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Seabird numbers and breeding success in Britain and Ireland, 1996

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Contents

Summary

This report presents the results of monitoring of seabird populations and breeding success throughout Britain and Ireland in 1996 and makes comparisons with previous years. The report is produced annually as part of JNCC's Seabird Monitoring Programme, in collaboration with the Royal Society for the Protection of Birds and the Shetland Oil Terminal Environmental Advisory Group.

The 1996 breeding season was generally later than normal, leading to some difficulties in interpreting population data. However, despite the late start, most species had an average to good breeding season. The following are some results of particular note:

- Contrary to long-term trends, there was an overall decline in the numbers of pairs of breeding fulmars in all regions, apart from Shetland, from 1995 to 1996. However, breeding success returned to average levels following a poor year in 1995, and more than doubled at the Isle of Man following a series of poor years.
- A census of the storm petrel population on the Treshnish Isles, western Scotland, using tape playback methods, gave an estimated total breeding population of 5040 pairs.
- In Shetland, both cormorant and shag populations now show signs of recovery following prolonged declines.
- Numbers of cormorants breeding at inland colonies in England continue to increase rapidly.
- Shag populations in south-east Scotland and north-east England showed no evidence of further recovery from the 1994 winter wreck. However, breeding success at Scottish east coast colonies was higher than usual.
- On Hoy, Orkney, numbers of Arctic skuas decreased by 54% from 1992 to 1996, while great skua numbers increased by 11.5% over the same period. Great black-backed gull numbers at this site, formerly the largest colony in Britain, are continuing to decline.
- Breeding success of black-headed gulls in south-east England was much higher in 1996 than in recent years, with some movement of birds to sites less prone to flooding by high tides.
- Breeding success of lesser black-backed gulls in south Wales was poor for a fourth successive season.
- Overall kittiwake breeding success was average in 1996, but there were major differences between regions. Once again, the most productive regions were east and south-east England, the Northern Isles and northern Scotland while Irish Sea colonies were the least successful.
- Terns had a generally successful breeding season in England, Wales and Ireland, although tidal flooding or predators caused problems at some colonies. The most notable colony failure was that of Britain's largest little tern colony at Great Yarmouth, Norfolk. In Scotland, many colonies in the Northern Isles and on the east coast were severely affected by poor weather or high tides.
- There were apparent declines in the numbers of guillemots and razorbills attending colonies on the Isle of May, in south-east Scotland, possibly linked to a prolonged late winter wreck along the Scottish east coast.
- In south Wales, numbers of guillemots and razorbills attending monitored colonies levelled off or declined following significant increases in recent years. These results may potentially arise from mortality caused by the *Sea Empress* oil spill, but several more years' data will be required for the impact of this to be assessed.
- Overall breeding success of guillemots was higher than average in 1996.
- In western Scotland, an intensive trapping scheme is proving successful in safeguarding some breeding sites of ground-nesting seabirds, such as common terns and common gulls, from predation by American mink.

1 Introduction

This is the eighth 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. Breeding success and population changes noted at seabird colonies in 1996 are summarised and compared with results from previous years, primarily 1995. Where possible, results are collated for the British Isles as a whole, including the Isle of Man and the Channel Islands.

The information contained in this report has been collated from many sources. These include: research or wardening staff of a variety of organisations including RSPB, SOTEAG, JNCC, Scottish Natural Heritage, English Nature, Countryside Council for Wales, Irish National Parks and Wildlife Service, local wildlife or naturalists' trusts, bird observatories, the National Trust, the Institute of Terrestrial Ecology, the Seabird Group, and BirdWatch Ireland. Many dedicated fieldwork volunteers also contribute valuable data to the Seabird Monitoring Programme. Please refer to the Acknowledgements section for further details of contributors to this year's report.

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 additional information on numbers or breeding success for any seabird species, whether at coastal or inland colonies. 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 and the RSPB's Tern Database.

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

1.1 The Seabird Monitoring Programme and Seabird Colony Register

The JNCC's Seabird Monitoring Programme facilitates the coordination of seabird monitoring on a UK-wide basis, with the aim of ensuring that adequate data on breeding numbers and breeding performance of seabirds are collected both regionally and nationally. The programme assists JNCC, RSPB and partner organisations, including the statutory country agencies, to monitor aspects of the health of the wider marine environment around the UK and to provide sound advice relevant to the conservation needs of breeding seabirds.

Seabird monitoring directly funded by JNCC focuses particularly on marine 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, and the monitoring of terns in Britain is also largely coordinated by RSPB. Further RSPB monitoring or survey effort is directed at petrels and at Arctic terns and skuas at many colonies in Shetland and Orkney.

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

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

The JNCC and Seabird Group also collaborate on the Seabird Colony Register, a database of colony counts for Britain and Ireland, which is maintained as part of the Seabird Monitoring Programme. Many observers and organisations (including SOTEAG and RSPB) contribute to the Register annually, and these counts are also used in assessing annual population changes in particular regions.

Nearly all coastal colonies in Britain and Ireland were censused for the Register in 1985-87, providing a baseline for future largescale surveys of this kind. Population changes since the previous full survey (the Seabird Group's Operation Seafarer in 1969-70) are summarised in Table 1.1, which is derived from Lloyd, Tasker & Partridge (1991), with updates based on more recent data for some species. It is hoped that a full repeat census of coastal seabird colonies, *Seabird 2000*, will take place around the year 2000.

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 for each species, individual colonies are generally not considered in detail in this report, with the exception of gannet, Manx shearwater, petrels and some terns. 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 population as a whole, because such changes are known to vary markedly between different parts of the British Isles and monitoring effort is uneven. Instead, the coastline has been subdivided into 14 'regions', as defined in Figure 1.1 and Table 1.2. Within each region, valid counts (section 1.2.2) of whole colonies, or of sample plots within colonies, are summed for year-to-year population comparisons, as summarised in this report. 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 1995 and 1996. Readers should bear in mind that some of the population changes indicated by these counts may be of a short-term nature, not necessarily consistent with longer-term trends. For example, year-to-year changes in species such as kittiwake or shag may in some instances reflect fluctuations in the proportion of adults attempting

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

	Coastal population		% change[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]	250,000+	*c.* 275,000	?	250,000+	*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]	195,600	231,700	+36%	195,600	231,700
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]	65+	744+	-80%	65+	744+
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, Bourne & Saunders (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 in press) with updates for colonies also counted in 1996. Note that the totals published in the 1995 annual report (Thompson, Brindley & Heubeck 1996) were in error.
6. Skua figures are from the 1992 survey of Orkney & Shetland, with a 1996 update for Hoy, otherwise 1985-87 with updates to 1996 for Handa and St. Kilda. Although some nest inland in mainland Scotland, all are treated as coastal here.
7. Roseate tern figures are from 1996 (this report), allowing for small numbers at uncounted colonies.
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, Tasker & Partridge (1991).

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

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

to breed Movements of breeding birds to or from unmonitored colonies, notably in the case of cormorants, black-headed gulls and terns, may also contribute to apparent changes. Even where inter-colony movements do not occur, changes shown by sample populations may not necessarily be representative of a wider population.

1.2.2 Calculation of population trends

Regional population trends are assessed using population indices. Indices are used, rather than sums of actual colony counts, because different combinations of colonies are counted in different years. The population index in a baseline year is set at 100 and population changes either side of the baseline are expressed relative to 100. Average annual rates of population change, and their statistical significance, can then be assessed by regression of the logarithms of index values on year.

In previous annual reports, regional population indices for the years from 1986 up to and including 1993 adopted the average 1986-87 count of each colony in a region to calculate the baseline population (index value = 100) for that region. Full details are given in Walsh, Avery & Heubeck (1990). This approach has advantages in allowing maximum possible use of available data, particularly in the early years of the monitoring programme when few years' data were available for some colonies. However, there are also some problems inherent in it, notably the artificial flattening out of genuine changes in populations between 1986 and 1987 engendered by assuming no change between 1986 and 1987 for colonies counted in only one year.

Lack of time precluded calculation of updated population indices for inclusion in the 1994 (Walsh, Brindley & Heubeck 1995) and 1995 (Thompson, Brindley & Heubeck 1996) annual reports. However, in this report, revised regional population indices for the periods 1986-95 have been calculated for some species (fulmar, cormorant, shag, kittiwake, Sandwich tern, guillemot and razorbill), and used to calculate trends. These newly calculated indices adopt 1986 (rather than an average of 1986 and 1987) counts as the baseline and are, in some instances, derived from different combinations of colonies than those adopted up to and including 1993. As previously, very small colonies and colonies where counting error is known, or suspected, to exceed 5% are not included. Other aspects of the calculation of these indices are also the same as described by Walsh, Avery & Heubeck (1990). New population indices, covering variable periods, have also been calculated for black guillemots. It is intended that the new indices for all species will be adopted in all future annual reports.

After calculating these new indices, comparisons were made between the magnitude, direction and statistical significance of the population trends for the period 1986-93 derived from the old indices and the new indices. Agreement between the two sets of figures was generally very good. In only two instances was there disagreement between the two sets of indices as to whether or not a population trend was significant. For fulmars in south-east Scotland, the old indices gave an annual rate of increase of 3.5% significant at the 5% level, while the new indices gave a non-significant 2.5% per annum increase (increasing to a 3.3% per annum increase significant at the 1% level for the period 1986 to 1995). Conversely, for black guillemots at the Isle of Man, the old indices gave a non-significant 4.2% per annum rise while the new indices gave a 6.3% per annum rise, significant at the 5% level. In four other instances, the level of significance varied between the two sets of figures. The new indices indicated stronger population trends for cormorants in north-east Ireland and shags in Shetland than the old indices, while the converse applied to razorbills in south-east Scotland and Wales.

There was generally very good agreement between the two sets of figures in the relative year to year changes in index values (i.e. in the pattern of graphs of index against year) for fulmars, shags, guillemots and razorbills. Given the relatively restricted choice of colonies for inclusion, and these species' high degree of colony faithfulness, this is to be expected. Similarly, for Sandwich terns,

exactly the same colonies were included in the two sets of indices and the only differences derive from the use of different baseline figures (1986 compared with 1986/87).

However, the degree of matching between the two sets of indices was less good for cormorants and kittiwakes, as might be anticipated given the greater mobility of these species between colonies and wider choice of colonies for inclusion in the indices. For cormorants, matching was poor in two out of nine regions and only moderate in a further three. The best matches were for Shetland and for English inland colonies, where most or all colonies are counted each year. For other regions, the mobility of birds between colonies means that differences in the choice of colonies to include in any given year can profoundly affect the index value obtained. However, despite the discrepancies in the details of year to year patterns of change, there was agreement between the two sets of indices as to which regions displayed significant population trends and in the direction of these trends. Similarly, for kittiwakes, matching was poor in two regions (south-west and north-west Scotland) and only moderate in a further four regions. However, as with cormorants, there was agreement in all regions between the two sets of indices as to the direction and significance of population trends.

1.2.3 Accuracy and representativeness of counts

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

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

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

1.2.3 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.

Note that for some species or regions, few colonies are currently monitored, so results may not be fully representative. In most cases, the 'low-input' methods used will overestimate the productivity of breeding pairs slightly (Walsh *et al.* 1995). This is considered acceptable, as major geographical or year-to-year changes will still be obvious.

1.3 General features of the 1996 breeding season

The 1996 breeding season followed a cold spring. Average sea surface temperatures in the North Sea were below normal in March, April and May, as were air temperatures in May throughout the UK (Cullum 1996). Reports from around the country indicated that cliff-nesting species, most notably kittiwakes, shags and, in some areas, auks, delayed breeding. This late season has resulted in some difficulties in interpretation of the data collected in 1996, as counts carried out at the recommended dates may have failed to sample peak breeding populations. In addition to the generally poor spring weather, severe gales in north and north-west Scotland at the end of May generated exceptionally heavy seas which destroyed nests in exposed sites (Heubeck 1997; K. Thompson pers. obs.). In these regions, the weather was also windy in June, potentially affecting both colony attendance and the quality of the colony counts obtained. Also in northern Scotland, dull, cool and wet weather in early July (Cullum 1997) may have affected chick survival of some species, notably terns in Shetland.

In northern and eastern Scotland, the late breeding season followed a major and prolonged seabird wreck in late winter, associated with strong easterly winds. In south-east Scotland, the overall density of beached birds found in the February survey was 6.24 birds per kilometre, as compared to a national average of 2.37. However, whereas the 1994 wreck in this region involved many shags, the overall density of shags in the 1996 survey was similar to previous years and auks were the main species affected, comprising 77% of all birds found (Andrews 1996). Similarly high numbers of dead, but unoiled, auks were found along Moray Firth coasts, with peak densities of guillemots and razorbills in mid-February and in late March and early April (Swann & Butterfield 1996). In Grampian, unusually high numbers of dead guillemots were found in March (Bourne 1996). In Shetland, the most noticeable feature was an increase in the proportion of oiled birds compared with recent years, despite the dilution effect of the overall increase in total numbers of beached birds (Heubeck 1997).

In February, the oil tanker *Sea Empress* ran aground near Milford Haven in south Wales, spilling an estimated 72,000 tonnes of crude oil and several hundred tonnes of heavy fuel oil. Extensive investigations of the effects of this major pollution incident on seabirds, and other marine life, are being reported upon elsewhere. However, where appropriate, reference is made in the following species accounts to the possible impact of this incident on seabirds in the affected areas of Wales.

2.1 Red-throated diver *Gavia stellata*

Breeding numbers and success (figure 2.1.1, table 2.1.1)

Four sample areas of Shetland are monitored annually by the Shetland Ringing Group. At these sites, numbers of pairs with chicks in mid-July increased by two from 56 in 1995 to 58 in 1996, slightly above the mean for the period 1980 to 1995 (53.5 ± s.e. 2.11). The mean brood size of 1.38 was close to the average of 1.36 (s.e. 0.03) for the period 1980-1995, but substantially lower than the peak value of 1.57 recorded in 1995.

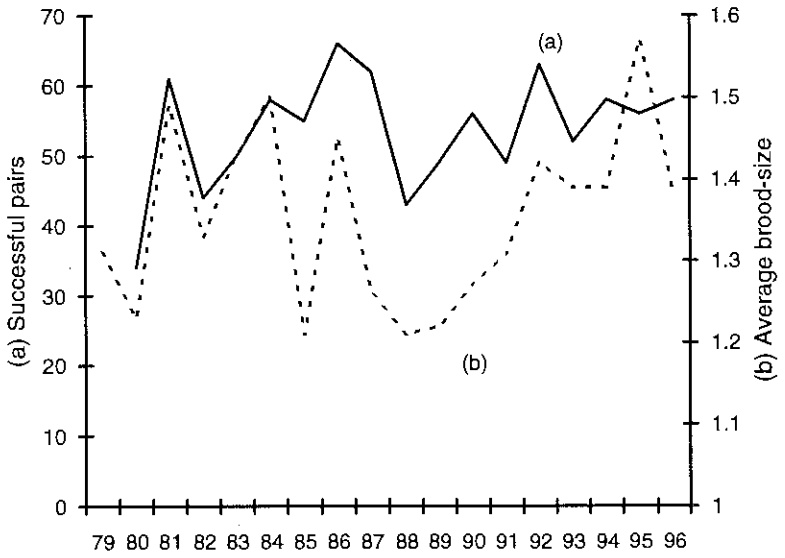

Figure 2.1.1 Annual variation in (a) numbers of 'successful' pairs (with chicks in mid-July) and (b) average brood-size near fledging at red-throated diver study areas in Shetland (parts of Unst, Eshaness, North Roe and Bressay), 1979-96. Data are from Okill (1996a).

Elsewhere in Shetland, eleven pairs laid eggs in the SOTEAG study area at Northmavine. This was the largest number recorded since 1990, but still well below the levels recorded throughout the 1980s (Heubeck 1997). However, the total number of pairs present in the area was relatively low at nineteen, compared with 29 when the site was last monitored in 1994. At Hermaness, there were again eight breeding attempts, three fewer than the peak numbers of 1986 and 1987, but average for subsequent years. Breeding success at Hermaness (0.88 fledglings per nesting pair) was again higher than recorded at other sites in Shetland, but substantially lower than in 1995.

At the RSPB study sites on Yell (Lumbister and South Yell quadrat) breeding success was only moderate (0.43 chicks fledged per breeding pair), but not significantly different from the 1988-1995 mean. On Fetlar, productivity fell slightly, from 0.74 chicks fledged per pair in 1995 to 0.68 in 1996, but was significantly above the mean for the period 1986-95. On Foula, numbers of breeding pairs recovered to early 1980s levels, but the number of chicks surviving to mid-July was lower than in 1995. On Noss, where one pair has bred for a number of years, the eggs and one adult were taken by great skuas in 1996.

Overall in Shetland, up to 0.57 chicks fledged per breeding pair in 1996, similar to the average for the period 1988 to 1995, but lower than recorded in 1995.

Productivity at sites monitored on Mainland Orkney was very low for a second season and significantly below the 1989-95 average. On Hoy, productivity was substantially lower than in 1995, but not significantly below the mean for 1989-95. Overall productivity in Orkney was rather low in 1996, at 0.43 fledglings per occupied site.

Away from the Northern Isles, little information is routinely collected for this species. However, on Handa (Sutherland) in 1996 three pairs again bred and raised a total of four chicks (1.33 per breeding pair). In the Small Isles (Lochaber), three pairs bred on Eigg but reared only two chicks (0.67 per breeding pair) while on Rum eleven pairs were present and reared a total of six chicks (0.55 per pair).

Table 2.1.1 Red-throated diver breeding success, 1986-95, 1995 and 1996: figures are estimated number of chicks fledged per breeding pair or occupied site (Orkney).

	1986-95 mean		1995		1996	
	No. years	Fldg/pr (±s.e.)	Pairs	Fldg/pr	Pairs	Fldg/pr
Hermaness	10	1.08 (± 0.13)	8	1.50	8	0.88
Fetlar	10	0.45 (± 0.06)	19	0.74	19	0.68
Yell	8	0.61 (± 0.12)	25	0.44	23	0.43
Foula	10	0.52 (± 0.08)	12	≤0.75	13	0.38-0.46
Shetland sample total	8	0.60 (± 0.07)	64	≤0.72	63	0.56-0.57
Hoy	7	0.55 (± 0.04)	65	0.69	66	0.47
Rousay	7	0.18 (± 0.05)	11	0.00	-	-
Mainland	7	0.48 (± 0.08)	21	0.19	14	0.21
Orkney sample total	7	0.49 (± 0.03)	97	0.51	80	0.43
Handa	10	1.18 (± 0.12)	3	1.67	3	1.33
Eigg	10	1.18 (± 0.16)	3	1.67	3	0.67
Rum	-	-	-	-	11	0.55

Note that numbers of pairs do not necessarily indicate total populations in study areas.

2.2 Fulmar *Fulmarus glacialis*

Breeding numbers (table 2.2.1)

In contrast to general trends over the past ten years, numbers of apparently occupied sites (AOS) counted in sample populations decreased in several regions between 1995 and 1996. In north-west Scotland, there was no significant change in numbers in monitored plots on Handa, but total numbers recorded on Canna decreased by 10%. On Hirta, St. Kilda, overall numbers of AOS in sample plots were not found to have changed significantly between 1993 and 1996, but the number and quality of the 1996 counts were restricted by poor weather. The fulmar population on Eilean Mor, Flannan Islands, was found to have more than doubled, to over 930 AOS, since last censused in 1988.

In Shetland, there was a further increase in monitored populations from 1995, in line with long-term trends. A whole-colony count on Fair Isle found 43,317 AOS, a 23% increase from the last count in 1991. At sites where population plots are monitored, numbers increased significantly at Eshaness ($P < 0.01$), Troswick Ness ($P < 0.01$) and Sumburgh Head ($P < 0.05$), but were unchanged at Burravoe.

In south-east Scotland, numbers of AOS in monitored colonies fell slightly overall, following an unusually large overall increase in the previous year. However, trends were not consistent between colonies, with slight increases at four out of eight colonies monitored. In north-east England, decreases were recorded at the Farnes and Coquet Island .

In north-west England plus the Isle of Man and in Wales, overall numbers were virtually unchanged from 1995. A comprehensive survey of fulmar colonies in south Wales recorded localised declines at a number of colonies, but concluded that there had been no significant immediate effect of the *Sea Empress* incident on fulmars in this region (Baines & Earl in prep.). The declines recorded in other regions, apart from Shetland, in 1996 further support this conclusion, and are suggestive of some more general factor, possibly weather, affecting numbers of pairs returning to colonies to breed.

A full census of fulmars on Lundy, south-west England, recorded 203 AOS, a 17% increase on 1992.

Table 2.2.1 Population changes at monitored fulmar colonies, 1995-96 (apparently occupied sites in late May or June).

Counts with a reported inaccuracy of $> \pm 5\%$, and regional samples < 100 AOS, are excluded. Except where otherwise indicated, regional totals are derived from single complete counts of the colonies listed below. Trends for 1986-95 are average annual rates of change shown by sample populations (significant trends indicated as: * $P < 0.05$; ** $P < 0.01$, ***$P < 0.001$). Further details are given in section 1.2.2.

	NW Scotland	Shetland	SE Scotland	NE England	Wales	NW England & Isle of Man
1986-95 annual % change	+2.1	+1.3*	+3.3**	+4.6**	+3.9***	+0.8
1995	766	2468	2143	343	1274	1291
1996	710	2651	2073	319	1265	1280
1995-96 % change	-7.3[a]	+7.4[b]	-3.3[c]	-7.0[d]	-0.7[e]	-0.9[f]

Colonies: [a] Canna, Handa (plot counts); [b] Hermaness (productivity plot), Eshaness (plot counts), Burravoe (plot counts), Troswick Ness (plot counts), Sumburgh Head (plot counts), Fair Isle (productivity plots); [c] Isle of May, Fidra, St. Abb's Head, Inchkeith, Inchgarvie, Inchmickery, Inchcolm, Craigleith; [d] Farne Islands, Coquet Island; [e] Skomer, Skokholm, Caldey, Bardsey, Ramsey; [f] Traie Vane - Gob yn Ushtey, Peel Hill, Glen Maye, Contrary Head - Traie Cronkan, Marine Drive Douglas, Lynague - Will's Strand, Bradda, Glen Mooar - Gob y Deigan, St. Bee's Head.

Breeding success (table 2.2.2)

Overall, in 1996 breeding success averaged 0.48 (± s.e. 0.03) chicks fledged per site at 41 colonies, not significantly different from the 1986-95 average (0.42 ± s.e. 0.01, based on 13-37 colonies annually). However, across 35 colonies where breeding success was measured by comparable methods in both 1995 and 1996, there was a highly significant increase between these years. In 1995, fulmar breeding performance at a number of colonies throughout Britain was apparently depressed by fatal heat stress among chicks (Thompson, Brindley & Heubeck 1996), so the generally improved performance in 1996 is not unexpected. However, colonies in the areas affected by severe gales in late May (Northern Isles, excluding one colony possibly affected by ferrets, north-west Scotland and the north Scottish coast) showed no significant change in breeding success from 1995 (+0.01 ± s.e. 0.02, n = 16) in contrast to the very highly significant increase observed at colonies in all other areas (+0.13 ± s.e. 0.03, n = 18).

At a regional level, the most significant change measured was on the Isle of Man, where breeding success more than doubled from 1995 to 1996 following a series of poor years. Elsewhere in the Irish Sea, breeding success at both Skokholm (0.63 chicks fledged per AOS) and Skomer (0.73) in Dyfed was high, but at Bardsey (Gwynedd) an average of only 0.18 chicks fledged per AOS. The only other significant regional change was in north-east England, where average breeding success at the Farnes and Coquet Island returned to 1994 levels, following a significant decrease in 1995.

Table 2.2.2 Fulmar breeding success, 1995-96: 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 based on the *t*-test are indicated as *P < 0.05, **P < 0.01).

Region	1995 chicks fledged/site				1996 chicks fledged/site				1995-96 change	
	AOS[n]	range	mean	±s.e.	AOS[n]	range	mean	±s.e.	mean[n]	±s.e. (n)
SW Scotland[a]	14[1]		0.79		19[1]		0.79		0.00[1]	
NW Scotland[b]	188[2]	0.34-0.42	0.38	±0.04	324[3]	0.29-0.39	0.36	±0.04	-0.05[2]	±0.01
Shetland[c]	2867[7]	0.48-0.68	0.53	±0.03	>3471[8]	0.36-0.71	0.49	±0.04	-0.03[7]	±0.04
Orkney[d]	>1109[7]	0.00-0.56	0.41	±0.07	1158[8]	0.10-0.77	0.48	±0.07	+0.02[6]	±0.04
N Scotland[e]	311[4]	0.17-0.70	0.49	±0.11	289[4]	0.15-0.90	0.53	±0.15	+0.04[4]	±0.06
SE Scotland[f]	371[4]	0.20-0.50	0.36	±0.08	393[4]	0.31-0.53	0.43	±0.05	+0.07[4]	±0.05
NE England[g]	182[2]	0.42-0.42	0.42	±0.00	261[2]	0.58-0.65	0.62	±0.04	+0.15[2]	±0.02*
SW England[h]	49[2]	0.48-0.50	0.49	±0.01	49[2]	0.32-0.54	0.43	±0.11	-0.06[2]	±0.10
Wales[i]	230[2]	0.45-0.50	0.48	±0.03	274[3]	0.18-0.73	0.51	±0.17	+0.21[2]	±0.03
Isle of Man[j]	802[6]	0.03-0.32	0.17	±0.04	495[6]	0.36-0.60	0.44	±0.03	+0.28[5]	±0.03**
Total	>6123[37]	0.00-0.70	0.41	±0.03	6733[41]	0.10-0.90	0.48	±0.03	+0.06[35]	±0.02**

Colonies: [a] Ailsa Craig; [b] Canna, Handa, St. Kilda (1996 only); [c] Hermaness, Eshaness, Noss, Westerwick, Troswick Ness, Sumburgh Head, Fair Isle, Fetlar (1996 only); [d] Papa Westray, Holm of Papa (1996 only), Rousay coast, Rousay inland (1995 only), Costa Head, Mull Head, Gultak, Hoy, North Ronaldsay (1996 only); [e] Easter Ross, St. John's Head, Sandside Head, near Wilkhaven; [f] Isle of May, Fidra, Tantallon, St. Abb's Head; [g] Farne Islands, Coquet Island; [h] West Bay-Burton Bradstock, Annet; [i] Skomer, Skokholm, Bardsey (1996 only); [j] Traie Vane-Gob yn Ushtey, Will's Strand-Gob y Deigan (1995 only), Peel Hill, Glen Maye, Bradda, Douglas, Cass Strooan-Peel headlands (1996 only).

2.3 Manx shearwater *Puffinus puffinus*

Breeding numbers

A systematic whole-colony census of Bardsey (Gwynedd) in 1996 found 6,927 apparently occupied burrows, considerably higher than previous estimates of between 2,500 and 4,500 pairs. On Rum, in north-west Scotland, counts of occupied burrows in a series of 105 permanent quadrats in 1986, 1990 and 1995 are indicative of a gradual decline in this very major colony over the past decade (Furness in press). Also in 1995, a playback method was used to census sample quadrats on The Neck on Skomer (Dyfed), giving an estimate of 26,500 breeding pairs (95% confidence limits 21,000 - 32, 000), similar to the 23,000 to 24,000 pairs estimated in 1994 by chick mark and recapture (Gibbons & Vaughan in prep.). On Old Lighthouse Island, Copeland Islands in north-east Ireland, a record total of 711 fledglings were ringed.

On Canna, in north-west Scotland, occupancy of study burrows was again very low (31%) and estimated breeding success in the fifteen monitored burrows in which eggs were laid was only 0.12 chicks fledged per egg (Swann 1996), compared with an average of 0.49 (± s.e. 0.05) between 1987 and 1995. There was no evidence of rat predation in 1996 and the reason for the very poor breeding performance is unclear. On the neighbouring island of Rum, 87% of 125 study burrows were occupied and 72 % of these fledged chicks. On Skomer, breeding success per egg laid was 0.72 (n = 72), the highest figure in recent years. Note that in Thompson, Brindley & Heubeck (1996), breeding success on Skomer in 1995 was incorrectly reported as being 0.47 chicks fledged per egg laid when the correct figure was 0.68 (Poole *et al.* 1996). Breeding success in 1996 was also good on Bardsey, where an average of 0.79 chicks per burrow fledged from 47 occupied burrows.

2.4 Storm petrel *Hydrobates pelagicus*

Breeding numbers

In 1996, a large project to test survey methods for storm petrels was undertaken by Scottish Natural Heritage and the Royal Society for the Protection of Birds. The work aimed to develop census techniques further, and to examine variation in the timing of breeding in different parts of the UK and Republic of Ireland. Studies were carried out on the Treshnish Isles (Argyll), Mousa (Shetland), Isles of Scilly and the Skelligs (south-west Ireland), and analyses are currently being undertaken. The results will be published separately.

As part of this project, a complete survey was made of the Treshnish Isles in western Scotland. The survey was carried out in July, to coincide with the peak incubation period, and examined all accessible habitat. Diurnal playback of the male 'purr' call was used and a probability of response estimated at sample plots. Using these methods, the total breeding population of the Treshnish Isles was estimated at 5,040 pairs, 3,120 of which were on Fladda (Gilbert & Hemsley 1996). The majority of colonies were in boulder beach, scree or soil and rubble mixtures, with highest densities in dry stone walls.

Elsewhere, ringing studies indicate that storm petrels continue to breed on the Calf of Man. Other colonies visited in 1996 included Sanda (Kintyre, south-west Scotland) where 150-220 burrows were thought to be occupied. In Ireland, the population on Rathlin O'Birne, Donegal, was estimated at 500-1,000 pairs and on High Island, Galway, a minimum of 1,000 breeding pairs were estimated to be present in mid-August.

2.5 Leach's Petrel *Oceanodroma leucorhoa*

Breeding numbers

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

At the annually monitored colony at Ramna Stacks on Gruney (Shetland), there were seventeen to twenty occupied burrows in 1996. This colony has remained stable since breeding was confirmed in 1991. Prior to 1991, breeding had last been confirmed in 1981, when the population was estimated at fewer than 50 pairs (Fowler 1982). In Ireland in 1996, ten birds were mist-netted on Rathlin O'Birne off the coast of Donegal (although breeding has yet to be proved at this site) and one on Great Skellig in south-west Ireland.

2.6 Gannet *Morus bassanus*

Breeding numbers (table 2.6.1)

The numbers of gannets breeding on Fair Isle, Shetland, increased by a further 13% in 1996, in line with the steady rise over the past decade, although it was noted that numbers in some areas may be reaching saturation levels for possible nest sites (Riddington, Newell & Votier 1997). At Bempton in Humberside and at Great Saltee in south-east Ireland, numbers of nests in 1996 had increased by 11.6% and 18.4% respectively from 1994, also in line with the observed increases at these sites over the past decade.

At the small colony on Ireland's Eye, County Dublin, which formed in 1989, 106 nests were counted in 1996, more than double the most recent previous count of 45 in 1994. At Troup Head in Grampian (north-east Scotland), 290 chicks were present in late July, compared with 146 in 1994 and at least 184 in 1995 (Wanless, Matthews & Bourne 1996). This suggests a further increase in numbers of breeding pairs at this recently established colony.

Several gannets were reported sitting around on Am Balg in Sutherland (W. Boyd Wallis, pers. comm.), a site previously identified as a potential new colony location (Murray & Wanless 1986). A general review of the current status of the gannet in Scotland is given in Murray & Wanless (in press).

Table 2.6.1 Population changes at individual gannet colonies 1994-96 (peak or single counts of apparently occupied nests in June-July).

Trends for 1986-95 are average annual rates of change (significant trends indicated as ** $P < 0.01$, *** $P < 0.001$). Further details of the calculation of these trends are given in section 1.2.2.

	Fair Isle (Shetland)	Bempton (NE England)	Great Saltee (SE Ireland)
1986-1995 annual % change	+14.0 ***	+11.4 ***	+9.2 **
1994	825	1631	1250
1995	965	-	-
1996	1090	1820	1480
% change	+13.0 (1995-96)	+11.6 (1994-96)	+18.4 (1994-96)

In the 1995 seabird monitoring report (Thompson, Brindley & Heubeck 1996), the 1994 count of the Grassholm gannetry in Dyfed, Wales was given as 26,277 AOS, suggesting that this colony had remained relatively stable since 1991. However, as the quality of the photographs available in both 1994 and 1991 were poor (Murray & Walsh 1992; S. Wanless pers. comm.), the estimates for both of these years need to be treated with some caution, and the colony extent may in fact have increased in recent years (I. Bullock pers. comm.). A new aerial survey, with ground verification of colony boundaries, will be required in order to obtain an accurate assessment of both colony extent and numbers at Grassholm.

Breeding success (table 2.6.2)

Mean breeding success across all six colonies monitored in 1996 was identical to the 1986-1995 average of 0.69 chicks fledged per occupied nest. Similarly, at none of the individual colonies did breeding success in 1996 differ significantly from the 1986-95 mean. Highest productivity (0.73) was recorded at Ailsa Craig (south-west Scotland) and at Bempton. At the three Shetland colonies, productivity averaged 0.67 (± s.e. 0.02), not significantly below the 1995 figure of 0.69 (± s.e. 0.03).

Table 2.6.2 Gannet breeding success, 1986-95, 1995 and 1996: estimated number of chicks fledged per occupied nest.

In 1995 and 1996, productivity is shown as the mean and standard error of figures from three or more plots; n = number of nests (plots).

Colony	1986-95 fledged/nest			1995 fledged/nest			1996 fledged/nest		
	years	mean	s.e.	n	mean	s.e.	n	mean	s.e.
Ailsa Craig (SW Scotland)	5	0.66	0.04	64(1)	0.66	-	92(1)	0.73	-
Hermaness (Shetland)	7	0.67	0.03	716(3)	0.67	0.01	702(3)	0.64	0.02
Noss (Shetland)	10	0.68	0.01	416(4)	0.66	0.03	429(4)	0.70	0.02
Fair Isle (Shetland)	10	0.69	0.04	166(1)	0.75	-	222(1)	0.67	-
Troup Head (NE Scotland)	4	0.53	0.05	-	-	-	≥ 385	(≤ 0.75)	-
Bempton (NE England)	8	0.78	0.03	-	-	-	122(1)	0.73	-
All colonies	-	0.69	0.04	1362	0.69	0.02	≥ 1952	0.69	0.02

Note: figures for Noss and Troup Head are based on single or peak counts of chicks and of occupied, well-built nests. Figures for other colonies are based on regular checks of mapped nests.

Conclusion

These results suggest that gannets in the British Isles had another successful year in 1996, with average breeding productivity and a continuing increase in numbers of breeding pairs at monitored colonies.

2.7 Cormorant *Phalacrocorax carbo*

Breeding numbers (table 2.7.1)

Most of the counts summarised here were compiled from various sources by Dr R.M. Sellers who runs the Cormorant Breeding Colony Survey. It should be noted that counts of breeding pairs of cormorants are difficult to interpret, particularly where regional coverage is incomplete, as there can be movements of birds between colonies and not all adults necessarily breed each year. In addition in 1996, the cold spring weather may generally have tended to depress breeding numbers.

In Shetland, a survey of all colonies by the Shetland Ringing Group in poor weather conditions found nearly the same number of pairs as in 1995, when numbers increased following a long-term decline. This suggests that the Shetland population may now have stabilised. In Orkney, late season counts of two colonies suggested a small decline in numbers of breeding pairs following a slight rise in 1995.

Numbers of breeding pairs declined at the majority of Scottish colonies monitored in 1996, but the changes seen were generally within the bounds of the population fluctuations observed over the past ten years. In south-west Scotland, a general decline in numbers at coastal colonies was most marked at Currarie-Portandea in Ayrshire, where numbers fell by 32.1% to 94 apparently occupied nests (AONs), but this may have reflected movement of birds to other sites.

Table 2.7.1 Population changes at monitored cormorant colonies, 1995-96 (apparently occupied nests in May-June).

Regional samples of under 50 AONs are excluded. Trends for 1986-95 are average annual rates of change shown by sample populations (significant trends indicated as: * P < 0.05; ** P < 0.01; *** P < 0.001). Further details of the calculation of these trends are given in section 1.2.2.

	SW Scotland	Shetland	Orkney	N Scotland	SE Scotland	NE England
1986-95 annual % change	+6.0*	-7.1***	-	+1.2	+0.2	+1.2
1995	505	215	216	465	475	286
1996	409	212	196	305	399	265
1995-96 % change	-19.0[a]	-1.4[b]	-9.3[c]	-34.4[d]	-16.0[e]	-7.3[f]

	Inland England	SW England	NW England & Isle of Man	Wales	NE Ireland	SE Ireland
1986-95 annual % change	+24.2***	+0.1	-	+0.7	+7.1***	-
1995	568	94	79	1843	199	256
1996	630	100	72	1812	199	250
1995-96 % change	+10.9[g]	+6.4[h]	-8.9[i]	-1.7[j]	0.0[k]	-2.3[l]

Colonies: [a] Port O' Warren, Rigg Bay, Currarie-Portandea, Sanda Island, Carraigh an Daimh, Eilean Buidhe; [b] High Holm, Clett Stacks, W. Muckle Roe, Grocken, Ramna Stacks; [c] Boray Holm, Little Green Holm; [d] Stack O' Brough, Stack of Ulbster, Stacks of Occumster, Ceann Leathad, Neuk Mohr, Ord Point, North Sutor; [e] Craigleith, Lamb, Carr Craig, Haystack, Long Craig & Inchkeith; [f] Farne Islands, Saltburn, Boulby Cliff; [g] Rutland Water (Leics.), Abberton Res. (Essex), Stodmarsh (Kent); [h] Carswell Cove, Thatcher Rock, Parson & Clerk, Burgh Island; [i] Grune Point, Wills Strand; [j] St. Margaret's Island, Llangranog, Blockhouse Stack & Thorn Island, New Quay Head, Penmoelciliau, Yns Gwylan-fawr, Rhoscolyn Beacon, Craig yr Aderyn, Great Orme's Head, Little Orme's Head, Llanddwyn Island, Penderi & Pen Glog, Puffin Island; [k] Bird Island, Black Rock; [l] Ireland's Eye.

The largest regional change was in northern Scotland, where the number of pairs breeding in Caithness fell by almost 50%, to 94 AONs, following a doubling of numbers between 1994 and 1995. At North Sutor (Ross and Cromarty), only 211 AONs were found, the lowest number recorded since population monitoring began there in 1991.

There was a slight fall in numbers of AONs at monitored colonies in north-east England, but numbers at inland colonies in England continue to increase rapidly. In south-west England, there was relatively little change from 1995 at routinely monitored colonies, but at Ballard Cliff (Dorset) only 101 AONs were recorded, compared with 117-172 AONs in seven count years from 1986 to 1993.

Numbers at regularly monitored colonies in Ireland and Wales were virtually unchanged overall from 1995. A full census of all colonies in Wales in 1996 found a total of 2,182 AONs, 5% fewer than in 1994 (Sellers & Hughes 1996). The largest colony, at Puffin Island in Gwynedd, continues to expand and held 776 AONs in 1996. Given the national and international significance of the Welsh cormorant population, there was particular concern about the potential impact of the *Sea Empress* incident on cormorant colonies in south Wales. A general decline of 20% was recorded in Pembrokeshire from 1994 to 1996 (Baines & Earl in prep.), with the largest colony, at St. Margaret's Island, holding just 205 AONs in 1996 compared with the population peak of 320 AONs in 1993. However, none of the declines observed from 1995 to 1996 were beyond the bounds of the population fluctuations observed in previous years, and the general fall in numbers of breeding pairs may have been related to the unusually cold spring weather. There is no evidence of an immediate impact of the oil spill on Welsh cormorants (Sellers & Hughes 1996; Baines & Earl in prep.).

Breeding success

At the few sites regularly monitored, breeding success appeared generally moderate to good in 1996. In western Scotland, *c.* 229 young fledged from 120 nests at five colonies, equivalent to an average of 1.9 per pair. On the Scottish east coast, at North Sutor, 2.29 chicks per nest fledged from a sample of 130 AONs, close to the mean of 2.24 (± s.e. 0.19) for 1991 to 1994, and higher than the 1995 figure of 1.73. At Ceann Leathad in Caithness, mean brood size was 2.60 (± s.e. 0.21) (Sellers & Hughes 1996). In Shetland, the average brood size per productive nest was 2.7, an increase on the 1995 figure of 2.3. At Will's Strand on the Isle of Man, 43 young were reared from twenty nests, an average of 2.15 fledglings per nest.

A number of additional sites were monitored in Wales and Devon as part of the assessment of the impact on cormorants of the *Sea Empress* oil spill. Mean brood sizes per successful nest were 2.25 (± s.e. 0.12) across four colonies in south Pembrokeshire, 2.14 (± s.e. 0.12) at three colonies in Cardigan Bay, 2.33 (± s.e. 0.06) at four colonies in north Wales and 1.87 (± s.e. 0.09) at three colonies in Devon. At St. Margaret's Island, fledging success in 55 nests averaged 2.05 (± s.e. 0.10) chicks per nest compared with 2.28 in 1995 (Sellers & Hughes 1996).

2.8 Shag *Phalacrocorax aristotelis*

Breeding numbers (table 2.8.1, figure 2.8.1)

Some caution is required in the interpretation of counts of nesting shags in 1996. At a number of colonies, including Canna (Lochaber), shags were noted as having a very late season while in Shetland the severe gale of 31st May destroyed many nests at some sites, leading to some late relays.

Despite these factors, which would be anticipated to reduce counts, there was a further increase in numbers of apparently occupied nests (AONs) at monitored colonies in Shetland, following a very highly significant decline of 7.7% per annum between 1986 and 1993 (figure 2.8.1). Numbers also increased, by 19.0% to 169 AONs, at three colonies last counted in 1994. On Fair Isle, numbers in the productivity monitoring plot increased from 160 to 206 AONs, reversing a six-year decline.

In north-west Scotland, overall numbers at monitored colonies were broadly similar to 1995. However, at An Glas Eilean in Loch nan Uamh (Lochaber), the population crashed to just 13 pairs in 1996 from over 100 in 1994 and 1995 and no young were fledged (see below). This, together with the recent disappearance of several smaller colonies from other island sites in western Scotland, has been attributed to predation of eggs and young by mink (J.C.A. Craik pers. comm.). In south-west Scotland, most of the observed increase was attributable to Sanda Island (Kintyre), where numbers rose by nearly 70% to reach the levels seen in 1993 and 1994 (*c.* 675 AONs). This suggests that a large section of the population simply failed to breed in 1995. In south-east Scotland and north-east England, there was little apparent change in numbers in 1996, following some initial recovery in 1995 from the 1994 winter wreck (figure 2.8.1).

A full census of shags in the Isles of Scilly in 1996 found a minimum of 638 AONs, compared with a total of *c.* 1100-1300 AONs in 1987. However, on Annet, which is monitored annually, numbers in 1996 (146) were only slightly down on the 1995 peak (163), following a gradual recovery from a sharp decline between 1987 and 1990 to 82 pairs (P. Robinson pers. comm.). In Ireland, at Great Saltee (Wexford), there was a slight increase in numbers from 1994, to a minimum of 204 AONs, but the colony still holds fewer than half the breeding pairs recorded in the late 1980s.

Table 2.8.1 Population changes at monitored shag colonies, 1994-96 (apparently occupied nests in May-June).
Counts with a reported inaccuracy of $> \pm 5\%$, and regional samples < 100 AONs, are excluded. Trends for 1986-95 are average annual rates of change shown by sample populations. Note that in some instances these overall trends may mask shorter term population fluctuations (see figure 2.8.1). Significant trends are indicated as * $P < 0.05$, *** $P < 0.001$. Further details of the calculation of these trends are given in section 1.2.2.

	SW Scotland	NW Scotland	Shetland	SE Scotland	NE England	SW England
1986 - 1995 % annual change	-	-1.4	-7.0***	-11.8*	-1.4	-
1994	979	-	714	753	771	144
1995	795	1105	757	1050	1016	163
1996	1028	1051	809	1038	994	146
1995-96 % change	+29.3[a]	-4.9[b]	+6.9[c]	-1.1[d]	-2.2[e]	-10.4[f]

Colonies: [a] Mull of Galloway, Sanda Island, Eilean Aoghainn, Eilean Buidhe, Ruadh Sgeir, Eilean Fraoich, Lunga; [b] Eigg, Canna, Handa; [c] Fair Isle (plots), Noness, Noss, Troswick Ness, Sumburgh Head, Mousa, Boddam cliffs, Boddam-Virkie; [d] Isle of May, Inchkeith, Craigleith, Lamb, Fidra, Inchmickery, St. Abb's Head; [e] Farne Islands; [f] Annet.

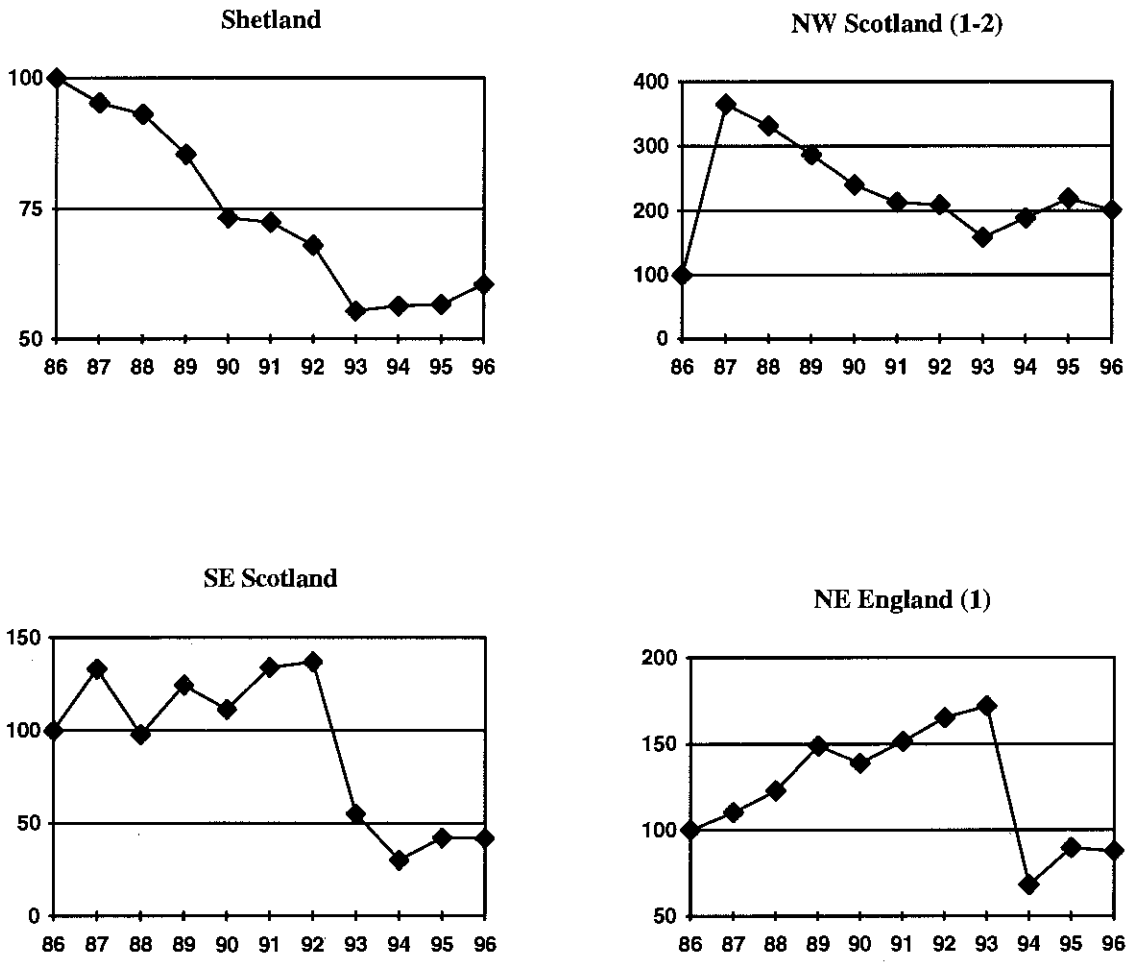

Figure 2.8.1 Population indices for breeding shags, 1986-96 (apparently occupied nests in late May or June). Three or more colonies are counted in each region in each year unless otherwise indicated.

Breeding success (table 2.8.2)

Across thirteen colonies where productivity was measured accurately in 1996, an average of 1.42 chicks fledged per active nest, not significantly different from the 1986-95 average of 1.34 (± s.e. 0.07) as measured over between three and twenty colonies annually. There was no significant difference in breeding success between 1995 and 1996 across ten colonies monitored in both years.

In Clive Craik's study area in western Scotland, estimated productivity at six mink-free colonies was good, with a minimum of 305 young fledging from 195 occupied nests, an average of 1.56 per nest. However, the depleted colony at An Glas Eilean (see above), where mink were active, produced no young. In Shetland, despite brood losses to cool, wet weather, breeding success averaged 1.39 chicks per nest, similar to the 1995 figure, but lower than the figures in excess of 1.5 recorded between 1992 and 1994.

Along the Scottish east coast, productivity at North Sutor in Ross and Cromarty (1.84 chicks per nest) was the highest recorded in five years of monitoring and the St. Abb's Head (Berwickshire) shags also had a good season (1.76 chicks per nest). At the Isle of May in the Firth of Forth, breeding success remained lower than at these other two sites, but, at 0.99 chicks per nest, was among the highest ever recorded at this colony. Further south, at the Farnes in north-east England, productivity was only moderate, at 0.88 chicks per nest.

To the west, shags at Bardsey in Wales and at Great Saltee in south-east Ireland had a good season fledging an average of 1.94 and 2.58 chicks per nest respectively.

Table 2.8.2 Shag breeding success, 1995-96: 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. The average change in breeding success is indicated for colonies studied in both years (none of the regional changes was statistically significant).

Region	1995 chicks fledged/nest				1996 chicks fledged/nest				1995-96 change	
	nests[n]	range	mean	±s.e.	nests[n]	range	mean	±s.e.	mean[n]	±s.e.
SW Scotland[a]	175[7]	0.00-2.67	1.76	±0.32	195[6]	1.16-2.00	≥1.70	±0.14	-	
NW Scotland[b]	62[1]		1.37		64[2]	0.00-1.35	0.68	±0.68	-0.02[1]	
Shetland[c]	264[5]	0.96-1.69	1.33	±0.14	393[4]	1.34-1.49	1.39	±0.03	+0.15[4]	±0.15
N Scotland[d]	72[1]		1.64		80[1]		1.84		+0.20[1]	
SE Scotland[e]	212[2]	0.90-1.00	0.95	±0.05	173[3]	0.99-1.76	1.44	±0.23	+0.46[2]	±0.31
NE England[f]	239[1]		0.91		260[1]		0.86		-0.05[1]	
Wales[g]		-			18[1]		1.94		-	
Isle of Man[h]	18[1]		*c.* 1.28		23[1]		*c.* 1.48		+0.20[1]	
SE Ireland[i]		-			186[1]		2.58		-	
Total	1042[18]	0.00-2.67	1.45	±0.14	1392[20]	0.00-2.58	≥1.51	±0.12	+0.19[10]	±0.09

Colonies: [a] Mull of Galloway (1995 only), Ruadh Sgeir, Eilean Buidhe, Eilean Dubh, Eilean na Cille, Carraig an Daimh, Eilean Glasa [b] Canna, An Glas Eilean (1996 only); [c] Noness, Troswick Ness (1995 only), Westerwick, Sumburgh Head, Fair Isle; [d] North Sutor; [e] Isle of May, Fidra (1996 only), St. Abb's Head; [f] Farne Islands; [g] Bardsey; [h] Peel Hill; [i] Great Saltee.

2.9 Arctic skua *Stercorarius parasiticus*

Breeding numbers (table 2.9.1)

At eleven regularly monitored colonies in Shetland, overall breeding numbers continued to decline in 1996, to 115 apparently occupied territories (AOTs) from 127 in 1995, and 143 in 1994. On Noss, twelve AOTs were present at the annual study site, a slight decrease on the two previous years, while a full survey of the Hermaness colony (Unst) revealed eleven AOTs, a decline of one AOT on 1995. Similarly, numbers at Lumbister and Blackpark, Yell, continued the decline seen over the past few years, to only fifteen AOTs at the two colonies. On Fair Isle, numbers of AOTs remained stable, at 86 (87 in 1995), following the previous year's decline, with a similar distribution to 1995. On Foula, there were 125 AOTs, a decrease of one AOT from 1995.

A complete survey of Hoy in Orkney was carried out by Glasgow University in 1996. This survey revealed only 98 AOTs (Furness 1997), which represents a decline of 54% in the four years since the full survey of the Orkney Islands in 1992 (Meek, Sim & Ribbands 1994). It is likely that the declines reflect both difficulties with food supply and increasing pressure from great skuas (Furness 1997). Numbers have declined to a lesser extent on North Hill, Papa Westray, where a full survey in 1996 found 139 AOTs compared with 151 in 1992.

A complete census of Handa (Sutherland), north-west Scotland, carried out at the end of May found an estimated 29 AOTs. The population here has been relatively stable over the past ten years.

Table 2.9.1 Population changes at monitored Arctic skua colonies, 1995-1996 (apparently occupied territories).
Superscript = number of colonies counted in both years.

	Foula	Fair Isle	other Shetland	total Shetland	Orkney
1995	126	87	127	340	231
1996	125	86	115	326	229
% change	-0.8	-1.2	-9.5^{11}	-4.1^{13}	-0.1^{5}

Breeding success (table 2.9.2)

Despite declines in breeding numbers, productivity in both Orkney and Shetland was again good overall in 1996, although predation by great skuas was reported from several study sites. At the Noss study site, seven chicks fledged from twelve AOTs, giving an overall productivity of 0.58. Great skua predation occurred mainly during the pre-fledging period, although it was thought to involve only two pairs of great skuas. On Fair Isle, the season was better than in previous years, with a total of 76 chicks thought to have fledged from 86 AOTs (0.88 chicks per AOT). At Hermaness, nine chicks fledged from the eleven AOTs (0.82 per AOT). On Foula, survival of larger chicks was thought to have been good, although smaller chicks and eggs succumbed to poor weather.

Productivity also remained high at study colonies in Orkney, at 0.89 chicks fledged per AOT, although the Hoy area is very heavily predated by great skuas. An estimated 140 chicks fledged from the total of 139 AOTs counted on Papa Westray.

On Handa, fledging success was not estimated directly, but is thought to have been low, following the discovery of six Arctic skua corpses on the reserve in August.

Table 2.9.2 Arctic skua breeding success 1995 and 1996: number of chicks fledged per apparently occupied territory (AOT).

Colony	1995		1996	
	AOTs	number fledged per AOT	AOTs	number fledged per AOT
Shetland				
Unst (2 colonies)	29	0.90	28	0.79
Fetlar	18	0.94	18	0.72
Yell (2 colonies)	18	1.17	15	0.80
Noss	14	0.93	12	0.58
Mousa	19	1.21	19	1.26
Mainland (4 colonies)	29	1.10	23	1.00
Fair Isle	87	0.75-0.80	86	0.88
Orkney				
Papa Westray	135	1.00	139	1.00
Westray	29	0.74	28	0.71
Rousay	33	1.12	33	1.30
Mainland	22	0.95	23	0.65
Hoy	12	0.08	6	0.00

2.10 Great skua *Stercorarius skua*

Breeding numbers (table 2.10.1)

At the eight colonies which are monitored annually in Shetland, there was an increase in the overall number of apparently occupied territories (AOTs) from 228 in 1995 to 246 in 1996. At the traditional study site on Noss, Shetland, the number of AOTs increased to 63, approximately ten more than there have been since 1992. However, territories continued to be occupied after the end of the normal recording period (2nd June), and it is possible that this increase reflects the inclusion of these late territories. Fair Isle saw a 7% decline on the 1995 figure, to 120 AOTs, still, however, the second highest recorded figure since 1986.

On Foula, breeding numbers remained stable, with high survival of colour-ringed birds between 1995 and 1996. By late June, sandeel pellets had become scarce and most instead contained whitefish. The impression was that herring were more frequent and birds less frequent in the diet than in the last ten years or so (Furness 1996). Dietary studies on Fair Isle revealed roughly equal proportions of 'bird' and 'fish' within pellets, 'bird' possibly consisting of kittiwake or Arctic tern. The systematic approach used in 1996 may explain the difference between this and previous years, when a greater 'bird' component has been reported (Riddington *et al.* 1996).

Breeding numbers remained stable at three study colonies in Orkney, with 112 AOTs in 1996, following the 17% increase between 1994 and 1995. On Hoy, a complete survey by Glasgow University found a total of 2,119 AOTs (Furness 1997), an increase of 11.5% since the last full survey in 1992, while on Papa Westray, the number of AOTs increased to eight (Meek 1996).

A survey on St. Kilda (Western Isles) found 213 AOTs on Hirta, one on Dun, three on Boreray and twelve on Soay (Richard Phillips pers. comm.). Also in north-west Scotland, on Handa, the overall population remained stable at 116 AOTs.

Table 2.10.1 Population changes at monitored great skua colonies, 1995-1996 (apparently occupied territories). Superscript = number of colonies counted in both years.

	Fair Isle	other Shetland	total Shetland	Orkney
1995	130	228	358	111
1996	120	246	366	112
% change 1995-96	-7.7[1]	+7.9[8]	+2.2[9]	+0.9[3]

Breeding success (table 2.10.2)

At study colonies in both Shetland and Orkney, great skuas are continuing to do well in terms of numbers of young fledged per AOT.

The annual study of productivity at Hermaness, Shetland, revealed 42 chicks to have fledged from 38 AOTs (1.1 chick per AOT), the highest figure since 1992. However, detailed studies of the progress of chicks on Noss gave an estimate of 0.68 chicks fledged per AOT, slightly lower than in recent years. Casual observations suggested that a good number of large chicks were taken by adult great skuas (Lewis & Goddard 1996). Similarly, on Fair Isle, approximately 100 chicks of 119 ringed were estimated as surviving to fledge, equivalent to 0.83 chicks fledged per AOT, lower than in the previous three years, but still a good season. Fledging success on Foula was very high (probably the highest since 1984) at over one chick per pair.

On Hoy, 79 young were estimated to have fledged (0.71 per AOT), and on Papa Westray, four to five young fledged from the eight AOTs.

Table 2.10.2. Great skua breeding success, 1995-1996: number of chicks fledged per apparently occupied territory (AOT) (n = number of AOTs).

Colony	1995		1996	
	n	number fledged per AOT	n	number fledged per AOT
Hermaness	38	0.92	38	1.11
Fetlar	55	0.95	53	1.13
Mainland (2 colonies)	47	0.94	51	0.71
Yell (2 colonies)	25	0.64	29	0.79
Mousa	11	1.09	11	1.09
Noss	52	0.96	63	0.68
Fair Isle	130	*c.* 1.15	120	0.83
NW Hoy	40	0.93	36	1.11
S Hoy	31	0.84	34	0.41
E Hoy	40	1.00	42	0.83

2.11-2.15 Gulls *Larus* spp.

2.11 Black-headed gull *Larus ridibundus*

Breeding numbers (table 2.11.1)

Given the mobility of black-headed gulls between colony sites, annual changes in numbers at the few colonies that are counted regularly should not be assumed to be representative of broader regional trends. For example, Chichester Harbour in Sussex, which has regularly held in excess of 1,000 pairs of black-headed gulls over the past decade, was abandoned in 1996 following repeated flooding of the colony by high tides in 1995. Many, but not all, of the Chichester birds apparently moved to Langstone Harbour in Hampshire, where numbers increased from fewer than 50 pairs in the past few years to 549 in 1996. Over the four regularly monitored colonies in south-east England, which together hold roughly a third of the regional total (Lloyd, Tasker & Partridge 1991), numbers fell by 9% from 1995, but this could simply reflect movements of birds between these monitored sites and other colonies. Other colonies in south-east England from which records have been received for 1996 include Flanders Mare (3,448 pairs) and Dungeness (*c.* 600 pairs), both in Kent. In both cases, the 1996 figures are broadly in line with previous recent estimates.

In north-west England, 11,875 pairs nested at the Ribble Estuary (Lancashire), the largest coastal colony in the country which held 15,000 pairs in 1989 and an estimated 9000 pairs in 1993. In north-east England, there was a further slight decline in the region's largest colony on Coquet Island, to 2,217 pairs, the lowest total in eleven years and just over 50% of the 1986 figure.

A large drop in numbers was recorded at Strangford Lough in Northern Ireland, from roughly 7,000 pairs in 1994 and 1995 to just over 4,600 in 1996. However, this apparent decline is partially attributable to previous over-estimates of the size of the declining colony on Jackdaw Island, which was counted accurately for the first time in 1996 (D. Thompson pers. comm.).

In western Scotland, the numbers of black-headed gulls nesting on regularly monitored small islands in parts of Argyll and southern Lochaber have declined by over 50% since 1989. In 1996, thirteen former breeding sites encompassing six sea lochs held no birds and the twelve sites which were occupied held a total of just over 300 pairs. Much of this decline is attributed to repeated breeding failures caused by mink (Craik 1996).

Table 2.11.1 Population changes at monitored black-headed gull colonies, 1994-96 (breeding pairs or apparently occupied nests in May-June).

Regional samples <200 pairs are excluded.

	NE England	SE England	NE Ireland
1994	3123	8479	7355
1995	2306	7841	7173
1996	2286	7113	5055
1995-96 % change	-0.9[a]	-9.3[b]	(-29.5[c])

Colonies: [a] Coquet Island, Farnes; [b] Rye, Langstone and Chichester Harbours, North Solent NNR; [c] Strangford Lough (several colonies), Swan & Blue Circle Islands (Larne Lough), Green Island (Carlingford Lough).

Breeding success (table 2.11.2)

In western Scotland, breeding success in 1996 was only moderate, although better than in 1994 or 1995. Mink were apparently responsible for the complete failure of three colonies holding a total of twenty pairs, while high tides flooded out another colony of 26 pairs. The remaining seven colonies monitored, totalling 250 pairs, fledged at least 94 young, a minimum overall productivity of 0.38 chicks per nest (J.C.A. Craik pers. comm.).

Following the desertion of Chichester Harbour, breeding success improved in south-east England, with an average of 0.78 chicks fledged per pair at four colonies. The most productive site was again Langstone Harbour (0.97 chicks per pair). At Newtown Estuary (Isle of Wight), 0.71 chicks fledged per pair, a major improvement on 1995 when high tides caused almost complete breeding failure. In addition to the sites monitored in detail, an estimated 12-15,000 chicks fledged from 6,229 apparently occupied nests at North Solent NNR (Hampshire), *c.* 2.0 - 2.4 per pair, normal for this colony.

Breeding success was again also good at Coquet Island in north-east England, where an average of 1.51 chicks per pair fledged from a sample of 63 pairs.

Table 2.11.2 Black-headed gull breeding success, 1995-96: estimated numbers of chicks fledged per breeding pair at sample colonies (n = number of colonies).

Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these colonies.

Region	1995 fledged/pair			1996 fledged/pair		
	prs[n]	range	overall success	prs[n]	range	overall success
SW Scotland[a]	289[7]	0.00-0.83	0.17-0.29	270[10]	0.00-1.00	0.35-≥0.46
NW Scotland[b]	20[2]		0.00	26[1]		0.00
Shetland[c]	32[1]		0.66	30[1]		0.47
NE England[d]	51[1]		1.70	75[2]	1.00-1.51	1.43
SE England[e]	*c.* 1677[5]	*c.* 0.02-*c.* 0.65	*c.* 0.33	*c.* 1834[4]	0.45-0.97	*c.*0.78
Orkney[f]	-		-	658[2]	≥0.29-0.40	≥0.30
Total	*c.* 2069[16]	0.00-1.70	*c.* 0.35	*c.* 2893[20]	0.00-1.51	*c.* 0.64

Colonies: [a] Argyll & Bute coast; [b] southern Lochaber coast; [c] Fetlar; [d] Coquet Island, Farne Islands (1996 only); [e] Rye Harbour, Langstone Harbour, Chichester Harbour (1995 only) Newtown estuary, Dungeness; [f] Shapinsay, Egilsay.

2.12 Common gull *Larus canus*

Breeding numbers

Few common gull breeding sites are counted regularly, so little information is available on regional or national trends. In particular, very few colonies in Orkney or Shetland, which together hold almost 70% of the British coastal nesting population (Lloyd, Tasker & Partridge 1991) have been counted in recent years. However, in the course of a survey of skuas on Hoy (Orkney) in 1996, a total of 312 pairs of common gulls were located in the northern section of the island (Furness 1997). This compares with an estimated 498 pairs in the same area in 1986 (Seabird Colony Register), with the greatest change over the intervening ten years being the disappearance of a colony of approximately

200 pairs from Lender's Dale. Otherwise, the distribution of birds in 1986 and 1996 was broadly similar. On the South Walls peninsula, approximately 250 pairs were estimated to have bred in 1996, compared with 287 in 1986.

Counts at 21 sample colonies in western Scotland from 1994 to 1996 (table 2.12.1) suggest a further decline in numbers in this region, attributed to predation by mink (Craik 1996).

Table 2.12.1 Numbers of common gulls in study colonies on the west coast of Scotland 1994-96.

Figures are sum of counts of pairs at 21 colonies in Argyll & Bute and southern Lochaber.

Year	1994	1995	1996	1995-96 % change
No. of pairs	1148	1082	869	-19.7

Breeding success (table 2.12.2)

In 1996, following a successful pilot scheme in 1995, a mink-trapping programme was established in western Scotland under the auspices of the Argyll Farming Forestry and Wildlife Advisory Group (Craik 1996). Mink were removed before the breeding season from six common gull colonies holding a total of 477 breeding pairs. These colonies fledged a total of 330 to 440 chicks, equivalent to between 0.69 and 0.92 chicks per pair. At a further twelve colonies (of more than ten pairs) where mink were not controlled, a total of *c.* 399 pairs reared only *c.* 0.2 chicks per pair. With increased efforts being made to control mink at seabird breeding sites, there has been a steady improvement in overall productivity of common gulls in western Scotland over the past four years, although numbers continue to decline (see above).

Elsewhere, the few pairs on Fair Isle (Shetland) had a relatively good season. In Ross and Cromarty (northern Scotland), eighteen sample pairs at Nigg fledged 0.82 chicks per pair, but the colony at Alness Point produced only 0.44 young per pair. Breeding success improved markedly at Dungeness in Kent, having been depressed by mammalian predation in 1995.

Table 2.12.2 Common gull breeding success, 1995-96: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies).

Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these colonies.

Region	1995 fledged/pair			1996 fledged/pair		
	prs[n]	range	overall success	prs[n]	range	overall success
SW Scotland[a]	951[23]	0.00-0.98	0.40-0.52	*c.* 744[25]	0.00-0.97	0.50-0.67
NW Scotland[b]	235[10]	0.00-1.90	0.16-0.17	*c.* 194[9]	0.00-2.00	0.15-0.21
Shetland[c]	5[1]		0.60	6[1]		1.00
N Scotland[d]	-		-	112[2]	0.44-0.82	0.52
SE England[e]	12[1]		0.17	13[1]		0.54

Colonies: [a] various, Argyll & Bute coast; [b] various, southern Lochaber coast; [c] Fair Isle; [d] Alness Point, Nigg; [e] Dungeness.

2.13 Lesser black-backed gull *Larus fuscus*

Breeding numbers (table 2.13.1)

Few of the larger lesser black-backed gull colonies are counted regularly, particularly in England, which holds over 40% of the UK population. However, some recent estimates from colonies in north-west England, which held over 50% of the English population in 1985-87 (Lloyd, Tasker & Partridge 1991), suggest that the population in this region is continuing to increase, in line with the current national trend for coastal colonies identified by Walsh & Gordon (1994). In 1996, there were estimated to be in excess of 7,000 pairs of lesser black-backed gulls in the mixed gull colony at Rockcliffe (W. Makin, pers. comm.), compared with estimates in the order of 1,500 to 2,000 pairs in the early 1990s (Seabird Colony Register). Also in Cumbria, at South Walney, the largest gull colony in the region, there were an estimated 22,000 pairs of lesser black-backed gulls in 1996 (W. Makin pers. comm.), compared with approximately 17,000 in 1991 (Seabird Colony Register). Similarly, the mixed lesser black-backed and herring gull colony at the Ribble estuary (Lancashire) held an estimated minimum total of 3,000 pairs in 1996, the majority lesser black-backed gulls, compared with under 1,000 pairs before 1990 and just over 2,000 pairs in 1993 (Seabird Colony Register).

Elsewhere, the annual gull census on the Isle of May in south-east Scotland suggested a possible slowing down of the rate of increase of the island's lesser black-backed gull population, although there is some uncertainty over the accuracy of the 1996 estimate (Harding 1996). In Wales, there was a further decline of 7% (to *c.* 14,400) in total numbers of nests at the largest lesser black-backed gull colony, on Skomer (Dyfed), from the peak counts of 1993 and 1994. An estimated 49% of nests were empty at the time of the count. On neighbouring Skokholm, numbers increased slightly, by 5% to 3,137 nests, of which 35% were empty. At other colonies in Dyfed, numbers increased by 20% from 1995, at Cardigan and Caldey Islands, to 3,933 and 452 pairs respectively, while there was a 51% increase at Ramsey Island, to 413 pairs.

Table 2.13.1 Population changes at monitored lesser black-backed gull colonies, 1994-96 (breeding pairs or apparently occupied nests in May-June). (Regional samples < 200 pairs are excluded).

	SE Scotland[a]	Wales[b]
1994	1270	24078
1995	1635	19526
1996	≥1641	18830
1995-96 % change	+0.4	-3.6

Colonies: [a] Isle of May; [b] Skomer, Skokholm, Bardsey, Caldey, Ramsey.

Breeding success (table 2.13.2)

No detailed information is available on the breeding success of lesser black-backed gulls in Argyll, western Scotland in 1996. However, two small colonies failed completely as a consequence of mink predation, while at Reisa mhic Phaidean, where there was heavy mink predation of eggs and chicks, fewer than 50 chicks fledged from a colony of at least 300 pairs. Colonies where mink were not known to be active generally fared better with, for example, 50-100 chicks fledging from 100-150 pairs at Bach Island and 50-70 chicks from *c.* 100 pairs at Eilean na Cille (J.C.A. Craik pers. comm.).

On the Isle of May, estimated breeding success was 0.88 chicks per pair, identical to the mean for the period 1989 to 1995. Once again, the estimated productivity of lesser black-backed gulls was substantially less than that of herring gulls, but an analysis of the methods used suggests that

differences between the species in detectability, together with various other factors, could lead to underestimates of breeding success among lesser black-backed gulls at this colony (Harding 1996).

On Skomer, breeding success was low for a fifth successive season, although slightly better than recorded in 1995, with an average of 0.14-0.20 chicks fledged per pair, Productivity was also poor at Skokholm (0.24 chicks per pair) and only moderate (0.56 chicks per nest) at Bardsey (Gwynedd).

Table 2.13.2 Lesser black-backed gull breeding success, 1995-96 (n = number of colonies).

Colonies where breeding success is reduced by control measures are excluded. Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these colonies.

Region	1995 fledged/pair			1996 fledged/pair		
	prs[n]	range	overall success	prs[n]	range	overall success
SW Scotland[a]	*c.* 900[7]	0.0-*c.* 0.7	*c.* 0.40	-		-
SE Scotland[b]	*c.* 1635[1]		*c.* 0.56	*c.* 1641[1]		*c.* 0.88
Wales[c]	*c.* 18500[2]		0.04-0.11	*c.* 17620[3]	*c.* 0.17-0.56	0.16-0.21

Colonies: [a] Reisa mhic Phaidean, Eilean na Cille, Eilean Ghamhna, Eilean Fraoch, Corr Eilean, Eilean Mor, Eilean Dubh, Reisa an t'Struith; [b] Isle of May; [c] Skomer, Skokholm, Bardsey.

2.14 Herring gull *Larus argentatus*

Breeding numbers (table 2.14.1)

Few colonies are counted regularly, but coastal populations of herring gulls have apparently been roughly stable or declining in recent years following major declines from the early 1970s to mid-1980s (Walsh & Gordon 1994; Lloyd, Tasker & Partridge 1991).

At eight colonies in south-west Scotland, where accurate counts of herring gulls were made in both years, there was a 21% decline in numbers of breeding pairs between 1995 and 1996. However, minimum and maximum estimates of numbers at a further twenty colonies, holding some 3,000 pairs, were virtually unchanged. There is evidence to suggest that predation by mink may have caused declines in colonies of large gulls in western Scotland, as previously documented for smaller gulls and terns (J.C.A. Craik pers. comm.). However, in view of the apparent general decline of this species in Scotland since 1986 (Walsh & Gordon 1994), other factors may also be involved.

In south-east Scotland, numbers at the Isle of May in the Firth of Forth increased for the fourth successive year, by 16% to *c.* 2,970 pairs, continuing the trend observed since 1992. At two colonies in Cleveland, where estimated numbers have fluctuated considerably over the past ten years, numbers fell by 28% in 1996, to *c.* 485 pairs, the third lowest figure since 1986. In Cumbria (north-west England), numbers have also fluctuated over the past ten years at the small St. Bee's Head colony, which held 540 pairs in 1996. However, at the much larger South Walney colony there is evidence of a continuation of the long-term decline, with an estimated 8,000 pairs breeding in 1996, compared with estimates in excess of 20,000 pairs in the 1970s (W. Makin pers. comm.).

In Wales, there was again little overall change in numbers in monitored colonies from the previous year. Numbers of nests on both Skomer (401) and Skokholm (317) declined for the third year in succession, by 11% and 17% respectively, while numbers at the other colonies monitored increased. A sharp fall in numbers at Guns Island in north-east Ireland, from 673 pairs in 1995 to 269 pairs in 1996, may have been caused by fox predation.

Table 2.14.1 Population changes at monitored herring gull colonies, 1994-96 (breeding pairs or apparently occupied nests in May-June). (Regional samples < 200 pairs are excluded).

	NW Scotland[a]	SW Scotland[b]	SE Scotland[c]	NE England[d]	Wales[e]	NW England & Isle of Man[f]	NE Ireland[g]
1994	997	-	2501	*c.* 695	2889	421	1134
1995	995	1130	3007	*c.* 670	2861	495	1216
1996	*c.* 950	896	3392	*c.* 485	2922	540	799
1995-96 % change	-4.5	-20.7	+12.8	-27.6	+2.1	+9.1	-34.3

Colonies: [a] Eigg, Canna (plots); [b] Fladda Light, Sgeir nan Gobhar, Eilean Beag, Eilean Loch Oscair, Eilean nan Caorach, Ruadh Sgeir, Eilean Eoghainn, Lunga; [c] Isle of May, Eyebroughty, Carr Craig, St. Abb's Head; [d] Huntcliff, Boulby - Cowbar Nab; [e] Stackpole Head, Skomer, Skokholm, Ramsey, Caldey, Bardsey; [f] St. Bee's Head; [g] Strangford Lough (several colonies), Gun's Island.

Breeding success (table 2.14.2)

Overall breeding success at colonies in western Scotland was similar to 1995 and 1994. However, in study colonies holding ten or more nests, overall breeding success was 0.58-0.79 chicks fledged per pair from *c.* 1,587 nests in twelve colonies where there was no evidence of mink predation, compared with just 0.16-≥ 0.23 chicks fledged per nest from *c.* 1,514 nests in another twelve colonies where mink predation occurred. Seven of these colonies, holding *c.* 500 nests, failed completely. Further offshore in north-west Scotland, productivity in a sample colony in Canna (Lochaber) was the lowest recorded since 1979, averaging just 0.25 chicks per nest (Swann 1996). This contrasts with neighbouring Eigg, where herring gulls were had a very successful season (J. Chester pers. comm.).

On the Isle of May, productivity was average at 1.23 chicks fledged per pair (mean 1989-95: 1.25 ± s.e. 0.07). Elsewhere in 1996, productivity was also generally moderate to good, with a notable improvement from 1995 at Skokholm.

Table 2.14.2 Herring gull breeding success, 1995-96, (n = number of colonies).

Colonies where breeding success is reduced by control measures are excluded. Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these colonies.

Region or colony	1995 fledged/pair		1996 fledged/pair		
	prs[n]	overall success	prs[n]	range	overall success
SW & NW Scotland[a]	*c.* 2656[28]	0.45-0.65	*c.* 3113[31]		0.38-0.52+
Canna	101	1.8	125		0.25
Isle of May	*c.* 2554	*c.* 1.44	*c.* 2969		*c.* 1.23
Skokholm	103	0.68	113		1.35
Other Wales[b]	-	-	292[7]	1.03-1.71	1.32
Dorset[c]	-	-	38[1]		*c.* 1.84
Dungeness (Arl Pit)	-	-	54		1.44
Strangford Lough			182[3]	1.14-2.56	1.66

Colonies: [a] Various colonies in Argyll & Bute and southern Lochaber; [b] Needle Rock, Ynys Meicel, Skomer, Elegug Stacks, Stackpole, Caldey (2 colonies); [c] West Bay - Burton Bradstock

2.15 Great black-backed gull *Larus marinus*

Breeding numbers (table 2.15.1)

Only small regional samples are counted regularly, but a review of the available data by Walsh & Gordon (1994) suggests that coastal populations in the UK have generally increased or been roughly stable since 1986.

In 1996, great black-backed gulls on Hoy (Orkney) were counted in the course of a survey of skuas. A total of 645 pairs were located, as compared with 3,400 pairs in 1974 and 1,600 pairs in 1984. Although the 1996 counts were rather later in the season than optimal for gulls, and should therefore be treated as minimum estimates, these data indicate that the Hoy great black-backed gull population, formerly the largest in Britain and holding over 5% of the British total in 1987 (Lloyd, Tasker & Partridge 1991), is continuing to decline rapidly. The reasons for this decline are unclear, although interactions with the increasing great skua population on Hóy may be involved (Furness 1997). Elsewhere in Orkney, the Calf of Eday colony was also censused in 1996 and held 1,500 birds (estimated to represent *c.* 938 breeding pairs), similar to previous estimates for this colony (Seabird Colony Register). The Copinsay group held 1,065 adults in 1996, somewhat lower than the 1,390 and 1,587 birds recorded in 1994 and 1987 respectively.

There were few changes of note in 1996 at regularly monitored colonies. A general increase at several small colonies in south-west Scotland is largely attributable to an increase from 44 to 64 pairs on Lunga (Argyll). The expansion of the new colony at the Nigg oil terminal (Ross and Cromarty) continued, although at a reduced rate, to reach 104 pairs in 1996. In Wales, numbers on Skomer (Dyfed) declined further, to 58 pairs, from the peak of 69 pairs reached in 1994 following a gradual increase from 1984, but numbers at other colonies were little changed from 1995.

At the Calf of Man, there has been a decline in numbers of great black-backed gulls from 100-150 pairs in the late 1980s and early 1990s to *c.* 50 pairs in both 1995 and 1996. In western Ireland in 1996, estimated numbers at Roaninish (120-180 apparently occupied nests) and Rathlin O'Birne (≥ 75 apparently occupied territories) in Donegal and at High Island in Galway (≥ 100 apparently occupied nests) were similar to those of the 1980s.

Breeding success (table 2.15.2)

No breeding success data were available from Orkney in 1996. In western Scotland, mink apparently have relatively little impact on the breeding success of this species compared with other gulls, although a number of small colonies, of one to five pairs, did fail in 1996 because of mink predation (J.C.A. Craik pers comm.). Breeding success at unaffected colonies in this region in 1996 was moderate, in the range of 0.87-1.03 chicks per nest over 89 pairs in nine colonies. Productivity at the Nigg oil terminal was the lowest recorded since the colony became established in 1990. On Skokholm, 1.40 chicks fledged per pair, substantially higher than in recent years.

Table 2.15.1 Population changes at monitored great black-backed gull colonies, 1993-96 (breeding pairs or apparently occupied nests in May-June).

Regional samples < 50 pairs are excluded.

	SW Scotland[a]	NW Scotland[b]	Shetland[c]	N Scotland[d]	Wales[e]	NE Ireland[f]
1993	-	122	68	50	-	54
1994	133	138	76	85	198	43
1995	147	124	75	99	205	70
1996	173	121	67	104	200	73
1995-96 % change	+17.7	-2.4	-10.7	+5.0	-2.4	+4.3

Colonies: [a] Sanda, Lunga, Eilean Gainimh, Abbots Isle, Ruadh Sgeir; [b] Eigg, Canna, Handa; [c] Noss; [d] Nigg oil terminal; [e] Skomer, Skokholm, Middleholm, Ramsey, Caldey, Elegug Stacks, Ynys Gwylan, Bardsey; [f] Strangford Lough (several colonies).

Table 2.15.2 Great black-backed gull breeding success, 1995-96: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies).

Colonies where breeding success is reduced by control measures are excluded. Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these colonies.

Region	1995 fledged/pair			1996 fledged/pair		
	prs[n]	range	overall success	prs[n]	range	overall success
SW & NW Scotland[a]	71[6]	0.00-3.00	1.31	*c.* 103[16]	0.00-2.00	0.75-0.89+
N Scotland[b]	79[1]		2.00	83[1]		1.49
Wales[c]	39[1]		0.85	67[3]	1.14-1.50	1.30
NE Ireland[d]	-		-	57[1]		1.78
Total	189[3]	0.00-3.00	1.50	310[21]	0.00-2.00	1.26-1.31

Colonies: [a] Various Argyll & southern Lochaber; [b] Nigg; [c] Skokholm, Skomer (1996 only), Bardsey (1996 only); [d] Strangford Lough.

2.16 Kittiwake *Rissa tridactyla*

Breeding numbers (table 2.16.1)

Along the east coast of Britain, numbers of kittiwakes recorded at the fourteen colonies monitored in 1996 were consistently lower than in 1995, with an overall decrease of 9.8%. However, given the late breeding season reported from a number of these colonies, including the Sands of Forvie, Isle of May and Farne Islands (Northumberland), it is likely that additional pairs will have constructed nests after the colonies were censused. These counts should therefore be treated with some caution.

In Shetland, there was little overall change in numbers at monitored colonies from 1995 to 1996, suggesting some stabilisation of populations following a long-term decline (Walsh, Brindley & Heubeck 1994). However, further declines were recorded at six out of seven colonies, holding a total of 1,945 apparently occupied nests (AONs) in 1996, which had last been counted in 1993 or 1994. The further decline from 1995 in cumulative numbers of AONs recorded in productivity monitoring plots on Mainland Orkney is in line with the *c.* 10% decline observed in population monitoring plots on Mainland Orkney from 1991 to 1994 (Walsh, Brindley & Heubeck 1995). At North Sutor, Ross and Cromarty, 798 AONs were recorded in 1996 compared with 568 at the last count in 1991.

Table 2.16.1 Population changes at monitored kittiwake colonies, 1993-96 (apparently occupied nests in late May or June).

Superscript = colonies with 10+ AONs counted in 1993, 1994, 1995 and 1996; counts with a reported inaccuracy of > ± 5%, and regional samples <100 AONs, are excluded. Trends for 1986-95 are average annual rates of change shown by sample populations (significant trends indicated as: * P < 0.05). Further details of the calculation of these trends are given in section 1.2.2.

	SW Scotland	NW Scotland	Shetland	Orkney	NE Scotland	SE Scotland	NE England
1986-95 % annual change	+1.9	+0.7	-6.9*	+2.5 (1985-94)	+6.0	-1.0	+2.2
1993	719	1045	2150	793	-	24546	6160
1994	-	1171	2131	777	-	18349	5897
1995	1085	1225	1943	720	1125	23610	6641
1996	1003	1381	1910	656	805	21248	6558
1995-96 % change	-7.6[a]	+12.7[b]	-1.7[c]	-8.9%[d]	-28.4[e]	-10.0[f]	-1.2[g]

	E England	SE England	SW England	Wales	NW England	NE Ireland	SE Ireland
1986-95 % annual change	-	+0.9	-	-0.8	+3.8*	-	+0.4
1993	≥167	2413	-	3059	-	807	-
1994	222	2603	-	3106	1630	801	2209
1995	259	2822	799	2823	1189	788	2150
1996	192	2266	939	2724	1213	746	1988
1995-96 % change	-25.9[h]	-19.7[i]	+17.5[j]	-3.5[k]	+2.0[l]	-5.3[m]	-7.5[n]

Colonies: [a] Mull of Galloway, Lunga; [b] Canna, Handa (plots); [c] Hermaness (productivity plots), Troswick Ness, Noness, Boddam, Fair Isle (productivity plots); [d] Mainland productivity monitoring plots; [e] Fowlsheugh (plots), Covesea, Portknockie; [f] Isle of May, Inchkeith, Craigleith, Lamb, Fidra, Incholm, St. Abb's Head; [g] Farne Islands, Gateshead; [h] Lowestoft; [i] Fan Bay-West Langdon Cliffs (3 colonies); [j] Lundy (plots), Blackers Hole, North Hallsands, Isles of Scilly; [k] Elegug Stacks, Skomer, Bardsey; [l] St. Bee's Head; [m] Rathlin (plots), Guns Island; [n] Dunmore E, Portally, Ireland's Eye.

In south-west Scotland, numbers fell by 7.6% at the two colonies monitored in both 1995 and 1996. However, further north, on Canna (Lochaber), numbers increased by 16.6% to 1,087 AONs, the highest total ever recorded at the site, reversing a decline from 1982 to 1993 (Swann 1996). On Handa (Sutherland), numbers of AONs in sample plots were little changed from 1995, but have declined over recent years, possibly because of predation by great skuas (Stoneman 1996). On Hirta, St. Kilda (Western Isles), counts from land of visible sections of cliff indicated a substantial decline in numbers of breeding kittiwakes in these areas from 1993.

In south-west England, there was a 17.5% increase in numbers, almost entirely attributable to the continued expansion of the newly established colony at North Hallsands (Devon) which held 512 AONs in 1996. This contrasts with Lundy (Bristol Channel) where just 390 AONs were present in 1996, continuing a long-term population decline. In Dyfed, Wales, a small decline to 2,262 AONs on Skomer fell within the population range seen in recent years, but at Elegug Stacks numbers (274 AONs) were the lowest recorded in the seven years in which counts have been recorded since 1986. Large percentage declines were also reported from Ramsey (341 AONs) and St. Margaret's Island (123 AONs) (Baines & Earl in prep.). However, as in eastern Britain, the breeding season was later than usual (Poole & Smith 1996), which may have artificially lowered counts and the numbers recorded in 1996 are not inconsistent with long term trends. A decline was also recorded at monitored colonies in south-east Ireland in 1996.

Breeding success (table 2.16.2, figure 2.16.1)

Kittiwake breeding success in 1996 averaged 0.76 (± s.e. 0.06) chicks fledged per nest at 46 colonies, compared with the 1986-95 mean of 0.74 (± s.e. 0.03) across 30 to 61 colonies annually, and 0.79 (± s.e. 0.07) at 45 colonies monitored in 1995. There was no significant change in productivity between 1995 and 1996 across 42 colonies monitored in both seasons (mean change -0.04 ± s.e. 0.05).

However, as usual there was considerable variability both between and within regions. In line with rankings of ten-year means, colonies in east and south-east England were the most productive (1.19 ± s.e. 0.02 chicks fledged per nest) with those in Orkney and northern Scotland ranked second (1.05 ± s.e. 0.10 chicks fledged per nest). Within these regions, most colonies fledged one or more chick per nest, the only exception being North Sutor in Ross and Cromarty where breeding success (0.50 chicks fledged per nest) was the lowest recorded over seven years of monitoring .

In Shetland, there was considerable variation in breeding success among colonies, apparently mainly attributable to differences in the intensity of great skua predation of chicks. There was no evidence of food shortages. The colony at Eshaness again failed completely and chick losses were also high at Westerwick, Hermaness and at some sites on Foula. If these four colonies are excluded, mean breeding success across five other colonies in Shetland was 0.89 (± s.e. 0.09) chicks fledged per nest, significantly higher than recorded at the same colonies in 1995 (mean change +0.23 ± s.e. 0.05, $P < 0.05$). Breeding success at Fair Isle (1.23 chicks fledged per nest) was particularly high.

Kittiwakes on the Isle of May in the Firth of Forth had a very late but unusually synchronised and relatively productive season, with 0.56 chicks fledged per nest, the highest output in four years (Harris 1996). Overall productivity in eastern Scotland remained only moderate, with an average of 0.48 (± s.e. 0.13) chicks fledging per nest at seven colonies. Very few chicks fledged at Bullers of Buchan and Sands of Forvie in Grampian or at Fidra (Firth of Forth). At the other extreme in this region was St. Abb's Head (Berwickshire), where a record 1.06 chicks fledged per nest.

On the Scottish west coast, productivity at Ailsa Craig in Strathclyde (0.86 chicks fledged per nest) was reported as being the best for decades. Breeding success on Handa (1.59 chicks fledged per nest) was the highest recorded anywhere in 1996, and the Canna birds had their second best year since 1986 (0.95 chicks fledged per nest). The lowest breeding success recorded in this region was on

Hirta, St. Kilda (0.62 chicks fledged per nest), where a severe gale at the end of May was observed to have washed out nests in some study plots.

Table 2.16.2 Kittiwake breeding success, 1995-96: estimated number of chicks fledged per occupied, well-built nest at sample colonies (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, based on *t*-test: * $P < 0.05$).

Region	1995 chicks fledged/nest				1996 chicks fledged/nest				1995-96 change	
	nests[n]	range	mean	±s.e.	nests[n]	range	mean	±s.e.	mean[n]	±s.e.
SW Scotland[a]	105[1]		0.78		125[1]		0.86		+0.08[1]	
NW Scotland[b]	596[2]	0.80-1.47	1.14	±0.34	1077[3]	0.62-1.59	1.05	±0.28	+0.135[2]	±0.015
Shetland[c]	2292[9]	0.00-1.04	0.54	±0.13	2731[9]	0.00-1.23	0.61	±0.13	-0.02[8]	±0.13
Orkney[d]	1176[6]	0.95-1.42	1.22	±0.07	1125[6]	0.98-1.23	1.14	±0.04	-0.08[6]	±0.045
N Scotland[e]	198[2]	1.18-1.27	1.23	±0.05	221[1]		0.50		-0.68[1]	
NE Scotland[f]	1004[3]	0.45-0.82	0.66	±0.11	768[3]	0.10-0.53	0.26	±0.13	-0.39[3]	±0.17
SE Scotland[g]	1861[4]	0.12-0.95	0.51	±0.17	1988[4]	0.24-1.06	0.65	±0.17	+0.14[4]	±0.145
NE England[h]	1372[5]	0.85-1.39	1.09	±0.09	1536[5]	1.14-1.28	1.22	±0.02	+0.13[5]	±0.08
E England[i]	259[1]		1.17		192[1]		1.13		-0.04[1]	
SE England[j]	110[1]		0.82		88[1]		1.12		+0.30[1]	
SW England[k]	330[3]	0.73-1.52	1.06	±0.24	598[5]	0.18-1.06	0.72	±0.16	-0.35[3]	±0.15
NW England & I. of Man[l]	204[2]	0.00-0.00	0.00		101[1]		0.00		0.00[1]	
Wales[m]	1930[4]	0.37-0.95	0.66	±0.16	1841[4]	0.20-1.22	0.72	±0.24	+0.055[4]	±0.28
SE Ireland[n]	1014[2]	0.00-0.50	0.25	±0.25	1483[3]	0.02-0.48	0.24	±0.13	0.00[2]	±0.02
Total	12451[45]	0.00-1.52	0.79	±0.07	13874[47]	0.00-1.59	0.76	±0.06	-0.04[42]	±0.05

Colonies: [a] Ailsa Craig; [b] Canna, Handa, St. Kilda (1996 only); [c] Hermaness, Eshaness, Westerwick, Foula, Noss, Ramna Geo, Troswick Ness (1995 only), Sumburgh Head, Fair Isle, Noness (1996 only); [d] Papa Westray, Rousay, Marwick Head, Row Head, Mull Head, Gultak; [e] North Sutor, near Nigg (1995 only); [f] Bullers of Buchan, Sands of Forvie, Fowlsheugh; [g] Isle of May, Fidra, Dunbar, St. Abb's Head; [h] Farne Islands, Coquet Island, Gateshead, Saltburn, Bempton; [i] Lowestoft; [j] South Foreland; [k] Durlston Head-St. Albans Head, North Hallsands, Lundy (1996 only), Dollar Cove (1996 only), Isles of Scilly; [l] Contrary Head-Traie Cronkan; [m] Elegug Stacks, Skomer, Bardsey, Great Ormes Head; [n] Dunmore, Portally, Ram Head (1996 only).

Further south, kittiwakes at some Irish Sea colonies had another poor season. Complete failure was recorded at the colony monitored on the Isle of Man and at one of two colonies in Waterford, with low productivity at a second. In south Wales, only 0.20 chicks fledged per nest at Elegug Stacks and only 0.45 at Skomer, the lowest output there since 1986, while complete failure was reported at St. Margaret's Island (Baines & Earl in prep.). The Skomer birds had a late season and showed evidence of experiencing difficulties in finding sufficient food to feed their young throughout the chick period (Poole & Smith 1996). However, kittiwakes at both Bardsey and Great Ormes Head in Gwynedd had a successful season, fledging 1.22 and 0.99 chicks per nest respectively. The overall mean for Irish Sea colonies was just 0.45 (± s.e. 0.16) chicks fledged per nest, the lowest of any region.

Productivity also varied in south-west England. However, the poor performance at Durlston in Dorset (0.18 chicks fledged per nest) was attributable to predators, with the other four colonies monitored in this region fledging a mean of 0.86 (± s.e. 0.10) chicks per nest.

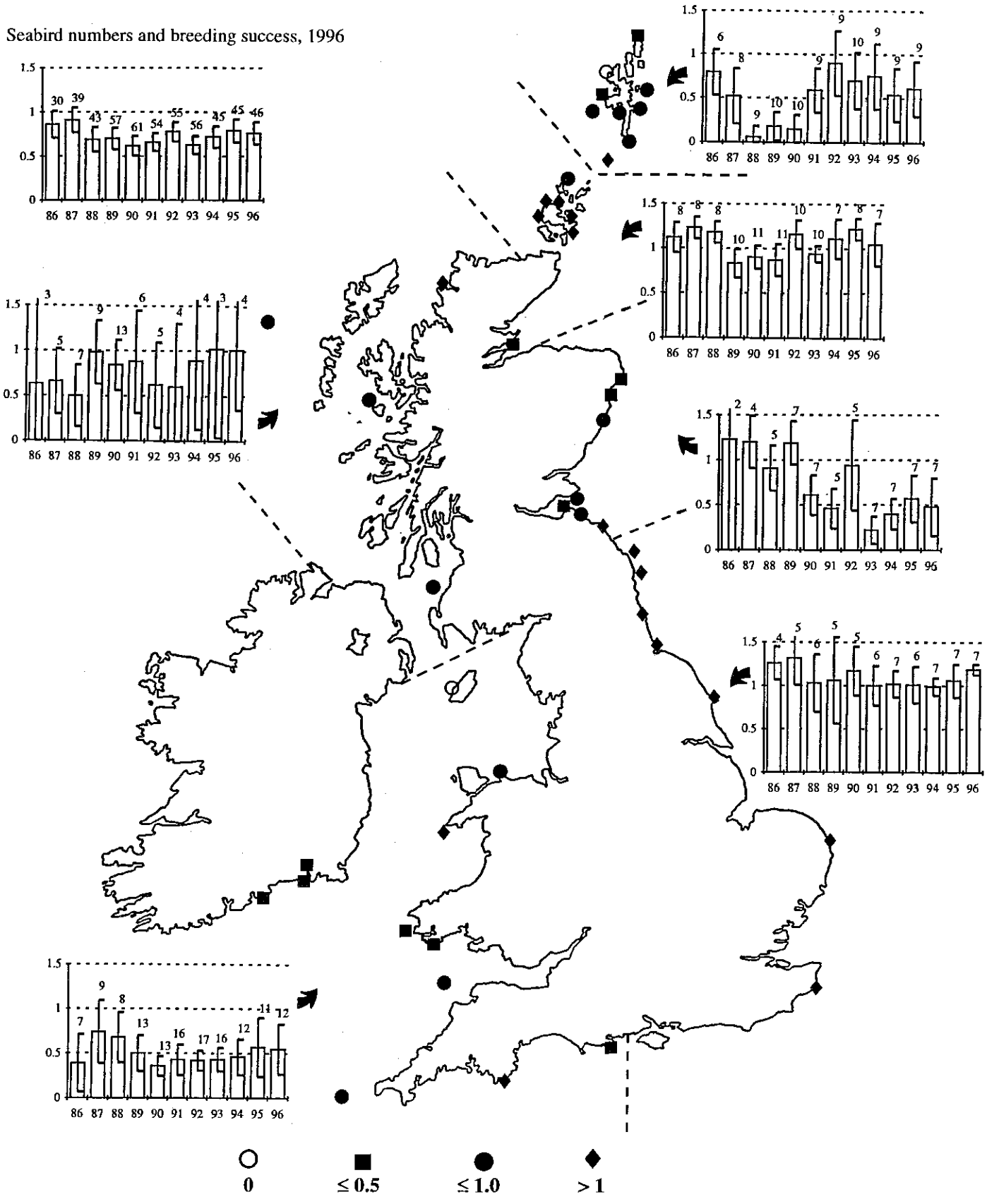

Figure 2.16.1 Breeding productivity (chicks fledged per well-built nest) at kittiwake colonies during 1986-96, showing regional and annual variation.
Map symbols indicate productivity levels at colonies monitored in 1996 while bar charts show annual averages for each broad region (with 95% confidence limits and numbers of colonies).

2.17-2.21 Terns *Sterna* spp.

2.17 Sandwich tern *Sterna sandvicensis*

Breeding numbers (tables 2.17.1 & 2.17.2, figure 2.17.1)

Declines were reported from all monitored colonies in Scotland in 1996. In south-west Scotland, the colony at Loch Ryan, which had been growing for several years to a maximum of 80+ pairs in 1995, held only nineteen pairs in 1996. In the north-east, breeding numbers similarly fell at Loch of Strathbeg (Grampian). In south-east Scotland, only two pairs were reported from the two sites in the Firth of Forth used in 1995 and there was one pair at a third site.

At monitored colonies in England and Wales, however, there was an overall increase in numbers of breeding pairs. On Coquet and the Farnes in north-east England numbers increased by 9% from 1995. In East Anglia, there was apparent movement between colonies, with declines at Scolt Head and Maplin Bank being compensated by a large increase at Blakeney. In south-east England, several sites reported late arrival and reluctance of birds to settle. At Rye Harbour (Sussex), for example, up to 200 pairs were prospecting in April, but only twelve pairs settled to nest. This was thought to be a result of inability to defend nests as a consequence of poor food availability (B. Yates pers. comm.). However, overall breeding numbers at the six colonies in this region which were counted in both 1995 and 1996 were little changed from 1995.

Breeding numbers increased in south-west England, and on Anglesey, in Wales, there were thought to be up to 700 pairs. In north-west England, fox predation in 1995 may have played a role in the apparent shift of breeding birds in Cumbria from Foulney to Hodbarrow, where there were an estimated 360 pairs in 1996.

Numbers increased by over 40% overall at Strangford, Larne and Carlingford Loughs in north-east Ireland and there was a further increase at Lady's Island Lake, Co. Wexford, where there were an estimated 1,358 nests, an increase of over 20% on the 1995 figure. Over 1,100 pairs have nested at this site each year since 1989.

Overall in Britain and Ireland, numbers at monitored colonies (equivalent to 74.5% of the total population in 1986) have declined significantly ($P < 0.01$) by 2.4% per annum between 1986 and 1996, although there was evidence of some recovery in 1996 (figure 2.17.1).

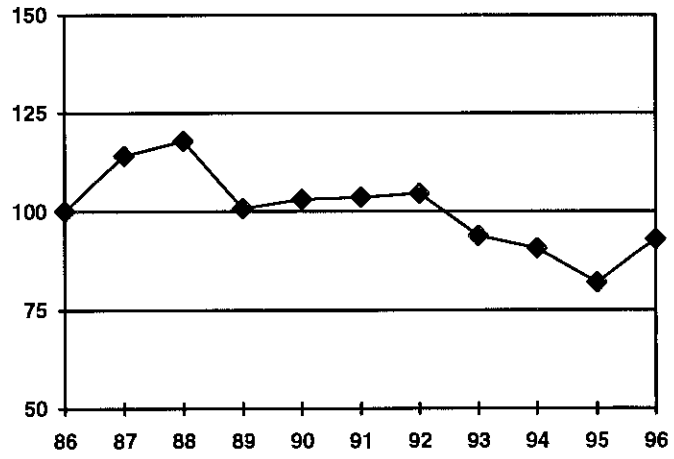

Figure 2.17.1 Population indices for breeding Sandwich terns in Britain and Ireland 1986-95.

Table 2.17.1 Population changes at monitored Sandwich tern colonies, 1995-1996 (breeding pairs).

Trends for 1986-95 are average annual rates of change shown by sample populations (significant trends indicated as *P < 0.05, **P < 0.01). Further details of the calculation of these trends are given in section 1.2.2. Superscript = number of colonies counted in both years.

	SW Scotland	NE Scotland	SE Scotland	NE England	E England	SE England
1986-95 annual % change	-	-9.2	-28.3*	-3.4*	+0.9	-4.3**
1995	80+	481	5	3380	3641	335
1996	19	375	2	3690	4107	332
1995-96 % change	-76.3[1]	-22.0[1]	-60.0[2]	+9.2[2]	+12.8[5]	-0.9[6]

	SW England	NW England	Wales	NE Ireland	NW Ireland	SE Ireland
1986-95 annual % change	+6.3	-5.3	-3.1	-8.2*	-2.7*	+10.8*
1995	107	402	650	1036	222	1130
1996	140	360	650-700	1468	240	1358
1995-96 % change	+30.8[1]	-10.4[2]	0 - +7.6[1]	+41.7[3]	+8.1[1]	+20.2[1]

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

Colony	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Loch of Strathbeg	130	404	239	121	283	304	515	923	481	375
Sands of Forvie	1082	664	744	1126	1115	29	0	0	0	1
Inchmickery	656	383	272	418	473	112	9	98	1	0
Coquet Island	1586	1616	1164	1203	1736	2131	1469	1611	1543	1511
Farne Islands	2870	3408	3445	2846	2126	2730	2349	*c.*1750	1837	2179
Scolt Head	3089	2775	1052	0	320	280	853	2406	1588	450
Blakeney Point	475	1000	1500	3000	3000	4000	3000	1000	1450	3500
Minsmere	0	0	0	5	20	0	0	0	23	0
Havergate	200	63	50	60	84	70	125	300	250	104
Foulness & Maplin	243	350	300	280	280	548	275	405	330	53
Dungeness	3	125	220	240	250	250	40	0	0	120
Rye Harbour	155	0	3	25	2	0	90	*c.*125	*c.*100	12
Pagham Harbour	0	0	0	26	2	0	0	0	0	0
Chichester Harbour	27	0	15	22	5	27	45	9	0	0
Langstone Harbour	0	3	2	0	0	0	0	0	0	12
North West Solent	220	305	198	150	151	150	85	148	233	173
Pitts Deep-Hurst	50	70	-	25	0	90	103	150	-	-
Brownsea Island	25	72	90	64	75	82	120	70	107	140
Anglesey	700	1080	830	517	601	500	564	400	650	650
South Walney	180	0	0	0	0	450	0	0	0	0
Foulney	550	700	770	720	332	0	253	380	343	0
Hodbarrow	0	0	50	120	520	360	100	0	59	360
Swan Island	74	117	138	130	135	132	*c.*64	152	234	255
Green Island	286	78	36	59	172	108	*c.*721	449	270	502
Strangford Lough	2127	2228	962	1482	879	657	587	346	532	711
Lady's Island Lake	708	412	1317	1395	1469	1129	1254	1447	1130	1358
Lough Swilly	102	73	76	109	99	116	119	220	222	240
Mulroy Bay	98	225	240	79	76	107	117	23	0	0
Total	15639	16150	13763+	14122	14205	14333	12857	12412	11183	12706

Breeding success (table 2.17.3)

Breeding success at Strathbeg was again quite low in 1996, with only 70-90 young fledging from 375 nests. The three pairs at two sites in the Firth of Forth failed to rear any young.

Productivity at Coquet Island (Northumbria), however, appears to have been quite good, at an estimated 0.7 young per pair. Colonies in East Anglia also had a good season with *c.* 0.75 young fledged per pair at three monitored colonies. In south-east England, Sandwich terns had a very successful season overall: 120 pairs at Dungeness (Kent) fledged 126 young (1.05 per pair), and in the Solent overall productivity reached a minimum of 1.73 per pair. The colony on Brownsea Island (Dorset) was also reported as having good season, with an average of 0.87 young fledged per pair. Sandwich terns in Wales also had a very productive season. On Anglesey, up to 770 young fledged from a maximum of 700 pairs, over 1.0 young per pair.

In north-west England, breeding success was higher than in 1995, with 360 pairs fledging an estimated 100 young, following the apparent move from Foulney to Hodbarrow.

Terns breeding on Inch Islands, Lough Swilly in Donegal, had a very successful season, with 329 young ringed from a total of 240 breeding pairs. At Lady's Island Lake, Co. Wexford, 1,209 chicks were ringed, an overall maximum productivity of 0.89 chicks per pair.

Table 2.17.3 Sandwich tern breeding success, 1995-1996: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies).

Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these 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 which do not necessarily indicate population changes between years.

Region	1995 fledged/pair			1996 fledged/pair		
	prs[n]	range	overall success	prs[n]	range	overall success
NE Scotland	491[2]	-	0.21	376[2]	-	0.21
SE Scotland	5[2]	-	0.40	2[1]	-	0.00
NE England	1543[1]	-	0.75	1511[1]	-	*c.* 0.70
E England	2191[4]	0.00-1.20	0.78	4054[3]	0.04-0.86	0.75
SE England	*c.*100[1]	-	0.03	320[5]	0.00-1.88	1.43
SW England	107[1]	-	0.93	140[1]	-	0.87
Wales	650[1],	-	0.78	650[1]	-	≤1.18
NW England	402[2]	-	0.00	360[1]	-	0.28
NW Ireland	222[1]	-	0.89	240[1]	-	≤ 1.37
SE Ireland	1130[1]	-	≤0.51	1358[1]	-	≤ 0.89
Total	6841[16]	0.00-1.20	0.64	9011[17]	0.00-1.88	0.68

2.18 Roseate tern *Sterna dougalli*

Breeding numbers (table 2.18.1)

The following is based on information collated by Norman Ratcliffe (Ratcliffe 1997).

Although 1996 was generally a good year for roseate terns, with increases at most major colonies, overall breeding numbers in the UK fell slightly, to 65 pairs.

Only eight pairs bred at two sites in the Firth of Forth in 1996. In north-east England, there appears to have been a shift away from Coquet Island to a new site, where fourteen pairs nested in 1996, one pair having been there in 1995. Puffin burrows are reducing the vegetation cover on Coquet Island and it is possible that this precipitated the move of the fourteen pairs away from the island. This idea is supported by the unusually high occupancy of nest-boxes on the island in 1996. Interestingly, checks of ringed birds there in 1995 showed that at least half of the birds nesting there had fledged from Rockabill (Co. Dublin). On the Farne Islands, there were again only two nesting pairs.

On Anglesey in Wales, numbers of roseate terns have been falling steadily since the mid-late 1980s, and in 1996 only one pair is known to have nested. No roseate terns nested on the Isles of Scilly again in 1996, despite efforts to attract them using decoys and sound recordings. It is possible that birds have been discouraged by the increase in gull numbers in the most suitable areas.

There was more encouraging news from Ireland in 1996. In Northern Ireland, thirteen pairs bred at Larne, Co. Antrim, where there had been seven pairs in 1995. Nest boxes were positioned on a nearby artificial island and, although this was not used in 1996, it is hoped that a colony may become established here in the next few years. A real increase was seen in the Republic of Ireland: breeding numbers at Rockabill remained at the same high level as in 1995, with a minimum of 557 pairs recorded by the end of June, while at Lady's Island Lake, Co. Wexford, numbers doubled to 120 pairs.

Counts of incubating birds in Brittany rose from 85 in 1995 to 100 in 1996, indicating that the colony there is continuing to increase. In the Azores, a complete survey of the islands revealed a total of 1,197 pairs, the highest count for seven years. In the USA, the annual census of roseate terns estimated a total of 3,650 nests at seventeen sites. This is the highest population figure since detailed monitoring began in 1987, and may be the highest since the population crash of the early 1970s.

Breeding success (table 2.18.1)

The main colony in the Firth of Forth was completely flooded in 1996 while at the second occupied colony one pair hatched two chicks but neither survived to fledging. On Coquet Island, breeding success was good, with overall 1.08 chicks fledged per pair. Meanwhile, the fourteen pairs which had formed a new colony in the region did not appear to have a good season, with only two young being seen.

Productivity at Lady's Island Lake was estimated at 1.07 chicks per pair, with 106 roseate chicks ringed. In 1996, 45 pairs used nest boxes (similar numbers to 1995), while the remaining birds nested either alongside nest-boxes or in natural vegetation. Rockabill also had another good season, with an overall maximum productivity of 1.37 chicks per pair; indeed 1996 was the most successful season yet for all three tern species on Rockabill. Nest boxes were again popular, with 79% being occupied by roseate terns. If not used as a nest site, these can also provide valuable shelter for both roseate and common tern chicks. Studies of chick feeding rates and prey species were undertaken and the results will be published elsewhere.

Table 2.18.1 Roseate tern numbers (breeding pairs) at major colonies (those holding at least 20 pairs in at least one year) during 1986-1996, and breeding success (chicks fledged per pair) in 1996.

Region / Colony	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Chicks/ pair 1996
SE Scotland:												
Inchmickery	18	20	21	5	0	0	0	0	2	0	0	-
Forth colony B	-	2	12	-	15	23	17	17	7	11	7	0.00
Forth colony C	0	0	0	0	0	0	0	0	0	1	1	0.00
NE England:												
Farne Islands	9	14	21	12	4	3	4	3	2-3	2	2	-
Coquet Island	20	17	21	25	23	20	29	*c.*30	*c.*38	38	24	1.08
New colony	0	0	0	0	0	0	0	0	0	1	14	-
Wales												
Anglesey colony A	200	40	45	70	35	1	0	16	18	0	0	-
Anglesey colony B	0	21	0	19	7	0	0	0	0	0	0	-
NE Ireland:												
Larne Lough	21	25	23	37	19	4	3	0	4	7	13	0.46
Carlingford Lough	34	40	7	25	3	0	0	0	0	0	0	-
SE Ireland												
Rockabill	177	250	332	194	321	366	378	427	394	554	557	1.37
Lady's Island Lake	0	8	0	76	60	56	76	76	140	60	120	1.07
Total*	490	450	480	470	490	450	520	578	614	686	744	<1.28

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

2.19 Common tern *Sterna hirundo*

Breeding numbers (table 2.19.1)

At study colonies in western Scotland, overall numbers of common terns remained stable in 1996. Over the past two years, former breeding areas have been recolonised following an intensive programme of mink trapping in the area (see below). Full surveys of Tiree and Oronsay in Argyll estimated 84 individuals and five pairs respectively. Numbers in north and north-east Scotland increased slightly overall in 1996, with birds returning to breed at McDermott's Yard (Inverness) for the first time in five years. In south-east Scotland, there were no major changes, with all regular coastal colonies occupied. The largest colony, of 488 pairs, was at Leith Docks, Edinburgh.

Numbers fell overall at monitored colonies in north-east England, mainly due to a decline on the Farne Islands from 763 pairs in 1995 to 611 in 1996. In south-east England, the season was reported to have been fairly late, although birds did nest at all regular sites. In Wales, breeding numbers at monitored colonies fell to 391 pairs, compared with 530 pairs at the same colonies in 1995. This was mainly due to lower numbers at Shotton in Clwyd. The Ribble Estuary in Lancashire, north-west England, held 170 pairs in 1996, following a poor season in 1995 when all birds were washed out by high tides.

In north-east Ireland, an increase in breeding numbers at Carlingford Lough helped to raise the overall total at all monitored colonies by over 25%. Similarly, numbers at four monitored colonies in south-east Ireland increased overall by 18% between 1995 and 1996.

Table 2.19.1 Population changes at monitored common tern colonies, 1995-1996 (breeding pairs).

Superscript = number of colonies counted in both years (including known colonies not occupied in 1995-1996). Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as *P < 0.05; **P < 0.01; ***P < 0.001). Further details are given in section 1.2.2.

	NW & SW Scotland	N Scotland	NE Scotland	SE Scotland	NE England
1986-93 annual % change	-	-	-6.3	+3.1	-1.2
1995	1137	331	339	963	774
1996	1179	415	375	833	630
1995-96 % change	$+3.7^{20}$	$+25.4^{5}$	$+10.6^{7}$	-13.5^{14}	-18.6^{3}

	SE England	SW England	NW England	Wales	NE Ireland	SE Ireland
1986-93 annual % change	-4.9*	+0.2	-5.2*	-4.3	-2.4	+13.3***
1995	554	216	92	530	1000	727
1996	520	193	246	391	1256	859
1995-96 % change	-6.1^{9}	-10.6^{2}	$+167.0^{3}$	-26.2^{4}	$+25.6^{4}$	$+18.2^{4}$

Breeding success (table 2.19.2)

Mink were controlled at five common tern study sites in Argyll in 1996, following the success of a pilot scheme organised by Argyll Farming, Forestry and Wildlife Advisory Group in 1995. Common terns bred successfully at three of these sites, with an overall productivity of approximately 1.3 young fledged per pair. Losses at the remaining two sites were due to predation by otters, foxes and birds of prey. At fourteen sites where mink were not trapped, only 0.1 chicks fledged per pair overall, and mink are known to have been responsible for complete breeding failure at four of these sites (J.C.A. Craik pers. comm.). Other sites were also badly affected by otters and birds of prey.

Productivity in eastern Scotland was particularly poor in 1996. Several of the larger colonies failed completely, and across fourteen colonies overall productivity was only 0.05 chicks fledged per pair. At the largest colony in north-east Scotland, St. Fergus (Grampian), 184 pairs fledged only three young. The main problems here were reported to be poor weather plus lack of food at the critical hatching stage, and human disturbance. Traps set for mink captured seven stoats and two polecat ferrets (Leitch 1996). The picture was similar in south-east Scotland, several colonies being washed out by high tides. One of the largest colonies in the region, the Isle of May in the Firth of Forth, suffered heavily from gull predation, thought to be attributable to three individuals.

In south-east England, overall fledging success was rather better at 0.46 per pair, although lower than in 1995. The season was reported to be unusually late, however, and at some colonies, low water levels allowed predators access to the colonies. In north-west England, Rockcliffe Marsh (Cumbria) was completely flooded with the loss of all nests, while at Seaforth in Merseyside there were problems mid-season with weak-shelled eggs (S. White, pers. comm.). The cause of this is unknown, but did not appear to have extended to other sites in the locality.

All coastal colonies in Wales had a good season in 1996, with an overall productivity of 1.8 per pair. The season was particularly good at Shotton, where over 2.0 young fledged per pair. The colony at Rockabill, south-east Ireland, also continued to do well, fledging approximately two young per pair.

Table 2.19.2 Common tern breeding success, 1995-96: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies).

Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these colonies. Note that the same colonies have not necessarily been monitored in each region in each year, and that numbers of pairs given here are sample sizes (not necessarily indicative of population changes between years).

Region	1995 fledged per pair			1996 fledged per pair		
	prs^n	range	overall success	prs^n	range	overall success
SW Scotland	1063^{11}	0.00-1.80	0.41	874^{11}	0.00-1.80	0.33-0.38
NW Scotland	46^{2}	-	0.00	275^{7}	0.00-2.13	0.29-0.37
N Scotland	331^{3}	0.00-0.36	0.13	457^{7}	0.00-0.24	0.08
NE Scotland	253^{2}	0.50-0.60	0.55	383^{7}	0.00-0.18	0.07
SE Scotland	236^{6}	0.00-1.05	0.67	608^{7}	0.00-0.66	0.02
Scotland	1924^{24}	0.00-1.80	0.40	2597^{39}	0.00-2.13	0.17-0.20
NE England	963^{2}	-	1.75			
E England				860^{8}	0.00-0.73	0.50
SE England	499^{8}	0.00-2.31	0.86	518^{7}	0.25-1.00	0.46
SW England	267^{3}	0.00-0.66	0.45	166^{1}	-	0.57
NW England	92^{2}	0.08-0.77	0.51	150^{4}	0.00-0.38	0.26
England	1821^{15}	0.00-2.31	1.25	1694^{20}	0.00-1.00	0.47
Wales	590^{5}	0.02-1.00	0.84	406^{5}	0.10-2.27	1.79
Britain	4340^{44}	0.00-2.31	0.82	4697^{64}	0.00-2.27	0.43
SE Ireland	351^{1}	-	1.89	387^{1}	-	2.01

2.20 Arctic tern *Sterna paradisaea*

Breeding numbers (table 2.20.1)

In Argyll, south-west Scotland, complete counts carried out on Tiree, Oronsay and Lunga in June gave an estimated 937 breeding birds, 300 pairs and eighteen pairs respectively. A full survey of Tiree in 1987 gave an estimated 366-376 breeding pairs, so the 1996 figure represents an increase in breeding numbers over the last ten years. Complete coverage of 1,000 kilometres of the coast in western Scotland revealed 178-193 pairs at seventeen colonies, as compared with 290-300 pairs at twelve colonies in the same area in 1995, a decrease in numbers of 37%.

On Fair Isle (Shetland), breeding numbers remained high at 1,250 apparently incubating adults, the highest population recorded for the last eleven years. Northern Scotland, though, held fewer pairs than in 1995, mainly due to a decline from 200 to only 25 pairs at Brora (Sutherland). This is thought to be possibly due to human disturbance problems in previous years (A.D.K. Ramsay pers. comm.). In north-east Scotland, however, numbers were higher than in 1995, at *c.* 980 pairs, with a large increase at Kinloss (Grampian) matching the decline at Brora. In south-east Scotland, breeding numbers were similar to 1995, by far the largest colony being at the Isle of May which held 531 pairs in 1996. Only five colonies now appear to be regularly occupied in south-east Scotland.

Twenty-four pairs were thought to have bred in Norfolk, the majority (20 pairs) at Blakeney. In Wales, four colonies are regularly occupied, the largest being at Skerries, off the coast of Anglesey. This colony held 1,020 pairs in 1996, the second successive year in which breeding numbers have exceeded 1,000 pairs.

In Northern Ireland, breeding numbers fell at Strangford Lough and Cockle Island, from 549 pairs in 1995 to 327 in 1996. However, in south-east Ireland, there were increases at Rockabill (Co. Dublin) and Lady's Island Lake, Co. Wexford.

Table 2.20.1. Population change at monitored Arctic tern colonies 1995-1996 (breeding pairs).

Superscript = number of colonies counted in both years (including known colonies not occupied in 1995-96). Regional samples <100 pairs are not included. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as *P < 0.05). Further details of the calculation of these trends are given in section 1.2.2.

	N Scotland	NE Scotland	SE Scotland	SW Scotland	NE England	Wales	SE Ireland
1986-93 annual % change			+5.9		-3.3	+10.8*	
1995	256	793	634	125	3774	1247	170
1996	105	984	565	78	3078	1186	220
1995-96 % change	-58.9[3]	+24.1[4]	-10.9[11]	-37.6[7]	-18.4[2]	-4.9[2]	+29.4[4]

Breeding success (table 2.20.2)

In western Scotland, breeding success was monitored at eleven colonies; otters were serious predators at five colonies and mink at two. On Eigg (Lochaber), 40 pairs failed completely due to a combination of bad weather and rat predation.

Breeding success in Shetland and Orkney was low in 1996. The reasons for this are unknown, but it is thought that bad weather in late May contributed to failures, with two study colonies in Shetland and at least one in Orkney flooded by high seas. Mean clutch size was lower than in previous years in both Orkney and Shetland and there appeared to be large scale movement of failed breeders between colonies in late June (Towll & Ribbands 1996). At the 22 monitored colonies in Shetland, overall productivity was only 0.25 per pair, with most failures occurring at the egg or early chick stage. However, Fair Isle had a very successful season, with over 900 young thought to have fledged from 1250 apparently incubating adults (> 0.72 chicks per pair), the highest productivity since 1991 and 1992. Overall productivity at twelve study colonies in Orkney was very poor at 0.17 chicks per pair, most failures again occurring during incubation or soon after hatching (Towll & Ribbands 1996).

In northern Scotland, only three young fledged from approximately 110 pairs at four monitored colonies and at nine colonies in eastern Scotland, 1029 pairs fledged only 37 young (0.04 per pair). Several of the largest colonies failed completely, including 550 pairs at Kinloss and 423 pairs at St. Fergus in Grampian. Reasons for these failures were not apparent, although at St. Fergus many chicks died soon after hatching. On the Isle of May in the Firth of Forth, many chicks of both common and Arctic terns were taken by one or two individual gulls.

In East Anglia, the birds at Blakeney raised between 0.4 and 0.5 young per pair, despite gull predation. Birds breeding in Wales had another very good season, with two colonies in Anglesey fledging over one chick per pair. In north-west England, the main colony at Foulney (Cumbria) suffered predation by foxes, gulls and a little owl and only three young fledged from 59 pairs.

Productivity was again high on Rockabill, south-east Ireland, where approximately 86 young were thought to have fledged from 67 pairs (1.28 young per pair).

Table 2.20.2 Arctic tern breeding success, 1995-1996: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies).

Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these 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 which do not necessarily indicate population change between years. (< = figures which may be substantial overestimates, mainly based on numbers of chicks ringed).

Region	1995 chicks fledged/pair			1996 chicks fledged/pair		
	prs[n]	range	overall success	prs[n]	range	overall success
SW Scotland	290[12]	0.00-1.40	0.86-0.94	102[8]	0.00-1.80	0.61
NW Scotland	-	-	-	8[3]	0.00-1.66	0.75
Shetland	2881[20]	0.00-0.87	0.52	3624[22]	0.00-0.62	0.25
Orkney	3431[7]	0.00-1.50	0.79	2070[12]	0.00-0.72	0.17
N Scotland	243[3]	0.00-0.42	0.02	110[4]	0.00-0.08	0.03
NE Scotland	793[4]	0.00-1.13	0.68	995[5]	0.00-0.01	0.00
SE Scotland	24[4]	0.00-0:80	0.21	34[4]	0.00-2.20	0.97
NE England	988[2]	0.36-1.35	1.07	-	-	-
Wales	1277[3]	0.00-0.97	0.82	1202[3]	0.09-1.20	1.00
NW England	54[1]	-	0.15	61[2]	0.00-0.05	0.05
SE Ireland	49[1]	-	<1.43	67[1]	-	<1.28

2.21 Little tern *Sterna albifrons*

Breeding numbers (table 2.21.1)

In south-west Scotland, a survey of all known colonies in Argyll estimated 91 pairs which is similar to the last complete survey in this area in 1987, when 91-102 pairs were located. No birds nested at Loch Ryan, although a few birds prospected. In eastern Scotland, from Fraserburgh to the English border, only four sites were known to have been occupied, although breeding numbers were higher than in 1995. Most of the breeding birds appeared to be concentrated in two colonies, at Foveran Links in Grampian (28 pairs, possibly the same birds as seen later at Forvie) and at the Eden Estuary in Fife, the largest colony, where over forty pairs nested close to a large Arctic tern colony.

Overall breeding numbers were down in northern England, where 14% fewer pairs nested than in 1995. However, all main colonies were occupied. The long-standing colony at Coatham Sands in Cleveland has been severely affected by high tides and predation over the past few years and a new site has been occupied.

The colony at Chesil Beach in Dorset continues to grow, almost doubling in numbers to 95 pairs in the last three to four years. At Gronant (Clwyd), the picture is similarly encouraging with 78 pairs nesting in 1996, although the fact that this is the only remaining colony in Wales is of concern. In north-west England, all six colonies were occupied, holding a total of 60 pairs.

In Ireland, the colony near Kilcoole and Newcastle on the Wicklow coast is the most regularly used site on the east coast and has been wardened annually since 1989. A minimum of 25 pairs are thought to have nested at the site in 1996.

Table 2.21.1 Population changes at monitored little tern colonies, 1995-1996 (breeding pairs).

Superscript = number of colonies counted in both years (including known colonies not occupied in 1995-1996). Regional samples < 50 pairs are excluded. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as *P < 0.05; **P < 0.01). Further details of the calculation of these trends are given in section 1.2.2.

	Scotland	NE England	E England	SE England	SW England	Wales	NW England	Britain
1986-93 annual % change	-2.6	-2.3	-2.9	-6.4**	-	+0.5	-3.9	-3.9**
1995	52	219	687	156	90	65	51	1320
1996	92	187	742	144	95	78	60	1398
1995-96 % change	$+76.9^{8}$	-14.6^{10}	$+8.0^{25}$	-7.7^{6}	$+5.6^{1}$	$+20.0^{1}$	$+17.6^{6}$	$+5.9^{57}$

Breeding success (table 2.21.2)

In eastern Scotland, chicks fledged from only three colonies with available data. Twenty-eight nests at Foveran were washed out by tidal flooding, and, although possibly relaying at Forvie, these birds did not raise any young. The largest colony at the Eden Estuary was, however, successful with 42-45 nests and 55-74+ chicks fledged. Their proximity to an Arctic tern colony and the presence of electric fencing are thought to have considerably reduced predation

In north-east England, the situation was similar, with the majority of chicks fledging from only two colonies. The overall figure of 0.52 fledged per pair was however, a major improvement on 1995. The figure of 0.63 chicks fledged per pair at Easington (Humberside) is the highest since 1990, an early incursion by a fox presumably being curtailed by a sharp shock from the electric fencing on leaving the colony. However, one of the largest colonies in the region suffered severe predation by kestrels, which also took large numbers of Arctic tern chicks. At Lindisfarne (Northumbria), flooding and sand-blow destroyed many nests and at least ten adults were taken by a sparrowhawk.

The largest British colony at Great Yarmouth had a disastrous year compared with the successful season in 1995. February storms had forced breeding pairs into a lower and more restricted area of beach than in previous years. Then, successive problems of flooding, fox predation and kestrel predation accounted for all of the chicks hatching from 197 pairs nesting at the site. At monitored colonies elsewhere in East Anglia, productivity was also low, at 0.27 young fledged per pair at colonies where estimates were available, although some colonies reported 'high' productivity.

In south-east England, however, several colonies had their most successful season for quite a few years. All birds previously nesting at Chichester Harbour (Sussex) now appear to have moved over to

Langstone Harbour (Hampshire), where little tern productivity reached 0.77 per pair in 1996. The proximity of a large black-headed gull colony (*c.* 550 pairs) is thought to have considerably reduced the extent of predation by crows, falcons and larger gulls. At Chesil Beach in Dorset, the initial stage of the season went well, but all breeding attempts were later curtailed by foxes.

In Wales, the birds nesting at Gronant also had their best season to date in terms of productivity, with 1.4 young fledged per pair. Early-nesting birds chose sites which were subject to later flooding. Brightly coloured tape was later strung across these unsuitable areas to discourage any further nesting.

At the colony near Kilcoole and Newcastle, foxes took an estimated 70% of nests while another 10% were predated by mink. Nest cages have been used at the colony for several years and have up to now been successful in preventing fox predation. However, in 1996 the foxes learned how to gain access to the cages and took many chicks. Mink were also thought to have learned to associate cages with a food supply. With this experience in mind, any caged nests should be very closely monitored to ensure that cages do not begin to facilitate the predation of chicks or adult terns.

Table 2.21.2. Little tern breeding success, 1995-6: estimated number of chicks fledged per breeding pair at sample colonies (superscript n = number of colonies).

Figures in the 'overall success' columns are equivalent to the estimated total number of chicks fledged across all the colonies monitored divided by the estimated total number of breeding pairs in these 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	1995 fledged/pair			1996 fledged/pair		
	pairs^n	range	overall success	pairs^n	range	overall success
SW Scotland	17^2	0.64-0.67	≥0.65	-	-	-
N Scotland	19^1	-	≤0.16	5^1	-	0.00
NE Scotland	22^4	0.00-0.71	≤0.45	30^2	0.00-1.00	0.07
SE Scotland	21^3	0.00-0.60	≥0.33	55^3	0.75-1.49	≥1.19
Scotland	79^{10}	0.00-0.71	0.39	90^6	0.00-1.49	≥0.73
NE England	179^8	0.00-0.33	0.08	187^9	0.00-1.58	0.52
E England	687^{20}	0.00-1.27	0.59	671^{20}	0.00-0.61	0.27
SE England	171^6	0.00-1.43	0.52	184^6	0.00-0.77	0.62
SW England	90^1	-	0.41	95^1	-	0.17
Wales	65^1	-	0.57	78^1	-	1.41
NW England	38^4	0.00-1.20	0.76	54^4	0.00-1.00	0.41
England & Wales	1230^{40}	0.00-1.43	0.50	1269^{41}	0.00-1.58	0.42
Total (GB)	1309^{50}	0.00-1.43	0.49	1359^{47}	0.00-1.58	0.45

2.22 Guillemot *Uria aalge*

Breeding numbers (table 2.22.1, figure 2.22.1)

Guillemots at colonies in Orkney, eastern Scotland and Wales bred later than normal in 1996. At the Isle of May, laying dates were seven to ten days later than average (Harris 1996). At North Sutor, birds on lower ledges were washed out by severe gales early in the season, and the breeding season was consequently protracted, with chicks from relays fledging later than usual. However, in north-western Britain (e.g. Canna, St. Kilda), the timing of the breeding season was apparently normal.

There was a significant ($t = 2.650$, d.f. = 12, $P < 0.05$) increase of 8% in the average number of birds attending study plots on Handa (Sutherland) while at St. Kilda (Western Isles), numbers in plots were 20% greater than when last counted in 1993 ($t = 5.170$, d.f. = 5, $P < 0.01$). The numbers of breeding sites in study plots on Canna (Lochaber) increased further from the low reached in 1991 to match the peak numbers of 1983. Total numbers of birds also increased at two colonies in south-west Scotland.

In Shetland, numbers remained relatively stable in study plots, with no significant changes from 1995 in any of the five colonies monitored. On Noss, a whole-colony count found 45,696 birds, a 15% increase from 1991 and a partial count of the Hermaness colony also indicated substantial increases in numbers over the same period. In Orkney, there was a highly significant ($t = 4.919$, d.f. = 10, $P < 0.001$) increase in mean numbers of birds attending study plots at Papa Westray, but in two Mainland productivity monitoring plots there were declines of 14% and 5% in the numbers of breeding sites occupied over the season.

In eastern Scotland, a count of the Bass Rock (Firth of Forth) found 3,225 birds, *c.* 20% higher than counts in the 1980s. At Fowlsheugh (Grampian), there was no change from 1995 in average numbers of birds attending plots. On the Isle of May in the Firth of Forth there was a significant ($t = 2.47$, d.f .= 15, $P < 0.05$) decline of 9% from 1995 to 1996 in numbers in study plots and a 5% decline in the whole-colony count, but numbers of birds were the second highest ever recorded. Adult survivorship between 1995 and 1996 was the lowest since monitoring began in 1981, probably at least partially as a consequence of the east coast wreck in February and March (Harris 1996). However, care is required in interpreting the 1996 population figures given the late breeding season, which would tend artificially to reduce counts made in early June compared with normal years.

The same caveat applies to the interpretation of counts made in Wales in 1996. There was a significant ($t = 2.872$, d.f. = 8, $P < 0.05$) decline of 11% in mean numbers of birds attending plots at Elegug Stacks (Dyfed). Also in Dyfed, numbers in study plots on Skomer were the same as in 1995, the first season since 1990 with no increase (Poole & Smith 1996), and there was no significant change on Skokholm. Whole colony counts in Wales were down overall by 11% on 1995, with decreases being recorded at all the major colonies, although increases were recorded at some small colonies. The general decreases in numbers from 1995 are at odds with the rising trend in guillemot numbers in Wales from 1986 to 1995 (figure 2.22.1), and are suggestive of some impact of the *Sea Empress* spill on breeding populations (Baines & Earl in prep.). More than 2,000 guillemots were found dead or oiled in Wales, south-west England and south-east Ireland after the *Sea Empress* incident, and surveys at sea plus corpse tagging experiments indicate that many more died undetected (Columbé, Reid & Webb 1996). However, given the atypical breeding season, the 1996 figures should be treated with caution. Several more seasons' data on breeding numbers and adult survival rates are required before the true extent of any impact may be assessed.

Also in south-west Britain, there was a non-significant decline from 1995 of 8% in numbers of guillemots attending plots on Lundy (Devon), while a whole-colony count found 1,921 birds, 27% fewer than when this colony was last censused in 1992. In south-east Ireland, numbers of birds at Ireland's Eye (Co. Dublin) were 11% higher than recorded in 1995.

Table 2.22.1 Population changes at monitored guillemot colonies, 1995-96 (adults attending colony in first three weeks of June).

Trends for 1986-95 are average annual rates of change shown by sample populations (significant trends indicated as:* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$). Further details are given in section 1.2.2.

2.22.1a Counts of birds in study plots.
Figures are based on the means of 5-10 annual counts of study plots within each colony.

	NW Scotland	Shetland	Orkney	NE Scotland	SE Scotland	Wales	SW England	NE Ireland
1986-95 annual % change	+0.7	-1.1	+1.3	+5.1**	+3.0*	+4.2***	-1.0 (1989-95)	+0.7
1995	1610	8107	222	3217	5930	7788	647	3088
1996	1741	7899	264	3206	5390	7686	597	2946
1995-96 % change	+8.1[a]	-2.6[b]	+18.9[c]	-0.3[d]	-9.1[e]	-1.3[f]	-7.7[g]	-4.6[h]

Colonies: [a] Handa; [b] Sumburgh Head, Burravoe, Eshaness, Noss, Troswick Ness, Fair Isle; [c] Papa Westray; [d] Fowlsheugh; [e] Isle of May, St. Abb's Head; [f] Skomer, Skokholm, South Stack, Elegug Stacks; [g] Lundy; [h] Rathlin Island (figures are sum of mean counts for three individual plots).

2.22.1b Counts of whole colonies.
Note that whole-colony counts should be treated with some caution as the numbers of birds attending colonies may vary markedly from day to day. Replicate study plot counts are better indicators of population change. Trends for NE England are based on whole-colony counts at the Farne Islands plus plot counts at Bempton and for NW England on a combination of whole-colony and plot counts at St. Bee's Head.

	SW Scotland	SE Scotland	NE England	Wales	SW England	NW England	SE Ireland
1986-95 annual % change	+2.8	-	+3.3*	-	-	+0.3	-
1995	8422	28972	28349	22600	806	5679	2223
1996	9840	28199	29610	20177	830	5321	2468
1995-96 % change	+16.8[a]	-2.7[b]	+4.4[c]	-10.7[d]	+3.0[e]	-6.3[f]	+11.0[g]

Colonies: [a] Mull of Galloway, Lunga (late June); [b] Isle of May, Inchkeith, Lamb; [c] Farne Islands; [d] Mewsford Arches, Stackpole Head, Crickmail Point, Elegug Stacks, Skokholm, Skomer, Middleholm, Ramsey Island, St. Margaret's Island, Bardsey, Ynys Gwylan; [e] Berry Head (peak June count); [f] St. Bee's Head, Peel Hill; [g] Ireland's Eye.

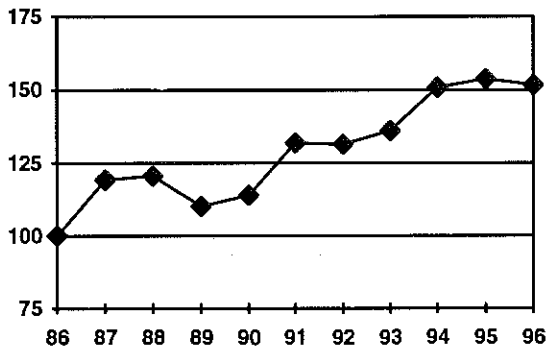

Figure 2.22.1 Population indices for breeding guillemots in Wales, 1986-96. Indices are derived from mean counts of adults in study plots in June at between two and four colonies each year.

Breeding success (table 2.22.2)

Guillemots had a generally good season in 1996, with average or above average breeding success at all regularly monitored colonies. Mean breeding success across fifteen colonies monitored in 1996 was 0.79 (± s.e. 0.013) chicks fledged per site (pair), significantly higher ($t = 2.304$, d.f. = 20, $P < 0.05$) than the 1986-95 mean of 0.74 (± s.e. 0.010) measured across between three and twelve colonies annually). However, there was no significant change in mean breeding success from 1995 across twelve colonies monitored in both years.

In north-west Scotland, productivity on Handa, at 0.80 chicks per pair, was the highest recorded in nine years of monitoring (mean 1988-1995: 0.72 ± s.e. 0.021) and guillemots on Canna were also reported to have had a successful season (Swann 1996).

In the Northern Isles, breeding success was also exceptionally high at Papa Westray, where 0.87 chicks fledged per pair (mean 1989-95: 0.72 ± s.e. 0.049), but fledging rates at Marwick Head, Mull Head and Fair Isle were average for these colonies.

Breeding success at colonies in Wales was good, despite the late season. On Skomer, the breeding season was reported as being more synchronous than usual, which may have contributed to the high success rate of 0.77 chicks per pair (mean 1989-95: 0.74 ± s.e. 0.011). Mean productivity across five colonies in Wales was 0.79 (± s.e. 0.029).

Table 2.22.2 Guillemot breeding success, 1995-96: 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 two or more study plots are monitored, colony figures are mean and standard error across all plots.

Colony	1995 chicks fledged/pair			1996 chicks fledged/pair			1995-96 change	
	sites[n]	mean	±s.e.	sites[n]	mean	±s.e.		
Handa	196[3]	0.69	±0.03	188[3]	0.80	0.02	+0.11	
Sumburgh Head	103[1]	0.79		110[1]	0.75		-0.04	
Fair Isle	165[2]	0.67	±0.02	214[2]	0.76	±0.02	+0.09	
Papa Westray	144[1]	0.80		127[1]	0.87		+0.07	
Marwick Head	112[1]	0.79		96[1]	0.75		-0.04	
Mull Head	98[1]	0.73		93[1]	0.74		+0.01	
North Sutor	91[1]	0.76		88[1]	0.74		-0.02	
Isle of May	805[5]	0.81	±0.02	786[5]	0.82	±0.02	+0.01	
Bempton	164[1]	0.77		112[1]	0.76		-0.01	
Durlston	≤74[1]	0.85		≤76[1]	0.85		0.00	
Skokholm	135[1]	0.78		88[1]	0.80		+0.02	
Skomer	198[6]	0.75	±0.04	210[6]	0.77	±0.02	+0.02	
Needle Rock		-		51[?]	0.89	±0.07	-	
Elegug Stacks		-		262[?]	0.75	±0.04	-	
St. Margaret's Island		-		52[?]	0.72	±0.09	-	
Total (n = number of colonies)	2185[12]	0.76	±0.01	2533[15]	0.79	±0.01	+0.02[12]	±0.01

2.23 Razorbill *Alca torda*

Breeding numbers (table 2.23.1, figure 2.23.1)

As with guillemot, care is needed in the interpretation of razorbill counts in 1996 because of the late start to the breeding season in at least some regions (see section 1.3).

In Shetland, there were no significant changes in numbers of razorbills in individual sample monitoring plots at five colonies between 1995 and 1996 while a count on Noss found a total of 1,793 birds compared with 1,180 in 1991 and 783 in 1986. In north-west Scotland, only 396 breeding sites were found in the colonies routinely monitored on Canna (Lochaber), the lowest total in the past decade. On Hirta, St. Kilda (Western Isles), numbers of birds counted in study plots were generally higher than when last counted in 1993, although the overall increase was not quite statistically significant ($t = 2.214$, d.f. = 9, $0.10 > P > 0.05$). On Eilean Mor, Flannan Islands (Western Isles), a count in late June indicated an increase in the razorbill population, with a minimum of 998 birds present compared with a total of 729 in mid-June 1988.

In north-east Scotland, the observed decline of 13% in numbers of birds attending study plots at Fowlsheugh (Grampian) was not statistically significant. However, in south-east Scotland, plot counts at St. Abb's Head (Berwickshire) declined significantly between 1995 and 1996 ($t = 4.114$, d.f. = 14, $P < 0.01$), to the lowest total since 1988. Similarly, there was a highly significant 20% decline in mean numbers of birds attending plots on the Isle of May in the Firth of Forth ($t = 3.98$, d.f. = 13, $P < 0.01$; Harding 1996). This decline was matched by that in the whole colony count of birds, although the estimated numbers of breeding pairs declined by only 4% and the counts were second only to the record totals of 1995. As for guillemots, annual adult survival of razorbills on the Isle of May from 1995 to 1996 was the lowest yet recorded (Harris 1996), following the wreck in February and March.

In Dyfed, Wales, contrary to recent population trends, average numbers of birds in study plots declined significantly at both Skokholm (-11.5%, $t = 2.760$, d.f. = 18, $P < 0.05$) and Skomer (-9%, $t = 5.564$, d.f. = 18, $P < 0.001$). However, there were no significant changes at Elegug Stacks or Stackpole Head. The decrease on Skomer was the first recorded since 1991, and was matched by a 13.5% decline in the whole-colony count, although on Skokholm the whole-colony count increased by 6%. There was an overall decline in whole-colony counts at sites between Skomer and Caldey Island of 7%, with a particularly marked decline of 65% to 116 birds at St. Margaret's and Caldey Islands (Baines & Earl in prep.). A minimum of 340 razorbills died in the immediate aftermath of the *Sea Empress* incident (Columbé, Reid & Webb 1996) and the 1996 counts are suggestive of a direct impact on some breeding colonies in south Wales (figure 2.23.1). However, as with guillemots, several more seasons' data will be required before the scale of any such impact may be ascertained.

On Lundy (Devon), a total of 959 razorbills were counted in 1996, compared with 785 in 1992 and 761 in 1986 (D. Price pers. comm.), in line with a significant increase in numbers in monitored plots between 1989 and 1995. However, the observed increase in plot counts from 1995 to 1996 was not significant. In north-west England, numbers of razorbills at St. Bee's Head in Cumbria (181) were the lowest recorded since 1989.

In north-east Ireland, a count of Muck Island (Co. Antrim) found 447 razorbills, compared with 315 when last counted in 1987.

Table 2.23.1 Population changes at monitored razorbill colonies, 1995-96 (adults attending colony in first three weeks of June).

Regional totals of under 50 birds are excluded. Trends for 1986-95 are average annual rates of change shown by sample populations (significant trends indicated as: *** $P < 0.001$). Further details of the calculation of these trends are given in section 1.2.2.

2.23.1a Counts of birds in study plots

Figures are based on the means of 5-10 annual counts of study plots within each colony.

	Shetland	NE Scotland	SE Scotland	Wales	SW England	NE Ireland
1986-95 annual % change	+0.9	+1.8	+6.1***	+4.5***	+10.0*** (1989-95)	+0.6
1995	421	174	1108	1817	114	943
1996	404	152	871	1665	130	838
1995-96 % change	-4.0[a]	-12.6[b]	-21.4[c]	-8.4[d]	+14.0[e]	-11.1[f]

Colonies: [a] Sumburgh Head, Eshaness, Noss, Troswick Ness, Burravoe; [b] Fowlsheugh; [c] Isle of May, St. Abb's Head; [d] Skomer, Skokholm, Elegug Stacks, South Stack; [e] Lundy; [f] Rathlin Island.

2.23.1b 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.

	SW Scotland	Isle of May (birds)	Other SE Scotland (sites)	NE England	Wales	NW England & Isle of Man
1986-95 annual % change	-2.0	-	-	-		+2.1
1995	916	4248	213	216	6657	258
1996	1308	3405	217	141	6208	238
1995-96 % change	+42.8[a]	-19.8	+1.9[b]	-34.7[c]	-6.7[d]	-7.8[e]

Colonies: [a] Mull of Galloway, Lunga (late June); [b] Inchcolm, Inchkeith, Craigleith, Lamb; [c] Farne Islands; [d] Elegug Stacks, New Quay - Broadhaven, Skokholm, Skomer, Middleholm, Ramsey Island, St. Margaret's Island, Caldey Island; [e] St. Bee's Head, Peel Hill.

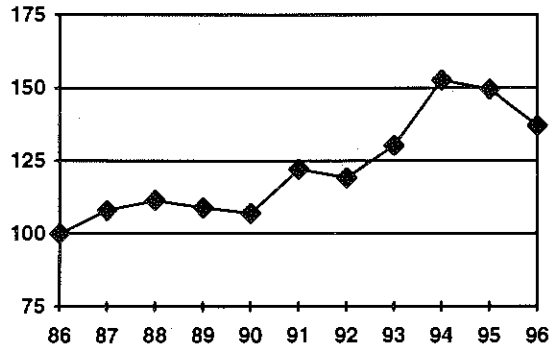

Figure 2.23.1 Population indices for breeding razorbills in Wales, 1986-96. Indices are derived from mean counts of adults in study plots in June at between two and four colonies each year.

Breeding success (table 2.23.2)

Given the difficulties inherent in assessing razorbill productivity, few colonies are monitored each year. Mean breeding success across five colonies monitored in 1996 was 0.69 (± s.e. 0.02) chicks fledged per site (pair), close to the 1986-95 mean of 0.70 (± s.e. 0.01) measured across between one and four colonies annually. There was no significant change in mean breeding success from 1995 across four colonies monitored in both years.

In Scotland, razorbills on Fair Isle (Shetland) had a very productive breeding season in 1996, with an estimated 0.72 chicks per pair fledging in the study plot, compared with a mean of 0.61 (± s.e. 0.05) for the period 1991-95. However, birds on the Isle of May had a second poor season, fledging just 0.63 (± s.e. 0.11, n = 4) chicks per pair compared with an average of 0.72 (± s.e. 0.02) from 1986 to 1995. Once again, most losses occurred at the egg stage (Harris 1996).

In Wales, an average of 0.64 (± s.e. 0.02) chicks per pair fledged in five monitored plots on Skomer compared with 0.54 (± s.e. 0.08) in 1994 and 0.72 (± s.e. 0.03) in 1995 (Poole 1996). On Skokholm, less detailed monitoring recorded 0.75 chicks per pair from a sample of 52 pairs, compared with a very high 0.97 from 66 pairs in 1995.

Table 2.23.2 Razorbill breeding success, 1995-96: 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	1995 chicks fledged/pair			1996 chicks fledged/pair			1995-96 change	
	sites[n]	mean	±s.e.	sites[n]	mean	±s.e.		
Fair Isle	47[1]	≤0.49		78[1]	≤0.72		+0.23	
Isle of May	143[4]	0.62	±0.09	140[4]	0.63	±0.11	+0.01	
Farnes				23[1]	0.70		-	
Skokholm	66[1]	0.97		52[1]	0.75		-0.22	
Skomer	177[5]	0.72	±0.03	201[5]	0.64	±0.02	-0.08	
Total (n = number of colonies)	433[4]	0.70	±0.10	494[5]	0.69	±0.02	-0.02[4]	±0.09

2.24 Black guillemot *Cepphus grylle*

Breeding numbers (table 2.24.1)

In Shetland, numbers of black guillemots at West Burra showed further evidence of recovery from the 1993 *Braer* oil spill, increasing by 13% from 1995 to 124 birds, 82% of pre-*Braer* levels. However, between Boddam and Virkie, where numbers had also increased from 1993 to 1995, there was a decline (from 125 to 112 birds), in line with an overall decrease of 7% from 1995 to 1996 at monitored sites. This fall in numbers may possibly be associated with the unusually large numbers of oiled seabirds, including a few black guillemots, found on winter beached bird surveys along the east coast.

At Fair Isle, numbers increased slightly in 1996, but have yet to recover to the levels recorded prior to 1993. In Yell Sound, numbers had increased by 0.9% per annum since the last full survey in 1993. The results suggest that the Yell Sound population has now levelled off, following recovery from the effects of the 1979 *Esso Bernicia* oil spill, with some continued increases in good habitat in the north-east being offset by fluctuating or decreasing counts in other areas. Some smaller colonies in the south of the Sound may be adversely affected by otters.

American mink continue to pose problems for black guillemots in other areas. Mink were reported to have reached Sanda Island, off Kintyre, in 1996 and to have killed adult black guillemots there (R. Morton pers. comm.). Elsewhere in western Scotland, a further four former breeding sites, at all of which mink have been previously recorded, were abandoned in 1996 (J.C.A. Craik pers comm.).

Table 2.24.1 Population changes at monitored black guillemot colonies, 1993-96 (adults in breeding habitat in early morning, late March-early May).

Trends for 1983/86-95/96 are average annual rates of change shown by sample populations (significant trends indicated as: * $P < 0.05$). For further details of the calculation of these trends see section 1.2.2.

	Fair Isle (east coast)	Yell Sound Shetland	Other coasts, Shetland	Papa Westray, Orkney	Isle of Man
1983/86-95/96 annual % change	-1.5 (86-96)	+6.4* (85-96)	-0.5 (85-95) (+5.9%, 85-89)	-4.1* (83-95)	+2.5 (86-96)
1993	190	1285	873	134	126
1994	240	-	935	201	120
1995	216	-	959	168	106
1996	224	1321	892	164	121
1995-96 % change	+3.7	+2.8 (93-96)	-7.0[a]	-2.4[b]	+14.2[c]

Colonies: [a] Kettlaness, West Burra, Boddam-Virkie, Lunning, Levaneap, Kirkabister, Aithsetter; [b] North Hill only; [c] Peel Hill.

Breeding success

On Fair Isle, 31 monitored sites fledged an average of only 0.55 young per site, the second lowest productivity value recorded since 1987. At Holm of Papa Westray in Orkney, between 0.47 and 0.65 chicks per site fledged from 62 monitored, similar to 1995 (0.57) but substantially lower than 1994 (0.89). Great black-backed gulls were responsible for at least 30% of the observed chick losses. Elsewhere in Orkney productivity was generally good, with 1.42 chicks per site fledged from 48 sites monitored on North Ronaldsay and up to 1.43 chicks per site fledged from 28 nests located on Auskerry in July. In north-east Ireland, 0.77 chicks per nest fledged from 22 sites on Lighthouse Island, Copeland Islands, below the average of 1.01 (± s.e. 0.11) for the previous five years.

2.25 Puffin *Fratercula arctica*

Breeding numbers

Few complete counts of apparently occupied burrows (AOBs) were made at puffin colonies in 1996. On Coquet Island in north-east England, where numbers of occupied burrows increased four-fold between 1986 and 1993, *c.* 10,200 AOBs were counted in July, somewhat lower than the estimates of between 11,400 and 13,300 over the previous three years. On Lunga, Treshnish Isles (Argyll), 1,643 AOBs were counted, virtually unchanged from 1994 or 1995. Counts of AOBs in sample quadrats on the Isle of May in the Firth of Forth indicated that this colony continues to increase slowly (M.P. Harris pers. comm.).

On Eilean Mor, Flannan Islands (Western Isles), mean densities of AOBs were assessed by an SNH and JNCC expedition using a series of random 20 m^2 quadrats. Comparison of the results with counts made in sample transects in 1975 and 1992 (Murray 1995) indicates that occupied burrow densities have remained stable within the Lighthouse colony over the past four years, having previously increased. However, in the second main colony on the island, centered around McPhail's bothies, the 1996 survey found substantially higher densities of occupied burrows than were recorded in 1992 in the same area. There are statistical difficulties in making comparisons between transect and random quadrat counts, but even when allowances are made for this it appears that there has been a further increase in burrow densities in this colony over the past four years. However, because of difficulties in assessing colony areas, no reliable estimate can at present be made of the actual number of occupied burrows on Eilean Mor.

Breeding success (table 2.25.1)

Mean breeding success across the five colonies monitored in 1996 was 0.82 (± s.e. 0.011), not significantly different from the 1986-95 average of 0.78 (± s.e. 0.014) measured across between two and six colonies annually. There was no significant difference in productivity between 1995 and 1996 across the five colonies monitored in both years.

Puffins on Fair Isle (Shetland) had a good season, fledging 0.80 chicks per egg compared with a mean of 0.74 (± s.e. 0.029) over the period 1987 to 1995. The Skomer (Dyfed) birds too had a good year, fledging 0.83 chicks per occupied burrow, compared with a mean of 0.74 (± s.e. 0.034) over eight years between 1986 and 1995. By contrast, overall productivity on the Isle of May, 0.79 chicks per egg, was relatively poor (1986-95 mean: 0.84 ± s.e. 0.020), although there was considerable variation between study areas. Puffins at this colony bred late in 1996 (Harris 1996).

Table 2.25.1 Puffin breeding success, 1995-96: estimated number of chicks fledged per egg or occupied burrow (Welsh colonies). Superscript n indicates number of colonies.

Colony	1995 chicks fledged/pair				1996 chicks fledged/pair				1995-96 change	
	sites[n]	range	mean	±s.e.	sites[n]	range	mean	±s.e.		
Fair Isle	109		0.74		109		0.80		+0.06	
Isle of May	180		0.83		173		0.79		-0.04	
Farne Islands	98		0.89		100		0.85		-0.04	
Coquet Island	126		0.80		142		0.82		+0.02	
Skokholm	64		0.63		-		-		-	
Skomer	78		0.77		83		0.83		+0.06	
Total	655[6]	0.63-0.89	0.78	±0.04	607[5]	0.79-0.85	0.82	±0.01	+0.01[5]	±0.02

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