). At Hermaness, numbers have declined to only 788 AON, compared to 1,656 in 1995. The Fair Isle monitoring plots showed a 2% fall in numbers between 1998 and 1999. In north-east Scotland, a complete survey of the coastline from Fowlsheugh to Dunnottar Castle, revealed a 53% decrease to 23,882 AON since the last count in 1992. This is in line with major declines at other colonies in this region (Thompson *et al.* 1999). In south-east Scotland, a total of 9,576 AON were found at St. Abb's Head, compared with 8,044 in 1998 and 13,393 in 1997. The record low figure in 1998 was probably due to many birds not attempting to breed, despite having been present at the colony (Thompson *et al.* 1999). On the Isle of May, numbers fell from 4,306 to 4,196 AON between 1998 and 1999.

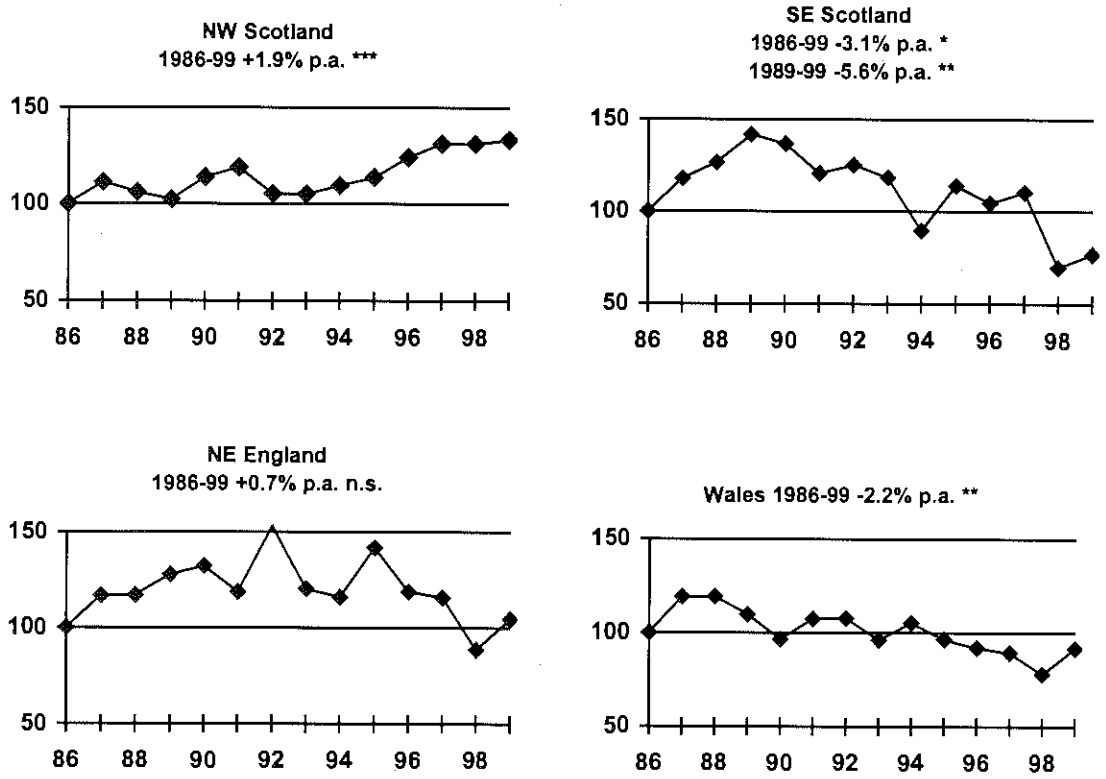

Figure 3.16.1 Sample population indices for breeding kittiwakes, 1986-1999. Average annual rates of change as shown were calculated by regression of natural log of index against year (see section 1.2.2. for details). Statistical significance of trends (t-test) indicated as: n.s. not significant, * $P < 0.05$; ** $P < 0.01$; *** $P<0.001$.

In north-west Scotland, a complete survey of St. Kilda found 3,886 AON, only half the number recorded during the last count in 1987, and on Handa, a total of 7,013 AON were counted, a 5.5% decrease since 1995. However, numbers on Canna reached a record high at 1,252 AON and a census of the Shiant Isles found 2,006 AON, a 11.6% increase since 1995.

In north-west England, there was an 18% increase in the population at St. Bees Head to 1,269 AON, after the low figure recorded in 1998, and on the Calf of Man, numbers increased from 32 to 182 AON between 1998 and 1999. It is thought that many pairs did not nest in 1998 due to high winds

(T. Bagworth, pers. comm.). On the Farnes in north-east England, the population increased by nearly 10% to 5,492 AON. In Suffolk, the small colony on the Sizewell rigs increased again to 140 AON (90 in 1998), but there was a slight decline at Fan Bay and Langdon Bay in Kent. A complete census of the Isles of Scilly found 281 AON, compared with 228 in 1998 and 584 in 1987.

There was a slight increase in numbers on Skomer, from 2,092 AON in 1998 to 2,156 in 1999. Elsewhere in Wales, the Little Orme colony more than doubled in size between 1998 and 1999 to 661 AON, although this may have been due to birds not breeding in 1998. In Northern Ireland, a complete count of Rathlin Island found a total of 9,917 AON, a 54.5% increase since the last survey in 1985. Elsewhere in Ireland, 7,698 AON were counted at the Cliffs of Moher (Co. Clare), a 78% increase since 1987, and on Lambay (Co. Dublin), the colony has declined by 20% since 1995 to 4,091 AON in 1999.

Table 3.16.1 Population changes at monitored kittiwake colonies, 1997-99 (apparently occupied nests in late May or June) and 1986-98 population trends. Counts with a reported inaccuracy of > 5% and regional samples <500 AON are excluded. Average annual rates of change for 1986-98 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, * $P < 0.05$, ** $P < 0.01$.

	SW Scotland	NW Scotland	Shetland	N Scotland	NE Scotland	SE Scotland
% annual change	1986-98 +2.9 n.s.	1986-98 +1.8**	1986-99 -9.7**	-	1992-98 -9.4 n.s.	1986-98 -2.6 n.s.
1997	1,279	1,785	4,343	827	1,622	20,745
1998	1,177	1,784	3,790	746	1,468	13,107
1999	1,225	1,831	3,842	658	1,183	14,462
1998-99 % change	+4.1[a]	+2.6[b]	+1.4[c]	-11.8[d]	-19.4[e]	+10.3[f]

	NE England	SE England	Wales	NW England	SE Ireland
% annual change	1986-98 -0.3 n.s.	1986-98 -1.8 n.s.	1986-98 -2.4**	1986-98 +2.0 n.s.	1986-98 +1.0 n.s.
1997	13,430	1,978	3,151	1,427	1,037
1998	10,278	1,880	2,753	1,075	747
1999	12,118	1,861	3,239	1,269	922
1998-99 % change	+17.9[g]	-1.0[h]	+17.7[i]	+18.0[j]	+23.4[k]

Colonies: [a] Mull of Galloway, Lunga, Colonsay plot; [b] Canna, Handa (productivity plots); [c] SOTEAG area 3, Ness of Ireland, West Burra, Eshaness, Foula, Hermaness & Fair Isle (productivity plots); [d] North Sutor; [e] Fowlsheugh (plots), Covesea, Portknockie, Sands of Forvie NNR; [f] Isle of May, Inchkeith, Fidra, Inchcolm, St. Abb's Head; [g] Farne Islands, Coquet, Saltburn, Boulby-Cowbar Nab; [h] Fan Bay-West Langdon Cliffs; [i] Elegug Stacks, Skomer, St. Margaret's, Bardsey, Little Orme; [j] St. Bee's Head; [k] Dunmore East, Portally.

Breeding success (Table 3.16.2, Figure 3.16.2)

Kittiwake breeding success in 1999 averaged 0.81 (s.e. ± 0.06) chicks fledged per breeding pair at 42 colonies, compared with the 1986-98 mean of 0.71 (s.e. ± 0.03) at 30 to 61 colonies annually, and 0.55 (s.e. ± 0.07) at 43 colonies monitored in 1998. Across a total of 39 colonies monitored in both 1998 and 1999, there was an overall improvement in mean breeding success of 0.28 (s.e. ± 0.01) chicks fledged per breeding pair. However, these overall figures mask marked regional differences.

Table 3.16.2 Kittiwake breeding success, 1998-99: 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, ***P < 0.001).

Region	1998 chicks fledged/nest				1999 chicks fledged/nest				1998-99 change	
	Nests[n]	Range	Mean	±s.e.	Nests[n]	Range	Mean	±s.e.	Mean[n]	±s.e.
SW Scotland[a]	404[1]	-	0.83	-	288[1]	-	1.21	-	+0.38[1]	-
NW Scotland[b]	2,047[4]	0.36-1.43	0.94	±0.22	1,253[3]	0.22-1.22	0.69	±0.29	-0.24[3]	±0.02**
Shetland[c]	2,173[9]	0.00-0.20	0.06	±0.02	2,050[9]	0.20-1.31	0.74	±0.13	+0.68[9]	±0.11***
Orkney[d]	1,125[7]	0.00-1.17	0.85	±0.17	1,235[7]	0.75-1.18	1.04	±0.06	+0.19[7]	±0.11
N Scotland[e]	184[1]	-	0.92	-	155[1]	-	0.52	-	-0.40[1]	-
NE Scotland[f]	694[3]	0.08-0.24	0.19	±0.05	692[3]	0.11-0.45	0.23	±0.11	+0.04[3]	±0.06
SE Scotland[g]	1,458[3]	0.02-0.69	0.33	±0.20	1,457[3]	0.20-0.75	0.52	±0.16	+0.19[3]	±0.04*
NE England[h]	1,277[4]	0.15-0.87	0.48	±0.16	1,513[5]	0.76-1.34	0.97	±0.11	+0.46[4]	±0.03***
E England[i]	126[1]	-	0.81	-	138[1]	-	0.80	-	-0.01[1]	-
SE England[j]	80[1]	-	1.31	-	-	-	-	-	-	-
SW England[k]	255[2]	0.14-1.22	0.68	±0.54	46[1]	-	0.67	-	-0.55[1]	-
I. of Man[l]	-	-	-	-	55[1]	-	0.55	-	-	-
Wales[m]	1,162[3]	0.22-0.80	0.54	±0.17	1,285[3]	0.66-0.95	0.81	±0.08	+0.27[3]	±0.09
NE Ireland[n]	132[1]	-	0.82	-	-	-	-	-	-	-
SE Ireland[p]	1,244[3]	0.49-1.04	0.72	±0.16	1,441[4]	0.93-1.55	1.21	±0.13	+0.47[3]	±0.02**
Total	12,361[43]	0.00-1.43	0.55	±0.07	11,608[42]	0.11-1.55	0.81	±0.06	+0.28[39]	±0.01***

Colonies: [a] Ailsa Craig; [b] Canna, Handa, St. Kilda, Cape Wrath (1998 only); [c] Noness, Hermaness, Eshaness, Westerwick, Foula, Noss, Ramna Geo, Sumburgh Head, Fair Isle; [d] Papa Westray, Rousay, Marwick Head, Row Head, Mull Head, Gultak, Costa Head; [e] North Sutor; [f] Bullers of Buchan, Sands of Forvie, Fowlsheugh; [g] Isle of May, Dunbar, St. Abb's Head; [h] Farne Islands, Coquet Island, Gateshead-Newcastle (1999 only), Saltburn, Bempton; [i] Lowestoft; [j] South Foreland (1998 only); [k] Durlston Head-St. Albans Head, Isles of Scilly (1998 only); [l] Contrary Head-Traie Cronkan (1999 only); [m] Elegug Stacks, Skomer, Great Orme; [n] Rathlin (1998 only); [p] Dunmore, Portally (1999 only), Ram Head, Rockabill.

In Shetland, fledging success in nine monitored colonies averaged 0.74 (s.e. ± 0.13) chicks per AON, greater than in 1998 (0.06) and well above the 1991-98 mean of 0.55 (s.e. ± 0.09). There appeared to be greater availability of sandeels in 1999 after the poor season in 1998 (Heubeck 1999). However, predation of fledglings by great skuas reduced breeding success at a number of colonies. At Foula (Furness 1999) and Hermaness (King 1999), colonies located within sea caves were notably more successful as they were less accessible to great skuas. Productivity on Fair Isle was the highest recorded in the period since 1986 at 1.31 chicks fledged per AON. In Orkney, breeding performance was again high at five Mainland colonies, where an average of just over one chick fledged per breeding pair. The colony on Rousay fledged 0.75 chicks per AON after failing completely in 1998, and on Papa Westray, the Fowlcraig colony produced 1.17 chicks per AON, the second highest figure recorded since 1989.

The pattern along the east coast of Britain was again mixed. At North Sutor (Easter Ross), breeding success was below average at 0.52 chicks per AON (0.92 in 1998). In north-east Scotland, productivity at Sands of Forvie (0.11 chicks fledged per AON), Bullers of Buchan (0.13) and

Fowlsheugh (0.45) was lower than the respective colony averages. At the Bullers of Buchan, wet weather was responsible for a number of nests being washed away (A. Crawford, pers. comm.). In south-east Scotland, it was a late breeding season on the Isle of May, with 17% of pairs not completing nests, and a high number of breeders failing during incubation. The situation improved later in the season, with adult attendance at nests above the long-term average and most chicks near to fledging appeared healthy. Productivity was 0.20 chicks per AON, compared to 0.02 in 1998, but well below the 1986-98 average of 0.55 (s.e. $\pm$ 0.12) (Bull *et al.* 1999). At St. Abb's Head, 0.60 chicks were produced per AON, compared with 0.68 in 1998 and 1.06 in 1997. Predation by mink was thought to be responsible for the loss of half the chicks in one of the monitoring plots (Rideout & McCafferty 1999). The colony at Dunbar fledged 0.75 chicks per AON, compared with 0.69 in 1998, but lower than the 1987-98 average of 0.96 (s.e. $\pm$ 0.11).

In north-east England, breeding success on the Farnes (0.82 chicks fledged per AON), Coquet (0.83) and Saltburn (0.76) was higher than in 1998, but remained lower than the long-term average for each site. At Bempton, the colony produced 1.34 chicks per AON, the highest figure since 1990. The redevelopment of the Old Baltic Flour Mill at Gateshead has resulted in the dispersion of the colony to a number of sites on Tyneside. The construction of an artificial tower next to the mill as a replacement proved successful, with 65 pairs fledging an average of 1.17 chicks per AON (B. Little, pers. comm.). Further south at Lowestoft, only 0.73 fledged per AON due to heavy rainfall in June, the second lowest figure recorded since 1986 (T. Brown, pers. comm.). In Dorset, the colony at Durlston Head - St. Albans Head, produced 0.67 chicks per AON, compared with 1.22 in 1998 and 1.29 in 1997.

In western Scotland, breeding success at St. Kilda (0.22 chicks fledged per pair), Canna (0.64) and Handa (1.22), was below the figures recorded in 1998 and the long-term average for each site. At Canna, it was the poorest season since 1993 and peregrines *Falco peregrinus* were observed taking a significant number of fledglings (Swann 1999a). At Ailsa Craig, productivity was the highest recorded in the period since 1987 at 1.21 chicks fledged per AON. In Wales, success on Skomer (0.95) was the highest recorded since 1987 and at Elegug Stacks (0.82), it was the most productive season in the period since 1991. It was also reported to be the best season on Bardsey for over 20 years, with 1.25 chicks fledging per pair (S. Stansfield, pers. comm.). On the Isle of Man, the Peel Hill colony had an above average year, with 0.55 chicks per AON (A. Moore, pers. comm.).

The four colonies monitored in south-east Ireland had a very productive season. At Ram Head, success was the highest recorded during 1989-99 at 0.93 chicks per AON, and the Dunmore colony fledged an average of 1.10 chicks per AON, the highest figure in the period since 1986. The Rockabill colony was even more successful, with 1.55 chicks fledging per AON, compared with 1.04 in 1998.

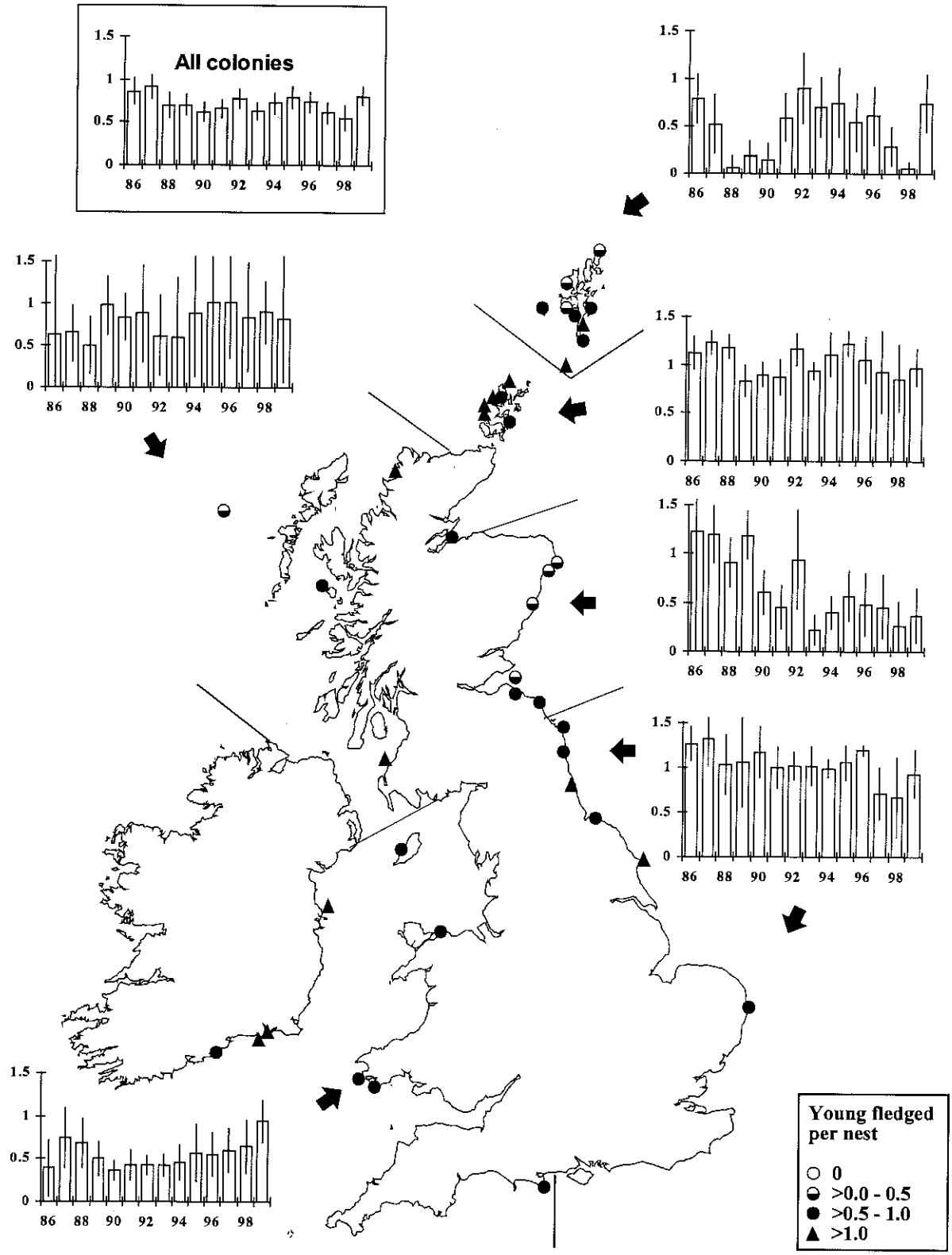

Figure 3.16.2 Breeding productivity (cbicks fledged per well-built nest) at kittiwake colonies during 1986-99, showing regional and annual variation. Symbols on map represent 1999 figures for individual colonies; histograms show annual averages (with 95% confidence limits) for the regions indicated.

3.17 Sandwich tern *Sterna sandvicensis*

Breeding numbers (Tables 3.17.1 & 3.17.2)

The 1999 season was notable in that the number of breeding Sandwich terns increased in nearly every region that contributed data. At four colonies monitored in Scotland in 1998 and 1999, the total number of breeding pairs increased by 35%, to 900 pairs, despite numbers at Loch Ryan (south-west Scotland) falling to 70 pairs, from their peak in 1998. A 9.6% decline in numbers at Loch of Strathbeg (north-east Scotland) to 473 pairs, was more than compensated for by an increase at the Sands of Forvie NNR, from 22 pairs to 247 pairs in 1999, the highest level here since 1991. In south-east Scotland, there was also a large increase on the Isle of May, to 110 pairs (Helmsley 1999).

Numbers on Coquet and the Farnes (north-east England) remained stable in 1999, while in eastern England, numbers rose at both Scolt Head and Blakeney Point. Following three years of successive increase, numbers at Langstone Harbour fell by 62.6% in 1999, to 59 pairs. Despite this, there was an 85% improvement overall in the numbers of breeding pairs at monitored colonies in south-east England, due to large increases at Burntwick Island (from 15 to 155 pairs) and North Solent NNR (from 92 to 275 pairs).

Colonies elsewhere in the Channel and in the Irish Sea also had a good year, with the most pairs for at least 31 years nesting on Brownsea Island (south-west England), and the highest number since 1991 breeding at Hodbarrow (north-west England). At the colony on Anglesey, the breeding population was higher than the ten year mean of 562 (s.e. ± 40). In north-east Ireland, a 51.5% decline from 1998's peak of 1,200 pairs at Green Island was compensated for by an increase to 450 pairs at Larne Lough, (the highest recorded at this site) and a return to 1997 levels at Strangford Lough (782 pairs). Although there was a slight increase at Lady's Island Lake (south-east Ireland), to 1,048 pairs, numbers remain below the 1989-98 mean of 1,256 (s.d. ± 166).

Table 3.17.1 Population changes at monitored Sandwich tern colonies, 1998-1999 (breeding pairs). Trends for 1986-98 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. Superscript = number of colonies counted in both years.

	SW Scotland	NE Scotland	SE Scotland	NE England	E England	SE England	SW England
1986-1998 annual % change	-	-9.4**	-42.4***	-2.3*	-0.1 n.s.	-4.9***	+9.0*
1998	120	545	2	3,682	3,650	278	*c.*155
1999	70	720	110	3,622	4,200	515	174
1998-1999 % change	-41.7[1]	+32.1[2]	+5400.0[1]	-1.6[2]	+15.1[2]	+85.2[4]	+12.3[1]
	NW England	Wales	NE Ireland	NW Ireland	SE Ireland	Britain & Ireland	
1986-1998 annual % change	-8.0**	-3.0 n.s.	-2.0 n.s.	-1.5 n.s.	+5.8 n.s.	-2.1**	
1998	320	460	1,767	192	1,015	12,186	
1999	380	604	1,814	280	1,048	13,537	
1998-1999 % change	+18.8[1]	+31.3[1]	+2.7[3]	+45.8[2]	+3.3[1]	+11.1[22]	

Table 3.17.2 Numbers of Sandwich tern breeding pairs at regularly counted colonies in Britain and Ireland, 1989-1999. (- indicates that no data were available)

Colony	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Loch Ryan	0	0	14	13	35	60	80	19	0	120	70
Loch of Strathbeg	239	121	283	304	515	923	481	375	355	523	473
Sands of Forvie	744	1126	1115	29	0	0	20	0	4	22	247
Long Craig	0	0	1	40	200	31	4	2	0	0	16
Inchmickery	272	418	473	112	9	98	1	0	0	0	0
Coquet Island	1164	1203	1736	2131	1469	1611	1543	1511	1659	1897	1676
Farne Islands	3445	2846	2126	2730	2349	*c.*1750	1837	2179	2484	1785	1946
Scolt Head	1052	0	320	280	853	2406	1588	450	220	650	1000
Blakeney Point	1500	3000	3000	4000	3000	1000	1450	3500	3000	3000	3200
Minsmere	0	5	20	0	0	0	23	0	0	0	0
Havergate	50	60	84	70	125	300	250	104	0	0	0
Foulness/Maplin	300	280	280	548	275	405	330	53	36	0	0
Dungeness	220	240	250	250	40	0	0	120	110	0	0
Rye Harbour	3	25	2	0	90	*c.*125	*c.*100	12	*c.*30	13	26
Pagham Harbour	0	26	2	0	0	0	0	0	0	0	0
Chichester Harbour	15	22	5	27	45	9	0	0	0	0	0
Langstone Harbour	2	0	0	0	0	0	0	12	91	158	59
North West Solent	198	150	151	150	85	148	233	173	155	92	275
Pitts Deep - Hurst	-	25	0	90	103	150	2	25	0	-	-
Brownsea Island	90	64	75	82	120	70	107	140	165	*c.*155	174
Anglesey	830	517	601	500	564	400	650	650	450	460	604
South Walney	0	0	0	450	0	0	0	0	0	0	0
Foulney	770	720	332	0	253	380	343	0	0	0	0
Hodbarrow	50	120	520	360	100	0	59	360	230	320	380
Larne Lough	138	130	135	132	c64	152	234	255	253	178	450
Green Is., Carlingford	36	59	172	108	*c.*721	449	270	502	935	*c.*1200	582
Strangford Lough	962	1482	879	657	587	346	532	711	789	389	782
Lady's Island Lake	1317	1395	1469	1129	1254	1447	1130	1358	1050	1015	1048
Lough Swilly	76	109	99	116	119	220	222	240	149	176	259
Mulroy Bay	240	79	76	107	117	23	0	0	0	0	0
Lower Lough Erne	-	45	42	42	51	40	61	56	39	16	21
Total	13713+	14267	14262	14457	13143	12543	11550	12807	12203	12169	13288

Breeding success (Table 3.17.3)

Cold weather at the beginning of the season led to low breeding success at Loch Ryan in south-west Scotland (P. Collin, pers. comm.). Overall breeding success in east Scotland in 1999 was little changed from 1998. However, birds nesting at the Sands of Forvie (north-east Scotland) had increased success in 1999, with 120 young fledged from 247 pairs (0.49 per pair). Although chicks hatched on the Isle of May (south-east Scotland) for the first time since 1956, all were believed lost to gull predation or washed away before fledging, after moving below the tide line (Hemsley 1999).

Productivity on Coquet was estimated to be *c.* 0.50 chicks fledged per pair, higher than the 1998 estimate of 0.30, but dense vegetation made censusing difficult. Elsewhere in north-east England, 1,946 pairs on the Farnes fledged just 0.15 young per pair. This low number was as a consequence of a lack of available food, which was not a problem on Coquet (J. Walton, pers. comm.). In East Anglia, productivity at Blakeney Point (0.63 fledged per pair) was similar to that for 1998, but at Scolt Head productivity was higher than in the the previous two years, with 0.65 fledglings per pair. In south-east England, birds at Langstone Harbour fared well, 63 chicks fledging from 59 pairs, and at North Solent NNR about 0.73 chicks fledged per pair. However, birds did less well at Burntwick Island (0.47 chicks per pair), and failed at Rye Harbour, resulting in a similar overall regional productivity to 1998.

Only two chicks fledged from 174 pairs on Brownsea Island (south-west England) as birds ended up incubating infertile or damaged eggs. Although grazing deer may have been responsible, the exact reasons for this remain unclear. Birds at Hodbarrow (north-west England) had an excellent year, with about 500 young thought to have fledged from 380 pairs. The Anglesey colony continued to show high productivity.

Table 3.17.3 Sandwich tern breeding success, 1998-1999: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). When more than one colony was sampled in a given region, the overall figure given is the total number of fledglings divided by the total number of breeding pairs across all 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	1998 fledged/pair			1999 fledged/pair		
	pairs[n]	range	overall	pairs[n]	range	overall
NE Scotland	545[2]	0.00-0.38	0.37	720[2]	0.36-0.49	0.40
SE Scotland	2[1]		0.00	126[2]	0.00-0.50	0.06
NE England	1,897[1]		*c.* 0.30	1,946[1]		0.15
E England	3,650[2]	0.00-0.67	0.55 max	4,204[3]	0.00-0.65	0.63
SE England	186[3]	0.62-0.69	0.63	515[4]	0.00-1.07	0.65
SW England	*c.* 156[2]	0.00-0.65	*c.* 0.64	174[1]		0.01
Wales	460[1]		0.98	604[1]		0.91
NW England	320[1]		0.94	380[1]		*c.*1.32
Total	7,216[13]	0.00-0.98	0.45-0.52	8,669[15]	0.00-1.32	0.53

3.18 Roseate tern *Sterna dougalli*

Breeding numbers (Table 3.18.1)

The total UK and Irish breeding population of roseate terns increased by 10.7% in 1999, to 788 pairs. Although there was a 13% increase in numbers in the UK, birds bred at fewer sites in 1999, with six colonies holding a total of 61 pairs. Much of the increase was due to numbers recovering somewhat at Larne Lough in north-east Ireland. In north-east England, no terns bred at the 'New Colony', but numbers increased on Coquet and the Farnes. The breeding population in Wales remained at very low levels. One pair also bred on the North Norfolk coast.

Table 3.18.1 Roseate tern numbers (breeding pairs) at major colonies (those holding at least 15 pairs in at least one year) during 1988-1999, and breeding success (chicks fledged per pair) in 1999.

Region: Colony	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Chicks per pair 1999
SE Scotland:													
Inchmickery	21	5	0	0	0	0	2	0	0	0	0	0	-
Forth B	12	-	15	23	17	17	7	11	7	8	8	9	1.00
NE England:													
Farne Islands	21	12	4	3	4	3	2-3	2	2	3	3	4	0.75
Coquet Island	21	25	23	20	29	*c.* 30	*c.* 38	38	24	25	29	34	0.97
New colony	0	0	0	0	0	0	0	1	14	2	3	0	-
Wales													
Anglesey A	45	70	35	1	0	16	18	10	1	2	3	3	0.67
Anglesey B	0	19	7	0	0	0	0	0	0	1	0	0	-
Anglesey C	15	9	3	4	7	5	2	0	0	0	2-3	0	-
NE Ireland:													
Larne Lough	23	37	19	4	3	0	4	7	13	7	3	10	-
Carlingford L.	7	25	3	0	0	0	0	0	0	2	0	0	-
SE Ireland													
Rockabill	332	194	321	366	378	427	394	554	557	602	578	611	1.43
Lady's Island	0	76	60	56	76	76	140	60	120	48	80	116	0.80
TOTAL*	480	470	490	450	520	578	614	686	744	703	712	788	1.29

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

A total of 727 pairs bred in the Republic of Ireland in 1999, a 10.3% increase compared with 1998. The largest colony at Rockabill continued to grow, with a record 611 nests counted in 1999. On average, birds laid around three days earlier compared with 1998, possibly indicating that prey was available at an earlier date. For the first time, common and roseate terns nested in roughly equal proportions on Rockabill, and increased numbers of both species may lead to interspecific competition for nest sites in the future (Crowe *et al.* 1999). Resightings of ringed adult birds at Irish and North Sea colonies suggest that Rockabill is attracting breeding birds away from other colonies in the Irish Sea, perhaps leading to the observed declines in Anglesey and Northern Ireland. Few chicks ringed at colonies in the North Sea recruit at Rockabill (Newton & Crowe 1999).

Breeding success (Table 3.18.1)

Overall productivity in Great Britain and Ireland reached 1.29 chicks fledged per pair, the highest since 1994. In south-east Scotland, birds at the Firth of Forth had a more productive year than 1998, with nine pairs fledging nine young. Although productivity on the Farnes was moderately successful, with 0.75 chicks raised per pair, it was below that of 1998, due to a poor food supply (J. Walton, pers. comm.). On Coquet, 34 pairs fledged nearly one chick each, which was slightly better than 1998, but still lower than 1992-96 levels. On Anglesey, three pairs fledged two young.

Roseate terns on Rockabill had an excellent year, with 1.43 chicks fledged per pair. Fair weather and good food availability led to almost 50% of pairs fledging two chicks. Productivity at Lady's Island Lake was below that of recent years.

3.19 Common tern *Sterna hirundo*

Breeding Numbers (Table 3.19.1)

With the exception of two regions, breeding numbers showed an overall increase throughout the UK in 1999. The fifth year of the mink control project in west Scotland saw a continued expansion of the number of sites and breeding pairs (Craik 1999a), and overall levels in north Scotland were the highest since 1994, despite the fact that numbers at Nigg were thought to be an underestimate. Increases at most of the monitored colonies in north-east Scotland in 1999 masked a 41% drop in numbers at St. Fergus, to their lowest level for seven years (100 pairs). In south-east Scotland, much of the increase was attributable to a maximum count of 415 pairs on the Isle of May, more than three times the 1998 figure (Hemsley 1999).

In north-east England, there was a 30% increase on Coquet, to 1,049 pairs, the highest since 1982, and there was also a 172% increase in numbers at the ICI Lagoons. However, numbers on the Farnes continued their recent decline, to 128 pairs, the lowest for 23 years. Although the overall population in east England remained stable between 1998 and 1999, numbers at Blakeney Point reached their lowest recorded level (105 pairs), continuing a long-term decline. In central England, increases were spread throughout the region. Much of the increase observed in south-east England was attributable to a 164% increase at Dungeness, where numbers had been falling since the early 1990's. The colony at Langstone Harbour (136 pairs) continued to grow. On the Isles of Scilly (south-west England), a full census revealed a 26% decline from 1998, with a minimum of 96 breeding pairs. However, an additional 100 birds were estimated to be present from flush-counts (Robinson 1999). In north-west England, a decline from 50 to 40 pairs at Hodbarrow was masked by further increases at Seaforth, from 129 to 171 pairs. In addition, an incomplete survey carried out on the Ribble Estuary revealed a minimum of 106 nests, and about 20 pairs also bred at Rockcliffe Marsh.

In Wales, the Cemlyn colony continued to decline, to 30 pairs. However, the Shotton colony increased further, to a record 433 pairs, and Ynys Feurig increased by 45% to 109 prs, the highest for 15 years. In addition, 25-30 'commics' were recorded at Inland Sea. On the other side of the Irish Sea, the Larne Lough and Carlingford Lough colonies (north-east Ireland) also increased to record

numbers of 554 pairs and 467 pairs respectively. In north-west Ireland, there was a 63% increase at Lough Swilly, to 88 pairs. On Rockabill (south-east Ireland) there has been a six-fold increase in numbers over the last 10 years, to 610 pairs in 1999, and at Lady's Island Lake, 715 'commics' were recorded, thought to represent *c.* 480 pairs (S. Newton, pers. comm.) (281 pairs in 1998).

Table 3.19.1 Population changes at monitored Common tern colonies, 1998-1999 (breeding pairs). Superscript = number of colonies counted in both years.

	NW & SW Scotland	N Scotland	NE Scotland	SE Scotland	NE England	E England	Central England
1998	980	421	338	865+	1367	639	248
1999	1231	504	378	<1170	1869	633	296
1998-99 % change	$+25.6^{22}$	$+19.7^{3}$	$+11.8^{8}$	$+35.3^{6}$	$+36.7^{12}$	-0.9^{14}	$+19.4^{17}$
	SE England	SW England	NW England	Wales	Great Britain	NE Ireland	SE Ireland
1998	421	325	179	569	6489	1277	653
1999	518	306	211	638	7860	1569	799
1998-99 % change	$+23.0^{5}$	-5.8^{3}	$+17.9^{2}$	$+12.1^{4}$	$+21.1^{97}$	$+22.9^{4}$	$+22.4^{2}$

Breeding success (Table 3.19.2)

As in 1998, birds generally had a successful season in Great Britain in 1999, with an overall productivity of 0.82 chicks fledged per pair being higher than the 1991-98 mean (0.67, s.e. ± 0.05). Colonies in Wales enjoyed an especially productive year, as did those in south-east Ireland.

Fledging success in west Scotland was six times higher at nine colonies with mink-control (0.66 fledged per pair) than at five sites without control (Craik, 1999a). In addition, on Canna (north-west Scotland), seven pairs fledged 12 chicks (Swann 1999a). In north Scotland, feral cats *Felis domesticus* caused the complete breeding failure of the colony at McDermott's Oil Construction Yard (250 pairs). However, for the second successive year, breeding success at both Alness Point and Nigg was well above the average for the previous nine year period. Colonies in north-east Scotland continued to have low overall productivity. Few chicks were seen at St. Fergus, and Loch of Strathbeg had its lowest productivity since 1990 (0.11 fledged per pair). However, 50 pairs at Kirkhill fledged an average of one chick each. In south-east Scotland, a maximum of 177 'commic' fledglings were counted on the Isle of May, indicating a poor productivity of 0.15 chicks per pair (Hemsley 1999).

In north-east England, overall productivity was similar to the 1986-98 average. Whereas Coquet had a fairly good year (1.09 fledged per pair from a sample of 116 nests), birds breeding on the Farnes suffered from low food availability, and 128 pairs fledged just nine young. The highest productivity in the region occurred at Fairburn Ings, Gosforth Park and Big Waters, where a total of 22 pairs all fledged at least two chicks per pair. Overall breeding success in east England was much improved in 1999, due to high productivity at the north Norfolk colonies of Blakeney (105 pairs fledged 1.29 per pair), Scolt Head (185 pairs fledged 1.89 per pair) and Holkham (88 pairs fledged 1.36 per pair). In south-east England, fox and/or badger predation led to only five chicks fledging from 153 pairs at Dungeness, and to a total failure at Rye Harbour. Birds in the south-west generally had an average season, although 18 pairs at Lodmoor (Dorset) fledged 41 young. Vegetation once again made censusing difficult on Brownsea. Productivity in north-west England was well above the 1986-98 average of 0.25 fledged per pair (s.e. ± 0.06). In addition, birds breeding on the Ribble Estuary fared

well; a sample of 50 nests from one sub-colony produced at least 56 well-grown chicks (R. Lambert, pers. comm.)

Colonies in Wales experienced an above average season, most notably on the Skerries and Ynys Feurig, where birds fledged 1.74 and 1.61 young per pair respectively. In north-west Ireland, poor weather caused many nests to be washed away at Lough Swilly (K. Perry, pers. comm.). In south-east Ireland, an average of 1.81 chicks fledged per pair on Rockabill (n = 190) (Crowe *et al.* 1999) and 189 pairs at Dublin Port fledged 271 young.

Table 3.19.2 Common tern breeding success, 1998-99: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). When more than one colony was sampled in a given region, the overall figure given is the total number of fledglings divided by the total number of breeding pairs across all 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	1998 fledged per pair			1999 fledged per pair		
	pairs[n]	range	overall	pairs[n]	range	overall
SW Scotland	825[8]	0.00-2.50	0.59 max	1,051[9]	0.00-3.00	0.65
NW Scotland	129[9]	0.00-1.00	0.06	154[6]	0.00-2.00	0.22
N Scotland	421[3]	1.03-1.23	1.14	504[3]	0.00-1.36	0.58
NE Scotland	337[5]	0.00-0.83	0.17	357[7]	0.00-1.00	0.27
SE Scotland	165[2]	0.10-0.48	0.24	227[2]	0.41-1.02	>0.73
Total Scotland	1,877[27]	0.00-2.50	0.57	2,293[27]	0.00-3.00	0.57
NE England	1,028[10]	0.67-2.33	1.23	1,270[9]	0.07-2.50	1.00
E England	608[8]	0.00-0.85	0.29	625[10]	0.00-1.89	1.29
C England	125[7]	0.40-1.83	>1.26	257[15]	0.00-2.80	1.05
SE England	421[5]	0.13-2.44	1.41 max	518[5]	0.00-1.17	0.51
SW England	136[2]	0.15-2.00	0.31 max	306[3]	0.36-2.28	0.58
NW England	179[2]	0.43-0.60	0.48	211[2]	0.74-1.25	0.83
Total England	2,497[34]	0.00-2.44	*c.*0.93	3,187[44]	0.00-2.80	0.90
Wales	569[5]	0.33-1.54	1.44	638[4]	0.53-1.74	1.34
Total Great Britain	4,943[66]	0.00-2.50	0.84	6,118[75]	0.00-3.00	0.82
SE Ireland	653[2]	0.96-1.42	1.07	799[2]	1.43-1.81	1.72

3.20 Arctic tern *Sterna paradisaea*

Breeding numbers (Table 3.20.1)

In Shetland, whole island counts were made on Noss, 14 pairs (Upton *et al.* 1999), Mousa, 787 pairs (Croft & Marks 1999) and Fetlar, 371 pairs (Smith 1999). In addition, 750 pairs bred on Foula (Furness 1999) and 562 pairs were counted on Fair Isle (Shaw *et al.*1999). For these five sites, for which breeding numbers were directly comparable between 1998 and 1999, there was a 23.5% overall decline, most notably on Fair Isle and Fetlar, which declined by 55% and 50% respectively.

The south Mainland colony of Mousa, however, increased by 162%. On Orkney, 1,500 individuals (equal to 1,000 pairs (Bullock & Gomersall 1980)) were counted on Auskerry (2,330 birds in 1998), and 1,972 pairs bred at the North Hill colony on Papa Westray, which was similar to the 1998 figure. The largest increases seen in western Scotland occurred on Oronsay (Argyll), from 11 to 139 pairs, and on Coll, from 20 to 64 pairs. A total of 175 pairs bred at 13 sites where mink control was carried out (126 pairs at nine sites in 1998) (C. Craik, pers. comm.). In addition, 153 pairs bred on the Treshnish Isles. In north Scotland, 50 pairs nested at McDermott's Oil Construction Yard, where no birds have been recorded breeding since 1992. At Nigg, numbers fell to 1997 levels (33 pairs), but were the highest since 1990 at Alness Point (45 pairs). Numbers fell at all monitored colonies in north-east Scotland, with the exception of RAF Kinloss, where there was a five-fold increase to 150 pairs. In south-east Scotland, the increase observed between 1998 and 1999 was attributable to numbers rising by 63% on the Isle of May, to at least 737 pairs, the highest ever recorded at this site and continuing a long-term increase.

The overall decline in north-east England was due to numbers falling by 29% on the Farnes, to 1,223 pairs, the second lowest level since 1969. However, the colony at Long Nanny continued to increase, by 46%, to over 830 pairs and, as in 1998, numbers on Coquet (830 pairs) were well above average for the site. In East Anglia, 20 pairs bred at three sites (24 pairs in 1998), and a total of 35 pairs bred at two sites in north-west England, compared with 39-55 pairs in 1998.

Following several years of good productivity, breeding numbers on the Skerries (Anglesey) continued to increase, to 1,122 pairs. The colony at Ynys Feurig was the fifth largest since 1969, up 5% to 304 pairs. As mentioned, 25-30 'commics' were recorded at Inland Sea. Increases in north-east Ireland were mainly attributable to a doubling of numbers at Big Copeland, to 650 pairs. However, numbers fell by 82% at Strangford Lough, to 30 pairs (Andrews *et al.* 1999), the lowest for 15 years. In addition, no birds bred on Cockle Island in 1999. In south-east Ireland, numbers on both Rockabill and at Lady's Island Lake continued to increase, to 89 pairs and *c.* 235 pairs respectively (estimated from 715 pairs of 'commics'; S. Newton, pers. comm.).

Table 3.20.1 Population change at monitored Arctic tern colonies, 1998-1999 (breeding pairs). Superscript = number of sites counted in both years. Regional samples <100 pairs not included.

	NW & SW Scotland	N Scotland	NE Scotland	SE Scotland	NE England	Wales	NE Ireland
1998	476	104	755	457	3,127	1,292	593
1999	661	78	590	740	2,883	1,430	686
1998-99 % change	$+38.9^{23}$	-25.0^{2}	-21.9^{6}	$+61.9^{4}$	-7.8^{3}	$+10.7^{3}$	$+15.7^{4}$

Breeding success (Table 3.20.2)

In Shetland, productivity of 5,229 pairs of Arctic tern averaged 0.29 chicks per pair, which was higher than 1996-98 levels, but still below that of the early 1990's (1990-99 average = 0.32, s.e. ± 0.08). The most successful site was on North Mainland, where 84 pairs fledged 80 young. By contrast, colonies in West Mainland and the North Isles fared particularly poorly; i.e. on Fetlar, 371 pairs fledged just one chick (Smith 1999). Poor weather was blamed for failures earlier in the season, however; from mid-July there was evidence that sandeels became very scarce (Croft & Marks 1999; Furness 1999), causing high chick mortality at this time. On Orkney, 4,511 pairs fledged an average of 0.10 chicks per pair, the lowest productivity since 1990 (1990-99 average = 0.28, s.e. ± 0.08). Many colonies failed to raise young, despite provisioning rates being high at all colonies where observations were undertaken. Adverse weather was thought to be the main reason for chick failure. During May, rainfall was 74% higher than usual, and there were prolonged gales. As well as this,

poor weather in the middle of June caused the death of many newly-hatched chicks (Croft & Marks 1999).

In west Scotland, mink control improved fledging success by a factor of 24. A total of 98 pairs fledged 72 young at five sites with mink control, but just two chicks fledged from 67 pairs at three sites without control (Craik 1999a). In addition, 53 pairs fledged 18 chicks on the Isle of Eigg (north-west Scotland) and at least 15 chicks fledged from 95 pairs on Tiree (south-west Scotland). In north Scotland, feral cats caused a complete breeding failure of 50 pairs at McDermott's, resulting in an overall regional productivity below the eight year average (0.29, s.e. ± 0.09). Overall productivity in north-east Scotland was higher than the previous three years, but still below the 1986-98 average of 0.28 (s.e. ± 0.06). Productivity on the Isle of May (south-east Scotland) was *c.* 0.15 ('commic') chicks fledged per pair (Hemsley 1999).

In north-east England, poor food supply led to 1,223 pairs fledging an estimated 12 chicks on the Farnes (J. Walton pers. comm.), and also to reduced breeding success at Long Nanny (0.33 chicks per pair) in 1999. Birds on Coquet fared reasonably well, however, with productivity reaching 0.70 chicks per pair (n = 77). Sixteen pairs at Blakeney (Norfolk) fledged ten young. Colonies in Wales had another excellent year; Ynys Feurig had the highest recorded fledging success since 1980 (1.40 chicks per pair) and 1,122 pairs at the Skerries fledged between 1,403 and 1,533 young. On Foulney (Cumbria), predation was the main direct cause of egg and chick failure, resulting in 34 pairs fledging ten young.

In north-east Ireland, 650 pairs on Big Copeland fledged an average of at least one chick each, and a rough estimate put productivity on Rockabill (south-east Ireland) at about one chick per pair.

Table 3.20.2 Arctic tern breeding success, 1998-1999: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). When more than one colony was sampled in a given region, the overall figure given is the total number of fledglings divided by the total number of breeding pairs across all 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).

Region	1998 chicks fledged/pair			1999 chicks fledged/pair		
	pairs[n]	range	overall	pairs[n]	range	overall
Shetland	4,020[37]	0.00-0.52	0.01	5,229[36]	0.00-0.95	0.29
Orkney	11,022[39]	0.00-1.25	0.12	4,511[29]	0.00-1.10	0.10
SW Scotland	196[6]	0.00-1.47	0.42 max	241[7]	0.00-1.00	0.36
NW Scotland	103[5]	0.00-0.25	0.03 max	72[3]	0.00-2.00	0.28
N Scotland	104[2]	0.30-0.90	0.36	128[3]	0.00-0.33	0.20
NE Scotland	835[7]	0.00-0.69	0.11	659[7]	0.00-0.63	0.22
SE Scotland	5[2]		0.00	740[3]	0.00-0.15	0.15
NE England	3,127[3]	0.35-0.58	0.41 max	2,883[3]	0.01-0.70	0.30
E England	22[2]	0.15-0.50	≥0.18	18[2]	0.50-0.63	0.61
Wales	1,292[3]	0.00-1.45	1.39 max	1,457[3]	0.00-1.40	1.34 max
NW England	*c.*41[1]		0.44	34[1]		0.29
NE Ireland	*c.*320[1]		*c.*0.62	650[1]		≥1.00
SE Ireland	6[1]		1.83	93[2]	1.04-1.50	*c.*1.06
Total	20,947[106]	0.00-1.47	0.23 max	16,715[100]	0.00-2.00	0.35 max

3.21 Little tern *Sterna albifrons*

Breeding numbers (Table 3.21.1)

Between 1998 and 1999, the total number of breeding birds at monitored colonies in Great Britain increased by nearly 29%. Sites in Scotland showed particular improvement, with the Sands of Forvie (north-east Scotland) holding the highest number since 1977 (67 pairs), a threefold increase compared with 1998. However, numbers continued to decline at three other annually monitored colonies in south-east Scotland, to five pairs. There was also a 45% increase in the number of breeding birds at three sites in south-west Scotland, notably an increase from 4 to 28 pairs on Coll. Five pairs once again bred on Orkney (Meek 1999).

In north-east England, the largest increases occurred at Easington Lagoon and Tetney, up from 41 to 53 pairs, and from one to 12 pairs respectively. However, they fell for the second successive year at Crimden Dene (48 pairs). The largest increase in East Anglia occurred at Blakeney Point, where numbers rose by 118%, to 131 pairs, equal to the ten year average for the site. The Orford Ness (Suffolk) colony was the largest for 13 years (109 pairs). In south-east England, increases at North Solent NNR, from 9 to 23 pairs, and Shellness Point (Kent), from 6 to 18 pairs, were offset by numbers at Langstone Harbour declining to 91 pairs, below the ten year mean for the site of 110 (s.d. ± 31). At Chesil Bank (south-west England), 85 pairs were recorded. This increase is despite many years of low productivity at the colony.

The Welsh colony at Gronant had it's best year on record, with 86 breeding pairs, and in north-west England, 27 pairs nested at Hodbarrow, the highest number for 12 years. At nearby Haverigg, a new site in 1998, numbers increased to 15 pairs. Twenty birds were also recorded at Siddick (equivalent to 13 pairs (Bullock & Gomersall 1980), and 24 birds were counted at Mawbray (four pairs in 1996). In south-east Ireland, there was a 29.6% decline in breeding numbers at Kilcoole/Newcastle, to 19 pairs, the lowest level since 1987.

Table 3.21.1 Population changes at monitored little tern colonies, 1998-1999 (breeding pairs). Regional samples < 40 pairs are excluded. Superscript = number of colonies counted in both years (including known colonies not occupied in 1998-1999).

	Scotland	NE England	E England	SE England	SW England	Wales	NW England	Great Britain
1998	78	180	622	174	80	37	32	1,203
1999	140	198	795	190	85	86	55	1,549
1998-99 % change	+79.5[9]	+10.0[9]	+27.8[12]	+9.2[8]	+6.3[1]	+132.4[1]	+71.9[3]	+28.8[43]

Breeding success (Table 3.21.2)

Generally, little terns bred more successfully in 1999 than in 1998. As well as better weather, there was increased wardening effort, with increased use of electrified mesh fencing at some sites.

In Orkney, high tides washed out the efforts of three pairs on North Ronaldsay, but at a second site, one pair fledged two chicks (Meek 1999). In Scotland as a whole, an average of 0.81 chicks per pair fledged in 1999, nearly double that in 1998, and well above the average for the 1986-98 period (0.37, s.e. ± 0.05). On Tiree (south-west), 36 pairs fledged 21 young. Birds at the Sands of Forvie (north-east) had a very successful year, with 67 pairs fledging 65 chicks, the best on record since 1975. However, no young were successfully raised at either Aberlady or the Eden Estuary, resulting in a third successive year of zero productivity for south-east Scotland.

In north-east England, the colony at Crimden Dene had a disastrous season, with no eggs hatching due to a combination of egg theft and crow predation. Three pairs later re-laid at South Gare and fledged two chicks. A lack of food caused the death of at least 68% of chicks at Long Nanny, where 47 pairs fledged 29 young. However, food availability further down the coast was good, and at Gibraltar Point birds experienced their best year on record, 37 pairs fledging 34 chicks. Good weather also benefitted chicks at Easington Lagoon, where productivity reached 0.85 fledged per pair, although fox predation was a problem for those chicks raised outside the electric fence (Tees Valley Wildlife Trust 1999). In eastern England, the largest colony at Great Yarmouth suffered from kestrel *Falco tinnunculus* predation of chicks, 206 pairs fledging 0.40 chicks per pair. However, in north Norfolk, plentiful food and good weather resulted in the highest productivity on record for Scolt Head (*c.* 200 fledged from 98 pairs), and birds at Blakeney fledged 1.1 chicks per pair, the highest for five years. Productivity in south-east England was more than double that of 1998, and above the average for the period 1986-98 (0.34, s.e. ± 0.04). Flooding caused losses at Langstone Harbour (0.26 per pair), but at nearby Hayling Oysterbeds, six pairs fledged 13 young. Mesh fencing helped raise productivity at Rye Harbour, to the highest level since 1991 (0.67 chicks per pair).

Fox predation was responsible for the loss of most of the first clutches at Chesil Bank (south-west England). However, birds re-nested, resulting in 85 pairs fledging 40 young, higher than the ten year average of 0.33 chicks per pair (s.e. ± 0.07). In north-west England, 27 pairs at Hodbarrow failed to raise young, continuing a recent run of poor productivity at this site, and overall productivity in the region was well below the 1986-98 mean of 0.44 (s.e. ± 0.07). However, excellent weather contributed to a very good season in Wales, with 86 pairs at Gronant fledging over 110 chicks (A.Gouldstone, pers. comm.). In addition, the Kilcoole/ Newcastle colony in south-east Ireland had a record year, with 19 pairs fledging 44 chicks (Wilson *et al.* 1999).

Table 3.21.2 Little tern breeding success, 1998-99: estimated number of chicks fledged per breeding pair at sample colonies (superscript = number of colonies). When more than one colony was sampled in a given region, the overall figure given is the total number of fledglings divided by the total number of breeding pairs across all 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	1998 fledged/pair			1999 fledged/pair		
	pairs^n	range	overall	pairs^n	range	overall
SW Scotland	40^2	0.00-0.32	0.30	36^1		0.58
NE Scotland	23^2	0.00-0.86	0.83	69^2	0.97-1.00	0.97
SE Scotland	9^2		0.00	5^2		0.00
Scotland	72^6	0.00-0.86	0.43	110^5	0.00-1.00	0.81
NE England	180^8	0.00-1.29	0.69	198^8	0.00-0.92	0.57
E England	553^{15}	0.00-1.55	0.71	650^{12}	0.00-2.04	0.79
SE England	156^7	0.00-2.00	0.19	190^8	0.00-2.17	0.43
SW England	80^1		0.23 max	85^1		0.47
Wales	$35\text{-}40^1$		0.57 max	86^1		1.28
NW England	30^2	0.30-0.67	*c*0.37	40^2	0.00-0.46	≥0.15
England & Wales	1039^{34}	0.00-2.00	0.58	1249^{32}	0.00-2.17	0.69
Total (GB)	1111^{40}	0.00-2.00	0.57	1359^{37}	0.00-2.17	0.70
SE Ireland	$27+^1$		1.00	19^1		2.32

3.22 Guillemot *Uria aalge*

Breeding numbers (Table 3.22.1, Figure 3.22.1)

The general trend in numbers of adult guillemots attending breeding ledges varied between regions from 1998 to 1999. In Wales, both whole-colony and sample plot counts increased, most notably on Skomer where the count of 12,135 individual birds was the highest since monitoring began in 1963. Sample plot counts also increased significantly on Skomer (+13.1%, t=5.158, d.f.=18, P<0.001), and similar increases were recorded in sample plots on Skokholm (+8.2%, t=2.213, d.f.=18, P<0.05), Elegug Stacks (+14.3%, t=7.768, d.f.=8, P<0.001), and at Stackpole Head (+13.3%, t=3.126, d.f.=8, P<0.05). There was a non-significant 2% increase in study plots at South Stack between 1996 and 1999. Numbers also increased at St. Bees Head (Cumbria), where the whole-colony count of 7,122 birds was 17% up on 1998, and the highest recorded in the period since 1986.

The largest proportional decrease in numbers was in south-east Scotland, where numbers on the Isle of May declined by 19.5% to 21,694 individuals. Sample plot counts decreased significantly at St. Abb's Head (-12.3%, t=5.837, d.f.=12, P<0.001), but a 6.4% decline in plots on the Isle of May was not statistically significant. On the Farnes in north-east England, numbers declined for a second successive year, down by 6.2% to 31,386 birds. In north-east Scotland, sample plot counts declined significantly at Fowlsheugh (-7.0%, t=5.789, d.f.=7, P<0.05). However, a whole colony count of Fowlsheugh found a total of 62,330 birds, a 4% increase since the last survey in 1992. In Shetland, sample plot counts at Sumburgh Head increased significantly (+13.6%, t=2.389, d.f.=8, P<0.05). There was also a non-significant increase of 6.2% in plot counts at Noss, and non-significant decreases in plot counts at Troswick Ness (-2.3%), Eshaness (-3.8%), and Burravoe (-8.7%). On Fair Isle, there was a non-significant decrease across three plots counted in both 1998 and 1999, and a significant decrease across all plots counted between 1997 and 1999 (-9.0%, t=4.362, d.f.=14, P<0.001). Sample plot counts at Hermaness were almost identical to the 1998 counts. A whole-island count on Fair Isle found 39,257 individuals, a 4.5% increase since the last survey in 1994. In Orkney, plot counts on Papa Westray increased significantly (+22.8%, t=11.962, d.f.=12, P<0.001).

Table 3.22.1 Population changes at monitored guillemot colonies, 1998-99 (adults attending colony in first three weeks of June). Trends for 1986-98 are average annual rates of change shown by sample populations. Significance of trends (t-test) indicated as: n.s. not significant, ** P < 0.01, *** P < 0.001). Further details of calculation of trends are given in section 1.2.2.

3.22.1a Counts of birds in study plots. Figures are summed means of 5-10, or exceptionally [4], annual counts of study plots.

	NW Scotland	Shetland	Orkney	NE Scotland	SE Scotland	Wales
1986-98 annual % change	+1.0 n.s.	+0.1 n.s.	-	+5.7***	+3.7***	+4.7***
1998	3,265	5,753	272	[3,582]	5,869	6,263
1999	3,419	5,931	334	3,332	5,394	7,095
1998-99 % change	+4.7[a]	+3.1[b]	+22.8[c]	-7.0[d]	-8.1[e]	+13.3[f]

Colonies: [a] Handa; [b] Hermaness, Sumburgh Head, Burravoe, Eshaness, Troswick Ness; [c] Papa Westray; [d] Fowlsheugh; [e] Isle of May, St. Abb's Head; [f] Skomer, Skokholm, Stackpole NNR, Elegug Stacks.

3.22.1b 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, those for Wales are whole-colony counts at Skomer, Skokholm, Stackpole and Elegug Stacks 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
1986-98 annual % change	+6.2**	+3.9**	+4.8***	+4.8***	-	+0.4 n.s.
1998	8,931	30,247	33,456	22,250	1,192	7,041
1999	10,895	25,502	31,386	25,054	1,259	8,251
1998-99 % change	+22.0[a]	-15.7[b]	-6.2[c]	+12.6[d]	+5.6[e]	+17.2[f]

Colonies: [a] Mull of Galloway, Lunga (late June); [b] Isle of May, Inchkeith, Lamb; [c] Farne Islands; [d] Stackpole Head plus Elegug Stacks and nearby, Skokholm, Skomer, Middleholm, St. Margaret's Island, Bardsey, Ynys Gwylan; [e] St. Alban's - Durlston, Berry Head (peak June count); [f] St. Bees Head, Peel Hill.

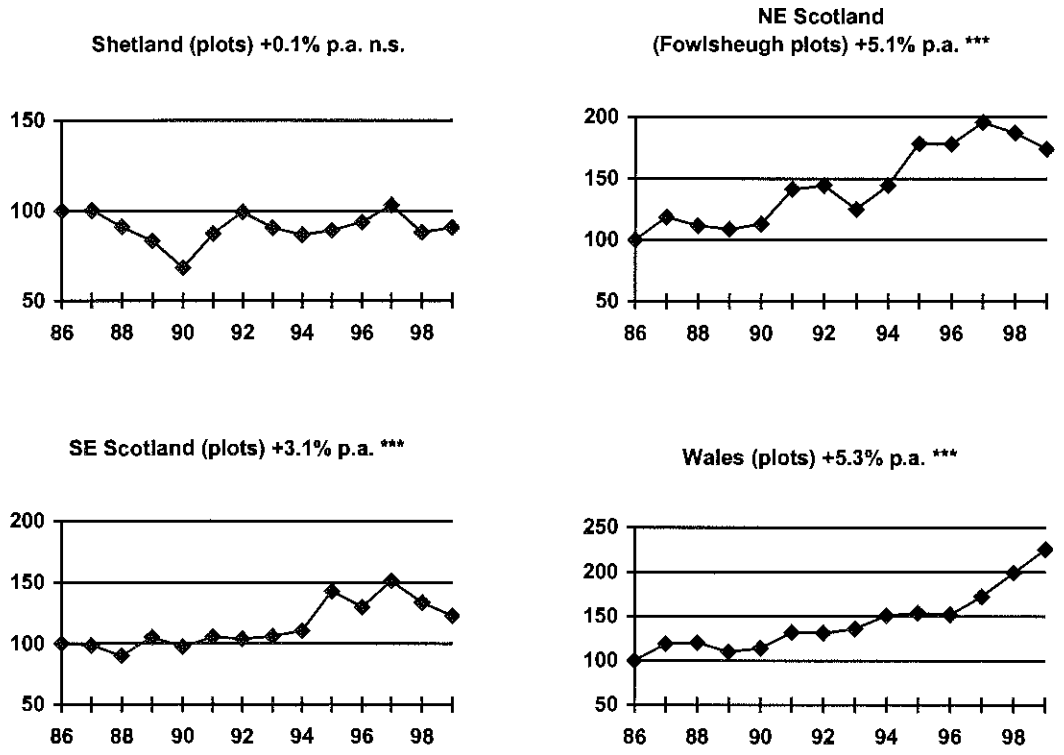

Figure 3.22.1 Population indices for breeding guillemots in various regions, 1986-99. Indices are derived from counts of adults in June. Trends for 1986-99 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, *** $P < 0.001$. Further details of calculation of trends are given in section 1.2.2.

In north-west Scotland, there was a non-significant increase at sample plots on Handa (+4.7%). On Hirta, St. Kilda, numbers increased in monitoring plots by 5.3% between 1996 and 1999, although this was not statistically significant. A complete survey of St. Kilda found a total of 23,457 birds, a 3.3% increase since the last count in 1987. On the Shiant Isles, 15,171 individuals were counted, which represents a 18.8% increase since the last survey in 1995. In Northern Ireland, a complete census of Rathlin Island indicated that numbers had increased by at least 140% to *c.* 95,567 birds since the last count in 1985 (L. McFaul, pers. comm.). There were similar increases at a number of colonies in southern Ireland, most notably at Lambay (Co. Dublin), where numbers increased by 16% since 1995

to 59,839 birds, and the Cliffs of Moher (Co. Clare), where 19,962 individuals were counted, a 63% increase since 1987.

Breeding success (Table 3.22.2)

The intensity of monitoring at the colonies listed in Table 3.22.2 varies and this may affect estimates of breeding success (Walsh *et al.* 1995). Direct comparisons between colonies are therefore inadvisable without prior consultation with the authors. It was generally a poor season in 1999, with average or below average breeding success at all monitored colonies except Fair Isle. Average breeding success across nine monitored colonies in 1999 was 0.66 chicks fledged per breeding pair, below the 1986-98 mean of 0.74 (s.e. ± 0.01) across between three and 14 colonies monitored annually.

The monitored colony at North Sutor (Easter Ross) had a very poor breeding season, partially due to predation of chicks by great black-backed gulls (Swann 1999b). On the Isle of May, adults once again experienced problems in raising chicks, with fledgling weights at their lowest level since observations began in 1983, and losses during the chick period (19%) much higher than the normal rate (5-6%). Breeding success was the lowest recorded at 0.66 chicks per pair, significantly below the mean for the previous 18 seasons (95% confidence interval 0.78-0.82) (Bull *et al.* 1999).

In Shetland, the sheltered Sumburgh Head study plot did not reflect the general situation, as thousands of eggs were washed into the sea along the west coast of Shetland during gales in May. A proportion of birds re-laid, but survival of these chicks was low due to predation by great black-backed gulls (Heubeck 1999). On Handa (Sutherland), success was the lowest recorded in the period since 1988 at 0.60 chicks per pair. In Wales, productivity at the Amos colony on Skomer was 0.76 chicks per pair (Birkhead 1999). This was well above the figures for the JNCC monitoring plots, where breeding success was lowered by an overestimate in the number of regular sites (Smith *et al.* 1999).

Table 3.22.2 Guillemot breeding success, 1998-99 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, figures are mean and standard error across all plots.

Colony	Colony average 1986-99			1998 chicks fledged/pair			1999 chicks fledged/pair			1998-99
	years	Mean	±s.e.	Sites[n]	Mean	±s.e.	Sites[n]	Mean	±s.e.	Change
Handa	11	0.70	±0.02	239[3]	0.66	±0.09	219[3]	0.60	±0.03	-0.06
Sumburgh Head	10	0.67	±0.03	128[1]	0.65	-	128[1]	0.67	-	+0.02
Fair Isle	12	0.75	±0.01	219[2]	0.71	±0.00	168[2]	0.79	±0.02	+0.08
Papa Westray	10	0.70	±0.05	235[1]	0.47	-	264[1]	0.70	-	+0.23
Marwick Head	12	0.73	±0.02	94[1]	0.73	-	86[1]	0.69	-	-0.04
Mull Head	9	0.71	±0.02	97[1]	0.73	-	102[1]	0.70	-	-0.03
North Sutor	5	0.76	±0.01	83[1]	0.78	-	122[1]	0.52	-	-0.26
Isle of May	13	0.80	±0.01	852[5]	0.73	±0.01	870[5]	0.66	±0.01	-0.07
Bempton	8	≥0.69	±0.07	240[1]	0.73	-	-	-	-	-
Durlston	5	0.83	±0.02	63[1]	0.88	-	-	-	-	-
Skokholm	4	0.87	±0.05	110[1]	0.95	-	-	-	-	-
Skomer	10	0.75	±0.01	199[5]	0.77	±0.04	242[5]	0.65	±0.05	-0.12
Total [no colonies]	-	-	-	2,559[12]	0.73	±0.03	2,201[9]	0.66	±0.02	-0.03[9]

3.23 Razorbill *Alca torda*

Breeding numbers (Table 3.23.1, Figure 3.23.1)

Tables 3.23.1a and 3.23.1b show overall regional changes in razorbill numbers in sample plots and at whole colonies from 1998 to 1999. Generally, multiple plot counts are preferred for monitoring annual population changes in razorbills as they smooth out day-to-day fluctuations in numbers of birds attending breeding colonies. It should also be noted that, because of their nesting habits, razorbills are difficult to census, particularly in large colonies, and that consequently there may be considerable variation in counts between individual observers.

As with guillemots, mean numbers of adult razorbills attending sample plots varied between regions from 1998 to 1999. In Shetland, numbers increased significantly at Sumburgh Head (+42.6%, t=2.992, d.f.=8, P<0.05), Eshaness (+30.9%, t=3.345, d.f.=8, P<0.05), Hermaness (+83.1%, t=2.898, d.f.=8, P<0.05) and Noss (+57.3%, t=5.029, d.f.=8, P<0.01). There was also a non-significant increase at Burravoe (+23.5%) and a non-significant decrease at Troswick Ness (-18.8%). In Orkney, sample plot counts on Papa Westray increased by 32.4% (t=4.418, d.f.=8, P<0.01), but given the very small average number of birds present (55), this result should not be taken as representative of Orkney as a whole.

Table 3.23.1 Population changes at monitored razorbill colonies, 1998-99 (adults attending colony in first three weeks of June unless otherwise indicated). Regional totals of fewer than 50 birds are excluded. Trends for 1986-98 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.

3.23.1a Counts of birds in study plots. Figures are based on the means of 5-10, exceptionally [4], annual counts of study plots within each colony.

	NW Scotland	Shetland	NE Scotland	SE Scotland	Wales
1986-98 annual % change	-	+0.9 n.s.	+1.4 n.s.	+4.6***	+4.3***
1998	475	305	[194]	895	1,640
1999	534	430	200	1,049	1,393
1998-99 % change	+12.4[a]	+41.0[b]	+3.1[c]	+17.2[d]	-15.1[e]

Colonies: [a] Handa; [b] Sumburgh Head, Hermaness, Eshaness, Burravoe, Troswick Ness; [c] Fowlsheugh; [d] Isle of May, St. Abb's Head; [e] Skomer, Skokholm, Elegug Stacks, Stackpole NNR.

3.23.1b Single counts of whole colonies

	SW Scotland	Isle of May (birds)	Other SE Scotland (sites)	NE England (sites)	Wales	NW England & Isle of Man
1986-98 annual % change	+8.1*	+6.7***	-	-	+1.8**	+0.6 n.s.
1998	1,821	3,859	163	156	5,740	273
1999	1,168	3,786	169	146	5,420	432
1998-99 % change	-35.9[a]	-1.9	+3.7[b]	-6.4[c]	-5.6[d]	+58.2[e]

Colonies: [a] Mull of Galloway, Lunga (late June); [b] Inchcolm, Inchkeith, Fidra; [c] Farne Islands; [d] Stackpole Head plus Elegug Stacks and nearby, Skokholm, Skomer, Middleholm, St. Margaret's Island; [e] St. Bees Head, Peel Hill.

In south-east Scotland, plot counts increased significantly on the Isle of May by 13.2% (t=2.532, d.f.=18, P<0.05), but there was a non-significant decline at St. Abb's Head (-13.3%). A whole-colony count of the Isle of May found a total of 3,786 birds, 2% fewer than in 1998. At Fowlsheugh in north-east Scotland, there was a non-significant increase of 3.1% in plot counts, but a whole-colony count found a total of 6,362 individuals, a 6.8% decrease since 1992. In north-west Scotland, there was a non-significant increase of 12.4% in sample plots on Handa. On St. Kilda, a 6.1% increase in plot counts on Hirta between 1996 and 1999 was not significant. However, a complete survey of St. Kilda found only 2,545 birds, a 33% decline in numbers since the last survey in 1987. On the Shiant Isles, 8,046 individuals were counted, a 4% increase since 1995. In north-west England, numbers increased from 1998 at St. Bees Head by 51% to 312 birds. There were also notable increases at Peel Hill (+79%) and Calf of Man (+146%), on the Isle of Man between 1998 and 1999.

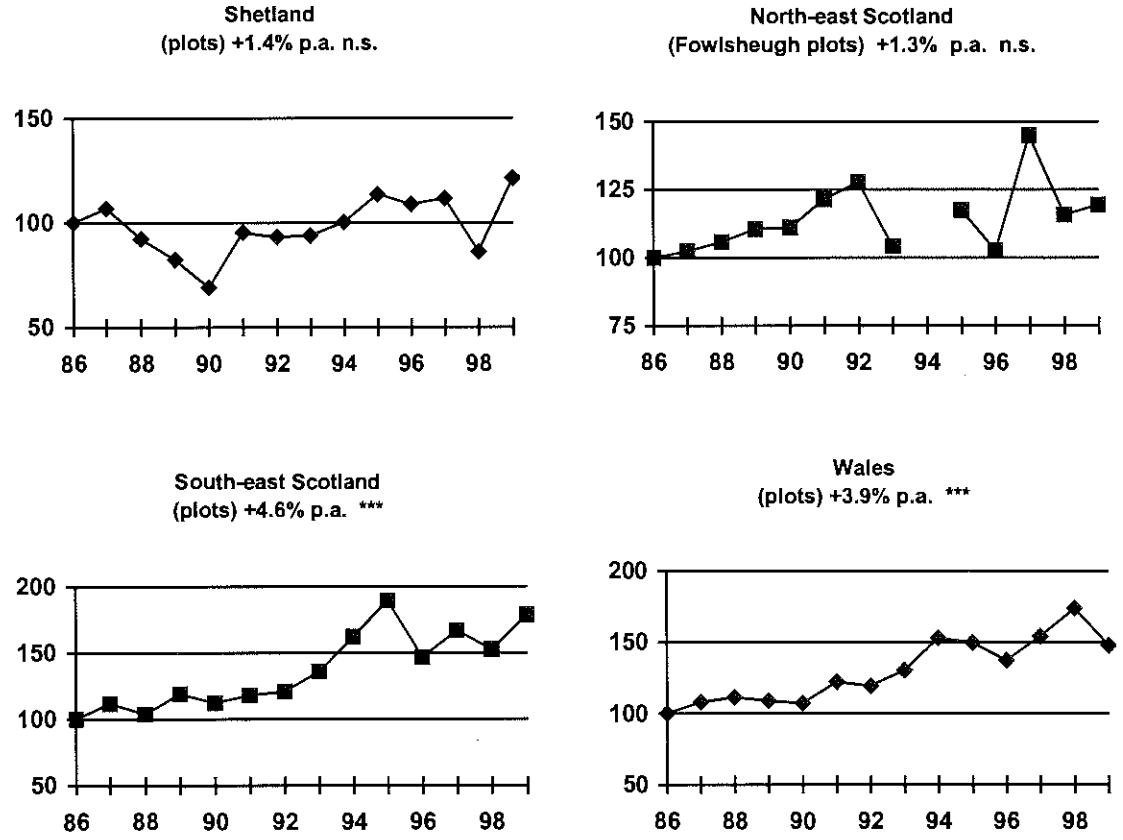

Figure 3.23.1 Population indices for breeding razorbills in various colonies and regions, 1986-99. Trends for 1986-99 are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, *** P<0.001. Further details of calculation trends are given in section 1.2.2.

The largest proportional decrease between 1998 and 1999 was in Wales, the whole colony count on Skomer had declined by 12% to 2,938 birds. There was also a significant decrease in sample plot counts on Skomer (-20.8%, t=5.910, d.f.=18, P<0.001) and non-significant decreases were recorded in sample plots on Skokholm (-9.0%) and Elegug Stacks (-7.3%). At Stackpole Head, there was a non-significant increase of 6.7% and numbers increased on St. Margaret's Island, from 71 birds in 1998 to 115 in 1999. On South Stack, plot counts increased significantly between 1996 and 1999, by 40.3% (t=5.383, d.f.=9, P<0.001).

In north-east England, numbers declined on the Farnes to 146 sites (156 in 1998). In south-west Scotland, numbers between 1998 and 1999, declined on Lunga by 40% to 881 birds and Mull of Galloway by 20% to 287 birds, but there was little change on Sanda.

In Northern Ireland, a whole-colony count of Rathlin Island found a total of *c.* 20,860 individuals, a substantial increase since the last survey in 1985, when 9,071 birds were counted (L. McFaul, pers. comm.). Elsewhere in Ireland, a three-fold increase to 7,700 birds was recorded at the Cliffs of Moher since 1987 (Co. Clare) (Walsh *et al.* 1999) and numbers have increased on Lambay (Co. Dublin) by 19% to 4,337 birds, since the last survey in 1995.

Breeding success (Table 3.23.2)

It should be noted that the intensity of monitoring at the colonies listed in Table 3.23.2 varies and that this may affect estimates of breeding success (Walsh *et al.* 1995). Direct comparisons between colonies are therefore inadvisable without prior consultation with the authors.

Mean breeding success at five colonies monitored in 1999 was 0.61 (s.e. ± 0.05) chicks fledged per breeding pair, significantly lower than the 1986-98 mean of 0.70 (s.e. ± 0.01) measured in between one and six colonies annually. However, this masks some variation between colonies, as a small sample of monitored pairs at North Sutor (Easter Ross) again had a successful season, and further south on the Farnes, breeding success was about average.

However, on the Isle of May, breeding success averaged only 0.52 young fledged per pair, the lowest figure recorded in the period since 1981, and well below the 1986-1998 mean of 0.70 (s.e. ± 0.02) (Bull *et al.* 1999). On Fair Isle (Shetland), mean breeding success was only 0.51 chicks fledged per egg, significantly lower than in 1998 (0.80), and well below the 1991-98 average of 0.64 (s.e. ± 0.04). In Wales, breeding success on Skomer was only 0.56 chicks fledged per pair, significantly lower than in 1998 (0.66), and below the 1993-98 mean of 0.63 (s.e. ± 0.03).

Table 3.23.2 Razorbill breeding success, 1998-99: 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	1998 chicks fledged/pair			1999 chicks fledged/pair			1998-99 change	
	Sites[n]	Mean	±s.e.	Sites[n]	Mean	±s.e.	Mean	±s.e.
Fair Isle	75[1]	≤0.80	-	59[1]	≤0.51	-	*c.* -0.29	-
North Sutor	18[1]	0.78	-	19[1]	0.79	-	+0.01	-
Isle of May	134[4]	0.57	±0.04	142[4]	0.52	±0.06	-0.05	±0.02
Farnes	58[1]	0.59	-	37[1]	0.65	-	+0.06	-
Skokholm	71[1]	0.86	-	-	-	-	-	-
Skomer	214[5]	0.66	±0.03	311[5]	0.56	±0.06	-0.10	±0.03
Total [no. colonies]	570[6]	0.71	±0.05	568[5]	0.61	±0.05	-0.07[5]	±0.00

3.24 Black guillemot *Cepphus grylle*

Breeding numbers (Table 3.24.1)

Unless otherwise stated, all figures refer to early morning spring counts of individuals in adult plumage (Walsh *et al.* 1995). In Shetland, there was an overall decrease of 12.2% in sample areas surveyed in both 1998 and 1999. The monitoring plot on the east coast of Fetlar showed a 11.5% decline in numbers between 1998 and 1999, although a whole-island survey of Fetlar found 1,386 breeding adults, which represents a 16% increase since the last count in 1987 (Smith 1999). A whole-island survey of Noss found 114 breeding adults, a 20% decline since the last count in 1994. On the west side of Shetland, monitored colonies along the coast affected by the *Braer* oil spill in 1993, declined slightly after a sustained period of recovery, and numbers on Foula fell by 9%. On Fair Isle, a whole-island count found a maximum of only 191 birds, compared to 206 in 1998, and the east coast monitoring plot also showed a 10% decline since 1998. Although domestic cats have been partially blamed for this decline on Fair Isle, they cannot be responsible for the decreases at cliff colonies inaccessible to land mammals (D. Shaw, pers. comm.).

In Orkney, 377 birds were counted at North Ronaldsay, similar to the last survey in 1997. On the Isle of Man, the number of birds at Peel Hill increased again. Along the south and west coasts of the Republic of Ireland, from West Cork to the Aran Islands, a survey of known breeding areas found a total of 1,150 birds at 90 sites.

Table 3.24.1 Population changes at monitored black guillemot colonies, 1997-99 (adults in breeding habitat in early morning, late March-early May). Trends for periods indicated are average annual rates of change shown by sample populations. Significance of trends indicated as: n.s. not significant, * $P < 0.05$. For further details of the calculation of these trends see section 1.2.2. The figures for Fetlar (east coast) differ from Thompson *et al.* 1999), as first-year birds have been excluded.

	Fair Isle (east coast)	Fetlar (east coast)	Foula (N & S coasts)	Braer coast Shetland	Other Shetland	Isle of Man
Annual % change (period covered)	-1.9 n.s (1986-98)	+1.3 n.s. (1987-98)	-	+4.6* (1993-98)	-	+1.9 n.s. (1986-98)
1997	254	267	154	215	544	101
1998	160	235	175	230	482	142
1999	144	208	159	219	499	154
1998-99 % change	-10.0	-11.5	-9.1	-4.8[a]	+3.5[b]	+8.5[c]

Colonies: [a] Kettlaness, West Burra, [b] Lunning, Noss north coast, Hillswick Ness, Tingon east; [c] Peel Hill.

Breeding success

Few data were collected in 1999. On Fair Isle, breeding success averaged one chick fledged per nest from a small sample of nine sites, above the 1988-98 mean of 0.77 (s.e. $\pm$ 0.07). Elsewhere in Shetland, reasonable numbers of fledglings were again observed at the Skerries, although otters were thought to have predated some young in the harbour area (Okill 1999b). In Orkney, average clutch/brood size in 34 nests checked on Auskerry in mid July was 1.35 (including five nests that failed), compared to 1.43, 1.07 and 1.22 in the previous three years. On North Ronaldsay, average brood size in 57 successful nests was 1.49 (1.48 in 1997, 1.61 in 1998), and a further six nests failed. In western Scotland, mink caused breeding failure at several sites (Craik 1999a). In Ireland, an average of 1.35 chicks fledged from 20 monitored nests on Old Lighthouse Island (Co. Down), well above the 1986-97 mean of 0.96 (s.e $\pm$ 0.09), and on Rockabill (Co. Dublin), a total of 34 nests fledged an average of 1.21 chicks.

3.25 Puffin *Fratercula arctica*

Breeding numbers

Few data were collected in 1999. In south-east Scotland, a burrow count on Craigleith indicated a population of *c.* 28,000 pairs, compared with only 3,600 in 1985. This is in line with similar increases noted on the Isle of May (A. Leitch, pers. comm.). On Handa in north-west Scotland, puffins recolonised the main part of the island following the successful rat eradication programme in 1997 (Stoneman 1999). In north-east England, a survey of occupied burrows in sample areas on Coquet Island, indicated a total population of *c.* 12,837 breeding pairs. This is within the range of annual estimates from 1993 to 1998 (*c.* 10,200 - *c.* 13,300). In Wales, peak spring counts at Skomer (9,213 birds) and Skokholm (3,083 birds) were within the ranges recorded over the previous four to five years. On Ynys Gwylan Fawr (Gwynedd), there were 524 occupied burrows, compared to 457 in 1998. In Ireland, *c.* 4,000 birds were counted on Great Skellig (Co. Kerry), compared to 3,275 in 1997.

Breeding success (Table 3.25.1)

There appeared to be no problem with burrows being flooded at monitored colonies in 1999, which reduced breeding success in the previous two years on the Farnes and Isle of May (Thompson *et al.* 1999). However, breeding success on the Isle of May was only 0.58 chicks fledged per egg laid, below the 1986-98 average (0.78, s.e. $\pm$ 0.03) and this was thought to be due to low availability of sandeels (Bull *et al.* 1999). Productivity doubled on the Farnes in 1999 compared with 1998, to 0.64 chicks per egg laid, although this was below the 1994-97 average of 0.82 (s.e. $\pm$ 0.03).

In Shetland, breeding success on Fair Isle averaged 0.63 chicks per egg laid, below the 1986-98 mean (0.74, s.e. $\pm$ 0.03). On Foula, no emaciated chicks were found dead in 1999, in contrast to 1998, although productivity remained low (Furness 1999). Adults appeared to have little problem in obtaining sandeels in Shetland during the breeding season (Okill 1999b). In Wales, breeding success on Skomer averaged 0.70 chicks fledged per occupied burrow, slightly below the 11 year colony mean of 0.78 (s.e. $\pm$ 0.02).

Table 3.25.1 Puffin breeding success, 1998-99: estimated number of chicks fledged per egg or occupied burrow (Welsh colonies). Superscript indicates number of colonies.

Colony	1998 chicks fledged/pair				1999 chicks fledged/pair				1998-99 change	
	Burrows	Range	Mean	±s.e.	Burrows	Range	Mean	±s.e.		
Fair Isle	79	-	0.58	-	68	-	0.63	-	+0.05	-
Isle of May	179	-	0.54	-	181	-	0.58	-	+0.04	-
Farne Islands	100	-	0.32	-	100	-	0.64	-	+0.32	-
Skokholm	74	-	0.66	-	-	-	-	-	-	-
Skomer	77	-	0.79	-	88	-	0.70	-	-0.09	-
Total	509[5]	0.32-0.79	0.58	±0.08	437[4]	0.58-0.70	0.64	±0.02	+0.08[5]	±0.09

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