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UK Nature Conservation No. 18

Seabird numbers and breeding success in Britain and Ireland, 1994

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Cover painting of kittiwakes by David Bennett
Cover design by Green Associates, 1994
Printed by W. Lake (Birmingham) Ltd.

Further information about JNCC publications can be obtained from:
Publications Branch, JNCC, Monkstone House, City Road, Peterborough, PE1 1JY.

Published by JNCC, Peterborough

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ISBN 1 873701 93 4

ISSN 0963 8083

This report should be cited as follows:

Walsh, P.M., Brindley, E., & Heubeck, M. 1995. *Seabird numbers and breeding success in Britain and Ireland, 1994*. Peterborough, Joint Nature Conservation Committee. (UK Nature Conservation, No. 18.)

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Summary

This report presents results of seabird monitoring at colonies throughout Britain and Ireland in 1994, and comparison is made with results from 1993 or earlier 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, the Shetland Oil Terminal Environmental Advisory Group and other organisations.

For most species, 1994 was a good or moderately good year overall, with populations generally stable or increasing and with good numbers of chicks fledging. However, some species or regional populations fared badly, and we draw attention to the following findings in particular :

- recent largescale predation by feral mink *Mustela vison* on a range of seabird species on small islands along the west coast of Scotland, causing widespread breeding failures and abandonment of colonies;
- continued long-term declines of cormorant numbers in Shetland and northern Scotland;
- a 78% decrease in breeding numbers of shags in south-east Scotland between 1992 and 1994, directly resulting from high mortality of adult birds during a winter 'wreck' off eastern Scotland;
- apparent total breeding failure of the largest British or Irish colony of common gulls, on the Correen Hills in north-east Scotland, possibly a result of foraging difficulties caused by weather conditions in spring;
- continued low breeding success of lesser black-backed gulls at the largest British or Irish colony, on Skomer in south Wales, possibly related to changes in food availability;
- a 25% decrease in the nesting population of kittiwakes in south-east Scotland, evidently because a high proportion of adults did not attempt to breed, probably a result of low food availability;
- continued low breeding success of kittiwakes on the east coast of Scotland and at many colonies in south-west Britain;
- large decreases in numbers of arctic terns in Orkney and Shetland (which hold most of the British and Irish population) in 1994, and little evidence of recovery from major declines seen in the 1980s;
- continued low breeding success of arctic terns in Orkney, likely to lead to further population decline there;
- continued marked geographical variation in breeding success among tern species elsewhere in Britain and Ireland, with predation, bad weather or high tides contributing to low productivity in many colonies, possibly warranting further protective measures at colonies where consistently few chicks have been reared in recent years;
- continued significant declines by common terns in north-west England and little terns in south-east England.

1 Introduction

This is the sixth 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 1994 are summarised, with comparative results from 1993 or, in some cases, earlier years.

The Seabird Monitoring Programme is designed to help coordinate seabird monitoring on a UK-wide basis, ensuring that adequate data are collected on breeding numbers and breeding performance of seabirds. The programme helps JNCC, RSPB and partner organisations (including the statutory country agencies) to monitor aspects of the overall health of the wider marine environment around the UK and to provide sound and up-to-date advice relevant to the conservation needs of breeding seabirds. Where possible, results are collated for Britain and Ireland as a whole, along with the Isle of Man and the Channel Islands, to provide a wider context.

One aim of the annual report is to draw attention to notable changes in seabird numbers or success which may merit direct conservation action or further research. The information included is also intended to provide feedback to the many individuals and organisations contributing data, placing results for individual colonies or regions in a wider context and, we hope, providing encouragement to observers to continue their valuable work. Except where specifically noted, the results presented refer to coastal/marine populations of seabirds, but reference is made to inland results for some species (cormorant, gulls and terns).

Previous reports in this series have summarised population trends or breeding success for some species over periods of up to ten years (e.g. 1983-93). This year's report concentrates mainly on comparison between 1993 and 1994 results, although some reference is made to earlier years where relevant. Longer-term trends will be reassessed in a future report; summary details for the period 1986-92 can be found in the 1993 report (Walsh *et al.* 1994). Otherwise, the format of this report is similar to that in previous years.

Any offers of help for future seasons, or comments on this report, would be greatly appreciated. We would be keen to receive information on breeding success or year-to-year population changes for any species. In addition to results of regular monitoring, *any* unpublished or unreported data on numbers or breeding success at colonies in Britain or Ireland, whether coastal or inland, would be useful. Such data would be added to the long-term databases maintained by JNCC and RSPB, including the JNCC/Seabird Group Seabird Colony Register and the RSPB Tern Database.

Details of recommended methods for assessing seabird numbers and breeding success may be obtained from the report compilers. These will also be able in the form of a *Seabird monitoring handbook for Britain and Ireland* this year (Walsh *et al.* in press).

1.2 Sources of information for the report

Information is collated from many sources, including: research or wardening staff of RSPB, SOTEAG, JNCC, Scottish Natural Heritage (SNH), English Nature (EN), Countryside Council for Wales (CCW) and the Office of Public Works Wildlife Service; local wildlife trusts, bird observatories, the National Trust, the Institute of Terrestrial Ecology, the Seabird Group, the Irish Wildbird Conservancy, and other organisations; and many fieldwork volunteers (see Acknowledgments).

Seabird monitoring funded by JNCC focuses particularly on marine species such as fulmar, shag, kittiwake and auks, for which changes in breeding populations, success or other parameters may provide evidence of changes in the marine environment as a whole. The most detailed monitoring (through external contracts) is undertaken at several geographically-dispersed 'key sites': the Isle of May (SE Scotland), Fair Isle (Shetland), Canna (NW Scotland) and Skomer (Wales). Long-term monitoring of numbers and breeding success is also undertaken on Orkney Mainland, on St Kilda (NW Scotland) and in Grampian (NE Scotland).

Monitoring of breeding success of cliff-breeding species is encouraged by JNCC at many other colonies, partly by contributing to fieldwork costs of volunteers through contracts with the Seabird Group. Collaboration with the Seabird Group also involves 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 the counts can in many cases be used in assessing annual population changes in particular regions.

Virtually 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 by Lloyd *et al.* 1991; a summary is given here in Table 1.2, with updates based on more recent data for some tern and skua species. It is hoped that a full repeat census of coastal colonies will take place near the end of this decade.

Through their network of reserves, the RSPB monitors the numbers and breeding success of a range of species throughout the UK. For cliff-breeding species, populations and breeding success are monitored using the same methods as JNCC and SOTEAG. Monitoring of terns in Britain is largely coordinated by RSPB, with collation of data from

many other organisations and individuals in addition to RSPB staff. The roseate tern is the subject of a special, international study by RSPB, aimed at conserving the species in the northeast Atlantic as a whole. In the northern isles (Shetland and Orkney), monitoring of arctic terns and skuas is undertaken at many colonies. Other monitoring or survey effort is directed at species including petrels.

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

Available data for Irish colonies are also collated by JNCC and RSPB (in part through the latter's wardening staff), helping to place patterns or trends for British colonies in a wider context. Contacts are maintained with organisations including the National Parks and Wildlife Service, the Irish Wildbird Conservancy, and the National Trust. Fieldwork at some Irish colonies is grant-aided by the Seabird Group.

1.2 Data-presentation and methods

Fuller details are given in previous reports, but some indications of the potential limitations of information presented in this report are given below.

1.2.1 Population changes: use of regional samples

To allow a concise and standardised presentation of population data for each seabird species, individual colonies have, in most cases, not been considered in detail here (notable exceptions being gannet, Manx shearwater, petrels and some terns). Original counts used in assessing population changes are included in limited-circulation appendices held by JNCC, RSPB and SOTEAG. Population changes of seabirds are known to vary markedly between different parts of the Britain and Ireland, and monitoring effort is uneven. For most species (the exceptions being several of the terns), it is thus not practicable to assess year-to-year changes for the population as a whole.

Instead, the coastline has been subdivided into 14 'regions', as defined in Table 1.1 below. For most species, population data have been summarised region-by-region. Valid counts (section 1.2.2) of

whole colonies, or of sample plots within different colonies, have been summed for each year-to-year comparison. By using such regions, the aim 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 have been tabulated for 1993-94 (and 1992-93 in the case of gulls *Larus* spp., which were not covered fully in the 1993 report). 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 (see below). For example, some year-to-year changes may reflect fluctuations in the proportion of adults attempting to breed. Movements of breeding birds to or from other, uncounted 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 (section 1.2.2).

In previous reports, population trends have been assessed over periods of several years (e.g. 1986-93), using a system of population indices, with 1986-87 average counts set as an arbitrary 100. Average annual rates of population change (and whether these differ significantly from 'no change') can be assessed by regression of the logarithms of index values against year. Trends have not been calculated for periods including 1994, but summaries of earlier trends are presented in this report. Fuller details on derivation of indices and trends can be found in the 1993 report.

1.2.2 Accuracy and representativeness of counts

In comprehensive assessments of long-term changes in seabird numbers, for example between 1969-70 and 1985-87 (Lloyd *et al.* 1991), there is inevitably some loss of count accuracy at the expense of obtaining complete coverage. For this report, stricter criteria have been used to select counts for assessment of short-term changes. These criteria vary between species, and cover such factors as census unit ('pairs' or adult individuals) and the timing, frequency and apparent accuracy of counts. For most species, single, well-timed counts of apparently occupied nests are sufficient. The possibility of undetected variations in count accuracy, timing of season or completeness of counts should be borne in mind, however.

For several species (fulmar, guillemot and razorbill), numbers of adults attending colonies can fluctuate markedly from day to day. To allow for this source

of variation, assessment of population change for these species ideally requires 5-10 counts of adults (or apparently occupied fulmar nest-sites) in June each year. The statistical significance of changes shown by such counts can be assessed using *t*-tests.

Where such replication of counts, under a restricted range of counting conditions, is necessary, it is rarely possible to count the whole of a large colony. Counts of sample plots within a colony are usually needed, but these plots will not necessarily be representative of the colony as a whole. Random selection of plots is therefore recommended, although this is not always achieved. Even this does not allow for colony expansion, or inability to sample from the whole colony (some sections may be difficult or impossible to count accurately from land).

The seabird colonies regularly monitored may not be representative of British or Irish populations as a whole. Representativeness within particular regions is more likely to be achieved, 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 (or nest-occupying) pair is the most useful parameter. This is less time-consuming to assess than, for example, clutch-size, hatching success, or fledging success of hatched chicks, although will reflect all of these (to varying degrees). Productivity of species other than terns is usually assessed for sample plots (ideally c50 'pairs' each) within colonies. For such species, figures presented here have generally been averaged (rather than combined) between plots. Random selection of plots improves the likelihood of achieving representativeness within a colony. For terns, whole-colony assessments of productivity are usually made. Note that for some species or regions, few colonies are monitored as yet, so that results may not be geographically representative.

In most cases, the 'low-input' methods used (Walsh *et al.* in press) will overestimate the productivity of breeding pairs slightly. This is considered acceptable, as major geographical or year-to-year changes will still be obvious.

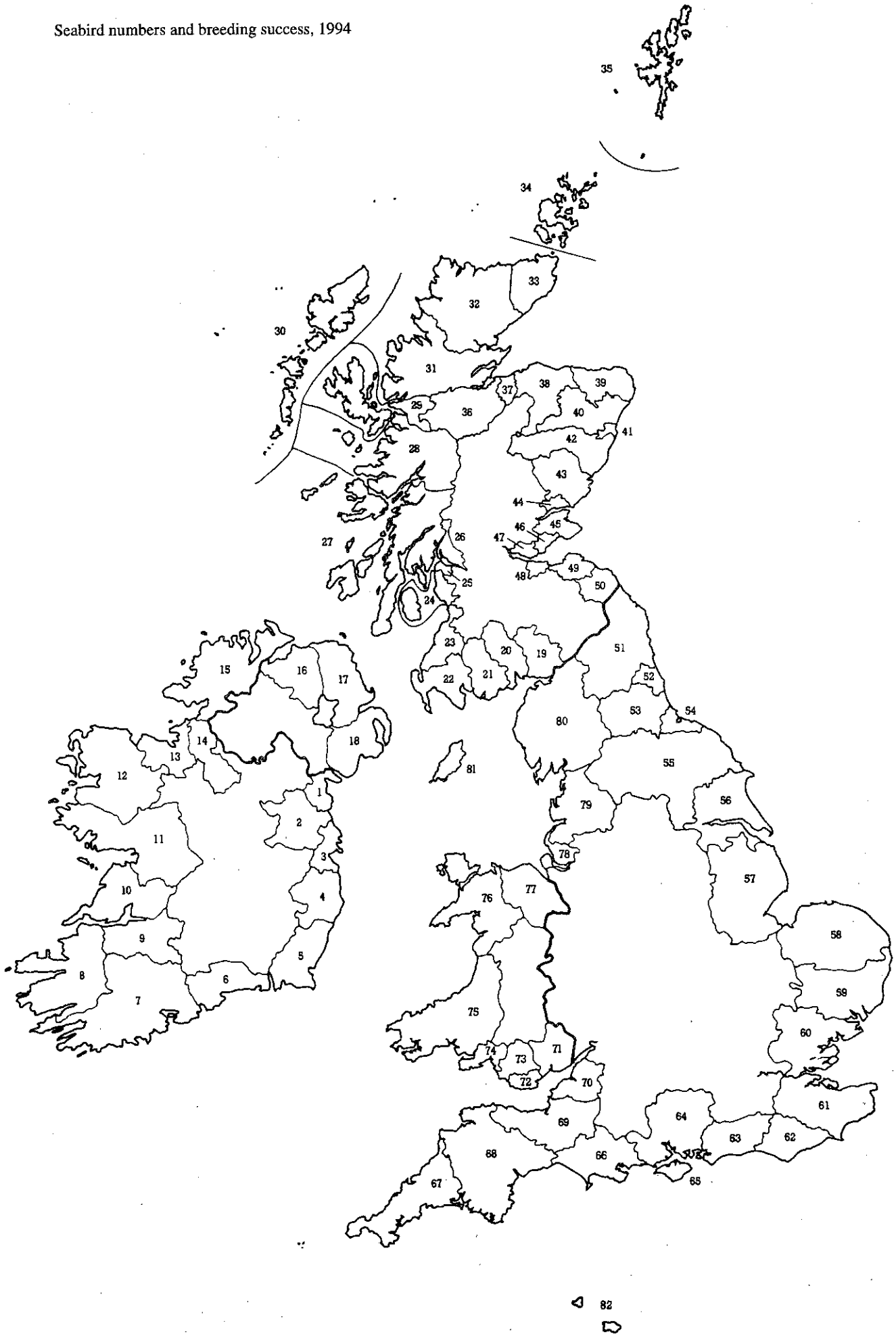


Figure 1.1 Coastal counties / districts of Britain and Ireland. See table 1.1 for details of the coastal regions (combinations of counties or districts) used in this report. Reproduced, with permission, from Lloyd *et al.* (1991)

Table 1.1 Groupings of coastal counties or districts used in assessing population changes for regional samples. The regions are based on Figure 2 of Lloyd *et al.* (1991), except that Shetland and Orkney are each treated separately from 'NE Scotland' and the Inverness-to-Caithness coastline is treated separately ('N Scotland') from 'NW Scotland' here

County / district name (numbers refer to figure 1.1, which shows boundaries)	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), W coast of Ross & Cromarty (31), NW 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), NE 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 / 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 / Isle of Man
Londonderry (16), Antrim (17), Down (18)	NE Ireland

Table 1.2 Counts or estimates of total breeding populations of seabirds in Britain and Ireland in 1985-87 (mainly) (Seabird Colony Register). Units are 'pairs' for most species (apparently occupied nest-sites or, for skuas, territories), with the exception of auks (individual birds). See Lloyd *et al.* 1991 (from which most counts are taken) for further details; figures for skuas, and roseate and arctic tern include recent updates

	Coastal population		% change ^c 1969-87 B & I coast	Total population ^d	
	Britain ^a	Britain & Ireland ^b		Britain ^a	Britain & Ireland ^b
Fulmar	537 000	571 000	+85%	537 000	571 000
Manx shearwater ^e	250 000+	c275 000	?	250 000+	c275 000
Storm petrel	41+ colonies	72+ colonies	?	41+ cols.	72+ cols.
Leach's petrel	6+ colonies	7+ colonies	?	6+ cols.	7+ cols.
Gannet	158 700	187 900	+36%	158 700	187 900
Cormorant	6 000	10 400	+30%	6 800	11 700
Shag	36 400	47 300	+40%	36 400	47 300
Arctic skua ^f	3 200	3 200	≤ +220%	3 200	3 200
Great skua ^f	8 500	8 500	≤ +150%	8 500	8 500
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 ^g	76-80	615-625	-80%	75-80	615-625
Common tern	11 800	14 700	-1%	12 700	16 000
Arctic tern ^h	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 001i	+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 ⁱ	898 000i	940 000i	slightly +?	898 000i	940 000i

Notes:

- Figures for Britain exclude the Isle of Man and the Channel Islands (included under Britain & Ireland).
- Irish figures include some estimates (mainly for fulmar, shag and gulls) for coastal sections which had not been surveyed by 1988.
- Net change based on comparison with total recorded during the 1969-70 'Operation Seafarer' survey (re-analysis of counts summarised by Cramp *et al.* 1974); differences in count methods prevent direct comparison for some species.
- British & Irish totals for some species include estimates of inland populations, to be revised once further information has been collated for the SCR.
- Manx shearwater figures very approximate (midpoints of population estimates).
- Skua figures include are from 1992 survey of Orkney & Shetland, plus 1991-93 updates for Handa and St Kilda, otherwise 1985-87. Although some nest inland in mainland Scotland, all are treated as coastal here.
- Roseate tern figures are from 1994 (this report), allowing for small numbers at uncounted colonies.
- Arctic tern figures include Shetland and Orkney counts from the 1989 RSPB survey (Avery *et al.* 1993), with counts of individuals divided by 1.5 to give an estimate of pairs;
- Puffin figures very approximate (include high proportion of counts of pairs, multiplied by two to give individuals).

2.1 Red-throated diver *Gavia stellata*

Breeding numbers and success (figure 2.1.1, table 2.1.1)

A complete survey in Shetland and Orkney this year (organised by RSPB and SNH) recorded totals of c390 proven breeding pairs in Shetland and c95 proven pairs in Orkney. However, in both island groups birds were recorded at many other sites where breeding could not be proved. Population changes since previous surveys have not been assessed in detail yet.

In four sample areas of Shetland, monitored annually, numbers of 'successful' pairs increased from 52 in 1993 to 58 in 1994 (+11%), slightly above average for the period since 1980 (Figure 2.1.1). In other regular study areas (Hermaness and part of Yell and Northmavine), combined numbers of breeding pairs showed no overall change from 1993 (35 pairs) but have fallen markedly since the early 1980s. Breeding success in Shetland was variable, but low overall: only 0.35 chicks fledged per breeding pair in regularly monitored areas, a 50% reduction compared to 1993 (Table 2.1.1). Breeding success was also low in Orkney (overall average ≤ 0.38 chicks/pair), and again fell between 1993 and 1994.

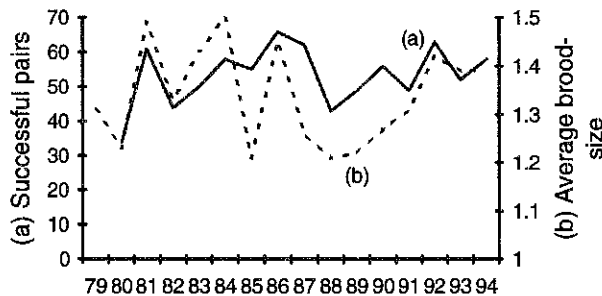


Figure 2.1.1 Annual variation in (a) numbers of 'successful' pairs (with chicks in mid July) and (b) average brood-size near fledging at red-throated diver study areas in Shetland (parts of Unst, Eshaness, North Roe and Bressay), 1979-94. Data are from Okill 1994a

Table 2.1.1 Red-throated diver breeding success, 1993-94: estimated number of chicks fledged per breeding pair. Note that numbers of pairs do not necessarily indicate total populations in study areas; Orkney figures include probable as well as proven breeding pairs

	1993	fledged	1994	fledged
	prs	/pr	prs	/pr
Hermaness	8	1.50	7	0.86
Fetlar	18	0.44	19	0.37
Yell	18	0.50	22	0.27
Foula	10-11	1.0-1.1	11	0.18
SHETLAND sample total	54-55	0.72	59	0.35
Hoy	64	0.52	73	0.42
Rousay	12	0.33	10	0.10
Mainland	18	0.78	35-39	c0.41
Other islands	-	-	16	0.31
ORKNEY sample total	94	0.54	c136	≤ 0.38

2.2 Fulmar *Fulmarus glacialis*

Breeding numbers (table 2.2.1)

Counts of sample populations indicated that numbers of apparently occupied sites (AOS) in most monitored regions either showed no change or increased slightly between 1993 and 1994. In general, there was broad agreement with the regional trends seen during the period 1986-93. Replicate counts of sample plots were made at seven colonies in both 1993 and 1994. Of these, three showed significant increases (+9% at Burray and +12% at Sumburgh Head, Shetland, +12% at St Abb's Head, Berwickshire) and one a significant decrease (-13% on Handa, Sutherland). Sample counts at five colonies on Mainland Orkney showed little overall change (+2%) since they were last counted in 1991, and no significant changes at individual colonies.

Breeding success (table 2.2.2)

Overall, breeding success was moderately high, averaging 0.47 (\pm s.e. 0.02) chicks fledged/site at 33 colonies. This is slightly higher than the average for 1993 (0.43) and for the period 1986-93 (0.42 \pm 0.01, based on 13-33 colonies annually), but there was no significant change overall or in any region. There was considerable variation between individual colonies within some regions, and no broad geographical patterns were evident. Productivity was lowest overall in colonies on the Isle of Man (0.33 chicks/site). There was evidence at some Orkney and Shetland colonies that avian and mammalian predators had reduced success, e.g. feral ferrets *Mustela furo* at Troswick Ness (Shetland), but factors influencing success were generally unclear.

Table 2.2.1 Population changes at monitored fulmar colonies, 1993-94 (apparently occupied sites in June). Superscript = number of colonies with 10+ AOS counted in 1993; counts with a reported inaccuracy of $>\pm 5\%$, and regional samples <100 AOS, are excluded. Figures for Shetland are based mainly on the means of 5 annual counts of study plots within each colony. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: * $P<0.05$; ** $P<0.01$)

	NW Scotland	Shetland	SE Scotland	NE England	Wales	NW Eng. & I. of Man
1986-93 annual % change	+2.6	+1.5*	+3.2*	+5.0*	+4.4**	+1.2
1993	922	1882	1872	315	928	453
1994	808	1906	1910	340	919	453
1993-94 % change	-12.3 ³	+1.2 ⁵	+2.0 ⁸	+7.8 ³	-0.1 ³	0.0 ⁴

Table 2.2.2 Fulmar breeding success, 1993-94: estimated number of chicks fledged per apparently occupied site 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 mean and standard error of figures for individual colonies (standard error is equivalent to half-range of figures from two colonies). Changes in breeding success are indicated for colonies where similar methods have been used in both years (none of the regional changes is statistically significant)

Region	1993 chicks fledged/site				1994 chicks fledged/site				1993-94 change	
	sites ⁿ	range	mean	±s.e.	sites ⁿ	range	mean	±s.e.	mean ⁿ	±s.e. (n)
SW Scotland ^a	14 ¹		0.71		19 ¹		0.68		-0.03 ¹	
NW Scotland ^b	197 ²	0.40-0.50	0.45	±0.05	372 ²	0.45-0.50	0.47	±0.03	0 ¹	
Shetland ^c	2666 ⁸	0.28-0.61	0.49	±0.04	>2916 ⁸	0.37-0.64	0.50	±0.03	0 ⁸	±0.04
Orkney ^d	1029 ⁶	0-0.69	0.41	±0.10	826 ⁶	0.39-0.61	0.51	±0.04	+0.01 ⁵	±0.03
N Scotland ^e	1036 ³	0.21-0.56	0.35	±0.11	63 ¹		0.44			
SE Scotland ^f	>558 ⁴	0.31-0.51	0.44	±0.05	583 ⁴	0.21-0.63	0.48	±0.10	+0.04 ⁴	±0.05
NE England ^g	200 ²	0.56-0.63	0.59	±0.04	158 ²	0.62-0.66	0.64	±0.02	+0.03 ²	±0.04
SW Eng/Chan. Isds ^h	72 ³	0.04-0.40	0.27	±0.12	32 ¹		0.34		+0.30 ¹	
Wales ⁱ	84 ¹		0.71		217 ²	0.44-0.55	0.49	±0.06	-0.16 ¹	
Isle of Man ^j	510 ⁵	0.10-0.61	0.32	±0.10	734 ⁶	0.12-0.49	0.33	±0.06	-0.03 ⁵	±0.10
TOTAL	>6366 ³⁵	0-0.71	0.43	±0.03	>5920 ³³	0.12-0.68	0.47	±0.02	+0.01 ²⁸	±0.02

Colonies: ^a Ailsa Craig; ^b Canna, St Kilda (1994), Handa (1993); ^c Hermaness, Lumbister, Eshaness, Noss, Westerwick, Troswick Ness, Sumburgh Head, Fair Isle; ^d Papa Westray, Rousay, Costa Head, Mull Head, Gultak, Hoy; ^e Iresgeo (1993), An Dun (1993), Easter Ross; ^f Isle of May, Fidra, Tantallon, St Abb's Head; ^g Farne Islands, Coquet Island; ^h West Bay-Burton Bradstock, Annet, Guernsey; ⁱ Skomer, Skokholm (1994); ^j Traie Vane-Gob yn Ushtey, Will's Strand-Gob y Deigan (1994), Peel Hill, Glen Maye, Bradda, Douglas.

2.3 Manx shearwater *Puffinus puffinus*

Breeding numbers

On Skomer (Dyfed), perhaps the largest colony in Britain or Ireland, numbers of chicks fledged on part of the island were estimated in 1994 using a capture-recapture technique. Based on recaptures among a total of 4,009 fledglings caught, c11,000 fledglings were estimated for an area though to hold about one-ninth of the island's shearwaters. This may indicate a total breeding population of c140-180,000 pairs on the island, but confidence limits for these estimates are difficult to assess. Changes since previous surveys (in 1971, 1978 and 1989) are also difficult to assess, and the safest conclusion is that there is little evidence of very large changes in numbers in recent years (C.M. Perrins, pers. comm.)

A further reduction in numbers was evident on Canna (Lochaber) in 1994, with an estimated total of less than 100 breeding pairs (compared to 120-150 in 1993 and 1,000-1,500 in 73-74). Brown rats *Rattus norvegicus* occur on the island, but a preliminary survey in April 1994 suggested that rats were not present near the burrows (Swann 1994). In Shetland, the small colony on Fetlar showed signs of recovery (8+ pairs with eggs were confirmed in 1994), and there was no evidence this year of predation by feral cats. For the second year in succession, however, no shearwaters were found ashore on the Horse of Burravoe, Yell, and the colony on Foula may now be extinct (Harvey 1994). Small colonies like these are particularly vulnerable to mammalian predators, which are probably responsible for these declines.

Two of the recently discovered colonies in the Channel Islands were revisited, and estimates of 11-21 occupied burrows on Little Sark and 15+ on Big Sark were made, similar orders of magnitude to estimates during 1989-92 (Hill 1994). Observations at other colonies in 1994 included an estimated 50-100 territories on the Calf of Man (Isle of Man), as in other recent years.

Breeding success

Although breeding numbers were low, productivity of shearwaters on Canna appeared to be high in 1994. An average of 0.75 large chicks/pair were produced ($n = 16$ burrows with eggs), the highest figure there since 1980. On Skomer, 47 burrows with eggs fledged an average of only 0.47 chicks, mainly reflecting low hatching success, although it was not clear how representative this figure was of the colony as a whole.

2.4 Storm petrel *Hydrobates pelagicus*

Breeding numbers

Tests of census methods continued on Mousa (Shetland) this year, with an examination of the effects of stage of season on responses of birds in crevices to tape-playback of Churr calls. The number of adults responding to tapes peaked in late July, by which time *c*90% of breeding pairs had laid eggs. There was then a steady decrease in numbers responding, as eggs hatched, suggesting that seasonal variation in response to playback was related to laying and hatching dates.

On Skokholm (south Wales), monitoring studies of petrels nesting in drystone walls were continued, mapping birds calling at night during the period late May to mid July. Additional visits were made by day and night to check for responses to tape-playback of Churr calls. Overall, the results suggested that there has been little change in population levels in study-areas over the three years of the study (1992-1994). Based on sample quadrats, an estimate of 1,400-2,800 calling birds was made at the quarry on Skokholm, compared with an estimate of *c*2,000 pairs based on mist-netting studies in 1970. The quarry was estimated to hold about one-third of the island population in 1970 and 1989, and a total population of 4-8,000 pairs was thus estimated in 1994. The long-term trend on Skokholm is unclear, although the smaller population on nearby Skomer appears to have declined markedly in recent decades.

Large numbers of storm petrels were again ringed on Annet (Isles of Scilly) in 1994, including many birds carrying food, and retrap rates suggest that the breeding population may be 2,000 pairs or more (although estimates are complicated by non-breeding visitors). Other colonies visited in 1994 included the Calf of Man (Isle of Man), where *c*20-50 pairs were estimated (as in recent years); Sanda (Argyll & Bute), with *c*100-200 pairs (apparently increased since 1986); Bull Rock (Cork), with 230+ occupied sites (total estimate 2-5,000 pairs in 1969); and Beginish, Blasket Islands (Kerry), with *c*100-1,000 pairs. In Shetland, breeding was again confirmed at Lambhoga on Fetlar, and predation of storm petrels by cats was recorded at two locations on Yell.

Work on census methods is likely to continue on Scottish and Welsh islands in 1995, and it is hoped that definitive census methods will be published in the near future to update the *Seabird monitoring handbook* (Walsh *et al.* in press). In the meantime, further details of methods are available from JNCC or RSPB.

2.5 Leach's petrel *Oceanodroma leucorhoa*

Breeding numbers

A new colony was discovered on a small island off the north-west coast of Lewis (Western Isles) in 1994, when about 25 Leach's petrels were heard calling from burrows on the night of 27 August. More detailed observations, including confirmation of eggs or chicks, may be made in 1995. Only five or six other islands or island groups are currently known to be occupied in Britain and Ireland, although several others have been suspected on the basis of birds mist-netted for ringing.

In Shetland, monitoring continued at Gruney, Ramna Stacks. Tape-playback of Chatter and Purr calls during daylight drew responses from 22 burrows, and, using an endoscope, 19 were confirmed to hold breeding birds. Responses were noted from 18 and 21 burrows, respectively, in 1992 and 1993, and this small population thus appears to be stable.

2.6 Gannet *Morus bassanus*

Breeding numbers

Most of the gannetries in Britain and Ireland were censused in 1994, as part of a full survey to be completed in 1995 (S. Murray and S. Wanless, pers. comm.). Full details have not been collated yet, but some preliminary results, indicating continued widespread increase in the population, are given here. The largest colony, St Kilda (Western Isles), held c60,428 apparently occupied sites (AOS). This is c20% higher than the last count (in 1985), although this may result in part from improved coverage in 1994 (Murray & Wanless 1994). Counts at the Shetland colonies included c11,993 nests at Hermaness in 1994 (an increase by 17% since 1991), and 7,310 nests on Noss (+7% since 1992). Other large colonies where numbers have increased include those in the Channel Islands, with 3,377 AOS on Les Etacs (+27% since 1989) and 2,098 AOS on Ortac (+12% since 1989).

Among the smaller colonies, a possible decrease was noted at Troup Head (Banff & Buchan), from 331 nests in 1993 to 239+ in 1994, while Ireland's Eye (Dublin) showed little change from 47 nests in 1992 to 45 in 1994. Both of these colonies have only been occupied since 1988-89. Other counts included 825 nests on Fair Isle (Shetland), an 8% increase since 1993; 1,250 AOS on Great Saltee (Wexford), similar to 1993; and 1,815 AOS on Bull Rock (Cork), a 20% increase since 1985.

Breeding success (table 2.6.1)

Average productivity at monitored colonies was moderately high (0.65-0.7 chicks fledged/nest) in both 1993 and 1994, close to the average for the period 1986-93 (0.67 \pm s.e. 0.02, based on up to six colonies annually). There was a notable improvement in success on Ailsa Craig (Kyle & Carrick), reflecting less severe weather in spring, and at Bempton (Humberside), the most successful colony this year. Reduced productivity at Troup Head may have resulted in part from disturbance or predation in one sub-section of the colony.

Table 2.6.1 Gannet breeding success, 1993-94: estimated number of chicks fledged per occupied 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 (none of the regional changes is statistically significant)

Region	1993 chicks fledged/nest				1994 chicks fledged/nest				1993-94 change	
	nests ⁿ	range	mean	\pm s.e.	nests ⁿ	range	mean	\pm s.e.	mean ⁿ	\pm s.e. (n)
SW Scotland ^a	62 ¹		0.53		72 ¹		0.67		+0.14 ¹	
Shetland ^b	773 ³	0.61-0.78	0.68	\pm 0.05	1314 ³	0.68-0.77	0.71	\pm 0.03	+0.03 ³	\pm 0.02
NE Scotland ^c	322 ¹		0.59		239 ¹		\leq 0.50		-0.09 ¹	
NE England ^d	128 ¹		0.74		131 ¹		0.87		+0.13 ¹	
TOTAL	1289 ⁶	0.53-0.78	0.65	\pm 0.04	1756 ⁶	\leq 0.5-0.87	\leq 0.69	\pm 0.05	+0.04 ⁶	\pm 0.04

Colonies: ^a Ailsa Craig; ^b Hermaness, Noss, Fair Isle; ^c Troup Head; ^d Bempton.

2.7 Cormorant *Phalacrocorax carbo*

Breeding numbers (table 2.7.1)

Coverage of colonies improved further in 1994, and included a complete survey in Wales (Sellers 1994). A total of 2,291 apparently occupied nests at 30 Welsh colonies represented a *c*37% increase since the mid 1980s (Sellers 1994), and sample colonies showed a *c*20% increase between 1993 and 1994. Puffin Island (Gwynedd) held a record 642 nests, the highest count ever recorded at a British colony. Sample populations in five other coastal regions also showed increases between 1993 and 1994 (by 9-47%), but there were marked decreases in three regions (by 19-29%). Movements to or from other (uncounted) colonies may account for some of these changes. The 29% decline in N Scotland is based on complete coverage of that region, and reflects a decrease at Caithness colonies (where numbers fell between 1969 and 1986, but had shown little change during 1986-93). In SE Scotland, the 45% increase seems most likely to represent an increase in the proportion of adults breeding (compared to 1993, when numbers of nesting pairs fell by 37% in the Firth of Forth) (cf. Walsh *et al.* 1994). Trends for most regions indicated stable or increasing populations during 1986-93, but a significant decline in the Shetland population continued in 1994 (a further 23% decrease).

The inland breeding population in England continued to increase in 1994, with a minimum total of 929 nests in at least nine colonies. The rate of increase (+2.5% 1993-94) has possibly slowed, and numbers at Abberton Reservoir (Essex) fell from 526 nests in 1993 to 459 in 1994, but figures have not been compiled yet for all colonies.

Breeding success

At the few colonies studied, moderately good numbers of chicks were reared (average 1.60 \pm s.e. 0.12 chicks fledged/nest at three coastal colonies in Scotland). Cormorants at North Sutor (Ross & Cromarty) fledged an average of 1.84 (\pm s.e. 0.18) chicks/nest (based on 132 nests in two plots), although this was below average for the colony in recent years (2.46-2.54/nest, 1991-93). Two colonies on the west coast of Scotland reared slightly fewer chicks: 1.54/nest (*n* = 33) at a colony in the Sound of Arisaig (Lochaber) and 1.43/nest (*n* = 48) in Loch Fyne (Argyll & Bute). In Shetland, the average brood-size for productive pairs was high (2.9, cf. 3.1 in 1993).

Table 2.7.1 Population changes at monitored cormorant colonies, 1993-94 (apparently occupied nests in May-June). Superscript = number of colonies counted in both years. Regional samples <50 AONs 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; *** *P*<0.001)

	SW Scotland	Shetland	N Scotland	SE Scotland	NE England
1986-93 annual % change	+5.5	-6.7**	+0.5	+0.6	+2.9*
1993	414	264	484	300	327
1994	583	203	343	434	264
1993-94 % change	+40.8 ²	-23.1 ⁵	-29.1 ⁷	+44.7 ⁵	-19.3 ³
	INLAND, England	SW England	NW Eng./I. Man	Wales	NE Ireland
1986-93 annual % change	+24.1***	+0.3	+1.5	-0.3	+6.5**
1993	765	141	72	909	240
1994	784	160	84	1095	262
1993-94 % change	+2.5 ⁶	+13.5 ⁶	+16.7 ⁴	+20.5 ¹²	+9.2 ³

2.8 Shag *Phalacrocorax aristotelis*

Breeding numbers (table 2.8.1)

Large numbers of shags died in a 'wreck' along the east coast of Scotland during February-March 1994, notably in the Moray Firth (Swann 1994), associated with a prolonged period of onshore winds. Although many guillemots also died, total mortality among shags (possibly as high as 5-10 000 birds) was proportionately much higher (M.P. Harris & S. Wanless, in prep.). Birds apparently died from starvation, probably due (at least in part) to poor weather. Ringing recoveries indicated that many of the shags involved had been ringed on the Isle of May and other colonies in the Firth of Forth, and on the Farne Islands (Northumberland), although colonies as far north as Shetland were also involved.

Numbers of apparently occupied nests fell by *c*45% on the Isle of May, and overall at colonies in SE Scotland (mainly in the Firth of Forth), between 1993 and 1994. In fact, the true impact of the wreck on numbers was much greater, as counts in 1993 had been lower than usual because many adults had not nested. Comparison of 1992 and 1994 counts indicated a 78% decrease in SE Scotland, including a 75% decrease on the Isle of May (from 1,634 to 403 nests, the lowest since 1959). Detailed studies on the Isle of May indicated a massive decrease in survival rates of adults between 1993 and 1994, unprecedented for any British colony, and it is estimated that, without substantial immigration, the population there may take ten years or more to return to 1992 levels (Harris & Wanless, in prep.).

In NE England, numbers on the Farne Islands (where the population was high in 1993) fell by 60% between 1993 and 1994, and this was clearly also due to the wreck. Elsewhere on North Sea coasts, little detailed information was available, but numbers at study colonies in Shetland were stable or increased slightly between 1993 and 1994. Further counts in 1995 may help assess how widely populations have been affected, and continued monitoring will be needed to assess the rate of recovery in the most affected regions.

On other coasts, numbers generally increased or showed little change at colonies in SW England and SW and NW Scotland (including a 20% increase on Canna, Lochaber).

Breeding success (table 2.8.2)

Average productivity was moderately high at 20 study-colonies ($1.55 \pm \text{s.e. } 0.16$ chicks fledged/nest), higher than the averages for 1993 (1.30) and 1986-93 (1.29 ± 0.08). Individual colonies in the Isle of Man, SW England, SW Scotland and Shetland were the most successful, although predation by *Corvidae* reduced success at some Shetland colonies. There was less regional variation than in 1993, but the lowest figures were again recorded in SE Scotland (1.10) and NE England (1.01). Even these were improvements over 1993, although total numbers of chicks reared will have been lower because of the reduction in breeding numbers (see above). It was a rather late breeding season in these regions and in Shetland, and some chicks on the Farne Islands were washed away by a storm in late August. Nevertheless, in the Firth of Forth the season was not as late as in 1993 and food availability during the nestling period may have been higher. In SW Scotland, success was high at most study-colonies, but mink *Mustela vison* took all the eggs on one island and many chicks died on another island during June, possibly a result of wet weather.

Table 2.8.1 Population changes at monitored shag colonies, 1993-94 (apparently occupied nests in May-June). Superscript = number of colonies with 10+ AONs counted in 1993; counts with a reported inaccuracy of $>\pm 5\%$, and regional samples <100 AONs, are excluded. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: ** $P<0.01$; *** $P<0.001$)

	SW Scotland	NW Scotland	Shetland	SE Scotland	NE England	SW England.	Isle of Man
1986-93 annual % change		-1.1	-5.2**	-3.5	+7.9***	-3.3	
1993	669	792	840	1392	1948	142	317
1994	700	924	854	758	771	144	352
1993-94 % change	+4.6 ²	+16.7 ³	+1.7 ¹¹	-45.5 ⁹	-60.4 ¹	+1.4 ¹	+11.1 ¹

Table 2.8.2 Shag breeding success, 1993-94: estimated number of chicks fledged per occupied nest at sample colonies (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	1993 chicks fledged/nest				1994 chicks fledged/nest				1993-94 change	
	nests ⁿ	range	mean	±s.e.	nests ⁿ	range	mean	±s.e.	mean ⁿ	±s.e. (n)
SW Scotland ^a					161 ⁷	0-2.7	1.77	0.43		
NW Scotland ^b	51 ¹		1.14		56 ¹		1.45		+0.31 ¹	
Shetland ^c	353 ⁷	1.09-1.98	1.58	±0.11	254 ⁵	1.15-1.81	1.52	±0.13	-0.08 ⁵	±0.10
N Scotland ^d	61 ¹		1.74		56 ¹		1.54		-0.20 ¹	
SE Scotland ^e	>152 ³	0.21-1.40	0.70	±0.36	140 ³	0.68-1.31	1.10	±0.21	+0.39 ³	±0.26
NE England ^f	206 ¹		0.77		179 ¹		1.01		+0.24 ¹	
SW England ^g	142 ¹		1.22+		6 ¹		1.66			
Isle of Man ^h			-		15 ¹		2.13			
TOTAL	>965 ¹⁴	0.21-1.98	1.30	±0.14	867 ²⁰	0-2.7	1.55	±0.16	+0.10 ¹¹	±0.10

Colonies: ^a Ruadh Sgeir, Eilean Aoghainn, E. Fraoich, E. Buidhe, Dubh Fheith, E. na Cille, Garbh Eilean (Mull);

^b Canna; ^c Hermaness (1993), Kettlaness (1993), Noness, Troswick Ness, Westerwick, Sumburgh Head, Fair Isle;

^d North Sutor; ^e Isle of May, Fidra, St Abb's Head; ^f Farne Islands; ^g Annet (1993), Berry Head (1994); ^h Peel Hill.

2.9 Arctic skua *Stercorarius parasiticus*

Breeding numbers (table 2.9.1)

At 11 monitored colonies in Shetland, numbers of apparently occupied territories (AOTs) decreased overall by 12%, a similar decline to that seen from 1992 to 1993. This decline was also evident at one of the largest colonies, on Foula, which held only 134 AOTs compared with 144 in 1993 and 159 in 1992. Studies on Foula suggests a reduced level of recruitment in recent years (Furness 1994). This most likely reflects the few chicks reared during the period 1988-90 (in particular), and reduced recruitment elsewhere in Shetland is also likely to have been a major cause of recent population declines. At colonies in the south Mainland, however, first- and second-summer birds appeared to be in good numbers at 'club sites' in 1994 - potentially encouraging news for the future. This is the first time that clubs have been recorded since 1990 (when such clubs consisted of non-breeding adults).

In contrast, numbers at five monitored colonies in Orkney increased by 10% overall. Numbers on Papa Westray showed the greatest change, increasing by 18% and approaching 1992 figures. As in Shetland, first- and second-summer birds appeared for the first time since 1990 at club sites (on Rousay and Westray).

Breeding success (table 2.9.2)

At regularly monitored colonies in Shetland, clutch size and hatching success showed little change from 1993. Average productivity remained high, at c1.0 chicks per apparently occupied territory (AOT), despite poor weather conditions in June. In Orkney, average productivity was lower than in Shetland, but increased to 0.55 fledged/AOT from 0.41 in 1993. There were notable improvements on Papa Westray and Rousay, thought to be due to decreased levels of predation from great skuas and great black-backed gulls. On Hoy, however, predation levels remained high.

In both Shetland and Orkney, adult attendance was high at all monitored colonies throughout the season, and all samples of regurgitated food comprised sandeels. Observations on Foula, however, suggested that sandeel availability was low in late June and early July. There was no evidence of high post-fledging mortality, except on Noss (Shetland), where at least five fledglings were taken by great skuas, and on Hoy and Papa Westray (Orkney).

Table 2.9.1 Population changes at monitored arctic skua colonies in Shetland, 1993-94 (apparently occupied territories in late May/June). Superscript = number of colonies counted in both years

	Foula	Fair Isle	other Shetland	total Shetland	Orkney
1993	144	107	171	422	223
1994	134	93	151	378	245
% change	-6.9	-13.1	-11.7 ¹¹	-10.4 ¹³	+9.9 ⁵

Table 2.9.2 Arctic skua breeding success, 1993-94: number of chicks fledged per apparently occupied territory (AOT)

Colony	1993 fledged per AOT		1994 fledged per AOT	
	AOTs	mean	AOTs	mean
Unst (2 colonies)	39	0.93	34	0.97
Fetlar (2 colonies)	21	1.14	17	1.23
Yell (2 colonies)	24	1.08	29	0.93
Noss	14	0.86	14	0.71
Mousa	23	1.17	23	1.04
Mainland (3 colonies)	37	1.03	34	1.03
SHETLAND mean \pm s.e. excluding Foula and Fair Isle	158(11)	1.08 \pm 0.06	151(11)	1.08 \pm 0.10
Foula	144	c1.05	134	1.19
Fair Isle	107	0.76-0.93	93	0.70
Papa Westray	126	0.44	31	0.68
Westray	33	0.73	32	0.63
Rousay	29	0.48	20	1.07
Mainland	23	0.52	24	0.21
Hoy	15	0.0	11	0.18
ORKNEY mean \pm s.e.	226(5)	0.41 \pm 0.12	128(5)	0.55 \pm 0.16

2.10 Great skua *Stercorarius skua*

Breeding numbers (table 2.10.1)

Numbers at nine monitored colonies in Shetland showed little change overall (-2%), although some colonies have shown a more marked recent decline. The largest colony, on Foula, was not surveyed fully in 1994, but observations in study areas suggested a continuation of the decline seen since 1986. High recruitment rates followed increased adult mortality on Foula as a result of the low sandeel availability in the late 1980s, but there are now few potential recruits to replace those being lost from the breeding population and further declines are predicted (Furness 1994).

In Orkney, there was a 7% increase overall at sample colonies, although this may in part reflect more complete coverage of late breeders in 1994. Elsewhere, numbers of apparently occupied territories (AOTs) on Hirta, St Kilda (Western Isles) increased again from a record 107-112 in 1993 to 128 in 1994 - the largest colony outside the northern isles. Nearby Soay held an estimated 15 AOTs. Also in NW Scotland, Handa held an estimated 112 AOTs in 1994 (+22% since 1991).

Breeding success (table 2.10.2)

Mean clutch size and hatching success at Shetland study-colonies showed little change compared with 1992 and 1993 figures, and average productivity remained high, at c0.85 chicks fledged per AOT. The 1994 breeding season was protracted, with, for example, the laying period at Noss extending from mid-May until the end of June. On Foula, an overall increase from c0.5 to c0.8 chicks fledged/AOT was recorded, although food availability appeared poor and there was some cannibalism of chicks. It was a less successful season in Orkney, although there was an overall improvement in productivity from 0.35/AOT in 1993 to 0.6 in 1994. This was thought to be partly due to reduced cannibalism at two colonies, Grut Fea and Lyrava Hill. In NW Scotland, productivity was again high on Hirta, St Kilda, at 1+ chicks/AOT.

Table 2.10.1 Population changes at monitored great skua colonies in Shetland, 1993-94 (apparently occupied territories in late May/June). Superscript = number of colonies counted in both years

	Fair Isle	other Shetland	total Shetland	Orkney
1993	101	267	367	89
1994	101	258	359	95
% change	0	-3.4 ⁸	-2.2 ⁹	+6.7 ⁹

Table 2.10.2 Great skua breeding success, 1993-94: number of chicks fledged per apparently occupied territory (AOT)

Colony	1993 fledged per AOT		1994 fledged per AOT	
	n	mean	n	mean
Hermaness	43	0.98	42	0.74
Fetlar	58	0.83	52	1.08
Mainland	53	0.64	50	0.90
Yell	23	0.74	49	0.65
Mousa	10	0.90	12	0.92
Noss	52	0.86	53	0.75
SHETLAND mean \pm s.e. excluding Foula and Fair Isle	239(8)	0.83 \pm 0.08	258(8)	0.87 \pm 0.06
Fair Isle	101	0.99-1.19	101	c1.2
Foula		c0.5		c0.8
NW Hoy	32	0.38	38	0.61
S Hoy	30	0.37	24	0.29
E Hoy	31	0.29	33	0.82
*Hoy (ORKNEY) mean \pm s.e.	93(3)	0.34 \pm 0.03	95(3)	0.57 \pm 0.15

2.11-2.15 Gulls *Larus* spp.

Only a brief summary was given in the report for 1993, and fuller details are given here.

2.11 Black-headed gull *Larus ridibundus*

Breeding numbers (table 2.11.1)

Regular counts are available for very few colonies, and movements of breeding populations between colonies further complicate assessments of population change. The limited comparative data available for 1992-93 and 1993-94 show some marked variations between regions, but these are generally based on small populations or few colonies. Among the more notable changes was a 23% decrease in NE England in 1994, largely reflecting changes on Coquet Island (Northumberland), which holds the bulk of the coastal population there. In Ireland, a 16% increase at colonies in Strangford Lough (Down) was also notable. Small coastal colonies in NW England have shown some marked fluctuations in recent years, but overall changes have probably been much less. Some decline has occurred at the Ribble Estuary (Lancashire), which held c20,000 pairs in 1988, although this is still the largest coastal colony in Britain, with at least 8-10,000 pairs in 1993. Detailed population changes on the west coast of Scotland are difficult to assess, but a high proportion of colonies in Argyll & Bute and southern Lochaber have been abandoned in recent years following breeding failure caused by mink (J.C.A. Craik, pers. comm.).

A survey of inland colonies in Co. Mayo recorded a c52% decrease in breeding numbers between 1977 and 1993 (Whilde *et al.* 1993). Total numbers inland in NW Ireland (Donegal, Sligo, Mayo and Galway) fell by c27% between 1977/78 and 1992/93, but other gull species showed more substantial declines.

Breeding success (table 2.11.2)

Coverage is generally poor, but the available data indicate low breeding success at most colonies in 1993-94. At study-colonies on the west coast of Scotland, overall breeding success was low in 1993 and 1994, largely a consequence of predation by mink (Craik 1995). Of nine colonies monitored there in 1993, mink were recorded at seven, all of which failed totally. Success appeared to improve somewhat in 1994, with less evidence of mink predation, but this in part reflects abandonment by gulls of some islands. Elsewhere, breeding success was highest on Coquet Island (Northumberland), where an average 1.15 chicks fledged/nest in 1994. Total or near-total failure occurred at the few other English colonies for which data were available, in most cases resulting from predation, high tides or bad weather. However, success may have been higher in some of the larger colonies, e.g. 'good' numbers of chicks were reported to have fledged in the NW Solent (Hampshire) in 1994.

Table 2.11.1 Population changes at monitored black-headed gull colonies, 1992-93 and 1993-94 (breeding pairs / apparently occupied nests in May-June). Superscript = number of colonies counted in both years. Regional samples <200 pairs are excluded. Trends for 1986-92 are average annual rates of change shown by sample populations (none of the trends is statistically significant)

	NE England	SE England	NW Eng. / I. of Man	NE Ireland
1986-92 annual % change	-4.9	-4.5	+3.0	+6.2
1992		1322	520	
1993		1178	152	
1992-93 % change		-10.9 ¹	-70.8 ²	
1993	4064	1178	152	6075
1994	3123	1226	141	7023
1993-94 % change	-23.1 ²	+4.1 ¹	-7.2 ²	+15.6 ^{>1}

Table 2.11.2 Black-headed gull breeding success, 1993-94: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies)

Region	1993			1994		
	prs ⁿ	fledged/pair range	total	prs ⁿ	fledged/pair range	total
SW Scotland ^a	416 ⁶	0-0.77	0.05-0.09	340 ⁴	0-0.72	0.26-0.35
NW Scotland ^b	53 ³		0	39 ¹		0
NE Scotland ^c			-	10 ¹		0
NE England ^d			-	76 ¹		1.15
SE England ^e			-	1838 ⁴	0-0.5	0.10
NW England ^f	142 ¹		0.01			-

Colonies: ^a Argyll & Bute coast; ^b southern Lochaber coast; ^c Sands of Forvie; ^d Coquet Island; ^e Rye, Langstone and Chichester Harbours, Newtown estuary; ^f Foulney.

2.12 Common gull *L. canus*

Breeding numbers

Few colonies are counted regularly, and recent population changes are unclear, except for (variable) changes shown by individual small colonies in some regions. Counts at study colonies on the west coast of Scotland (Argyll & Bute and southern Lochaber) suggest that some decrease may have occurred in recent years, possibly associated with predation by mink (cf. black-headed gull).

In NW Ireland, numbers breeding inland in Co. Mayo fell by *c*23% between 1977 and 1993, while total numbers inland fell by *c*30% between 1977/78 and 1992/93 (Whilde *et al.* 1993). This decline was most severe in Donegal (-72%) and Sligo (-44%), possibly a result of predation by mink, which are widely distributed in these counties (but not Mayo or Galway).

Breeding success (table 2.12.1)

Most of the available data are from colonies in SW and NW Scotland, where few chicks were reared in 1994 and, particularly, 1993. As with other gull species and terns in these regions, predation by mink appears to be the main factor behind low breeding success. For example, mink were recorded at at least 16 out of 26 colonies in 1993 and at least 21 out of 35 colonies in 1994, and usually caused total breeding failure unless trapped early in the season.

The large inland colony on the Correen Hills in NE Scotland, which held 14-20,000 pairs in 1988 (*c*20% of the British population), appeared to suffer total or near-total breeding failure in 1994. Very few eggs, and no chicks, were seen during the season. Anecdotal evidence from previous years suggested that poor feeding conditions in spring may have led to many birds failing to lay eggs; late frosts were followed by an extended period of dry conditions, and this may have prevented effective foraging for earthworms. A full census of this colony is planned for 1995, assuming that normal breeding resumes; more detailed assessment of breeding success (and the factors involved) may also be warranted.

Table 2.12.1 Common gull breeding success, 1993-94: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies)

Region	1993		1994	
	prs ⁿ	fledged/pair range	prs ⁿ	fledged/pair range
SW Scotland ^a	706 ¹⁰	0-0.59	1020 ²³	0-1.07
NW Scotland ^b	289 ⁵	0-0.19	203 ¹¹	0-1.0
Shetland ^c	10 ¹	0.40	7 ¹	0.57
SE England ^d		-	8-10 ¹	<i>c</i> 0.33

Colonies: ^a various, Argyll & Bute coast; ^b various, southern Lochaber coast; ^c Fair Isle; ^d Dungeness.

2.13 Lesser black-backed gull *L. fuscus*

Breeding numbers (table 2.13.1)

Few substantial colonies are counted regularly, but available data suggest that coastal populations are generally increasing (Walsh & Gordon 1994). There were notable increases between 1992 and 1993 at colonies in SE Scotland (+68%, largely based on the Isle of May) and Wales (+29%), but relatively little change between 1993 and 1994. Recent increases shown by sample populations in SE Scotland were confirmed by a full survey of islands in the Firth of Forth in 1994. This found a total of c7,200 occupied nests (AONs), 72% higher than in 1987 (Harris & Wanless 1994). Large increases were also noted on the Ribble Estuary (Lancashire), which held 1,700+ nests in 1993 (+210% since 1990) and on Great Saltee (Wexford), with 620 nests in 1994 (+850% since 1986: Creme & Kelly 1994).

Counts at inland colonies in Co. Mayo in 1993 showed little overall change since 1977 (+2%), but overall numbers inland in NW Ireland fell by c36% between 1977/78 (c2,490 pairs) and 1992/93 (c1,600 pairs) (Whilde *et al.* 1993). Most of the decline occurred in Co. Galway (from c1,295 to c195 pairs), although the main decrease occurred between 1983 and 1988, possibly associated with an increased incidence of large gulls showing symptoms of botulism. Possible movements to coastal colonies could not be excluded however.

Breeding success (table 2.13.2)

Productivity was again low on Skokholm and Skomer (Dyfed) in 1993 and 1994, although some improvement (to 0.25-0.3 chicks fledged/nest) was seen in 1994. These figures are higher than in 1989-90, when an average of <0.05 chicks fledged/nest on Skomer, but it seems likely that the same causative factors are involved (perhaps shortage of fish discarded from trawlers: Walsh *et al.* 1993). Few chicks were reared at five study-colonies in SW Scotland in 1994, reflecting predation by mink (cf. accounts for other gulls), although some colonies further north and south were more successful. One mixed colony of over 1000 pairs of lesser black-backed and herring gulls produced no fledged chicks in either 1993 or 1994. Breeding success was much higher on the Isle of May (NE Fife), averaging 0.81 chicks fledged/nest in 1993 (compared to 1.04 in 1992). For unknown reasons, however, breeding output there was consistently lower than for herring gulls throughout 1989-93 (average 0.87 chicks/nest for lesser black-backed gulls v. 1.33 for herring gull) (Harris & Calladine 1993).

Table 2.13.1 Population changes at monitored lesser black-backed gull colonies, 1992-93 and 1993-94 (breeding pairs / apparently occupied nests in May-June). Superscript = number of colonies counted in both years. Regional samples <200 pairs are excluded. Trends for 1986-92 are average annual rates of change shown by sample populations (neither trend is statistically significant)

	SE Scotland	Wales		SE Scotland	Wales
1986-92 annual % change	+5.2	+3.5			
1992	756	19395	1993	1269	25299
1993	1269	25075	1994	1281	23784
1992-93 % change	+67.8 ²	+29.3 ³	% change	+0.9 ²	-6.0 ⁴

Table 2.13.2 Lesser black-backed gull breeding success, 1993-94: 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

Region	1993		1994	
	prs ⁿ	fledged/pair range total	prs ⁿ	fledged/pair range total
SW Scotland ^a		-	c1000 ⁵	0-c0.4 c0.10
SE Scotland ^b	c1259 ¹	0.81		-
Wales ^c	c20200 ¹	0.1-0.2	c23100 ²	0.25-0.31 0.25-0.30

Colonies: ^a Reisa mhic Phaidean, Eilean na Cille, Eilean Ghamhna, Bach Island, Eilean Fraoch; ^b Isle of May; ^c Skomer, Skokholm (1994).

2.14 Herring gull *L. argentatus*

Breeding numbers (table 2.14.1)

Available data from coastal colonies suggest that most regional populations have been roughly stable or declining in recent years (table 2.14.1; Walsh & Gordon 1994). Sample population changes during 1992-94 vary greatly between regions, usually based on small samples, and suggest few clear trends (in combination with 1986-92 changes). There was evidence of a population recovery or upswing in some regions in 1993 or 1994, e.g. in SE Scotland, where a full survey of the Forth islands found c13,000 occupied nests (a 22% increase since 1987; Harris & Wanless 1994).

Substantial declines continue at some colonies, however, e.g. on Great Saltee (Wexford), where numbers have fallen by c65% since 1986 (by 90% since 1980) to 277 nests in 1994. In NE Scotland, the colony at St Cyrus (Kincardine & Deeside) has declined dramatically from 911 nests in 1989 to only 9 in 1994. Losses of fulmars at the same colony suggest that predation or disturbance (perhaps by foxes) may be the main factor involved, although some gull losses may also be occurring to botulism. Birds showing symptoms of botulism are regularly recorded at some other colonies, and the disease is believed to be responsible for much of the recent decline seen in Strangford Lough (Down). Circumstantial evidence also suggested that botulism contributed to the c93% decline seen at inland colonies in NW Ireland between 1977/78 and 1993/94 (from c375 to 25 pairs) (Whilde 1993).

Breeding success (table 2.14.2)

The limited data available suggest that herring gulls in many regions fledged good numbers of chicks in 1993-94, and that productivity can average 1-2 chicks/pair in the absence of human interference or heavy predation. Notable improvements in success were seen at Strangford Lough (Down) in 1994 (2.0 chicks/nest), and on Canna (Lochaber) in 1993-94 (1.6, v. 0.75-0.9 in 1991-92). However, other study-colonies on the west coast of Scotland, mainly on small islands, produced few chicks in 1994 (c0.4/nest overall). As with other gulls and terns in that study-area, predation by mink had a severe impact on breeding success: 12 colonies where mink predation was not recorded averaged 0.72 chicks fledged/pair, whereas 14 colonies where mink predation occurred produced only 0.16/pair (including total failure at 5 colonies).

Table 2.14.1 Population changes at monitored herring gull colonies, 1992-93 and 1993-94 (breeding pairs / apparently occupied nests in May-June). Superscript = number of colonies counted in both years. Regional samples <200 pairs are excluded. Trends for 1986-92 are average annual rates of change shown by sample populations (significant trends indicated as: * P<0.05; ** P<0.01)

	NW Scotland	NE Scotland	SE Scotland	Wales	NW England / Isle of Man	NE Ireland
1986-92 annual % change	+1.6		-7.5**	-0.7	-2.7	-15.3**
1992	1072	253	1946	2182	866	1340
1993	1161	59	2676	2449	801	1008
1992-93 % change	+8.3 ²	-76.7 ¹	+37.5 ⁴	+12.2 ⁶	-7.5 ²	-24.8 ^{>2}
1993	1161	59	3146	2500	801	1008
1994	997	9	3071	2811	770	1134
1993-94 % change	-14.1 ²	-84.7 ¹	-2.4 ⁷	+12.4 ⁵	-3.9 ²	+12.5 ^{>2}

Table 2.14.2 Herring gull breeding success, 1993-94: 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

Region	1993		1994	
	prs ⁿ	fledged/pair range total	prs ⁿ	fledged/pair range total
SW/NW Scotland ^a		-	4176 ²⁸	0.38-0.40
NW Scotland ^b	145 ¹	1.6	162 ¹	1.6
SE Scotland ^c	c2059 ¹	1.04		-
SW England ^d	140 ³	0.80-2.5 ≤1.50	39 ¹	1.23
Wales ^e		-	105 ¹	1.31
NE Ireland ^f	.1	1.15	.1	2.0

Colonies: ^a Various colonies in Argyll & Bute and southern Lochaber; ^b Canna; ^c Isle of May; ^d Tresco (1993), Gugh (1993), West Bay-Burton Bradstock; ^e Skokholm; ^f Strangford Lough.

2.15 Great black-backed gull *L. marinus*

Breeding numbers (table 2.15.1)

Recent population trends are difficult to assess, and only small regional samples are counted regularly. The available data suggest that coastal populations in Britain have generally increased or been roughly stable during the period since 1986 (Walsh & Gordon 1994, Seabird Colony Register unpublished), and counts in 1993 and 1994 supported this. However, only a very small proportion of the large populations in Orkney, Shetland, N and NW Scotland have been counted regularly, and counts of the larger colonies are infrequent. On North Rona (Western Isles), the largest colony outside Orkney, 851 pairs were counted in 1993, suggesting a c15% increase since 1986 (Murray & Love 1993). In Orkney, 1,390 adults were counted on the Copinsay group in 1994, suggesting little major change (perhaps some decrease) since 1987. In NE Ireland, the small population in Strangford Lough (Down)

has decreased significantly over the period 1986-94, and this may in part reflect the incidence of botulism (or botulism-like symptoms) among large gulls there.

Breeding success (table 2.15.2)

The available data from 1993-94 suggest that breeding success has generally been high, at *c*1-2 chicks fledged/pair. However, a study-population on the Calf of Man failed totally in 1993, apparently a result of bad weather in May. In SW Scotland, moderate to low success at some colonies may have reflected predation by mink, but the overall impact of predation was less than for other gull species in the region.

Table 2.15.1 Population changes at monitored great black-backed gull colonies, 1992-93 and 1993-94 (breeding pairs / apparently occupied nests in May-June). Superscript = number of colonies counted in both years. Regional samples <50 pairs are excluded.

	NW Scotland	Shetland	SW England	Wales	NE Ireland
1992	118	57	118	87	85
1993	122	68	121	99	74
1992-93 % change	+3.4 ³	+19.3 ¹	+2.5 ¹	+13.8 ⁶	-12.9 ^{>3}
1993	95	68	121	81	74
1994	112	76	149	108	61
1993-94 % change	+17.9 ²	+11.8 ¹	+23.1 ¹	+33.3 ³	-17.6 ^{>3}

Table 2.15.2 Great black-backed gull breeding success, 1993-94: 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

Region	1993	fledged/pair		1994	fledged/pair	
	prs ⁿ	range	total	prs ⁿ	range	total
SW Scotland ^a		-		155 ⁶	0.11-1.33	0.72+
Orkney ^b		-		145 ³	0.85-1.25	1.10
N Scotland ^c	42 ¹		2.14	69 ¹		1.90
SE Scotland ^d		-		6 ¹		2.17
Wales ^e		-		32 ¹		0.94
Isle of Man ^f	28 ¹		0			-
NE Ireland ^g	37 ⁺¹		1.9	30 ⁺¹		2.2

Colonies: ^a Bach Island, Ruadh Sgeir, Carraig an Daimh, Abbot Island, Dubh Sgeir, Eilean Gainimh; ^b Birsay moors, Hobbister, Papa Westray North Hill; ^c Nigg; ^d Isle of May; ^e Skokholm; ^f Calf of Man; ^g Strangford Lough.

2.16 Kittiwake *Rissa tridactyla*

Breeding numbers (table 2.16.1)

The most notable population change seen was a 25% decrease in numbers of apparently occupied nests (AONs) at colonies in SE Scotland between 1993 and 1994, the largest of several decreases seen in this region in recent years. There was a 46% decrease from 7,009 to 3,751 AONs on the Isle of May (NE Fife), where it was evident that much of the decrease was due to many of the adults present not building nests. A high proportion of birds which did build nests on the Isle of May failed to lay eggs, and observations there would be consistent with low food availability during the period April to early June (Harris 1994a). A similar decrease may have occurred at colonies in NE Scotland, although data were limited, and in NE England a less marked decline was seen on the Farne Islands (Northumberland). Little change was seen in Shetland, while colonies on Mainland Orkney showed an overall decrease by c10% since 1991. The southernmost North Sea colonies, in E and SE England, showed an increase in numbers between 1993 and 1994.

On western coasts, little change was seen in Wales, and sample populations in NW Scotland showed a 12% increase. In SW England, colonies in the Isles of Scilly showed a further slight decrease (from 262 to 248 pairs). Numbers at colonies in SE Ireland appeared to show some recovery, or continued to level off, in 1994.

Breeding success (table 2.16.2, figure 2.16.1)

Average productivity was moderately high in 1994 (0.72 \pm s.e. 0.06 chicks fledged/nest at 46 colonies). This was a significant overall improvement compared with 1993 (0.63 chicks/nest), and close to the average for the period 1986-93 (0.73 \pm 0.04, based on 30-61 colonies annually). Most individual colonies and regions showed some improvement, significantly so in the cases of NW Scotland, Orkney, Wales and (in combination) NE and SE Scotland. Colonies in NW and N Scotland, Orkney and NE to SE England were the most successful overall, with regional averages of 0.9-1.2 chicks fledged/nest.

On North Sea coasts, NE and SE Scotland were the least successful regions for the second year in succession (c0.4 chicks/nest). There was some improvement compared to 1993, and observations on the Isle of May suggested that, after a poor start to the season, feeding conditions improved later (Harris 1994a). Failure rates were high at the incubation stage, however, while many adults failed to lay eggs, and overall breeding output was also reduced because of a large decrease in the proportion of adults nesting (see *Breeding numbers*). Kittiwakes elsewhere on North Sea coasts were much more successful. In Shetland (average 0.75 chicks/nest), productivity would have been higher but for predation by great skuas which, in the most extreme case, contributed to total failure of the Eshaness colony (670+ pairs).

Productivity was moderate or high in NW Scotland, and the average of 1.54 chicks fledged/nest on Handa (Sutherland) was the highest figure recorded at any colony in 1994. Kittiwakes in other 'western' regions were less productive, as in most recent years, with colonies in SW England and around the Celtic and Irish Sea averaging 0.45 chicks/nest overall (slightly improved over 1993). At Start Point (Devon), total failure occurred for the second year in succession; the colony was largely abandoned this year, possibly associated with human disturbance (sand-blasting of a lighthouse) in 1993. Poor weather contributed to breeding losses at some colonies, and predation by brown rats was again recorded in Scilly. The overall factors contributing to low breeding success in SW Britain and SE Ireland remain unclear, but food availability seems likely to be the most important.

Table 2.16.1 Population changes at monitored kittiwake colonies, 1993-94 (apparently occupied nests in late May/June). Superscript = number of colonies with 10+ AONs counted in 1993; counts with a reported inaccuracy of $>\pm 5\%$, and regional samples <100 AONs, are excluded. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: ** $P<0.01$)

	NW Scotland	Shetland	NE Scotland	SE Scotland	NE England	E England
1986-93 annual % change	+0.7	-6.7		+1.6	+1.8	
1993	1045	3690	531	24546	6173	167
1994	1171	3641	430	18349	5930	222
1993-94 % change	+12.0 ²	-1.3 ⁹	-19.0 ¹	-25.2 ⁷	-3.9 ²	+32.9 ¹

	SE England	SW England	Wales	NE Ireland	SE Ireland	NW Ireland
1986-93 annual % change	+0.3		-1.4		-5.8**	
1993	2413	346	2747	807	1095	452
1994	2603	324	2783	801	1136	476
1993-94 % change	+7.9 ³	-6.3 ⁶	+1.3 ³	-0.7 ²	+3.7 ²	+5.3 ¹

Table 2.16.2 Kittiwake breeding success, 1993-94: 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 (standard error is equivalent to half-range of figures from two colonies). Changes in breeding success are indicated for colonies studied in both years (significant changes, based on t-test: * $P<0.05$; ** $P<0.01$)

Region	1993 chicks fledged/nest				1994 chicks fledged/nest				1993-94 change	
	nests ⁿ	range	mean	±s.e.	nests ⁿ	range	mean	±s.e.	mean ⁿ	±s.e. (n)
SW Scotland	131 ¹		0.37		124 ¹		0.40		+0.03 ¹	
NW Scotland	1179 ³	0.36-1.27	0.68	±0.29	1026 ³	0.74-1.54	1.05	±0.25	+0.36 ³	±0.05 *
Shetland	>2164 ¹⁰	0-1.24	0.70	±0.14	2462 ⁹	0-1.23	0.75	±0.16	-0.02 ⁹	±0.13
Orkney	1255 ⁶	0.61-1.08	0.91	±0.07	1283 ⁶	0.80-1.49	1.14	±0.09	+0.22 ⁶	±0.05 **
N Scotland	879 ⁴	0.90-1.11	0.98	±0.05	165 ¹		0.96		+0.02 ¹	
NE Scotland	1099 ³	0.01-0.38	0.23	±0.11	789 ³	0.29-0.49	0.41	±0.06	+0.18 ³	±0.06
SE Scotland	>2576 ⁴	0.07-0.34	0.21	±0.07	2124 ⁴	0.10-0.64	0.39	±0.12	+0.18 ⁴	±0.06
NE England	1375 ⁵	0.73-1.28	0.98	±0.10	1468 ⁵	0.88-1.01	0.96	±0.02	-0.03 ⁵	±0.08
E England	167 ¹		1.17		222 ¹		1.21		+0.04 ¹	
SE England			-		137 ¹		0.95			
SW England	615 ⁴	0-0.69	0.35	±0.15	422 ⁴	0-0.89	0.45	±0.20	+0.10 ⁴	±0.05
NW Eng./I. of Man	328 ³	0.29-0.39	0.33	±0.03	191 ²	0.16-0.73	0.44	±0.28	+0.16 ¹	
Wales	1705 ⁴	0.04-0.66	0.36	±0.13	1593 ³	0.27-0.90	0.54	±0.18	+0.19 ³	±0.04 *
SE Ireland	3509 ⁵	0.39-0.85	0.63	±0.08	1134 ²	0.03-0.63	0.33	±0.30	-0.22 ²	±0.14
SW Ireland	1278 ²	0.66-0.89	0.77	±0.12			-			
NW Ireland	452 ¹		0.47		476 ¹		0.67		+0.20 ¹	
TOTAL	>18712 ⁵⁶	0-1.28	0.63	±0.05	13358 ⁴⁶	0-1.54	0.72	±0.06	+0.09 ⁴⁴	±0.04 *

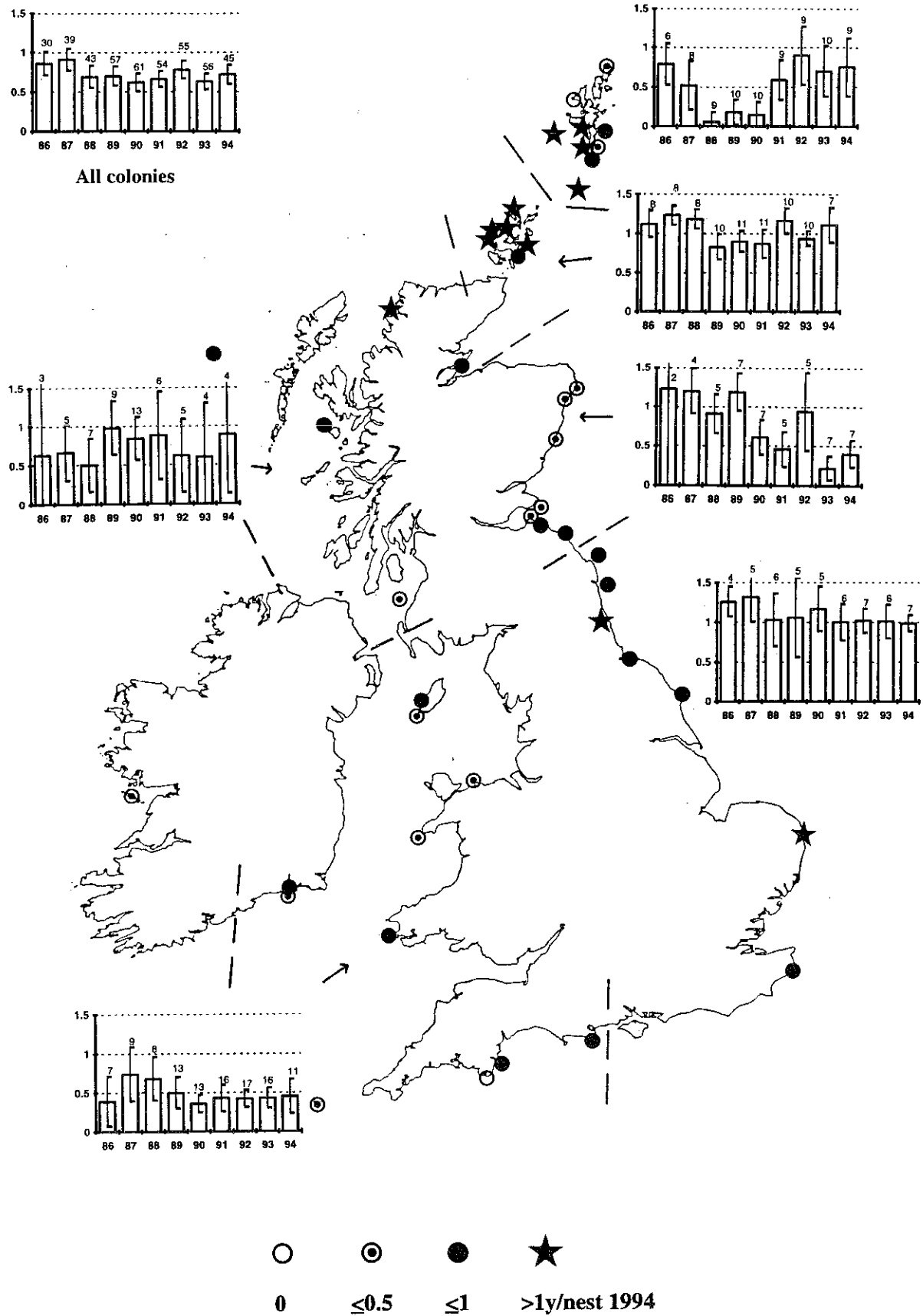


Figure 2.16.1 Breeding productivity (chicks fledged / well-built nest) at kittiwake colonies during 1986-94, showing regional and annual variation. Dot symbols represent 1994 figures; histograms show annual averages for each broad region (with 95% confidence limits and numbers of colonies)

2.17 Sandwich tern *Sterna sandvicensis*

Breeding numbers (tables 2.17.1-2)

Once again, different regions showed markedly different population changes between 1993 and 1994, with large increases in one region largely balanced by declines elsewhere, probably reflecting shifts of breeding adults between colonies or over longer distances. Overall, there was little change (-3%) at 24 study-colonies compared to 1993 (and there was no significant trend during 1986-93). At monitored colonies in two regions of Scotland, changes differed substantially, numbers at Loch of Strathbeg increasing dramatically to 923 pairs in 1994 (+79%), while at two colonies in SE Scotland numbers fell by 50% to 129 pairs. In NE England, there may have been a small decrease, while E England (the other main stronghold) showed little change overall. Numbers at Scolt Head increased greatly (+180% to 2,406 pairs), but this balanced and probably included birds lost from the Blakeney colony (where numbers fell by 66% to 1,000 pairs). Smaller populations in SE England increased by 19% and in NW England by 8%, while those in SW England fell by 42% and in Wales by 29% (from 564 to 400 pairs). Numbers also fell (by 31%) in NE Ireland, but there was little overall change at two colonies in NW Ireland. A 15% increase (to 1447 pairs) was noted at the single colony in SE Ireland (Lady's Island Lake), continuing the significant increase seen during 1986-93.

Breeding success (table 2.17.3)

Productivity was again moderately high overall, at c0.84 chicks fledged per pair (based on 13 colonies). This was slightly higher than the 1993 figure (≤ 0.75) and the 1986-93 average ($0.72 \pm \text{s.e. } 0.05$, based on 7-20 colonies annually). To a large extent, these figures reflect productivity at study-colonies in E England, which had another successful year overall (0.99 chicks/pair). No information was available for NE England, but productivity was generally rather low in other regions (where smaller numbers breed). Only 0.02 chicks/pair fledged from the small sample monitored in SE England, although productivity was reported as 'good' elsewhere in that region. Low productivity at Rye Harbour may have resulted from chilling of chicks among tall vegetation during wet weather. Only 0.16-0.33 fledged/pair in SE and NE Scotland (although there was some improvement at Loch of Strathbeg, from 0.08 to 0.33/pair). It appeared to be a successful season in NW Ireland, however, where ringing figures suggested that >1 chicks/pair may have fledged. Mink were recorded near the latter colonies in 1994, but their main effect on this species seems to have been to cause a shift between colonies. In several other regions, foxes were noted as a likely predator.

Table 2.17.1 Numbers of Sandwich tern breeding pairs at regularly-counted colonies in Britain and Ireland, 1986-94

Colony	1986	1987	1988	1989	1990	1991	1992	1993	1994
Loch of Strathbeg	493	130	404	239	121	283	304	515	923
Sands of Forvie	597	1082	664	744	1126	1115	29	0	0
Inchmickery	416	656	383	272	418	473	112	9	98
Coquet Island	1049	1586	1616	1164	1203	1736	2131	1469	1611
Farne Islands	3456	2870	3408	3445	2846	2126	2730	2349	c1750
Scolt Head	2550	3089	2775	1052	0	320	280	853	2406
Blakeney Point	1000	475	1000	1500	3000	3000	4000	3000	1000
Minsmere	1	0	0	0	5	20	0	0	0
Havergate	145	200	63	50	60	84	70	125	300
Foulness/Maplin	98	243	350	300	280	280	548	275	405
Dungeness	350	3	125	220	240	250	250	40	0
Rye Harbour	42	155	0	3	25	2	0	90	c125
Pagham Harbour	0	0	0	0	26	2	0	0	0
Chichester Harbour	12	27	0	15	22	5	27	45	9
Langstone Harbour	0	3	2	0	0	0	0	0	0
North West Solent	176	220	305	198	150	151	150	85	148
Pitts Deep-Hurst	45	50	70	?	25	0	90	103	150
Brownsea Island	103	25	72	90	64	75	82	120	70
Anglesey	450	700	1080	830	517	601	500	564	400
South Walney	45	180	0	0	0	0	450	0	0
Foulney	400	550	700	770	720	332	0	253	380
Hodbarrow	0	0	0	50	120	520	360	100	0
Swan Island	63	74	117	138	130	135	132	c64	152
Green Island	61	286	78	36	59	172	108	c721	449
Strangford Lough	1418	2127	2228	962	1482	879	657	587	346
Lady's Island Lake	524	708	412	1317	1395	1469	1129	1254	1447
Lough Swilly	95	102	73	76	109	99	116	119	220
Mulroy Bay	112	98	225	240	79	76	107	117	23
Total	13701	15639	16150	13763+	14122	14205	14333	12857	12412

Table 2.17.2 Population changes at monitored Sandwich tern colonies, 1993-94 (breeding pairs). Superscript = number of colonies counted in both years. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: * P<0.05)

	NE Scotland	SE Scotland	NE England	E England	SE England	Wales
1986-93 annual % change	0.0	-10.5	-1.9	+2.3	-1.9	-2.8
1993	515	259	3818	4253	363	564
1994	923	129	c3661	4111	432	400
1993-94 % change	+79.2 ¹	-50.2 ²	c -4.1 ²	-3.3 ⁴	+19.0 ⁵	-29.1 ¹

	SW England	NW England	NE Ireland	SE Ireland	NW Ireland	SAMPLE TOTAL
1986-93 annual % change	+9.5	+0.1	-4.9	+16.3*	-1.2	-0.6
1993	120	353	1372	1254	236	13107
1994	70	380	949	1447	243	12745
1993-94 % change	-41.7 ¹	+7.6 ²	-31.0 ³	+15.4 ¹	+3.0 ²	-2.8 ²⁴

Table 2.17.3 Sandwich tern breeding success, 1993-94: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). Note that the same colonies have not necessarily been monitored in each region each year, and that numbers of pairs given here are sample sizes (and do not necessarily indicate population changes between years). ≤ = figures which may be substantial overestimates (mainly based on numbers of chicks ringed)

Region	1993	fledged/pair		1994	fledged/pair	
	prs ⁿ	range	total	prs ⁿ	range	total
NE Scotland	515 ¹		0.08	923 ¹		0.33
SE Scotland	259 ²	0.0-0.76	≤0.73	129 ²	0.0-0.68	0.16
NE England	40 ¹		0.0			-
E England	4253 ⁴	0.78-1.17	0.93	4111 ⁴	0.66-1.11	0.99
SE England	175 ³	1.12-1.4	1.29	c134 ²	0.0-0.02	0.02
SW England	123 ²	0.0-0.76	≤0.76	70 ¹		0.46
Wales	564 ¹		0.3			-
NW England	353 ²	0.0-0.85	0.61	380 ¹		0.60
SE Ireland	1254 ¹		c0.40			-
NW Ireland	287 ³	0.2-1.01	0.72	243 ²		≤1.32
TOTAL	7424 ²⁰	0.0-1.4	≤0.75	5990 ¹³	0.02-1.32	0.84

2.18 Roseate tern *Sterna dougallii*

Breeding numbers (table 2.18.1)

Overall numbers increased by *c*5% at regularly counted colonies in Britain and Ireland between 1993 and 1994. Four pairs returned to one of the colonies in NE Ireland, while in SE Ireland there was an encouraging increase to 140 pairs at Lady's Island Lake (Wexford). Rockabill (Dublin) continued to hold the largest British or Irish colony, although numbers fell slightly, to 394 pairs, from the peak of 427 pairs in 1993. It is likely that many of these birds had moved to the Wexford colony. At two colonies in Wales, numbers showed little change (20 pairs) from 1993. In SE Scotland, breeding numbers decreased at colonies in the Firth of Forth from 17 pairs in 1993 to an estimated 9 pairs in 1994. Further south on the North Sea coast, however, there was a notable increase on Coquet Island (Northumberland), to 35-42 pairs.

Total numbers at NE Atlantic colonies were estimated at *c*1,200 pairs, higher than in 1993 but still below the 1992 figure of 1,354 pairs. There were 547 pairs at the main colonies in the Azores (an increase since 1993), and 71-91 pairs at two colonies in Brittany, France (little change).

Breeding success (table 2.18.1)

Overall productivity in Britain and Ireland was high, at *c*1.30 chicks fledged/pair. This was slightly lower than in 1993 (1.49), but close to the 1990-93 average (*c*1.35). The colonies in Northumberland, on Anglesey and on Rockabill (where 552 chicks were ringed) were the most successful, fledging >1.0 chicks/pair. No estimate was available for the Lady's Island Lake colony, and only one chick fledged from the four pairs in NE Ireland. Elsewhere in the NE Atlantic, productivity was moderately high (0.8 chicks/pair) at colonies in Brittany. No estimate was made for the Azores, but further work is planned for the 1995 season.

Table 2.18.1 Roseate tern numbers (breeding pairs) at major colonies (those holding 20+ pairs in at least one year) during 1986-94, and breeding success (chicks fledged/pair) in 1994

Colony	1986	1987	1988	1989	1990	1991	1992	1993	1994	Chicks/pair, 1994
Inchmickery (Edinburgh)	18	20	21	5	0	0	0	0	2	-
Forth colony B	-	2	12	-	15	23	17	17	7	1.0
Farne Islands (Northumberland)	9	14	21	12	4	3	4	3	2-3	2.0
Coquet Island (")	20	17	21	25	23	20	29	<i>c</i> 30	<i>c</i> 38	1.16
Anglesey colony A (Gwynedd)	200	40	45	70	35	1	0	16	18	1.17
Anglesey colony B (")	0	21	0	19	7	0	0	0	0	-
Larne Lough (Antrim)	21	25	23	37	19	4	3	0	4	0.25
Carlingford Lough (Down)	34	40	7	25	3	0	0	0	0	0.0
Rockabill (Dublin)	177	250	332	194	321	366	378	427	394	1.40
Lady's Island Lake (Wexford)	0	8	0	76	60	56	76	76	140	-
TOTAL*	490	450	480	470	490	450	520	578	614	1.30

* Annual totals, and overall productivity in 1994, include other regularly-counted, small colonies.

2.19 Common tern *Sterna hirundo*

Breeding numbers (table 2.19.1)

Numbers overall at coastal colonies appeared to change little between 1993 and 1994, with increases in some regions matched by declines in others and no broad patterns evident. Sample colonies in England and Wales showed little or no overall change (-1.0%) between 1993 and 1994. There was a 22% increase in SE England, suggesting some recovery from the significant decrease seen during the period 1986-93. Numbers fell at three colonies in NW England, continuing the recent decline; this decline was also evident at the larger colony on the Ribble Estuary, where numbers fell by c60% between 1989 and 1994. Less marked changes were seen in other English/Welsh regions (none of which showed significant trends during 1986-93), most notably a 15% decrease in E England and a 15% increase in Wales.

Numbers increased by 53% in NE Scotland, and showed little change in N Scotland, but fell by 23% in SE Scotland and by 19% in a study-area of NW/SW Scotland. In the latter study-area, numbers have fallen by c31% from 1,829 pairs in 1987 to c1,263 in 1994, this decline coinciding with several years of heavy predation by mink, which have caused total breeding failures at many colonies (Craik 1995). In NE Ireland, numbers fell by 16%, but a slight increase (+4%) was noted on Rockabill in SE Ireland.

Breeding success (table 2.19.2)

Productivity was moderately high overall, with c0.79 chicks estimated to have fledged per pair at 47 British colonies. This was an improvement over 1993 (0.67/pair), and higher than the 1986-93 average (0.62 \pm s.e. 0.07, based on 13-59 colonies annually). As usual, there was much regional variation, and some regions showed large decreases, but productivity was moderate or high in most regions.

Mink again caused some whole-colony failures in NW and SW Scotland, but control of mink early in the breeding season allowed some colonies to fledge 1.0-1.6 young per pair, and there was a substantial improvement overall. Productivity fell to 0.29 chicks/pair in N Scotland in 1994, and to only 0.06 in NE Scotland (largely due to poor success at Strathbeg and St Fergus). In contrast, colonies in SE Scotland showed an marked improvement to 0.91 chicks/pair, largely reflecting a successful year on the Isle of May.

Elsewhere, productivity also improved markedly in E England, to 1.31 chicks/pair, with a successful season at Havergate and Blakeney. Colonies in SW and SE England were less successful overall, and at Dungeness (for unknown reasons) only 15-20 young were thought to have fledged from 200 pairs. As in 1993, NW England appeared to be the least successful region outside Scotland, with c0.2 chicks fledged/pair. In contrast, Welsh colonies had another successful year (1.1 chicks/pair), and ringing totals suggested a productive season on Rockabill in SE Ireland.

Table 2.19.1 Population changes at monitored common tern colonies, 1993-94 (breeding pairs). Superscript = number of colonies counted in both years (including known colonies not occupied in 1993-94). 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)

	NW/SW Scotland	N Scotland	NE Scotland	SE Scotland	NE England	E England	SE England
1986-93 annual % change			-6.3	+3.1	-1.2	-1.3	-4.9*
1993	1553	494	258	1166	994	811	391
1994	c1263	493	395	907	1040	691	478
1993-94 % change	-18.7 ^{>20}	-0.2 ³	+53.1 ³	-22.2 ⁷	+4.6 ²	-14.8 ⁶	+22.2 ⁵
	SW England	NW England	Wales	ENGLAND /WALES	NE Ireland	SE Ireland	
1986-93 annual % change	+0.2	-5.2*	-4.3	-2.2	-2.4	+13.3***	
1993	255	67	415	2933	1296	279	
1994	286	32	478	3005	1082	289	
1993-94 % change	+12.1 ⁴	-52.2 ³	+15.2 ⁵	+2.4 ²⁵	-6.5 ⁴	+3.6 ¹	

Table 2.19.2 Common tern breeding success, 1993-94: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). Note that the same colonies have not necessarily been monitored in each region each year, and that numbers of pairs given here are sample sizes (not necessarily indicating population changes between years). ≤ = figures which may be substantial overestimates (mainly based on numbers of chicks ringed)

Region	1993	fledged/pair		1994	fledged/pair	
	prs ⁿ	range	total	prs ⁿ	range	total
SW Scotland	795 ⁶	0.0-0.74	0.18	785 ⁸	0.0-1.59	0.88
NW Scotland	579 ⁷	0.0-1.03	0.48	379 ⁵	0.0-1.31	1.05
N Scotland	506 ⁴	0.0-1.0	0.45	493 ³	0.22-0.48	0.27
NE Scotland	276 ⁴	0.0-0.8	0.46	395 ²	0.03-0.14	0.06
SE Scotland	383 ⁵	0.1-0.9	0.45	339 ⁶	0.54-1.35	0.91
SCOTLAND	2539 ²⁶	0.0-1.03	0.50	2391 ²⁵	0.0-1.59	0.65
NE England	97 ³	1.2-3.0	≤2.45			-
E England	869 ⁷	0.0-1.1	0.65	691 ⁶	0.5-2.50	1.31
SE England	277 ³	0.1-1.5	0.98	354 ⁴	0.0-1.73	0.41
SW England	130 ¹		≤0.8	281 ³	0.08-2.0	0.65
NW England	67 ³	0.0-0.19	0.15	66 ⁴	0.0-0.43	0.18+
ENGLAND	1440 ¹⁷	0.0-3.0	0.82	1392 ¹⁷	0.0-2.5	0.91
Wales	415 ⁶	0.43-2.0	1.17	478 ⁵	0.7-1.9	1.1
BRITAIN	4394 ⁴⁹	0.0-3.0	0.67	4261 ⁴⁷	0.0-2.5	0.79
SE Ireland	279 ¹		≤2.34	289 ¹		≤1.74

2.20 Arctic tern *Sterna paradisaea*

Breeding numbers (tables 2.20.1-2)

In the northern isles (which hold the bulk of the population), numbers at monitored colonies in Shetland decreased (by 37%) for the second year in succession while a 22% decrease in Orkney continued the decline seen since regular monitoring began in 1990. A wider survey of these island groups in 1994 indicated that there had been little or no recovery from the decline seen in the 1980s. Continued poor breeding success in Orkney (see below) suggests that the decline there, at least, will continue. Counts in a study-area of NW and SW Scotland indicated a 7-21% decline since 1987, suggesting that numbers there have not fallen as markedly as numbers of common terns. Colonies in NE Scotland showed a 32% decline in between 1993 and 1994, but there was little change in SE Scotland and a 56% increase in the N Scotland sample (largely an increase at Brora in Sutherland). Numbers also increased in Wales (+36%) and NE Ireland (+18%), with little change (+3%) in NE England (the largest regional population outside Scotland). Some smaller populations elsewhere also increased, including those in NW England (from 20 pairs to 44 pairs at Foulney Island) and E England (from 16 to 21 pairs).

Breeding success (table 2.20.3)

Most regions had a moderate or poor season in 1994, with colonies away from the northern isles producing c0.63 chicks/pair overall (compared to c0.49 in 1993). Poor weather was thought to have been a major contributory factor to low breeding success in both Orkney and Shetland. In Shetland, the overall estimate of productivity was 0.19 chicks fledged/pair, about half the 1993 figure. Productivity remained low in Orkney, at 0.17 chicks/pair. Mink *Mustela vison* were again responsible for several complete colony failures in NW and SW Scotland. As with common tern, however, control of mink early in the season allowed some colonies to produce ≥ 1.0 chicks/pair. In NE Scotland, productivity was again very low (0.02 chicks/pair), and there was a reduction to 0.20/pair in N Scotland. Productivity in SE Scotland, however, was reasonably good (0.70/pair compared to 0.07 in 1993), much of the improvement reflecting a good season on the Isle of May. The few pairs in E England produced about 1.0 chick/pair, similar to the Welsh figure (0.98). Study-colonies in NE and NW England were less successful, at 0.48-0.54 chicks/pair.

Table 2.20.1 Population changes at monitored arctic tern colonies, 1993-94 (breeding pairs).

Superscript = number of colonies counted in both years (including known colonies not occupied in 1993-94). Regional samples < 100 pairs in 1993 are excluded. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: * P<0.05)

	Shetland	Orkney	N Scotland	NE Scotland	SE Scotland	NE England	Wales	NE Ireland
1986-93 annual % change					+5.9	-3.3	+10.8*	-17.4*
1993	4779*	7553*	348	360	560	4057	795	246
1994	2990*	5878*	544	245	568	4189	1078	301
1993-94 % change	-37.4 ⁷¹	-22.2 ³⁶	+56.3 ³	-31.9 ³	+1.4 ⁸	+3.3 ³	+35.6 ³	+18.3 ²

* Counts of individual adults, Shetland and Orkney (cf. table 2.20.2)

Table 2.20.2 Numbers of arctic terns (individuals) recorded at sample colonies in Shetland and Orkney which were surveyed in both 1993 and 1994

Colony location	1993	1994	% change
Fetlar	2100	1066	-49
N Mainland	163	89	-45
S Mainland	321	226	-30
W Mainland	98	113	+15
Central Mainland	84	122	+45
Noss	200	16	-92
Mousa	1500	1151	-23
Unst	313	207	-34
SHETLAND sample total	4779	2990	-37
N Ronaldsay	555	614	+11
Westray	1520	1527	0
Papa Westray	3765	2945	-22
Mainland	370	62	-83
S Ronaldsay	3	0	-100
Rousay	1200	500	-58
Hoy	120	130	+8
ORKNEY sample total	7553	5878	-22

Table 2.20.3 Arctic tern breeding success, 1993-94: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). Note that the same colonies have not necessarily been monitored in each region each year, and that numbers of pairs given here are sample sizes (and do not necessarily indicate population changes between years). \leq = figures which may be substantial overestimates (mainly based on numbers of chicks ringed)

Region	1993	fledged/pair		1994	fledged/pair	
	prs ⁿ	range	total	prs ⁿ	range	total
SW Scotland	272 ⁸	0.0-0.71	0.18	66 ⁶	0.0-1.11	0.77
NW Scotland	79 ³	0.07-0.38	0.13	41 ³	0.0-1.0	0.22
Shetland	1074 ¹⁶	0.0-0.96	0.42	707 ¹⁵	0.0-1.14	0.19
Orkney	>970 ¹²	0.0-0.45	\leq 0.25	807 ⁶	0.01-0.59	0.17
N Scotland	398 ⁴	0.08-1.16	0.53	544 ³	0.11-0.48	0.20
NE Scotland	383 ⁴	0.0-0.4	\leq 0.08	245 ²	0.0-1.0	0.02
SE Scotland	562 ⁶	0.0-2.0	0.07	570 ⁵	0.0-0.74	0.70
NE England	919 ²	0.45-0.73	\leq 0.65	256 ¹		0.54+
Wales	935 ⁴	0.43-1.39	0.85	1078 ³	0.87-1.3	0.98
NW England	20 ¹		0.4	44 ¹		0.48
SE Ireland	23 ¹		\leq 0.78			-

2.21 Little tern *Sterna albifrons*

Breeding numbers (table 2.21.1)

Numbers at British study-colonies showed little change between 1993 and 1994 (-1%), following a period of fairly sustained decline during 1986-93. Numbers at 22 study-colonies in E England increased by 8%, to 820 pairs. Most notably, in Norfolk the colony at Great Yarmouth reached its highest total yet (230 pairs) while that at Blakeney increased to 183 pairs. Despite the increase in Norfolk, however, numbers fell again at colonies in other counties in E England, and in NE and SE England (continuing the significant 1986-93 decline in the latter region). Numbers also fell in NW England, but increased overall at study colonies in Scotland and at the Gronant colony in Clwyd, Wales (+71% to 77 pairs).

Breeding success (table 2.21.2)

Breeding output was moderately high overall (0.67 chicks fledged/pair at 55 colonies). This was a marked improvement over recent years (0.40/pair in 1993, $0.53 \pm \text{s.e. } 0.07$ 1986-93), and higher than in any year 1988-93. The main improvement was in E England (from 0.42/pair in 1993 to 0.86), with the large colonies at Blakeney and Great Yarmouth having a very good season. A high proportion of the British population of little terns breeds in this region, and continued wardening at large colonies such as Great Yarmouth is undoubtedly essential to their success. At the Gronant colony in Wales, productivity continued high at about 1.68 chicks/pair; this colony has consistently raised good numbers of young in recent years.

Most other regions had another poor season, however. Scottish study-colonies fledged only 0.1 chicks/pair, and colonies in SE and NW England and SE Ireland fledged no more than 0.2 chick/pair (similar to or lower than 1993 figures). Failures in SE and NW England were attributed to high tides and predation by foxes and gulls, while foxes, kestrels *Falco tinnunculus* and human disturbance were implicated in SE Ireland.

Table 2.21.1 Population changes at monitored little tern colonies, 1993-94 (breeding pairs). Superscript = number of colonies counted in both years (including known colonies not occupied in 1993-94). Regional samples <50 pairs are excluded. Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: * $P < 0.05$; ** $P < 0.01$)

	Scotland	NE England	E England	SE England	Wales	NW England	BRITAIN
1986-93 annual % change	-2.6	-2.3	-2.9	-6.4**	+0.5	-3.9	-3.9**
1993	49	221	760	226	45	64	1365
1994	59	154	820	192	77	56	1353
1993-94 % change	+20.4 ¹⁰	-30.0 ⁸	+7.9 ²²	-15.0 ⁹	+71.1 ¹	-12.5 ⁷	-0.9 ⁵⁷

Table 2.21.2 Little tern breeding success, 1993-94: estimated number of chicks fledged per breeding pair at sample colonies (n = number of colonies). Note that the same colonies have not necessarily been monitored in each region each year, and that numbers of pairs given here are sample sizes (and do not necessarily indicate population changes between years). \leq = figures which may be substantial overestimates (mainly based on numbers of chicks ringed)

Region	1993			1994		
	pairs ⁿ	fledged/pair range	total	pairs ⁿ	fledged/pair range	total
SW Scotland	8 ²	0.0-0.66	0.25	5 ²		0.0
N Scotland	8 ²	0.71-1.0	0.75	10 ¹		0.4
NE Scotland	13 ²		0.0	2 ¹		0.0
SE Scotland	40 ⁴	0.0-0.33	0.22	42 ⁵	0.0-0.1	0.05
SCOTLAND	69 ¹⁰	0.0-1.0	0.25	59 ⁹	0.0-0.4	0.11
NE England	223 ⁸	0.0-2.0	0.54	154 ⁶	0.0-1.17	0.40
E England	755 ²¹	0.0-1.22	0.42	811 ²²	0.0-1.60	0.86
SE England	167 ⁵	0.0-0.5	0.16	167 ⁷	0.0-0.6	0.18
SW England	50+ ¹		c0.5	77 ¹		0.53
Wales	45 ¹		1.04	77 ¹		1.68
NW England	55 ⁶	0.0-0.66	0.16	56 ⁷	0.0-1.0	0.20
ENGLAND/WALES	1295 ⁴²	0.0-1.22	0.42	1342 ⁴⁴	0.0-1.6	0.72
SE Ireland	58 ⁴	0.0-0.06	0.05	\leq 69 ²		<0.1
TOTAL	1422 ⁵⁴	0.0-2.0	0.40	\leq 1470 ⁵⁵	0.0-1.6	0.67

2.22 Guillemot *Uria aalge*

Breeding numbers (table 2.22.1)

Large numbers of guillemots and shags (among other species) were found dead or dying along the NE coasts of Britain during February-March 1994, during a prolonged period of onshore winds. Total mortality of guillemots involved in this 'wreck' was estimated as probably 20-50,000 birds (RSPB National Beached Bird Survey and M. Heubeck, unpublished data). This would be within the normal range of annual mortality for the large guillemot population (including immatures) along North Sea coasts (M.P. Harris & S. Wanless, in prep.), but some impact on breeding populations was feared. In fact, counts at colonies in 1994 provided little evidence of any major impact on guillemot numbers.

Counts at study plots in five colonies between NE Scotland and NE England indicated that numbers increased slightly between 1993 and 1994, although none of the increases was statistically significant. In Orkney, sample plots at six colonies showed little change between 1991 and 1994 (+3% overall), but a significant increase at Mull Head (+15%). Numbers of guillemots attending sample plots in Shetland colonies did fall slightly overall, with significant decreases at Hermaness (-7%), Burravoe (-11%) and Eshaness (-7%). Unfortunately, no counts were made at colonies in east Caithness in 1994. Some additional whole-colony counts were made along North Sea coasts, although interpretation of such counts is more difficult. Again, however, there was no clear evidence of any major decreases in numbers, and most whole-colony counts suggested stable or increased populations.

Elsewhere, sample counts at study plots indicated a further increase in Wales (continuing a significant increase evident during the period 1986-93), including a significant increase on Skomer (Dyfed) since 1993 (+9%). Sample populations in NE Ireland fell by c24% (Rathlin, Co. Antrim). In NW Scotland, no change was evident from plot counts on Handa (Sutherland). A whole-colony count there recorded at least 113,590 adults on the cliffs, suggesting an increase by at least 15% since 1987; Handa remains the largest single colony in Britain or Ireland. In other regions, replicate counts for study plots were not made and population changes were difficult to assess from the available whole-colony counts. Among the larger colonies, a count of 14,564 adults on Great Saltee (Wexford) was c17% lower than in 1989.

Breeding success (table 2.22.2)

Overall breeding success was again high, averaging 0.76 chicks/site (\pm s.e. 0.02) at 12 study-colonies. This was similar to the 1993 figure, and close to the 1986-93 average (0.74 \pm 0.01, based on 3-11 colonies annually). Productivity at most colonies was within the range 0.7-0.85 chicks/site (highest in SW England and on Papa Westray, Orkney), and individual colonies generally showed no major change. However, there were marked improvements at Sumburgh Head (Shetland), from 0.57 chicks/nest to 0.78 in 1994, and on Papa Westray, from 0.44 to 0.83. Poor weather may have accounted for a reduction in success at other Orkney colonies (e.g., from 0.77 chicks/nest to 0.65 at Mull Head).

Table 2.22.1 Population changes at monitored guillemot colonies, 1993-94 (adults attending colony in first three weeks of June). Superscript = number of colonies counted in both years. Figures are based on the means of 3-10 annual counts of study plots within each colony (except [] = <3 valid counts). Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: * P<0.05)

	NW Scotland	Shetland	NE Scotland	SE Scotland
1986-93 annual % change	+8.5	-0.7	+4.0*	+1.4
1993	1706	11708	2384	4508
1994	1711	11192	[2756]	4705
1993-94 % change	+0.3 ¹	-4.4 ⁷	[+15.6] ¹	+4.4 ²
	NE England	Wales	NE Ireland	
1986-93 annual % change	+2.8	+3.6*	+1.8	
1993	26487	5113	2846	
1994	27521	5662	2168	
1993-94 % change	+2.6 ²	+10.7 ²	-23.8 ¹	

Table 2.22.2 Guillemot breeding success, 1993-94: estimated number of chicks fledged per site regularly occupied by a pair or per pair laying (n = number of colonies). Figures are presented as the mean and standard error of figures for individual colonies (standard error is equivalent to half-range of figures from two colonies). Changes in breeding success are indicated for colonies studied in both years (none of the regional changes is statistically significant)

Region	1993 chicks fledged/pair				1994 chicks fledged/pair				1993-94 change	
	sites ⁿ	range	mean	±s.e.	sites ⁿ	range	mean	±s.e.	mean ⁿ	±s.e. (n)
NW Scotland ^a	107 ¹		0.74		216 ¹		0.70		-0.04 ¹	
Shetland ^b	302 ²	0.57-0.85	0.71	±0.14	301 ²		0.75	±0.03	+0.04 ²	±0.17
Orkney ^c	339 ³	0.44-0.80	0.67	±0.12	354 ³	0.72-0.78	0.72	±0.05	+0.05 ³	±0.17
N Scotland ^d	151 ¹		0.70		83 ¹	0.65-0.83	0.73			
SE Scotland ^e	797 ¹		0.76		775 ¹		0.79		+0.03 ¹	
NE England ^f	148 ¹		0.80		140 ¹		0.81		+0.01 ¹	
SW England ^g	189 ²	0.75-0.77	0.76	±0.01	166 ²	0.82-0.86	0.84	±0.02	+0.08 ²	±0.01
Wales ^h	198 ¹		0.74		187 ¹		0.73		-0.01 ¹	
TOTAL	2231 ¹²	0.44-0.85	0.72	±0.03	2222 ¹²	0.65-0.86	0.76	±0.02	+0.03 ¹¹	±0.05

Colonies: ^a Handa; ^b Sumburgh Head, Fair Isle; ^c Papa Westray, Marwick Head, Mull Head; ^d Iresgeo (1993), North Sutor (1994); ^e Isle of May; ^f Bempton; ^g Durlston Head, Berry Head; ^h Skomer.

2.23 Razorbill *Alca torda*

Breeding numbers (table 2.23.1)

Sample populations in most regions showed increases between 1993 and 1994. This included continued growth at colonies in SE Scotland and Wales (where numbers increased significantly over the period 1986-93). Average counts also increased in sample plots at most individual study-colonies. There were significant increases at two of the eleven colonies counted in both years: +21% on the Isle of May (NE Fife), and +15% on Skomer (Dyfed), but a significant decrease (-16%) was noted in plots on Noss (Shetland). In addition, numbers in sample plots at six Orkney colonies increased by 14% overall between 1991 and 1994 (matching the average annual increase by c4% between 1986 and 1992), with significant increases at Costa Head (+18%), Marwick Head (+28%) and Mull Head (+14%).

Breeding success

As usual, limited data were available. Average breeding success at three colonies was moderately high ($\leq 0.62 \pm \text{s.e. } 0.04$ chicks fledged per breeding site), slightly lower than in 1993 ($\leq 0.68 \pm 0.05$ at the same colonies). On the Isle of May, 134 breeding sites in four plots averaged of 0.69 ($\pm \text{s.e. } 0.05$) chicks/site (0.72 in 1993), while 72 sites on Fair Isle (Shetland) averaged ≤ 0.64 chicks/site (≤ 0.77 in 1993). It also appeared to be a successful season at several other Scottish colonies, based on less detailed observations. Elsewhere, 134 sites in five plots on Skomer produced an average of 0.54 (± 0.08) chicks/site (0.55 in 1993). Razorbill sites on open ledges there were noticeably less successful than enclosed sites, probably reflecting exposure to predation (Poole *et al.* 1994).

Table 2.23.1 Population changes at monitored razorbill colonies, 1993-94 (adults attending colony in first three weeks of June). Superscript = number of colonies counted in both years. Figures are based on means of 3-10 annual counts of study plots within each colony (except [] = <3 valid counts). Trends for 1986-93 are average annual rates of change shown by sample populations (significant trends indicated as: * $P < 0.05$; ** $P < 0.01$)

	Shetland	NE Scotland	SE Scotland	Wales	NE Ireland
1986-93 annual % change	-0.2	+2.2	+3.5**	+3.1**	-1.2
1993	349	180	799	1222	761
1994	361	[258]	952	1431	561
1993-94 % change	+3.3 ⁵	[+43.3] ¹	+19.1 ²	+17.1 ²	-26.3 ¹

2.24 Black guillemot *Cephus grylle*

Breeding numbers (table 2.24.1)

In Shetland, pre-breeding counts of adults at SOTEAG monitoring sites generally indicated no change or slight increases between 1993 and 1994, consistent with 1985-93 trends. Following the wreck of the *Braer* oil-tanker in January 1993, coasts directly affected by the oil-spill (near the southern tip of Shetland) showed a decrease in numbers. Counts on two stretches of 'Braer coast' (Kettlaness and West Burra) showed a combined 29% increase between 1993 and 1994, suggesting that rapid recovery (probably through immigration) may be taking place. There was also evidence of recovery on Fair Isle (where a decrease in 1993 may have been related to the *Braer* wreck), with a 16% increase in 1994.

Pre-breeding counts of adults also increased overall (by 13%) at count sites on Papa Westray (Orkney), involving a 50% increase 1993-94 at North Hill (to 201 adults) but an 8% decrease at the Holm of Papa Westray. The latter colony has shown an ongoing decline since 1983, perhaps related to predation or disturbance by rats *Rattus* (which have contributed to low breeding success in recent years). Elsewhere, the only standardised counts available were from Peel Hill (Isle of Man), where a slight decrease was seen in 1994 (-5%), for the second year in succession. In SW and NW Scotland, widespread abandonment of colonies on various small islands in recent years has been associated with predation by mink (see below).

Breeding success

Limited data were available (based on nest-sites where eggs or apparent incubation were recorded). On Fair Isle (Shetland), an average of 0.58 chicks fledged/site ($n = 19$). This was markedly lower than in 1993 (1.23), but the 1994 sample may have been biased towards more accessible sites, potentially more vulnerable to predation. An average of 0.89 chicks fledged/site ($n = 62$ sites) on the Holm of Papa Westray (Orkney) was an improvement over 1993 (≤ 0.76 , based on chicks present in mid July). Pairs elsewhere on Papa Westray were less successful: ≤ 0.25 chicks/site from 20 sites at North Hill (≤ 0.54 in 1993) and ≤ 0.71 from 7 sites at Sheepheight (≤ 0.78 in 1993). On nearby Westray, an average of ≤ 1.0 chicks fledged from 10 sites.

Observations in SW and NW Scotland (Argyll & Bute and the southern part of Lochaber district) suggested that productivity of pairs nesting on small islands near the mainland was low overall (probably < 0.5 chicks fledged/pair). Predation by mink was recorded on at least 4 of 12 islands where black guillemots nested in 1994, and elsewhere in previous years before mink were controlled. In most cases, both adults and eggs or chicks were taken by mink. Other small islands in these regions have been abandoned by black guillemots in recent years, in at least some cases following heavy predation by mink (J.C.A. Craik pers. comm.).

Table 2.24.1 Population changes at monitored black guillemot colonies, 1993-94 (adults in breeding habitat in early morning, late March-early May). Superscript = number of colonies/lengths of coastline counted in both years. Trends for 1983/85-93 are average annual rates of change shown by sample populations (significant trends indicated as: * $P < 0.05$). In Shetland, "other coasts" excludes Yell Sound.

	'Braer coast', Shetland	Fair Isle	Other coasts, Shetland	Papa Westray, Orkney	Isle of Man
1986-93 annual % change	-1.2 (85-93)		+1.7* (85-93)	-3.7 (83-93)	+4.2
1993	163	263	1388	374	126
1994	210	304	1423	422	120
1993-94 % change	+28.8 ²	+15.6 ¹	+2.5 ¹²	+12.8 ²	-4.8 ¹

2.25 Puffin *Fratercula arctica*

Breeding numbers

Very little information is available on numbers of apparently occupied burrows (AOBs). On the Isle of May (NE Fife), counts of study plots indicated little or no change between 1993 (sample total 2,313 AOBs) and 1994. The population there was stable or increased only slowly over the period 1986-93 (average rate of change for sample population = +0.4% per year). The population on Coquet Island (Northumberland) increased by *c*22% per year between 1986 and 1993, and was estimated as *c*12,690 AOBs in 1994 (*c*4% less than in 1993).

Breeding success (table 2.25.1)

Average breeding success was high in 1994 (0.79 chicks/pair at six colonies), at least for colonies studied from the incubation period onwards. This was a significant overall improvement compared with 1993, and included notable improvements on the Isle of May (where puffins had a more successful season than most other seabirds) and on Fair Isle (Shetland). Observations at several other colonies in Shetland suggested only a moderately successful season, although detailed figures were not available. At Hermaness, survival of small chicks to the fledging stage was high (88% of 34 chicks, compared to 73% in 1993), but chick survival at Sumburgh Head was lower, probably a result of predation by feral cats. Noticeably fewer adults were bringing food ashore on Foula in early July compared to 1993, suggesting a less successful season.

Table 2.25.1 Puffin breeding success, 1993-94: estimated number of chicks fledged per burrow with egg (n = number of colonies). Figures are presented as the mean and standard error of figures for individual colonies (standard error is equivalent to half-range of figures from two colonies). Changes in breeding success are indicated for colonies studied in both years (significant changes, based on t-test: ** P<0.01)

Region	1993 chicks fledged/pair				1994 chicks fledged/pair				1993-94 change	
	sites ⁿ	range	mean	±s.e.	sites ⁿ	range	mean	±s.e.	mean ⁿ	±s.e. (n)
NW Scotland ^a			-		100 ¹		0.73			
Shetland ^b	110 ¹		0.69		64 ¹		0.83		+0.14 ¹	
SE Scotland ^c	182 ¹		0.70		189 ¹		0.85		+0.15 ¹	
NE England ^d	1		0.76		216 ²	0.80-0.82	0.81	±0.01	+0.06 ¹	
Wales ^e	249 ¹		0.67		171 ¹		0.76		+0.09 ¹	
TOTAL	>541 ⁴	0.67-0.76	0.70	±0.02	740 ⁶	0.73-0.85	0.79	±0.02	+0.11 ⁴	±0.02 **

Colonies: ^a Dun (St Kilda); ^b Fair Isle; ^c Isle of May; ^d Farne Islands (1994), Coquet Island; ^e Skomer.

3 Acknowledgments

Our thanks are due to the following observers and organisations who provided or compiled counts or assessments of breeding performance for seabirds in 1994:

R.G. Adam, M. Adcock, D. Andrews, D. Allen, I.J. Andrews, T.R. Appleton, P. Akers, V. Astbury, G.R. Avery, S. Babbs, D. Bailey, M.E. Baines, G. Baker, P. Bardell, Bardsey Bird & Field Observatory, C. Barton, J. Bateman, S. Berrows, P. Berry, M. Betts, T.R. Birkhead, K. Black, M.A. Blick, M. Bolton, C.J. Booth, R.A. Broad, B.J. Brown, M. Brown, W. Bruce, I. Bullock, D. Burges, D. Buxton, I.J. Buxton, Calf of Man Bird Observatory, J. Calladine, D. Callaghan, J. Callion, M. Carrier, S. Casey, T. Charlton, J. Chester, Chichester Harbour Conservancy, A. Clark, T. Cleeves, M. Cockram, P.N. Collin, T. Collins, R. Connor, D. Cooper, Countryside Council for Wales, J.C.A. Craik, A. Crawford, G. Creme, C. Crooke, Cumbria Wildlife Trust, G. Cumming, S.R. da Prato, T. Daniels, F. Davidson, R. Davis, T. Dean, A. de Potier, A. Dixon, C. Durdin, Dyfed Wildlife Trust, T. East, East of Scotland Tern Conservation Group, Edward Grey Institute, G.R. Ekins, P.M. Ellis, English Nature, Fair Isle Bird Observatory Trust, K. Fairclough, J. Fairhurst, D. Fairlamb, A. Ferguson, K. Ferry, I. Fisher, Forth Seabird Group, I.S. Francis, M. Freeman, R.W. Furness, F. Gallagher, D.J.G. Gill, T. Gittings, Glasgow University Applied Ornithology Unit, P. Goddard, E. Godwin, R. Gomes, J.R.W. Gordon, P. Gordon, T. Gravett, M. Gray, M. Greening, R. Grogan, G.C. Guille, J.M. Gunn, S. Hales, D. Hallet, C. Hannon, N. Harding, M. Harman, M.P. Harris, P.V. Harvey, R.J. Haycock, M. Heubeck, Highland Ringing Group, M.G. Hill, J. Hodge, T. Hodge, A. Hogg, P. Hollinrake, J. Hopper, B. Hughes, K. Hughes, Institute of Terrestrial Ecology, Irish Wildbird Conservancy, A. Jones, C. Jones, T.C. Kelly, M. Kennewell, J.S. Kirby, R. Kent, S. Knapp, R. Lambert, R. Lawman, G.M. Leaper, O.J. Leyshon, B. Lightfoot, B. Little, I. Livingstone, C. Lodge, R. Lord, Lothian Ringing Group, J.A. Love, B. Madden, S.C. Madge, D. Mainland, W. Makin, N.V. McCanch, L. McFaul, D. McGrath, D. Mackie, J. Matthews, F. Maughan, E.R. Meek, S.J.R. Meikle, O.J. Merne, A.S. Moore, A. Moralee, R. Morris, H. Morrow, R.A. Morton, J. Murphy, R.D. Murray, S. Murray, National Parks & Wildlife Service (Ireland), National Trust, North Ronaldsay Bird Observatory, J.D. Okill, M. Oksien, D. Osborne, D.J. Pankhurst, A. Parker, J. Parslow, K.E. Partridge, A. Patterson, R.J. Perkins, C.M. Perrins, K. Perry, B. Pickess, B. Pinchen, R. Plowman, A. Polkey, C. Pollock, A. Poole, J. Poole, L.S. Powell, T. Prescott, R. Price, P. Quillfeldt, D.J. Radford, J. Reid, A. Rennells, N. Renwick, B. Ribbands, J. Richardson, R. Riddington, K.J. Rideout, M. Robins, P. Robinson, M.A. Robinson, H.W. Roderick, G. Rolland, C. Rollie, M. Rooney, A. Rothwell, C. Rouse, A. Rowlands, S. Rowland, S. Sankey, D. Saunders, T. Sawyer, Scottish Natural Heritage, Scottish Wildlife Trust, Seabird Group, R.M. Sellers, Shetland Ringing Group, A. Silcocks, R. Simpson, N.A. Smallbones, P. Smiddy, A.J.M. Smith, E.M. Smith, J. Smith, M. Smith, R.W.J. Smith, S.C. Smith, D.J. Stanyard, K. Steele, M. Stephenson, P. Stevens, A. Strand, J. Stratford, G. Stringer, D. Suddaby, A. Sutcliffe, S.J. Sutcliffe, T. Swandale, R.L. Swann, M.L. Tasker, K. Taylor, A. Tharme, D. Thompson, G. Thompson, H. Towll, Treshnish Isles Auk Ringing Group, W. Tupling, J. Tymon, A.J. Upton, J.D. Uttley, E.A. Vaughan, J. Vaughan, J. Venner, W. Wagstaff, D. Walker, I. Walker, S. Walker, E. Wallace, A. Walsh, J. Walton, P. Walton, S. Wanless, N. Ward, C. Wastlake, A. Whilde, G.J. White, R. White, Wigan Ranger Service, A. Wight, The Wildfowl & Wetlands Trust, I. Williams, J. Williams, S. Williams, E.J. Wiseman, D. Wood, B. Yates, R. Young, and B. Zonfrillo.

Our apologies are due to any observers inadvertently omitted.

We would also like to thank Mark Tasker for comments on the draft report, and Dave Suddaby and Robin Sellers for comments on the skua and cormorant texts, respectively.

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